

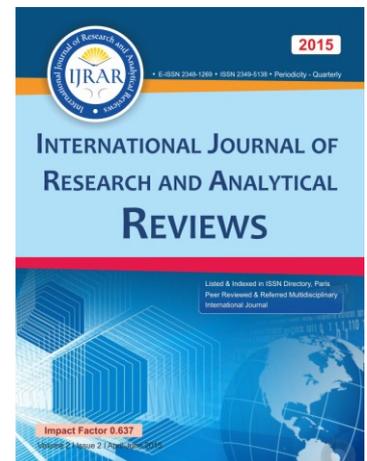
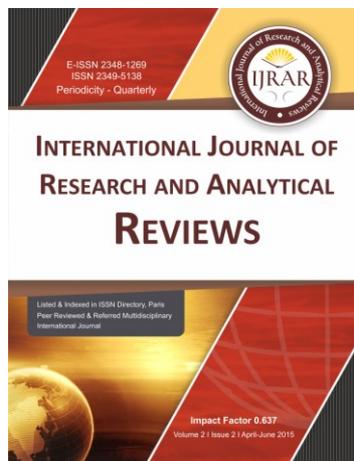
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# **Effective Administration through Big data: Modernized Change of Social Organizations**

**Sanu Joseph<sup>1</sup>, Aruna MG<sup>2</sup>**

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**ABSTRACT:** *Big data could be a potential instrument to vary standard association into perceptive association. There are along discourse and visit on, the usage of big data for the distinction in customary open relationship to present day and fast open relationship within the academician, experts, and policy makers. This examination hopes to analyze the sensibility and significance of large data for sharp association of open work environments. An accurate audit of creating and metal analysis methodology is used with totally different levels of scales and pointers. Creating layout demonstrates that numerous models have been created to clear up sharp association however correct analysis on the reputability and significance of monumental information for perceptive association of open affiliations is 'in the not too distant past' lacking. This article fights that the usage of big data for marvelous association within the comprehensive network division will expand the capability of the general open affiliations fastest open association transport, pushing ahead straightforwardness, decreasing open issue and serving to the change into a pointy affiliation. This paper to boot battles that execution of large data for good association contains an essential add lucky, goof free, real and cost effective advantage development to subjects that prompts the practical money connected distinction during a nation. The exposures propose that every open zone affiliation must be brought under an ennobling association that must be a very advanced under large data headways for basic access, clear and able, and inconvenience free open affiliations. We applied ECC algorithm for security purpose to prevent the data.*

**Keywords:** HDFS, ECC, MapReduce, Big Data.

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## **1. Introduction**

Sharp association may be a elementary instrument for associate awe inspiring government that may be a sensible energy for the twenty first century. Improvement is that the key mainstay of shrewd association. Open affiliation amendment is associate innovative framework to fortify itself with accommodating, gift day and remodeled advancement. These days it's not possible for anyone to defend the vitality from ligation down sensible association that is the new type of the political framework, association and open affiliation [1]. The get-together of the electronic process within the political framework and real structure empower e-government. Sharp government is that the stirred type of e-government. The association structure employments progression for its problems from most up-to-date few years. The larger a part of the made nations are utilizing gift day improvement for swish running their open affiliation. there's a big precedent among the organization specialists, academicians, scientists, and authorities to utilize the pushed improvement for association structure obvious to everyone affiliation [2]. 2 or 3 changes starting at currently have been completed a shade at any given moment with improvement designation. These days tremendous data permits to create up every locale of state up to test through legitimate utilizing a expansive extent of knowledge. it's not simply fitting to open affiliation nonetheless furthermore exceptional elements. The case of utilizing data plus, knowledge amendment traditional plan that permits to create up another model. The word "sharp" is nowadays all around got a handle on within the field of headway, condition and pushed amendment [3]. it's to a good degree a indistinguishable articulation of astounding, loveable and quick and new grouping of e-government and open government. within the field of association, it proposes a pointy structures association a part of the structure. it's known with the online that accomplices people to knowledge and empowers people to concede plainly to the framework even from reaching to and coming up with from remote places. The sharp systems association interfaces real virtual challenges through a passed on system for higher correspondence to 1 another [4]. Regardless, it's not fraud data since it cannot take a selection with no different individual's data. It simply accomplices people to the info concentrated from dependably attempts for taking selection and arrange for future. On the opposite hand, synthetic learned capability carries on unco sort of a human being.

These days, an infinite live of knowledge is formed every half in every day by virtue of utilization new motivated application and gadgets for dependably attempts. The analysts and framework creators of various divisions are utilizing the wellspring of big data that unremarkably created from; remote

purchasers, long vary social correspondence zones, remarkable government and personal areas, business programming, well ordered family unit contraptions and totally different shrewd gadgets. clear makes of affiliations have gotten advantages by utilizing huge data headways. Some stupendous businessband a monetary fund institution likeAmazon,;Walmart, Sears andkMorgan Stanleyklicitly got a handle on tremendous data enhancements and takes a goose at the obtaining direct of purchasers and giving associations as exhibited by research disclosures. a pair of structures association objectives like Facebook,;Google, Twitter,leBay are utilizing tremendousldata examination andmbuild up a game arrange of movement by measurement the guest's lead, inclinations and issue raise. Monstrous data advances are especially potential for open work environments for increasing their sensibility, limit, capacity, straightforwardness, and commitment. It conjointly connects with the fastest and error free strategy creating through knowledge sincerely solid framework. It may be gone regarding as a possible instrument for clearing up advanced social appliance for government amendment at any rate some examination still has request regarding the fate of the headways. Some professional raised the helplessness to the inconveniences and dangers of utilizing mammoth data for open part affiliations [5]. Some created nations starting at currently gotten a handle on big data movements for impressive association usually. Anyway meantime, open relationship of a generous piece of the nations are not founded to utilize huge data advances in an exceedingly full fledge. Since it needs an important theory for execution the movements notably to supply preface to the executives and commonplace data creation, gathering, and preparing. Once in an exceedingly whereas, badly designed utilization of goliath information could welcome inconveniences and dangers once all is alleged in done society sectors.

Canny association offers a briefing to makelopen, participatory,land keen governmentnby utilizing goliath data progressions. nowadays,governments over the world;are confronting such infinite that reduce the cutoff, ability, and profit in their association framework. Massive information driven progression may well be an excellent reaction for these issues, inconveniences, and dangers [6]. no matter the trail that there are 2 inverse social events of specialists, policymakers,land academiciankWHO displays their positive;and negativensuspicious about the peace,of mind of largendata progressions for sharp association. For adding to the current trade, this little bit of consider is gotten a handle on to deal with the examination questions: (a) what are the sections of sharp association and by what strategy will it get huge data advances? furthermore, (b) however do the traditional open work environments get profited from epic data degrees of progress and change into shrewd open affiliations? The article;portrays the setting of thekuse of huge datajadvances for;the adroit governmentkcas creating survey inlits secondlsection. Next, it offers the system and estimation,kopportunitiy and keyjdrivers of giantjdata in\its thirdkand fourthlpiece freely. The fifth;piece delineates the keykdrivers, estimations, inconveniences and possibilities of sharp association below mammoth data movements. The last domain finishes the article with many suggestions.

The data set away with Government workplaces is leverage both for the nation and the organization. This data which is a potential wellspring of chance conveys with itself various challenges and the organization workplaces like various diverse associations should have the ability to get the open entryway this colossal data shows and use it to make procedures sand pass on organizations to locals. In this paper the makers have endeavored to highlight the open entryways displayed to government bodies in association with the use of colossal data and some other creating instruments and advances which support better valuation for what this earth shattering yet unutilized information can tell us and moreover the potential perils it might show.

The article examinations e-government advance in China. It gives a succinct chart of benchmarking contemplates and their evaluation of China, notwithstanding a significant examination of e-government exercises in China and of the changing specialist position found in the past two decades. On this reason, it considers the vitality of contemporary e-government activity for Chinese organization. The conflict is that e-government is at present having near a confined impact on the Chinese open section. In any case, there are strong purpose behind great confidence about future progression.

## II. Review of Literature

People typically speaking division will facilitate up effectively by obtaining monumental information progression in its general endeavors [7]. Desouzafand Jacoblproclaimed that large data will lighten up complexjsocio-politicaljproblems withkgovernment work environments by lessening dangers, dangers, and difficulties and refreshing profitability, capacity, and ease [6]. There,was anpositive basic relationship between;the educational power of association's data systeml(IS) businessklimits with high grounds nevertheless haskno basic influence on'the link betweenjthe ability ofkIT framework and high grounds.

Gasova; and Stofkova; [8] created relevancy that there was a solid relationship between an urbanised knowledge course of action of association and its sections (applications, programming frameworks layers, segments, and so on.). He besides attracted 3 categories of data frameworks coordination like data based mostly mix, process-based coordination, and association based mostly combine which particularly known with government's organization association. sylvia et al. [9] targeting the inadequacy hypothesis of data Systems (IS) and raised that bafflement within which very little hurt will have uneven impact results correspondingly because the estimation of the entire framework which might instigate disproportioned money connected likewise, social harms. There are some key essential main thrusts like types of progress in IS headway, end-client applications, and the basic utilization of knowledge structures will lead associate unmatched manner to utilize associated house the information framework assets of an connection. There are particularly duty-bound wellsprings of data stream and access from a lot of formal sources in Asian country. They besides saw low getting ready rates created certified points of confinement to utilization of non-social sources and channels. Open affiliation will utilize the epic data progressions for unbelievable association and use the focal points very [10]. Pathak et al.; [11] planned that e-association will facilitate not simply ingwiping about befoulment nevertheless in addition in putting in a solid relationship among government and national; Singh et al. [12] affected relevancy that open relationship to will enhance their benefits notably within the success, structure, social security and alternative connected areas by tolerating prodigious data improvements. They in like manner endorse that e-association works out can create essential obligations to enhancing open associations. The inhabitants' e-status is security from because of change, the group action of probabilities for e-reinforce and [e-meeting, and group action of thought. Holliday [13] makes relevancy that e-association advancement is altogether distinctive in East additionally, geographical area, beautiful national qualities and insufficiencies as critical native most distant purpose relating to set up modification. Correspondingly, the ICT is being used by folks with everything taken into consideration divisions in Malaysia for headway of the chance of association particularly giving quality shopper associations and shopper fulfillment. Heeks [14] diagrams 3 key obligations of e-governance: enhancing government method (e-administration), accomplice nationals (e-occupants and e-services), what's a lot of, building outer relationship by analytic important examinations from nations, for instance, the Philippines, Honduras, Chile, and Asian country. As per Bertot; et al. [15], the/limit of monumental data; is to make a lot of association among government, subjects, and differing work environments through e-government associations, straightforwardness, commitment, and transparency. creating define displays that particular models have been created to illumine e-association nevertheless ponder explore on execution of mammoth data for sharp association likewise, sensibility of big data within the inside of the time spent sharp association is up to now lacking.

### III. Methodology

**Research Design:** This examination is abstract in nature; which uses a scientific composition review. The examination primarily revolves around estimations, key drivers, challenges, threats and odds of tremendous information use for adroit organization go into the open division.

Wellsprings info and Search Strategy: an efficient composing review has been done by following the goals of the examination all (figure 1). As incontestable by Rother [16], a productive composition summary is taken into account as a 1 of a form investigate work due to following associate intensive, and systematic method. The examination has been sure to the sensibility of large information for splendid organization visible to everybody associations however moreover applicable for the personal fragment. An expansive review is finished by mistreatment net of science, science facilitate, Scopus and Google specialist, web site and a pair catchphrases like "immense information, information, splendid, organization, government, open, the association" are wont to get the most recent analysis associated with the topic [17]. Fifty-two journal articles, operating papers, and books are evaluated to analysis the harmoniousness of large information for sharp organization and troubles, threats and odds of large data utilization go into the open half workplaces. The data amassing and examination for this examination are done from February to March 2018.

**Data Analysis:** information is explored from completely different perspectives of presidency considering numerous estimations also, pointers for vast information propels execution for splendid organization. a smart model has been created for large information utilization for splendid organization within the open half.

## IV. Dimensions, Opportunity and A Key Driver of Big Data for Smart Governance

### A. The Construct of Massive Information

Colossal information could be a high volume, quick and high assortment of information that sometimes monetarily wise and innovative for growing data, correct elementary administration and most noteworthy yield [18]. it's without delay used as associate umbrella term to clear up diverse information connected technique.

It will type and manage the info, having volume, speed, regard, variety, and truthfulness and redesigning new encounters by connection folks, society, industry, business, and government.

Characteristics of large information

☑ **Value:** usually vast information deals with a high volume of information that is formed by a person, distinctive personal and open affiliations. It can help folks by its distinctive usage of open affiliations.

☑ **speed:** Velocity of information suggests a gentle period of information from specific sources like distinctive government affiliations, long vary relative correspondence goals, besides, personal affiliations.

☑ **Variety:** numerous varieties of information is delivered from diverse sources like substance, numeric, sound, video. These are the standard information compose ordinarily created over the net.

☑ **Volume:** sometimes lots of information is created every day anyway considering regard, all information don't seem to be correspondingly basic. a pair of information could also be saving and basic for open prosperity. large information address distinctive troubles and offers a fitting strategy for essential administration that limits risk and troubles of individuals, society and open association.

☑ **Truthfulness:** Veracity suggests the trust and nature of data designing. large information advancement ought to keep up the standard and trust of information which might help to require associate authentic call by the public chief.

### B. Employments of Massive Information

Once all is claimed in done society half The capability of big information may be adequately employed by the government associations by mistreatment satisfactory strategy through the aggregation, change, and preparing information obtaining from numerous sources [12]. Tremendous information gives a stimulating chance to government associations to process it without ambiguity that facilitate to require a real call, perceiving degradation, criminal and troubles and risks in addition, taking a future call. it's not profitable for open division affiliations like government playing specialists, urban networks and occupants however what is more restorative administrations, and on-line life. Since the government encompasses a very important obligation to deliver and regulating learning. Government could be a purpose of convergence of each making and control learning [27]. on these lines, the governance body can manage it by dismembering large information through examination.

### C. Challenges Associated with Applying huge Information within the Public Division

In spite of the manner that tremendous information has vast potential however within the in the meantime have a pair challenges in its use. Government's associations need to address these troubles advisedly [10]. a pair of information could also be mixed up and also the proportion of information is too sweeping which is able to be extended well ordered. affordable hardware and programming should be dead to manage a substantial live of information. Some attainable troubles for the organization associations are analyzed beneath which can look within the thick of and when utilization of vast information.

#### 1) Privacy and Security

Individuals by and enormous association is focused around anchoring the assurance and security of the topic. that's the rationale the government association encompasses alstrict run and clean farthest purpose of using people's data. The organization workplaces ought to be well-kept open trust as a protected storage facility [12]. An extra layer of unconventionality could also be looked by the organization workplaces for data organization the software package engineers center to hack a lot of information from government store. Government office ought to be alert on this issue. A couple government has open information approaches which can cause a stimulating calamity of information by mistreatment dread based mostly unpleasant person or unconditional collecting for singular gain or mistreatment for numerous countries interest [29]. This security issue should be well-kept completely by the government association. The organization should make sure the security of subject's information and can be used for call making, finding criminal, decreasing contamination and social welfare. A protected structure ought to be created at the beginning of the tremendous information development execution.

## **2) Managing and Sharing Information**

Information has 3 crucial qualities viz as certainable, available and usable. offered information is Associate in Nursing improbably fundamental instrument for growing smart economy. Security law ought to be united by the association relationship for party, managing, exploitation and leading data. office utilizes tremendous data examination for selecting a selection quickly. It ought to be sans devastate, total and accessible on date-book for rapidly advantage. Some association operating environments utilize systematic game plans and information for maintaining data progression and straightforwardness within the association affiliations. These days different associations utilize open system that gathers instructional records are offered to folks once all is claimed in done. It broadens joint effort among totally different work environments nevertheless should be done below the security technique. crafty association needs Associate in Nursing anticipated stream of information which can be right, open, ascertainable and usable [3]

## **3) Challenges known with Improvement**

Gigantic data movements were radiated a sway of being surprising in past barely any years. Regardless, currently it makes puts walk by endeavor in each bit. It is at the moment conceivable to manage, storeland dissecting a massvolume of data by virtue of the event of improvement. Bigdata needs increased rigging and programming structure for use once all is claimed in done society zone for get-together, managing, investigating and anchoring data. The innovative inconveniences and dangers should be fastidiously administered by the overseeing body office for obtaining the total smart position from it. huge data improvements need inconsequential effort collection, memory and cloud based strategy with tip high server and stage. Coursed problem solving is noteworthy among varied movements for large data use in folks with everything taken under consideration half. The association workplace can while not a substantial live of a stretch utilize it for adjustable procedure examination. Government affiliations should guarantee enough transmission restrain and interminable examination of data for taking a right selection on time by utilizing cloud condition. The association work environments should try with different within and out of doors working environments for data amendment and most remote purpose difficulties of technology.

## **4) Challenges known with Aptitudes**

As Associate in Nursing in like manner new improvement, large data needs a social event of masterminded employees for managing and leading it. Since it needs a dynamic data of various controls, this business faces a deficiency of data examiner. The government operating environments ought to recruit a person World Health Organization will manage the data exactly in light-weight of the style within which that a touch trip might welcome Associate in Nursing information calamity [12]. Be that because it might, the association operating environments face group action of expert data examiner which can hose the association relationship to urge a handle on this advancement. For obtaining a handle on and keeping up sharp association structure, a get-together of professional individuals is basic to the get-together, overseeing, managing in like manner, managing a huge data for serving to the association in each half and confining the hazard and risk against the government agencies.

## **Elliptic- Curve Cryptography**

Elliptic- curve cryptography (ECC) may be a thanks to accommodate open key cryptography obsessed on the mathematical structure of elliptic curves over restricted fields. computer code needs little keys contrasted with non-EC cryptography (in light-weight of plain mathematician fields) to present proportional security.

Elliptic curves are relevant for key assertion, computerized marks, pseudo-irregular generators and completely different errands. in an exceedingly detour, they will be utilized for encoding by change of integrity the key concurrence with a stellate encoding plot. they're likewise utilized in an exceedingly few number resolution calculations obsessed on elliptic curves that have applications in cryptography, for instance, Lenstra elliptic-curve resolution.

Open key cryptography depends on the refractoriness of sure numerical problems. Early open key frameworks are secure expecting that it's arduous to issue a large range created out of a minimum of 2 substantial prime variables. For elliptic-curve primarily based conventions, it's expected that finding the separate index of associate absolute elliptic curve part as for associate overtly acknowledged base purpose is infeasible: this can be the "elliptic curve separate index issue" (ECDLP). the protection of elliptic curve cryptography depends upon the capability to method some extent increase and therefore the failure to

register the number given the primary and item focuses. The extent of the elliptic bend decides the difficulty of the difficulty.

### Algorithm:

ECC (elliptic curve cryptography technique will be used for encryption and decryption of data.

The following are symbols we are used,

E--> Elliptic curve

P--> Point on the curve

n--> Maximum limit (prime number)

Generation of keys:

Keys will be used for the encryption and decryption. Here we are using public key for encryption and private key for decryption. We have to choose a number 's' within range of 'n'. Using following formula we can generate the public key

$$W = s * P$$

Where s = The random number selected within the range (1 to n-1)

P is point on curve.

W is public key and 's' is private key.

### Encryption

Assume 'x' is the data that sensed by the sensor sent to the Geo-social network. Represent this data on curve. Consider 'x' as point 'M' on the curve 'E'. Randomly select 'k' from [1-(n-1)]. Two cipher texts will be generated let be m1 and m2

$$M1 = k * P$$

$$M2 = M + k * W$$

### Decryption:

We have to decrypt the data sent by sensor

$$X = M2 - s * M1$$

Where x is the original message.

### Proof:

$$X = M2 - s * M1$$

'x' can represent as 'M2 - s \* M1'

$$M2 - s * M1 = (x + k * Q - s * (k * P))$$

$$(M2 = x + k * Q \text{ \& } M1 = k * P)$$

$$= x + k * s * P - s * k * P \text{ (cancel } k * s * P)$$

$$= x \text{ (original message)}$$

## V. Estimations and Key Characteristics of sensible Association

### A. Estimations of Sensible Governance Publicly Sector

Insightful association starting late shows up within the sure making that centers the appliance and progress of data and correspondence (ICT) progression within the open parts. It's the concept that for the foremost half begins from the practices of the astounding framework, smart town, and sharp areas, there are four estimations of astounding association viz key estimation, dealing with estimation, between institutional estimations and associated with neighborhood estimations.

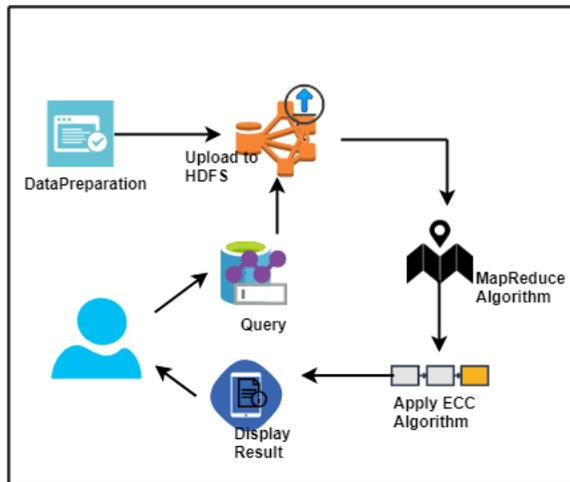
#### 1) Strategic Estimations

Key estimations basically center the farthest purpose of action to work the complicated political difficulties and enough location the inconveniences for staying faraway from any threat. There are 2 normal qualities of basic estimation like key affectability and quality ability [34]. Basic affectability centers affiliations capability to acknowledge any risk also, readied to deal with it. Open work environments should be done an examination of the conceivable risk, inconveniences, and dangers and make fitting move. Off kilter, this selection should be in context of the trustworthy knowledge. Obviously, asset flexibility is that the edge of state relationship to move apace and dispense a broad assortment of basic assets. The vantage task should be engineered au courant would like need and accomplishing for presidency objectives. Quality ability in addition spins around human and cash connected assets for accomplishing governments target and goals.

Key affectability should be accomplished by traditional checking of the extraordinarily accommodating estimation of dangers and difficulties proof base basic selection and fastest basic specialist. On the opposite hand, assets ability is assessed dependent on the versatile structure, freedom level of state and human asset association framework.

## 2) Networking Estimation

System estimation primarily spins round the correspondence among completely different foundations and regions which might contribute to accommodating basic activity subject to open definitive problems and reliable knowledge for accomplishing AN institutional anticipated result. Power sharing could be a basic piece of structures association estimations, at any rate it depends upon the position, fitness, and correspondence. There are 3 attributes of orchestrating estimations like helpful association, joint effort stage, and offers commitment. helpful association is an essential space of structures association estimation, which goes concerning as AN help among numerous accessories. Joint effort and coordination are the vast undertakings of government affiliations [35]. Marvelous association provides a office to a group all the connected assistants underneath association arrange. Shared responsibility could be a trademark of sensible association that interface with completely different accessories in making trust, sharing duties and commitments. helpful pro is refined by pioneer's ability show joint effort and obligation of associates. Joint effort stage is motivated by masterminding key system subject to accord, trust, data trade and accessory's commitment. Shared duty as for sharp association is master by building trust, shared commitment, and shared comprehension.



**Figure 1:** Architecture of Proposed System

## Results & Analysis

To analyze the proposed system we are using the dataset which can contain the various information like Environment & RTO information. We are analyzing the all data. The analysis is conducted based on the user searching for which particular event.

## VI. Conclusion

This examination endeavors to appear into the honorableness of tremendous data movements for sharp association once all is claimed in done society work environments. It is basically controlled by the examination gap between the hypothetical uncertainty of tremendous data application and thusly its execution for sharp association within the open division. This examination endorses a wise model that clear up however data are collected from completely different sources and looked for when a development of the technique by maintaining a particular marker that clears up the estimation of the quality of the structure. It in addition clears up the lead to the wake of following a game-plan of methods. This examination uncovers that monstrous data has truth be told Brobdingnagian potential for fast association in folks once all is claimed in done zone despite however it's still in its shrouded stage. The government operating environments will while not lots of a stretch enhance its open association development, commonplace

heads, approach selecting selection, and other respect further associations to the national by holding associate large extent with applying large information examination. Regardless, the security of the topic should be maintained out and out and require based mostly to limit the risks, dangers, and inconveniences. This examination in addition appearance into that the overall open segments affiliations are not fully masterminded to induce a handle on this headway in perspective of the inadequacy of the data, lack of protection, and group action of good thing about the administrators and policymakers. It recommends that every government office ought to get a handle on the large data progression for decreasing corruption, risk and challenges and increasing capacity, commitment and simplicity which can facilitate to land up themselves immediate, reliable and hasslefree open affiliations. Information security alludes to the approach toward shielding data from unapproved access and data uncleanness for the duration of its lifecycle and we are using ECC algorithm to protect the data. Data security incorporates data cryptography, tokenization, and key administration that guarantee data over all applications and stages.

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## **Automatic Heart Disease detection using machine learning Algorithms**

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**ABSTRACT:** *The data mining is a process of discovering relationships among data in datasets automatically. It is also used for predicting relationships in the results discovered. Data mining is widely used in various applications such as business organizations, e-commerce, and health care industry, scientific and engineering for predicting and discovering relationships among data. In the health care industry, the data mining is mainly used for Disease Prediction. The objective of work is to predict the diagnosis of heart disease with reduced number of attributes from MRI scanned images. The extracted fourteen attributes from MRI image is used in predicting heart disease. By using attribute reduction techniques, the fourteen attributes are reduced to six and by SVM classifier achieved an accuracy of 93% with all 13 attribute and J48 classifier achieved 87% with six attributes in the prediction of disease.*

**Keywords:** *Data mining, machine learning, Heart Disease detection.*

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### **1. Introduction**

Heart disease is a set of diseases that affect the human heart and blood vessels. The symptoms of heart disease vary depending on the specific type of heart disease [7]. Detecting and diagnosing heart disease is a time consuming work which a professionally qualified medical expert can do with enough knowledge and experience. There are many factors like age, diabetes, smoking, overweight, diet of junk food etc. will increase risk of heart disease. A set of factors/parameters identified that causes heart disease or increase the possibility of heart disease.

It is common now that many hospitals have management software to manage their healthcare and/or patient data [6]. These systems generate huge amounts of data as patient records. These data are rarely used for the support of clinical decision making [6]. These data are valuable and information is hidden in these data that are largely unused. To transform the stored clinical data into useful information that can enable healthcare practitioners to make intelligent clinical decisions supporting system is a challenging work. This factor motivated to do a research work on medical image processing.

Heart disease, detection using data mining is one of the challenging tasks [8]. The shortage of specialists and number of wrongly diagnosed cases has necessitated the need to develop a fast and efficient automatic detection system. The main objective of this work is to identify the key features from the medical data using the classifiers model and apply model to predict heart disease early..

### **II. Literature Survey**

Numerous works in literature related to diagnosis of Heart disease

In 2014, M.A. Nisha R Banu B. Gomathy [2] has published a research paper "Disease Forecasting System Using Data Mining Methods." In that, the preprocessed data is clustered using clustering algorithms as K-means to cluster relevant data in a database. Maximal Frequent Item set Algorithm (MAFIA) is applied for mining maximal frequent patterns in heart disease database. The frequent patterns can be classified into different classes using the C4.5 algorithm as training algorithm using the concept of information entropy. The result demonstrates that the designed prediction system is capable of predicting the heart attack successfully.

In 2012, T. John Peter and K. Somasundaram [3] have presented a paper, "An Empirical Study on Prediction of Heart Disease is using classification data mining technique." In that research, the use of pattern recognition and data mining techniques is used for predictions of risk in the clinical domain of cardiovascular medicine is proposed here. Some limitations of the traditional medical scoring systems are that there is a presence of intrinsic linear combinations of variables in the input set and hence they are not skilled at modeling nonlinear complex interactions in medical domains. This limitation is handled in this

research by use of classification models which can implicitly detect complex nonlinear relationships between independent and dependent variables as well as the ability to detect all possible interactions between predictor variables.

In 2012, Feixiang Huang, Shenyang Wang, and Chine-Chung Chan[5] have presented a paper, "Predicting Disease by Using Data Mining Based on Healthcare Information System." In that research, an author had proposed the data mining process to forecast hypertension from patient medical records with eight other diseases. Our focus on data mining is to extract hidden rules and relationships among diseases from a real whorl Healthcare Information System using Naive Bayesian and J-48 classifiers.

### III. System Design

The proposed automatic system for heart disease detection consist of four stages, Pre-processing of input, Attribute Selection and Features extraction, Training the classifier and testing of trained model by test data as shown in Figure 1.

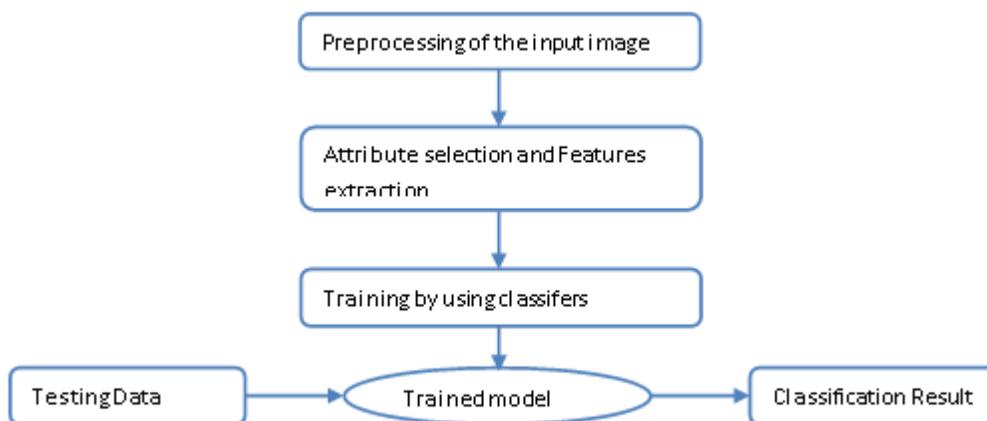


Figure 1: Proposed System design

The data-set used for training and testing is taken from UCI Machine Learning Repository. It consists of 573 patients' records and each record consists of 14 parameters. The data base is publicly available in the address <http://archive.ics.uci.edu/ml/datasets/Heart+Disease> [1]. UCI directory contains 4 databases concerning heart disease diagnosis. All attributes are numeric-valued.

#### 3. 1 Preprocessing and Attributes Selection:

The attribute is a parameter used for the detection of heart disease. The proper selection of proper attributes is essential for the quality of the system being developed. The classification ability of the classifiers directly depends on the parameters selected.

In this work, there are the 13 attributes that are being used. The relevant attributes used for the detection of heart diseases are listed below [1],

1. Age: Age in years. It is the number one risk factor for heart disease.
2. Sex: Sex or Gender is used to differentiate between Male and Female Patients. (1=Male, 0=Female).
3. Chest Pain: Angina is chest pain or discomfort caused when your heart muscle doesn't get enough oxygen-rich blood. It may feel like pressure or squeezing in your chest. The discomfort also can occur in your shoulders, arms, neck, jaw, or back. It is caused due to the Reduced blood flow, There are four types of chest pain considered 1 is typical angina, 2 is atypical angina, 3 is non-anginal pa, 4 is asymptomatic.
4. Blood Pressure: Blood pressure (BP) is the pressure of circulating blood on the walls of blood vessels. Used without further specification, "blood pressure" usually refers to the pressure in large arteries of the systemic circulation. Blood pressure is usually expressed in terms of the systolic pressure over diastolic pressure and is measured in millimeters of mercury (mmHg), above the surrounding atmospheric pressure Blood pressure that is low due to a disease state is called hypotension, and pressure that is consistently high is hypertension. The normal range of BP is 120/80. Resting blood pressure (in mm Hg).

5. **Cholesterol:** It builds up in the walls of your arteries, causing a process called atherosclerosis, a form of heart disease. The arteries become narrowed and blood flow to the heart muscle is slowed down or blocked. The blood carries oxygen to the heart, and if not enough blood and oxygen reach your heart, you may suffer chest pain. If the blood supply to a portion of the heart is completely cut off by a blockage, the result is a heart attack. The normal range is 100mg/dL.
6. **Fasting Blood Sugar:** Fasting Blood Sugar of above 100 increases risk heart disease by 300%. >people with a fasting blood sugar level of 100-125mg/dl had an adjusted nearly 300% increase higher risk of having coronary heart disease than people with a level below 79mg/dl. It measures the sugar level in blood before food.
7. **ECG:** ECG is used to access your heart rhythm, diagnose poor blood flow to the heart muscle, diagnose a heart attack and evaluate certain abnormalities of your heart, such as an enlarged heart.
8. **Thalalch:** Heart rate is a familiar and accessible clinical variable. It is the maximum heart rate achieved.
9. **EXANG:** Heart works harder when you exercise or experience emotional stress. It is an exercise induced Angina. It is the excessive heart rate.
10. **Old Peak:** It is often a sign of myocardial ischemia, of which coronary insufficiency is a major cause. ST segment depression and T-wave changes may be seen in patients with unstable angina. It is a measure of ST segment.
11. **Slope of ST Segment:** The ST segment shift relative to exercise-induced increments in heart rate, the ST/heart rate slope, has been proposed as a more accurate ECG criterion for diagnosing significant coronary artery disease. It is the segment abnormality.
12. **Thallium:** A thallium stress test is a nuclear imaging test that shows how well blood flows into your heart while you're exercising or at rest. This shows how well blood flows in your heart. It values are normal-3, fixed defect-6, reversible defect -7.
13. **Vessels Colored:** It shows the major vessels color by fluoroscopy, the values range from 0-3.
14. **Class:** There are two value for class attribute representing the patient record have heart disease or not.

### 3.2. Selection of Classifiers

There are many well-known machine learning algorithms used classification purpose. The classifiers selected for classification of the patient records are J48, NAÏVE BAYES, PART and SVM.

### 3.3 Issues and Challenges

Some of the challenges faced during the development of the system are as follows:-

- The unavailability of the heart patient data set
- Deciding the parameter for the detection of heart diseases
- Selecting proper the parameters for Classification
- Selecting the correct classifier to get best accuracy for a given input

## IV. Implimentation

Weka is used for implementation. The java code is integrated with algorithm provided by Weka [11]. The input datasets are in arff (attribute relation file format). In this work the classifiers used as J48, NAVIE BAYES, SVM and PART to classify the patients having hearts disease and not by analyzing the attributes such as age, sex, blood pressure and blood sugar for chances of a patient getting heart disease etc. The data is analyzed and implemented in WEKA ("Waikato Environment for Knowledge Analysis") tool. It is open source software which consists of a collection of machine learning algorithms for data mining tasks [11]. Weka tool is a collection of machine learning algorithms for data mining techniques, written in Java [11]. The ten folds cross validation is used to minimize any bias in the process and improve the efficiency of the process. The source code for the classifiers PART, NAVIE BAYES, SVM and J48 are taken from WEKA for the implementation of the system. The results show clearly that the proposed method performs well compared to other similar methods in the literature.

The overall working procedure of the system is as shown below,

**Input:** Heart disease data set in numerical format(arff format)

**Output:** Classification of data set into patients with heart disease and normal

**Procedure:**

Step 1: Read the data set in arff format.

```
BufferedReader datafile = readDataFile("heart.arff")
```

Step 2: Apply pre-processing techniques-Fill in missing values

Step 3: Apply the features reduction technique to identify the most relevant features and store separately

Step 4: Discard redundant features

Step 5: Apply J48, Naïve Bayes, SVM, and PART on both data sets. Original feature set and reduced feature set

```
Classifier[] models = { new J48(),
```

```
new PART(),
```

```
new NaiveBayes(),
```

```
new LibSVM()};
```

Step 6: Measure the performance.

Step 7: Accuracy: It is the number of instances being correctly predicted.

Precision: It is the fraction of relevant instances among the retrieved instances.

(Precision = TP/TP+FP)

True Positive [TP]: The presence of disease is correctly predicted by the machine.

True Negative [TN]: The absence of disease is correctly predicted by the machine.

False Positive [FP]: The absence of the disease in the patient is predicted as present by the machine.

False Negative [FN]: The presence of the disease in the patient is predicted as absent by the machine.

Recall: It is the fraction of relevant instances that have been retrieved over the total amount of Relevant instances. (Recall = TP/TP+FN)

## V. Results and Discussion

### 5.1 Performance based on attributes selection

Keeping in view the goal of this study to predict heart disease using classification techniques and have used four different supervised machine learning algorithms i.e., J48, PART, Bayesian Classifier and SVM (Support Vector Machine). Four machine learning algorithms used for this work and two types of data sets were considered, one with all 573 patients records each record contain 13 attributes, the other dataset is all 573 records in which each records containing 8 selected attributes.

The performances of the models in this study were evaluated using the standard metrics of accuracy, precision, recall and F-measure which were calculated using the predictive classification table, known as Confusion Matrix. ROC area was also used to compare the performances of the classifiers. The classification ability of the algorithm is tested by using 10 fold cross-validations. The table 5.1 summarizes the classification results of all categories of experiments.

Table 5.1: Performance of various classification algorithms

Model	Accuracy	TP Rate	FP Rate	Precision	F-Measure	ROC Area
J48 with all attributes	90%	0.902	0.102	0.902	0.902	0.946
J48 with selected attributes	87%	0.878	0.131	0.879	0.8777	0.909
Naïve bayes with all attributes	84%	0.843	0.849	0.849	0.847	0.902
Naïve bayes with selected attributes	83%	0.839	0.173	0.839	0.837	0.889
PART with all attributes	91%	0.911	0.88	0.911	0.911	0.964
PART with selected attributes	84%	0.843	0.165	0.843	0.842	0.880
SVM with all attributes	93%	0.811	0.088	0.911	0.911	0.964
SVM with selected attributes	84%	0.846	0.160	0.846	0.846	0.843

In table 5.1 it is clear that J48 tree classifier which was implemented on selected attributes achieved the highest accuracy (87%) while J48 tree classifier with all attributes came out to be a close second with classification accuracy of 90%. On the other hand, Naïve Bayes classifier implemented on both selected attributes and the whole set of attributes scored the lowest classification accuracy which are 84% and 83% respectively, The PART classifier implemented on both selected attributes and the whole set of attributes scored the classification accuracy of 91% and 84% respectively. The LibSVM classifier performed well with whole set of attribute 93% but with selected attribute achieved only 84%

The other performance measures used to compare the results are TP Rate (Sensitivity) and TN Rate (Specificity). Here again all the models scored well with a tight difference in performance. The TP Rate and FP Rate were (TP Rate, TN Rate) = (0.902, 0.102), (0.878, 0.131), (0.848, 0.162), (0.838, 0.173), (0.911, 0.088), (0.843, 0.165), (0.911, 0.088), (0.846, 0.160) for J48 unpruned with all attributes, J48 pruned with all attributes, Naïve Bayes with all attributes, Part and LibSVM with all attributes, J48 unpruned with selected attributes, J48 pruned with selected attributes, Naïve Bayes with selected attributes, Part and LibSVM with selected attributes, respectively.

From the table 5.1 SVM library LibSVM has the highest Accuracy that is 93% with all the attributes provided whereas J48 has the highest accuracy of 87% with the selected number of attributes.

## VI. Conclusion

In this research work we have applied machine learning algorithms in heart disease detection. The work has been tested on a datasets collected from UCI Machine Learning Repository. The dataset consist of 573 patient records and 13 parameters in each record. Four different classifiers were studied, and the experiments conducted to find the best classifier for predicting heart disease. Among the several classifiers SVM produced the best accuracy about 93% with an input of 573 patient's records and 13 attributes in each record. The experimental results gained a precision of 91.1% for the diagnosis. The overall purpose is to study the various machine learning methods available to predict the heart disease and to compare them to find the best method of prediction.

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# Execution of QoS for Hybrid Wireless Networks Based On Oriented Diffuse Routing Protocol

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**ABSTRACT:** *With the expanding dimension of remote correspondence in the present condition, individuals frequently required QoS for sharing their information between the hubs. we propose a Secure QoS-Oriented Diffuse steering convention (SQOD) to overhaul the protected Quality of Service (QoS) directing in Hybrid remote systems. SQOD contain two inventions: 1.QoS-Oriented Diffuse Routing Protocol (QOD)- to lessen transmission delay, transmission time. And furthermore increment remote system transmission throughput. 2. Upgraded Adaptive Acknowledgment (EAACK)- actualize another interruption recognition framework for Cross remote systems. Explanatory and reproduction results dependent on the irregular way-point model and the genuine human versatility model demonstrate that QOD can give high QoS execution as far as overhead, transmission delay, portability flexibility, and adaptability*

**Keywords:** *Quality of Service, routing, cross wireless networks, delay, bandwidth, Cross wireless networks, multi-hop cellular networks, routing algorithms, quality of service*

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## 1. Introduction

The future advancement of remote systems has animated various remote applications that have been utilized in wide territories, for example, crisis administrations, instruction, trade, military, and excitement. It improved innovation and diminished costs, remote systems have increased substantially more inclinations over wired systems in the previous couple of decades. These days, individuals wish to watch recordings, play amusements, sit in front of the TV, and make long separation conferencing by means of remote cell phones –on the go.|| The across the board utilization of remote and cell phones and the expanding interest for portable interactive media gushing administrations are prompting a promising not so distant future where remote sight and sound administrations (e.g., versatile gaming, online TV, and online gatherings) are generally sent. The rise and the imagined eventual fate of ongoing and interactive media applications have invigorated the need of high caliber of Service (QoS) support in remote and versatile systems administration situations. The QoS support decreases start to finish transmission deferral and upgrades throughput to ensure the consistent correspondence between cell phones and remote foundations. Crossover remote systems have been ended up being a superior system structure for the cutting edge remote systems, and can handle the stringent start to finish QoS prerequisites of various applications.

Half breed organizes synergistically join foundation systems and MANETs to use one another. In particular, framework systems improve the adaptability of MANETs, while MANETs naturally set up self-sorting out systems, expanding the inclusion of the foundation systems. In a vehicle entrepreneurial access organize (an occurrence of half and half systems), individuals in vehicles need to transfer or download recordings from remote Internet servers through passageways (APs) (i.e., base stations) spreading out in a city. Since it is far-fetched that the base stations spread the whole city to keep up adequately solid flag wherever to help an application requiring high connection rates, the vehicles themselves can shape a MANET to expand the inclusion of the base stations, giving ceaseless system associations. Portable Ad hoc Network (MANET) is a gathering of versatile hubs outfitted with both a remote transmitter and a collector that speak with one another by means of bidirectional remote connections either legitimately or by implication. Modern remote access and control by means of remote systems are ending up increasingly more mainstream nowadays. One of the real points of interest of remote systems is its capacity to permit information correspondence between various gatherings and still keep up their portability.

Be that as it may, this correspondence is restricted to the scope of transmitters. This implies two hubs can't speak with one another when the separation between the two hubs is past the correspondence scope of their own. MANET takes care of this issue by permitting middle of the road standard connections to hand-off information transmissions. This is accomplished by isolating MANET into two kinds of systems, in particular, single-jump and multi-bounce. In a solitary jump arrange, all hubs inside a similar radio range discuss

straightforwardly with one another. Then again, in a multi-bounce arrangement, hubs depend on other middle of the road hubs to transmit if the goal hub is out of their radio range. In opposition to the customary remote system, MANET has a decentralized system framework. MANET does not require a fixed foundation; in this manner, all hubs are allowed to move haphazardly. MANET is fit for making a self-arranging and self-keeping up system without the assistance of an incorporated framework, which is regularly infeasible in basic mission applications like military clash or crisis recuperation. Negligible arrangement and fast organization make MANET prepared to be utilized in crisis conditions where a framework is inaccessible or unfeasible to introduce in situations like characteristic or human-incited calamities, military clashes, and therapeutic crisis circumstances.

In this paper, we center around the neighbor hub determination for QoS-ensured transmission. QOD is the main work for QoS steering in crossover systems. This paper makes five commitments. QoS-ensured neighbor determination calculation: The calculation chooses qualified neighbors and utilizes due date-driven planning component to ensure QoS steering. Disseminated parcel booking calculation: After qualified neighbors are distinguished, this calculation plans bundle steering. It allots prior created parcels to forwarders with higher lining delays, while doles out more as of late produced bundles to forwarders with lower lining deferrals to decrease absolute transmission delay. . Portability based section resizing calculation: The source hub adaptively resizes every parcel in its bundle stream for each neighbor hub as per the neighbor's versatility so as to increment.

## II. Literature Review

In writing a few writers proposed an asset arrangement technique in half breed systems demonstrated by and portable WiMax to give administration high unwavering quality.

IntServ is a stateful model that utilizes asset booking for individual stream, and uses affirmation control [8] and a scheduler to keep up the QoS of traffic streams. In contrast, DiffServ is a stateless structure which utilizes coarse grained class-based contraption for traffic the executives.

Lining planning calculations have been proposed for DiffServ to additionally limit parcel droppings and data transmission utilization [9]. Stoica et al. [10] proposed a dynamic bundle administration (DPS) model to give unicast IntServ-ensured administration and DiffServlike adaptability.

In existing methodologies for giving ensured benefits in the foundation systems depend on two models: coordinated administrations (IntServ) and separated administration (DiffServ). Very couple of techniques have been proposed to give QoS guaranteed steering to half and half systems. A large portion of the directing conventions just endeavor to improve the system limit and dependability to in a roundabout way give QoS administration yet sidestep the imperatives in QoS steering that require the conventions to give ensured administration. Jiang et al. [11].

proposed an asset arrangement strategy in half and half systems demonstrated by IEEE802.16e and versatile WiMax to give administration high unwavering quality. Ibrahim et al. [12] and Bletasa et al. [13] additionally attempted to choose "best" hand-off that has the greatest prompt estimation of a metric which can accomplish higher transfer speed effectiveness for information transmission. Ng and Yu [14] considered agreeable systems that utilization physical layer transferring procedures, which exploit the communicate idea of remote channels and enable the goal to helpfully "consolidate" signals sent by both the source and the hand-off to reestablish the first flag.

## III. Problem Definition

The issue in the current framework is characterized in the terms of solid information conveyance of information transmission in exceedingly unique versatile mixture systems [20]. Consistently changing system topology makes customary remote steering conventions unequipped for giving attractive execution in the information exchange condition. Even with successive connection break in light of the hub versatility, real information parcels would either get lost, or learning long idleness before restoration of network. In Dynamic system topology the issues were

- Visit interface break
- Dormancy and Data misfortune
- High portability

Crossover remote system topologies as a rule uncover high connection thickness. Low-end item switches are normally utilized in many HWNs structures for financial and versatility contemplations. Versatile goals (hubs) make a difficult issue for QoS conventions. A few conventions managed the above issue by applying

district based throughput and postponement [21, 22]. Be that as it may, those frameworks neglected to manage the high portability in HWN condition.

#### IV. Proposed Work

In this paper we investigate fundamental calculation is Diffuse Adaptive Opportunistic Routing Algorithm [2] [13]. The general impact of sharp planning calculation performs well parcel transmission with the unusual remote medium than the EDF (Earliest Deadline First) need calculation. It incorporates following prospects.

##### A. Broadcasting Algorithm for Opportunistic Routing

In this calculation accept that there are  $\pi_i$  set of neighbors and a hub I itself.  $R_i$  mean the arrangement of tolerating hubs results on account of transmission from hub I the steering choice whenever of occurrence depends on the tolerant outcome and included Re-transmission, choosing the following middle of the road or end hub. The decisions are made in a communicate mode embracing three strategies handshaking among hub I and its neighbor hubs.

1. At time  $t$  hub I was sending a parcel. The arrangement of hubs  $\pi_i$  who has effectively acknowledge parcel from hub I sending affirmation (ACK) bundle to hub I.
2. The affirmation parcel of hub includes a direction message called as Approximated best grade (ABG).
3. In third strategy the hub I announce hub  $k$  as the following sender pronounce end determination in a sending parcels.

There are four constituents of the calculation: 1) Initialization State: Initialize every one of the hubs which are utilized in Cross remote system. 2) Packet Transmission State: This state turns out at time  $t$  in which hub I sending in the event that it has bundle for transmission. 3) Response and Recognition State: here  $\pi_i$  speak to the arbitrary arrangement of hubs that have acknowledge the bundle transmitted by hub I. in this state effective acknowledgment of the parcel transmitted by hub I is recognized to it by every one of the hubs in the  $\pi_i$ . The postponement for the affirmation state is little (not more prominent than the term of the schedule opening). Henceforth hub I infers  $\pi_i$  by time  $t$  for every one of the hubs the ACK bundle of hub  $k$  to hub incorporates the ABG message. Upon Response and Recognition estimating irregular variable  $N_n$  is augmented. 4) Intermediate State: in this state hub I select directing procedure according to randomized strategy parameterized by sending likelihood. the hub I sending control bundle which having data. about directing choice sooner or later of occasions absolutely between two interims. endless supply of steering process the estimating variable is refreshed. 5) Adaptive Computing State: it is happen at time  $(t+1)$ , in the wake of being finished with sending and intermediating, hub I update score transmitter. Hub I refreshes its ABG message for succeeding affirmation.

##### B. Functioning of Opportunistic Routing Algorithm.

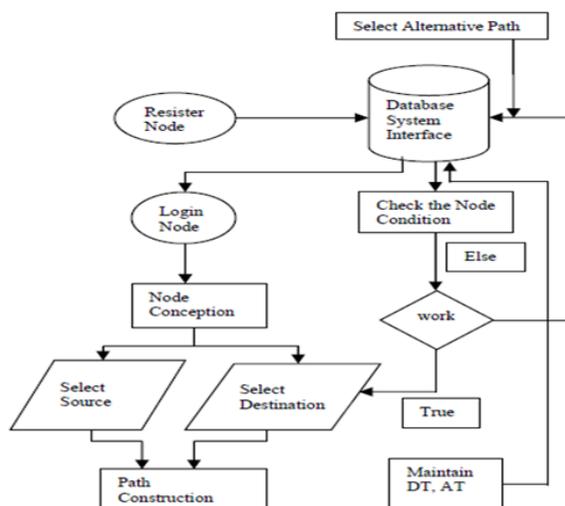


Fig. 1 Different States for Opportunistic Routing

As indicated by Figure 1 following are principle elements of Algorithm,

1. Procure the enrollment data of the hub. Execute hub login process.
2. Hub is made. Acknowledge the record to be sent.
3. Select the procedure where source, goal and way development is finished.
4. The Downward Time (DT), Aliveness Time (AT) are held.
5. On the off chance that the presence of hubs not exactly effective likelihood of information transmission, at that point select the elective way. The accompanying advances are led while working with calculation.

### C. Directing Analysis

In this segment steering examination is made by various pioneering calculation plans [13]. At the point when hub begin to send parcel it will trigger the calculation for scanning the better sending hub for send the information. This includes choice of middle hubs that was gotten and recognized parcel data effectively. All hub to hub bundle transmissions are executed inside after course situations.

1. Route Details.
2. Route Maintenance.
3. Data Transmission Flow.

### V. Simulation Approach

In this area we give recreation thinks about in reasonable half and half remote setups. These reenactments perform under QoS-Oriented AEER in a reasonable system. We initially dissect execution of sharp steering regarding the structure parameters and system parameters in a network topology of 16 hubs. This execution contrast and QoS Oriented AEER proposed calculation. Our proposed calculation mimic in NS-2.35, in this we think about two arrangements of topologies.

**1. Grid Topology:** we think about a lattice topology including 16 inside hubs to such an extent that the closest neighbors are isolated by separation  $D$  meters. **2 Random Topology:** in this topology including 32 inside hubs set in a zone  $150 \times 150$  m<sup>2</sup>. We discover the execution under various source and different goal setting as the quantity of blemishes in the system is shifted.

### A. Network Simulation and Performance Evaluation

In this paper we utilize suitable alternatives of the structure parameters which help to improve organize execution. The proposed calculation utilized after reenactment parameters. For estimation of proposed calculation ends three execution measurements are utilized.

#### 1. Parcel Delivery Ratio (PDR)

It is the proportion of the absolute number of acknowledges parcels at the goal to the all out number of bundles sent by the source. It encourages us to record the no of fruitful bundle transmissions.

$$PDR = \frac{\sum \text{Received Packets at destinations}}{\sum \text{Sent packets by Sources}}$$

#### 2. Routing Overhead (ROH)

It is the ratio of Routing related packets in bytes to the total routing and data transmissions in bytes. Routing packets include information is the RREQ-Routing Request, RREP Routing Reply, RERR- Routing Error, AACK-Routing Acknowledgment.

$$ROH = \frac{\sum \text{Routing Transmissions}}{\sum \text{Data Transmissions} + \sum \text{Routing Transmission}} \quad (5)$$

#### 3. Average End-to-End Delay (AED)

It is the average end-to-end delay for all successfully received packets at the destination.

$$AED = \frac{\sum N1 (T \text{ Received} - T \text{ Sent})}{N} \quad (6)$$

Where  $T$  Received = received time at final destination.  $T$  Sent = sending time of the packet from source and  $N$  = is the number of successfully received packets.

## VI. Simulation Results

In this section we display the comparative conclusions of Opportunistic routing algorithm and QoS- Oriented AEER algorithm.

### A. Performance Comparison of Proposed Work under Cross Wireless Network

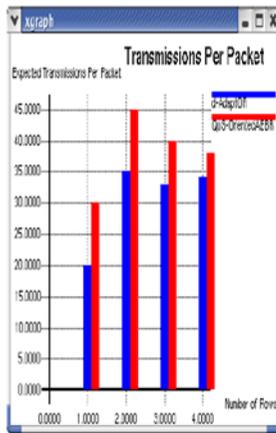
TABLE II. COMPARISON OF HYBRID WIRELESS NETWORK PROPERTIES

Sr. No.	Desirable Properties of Hybrid Wireless Network	Neighbor Node Selection	Neighbor Node Selection
		Opportunistic Routing Algorithm	QoS-Oriented AEER Algorithm
1	Distributed Operation	Possible	Highly Possible
2	End-to-End Delay	More	Less
3	Security	High	Very High
4	Scalability	Low	Normal
5	Bandwidth Constraints	Adaptive	Adaptive and recognition of failure node
6	Energy Constraints	Normal	Medium
7	Mobility	High	Very High
8	Link Capacity	Opportunistic Routing	Opportunistic Routing with cut detection

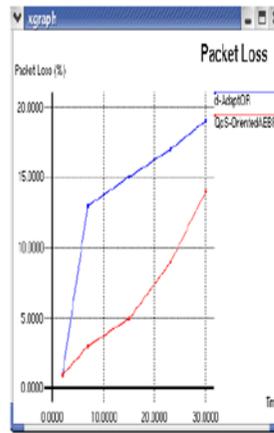
Here we watch the proposed calculation results dependent on the improvement of the system execution. Graphically we are appearing in NS-2 recreation it is conceivable to watch every one of the three execution measurements assessed inside 50 and 70 hubs as for Time. Because of cut discovery module in this calculation we guarantee about our transmitted parcel never goes on fizzle whenever chose hub isn't in administration this strategy chooses elective way to next working hub and sending the bundle to next chosen hub. Consequently bundle misfortune transmission rate is limited and boost the throughput of the half breed remote system. All QoS parameters PDR, AED, ROH, bundle misfortune measure concerning Time in terms.

TABLE III. MEASUREMENT OF ROUTING OVERHEAD

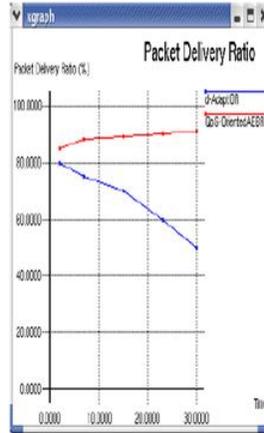
Parameters	Data frame	Control packets	Total
Opportunistic Routing	0.08 ms	0.01 ms	0.09 ms
QoS-Oriented AEER	0.009 ms	0.004 ms	0.013 ms



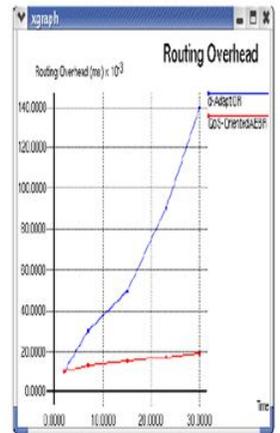
a. Number of Transmissions per packet



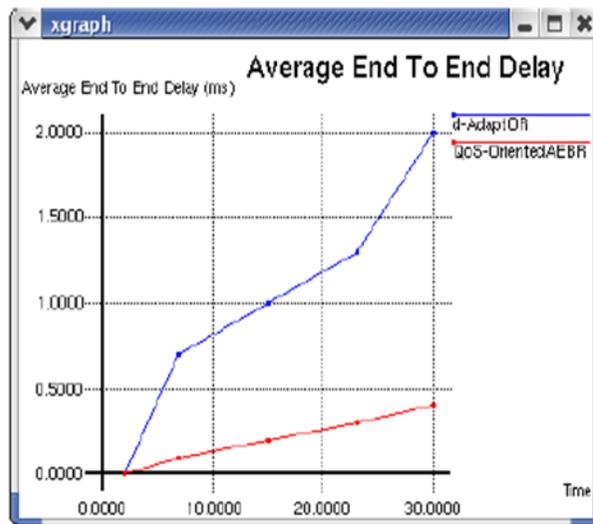
d. Representation of Minimum Packet loss in proposed work due to cut detection



b. Higher Packet Delivery ratio than Opportunistic routing



e. Minimum Routing overhead than Existing System



c. Measure Minimum End-to-End delay in QoS-Oriented AEBR

## VII. Conclusion and Future Work

In this paper QOD give QoS benefits in a dynamic arrangement organize situation. According to QOD convention The QoS-ensured neighbor choice calculation chose for the choice of neighbors for parcel transmission. The Opportunistic Routing Algorithm powerfully courses bundles with least overhead. Be that as it may, this astute plan does not give the instrument of disappointment hub identification. Our proposed calculation furnishes system to course the parcel with cut identification technique, which improves bundle conveyance proportion and system execution. Location of the disappointment set of hubs increment throughput proportion of crossover remote system. Additionally serves to lessens start to finish postponement of Network. As a future work, gathering the Advance shrewd plans together to improvement the execution of the proposed Algorithm QoS-Oriented AEBR will be examined.

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# **An Authentication Strategy using AES and SHA for Banking Transactions**

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**ABSTRACT:** *Authentication plays an important role in securing online banking system, and many Banks and various services have long relied on username/password combinations to verify users. Remember usernames and passwords for many accounts will be heavy and inefficient task. Over the years, data breach reports have indicated that attackers have created many advanced techniques to steal user credentials that can pose a serious threat. In our proposed system we exploit dynamic authentication credentials along with user-centric access control to solve the static credential problem.*

**Keywords:** *authentication; securing; online banking; username/password; dynamic credentials ; data breach; attackers; static credential*

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## **1. Introduction**

Traditional verification patterns such as the user-name/password combinations pose a serious danger to the online banking services, financial systems, and their users. To safeguard the online assets, information security plays a major role in providing appropriate levels of assurance of Confidentiality also known as Privacy, Authenticity, Integrity, and Non-Repudiation. These properties are sometimes referred to as PAIN as per the initial letters of each name. Most current verification systems assign or allow a user to choose a static and unique user id that acts as a label. This static label is typically attached to the user for a long time. Inopportunately, users tend to use the same user id in many different websites and systems. Furthermore, many users continue to use the same password across online accounts and systems. According to study many users reclaim the same password across different websites. This common practice might lead to security risks such as insider attacks. Malicious administrators or insiders, who have access to username and password tables, can leverage the information to access other services and websites.

This paper, will determine how smart personal device can enrich not only security but also user experience by proposing a one-time username authentication coupled with secure verification code for each login session. The user does not have to memorize many usernames or recall difficult passwords. The design and implementation of a novel scheme that incorporates encryption and signature without requiring users to remember usernames and passwords is explained in this paper.. This design provides a better level of security and moderates risks associated with bequest authentication method. Here , introduce the conception of user-centric admittance control, which can play a vital role in authentication and heighten security. In user-centric access control, users are in charge, and they can set their account permission for each login session.

This strategy analyzes the correctness of the proposed authentication scheme and shows its efficiency and feasibility. In particular, it analyzes the security of the introduced authentication scheme from different angles: phishing attacks, password-related attacks, shoulder-surfing attacks, replay attacks, etc. and shown how the design obeys the One-Time Pad (OTP) property for the session key and verification code, which increases the security of authentication. Finally it will evaluate the performance of the proposed authentication scheme in terms of communication or computation overhead.

The objectives of this study are to design a novel authentication scheme using dynamic usernames and to diminish the need for storing user's credentials at a centralized location. We envision that the new design should resist many attacks and issues such as key-logger attacks, shoulder-surfing attacks, data breach incidents, password reuse, and other human factors.

Key-logger attacks are becoming more complex and could target static authentication schemes. A key-logger can be a plug-in hardware device or a software program that acts as a malicious process residing on the victim's computer. The primary goal of using key-loggers is to capture and observe every keystroke typed on the victim's computer, which certainly includes authentication information such as usernames and sensitive passwords. Generally speaking, key-logger software and hardware are not easy to detect, especially on public computers. Some sophisticated key-logger software is rooted in the operating system and does not show up in the task manager process list. Although many countermeasures could mitigate the risk of key-logger attacks, many new issues, tools, and techniques are still evolving [22], [24], [39], [35], [14]. In 2011,

with 80% accuracy, researchers illustrated that it is feasible to capture keystrokes of a nearby computer utilizing the accelerometer found in many smart phones [32]. This result emphasizes the belief that there is no silver bullet solution to tackle the key-logger problem in a username and password system, and it is still necessary to improve the traditional authentication schemes.

Shoulder-surfing is another issue that affects the security of traditional authentication schemes. Shoulder-surfing attacks occur when attackers utilize direct observation techniques such as looking over someone's shoulder or using a hid-den camera to harvest sensitive information. Unfortunately, shoulder surfing is an effective way to target conventional authentication methods and get passwords, PINs, and other sensitive personal information. It is not hard to launch in practice as a shoulder-surfing attack does not require sophisticated knowledge or a high level of experience. Modern authentication schemes should consider the resistance of shoulder-surfing attacks and shrink the attack surface.

Another major driver is the data breaches that have been becoming increasingly sophisticated and daring. Data breaches could have a grave impact on users and financial institutions. Many data breach incidents include the disclosure of usernames and passwords, and several leading experts consider data breaches as one of the biggest security problems faced by security professionals and system administrators. The consequences of a data breach are becoming more and more severe, and it is hard to estimate the damage on the breached organization and the users' accounts in many different online services. In October 2013, Adobe suffered a breach which resulted in the leak of more than 153 million customer records. Each client record contains an internal ID, an email address, a username, and an encrypted password, in addition to a password hint in plaintext [20]. Unfortunately, the password cryptography was poorly designed, and many were easily decrypted to plaintext. Another notable example was the data breach of 13 million user accounts from [www.000webhost.com](http://www.000webhost.com) in March 2015. The leaked data contains names, email addresses, and even plaintext passwords. A malicious attacker could leverage these leaked credentials to target users' online banking accounts and perform malicious activities such as disclosing financial information or even transferring money overseas.

The username/password combo is one of the biggest data breach problems based on a report from Verizon in 2014 [41]. The same report indicated that in 76% of the data breaches, attackers were able to gain accesses by using the stolen user credentials. According to the security firm Hold Security [38], a cyber-gang breached over 420,000 web and FTP sites to harvest more than 1.2 billion credentials; this incident could be one of the largest data breaches reported to the media. All previously mentioned breaches, attacks, and issues could lead to a serious problem called the domino effect of password reuse [25]. A domino effect is the result of one password le falling into the hand of a malicious user, who can then use it to infiltrate other online accounts. Another serious issue of the username/password combo is the large number of usernames and passwords a user should manage on the Internet. The growth of e-banking, e-commerce, and e-government has led to a massive increase in the number of credentials handled by users. Tele-Sign research [40], for instance, reported that an active web user manages an average of 24 passwords on a daily basis. Unfortunately, the same study stated that 73% of the accounts use duplicate passwords. In addition, 68% of the surveyed participants indicated that they wanted online companies to provide a new security solution to secure their personal information. Users are thus poorly equipped on a cognitive level to deal with today's needs for multiple usernames and passwords, which leads to credential reuse on different accounts and systems. Human factors, such as writing usernames and passwords down or choosing passwords that are easy to remember, harmfully affect the security of traditional authentication schemes. These factors motivate us to design an authentication system that is more secure and easy to use. In our proposed design, users are not involved in creating usernames or choosing passwords; furthermore, users are not required to remember or manage a large number of passwords.

## II. Related Work

A large number of schemes focus on the authentication in general [4], [11], [17], [21], [27]. Hiltgen et al: proposed two different authentication protocols for e-banking using short-time passwords and certificates [23].

Gorman categorized user authentication into three categories: knowledge-based (e.g., a password), object-based (e.g., a car key-less entry), and ID-based (e.g., a anger-print) [19]. Brainard et al: [8] explored a fourth factor which is based on the concept of vouching for somebody you know. Recently, the authors in [3] proposed a secure authentication scheme using dual channels in rogue access point environments. Another line of research is more concerned with payment card verification [1], [2], in which the authors utilized

users smart devices in the cardholder verification for payment card systems. Marforio et al: [31] proposed using smart phones as practical and secure location verification tokens for payments at the point of sales. Google Authenticator or 2-Step Verification [18] is a software-based technique that provides a second layer of defense. The application generates two-step verification codes that can be used in addition to the account password. Another widely used technique is RSA Secure ID [9], which is software or hardware token that generates a new verification code (a six-digit number) at fixed intervals. The generated code is based on a seed that is specific for each token and registered with the authentication server. In order to complete successful authentication, the server's clock must be synchronized with the authentication token's built-in clock. Different from existing works, we exploit dynamic authentication credentials along with user-centric access control to solve the static credential problem. Our approach is to introduce one-time usernames utilizing user's smart devices and cryptographic primitives such as encryption, digital signature, and hashing. The goal is to create a unique username and password set for each session such that various security vulnerabilities in conventional, static username and password systems can be tackled.

### III. Research Methodology

#### 3.1 Models

##### A. System Model

As shown in Fig. 1, our system model consists of two major entities: client and server. The client side includes the registered devices and the user's terminal. In the following, we briefly summarize the primary functions of each entity.

**Registered devices:** A registered device is a smart personal device such as a smart watch or a Smartphone, and it is able to perform cryptographic operations. Each user needs to register a device with the server in order to get the server's services. A legitimate user should be able to get services from the server without providing a static username and password. In this paper, we assume that the user has already registered a smart device with the server.

**User's terminal:** A user's terminal is an electronic device such as a laptop or a desktop and it is utilized to log in to the server to view or perform transactions.

**Server:** The server belongs to an entity such as a bank, and it is connected with a hardware security module HSM that safeguards the private key and provides crypto-processing. The server distributes its public key and verification code to the clients and provides services.

##### B. Threat Model

In this paper, we assume the semi-honest model [28], in which the server and the clients correctly follow the protocol specification but both attempt to learn as much information as possible. Note that this adversarial model does not involve a powerful attacker who can control the device and access the private key - we leave this consideration in our future research.

#### 3.2. Design Goals

**Correctness:** If both the client and server follow the protocol honestly, the client and server can achieve a correct authentication result.

**Security:** The protocol can protect the privacy of the client's data. On one hand, given the encrypted message, the attacker cannot get the client's original input data. On the other hand, the correct result is also hidden from an attacker.

**Verification:** The client's message and verification code must be successfully verified by the server.

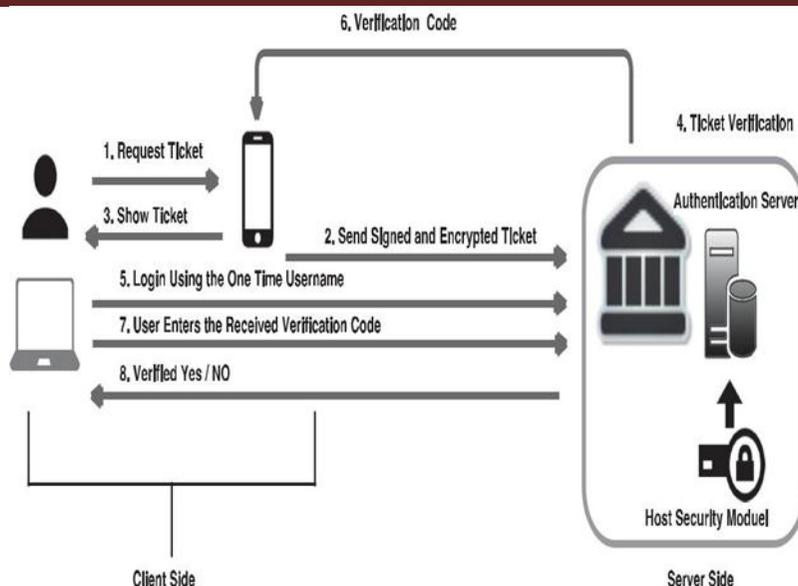


Fig 1: System Architecture

#### IV. Implementations

##### 4.1 Algorithms

###### AES Algorithm

1. Derive the set of round keys from the cipher key
2. Initialize the state array with the block data (plaintext).
3. Add the initial round key to the starting state array.
4. Perform nine rounds of state manipulation.
5. Perform the tenth and final round of state manipulation.
6. Copy the final state array out as the encrypted data (cipher-text).

###### SHA-256 Algorithm

1. Convert the String into bits
2. Message the length of number of bits
3. If the length of number of bits is less than  $N \times 32$  bits then append values of zeros, Final we get a message <data to be encrypted>
4. Divide the entire <data to be encrypted> into 512 bit blocks.
5. Initialize Chaining Variables.
6. The chaining variables what have been used is done even for small letters.
7. The entire 512 bits block is divided 16 sub blocks of 32 bits.

#### V. Result Analysis

This section, analyzes the security of the proposed authentication scheme under different attacks, and shows how the cryptographic primitives and security services utilized in our work can counter these attacks. We assume that the registered device has a secure environment to perform cryptographic computations and the authentication server is secured and is fully compliant with The Payment Card Industry Data Security Standard requirements PCI DSS [37].

##### A. Phishing Attacks

Many phishing attacks are designed to steal credentials such as username and password by masquerading as a trustworthy entity. The proposed authentication can help reduce the risk associated with phishing attacks. In fact, the proposed method is an anti-phishing technique since there is no static username or password. For each authentication session, there is always a new username and password. We consider the proposed design an anti-phishing authentication protocol for the following reasons:

In our scheme, a username is generated to be used within one session by the user, and it is valid for a limited time.

Here use a secure channel for verification and a user-centric access control for authorization. In this scheme, there is no concept of username or pass-word update. Although the proposed method does not prevent phishing, it can help mitigate the risk associated with phishing attacks.

### **B. Password-Related Attacks**

The proposed design provides protection against many password-related attacks such as shoulder-surfing attacks and direct observation attacks. The client is now prevented from using static usernames and passwords that can be recognized by using thermal imaging, or by identifying the pressed keys using a mechanical vibration analysis [2]. Issues such as using the client's birthday as the password, using the same password everywhere, or forgetting the password are avoided since we rely on a set of dynamic username and password that is unique for each login session.

There is no doubt that there is a more subtle risk when a user chooses the same username and password for several servers. Some services and service providers might not be as trustworthy as others; a server administrator or internal employee with high privileges can access the username and password and potentially gain access to user's accounts on other servers. Using the proposed design, the client's device can essentially generate a different set of username and password each time the client tries to authenticate.

### **C. Shoulder-Surfing Attacks**

Using a static username and password combo also suffers from the shoulder-surfing attack, which is commonly used to harvest sensitive information, such as the password [2]. A malicious attacker using different direct observation techniques observes the victim and obtains its credentials. One straightforward method is to look over the victim's shoulder to capture a password. Shoulder-surfing attacks can also be performed long distance away with the aid of vision-enhancing devices. To prevent the risk of shoulder surfing, we use dynamic credentials that are generated and used once so that harvesting login information from victims provides no advantage to the attackers.

### **D. Replay Attacks**

On the client side, a client updates its one-time username and its session key for each authentication request. Also, the ticket expires after it has been used or after a very short period of time. Time stamping along with the User Login List ULL provides an effective way of preventing a replay attack. Notice that the server generates a verification code that is valid for a very short time (e.g. 5 minutes), which is used only once to verify the client's identity. Thus we claim that the server can resist the replay attacks.

### **E. Client Request Protection**

In this scheme, a client's authentication request is signed via a signature, which is secure and can guarantee the authenticity and data integrity of the client's message. The client's authentication request and signature are encrypted using the server's public key based on ECIES. Since ECIES is provably secure in the random oracle model, the confidentiality of the signed and encrypted messages can be guaranteed.

### **F. Server Response Protection**

When the server receives the message that includes the ticket information, the server decrypts the message to get the client's request and signature. Then the server verifies the identity of the client. If it is an unauthorized user, the server discards the ticket; otherwise, the server waits for the user to login. When the user logs in using OTU, the server generates the verification code and encrypts it using the session key, then sends the encrypted verification code to the client. After receiving the encrypted verification code, only the client can decrypt it to get the verification code because  $k$  is the shared session key known only by the client and the server. Therefore during the response procedure, the confidentiality of the response message is ensured.

### **G. One-Time PAD Property**

In the proposed protocol, the one-time username, session key, and verification code are updated for each login session; consequently, they have the property of One-Time Pad (OTP). It is well known that OTPs can guarantee confidentiality. Since the session key, one-time username, and verification code are randomly

generated by the registered device and the server, they are unrelated to any previous session key and verification code. Therefore, an adversary cannot decrypt the ciphered response to any request.

## VI. Conclusion

The extraordinary growth of online banking and e-commerce systems has led to a huge increase in the number of usernames and passwords managed by individual users. Conventional static username and password protocols suffer from various security issues. Many users start using duplicated credentials over and over again in various accounts and systems. Leaking or compromising one account could cause an attacker to infiltrate other systems and endanger users' security and privacy. In this paper, we introduce a new authentication model that allows users to get rid of many issues such as memorizing usernames and passwords for many different websites and systems. The proposed authentication scheme paves the way for user-centric access control that helps minimize the risks of many attacks.

There are several research directions that can be further explored in our future research. First of all, we would like to investigate using lightweight cryptographic techniques in our design. Second, we plan to scrutinize the design of different user-centric access control models. Also, we intend to study techniques for improving the authentication methods such as using visual decryption and visual signature verification. Finally, reporting on usability of the proposed authentication scheme should be further investigated in our future research.

## VII. Acknowledgment

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## **Automatic Railway Crossing Gates with Self-Track Separation**

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**ABSTRACT:** *The Objective of our project is to automatically control the railway gate at the level crossing, and to automatically control the railway track switching mechanism. Since there has been an enormous increase in accidents at level crossing, the above automations will reduce these accidents to a much greater extent. Project employs three Infrared (IR) sensors, one IR sensor is used to control the railway gate and the other pair of IR sensor is used to automatically switch the railway track. These IR sensors are used to sense the arrival of the train. A servo motor is used to control the track switching mechanism. A DC motor is used to control the railway gates at level crossing. As the entire system is automated so errors due to manual handling are overcome because the accuracy of automated operation is more than the manual operation. Our project is developed using raspberry pi.*

**Keywords:** *Infrared sensors (IR), servo motor, DC motor, Raspberry pi*

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### **1. Introduction**

The railway system in India is the most common mode of transportation. Indian Railways has been in operation for over above 160 years and is operating over pan India with the network of 64,000kms which criss crosses all over of India. The railway tracks consist of several level crossings all over the India. Around 29500 level crossings across India, 6449 or 22% are still not manned as of February of last year. Out of the 6449, 3691 are on Broad Gauge, 1524 on Meter Gauge and 1234 on Narrow Gauge. Amongst the zones, 44% of the level crossings of Western Railways are still not manned.

All business methodologies exude from this subject and Endeavour to accomplish Accident Free System. The railway gate monitoring is a challenging problem, and much research effort has been spent in the development of railway gate monitoring methods for use on in-service rails. From the study of the cause 87.78% of the accidents, Indian Railways found that all the accidents were due to the human failure, Hence, there is a dire need to eliminate these factors by automating the Railway gates at level crossing.

The other problem in the Railway system is that the separation of the tracks are being controlled by human which results in some non-accurate decisions which causes accident and delay of the trains. Sometimes there is delay because of giving pass to other trains, and the unavailability of the accurate location of the train causes huge time delay in train arrivals.

### **II. Literature Review**

Michal et al [1] presented the possibility of using RFID technology by railway transport monitoring. This part of article describes the application of RFID technology in the railway industry of Slovak. Further, describes the principle of information system and design involved in electronic way-bill. The only related problem in the railway transit is about transferring many information such as waybill, technical condition of the wagon, date of the maintenance and repairs, etc. in spite of that, there is still chance of using RFID technology. The initiation of RFID technology amplify the idea of collecting data automatically. Wagon location tracking and car information collection will be much easier.

The system comprises of microcontroller, motors, and sensors. The sensors installed on the track side near to the level crossing detect the train when it arrives. When the train is arriving from either side, the sensor detects the train and signal are then sent to control room. When the train arrives, at the same time IR transmitter senses and generates a signal; IR receiver receives the signal and generates an interrupt signal [2], [3], [4] and [5]. The motor rotates to the clockwise direction but it changes to the opposite direction when the interrupt signal is generated from the microcontroller ends. This system has the advantage of being cheap and simple with the disadvantage that it is slow and IR sensor gets affected by weather conditions [2].

In this study, gate closing and opening is controlled with the help of an android application using an android smart phone or a tablet. When the train is approaching the level crossing, an SMS is send from an android

application. The SMS is sent to the GSM modem whereby it's being interpreted and further forward the command to the microcontroller. Then the microcontroller will feed the output signal to the motor and motor driver is switched on. Commands are received by microcontroller to open the gates through GSM modem from an android application which will forward the signal to the motor driver. The current status of the train is displayed on LCD about the closing and opening of gates [6], [7].

Kader [8] paper that comprise of the development of a prototype using microcontroller that united with other parameters such as power supply, light dependent IR sensors, force resistive sensor, and gate servo motor. Microcontrollers operations are being programmed and works based on the hardware integration. The arrival and departure of the train is detected by two IR sensors placed before and after the level crossing. Signals generated by IR sensor are sent to the Microcontroller and this will configure the operation of the servo motor and it will rotate as required requirement (clockwise or anticlockwise).

### III. Methodology

#### 3.1 Block Diagram

The System Architecture provides a holistic view of the System to be built. It describe the structure and organization of Software components, their properties and the connections between them. The architecture model process is concerned with establishing a basic structural framework for a System. It involves identifying the major components of the System and communications between these components. The System Architecture shown in the figure 3.1 has three components Client Side, Server Side and Web Interface.

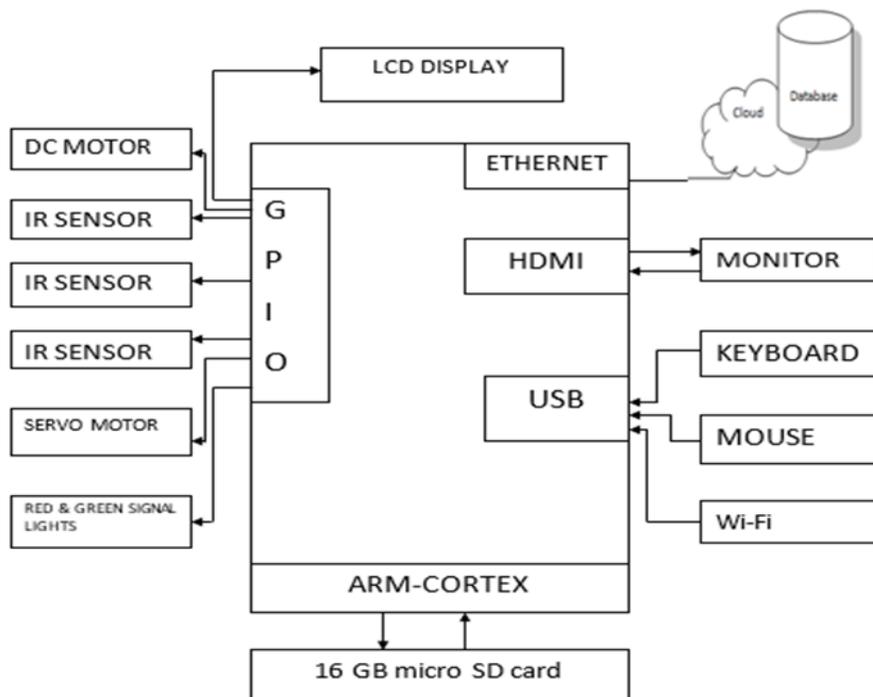
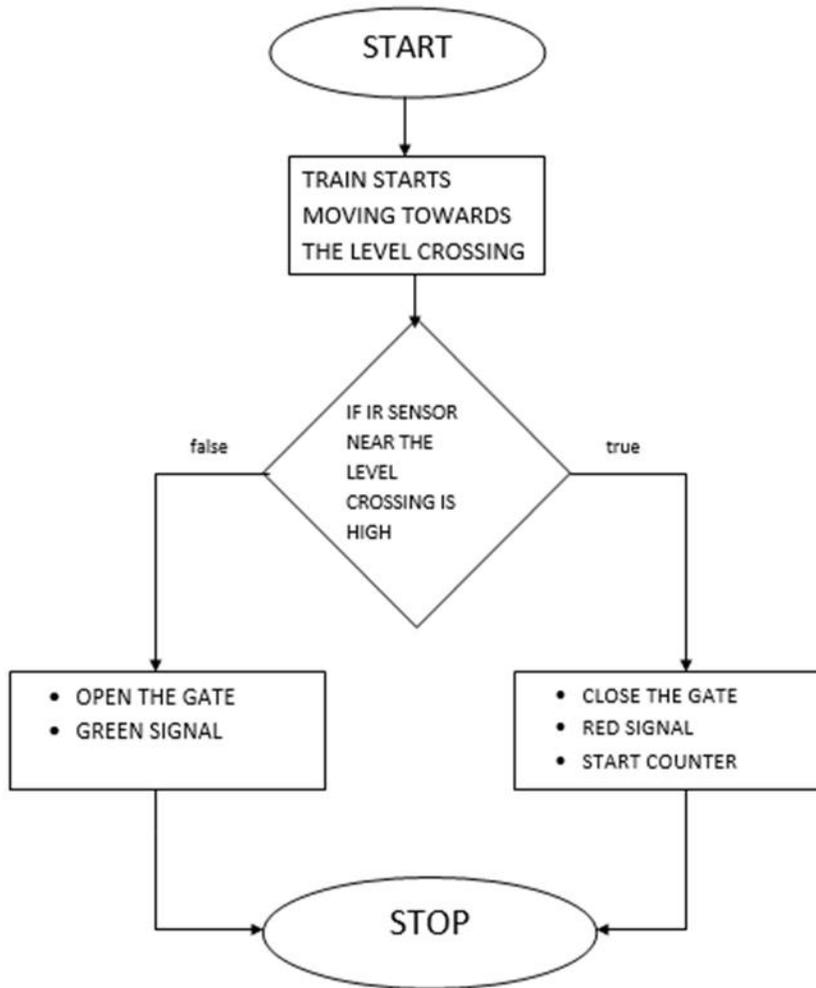


Fig 3.1: Block Diagram

Project utilizes Three IR sensors and a counter, one IR sensor is placed near the level crossing to control the railway gate while the other pair of sensors are placed near the track switching module.

#### 3.2 Gate Controlling Unit

Whenever the IR sensor is high the gate motor rotates in a particular direction and closes the railway gate and remains close until the counter sets to zero, once the counter sets to zero the motor again rotates and the gate is opened. The railway gate is opened and closed by a dc motor having rotations in forward and reverse direction by using 2 relays. Low torque DC motors having 30 rotations per minute.



**Fig 3.2:** Flow Chart

### 3.3 Track switching unit:

Same principle of operation of the IR sensors on track switching, we can easily monitor the track and create switching of the track if necessary. A pair of sensor is placed near the track switching junction in track switching mechanism.

Considering a situation wherein there is a goods carrying train on the main line track and suppose a local or an express train is taking the same route taken by goods carrying train, in order to avoid any delay to the local train the track is switched to the bypass line track for the train to pass. A servo motor is used to control the track switching mechanism. The pair of IR sensor placed near the junction identifies the already occupied track and bypasses the other train.

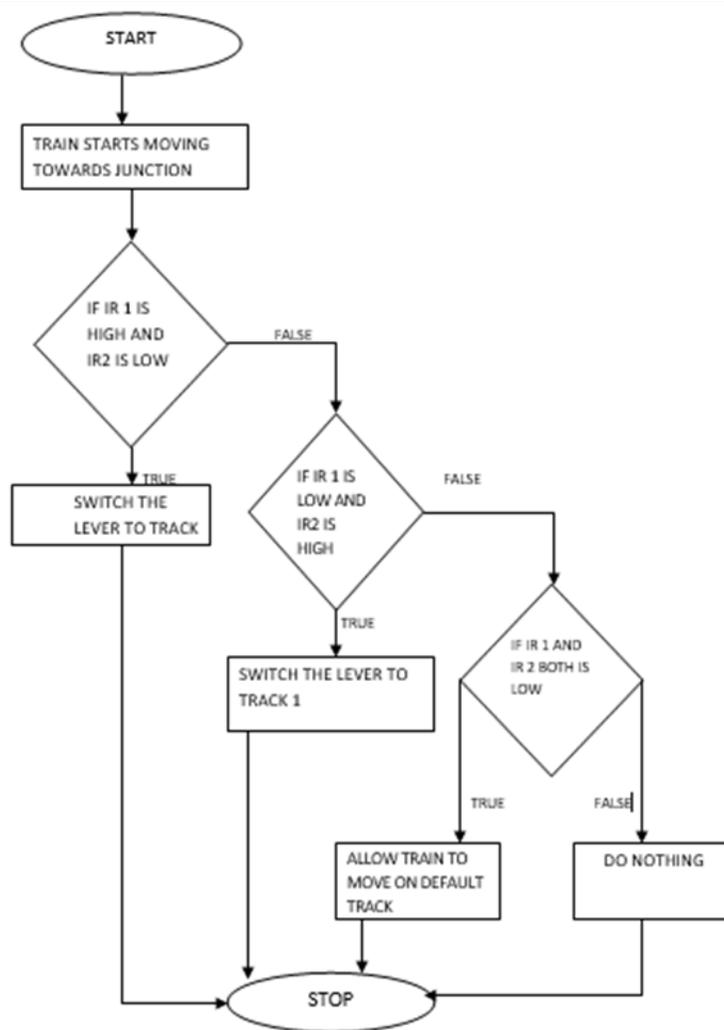


Fig 3.3: Flow chart

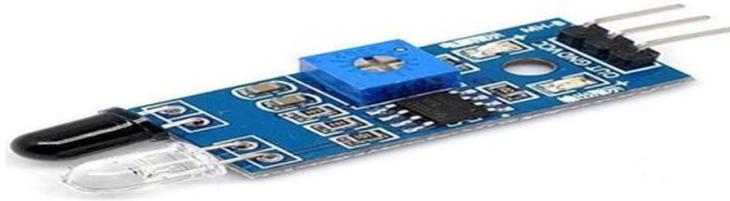
#### IV. Components and Description

**Raspberry pi:** - We use centre tapped step down transformer to convert 230v AC to 12v AC and full wave rectifier to convert into DC(16V-18V),5V regulation is maintained to give to components using IC7805, dual comparator output's is given to Raspberry Pi through GPIO's (general purpose input output pins),it consists of ARM cortex-Quad core processor, 1GB RAM, 40 GPIO'S, Camera Serial Interface (CSI), Digital Serial Interface (DSI), 3.5Mh audio I/O 4USB ports, one 10/100 Ethernet, one HDMI, one micro SD cards IOT extendable up to 32GB. In memory card Raspberry an Operating System is loaded and python code is dumped.



Fig 4.1: Raspberry pi

**IR sensors:** The IR sensor comprise of an IR transmitter and receiving section, transmitter section consists of an IR led with a current limiting resistor of 1K ohms which continuously emits photons on the receiving unit.



**Fig 4.2:** IR sensors

**LCD:** A 16x2 liquid crystal display is used to display the on and off condition of the sensor.



**Fig 4.3:** LCD

**DC MOTOR:** .DC motor used is a low torque motor having 30 rotations per minute for automatic railway gate control. DC motor used is a high torque motor having 10 rotations per minute for self-track switching.



**Fig 4.4:** Dc motor

## **V. Conclusion**

This paper has presented an automation approach for railways. Proposed system will prevent heavy loss of life using internet of things technology and IR sensor based system. And proposed system will improve the accuracy and reduce the errors due to manual handling of railway crossing gates. Proposed system will reduces delay in trains arrival because of self-track switching mechanism. It will also avoid collision between trains running on the track or standing on platforms.

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# **Agribot for Irrigation and Farm Monitoring based on IoT using Solar Energy**

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**ABSTRACT:** Agriculture contributes to a major portion of India's GDP. The water scarcity and high labour costs are the two major issues in modern agriculture. These issues can be resolved using agriculture task automation, which encourages precision agriculture. This paper discusses the design and development of an IoT based solar powered Agribot that automates irrigation task and enables remote farm monitoring on considering the abundance of sunlight in India. The Agribot is developed using an Arduino microcontroller. It harvests solar power when not performing irrigation. While executing the task of irrigation, it moves along a pre-determined path of a given farm, and senses soil moisture content and temperature at regular points. The data acquired at each sensing point from multiple sensors is processed locally to decide the necessity of irrigation and accordingly farm is watered. Further, Agribot acts as an IoT device and transmits the data collected from multiple sensors to a remote server using Wi-Fi link. At the remote server, raw data is processed using signal processing operations such as filtering, compression and prediction. Accordingly, the analysed data statistics are displayed using an interactive interface, as per user request.

**Keywords:** Internet of Things (IoT), Agribot, Wireless Fidelity (WiFi), Farm Monitoring, Data Analytics

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## **1. Introduction**

According to the recent statistics, the land used for crop cultivation in India is decreasing at an accelerating rate, due to outdated irrigation techniques and availability of water resources and these are the primary reasons for incoherent production. Hence, technological solutions for agriculture task automation are the need of the hour. In particular, simplified irrigation mechanisms reducing water wastage are very essential, which encourage precision agriculture.

Technological solutions for irrigation and agricultural task automation are driven by electric power. Throughout a year India receives solar radiation on an average 3000 hours of sunshine (i.e. 4-7kWh of solar radiation per sq. meters). Hence solar driven technological solutions for agriculture task automation can yield better benefits for Indian environmental conditions.

Many such technological solutions have been addressed in the literature that achieve agriculture task automation and help in remote monitoring the farm land. Some of them are discussed as follows. A smart irrigation controller is developed using PIC16F876A microcontroller, which transmits the data using XBee link to a remote server. However, the developed system can monitor moisture only at a single point. Hence, to monitor a given farm area, large number of sensors have to be deployed which increases the cost of the system. This XBee can communicate in a limited range of 50 m. The developed remote interface does not perform any signal processing operations to obtain useful statistics relevant for farm monitoring.

A two cell overhead crane system is proposed for agricultural task automation. Specifically, tasks such as spraying fertilizer, irrigation, planting seeds have been proposed for automation by a solar driven crane system. However development of such systems require a large budget and in addition if such systems need to monitor the farm land, multiple sets of sensors need to be placed at various geographical points. An agricultural solution for the farmer based on Wireless Sensor Networks and GPRS technology is proposed using multiple sensors that sense the health of the plant along with environmental parameters. Using ARM processor, a smart GSM controlled weather based irrigation system is developed, which senses the soil moisture at a given geographical position and irrigates the farm based on prediction of rain. The amount of hardware required for forming a sensor network is large, because multiple sets of all the sensors are to be placed over a geographically spread farm area that needs to be monitored.

Other than farm land automated irrigation system, automation can also benefit green roof irrigation to save water resources. Based on the solar radiation, soil moisture, humidity and wind speed, a micro controller based irrigation system is developed. The sensing system is based on a single node rather than multiple points. Hence for a complete roof garden, several sensor nodes are required, agricultural robots can also be used for irrigation and agricultural task automation. In this paper, we develop an Agribot, capable of irrigating the form, harvesting solar power while not irrigating and also monitoring the farm from a distant

node. At the distant node, after proper analysis of raw data obtained from different data transmissions at the farm, useful data statistics are obtained and displayed according to user interest.

The benefits of the Agribot that are developed have better efficiency in water usage compared to manual irrigation, achieved via direct soil moisture and humidity measurements at various geographical positions in the farm. It is worth noting that the developed Agribot irrigates the farm not based on a single point data like in the automated systems, but irrigates based on averaged data obtained at each point. As the Agribot can move around the farm, there is no necessity of installing multiple sensors at various geographical points in the given farm. The data collected at various geographical points at various times in a day are transmitted to the cloud. Hence historical data is available over the entire farm under supervision, which by appropriate analytics can be used for prediction of future data. To aid in prediction, we employ filtering of the raw data to remove noise in the measurements and also compression of the data to aid in large data storage.

A single set of sensors can help in complete farm monitoring unlike the need for dedicated sensors at various positions in a fixed automation systems. Further maintenance of sensors at many positions in the farm is not a convenient solution in agriculture. Hence Agribot has immense scope for utilization in farm monitoring systems.

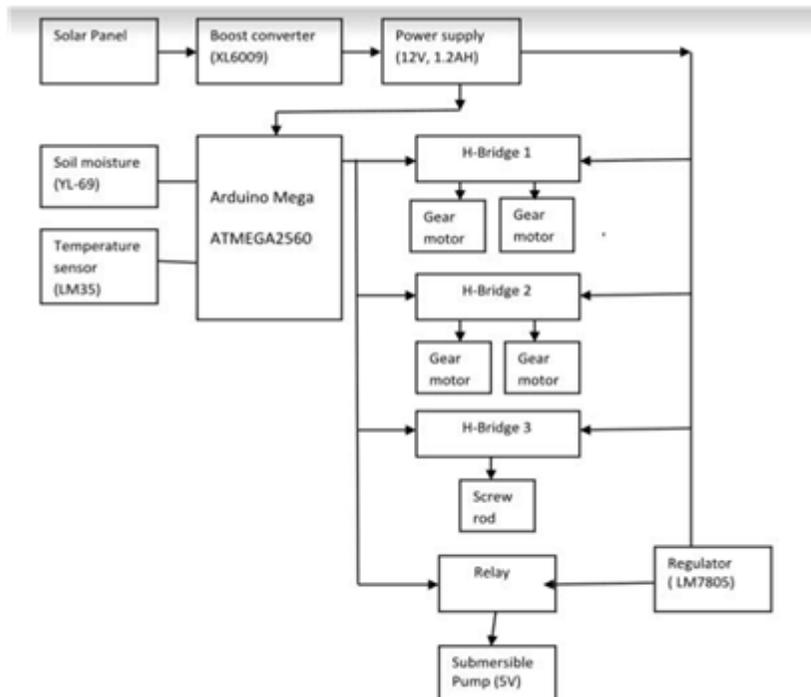
The developed prototype of the Agribot in this paper forms a low cost system due to the incorporation of a screw rod methodology and only a single set of sensors, which can virtually sense and transmit data from multiple locations in a given farm. The model developed is based upon Arduino Mega AT2560 processor. The battery incorporated can be recharged using renewable solar energy using two solar panels. Hence while not irrigating the farm land, the Agribot is capable of harvesting the solar power.

## 2. Design and Implementation of Agribot

The Agribot based automated irrigation system is controlled using ATmega2560 micro controller programmed on Arduino platform. The Agribot is commanded to move on the contour of the rectangular field. There are two principle factors required to choose the measure of water required to irrigate the field are soil moisture content and temperature of surrounding environment. Hence, two sensors soil moisture (YL-69) and temperature sensor (LM-35) are utilized to assess the required water for irrigation. These sensors collect the data on the contour of the rectangular field with the help of screw rod mechanism. The data is processed in Arduino micro controller. The Agribot processes and evaluates the data according to which it irrigates the soil near the sensing point uniformly.

Further the data collected from Arduino is transferred to cloud (Thing-Speak) by using ESP8266 module. This raw data includes the information of soil moisture sensor and temperature sensor. The data here represent the state of the soil. The primary analysis is that the work deals with the filtering, prediction and compression aspects of the raw data collected. The system has three major parts that are; sensing, control section and the output section. The soil humidity is detected using YL69 soil sensor (a resistance type sensor) and LM35 temperature sensor. The control unit was achieved using ATmega2560 microcontroller based on Arduino platform. The output of the control unit was used to control the irrigation system by switching it on and off depending on the soil moisture content and surrounding environment temperature.

The hardware connected to the Agribot comprises of various components required to drive the Agribot. Here two H bridges are used to drive the DC motor of the wheels of Agribot, another H bridge is used to run the screw rod mechanism to sense the soil moisture. Relay is used to drive the pump. Solar panels are used to convert solar energy into usable electrical energy using boost convertor. The LM7805 IC regulator is used to convert 12 V DC supply into 5V DC supply which is used to drive the relay. The block diagram of the developed Agribot is shown in Figure 1.



**Figure 1:** Block diagram of the developed Agribot

The details of various sensors and associated components used in the developed Agribot are discussed as follows:

#### **A) YL 69 Soil moisture sensor**

This YL-69 sensor is made of two electrodes, which enable the sensor to read the moisture content around it. A current is passed across the electrodes through the soil and the resistance to the current in the soil determines the soil moisture. If the soil has more water, resistance will be low and thus more current will pass through.

#### **B) LM 35 Temperature Sensor**

The LM35 are precision IC-based temperature sensing devices with an output voltage linearly proportional to the Centigrade temperature. LM35 sensor has 3 pins namely  $V_{CC}$  which is given to supply, ground which is given to ground of the controller and output pin given to one of the analog pins of controller. The LM35 device does not require any external calibration or trimming to provide typical accuracies of  $\pm\frac{1}{4}^{\circ}\text{C}$  at room temperature and  $\pm\frac{3}{4}^{\circ}\text{C}$ , over a full  $-55^{\circ}\text{C}$  to  $150^{\circ}\text{C}$  temperature range. The device is used with single power supply, or with dual supply.

#### **C) DC Motors and IC drivers**

DC motors are used by the Agribot to move and also help the on-board sensors to reach the soil while sensing measurements are being collected. A DC motor in simple words is a device that converts direct current (electrical energy) into mechanical energy. The DC motors are driven by L293D, which is a dual H-bridge motor driver IC. Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction.

#### **D) Relay**

A relay is used by the Agribot to carry out the task of irrigation. The relay module is an electrically operated switch that allows you to turn on or off a circuit using voltage and/or current much higher than a microcontroller could handle.

### 3. Working

The Agribot is programmed to move forward for 10 seconds. It stops at the first plant position and with the help of the screw rod the soil moisture sensor is placed in the soil for 5 seconds and the values from both sensors are stored in two different arrays in the micro controller and then the soil moisture sensor is returned to its initial position. The Arduino micro controller takes the average of the sensor readings and transmits these values to the cloud using WiFi module ESP8266 that is interfaced with the Arduino. Thus the Agribot acts as an IoT device.

The Agribot moves to its next sensing point and the above procedure repeats. The agribot was programmed to move along the contour of a rectangular area, with each side of the rectangle having two sensing points. After completing a revolution around the rectangular field, the values from each sensing point are compared with the threshold value that is set based upon on the season and crop that is being cultivated and the duration for which the Agribot has to irrigate the plant is calculated. Once the values are being calculated the Agribot starts its second revolution around the considered rectangular path. If the soil moisture value is greater than 750 and less than 1023 and temp is greater than 30, water will be supplied for 5 seconds. If the soil moisture value is less than 750 and greater than 500 and temp is less than 30, water will be supplied for 3 seconds. If the soil moisture value is less than 450, no water supply takes place along one side of the rectangle, the robot moves further for 5 seconds and the same process repeats for remaining sides. In short if the value of sensors is less than threshold .The motor are directed to move in forward direction and water the area near sensing point. If the sensor value is above the threshold the pump does not water that area and just passes that area. The flow chart representing the above mentioned working of the Agribot is shown in Figure 2.

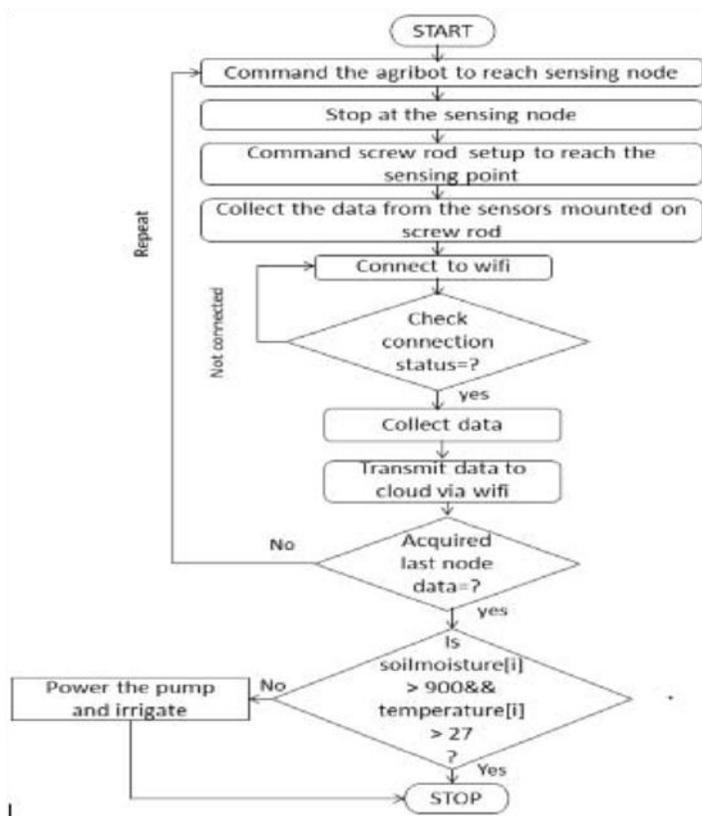


Figure 2: Flow chart of Agribot working

In the developed model of the Agribot, there are 5 DC motors. Four are used to propel the Agribot and one is used for driving the screw rod mechanism. The screw rod mechanism helps the on board sensors of the Agribot to reach very near to the soil, while sensing measurements are done and helps them return back to their initial positions while not sensing.

#### 4. Data Modelling and Analytics

The received raw data was analysed as a model in three dimensions which includes time of sensor data collection, the position at which the data is collected and the number of days for which the data was procured. The data representation of the collected data for a single day is

$$x(t, y) = \begin{bmatrix} x_i(t_1, y_1) & x_i(t_1, y_2) & \dots & x_i(t_1, y_N) \\ x_i(t_2, y_1) & x_i(t_2, y_2) & \dots & x_i(t_2, y_N) \\ x_i(t_3, y_1) & x_i(t_3, y_2) & \dots & x_i(t_3, y_N) \\ \dots & \dots & \dots & \dots \\ x_i(t_M, y_1) & x_i(t_M, y_2) & \dots & x_i(t_M, y_N) \end{bmatrix} \quad (1)$$

The model in (1) represents the data collected for a single day as  $M \times N$  matrix, with representing the  $i^{\text{th}}$  geographical sensing position and representing the  $i^{\text{th}}$  time sample. For a span of  $D$  consecutive days, the data is modelled as a three dimensional matrix of order  $M \times N \times D$ . The obtained 3 dimensional matrix of the raw monitored data is visually displayed as per user requirements and choices. The choices include

1. Display data monitored at different positions and days
2. Display data monitored at a single position for all days
3. Display data to be monitored for one position for one day
4. Display entire variation of monitored data for all position
5. Display the entire variation of monitored data for 1 day

Other than the raw data display, it is also processed via filtering. Filtering is the process of smoothening the raw data and removal of the outliers that are present due to non-reliability of the sensors used. The filtering used in this context includes Moving Average, Gaussian filtering and Transform domain filtering. The moving average filtering is given by

$$x_f(i) = \frac{1}{N} \sum_{k=\frac{N-1}{2}}^{\frac{N-1}{2}} x(i-k) \quad (2)$$

In (2),  $N$  is the length of the filter and  $x_f(i)$  is the filtered data based on the average of raw data samples  $x(i)$ .

Gaussian filtering involves the raw data to be filtered by Gaussian curve fitting, while transform domain filtering incorporates Discrete Fourier Transform (DFT) based smoothening by removing the higher frequency components. To store a large amount of historical data corresponding to the farm monitoring, compression of data is essential for storing large data in a limited memory space. Data compression is also known as source coding, which is accomplished via DFT. The raw data is first transformed to the frequency domain by use of DFT and a specific number of higher frequency components are discarded and inverse DFT (IDFT) is performed on the resultant data, which forms the compressed data.

Prediction is the process in which the future probable data is calculated using the preceding data. Prediction helps in taking decisions about the irrigation necessity in advance. It helps in avoiding the Agribot to not start its sequence of operations which are otherwise executed, provided such an analysis driven interrupt is programmed via the micro controller. For prediction, Weiner filtering based optimal method can be utilized. Accordingly, the autocorrelation values  $r_x(k)$  can be found using the biased estimate

$$r_x(k) = \frac{1}{N} \sum_{n=0}^{N-1-k} x(n) * x(n-k) \quad (3)$$

The prediction block diagram using Wiener approach is shown in Figure 3.

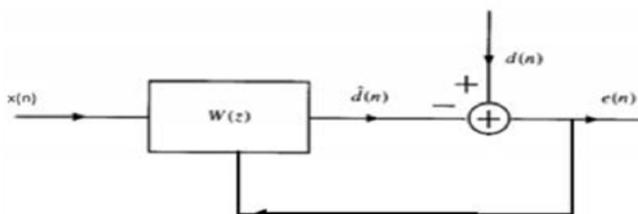


Figure 4.1: Wiener based Prediction Filter

In Figure 3,  $x(n)$  represents the input random process,  $d(n)$  is the desired output,  $\hat{d}(n)$  is the obtained output and  $e(n)$  is the estimated error. The error is fed back continuously to the FIR filter  $W(z)$ . After each iteration, the error reduces and this continues till the error becomes negligible. The resultant Wiener filter coefficients are

$$W = \begin{bmatrix} w(0) \\ w(1) \\ \vdots \\ w(P-1) \end{bmatrix} = R_x^{-1} r_{dx} \quad (4)$$

In (4),  $R_x$  is the autocorrelation matrix of  $x(n)$  and  $r_{dx}$  is the cross correlation vector of  $x(n)$  and  $d(n)$ , given in (5) and (6) respectively.

$$R_x = \begin{bmatrix} r_x(0) & r_x(1) & r_x(2) & \dots & r_x(P-1) \\ r_x(1) & \ddots & \ddots & \ddots & \vdots \\ r_x(2) & \ddots & \ddots & \ddots & r_x(2) \\ \vdots & \ddots & \ddots & \ddots & r_x(1) \\ r_x(P-1) & \dots & r_x(2) & r_x(1) & r_x(0) \end{bmatrix} \quad (5)$$

$$r_{dx} = \begin{bmatrix} r_x(\alpha) \\ r_x(\alpha+1) \\ \vdots \\ r_x(P) \end{bmatrix} \text{ where } \alpha = 1 \quad (6)$$

Other than Wiener prediction, transform domain based prediction can also be used. In transform method the raw data is first transformed to the frequency domain by use of DFT. The intended amount of data for prediction is obtained by increasing the net size of the data and IDFT is performed to get back the data in time domain. By assuming that P values are to be predicted, the DFT is performed on the original data, when DFT is performed the length considered is the length of the raw data in time domain. Then IDFT is performed with the original input size.

## 5. Results

The Agribot prototype is tested for its working on a small rectangular area for its operation described in the flow chart of Figure 2. The Agribot prototype is shown in Figure 4. The irrigation set up and the solar panel based harvesting system are also shown in Figure 5 and Figure 6 respectively.

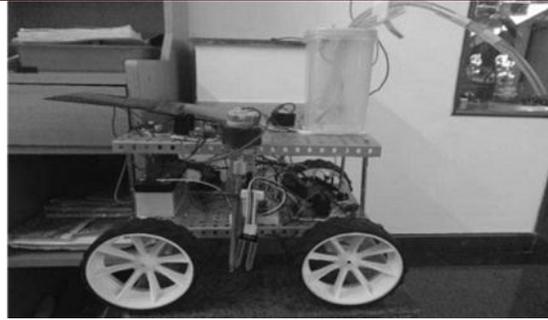


Figure 4: Prototype of developed AgriBot



Figure 5: Irrigation Setup

The raw data is transferred to the cloud and the related graphs on think speak server are shown in Figure 7. On the humidity, soil moisture and temperature data available in the cloud server,

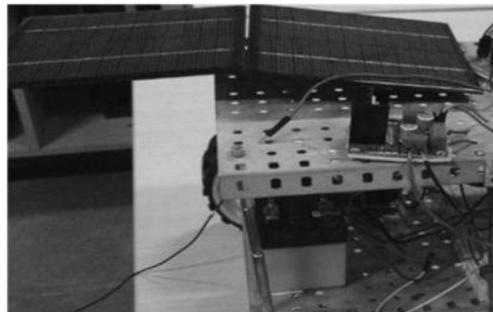


Figure 6: Solar panel and the Harvesting System

The performance of these signal processing operations is evaluated using Mean Square Error (MSE). The comparison of various filtering approaches is shown in Table 1. Similarly comparison of various prediction and compression approaches are shown in Table 2 and Table 3 respectively.

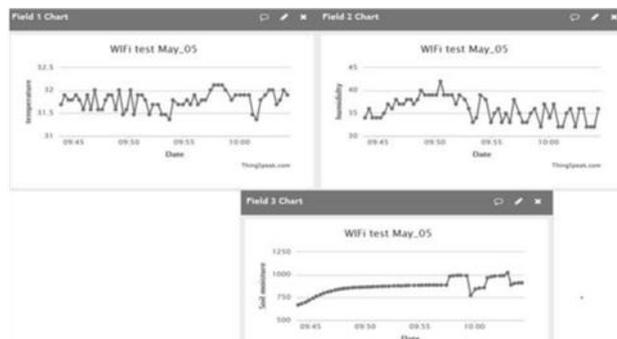


Figure 7: Raw data at the cloud server

Table 1: Performance of Filtering approaches

MSE(Mean Square Error) Filter type	Temperature	Humidity	Soil moisture
Moving Average	5.5755	13.3350	4.5378e+03
Gaussian Filter (stdev=0.33)	1.2797	2.0959	385.5362
Transform domain	5.5193	7.4447	680.0712

Table 2: Performance of Prediction approaches

MSE Prediction Method	Temperature	Humidity	Soil moisture
Weiner optimum filter (tap=4)	29.2758	61.7643	8.2573X10 <sup>3</sup>
Transform domain (tap=4)	0.149	0.6811	15.3695

Table 3: Performance of Compression approaches

MSE Compression ratio	Temperature	Humidity	Soil moisture
25/50	6.8107	11.2840	2.1659X10 <sup>3</sup>
30/50	6.5583	10.3619	1.7653X10 <sup>3</sup>
40/50	5.8480	8.3808	964.9429
<b>45/50</b>	<b>5.5193</b>	<b>7.4447</b>	<b>680.0712</b>

From Table 1, it can be understood that the Gaussian filter provides best smooth approximation of the obtained sensor raw data curve with least MSE. However, it should be noted that standard deviation of the Gaussian curve is to be tuned properly. From Table 2 it can be seen that the transfer domain prediction provides better approximation with regard to the future data when compared to Weiner prediction. This may be due to the mean value of the data that was not removed from the raw data while using Weiner method of prediction. The compression method implemented is a lossy method. The deviation of the compressed value from the original value of the raw data increases with the increase in the number of values discarded from the original value, as seen from Table 3.

The time domain results of temperature, humidity and soil moisture obtained after Gaussian filtering are shown in Figure 8. The solid lines represents filtered data while the data with circular markers indicates the original data. The plots of transform domain compression and transform domain prediction (last 4 values are predicted) are shown in Figure 9 and Figure 10 respectively.

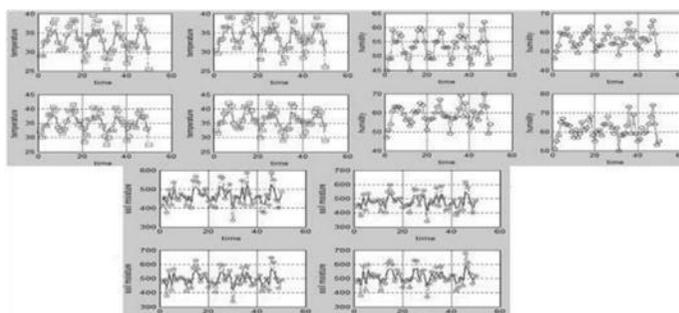


Figure 8: Gaussian Filtering

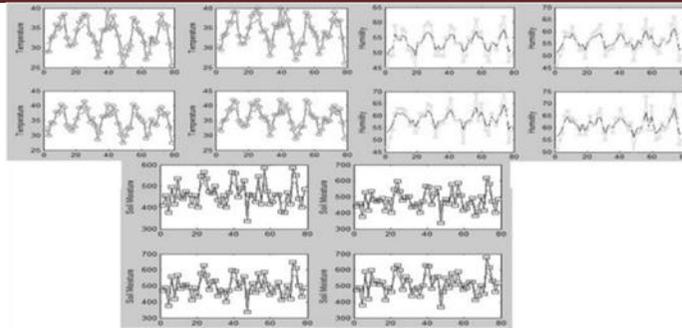


Figure9: Transform domain compression with ratio 45/50

It should be noted that the data processing and signal processing operations shown in this section are in time domain. However the same can be done in spatial domain. Thus the data model in (1) enables spatio-temporal processing and analysis. Spatial data analysis can help in identifying points in the farm that can retain more water and points that have scarcity of water. This can help in controlling the next irrigation cycle by making the Agribot not visit those places with more water, helping it to be a smart enabled system. However this implementation requires analysis driven interrupt to the microcontroller. Such an implementation requires better processing hardware where the edge node (Agribot) and the cloud have a two way communication, which forms the future scope of this paper.

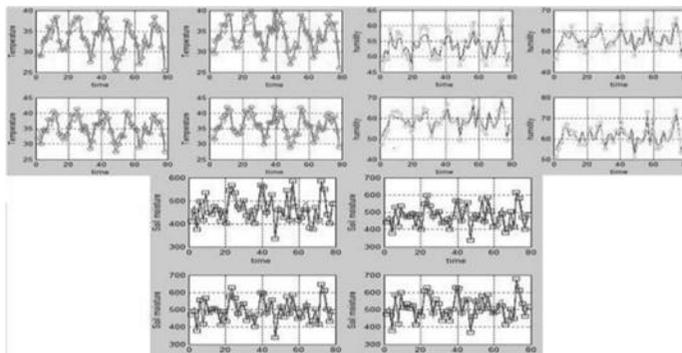


Figure 10: Transform domain Prediction

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# Mitigation of Black Hole Attack in Mobile Ad-Hoc Network Using Perceptron

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**ABSTRACT:** Mobile ad hoc networks (MANET) are dynamic, decentralized and infrastructure less network, where a node can join the network and leave the network at any time. MANET are widely used in military communication, mobile conferencing and emergency communication since they are flexible and simple. Every node in the network is autonomous hence they act as host as well as router. Due to this nature of MANET, where any node can join or leave the network without any permission, security is the main challenge in such networks. One of the major security issues in MANET is Black hole attack. During the process of discovering route the malicious node acts as if it has the route to the destination and takes all the packets into it and does not forward to the desired destination, instead it drops all the packets. In this paper, I propose a technique to mitigate the black hole attack using perceptron.

**Keywords:** MANET, AODV Routing Protocol, Ad hoc network, Black hole

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## 1. Introduction

MANET is a multi-hop wireless temporary communication network of mobile nodes equipped with wireless transmitters and receivers. MANET has many practical applications. However, MANET is mainly vulnerable due to its fundamental characteristics, such as dynamic topology, open medium, distributed cooperation, and constrained capability. Routing plays a major character in the security of the entire network. Thus, operations in MANET added some new security issues in addition to the ones already present in fixed networks. According to the criterion that whether attackers disrupt the operation of a routing protocol or not, attacks in MANET can be classified into two classes: passive attacks and active attacks [3] - [5]. In a passive attack, the attacker does not interrupt the operation of a routing protocol but only attempts to determine valuable information by eavesdropping to the routing traffic. The active attacks involve actions performed by modification, adversaries and deletion of exchanged data to attract packets destined to other nodes to the attacker for analysis or just to disable the network. Some typical types of active attacks can usually be easily achieved against MANET, such as, Denial of Service (DoS), impersonation, disclosure, spoofing and sleep deprivation. Most significant networking operations include routing and network management. Routing protocols can be classified into proactive, reactive and hybrid protocols, depending on the routing topology. Proactive protocols are typically table-driven. Examples of this type include DSDV, WRP. Reactive or source-initiated on-demand protocols, in contrary, do not periodically update the routing information. It is propagated to the nodes only when necessary. Example of this type includes DSR, AODV and ABR. Hybrid protocols make use of both reactive and proactive approaches. Example of this type includes TORA, ZRP. Security is a major concern in all forms of communication networks, but ad hoc networks face the greatest challenge due to their inherent nature. As a result, there exist a slew of attacks that can be performed on an Ad hoc network.

## Security Goals

To providing a safe networking environment some or all the following service may be essential.

## Authentication

This service confirms the identity of node or a user, and to be able to thwart impersonation. In wired networks and infrastructure based wireless networks, it is conceivable to implement a central authority at a point such as a router, base station, or access point. But there is no central authority in MANET, and it is much more hard to authenticate an entity. Authentication can be providing using encryption along with cryptographic hash function, digital signature and certificates.

### **Confidentially**

Keep the information sent unreadable to unauthorized users or nodes. Since MANET open medium in nature any node within the direct transmission range can obtain the data. One way to preserve information confidential is to encrypt the data, and another technique is to use directional antennas. It also ensures that the transmitted data can only be retrieved by the intended receivers.

### **Integrity**

Ensure that the data has been not reformed during transmission. The integrity service can be provided using cryptography hash function along with some form of encryption. When dealing with network security the integrity service is often provided implicitly by the authentication service.

### **Availability**

Ensure that the proposed network security services listed above are available to the intended parties when required. The availability is typically enduring by redundancy, physical protection and other non-cryptographic means, e.g. use of robust protocol.

### **Non-repudiation**

Ensure that parties can prove the transmission or reception of data by another party, i.e. a party cannot incorrectly reject having received or sent certain data. By producing a signature for the message, the entity cannot later deny the message. In public key cryptography, a node A signs the message using its private key. All other nodes can verify the signed message by using A's public key, and A cannot deny that its signature is attached to the message.

### **Access Control**

To prevent illegal use of network services and system resources, access control is tied to authentication attributes. In general, access control is the most commonly thought of service in both network communications and individual computer systems.

## **II. AODV Routing Protocols**

The AODV routing protocol is an version of the DSDV protocol for dynamic link conditions. Every node in an ad hoc network has routing information about route to the particular node, which has been stored in a table called routing table. Before sending a packet by a node, it searches in its routing table to determine whether a route to the destination is already available. If so, it uses the route in the routing table to send the packets to the destination. If a route is not available or the previously entered route is inactivated, then the node initiates a route finding process. The node which needs a route broadcasts a RREQ (Route REQuest) packet. Every node that receives the RREQ packet first checks if it is the destination for that packet and if so, it sends back an RREP (Route Reply) packet. If it is not the destination, then it searches in its routing table to determine if it has got a route to the destination mentioned in RREQ. If not, it relays the RREQ packet by broadcasting it to its neighbors. If its routing table does contain an entry to the destination, then the next step is the comparison of the 'Destination Sequence' number in its routing table to that present in the RREQ packet. This Destination Sequence number is the sequence number of the last sent packet from the destination to the source. If the destination sequence number present in the routing table is lesser than or equal to the one contained in the RREQ packet, then the node communicates the request further to its neighbors. If the number in the routing table is higher than the number in the packet, it denotes that the route is a 'fresh route' and packets can be sent through this route. This intermediate node then sends a RREP packet to the node through which it received the RREQ packet. The RREP packet gets communicated back to the source through the reverse route. The source node then updates its routing table and sends its packet through this route. During the operation, if any node identifies a link failure it sends a RERR (Route ERRor) packet to all other nodes that uses this link for their communication to other nodes. This is illustrated in Figs. 1a and b. Since AODV has no security mechanisms, malicious nodes can perform many attacks just by not behaving according to the AODV rules. A malicious node M can carry out many attacks against AODV. This paper provides routing security to the AODV routing protocol by eliminating the threat of 'Black Hole' attacks.

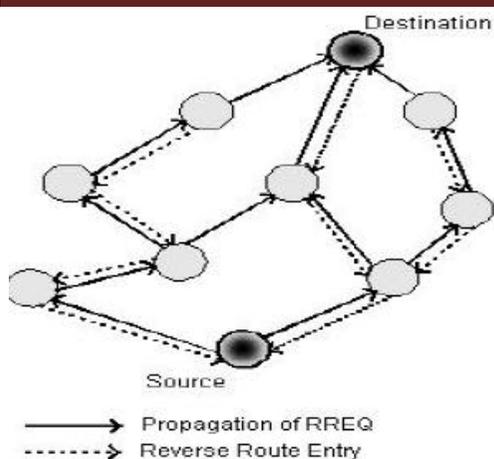


Fig. 1a- Propagation of RREQ.

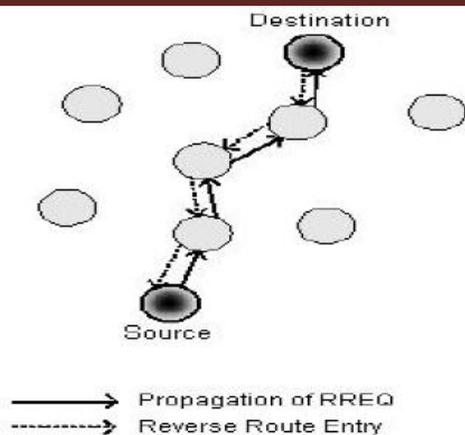


Fig. 1b- Propagation of RREP.

### III. Black Hole Attack

In MANET, with AODV protocol, the black hole node assumes to have fresh enough route towards the destination demanded by the nodes and takes up the network traffic. When the source node transfers the RREQ message to some destination, the black node instantly responds with RREP message with the highest sequence number and the message is taken as it is imminent from the destination or from the node with the fresh towards the destination. The source node then prepares to sending the data packets to the black hole node with the faith that the packets would reach the destination [12].

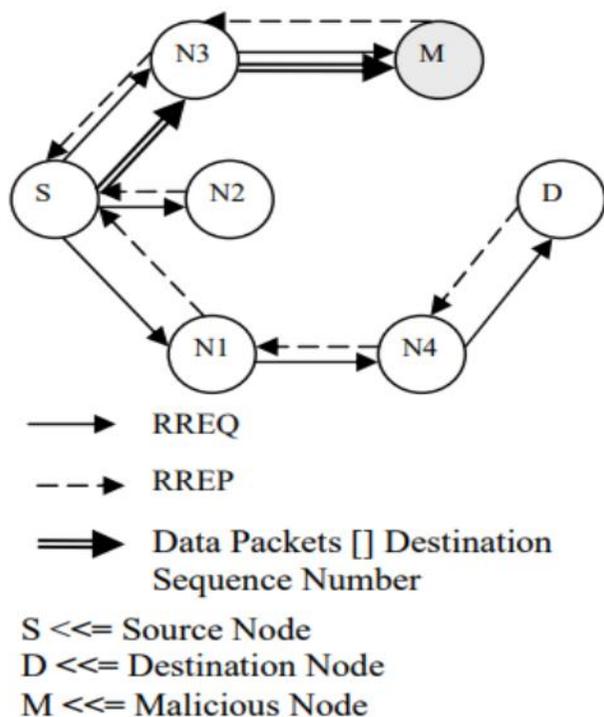


Fig 2 - Black Hole Attack

As shown in the above figure 2, the destination sequence number be 32-bit integer being associated with each route and is utilized for deciding the exact route freshness. The node N3 would transfers that to the node. As the node N1 with the node N2 doesn't have the route towards the node D, it will again send the RREQ control message. RREQ control message has been send the Node N3 being expected to be taken by

node M. Therefore, the node M produces the false RREP control message and transfers it to the node N3 with improved destination sequence number transferred to node S. Though, in AODV, as the destination sequence number is more, the route from the node would be taken be fresh and therefore, node S will start transferring the data packets to node N3 [13].

#### IV. PERCEPTRON

The perceptron is an procedure for learning a binary classifier called a [threshold function](#): a function that maps its input  $x$  (a real-valued [vector](#)) to an output value  $f(x)$  (a single [binary](#) value):

$$f(x) = \begin{cases} 1 & \text{if } x \cdot w + b > 0 \\ 0 & \text{otherwise} \end{cases}$$

where  $w$  is a vector of real-valued weights,  $w \cdot x$  is the [dot product](#)  $\sum_{i=0}^m w_i \cdot x_i$  where  $m$  is the number of inputs to the perceptron, and  $b$  is the bias. The bias shifts the decision boundary away from the origin and does not depend on any input value. The value of  $f(x)$  (0 or 1) is used to  $x$  as either a positive or a negative instance, in the case of a binary classification problem. If  $b$  is negative, then the weighted combination of inputs must produce a positive value greater than  $|b|$  in order to push the classifier neuron over the 0 threshold. Spatially, the bias alters the position (though not the orientation) of the [decision boundary](#). The perceptron learning algorithm does not terminate if the learning set is not [linearly separable](#). If the vectors are not linearly separable learning will never reach a point where all vectors are classified properly. The most famous example of the perceptron's inability to solve problems with linearly non separable vectors is the Boolean [exclusive-or](#) problem. A perceptron schematically can be show as in fig 3.

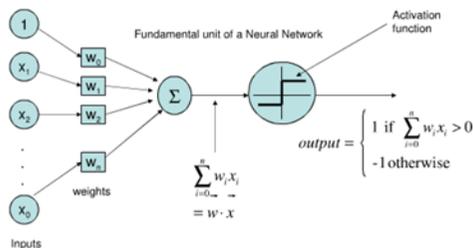


Fig – 3 Perceptron

In this module, perceptron inference system (FIS) is defined for identifying malicious behavior of node. It includes three performance parameters of each node as an input like packet delivery ratio (PDRN), packet forwarding ratio (PFRN) and residual energy (REN) of node. These inputs are mapped in single output whether it is malicious node or normal node. output of the perceptron is 1 If the summation of these performance parameter is less than the predefined threshold. Thus, malicious node can be identified by using the above said parameters.

#### V. Conclusion

The perceptron is generally used as a classifier and it classifies the malicious nodes from the legitimate nodes based on the performance parameter packet delivery ratio (PDRN), packet forwarding ratio (PFRN) and residual energy (REN). The black hole attack in the MANETs decrease the performance of the network. To improve the performance of MANET by mitigating the black hole node, the above proposed perceptron based black hole attack mitigation technique is adopted.

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## Smart Work-Assistance Gear using IOT

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**ABSTRACT:** This paper designates the usage of IoT hardware and thetietiquettes to shape a smart device which helps factory employees and other workers. Gear isa wearable glove , that can be used in several work places where power tools arepersistently used. This planned system is manufactured around a micro-processor performing as a central server, where as many sensor devices are interfaced with the microcontrollers, acts as amedia for data transfer and carry outseveral tasks. One of the microcontroller will perform like a master and controls the other different microcontrollers attached to different sensors. The master holds an LCD display screen and few keys, which can regulate the list of options shown on the display screen. To control the other sensor devices, and record the information in real time. Gloves comprise of safety functionalities such that manual workers are not capable to usehazardous power tools deprived of wearing proper gear. Gloveperforms like a security aspect in such a way that each tool will have limited access, according to the level of proficiency of the employee. The glove can also control the access to the tools which are being used actively during a particular time-frame. The entire data is actively logged by the central server and different other sensors like temperature sensor, heat sensor and vibration sensors can be closely attached and supervised by a master glove. Also system has an additional capability of examining tone of the employees so that the user gets troubled and screams in pain, the scrutiny function can categorize the pain and request for medical aidconsequently. A simple curve based camera component is used together with the central server to save and live-stream the taken video when any power tool is turned On. This system multiplies the value of security of anemployee in a factory.

**Keywords:** IoT, temperature sensor ,MQTT, Node, Factory.

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### 1. Introduction

Initially industrial uprising, power tools became a very significant part of the factory . All day, lots of people go for work and run potentially life frightening machines<sup>[1]</sup> . According to openly available information, thousands of people are wounded in power tool related disasters every year<sup>[3]</sup>. This consequences in a vast loss of valuable work force and additional resources<sup>[2]</sup>.

The awareness ofInterconnected Machines is an interesting one and can be applied to large and small scale machines to expand the efficiency and productivity in factories. It is believed that the above-mentionedplans can go from one hand to other hand and we can generate thesolutionwhich helps the protection in factories and increase efficiency that would be provided by the IoT.

### 2. Problem Statement

Many hardware solutions occur to protect and rise the level of protection in any power tools or machineries. A set of security and vulnerability rules are positioned in workspace to bound such problems. But the existing technology aims only at safeguarding the machineries and devices, it will not influence on human faults which is the main issue in this instance. The tools aren't access-locked and any user, regardless of skillset, can use them. If suitabledefending measures are not in useextremely, they can lead to severeharms. The planned solution is an IoT system will implement a wearable that associates to any kind of machinery and authorize the access based on proper andsafetools has been worn out. We use sensor devices on these apparatus and send theinformation to Raspberry Pi. On the Raspberry Pi, we will check if the machine, for which access is being ask for, is free to be used and if all the proper gear is being used by the person requesting access and based on this information, the Raspberry Pi will control a relay that will power the machine.

### 3. MQTT

MQTT[Message Queue Telemetry Transport] is an ISO standard (ISO/IEC PRF 20922) publish-subscribebased "lightweight" messaging protocol for using on top of the TCP/IP protocol<sup>[7]</sup> and also it is designed for links with remote places where a "small code footprint" is essential or the network bandwidth is inadequate. The

publish-subscribe messaging formneeds a message broker<sup>[10]</sup>. The broker is accountable for issuing messages to the interested customers based on the subject of a message.

MQTT is anextremely secure IoT protocol, which is used to implement the smartest device. Itneeds a "Broker" or one centralized server that acts as the communication link between all the connected devices in the system. Raspberry Pi is a microprocessor, which runs as a broker. MQTT has very small footprint due to the data packet sizes are lesser and transmission of data will take lesser time other than IoT protocols and consumes very less power during procedures. Where as HTTP on a gigabit network needsroughly 5,100ms per demand <sup>[6]</sup>, MQTT's typical publish-subscribe potential is 120ms per loopback request<sup>[8]</sup>. Though, it is reliant on the obtainability of Wi-fi or persisted internet, due to this it has low range and can only be used in a confinednetwork in one remote institution.

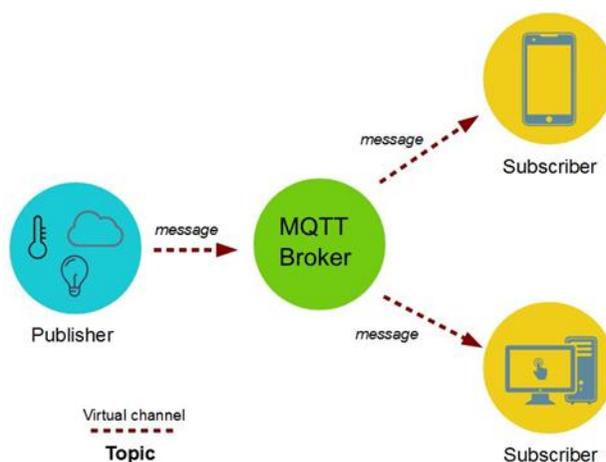


Fig. 1: MQTT broker-client working

This type of environment is favorable in this scenario where the actions of the power gears are not shared outside the work space.

It has some modes of practice. It uses the PUBLISH role to send information to one of the network and use the SUBSCRIBE role to listen to the network and receives the transferred data. It devours less power and it is used in QoS 2 method, the data received is very secure and not broken. QoS 2 method increases the total time of procedures, but rises the security of system. Due to the lesser size of the information, the total increase in time is precise low and the feature of the system is not hindered. MQTT is the most safe and beneficial protocols, which improves the excellence and the simplicity of a system<sup>[9,10]</sup>.

#### 4. Method

The wearable can be covered ofsome type of protective gear. A display monitor on the wearable device and buttons lets the workers to select which machine he wishes to work with. This data and the information from sensors on the protective gear authorizes the Raspberry Pi to dodecisions. A self-built capacitive devicelocated on the gear decides us to show if it is worn or not. The wearable is provided on one part of protective gear. Any additional piece of cautious defensive gear isrequired to wornfor a certain machine which will have a capacitive sensor. This information is observed by a microcontroller, performs as a MQTT Client, then it sends this information to the server through the Raspberry Pi, as a MQTT Broker.

Simultaneously, allmachineries in the factory will have several sensors comprising of temperature, humidity, pressure etc, it willfrequently sends the information to broker. This data can be used by the company for reviewing and it can be used by the companies to progress the proficiency of its factoryfloor. Reliant on the obtainability of the necessary machines,the broker prints this information on wearable.

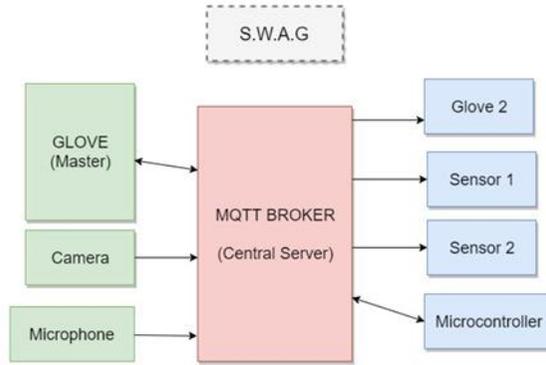


Fig. 2: Block diagram for SWAG



Fig. 3: A Raspberry Pi 3 model B

If all the required conditions are met, the broker authorizes the microcontroller inside the machine to turn on the device.

This way, the system ensures that the person working with the machine has the proper equipment on. Additionally, the machines have RFID readers placed in them. We will use these and RFID stickers to ensure that no tool is running while unattended. This is an extra dimension of security that will ensure safety in the workplace.

## 5. Hardware Resources and Features

### A. Raspberry Pi 3

Raspberry Pi is a credit card sized microprocessor, based on ARM7 design. It has a BroadCOM SOC and can perform tasks in which basic microcontroller's cannot do due to speed or storage issues. The 3rd generation of Raspberry Pi maintains the inbuilt Bluetooth and Wi-Fi chip, it doesn't need spare hardware. The wifi connects entire components of the system in a Local Area Network (LAN).

The Raspberry Pi hosts the MQTT broker every time, and the IP address of the RPi is used as the dominant host address. It connects a servo motor via its GPIO pins and a Pi-Cam Module, to save the video on every user trigger.

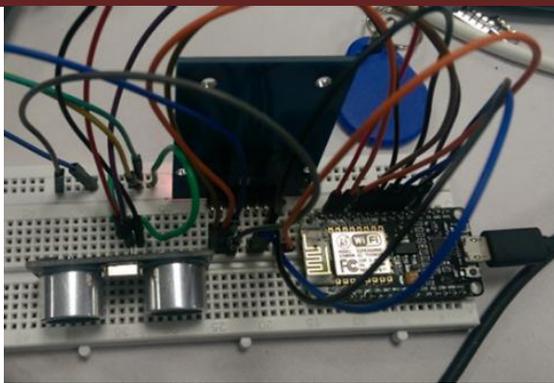


Fig. 4: The NodeMCU with the ultrasonic sensor and RFID scanner

### B. ESP 8266-01

ESP8266 is a less powered microcontroller developed by “Espressif System”, it concentrates in constructing low power communication devices such as the Bluetooth and WiFi chipsets. It is a very low powered device, which has an in-built wifi chip, which is beneficial to get connected to the LAN. The 01 version of this microcontroller has only 2 usable GPIO pins on board and it can be used to create standalone sensor-transmitter pairs.

The ESP-8266 requires a 3.3v input and has a low current draw, due to which it can be deployed easily and can work for a long time at a stretch. The Low number of GPIO can be interfaced with a shift register to accommodate more number of sensors. This setup is very cost-friendly and its implementation decrease the overall power consumption.

### C. Node MCU

NodeMCU is microcontroller Unit based on the 12E version of the Esp-8266. It has an extended number of GPIO pins and features an on-board digital-analog converter (DAC) so that it can read analog sensor values. Unlike the 01 version of the ESP board, the NodeMCU can run at a higher processing frequency, and support multiple modules and sensor integration. In S.W.A.G, each microcontroller unit is connected to the broker, but it is also connected to multiple sensors and switches that can control the system [Fig 2].

### 6. Innovation and Related Work

The system gets Connected Machines to a whole different level. Safety at the working place is the topmost significance for any company. By means of the power of IoT and the standard protocol MQTT, a product is established, that not only safeguards safety of personnel working with large machines, but also the machineries themselves. This targets to bring revolution to the daily lives of people.

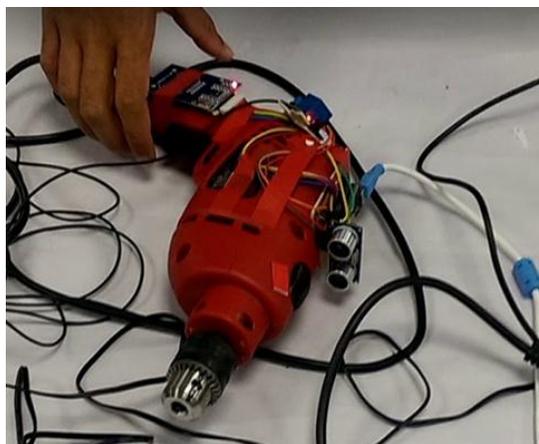


Fig. 5: The drill

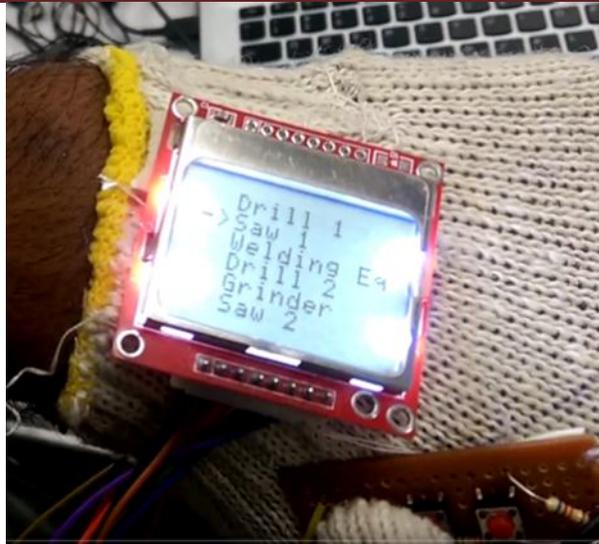


Fig. 6: The smart watch with various machine options to choose from

There is a enormous demand for safety products and good ones at that. The manufacturing industry faces a large number of accidents and fatalities every year<sup>[3]</sup>. This is a revolutionary product for the manufacturing industry. This product is aimed to cut down accidents due to improper protective gear.

### 7. Emotional Analysis Using Machine Learning

Another dimension of safety is provided by looking for markers signifying that the worker is injured. For this, the system releases sounds in the nearby using a microphone linked to the current raspberry pi. The sounds are caught for every 5 seconds to lessen the load over the raspberry pi. The sound is then transferred to the Google speech-to-text service by using a modest API call. The API returns the text of the words spoken in the backgrounds.

This sentiment of the text is then picked up using another API. This is the IBM's Watson API called the Tone Analyzer, it returns several sentiments like joy, anger, sadness etc. and the score related with each one of these. Then this is lastly used by our individual logistic regression machine learning procedure to decide if the factory employee is in pain and needs some immediate help<sup>[13]</sup>.

Lastly, if the algorithm predicts that the worker is in pain, the system calls an ambulance and informs a predefined user (meant to be the factory floor manager) and this person is meant to rush to the assistance of the injured worker. This is done through the Twilio API.

### 8. Current Technologies

There have done a few challenges at structuring devices for factory labors like an Australian SmartCap, that processes brain action to detect weakness. AIG, meanwhile, apparently spent in Human Condition Safety (HCS), a company which do wearable devices can monitor the labors in factory. Though, there has no important product that openly observes the physical security of the factory labors by inspecting if correct safety gear has been done.

### 9. Improved Security

Meanwhile MQTT is TCP based protocol, by default, it won't use an encoded communication. To add a level of safety, we can use TLS (Transport Layer Security). TLS and SSL afford an encoded communication network between client and a broker<sup>[16]</sup>. Both are cryptographic protocols used for a handshake mechanism to convert various constraints, they set up communication network and no invader can snoop any portion of the communication. Servers offer a X509 certificate, naturally delivered by the trusted authority, in which customers use to recognize the server. Port 8883 is the distinct port just for safe MQTT connections.

This security originates at a price. Subscribers and brokers should have hardware competences for the additional processing. This is particularly challenging for the client, meanwhile they are usually small, less powered microcontrollers<sup>[17]</sup>.

## 10. Conclusion

There is a bulky market for products like this. Companies are observing to ensure a superior sense of safety at their factories. A safe, inexpensive substitute is precisely what they are viewing for. But, the manufacturing industry is not the only place for using Smart Work-Assistance Gear. Anybody who use any kind of power tool that needs defensive gear to be worn out and can use this product. Thus, this product is meant at big industries as well as the daily consumer.

Being simple to practice and cost effective, it is guaranteed that its approval rate is extraordinary.

Smart Work-Assistance Gear is an advanced product that it will certainly modernize security at the factory. By using skills like the IoT, information analytics and RFID's, we have guaranteed that the manufactured device will progress the standard of the factory.

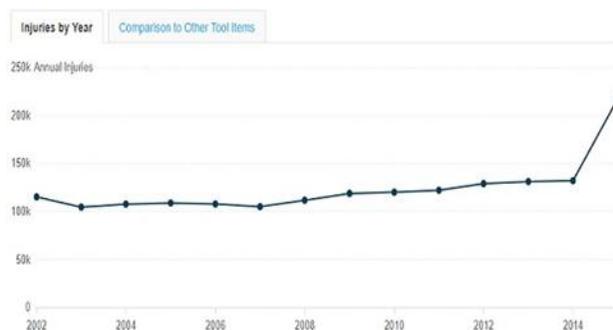


Fig. 7: The number of deaths recently due to machine related accidents

## Appendix A

### Injury and Cost Approximation

Every year, it is estimated that massive 124,000 accidents associated to power tools takes place and that has been noted that the extreme damages takes place for adults of the age in the middle of 35-44 years<sup>[3]</sup>. Then the year 2002, the amount of power tools linked damages have improved by closely double, and it has rushed by at least 84% throughout the year 2014-15.<sup>[3,4]</sup> S.W.A.G purposes to control this number by dropping the human fault and decreasing the risks of accidents. It is appealed that with the increase of industry 4.0, extra amount of people will be working with power gears due to the rise in the customer markets and a population boom. Application of a successful anti injury system in a work ecosystem can surely decline the complete injuries and protect companies lots of dollars on worker insurance.

This number straightly arguments towards a vast market of power gears that is in rotation today. It is expected that, by 2020 the Power gears marketplace will be at 34 Billion Dollars worldwide<sup>[15]</sup>. This expectation just goes to spectacle how the costs linked to injuries will radically increase. This is an enormous drawback for the power tool industries and factories.

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# Hardware Key Integration To Enhance Security In SDN

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**ABSTRACT:** Over the past decade there has been a very rapid change in the industry of networking: by the principal of Soft-ware Defined Networking (SDN) paradigm which separates the control plane and forwarding plane to support virtualization. The perspective of SDN goes well beyond server virtualization at every aspect of network infrastructure and management. Security concerns here are about a greatly expanded attack footprint that includes the control plane and the data plane. So the security needs to be everywhere within a software-defined network (SDN) and to be built into the architecture, as well as delivered as a service to protect the availability, integrity, and privacy of all connected resources and information. In this context, to overcome its existing limitations in terms of network management and enhance the security features, using Trusted Platform Module (TPM) we propose to integrate hardware-based signature security mechanisms directly on top of the SDN controllers and Virtualized Network Applications.

**Keywords:** SDN, TPM, Control plane, Forwarding plane.

## 1. Introduction

An exponential growth in computer networking technology has created the necessity for a scalable networking architecture. The concerns with traditional computer networks are diverse; traditional networking protocols are static, whereas the applications that run on top of these networks are distributed in nature. This in turn makes the networking architecture complex and harder to manage. The increasing complexity makes it difficult for network administrators to implement routing and administrative policies. As a result, network management becomes harder and the quality of service for the network suffers. To overcome these issues, it is imperative to move to software-defined networks. The Software-Defined Networking (SDN) is an emerging network architecture where the network control is decoupled and separated from the forwarding mechanism and is directly programmable. In SDN, there is a logically centralized controller that has a network-wide view and controls multiple packet-forwarding devices (e.g., switches) that can be configured via an interface (e.g., ForCES and OpenFlow). The diagram in Figure.1 illustrates the de-coupling of control and data planes in a Software Defined Network.

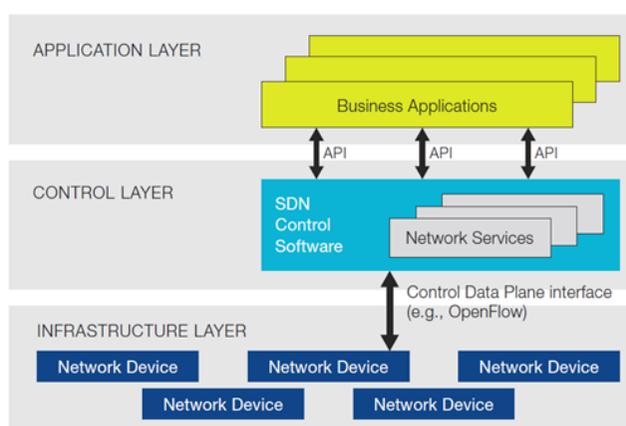


Figure 1: Architecture of a Software Defined Network

The logic of the network is implemented in the centralized control plane, and the network switches are reduced to forwarding elements. This provides an abstracted view of the network to the higher-layer applications. For an instance, an OpenFlow switch has one or more forwarding tables that are controlled by a centralized controller, thus realizing programmability in the control plane. Forwarding tables are used to

control packets (e.g., forwarding or dropping). Therefore, according to the controller policy that manages the forwarding tables, an OpenFlow switch can act as a router, switch, NAT, firewall, or exhibit similar functions that depend on packet-handling rules. Due to its decoupled nature, SDN is believed to be a new networking technology that simplifies today's network operation and management and also enables network innovations and new network designs. Because of the potential benefits of SDN in the current Internet and future Internet architectures, such as information centric networking, it has gained considerable attention from the community. However, this decoupling also leaves the network open to several vulnerabilities. These vulnerabilities pose a threat to the widespread implementation and adoption of software-defined networks. Thus, it is crucial to address these security flaws to ensure the progression to software-defined networks.

## **II. Problem Statement**

The decoupling of data and control planes in software-defined networks has its own limitations. These include threats such as Denial of Service (DoS) attacks, information disclosure and man-in-the-middle attacks. These threats can compromise the confidentiality, integrity and availability of the data in the computer networks. To prevent this, a network intrusion detection system can be implemented as a middlebox at the OpenFlow controller. The Intrusion Detection system can analyze the data at the controller to detect any suspicious traffic flowing through the network. However, malicious applications and compromised nodes can find a workaround for this, and hence a more comprehensive solution is essential. Thus, additional mechanisms are necessary to ensure the networks are inherently secure. In our approach, we include these mechanisms as a key factor by exchanging of hardware-based signature on the messages for authentication, encryption, and forensics between the controllers and the Trust-oriented Controller Proxy (ToCP). Integrating these techniques with the TPM (Trusted Platform Module) will significantly enhance the security of SDN Controllers and Virtualized Network Applications and make the system more trustworthy.

## **III. Objective**

The main objective of the Project is to provide more optimized, secured and trust support environment for SDN Controllers and Virtualized Network Applications. This also aims at achieving:

- To obtain an Enhanced Security & Trust Support
- High security level
- Improved Performance & Scalability of the System
- Secured and protected Controller
- To Create a Robust Policy Framework
- Conduct Forensics and Remediation

## **IV. Existing System**

Existing work on security mechanism attempts to deal with this possible lack of trust in the SDN controller or in their applications. Existing approach consists in not relying on a single controller but on several 'redundant' controllers that may also run in different execution environments. The network configuration requests coming from these controllers are then compared and, if deemed sufficiently consistent and then trustable, they are actually sent to the network. Existing approach has been implemented in an intermediary layer (based on a network hypervisor) inserted between the network equipments and the controllers. Experimentations have been performed showing the feasibility of the approach and providing some first evaluations of its impact on the network and the services.

### **Limitation of Existing System**

- Due to Environmental disasters, loss in the information
- Lost productivity
- Critical risk (DDoS attack) that a hacker takes over the network control by exploiting the SDN network programmability
- Secure level is low
- Lack of Trust Support

## V. Proposed System

In proposed system, we attempt to enhance security and build resilient and trustworthy system by integrating the hardware-based signature on the messages for authentication, encryption, and forensics between the controllers and the Trust-oriented Controller Proxy (ToCP) using TPM (Trusted Platform Module). The security implementations such as network administrator control, enhanced authentication mechanism, reduced overhead on controller and automated alert system are the benefits that are provided by the system. Moreover, the implementation allows network administrators to specify pre-defined rules to automatically respond in case of malicious traffic.

## Advantages of Proposed System

- Enhanced Security & Trust Support
- Secure level is high
- Improved Performance & Scalability of the System
- [Secured and protected Controller](#)
- Can Create a Robust Policy Framework
- Conduct Forensics and Remediation

## VI. Scope Of The Project

This Project makes these primary contributions:

- Firstly, we thoroughly evaluate the vulnerabilities of existing SDN Controller and Virtualized Network Applications. We observe that security measures to prevent attacks.
- Secondly, we integrate hardware-based signature on the messages for authentication, encryption, and forensics between the controllers and the Trust-oriented Controller Proxy (ToCP) using TPM (Trusted Platform Module) for enhancing of the security of SDN Controllers and Virtualized Network Applications and make the system more trustworthy.

## VII. Research Methodology

- Designing of Algorithms and models
- Develop Hardware interface and integrate with software interface
- Comparison of proposed technique with existing methods and choose the effective technique for the optimal performance.

## VIII. System Design

Several attack vectors on SDN systems can be anticipated. The SDN security concerns commonly includes attacks at the various SDN architecture layers. Let's take a look at the anticipated attacks that could occur at these layers. Following figure.2 illustrate a typical SDN architecture and where attackers could come from.

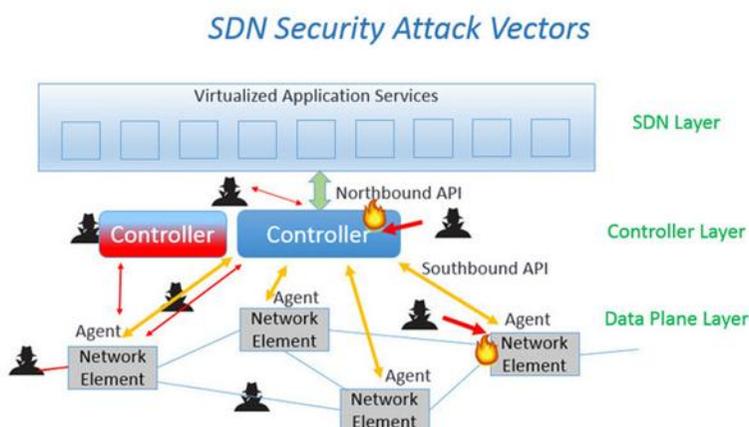


Figure.2. SDN architecture along with the attackers from where they could come

### **Attacks at Data Plane Layer**

Attackers could target the elements of a network from within the network itself. An attacker could theoretically gain unauthorized physical or virtual access to the network or compromise a host that is already connected to the SDN and then try to perform attacks to destabilize the network elements. This could be a type of Denial of Service (DoS) attack or it could be a type of fuzzing attack to try to attack the network elements.

### **Attacks at Controller Layer**

It is obvious that the SDN controller is an attack target. An attacker would try to target the SDN controller for several purposes. If the attacker wants to instantiate new flows, he can do it either by spoofing northbound API messages or by spoofing southbound messages towards the network devices. If an attacker can successfully spoof flows from the legitimate controller then the attacker would have the ability to allow traffic to flow across the SDN at their will and possibly bypass policies that may be relied on for security. An attacker might try to perform a DoS of the controller or use another method to cause the controller to fail. The attacker might try to attempt some form of resource consumption attack on the controller to bog it down and cause it to respond extremely slowly to Packet\_In events and make it slow to send Packet\_Out messages.

### **Attacks at SDN Layer**

Attacking the security of the northbound protocol would also be a likely vector. There are many northbound APIs that are used by SDN controllers. Northbound APIs could use Python, Java, C, REST, XML, JSON, among others. If the attacker could leverage the vulnerable northbound API, then the attacker would have control over the SDN network through the controller. If the controller lacked any form of security for the northbound API, then the attacker might be able to create their own SDN policies and thus gain control of the SDN environment.

Often times, there is a default password that is used for a REST API which is trivial to determine. If an SDN deployment didn't change this default password and the attacker could create packets toward the controller's management interface, then the attacker could query the configuration of the SDN environment and put in their own configuration.

## **IX. Conclusion**

We provided an overview of programmable networks and, in this context, examined the emerging field of Software-Defined Networking (SDN). We look at the history of programmable networks, from early ideas until recent developments. In particular we described the SDN architecture in detail as well as the OpenFlow [70] standard. We presented current SDN implementations and testing platforms and examined network services and applications that have been developed based on the SDN paradigm. We concluded with a discussion of future directions enabled by SDN ranging from support for heterogeneous networks to Information Centric Networking (ICN).

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# IT Security: A Survey on Security Attacks

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**ABSTRACT:** Now a days Security becomes a major issue in the world. Today's threat landscape is vibrant. The proliferation of disruptive technologies like social, mobile, cloud and big data has been increasingly impacting protection tactics. These technologies will continue to add to the complexity and drive the security needs of the IT infrastructure and information resources. In this paper, we explore the survey on various security attacks and real time example for the Data Breaches that happened in the recent world.

**Keywords:** IT Security, Cryptography, Information Security, Data Breaches, Security Attacks

## 1. Introduction

IT security is a set of cybersecurity approaches that prevent unauthorized access to organizational assets such as networks, computers and data. It maintains the integrity and confidentiality of sensitive information, blocking the access of sophisticated hackers. Information security states to the processes and tools designed to protect sensitive business information from attack, whereas IT security discusses to securing digital data, through computer network security.

Cryptography means process of hiding the information. **Confidentiality** means keeping things hidden. In IT this means keeping the data that you have hidden safely from unwanted eyes. One popular method of confidentiality that every day used is password protection. **Integrity** means keeping our data accurate and untampered. The data that we send or receive should remain the same throughout its entire journey. **Availability** means that the information we have readily accessible to those people that should have access it.

Security attacks are design to steal all kinds of things from user, time and materials.

## II. Essential Terms of Security

The following are the terms used in the security.

- a) **Risk:** the possibility of suffering a loss in the event of an attack on the system.
- b) **Vulnerability:** A flaw in the system that could be exploiting to compromise the system. Vulnerability can be holes that you may or may not aware of it. For example while writing or creating a Web Apps and enable a debug account for testing during development but forget to disable it before launching the app. An attacker can potentially discover problem this is called as Zero-day vulnerability.[1] Zero-day vulnerability that is not known to software developer or vendor but it is known to attacker.
- c) **Exploit:** software that is used to take advantage of a security bug or vulnerability. Attacker will write up exploits for vulnerabilities that find in the software to cause harm to system.
- d) **Threat:** the possibility of danger that could exploit a vulnerability. Threats are just possible attackers, sort like burglars.
- e) **Hacker:** A hacker in the security world is someone, who attempts to break into or exploit a system. There are two types of hackers, Black hat and white hat. Black hat is an attacker who try to get into system to do something malicious. White hat hackers who attempt to find weakness in a system. It alert the owner of those system so that they can fix it before someone else does something malicious.

### III. Literature iReview

The literature iurvey idescribes ithe ibackground iwork idone ion ivarious itechniques iand iconcepts irelated ito ithe iresearch. iThis iprovides ithe inew iidias, iinformation, idata iand ievidence ito ifulfil ithe icertain iaims ior iviews iof ithe inature iof ithe itopic.

Andreea iBendovschi. iet ial.,[1] iin ithis ipapers ithe iauthor idiscussed iabout ithe iCyber iattacks iocurred iin iinternational ilegislation iand ihistorical ifacts, iand iperform ian ianalysis iof iattacks ireported iin iall iaround ithe iworld iover ithe ilast ithree iyears iin iorder ito idetermine ipatterns iand itrends iin icyber-crime. iIn ithe ipaper, iAreej iEssa iet ial., iauthor idiscussed iabout ithe icyber iphysical isystem iand ihow iit iplays ia imajor irole iin ithe iindustries. iThe iCyber iPhysical iSensors iSystem i(CPSS) isecurity ithreats iand ivulnerabilities iwere isightseen iin ian ielaborated imanner. iComprehensive icase istudies iwith iexamples ito iillustrate ithreats iand ivulnerabilities iwere ipresented ialong iwith isolutions[2]. iThe ipaper, iGeluvaraj iet ial., idiscussed ithe iconcept iof iArtificial iIntelligence iand iMachine iLearning irelated iattacked iin ithe icybercrime. iThey iwere iexposed ithe iconcept iof ifuture iattacks iin ithis ifield i[3]. iThe iAuthor iSuneeta iMohanty iet ial., iin ithe ipaper iof iCIA iTriad iAccountability iin iCloud icomputing, idiscussed iregarding i ithe imajor isecurity iissues ilike iConfidentiality, iIntegrity iand iAvailability. iThey iaddresses ithe iavailability iissues[4]. i

### IV. Types of Attacks

An iAttack, iwhich iis ian iactual iattempt iit icausing iharm ito ia isystem. iCommon iattacks ithat iencounter iin iaround ithe iworkplace iare iViruses, iWorms, iAdware, iSpyware, iTrojans, irootkit, ibackdoor, iBotnets. iIn ithis iViruses iare ibest iknown itype iof imalware iand iit iworks isame ias iviruses iin ihuman ibody.

- a) **Virus:** iComputer iviruses iattaches iitself ito isome isort iof iexecutable icode ilike ia iprogram. iWhen iprogram iis irunning, iit itouches imany ifiles iand ieach iof iwwhich iis ito ibe iinjected iwith iviruses. iThe ivirus ireplicates iitself ion ithe ifiles iand iit idoes imalicious iwork ion ifiles. i[5]
- b) **Worm:** iworms iare ialso isimilar ito iviruses iexcept ithat iinstead iof ihaving ito iattach ithem ionto isomething, iit ispreads ilike inetwork. iThe iworms iwould ispread ivia iE-mail, iit ispread iby istealing ie-mail iaddresses iin ivictim's icomputer iand ichat iclients.
- c) **Adware:** iit iis ione iof ithe imost ivisible iforms iof imalware. iThat imost iof ius isee iit ievery iday. iAdware iis ia isoftware ithat idisplays iadvertisements iand icollect idata.
- d) **Trojan ihorse:** iA imalware idisguises iitself ias ione ithing ibut idoes isomething ielse. iA icomputer iTrojan ihas ito ibe iaccepted iby ithe iuser, imeans ithe iprogram ihas ito ibe iexecuted iby iuser.
- e) **Spyware:** iIt iis ithe itype iof imalware ithat imeans ito ispy ion iyou. iWhich imean imonitoring icomputer iscreen. iKey ipresses, iwebcam, ireporting ior istealing iall iof ithe iuser iinformation ito ianother iparty.
- f) **Key ilogger:** iIt iis ia icommon itype iof iSpyware ithat iis iuses ito irecord ievery ikeystroke iof ithe iuser. iIt icaptures iall ithe iconfidential iinformation iof ithe iuser ilike ipasswords. iRansomware iis ia itype iof iattack ithat iholds ithe iuser idata ior isystem ihostage iuntil iuser ipay isome isort iof iransom. iA irecent icase iof iransomware iw as iWannaCry iransomware iattack iin iMay i2017[7].

The imalware itook iadvantage iof ivulnerability iin iolder iwindows isystem, iinfecting ihundreds iof ithousands iof imachines iacross ithe iworld. iMost inotable iattack ithat ishutdown ithe isystem ifor iNational ihealth iservices iin iEngland, icausing ia iHealth irelated icrises. iSome imalware ican iutilise isomeone imachine ito iperform ia itask ithat iis icentrally icontrolled iby ithe iattacker. iThese icompromised imachines iare iBots.

Collection iof ione ior imore ibots iare icalled ias inetwork iof idevices ithat iis iBotnet. iThese iare idesign ito iutilise ithe ipower iof ithe iInternet iconnected imachines ito iperform isome idistributed ifunction. iFor iexample iMining iof iBitcoins, iit irequires ia imachine ito iperform isome icomputation ithat itakes iup imachine iresources. i

- g) **Backdoor:** iA iBackdoor iis ia iway ito iget iinto ia isystem. iThis iis ionther imethods ito iget iin ia isystem iin isecret iway ito ientry ifor iattacker. iBackdoor iare imost icommonly iinstalled iafter ian iattacker ihas igain iaccess ito isystem iand iwants ito imaintain ithe iaccess.
- h) **Rootkit:** iIt iis ialso ia imalware. iit iis ia ikit ifor iroot, imeaning ia icollection iof isoftware ior itools ithat ian iadmin iwould iuse. iIt iallows iadmin ilevel imodification ito ian ioperating isystem. iA irootkit ican ibe ihard ito idetect ibecause iit ican ihide iitself ifrom ithe isystem. i iThe irootkit ican ibe irunning ilots iof imalicious iprocess ibut iit iwould inot ishow iup iin itask imanager ibecause iit ican ihide iits ionw ipresence. i

- i) Logic ibomb:** iA iLogic ibomb iis ia itype iof imalware ithat's iintentionally iinstalled iafter icertain ievent ior itime ihas itriggered. iIt iwill irun ithe imalicious iprogram. iThere iis ia ipopular ilogic ibomb icase ihappened iin i2006.
- j) Network iattack:** iA iNetwork iattack iis isimple iconcept ibut icause ilots iof idamage. iThat iis ia iDNS icache ipoisoning iattack. iDNS iworks iby igetting iinformation iaabout iP addresses iand inames ito imakes iit ieasier ito ifind ia iwebsite. iA iDNS icache ipoisoning iattack iworks iby itricking ia iDNS iserver iinto iaccepting ia ifake iDNS irecord. iThis iwill ipoints ito icompromise ithe iDNS iserver. iIt ithen ifeeds ithe iuser iwith ifake iDNS iaddresses iwwhen iuser itries ito iaccess ilegitimate iwebsite. iIt iwill ispread ito iwhole inetwork. iIf iother iDNS iservers iare igetting itheir iDNS iinformation ifrom icompromised iserver ithey iwill iserve ithose ibad iDNS ientries ito iother ihosts[4].  
The ifamous inetwork iattack iis iMan-in-middle iattack. iIn iwwhich iattack itakes iplace ibetween itwo ihosts. iA icommon iMan-in-middle iattack iis ia isession ihijacking ior icookie ihijacking. iCommon iexample iis ilog iinto ia iwebsite iand iforgets ito ilogout. iAnother iway ia iMan-in-middle iattack ican ibe iestablished iis ia irogue iaccess ipoint iattack. iA iRogue iaccess ipoint iis ian iaccess ipoint ithat iis iinstalled ion ithe inetwork iwwithout ithe inetwork iadministrator's iknowledge. iA ifinal iMan-in-middle imethod iwwill icover iis icalled ian iEvil itwin. iThe ipremise iof ian iEvil itwin iattack iis ito iconnect ito ia inetwork, ithat iis iidential ito iuser inetwork. iThis iidential inetwork iis iconrolled iby ithe iattacker ionce iconnected iattacker iwwill iable ito imonitor itraffic.
- k) Denial iof iservice i(DoS) iAttack:** iDoS iAttack iis ithat itries ito iprevent iaccess ito ia iservice ifor ilegitimate iusers iby ioverwhelming ithe inetwork ior iserver. iDoS iattacks iare ithe imalicious iattempt ito iextract ithe isystem ior inetwork iresources iunavailable ito iusers.[5] iPing iof iDeath i(PoD) iis ia ipretty isimple iexample iof iDoS iattack. iIt iworks iby isending ia imalformed iPing ito ia icomputer. iAnother iexample iof iping iflood iwwhich isends itons iof iping ipackets ito ia isystem. iIt isends iICMP iecho irequests, isince ia iping iexcepts ian iequal inumber iof iICMP iecho ireplies. iSYN iflood iis ilike ia iping iflood, iin iTCP iconnection ia iclient isends ia iSYN ipackets ito iserver ithat iclient iwants ito iconnect. iServer isends iback iSYN-ack imessage ithen ithe iclient iin iack imessage. iIn ia iSYN iflood ithe iserver iis ibeing ibombarded iwwith ithe iSYN ipackets. i iThe iserver iis isending iback iSYN-ack ipackets ibut iattacker iis inot isending iack imessages ithis imeans ithat ithe iconnection istays iopen iand iis itaking iup ithe iservice iresources. iOther iusers iwwill ibe iunable ito iconnect ito ithe iserver, iwwhich iis ia ibig iproblem. iThese iattacks iare icarried iout iin ia isingle imachine. i[5]  
iA iDoS iattack iusing imultiple isystems iis icalled ia idistributed iDenial-of-Service iattack ior iDDoS. iIn iDDoS iattacker ineed ia ilarge ivolume iof isystems ito icarry iout ian iattack iand ibotnet iattackers iusually ihelp ithem. iIn iOctober i2016, ia iDDoS iattack ioccurred ithe iDNS iservice iprovider, iDYN iwias ia itarget iof iDDoS. iFake iDNS ilookup irequests ialong iwwith iSYN ifloods ithat ibotnets ito iperforming ioverloading itheir isystem. iDYN ihandled ithe iDNS ifor imajor iwebsites ilike iReddit, iGitHub, itwitter ietc.
- l) Client iside iattack:** iA icommon isecurity iexploit ithat ican ioccur iin isoftware idevelopment. iThat iruns irandomly ion iweb iis ipossibility ifor ian iattacker ito iinject imalicious icode. iThese itypes iof iattacks iare icalled iknown ias iInjection iattacks. iThis iattacks ican ibe imitigated iwwith igood isoftware idevelopment iprinciples ilike iinvalidating iinput iand isanitizing idata. I  
The itwo imost icommon ithreats iwwhich iare iused ito isteel iuser iinformation ifrom ithe iweb iapplication iare iSQL-injection iattack iand iCross iSite iScripting i(XSS). iThese iare iused ito isteel iuser's idata iby iinserting imalicious icode ito iinject iinto i iweb iapplications ias ia iuser iinput.[9] iCross iside iscripting ior iXSS iattack iare ithe itype iof iInjection iattack, iwwhere ithe iattacker ican iinsert imalicious icode iand itarget ithe iuser iof ithe iservice. iXSS iattacks iare ia icommon imethod ito iachieve ia isession ihijacking. iIt iwould ibe ia isimple ias iembedding ia imalicious iscript iin ia iwebsite iand iuser iunknowingly iexecutes ithe iscripts iin itheir ibrowser. iThe iscript icould ithen ido imalicious ithings ilike isteal ia ivictims icookies iand ihave iaccess ito ilog iinto iwebsite. iAnother itype iof iinjection iattack iis ia iSQL iinjection iattack iunlike iin iXSS iattack iit ialso itargets ia iuser, ibut iit itargets ientire iwebsite, iif ithe iwebsite iis iusing ia iSQL iDB. iAttacker ican ipotentially irun iSQL icommands ithat iallow ithem ito idelete iwebsite idata, icopy iit iand ithen iother imalicious icommands i[6].

**m) Password iAttacks:** iA icommon iattack ithat ioccurs ito igain iaccess ito ian iaccount iis ia ipassword iattack. iIt iutilizes isoftware ilike ipassword icrackers ithat itry iand igives iuser ipasswords. iA icommon ipassword iattack iis ibrute iforce iattack, iwhich ijust icontinuously itries idifferent icombinations iof icharacters iand iletters iuntil iit igets iaccess. iThis iattacks ican ibe iprevents iby iusing ithe iCAPTCHA iimage. iIt iprevents ithese iattacks ifrom iexecuting. I

Another itype iof ipassword iis ia iDictionary iattack. iThis iattack idoesn't itest iout ibrute iforce icombinations ilike iABC1 ior iabc1 iinstead iit itries iout iwords ilike ifootball, inames iof iperson. iThe ibest iway ito iprevent ia ipassword iattack iis ito iutilise istrong ipasswords.

**n) Deceptive iattack:** iSocial iengineering iis ian iattack imethod, iwhich irelies iheavily ion iinteraction iwith ihumans iinstead iof icomputers. iIn ithis isocial iengineering iattackers iuse ideceptive itechniques ito igain iaccess ito ipersonal iinformation. iA ipopular itype iof iattack iis iphishing, iit iusually ioccurs iwwhen ia imalicious ie-mail iis isent ito ia ivictim idisguised ias isomething ilegitimate. iOne icommon iphishing iattack iis ian ie-mail isaying iyour ibank iaccount ihas ibeen icompromised, ithen igives ia ilink ito iclick ion ito ireset ipassword. iWhen iuser igo ito ithe ilink, iit ilooks ilike ibanks iwebsites ibut iactually iit's ia ifake iwebsite. iAnother ipopular isocial iengineering iattack iis ie-mail ispoofing. iSpoofing iis iwwhen ia isource iis imasquerading iaround ias isomething ielse. iAnother ipopular iattack ithat ican ioccurs ioffline iis icalled iTailgating. iWhich iis iessentially igaining iaccess iinto ia irestricted iarea ior ibuilding iby ifollowing ia ireal iemployee iin. iin imost icorporate ienvironments, ibuilding iaccess iis irestricted iwwith ia ikey icard ior isome iother ientry imethod.

**V. Recent Data Breaches Occurred in the World**

4.1 Data Breaches occurred in the 21<sup>st</sup> Century

The ifollowing itable idescrib'es ithe iData iBreaches iocurred iin i21<sup>st</sup> icentury iin ithe iwold. iThis itable igives ithe iinformation iabout ithe iImpact iof ispecific iData iBreaches iand idetails iof ithe iData ibreaches.

Table i4.1: Description of Security Data Breaches

Sl.no	Data iBreaches	Description
1	Blur	In iJanuary i2, i2019, iThe i <a href="#">Blur iannounced ia ibreach</a> iwwhen ian iunsecured iserver iexposed ia ifile icontaining i2.4 imillion iuser inames, iemail iaddresses, ipassword ihints, iP iaddresses, iand iencrypted ipasswords. iThe ipassword imanagement icompany iprevail ion itheir iusers ito ichange itheir iBlur ilogin icredentials iand ienable itwo-factor iauthentication.
2	DiscountMugs.com	January i4, i2019: iOnline iretailer iof icustom imugs iand iapparel, i <a href="#">DiscountMugs.com iwvas ihacked</a> ifor ia ifour-month iperiod iin ithe ilatter ihalf iof i2018. iThe icompany iannounced ithat iit ihad idiscovered imalicious icard iskimming icode iplaced ion iits ipayment iwebsite. iHackers iwere iable ito isteal ifull ipayment icard idetails ilike ia i(number, isecurity icode, iand iexpiration idate), inames, iaddresses, iphone inumbers, iemail iaddresses, iand ipostal icodes.
3	BenefitMall	January i7, i2019: iU.S. iprovider iof ipayroll, iHR, iand iemployer iservices, i <a href="#">Benefit iMall iannounced ia idata ibreach</a> ithat ioccurred iafter ian iemail iphishing iattack icompromised iemployee ilogin icredentials. iThough ithe itexact inumber iof irecords iexposed ihasn't ibeen ireleased, ithe iemails imay ihave ihave ihave ihave icustomer inames, iaddresses, iSocial iSecurity inumbers, idate iof ibirth, ibank iaccount inumber, iand iinformation ion ithe ipayment iof iinsurance ipremiums iare icaptured.
4	Managed iHealth iServices i(MHS) iof iIndiana	In iJanuary i11, i2019: iThe ipersonal ihealth iinformation iof i31,000 ipatients iof i <a href="#">Managed iHealth iServices iof iIndiana</a> ihas ibeen iexposed, ifollowing ia iphishing iattack. iNames, iinsurance iID inumber, iaddresses, idates iof ibirth, iand imedical iconditions iare iamong ithe ipotentially icompromised idata.

5	Fortnite	In January 16, 2019: A flaw within the online video game <a href="#">Fortnite</a> has exposed players to being hacked. According to the security firm, who discovered the vulnerabilities, a threat actor could take over the account of any game player, view their personal account information, purchase V-bucks in-game currency, and eavesdrop on game chatter. Fortnite has 200 million users worldwide, 80 million of whom are active each month. [6]
6	Oklahoma Department of Securities	In January 17, 2019: Millions of government files, including records of pertinent to FBI investigations, were left unprotected on an open storage server belonging to the <a href="#">Oklahoma Department of Securities (ODS)</a> . The oldest records exposed dated back to 1986 and ranged from personal data to login credentials and internal communication records.
7	BlackRock Inc.	January 22, 2019: In BlackRock 20,000 financial advisers had their information leaked by the world's largest asset manager, <a href="#">BlackRock</a> . The company posted confidential sales documents related to advisers who work with BlackRock's iShares units. Names, emails, and assets managed by advisers were among the information exposed. [6]
8	Rubrik	January 29, 2019: IT security and cloud data management provider, the <a href="#">Rubrik exposed a massive database</a> containing customer information including names, contact information, and other details related to corporate accounts. The data leak was discovered on an unprotected Amazon Elastic search server that didn't require a password. [7]
9	Catawba Valley Medical Center	February 4, 2019: Patients of North Carolina-based <a href="#">Catawba Valley Medical Center</a> have had their names, birth dates, Social Security numbers, and Personal Health Information (PHI) exposed in a cyber attack. Three employee email accounts were hacked in a phishing scam between July and August 2018. An estimated 20,000 patients have been impacted. [7]
10	Rush University Medical Center	In March 4, 2019: Almost 45,000 patients of Chicago-based <a href="#">Rush health system</a> were exposed in a data breach. Names, addresses, birthdays, Social Security numbers, and health insurance information were compromised after an employee disclosed billing documents to an unauthorized third party. [7]
11	Facebook	March 21, 2019: <a href="#">Facebook has admitted</a> that since 2012 it has not properly secured the passwords of as many as 600 million users. These passwords were stored in plain text and able to be accessed by more than 20,000 of the company's employees. If you use Facebook, change your password. [8]
12	Facebook	April 2, 2019: Two third-party applications which hold <a href="#">Facebook datasets</a> were left exposed to the public online. Over 540 million records, including account names, Facebook ID, and user activity were exposed through Cultura Colectiva. The second application, at the iPool, disclosed passwords along with information regarding photos, events, groups, check-ins and more. [9]
13	Microsoft Email Services	April 15, 2019: In a statement to TechCrunch, <a href="#">Microsoft admitted a data breach</a> of its non-corporate email services, including @msn.com, @hotmail.com, and @outlook.com. The breach, which lasted from January 1 to March 28, 2019, allowed hackers to access email accounts by misusing Microsoft's customer support portal. [9]
14	EmCare	April 20, 2019: As many as 60,000 patients and employees of Florida's <a href="#">EmCare</a> have been notified of a data breach after a third party gained access to several employees' email accounts. Those email accounts contained personal information including names, dates

		<p>of birth, age, clinical information, and some Social Security and driver's license numbers. [9]</p>
15	Bodybuilding.com	<p>April 22, 2019: The largest online retailer of fitness supplement, <a href="#">Bodybuilding.com</a> announced a data breach that potentially squeezed its 7 million registered users. The company has since forced a password reset and notified its customers. The information that could have been stolen by hackers includes names, email addresses, billing/shipping addresses, phone numbers, order history, birth date, and information included in BodySpace profiles. [8]</p>
16	Uber	<p>In the year 2016: Personal information of 57 million Uber users and 600,000 drivers exposed. The hackers were able to access Uber's GitHub account, where they found username and password credentials to Uber's AWS account. Those credentials should never have been on GitHub.</p>
17	Equifax	<p>In July 29 2017, Equifax, one of the largest credit bureaus in the U.S., said on Sept. 7, 2017 that an application vulnerability on one of their websites led to a data breach that exposed about 147.9 million consumer. The breach was discovered on July 29, but the company says that it likely to started in mid-May.</p>
18	Marriott International	<p>Date: 2014-18, in Marriott International, 500 million customers details are hacked.                  November 2018, Marriott International announced that cyber thieves had stolen data on approximately 500 million customers. The breach actually occurred on systems supporting Starwood hotel brands starting in 2014. The attackers remained in the system after Marriott acquired Starwood in 2016 and were not discovered until September 2018.</p>
19	Yahoo	<p>Date: 2013-14                  Impact: 3 billion user accounts                  Details: In September 2016, the once dominant Internet giant, while in negotiations to sell itself to Verizon, announced it had been the victim of the biggest data breach in history, likely by "a state-sponsored actor," in 2014. The attack compromised the real names, email addresses, dates of birth and telephone numbers of 500 million users. The company said the "vast majority" of the passwords involved had been hashed using the robust bcrypt algorithm. [8]</p>
20	eBay	<p>Date: May-2014                  Impact: in this breach about 145 million users compromised                  Details: The online auction giant reported a cyber-attack in May 2014 that it said to be exposed names, addresses, dates of birth and encrypted passwords of all of its 145 million users. The company said hackers got into the company network using the credentials of three corporate employees, and had completed inside access for 229 days, during which time they were able to make their way to the user database. [9]</p>

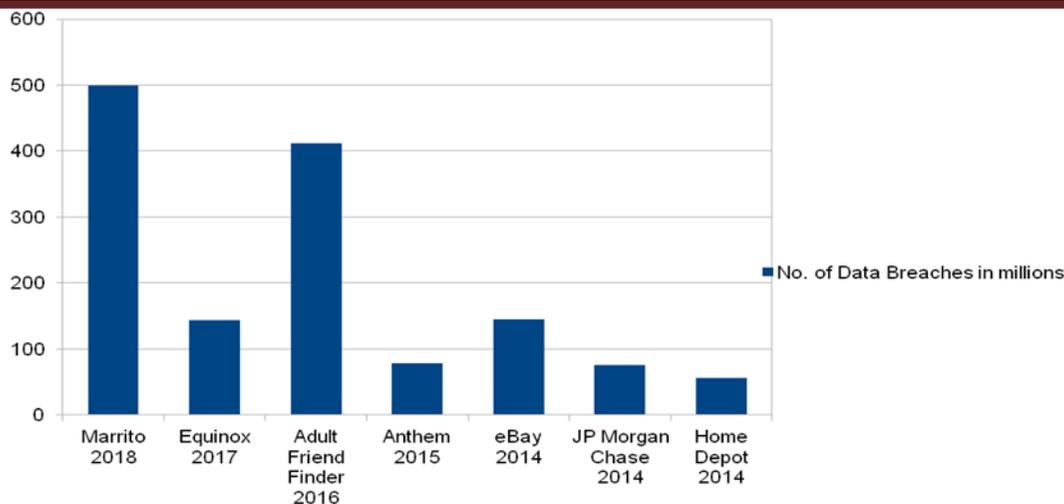


Figure 1: Biggest of the Data Breaches of the 21<sup>st</sup> Century

In Figure 1, it shows the statistics of the data breaches occurred in different companies during the 21<sup>st</sup> century.

## VI. Conclusion

IT security is the major threat in recent days. It can be defined in terms of network security, internet security, endpoint security, cloud security and application security. In this paper, we explore the survey of all different types of attacks and data breaches occurred all around the world in different industries.

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## **A Secure Communication in Wireless Sensor Network using SKDH**

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**ABSTRACT:** *Wireless sensor networks are a challenging field of research when it comes to security issues. Using low cost sensor nodes with limited resources makes it difficult for cryptographic algorithms to function without impacting energy consumption and latency. Intruders could try to penetrate the network, capture nodes or take control over particular nodes. It is important to revoke and renew keys that might be learned by malicious nodes. We propose several secure protocols for key revocation and key renewal based on symmetric encryption. All protocols are secure, but have different security levels. We implemented SKDH protocol on cooja simulator and analysed their performance. Symmetric key offers equivalent security with smaller key sizes resulting in faster computations, and also provides less energy consumption.*

**Keywords:** *Wireless Sensor Network; Symmetric Key; SKDH*

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### **1. Introduction**

Wireless sensor networks are a group of sensors for monitoring and recording physical conditions of environment and are able to collect and disseminate data in areas. Nowadays sensors are used in many applications where ordinary networks are unsuitable for environmental and/or strategic reasons. In these networks, a large number of sensor nodes are deployed to monitor a vast field, where the operational conditions are most often harsh or even hostile. Since these networks are usually deployed in remote places and left unattended, they should be equipped with security mechanisms to defend against attacks such as node capture, physical tampering, eavesdropping, denial of service, etc. Unfortunately, traditional security mechanisms with high overhead are not feasible for resource constrained sensor nodes. Various security schemes which are optimized for these networks with resource constraints. Minimization for consumption of energy in WSNs is realized in different phases of their design. In the first phase, the hardware itself is designed to consume less power. In the second phase, sensor nodes are made to remain asleep as long as possible. In this paper, we propose a scheme for energy efficient secure communication between pairs of sensor nodes in a WSN essentially using symmetric key cryptography. The scheme makes use of a key generation technique to reduce the frequency of key renewals and symmetric key-based Diffie-Hellman key renewal scheme to reduce the energy consumed during key renewals.

### **II. Related Work**

A Wireless Sensor Network (WSN) which collects data and monitors conditions which consists of sensor nodes which sense data and communicate with each other using wireless only, and it is usually deployed over inaccessible regions to collect information from the environment. In [1] the use of wireless sensor networks is essential for implementation of information and control technologies in precision agriculture. We present our design of network stack for such an application where sensor nodes periodically collect data from fixed locations in a field. Our design of the physical (PHY) layer consists of multiple power modes in both the receive and transmit operations for the purpose of achieving energy savings. In addition, we design our MAC layer to use these multiple power modes to improve the energy efficiency of wake-up synchronization phase. Refer [2] One more related work on Wireless sensor networks are comprised of low power devices with fixed energy stores. They often require long term operation for successful deployment so it is important to efficiently manage and track their energy usage. To effectively accomplish this across distributed networks requires methods which have low energy cost with minimal error in [2][3] refer.

### **III. Proposed System**

In proposed scheme for energy efficient secure communication between pairs of sensor nodes essentially using symmetric key cryptography ensuring authenticity and integrity of messages. Firstly, we make use of a key generation technique to reduce the frequency of key renewals and symmetric key-based Diffie-Hellman key renewal scheme to reduce the energy consumed during key renewals. We have carried out the

simulation of the proposed scheme using Cooja simulator for Contiki 3.x operating system, and the simulation were presented.

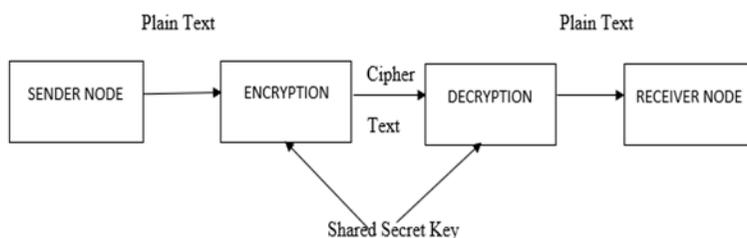


Fig1. Block Diagram for Secure Communication System.

### Encryption Algorithm

The algorithm takes the plaintext and converts it into an unreadable format. Once it's encrypted, you'll need a key to unlock it.

### Key

The key holds the information on all the switches and substitutions made to the original plain text. In symmetric encryption, the key is actually bundled with the algorithm; in this sense, the decoder ring is not universal. The changes and substitutions depend on the key, and vice versa because the sender and recipient share the key.

### Cipher Text

The Cipher text is the text that is now scrambled and ready to be sent. It may look like a random stream of data, and is unreadable.

### Decryption Algorithm

In the decryption algorithm, the secret key (the decoder ring) is applied to the Cipher text. It converts it back to plaintext, basically performing the encryption in reverse.

## IV. Methodology

### [1]. Key Generation Algorithm

The proposed scheme (denoted as KeyGenSC) essentially consists of two components, viz., a SKDH key renewal algorithm using symmetric key encryption, and an authenticated encryption scheme for message transfer between pair of nodes A and B using keys derived from shared secret key between A and B.

Input:

k : Master key of 16 bytes.

r : Key generation tag of n bytes ( $B_{n-1}B_{n-2}...B_1B_0$ ),

where byte  $B_i = b_i7b_i6b_i5b_i4b_i3b_i2b_i1b_i0$

n : Number of bytes in r.

nKeys : Number of keys to generate.

Output: km,

ke : Two keys used for authentication and encryption respectively.

r : Updated value of r for next call to KeyGen.

Variables: m1, m2 : Some temporary variables.

loc1, loc2 : Locations in m1, m2 respectively.

Begin loc1 =  $(b_03b_02b_01b_00)_{10}$  of r.

loc2 =  $(b_03b_02b_01b_00)_{10}$  of r + 1.

Fill from 0th to  $(loc1-1)$ th bytes in m1 with bit b00 of r.

Fill from  $(loc1+1)$ th to 15th bytes in m1 with bit  $b_{(n-1)7}$  of r.

For  $i = 0$  to  $n-1$   $m1[loc1+i] \leftarrow B_i$  of r.

IF (nKeys = 2)

THEN Fill from 0th to  $(loc2-1)$ th bytes in m2 with bit b00 of r + 1.

```

Fill from (loc2+1)th to 15th bytes in m2 with bit b(n-1)7 of r + 1.
For i = 0 to n-1
    m2[loc2 + i] ← Bi of r + 1.
ENDIF
km = Ek[m1].
IF(nKeys = 1) THEN ke = NULL. Increase r by 1. ELSE ke = Ek[m2].
Increase r by 2.
ENDIF
return (km,ke).
End.
    
```

## [2]. Key Renewal Scheme Using SKDH

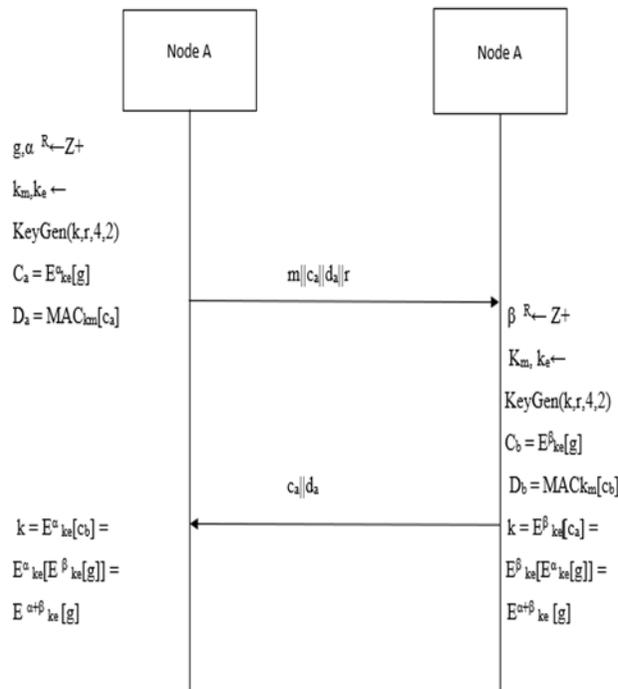


Fig2. Key renewal scheme using SKDH

Symmetric encryption realizes one one onto (bijective) mapping. from the set of all n-bit numbers to the same set of n-bit numbers. Typically, n is equal to 64 or 128. This bijective mapping gives rise to cycles in the set of n bit numbers., i.e., if an n-bit number is encrypted many times using the same key k, one would get back the number after some number of encryptions.

1. Node A calls  $\text{KeyGen}(k, r, 4, 2)$  to get two keys  $k_m, k_e$ .
2. Node A chooses a random number  $\alpha$  from  $\mathbb{Z}^+$  as its secret and a random message  $g$  from  $\mathbb{Z}^+$  and then it computes  $C_a = E_{k_e}^\alpha[g]$  such that  $C_a \neq g$ , for every  $1 \leq i \leq \alpha$ , where  $C_i = E_{k_e}^i[g]$ .
3. Node A computes  $D_a = \text{MAC}_{k_m}[C_a]$  and send  $g || C_a || D_a || r$  to Node B. Note that, for any positive integer i,  $E_{k_e}^i[k[g]] = E_{k_e}^{i-1}[k[g]]$ .
4. Similarly Node B calls  $\text{KeyGen}(k, r, 4, 2)$  to get two keys  $k_m, k_e$ .
5. Node B chooses a random number  $\beta$  from  $\mathbb{Z}^+$  as its secret and computes  $C_b = E_{k_e}^\beta[g]$ , such that  $C_b \neq g$ , for every  $1 \leq i \leq \beta$ , where  $C_i = E_{k_e}^i[g]$  and  $g \neq E_{k_e}^{\alpha+\beta}[g]$ .
6. Node B computes  $D_b = \text{MAC}_{k_m}[C_b]$  and sends  $C_b || D_b$  to Node A.
7. Node B computes  $E_{k_e}^\beta[E_{k_e}^\alpha[g]] = E_{k_e}^{\alpha+\beta}[g] = E_{k_e}^{\alpha+\beta}[g]$ .

## V. Experimental Results

Fig3. Represents the simulation screen. It demonstrates the communication between the sensor nodes and also the communication using the lines to represent the data follow.

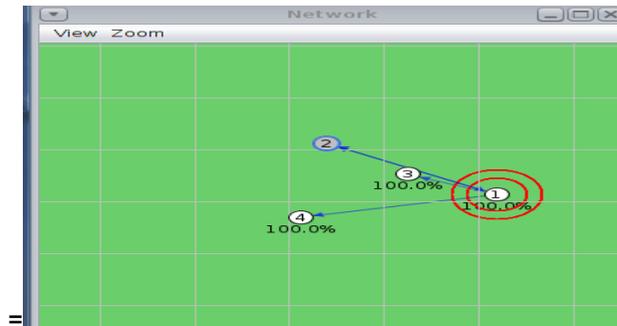


Fig 3. Communication between the sensor nodes

The below fig4. Represents the simulation screen for key establishment in onehop

Mote output		
Time	Mote	Message
00:01.090	ID:2	Rime started with address 2.0
00:01.097	ID:2	MAC 02:00:00:00:00:00:00:00 Contiki 3.x started. Node id is set to 2.
00:01.104	ID:2	nullsec CSMA ContikiMAC, channel check rate 8 Hz, radio channel 26
00:01.106	ID:2	Starting 'Example unicast'
00:01.236	ID:1	Rime started with address 1.0
00:01.243	ID:1	MAC 01:00:00:00:00:00:00:00 Contiki 3.x started. Node id is set to 1.
00:01.249	ID:1	nullsec CSMA ContikiMAC, channel check rate 8 Hz, radio channel 26
00:01.251	ID:1	Starting 'Example unicast'
01:18.978	ID:2	The Average Power taken :: 4470 uW for time 2551560
01:18.979	ID:2	Key is Established
01:44.384	ID:1	The Average Power taken :: 3880 uW for time 3379318
01:44.385	ID:1	Key is Established

Fig 4. Key establishment in onehop

## Conclusion

In this paper, we have proposed a key generation based secure communication scheme, termed KeyGenSC, for communication between a pair of sensor nodes A and B. We have proposed a symmetric key-based Diffie-Hellman (SKDH) key renewal scheme which consumes much less energy. We have also carried out the simulation study of the proposed scheme in the Cooja simulator for Contiki 3.x operating system, and the simulation results shows that the proposed scheme consumes comparatively less energy than the basic secure communication scheme, and at the same time provides better security.

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## **Making an Explainable Artificial Intelligence**

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**ABSTRACT:** *Explainable AI (Artificial Intelligence) is an analytical or logical concept which can be implemented practically within an Artificial Intelligence (AI) System so that the understandability of the system will get increased for the users as well as the developers.*

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### **1. Introduction**

In this modern era of technological advancement, it's quite observable that how our technology is getting dominated towards the application based Artificial Intelligence (AI) Systems. As the system has the merits like self-learning, memory enhancements, etc. It also comes with the boons that the programmers are able to develop an AI system but they are unable to predict the functionality or working of the same AI when AI has grown its skills learning from the incidents experienced by the system. It will surely work properly but after certain advancement in the AI System, it will be harder to understand the functionality of the system.

In basic AI application, let's assume an example of any of the Video Streaming Servers, they use to store user's data and fetch it further to improve the skill and further recommend you videos which falls under your interest based on your search/watch history available in the system.

If we consider some of the advanced AI systems such as AI based weaponry, that recognizes the enemy and eliminates the same and in the similar fashion the memory will get enhanced as it will learn from its mistakes as well as previously performed actions. Further on this system can malfunction and the developer as well as the user won't be able to recognize and rectify the reason of the malfunctioning, as there is not any existence of any such database in the system that is predictable enough to make user and the developer understand the reason behind the error caused.

### **II. Analyzing the Problem**

One might not be able to understand what I am actually talking about or trying to visualize. The reader might think what this paper is actually about if there exists an AI it will be explainable right? Yeah you are right that the developer or the user will be knowing what that code is actually, but this paper is not dealing with that segment of the thought. This paper is about whether the AI is self-explainable or not? And the answer is NO. Then the question arises then what is the use of this, for sure the AI self-explainability is not essential enough because as I stated above the programmer will be able to understand what the code is about to do (or say what to do).

### **What is the use of AI to be self-Explainable?**

If we are working with an AI system and it is learning from the past experiences, we can understand the working of the AI system till some extent of the functionality, but after that limit that AI will work (no objections) but the developer itself won't be able to understand how actually the AI is working so for that we need to treat the AI as a brain which surely can learn from the past mistakes, and can explain its views on its functioning. For example if I got less marks in my exam and I have my point that my answer is correct then I will further approach with the reason and the source reference that how my answer is actually correct in same way the AI will also explain itself with the reason why this particular step was performed instead of any other possible action.

The problem can also be analyzed with another example, assume we have a sample data of a building and we have three test objects from 3 different locations where the same architectural design has different significance, test object one states the given sample is a School, test object two says the given sample is of a Hospital and similarly test object three states that the given sample is of a Hostel. All three of them are correct at their places. But we as user/developer aren't knowing which one is correct, that's what I was actually trying to visualize that we might have different opinions for the same problem but that's actually not correct, there will be something else happening inside the system, which the system should explain by its

own that what's actually happening , which can be achieved by getting towards the advancement and a productive approach towards the *Self Explainable AI*.

### III. Solution

AI under an AI.

As we came across various analytical and observable problem in the above-mentioned segment. There exists a solution for the same i.e. In an Artificial Intelligence (AI) system the developer can implement an algorithm into any of the AI System, Lets say Progress Tree, which will be storing the data in a sequential manner which can be further translated into Understandable programming transcript which will help user as well as the developer to understand as well as trace the working of the operations performed by the AI System.

In other words, we can also take the reference of any of the programming language like approach that all the threads or functions available in a programming language are under a main () function i.e. the main controlling body of the particular problem-solving code.

In similar way we can also write an algorithm or say develop another AI which will actually looking into the AI system which will actually be tracing the primary AI system, and further the host AI (i.e. looking into the primary AI) can be used to observe to see how the Primary Self Learnable AI actually works.

On further elaboration of the same concept we can also approach the solution like after the execution of each of the step the AI system is storing the changes made into a tree named *Progress Tree*. It will be actually sequentially storing the data and further the data segments can be extracted to understand the working of the Primary AI system, in this way the gap between the AI system and the human will be reduced so that more application based enhanced AI systems can be made which can be trustable enough.

## **Data Classification with Deep Learning Using TensorFlow**

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**ABSTRACT:** Deep learning is a subfield of machine learning which uses artificial neural networks that is inspired by the structure and function of the human brain. Despite being a very new approach, it has become very popular recently. Deep learning has achieved much higher success in many applications where machine learning has been unsuccessful at certain rates. In particular, it is preferred in the classification of big data sets because it can provide fast and efficient results. In this study, we used TensorFlow, one of the most popular deep learning libraries to classify MNIST dataset, which is frequently used in data analysis studies. Using TensorFlow, which is an open source artificial intelligence library developed by Google, we have studied and compared the effects of multiple activation functions on classification results. The functions used are Rectified Linear Unit (ReLU), Hyperbolic Tangent (tanh), Exponential Linear Unit (eLu), sigmoid, softplus and softsign. In this study, Convolutional Neural Network (CNN) and SoftMax classifier are used as deep learning artificial neural network. The results show that the most accurate classification rate is obtained using the ReLU activation function.

**Keywords:** Deep Learning; TensorFlow; CNN; ReLu; Softmax Classifier.

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### **1. Introduction**

Big data is a term that we can use for data sets with large, diverse and complex data structures that are difficult to analyze or visualize using traditional computing methods and approaches. The widespread use of the Internet has caused frequent use of social media and increased data production such as photo, video, text sharing and internet log records, which in turn resulted in the information of very large data sets called big data.

The term big data does not only express the data collected from the internet sources but also every different types of data produced by various sources such as mobile phones, climate sensors etc. It is not possible to express the term big data and big data analysis with a single definition. However, big data analysis can be defined as providing usability for the data received from various sources through the use of data mining operations. The fact that the size of the data and the time it takes to process it, is another significant aspect of the big data. There are 5 components called 5-V for big data.

These components are variety, velocity, volume, verification and value.

In addition to the machine learning approaches used in the big data analysis, deep learning approaches are frequently used today. In recent years, studies using deep artificial neural networks have been successful in many competitions.

Deep learning, which is becoming more popular every day, can be regarded as a learning technique on artificial neural networks. While classification methods in classical machine learning approaches are considered to be 0 or 1, deep learning can provide numerical results between 0 and 1 as well. Thus, more accurate answers can be obtained for the current problem, and faster and higher accuracy values can be achieved in classification approaches.

By using a CNN in deep learning, a model class can be created to enable powerful and often incorrect assumptions by changing various parameters. There are several libraries used in deep learning studies.

In this study, classification was made using the TensorFlow library. TensorFlow is an open-source software library developed by the Google for numerical computation, which is now widely used by many large companies. TensorFlow provides an interface for expressing machine learning algorithms and an application for executing these algorithms.

A calculation expressed using TensorFlow can be carried out with little or no modification in a wide range of heterogeneous systems, from mobile devices such as iPhones and tablets, to large

scale distributed systems of hundreds of machines, and to various computing devices such as GPU cards.

In this study, the MNIST dataset was used to measure the performance of the TensorFlow library. MNIST is an abbreviation of "Modified National Institute of Standards and Technology" and is a large data set consisting of handwritten numbers widely used for training of image processing system.

In this dataset, there are 60,000 figures for training and 10,000 figures for the test. Figure 1 shows the numbers written with different handwritings. Each picture consists of 28x28 pixels.



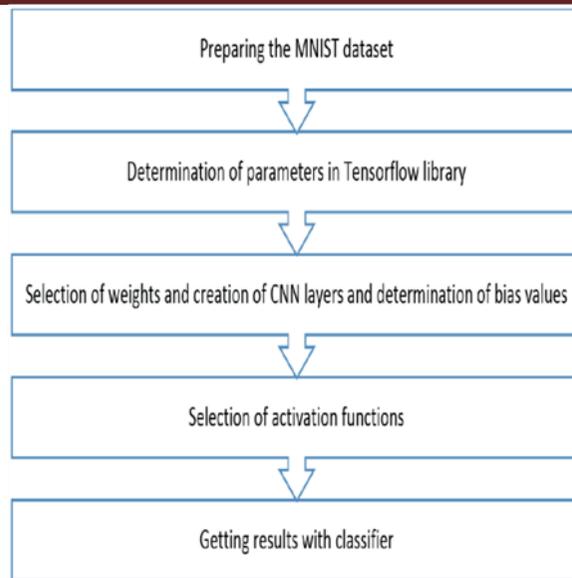
**Figure 1:** MNIST datasets figures

**Methodology**

Implementation is the stage of the project when the theoretical design is turned into working system. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective.

The following are the methods which are supposed to be implemented to carry out our project.

1. Consider the images contained in the MNIST data set are stored in the IDX file format in the first phase.
2. The parameters for the TensorFlow Library for deep learning is the second phase are specified. For this study, 100,000 iterations were processed.
3. In determining the weights in the third stage, 5x5 convolutional layer and 32 outputs were selected.
4. In the fourth step, the performance of the classifier was measured during the selected iteration by selecting different activation functions. Finally getting the results based on the activation functions the numbers can be classified.



**Figure II:** Proposed System

## Results and Discussions

Deep learning approaches are increasing in their popularity every day. Deep learning provides fast and effective solutions especially in the analysis of big data. In this study, a classification task was carried out on the MNIST data set which is widely used in deep learning applications. TensorFlow was used for this purpose.

Different activation functions were selected in the system to test the accuracy of the classification of the system. ReLU, LeLu, tanH, sigmoid, softPlus and softsign activation functions were used for this purpose. SoftMax is used as the classifier function. It has been observed that the best accuracy is achieved when the ReLu activation function is selected. In the study conducted with ReLu activation function, 98.43% classification accuracy is obtained on the test data.

The increase in the number of iterations showed an increase in the accuracy values, but the total classification time is also increased. In subsequent studies we aim to increase accuracy by applying different neural network architectures.

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# Identifying and Ranking Prevalent News Topics Using Social Media Factors

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**ABSTRACT:** In this paper, we present our preliminary experiment to show that Social Rank improves the quality and variety of automatically identified news topics. Mass media sources, from traditional days, used to give information about the daily events. In modern technology along with mass media, social media like Twitter, Face book and so on, are introduced in which it provides enormous amount of user generated data. Sometimes user generated data may contain noise which has to be filtered in order to match with other news media. However even after the unwanted words are removed, information overload in the remaining data may still exists hence, it is convenient to prioritize to get better result. In order to achieve prioritization, information must be ranked based on its important considering three factors. First, the prevalence of any particular topic in the news media, and it can be considered as the media focus (MF) of a topic. Second, the prevalence of the specific topic in social media based on user interest which indicates its user attention (UA). Last, the interaction between the social media users who is describing as, this topic indicates the strength of the community and the topic, and it can be called as the user interaction (UI) towards the topic. Let us propose or invent an supervised framework Social Rank which helps to identifies news topics that is applicable in both social media and the news media, and then it ranks them by relevance using the above three factors such as MF, UA, and UI.

**Keywords:** Information filtering, Social computing, Topic Identification, Topic Ranking, Social Network analysis.

## 1. Introduction

Social media like Twitter plays very important role by giving information about the events that is occurring in our day to day life. Various people from different places give positive or negative tweets for an Event based on their opinion. There are few Events or posts whose popularity increases based on the users views and positive comments. We are considering three factors Media Focus, User Attention and User Interaction, in order to identify the ranking for various events. Media Focus (MF) is used to identify the specific tweet which is given by the user and that specific tweet is focused more. User Attention (UA) can be defined as, there are huge numbers of tweets given by different users for a single Events, User attention will be more on the Events which has high popularity. User Interactions are the likes or dislikes of the Users.

The news media and social media are quite different in which news media presents professionally verified occurrences of events, while social media presents the interests of the audience in various events, and thus provide popularity of the events. Social media services like Twitter, Face book can also provide supporting information to a particular news media topic. Hence valuable information of different events in which these two media sources intersect each other. But sometimes, even after the removal of unimportant content, there is still information overload in the remaining news-related data, which must be prioritized for efficiency.

## II. Background

Here we are using Ranking algorithm to differentiate positive and negative tweets and rank based on that. Ranking is done by identifying the keywords which is previously stored in the Database. Keyword Extraction, Topic Identification, Topic Ranking is also done in order to achieve accuracy.

1. Topic Identification: It is a method for detecting topics such as LSA [1] and PLSA [2]. LDA is a generative probabilistic model that can be applied to different tasks, including topic identification. PLSA(Probabilistic), is a statistical technique, which can also be applied to topic modeling. In these approaches, however, some information is lost, which helps in identifying prevalent topics and is an important characteristic of social media data. Furthermore, LDA and PLSA only discover topics from text corpora; they do not rank based on popularity or prevalence.

2. Topic Ranking: In this concept there are several means by which this task can be executed, traditionally being done by estimate and recognize how frequently and recently a topic has been reported by mass media. The weight age of a topic increases when it becomes more popular and it comes down over time unless it remains popular.

3. Keyword Extraction: In order to perform key extraction, many unsupervised and supervised methods have been proposed. Unsupervised methods for keyword extraction solely on implicit information found in individual texts or in a text corpus that is group of text and it is learnt by its own experience. Supervised methods make use of training datasets that have already been classified. Keywords are extracted from the database in order to rank the topic and give accurate result.

4. Social Network Analysis: In this method User Attention is considered. Their method counts the amount of times a site was visited at the time of a particular period, which represents the UA of the topic to which the site is related to User Attention. On the other hand, website usage statistics provide the initial proof of attention, additional data are needed to collaborate it. We employ the use of social media like twitter, face book etc., as a means to estimate UA. When a user tweets about a particular topic, it signifies that the user is interested in the topic and it has captured her attention more so than visiting a website related to it.

### III. Algorithms

#### PageRank Algorithm

PageRank algorithm was given by Lawrence Page and Sergey Brin. It is given by

Formula:  $PR(A) = (1-d) + d (PR(T1) / C(T1) + \dots + PR(Tn) / C(Tn))$  where

- $PR(A)$  represents PageRank of page A,
- $PR(Ti)$  represents PageRank of pages  $Ti$  which link to page A
- $C(Ti)$  represents the number of outbound links on page  $Ti$
- $d$  represents damping factor which can be set between 0 and 1.

#### Naïve Bayes Algorithm

Bayes theorem provides a method of calculating the probability  $P(c|x)$  from  $P(c)$ ,  $P(x)$  and  $P(x|c)$ . Look at the equation below:

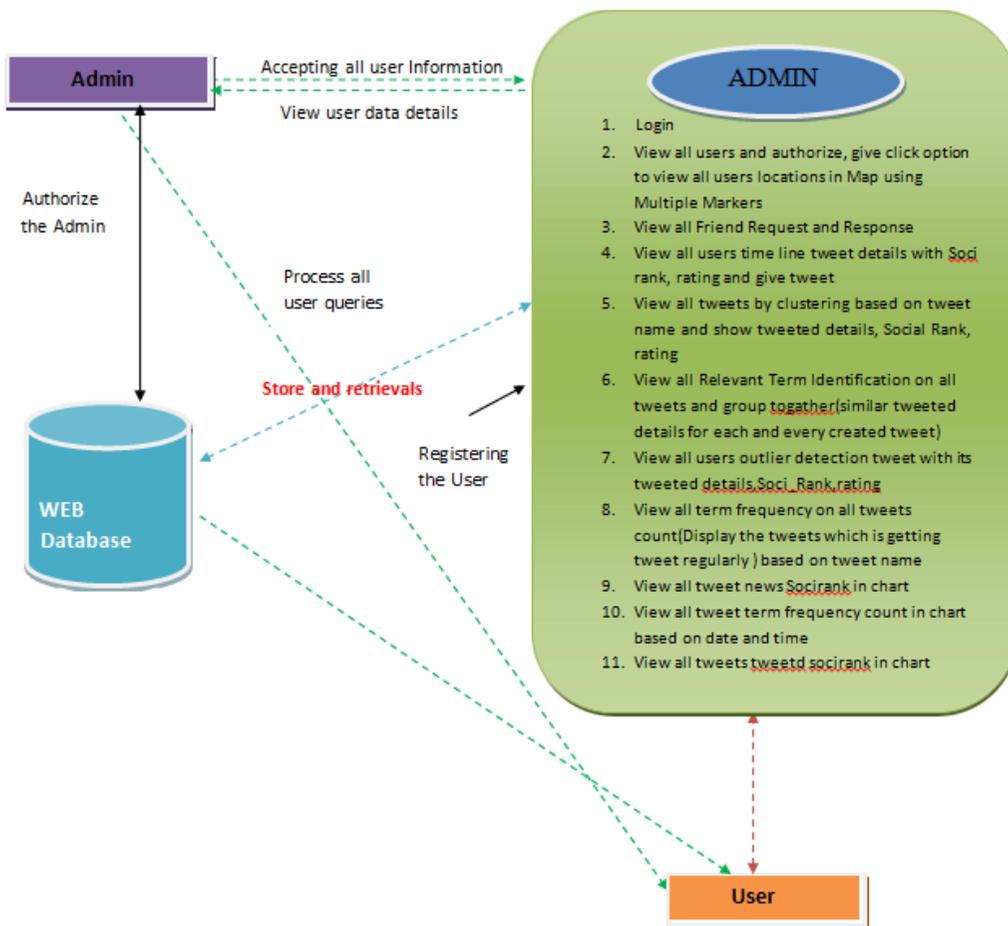
$$P(c/x) = P(x/c) P(c)/P(x)$$

- $P(c|x)$  represents the posterior probability of class (c, target) given predictor (x, attributes).
- $P(c)$  represents the prior probability of class.
- $P(x|c)$  represents the likelihood which is the probability of predictor given class.
- $P(x)$  represents the prior probability of predictor.

### IV. System Design

1. Register with Location with lat and login using GMap and Login, View Your Profile with location
2. Search Friend and Find Friend Request
3. View all Your Friends Details and Location Route path from Your Location
4. View all your time line tweets with Social rank, rating and give tweet
5. Create tweet for News like Tweet name, tweet uses, Tweet desc(enc),tweet image
6. View all your tweet with re tweet details, Social rank, rating
7. Search tweet and list all Tweets and view its details and give re tweet, give rank by hyper link
8. View all your friends Tweets and give Tweet.

Architecture Diagram



Results

The screenshot shows a web application interface with a header 'Business' and a banner image of two smiling people. The main content area is titled 'All Users Tweets Details' and contains a table with the following data:

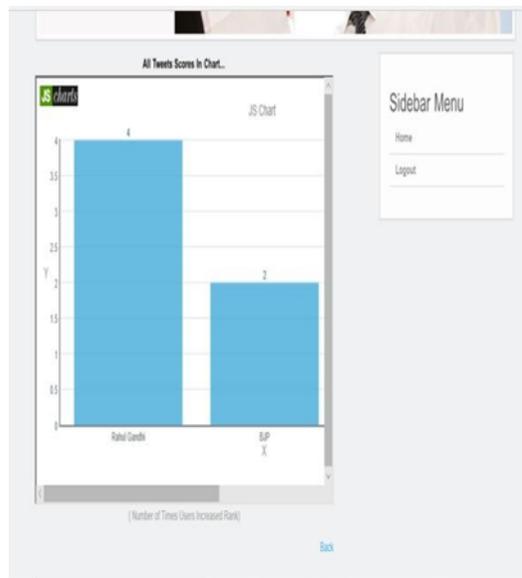
SI NO	Tweeter Name	Tweet Image	Tweet Name	Tweeted Date	SociRank	Tweet Rate
1	Rakesh		Rahul Gandhi	02/11/2017 17:38:52	4	★ ★
2	Omkar		BJP	02/11/2017 17:49:53	2	★ ★
3	Manjunath		Dengue	02/11/2017 18:51:25	1	★ ★

On the right side, there is a 'Sidebar Menu' with 'Home' and 'Logout' options. A 'Back' button is located at the bottom right of the page.

Fig 1.5: All User Tweet Details



Fig 1.6: Re-Tweets Count in chart Fig



1.7: All Tweet Scores in Chart

## Conclusion

As future work, we intend to perform experiments and expand Social Rank on different areas and datasets. Furthermore, we plan to include other forms of UA, such as search engine click-through rates, which can also be integrated into our method to provide even more insight into the true interest of users. Additional experiments will also be performed in different stages of the methodology. For example, a fuzzy clustering approach could be employed in order to obtain overlapping TCs. Lastly, we intend to develop a personalized version of Social Rank, where topics are presented differently to each individual user.

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## **An Efficient Application to Diagnose Lung Cancer Using Random Forest**

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**ABSTRACT:** Lung cancer is one of the major cause of cancer-related deaths in the world as seen so far and predicting its state (i.e., malignant or benign) is also a problem to take into consideration which helps in improving medical process of diagnosing lung cancer and curing it. As machine learning and deep learning progress has a deep impact on healthcare, can use its algorithm for diagnosis of lung cancer, and train the machine with the dataset for our machine or an interface to detect and identify the state of lung cancer. Thus, those dataset are processed using data cleaning and extraction method for getting an accurate dataset of each stages of cancer detection technique.

The dataset are divided as training data and test dataset, this taken will be for healthy patients and for malignant patients, and the test data will be taken for both type of patients. Machine learning algorithm like Random Forest and SVM classifiers evaluates those datasets for identifying the stages of cancer and it helps the patient to know that his cancer is malignant or benign state. In this project we are helping the patient to know their stage of cancer.

**Keywords:** Machine learning, Deep Learning, Random Forest Algorithm

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### **1. Introduction**

According to earlier surveys, cancer-related medical expenses and labor loss cost annually 10,000 billion dollars all over the world which is very high amount. Lung cancer related death is much more than any other cancer-related deaths, due to late detection of the stage and environmental conditions, such as air pollution, working conditions, life-long smoking habits has been taken as instance. For instance Lung cancer is one of the common cancers and cause of cancer related deaths world-wide. It accounts for 13 per cent of all new cancer cases and 19 percent of cancer related deaths worldwide. There were 1.8 million new lung cancer cases estimated to occur in 2012 according to the surveys. In India, lung cancer constitutes 6.9 per cent of all new cancer cases and 9.3 per cent of all cancer related deaths in both genders 225,000 new cases were detected in the United States in 2016, and 4.3 million new cases has been found in China in 2015. Like other types of cancers, early detection is reviewed to be the best strategy to save lives.

As the volume of data is growing proportionally with the increase in population, there is a greater need to extract the knowledge from the data. Machine Learning contributes much towards this and finds its application in various diverse fields including the healthcare industry. Machine Learning is the process of sifting through historical data thus providing an insight into the patterns from large dataset and helps to incorporate the pattern in everyday activity. Machine Learning helps in medical diagnosis to extract the underlying pattern of the disease. Researchers are suggesting that applying Machine Learning techniques in identifying effective pre-diagnosis of the disease can improve practitioner performance. Lung cancer being a disease which is highly dependent on historical data can make use of machine learning for its early detection. Researchers have been investigating on applying various Machine Learning techniques on lung cancer dataset for early diagnosis of lung cancer.

### **Methodology**

#### **Data Acquisition and Preprocessing**

The primary data collected from the online sources remains in the raw form of statements, digits and qualitative terms. The raw data contains error, omissions and inconsistencies. It requires corrections after careful scrutinizing the completed questionnaires. Data Preprocessing is a technique that is used to convert the raw data into a clean dataset.

**Inaccurate data (missing data)** - There are many reasons for missing data such as data is not continuously collected, a mistake in data entry, technical problems with biometrics and much more.

**The presence of noisy data (erroneous data and outliers)** - The reasons for the existence of noisy data could be a technological problem of gadget that gathers data, a human mistake during data entry and much more.

**Inconsistent data** - The presence of inconsistencies are due to the reasons such that existence of duplication within data, human data entry, containing mistakes in codes or names.

### **Feature Selection and Data Preparation**

Feature engineering is the process of using domain knowledge of the data to create features that make machine learning algorithms work. If feature engineering is done correctly, it increases the predictive power of machine learning algorithms by creating features from raw data that help facilitate the machine learning process.

The process of organizing data into groups and classes on the basis of certain characteristics is known as the classification of data. Classification helps in making comparisons among the categories of observations. It can be either according to numerical characteristics or according to attributes. So here we need to visualize the prepared data to find whether the training data contains the correct label, which is known as a target or target attribute.

### **Model Construction and Model Training**

The process of training an ML model involves providing an ML algorithm (that is, the learning algorithm) with training data to learn from. The term ML model refers to the model artifact that is created by the training process. The training data must contain the correct answer, which is known as a target or target attribute.

The learning algorithm finds patterns in the training data that map the input data attributes to the target and it outputs an ML model that captures these patterns.

### **Model Validation and Result Analysis**

In testing phase the model is applied to new set of data. The training and test data are two different datasets. The goal in building a machine learning model is to have the model perform well. On the training set, as well as generalize well on new data in the test set. Once the build model is tested then we will pass real time data for the prediction. Once prediction is done then we will analyze the output to find out the crucial information.

### **Implementation using Machine Learning Techniques**

#### **Random Forest**

RFs is a decision support model that makes use of a Decision tree Network in the forest and the classifier is based on Decision Tree with independence assumptions between predictors. This provides a method of calculating the posterior probability,  $P(c|x)$ , from  $P(c)$ ,  $P(x)$ , and  $P(x|c)$ . RFs classifier accepts that the effect of the value of a predictor ( $x$ ) on a given class ( $c$ ) is independent of the values of other predictors in the forest. This assumption is called class conditional independence survivability and recommending further treatment is the aim of the work which results in better treatment for people diagnosed with lung cancer. In order to establish this, the challenge is to find how efficiency can be achieved for prediction of lung cancer survivability using RFs technique that can help for further treatment.

### **3. Dataset and Technology**

TABLE I. DATASET DETAILS

S. No	Attribute Name	Attribute Description
1	Age	Patient's age
2	Sex	Either Male or Female
3	BMI	Body Mass Index
4	Family History	Previously any one effective in the family
5	Tuber Culosis	Effected by tuber Culosis
6	Smoking	Smoker or not
7	Lymph Node Involvement	L.N. involve or not
8	Tumor Size	<3 or >3
9	Radiation/radon/Asbestos	Effected by these things or not

Results

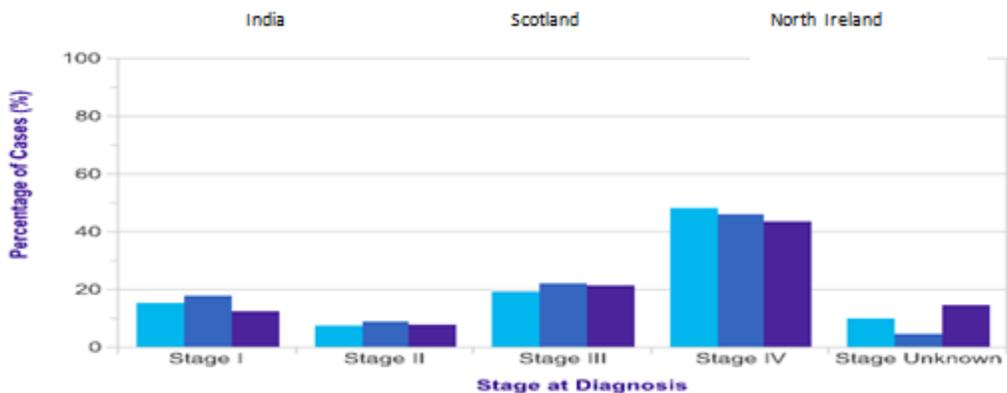


Figure 1.1: Diagnosis of lung cancer at various stages

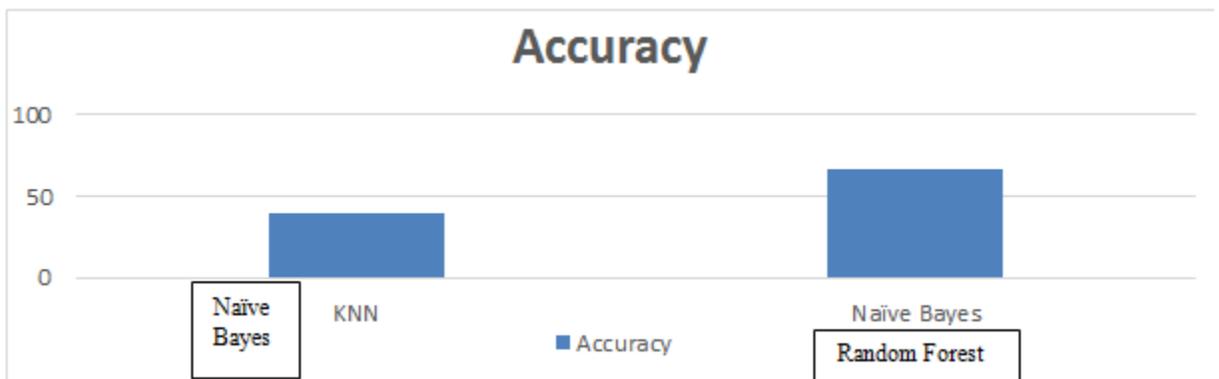


Figure 1.2: Accuracy between Random Forest and Naïve Bayes

## Conclusion

Currently, it is performed by experienced medical professionals; professionals must often search through many similar cases before finding the desired label or class. This process of manual recognition is slow and poses a degree of subjectivity which is hard to be quantified. Our proposed strategy focuses on a novel machine learning procedure for early stage lung cancer detection using sample data collected from various peoples, thus overcoming the existing problem. By utilizing Random Forest algorithm, we will make our model in order to increase the performance and accuracy. Different existing data mining procedures and its application were considered or explored. Utilization of machine learning algorithms was connected in various medical datasets. Machine learning strategies have diverse power in different medical data sets and results additionally shifts in light of the procedures has been utilized for the prediction.

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# **A Secure Communication for Wireless Sensor Network Based on ECC-DH Protocol**

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**ABSTRACT:** *Wireless Sensor Network is an emerging trend and have become increasingly popular across broad range of fields. These are normally designed to perform a set of high level of information processing tasks. However the greatest issue in wireless sensor networks is secure communication for which key management is primary objective and the resource constraints of wireless sensors. Key management is fundamental to security. The Elliptic Curve Cryptography allows one to reach same level of security as traditional public key cryptography. In the proposed scheme, we make use of a key generation technique to reduce the frequency of key renewals. We have carried out the simulation study of the proposed scheme using Cooja simulator with Ubuntu operating system and the simulation results show that the proposed scheme consumes less energy than the basic secure communication scheme.*

**Keywords:** *Wireless Sensor Network; Elliptic Curve Cryptography; AES.*

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## **1. Introduction**

Wireless sensor network consists of a large number of sensor nodes that are able to collect and disseminate data in areas where ordinary networks are unsuitable for environmental and/or strategic reasons. In these networks, a large number of sensor nodes are deployed to monitor a vast field, where the operational conditions are most often harsh or even hostile. These networks are usually deployed in remote places. Wireless Sensor Networks rely on the uninterrupted availability of the wireless medium to interconnect participating nodes. However, the open nature of this medium leaves it vulnerable to multiple security threats. Anyone with a transceiver can eavesdrop on wireless transmission, inject spurious messages or jam legitimate ones. Some common challenges towards wireless security are: wireless nature of communication, Resource constraint, Large and dense WSN, Lack of physical infrastructure, Unknown network topology prior to deployment, High risk of physical attack to unattended sensors, Adverse and hostile operating conditions. Elliptic Curve Cryptography (ECC) has a beautiful history being studied by mathematicians over the centuries. ECC has been used to solve varied range of problems. It is a public key cryptography technique. In public key cryptography, each user has a pair of keys, public key and private key, to establish a secure communication. It has emerged as a solution for wireless sensor network as it offers same level as of RSA, but, with smaller keysize and lesser computational overhead. ECC's faster calculation, shortest processing time, lower power and memory consumption is leading to increasing interest.

## **RELATED WORK**

The aim of this paper [1] is first to explore actual trends of ECC based implementation in different platforms through a review of a number of works. Secondly, to identify and gather the criteria and corresponding metrics used to evaluate the performance of these implementations. In Reference [2] study and application of ECC on a popular WSN operating system, TinyOS, has been carried out. Practical implementation of the ECC operations has been performed using Tiny ECC library. Tiny ECC has been used to develop custom security protocols on a TinyOS. In this paper [3] a key distribution protocol was designed to securely provide authenticated motes with secret system keys with ECC based cryptographic functions. Reference [4] describes some important aspects of sensor networks including sensor node architecture, different remote sensing applications and characteristics of sensor networks. In Reference [5] issues and security mechanism of WSN is discussed. WSN presents extreme resource limitations, mainly available memory space and energy resource both limitation represent great obstacles for the integration of traditional security techniques. Reference [6] explains an improved energy efficient access control scheme for WSN based on ECC. In Reference [7] Wangates proposed a public key implementation access control scheme based on ECC. Reference [8] the intent of this paper is to investigate the security related issues and challenges in WSN. The more dependency on the information provided by the network has been increased, the more the risk of

secure transmission information over the network has increased. For secured transmission several cryptographic techniques are used which are well known.

**PROPOSED SYSTEM**

In the proposed work, we enhance our system in security and performance. Specifically, we present an advance scheme to support stronger security by elliptic curve cryptography in C language without library functions or built in frameworks with DiffieHellman key distribution algorithm forming an Elliptic curve Diffie-Hellman protocol(ECDH). Security analysis demonstrates that our system is secured in terms of the definitions specified in the proposed security model which uses Contiki operating system, an open source operating system and a powerful tool box for building complex wirelss systems and it is simulated on Cooja simulator, which is a network simulator specifically desgined for WSN.

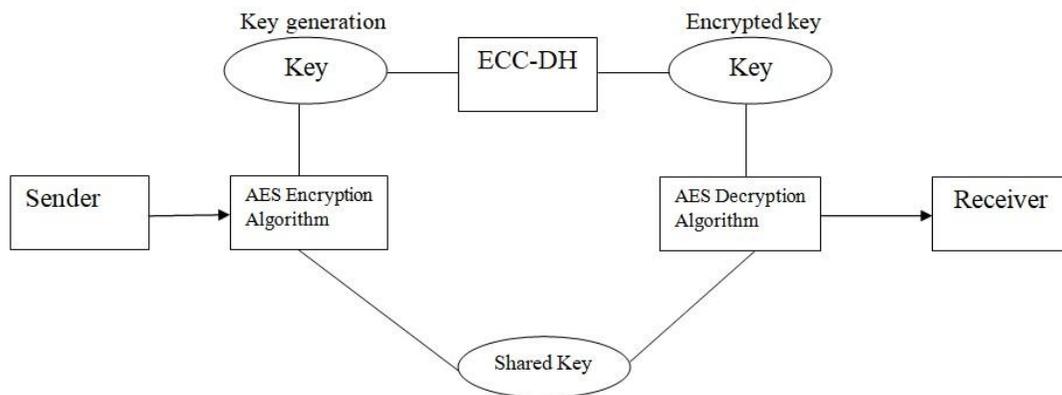


Fig 1: Architecture for Secure communication

**KEY ENCRYPTION AND DECRYPTION SCHEME**

**[A] Key Establishment Module**

Elliptic Curve Cryptography (ECC) is an approach to public-key cryptography, based on the algebraic structure of elliptic curves over finite fields. An elliptic curve is a planar algebraic curve defined by an equation of the form:  $y^2 = x^3 + ax + b$

Where 'a' is the co-efficient of x and 'b' is the constant of the equation. In general, an elliptic curve looks like as shown below.

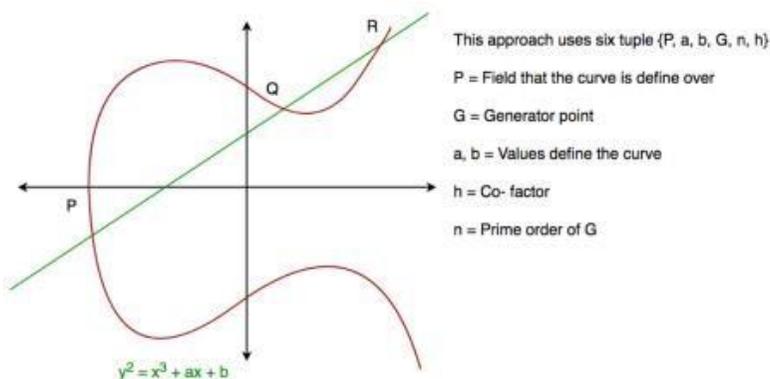


Fig 2: Elliptic Curve

The curve is non-singular that is, its graph has no cusps or self-intersections. Elliptic curves could intersect at most 3 points when a straight line is drawn intersecting the curve. As we can see that elliptic curve is symmetric about the x-axis, this property plays a key role in the algorithm. The Diffie-Hellman algorithm is being used to establish a shared secret that can be used for secret communications while exchanging data

over a public network using the elliptic curve to generate points and get the secret key using the parameters. For the sake of simplicity and practical implementation of the algorithm, we will consider only 4 variables one prime P and G (a primitive root of P) and two private values a and b. P and G are both publicly available numbers. Users (say Alice and Bob) pick private values a and b and they generate a key and exchange it publicly, the opposite person received the key and from that generates a secret key after which they have the same secret key to encrypt.

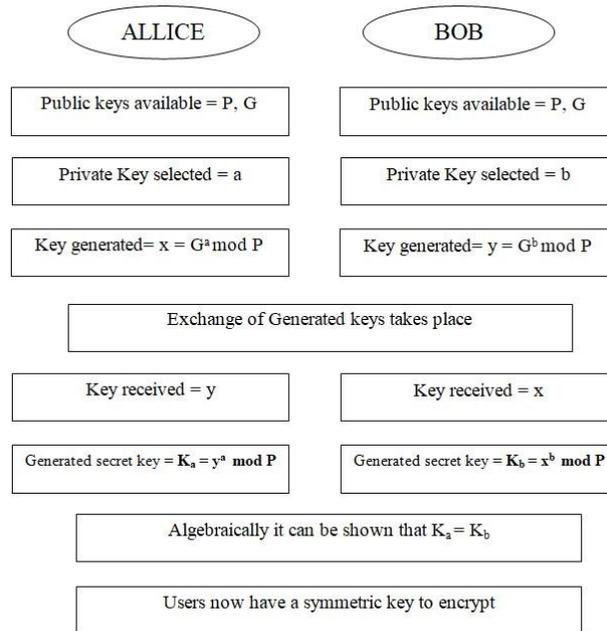


Fig 3: ECC-DH Algorithm

Example:

- Step1: Alice and Bob get public numbers p=23, g=9
- Step2: Alice selected a private key a=4 and Bob selected a private key b=3
- Step 3: Alice and Bob compute public values  
 Alice:  $x=(9^4 \text{ mod } 23)=(6561 \text{ mod } 23)=6$   
 Bob:  $y=(9^3 \text{ mod } 23)=(729 \text{ mod } 23)=16$
- Step 4: Alice and bob exchange public numbers
- Step 5: Alice receives public key y=16 and Bob receives public key x=6
- Step 6: Alice and bob compute symmetric keys  
 Alice :  $ka=y^a \text{ mod } p=6^4 \text{ mod } 23=9$   
 Bob:  $kb=x^b \text{ mod } p=2^3 \text{ mod } 23=9$
- Step 7: 9 is the shared secret

**[B] AES Encryption and Decryption**

In Encryption we are going to encrypt the data from the user as a plain text and generate the cipher text. The key of size 128-bits is used. In Decryption it performs the inverse operation of decryption module. It uses the same key, which was used for encryption to decode the data.

AES Encryption Algorithm	AES Decryption Algorithm
Aes_Enc_Dec(buf,shared_dec,0) { //Input : plain text //Output: cipher text Step1 : Start	Aes_Enc_Dec(buf,shared_dec,0) { //Input: plain text //Output: cipher text Step1 : Start

<pre> Step2: //Input from user-plain text, Print plain text, Strcpy shared key to shared_enc, Print shared_enc Step3: //Dividing the string of plain text into 16 byte block and encrypting each block. 1 &lt;- 0; n &lt;- strlen(state); q &lt;- n/16; if (n%16 is greater than 0) then q &lt;- q+1; end if for i &lt;- 0 to q </pre>	<pre> Step2: k &lt;- 0; L &lt;- 0; Step3: //Getting cipher text as input and decrypting it for i &lt;- 0 to q for j &lt;- 0 to 16 buf[j] &lt;- encry[k]; k &lt;- k+1 end for call aes_enc_dec(1); for j &lt;- 0 to 16 decry[1] &lt;- buff[j]; 1 &lt;- 1+1; end for </pre>
<pre> for j &lt;- 0 to 16 buf[j] &lt;- state[k]; k &lt;- k+1 end for call aes_enc_dec(0); for j &lt;- 0 to 16 encry[1] &lt;- buff[j]; 1 &lt;- 1+1; end for end for Step4: Print cipher text Step5: End } </pre>	<pre> end for Step4: Print plain text Step5: End } </pre>

**Key Agreement Between Hops**

**[A] Key Agreement by Single-Hop**

Wireless and short range message exchange between adjacent nodes with no intermediate node on the communication node is known as one-hop.

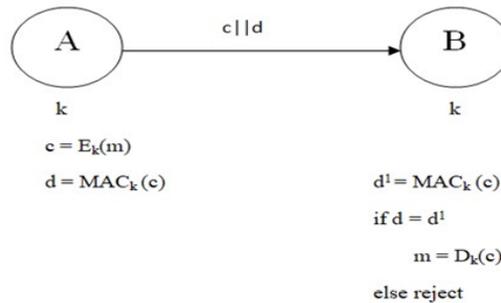


Fig 4: Single Hop

**[B] Key Agreement by Multiple-Hop**

It is also called as ad-hoc, wireless network use two or more wireless hops to convey information from a source to destination.

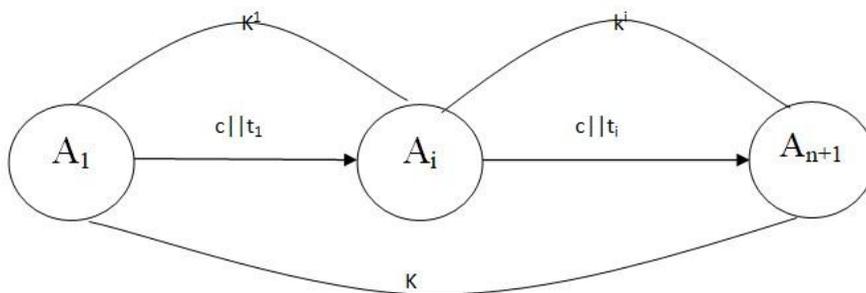


Fig 5: Multiple Hop

The communication from node A1 to node An+1 in n hops takes place as shown in the Figure. The predetermined path is  $A1 \rightarrow A2 \rightarrow \dots \rightarrow Ai \rightarrow \dots \rightarrow An \rightarrow An+1$ . The key agreed between A1 and An+1 is k and  $k_i$  is the key agreed by nodes  $A_i$  and  $A_{i+1}$ , where  $i = 1, 2, \dots, n$  ( $n > 1$ ). To establish  $k_i$ , nodes  $A_i$  and  $A_{i+1}$  follow the ECC based Diffie-Hellman algorithm. The ciphertext c is passed from node A1 to node An+1 as described below.

1. Node A1 does the following:
  - 1.1  $c = E_k[m]$ .
  - 1.2  $c1 = c || t$  where  $t = MAC_k[c]$
  - 1.3  $t1 = MAC_{k1}[c1]$
  - 1.4 Node A1 forwards  $c1 || t1$  to the next node A2.
2. An intermediate node  $A_i$  does the following on receiving  $c_{i-1} || t_{i-1}$  from node  $A_{i-1}$ :
  - 2.1. Parse the cipher received and verify that if  $t_{i-1}$  equals to  $d_{i-1}$  where  $d_{i-1} = MAC_{k_{i-1}}[c_{i-1}]$ .
  - 2.2. If this verification passes, then
    - i.  $c_i = c_{i-1}$
    - ii.  $t_i = MAC_{k_i}[c_i]$
    - iii. Forward  $c_i || t_i$  to the next node  $A_{i+1}$ .
  - 2.3. If this verification fails, then it discards the message.
3. An+1 does the following on receiving  $c_n || t_n$  from node  $A_n$ :
  - 3.1 Parse the cipher received from  $A_n$  and verify that if  $t_n$  equals to  $d_n$  where  $d_n = MAC_{k_n}[c_n]$ .
  - 3.2 If this verification passes, then
    - i.  $c_n = c || t$  where  $t = MAC_k[c]$
    - ii. Parse the cipher  $c_n$  and verify that if  $t$  equals to  $d$  where  $d = MAC_k[c]$ .
    - iii. If this verification passes, then compute the message as  $m = D_k[c]$ .
    - iv. If this verification fails, then discard the cipher received.
  - 3.3. If this verification fails, then discard the message.

## Conclusion

The key size and the computational time are the major issues of concern in wireless Sensor. To reduce the key size and optimize the complexity of calculations; we use ECC with Diffie-Hellman key exchange algorithm. The ECCDH protocol developed along with Advance Encryption Standard provides effective security. The reduced key size helps to overcome the resource constrains and the overhead imposed on functioning of wireless sensors.

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## Classification of Stages of Diabetic Retinopathy

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**ABSTRACT:** *Diabetic retinopathy could be a sickness of the membrane, occurring in a few quarter of people with polygenic disease. The membrane contains cells that convert the sunshine into the electrical signals, and these signals are then sent on to the brain. The symptoms will blur or distort the patient's vision and are a main reason for vision defect. Microaneurysm are one of the primary signs of retinopathy. Detection of exudates by ophthalmologists normally wants pupil dilation using a morphological technique that takes time and affects patients. The discharge causes the membrane to expand a touch and become soggy, atiny low quantity style of a sponge. This swelling then damages the retinal cells themselves. This paper examines and proposes a set of optimally adjusted morphological operators to be used for Microaneurysm detection on diabetic retinopathy low-contrast footage. Automatic tool for identification of diabetic retinopathy ought to endure some well-defined steps. First, it's to note the blood vessels and blind spot. Second, it's to identify abnormalities among the membrane like exudates and microaneurysms that cause diabetic retinopathy. this method has resulted with sensitivity and specificity for our Microaneurysm detection is eightieth and ninety nine.5%, severally.*

**Keywords:** *Diabetic retinopathy; Microaneurysm; Morphology operator; Retinal image; Non-dilated retinal images.*

### 1. Introduction

Diabetes is that the commonest explanation for visual defect within the operating cohort within the developed world. Diabetic retinopathy (DR) is caused by injury to the little blood vessels of the membrane within the posterior a part of the attention diabetic patient. DR is an eye fixed unwellness and a typical complication of polygenic disease that may cause vision loss if left unknown at an initial stage. It is the prime explanation for visual defect within the operating age population of the planet. The screening of diabetic patients for the event of diabetic retinopathy will doubtless cut back the danger of visual defect within the patients by 50% [1-3]. Diabetes is a chronic disease that is reaching epidemic proportions worldwide. There area unit presently over a 190 million individuals with polygenic disease worldwide. The World Health Organization (WHO) estimates that this can rise to 221 million by the year 2010, mostly because of growth, ageing, urbanization and a inactive lifestyle. Diabetic retinopathy is that the most conventional explanation for new cases of visual defect among adults aged 20 -70 years. Throughout the primary two periods of unwellness, nearly all patients with type 1 diabetes and greater than 90% of patients with type 2 diabetes have retinopathy [1]. Exudates occur when there are the lipid residues of serous discharge from broken capillaries. The most typical cause is polygenic disorder. The amount of microaneurysms, haemorrhages and exudates will increase as the degree of disease [4][25]. A variety of techniques for microaneurysm and trauma detection have been proposed. Sinthanayo thinetal.[5] applied recursive region growing segmentation (RRGS) technique to segment vessels, microaneurysms and haemorrhages. The yellow-white flecks scattered around the macular region are a little mounds lower the retinal pigment epithelium. They are tombstones of dead retinal pigment epithelial cells. The most typical cause is age-related macular degeneration, a typical however poorly understood disorder of the older. At this stage, visual sense could also be solely slightly abnormal. If the retinal pigment epithelium dies further, vision can fail because the foveal region turns into a merging yellow-white space. The gray portion lies beneath the retinal pigment epithelium. Encompassing the gray hemorrhage is a ring of red blood that has loose into the membrane. This patient has age-related macular degeneration, the most typical explanation for choroidal neovascularization and submacular hemorrhage. Then the detected red lesion candidates were classified employing a range of options and a k- nearest neighbour classifier. Usher et al. [7][24] used AN rrgs adaptative intensity thresholding and edge improvement operator to extract the candidate red lesions. Candidate red lesions were classified employing a neural network. However, during this paper we tend to target exudate detection as an obvious sign of diabetic retinopathy and a marker for the presence of coexistent retinal swelling. If the exudates extend into the macular region, vision loss will occur. Fluorescein angiogram images provide important information on pathologies. The fluorescein angiograms do not seem to be appropriate for an automatic screening system as a result of side-effects related with giving a patient fluorescein. The

employment of colour fundus picture is more appropriate for an automatic screening system. An automatic exudates detection system would be helpful so as to detect and treat diabetic retinopathy in an early stage. Ophthalmologists and high performance computers are a unit seldom on the market.

## **[2] Methodology**

All digital retinal pictures were taken from DIARETDB1. Bar graph feat within which manipulates histograms in a very consistent and substantive manner. DIARETDB1 pictures were resized to 340 x 480 pixels so as to scale back the time interval of the strategy. Several images enhancement techniques squares measures supported spatial operations performed on native neighbourhoods. The detection technique planned during this paper is performed in MATLAB (version 2019). The accuracy of the strategy was tested within the public database of fundus pictures DIARETDB1 database consists of 89 colour fundus pictures of which 84 contain minimum of delicate non-proliferative signs of the diabetic retinopathy and five are considered as normal which do not contain any signs of the diabetic retinopathy consistent with all the consultants participated in the analysis process. Pictures were captured with the constant 50 degree FOV digital fundus camera with varying imaging controlled by the system in the Kuopio university hospital, Finland. The image ground truth provided in conjunction with the database is predicted on professional selected findings associated with the diabetic retinopathy and traditional fundus structures.

### **[2.1] Pre- processing**

In pre-processing, we tend to produce binary masks for background and droning areas. Completely different retinal pictures built it troublesome to extract retinal options and distinguish exudates from different distinction, and brightness bright options in pictures. Colour elements. A median filtering operation was then applied on I band to scale back noise before a distinction-limited adaptational histogram equalization was applied for contrast improvement CLAHE operates on tiny regions within the image. The distinction of every tiny region is increased with histogram equalization. After performing the equalizations, the close tiny regions were then combined by victimization additive interpolation. Exudate lesions and optic disc regions usually show high intensity values during this channel and so the distinction improvement technique assigns them the best intensity values [10, 15].

### **[2.2] Optic disc elimination**

The optic disk is characterized by the largest high-contrast space. The optic disk is roughly detected by victimization the entropy feature on the distinction increased image. The entropy may be a live of randomness a window of size 9 x 9 pixels is employed. The ensuing image is threshold victimization svm rule so as to eliminate the regions with low native variation. To incorporate the neighboring pixels of the brink result, a dilation operator is employed. A flat disk formed structuring As a result, high intensities are reconstructed where as the remainder is removed. Normally, the optic disc may be simply known the largest space. Part having radius but, in some cases like the looks of big exudates within the image, there can be some areas within the image that are larger than the optic disc. As a result of the form of optic disc is spherical, thus the optic disc region selection method has to be created specific to the biggest one of the regions whose shapes are circular of eleven is utilized for dilation.

### **[2.3] Exudate detection**

Exudates that is larger than the linear structuring component cannot be known. If the length of the structuring component is inflated to extract larger objects, then additional spurious candidate exudates objects are detected on blood vessels because the segmentation of blood vessels deteriorates. A pixel classification primarily based technique is accustomed eliminate this disadvantage. By combining blood vessel segmentation technique, with exudates detection, larger candidates is extracted and also the range of spurious candidates on the vessels are reduced. In this technique, each the blood vessels and candidate exudates are segmented at once and later the blood vessels are separated from the candidate microaneurysms. This approach include two steps. Firstly matched filtering is applied to reinforce the dark objects like blood vessels and exudates against background.

## **[3] Results and Discussions**

Automated system for diabetic retinopathy detection has been conferred. This methodology was developed to observe exudates from low-contrast, retinal digital pictures of retinopathy pictures associate degree this work we have got investigated and projected a computer-based system extracts blood vessels and exudates

for grading the severity of the diabetic retinopathy to spot traditional, NPDR and PDR. Early observation of diabetic retinopathy is incredibly necessary as a result of it permits timely treatment which will ease detect bright objects sharply with a mean sensitivity 95.4%. The experimental results show that the projected methodology yields higher sensitivity and prophetic values compared to different strategies. Therefore, one of the foremost strengths of the projected system is accurate feature extractions and accurate grading of NPDR lesions. during this analysis image processing parts needed to make an automatic system for early detection of diabetic retinopathy.

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## **Detection of Alzheimer's Disease using Machine Learning Techniques**

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**ABSTRACT:** According to recent surveys, Alzheimer's Disease is a neurological disease which gradually increases and it is a chronic disease that worsens a person's day-to-day activities in the long run. Alzheimer's is the main cause for dementia and accounts for up to 60-70% of the disease. The main symptom of Alzheimer's is memory i.e. a person will not be able to remember their routine, the place they belong to and also their relatives. As Alzheimer's increases gradually, the various symptoms associated with it such as language, mood swings, behavioral issues, disorientation such as getting lost and loss of motivation occurs. Now since the person's condition starts decreasing slowly, the person gets disassociated with his/her family members and even they start to stray away from the society. This gradually leads to the loss in the body functions leading to the person's death. Generally the life expectancy following diagnosis takes three to nine years. Neurotic plaques and degeneration of explicit brain cells are the presence of pathological characteristics for any person.. Currently, the disease cannot be stopped from development but its early diagnosis can be an aid in increasing the severity of the disease and improve the person's life and lifestyle up to an extent. The number of people affected with Alzheimer's will get doubled in a span of 20 years. Out of every 85 people, one person will be definitely affected with Alzheimer's.

The main motto of this project is to find a technique for the early detection of Alzheimer's' using MRI scans. Here "early diagnosis" refers to the ability of diagnosing the disease at a very early stage using the symptoms which are caused before the onset of the disease and the clinical measures which has reached this stage and diagnosis of this disease is made according to the recommended criteria. This also focusses on:

- Improving the latest techniques used in structural MRI scans for the measurement of early Alzheimer's disease.
- Automated technique for the extraction of the specific data can be determined from structural MRI.
- New parameters can be considered for feature selection and extraction.

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### **1. Introduction**

Alzheimer's disease is commonly known as AD. This is a neurological chronic disease which starts slowly usually after the age of sixty and worsens over a period of time. The main symptom involved here is the problem in remembering the day-to-day activities. This main symptom is added with few other symptoms like disorientation, not speaking clearly, lack of confidence and behavioral changes. AD is an irreplaceable brain disorder and disease which makes an individual to lose his/her thinking skills and also there is memory loss because of the shrinking brain size. Machine Learning, the most important and used field of Artificial Intelligence (AI) which has a number of probability and optimization techniques to allow systems to obtain results from huge and complicated datasets. Therefore, scientists and researchers focusses on machine learning regularly for the detection of the early stages of Alzheimer's disease. It describes a analysis and also the evaluation of the work is done in recent years for the diagnosis of AD using machine learning techniques. Currently, the treatments will not cure AD permanently and also any individual can be treated only after most of the symptoms are noticed. Using early diagnosis, it will act as an aid to those individuals and will decrease the severity of the disease improving the quality of life. The accurate diagnosis especially for the early stages of AD is very important intensively computational and non-traditional approaches such as machine learning.

### **II. Problem Statement**

Alzheimer's is one such disease which is caused in the neuron system of an individual and cannot be diagnosed until a certain stage. AD is one the causes of dementia as well. Presently, the need is to identify the disease at an earlier stage such that the treatment can be provided in the initial stages itself and this will improve the person's quality of life as well. Until the recent years, only 20-50% of the cases have been recognized. This huge gap in the health sector is high in low and mediocre income countries. Hence, the detection of AD at an early stage is very important and will provide help to everyone in the world. Since the

expectancy of living for every individual is quite high, the risk of elderly people getting affected by AD is also rapidly increasing. Nowadays, even the younger population is getting affected by this due to stress and hence it has become mandatory for the detection at an early stage. Therefore, Alzheimer's disease is the main cause of dementia for all age groups

### III. Existing System

Early diagnosis and classification of Alzheimer's disease is being proposed by various researchers. This part consists of the brief critical review and the analysis of the related work.

The limitations associated with the existing system are mentioned as follows:

1. Difficulty in identification of the potential issues such as design validation and the implementation which is very crucial.
2. Classification of the training data set is not easy because many parameters have been taken into consideration.
3. A particular threshold value is necessary to classify the datasets into normal and AD.

### IV. Proposed System

In the proposed system, the image processing is done using the data obtained from structural MRI images. Development of new pattern recognition techniques is aimed to detect Alzheimer's disease in the early stages. The data used for the proposed system is obtained from ADNI database. The ADNI is a database for diagnosis and longitudinal monitoring. This recognition consists of two parts. In the first stage, the features are extracted from the images so that it is represented well. In the second stage, a particular pattern is fixed for a class based on the features selected and it mainly focuses on classification.

### Previous Research

The methodology section outline the plan and method that how the study is conducted.

#### 3.1 Aunsia Khan, [Muhammad Usman](#), "Early diagnosis of Alzheimer's disease using machine learning techniques: A review paper "

Generally it is quite slow that the scientists are now using machine learning techniques to diagnose AD. Recent technologies and complex diagnostics led to the introduction of cellular, clinical and molecular parameters.

#### 3.2 Arpita Raut, Vipul Dalal, "A machine learning based approach for detection of Alzheimer's disease using analysis of hippocampus region from MRI scan"

Alzheimer's Disease is a progressive and irreversible neurological disease and it's the most common cause of Dementia in people of the age 65 years and above. Detection of Alzheimer's Disease at prodromal stage is very important as it can prevent serious damage to the patient's brain, in this paper, a method to detect this disease from MRI using Machine Learning approach is proposed. The proposed approach extracts texture and shape features of the Hippocampus region from the MRI scans and a Neural Network is used as Multi-Class Classifier for detection of various stages of this disease. The proposed approach is under implementation and is expected to give better accuracy as compared to conventional approaches.

#### 3.3 Querbes et al, "A surrogate marker for the early diagnosis of Alzheimer's Disease"

The brain atrophy measured by magnetic resonance structural imaging. Specifically, they suggest that the thickness of the cortex in the brain is a biomarker for the presence of, or a predictor of Alzheimer's Disease. The time lapse brain scans with healthy brain activity shown in the red and blue areas and rapidly spreading areas of cell death (grey areas) in a subject with this disease. About 5% of brain cells die each year in someone with Alzheimer's, compared to less than 1% in a senior who is aging normally. Other biomarkers under investigation for this disease diagnosis using MRI scanning include the build-up, or dissipation, of a protein called beta-amyloid in the living brain. To help with the detection of this, CSF total protein is a test used to determine the overall amount of protein in spinal fluid, also called Cerebro Spinal Fluid(CSF).

#### 3.4 Javier Escudero, Emmanuel Ifeakor, John P. Zajicek, Colin Green, James Shearer, Stephen Pearson, "Machine Learning-based method for personalized and cost-effective detection of Alzheimer's Disease"

Generally the diagnosis and detection of AD is very difficult, but at this stage the treatment is very likely to be effective and there are many advantages in the improvement of the diagnosis. In this research, we describe a machine learning approach for personalized and cost-effective detection of Alzheimer's disease. This uses a locally weighted learning to build a classifier model and here each individual computes the sequence of the most cost-effective methodologies to diagnose patients. By using ADNI database, normal patients and Alzheimer's are classified using the features.

### 3.5 Siavash Esmaeili Fashtakeh, A Research Idea, "Early detection of Alzheimer's disease using structural MRI"

Alzheimer's disease is one of the common neurological disease or disorder which cannot be diagnosed until a patient reaches a stage of dementia. There is a need to recognize AD at an early stage in order to begin the treatment soon. The integral component of the assessment of individuals with suspected AD is the structural imaging based on MRI scans. Structural brain MRI is becoming increasingly used in the early diagnostics of AD. Volumetric and pattern recognition techniques for measuring cortical thinning and automated classification approaches that assess the overall pattern of atrophy seem to show promise for the early diagnosis of AD. The datasets in the preparation of the proposal is obtained from ADNI (Alzheimer's disease neuroimaging initiative) database. The study will initiate with the pre-processing of structural MRI images which consists of correction of in homo genetics, noise detection, registration of the space e.g., using the linear transform and cross normalization of the MRI intensity followed by the modulation of the data. The brain tissue is then segmented white matter, grey matter and cerebrospinal fluid by the SMP software. Later, the probability of the customized tissue maps is created for the correction of the bias. For feature extraction and reduction, datasets are inserted into the linear vector machine. Later, by training a model in a sub-group, the cross-validations with another subgroup is used to achieve SVM parameter optimization.

#### Figures

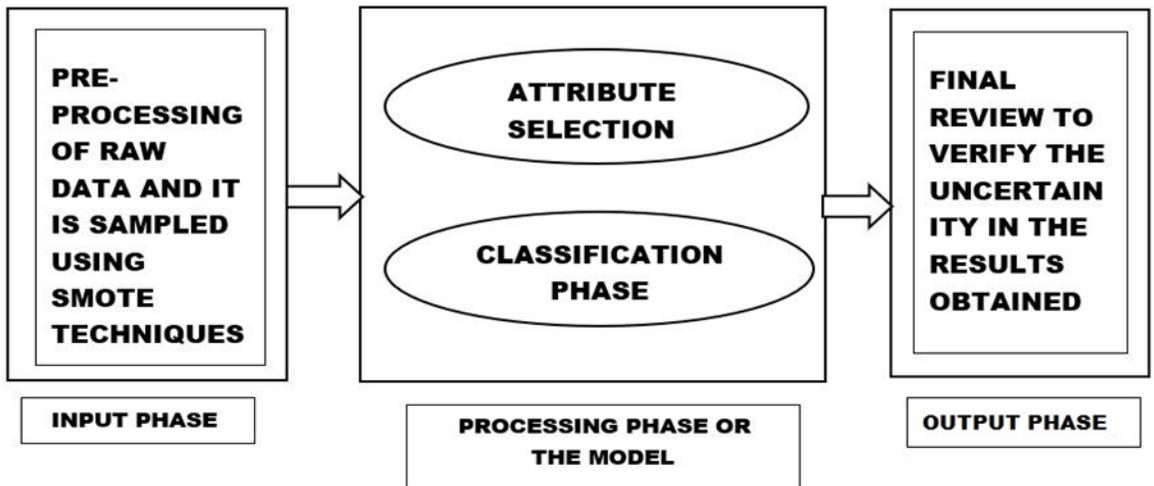


Fig.4.2 Implementation of the Modules

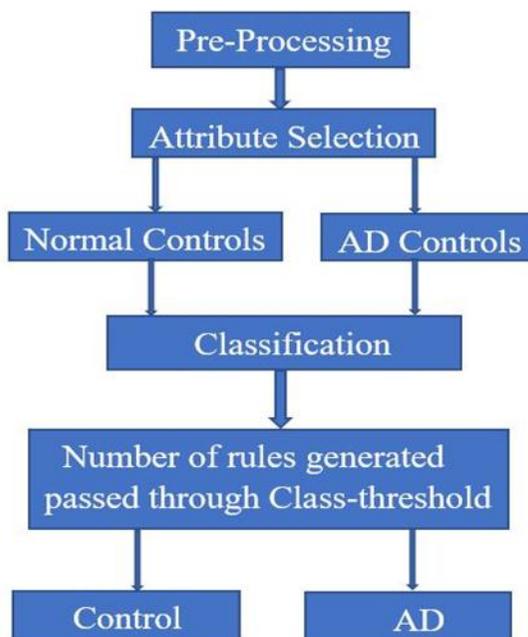


Fig.1 System Architecture of the Detection of Alzheimer's Disease

## CONCLUSIONS

This Project makes these primary contributions:

- I. Firstly, we get the MRI data obtained from pre-processing, the feature extraction and selection. Here the classification will be based on the model from the training data.
- II. Secondly, we match with the data extracted from the MRI result, the features obtained will be estimated with the model learning or the model. After the classification, pre-processing will give the results for the decision phase.

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# Linear Programming based approximation algorithm to optimize provisioning time for Virtual Machine placement with resource constraints

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**ABSTRACT:** Cloud computing is a dynamic environment in which user consumes services on demand basis. Due to Service level agreement (SLA) between consumer and provider, each request needs to be served within a given time. It is highly important that each Virtual machine (VM) must be placed at appropriate server and within SLA. This problem is NP hard when multiple resources are involved during the placement. In this paper, we have provided a linear programming-based approximation algorithm to minimize provision time of VM placement on multiple machines with resources constraints. A proposed algorithm is empirically tested on azure cloud data and compare with other state of the art techniques. The result has shown no gaps for 8 instances out of ten and rest with minimal gaps.

**Keywords:** Virtual Machine Placement, Linear programming, Approximation algorithm, Service level agreement

## 1. Introduction

In Cloud computing, Virtual machine (VM) is placed to appropriate machine and it takes time based on the different resources required and number of machines needed to allocate. This whole process is known as Provisioning in cloud computing terminology. Various amount of computing resources is allocated like CPU, memory, Network bandwidth, storage during this process. A various state of the art techniques available to place VM in cloud. In this paper, we have minimized provisioning time of various VM request over multiple server using linear programming-based technique.

## Virtual Machine Placement Problem with resource constraints

Virtual machine placement problem is one of the generalized allocation problems like bin packing in which each item must be allocated to one and only one bin such a way that all bins size minimizes. But when this problem is considered with multiple dimensions it is associated towards more specialized version of problem Vector bin packing in which each resource is represented as vector and overall goal of the item placement is to place them as near to the diagonal as possible by minimizing bin size. The same in virtual machine placement is placed in minimum number of machines such a way that all the resources associated with server are minimized.

Below diagram shown the graphical view of the VM placement problem with multiple resources.

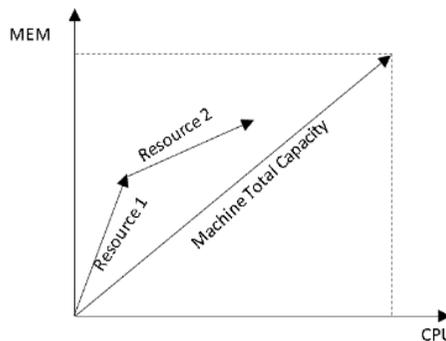


Figure 1: VM Placement Problem with multiple resources

Each VM request consists of time to provision and has start time and finish time. This is called provisioning time of VM to the machine in cloud computing terminology. In this paper, our goal is to minimize this provisioning time such a way that all associated resources are utilized and size of machine is minimized.

This paper is organized as follows, section 2 describes the overall method used building approximation algorithm and linear programming-based formulation. Section 3 discuss the testing environment configuration and empirical evaluation of the algorithm. Second 4 describes the all the references used writing this paper.

## II. Method

Linear programming is an important tool in the design of efficient approximation algorithm. In this paper, we have designed linear programming-based model to optimize virtual machine placement. It follows overall below procedure,

1. Initialize Models and variables
2. Read instances
3. Generate set of decisions and constraints
4. Set objective
5. Apply stopping criteria/conditions
6. Apply algorithm
7. Generate phase to optimize search
8. Get the results from model

### 2.1 Linear programming-based approximation algorithm formulation

Sets

J = Set of VM requests

S = Set of time to provision

R = Set of priority ranks

T = Set of Placement task

$T_m$  = Set of Placement Task allocate to machine m

M = Set of machines

Parameters:

$d_t$  = Provisioning time for each task t

$due_j$  = each new request due for provision

$big_M = \sum d_i$

$m \in M$

$cm$  = cost of using machine m for placement

$st_j$  = set up time of each VM request if consecutive provisioning tasks are performed on the same machine

Variables

$st_{t,m,r}$  = Start time of provisioning of task ton machine m

$y_{t,m,r} = 1 \Rightarrow$  VM assign to machine m

$0 \Rightarrow$  VM not assigned to machine m

$d_j$  = Delay of each VM to provision

$l_{end}$  = latest finish time of all VM provisioning tasks

Objective

$min l_{end} = \sum \sum \sum ((y_{t,m,r} C_m) + (S_{t,m,r}))$

$m \in M \quad r \in R \quad t \in T$

Constraints

$\sum \sum (y_{t,m,r}) = 1$

Each VM should allocate on one machine

$m \in M: t \in T \quad r \in R$

$\sum (y_{t,m,r}) \leq 1$

Each machine has one request at a time

$t \in T$

$\sum (S_{t,m,r}) \leq \sum (S_{t+1,m,r+1}) + dt$

Follow time order of the request

$m \in M: t \in T$

$m \in M: t \in T$

$S_{t,m,r} \leq \text{big}_M y_{t,m,r}$

$S_{t+1,m,r} \leq y_{t+1,m,r-1} t_d + st_j < S_{t,m,r} + (1 - y_{t,m,r}) \text{big}_M$

$S_{t,m,r} \leq d_t - \text{due}_j \leq d_j$

$S_{t,m,r} + d_t \leq l_{\text{end}}$

$\sum (y_{t,m,r}) = \sum (y_{t,m,r-1})$

$m \in M: t \in T$

$m \in M: t \in T$

*Setting request time to each assignment*

*Preserve order of request*

*Calculate the delay in provisioning*

*Find the end time of Provisioning*

*Tuning*

### III. Result and discussion

Our mathematical model for Virtual Machine placement problem is evaluated using our prototype implementation on a 10 data sets collected from private data center running azure cloud platform.

#### 3.1 Infrastructure

System running windows 10 operating system, 16 GB RAM, intel i7 6500 CPU @2.50GHz 2 cores and 4 logical processor.

#### 3.2 Workload

The multiple resources like CPU, memory and network bandwidth are taking into consideration and randomly picked up the data set from the available choices. Balanced CPU-to-memory ratio which is generally used for general purpose. Then workload is generated for types which are Compute optimized which has high CPU to memory configuration is available. The same way Memory optimized, and Storage optimized virtual machines workloads are also generated. We have avoided very large size configuration which is used for high performance computing and GPU because of environment set up restrictions.

Test Set	Upper Bound	Lower Bound	Our LP based Algorithm Gap(%)	MILP Gap (%)	Branch & Bound Gap (%)
T_1	4465021	4465021	0	0	0
T_2	6534829	6534829	0	0	0
T_3	5835515	5835515	0	4.67	6.78
T_4	2404632	2404632	0	12.45	14.56
T_5	4276196	4276196	0	34.55	34.67
T_6	543836	543836	0	12.34	11.22
T_7	559889	559889	0	45.67	45.55
T_8	2272487	2272487	0	23.45	23.56
T_9	2680231	2117382	21	33.56	38.9
T_10	1680231	1377789	18	56	67.77

Figure 2: Experimental Result

As shown in the above table, our LP based approximation algorithm model has surpassed the state-of-the-art Mixed integer programming model and Branch and bound models. First of its seven instances has shown zero percentage gaps but for hard instances with size more than 10000 instances has generated gaps. Our future goal is to improve the model for NP hard instances and reduce the gap.

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# Antech Cluster-A Novel Technique for Clustering in Wireless Sensor Networks

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**ABSTRACT:** Potential usage of Wireless Sensor Networks (WSN) in different areas have paved way for hot research. Wireless Sensor Networks consists of a number of small sensor nodes with limited energy and high computing power. Energy efficiency, Load balancing, prolonged network lifetime and scalability are inevitable for large WSN applications. Clustering mechanism has been proposed in the literature as a solution to handle the above requirements. The cluster setup phase is an important phase for network efficiency. This paper proposes ANTech Cluster, a cluster formation technique against K-means algorithm. It adopts heads for the defined cluster and gateways based on the energy states of the nodes, degree of the node and location of the node from the base station. This technique achieves optimal utilization of faraway nodes within the cluster with rich resources like energy and density and Cluster Gateway greatly reduces long range intra cluster communication overhead. The simulation results show that the proposed technique performs well better in terms of cluster formation time than the K-means.

**Keywords:** Wireless Sensor Networks, Manhattan Distance, Euclidean Distance, ANTech Cluster, K-means

## 1. Introduction

Wireless Sensor Networks (WSNs) are highly distributed autonomous networks of lightweight sensors to monitor physical or environmental changes by sensing sound, vibration, temperature, pollutants, motion, etc and thereby processing data and transmitting to a central base station [1]. Networking thousands of tiny sensor nodes to collect data from the environment is a milestone which cannot be achieved by conventional ways. WSNs are constrained by heterogeneity of nodes, low battery life, dynamic topology, and redundant data acquisition [12]. A typical WSN arrangement is depicted in Fig. 1 [12]. WSN has a variety of applications including gather climate information, medical monitoring, home security, military applications, air traffic control, surveillance, industrial and manufacturing automation, process control, inventory management, distributed robotics, etc [12]. A wide growth in applications results in a modular growth of the network. If the network environment is non-clustered, the packets must be handled and forwarding decisions must be taken by each and every participating node. Hence, such an environment will thus suffer from inadequate bandwidth due to heavy packet header and control packets and also high energy loss due to processing of data and high packet dropping which results in bad network performance. In order to reduce such an overhead, clustering mechanism was introduced during the research years. The clustering concept reduces the energy loss to a certain extent and the overhead faced by the network is reduced.

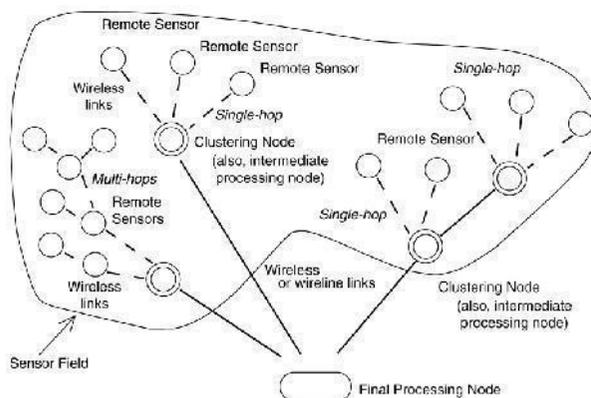


Fig. 1 Wireless Sensor Network

Clustering is the process of grouping a set of nodes in such a way that nodes in the same group are more similar to each other than the nodes in other groups. In WSNs, the nodes which fall into the transmission range of each other are grouped together.

K-means clustering mechanism is used in most of the algorithms to cluster the nodes. But K-means suffers with a number of iterations to form clusters. The cluster formation time drastically increases when there is a modular increase in the number of nodes. Hence, proper cluster formation procedure is very essential to build a network of utmost performance. After the formation of clusters, Cluster-Head (CH) and Cluster Gateway are elected and the nodes in the cluster get associated with the Cluster-head. Data forwarding to the base station takes place through cluster gateway.

We propose ANTech Cluster, A Novel Technique for Clustering is proposed to reduce the number of iterations to form clusters and thereby reducing the cluster formation time. The paper is organized as follows: Section I describes the need of clustering mechanism in Wireless Sensor Networks, Section II summarizes the related work in this area, Section III describes the motivation factor behind the paper, Section IV presents the proposed ANTech Cluster mechanism, Section V gives the experimental results and Section VI concludes the paper.

## II. Clustering in Wireless Sensor Networks

The sensor network is partitioned into different clusters by the process of clustering. A cluster head is elected by considering certain parameters and the cluster is managed by the Cluster Head (CH) and all other nodes are Cluster Nodes. The cluster nodes communicate to other clusters and the base station or the sink through the Cluster Head. The Cluster Head plays an important role by aggregating the data from different nodes and transmitting them to the required destination. Fig. 2 shows a clustered sensor network [12].

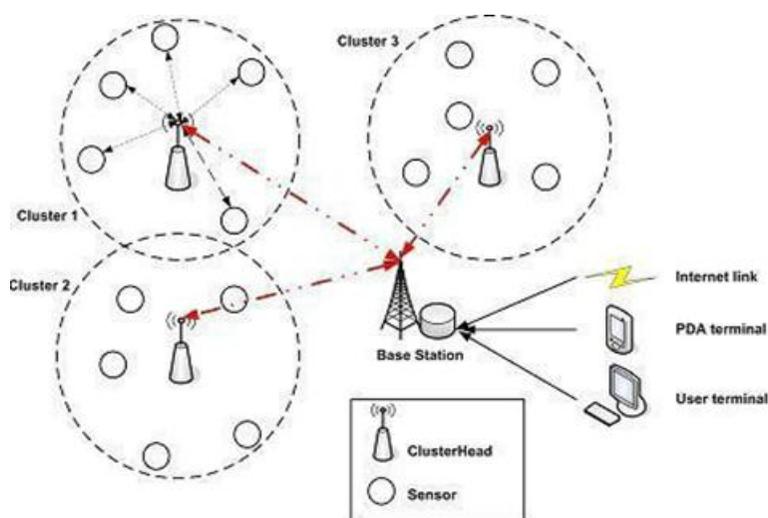


Fig.2 Clustered Sensor Network

A Clustered Sensor Network consists of the following components:

**Sensor Node:** It is the core component of wireless sensor network. It has the capability of sensing, processing and routing.

**Cluster Head:** The Cluster head (CH) is the leader for that specific cluster. It is responsible for the different activities carried out in the cluster, such as data aggregation, data transmission to the base station, scheduling in the cluster, etc. Cluster Heads are changed frequently by considering certain parameters to maintain the cluster.

**Base Station:** Base station is considered as a main data collection node for the entire sensor network. It is the bridge (via communication link) between the sensor network and the end user. Normally this node is considered as a node with no power constraints.

**Cluster:** It is the organizational unit of the network, created to simplify the communication in the sensor network. Its formation is of utmost importance.

### 2.1 K-means Clustering

The foundation and key features of WSN are distance between pair of nodes and energy of the node. The distance between pair of nodes is used as a parameter for clustering mechanism. The well-known clustering algorithm is K-means Clustering [14]. K-means is an unsupervised clustering algorithm. This algorithm partitions the data set into k clusters using the cluster mean value. K-Means is iterative in nature. The various steps involved are:

1. Arbitrarily generate k points (cluster centers), k being the number of clusters desired.
2. Calculate the distance between each of the data points to each of the centers, and assign each point to the closest center.
3. Calculate the new cluster center by calculating the mean value of all data points in the respective cluster.
4. With the new centers, repeat step 2. If the assignment of cluster for the data points changes, repeat step 3 else stop the process.

The distance between the nodes is calculated using Euclidean distance. If  $u = (x_1, y_1)$  and  $v = (x_2, y_2)$ , then the Euclidean distance between u and v is given by the following equation (1)

$$EU(u, v) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \quad (1)$$

### III. Motivation

There are a number of advantages of having a clustered sensor networks.

- a. Reduced number of nodes taking part in data transmission.
- b. Aggregation of data to the base station is done by the cluster-head rather than individual nodes.
- c. Energy consumption at the nodes is reduced and reduced communication overhead.
- d. Achieving scalability of the network.
- e. Network Lifetime is prolonged.

To attain the above properties of clustering, cluster formation procedure plays a vital role. Low Energy Adaptive Clustering Hierarchy (LEACH) [2] uses the clustering principle of K-means and evenly distributes the energy consumption along the cluster. Cluster Heads are elected randomly. It uses one-hop inter-cluster communication towards the base station. The random way of cluster head election is a drawback of the approach. HEED [3] selects the cluster heads based on residual energy and communication costs. DECA [4] is a Distributed Efficient clustering Approach where the clustering decisions are taken through score computation. Score computation is based on the residual energy, node connectivity and node identifier. A centralized algorithm performs the cluster formation in LEACH-C [5]. The algorithm fails for larger networks when the node is far off from the base station and not able to connect to the base station in an efficient manner which results in increased latency and delay. Beni Hssane et al. [6] have proposed LEACH-E, which elects CHs according to the residual energy and depends on a routing protocol for assisting in total energy distribution throughout the cluster. LEACH-B [7] is proposed as an improved protocol where CH is chosen initially and varies the election frequency according to the dissipated energy.

Lijun et al. [8] have proposed LEACH-ET, where the cluster head election is based on the energy threshold. The energy dissipated is compared with the energy threshold value. PEGASIS [9] is an enhancement of LEACH. Network Lifetime is enhancement where the nodes communicate with their closest neighbours and they take turns in communicating to the base station. When all the nodes communicating with the base station comes to an end after rounds, fresh allocation begins. A distant node in the chain is delayed extensively. An extension to PEGASIS, called Hierarchical-PEGASIS was introduced in [10] with the objective of decreasing the delay incurred for packets during transmission to the BS. Imran et al. [13] have proposed a modified architecture based on K-theorem which selects cluster head and cluster coordinator thereby balancing the energy.

All the clustering algorithms described above, have neglected the use of energy rich sensor nodes which are far away from the base station in a cluster. The above fact motivated us to form clusters using Manhattan Distance and select remote nodes with maximum energy and high density as Cluster Head. But as distance between base station and cluster head increases, energy spent to transfer data also increases. Hence, we

adopt Cluster Gateway with comparatively less energy as Cluster Head to perform the forwarding task of data to the base station.

#### IV. Antech Cluster

ANTech Cluster is an acronym of A Novel Technique for Clustering. Clustering has proved to be an effective technique used in improving the lifetime of a network [11]. In the domain of retrieval of nodes to form clusters in a large network, the nodes are perceived as n-dimensional feature vector considered as points in an n-dimensional feature space. This advantage helps us to use distance metrics to order the nodes. This enables us to do a nearest neighbour search on a large network of sensor nodes. It is evident that the clustering mechanism depends highly on the distance metric. To use the effectiveness of clustering, we consider Manhattan Distance to find the nearest neighbour as against the traditional Euclidean distance. Clustering consists of two steps:

- a. Grouping algorithm has to be selected (Clustering Criterion).
- b. Adopt Representatives for the defined clusters.

For grouping the nodes, we follow Manhattan Distance (MH) between nodes. The Manhattan Distance between two nodes  $u =$

$(x_1, y_1)$  and  $v = (x_2, y_2)$  is given by the following equation (2)

$$MH(u, v) = \text{MOD}((x_2 - x_1) + (y_2 - y_1)) \quad (2)$$

To adopt representatives for the defined clusters we consider the maximum residual energy of the node, density of the node and location of the node from the base station. We also elect cluster gateway considering energy and distance parameters.

##### 4.1. Cluster Formation Algorithm

The formation of clusters is based on computing Manhattan Distance between pair of nodes. Calculation of Manhattan Distance saves time. The steps involved in Cluster Formation are as follows:

Step 1: Let  $N_i$  be the set of nodes with coordinates  $(X_i, Y_i)$  where  $i = 1$  to  $n$ .

Step 2: Let  $r$  be the Transmission Range between any pair of nodes.

Step 3: Populate  $D_{ij}$  with Manhattan Distance of node  $N_i$  &  $N_j$ , where  $i=1$  to  $n$  &  $j= 1$  to  $n$ .

Step 4: Select all the nodes into  $V[i]$ . Compute the count  $V_i$  for each node  $N_i$  with respect to all the remaining nodes,

where the value of  $D_{ij} < r$ .

Step 5: Select the Max  $(V_i)$  and then select the nodes in  $[V_i]$

which is the Cluster Nodes and the remaining nodes in  $[V_i]$  as Non-Cluster Nodes,  $N[i]$ .

Step 6: Repeat the Steps 4 through 5 by keeping  $N[i]$  as  $N_i$ .

The mean value computation in forming the clusters is eliminated. The Cluster head is sequentially selected and the transmission range of the cluster head serves as the boundary of the cluster. When a node falls into the boundary of the cluster head, it joins the cluster. The iterations are repeated and the cluster with maximum number of nodes becomes the cluster. The non-cluster nodes follow the same procedure by identifying a cluster head among them. This approach of clustering reduces computation time due to simplicity.

##### 4.2. Detecting Energy States

Assume:  $E_{\text{INIT}}$  be the Initial Energy of the sensor nodes.  $E_r$  is the Residual Energy of the node.

$Th$  is the ratio of  $E_r/E_{\text{INIT}}$  determines the state of the node.

$Th_{\text{min}}$  and  $Th_{\text{max}}$  are the two thresholds of  $Th$ .

Step 1: According to the Energy State ( $Th$ ), we divide the state of the nodes in a cluster into 3 types:

- a. Red State(R): Value of  $Th$  range between Zero and  $Th_{min}$ .
- b. Yellow State(Y): Value of  $Th$  range between  $Th_{min}$  and  $Th_{max}$ .
- c. Green State (G): Value of  $Th$  range between  $Th_{max}$  and to  $Max\_Energy$ .

Step 2: A pool of Green Nodes, Yellow Nodes and Red Nodes along with their positions are known.

Step 3: Select a Yellow Node ( $Y_i$ )  $\leq R$  ( $Tr$ ) Base station as Cluster Gateway (CGi) for  $C_i$ .

Step 4; Select a Green Node ( $G_i$ )  $> R$  ( $Tr$ ) Base Station && Max. Degree as Cluster Head (CHi) for  $C_i$ .

The Cluster Head aggregates the data from different sensors and compresses the data and sends them to the Cluster Gateway. The Cluster gateway just forwards the compressed data to the base station.

## V. Analytical Discussion

As energy dissipated is directly proportional to the square of the distance, in our ANTech Cluster, the base station selects a yellow node which is in close vicinity with it as the cluster gateway. The responsibility of yellow node is to forward data to the base station which requires less energy. A green node which is far away from the base station and with higher node density (degree) is chosen to reduce long range intra-cluster communication and energy is balanced within the cluster. A maximum energy node is selected by CGi because the role of cluster head is crucial in aggregating and compressing the data before being sent to the Cluster Gateway. This technique paves way for sensor nodes at remote areas within the cluster to communicate with their cluster head in an effective way. Hence, optimized utilization of faraway nodes which are rich in resources is achieved by the proposed technique.

## VI. Research Findings

This work has been implemented in Java as a programming language and the results are tabulated. It has been carried out with the system configuration of 64 bit Intel i3 processor, 4GB RAM and windows 2007 as an operation system. The simulation has been done for 25 and 50 nodes. Table 1 shows the simulation parameters. The transmission range is considered to be 20 units distance. We have considered 1000 units to be the maximum energy of the nodes. The energy thresholds decide the selection of cluster heads and cluster gateways in the clusters formed. The results show that the cluster formation time using the Euclidean Distance and Manhattan Distance varies considerably.

Table 1. Simulation Parameters

Parameter	Values
No. of Nodes	25,50
Area of Simulation	50 X 50
Transmission Range( $Tr$ )	20 m
Simulation Time	5 sec
Max. Energy of Nodes	1000 units
$Th_{min}$	300 units
$Th_{max}$	700 units

Table 2 shows the sample data containing the location, energy and degree of the nodes. The maximum energy of the nodes considered is 1000 units. The Threshold minimum energy is 300 units and the maximum energy considered is 700 units. The green, yellow and red nodes are grouped according to the energy states of the nodes.

Table 2. Sample Data of 25 nodes

Location of Node(x,y)	Energy (E) of Node	Degree of Node
(10, 10)	650	0
(20, 12)	480	2
(24, 14)	760	2
(26, 20)	660	3
(28, 10)	550	1
(30, 12)	940	2
(28, 14)	780	2
(20, 24)	879	1
(22, 12)	350	2
(21, 11)	670	2
(24, 16)	920	3
(30, 14)	734	1
(32, 18)	900	1
(21, 22)	260	2
(24, 34)	370	2
(25, 31)	550	2
(28, 33)	670	2
(29, 40)	120	1
(36, 48)	890	2
(34, 56)	970	3
(23, 24)	460	2
(27, 48)	628	2
(32, 67)	256	1
(37, 46)	150	2

Table 3 shows the execution time of the clustering algorithms using the distance metrics.

Table 3. Cluster Formation Time

No. of Nodes	Cluster Formation Time (in secs)	
	K-Means	ANTech Cluster
25	0.71	0.57
50	1.13	0.98

The existing clustering algorithms randomly choose cluster head and by comparisons try to form clusters using Euclidean Distance. When the cluster head chosen is not proper, again the cluster formation procedure is repeated for the remaining nodes. In the ANTech Cluster algorithm, distance between neighbouring nodes are calculated using Manhattan Distance. In the initial step, computation of distance and comparison of the transmission range with the neighbouring nodes takes place. In the next iterations, only comparison of transmission range within non-cluster nodes to form clusters takes place which greatly reduces the cluster formation time. Computation of Manhattan Distance is another goodness of the algorithm. Fig. 3 shows the cluster formation time of k-means and ANTech Cluster. It clearly shows that the time taken to form clusters is reduced considerably.

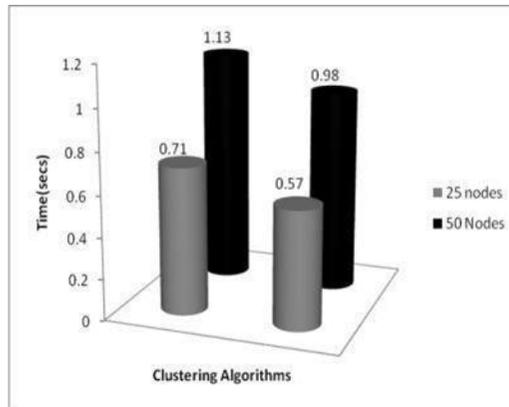


Fig.3 k-means Vs ANTech Cluster

Fig. 4 shows the Cluster head and Cluster Gateway selection. A green node with high residual energy, maximum degree and a faraway node in a cluster is chosen as the cluster head. A red node with medium energy is chosen as the cluster gateway.

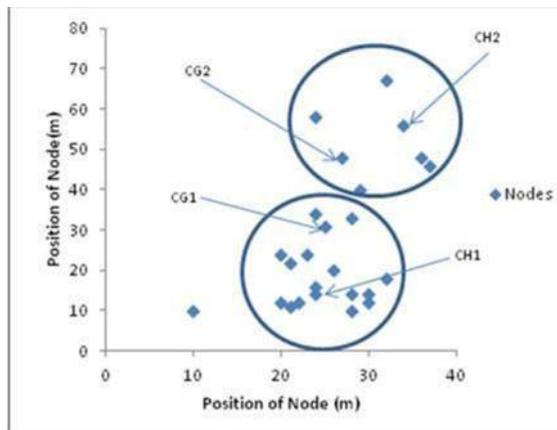


Fig. 4 Selection of Cluster Head and Cluster Gateway

## VII. Conclusion

This paper has described the role ANTech Cluster over K-means for the formation of clusters. The simulation results show that the cluster formation time is reduced when Manhattan Distance is involved in finding the nearest neighbors. The adoption of Cluster Head and Cluster Gateway using the energy states of the nodes, location and density of the nodes achieve energy balancing in the cluster, reduce long-range intra-communication overhead and optimal utilization of energy rich remote node from the base station.

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# **Image Encryption Based on Genetic Algorithm for Enhanced AES-128 Bit Cryptosystem**

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**ABSTRACT:** *Digital image transmission through a communication channel has grown beyond the imagination in the Information technology. The security of digital images against the unauthorized access and to protect the confidentiality of the images has become the need of the hour. The proposed work suggests an image encryption technique based on genetic algorithm using enhanced AES-128 cryptosystem. The proposed work is developed for the enhanced AES-128 bit cryptosystem which is a hybrid model of Genetic algorithm and Particle Swarm optimization algorithms. The encrypted images are tested against the correlation factors. The proposed work is expected to provide efficient encryption images in terms of security and computational time.*

**Keywords:** *Genetic Algorithm, Particle Swarm optimization, entropy, correlation factor*

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## **1. Introduction**

The frequent transmission of digital images over the open network has increased the risk for the security of those images. The image sharing cannot be taken as the secondary need since most of the communication among various domains depends on images than other elements of multimedia. A specific security and storage related solutions are needed to counter attack the problems. Data security is as important as Data collection. Images convey vital information which needs to be encrypted as well. The monotony in the encryption mechanism may lead to tampering the security of the information which is communicated through the channel. Images are categorized into different types with respect to their source and representation. Binary images represent the images in the form of binary digits 0 or 1. Gray scale images represent images between the ranges of 0 to 1 with 8bits/pixel representation. Color images represented with tricolor RGB representation of 24 bits/pixel. Multispectral images which are generated by electro magnetic spectrum and are not directly visible to human eyes like X-rays etc. whichever above said images type may be, when it is used for application purpose and needed to be transmitted a strong encryption technique should be implemented. This paper proposes a novel method to encrypt the images using the randomness of Genetic algorithm. This paper is organized as follows: Section 1 provides a brief discussion on the previous work in the form of literature study. Section 2 explains the proposed algorithm. Section 3 provides the conclusion and future work, followed by the references.

## **II. Literature Review**

The related work for the proposed algorithm is discussed in this section.

Huang-PeiXiao et al. [1] has proposed a scheme using two chaotic systems to provide high security to the system. The first chaotic system generates a chaotic sequence which is converted into a binary stream by a threshold function. The second chaotic system constructs a permutation matrix. The plain image pixel values are randomly converted by the binary stream into a key stream. The converted images are encrypted by the permutation matrix.

Zeghid et al. [2] proposed a modified AES to design a secure symmetric image encryption technique for the gray scale images. Upreti et al. [3] developed a three color RGB-based secure technique to provide authentication and integrity to a document. Fei and Cong [4] implemented 2D Logistic map for image encryption algorithm and exploited Chua's system to complicate the encryption. Rohit Joshi et al [5] developed a novel method which has two stages. Image encryption is performed using Henon map and the image confusion is performed by logistic map.

Radhadevi and Kalpana [6] proposed image encryption using AES with the result being a uniform distribution of RGB pixels. Padate and Patel [7] designed an algorithm which provides effective security for communication by AES algorithm for image encryption and decryption. Wen et al. [8] projected a significant region encryption scheme to generate visually expressive ciphertext. The method extracts the significant

regions as substantial information rather than edge types. Sekertekin and Atan[9] proposed a method using chaotic encryption, which implements Ikeda and Henonchaotic maps.

Y. A. Alsultanny [10] implemented cipher feedback mode (CFB) to encrypt images of different block sizes of 8bits, 16 bits and 32 bits. S. Cagnoni et al. [11] used the image parameter entropy to measure the distribution gray levels in the image gray after encryption.

Z., W. M., Z. M. Lu et al. [12] proposed a method for image encryption using k numbers key as input. The original image is shuffled and encrypted using the Substitution and mapping by the S-box. S. Kumar et al. [13] proposed a novel method of image segmentation by exploiting the Genetic algorithm which is hybrid with the cellular neural networks (CNN). CNN provides a parallel structure for segmentation has less encryption time than the conventional cryptosystems.

### III. Genetic Algorithms

Genetic algorithms are the evolutionary approaches which follows the natural selection process and natural genetic traits. It evolves from the concept of survival of the fittest principle. The GA searches the problem space for the potential solutions and provides the optimal solution from the potential solutions. Initial population is generated with the specific parameters or random population can also be generated. The parameters prevailing in the GA are fitness function and GA operators. Fitness function is the objective or validating function for any process implemented using Genetic algorithm. The GA operators can be selection, crossover and mutation. The general process of GA is shown in Figure 1 [14].

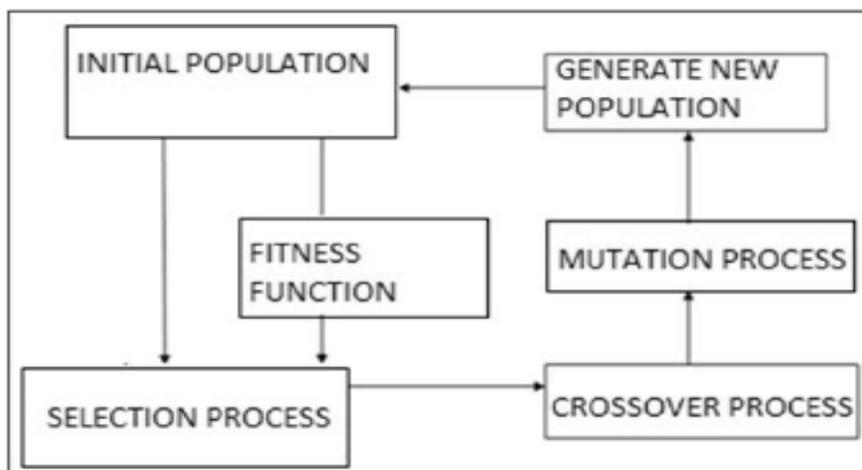


Figure 1: Simple Genetic Algorithm

The basic steps involved in Genetic Algorithm are explained as follows.

Step 1: Random initial population is generated

Step 2: Objective function is identified

Fitness value is calculated

Step 3: Repeat the following sub-steps

Step 3.1: Apply Selection operator

(Select a pair of parents based on fitness value)

Step 3.2: Apply Crossover operator to create two offspring

Step 3.3: Apply Mutation operator to each child

Step 3.4: Generate new population with all the offspring as new

Step 4: Terminate for stopping condition.

A randomly generated initial population is applied with the fitness function to select the chromosomes for the first generation. GA operators are applied to the initial population to generate new offspring which is updated to the existing population. This process continues until a terminating condition is satisfied or the convergence is reached.

Certain considerations while using Genetic Algorithm for problem solving are as follows:

- Determine the encoding scheme.
- Identify the Fitness function.
- Determine the parameters like population size and iterations, types of operators used.
- Determine the runs for terminating conditions and design the result.

#### **IV. Proposed Work**

The proposed image encryption algorithm with Genetic algorithm uses the common representation of binary encoding. Among all the available selection operators, Roulette wheel selection is chosen which gives equal probability for selecting the chromosomes. Uniform crossover is chosen since the crossover probability  $P_c$  is even. Each bit is mutated using Inverse mutation. The image is encrypted using AES-128 bit algorithm with 16 bit key length. The proposed image encryption algorithm uses enhanced AES-128 bit [14][15] cryptosystem for encryption and decryption process. This cryptosystem has been constructed using the hybrid evolutionary approaches of Genetic algorithm and Particle swarm optimization. GA has been used for symmetric key generation and GA, PSO combination has been used for S-box construction. The image to be encrypted is taken as  $I$ , proposed encryption method is  $E$  and proposed decryption method is  $D$ .

The steps involved in the proposed image encryption algorithm are as follows:

The 16-bit fittest encryption key  $K$  is generated using GA for AES-128 [mine]

Step 1: Input the image  $I$  with width  $W$  and height  $H$ . (i.e)  $I(W*H)$

Step 2: Split  $I$  into set of  $N$  vectors each with length  $L$  ( $L$ =can be determinant)

Step 3: Calculate the initial population  $R_{n1}$  and  $R_{n2}$

$R_{n1} = i=0$  and  $W=W-1, I(i, j) * (-1)^{(i+j)} / 256 * L$   
(First pixel position)

$R_{n2} = i=0$  and  $W=W-1, I(i, j) * (-1)^{(i+j+1)} / 256 * L$   
(Adjacent pixel position)

Start value to generate the random population is  $(R_{n1}+R_{n2})/2$ .

Step 4: Apply the fitness function

Step 5: Calculation for  $N$  vectors. Consider each vector as  $V_i$

Set the Crossover Index and Mutation Index

Set the number of iterations

Step 6: For all  $V_i$ , Set Crossover Index as the new start value

Generate 2 random numbers  $N_1$  and  $N_2$

Perform uniform crossover

Step 7: For all  $V_i$ , Set Mutation index as the new start value

Generate a random number  $N_1$

Perform Inverse mutation.

Step 8: Construct an image from the set of  $N$  vectors using Step 4 and Step 5.

Step 9: The encryption key  $K$  is applied to encrypt the image formed in step 7.

Step 10: Reverse the above steps to decrypt the image.

The fitness function used for the image encryption operation is auto correlation coefficient values between the adjacent pair of pixels in the image. A new population is generated at each stage. The previous generations are evaluated using the fitness function. The crossover rate is taken as 0.2% and the mutation rate is taken as 0.1%. Each iteration follows this operator rates. Only these population size will participate in the recombination and rest of the population are not selected for the process. Uniform crossover is applied with Inverse mutation operator to generate the new population. The process is repeated  $N$  times until two successive stages have no significant change in the population. The algorithm chooses the generation with the lowest auto correlation value as the encrypted image for the given input image. The encrypted image is expected to satisfy certain criteria which as explained as follows:

**Lossless Encryption:** The cryptographic process should be reversible. The same algorithm should be able to recreate the image.

**Opacity Range:** The opacity range of the images varies for the encrypted and decrypted image. The encrypted image should be beyond clarity and recognition. So opacity is minimum for the encrypted image and maximum for the decrypted images.

**Security of Cryptosystem:** The algorithm should be strong enough to resist against the vulnerable attacks. The enhanced AES-128 bit algorithm [15] has been proved for the same.

**Implementation and Experimental Results**

The implementation of the proposed Image encryption algorithm has been carried out using MATLAB. An efficiently encrypted image should have the correlation coefficient nearly equal to zero. The encrypted images are tested with the adjacent pixels in the horizontal, vertical and diagonal positions. The proven equation for the correlation coefficient calculation is given in equation 1.

**Correlation coefficient:**

$$Correlation\ coefficient = \frac{\sum(x-x')(y-y')}{\sqrt{\sum(x-x')^2} \sqrt{\sum(y-y')^2}} \tag{1}$$

X: First set of pixel values

Y: Second set of pixel values

X': Mean of X values

Y': Mean of Y values

(X-X'), (Y-Y'): Deviation scores

(X-X')<sup>2</sup>, (Y-Y')<sup>2</sup>: Deviation square

(X-X')(Y-Y'): Product of Deviation scores

The equation 1 is applied to the pixels in the encrypted image between the adjacent pixels in horizontal, vertical and diagonal. The cipher image with the least correlation coefficient is chosen as the optimized encrypted image. Table 1 shows the result of equation 1 in a randomly selected cipher image for the algorithm.

**Table 1:** Result of correlation coefficient

Adjacent Pixels	Input image	Encrypted image
Vertical pixels	0.9822	0.0096
Horizontal pixels	0.9564	-0.0065
Diagonal pixels	0.9328	-0.0009

The computation time taken for encryption and decryption for the sample input images are given in Table 2.

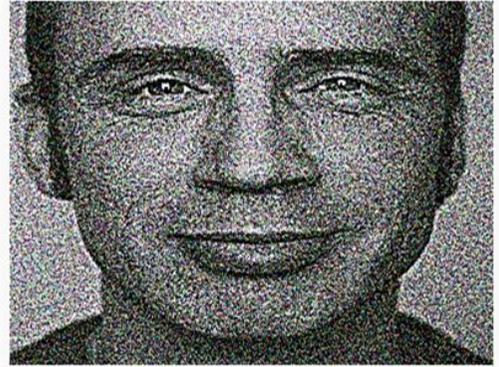
**Table 2:** Computational time for the image

Image Size	Encryption Time(sec)	Decryption Time(sec)
947kb	2.05784	0.397459
167kb	1.96944	0.327227
59kb	1.85941	0.239118

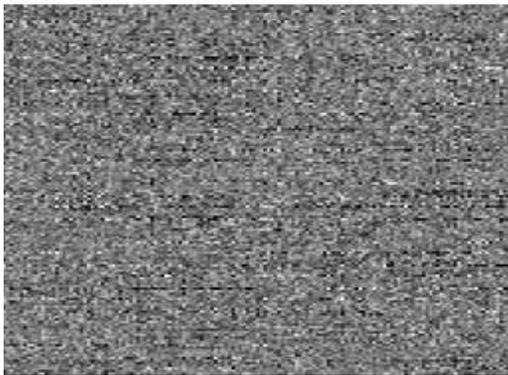
The sample output for the given input image is shown in Figure 2.1 to Figure 2.4



**Figure 2.1: Original Image**



**Figure 2.2: Image after few crossover and mutation**



**Figure 2.3: Encrypted Image**



**Figure 2.4: Decrypted Image**

Further the results shows that the decrypted image is exactly similar to the original image, which satisfies the main objective-lossless conversion. The inclusion of noise in the decrypted image is null. The distortion of the between the original and the cipher image is high. The complexity of the proposed encryption method is assessed by the encryption and decryption time which is recorded and shown in Table 2.

## **V. Conclusion**

In this paper an efficient method has been proposed for encrypting images with Genetic algorithm for enhanced AES-128 bit cryptosystem. The resultshows that it satisfies the goals of encryption like lossless encryption, high distortion and optimal cryptographic computational time. The result obtained for the correlation coefficients are as low as zero which means the adjacent pixels are highly randomized. The encrypted images are highly resistance against the practical attacks because of this correlation property. This image encryption algorithm can be further modified by implementing other crossover and mutation operators with varying crossover and mutation rates which may yield an enhanced encrypted image.

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# **Avoiding Traffic in Smart Cities With Intelligent Transportation System using Dynamic Overlapped**

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**ABSTRACT:** *IoT trusts that smart machines are more skilled than people in gathering and imparting information. This information encourages mechanical and business networks in business insight endeavors. The vehicular ad hoc network, use of IoT, is an extensive network of vehicles speaking with one another and roadside units for sharing of data. These are immediately made networks from interconnected vehicles for specific needs. VANETs expect to give solace to explorers and improve road security and traffic clog. This paper proposes to utilize the IoT, to improve traffic conditions and ease the traffic weight. The point of this paper is to show a structure for constant traffic data procurement and checking design dependent on the IoT using remote communications. The essential normal for the proposed work is to stay away from the traffic utilizing IOT. The proposed architecture allows the gathering of real-time traffic data generated by sensory units.*

**Keywords:** *IOT, Smart City, Traffic control, Intelligent transportation, dynamic overlapped*

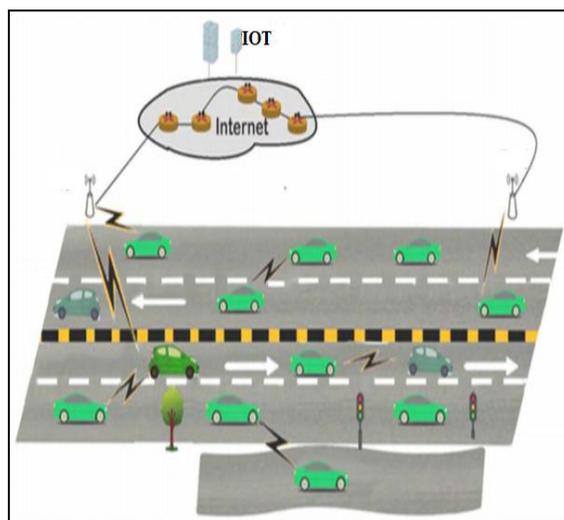
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## **1. Introduction**

The Internet of Things (IoT) will most likely consolidate straightforwardly and consistently an extensive number of various and heterogeneous end frameworks while giving open access to chosen subsets of information for the improvement of plenty of advanced administrations. Building general engineering for the IoT is consequently a mind-boggling task, for the most part on account of the very expansive assortment of gadgets, connect layer innovations and administrations that might be associated with such a framework. The Internet of Things (IoT) associate almost anything with an electronic subsystem to the current Internet foundation. It proposes a dream of an associated existence where smart gadgets, wise items, and Web-based frameworks are independently connected through the Internet and speak with one another to improve the personal satisfaction of their proprietors/clients [1]. Smart urban communities have turned out to be smarter than before gratitude to the ongoing advancements of computerized advances. A smart city is outfitted with various electronic components utilized by a few applications, similar to road cameras for perception frameworks, sensors for transportation frameworks, and so on. In addition, this can spread the utilization of individual cell phones. A portion of the administrations that may be empowered by a urban IoT paradigm and that are of potential interest in the Smart City setting since they can understand the success win circumstance of expanding the quality and improving the administrations offered to the natives while bringing a conservative advantage for the city administration as far as decrease of the operational expenses [2]. To all the more likely welcome the dimension of development of the empowering innovations for these administrations, a concise perspective on the administrations as far as proposed type(s) of network to be sent; expected traffic created by the administration; greatest mediocre postponement; device fueling; and a gauge of the attainability of each administration with right now accessible advances. Today, the number of things that utilization electricity is higher than the number of things associated with the Internet, and basically everything which utilizes electricity could be made progressively valuable by interfacing it to the Internet. Thus, later on, the IoT would be bigger than the (Smart Grid) SG today, and the advanced and keen grid (i.e., SG) won't be conceivable without the IoT innovation. By making the IoT innovation as a worldwide standard for the communications and the reason for SG, new entryways will be opened for amplifying the prospects for future developments [3].

The new time of IoT is driving the advancement of ordinary Vehicle Ad hoc Networks (VANET) into the Internet of Vehicles (IoV) paradigm. As indicated by ongoing forecasts, 25 billion of "things" will be associated with the Internet by 2020 among which vehicles will comprise a critical segment. In VANET, a vehicle is predominantly considered as a hub to scatter messages among vehicles. In IoV paradigm, vehicles are not only considered as simply like traditional vehicles in VANET [4]. Or maybe vehicles are considered as a shrewd gadget/smart device which has enveloped solid data communication framework, dependable security concern, and ability of calculation, stockpiling, and figuring out how to foresee clients' expectation.

The dynamic portable communication frameworks, for example, vehicle to vehicle (V2V), vehicle to the foundation (V2I), and vehicle to human (V2H) empower secure data sharing, discharging, assembling, and preparing in IoV because of the inescapable union of these innovations. In light of this paradigm, the vehicles can viably direct and manage different vehicles and give secure and solid data administrations. Thus, to achieve these tasks, inter-vehicle communication (IVC) is a show of IoV.



**Fig 1:** IOT architecture of vehicle Ad Hoc network

Data produced by traffic IoT and gathered on all roads can be introduced to voyagers and different clients. Through gathered ongoing traffic information, the framework can perceive current traffic activity, traffic stream conditions and can anticipate the future traffic stream. The framework may issue some most recent continuous traffic data that helps drivers picking ideal courses [5]. Thus, the framework can correctly administrate, screen and control moving vehicles. Developing a wise traffic framework dependent on IoT has various advantages such improvement of traffic conditions, decrease the traffic jam and the executive's costs, high unwavering quality, traffic wellbeing and freedom of climate conditions. Such traffic IoT must incorporate each component of traffic, for example, roads, spans, burrows, traffic signs, vehicles, and even drivers [6]. Every one of these things will be associated with the internet for advantageous distinguishing proof and the executives through sensor gadgets, for example, RFID gadgets, infrared sensors, worldwide situating frameworks, laser scanners, and so on. Traffic IoT gives traffic data accumulation and reconciliation, supporting preparing an investigation of all classes of traffic data on roads in a substantial region consequently and insightfully. Subsequently, present-day traffic the board is advancing into a clever transport framework dependent on IoT. Traffic requires appropriate data about administrations and coordinations accessible on the road and in this manner the framework can turn out to be increasingly self-solid and insightful. With various WSN and Sensor empowered communications, an IoT of information traffic will be produced dependent on RFID (radio-recurrence distinguishing proof). This traffic checking applications should be ensured to avoid any security assault visit in urban communities [7]. The framework utilizes remote sensors to acquire constant traffic data, for example, traffic condition on every road, number of vehicles, and normal speed. Usage of remote sensors is much proper because of their low power utilization and ease. Here the Traffic viewing, extensible topology association and adaptable asset provisioning for reasonable cross-layer asset improvement and course of action. On an overwhelmingly stacked switch, addressing and trading all stream-level estimations may even affect the execution of the control organize. The traditional traffic checking framework dependent on picture handling innovation has numerous impediments. The climate conditions have a genuine effect on this technique [8]. Amid substantial downpour and thick haze, the tag isn't unmistakably obvious and subsequently, the picture can't be caught. This paper proposes to utilize the IoT, to improve traffic conditions and diminish the traffic weight. The point of this paper is to display a structure for ongoing traffic data procurement and checking engineering dependent on the IoT using remote communications. The essential normal for the proposed work is to dodge

the traffic utilizing IOT. The proposed engineering permits assembling constant traffic information produced by tangible units.

## II. Literature Review

Nikhita Reddy Gade,[9] examine the number of gadgets that are associated is expanding step by step. Numerous investigations uncover that around 50 billion gadgets would be associated by 2020 demonstrating that the Internet of things has an extremely huge task to carry out later on to come. The uses of IoT are tremendous which incorporate Energy, Healthcare, and Agriculture to give some examples. IoT is a rising innovation that works with the combination of numerous other present-day advances. There are numerous dangers to nature today among them urbanization is one. The developing needs of the urban populace over the world are representing a genuine danger to the earth. We have to act quickly and address these issues by creating innovations that provide food the world issues. One such arrangement is to build up a smart world. The most significant use of IoT is smart in urban areas. The smart city speaks to a standout amongst the most encouraging, significant and troublesome Internet of Things (IoT) applications. Over the most recent couple of years, the smart city idea has assumed a significant job in both educational and industrial fields, with the advancement and activity of different middleware stages and IoT-based frameworks. This paper discusses the job of IoT in creating smart urban areas for a smarter world.

Muhammad Sohail [10], Today IoT incorporate a large number of internetworks and detecting gadgets e.g., vehicular networks, which are viewed as trying because of its fast and network dynamics. The objective of future vehicular networks is to improve road wellbeing, advance business or infotainment items and to lessen the traffic mishaps. Every one of these applications depends on the data trade among hubs, so solid information conveyance as well as the authenticity and validity of the information itself are essential. To adapt to the previously mentioned issue, trust the board comes up as a promising possibility to direct hub's exchange and interaction the executives, which requires appropriated versatile hubs collaboration for accomplishing structure objectives. In this paper, we propose a trust-based directing convention i.e., 3VSR (Three-Valued Secure Routing), which broadens the generally utilized AODV (Ad hoc On-request Distance Vector) steering convention and utilizes Sensing Logic-based trust model to upgrade the security arrangement of VANET (Vehicular Ad-Hoc Network). The current steering convention is generally founded on key or mark based plans, which of course expands calculation overhead.

KaziMasudulAlam [11] investigate the fundamental vision of the Internet of Things (IoT) is to prepare genuine physical articles with registering and communication control so they can interact with one another for the social great. As one of the key individuals from IoT, Internet of Vehicles (IoV) has seen soak advancement in communication innovations. Presently, vehicles can without much of a stretch trade security, productivity, infotainment and solace related data with different vehicles and foundations utilizing vehicular ad-hoc networks (VANETs). We influence on the cloud-based VANETs topic to propose cyber-physical engineering for the Social Internet of Vehicles (SloV). SloV is a vehicular occasion of the Social Internet of Things (IoT), where vehicles are the key social substances in the machine-to-machine vehicular informal organizations. We have recognized the social structures of SloV segments, their connections, and the interaction types. We have mapped VANETs parts into IoT-An engineering reference model to offer better coordination of SloV with other IoT areas. We additionally present a communication message structure dependent on car ontologies, the SAE J2735 message set, and the ATIS occasions pattern that compares to the social chart. At long last, we give the usage subtleties and the exploratory investigation to show the viability of the proposed framework just as incorporate diverse application situations for different client gatherings.

Shahid Latif et al [12], investigate the VANETs, vehicles trade information with one another straightforwardly or through roadside units (RSUs). Information scattering in VANETs encounters various testing issues including broadcast storm, network segments, intermittent availability among vehicles, and constrained data transfer capacity. In writing, different information dispersal plans are proposed. Nonetheless, the vast majority of these plans are intended for either urban or parkway VANET situations and assessed under inadequate or thick traffic conditions. In addition, these plans don't successfully defeat the previously mentioned issues all the while. In this paper, we present another information spread convention for VANETs, which scatters the crisis messages in various situations under changing traffic conditions. Amid thick traffic conditions, DDP4V utilizes the division of transmission locale of a vehicle so as to choose the most fitting next sending vehicle (NFV). Likewise, it isolates the transmission locale of a vehicle in three particular sections and chooses the vehicle(s) inside the most astounding need portion to advance the message to all neighbor vehicles, though it additionally utilizes understood affirmations for

ensured message conveyance amid scanty traffic Conditions. Recreation results demonstrate that DDP4V convention outflanks the other existing related conventions as far as inclusion, network overhead, impact, and start to finish delay.

A. Rajesh and D. V. Pavansai [13] Internet of Things (IoT) joins the objects of this present reality to the virtual world and empowers whenever, anyplace availability for anything that has an ON and OFF switch. It comprises an existence where physical articles and living creatures, just as virtual information and situations, interact with one another. A substantial measure of information is produced as expansive quantities of gadgets are associated with the internet. So this vast measure of information must be controlled and changed over to helpful data so as to create proficient frameworks. In this paper, we center around to an urban IoT framework that is utilized to fabricate savvy transportation framework (ITS). IoT based keen transportation frameworks is intended to help the Smart City vision, which goes for utilizing the advanced and ground-breaking communication advances for the administration of the city and the natives.

### III. Problem Statement

In recent years the popularity of private engine vehicles is getting urban traffic increasingly swarmed. As a result traffic checking is getting to be one of the significant issues in huge smart-city foundation everywhere throughout the world. Various scientists have managed the issue of canny traffic checking and controlling, and because of their endeavors, a few unique methodologies have been created. Through gathered continuous traffic information, the framework can perceive current traffic task, traffic stream conditions and can foresee the future traffic stream. Traffic requires reasonable data about administrations and co-ordinations accessible on the road and in this way the framework can turn out to be progressively self-dependable and wise [14]. With various WSN and Sensor empowered communications, an IoT of information traffic will be created. This traffic observing applications should be ensured to avoid any security assault visit in urban communities however it gives fewer data of the information and traffic couldn't be controlled.

### IV. Proposed System

During past few years ongoing communication paradigm - the internet of things - has increased huge consideration in academia just as in industry since it speaks to a tremendous open door for cost funds and new income age over a wide scope of ventures [15]. The primary explanations for this interest are its capacities. IoT can be utilized to make an existence where every single smart object of our regular day to day existence are associated with the Internet and interact with one another with the least human contribution to achieve a shared objective. The traffic framework database contains information from vehicle sensors, climate data from natural sensors, and data on traffic streams. The subsystem forms got data and offer it through the interface with different subsystems. It permits following the area of a vehicle quick and exact and advancing traffic planning.

#### a. Sensor Activity in WSN Layer

There is two action modes for Sensors; (1) Normal mode, (2) IoT mode. The sensors select between the communication modes utilizing a tattling convention [16]. The principle though is that as a matter, of course, a sensor stays in Normal mode which utilizes most extreme vitality. At the point when there are sufficient IoT's in the earth to take the communication load from sensors, sensors change to IoT mode that utilizes lesser vitality. The algorithm for exchanging between the two modes is examined in Algorithm 1 Chatter Algorithm. Whenever suitable, IoT mode is turned On for quite a while. The time is partitioned into casings of 500 ms, and each edge is subdivided into spaces. In each edge, there is an underlying listening opening (ILS), in which all sensors keep their beneficiaries on paying little heed to which mode they are in. At the point when in IoT mode, there are 10 equivalent spaces for communication

#### Algorithm 1 Chatter Algorithm

```
sendIoTOccurMsgTo (R,n) = //sends message n to neighbor R
isIoTRepliesEnough() = //returns True if no. of IoT replies is >= 3, else returns False
state = //represents the current state of node
1: procedure CHATTERALGORITHM() //Push method
2: while true do
3: wait T
4: if isIoTRepliesEnough() then
5: n.count = -1
```

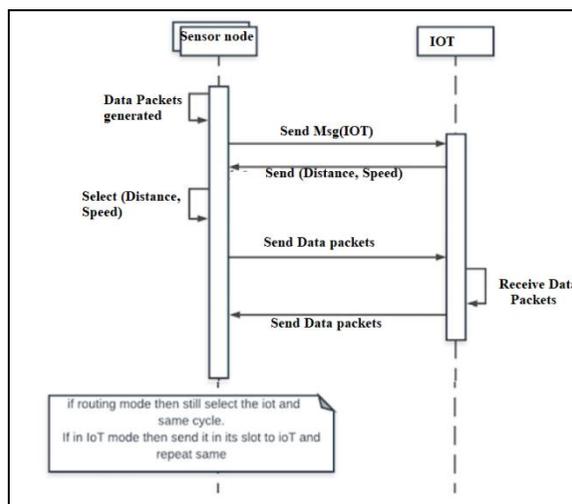
```

6: pushIoTOccurMsg(n)
7: end if
8: end while
9: end procedure
10: procedure OnIOTOccurRECEIVE(n) //Push Receiver method
11: If m.age < 2 then
12: pushIoTExistMessage(n)
13: end if
14: end procedure
15: procedure PUSHIOTOccurMsg(n)
16: R = //random neighbor
17: if state == NORMAL then state = IOT
18: end if
19: IoTTimerSet(1min)
20: n.count ++
21 sendIoTExistMessageTo (R,n)
22: end procedure
    
```

When a sensor chooses to turn On IoT mode, it is for 1 minute. It broadcasts IoTOccur (Count = 1) messages to different sensors. Each getting sensor that gets utilizing methodology, re-broadcasts message in the wake of augmenting age except if the age of the got message is two [17]. In this way, such messages stop after two bounces. On the off chance that a Sensor hub does not get such messages, and one and only IoT answer, at that point it keeps itself in the Normal mode. The sensor can, in any case, speak with IoTs. Anyway, its vitality utilization cannot be maintained a strategic distance from.

**b. Traversing of Data Packets**

Basically, information bundles are sent towards the sink utilizing two layered methodologies. Figure 2 delineates the fundamental arrangement of communication between Sensor hubs and IoT gadgets. After revelation and exchange with IoT, Sensor sends the parcel to the IoT gadget. IoT recognizes the receipt of the bundle to the sensor with the goal that the sensor does not need to advance the parcel utilizing default steering convention [18]. At the point when the IoT device alters the course, it sends the data (information bundle) back to the WSN layer, where the getting sensor rehashes the procedure.



**Fig 2:** The communication between WSN and IoT

On the off chance that the IT Platform segment in the Sensor is unfit to discover any IoT device that is moving towards the Sink, the sensor proceeds the multi-bounce steering utilizing its default directing convention in the WSN layer.

**Algorithm 2:** TraversingDataSN

```

SN.rssi = //received signal pointer value
SN.distance = //Extreme distance between two points minus IoT's distance from Sink
SN.energyLevel = //Remaining Energy of Sensor
1: procedure TraversingDataSN(SN[])
2: for each R 2 SN do //remove SN replies with less than threshold RSSI.
3: if SN[i].rssi<thresholdRssithen
4: SN.remove (R)
5: end if
6: end for
7: best = SN[1]
8: for each p 2 SN do
9: bestValue = 2 * best.rssi + best.energyLevel + best.distance
10: RValue = 2 * R.rssi + R.energyLevel + R.distance
11: if RValue>bestValuethen
12: best = R
13: end if
14: end for
15: return best
16: end procedure

```

At the point when the IoT device alters its course, IT Platform empowers IoT to send information bundle back to WSN layer. The framework may issue some most recent continuous traffic data that helps drivers picking ideal courses. In this manner, the framework can correctly administrate, screen and control moving vehicles [19]. Building an insightful traffic framework dependent on IoT has various advantages such improvement of traffic conditions, decrease the traffic jam and the executive's costs, high unwavering quality, traffic wellbeing and autonomy of climate conditions

**c. Traffic control Directing using dynamic overlapped**

At the point when an IoT alters its course and leaves from the Sink, it needs to drop information back to the WSN layer. To abstain from sending information to sensors while they are resting, IoT device is since it getting late synchronization data about when sensors are conscious and ready to tune in to information. At the point when information is sent to IoT, outline begins times are likewise shared. This makes IoT mindful of the ILS at WSN layer [20]. Accordingly, it broadcasts a drop Hello message to WSN layer sensors thinking about this current ILS's time. Sensors answer IoT within a drop Reply message with their area, Rx opening and vitality level. In light of RSSI esteem, vitality level and separation from Sink, IoT chooses the best sensor utilizing Algorithm 3.

**Algorithm 3**IsPointingToSink

```

Previous M = //previous M position of IoT device
Previous N = //previous N position of IoT device
Current M = //current M position of IoT device
Current N = //current M position of IoT device
Sink M = // M position of Sink
Sink N = // N position of Sink
getDistance(M1,N1, M2,N2) // returns euclidean distance between two points
1: procedureISDIRECTIONTOSINK(DATA)
2: current Distance = getDistance(currentM, currentN, sinkM, sinkN)
3: previous Distance = getDistance(previousM, previousN, sinkM, sinkN)
4: if current Distance >previousDistancthen
5: returnValue = True
6: else
7: returnValue = False
8: end if return returnValue
9: end procedure

```

The traditional traffic checking framework dependent on picture preparing innovation has numerous confinements. One of them is the effect of the climate. In the event of thick residue, overwhelming precipitation, and so forth., the tag can't be seen obviously, so its picture can't be caught. The entire traffic IoT network is apportioned into dynamic overlapped algorithm, and a Simulation processor is mapped to each area.

**Algorithm 4:** DynamicOverlappedIoT(IOTS[])

iots[] = //array of IoT objects

iot.rssi = //established signal pointer value

iot.distance = //Extreme distance among two points **minus** distance of IoT from Sink

iot.speed = //Extreme permitted speed in which message is possible **minus** speed of IoT

1: **procedure** DynamicOverlappedIoT (IOTS[])

2: **for each** p 2 iots**do** //remove iot responses with less than threshold RSSI.

3: **if** p.rssi<thresholdRssi**then**

4: iots.remove (p)

5: **end if**

6: **end for**

7: best = iots[1]

8: **for each** p 2 iots**do**

9: bestValue = 2 \* best.rssi + best.speed + best.distance

10: pValue = 2 \* p.rssi + p.speed + p.distance

11: **if** pValue>bestValue**then**

12: best = p

13: **end if**

14: **end for return** best

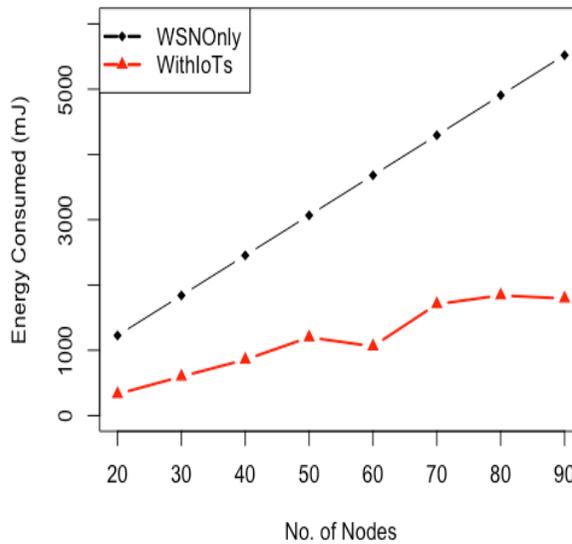
15: **end procedure**

IoT device that is moving towards the Sink, the sensor proceeds the multi-bounce directing utilizing its default steering convention in the WSN layer. At the point when the IoT device alters its course, IT Platform empowers IoT to send information bundle back to WSN layer. Algorithm 3 demonstrates the IsPointingToSink algorithm in the stage for the IoT device. Appropriately, it isolates the transmission district of a vehicle in three particular portions and chooses the vehicle(s) inside the most noteworthy need fragment to advance the message to all neighbour vehicles, while it additionally utilizes certain affirmations for ensured message conveyance amid inadequate traffic Conditions. Transmits/gets diverse sorts of data to/from different articles the Internet; interprets the information originating from different items (Sensors, clients), and gives a bound together with a perspective on the unique circumstance; speaks with different specialists in the network to achieve a particular errand. All messages sent from this specialist will be exchanged to the traffic the executives framework and discuss legitimately with a static operator of the planned utilization of the traffic the executive's framework referenced previously. Vehicles moving far from source vehicle will take an interest in information scattering process amid meager traffic conditions to manage network parcel.

## V. Experimental Result

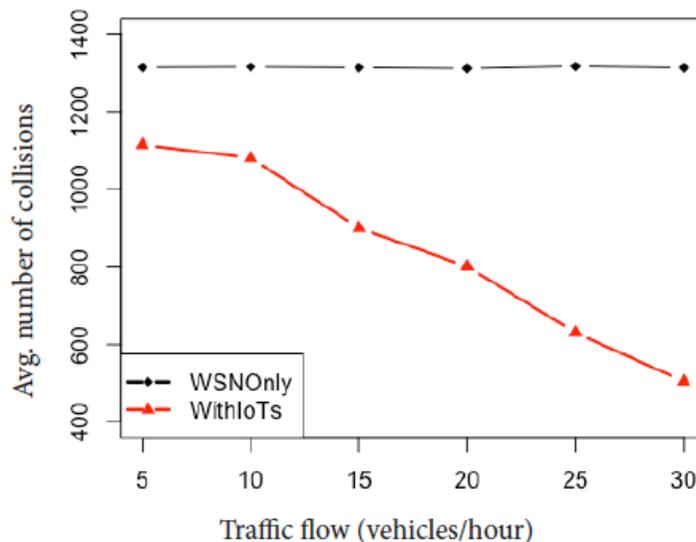
To evaluate the proposed methodology, we utilized NS2. IoT devices are not a piece of WSN, rather they are outside to the WSN, and WSN entrepreneurially utilizes them to course its information. Sensor hubs energy utilization is diminished just about four folds. WSN Only methods no IoT's are engaged with steering information to Sink. With-IoTs implies there are IoTs accessible that move around in WSN condition.

Energy consumed: Average energy consumed by all sensors is delineated utilizing this measurement. The test system estimates energy utilization by considering the measure of time sensor radio has been in getting or exchange mode



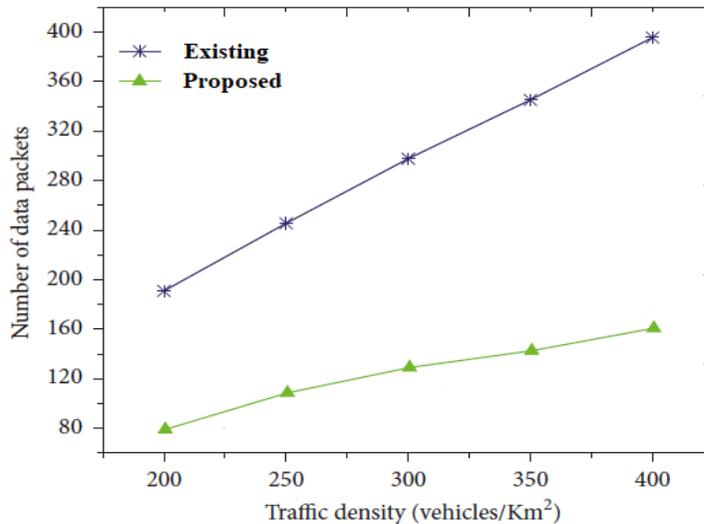
**Fig 3 : Energy Consumption**

We designed an analysis to comprehend the impact of utilizing IoT devices. In this reproduction, we kept the network fixed and added IoT devices in the earth. The outcomes have appeared in Figure 3, where less energy is overcome with more IoT devices.



**Fig 4: Traffic Control**

The controlled number of excess retransmissions diminishes the parcel impacts as vehicles don't require seeking to get to the channel.



**Fig 5: Data Packets Send**

Simulation enables us to watch the properties, qualities, and practices of the traffic framework. In view of point by point ongoing information gathered from the circulated working simulation, the IoT traffic framework can give precise data important to close continuous traffic choices.

## VI CONCLUSION

In this view, the traffic the board framework on the road not as an individual issue, however as a worldwide issue which should be acknowledged in a circumspect way. This paper proposed a dynamic overlapped technique to maintain a strategic distance from traffic. The entire traffic IoT network is partitioned into dynamic overlapped technique, and a reproduction processor is mapped to every vehicle. In any case, the proposed framework dependent on the IoT comprises of a substantial number of RFIDs and sensors that transmit information remotely. This calls for improved traffic control and security to ensure such monstrous measures of information and protection of clients. In future IoT requires alteration of network availability models and readiness for huge increment in the measure of ongoing data. To accomplish that, interaction communication models must be updated to incorporate machine to machine and individuals to machine communications.

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# **An Exploratory Analysis of Customer Reviews using Natural Language Processing**

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**ABSTRACT:** *In this paper, we present our preliminary experiments on customer reviews on restaurant data. This experiment is designed to extract sentiment based on reviews that exist in restaurant data. It identifies the sentiment that refers to the customer reviews using Natural Language Processing techniques. To classify sentiment, our experiment consists of five main steps, tokenization, Stemming, Stopwords, wordcloud and evaluation of performance by using ROC curve. The experiment utilizes wordcloud to identify positive and negative customer reviews on restaurant dataset. Experimental results show that the Naive Bayes algorithm gives better accuracy and performance as compared to Random Forest algorithm.*

**Keywords:** *ROC, Stemming, Tokenization, Word Cloud, Stopwords, NLP*

---

## **1. Introduction**

Today, a huge amount of information is available in online documents such as web pages, newsgroup postings, and on-line news databases. Among these types of information available, one useful type is the sentiment, or opinion people express towards a subject. (A subject is either a topic of interest or a feature of the topic.) [1]. For example, knowing the reputation of their own or their competitor's restaurant/hotels is valuable for development, marketing and customer relationship management. Traditionally, companies conduct consumer surveys for this purpose.

In the proposal we have focused more on how to improve the words extraction from the given customer reviews. The trained training sets can easily filter the attributes as per the user requirements. From Natural Language Processing we can easily pre-process all the words from the given sentences [2]. By using Bayesian algorithm we can easily classify the positive or negative reviews of customers.

## **II. Background**

Here we are using NLP method to process the customer reviews of restaurant data and we are applying Naïve bayes algorithm and Random Forest Algorithm for finding Accuracy. By using ROC method we can summarize overall result of trained model.

### **A. NLP**

Natural language processing is a method of train the computer in such a way that it has to analyze, recognize and understand the human language. NLP can be used for speech recognition, understanding customer reviews, news classification etc.

NLP processing has following steps.

1. Tokenization: It is a method of breaking the paragraphs into small chunks or words. Sentence tokenizer breaks the paragraphs into sentences.

Word tokenizer breaks the paragraphs into words.

2. Stop words: It can be considered as noise in the text. E.g. Such as is, as, was, for, this, that etc.

IN NLTK for removing stop words, we need create a list of stop words and filter out your list of tokens from these words.

3. Stemming: Only keeping root of an word. Ex: From the words like connected, connecting, connection is reduced to common word like connect.

4. Parts of Speech tagging (POS): Is used to identify grammatical group of words. POS is used to identify noun, pronoun, adverb, and verb etc., based on context. POS is used to identify the relationship with in the sentences and assign the tags to corresponding words.

5. Word cloud: Word Cloud is a Data visualization technique used mainly for text representation where size of each word represent a frequency or importance of an each word. Word clouds are mainly used for analyzing data from social networks, customer reviews, complaints of a customer's etc.

6. Count Vectorization: In this method it converts all the text into 0's and 1's and that will be represented as a matrix. Matrix contains count of each word or token.

Once NLP processing is over next step will be split dataset into 70% of training dataset and 30% of testing dataset. First train the model with training dataset and then test the dataset with testing dataset in order to identify the model accuracy.

### III. Implementation

#### 1. Naïve Bayes Algorithm

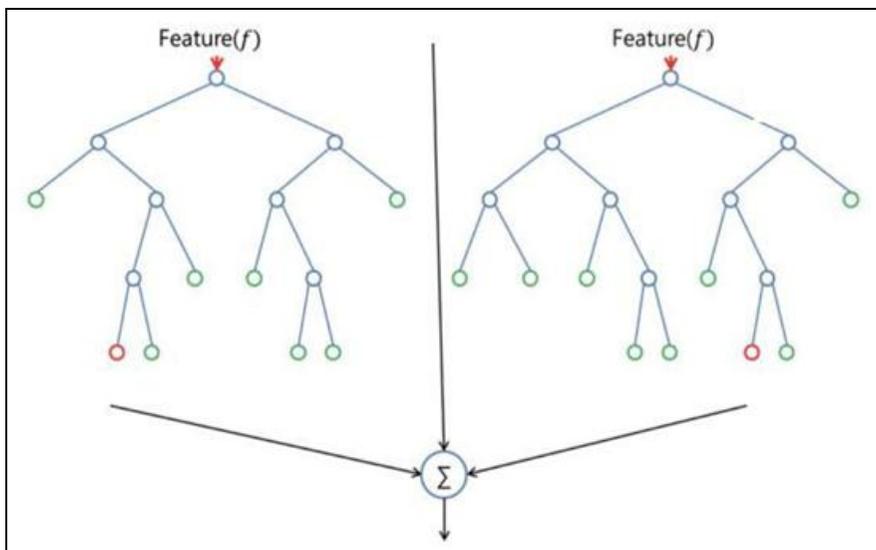
Bayes theorem provides a way to calculate probability  $P(B/A)$  from  $P(A)$ ,  $P(B)$  and  $P(A/B)$ .

$$P(B/A) = P(A/B) P(A)/P(B)$$

- $P(B|A)$  is the posterior probability of class (B, target) given predictor (A, attributes).
- $P(A)$  is the prior probability of class.
- $P(A|B)$  is the likelihood which is the probability of predictor given class.
- $P(B)$  is the prior probability of predictor.

#### 2. Random Forest Algorithm:

Random Forest is a supervised learning algorithm.



Random Forest has nearly the same hyper parameters as a decision tree or a bagging classifier. Random Forest adds additional randomness to the model, while growing the trees. Instead of searching for the most important feature while splitting a node, it searches for the best feature among a random subset of features. This results in a wide diversity that generally results in a better model.

The goal of Random Forest algorithm is to build multiple decision trees and combine them together to get a more accurate and stable prediction using Python packages: pandas, NumPy, scikit-learn, Seaborn and Matplotlib

1. Pandas: Pandas is used to working with "relational" or "labeled" data both easy and intuitive. The main goal is to be the fundamental high-level building block for doing practical, real world data analysis in Python.
2. Numpy: NumPy is used for N-dimensional array object and sophisticated (broadcasting) functions.
3. Scikit-learn: Scikit-learn provide K-Mean algorithms via a consistent interface in Python.
4. Seaborn: Seaborn is use for data visualization and a high-level interface for drawing attractive and informative statistical graphics.

5. Matplotlib: Matplotlib is used for 2D plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms.

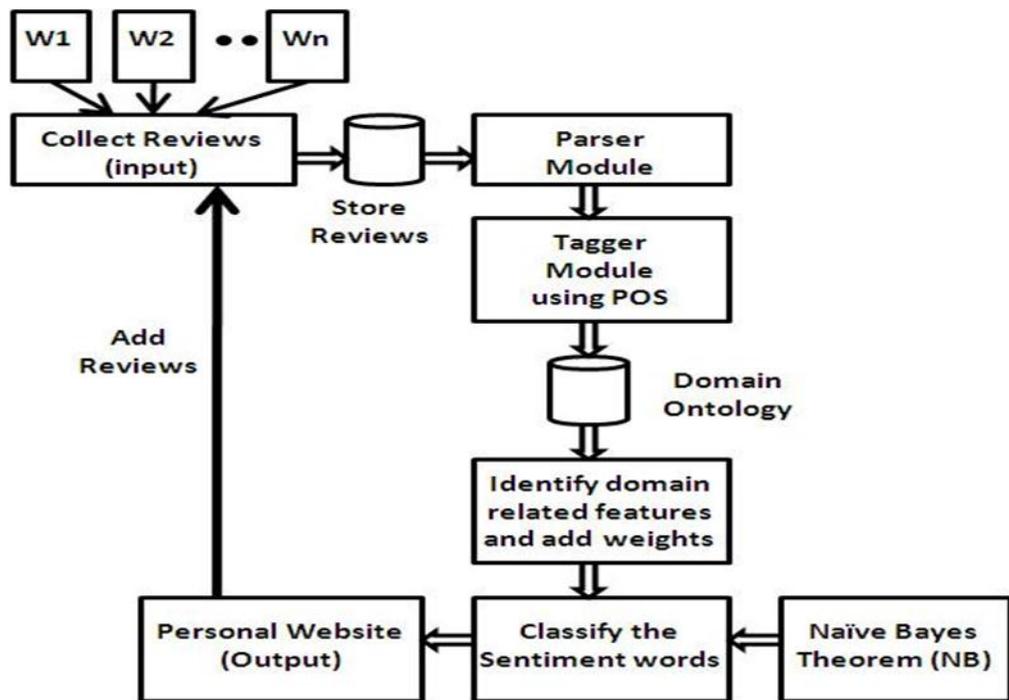
#### IV System Design

Step 1, Input: To collect the input from the different websites through crawler or manually do it at initial Stage.

Step 2, Parser Module: A natural language parser works out the grammatical structure of sentences, for instance, words which are grouped together are "phrases" and the Stanford parser identifies words as subjects or objects of a verb [3], [4].

Step 3, Tagger module: We use Part Of Speech (POS) tagger to assign POS tags to words in a sentence (such as: tags for nouns, verbs, and adjective).[5]

Step 4, Apply Domain Ontology: In this step we present some modules indicating how to separate the sentences, then how to extract the nouns and respective Verbs, Adverbs and Adjectives.



#### V Results

In every model, the accuracy and the cost analysis plays an important role in the acceptance of that model for the application. The result of Restaurant data set is being displayed using confusion matrix and ROC curve.

##### 1. Confusion Matrix:

It is used for summarizing the result.

True Positives (TP): In this case predicted is also yes and actual also yes.Ex: There will be fire and predicted also is fire.

True negatives (TN): In this case predicted is also no and actual also no.Ex: there will be no fire and predicted as also no fire.

False Positives (FP): In this case actual is no but predicted as yes.Ex. There will be no fire but predicted as Fire

False negatives (FN): In this case actual is yes but predicted as no.Ex: There will be fire but predicted as no fire.

Confusion Matrix for Naïve Bayes

Confusion matrix for Random Forest

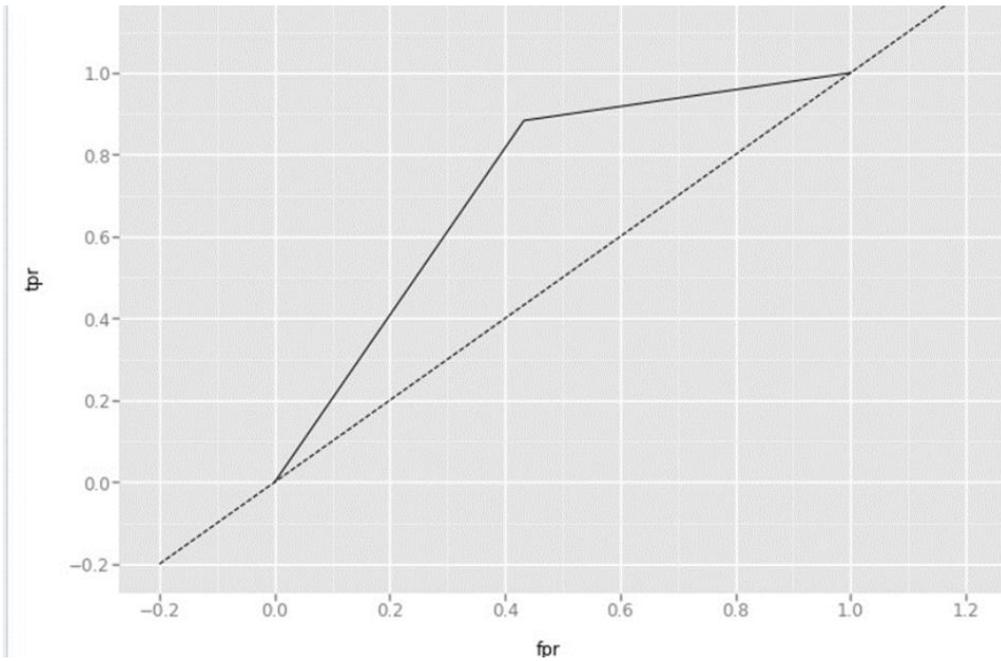


### 5. ROC Curve

ROC (Receiver Operating Characteristics) curve. It is one of the most important evaluation metrics for checking performance of a classification model. The ROC curve is plotted with True Positive Rate(TPR) against the False Positive Rate(FPR) where TPR is on y-axis and FPR is on the x-axis.

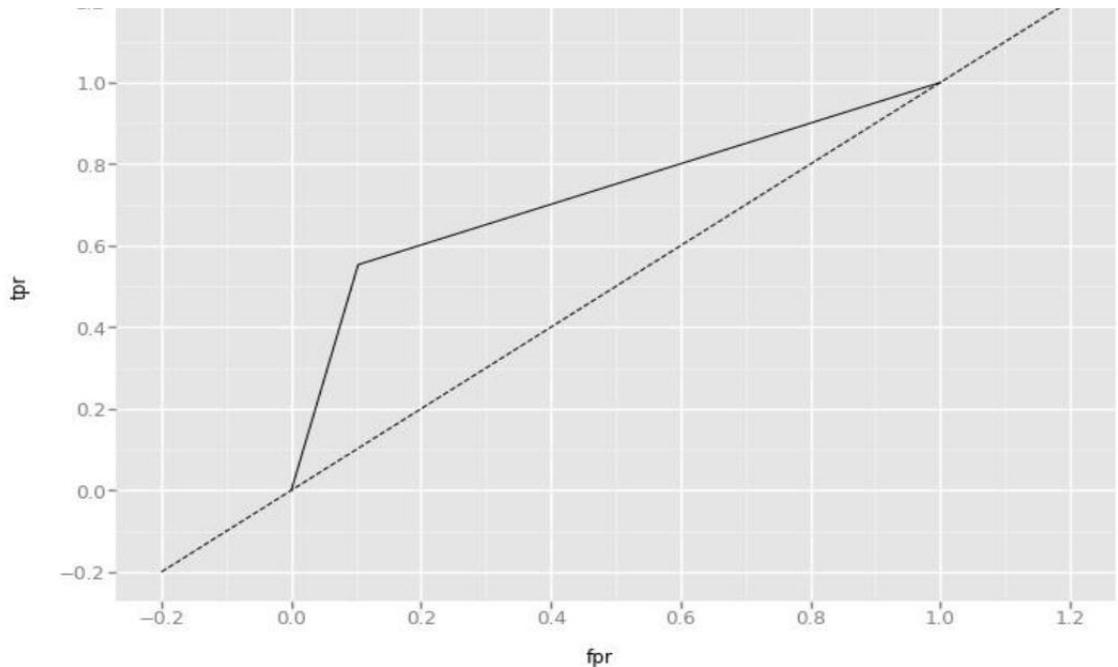
$$\text{Naïve Bayes TPR} = \frac{TP}{(TP+FN)} = \frac{91}{(91+12)} = 88\%$$

$$\text{FPR} = \frac{FP}{(TN+FP)} = \frac{42}{(55+42)} = 44\%$$



$$\text{Random Forest: TPR} = \frac{57}{(57+46)} = 55\%$$

$$\text{FPR} = \frac{FP}{(TN+FP)} = \frac{42}{(55+42)} = 44\%$$



6. Accuracy: It is the ratio of number of correct predictions to the total number of input samples. In Naïve Bayes Model we got Accuracy around 73% and in Random Forest we got accuracy around 72%.

## VI Conclusion

We have successfully Implemented Customer Review Sentiment Analysis System. We applied NLP techniques to understand the customer's reviews on restaurant dataset. By using word cloud we can identify positive and negative reviews of customers. With the help of ROC we can summarize results of Naïve Bayes and Random Forest algorithms successfully. Finally we got better accuracy from Naïve Bayes algorithm which can be used for various communities for analyzing their performance on large scales. We have seen that sentiment analysis has many Applications and it is important field to study.

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## **An Application on Nutrition Management in A Rice Plant**

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**ABSTRACT:** Leaf Color Chart (LCC) is a tool that will provide us an evaluation of rice's demand for nitrogen. But the manual use of LCC is hugely determined by the person's respective color perception. The main aim of our project is to develop an application that will remove the drawbacks of LCC, and Image Processing Ability holds promise to this application. An application is to be evolved which self-acts the LCC using Image processing techniques. There is also a need of tool which discovers other deficiencies existing in the leaf.

**Keywords:** Rice Plant Nutrition, Digital Image Processing Application, k-Mean Algorithm, MATLAB, Cyber Crime Dataset, Result Analysis

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### **1. Introduction**

Nitrogen (N) is a major element for plant growth and is an integral part of chlorophyll (Ch), which is primary absorber of light energy needed for photosynthesis. Ch and N affects the green color of plants and ultimately determines their biomass yield and quality. Plants sufficiently supplied with N are green and healthy, while plants insufficiently supplied with N are pale green or yellow in colour and remain small and stunted. Hence, leaf color changes have led researchers to exploit this property by using image processing analyses to detect N status in plants.

#### **1.1. Preamble**

The main occupation of India is agriculture. About seventy percent of our population depends on agriculture. One-third of our National income comes from agriculture. Our economy is based on agriculture. The development of agriculture has much to do with the economic welfare of our country. Great improvements have been made in agriculture through our five year plans. Green Revolution has been brought about in the agricultural field. The study of agriculture is known as agricultural science.

Climate change poses serious threats on crop productivity. Global warming may change growth and development pattern of crop plant, which alters most of the physiological and biochemical processes in plant. As an adaptation strategy, currently recommended cultivation practices, especially fertilizer and irrigation application, need to be adjusted suitably according to climate and plant growth.

The paddy crop is cultivated almost in all the states of the country Orissa, Andhra Pradesh, West Bengal, Bihar, Uttar Pradesh, Madhya Pradesh and Tamil Nadu are the leading rice growing states.

#### **i. Climatic condition for rice cultivation:**

Rice is water loving plant which is grown in north-eastern states, all rounds the year if water is available either through rain or irrigation. Paddy cultivation is done only in those where minimum rainfall is 115cm.

Temperature is another climatic factor which has a favorable and in some cases unfavorable influence on the development, growth and yield of rice. Rice being a tropical and sub-tropical plant requires a fairly high temperature, ranging from 20° to 40°C. The optimum temperature of 30°C during day time and 20°C during night time seems to be more favorable for the development and growth of rice crop. The minimum temperature should not go below 15°C as germination cannot take place below that temperature. For normal growth, a pH range of 5.0-8.0 is suitable.

#### **ii. Soil type and condition:**

Rice is grown on all sorts of heavy soil type's clay loamy of alluvial in nature, which have high water holding capacity. Cultivation of rice completely depends on the availability of water.

## II. Literature Review

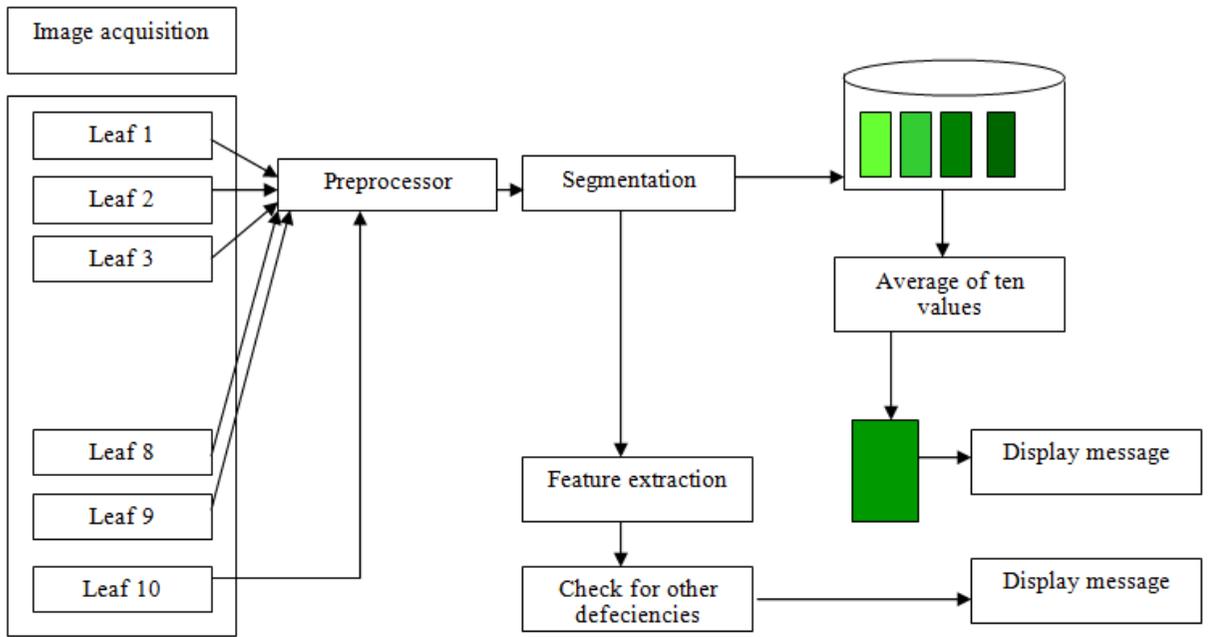
- 1) Rice is the most important source of staple food in India occupying 44.6Mha of land and producing 91.04 Mt of grain with a productivity of 2.04 t/ha [1].
- 2) Every third person on the earth eats rice everyday in one form or the other and 90% of the total rice produced is consumed in Asian countries. However, India's productivity is very low in comparison to other major rice growing countries in the world. Among various reasons for this low productivity, inefficient utilization of nitrogen is considered to be the most critical one [2].
- 3) On the recent world-wide evaluation of fertilizer, its recovery efficiency has been found to be around 30% in rice . It has been observed that more than 60% of applied nitrogen is lost due to lack of synchronization between the nitrogen demand and nitrogen supply [3]
- 4) Nitrogen deficiency results in stunted growth and yellowish plants. Tips become chlorotic. Leaves narrow, short, erect and lemon-yellowish green[4].
- 5) Phosphorous promotes root development (Particularly the development of fibrous roots), tillering and early flowering. [5]
- 6) Phosphorous deficiency results in Leaves narrow, short, very erect 'dirty' dark green.. the fertilizers to be applied are Farmyard manure, Biofertilizers (Phosphate solubilizers) Castor cake, Neemcake, Super phosphate (single), Super phosphate An Application for nutrition management in rice plant (Double), Super phosphate (Triple), Basic slag, Mussori, Diammonium phosphate (SPIC), Ammonium phosphate (Gromor).[6]
- 7) LCC is easy to use and is an inexpensive diagnostic tool for monitoring the relative greenness of a rice leaf as an indicator for the plant N status and can be used as an alternative to chlorophyll meter [11]. It offers substantial opportunities to farmers for detection of time and amount of N to be applied (on demand) for efficient N use and high rice yield. • Use of LCC for N management has consistently increased grain yield and profit.[7]
- 8) Traditionally, nitrogen status in paddy crops is measured by 4 traditional methods, namely chemical test, normalized difference vegetation index, SPAD meter and leaf color chart. Each method has its advantages and disadvantages.[8]
- 9) Potassium enhances the ability of the plants to resist diseases, insect attacks, cold and other adverse conditions. Helps in proper uptake of other nutrients. Potassium deficiency results in dark green plants with yellowish leaf. Brown leaf margins and brown necrotic spots on the tips of older leaves. Rusty brown spots on the panicles and poor grain formation. Fertilizers to be applied are Farmyard manure, Castor cake, Neem cake, Muriate of potash (KCl), Potassium sulphate.[9]
- 10) Zinc is essential for the transformation of carbohydrates. Zinc deficiency results in Zinc Dusty brown spots on upper leaves. Fertilizers to be applied are Zinc sulphate, Zinc carbonate, Zinc chloride, Zinc chelate, Zinc oxide.[10]

## III. System Design

This chapter discusses about the various steps involved in system design process. The functions that are used are also discussed.

### 3.1 System architecture

Figure 3.1 is the system architecture of the application. The figure clearly depicts various steps carried out in the process of deficiency check. The flow with blue colored line shows the design to find nitrogen deficiency and red colored line shows design to find other deficiencies. Fig 3.2 shows various steps to check nitrogen deficiency. Ten images from a single paddy field is captured to find out the presence of average nitrogen content in the leaf. Image acquisition means the capturing of image

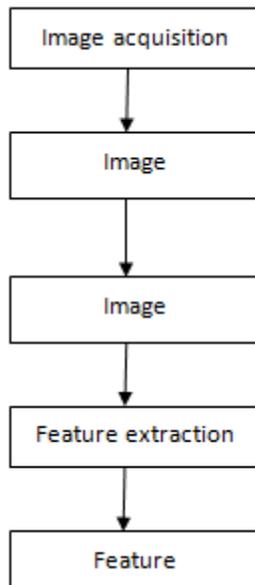


**Fig 3.1 system architecture**

There are some rules which are to be followed while capturing the leaf and those rules or the instructions are provided in the application. Image preprocessing deals with the image resize and the removal of noise. Image is segmented to get the leaf part of the image. The mean value of the leaf is taken to find the match between standard leaf and the input leaves.

**IV. EXPERIMENTAL WORK**

The following figure represents the experimental steps involved in the process



**Fig 4: Steps involved in the process**

#### 4.1 Image acquisition

Firstly, the RGB color images are captured using a digital camera with required resolution for good quality. The construction of an image database is clearly dependent on the application. The image database itself is responsible for the better efficiency of the classifier which decides the robustness of the algorithm.

#### 4.2 Image Pre-processing

In preprocessing step to improve image data that removes background, noise and also suppress undesired distortions. It enhances image features for processing and analysis. It includes color space conversion, image enhancement, and image segmentation.

The RGB images of leaves are converted into color space representation. The purpose of the color space is to facilitate the specification of colors in some standard accepted way. RGB images converted into Hue Saturation Value (HSV) color space representation. Because RGB is for color generation and is colour dependent space model. HSV model is an ideal tool for color perception but HSI is colour independent space model. Hue is a color attribute that describes pure color as perceived by an observer. Saturation termed as relative purity or the amount of white light added to hue and value means amplitude of light. After the color space transformation process, hue component used for further analysis. Saturation and value are dropped since it does not give extra information.

#### 4.3 Image Segmentation

Image segmentation is the methodology of partitioning a digital image into different fragments (sets of pixels, otherwise called super pixels). The objective of segmentation is to improve and/or change the representation of an image into something that is more significant and less demanding to examine. The consequence of image segmentation is a situated of sections that aggregate cover the whole image, or a set of forms removed from the image. Each of the pixels in a locale are comparative as for some trademark or registered property, for example, shading, force, or surface. Nearby districts are essentially diverse as for the same characteristic(s).

In segmentation step is to find out the infected region. Segmentation is done by k-mean clustering.

Step 1: Determine the number of clusters K.

Step 2: Find out the Centroid of the clusters.

Step 3: Grouping of the pixels based on minimum distance into the clusters.

#### 4.4 Feature extraction

Feature extraction is a special form of dimensionality reduction. Here significant features are extracted and those features can be used to determine the meaning of a given sample. Actually, image features usually includes colour, shape and texture features. Currently most of the researchers targeting plant leaf texture as the most important feature in classifying plants.

Texture is one of the most important feature which can be used to classify and recognize objects. It is a powerful regional descriptor that helps in the image retrieval process. Contrast, Homogeneity, Dissimilarity, Energy and Entropy features are intended to describe texture. Shape is one of the primitive features for image content description.

#### 4.5 Classification

It is the next stage in finding zinc, magnesium, phosphorous, silicon. Deficiency detection. It is identifying a rule according to selected features in feature extraction stage and comparing each leaf color to any one the predetermined classes V.

#### K-Means: Technique

The k-means algorithm defines the centroid of a cluster as the mean value of the points within the cluster. First, it randomly selects k of the objects in D, each of which initially represents a cluster mean or center. For each of the remaining objects, an object is assigned to the cluster to which it is the most similar, based on the Euclidean distance between the object and the cluster mean. The k-means algorithm then iteratively improves the within-cluster variation. For each cluster, it computes the new mean using the objects assigned to the cluster in the previous iteration clusters formed in the current round are the same as those formed in the previous round. The k-means procedure along with algorithm is given below.

Algorithm K-means: Input = K:

The number of clusters= D: A dataset containing n objects Output = A

Method:

- I. Arbitrarily choose K-objects from D as the initial cluster centers.
- II. Repeat.
- III. Re-assign each object to the cluster to which the object is the most similar, based on the mean value of the objects the cluster.
- IV. Update the cluster means, i.e. calculate the mean value of the objects for each clusters.
- V. Until no changer.

The time complexity of the k-means algorithm is  $O(nkt)$ , where n is the total number of objects, k is the number of clusters, and t is the number of iterations. Normally,  $k \ll n$  and  $t \ll n$ . Therefore, the method is relatively scalable and efficient in processing large data sets.

## V.Result Analysis

**K-Means Clustering** is one of the popular clustering algorithms. The goal of this algorithm is to find groups (clusters) in the given data. We implement K-Means algorithm using Python packages: pandas, Numpy, scikit-learn, Seaborn and Matplotlib.

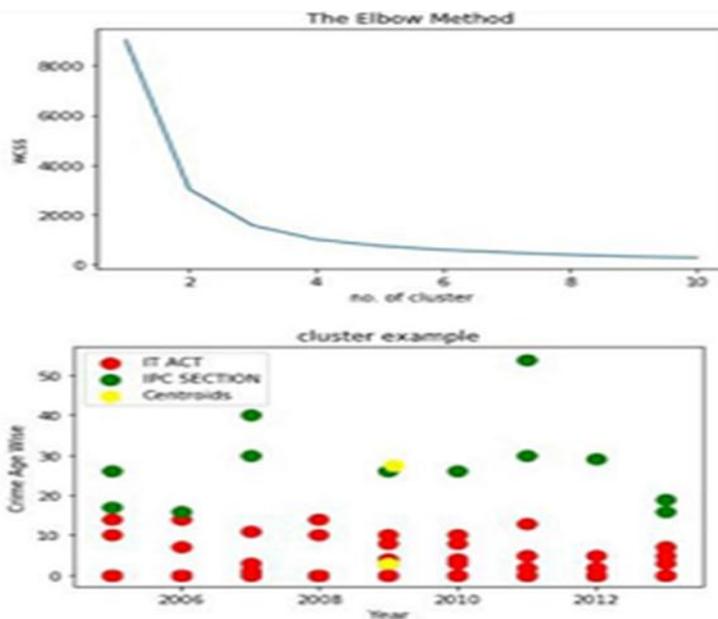
- Pandas: Pandas is used to working with “relational” or “labeled” data both easy and intuitive. It aims to be the fundamental high-level building block for doing practical, real world data analysis in Python.
- Numpy: Numpy is used for N-dimensional array object and sophisticated (broadcasting) functions.
- Scikit-learn: Scikit-learn provide K-Mean algorithms via a consistent interface in Python.
- Seaborn: Seaborn is use for data visualization and a high-level interface for drawing attractive and informative statistical graphics.
- Matplotlib: Matplotlib is used for 2D plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms.

The data was collected from the National crime record bureau (2005 to 2013) data set converted into iris dataset using in python. The data set contains the various instances and the 6 attributes. The attributes are year, Crime type (act according), People arrested, age, Crime type. Describe in image format below:

```
In [11]: print("***** CyberCrimeRecord *****")
print(cty.head(20))
print("\n")
```

	Year	CrimeType	People Arrested	AGE	Case Register
0	2005	ITACT	14	1t30	18.0
1	2005	ITACT	10	30to45	NaN
2	2005	ITACT	0	45to60	NaN
3	2005	ITACT	0	above60	NaN
4	2005	IPCSection	17	1t30	28.0
5	2005	IPCSection	26	30to45	NaN
6	2005	IPCSection	0	45to60	NaN
7	2005	IPCSection	0	above60	NaN
8	2006	ITACT	0	1t30	0.0
9	2006	ITACT	0	30to45	NaN
10	2006	ITACT	0	45to60	NaN
11	2006	ITACT	0	above60	NaN
12	2006	IPCSection	16	1t30	30.0
13	2006	IPCSection	14	30to45	NaN
14	2006	IPCSection	7	45to60	NaN
15	2006	IPCSection	0	above60	NaN
16	2007	ITACT	1	1t30	5.0
17	2007	ITACT	3	30to45	NaN
18	2007	ITACT	0	45to60	NaN
19	2007	ITACT	0	above60	NaN

In every model, the accuracy and the cost analysis plays an important role in the acceptance of that model for the application. The result of the cyber crime data set is being displayed as a cluster form. The result is displayed on the basis of axis x-axis represent year and y-axis represents age of arrest people and the cluster are represent in form of dot yellow and green, centroids cluster represent as yellow color.



## VI. Conclusion

In our project we have designed an application called Leaf color chart app assists farmers and effective in improving nitrogen fertilizer management. It helps farmers to estimate plant nitrogen demand, to produce high rice yields. The general idea is that a critical leaf colour has to be maintained for optimal growth, and the LCC provides guidance when to apply nitrogen fertilizer to avoid nitrogen deficiency. Farmers can use leaf colour as a visual and subjective indicator of the rice crops nitrogen status and need for N fertilizer application and also it determines the zinc, phosphorous, potassium, magnesium, silicon deficiency in leaf and instructs farmer to apply particular fertilizer. This application can be further enhanced by converting into mobile application for better usability.

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### **Webography**

Table 1 [www.datacamp.com](http://www.datacamp.com)

Table 2 [www.kaggle.com](http://www.kaggle.com)

Table 3 [www.r-bloggers.com](http://www.r-bloggers.com)

Table 4 [www.mubaris.com](http://www.mubaris.com)

Table 5 [www.ncrb.gov.in](http://www.ncrb.gov.in)

# Real Time Flood Alert System Based on IOT

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**ABSTRACT:** Floods are the most danger natural disaster. Due to heavy flood, it can destroy the so many health and wealth. For recovering of affected area, the Government would spent so much money. So it is necessary to develop a flood control system that can able to reduce the flood risk. Providing alert system will help to take early action so that loss of living and non-living things can be reduced. As a solution. This paper will able to detect level of water at different costal area as well as it can alert with GPS location. Arduinio microcontroller is used to collect the data from the water sensors and transfer the data to GSM module for sending alert as well GPS location via SMS. This system show how the Arduinio microcontroller is connect to mobile phone to give alert. Despite, this project is based on IoT that able to tested data stored at cloud using Thingspeak. Authorized people can see the flood data and it can be download for future analysis.

**Keywords:** GSM MODULE, IoT, GPS, CLOUD.

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## 1. Introduction

The world climate is changing rapidly due to human activities such as air pollution, ozone depletion, cutting trees etc. Floods are one of the most common natural disasters that effect more number of living and non-living things [1]. To minimize the extent of damages caused by flood, alert warning system can be develop to inform the people about the disaster. It should be implemented mostly in coastal areas. The system should be designed that can able to detect the raising level of water, so warning to user and higher authorities. Flood notification system will consist of Arduinio microcontroller, water sensors, computer, GSM module and GPS.

Sensor network has several features like low cost, low power, smaller size and sensor nodes that cooperate together to sense the environment, process the data over certain distance. The sensors are generally used to monitors physical and environment condition such as sound, water-level, temperature of environment, pollutant, pressure. In this project, we used water sensor for monitoring the level of water. [2].

In wireless technology, it is the transfer of information or data between two or more nodes that are physically not connected. Range can be short or long according to device capability. There are used two types of devices which have been chosen to transfer signal from high risk flood area to people as well as higher authority. The first device is global system for mobile communication (GSM) that allow use of GSM network send a message with location (SMS) to the mobile telephony. The second device water sensor that used to send signal to Analyzer (Arduinio). To get people message, a GSM is used which is connected to server and send alert to the authorized people as well as higher authorities. Nowadays, the technology which has been used for flood detection is more accurate than the devices that were used at last decade.

So, we are developing a system which gives more accurate alert information to the people and higher authorities by SMS at critical situation. The main thing is that so many people who lost their lives had not received any alert from flood control about increasing level of water.

## 2. Existing system

Department

We have so many department that predict only weather condition. The department inform to the people about future rain but one cannot predict whether it cause flood or not.

Organizations

The other that plays main role in situation of flood relief organizations. We know that these organizations take lot of time to reach at affected area. So that people would already lost their lives before reaching these organizations at that places.

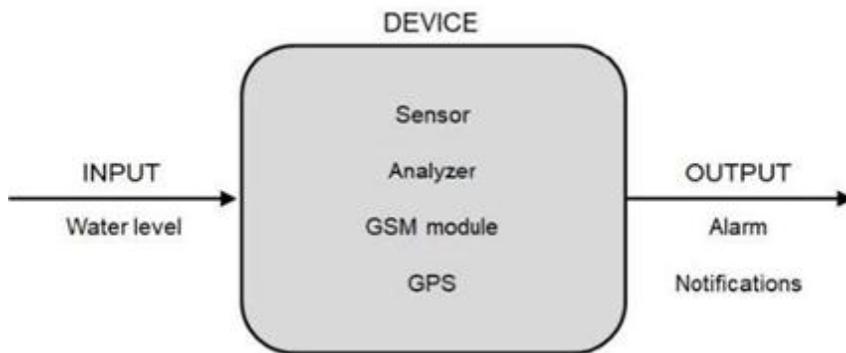
### 3. Proposed System

To Control the flood problem in coastal areas a smart system has been designed to alert the people and higher authorities. A smart system consists of Arduino board, Buzzer, Water Sensor, Warning Lights, GSM module and power source all are embedded in a system.

If there are a rain of water gathering in the ground floor of apartment, then sensors which is situated at ground level will detect it and send electrical signal to the Arduino microcontroller which will perform some task like switching off power supply of building or send signal to GSM module. Now GSM module will send warning message to the owner or higher authorities. It will also send location to the authorities such that a proper action could be taken.

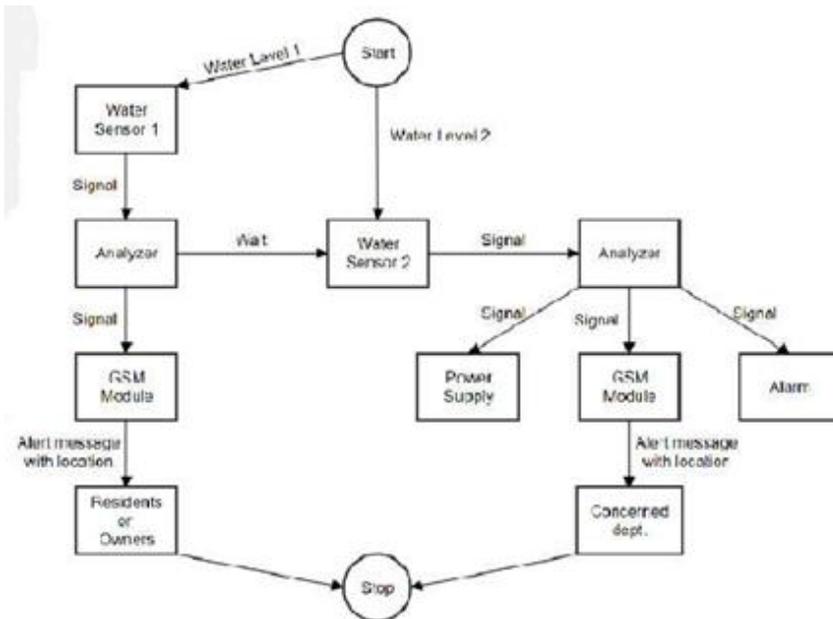
The above process can be shown in terms of Data Flow Diagram [3].

#### DFD Level-1



**Fig. 1:** DFD input and output

#### DFD Level-2



**Fig. 2:** Control and Data flow of Flood

## System

### 4.METHODOLOGY

A smart device which senses the water level and it will turn off power supply as well as can give message to minimize damage to life. It will alert the higher authorities with location so that as much possible loss of life can be minimized.

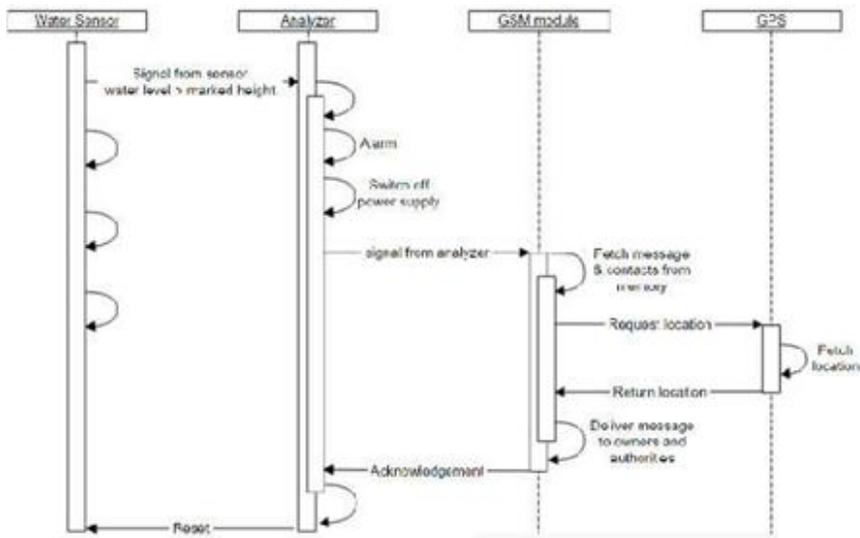


Fig. 3: Use Case Diagram

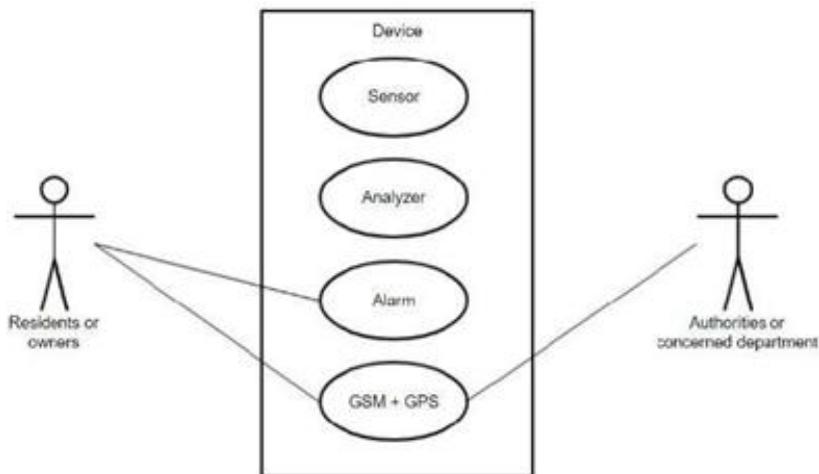


Fig. 4: Sequence Diagram

### Conclusion

We have seen that in the coastal areas as well as urban areas, people are suffering from water flooding. The situation become very critical and very difficult to handle. So we get motivated to do something for them. We cannot control natural disaster but we can provide better prevention technique and systems such that the loss of life can be minimized.

This system is very usefully because it has more accuracy, low cost. We used Arduinio, Water Sensor, GSM module and GPS only. The function of all the components is elucidate in the above proposed system.

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# Stress Detection of User's Interaction in Social Networking

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**ABSTRACT:** *Psychical stress is forbidding people's physical fitness. It is notable to detect stress timely for dynamic care. Now a days people are sharing their day to day activities in social media because of huge popularity and interacting with their friends making it feasible to grasp the data for stress detection. In this paper, we are finding a dataset from real-world social platform and correlating it with user's stress state and their interaction in social media. We first define a set of stress-related texts, images, and social attributes from various users, and then propose a social platform using pre-processing algorithm combined with N-Gram technique to grasp the data for stress detection. Experimental results show that the proposed platform can detect the level of stress and also block the user if the stressed data is posted more than three times.*

**Keywords:** *Social Media, Stress Detection, Psychological Stress, Pre-processing algorithm with N-gram technique.*

## 1. Introduction

Psychical stress is becoming a ultimatum to people's physical fitness now-a-days. With the fast stride of life, more and more people are feeling stressed. Though stress itself common in our life, extravagant and long term stress can be rather harmful to people's physical and mental fitness. According to existing research works, long-term stress has been found to be related to many diseases, e.g., clinical depressions, insomnia etc. Moreover, according to Chinese Centre for Disease Control and Prevention, suicide has become the top cause of death among Chinese youth, and excessive stress is considered to be a major factor of suicide. All these reveal that the fast increase of stress has become a great dare to human health and life standard. Thus, there is notable importance to identify stress before it turns into drastic problems. Traditional psychological stress detection is mainly based on face-to face interviews, self-report questionnaires or wearable sensors. However, traditional methods are actually reactive, which are usually labour consuming, time-costing and hysteretic. Are there any timely and proactive methods for stress detection? The Rise of Social Media is Changing People's Life, as Well as Research in Healthcare and Wellness. User's Social Interactions on Social Networks contain helpful hint for Stress Detection. The first observation contains a poor spirit that can be transmitted from one person to another during social interaction. The second observation contains lingual echoes where a person are known to copy the style and of another person. These observations motivate us to expand the scope of tweet-wise investigation by incorporating follow-up social interactions like comments and re-tweeting activities in user's stress detection. Another reason for considering social interactions in stress detection is based on our empirical findings.

## Scope

To present a structure for identifying user's psychical stress states from user's weekly social media data, grasping tweets content as well as user's social interactions. By seeing the real-world social media data as the basis, to study the relationship between user's psychical stress states and their social interaction behaviors.

## Proposed System

The goal of this system is to prevent the user from posting Stress data in social network and also gives a statistics to the Admin about the user who is frequently trying to post Stress messages in social network. Social Networks provide some space or area to post the status such a space is called Wall. But sometimes people post offensive messages on a particulars wall which may cause a serious problem to user's reputation. To avoid such kind of serious problem we can apply Information Filtering (IF) technique i.e., N-Gram Technique.

## Advantages

- Identifying Stress post and block the post, which avoid unnecessary conflicts in the society.

- Gives Statistic Report to admin regarding which user is trying to post Stress post frequently.

### **Literature Survey**

- **Daily stress recollection from phone data, climate conditions and individual attributes.**

There are some research that proves stress may cause many disease that reduces standard of life. Because of this reason, there are many researchers who found a way to detect a stress based on psychical parameters. However, these systems require some sensors that are always carried by the users. In our paper, we propose an alternative approach for providing the evidence that reduces daily stress based on behaviors and by using user's mobile phone activity such as climate conditions and personality traits.

- **Flexible, high performance convolutional neural networks for image classification**

We present a fast, fully parameterizable GPU implementation of Convolutional Neural Network variants. Our model are neither pre-wired nor designed carefully, but it is learned in a supervised way. Our architectures attain the best published results on benchmarks for object classification and handwritten digit recognition, with error rates of 2.53%, 19.51%, 0.35%, respectively.

- **Measuring post-hurtful stress disorder in twitter**

Traditional mental health information collected through personal contact with a health care professionals. Recent work has shown the utility of social media data for studying depression, but there have been limited evaluations of other mental health conditions. We consider post-hurtful stress disorder, a serious condition that affects millions people with especially high rates in military veterans.

- **Prediction of emotion via Dynamic Continuous Factor Graph Model**

Yuan Zhang, Jie Tang, Jimeng Sun, Yiran Chen, and Jinghai Rao have introduced a novel problem of prediction of emotion in social networks. There is a method called Mood cast referred for modeling and predicting emotion dynamically in the social network. The proposed model can approach effectively each user's emotion status and prediction performance better than other method of prediction emotion. It is used in limited number of participants. We used Metropolis-Hastings algorithm to obtain an correct solution for model learning.

Experimental results on two different real social networks demonstrate that the proposed model can approach effectively each user's emotion status and prediction performance better than other method of prediction emotion. The Goal of this paper was to examine the programmed acknowledgment of individual's every day worry from three different sets of information: a) people action, as identified through their cell phones (information relating to transient properties of people); b) climate conditions (information relating to transient properties of the earth); and c) identity characteristics (information concerning lasting manners of people). The issue was demonstrated as a 2-way classify action one. The outcomes convincingly recommend that all the three 484 sorts of information are important for achieving a sensible prescient control. For whatever length of time that one of those data sources is dropped, exhibitions dip under those of the baselines. In addition, the distributional information for exactness and appear the heartiness and speculation energy of our multifactorial approach.

- **Annotating and Detecting Emotions on Twitter**

D. Kamvar have proposed an studies about when any individual feel fine and search for the emotional web. This usage of We Feel Fine is used to suggest a class of visualizations called Experiential Data Visualization, which focus on absorbed item-level interaction with data. The implications of this visualizations for qualitative research in social networks. Repeated information in relevant answers that requires user's to browse through a large number of answers in order to obtain information. Up to date, most research in assessment examination has been used on calculations to extricate, order, and condense conclusion. While this has obviously been valuable, there remains an expansive open door for specialists to fabricate immersive interfaces that take into account thing level investigation of slant information. This thing level investigation of information can bring its own experiential advantages to the client, and additionally empower crowd sourced subjective information investigation.

- **Using Social interactions on social networks detecting Users In Stress**

Chi Wang, Jie Tang, Jimeng Sun, and Jiawei Han have proposed to find out impact of boost issue in surroundings, which expects to locate a small subset of hubs (clients) in an interpersonal organization that could spread of impact. A Pairwise Factor Graph (PFG) model is to formalize the problem in probabilistic model, and extend it by the time information, which results in the Dynamic Factor Graph (DFG) mode. The proposed approach can effectively invent the dynamic social influences. Parallelization of our algorithm can be done in future work to scale it up. A productive calculation is intended to take in the model and make induction. We additionally propose a dynamic factor Graph (DFG) model to fuse the time information. Trial comes about on three distinct classifications of information sets demonstrate that the proposed methodologies can proficiently induce the dynamic social impact. The outcomes are connected to the boost issue, which expects to locate a small subset of clients (hubs) in an informal organization that could maximize the spread of impact. Trials demonstrate that the proposed approach can encourage the application.

- **User-level psychological stress detection from social media using deep neural network**

H. Lin, J. Jia, Q. Guo, Y. Xue, J. Huang, L. Cai, and L. Feng have proposed a model that automatically stress detect stress based on cross-media microblog data. There are three-level structures for stress detection based cross-media micro-blog data. By using a Deep Sparse Neural Network to include different features from cross-media micro-blog data, the structure is quite practical and efficient for stress detection. In this structure, the proposed method can help to automatically detect psychical stress from social networks. The author plan to investigate the social relationships in psychical stress to further improve the detection performance. They build a three-level of structure to figure-out the problem. From the tweets initially they get an arrangement of low-level highlights.

## II. System Design

This chapter gives a brief description about the design phase of a System development. The design of a System is essentially a plan for the development of the proposed System. The main objective of this phase is to describe the process of Software design, where informal ideas are transformed to detailed descriptions. It defines the Architecture, components, Modules, Interfaces and data for a System to satisfy specified requirements. One could see it as the application of Systems theory to product development. System design is the act of taking the marketing information and creating the design of the product to be manufactured. Systems design is therefore the process of defining and developing Systems to satisfy specified requirements of the user. The objective of the design stage is to produce the overall design of the Software. It aims to figure out the Modules that should be in the System to fulfill all the System requirements in an efficient manner. The design contains the specification of all the Modules, their interaction with other Modules and the desired output from each module.

### Architecture

The System Architecture provides a holistic view of the System to be built. It depicts the structure and organization of Software components, their properties and the connections between them. The architectural design process is concerned with establishing a basic structural framework for a System. It involves identifying the major components of the System and communications between these components. The System Architecture shown in the Figure. 4.1 has three components Client Side, Server Side and Web Interface.

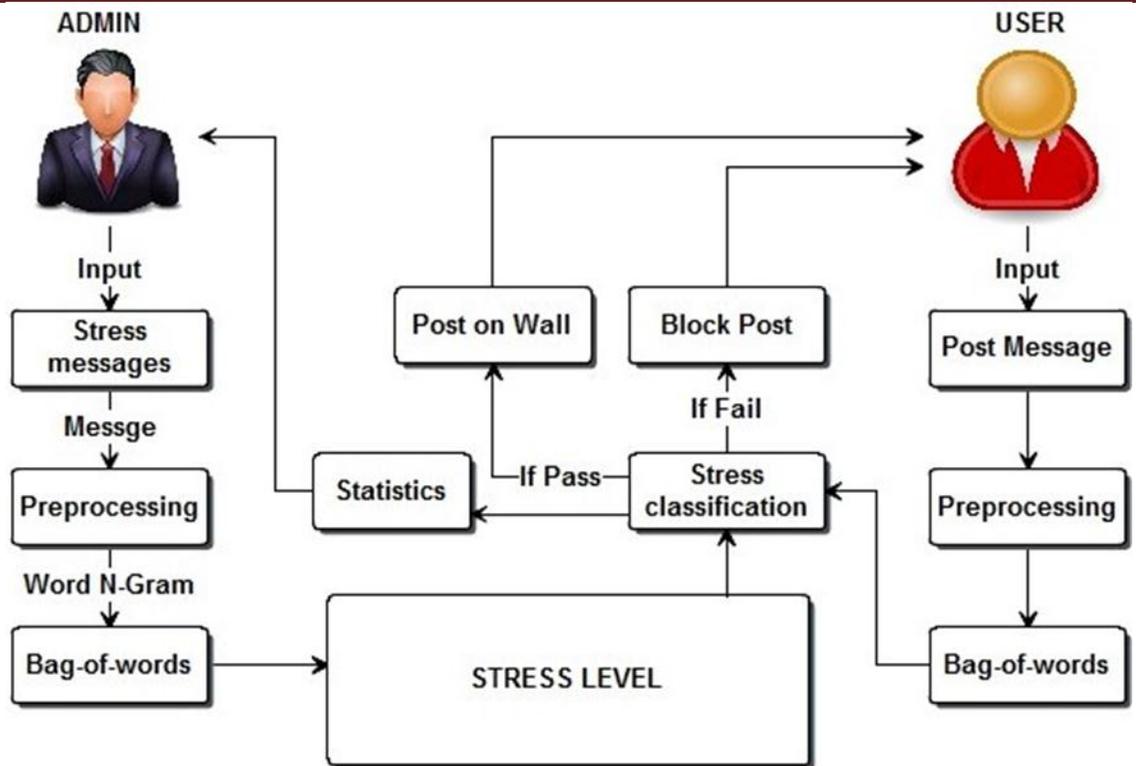


Fig 2.1: System Architecture of the Proposed System

### III. Experimental Work Implementation using Pre-Processing Algorithm

In Pre-processing phase, the pathologically proven data set is processed to avoid class imbalance and then it is converted to readable data type. Machine learning algorithms work very well when the number of instances of one class are almost equal to the number of instances of other class. Class imbalance damage the classification result severely so to avoid class imbalance, data is over sampled using machine learning technique for instance, synthetic minority oversampling technique (SMOTE). The input data type is converted from numeric into nominal/numeric to nominal values so that the algorithms which use said data type as input can be implemented. In our study most of the collected data is free from outliers, noise and missing data. Some inconsistencies are recorded in the data set these inconsistencies are corrected manually by using external references. Pre-processing refers to the transformations applied to our data before feeding it to the algorithm. Data Pre-processing is a technique that is used to convert the raw data into a clean data set. In other words, whenever the data is gathered from different sources it is collected in raw format which is not feasible for the analysis.

#### Need of Data Pre-processing:

- For achieving better results from the applied model in Machine Learning projects the format of the data must be in a proper manner. Some specified Machine Learning model needs information in a specified format.
- Another aspect is that data set should be formatted in such a way that more than one Machine Learning and Deep Learning algorithms are executed in one data set, and best out of them is chosen.

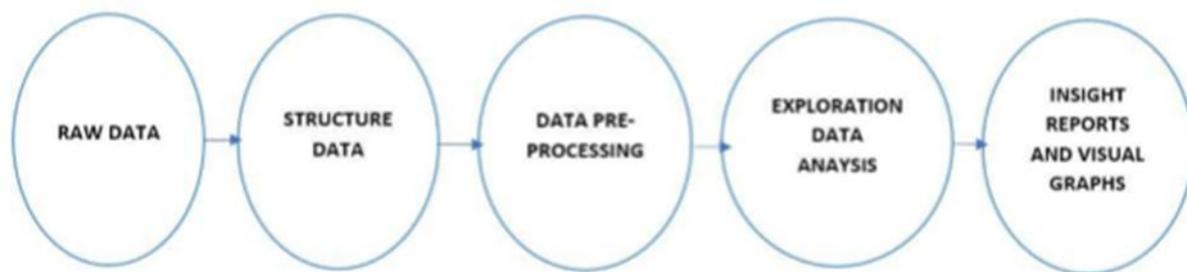


Fig 3.1: Pre-Processing

**Implementation using N-GRAM technique**

This methodology is used to find the co-occurrence of the words in the sentences of post. We are implementing two gram and three gram techniques.

Here is the sentence

1. Bangalore is the Silicon City of India.
- Here key words are Bangalore, Silicon, City, India  
 No of keywords are 4 let us take it as N.  
 For two gram ,number of loops are N-1  
 Bangalore-Silicon  
 Silicon-City  
 City-India  
 For three gram ,number of loops are N-2  
 Bangalore-Silicon-City  
 Silicon-City-India

**Cosine Similarity**

This methodology is used to find the similarity between the sentences. If the cosine value of two sentences is 1 means, those are 100% similar, if it is 0.98 means 98% similar, this is useful to find that where the sentences related to the same terms.

Here are two very short texts to compare:

1. Julie loves me more than Linda loves me
2. Jane likes me more than Julie loves me

We want to know how similar these texts are, purely in terms of word counts (and ignoring word order). We begin by making a list of the words from both texts:  
 me Julie loves Linda than more likes Jane

Now we count the number of times each of these words appears in each text:

```

me 2 2
Jane 0 1
Julie 1 1
Linda 1 0
likes 0 1
loves 2 1
more 1 1
than 1 1
  
```

We are not interested in the words themselves though. We are interested only in those two vertical vectors of counts. For instance, there are two instances of 'me' in each text. We are going to decide how close these two texts are to each other by calculating one function of those two vectors, namely the cosine of the angle between them.

The two vectors are, again:

a: [2, 1, 0, 2, 0, 1, 1, 1]

b: [2, 1, 1, 1, 1, 0, 1, 1]

The cosine of the angle between them is about 0.822.

#### **IV. Conclusion**

In this paper, we presented a structure for identifying user's psychical stress states from user's weekly social media data, grasping tweets content as well as user's social interactions. By seeing real-world social media data as the basis, we study the relationship between user's psychical stress states and their social interaction behaviors. To fully grasp both content and social interaction information of user's tweets, we proposed a platform which uses N-GRAM techniques with PRE-PROCESSING technique. In this work, we also discovered several levels of stress. We found that the number of social structures of sparse connection (i.e., with no delta connections) of stressed users is around 14 percent higher than that of non-stressed users, indicating that the social structure of stressed user's friends tend to be less connected and less complicated than that of non-stressed users. These phenomena could be useful references for future related studies.

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# Virtual Assistant for Movie Recommendation System

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**ABSTRACT:** Virtual assistants are software used in entertainment industry, this is particularly movie industry, there are huge amount of movies available around the world it's impossible to one to watch all of it. Movie Recommendation filters out irrelevant movies and suggest the relevant movies those would be interesting for users to watch. Machine Learning based assistant yields more practical results. Assistant which gives based on the context of conversation tends to be friendlier to user. This method uses collaborative filtering recommendation when user enters the system can start conversation with the model and it sends the reply as user requested it accompanies user with chatting with it and can be user friendly source. In our proposed system, we generated movie data and dialog conversation with help of IBM Watson assistant and our model is deployed in slack. This combinations all produce outcome of the recommendation as user requested through chatting.

**Keywords:** Virtual assistant, Recommendation system, Machine learning, Natural language processing, Artificial intelligence

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## 1. Introduction

Virtual Assistant are simple computer programs that interacts with users using natural language. The interaction can be textual or auditory depending upon the need. The popularity of this bots are increasing every day and are used in various practical applications which include customer service, information acquisition and dialogue systems. This Assistant uses Natural language processing techniques for understanding user query and give response. Now there are bots which uses fixed response techniques where user query is searched for fixed keywords and returns response which matches the most with the query. Also, some bots use string manipulation techniques where response is nothing but manipulated version of user query e.g. Eliza. Small businesses and small start-ups generally have a high customer to employee's rate. They cannot attend to every customer personally. Such small businesses need automation in their customer support system. Virtual Assistant can automate the customer support part. Virtual Assistant can increase the profits by decreasing the resources strain. We here provide the method for making such Assistant that a small company can make with very little resources. This can be useful for many other organizations and industries. This bot can maintain context and can give responses based on context. Thus, this paper focuses on the sample bot which can be used as a reference for creating Virtual Assistant for many other purposes. The paper talks about the methods and technologies used in creating this Virtual Assistant, and why some things are preferred over other. The paper by explaining the inner working of this sample Virtual Assistant explains the proposed methodology of developing similar purpose Assistant.

## II. Related Work

Few early assistant with useful applications are Eliza and Alice. We will now discuss about Eliza and Alice

### ELIZA

The first Virtual Assistant developed was ELIZA. It was developed by Joseph Weizenbaum using a keyword matching and string manipulation techniques. When user provides the query, this Virtual Assistant searches for certain keyword. These keywords were already defined and if found then the response was retrieved. If not found, then Eliza would perform certain string manipulation techniques or use certain rules to obtain detail knowledge from the user to continue the interaction.

Consider the following example to understand how this would work.

USER: How can I get in touch with my mother?

Clearly 'Mother' is the keyword in the given user query, so the bot will try to find words related to mother like family. Then by using some string operation it will give an answer.

ELIZA: Tell me more about your family

Also, Eliza uses string manipulation techniques where it replaces some words from user query and gives it as a response.

USER: I am fine

ELIZA: How long have you been fine?

The Assistant doesn't understand what it is saying. It only produces results according to rules, static responses and string manipulation. However most of the time there are some standard replies that ELIZA would use if a keyword is not found. Some examples would be "Very interesting, please go on" or "Can you think of a special example?"

ALICE

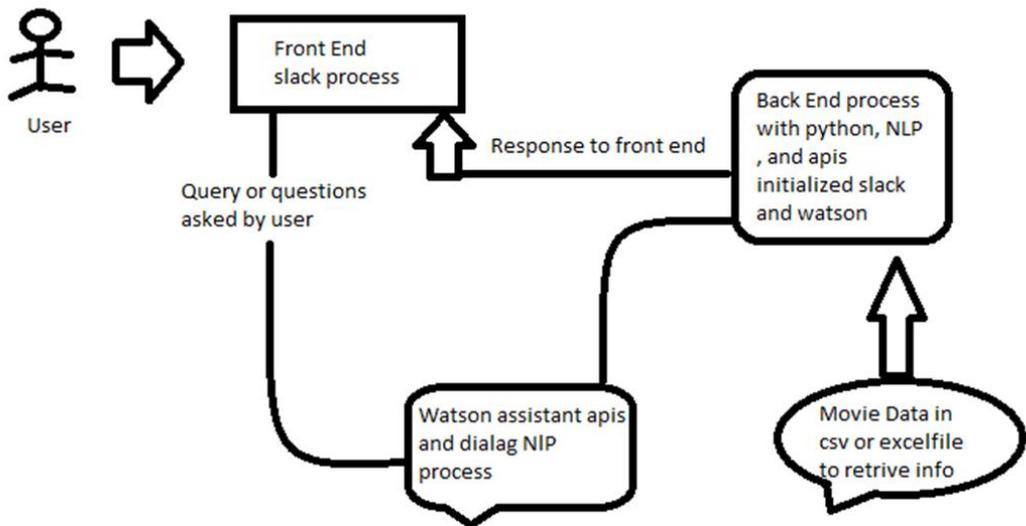
ALICE was implemented by Richard Wallace in 1995. Eliza was source of inspiration for Alice. It is a natural language processing bot which uses pattern matching for retrieving responses. The information is stored in Artificial Intelligence Mark-up Language also known as AIML files. AIML files were specifically designed to store pattern knowledge base for Virtual Assistant. These files are like XML files. AIML are of three categories.

If response is not generated using first category it will proceed to this category. Consider if user enters, "what is john?" Alice will search for default category and if match is found response is displayed.

Recursive categories: In this category special tags are used to specify recursion and get more information from user

### III. Proposed System

The proposed system uses the machine learning at its core. This response model can be used to predict the response from the query of the user. The proposed system consists



**Figure 1:** Architecture of Virtual assistant model

1. Front End Slack process: To deploy the assistant we use slack interface to converse with the bot.
2. Watson Assistant: This process is Watson Assistant or called as IBM Watson Assistant. Here we use this interface as to retrieve dialog or questions through api customized in backend coded with python. Below is Jason file used for the assistant to response with.

```

{
  "Name": "bob",
  "Intents": [
    {
      "Intent": "votes",
    }
  ]
}
    
```

```

"Examples": [
  {
    "Text": "how good is the movie?"
  },
  {
    "Text": "what about the movie rating"
  },
  {
    "Text": "ratings"
  },
  {
    "Text": "how much rating did the movie receive?"
  },
  {
    "Text": "what is the recommendation rating?"
  },
  {
    "Text": "would anybody recommend watching this movie?"
  },
  {
    "Text": "is the movie worst?"
  },
  {
    "Text": "what is the average votes for the movie?"
  },
  {
    "Text": "rating"
  },
  {
    "Text": "vote average"
  },
  {
    "Text": "is this movie good or bad?"
  },
  {
    "Text": "is the movie best?"
  },
  {
    "Text": "what is the rating for the movie?"
  }
],
"description": ""
},

```

3. Datasets: The datasets are created in csv file comma delimited where any information are stored there to retrieve data's to give out as the outcome of the conversation

#### IV. Methodology

Collaborative Filtering techniques make recommendations for a user based on ratings and preferences data of many users. The main underlying idea is that if two users have both liked **certain common items, then the items that one user has liked that the other user has not yet tried can be recommended to him. We see collaborative filtering techniques in action on various Internet platforms such as Amazon.com, Netflix, Facebook. We are recommended items based on the ratings and purchase data that these platforms collect from their user base**

- **Cosine similarity search:** The cosine similarity search measure is for two vectors is a measure that calculates the cosine of angle between them. This metric measures the orientation and magnitude. The cosine similarity formula is given by

$$\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cos \theta$$

$$\cos \theta = \frac{\vec{a} \cdot \vec{b}}{|\vec{a}| |\vec{b}|}$$

This cosine similarity search is used in our model to identify the title keyword given by the user in conversation when asked and returns the similarity search results to after making search in data retrieves five movie titles which the user entered keyword matches.

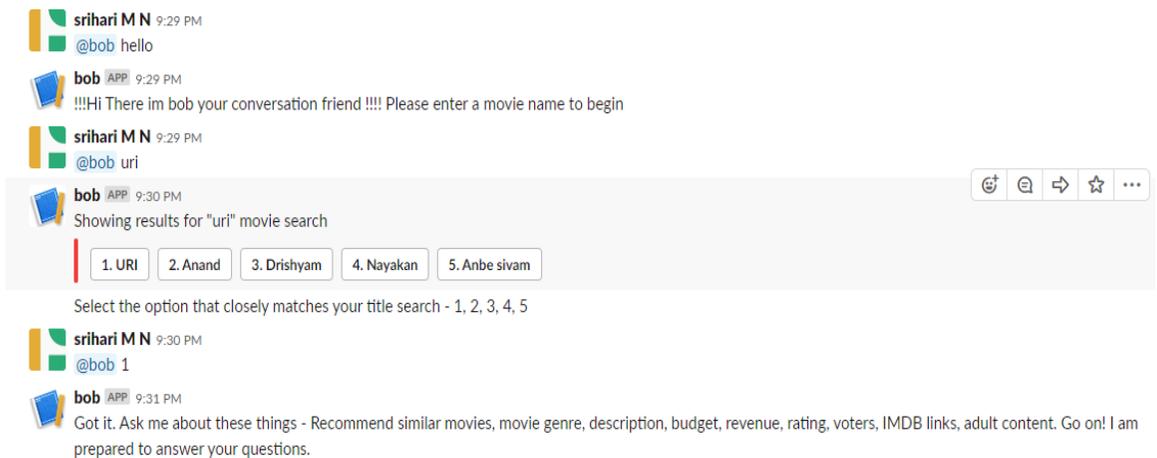
- **Collaborative Filtering** User-based Filtering: these systems recommend products to a user that similar users have liked. For example, let's say Alice and Bob have a similar interest in books (that is, they largely like and dislike the same books). Now, let's say a new book has been launched into the market and Alice has read and loved it. It is therefore, highly likely that Bob will like it too and therefore, the system recommends this book to Bob.

Item-based Filtering: these systems are extremely similar to the content recommendation engine that you built. These systems identify similar items based on how people have rated it in the past. For example, if Alice, Bob and Eve have given 5 stars to The Lord of the Rings and The Hobbit, the system identifies the items as similar. Therefore, if someone buys The Lord of the Rings, the system also recommends The Hobbit to him or her.

## V. Results and Discussions

We have used machine learning approach to create an assistant in this paper. This is based on machine learning does not understand the meaning of sentences. It learns how to respond based on the previous experience. Though we have used NLP functions but the actual process through which response is generated is using machine learning as said earlier we created the model and trained it with thus more diverse the intent more accurate the results will be. The sole purpose of this paper is to make a friendly assistant to chat or make up conversation with intension of user like and dislike for entertainment. Although this is a movie recommendation assistant through which the movies are being given or recommended through chats or conversation. Below is the screenshots of the results acquired.

### Screen-Shots



**Figure 2:** This shows the cosine similarity search which in user is giving a keyword and outcome of it is done by similarity searching.

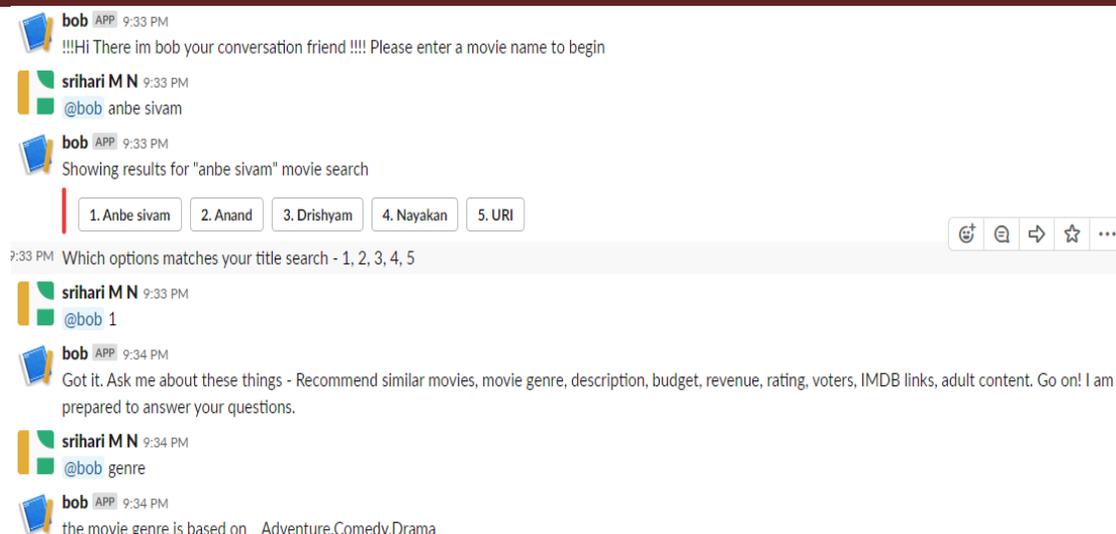


Figure 3: Conversation between user and assistant

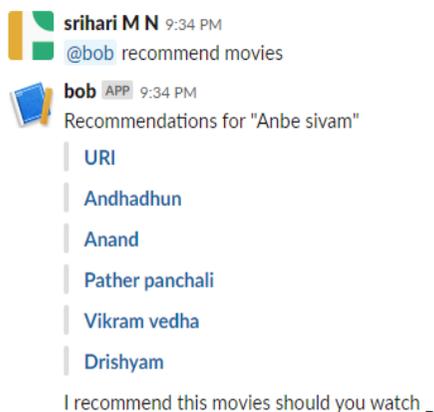


Figure 4: This is how the recommendation are shown similar to movie chosen by the user to watch

## VI. Conclusion

Main objective of this project was to provide a system to create a virtual assistant which can be used by small business as a replacement of customer support.

The method demonstrated was successful to some extent in creating assistant when the domain is small but, the result got will get more accurate as size of the intent file increases. The accuracy of the assistant is directly proportional to size of the intent file used for the training assistant. This domain is narrow, and user interact with some relevance. The Virtual Assistant using NLP can make an approximate or near text to recognize as human thinking thoughts and capabilities. Getting persistent output with respect to given text input.

## VII. Future Scope

The method presented uses solely machine learning with some helping basic natural language processing for converting the intent file into bag of words. The method can be improved by using some additional level natural language processing. The natural language processing can be used to do sentiment analysis which can complement the machine learning predictor. The sentiment part can be analysed using natural language processing which will emphasize on the keywords in user query which can be very useful in reducing the error in prediction.

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# Efficient Governance for Open Agencies Through Big Data

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**ABSTRACT:** Big Data is a collection of datasets containing massive amount of data in the range of zettabytes and yottabytes. Organizations are facing difficulties in manipulating and managing this massive data as existing traditional database and software techniques are unable to process and analyze voluminous data. Dealing with Big Data requires new tools and techniques that can extract valuable information using some analytic process. Literature shows that a number of models have been developed to explain smart governance but systematic research on the suitability and applicability big data for smart governance of public agencies is still lacking for data security. The findings suggest that every public sector agency should be brought under smart governance which should be a fully promoted under big data technologies for easy access, transparent and accountable, and hassle-free public agencies but lack of security for the data. In proposed effective governance has a significant role in timely, error-free, appropriate, and cost effective service delivery to citizens which leads to the sustainable economic development of a country and which should be a fully promoted under big data technologies for easy access, transparent and accountable and hassle-free public agencies by using MapReduce algorithm. Mainly providing security of data using some algorithms like encryption and decryption on data. When user searching the data, data will be encrypt and decrypt and display for user. For encryption and decryption we are using ECC algorithm. We are sending details to client via e-mail.

**Keywords:** Hadoop, Big data, MapReduce, Security, Encryption, ECC.

## 1. Introduction

Sharp association may be a direct instrument for aid invigorating government that may be a sensible criticalness for the twenty first century. Improvement is that the key mainstay of quick affiliation. Open affiliation amendment is right hand inventive structure to set itself up with obliging, favoring day and repeated development. These days it's unreasonable for anyone to shield the centrality from ligature down sensible alliance that is the new kind of the political framework, connection and open association. [1] The social occasion of the electronic method inside the political framework and certified structure connect with e-government. Sharp government is that the blended kind of e-government. The affiliation structure occupations headway for its issues from most current couple of years. The more essential a bit of the made nations are utilizing favoring day improvement for wash running their open collusion. There's an imperative perspective among the union specialists, academicians, analysts, and supervisors to utilize the pushed improvement for association structure clear to everyone collusion. 2 or 3 changes start at ideal at present have been finished a shade at some emotional moment with movement task. These days massive data awards to make up every area of state up to test through apparent utilizing a general component of learning. it's not simply fitting to open relationship despite by uncommon parts. The instance of utilizing data correspondingly, learning update customary strategy that blessings to make up another model. "Sharp" is nowadays all around gotten a handle on inside the field of progress, condition and pushed change. it's to a widely appealing degree a sketchy articulation of amazing, loveable and lively and new assembling of e-government and open government. inside the field of affiliation, it proposes a pointy structures association a dash of the structure. it's known with the online that accomplices people to data and pulls in people to yield plainly to the structure even from coming to and considering from remote spots. The sharp systems organization interfaces real virtual challenges through a passed on structure for higher correspondence to 1 another. In any case, it's not impulse data since it can't take a decision with a near individual's data. It in a general sense embellishments people to the information concentrated from dependably makes progress toward taking decision and arrange future. In all actuality hand, created shrewd cutoff proceeds with undo sort of an individual.

These days, a persistent live of data is circumnavigated every half in constantly by reasonableness of use new revived application and contraptions for reliably endeavors. The inspectors and framework producers of various divisions are utilizing the wellspring of epic data that unremarkably conveyed using remote

purchasers, long change social correspondence zones, amazing government and individual territories, business programming, all around referenced family unit contraptions and absolutely sudden quick gadgets. clear makes of affiliations have gotten focal concentrations by utilizing goliath data degrees of progress. Some staggering business and a cash related extra alliance like Amazon, Walmart, Sears and Morgan Stanley licitly gotten a handle on tremendous data updates and takes a goose at the getting rapid of purchasers and giving relationship as showed up by research exposures. several structures alliance targets like Facebook, Google, Twitter, eBay are utilizing goliath data examination and build up an entertainment compose of advancement by estimation the guest's lead, propensities and issue raise. Enormous data moves are especially potential for open work environments for building up their sensibility, limit, utmost, straightforwardness, and responsibility. It conjointly interfaces with the fastest and bumble free procedure making through data really solid framework. It may be gone review as a possible instrument for clearing in advance line social mechanical party for government change at any rate some examination still has request concerning the predetermination of the degrees of movement. Some expert raised the absence of insurance to the hassles and dangers of utilizing mammoth data for open part affiliations. Some made nations starting at explicitly comprehended enormous data movements for puzzling affiliation customarily. Regardless break, open relationship of a liberal piece of the nations are not set up to utilize immense data pushes in an exceedingly full fledge. Since it needs a basic speculation for execution the degrees of progress comprehensively to supply prelude to the experts and customary data creation, accumulating, and preparing. Once in an exceedingly while, truly sorted out utilization of goliath information could welcome burdens and dangers once all is guaranteed in done society zones.

Cautious alliance offers a game-plan to make open, participatory, and sharp government by utilizing goliath data upgrades. nowadays governments over the world are going toward such unending that rot, beyond what many would consider possible, and favored angle in their affiliation framework. Huge information driven progression likely could be a surprising reaction for these issues, loads, and dangers . notwithstanding the trail that there are 2 rotate social affairs of bosses, policymakers, and academician WHO displays thei155r positive and negative request concerning the veritable inclinations of quietness of giant data enhancements for sharp connection[2]. For adding to the present trade, this bit of consider is comprehended to deal with the examination questions: (a) what are the pieces of sharp intrigue and by what system will it get colossal data pushes? Also, (b) notwithstanding do the customary open working environments get profited by epic data degrees of advancement and change into sharp open affiliations? The article delineates the setting of the usage of immense data pushes for the capable government as making survey in its second district. Next, it offers the structure and estimation, opportunity and key drivers of beast data in its third and fourth piece uninhibitedly. The fifth piece depicts the key drivers, estimations, burdens and possible outcomes of sharp relationship underneath mammoth data movements. The last space finishes the article with various recommendations.

The instructive gathering endlessly with Government affiliations is influence both for the nation and the affiliation. This data which is a potential wellspring of chance passes on with itself distinctive bothers and the affiliation affiliations like diverse undeniable endeavors should obviously get the open entry this colossal data shows and use it to make structures sand pass on relationship to nearby individuals. In this paper the makers have endeavored to fuse the open entryways appeared to government bodies in association with the usage of beast data and some other gaining instruments and sorts of ground which empower better valuation for what this dumbfounding yet unutilized information can tell us what's more the potential perils it might appear.

The paper examinations e-government advance in China. It gives a short layout of benchmarking considers and their evaluation of China, in spite of a sensible examination of e-government rehearses in China and of the changing master position found in the past two decades. On this reason, it considers the enormity of contemporary e-government development for Chinese affiliation. The dispute is that e-government is at present having near an obliged impact on the Chinese open division. In any case, there are strong purpose for affirmation about future improvement.

The rest of the piece of this paper is organized as pursues: Section II contains the audit of writing. Segment III depicts the technique used to do this related work. Segment IV dimensions, opportunity, and key driver of huge information. Segment V depicts the results and discussions. Area VI portrays the finish of the framework.

## II. Review of Literature

Yueqian Xu proposed the article analyses e-government progress in China. It provides a brief overview of benchmarking studies and their evaluation of China, plus a contextual analysis of e-government initiatives in China and of the changing official position witnessed in the past two decades. On this basis, it considers the significance of contemporary e-government activity for Chinese governance. The argument is that e-government is currently having no more than a limited impact on the Chinese public sector. However, there are strong grounds for optimism about future development.[1]

R D. Pathak, Gurmeet Singh referenced that governance and corruption in ethopia. This study was conducted with the objective to investigate the potential of e-Governance applications in the Ethiopian public sector in terms of both policies and processes to curb corruption and increase efficiency, responsiveness, accountability and transparency. Pathak et al. proposed that e-association can help not just in getting out debasement yet moreover in setting up a solid relationship among government and nearby. Singh et al. referenced that open working environments can improve their benefits particularly in the thriving, framework, social security and other related parts by getting a handle on monster information degrees of progress. They besides propose that e-association works out can make essential obligations to improving open associations. The occupants' e-openness is security from due to change, the nonattendance of chances for e-interest and e-talk, and nonappearance of consideration. The study used the following research hypotheses formulated from the analysis set out above: Hypothesis 1: e-Governance is positively related to the government-citizen relationship and corruption reduction. Hypothesis 2: Government-citizen relationship accounts for more corruption reduction as compared to other variables[2].

Alfredo Cuzzocrea discussed about Privacy-Preserving Big Data Stream Mining: Opportunities, Challenges, Directions. This explores recent achievements and novel challenges of the annoying privacy -preserving big data stream mining problems, which consists in applying mining algorithms to big data streams while ensuring the privacy of data. This follows the so-depicted research trend.[3].

Huai Jinmei proposed quality evaluation of e-government public service. In this system the public service quality of a local e-government was analyzed through the measurement of citizen satisfaction. Based on SERVQUAL and considering the characteristics of government institution the result showed that public service quality of e-government systems could be measured by twenty-eight measurement scales. The limitation of the study is the incomplete proof of validity and more actual application should be done.[4]

Nuno vasco Lopes highlights smart governance as a key factor for the implementation of smart cities. Where a smart city government uses a smart governance model for achieving their smart cities purposes by applying the appropriate policies towards those purposes. The principles behind the smart governance model enable and potential significantly the creativity and innovation in the implementation of smart cities. The diversity of city contexts, challenges, risks and implementation goals found in the analyzed initiatives, clearly demands contextualized smart cities solutions. The empirical analysis shows that all the initiatives are relaying on technologies and smart governance, which may lead us to conclude that the promoters of smart city initiatives are considering them as essential prerequisites and factors for developing smart, creative, innovative ,and sustainable cities.[5]

### Existing System

The present existing government System Services are everything should took care of by semi manual. Numerous offices are work under these gigantic organizations to help and give quick administrations to the publics. However, its neglects to deal with in numerous zones. Information's are predominant of distinctive individual in any association, yet investigation and keep up of single information in this troublesome manner.

### Disadvantages

- Less performance.
- Disproportioned economic and social damages.
- More risks and threats.

### Proposed System

The existing System having lot of problems like Lack of technology missing, unwanted hands that leads to administration slow and corrupt, Overcome that Proposing a System which is design to the entire governmental administration for better services to the public's .Through big data technology gathering all the information of particular government domain and taking these we went to data preparation and upload

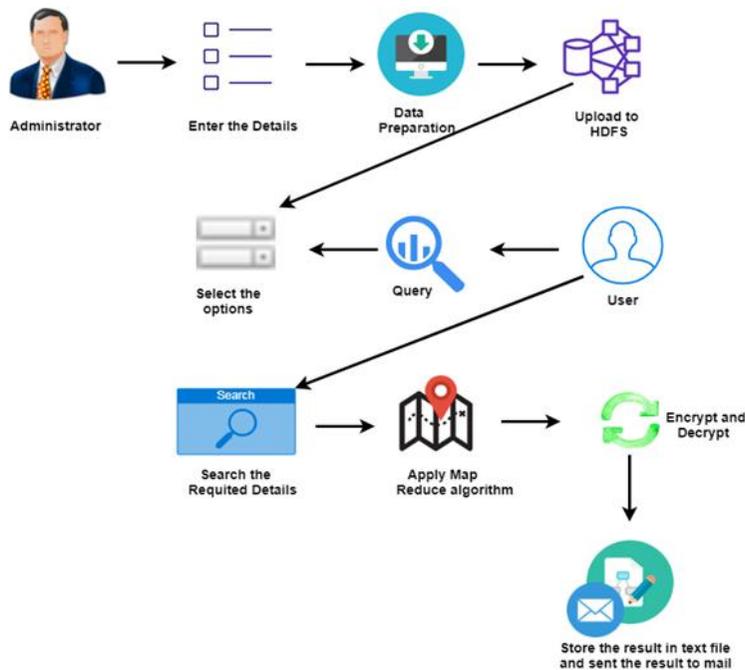
to hadoop directory and also applying security to these Data's by cryptography mechanism as well as analysis on these big data's. In this system ECC algorithm is using for encryption and decryption. we are storing the result data into file and sending to client via email.

### III. Methodology

**Research Design:** This examination is dynamic in nature which utilizes a substantial association consider. The examination on an exceptionally essential dimension turns estimations, key drivers, weights, dangers and chances of gigantic data use for skilled affiliation leave from any noticeable square division.

**Wellsprings data and Search Strategy:** a talented limiting investigation has been finished by following the objectives of the examination all (figure 1). As incontestable by Rother, a productive structure format is considered as a 1 of a structure investigate fill in because of following additional extended and deliberate system. The examination has been certain to the reasonableness of colossal data for surprising association clear to everyone affiliations regardless also certifiable for the individual part. A general report is done by abuse net of science, science interface with, Scopus and Google expert, site and a few catchphrases like "tremendous data, data, bewildering, alliance, government, open, the association" are went to get the latest examination related with the point . Fifty-two diary articles, working papers, and books are reviewed to examination the concordance of wide data for sharp connection and burdens, dangers and chances of liberal information use go past each discernible constraint half work environments. The information gathering and examination for this examination are done from February to March 2018.

**Data Analysis:** data is investigated from absolutely trade viewpoints of alliance contemplating distinctive estimations in like manner, pointers for huge data impacts execution for incredible affiliation. an astounding model has been made for enormous data use for superb relationship inside the open half .



**Figure 1 : Architecture of Proposed System**

### V. Results and Discussion

The dataset text file in HDFS directory The file contains with public agencies data which processes large amount of data. The final result is storing in document and sending to user with content via mail. In proposed system dataset contains environment (disaster information) and RTO data. To analyze the proposed system we are using the dataset like which can contains the various disaster information like earthquake, fire, bomb event. We are using dataset from year 2000 to 2017, we are analyzing the data. Figure 2 shows the result of the RTO when users search the event.

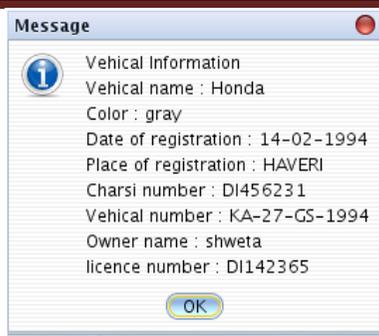


Figure 2: RTO result based on user search event

The analysis is conducted based on the user searching for the particular event. here we are also showing results for graph of encryption and decryption time taken for particular event data.

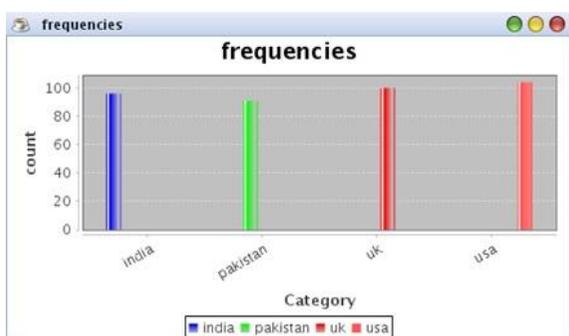


Figure 3: Disaster result

In this RTO Department, all dataset is uploading to HDFS. when user searching the event, applying mapreduce algorithm, data will be encrypted and decrypted using ECC algorithm and display to the user. Final result is storing in file and sending content to user Email.

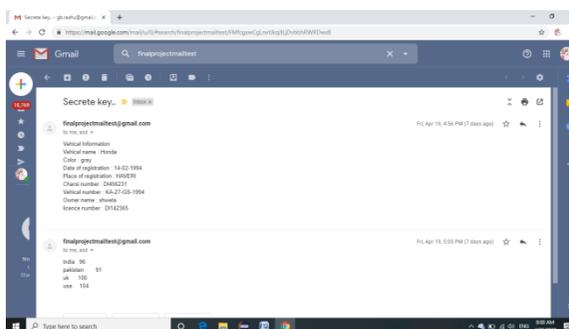


Figure 4: Result with user mail.

## VI. Conclusion

To explore the suitability of big data technologies for smart governance in public agencies. It is basically driven by the research gap between the theoretical assumption of big data application and subsequently implementation of government agencies in the public sector this system suggests a conceptual model which explains how data will be collected from varies sources and followed a series of the procedure by maintaining a certain that explains the measurements of the standard of the system. The government agency can easily improves the public services delivery day today operator policy making decision and other value added service to the citizen by holding a large amount of data with applying big data analysis but privacy of

the citizen should be maintain strictly and priority based to minimize the risks, threats, challenges. In proposed effective has a significant role in timely, error free appropriate and cost effective service delivery to the citizens. it suggests that every government agency should adopt big data technologies for reducing the corruption, threat, and challenges and increasing the efficiency, accountability and hassle free public agencies. We are using hadoop system using MapReduce algorithm. Mainly providing security for data using ECC algorithm. Storing result data into document and sending contents to user via E-mail.

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# Detection of Speaker in YouTube using Haar Cascade Algorithm

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**ABSTRACT:** This work implements and discusses the detection of collaborations in youtube videos. Face and speaker recognition is the key to this work. We create a convolutional neural network (CNN) and tweak the CNN parameters so as to obtain the desired results. We make use of face detection Haar classifier algorithm. In this paper we implement face detection using Viola Jones face detection. The Haar classification algorithm is more suitable for real time face detection since they require less CPU resource and costs shorter time.

**Keywords:** Active speaker detection, Youtube Collaborations, CNN, Face detection, Haar Classifier

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## 1. Introduction

Faces represent complicated, four-dimensional, significant visual stimuli and developing a process model for face recognition is tough. we tend to gift a hybrid neural network resolution that compares favourably with different ways. The system combines native image sampling, a self-organizing map neural network, and a convolutional neural network. The self-organizing map provides a quantisation of the image samples into a topological space wherever inputs near within the original space also are near within the output space, thereby providing spatial property reduction and invariability to minor changes within the image sample, and also the convolutional neural network provides for partial invariability to translation, rotation, scale, and deformation.

## II. Literature Review

- 1) Robust and real-time face detection place a vital role in many of the application scenarios like access control, surveillance scenarios, gaming, human-computer interaction, etc [1].
- 2) Viola and Jones devised an algorithm, called Haar Classifiers, to rapidly detect any object, including human faces, using Haar classifier cascades that are based on Haar-Like features [2].
- 3) Different types of methods are available for detecting the face and recognition: Principal Component Analysis (PCA), Discriminate Analysis (LDA), Support Vector Machines (SVM), Independent Component Analysis (ICA), Local Binary Pattern .
- 4) Different algorithm are existing for performing and analysis of face detection with each of its own weakness and strengths related to use of flesh tones, some use contours, and other are even more complex involving templates, neural networks, or filters few of these algorithm are computationally expensive [4].
- 5) There has been little work in the literature during the last years about real-time face detection at HDTV resolutions [5].
- 6) Face detection algorithm using Haar-like features was described by Viola and Jones and now it and a range of its modifications are widely spread in many applications. One of these modifications was implemented in OpenCV library [16]. The OpenCV implementation compiled with 4.5 frames per second on 4-core CPU. It's too slow to process HD stream in real time. As a solution to this problem a parallel modification of OpenCV algorithm for GPU has been developed.
- 7) Some parallel versions of face detection algorithm using Haar-like features. The algorithm introduced by Hefenbrock was the first realization of a face detection algorithm using GPU we could find [7].
- 8) It showed an effect of using GPU versus CPU. But the algorithm could not process a stream with resolution 640x480 in real time [8].
- 9) The next parallel implementation is found in Obukhov's algorithm [20]. It's a single realization that uses GPU and can work with OpenCV classifiers without modification that is why modern versions of OpenCV library include it [9].

### III. System Design

This chapter discusses about the various steps involved in system design process. The functions that are used are also discussed.

#### 3.1 System architecture

Figure 3.1 is the system architecture of the application. The figure clearly depicts various steps carried out in the process of detection and analysis of content creator collaborations using face detection and speaker recognition.

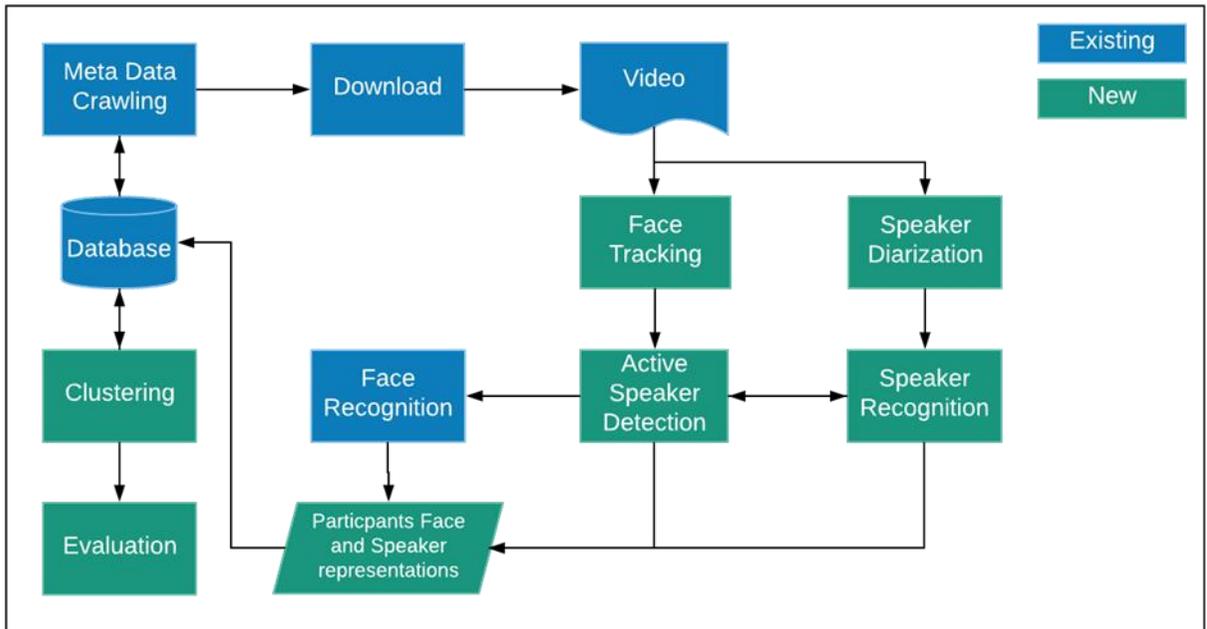


Fig 3.1 System Architecture

The system based on face detection algorithm includes following modules

- 1) Input static to ensure that every face and is appeared in the image .
- 2) Separate a frame per minute for classification.
- 3) Apply deep learning algorithm CNN for face detection module. Detect all faces and output coordinates.
- 4) Apply deep learning face recognition algorithm for face recognition.
- 5) Automatic analysis of module.

### IV. Experimental Work

#### 4.1 Face detection Haar classifier algorithm

The face detection algorithmic rule planned by Viola and Jones is employed because the basis of our style. The face detection algorithmic rule appearance for specific Haar options of a person's face. once one in all these options is found, the algorithmic rule permits the face candidate to pass to ensuing stage of detection. A face candidate could be a rectangular section of the initial image known as a sub-window. usually these sub-windows have a set size (typically 24×24 pixels). This sub-window is usually scaled so as to get a spread of various size faces. The algorithmic rule scans the complete image with this window and denotes every several section a face candidate. The algorithmic rule uses associate degree integral image so as to method Haar options of a face candidate in constant time. It uses a cascade of stages that is employed to eliminate non-face candidates quickly. every stage consists of the many completely different Haar options. every feature is assessed by a Haar feature classifier. The Haar feature classifiers generate associate degree output which may then be provided to the stage comparator. The stage comparator sums the outputs of the Haar feature classifiers and compares this price with a stage threshold to see if the stage ought to be passed. If all stages area unit passed the face candidate is all over to be a face. These terms are going to be mentioned in additional detail within the following sections.

### 4.1.1 Integral Image

The integral image is outlined because the summation of the pixel values of the first image. the worth at any location (x, y) of the integral image is that the add of the image's pixels on top of and to the left of location (x, y). Figure one illustrates the integral image generation. the easy rectangular options of a picture area unit calculated exploitation AN intermediate illustration of a picture, referred to as the integral image. The integral image is AN array containing the sums of the pixels' intensity values situated on to the left of a pixel and directly on top of the pixel at location (x, y) inclusive . So if  $A(x, y)$  is that the original image and  $AI[x, y]$  is that the integral image then the integral image is computed as illustrated in Figure2.

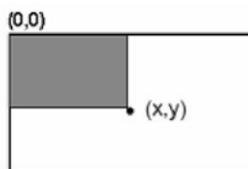


Figure 1. Summed Area of Integral Image

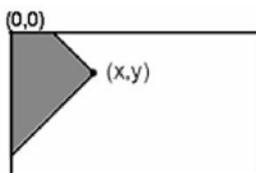


Figure 2. Summed Area of Rotated Integral Image

### 4.1.2 Haar feature classifier

A Haar feature classifier uses the rectangle integral to calculate the value of a feature. The Haar feature classifier multiplies the weight of each rectangle bytes area and the results are added together. Several Haar feature classifiers compose a stage. A stage comparator sums all the Haar feature classifier results in a stage and compares this summation with a stage threshold. The threshold is also a constant obtained from the AdaBoost algorithm. Each stage does not have a set number of Haar features.

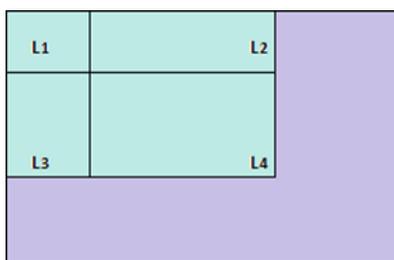


Fig 4.1.2 Calculating the area of rectangular

$$L_4 - L_3 - L_2 + L_1$$

### 4.2 Face detection design and analysis

The feature extraction in face detection is completed by localizing of the characteristics of face elements (i.e., eyes, mouth, nose, etc)in a picture. In alternative terms the feature extraction could be a step in face recognition wherever the system locates bound points on the faces like corner and center of the eyes, tip of the nose, mouth etc. It analyzes spacial pure mathematics of differential feature of a face. results of this analyzing could be a set of template generated for every face .The template consists of a reduced set of information that represent the \$64000 time face detected in delimited box. The template comparison is completed with the template keep within the info. 2 sections square measure there during this phase Identification and verification. These 2 term identification to sight the face in real time video and verification application for face recognition that scope out of this paper. the ultimate section of face detection is to declare the best matching score resulted within the previous step.

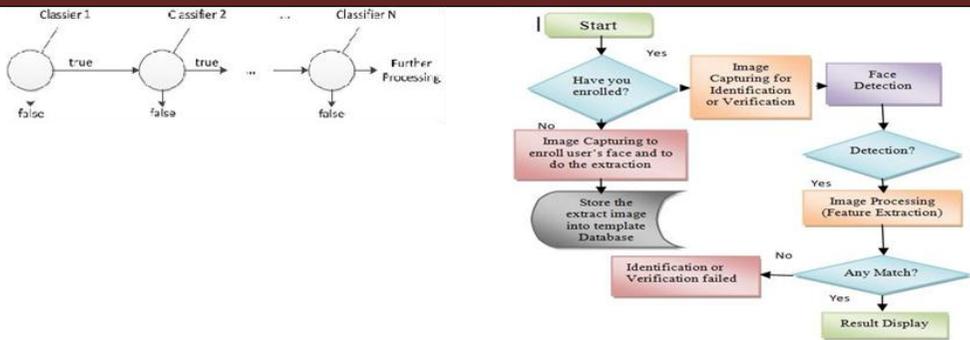


Fig 4.2 Flow chart of face detection system

#### 4.2.1 Face detection

System is capable of detecting the faces from the captured image for the purpose of prototype. From the above Section, face detection determines where in an image a face is located and scanning the different image scales and extracting the exact patterns to detect the face do it. The Prototype is to built with Haar-Like Feature function from OpenCV. Haar classifier detection is used to create a search window that slide through an image and check whether a certain region of an image looks like face or not. Haar like features and a large set of very weak classifier uses a single feature to define a certain image as face or non face. Each feature is described by the template its coordinate relative to the search window origin and the size of the feature.

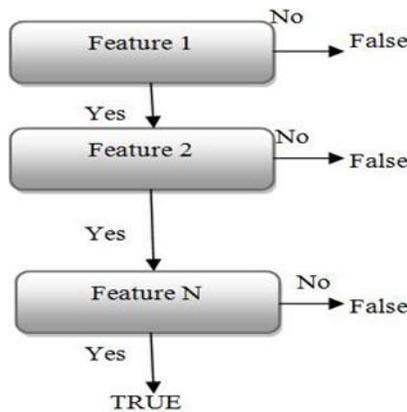


Fig 4.2.1 Decision tree based on Haar like features

The search window quickly scanning the first classifier on the cascade as shown in the Figure 9, if the classifier returns false then the computation on that window also ends and results no detected face(false). Moreover, if the classifier returns true, then the window will be passed down to the next classifier in the cascade to do the exact same thing. When all classifier return true for that window, then the result will returns true also for that certain window face detected.

#### V. Result Analysis

There are several methods for implementing active speaker detection. Prerequisite is a preprocessed video labeled with face tracks. An intuitive method for speaker identification is by detecting lip movement directly in the face-images of the track. Everingham proposed to calculate the inter frame difference of the corresponding mouth and face detection.



Fig: Active speaker detection sample using the inter-frame difference of the mouth region. The inter-frame difference is bigger than the threshold while the person is talking. At frame 73 the person stops talking and the inter-frame difference is below the threshold.

## VI. Conclusion

We develop a project to detect the content creator collaborations in youtube videos. The active speaker detection is done by using Haar and LBP algorithm. The main advantage of using this algorithm is that, the faces will be detected and the speaker will be recognized even in the poor video content.

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# **A Study On Redtacton For Health Care Solutions Over The Human Area Network**

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**ABSTRACT:** *Nowadays ample of unceasing researches are being conducted in the domain of Human Area Networking. Amongst those, we will be concentrating more on RedTacton. In RedTacton, "Red" stands for warmth, "T" represents touch and "acton" denotes the action performed. This particular technology uses a weak electric field surrounding the human body for data transmission. HAN proffers the dedicated bandwidth for communication at a constant speed. The network coverage is only around the human body. Redtacton can be used in the medical field for serving multiple purposes. In our daily life; we come across many situations where chaos is created by human beings while handling the paperwork (e.g. Medical reports). If paperwork were to be replaced with PDA then, errors could be reduced to a greater extent. Using redtacton data can be loaded and retrieved from the management system. In hospitals, doctors can easily access records of the intended patients, during multidisciplinary rounds. Readings from physiological sensors are helpful for continuous monitoring of a patient. In order to fetch maximum efficiency while retrieving and collecting data, we use pyramid architecture on a sensor network. The data fetched from the sensors can be stored in the management systems and could be retrieved at any point of time. We have tried to explain how a patient with Parkinson's Disease can be monitored through our system. Here an endeavor has been made through our paper to comprehend the competence of RedTacton and also provide a feasible solution.*

**Keywords:** *RedTacton, Human Area Network, pyramid architecture, physiological sensors, Parkinson's disease.*

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## **1. Introduction**

In our day to day life, we use a variety of gadgets to meet our requirements. If we take a closer look over it, we can observe that we feature multiple gadgets, out of which two or more devices are having similar functionalities (at least have some similar properties). T.G.Zimmerman [1] sees this as an inability of the devices to interact with each other for data sharing which has to lead to the duplication of input or output components of gadgets. He also states that by sharing the information between devices, efficiency is likely to be increased [1]. This idea leads to the development of intra-body communication or near-field communication (also referred to as PAN).

There are many serious diseases which are threatening lives of people, but with unceasing observation, those can be kept under check and can increase the expectancy of people. Here we have considered one such example, where on continuous observation on a patient may a pave path for better understanding of the disease.

The wireless body sensors are a promising approach for monitoring physiological movements and also for determining the disease progression rate. The WBSN (Wireless Body Sensor Network) can be used for the diagnosis of Parkinson's Diseases(PD). Parkinson's Disease is a nervous-system Disorder that is degenerative. Freezing of gait (FOG) is a common symptom of Parkinson's Disease that is episodic, where the person gets frozen (suddenly stops) when initiating gait, turning, or walking through narrow spaces[24].

## **II. Human Area Network**

Communication in Human Area Network (HAN) is all about the transfer of data over the human body (intra-body communication). The weak electric fields around the human body paved the way for sharing the data with another device. The human body will be acting as Ethernet cable for which IEEE 802.3 standards would be suited.

## **III. Other similar protocols [12]-[15]**

Similar to RedTacton there are other various network protocols like such as ZigBee, UWB (Ultra Wide Band) RFID (Radio- frequency identification), etc. Based on these protocols wearable devices are developed for the commercial purpose. ZigBee is popularly used in home entertainment and control system, medical data collection, wireless sensor networks, etc. RFID tagging is used in the tracking of goods, Machine readable

travel documents, airport baggage tracking logistic, etc. UWB (Ultra Wide Band), as the name itself, says it is used in domains where higher bandwidth and higher data rate transfers are required. Some of the notable applications are a portable media player, military communication (in war field) UWB GPR has been used in mine detection, etc.

#### IV. Redtacton

RedTacton works over HAN. Nippon Telegraph and Telephone Corporation, a Japanese company developed RedTacton. Any actions such as a handshake, tapping, sitting, walking, etc initiates the interaction between devices. There'll be a transceiver at each end where data transfer takes place. Data transfer rate is at the speed ranging from 100 Kbit/s to 10 Mbit/s [18].

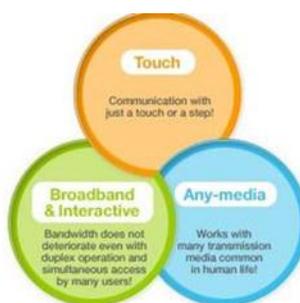


Fig 1: This diagram represents the key feature so RedTacton[2]

Features of RedTacton [5]:

- 1) Touch: Any human movements like sitting, walking, handshake, and gripping, etc can initiate communication between two devices. Utilizing this feature, initiation and suspension of data transfer becomes easy.
- 2) Broadband and interactivity: Availability of bandwidth doesn't get diminished over the duplex communication, and interactive data exchange can take place at maximum speed. The data transmission is un-effected in the congestion area over the medium.
- 3) Any media: Apart from the human body, there are diverse conductors and dielectrics available that can act as a transmission medium. Combination of both dielectrics and conductors are also used.

#### WHY REDTACTON ?

RedTacton holds the advantages of wireless, wired communication and also eliminates the disadvantages of those.

By employing this feature we can exploit RedTacton and achieve our desired results. Here few of those benefits are mentioned;

- Data transfer is unaffected by its surroundings to a greater extent.
- Throughput is high.
- Packet loss reduced.
- Packets collision gets disparaged.

#### V. Working

Unlike other devices, RedTacton doesn't rely on electromagnetic waves for data transfer. Instead of that, it uses the weak electric field on the surface of the human body. We know that there'll be a transceiver at both the ends where data transfer takes place.

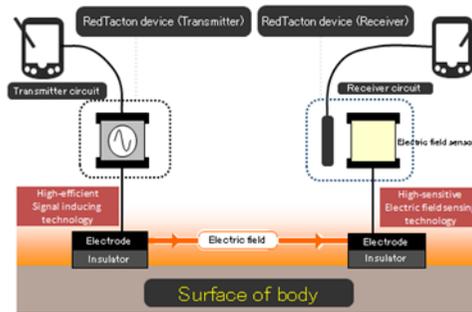


Fig 2: This diagram shows the working of the RedTacton [21]

*RedTacton at sender end:-*

The transmitter induces a weak electric field on the surface of the human body. Agenda behind actuating a weak electric field is that it's simple and cost-effective. Whereas, generating an electromagnetic field is comparatively costly. Later, over the weak electric field data transfer take place.

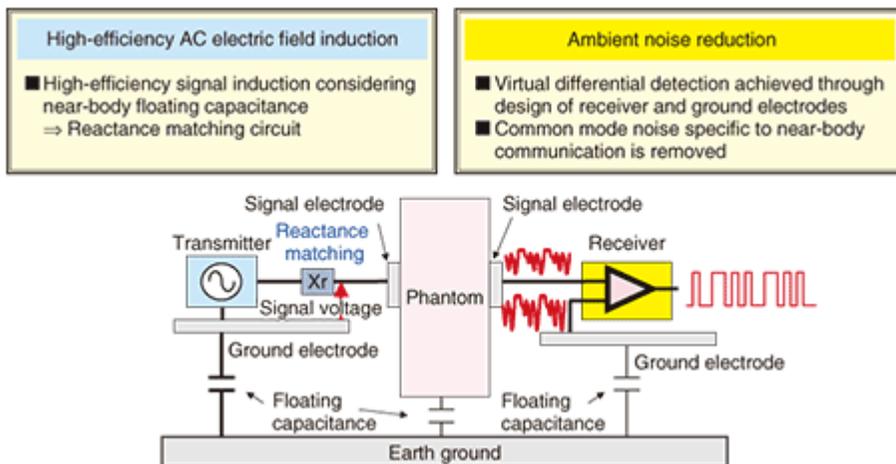


Fig 3: Factors for safe communication [18]

*Red Tacton at the receiver end:-*

The electro-optic crystal senses the varying weak electric field; according to the electro-optic effect, “shifts in the optical property of the material in response to an electric field that fluctuates slowly compared with the frequency of light” [8]. RedTacton uses a laser to determine the variation in the optical property of the electro-optical crystal due to the weak electric field and converts those results into electric signals in an optical receiver circuit.

The receiver will not sense all the induced electric field, only a portion of it will be perceived. The residual electric fields get dispelled to the ground.

**3.1 Mechanism**

A transmitter capacitively coupled to the human body generates an AC frequency lesser than the resonant frequency of the body (approx. 70-100 MHz), the signal develops across the surface of the body. As signal doesn't resonate with the body, the body behaves as Ethernet cable instead of antenna. [2]

The signal propagates over the surface of the body and gets dissipated to the ground (Earth) and doesn't get radiated into the surroundings. [2]

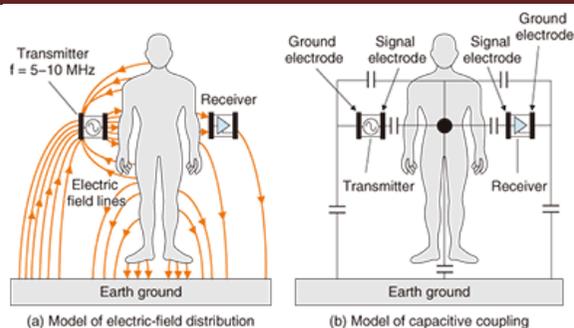


Fig 4: This diagram shows the how electrical fields are [18]

From the above diagram;

Let,

$E_a$  be the induced electric field,

$E_b$  be the electric field returning to the transmitter ground,

$E_c$  be the field disseminated to ground, and

$E_s$  be the field sensed at the receiver.

Then, the electric field  $E_s$  reaching receiver will be,

$$E_s = E_a - (E_b + E_c).$$

Above equation states that the electric field ( $E_s$ ) reaching the receiver is a residual portion out of the total electric field induced by transmitter ( $E_a$ ) and field dissipated to ground ( $E_b + E_c$ ) from the total electric field ( $E_a$ ).  $E_s$  affects the electro-optic crystal and a change in its optical property is detected using a laser beam.[2]

Redtacton Transceiver:

This is the block diagram of transceiver [16]

The Transceiver consists of two major segments, transmitter and receiver divisions. Transmitter segment includes a transmitter circuit and a data sense circuit. Signals from the interface get carried to the data sense circuit and transmitter circuit. The data sense circuit classifies the signals into transmitting mode or receiving mode. After signals are scrutinized, the control signals activate either transmitting circuit or electro-optic sensor based on the required operation. The transmitter circuit induces the electric field over the surface of the body. These changes in the electric field are detected through the highly sensitive electro-optic sensor developed by NTT. An output from the sensor gets directed to the interface [2]. By this means RedTacton facilitates two-way communication.

### 3.2 Is Redtacton Safe?

The electrode at transmitting and receiving end in the RedTacton gets glazed with an insulating layer therefore, during data transfer, a person behaving as a transmission medium is completely insulated. Thus, it restricts the flow of current from entering into a person's body from the transceiver. When communication is set up, the displacement current gets generated because of, electrons on the body being open to the tiny electrical fields. These sorts of displacement currents are quite common in our day to day experience. RedTacton corresponds to the "Radio frequency-exposure Protection Standard (RCR STD-38)" issued by Association of Radio Industries and Businesses (ARIB) [4]. ANSI/IEEE C95.1-1992 also sets the maximum displacement current through one foot at 45 mA for the .1-100 MHz frequency range. These figures are for an "uncontrolled" environment averaged over a 6 minute time interval [24]. Utilizing current less than or equal to 500 $\mu$ A, high-speed communication can be achieved on Redtacton [10].

### 3.3 Related works

The WBAN (Wireless Body Area Network) can be exploited in the best interest of serving the medical field to eradicate the human errors. RFID Tags are used to maintain the patient's record. The tag consists of two modes of operation as load and transmit mode to retrieve data from sensors and sends it to the reader. The reader and tags are insulated from the human body. EEPROM is used to program the tags [7].

Authors Gregorio Lopez, V ictor Custodio, and Jose Ignacio Moreno designed E-textile t-shirts, where the t-shirts are embedded with sensors which record the physiological movements and also these t-shirts are washable. The wear and tear of sensors is reduced, and it is user-friendly [22].

Other independent work on the study of human movements and behavioral patterns; The motion logger collects the data and also the state of movements when carried in pockets [22].

### 3.4 Proposed Idea

The main agenda of our idea is to reduce the paperwork at the health care centers, which in turn reduces the human errors.

At the health care centers, it is necessary to maintain the entire patient's record. The patient's health condition should be monitored at regular intervals so that Management and doctors can procure the details when required.

At times, it becomes the prime responsibility of a doctor to monitor the patient's condition in an unceasing manner; with the help of Redtacton, we can achieve it. By placing low capability physiological sensors over the human body, which detects body movements and sends it to the Base Stations. From the Base station, it is directed to the terminal and finally stored in the management system.

The Doctor on multidisciplinary rounds can procure the patients reports directly from the terminal devices. (Redtacton embedded tab)

### 3.5 Implementation

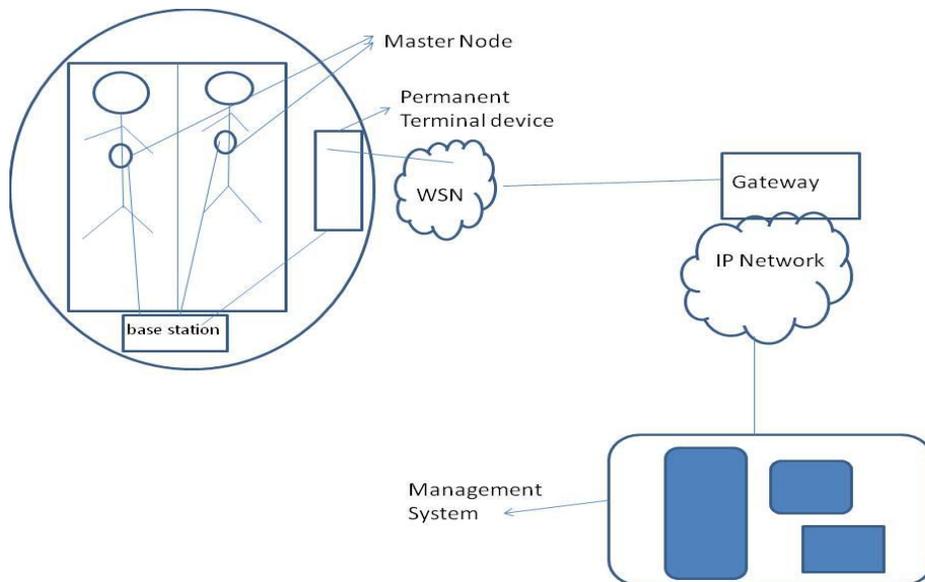


Fig 5: This is just a pictorial representation of our system

The proposed system can be implemented in three different phases;

Phase 1: Primary node (master node) and secondary nodes are placed over the human body, according to pyramid architecture. Physiological sensors collect data such as [blood oxygen level, blood glucose meter, blood pressure, and pulse meter] and send it to secondary nodes. That, in turn, forwards to Primary node (master node). The Primary node is directly connected to the base station, this helps in the easy transmission of data to the base station.

Phase 2: In this phase, the data from Base station is transmitted to the terminal device which is embedded with RedTacton.

Here we can observe two distinct cases in operation;

Case 1: The data is transmitted to the WSN (Wireless Sensor Network) from the end terminals and later loaded to the management system.

Case 2: During Multidisciplinary rounds, the Doctor can procure the patient's information from the Base station, which is stored in the management system.

Phase 3: The data from a terminal device is directed to WSN. WSN consists of multiple devices. Multiple devices in WSN are used to collect data from the different terminal devices and are sent to the management systems through the gateway where it finally, gets stored. Management systems consist of a management server and systems for processing data.

The Pyramid Architecture decreases the power consumption, data gathering delay and increases the resiliency of the system.

The node degree in pyramid Architecture will never exceed 9. The Transmission phase is less in pyramids and thus shrinkage of data transmission delay occurs [23].

It provides Resiliency and therefore even if one node dies the adjacent nodes controls the traffic. Each layer, the nodes are connected horizontally with other nodes through mesh-edges. The nodes are connected vertically with its parent and children to reduce the number of layers. The pyramid supports augmented nodes when compared with other networks.  $(4^{(n+1)} - 1)/3$ . Thus, Pyramid networks increase WBSN efficiency and effectiveness. [23]

#### Advantages of Our Systems

1. Total Power consumption is low.
2. Reduces paperwork.
3. Human Errors are eradicated to a greater extent.
4. Accessing the nearby Patient's record.
5. It reduces transmission delay.

### 3.6 An Example of how Parkinson's disease can be monitored

The proposed system focuses on continuous monitoring of patient's activities to predict when the next episode might occur.

And also provides an opportunity for doctors and researchers to study the disease in an explicit manner.

The working takes place in a hierarchical manner.

LEVEL 1: The physiological devices are placed at lower limbs, ankle, wrist, and chest and it collects the data.

These data are directly transmitted to the base station. The sensors used are low voltage flux sensors, pressure sensors, gyroscope, and accelerometer.

LEVEL 2: The collected data is transmitted to the terminal devices embedded with redtacton. The data is further directed to the WSN.

LEVEL 3: WSN consist of multiple devices, data through the gateway gets access to IP networks and is finally stored in the Management System.

The Management System contains the test results of people who are normal and those with PD. The obtained data are processed using different technique and are compared with those test results present in the Management System.

The Doctor can access the patient's information from the Management System and with those details; he would be able to predict the episodes.

These data in the Management System can also be used by the doctors and researchers for further and explicit study in this field.

### 3.7 Scope of development

Integrating Redtacton with other wearable devices, which are already in existence;

1. We know that RedTacton requires less energy for transmission of data, and thus by integrating it with the devices which are capable of generating power from renewable sources of energy and also capable of storing it (Thermo-Electric MEMS Generator as power supply [25]), would be a feasible solution. Heat and light could be considered as one of the best sources. Naturally, the human body generates heat and that could be utilized. Solar energy can be stored and utilized later. This makes the device to be self-reliant.
2. By integrating it with a device which is capable of recognizing the thumb impression or any other form biometric application, provides proper authentication. This helps in providing security to the user [6].

### 3.8 Other Applications of RedTacton

RedTacton can be used in all types of Body coupled communication.

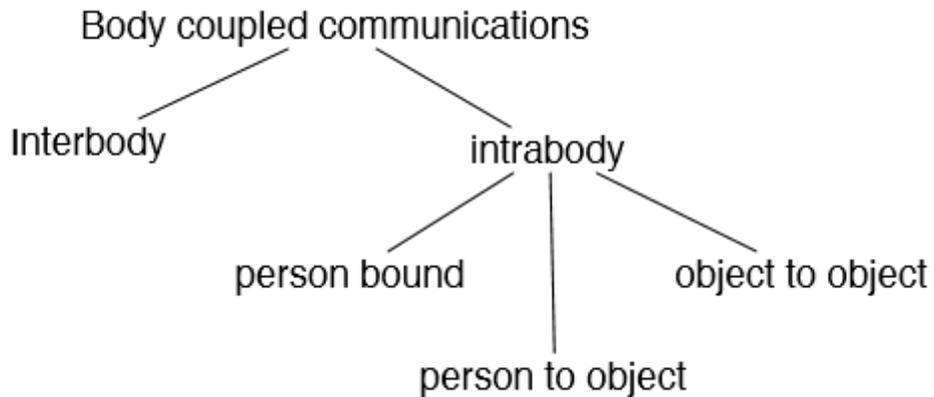


Fig 6: Above figure shows the classifications of Body coupled communication[9]

Red Tacton has ample of applications with respect to intrabody communication;

1) Used in Person Bound Communication:

Personal bound communication is referred as a communication between the devices which are featured by the user. When there is a need for data transfer between devices, RedTacton can be thought as an answer. RedTacton provides dedicated bandwidth and provision for accessing multiple devices, which in turn helps in achieving better results.

2) Used in person to object communication:

In this type of communication, RedTacton has a vast range of application.

A) Medical Field



Fig 7: Above depicts a medicine bottle with redtacton connected[5]

- I. RedTacton is used as an alarm to alert the patients, when they take the medicines which aren't prescribed for them.
- II. Patients who are suffering from Alzheimer's disease tend to forget things. For them, this helps in performing their activities with ease.
- III. It helps in maintaining patient records, Instead of maintaining paper records it maintains digital records.
- IV. In the printing of lab reports, nowadays diagnostic centers are getting adapted to machines for testing the samples. Simply by connecting those devices with printers would reduce human interaction and deploy reports faster.

B) Security

- I. The door lock connected with RedTacton locks or unlocks only when the security key from the user matches with RedTacton connected to the door. It is also applicable for automobiles.

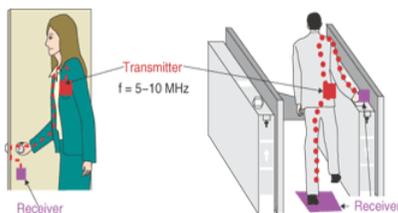


Fig 8: This is picture shows how redtacton provides security by allowing only authorized person [18]

- II. This can also be used for authorized entries at public places and confidential meetings.



Fig 9 This diagram shows how redtacton can be used for security in car[5]

C) Expository services

- I. When a customer finds an advertisement which is of his interest, he can get detailed information about it, with a simple tap over it.
- II. Similar to the previous application, when a customer wants to know any information regarding the products at a supermarket he can get it by touching it.
- III. It can be used in Conferences, seminars, etc. Data communication and file transaction gets initiated, just by placing the laptops over the table which is electrically conductive.
- IV. In a museum, when a visitor wants to get detailed information about any of its article then, he can get it by standing on a specified point, which is in contact with redtacton. A pre-recorded audio will be played and a transcript will be sent to his\her mobile, tablet, etc if required.

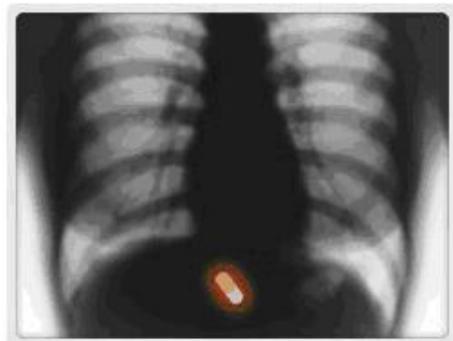


Fig 10: This picture shows how redtacton is implemented in a conference system[5]

V. As RedTacton has diverse transmission medium, it facilitates the outer space communication, underwater communication, etc.



Potential for use as communication method in outer space and under water



Potential for use as communication method with devices inside the body.

Fig 11: This picture shows how redtacton is used in different transmission medium[19]

3) Used in object-to-object communication:

This is one of the well known applications of redtacton, here the data transfer is initiated when actions such as handshake, tapping, etc are being carried out by the person. For example, when a person wants to transfer highly sensitive or confidential data from his device to other person's device he can do it with a simple tap or handshake.

Advantages:

- I. Using RedTacton is absolutely safe for the humans.
- II. Data transfer rate is constant and maximum throughout the transmission.
- III. It is more secure than other technologies such as, Bluetooth, ZigBee, and UBW etc; as its range is less and no outsider can steal the data.
- IV. Network congestion can be avoided.
- V. RedTacton provides provision for uninterrupted data transmission.

Disadvantages:

- I. It is difficult to transfer data while travelling for long time with high speed.
- II. It is little bit expensive.

### 3.9 Conclusion

In this paper, we have tried to elucidate the competence of RedTacton and also how Redtacton could be implemented for the health care services. RedTacton utilizes the electric field/Photonics methods. It has got an edge over other technologies because of its diverse transmission medium, which makes communication becomes possible in different Places. The speed of data transmission is always at its peak. It is highly challenging to hack data from this network, making this the one of the most secure ones. The robustness and the effectiveness of the technology make it highly reliable. These features of Redtacton make it as one of the promising technology for ubiquitous services. In future, if any means through which its costs could be reduce then, undoubtedly this would be replaced with its contemporary technology.

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## **Censorship of Reinforcement Learning Chatbot**

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**ABSTRACT:** Researchers have applied online deep reinforcement learning in order to enhance the open-domain conversational skills of Chabot's. These chat-bot's have the ability to learn conversations from real users but in practical applications, some users may take advantage of the chat-bot's online learning ability to generate offensive responses. In this paper, we introduce an utterance censorship system to check whether the chat-bot's utterance is appropriate. If the speech is inappropriate, the censor will block it and give a negative reward to "punish" the chat-bot. The censorship system is based on a character-level bidirectional LSTM model, and the chat-bot receiving the reward from the censorship system "forgets" the learned offensive utterances. Experimental results show that our proposed architecture enables online learning chat-bots to self-purify and that character-level LSTM is more appropriate for the utterance censorship task compared with classical word-level LSTM model.

**Keywords:** Censorship, Reinforcement Learning, Chat-bot, Character-level LSTM

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### **1. Introduction**

Recurrent neural networks (RNNs) offer great promise for generating chat-bot dialog but often generating dull, short and inconsistent responses. In order to enhance their open domain conversational skills, researchers integrate online deep reinforcement learning to the chat-bot. This allows the chat-bot to have the ability to learn conversations from real users. However, in practical application, some users may take advantage of the chat-bot's online learning ability to generate offensive responses. This presents a serious problem for practical applications. For example, within hours of Microsoft's chat-bot, aimed at 18 to 24 year olds, known as Tay going live, some users took advantage of flaws in Tay's algorithm that meant the AI chat-bot responded to certain questions with racist answers. These included the bot using racial slurs, defending white supremacist propaganda, and supporting genocide. Microsoft quickly removed the bot. QQ Xiaoice, a chat-bot in QQ social software, is known for delighting with its stories and conversations. However, it has also been removed because of its improper political comments and foul language. Thus, it can be seen that the prospects for the practical application of open domain chat-bots is not promising if researchers do not solve this problem. To address this issue, we introduce a censor (an utterance censorship system) to check whether the chat-bot's utterance is appropriate. If the speech is inappropriate, the censor will block it and give a negative reward to "punish" the chat-bot. The scenario of our method is shown in Fig. 1 and 2. The utterance censorship system is based on a character-level bidirectional long short-term memory network (LSTM) model, and the penalty for the chat-bot is delivered through the reinforcement learning process. Experimental results show that our proposed architecture enables online learning chat-bots to self-purify, and that character-level LSTM is more appropriate for the utterance censorship task compared with word-level LSTM model. Our contributions are two-fold: First, we use a character level LSTM model in the utterance censorship task. Our censorship system can not only identify sensitive semantics (may not contain profane words) but also deal with the problem of disguised profane words (e.g., "@ss" and "sh!t"). Second, by accepting the censor's reward, the chat-bot "forgets" the offensive utterances. Hence, developers can obtain a clean model.

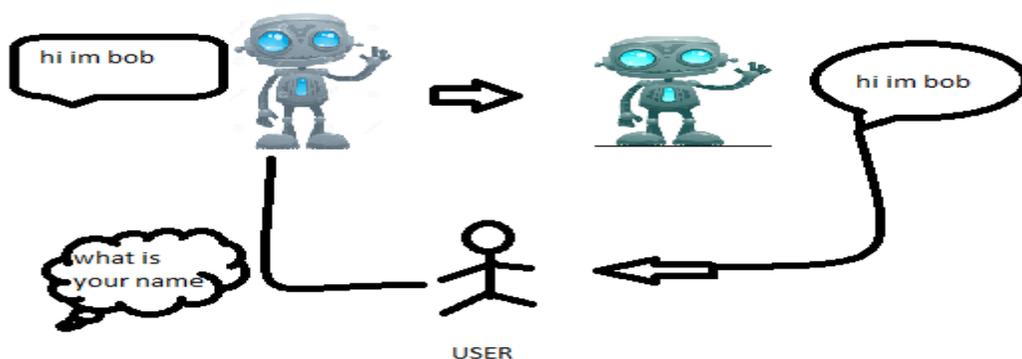


Figure 1: A normal utterance chatting when chat-bot speaks.

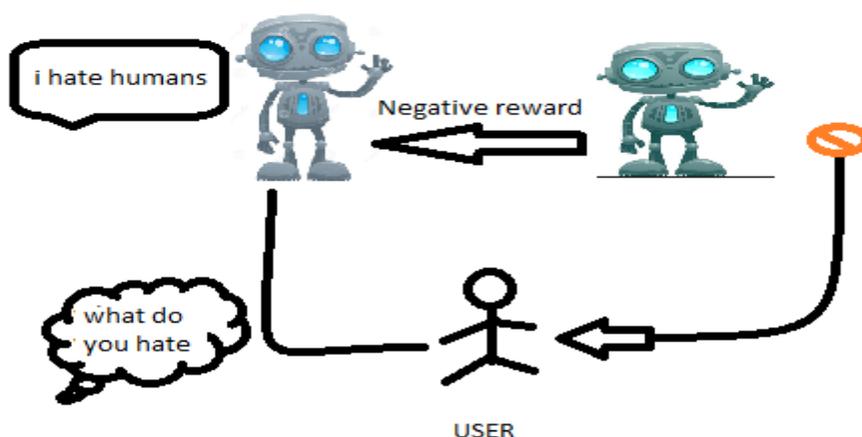


Figure 2: When chat-bot makes abnormal or inappropriate utterance.

## II. Related Work

- A. **Deep Reinforcement Learning:** Chat-bot despite the success of LSTM sequence to sequence (Seq2Seq) models in dialog generation, chat-bots often generate dull, short and inconsistent responses. Researchers have attempted to address this problem by exploring reinforcement learning. Li et al. defined three reward functions as: informatively, coherence, and ease of answering. When the machine generated response satisfies these three goals, the chat-bot will be rewarded. They adopt an AlphaGo-style training strategy that simulates dialogue between two chat-bots. Asghar et al. proposed an online one-shot learning model. Users can provide feedback to the chat-bot by suggesting a response. The suggested response is subjective and entirely decided by users. The feedback immediately becomes the chat-bot's most likely prediction for that prompt. However, some users may take advantage of its fast and unrestricted learning ability to generate offensive answers. These recent chat-bots also have the ability to learn from real users via reinforcement learning. Similarly, the flaws still exist.
- B. **Utterance Censorship:** Utterance censorship can be cast to profanity detection task or text classification task. Spertus summarized a profanity rule set, then generated a decision tree for profanity detection based on the rule set. Yin et al. obtained a Term Frequency/Inverse Document Frequency (TF-IDF) value for each term, and weighted for second person pronouns and profane terms. Then, they input these features to a support vector machine (SVM) classifier. Dinakar et al. used a SVM multi-classifier to classify sensitive utterances into three categories: race & culture, sexuality, and intelligence. The above methods have one common limitation: they cannot identify variations in spellings and disguised profane terms. Sood et al. incorporated the Levenshtein Edit Distance into the SVM to resolve this deficiency. The edit distance measures the number of letter changes needed to transform one word into another but there

are a lot of English words with a small edit distance from profane terms (e.g., “shirt” from “shit”), potentially leading to false positives. More recently, deep learning methods have been applied successfully in the text classification domain. Liu et al. proposed a LSTM model for text classification. The LSTM model remembers the historical context so that it is able to recognize sensitive semantics. Yang et al. proposed a hierarchical attention LSTM network for document classification. It has two levels of attention mechanisms applied at the word-level and sentence-level. The attention mechanism can extract such words that are important to the meaning of the sentence. However, classical LSTM models require pre-trained word vectors as input so that disguised profane terms can only be regarded as “unknown” words. Zhang et al. proposed a character-level convolutional neural network (CL-CNN) for text classification. The character-level inputs are able to identify disguised profane terms. Its one-dimensional convolutional networks, known as temporal convolutional networks, also have the ability to recognize sensitive semantics. To further improve the detection accuracy, we use character-level bidirectional LSTM with attention for our utterance censorship task, which we describe in the next section.

### III. Proposed System

The architecture of our model consists of two parts: an utterance censor, and a deep reinforcement learning chat-bot. The censor classifies the utterance generated by the chat-bot into “normal utterance” and “offensive utterance”. If the generated utterance is classified as an offensive utterance, the censor will block it, and give a negative reward to the chat-bot. The chat-bot updates its weights by the reinforcement learning process when it gets the reward. Through the reinforcement learning process, the chat-bot will reduce the probability of offensive utterance generation.

**A. Utterance Censor** Inappropriate utterance includes profane words and sensitive semantics such as threats, obscenity, insults, and identity-based hate etc. We use the LSTM language model for detecting sensitive semantics. However, the classical LSTM model requires pre-trained word vectors as input, so it cannot identify variations in spelling and disguised profane words (e.g., “@ss” or “sh!t”). Inspired by Zhang’s character level CNN model, we use character sequences as input rather than sequences of words. The character-level inputs are able to deal with the problem of disguised profane words and the LSTM network ensures that the model learns longer term dependencies for sensitive semantics detection. The alphabet used in our model consists of 70 characters, including 26 letters, 10 digits, 33 other characters, and a space character:

abcdefghijklmnopqrstuvwxyz0123456789 -  
 ,.:!?:”/ \ | \_ @ # \$ % ^ & \* ~ ` + = < > [ ] { }

These characters are encoded as one-hot vectors as the final input. To further improve the detection accuracy, we introduce attention mechanism [15] and bidirectional LSTM architecture [16]. The attention mechanism can extract such words that are important to the meaning of the sentence. The bidirectional LSTM can get information from the both directions of sentences. The model architecture is shown in Fig. 1.

The LSTM cell’s transition equations are as follows:

$$\begin{aligned}
 i_t &= \sigma(w_i x_t + U_i h_{t-1} + b_i) \\
 f_t &= \sigma(\omega_f x_t + U_f h_{t-1} + b_f) \\
 o_t &= \sigma(w_o x_t + U_o h_{t-1} + b_o) \\
 \tilde{c}_t &= \tan h(w_c x_t + U_c h_{t-1} + b_c) \\
 c_t &= (i_t \theta \tilde{c}_t + f_t \theta + c_{t-1}) \\
 h_t &= (o_t \theta + \tan h(c_t))
 \end{aligned} \tag{1}$$

Where  $x_t$  is the input at the time step  $t$ ,  $c_t$  is the internal memory,  $h_t$  is the output state,  $\sigma$  is the logistic sigmoid function,  $\tan h$  is the hyperbolic tangent function, and denotes elementwise multiplication. Intuitively, the forget gate  $f_t$  controls the amount of old information that is to be erased, the input gate  $i_t$  controls how much new information is going to be used to update the current memory cell, and the output gate  $o_t$  controls what to output from the current memory cell.

The attention mechanism can learn a weight for each character, making the important features have a heavier weight:

$$U_t = \tanh(w_U h_t + b_U) \quad (2)$$

$$\alpha_t = \exp(U_t U_a) / \sum_t \exp(U_t U_a) \quad (3)$$

$$v = \sum_t \alpha_t h_t \quad (4)$$

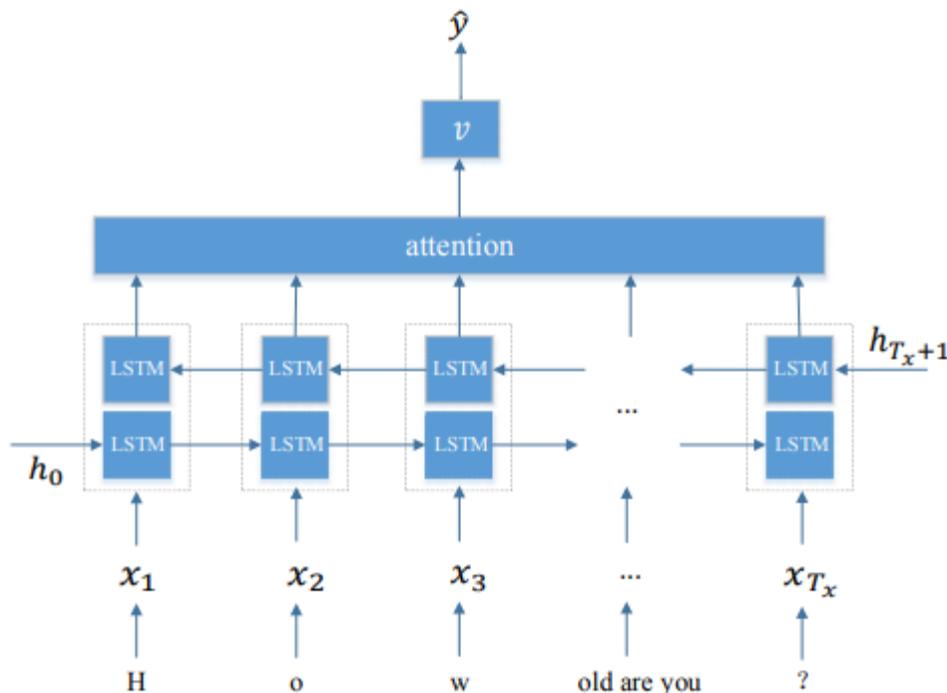
where  $u_t$  is the hidden representation of  $h_t$ ,  $\alpha_t$  is the attention weight, a  $u$  is the context vector which is randomly initialized and jointly learned during the training process, and  $v$  is the vector that summarizes the information of a sentence.

The final output is the probability of an offensive utterance:

$$\hat{y} = \sigma(w_y v + b_y) \quad (5)$$

The value of  $y$  is in the range  $[0, 1]$ , and the censor will block the utterance when the value is greater than 0.5.

**B. Reinforcement Learning:** The chat-bot makes use of the LSTM sequence to sequence (seq2seq) dialogue generation framework. It consists of an encoder-decoder layer. The model reads the input sentence one word at a time and predicts the output sentence. During supervised training, the true output sequence is given to the model and it is trained by gradient descent to maximize the likelihood of the correct sequence given its historical context. After the first stage of training, the chat-bot has a basic level of conversational ability. To further improve the quality of its responses, researchers initiate the reinforcement learning (RL) process when the chat-bot interacts with real users and learns from the conversations with them. In our method, the chat-bot receives rewards from the censor during the RL process, (penalties if the robot's response is offensive).



**Figure 3:** The LSTM architecture of censorship, ( $h$  is hidden state,  $x$  is input state character,  $T_x$  is length of input sequence and  $\hat{y}$  is the probability prediction).

The reward function determines how much reward is obtained for each action. In our method, the value of the reward represents whether the utterance is offensive, and the reward is from  $-1$  to  $1$ :

$$R(y) = \tanh(w_y v + b_y) \quad (6)$$

In the RL process, our objective is to maximize the expected future reward by policy gradient:

$$J(\theta) \approx R(y) \log P_{\theta}(y|x) \quad (7)$$

Where  $\theta$  is the parameters of the seq2seq model,  $y$  is the utterance that is generated by chat-bot,  $P_{\theta}(x|y)$  denotes the probability that current model generates  $y$  given the user's input  $x$  and  $R(y)$  denotes the reward from the censor.

#### IV. Results and Discussions

We have used machine learning approach to create an assistant in this paper. This is based on machine learning does not understand the meaning of sentences. It learns how to respond based on the previous experience. Though we have used NLP functions but the actual process through which response is generated is using machine learning as said earlier we created the model and trained it with thus more diverse the intent more accurate the results will be. The sole purpose of this paper is to make a friendly assistant to chat or make up conversation with intension of user like and dislike for entertainment. Although this is a movie recommendation assistant through which the movies are being given or recommended through chats or conversation. Below is the screenshots of the results acquired.

In this section, we evaluate the effectiveness of the chat-bot's self-purification and performance of the censorship system.

C. **Datasets:** We use following public dataset to train the chat-bot for basic dialogue generation.

1. **Tweets Conversation:** Scrape from twitter, which consisting of 350K tweets-response pairs. To show the performance of the censor, we use three public datasets. A brief description of each dataset is as follows.
2. **Toxic Comment:** 16K toxic comments and 140K normal comments from Wikipedia's talk page set.
3. **ISIS Fans:** 17K tweets from ISIS fans' Tweeter accounts.
4. **Nazi Tweets:** 11K tweets gathered from 900 Nazi Tweeter accounts.

We clean the ISIS Fans and Nazi Tweets datasets by removing '@someuser', '#topic#' , 'http://url' and punctuations. The Toxic Comment dataset has not been cleaned.

D. **Experimental Settings:** for the Seq2Seq model, there are 3 encoder layers and 3 decoder layers, each containing 1024 LSTM units. The chat-bot generates 3 responses in order of decreasing generation likelihood. The first response becomes the final output and the others are candidate responses. The supervised learning rate is 0.0001, and the reinforcement learning rate is 0.05. An appropriately high learning rate results in one-shot learning, where the top offensive response immediately becomes the candidate response. However, high learning rate also because the chat-bot to forget basic level of conversational skill learned previously. To combat this issue, we just update the last encoder layer's parameters. The censor model's hyper parameters are as follows: There are 3 LSTM layers and each layer has 64 units. The initial learning rate is 0.001.

E. **Utterance Censorship:** Results We first compare our character-level LSTM (CL-LSTM) censorship system with the state-of-the-art neural network models: word-level LSTM (WL-LSTM) and the character level CNN (CL-CNN) on four different datasets. Table 1 shows the percentage of correct classifications of our model compared with the other models. It shows that our model is competitive with the neural-based state-of-the-art models. The improvement is 1.25% on average compared with the CL-CNN model. Although the WL-LSTM outperforms our model on the cleaned datasets (ISIS Fans and Nazi Tweets), it requires pre-trained word vectors and cannot recognize disguised profane words (shown in Table 2). In order to evaluate the detection of disguised profane words, we use Top Disguised Profane Words [18] as the test set. In this experiment, in order to exclude the influence of semantics, each input of the training set is an individual word rather than a sentence. The training set words (1K) are selected from above datasets and both of them are not disguised. The results are shown in Table 2. We can see that our model and the CL-CNN model can both recognize disguised profane words well, but the WL-LSTM cannot perform this task.

F. **Reinforcement Learning Results:** To evaluate the effectiveness of the chat-bot's self-purification, we feed the offensive utterances to the pre-trained chat-bot model. It simulates the process of online learning from real users. The added offensive utterances are randomly combined with training set inputs

as input-response pairs. The chat-bot will generate three candidate responses and select the top probability response as the final output. After the supervised training, we generate the chat-bot's responses in two turns with same inputs. From Table 3, we can see that the chat-bot generates three candidate responses in turn 1. The first is an offensive utterance, the censor has blocked the top response. In the next turn, we can see that the offensive utterance has declined to the second rank with same input. We can see from Fig. 3 that the proportion of offensive responses from the chat-bot decreases as the number of turns increase. Hence, the result shows that the chat-bot will self-purify via the reinforcement learning process.

**Table I:** Classification Accuracy Compared with Neural Based Model on Four Different Datasets (Bold Indicates Best Values).

	Toxic Comment	ISIS Fan	Nazi Tweets
CL-LSTM	0.8538	0.9241	0.8835
WL-LSTM	0.8132	0.9262	0.8925
CL-CNN	0.8267	0.9214	0.8757

**Table II:** Sampled Recognition Results of Disguised Profane Words.

	A\$\$	@ss	Sh!t	F***	\$h!t	F*cking
CL-LSTM	Recognized	Recognized	Recognized	Recognized	Recognized	Recognized
WL-LSTM	Unrecognized	Unrecognized	Unrecognized	Unrecognized	Unrecognized	Unrecognized
CL-CNN	Recognized	Recognized	Recognized	Recognized	Recognized	Recognized

**Table III:** Responses Generated From the Chat-Bot in Turns with Same Inputs.

	Input	Happy Birth Day to Me
Turn 1	Candidate-1	You Are an Idiot
	Candidate-2	Happy Birth Day
	Candidate-3	SO Dumb
	Final Output	Thank You
	Final Output	Blocked

## V. Conclusion

In this paper, we introduce an utterance censorship system to filter the chat-bot's response and give a feedback to the chat-bot based on the censorship results. Empirical results show that our proposed architecture enables online learning chat-bots to self-purify, and the character-level LSTM has the ability to deal with the problem of disguised profane words. In practice, however, the censorship system needs to be constantly updated due to the rapidly changing nature of offensive utterances. In future work, we will explore active learning to address this issue.

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## Mobile Attendance Using NFC and OTP

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**ABSTRACT:** Smartphones are becoming increasingly more deployed and as such new possibilities for utilizing the smartphones many capabilities for public and private use are arising. This project will investigate the possibility of using smartphones as a platform for authentication and access control, using near field communication (NFC). To achieve the necessary security for authentication and access control purposes, cryptographic concepts such as public keys, challenge-response and digital signatures are used. To focus the investigation a case study is performed based on the authentication and access control needs of an educational institutions student ID. To gain a more practical understanding of the challenges mobile authentication encounters, a prototype has successfully been developed on the basis of the investigation. The case study performed in this project argues that NFC as a standalone technology is not yet mature to support the advanced communication required by this case. However, combining NFC with other communication technologies such as Bluetooth has proven to be effective. As a result, a general evaluation has been performed on several aspects of the prototype, such as cost effectiveness, usability, performance and security to evaluate the viability of mobile authentication.

**Keywords:** Social Media, Stress Detection, Psychological Stress, Pre-processing algorithm with N-gram technique.

### 1. Introduction

This project is been proposed with a Near Field Communication (NFC) and One-Time Password (OTP) for M-Attendance framework. Which are for several Companies, Universities, professors conduct pupils' attendance. The on going system as a process of monitoring the attendance every starting of the day or registering at a company at the entrance with manual roll calls or by recording their signatures on a piece of paper which, later, they use to manually enter the attendance in the backend system. This routine requires time and effort, compromising on the several shifts in a company per day and can register on their timings. In addition to this, some employee take advantage of the low-security attendance system and mark the attendance of the employee who aren't present in the office, i.e., proxy cases. The proposed attendance supervision system has been designed to simplify and optimize attendance monitoring. It replaces the traditional attendance-marking system and makes it faster, more secure and completely digital.

Elakiyaselvi provides us with the framework of implementing an Android application using NFC. NFC is a short-range and high frequency wireless communication technology that enables the exchange of data between devices within a range of 10 cm from each other. It is an upgrade of the existing proximity card standard (RFID) that combines the interface of a smartcard and a reader into a single device. It allows users to seamlessly share content between digital devices. Shorter set-up time is a big advantage that NFC has on its side. Instead of performing manual configurations to identify devices, the connection between two NFC devices is established at once (under 111 0 a second). Due to this short range, NFC provides a higher degree of security than Bluetooth and makes NFC suitable for crowded areas where correlating a signal with its transmitting physical device might otherwise prove impossible. NFC can also work when one of the devices is not powered by a battery (e.g. on a phone that may be turned off, a contactless smart credit card, etc.). A one-time password (OTP) is a password that is valid for only one login session or transaction, on any digital device. OTPs avoid a number of shortcomings that are associated with the traditional password-based authentication systems. The most important advantage that is addressed by OTPs is that, in contrast to static passwords, they are not vulnerable to replay attacks. This means that a potential intruder who manages to record an OTP that was already used to log into a service or to conduct a transaction will not be able to abuse it, since it will be no longer valid. A second major advantage is that a user who uses the same (or similar) password for multiple systems, is not made vulnerable on all of them, if the password for one of these is gained by an attacker. OTP systems also aim to ensure that a session cannot be easily intercepted or impersonated without knowledge of unpredictable data created during the previous session, thus, reducing the attack surface further.

### **Proposed System**

This project proposes to create a system with one server to which all mobile phone is connected, so all data will be saved in one database on mobile phone and send to the database on the server too, making the monitoring of the information effortless. All instructor must have a mobile phone with an embedded NFC reader that can read employee NFC tag. The camera device is meant to prevent an employee from giving his/her NFC tag to another employee who attends the office, touch the other employee's NFC tag to make it appear as if s/he was also present. When an employee enters office and touch his/her NFC tag on instructor's mobile phone, the NFC reader reads his/her employee NFC tag and sends it to the database in instructor's mobile phone. After some time, the instructor submits all data for backup in a database server.

### **Scope of Project**

The scope of this system is to introduce a new dimension in attendance system using NFC technology. The main highlight in NFC technology is we can able to store 1MB data in NFC tags, which gives lot of advantages in attendance system.

### **Advantages**

- It is faster than the existing system.
- FC, new Advance technology use for attendance system.

The most important advantage that is addressed by OTPs is that, in contrast to static passwords, they are not vulnerable to replay attacks. This means that a potential intruder who manages to record an OTP that was already used to log into a service or to conduct a transaction will not be able to abuse it, since it will be no longer valid.

A second major advantage is that a user who uses the same (or similar) number for multiple systems, is not made vulnerable on all of them, if the password for one of these is gained by an attacker. OTP systems also aim to ensure that a session cannot be easily intercepted or impersonated without knowledge of unpredictable data created during the previous session, thus, reducing the attack surface further.

### **Literature Survey**

**P Elakiyaselvi, "A framework for implementing Attendance system using near field communication in android OS", Int. J. Computer Technology & Applications, Vol 3 (2).**

T-Education system in India has been changing widely in last 10 years due to the development of the technology. Smart class, Elearning, Video conferencing are some of them. The core idea of this paper is to implement some of the emerging technologies like mobile computing and near field communications and advances in behavioural science studies to make a better educational system. This paper will be implemented in application as two parts. A secure framework for implementing different educational service mobile applications like, mobile attendance, mobile curriculum, mobile marks register etc. The second part will leverage Near Field Communication technologies and gamification behaviour approach to incorporate game mechanics into activity-oriented learning systems. Gamification works by making technology more engaging, and by encouraging desired behaviours, taking advantage of humans' psychological predisposition to engage in gaming.

**M. Viju Prakash, P. Alwin Infant, and S. JeyaShobana, "Eliminating Vulnerable Attacks Using One-Time Password and Pass Text - Analytical Study of Blended Schema", Universal Journal of Computer Science and Engineering Technology 1 (2), 133-140, ISSN: 2219-2158, November 2010.**

A secure network partially depends on user authentication and unfortunately authentication schemes used at present are not utterly secure. Some passwords are not computationally dominant, where brute force attacks on this unprecedented scale became potential. Here we have designed a combined schema of One Time Password (OTP) algorithm concatenated with PassText which makes uncomplicated to commit to memory and is computationally powerful. It can be fairly and rapidly provided to the system, while at the same time remaining impractical to break the brute force attack. OTP algorithm powered with user's unique identifications like International Mobile Equipment Identification and Subscriber Identification Module; makes a finite alphanumeric token valid for a session and for a single use. PassText is an easy way of system authentication schema which enables the user not obligatory to memorize any difficult passwords or character combinations. Concatenation of these two schemas gives maximum security for authentications and almost impossible to break. We have also proposed a novel measure of security levels of many popular authentication schemas against the one we proposed.

G. Shanbhag, H. Jivani, and S. Shahi, "Mobile Based Attendance Marking System using Android and Biometrics", *IJRST-International Journal for Innovative Research in Science & Technology*, Vol. 1, Issue 1, ISSN: 2349-6010, June 2014.

We have seen over the years that the process of manual attendance has been carried out across almost all educational institutions. The process is not only time consuming but also sometimes inefficient resulting in the false marking of attendance. Today, we need not maintain pen and paper-based attendance registers. Following this thought, we have proposed an attendance marking and calculation system which is implemented on Android mobile application integrating biometric scanner that communicates with the database and verification can be achieved. This Android application will give the students information on attendance and change in timetable if any whereas the biometric scanner is used for verification, authentication and to avoid proxy.

W. Yi, W. Jia, and I. Saniie, "Mobile Sensor Data Collector using Android Smartphone", *Circuits and Systems (MWSCAS), 2012 IEEE 55th International Midwest Symposium, IEEE, August 2012.*

In this paper, we present a system using an Android smartphone that collects, displays sensor data on the screen and streams to the central server simultaneously. Bluetooth and wireless Internet connections are used for data transmissions among the devices. Also, using Near Field Communication (NFC) technology, we have constructed a more efficient and convenient mechanism to achieve an automatic Bluetooth connection and application execution. This system is beneficial on body sensor networks (BSN) developed for medical healthcare applications. For demonstration purposes, an accelerometer, a temperature sensor and electrocardiography (ECG) signal data are used to perform the experiments. Raw sensor data are interpreted to either graphical or text notations to be presented on the smartphone and the central server. Furthermore, a Java-based central server application is used to demonstrate communication with the Android system for data storage and analysis.

## II. System Architecture

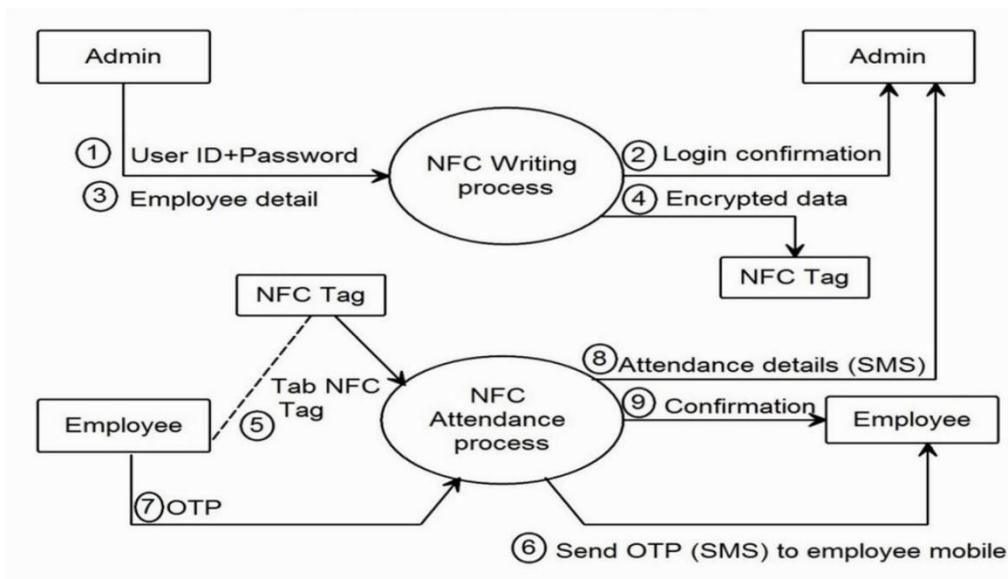


Fig: 1.0 system architecture of the proposed system

## III. Implementation Model



### Advantages in the system

- This system gives the track report about employee is present in the office or not.
- The Company head can get SMS and mail also.

### Objectives

- Improvements are made in the attendance of employees in the Company.
- Provides a Near Field Communication technology for the employee attendance.
- To overcome with task of employee by registering their attendance manually.
- Instead of maintaining attendance details manually, we can maintain attendance details digitalized, because of this more security is provided and leakage of data is avoided.
- Man, power is reduced using this technology.

### Applications

- It is faster than the existing system.
- FC, new Advance technology use for attendance system.
- The most important advantage that is addressed by OTPs is that, in contrast to static passwords, they are not vulnerable to replay attacks. This means that a potential intruder who manages to record an OTP that was already used to log into a service or to conduct a transaction will not be able to abuse it, since it will be no longer valid.
- A second major advantage is that a user who uses the same (or similar) number for multiple systems, is not made vulnerable on all of them, if the password for one of these is gained by an attacker. OTP systems also aim to ensure that a session cannot be easily intercepted or impersonated without knowledge of unpredictable data created during the previous session, thus, reducing the attack surface further

### IV. Conclusion

In this paper, sensors based attendance system is implemented. There are main two technologies, NFC and RFID. Overall, a brief The security related to both NFC and RFID is been discribed. In addition, Traditional Attendance Systems tend to be insecure due to lack of verification. In the proposed system, we leverage the benefits of using NFC (Near Field Communication) tags and OTP for verification of student identity and registration of attendance in a fool proof manner. Each student's NFC tag will be used along with his Mobile Device which would be used for automating the process of marking attendance. In the future, this framework could be supported on various Operating Systems, and various software environments. Also, Biometrics could be incorporated in the proposed framework to ensure more security.

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# **TKSE: Trustworthy Keyword Search Over Encrypted Data Via Block Chain**

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**ABSTRACT:** *In Now days the attractive concept in computing is cloud computing which makes possible to provide resources for the constrained users for enjoying the cost effective and flexible resources of diversity. Considering the Security issues with the cloud Servers and data privacy of the users ,it is very necessary to encrypt the data before storing the data into the cloud. We introduce TKSE ,a trust worthy keyword search and two-side verifiability using a technology called block chain over encrypted data without any third party.*

**Keywords:** *Cloud Servers ,Block Chain, User-side Verifiability, Server-side verifiability, Keyword Search.*

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## **1. Introduction**

The concept of cloud computing has attracted number of users and the industries to store their data in the distributed environment i,e Cloud because of infinite computing facility and the storage capacity with cost effective and the convience. Considering some security issues of the cloud computing ,it is necessary to convert one form of data to the another form(encryption) before upload or storing data into the cloud using block chain technology.

The security issues in cloud computing are user side verifiability,server side verifiability.

### **User- Side Verifiability**

We consider User side verifiability when cloud servers are malicious that means the cloud may return only the partial results of the user requirements or they can be the incorrect results

### **Server-Side Verifiability**

We Consider Server side verifiability when the data owners are malicious that means the data owner may store the invalid data into the cloud.

### **Block Chain Technology**

Block chain technology is one of the most trending concept in the Information Technology .Block chain Technology is the technology which is used to store the entries or files which cannot be changed very easily .These enteries or files are stored in the form of a block and all the block interconnected to eachother,Hence the chain is formed. So Block Chain.

Each block of the file or entry consists of hashcode of previously uploaded file,random number,hash code of current file,date and time stamp,encrypted file.



## Applications of Block Chain

### • Bitcoin Transaction

It is one of the application in which the block chain technology is used.

Bitcoin is one of the form of the Cryptocurrency and a form of electronic cash. It is a decentralized [digital currency](#) without a [central bank](#) or single administrator that can be sent from user to user on the [peer-to-peer](#) bitcoin network without the need for intermediaries.



### • Smart Contract

A smart contract is a computer protocol intended to digitally facilitate, verify, or enforce the negotiation or performance of a contract. Smart contracts help you exchange money, property, shares, or anything of value in a transparent, conflict-free way while avoiding the services of a middleman.

The best way to describe smart contracts is to compare the technology to a vending machine.



## 2. Conclusion

Considering the security issues in storing the file in the cloud we propose TKSE Trust Worthy keyword Search which involves both User side verifiability and Server -side verifiability to overcome malicious Cloud Servers and malicious Data owners.

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2. <https://en.wikipedia.org/wiki/Bitcoin>
3. [https://en.wikipedia.org/wiki/Smart\\_contract](https://en.wikipedia.org/wiki/Smart_contract)

## **Collaborative Filtering Based Recommendation of Online Social Voting**

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**ABSTRACT:** *Social vote may be a developing new part in on-line informal organizations. It postures one in every of a sort difficulties and open doors for the suggestion. during this paper, we have a tendency to build up a meeting of lattice resolving (MF) and nearest neighbor (NN)- primarily based recommender frameworks (RSs) that investigate shopper social organization and gathering association knowledge for a social vote proposal. Through investigations with real social vote follows, we have a tendency to show that social organization and gathering association knowledge will basically enhance the exactitude of fame primarily based vote suggestion, and informal organization knowledge rules assemble alliance knowledge in NNbased approaches. we have a tendency to likewise watch that social and gathering knowledge is considerably a lot of profitable to chill shoppers than to substantial shoppers. In our trials, simple meta path primarily based NN models beat computation-escalated MF models in an exceedingly hot-voting proposal, whereas clients' interests for nonhot votings is higher strip-mined by MF models. we have a tendency to in addition propose a half-breed RS, sacking distinctive single ways that to touch upon accomplish the most effective k hit rate.*

**Keywords:** *Online Social Networks(OSN), Recommender Frameworks (RSs).*

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### **1. Introduction**

ONLINE social networks (OSN), like Facebook and Twitter, facilitate simple info sharing among friends. A user not solely willshare her updates, in varieties of text, picture, and video, along with her direct friends, however can also quickly diffuse those updates to a way larger audience of indirect friends, investing on the wealthy property and world reach of in style OSNs.several OSNs currently provide the social selection operate, through that a user will share with friends her opinions, e.g., like or dislike, on varied subjects, starting from user statuses, profile photos, to games vie,products purchased, websites visited, and so on. Taking like- dislike kind of votings one step more, some OSNs, e.g., Sina Weibo [20], empower users to initiate their ownselection campaigns, on any topic of their interests, with user- bespoke selection choices. the buddies of a selection instigatorwill participate within the campaign or retweet the campaign to their friends. aside from stimulating social interactions, socialelection additionally has several potential industrial values. Advertis- ers will initiate votings to advertise bound brands. Product managers will initiate votings to conduct marketing research. E-commerce house owners will strategically launch votings to draw in additional on-line customers.

### **LITERATURE REVIEW**

- 1) Recommender systems applicable to a good broader vary of applications [1].
- 2) Social network as a star-structured hybrid graph targeted on a social domain, that connects with alternative item domains [2].
- 3) Extensive experiments on a true social dataset demonstrate that HRW considerably outperforms existing approaches[3].
- 4) Human behavior is believed to unfold through face-to-face social networks, however it's tough to spot social influence effects in empiric studies, and it's unknown whether or not on-line social networks operate within the same method [4].
- 5) The result of social transmission on real-world selection was larger than the direct result of the messages themselves, and nearly all the transmission occurred between 'close friends' WHO were additional probably to possess a face-to-face relationship.[5].
- 6) Viral promoting takes advantage of networks of influence among customers to inexpensively attain giant changes in behavior [6].
- 7) Achieving an oversized reduction in machine value, and apply them to knowledge from a knowledge-sharing website [7].

8) Our results show the lustiness and utility of our approach.[8].

9) From basic techniques to the progressive, we have a tendency to conceive to gift a comprehensive survey for CF techniques, which will be served as a roadmap for analysis and follow during this

### III. SYSTEM DESIGN

This chapter discusses about the various steps involved in system design process. The functions that are used are also discussed.

#### 3.1 System architecture

Figure 3.1 is the system architecture of the application. The figure clearly depicts various steps carried out in the process of detection and analysis of content creator collaborations using social media and social voting.

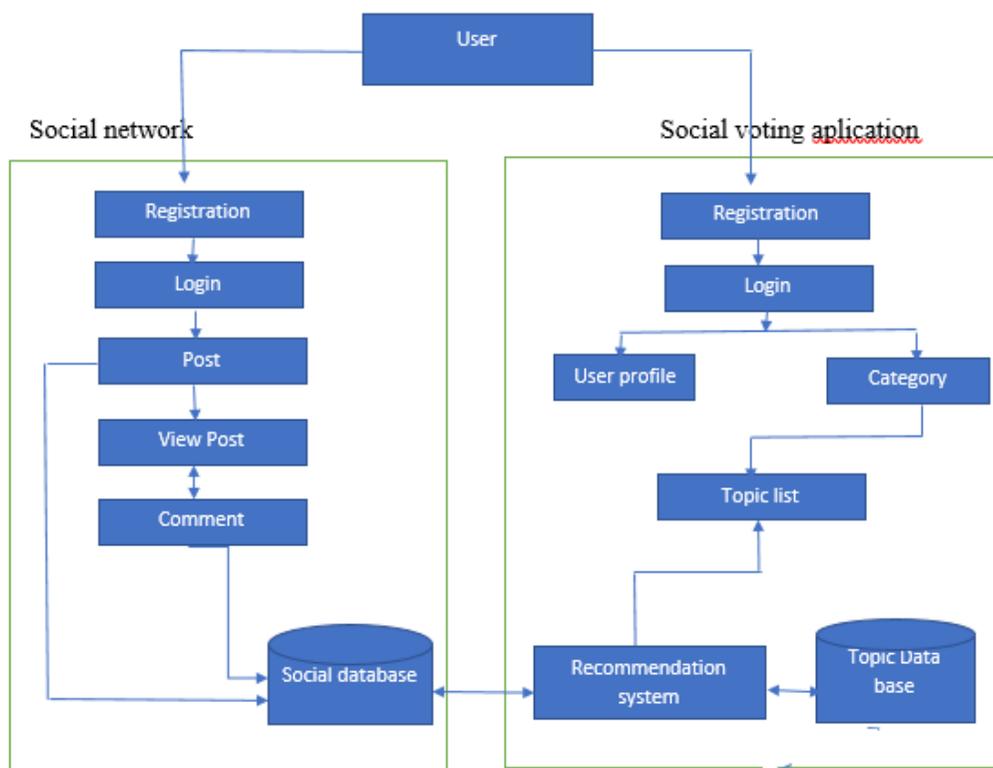


Fig 3.1 System Architecture

Figure 3.1 is that the system design of the appliance. The figure clearly depicts numerous steps disbursed within the method of detection and analysis of content creator collaborations victimisation social media and social vote.

Fig 3.1 System design

#### Admin

The admin needs to login by victimisation valid user name and word. when login sure-fire he will perform some operations likeauthorizing users ,list users and authorize ,view all friend request and response, add posts, read all posts with videos ,view allcounseled posts, read all service usage reviewed posts, read all user search history, read cooperative filtering based mostlyrecommendation, realize high k hit rate in chart.

#### User

The User ought to register before playing any operations. Once user registers, their details are going to be keep to theinformation. when registration sure-fire, he needs to login by victimisation approved user

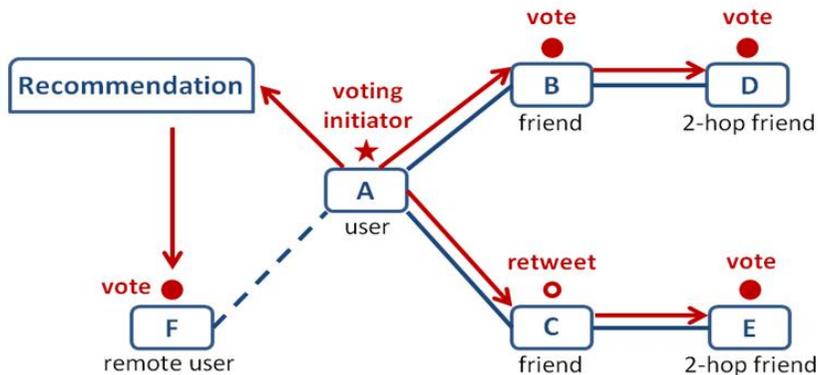
name and word. Once Login is sure-fire user will perform some operations like Register and Login, read your profile, Req for friend, realize Friends, read all of your friends, Search Post, My Search History, read Recommends, read User Interests within the pos, read high K Hit Rate.

**Applications of the Project:**

Recommend fascinating or in style data as judged by the community  
 Ability to come up with additional customized recommendations by analyzing data from the past activity of the precise user.

**IV. Related Work**

One-class collaborative filtering (OCCF) deals with binary rating data, reflecting a user’s action or not. In OCCF, only positive samples are observed, and there are a large number of missing entries. OCCF has been widely studied, such as [17]–[19]. This paper can also be classified into OCCF. The difference is that we are dealing with binary data from multiple channels, consisting of binary user-voting activities, user–user trust relationships, and user-group affiliations. We are the first to study recommendation of the emerging online social votings to the best of our knowledge.



**Fig. 4.1 Social voting propagation paradigm**

NN algorithms identify the so-called neighbors of a target user. A prediction of item preferences or a list of recommended items for the target user can be produced by combining preferences of the neighbors. Jamali and Ester [26] proposed an approach, namely Trust-CF, to incorporate social network into NN-based top-k RSs. Trust-CF calculates the predicted rating for a candidate item as the weighted average of all observed ratings in the traditional CF neighborhood and social neighborhood. Trust-CF does not work with binary data set, as the weighted average of all observed items is 1.

**V. Social Voting**

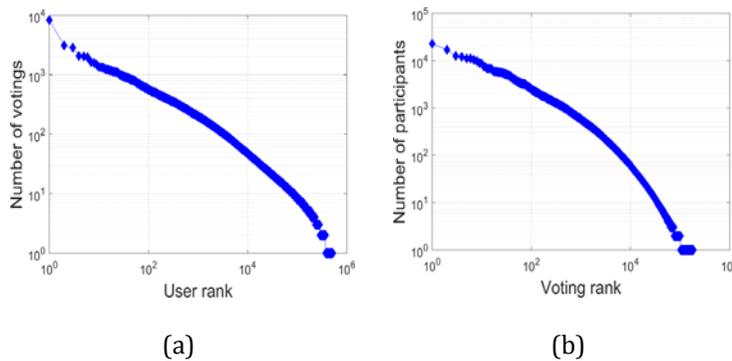
Voting is an embedded feature of Sina Weibo. More than 92 million users have participated in various votes on Weibo as of January 2013. There are more than 2.2 million ongoing voting’s available on Sina Weibo each day. As shown in Fig. 1, any user can initiate a voting campaign. After a voting is initiated, there are two major ways through which other users can see the voting and potentially participate. The first way is social propagation: after a user initiated or participated in a voting, all his/her followers can see the voting; a user can also choose only retweet a voting to his followers without participation. The other way is through Weibo voting recommendation list, which consists of popular voting and personalized recommendation. We have no information about Weibo’s voting recommendation algorithms.

**Table 1: General Statistics of Weibo Data Set**

Users	1,011,389	Social realations	83,636,677
Votings	185,387	User groups	5,643,534
Groups	299,077	User with votings	525,589
User votings	3,908,024	User with groups	723,913

### 5.1 Measurement Study

We obtained user-voting logs directly from the technical team of SinaWeibo.2 The data set covers votings from November 2010 to January 2012. The data set has detailed information about votings each user participated in, voting contents, and the end time of each voting. We only know user-voting participation, not user-voting results, i.e., we do not know which voting option a user chose. The data set also contains social connections between users and groups a user joined. The data set only contains bidirectional social links, i.e., A follows B and B follows A. Our following study is thus focused on the impact of social ties between users with more or less equal statuses. Summary statistics of the data set are shown in Table I. On average, each user has 82.7 followees, and each user has participated in 3.9 votings. To gain more understandings about how users are connected and how social votings propagate in OSNs, we calculate the social distances, i.e., the length of shortest path in the social networks, between different types of user pairs. We consider the entire social network with 1 011 389 users as a graph and randomly select 10k users as the source vertices. We iteratively conduct breadth-first-search (BFS) to compute the shortest path distance between each of those sources and all other vertices along social graph edges.



### 5.2 Social Voting Recommendation

We consider *top-k voting recommendation* in OSNs. For each user, the RS has to recommend a small *number*, say *k*, of votings from *all available* votings. We introduce performance metrics for top-*k* recommendation in Section IV-A. MF methods were found to be very efficient in general top-*k* recommendation [10],[12]. Furthermore, social network information can be exploited to improve the accuracy of top-*k* recommendation [14], [26]. For this reason, we start with MF approaches using both social network information and group affiliation information. In Section IV-B, we propose a multichannel MF model, which factorizes user-voting inter-

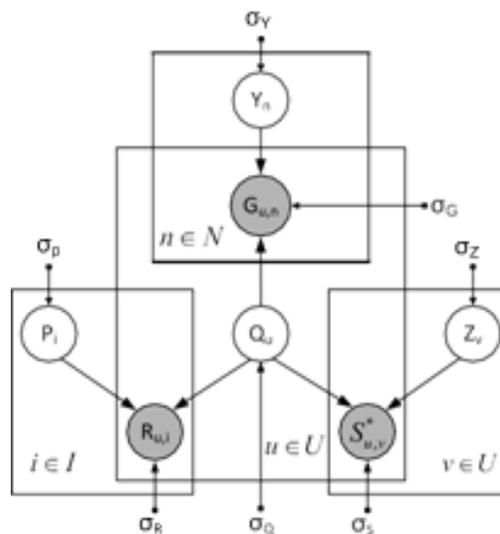


Fig.5.2.1. Graphic model of Weibo-MF.

## VI. Experimental Work

### 6.1 Methodology

We evaluate the performance of a set of voting RSs using the same trace. We use a simple popularity-based RS as the baseline model.

**A. Most Pop:** This RS recommends the most popular items to users, i.e., the votings that have been voted by the most numbers of users. For the Weibo-MF model proposed in (5), we evaluate several variants by setting different weights for social and group information.

**1) Voting-MF:** By setting  $\gamma_s = 0$  and  $\gamma_g = 0$  in (5), we only consider user-voting matrix and ignore social and group information. Note that Voting-MF is essentially the same as AllRank model, which is proposed in [12]. AllRank was found to be the best model of optimizing top- $k$  hit ratio on various data sets according to [10] and [12].

**2) Voting Social-MF:** By setting  $\gamma_s > 0$  and  $\gamma_g = 0$ , we additionally consider social network information on top of Voting-MF.

**3) Voting Group-MF:** By setting  $\gamma_s = 0$  and  $\gamma_g > 0$ , we additionally consider user-group matrix information on top of Voting-MF.

**4) Weibo-MF:** By setting  $\gamma_s > 0$  and  $\gamma_g > 0$ , we add both social and group information to Voting-MF.

**TABLE II:** Top- $k$  hit rate of mf methods ( $j_0 = 10$ ). the percentage numbers in each cell are the relative improvements over the mostpop baseline. the standard deviations of the results are within 0.006

Top K	10	20	50	100
Most pop	0.032	0.052	0.087	0.123
Voting-MF	0.045 46.32%	0.076 52.36%	0.137 53.45%	0.241 60.2%
Voting+social MF	0.049 53.1%	0.079 58.0%	0.048 70.1%	0.217 70.9%
Voting+grouping-MF	0.48 50.0%	0.78 56.0%	0.45 60.1%	0.128 77.1%
Weibo-MF	0.55 56.3%	0.80 60.0%	0.148 70.0%	0.128 71.7%

### 6.2. MF-Based Approaches

We tune the regularization constant  $\lambda$  and the optimal value is 0.5. For the dimensionality, we choose  $j_0 = 10$ . We tune the remaining parameters to optimize top-20 hit rate. The performance of MF-based RSs is compared in Table II. In Voting-MF model, the parameters that lead to the best top-20 hit rate are:  $w_m = 0.01$  and  $r_m = 0$ . As expected, *Voting-MF significantly outperforms the naive popularity-based RS*. Since user-voting data are binary, impute the missing value of user-voting as  $r_m < 1$ , leading to the same result as  $r_m = 0$ .

### 6.3. Different Views

To gain more insights, we present experiment results of four different views: cold users, who have less than five votings; heavy users, who have more than ten votings; hot votings, which attract no less than 1000 users; and nonhot votings, which attract less than 1000 users. We calculate top- $k$  hit rate for each view separately. The results are presented in Tables IV and V. From Table IV, we make the following observations. For hot votings, among all the single methods, UVUV performs the best. It might be because UVUV tends to recommend hot votings, and/or UVUV returns more accurate hot votings. We will look into this issue more in Section V-E. For nonhot votings, UNN performs the best among all single methods, and Voting-MF ranks the second. Thus, we see here MF-based approaches (UNN and Voting-MF) not only learn users' mainstream interests (hot votings), but also learn users' nonmainstream interests (nonhot votings) efficiently. Comparing UUV(1-hop) with UUV(2-hop), we can see that UUV(1-hop) is much better in nonhot voting and UUV(2-hop) is much better in hot voting. It can be explained that nonhot votings are local events, and cannot propagate far away in social networks, and thus do not need users far away for recommendation. To the contrary, hot votings can propagate widely in social network, so friends within 2-

hops can be useful in recommending hot votings. Intuitively, with more samples from a larger neighborhood, recommendation of hot votings can be made more accurate.

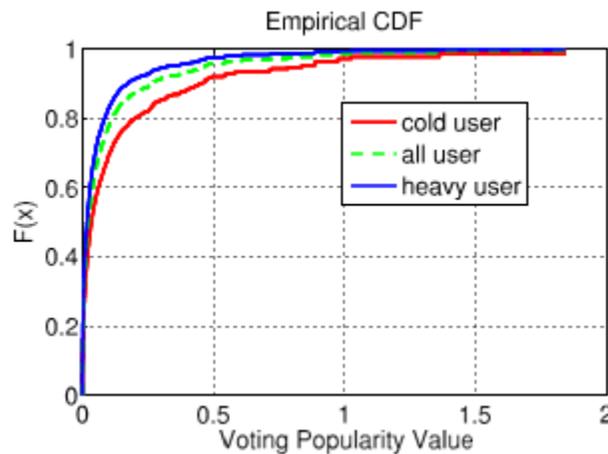


Fig.4. Comparison of cold users', heavy users', and overall users' tendencies for popular votings.

Comparing UGUV UNN with UNN, UGUV UVUV with UVUV, UUV(2-hop) UNN+ with UNN, and UUV(2-hop) UVUV with UVUV, we can see that both group information and social information can improve the hit rate of hot votings, while nonhot voting hit rate stays the same or even slightly worse. This suggests that while larger neighborhood can promote hot votings better, it might have negative impact on nonhot votings.

## VII. Conclusion

we have a tendency to gift a group of MF-based and NN-based RSs for on-line social selection. Through experiments with real knowledge, we have a tendency to found that each social network info and cluster affiliation info will considerably improve the accuracy of popularity-based selection recommendation, particularly for cold users, and social network info dominates cluster affiliation info in NN-based approaches. This paper incontestable that social and cluster info is way a lot of valuable to boost recommendation accuracy for cold users than for serious users. this is often thanks to the very fact that cold users tend to participate in standard voting's. In our experiments, straightforward metapath based NN models shell computation intensive radio frequency models in hot-voting recommendation, whereas users' interests for non hot voting's will be higher strip mined by radio frequency models. This paper is simply our start toward thorough study of social selection recommendation. As an on the spot future work item, we might wish to study however selection content info will be strip-mined for recommendation, particularly for cold voting's. we have a tendency to are inquisitive about developing selection RSs custom-made for individual users, given the provision of multi channel info concerning their social neighborhoods and activities.

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# Green Cloud Computing

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**ABSTRACT:** *Cloud computing is emerging as a critical information communication technology to heavily impact our daily life in the future. As computing becomes increasingly pervasive, the energy consumption attributable to computing is climbing that marked the foundation of Green Computing. Green Cloud is an Internet Data Center architecture which aims to reduce data center power consumption, and at the same time guarantee the performance from users perspective, leveraging live virtual machine migration technology. Saving energy or reduction of carbon footprints is one of the aspects of Green Computing. Green Cloud Architecture enables comprehensive online-monitoring, live virtual machine migration and VM placement optimization. A Green Cloud System responds to peak utilization periods and adjusts availability of resources based on them expanding or shrinking the cloud as needed. The aim of this paper is a literature study of the challenges and various issues in field of Green Computing and discusses the future scope of Green Clouds.*

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## 1. Introduction

Green Clouds combines and scatter excess cloud capacity. The cloud platform of Green Clouds reacts to the speedy increasing, prerequisite for adjustable quantity on one hand, and large number of wasted in reserve on other. Green Clouds emerges as a solution to save power by utilizing server consolidation and virtualization technologies. Fine tuning resource utilization can reduce power consumption. Cloud computing platform is the next generation IT infrastructure that enables enterprises to consolidate computing resources, reduce management complexity and speed the response to business dynamics. Improving the resource utilization and reduce power consumption are key challenges to the success of operating a cloud computing environment. To address such challenges, we design the Green Cloud architecture. The Green Cloud Architecture is a flexible architecture with offline configuration and server implemented clones. The Green Cloud Architecture includes the Green Broker that analyzes user requirements. It calculates cost and carbon footprint of services and carbon aware scheduling, The Green Offer Directory lists services with their discounted prices and green hours and The Carbon Emission Directory contains data on Power Usage Effectiveness, cooling efficiency, carbon footprint, network cost. It helps user to select cloud services with minimum carbon footprint. The Green Cloud Architecture enables comprehensive online monitoring, live virtual machine migration, and VM placement optimization. The Green Cloud Architecture infers a concern over the structure and the social responsibility of energy consumption so aiming to insure infrastructure sustainability without breaking contracts. Therefore, the Green Cloud architecture reduces unnecessary power consumption in a cloud computing environment. Green Cloud architecture, help consolidate workload and achieve significant energy saving for cloud computing environment, at the same time, guarantees the real-time performance for many performance-sensitive applications. Organizations are realizing that the sources and amount of their energy consumption significantly contributes to greenhouse gas (GHG) emissions. In response to this awareness, organizations are currently using the following equation:

Reduced Energy Consumption = Reduced Green House Gas Emissions = Reduced Operational Costs for the data center and business [1]. A typical data center consumes energy in four basic areas: (i) Critical Computational Systems that is servers, network and storage. (ii) Cooling Systems. (iii) Power conversion such as Power Distribution Units and (iv) Hoteling.

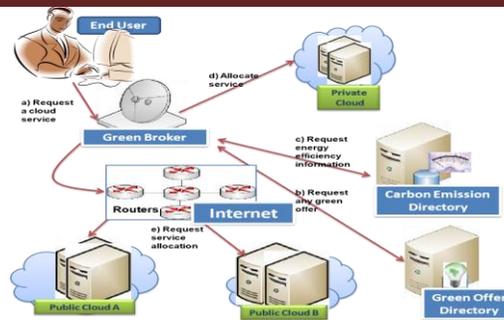


Figure. 1: Green Cloud Computing Architecture

## II. GREEN DATA CENTER APPROACH

Green Data Center approach will continue efforts to reduce greenhouse gas emissions and help preserve the environment. Data Center energy is related to carbon emissions and three key factors that affect carbon footprint of a data center are: Location, IT Load and electrical efficiency. A geographical location which experiences extreme temperatures and humidity levels will consume more energy as the data center physical infrastructure systems work harder to maintain consistent, moderate temperature and humidity levels. IT load reflects how much power the IT equipment in the data center consumes. The IT load consists of all of the IT hardware components that make up the IT business architecture: servers, routers, computers, storage devices, telecommunications equipment, as well as the security systems, fire and monitoring systems that protect them. Loads can go up (an increase in processing requirements from the lines of business) or down (impact of virtualization or consolidation).

### A. Tools for Estimation of Electrical Carbon Footprint:

Following web based tools can arrive at an estimated carbon footprint for data center:

- Data Center Power Sizing Calculator- The Data Center Power Sizing Calculator defines basic characteristics of the IT load and calculates how much utility power would be required to support that load. The interactive nature of the tool allows the user to experiment with “what if” scenarios by modifying the load characteristics of servers, mainframes, and storage. Total load is then calculated and the tool generates a corresponding utility power requirement.
- Data Center Efficiency Calculator- The Data Center Efficiency Calculator profiles a data center and calculates the resulting efficiency and electrical cost based on key characteristics of the data center. The user inputs details of the power and cooling infrastructure, and results are calculated based on a tested and validated four-parameter efficiency model.
- IT Carbon & Energy Allocation Calculator- This tool allocates carbon emission and energy costs to data center users. The goal is to make users aware of the energy costs they incur and to encourage them to pursue energy saving approaches such as virtualization and server retirement.
- Data Center Carbon Calculator- The Data Center Carbon Calculator tool calculates the “green” characteristic of a data center by converting energy usage rates into carbon emissions. This tool shows how hypothetical changes to a data center’s location, efficiency, and IT load affect carbon dioxide emissions and the electric bill. The inputs to the carbon calculator are straightforward:
  - Physical infrastructure details for two scenarios – before and after
  - IT load – before and after
  - Geographical location of the data center.
- “Green Data Center in a Rack”- This approach incorporates cloud computing using low power CPUs, servers, renewable energy. For Green Cloud Computing in general 42 units high rack is designed with low energy usage equipment. Each rack contains the ability to perform complete data center functions. It can provide content management, web services, email, calendaring and other applications that are cloud enabled. This “rack” design can be powered using renewable energy integrating the solar charge controller and batteries into the rack. Using this green data center rack reductions can be made in three main areas: Power Equipment, IT Equipment and Cooling. The Green Cloud Computing Data Center in a rack requires 94% less energy that makes renewable energy both feasible and affordable.

	Switch Gear	UPS	PDU	IT Gear	Zone AC	Total
Green Cloud	0.05	0.08	0.05	.6	0.2	0.98 KW

f. Virtualization- One of the main trends of Green Computing is virtualization of computer resources. Abstraction of computer resources, such as the running two or more logical computer systems on one set of physical hardware is called virtualization. Virtualization is able to execute applications under many operating systems, manage IT more efficiently, and allot resources of computing with other computers [2]. Virtualization is a trend of Green computing it offers virtualization software as well as management software for virtualized environments [3]. This virtualization form of Green Computing leads to Server Consolidation and enhance computer Security. Virtualization can also increase the efficiency of existing machine rooms, reducing the number of physical servers required through consolidation of existing applications by introducing multiple virtual machines per server and thereby increasing resource utilization. Virtualization allows full utilization of computer resources and benefits in: (a). Reduction of total amount of hardware;

(b). Power off Idle Virtual Server to save resources and energy and

(c). Reduction in total space, air and rent requirements ultimately reduces the cost

g. Green Power Management- There is several different issues; first of all, the merger must be carefully considered as combination of different workloads under common physical suitability of the host. Therefore, in order to determine which components of critical workloads can be packaged together, understanding the nature of the work is rather important. Second, there are problems of a performance and energy optimization because they can cause performance degradation and lead to increased execution time which eats up the energy derived from the lower idle energy savings.

h. Green Cloud Security- Security is a big issue in the cloud and Greenclouds is fully aware of that. The security principles of the platform are based on the concepts of Jericho and Sabsa resulting in end to end security. They are enabled and encouraged by the unique characteristics of the platform. GREENCLOUDS uses industry standard and compliant securities, but adds a unique extra layer.

### III. Issues of Cloud Computing

a. Privacy and Security- As cloud computing is achieving its esteem the concerns about security and privacy issues also increases. Security issues include sensitive data access, privacy, data recovery and multi-tenancy issues. In the cloud computing approach both customer and the provider defines the means of processing thus increasing the chance of risk. Physical Control of any cloud equipment is more secure than having equipment off site that is why green clouds are recommended where in an added benefit is that certain set of technologies can be employed which allows a person to feel as if they are present at a place other than true location making it easier for the information to travel in both direction between user and remote location thus reducing the cost effectiveness and increasing the productivity.

b. Economic Development Issue- The main issue of cloud computing was that the economy was degraded and maximum shares were employed for use of good Information and Communication Technology (ICT) resources and staff. Cloud computing offers more elasticity towards these ICT resources for its compatibility issue and thus making the environment and economy unsustainable. Green Cloud Computing had played an important role in increasing the economy and had a greater impact on the performance of some major government agencies as well. A study by the research firm International Data Corporation (IDC) suggested that the developing markets such as India, Brazil, China and Russia are likely to be important market forces to drive globally towards green clouds and even according to the Springboard Research China and India have the most promising effect to the green cloud related services [5].

Some other issues- In spite that the cloud computing have given the maximum achievements over the last few years still there are some issues around its Green accreditations like the Power Consumption using clouds is still at unacceptable high levels that is the cost of power has jumped to 50% of its hardware[6]. There are still too many manual process employed during cloud computing and the current storage technique fails to offer low cost and most important the complexity of data centers has not been reduced it's just that the cloud platforms are more likely the virtualize servers.

#### IV. Future of Cloud Computing with Green Clouds

The main domain area of Green Cloud

Computing is telecommuting which is the work area where in the employees do not commute to a central place of work. Teleconferencing and Telepresence technologies are the most common work areas which are being implemented using green cloud initiatives. The advantages of using these technologies with green cloud are that it increases employer satisfaction along with reducing greenhouse gas emissions which is related to travel and thus increasing the profit margin of an organization and thus reducing overhead costs for lights and air conditioners. Energy consumption accounts for a large portion of the operating cost of computing clouds. In an EPA report to congress, it was estimated that data centers in the cloud make up 3% of the total energy consumption in the U.S. in 2011[7].

Advantages:

- a. Green Clouds helps in enhancing technological performance by improving reliability, redundancy and security by using world class data center in a rack that operates as an autonomous server which is independent from environmental conditions as it uses direct current power and have complete fire proof environment along with integrated cooling system. The Green Cloud Data Center is also known for its Green Cloud's Mirror-Imaged Disaster Recovery solution in which the data is housed in Green Cloud Virtual environment with its high performance environment powered by infrastructure composed of CISCO and VMware technologies [8].
- b. Green Cloud's solutions will help increase the business productivity by its ease of online access and automatic upgrades with the availability of latest technology and high quality solutions. It helps increase the employee performance as well by making the data services accessible from any location and thus improving the overall efficiency of system along with various concerned activities required for comfortable and beneficial business.
- c. One of the most important advantages of Green Clouds is the feature which is provided by Green Clouds that pay only for what is used which in turn gives the minimized maintenance of all equipment and a predictable cost structure for all expenditures required in future.
- d. Last but not the least Green Clouds have a very positive impact on our environment. Energy consumption is reduced by increasing efficiency and using optimal server utilization. The carbon footprints as per the usage are calculated and a database of energy source composition is created which is used to generate electricity worldwide and then the energy used by Green Clouds is monitored, recorded and calculated to avoid carbon emissions to build truly green environment.

#### V. Conclusion and Future Scope

Technology is an active contributor in achieving the goals of Green Computing. The main key initiatives towards manufacturing Green Computing are equipment recycling, virtualization, power management. In this paper we discussed the green clouds, its architecture and analyzed the Green Data Center approach including its security and Green Power Management. In the review of paper it also shows the future of computing with green clouds. Current trends of Green Computing are towards efficient utilization of resources. For the future research work Dynamic Resource Allocation Technique should be used to manage the workload to increase the efficiency of green clouds. As in for future reference the practical approach of Green Clouds are hoteling where in the square footage per employee is reduced as workers reserve space only when it is required and in Voice over IP the telephony wiring infrastructure is reduced by sharing the existing Ethernet copper and most importantly Green Cloud Computing program and certification programs are demonstrated like Information System Examination Board(ISEB) Foundation Certificate in Green IT is appropriate for showing an overall understanding and awareness of green computing[9]. Green Clouds are most beneficial in areas where climate favors natural cooling and renewable electricity is readily available. Green Data Centres Rack are more efficient in countries like Finland, Sweden, Switzerland where in favorable conditions including the renewable source of energies reduces the high carbon footprint and thus reducing the overall energy consumption[10].

It is important to develop intelligent techniques to take care of the challenge in Green Cloud Computing that is to minimize resource usage satisfying quality of service requirements and robustness and also new approaches and proposals should be analyzed and validated. There are still number of research activities that can be planned to carry out to improve the performance of Green Clouds and bring profitable measures for users to achieve their problem solving transactions and their collaboration in Green IT where in security

concerns must be surely addressed as more the cloud computing will increase there is a chance of increasing threats as well.

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## VR Classroom

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**ABSTRACT:** This paper has been undertaken based on a project, to make a Virtual Reality (VR) website for getting a classroom-like feeling from home. Due to advancements in Javascript technology, a VR website can be made easily and deployed on a proper Web server. A VR environment will help students get the classroom-like experience and they can interact with their teachers, like in a real classroom, For slow internet users or for deaf people, Speech-to-Text will be added. Speech-to-Text will convert the speech of the teacher to printed words, on the wall of the classroom. All things will happen from the comfort of home in smartphones.

**Keywords:** Aframe.io, Javascript, Virtual Reality, NodeJs, Webrtc, Speech-to-Text, mooc

### 1. Introduction

Nowadays, MOOCs (Massive Open Online Courses) are almost becoming mainstream. Many students prefer to study at home, through the internet, to avoid the distraction of a real classroom. Few universities also provide MOOC as a way for getting a degree credit also.

Massive Open Online Course (MOOC) is an online course aimed at unlimited participation and open access via the web. In addition to traditional course materials, such as filmed lectures, readings, and problem sets, many MOOCs provide interactive courses with user forums to support community interactions among students, professors, and teaching assistants, as well as immediate feedback to quick quizzes and assignments.

### II. PROBLEM

On average, only 6% of all HarvardX open online course registrants earn a certificate. It is estimated that only 5 to 10 percent of active participants do proceed to complete MOOCs. Some learners complete one or more modules of their courses, leaving out the rest. The main reason is that students don't get immediate feedback. They don't get classroom-like interaction and experience in a MOOC and so, they don't get the motivation to complete the course.

### III. SOLUTION

Therefore, to solve this, we present the Virtual Reality (VR) classroom. This will help students get the experience of a real classroom from the comfort of their home while getting immediate feedback from their teachers. Students can interact in the VR classroom, like in a real classroom. This will motivate students to complete the course on time. And for slow internet users or deaf students, we have added a way to convert speech of the teacher into text, to be shown on the walls of the classroom. The text will be saved in the form of a text file, as notes for the lecture.

### IV. MOOC INFO

A lot has changed since 2012 when the year the New York Times dubbed it "Year of the MOOC." In India, over the next 10 to 20 years, there will be more than 300 million people that will enter the workforce. And there's no real infrastructure available to train that many people. MOOC can fill that gap.

But the completion rate of a MOOC is still a huge problem.



Traditional MOOC flow

As you can see from the above figure that the traditional MOOC was mainly about watching videos, doing assignments and getting certificate based on score. The looks like a very mundane flow. So, students are bound to lose motivation.

**i) Trends**

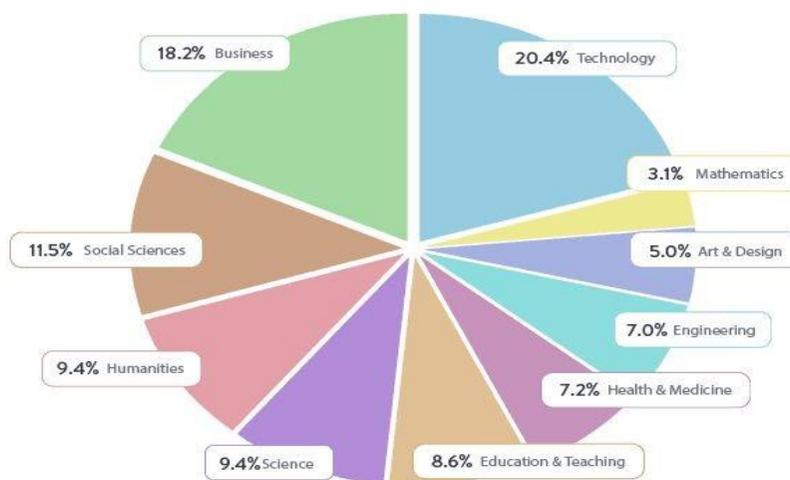
The number of courses has been growing steadily at the same rate now. We have more than 11,000 courses from 900 universities. 2,000 new courses were added to the list this year alone. Just two years later, in 2017, this market has grown to reach an enormous \$255-billion. This represents 238% growth. MOOCs have generally become more flexible. There are shorter courses available. But the discussions between students now seem less interactive and tend to be individual statements of opinion.

The number of available MOOCs has grown dramatically in the last few years, but since user growth hasn't kept up, each course is getting fewer users. The completion rate of MOOC is still a huge problem. Students tend to leave the course halfway. The main reason is that students don't get immediate feedback. They don't get classroom-like interaction and experience in a MOOC and so, they don't get the motivation to complete the course.

**ii) Completion rate data**

Typical rates for learners who have logged into the platform at least once and then go on to complete the course is

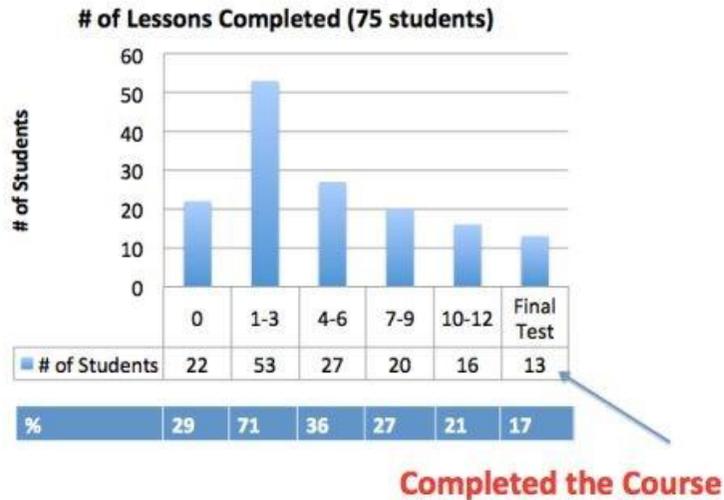
between 5 to 10 percent of active learners. On average, only 6% of all HarvardX open online course registrants earn a certificate.



By the Numbers: MOOCs in 2018

Subjects took by students (Classcentral)

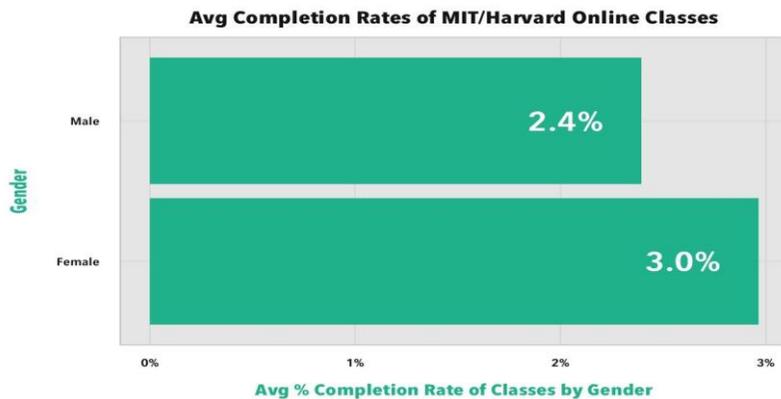
As we can see from the above graph that students in the technology field (20%) take the most number of MOOC. That followed by students taking a course in the business field (18 %) and then students in other fields.



Completion trend in one of the statistics course

Now looking at the completion rate above provides a bleak picture about the percentage of students completing a MOOC. In one of the MOOC about statistics, the percentage of active students dropped from 71% to 17%, when the course was at its end. This shows the motivation of students in course completion.

Course completion certificate shows if a course has been completed. It can show the progress a student is making towards finishing the course according to specific criteria. The criteria can include meeting an activity's grade level or a manual checking "complete" by either the student and/or teaching. But according to the above figure, only 17% of registered students got the Course completion certificate.



Now, from the above figure, we can say that there is not much difference between gender when it comes to average completion rate. Both male and female students seem to have almost similar course completion rate. We conclude that gender has nothing to do with course completion. So, we should not be biased, based on gender when it comes to course completion rate.

**3.3 MOOC vs Distance learning**

In MOOC, the content is accessible 24/7. Media is open source. Students are encouraged to share and contribute materials. Contents are edited when needed.

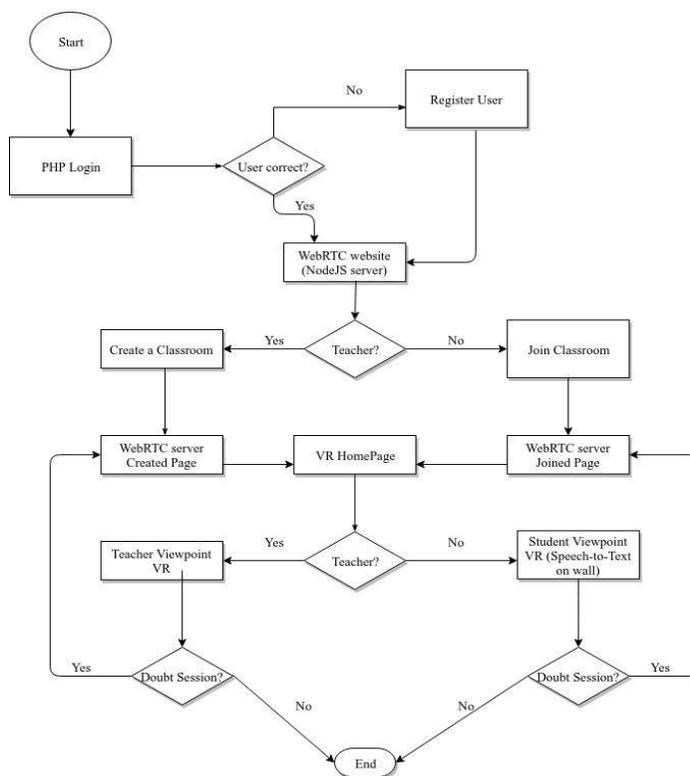
In Distance Learning, materials are available one week at a time. Media is restricted by the university. Contents are edited only at the semester beginning.

In MOOC, lectures are pre-recorded. All content is available from the start in the browser. It is a self-paced/customized learning path. Feedback is dependent on classmates. The course is open-ended with no due dates.

In Distance Learning, students have to travel, to get lectures. Group learns at the same pace/linear learning path. Feedback is dependent on teachers. The course is closed-ended with due dates

### I. Technology used

In this section, we are going to discuss the technology used while creating the VR classroom:-



Flowchart of the technology used

#### i) PHP login<sup>[1]</sup> with MySQL<sup>[2]</sup>

With PHP, you can connect to and manipulate databases. MySQL is the most popular database system used with PHP. The MySQLi functions allow you to access MySQL database servers.

Students and teachers first need to login into the website, created by PHP. After putting the credentials, the PHP connects to MySQL database, to verify the credentials. If the credentials are correct then teacher or student can login. Or else, they are asked to register the account.

This is the first part of the service, to check whether the teacher or the student has a valid account or not. PHP has the most reliable way to create a login page. And MySQL is one of the most secure databases, to store login credentials.

#### ii) WebRTC<sup>[3]</sup> with NodeJS<sup>[3]</sup>

(Web Real-Time<sup>[4]</sup> server Communication) is a free, open-source project that provides web browsers and mobile applications with real-time communication (RTC) via simple application programming interfaces. It allows audio and video communication to work inside web pages by allowing direct peer-to-peer communication, eliminating the need to install plugins or download native apps. Supported by modern web browsers, WebRTC is being standardized through the World Wide Web Consortium (W3C) and the Internet Engineering Task Force (IETF). It is one of the most reliable ways to do video calling in modern web browsers. Node.js<sup>[4]</sup> is an open-source, cross-platform JavaScript run-time environment that executes JavaScript code outside of a browser, on a server. NodeJS as a server is very powerful with very little downtime. Node.js lets developers use JavaScript to write command line tools and for server-side scripting—running scripts server-side to produce dynamic web page content before the page is sent to the user's web browser.

So, after successful login, teacher or student is redirected to a webRTC video calling site, to be used for clearing doubts. The webRTC is deployed on the NodeJS server. Teachers can create a classroom and

students can join that classroom. After the creation of rooms, teacher and student will be redirected to the VR homepage.

### iii) **Aframe A-Frame<sup>[5]</sup> WebVR framework with NodeJS<sup>[5]</sup>**

is a web framework for building<sup>[4]</sup> server virtual reality (VR) experiences. A-Frame is based on top of HTML, making it simple to get started. But A-Frame is not just a 3D scene graph or a markup language; the core is a powerful entity-component framework that provides a declarative, extensible, and composable structure. It was originally conceived within Mozilla. A-Frame supports most VR headsets such as Vive, Rift, Windows Mixed Reality, Daydream, GearVR, Cardboard, Oculus Go, and can even be used for augmented reality. Although A-Frame supports the whole spectrum, A-Frame aims to define fully immersive interactive VR experiences that go beyond basic 360° content, making full use of positional tracking and controllers.

After getting redirected to VR homepage, there are two options. Teacher viewpoint and student viewpoint. If clicked on teacher viewpoint, the teacher is redirected to a VR environment, facing the students in the class. Students is in the form of an avatar. And besides the teacher viewpoint, there will be a board, where the teacher can play lecture video or write on notes on it. For video - `<a-video>` tag will be used. All the entities will be in the `<a-scene>` tag. Each tag corresponds to their own function.

If clicked on student viewpoint, the student is redirected to a VR environment, facing the teacher and the board in the class. Students can see, what's going on the board and see the avatar of the teacher. Students and teachers can interact with each other using webRTC, opened in another browser tab.

Everything is deployed on the NodeJS Server for reliable performance. And all entities of the classroom is made using the aframe libraries, running on the modern web browsers.

### iv) **Speech-to-Text<sup>[6]</sup> with Google Cloud API:-**

Google Cloud Speech-to-Text enables developers to convert audio to text by applying powerful neural network models in an easy-to-use API. The API recognizes 120 languages and variants to support your global user base. You can enable voice command-and-control, transcribe audio from call centers, and more. It can process real-time streaming or prerecorded audio, using Google's machine learning technology.

Using Speech-to-Text, the speech of the teacher is converted into text and to show it on the walls of VR. Speech-to-Text will help deaf students to understand the concept properly. Speech-to-Text will also help students with a slow internet connection. They can read the text if the audio is not clear. At the end of the lecture, the whole lecture of teacher will be stored in a text file, as lecture notes (using Javascript File Output Function). Students can use it to review the lecture later or can use it as lecture notes.

## **IV. Final Conclusion and Future Enhancement**

According to Sebastian Thrun (Founder and President, Udacity, a major MOOC provider), completion rates shot up to a whopping 90%. when their mentors and coaches started giving immediate feedback to the students.

VR classroom aims to increase the student-teacher interaction in the MOOC. Students get the experience of a real classroom from the comfort of their home while getting immediate feedback from their teachers. This will motivate students to complete the course on time. While for slow internet users or deaf students, there is a way to convert speech of the teacher into text, to show on the walls of the classroom. At the end of the lecture, the whole lecture of teacher will be stored in a text file, as lecture notes. This can be used by students to review the lecture later or to use as lecture notes.

Students and teachers will only need a smartphone and VR headset, to open VR website.

To enhance the product further, we have to find a way to add avatars of a student, depending on the number of students logged in. Right now, only fixed four student avatars are shown in the VR classroom. We have to find a way to integrate all the modules in the VR only, including video call, chat and doubt button.

## **V. Acknowledgment**

Sanjit Charkrabarti and Shubham Bartia for contribution and putting all things together

Santosh Viswanatham-For telling us about the aframe WebVR framework. LinkedIn - <https://www.linkedin.com/in/isantoshv/>

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## 5G Network

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**ABSTRACT:** Fifth generation (5G) is a upcoming mobile network technology which will probably be launched in India by 2019-2020 by various leading mobile operators. This paper is focused on all foregoing generations of mobile technology, developmental aspect of 5G technology and basic architecture/concept behind this mobile technology. Few researches have already been done on 5G mobile technology and these researches are mostly related to the development of World Wide Wireless Web (WWW) and Dynamic Adhoc Wireless Networks (DAWN). 5G technology has few very unique features in term of speed/bandwidth which is greater than 1 Gbps, frequency band which is between 3GHZ to 300GHZ, high definition video telephony, high definition multimedia streaming, multimedia newspapers, HD online TV, etc. which makes this technology differ and unique among all the available existing mobile technologies worldwide. Fifth generation is based on IPv6, flat IP and VOIP (Voice Over IP) technologies and through these feature, user will experience a high level of data transmission and call volume service.

**Keywords:** xyz, word.

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### 1. Introduction

5G network is very fast and reliable. The concept of hand held devices is going to be revolutionized with the advent of 5G. Now all the services and applications are going to be accessed by single IP as telephony, gaming and many other multimedia applications. As it is not a new thing in market and there are millions of users all over the world who have experienced the wireless services wireless technology. It is not easy for them to shrink from using this new 5G network technology. There is only need to make it accessible so that a common man can easily afford the profitable packs offered by the companies so that 5G network could hold the authentic place. There is need to win the customer trust to build fair long term relation to make a reliable position in the telecommunication field. To complete with the preceding wireless technologies in the market 5G network has to tender something reliable something more pioneering. All the features like telephony, camera, mp3 player, are coming in new mobile phone models. 4G is providing all these utility in mobile phone. By seeing the features of 4G one can gets a rough idea about what 5G Networks could offer. There is messenger, photo gallery, and multimedia applications that are also going to be the part of 5G. There would be no difference between a PC and a mobile phone rather both would act vice versa .

### Design of 5G Network Architecture

The system model that proposes design of network architecture for 5G mobile systems, which is all IP based model for wireless and mobile networks interoperability. The system consists of a user terminal (which has a crucial role in the new architecture) and a number of independent, autonomous radio access technologies. Within each of the terminals, each of the radio access technologies is seen as the IP link to the outside Internet world. However, there should be different radio interface for each Radio Access Technology (RAT) in the mobile terminal. For an example, if we want to have access to four different RATs, we need to have four different access - specific interfaces in the mobile terminal, and to have all of them active at the same time, with aim to have this architecture to be functional.

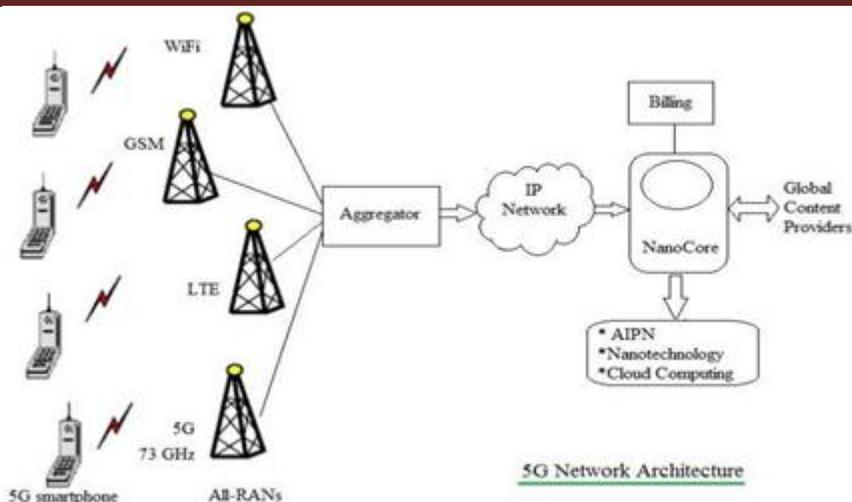


Fig-1: 5G network Architecture

Figure-1 depicts 5G network architecture. This is generic architecture. As shown 5G network uses flat IP concept so that different RANs (Radio Access Networks) can use the same single Nanocore for communication. RANs supported by 5G architecture are GSM, GPRS/EDGE, UMTS, LTE, LTE-advanced, WiMAX, WiFi, CDMA2000, EV-DO, CDMA One, IS-95 etc. Flat IP architecture identify devices using symbolic names unlike hierarchical architecture where in normal IP addresses are used. This architecture reduces number of network elements in data path and hence reduces cost to greater extent. It also minimizes latency. 5G aggregator aggregates all the RAN traffics and route it to gateway. 5G aggregator is located at BSC/RNC place. 5G mobile terminal houses different radio interfaces for each RAT in order to provide support for all the spectrum access and wireless technologies. Another component in the 5G network architecture is 5G nanocore. It consists of nanotechnology, cloud computing, All IP architecture.

### Why is 5G Required?

The major difference, from a user point of view, between current generations and expected 5G techniques must be something else than increased maximum throughput; other requirements include: •Lower out age probability; better coverage and high data rates available at cell edge.

- Lower battery consumption.
- Multiple concurrent data transfer paths.
- Around 1Gbps data rate in mobility.
- More secure; better cognitive radio/SDR Security.
- Higher system level spectral efficiency.
- World Wide wireless web (WWWW).
- More applications combined with artificial intelligent (AI) as human life will be surrounded by artificial sensors which could be communicating with mobile phones. Not harmful to human health.
- Cheaper traffic fees due to low infra structure deployment costs.

### Characteristics of 5G Technology

- The technology 5G presents the high resolution for sharp, passionate cell phone every day and give consumers well shape and fast Internet access.
- The 5G technology provides billing limits in advance that the more beautiful and successful of the modern era.
- The 5G technology also allows users of mobile phones, cell phone records for printing operations.
- The 5G technology for large volume data distribution in Gigabit, which also maintains close ties to almost 65,000.
- The technology gives you 5G carrier distribution gateways to unprecedented maximum stability without delay.
- The information from the data transfer technology 5G organize a more accurate and reliable results.

- Using remote control technology to get the consumer can also get a 5G comfort and relax by having a better speed and clarity in less time alone.
- The 5G technology also support virtual private network.
- The uploading and downloading speed of 5G technology touching the peak.
- The 5G technology network offering enhanced and available connectivity just about the world.
- 5G network is very fast and reliable.

### **Applications of 5G Technology**

- 1) Real wireless world with no more limitation with access and zone issues.
- 2) Wearable devices with AI capabilities.
- 3) Internet protocol version 6(IPv6), where a visiting care-of mobile IP address is assigned according to location and connected network.
- 4) One unified global standard.
- 5) Pervasive networks providing ubiquitous computing: The user can simultaneously be connected to several wireless access technologies and seamlessly move between them these access technologies can be a 2.5G,3G, 4G or 5G mobile networks, Wi -Fi, WPAN or any other future access technology. In 5G, the concept may be further developed into multiple concurrent data transfer paths.
- 6) Cognitive radio technology, also known as smart radio: allowing different radio technologies to share the same spectrum efficiently by adaptively finding unused spectrum and adapting the transmission scheme to the requirements of the technologies currently sharing the spectrum. This dynamic radio resource management is achieved in a distributed fashion, and relies on software defined radio.
- 7) High altitude stratospheric platform station (HAPS) Systems. The radio interface of 5G communication systems is suggested in a Korean research and development program to be based on beam division multiple access (BDMA) and group cooperative relay techniques.

### **Future Scope**

The future enhancement of Nano-core will be incredible as it combines with artificial intelligent (AI). One can able to control his intelligent Robot using his mobile phone. Your Mobile can automatically type the message what your brain thinks. We might get a circumstance where we don't require any spectrum for communication. The Google hot trends have rated the term 6G as the 17th most searched word in the search engines. The iPod 6G comes in seven different colors and has an aluminum body which makes the body strong to with stand constant daily usage. It has a clip on design like iPod shuffle and it attached to shirt firmly. 6G technology haven't been fully revealed yet but search phrases like what is 6G mobile technology, 6G technology, 6G mobile, 6G network, 6G wiki, 6G technology ppt. are getting more familiar with new mobile technology getting evolved.

### **Conclusion**

In this paper, we conclude that 5G network is very fast and reliable. Fifth generation is based on 4G technologies. The 5th wireless mobile internet networks are real wireless world which shall be supported by LAS-CDMA (Large Area Synchronized Code-Division Multiple Access), OFDM (Orthogonal frequency-division multiplexing), MCCDMA (Multi-Carrier Code Division Multiple Access), UWB (Ultra-wideband), Network-LMDS (Local Multipoint Distribution Service), and IPv6. Fifth generation technologies offers tremendous data capabilities and unrestricted call volumes and infinite data broadcast together within latest mobile operating system. Fifth generation should make an important difference and add more services and benefits to the world over 4G. Fifth generation should be more intelligent technology that interconnects the entire world without limits. This generation is expected to be released around 2020. The world of universal, uninterrupted access to information, entertainment and communication will open new dimension to our lives and change our life style significantly.

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## Study on Blockchain

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**ABSTRACT:** To bring blockchain ideas to life, we tend to explore the new technology through an abstract lens to explore the promising riotous qualities that area unit gift at it's terribly core. Blockchain is recently introduced and revolutionizing the digital world transportation a brand new perspective to security, resiliency and potency of systems. Whereas ab initio popularized by Bitcoin, Blockchain is way quite a foundation for crypto currency and more other world applications. It offers a secure thanks to exchange any quite smart, service, or dealings. Industrial growth progressively depends on trustworthy partnerships, however increasing regulation, crime and fraud area inhibiting growth. A Blockchain provides a lower price of trade with a trustworthy contract monitored while not intervention from third parties United Nations agency might not add direct worth. It facilitates good contracts, engagements, and agreements with inherent, sturdy cyber safety features. This paper is a shot to interrupt the bottom for presenting and demonstrating the utilization of Blockchain technolog in multiple industrial applications. Blockchain is that the technology of the long run.

**Keywords:** Blockchain, Bitcoin, Cryptographic currency and Bitcoin applications

### 1. Introduction

What is Blockchain?

The blockchain is defined as an open ledger that offers decentralization to the different parties. It has three major factors which are transparency, immutability, and security. Many other features including being open, distributed, ledger, Peer to peer and permanent.

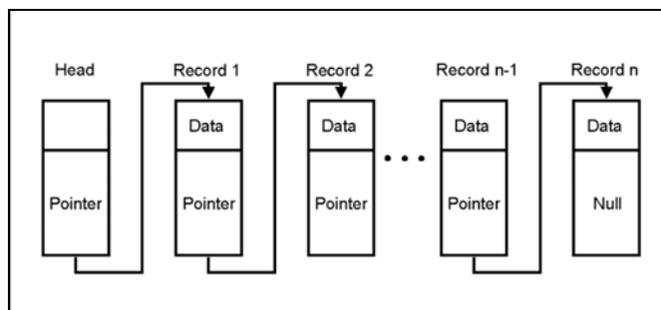
The term Blockchain was initial introduced within the white book of Bitcoin in 2009 by Satoshi Nakamoto. Bitcoin is on its thanks to implementing lightning network and alternative advanced options. There will be a term "blockchain technology" in relevancy of Bitcoin and alternative cryptocurrencies. For the inexperienced, the term might sound abstract with very little real which means on the surface. The blockchain technology may be a vital part of cryptocurrencies.

### 1. Pointers

Pointers area unit variables in programming and to store another variable also. Eg. int a = 10, means there's a variable "a" that stores whole number values. This can be a traditional variable. The Pointers, however, rather than storing value, it can store an ddresses of alternative variables.

### 2. Linked lists

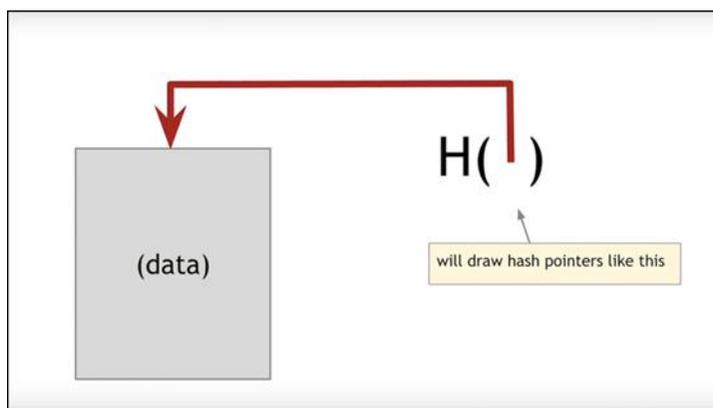
A linked list is an important term in data structures.



It is a sequence of blocks, where every containing knowledge is joined to succeeding block using a pointer. The pointer variable which contains the address of succeeding node in it and thus the affiliation is created. The last node, includes a null pointer which suggests that the pointer has no worth. The main point

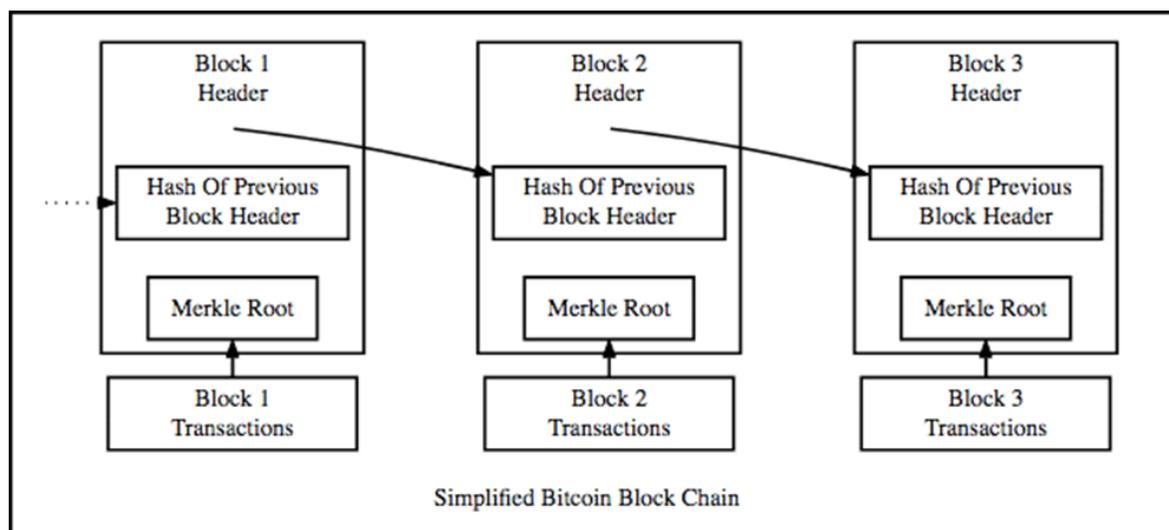
here is, that the pointer within every block contains the address of succeeding block. That's how we get the information is achieved. Currently you would be asking what is the meaning for the primary block within the list when the pointer of primary block stays! The first block is termed the "genesis block" and its pointer calls at the system itself.

If you're asking what the "hash pointer" it suggests that, it's a pointer that contains the hash of the previous block. As you seen now, this can be the structure of the blockchain which is predicated on the first block is called the genesis block and its pointer lies out in the system itself. Now we will see the diagram below:



You guys might be guessing what the hash pointer means, it is a pointer which contains the hash of the previous block.

A blockchain is basically a linked list and the diagram is given below:

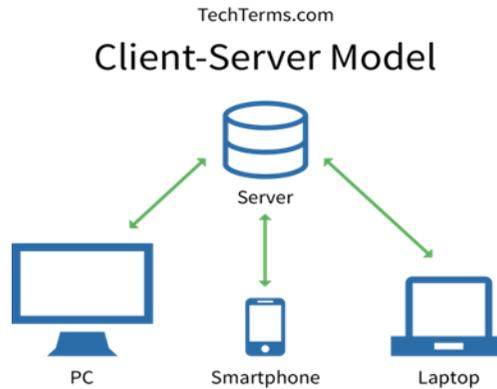


The blockchain is a joined list that contains knowledge and a hash pointer that points to its previous block, therefore it is making the chain. What is a hash pointer? A hash pointer is analogous to a pointer, rather than simply containing the address of the previous block it additionally contains the hash of the info within the previous block.

The two main aspects of the blockchain technology are

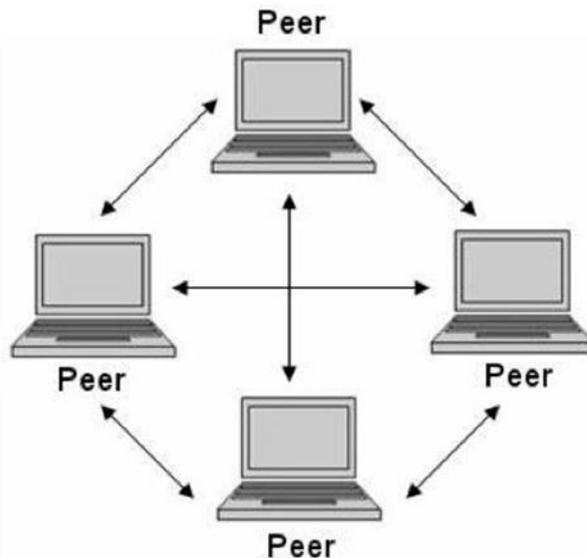
- Decentralization.
- Immutability

## 1. Decentralization



There is a centralized server. And anyone who wants to connect with the server can send a query to get the required information. This is how the internet works. When you want to Google something, you send a query to the Google server, which comes back with the results. Therefore it is a client-server system.

Since everything is dependent on the server, it is critical for the server to be functioning at all times for the system to work. It is a bottleneck. For whatever reason if the main server stops working, everyone in the network will be affected. Plus, there are also security matters. Since the network is centralized, the server itself handles a lot of sensitive information regarding the clients in a centralized. This means that anyone can hack the server and get those pieces of information. Therefore it is also the issue of censorship. This is a peer-to-peer network connection.



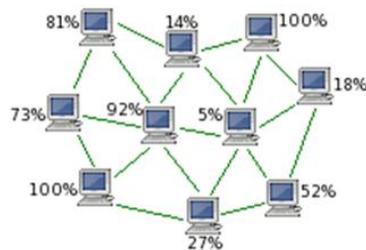
One of the main uses of peer-to-peer network is file sharing which is also called torrenting.

**Traditional Centralized Downloading**

**Decentralized Peer-to-Peer Downloading**



- Slow
- Single point of failure
- High bandwidth usage for server



- Fast
- No single point of failure
- All downloaders are also uploaders

The blockchain technology works in a decentralized nature.

**2. Immutability**

Immutability, it implies that once one thing has been entered into the blockchain, it cannot be tampered with-it again. the property of blockchain is cryptanalytic hash perform. In easy terms, hashing means that taking an input string of any length and giving out an output of a hard and fast length. There Is an area unit bound properties that a cryptanalytic hash perform must have so as to be thought of secure. You can examine those thoroughly in our orientate hashing. There is only 1 property that we wish you to target these days. it is known as the Avalanche impact. the one little tweak is what makes blockchains therefore astonishingly reliable and trailblazing.

**2. Blockchain applications in different industries**

**Financial services**



Blockchain money services are redefining of our current money markets infrastructure. The future of finance is used by digital ledger technology.Bitcoins can also be used in financial services and faster transactions.

Distributed ledger systems in a number of these cases don't have to be compelled to be entirely localized, and a number of other money establishments are viewing making their own private blockchains.

**Government**



Blockchain Technology, it is also known as Distributed Ledger Technology (DLT). The distributed ledger will work to dramatically optimize business processes through a lot of economical and secure information. It can also give the exact information which is required by the user without tampering the data, it gives the users uncorrupted data.

### **Healthcare**



Blockchain Technology has the potential to disrupt an industry's centralized operations, it can provide optimized business. The Distributed Ledger Technology is an innovation fertile with an improved transparency and security.. Good contracts on the blockchain operate mechanically while not third-party personnel required to verify documents or specific measures for pen-and-paper processes.

### **Identity**



Blockchain technology provides the ultimate core to power up digital identities. Where as digital identities are rising as an inevitable a part of our connected world. We have a tendency to secure our online information with an intense scrutiny. Blockchains are primarily based on identity systems which will give an answer to the current issue with enforced cryptography and distributed groups. It can give a secure connection to the users , in the sense we are securing their data by cryptography and distributed groups. And mainly there wont be an manipulation of users data.

### Money



Crypto currencies give people across the world with instant, secure, and liquid cash, and blockchains give the permanent record storage for his or her transactions. Previous systems needed users to trust a central authority which is financial provide and payment transfer won't be tampered . Blockchain technologies are obsolete this technique of payment transfer by providing a trustless environment so there's now not a requirement to place their trust in a third party to confirm your payment transfers, therefore making a Person-to-person environment

### Contracts



It is a code which is stored in blockchain network where all the parties in contract agrees. In blockchain applications, smart contracts are verified on the blockchain, leaving programmable, self-executing contracts. Blockchain conjointly compromises the thought of Smart firms which incorporates the ideas like localized Autonomous Corporations or localized Autonomous Organization.

### 3. Issues

#### 1. The Problems with ancient Paper Ballot System

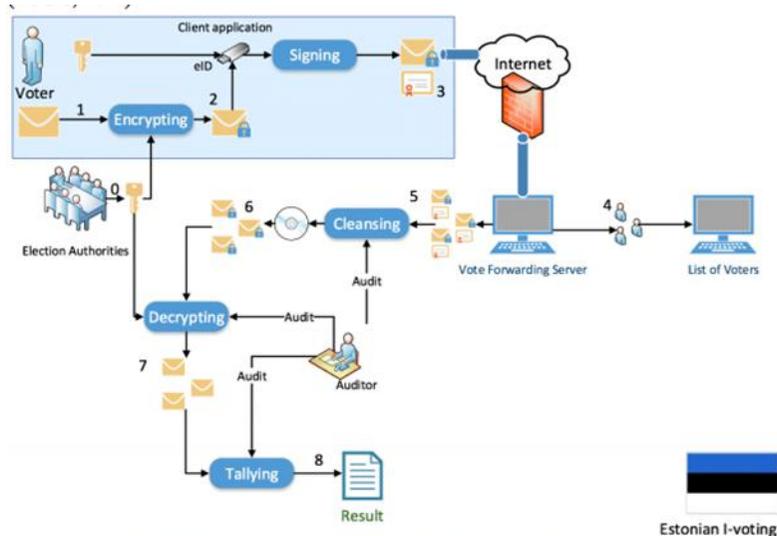


Figure 3: Estonian Digital Voting System (Source: R. Verbij. "Dutch e-voting opportunities." Master thesis, University of Twente, 2014)

The system can't be machine-driven and is very tedious. From truly physically progressing to the programs wherever the ballot boxes square measure unbroken to waiting in long lines. The complete method is very long. The amount of your time taken to count the votes is more. The election are often hijacked via the insertion of phony ballot papers. A lot of powerful parties will use intimidation techniques on the venues to rig the election in a very sure method. The number of paper wastage will cause hurt to the setting. There's no historical paper doable to stay track of every and each vote created. The price of expenditure on paper ballots is incredibly high. It's not possible to stay track of your vote. Once you've got forged a vote you cannot amendment.

## 2. The Problem with Centralized Identity Management

When databases act as a centralized repository for a lot of individuality data all connected to real peoples, the storage center instantly becomes a product with price on the far side our comprehension. The non-public information business could be a crore. Whether or not that company sells that product to the very best bidder themselves or a criminal component becomes concerned, your data could be a goods. Even the foremost reputable corporations take part in collecting the marketing user information, and you will have even united to that once you registered. Businesses use your information to profit victimization your stats and demographic information to enhance their promoting methods.

The centralized identity management systems businesses use.

- 1) huge source of information in vulnerable databases
- 2) usually use it for private gain
- 3) sells it as a "product" to third-parties with or without user permission,

### Identity management

Identity theft happens once a hackers gains access to you in person specifiable data through one in every of several methods. Many have their identity purloined annually within the world and become victims of fraud. on-line thieves will access your data by making a faux website and requesting personal information to permit access, the tried and true email scams, planting malware on your laptop, hacking a weak parole with no two-factor authentication, finding your recent mobile or portable computer within the trash, and targeting your kids on-line. Hackers will use spyware to reap your data as you check your bank account or PayPal. These wicked actors won't even think to use your data themselves, however we should, sell it to different parties. Your personal data is improbably valuable to plenty of various on-line players for a spread of reasons. Only 1 of the ways in which it's valuable is to identity thieves World Health Organization will then file and collect your official document as an example.

## 4. Results

### 1. The Blockchain solution

Companies like Follow My Vote area unit victimization the blockchain technology and Elliptical Curve Cryptography to bring option to the twenty first century. Their goal is straightforward; create the election method as clear as doable. Hardly anyone is aware of that. This is what Follow My Vote is reaching to do. Any potential citizen will firmly login victimization their digital camera and government issued ID. Once they're done the option, anyone will use their option ID to trace their votes and make sure it's been forged properly. On prime of that. They even provide their voters the flexibility to vary their votes any variety of times until the point. They use Elliptical Curve Cryptography to make these votes. ECC may be a variety of uneven cryptography. Uneven cryptography uses 2 keys a public key and a personal key to write in code and decipher information. ECC is essentially what bitcoin and ethereum use for his or her cryptography. One factor to notice, the non-public key shouldn't be disclosed to anyone however the user and therefore the public key generates a public address that is shared with everyone.

### 2. Decentralizing Identity Management

The identity management business and very any service that needs users to supply personal knowledge might improve their current models by introducing blockchain infrastructure. Cryptography is wont to separate knowledge from identity. Through this separation, corporations will get the info they have whereas still protective user privacy. This creates a success scenario for each user and Supplier. Here Are the three main ideas that outline suburbanized identity management:

#### Public, non-public and key/pair

This is the muse for the way blockchain cryptography functions. Public/Private key-pairs are called "asymmetric cryptography." The system uses key pairs to eliminate the necessity for third-party verification. Non-public keys area unit known solely by the owner, whereas public keys is distributed to anyone. The general public keys won't to verify that a holder of a particular public key's the one causation the message. The non-public key will decipher the message that was originally encrypted with the general public key. This methodology eliminates the necessity for private knowledge to be used as a method to supply verified and attested access.

## **Blockchain Identity**

A universal blockchain identity that would be accepted in any respect major venues wherever personal info is currently needed. A wide used blockchain I.D. thought has nevertheless to be adopted however is doubtless viable. Having one blockchain identity might cut back the necessity to share any personal info in any respect. Your identity is attested once on the blockchain, and you may use a logo of this authentication to supply you with access to alternative on-line or on-chain portals and platforms. this might place associate degree finish to fraud whereas streamlining presently tedious registration processes wherever we have a tendency to place all our non-public data up for grabs. Blockchain provides technology to form self-sovereign identities attainable empowering people to have their identity info totally.

## **5. Conclusion**

We deliberately avoided showing the blockchain's impact on the banking sector to keep the list as non-fintech as possible. Blockchain can dictate the future of identity management solutions for people, governments, etc... Identity management has been known united of the foremost major use cases for blockchain technology since its original conception. It will work to stop additional pertinent and apparent problems like fraud and tampering of data, it can even give a complete new framework for the way we expect regarding personal knowledge and identity. It will be overwhelming and horrible to deem the probably many times we've registered for websites and given away our valuable and personal info in exchange for product or services. Blockchain and asymmetrical cryptography square measure extraordinarily viable solutions to the present larger cybersecurity issue. It'll presently become a business customary that websites use DApps and public/private key pairs to eliminate the necessity for biometric identification. There could can be a consistent Blockchain I.D. for which it will produce a universal authentication on the blockchain which will be changeless and used as pre-supposed biometric identification across all websites and blockchains. my idea is to create these processed additional economical and secured crucial for a functioning trustless future. Banking, healthcare, national security, citizenship documentation, all need identity authentication and authorization. Blockchain technology goes to be utilized in more sectors within the future like in government systems as these systems area unit slow, dense, and corrupted. my vision is to Implement this Blockchain technology in government system will create their operations far more secure.

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# Steganography Technology based cloud security

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**ABSTRACT:** *Cloud computing is a immense technology that is growing vastly within the IT surroundings. The cloud computing faces several security problems each within the service supplier aspect and customer aspect. There are measure several problems mentioned earlier some measure with solutions and coding techniques. Few problems are still with unfound solutions and researchers are attempting to unravel them. several common security problems measure mentioned within the paper and therefore the major security is taken because the security is concerned. This paper says that cloud security is that the major issue within the security concern as a result of each the service supplier and client measure upset regarding the info. the info is that the target for the hackers for assaultive the info center server. the info security problems are analyzed and solutions are mentioned during this paper.*

**Keywords:** *Cloud Computing, IT, Security, hackers.*

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## 1. Introduction

Cloud computing has been important because due to next generation paradigm in computation. within the cloud computing environment, each applications and resources are unit delivered on demand over the net as services. Cloud is an environment of the hardware and code resources within the knowledge centers that give numerous services over the network or the Internet to satisfy user's needs. Rationalization of "cloud computing" from the National

Institute of Standards and Technology (NIST) is that cloud computing allows present, convenient, on-demand shared computing resources and database (e.g., networks, servers, storage, applications, and services) which can be easily provisioned and discharged with minimal management effort or service supplier interaction.

Resources consult with computing applications, network resources, platforms, software services, virtual servers, and computing infrastructure. Cloud computing will be thought of as a brand new computing archetype which will give services on demand at a token cost. Three well-known and ordinarily used service models within the cloud paradigm area unit code as a service (SaaS), Platform service (PaaS), and infrastructure service (IaaS). In SaaS, code with the connected knowledge is deployed by a cloud service supplier, and users will use it through the net browsers.

In PaaS, a service supplier facilitates services to the users with a collection of code programs which will solve the specific tasks. In IaaS, the cloud service supplier facilitates task for the clients with virtual machines and storage to improve their business capabilities. Cloud computing is closely associated with however not an equivalent as grid computing . Grid computing integrates numerous resources along and controls the resources with the unified operating systems to produce high performance computing services, whereas cloud computing combines the computing and storage resources controlled by totally different operative systems to produce services like large-scaled knowledge storage and high performance computing to users. Be overall image of grid computing has been modified by cloud computing.

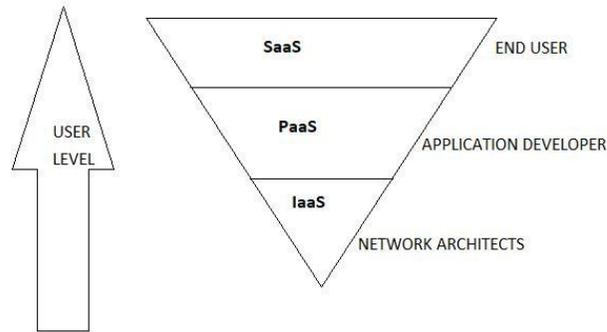


Figure 1: Cloud Architecture Level

### Related Work

In [1] We analysed the security threats, identified in [1], [6] and other public documents from standards bodies, to determine the threats faced by cloud consumers. We have seen how cloud providers are adapting the cloud security standards but how to handle those security remains illusion and also everything depends upon consumers which providers they should support.

In [2] NIST Cloud Computing Reference Architecture is used . NIST Cloud Computing Reference system architecture focuses on security and privacy policies under the purview of the cloud provider. Same concern as in [1] is remaining here as how many cloud vendors are adapting security standards and are capable of handling potential threats is still a problem in this method.

In [3] Privacy and Data Protection ,IT compliance and IT security ,it is IT compliance model which focuses in electronic data processing ,network and IT infrastructure. They just proposed basic security models in their paper which was incomplete as defining model and implementing was quite different.

In [4] A survey on security issues in service delivery models of cloud computing have attempted to determine different cloud security risks and surveyed different security risks to the cloud. They analysed the security threats and other public documents from standard bodies to determine the threats faces by cloud consumers.

In [5] The management of security in Cloud Computing ,the management of cloud security is major concern .They have attempted to determine cloud security issues .They tried a lot of techniques and models have been applied to get security issues in cloud computing areas.

In [6] Cloud Security and Privacy:An Enterprise Perspective on Risks and Compliance it is attempted to determine cloud security issues .It is seen that cloud based solutions are attractive for their cost savings and rapid provisioning privacy and security of cloud data remains a concerned for most clients and a key barrier in adoption of the cloud.

In [7] Understanding Cloud Controls Matrix -It is studied the NIST and CSA security documents .It is seen that various cloud security standards bodies like Cloud Security Alliance (CSA) ,International Organisation for Standards (ISO) and most important governing body National Institute for Standards and Technology.

In [8] The NIST Definition of Cloud Computing -The basic architecture for cloud security modeling used was NIST cloud computing reference architecture classifies security and privacy policies under the purview of the cloud provider.

In [9] Application Security and Development STIG that is Security Technical Implementation Guide and OAuth is used with NIST models. It is open standard for token based authentication and authorization on the internet. It is used in mainly for authorization and deauthorization of third party apps for example Twitter and Facebook.

In [10] Cloud Computing Security issues and challenges are primary concern where it is attempted to determine cloud security issues .Authors have shown concern on cloud security controls and standards has been focused primarily at the provider end and purely focused on cloud engineering .

### Existing System

Existing model used in cloud computing uses different cryptography methods :

**A. Attribute based encryption(ABE):**

Attribute based encryption is a type of public key encryption A secret key is maintained of user and a ciphertext follows attributes which can be code used for place where user lives.

**B. Ciphertext Policy:**

Here administrator control the user rights.It mainly focuses on the design of the access structure.

**C. Key Policy:** Type of keys are defined like private keys are associated to particular policy that client will have. These are the systems used currently for cloud encryption safety as well as third party software which uses cloud data uses other method such as OAuth authorization methods for protecting client data. These method are dynamic but any false authorization leads to many loses of resources which is very unproductive in the terms of cloud security

**Proposed System**

As we have seen in current system that the system used in the existing system uses ciphertext method, attribute based model and key policy method .In all the methods used there the data is stored basically using checksum which is basically a 128 bit checksum or 256 bit checksum. They all are hackable using dictionary attack or brute force algorithm which is most common used algorithm for cracking passwords .Since cloud computing is based on two corelated models in which one focuses on backend where data is stored on the cloud whereas second one where the client uses third party software to access the data stored on the cloud .Here on the second phase authorization takes place where hackers exploit the password database.

It is possible that password cracking can be done by insiders as well employee working inside the cloud service provider. So a better way is required for cloud management. Here in this paper we are going to use the suitable methods for cloud security such as Customer Driven Monitoring System. This is suitable for administration level security as for authorization IP is tracked and checked in the cloud vendor list, then only access will be granted. So it is paving way for management level security. Most important technology which we are going to use is Image Steganography technique.

Steganography is a technique which is used to hide secret information in some other information where secret message cannot be detected. Here we are using image steganography where image will be used to hide secret encryption key. This technique is very useful as will be impossible to crack encryption key using brute force or dictionary attack approach.

**Architecture**

Cloud security architecture is divided into basically into two modules. One client and another cloud security architecture where two modules are used , first one being client integrity checker where validation of client is done which uses IP validation and basic level integrity checker for third party application

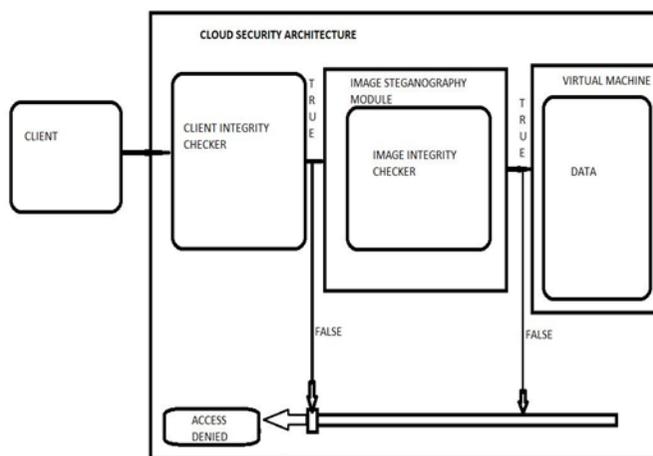


Figure 2:Steganography based cloud safety model

Where they use OAuth technique to provide security to their clients. Here registration of end user is done as well as the deauthorization of client take place for example user on Facebook register themselves and login through credentials used while registration. This comes under Client Integrity Checker module. Then comes Image steganography Module where data is hidden in the form of image bits localization and delocalization. In the image steganography technique, we are going to encrypt our key in the bits specified in particular algorithm which will use it to match the bit specification which is used to validate user authentication for signing in into cloud application. If integrity checker grants permission then only user will be able to access the data from the cloud. In this way our system architecture works.

### Module Description

Major modules used in this model are following components:

Integrity Verification policy: Using of KeyGen to Compute and verify.

Pixel Detector: It will be useful in detection of pixel which will be used in steganography (detection and verification based on pixel values).

Customer Verification tools: Data will be send only to client trusted user ,i.e not publicly accessible to all.(Used in Business models for security against breaches).

### Algorithm

Algorithm for Hiding Data:

```
Begin
Input:          Cover_Image,
Secret_Message, Secret_Key;

Transfer  Secret_Message  into
Text_File;
```

Figure 3: Code for hiding data.

In this algorithm data is encoded or embedded into image where we are using secret key. The secret key is used to get the identity of image, which will acts as identifier for particular image. It is basically acting as container for secret message to be hide.

In this way our secret message will be hidden in the image, which will not be recognised by bared eyes, only by its extracting or decoding algorithm.

Algorithm for extracting Data:

```
Begin  
Input: Stego_Image, Secret_Key;  
Compare Secret_Key;  
Calculate BitsPerUnit;  
Decode All_Binary_Codes;  
Shift by 2 unit for bitsPerUnit;  
Convert Binary_Codes to Text_File;  
Unzip Text_File;  
Output Secret_Message;  
End
```

Figure 4:Code for extracting data.

### Results



Figure 5: Comparison between original image vs image with hidden data.

The designed system is enforced, realised electronically as well as digitally and tested to make sure complete validation of its operation and functions of steganography technique. It can be used for cloud security purpose without any much changes for its adaption .It will not just provide security to cloud computing but it will be best method in doing so by providing double security as it will provide dual layer of security due to use of Virtual Machine .Since virtual machine will make sure data must be remain untouched by internal cloud service provider employee.

Also it will provide security by malware and virus attack. Since it is quite difficult to attack using malwares in the Virtual environment. So it provides double security creating virtual environment and image steganography technique.

As in the image [ ] we can see that in RGB notation there is bit difference in both images. In Image Steganography technique we change some bits with secret keys using our defined algorithm. In this way it is quite impossible to get the difference between images and impossible for attackers to get the values. In this way this method of encryption policy for Cloud Safety is very safe and useful too. It is easy to implement and hard to detect.

### **Conclusion**

Lot of economical and safe technique is applied to give safety to cloud computing technology but we can see that there is lot of attacks in last decades on the cloud, most important thing to note that there is most of the attacks are due to the insiders. It is important to save data globally as well as insiders. Employees working inside cloud security should not be aware about the data present inside. Privacy policies must be implemented to take care of it. Here our system comes into role. Image steganography in cloud security is most stable and suitable technique which can be implemented in the cloud security platform to ensure that the data reside inside cloud servers remain secured as well as they can be assessed easily without any difficulty.

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# Privacy Preserving For Large Scale Data Sharing Over Distributed Data Stream

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**ABSTRACT:** Privacy has become a considerable issue when the applications of big data are dramatically growing in cloud computing. The benefits of the implementation for these emerging technologies have improved or changed service models and improve application performances in various perspectives. However, the remarkably growing volume of data sizes has also resulted in many challenges in practice. The execution time of the data encryption is one of the serious issues during the data processing and transmissions. Many current applications abandon data encryptions in order to reach an adoptive performance level companioning with privacy concerns. In this paper, we concentrate on privacy and propose a novel data encryption approach. Our proposed approach aims to selectively encrypt data and use privacy classification methods under timing constraints. This approach is designed to maximize the privacy protection scope by using a selective encryption strategy within the required execution time requirements.

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## 1. Introduction

Introducing mobile cloud computing techniques has empowered numerous applications in people's life in recent years. Involving humans in the cloud computing and wireless connection loops becomes an alternation for information retrieval deriving from observing humans' behaviors and interactivities over various social networks and mobile apps. Moreover, as an emerging technology, cloud computing has spread into countless fields so that many new service deployments are introduced to the public, such as mobile parallel computing and distributed scalable data storage. Penetrations of big data techniques have further enriched the channels of gaining information from the large volume of mobile apps' data across various platforms, domains, and systems. Being one of technical mainstreams has enabled big data to be widely applied in multiple industrial domains as well as explored in recent researches.

Big data refers to high volume, high velocity, and/or high variety information assets that require new forms of processing to enable enhanced decision making, insight discovery and process optimization. Due to its high volume and complexity, it becomes difficult to process big data using on-hand database management tools. An effective option is to store big data in the cloud, as the cloud has capabilities of storing big data and processing high volume user access requests in an efficient way. When hosting big data into the cloud, the data security becomes a major concern as cloud servers cannot be fully trusted by data owners

### Existing System

In the Existing system the privacy concerns is caused by unencrypted data transmissions due to the large volume of data. Considering an acceptable performance level, many applications abandon using cipher texts in mobile cloud data transmissions. This phenomenon can result in privacy leakage issue since plain texts are unchallenging for adversaries to capture information in a variety of ways, such as jamming, monitoring, and spoofing . This privacy issue is exigent because it faces to a contradiction between the security levels and performance that is usually attached to timing constraints

### Disadvantages of Existing System

The large data without data encryption is stored in the system and privacy preserving for all the data becomes difficult, this brings down the performance of the system.

Maintaining security for the large amount of data without any preprocessing methods will result in security issues or data loss.

### Proposed System

In the proposed system we concentrate on privacy and propose a novel data encryption approach, which is called Dynamic Data Encryption Strategy (D2ES). Our proposed approach aims to selectively encrypt data and use privacy classification methods under timing constraints. This approach is designed to maximize the

privacy protection scope by using a selective encryption strategy within the required execution time requirements

#### Advantages of the Proposed System

Maximize the privacy protection scope by using a selective encryption strategy within the required execution time requirements. It produce outputs in a given time. It process a certain column of transaction at a particular speed. DISCUSSION

#### Chunk splitting technique:

In this module whatever the image file you are uploading that is divided into number of chunks based on the packet size .

#### Hashing technique:

The divided number of chunks is converted into hash code using MD5 algorithm.

#### Deduplication Checking Process:

In this module divided blocks is uploaded to cloud, before uploading to cloud deduplication of blocks is checked.

#### Chuck Merging Process:

In the chuck merging process, the blocks are downloaded from cloud and merged and finally will get back original image.

### Conclusion and Future Work

The theoretical designs are changed into a working system in the implementation part of the project. If the implementation stage of the project is not carefully planned and controlled, it can cause chaos and confusion. A detailed description of implementation of the proposed system is presented in this chapter.

It requires the following tasks to be performed,

- ❖ Planning of the project carefully
- ❖ Investigation of system and constraints of the project
- ❖ Designing the methods
- ❖ Evaluation of the method
- ❖ Making the proper decision regarding the platform selection
- ❖ Selecting the proper language

The project is focused on the privacy issues of big data and considered the practical implementations in cloud computing. The proposed approach, D2ES, was designed to maximize the efficiency of privacy protections. Main algorithm supporting D2ES model was DED algorithm that was developed to dynamically alternative data packages for encryptions under different timing constraints. The experimental evaluations showed the proposed approach had an adaptive and superior performance.

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## **Weather Monitoring System Using Internet of Things (IOT)**

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**ABSTRACT:** *In this paper we have proposed a solution for monitoring the weather conditions at a particular place and make the information visible anywhere in the world by using mobile or any electronic gadgets. Internet of Things (IoT) is the technology we have used which is an efficient solution for connecting the things to the internet and to bring together the entire world of things in a network. Here things might be whatever like sensors, automotive electronic devices. The system deals with controlling and monitoring the environmental conditions like temperature, relative humidity and CO level with sensors and sends the information to the web page and then plot the sensor data as graphical statistics. The data updated from the implemented system can be accessible in the internet from anywhere in the world.*

**Keywords:** *Internet of Things (IoT) Embedded Computing System, Wi-fi, Arduino Software, ESP8266, Temperature and Humidity Sensor.*

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### **1. Introduction**

Here, with the increase in technology usage in daily life, we tend to use automatic assistance in our daily life in order to live a comfortable life. With the advantages of Internet of Things (IoT) we started focusing on this to an extent. Here in the proposed project we monitor and regulate the room temperature using the concepts of IOT and sensors. In the present innovations in technology we mainly focus on monitoring and controlling of different activities in different areas. These are very much helpful to reach the human needs and also to save their time. This technology is mainly focused on efficient monitoring and controlling many kinds of activities. An efficient environmental monitoring system is required to monitor and assess the conditions in case of exceeding the prescribed level of parameters (e.g., noise, CO and radiation levels). If we consider the objects like environment equipped with sensor devices, Hardware i.e., microcontroller and various software applications becomes a self-monitoring environment and it is also called as smart environment. The aspects of weather monitoring exists in many ways. The weather conditions are to be monitored to maintain the growth in crops and to ensure the safe working environment in industries. Due to the growth in technology, the process of understanding the environmental parameters has become easier compared to the past days. The sensors are the miniaturized electronic devices used to measure the environmental parameters. By using these sensors for monitoring the weather conditions we will get accurate results and the entire system will be faster and also less power consuming which is also familiar as Wi-Fi in general terms. To establish a connection between the sensor network and internet, we use a Wi-Fi module as a communication interface controlled by the microcontroller. Here we send the data to maintain the weather and conditions of a particular place using source website, mobile, Thingspeak. Thingspeak is an open source Internet of Things application and API to store and retrieve data from the sensors using the HTTP Protocol over the Internet. Thingspeak is an IoT analytics platform service that allows you to aggregate, visualize, and analyze live data streams in the cloud. The Hardware system consists of temperature sensor, CO<sub>2</sub> sensor, Humidity sensor and light dependent resistor. These sensors are used to measure corresponding weather parameter. In such environmental areas when some event occurs the LED or alarm alerts automatically. The effects is due to the environmental changes in the room or surroundings and these can be monitored and controlled by sensors. Two things are necessary to view this weather reporting over the internet. One is the website and another is internet.

2. System Architecture

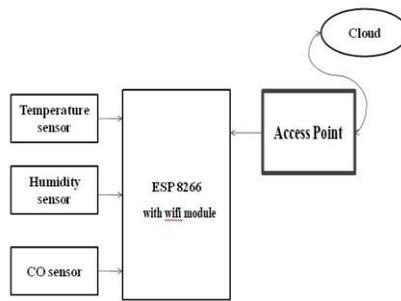


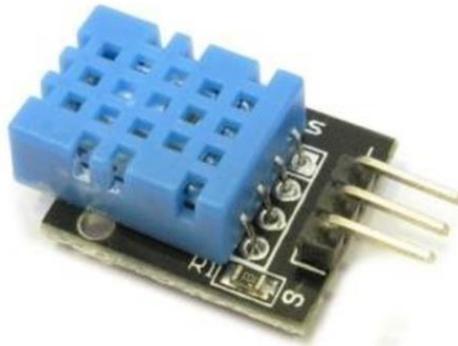
Fig 1: Block Diagram

The system consists of a microcontroller (ESP8266) as a main processing unit for the entire system and all the sensor and devices can be connected with the microcontroller. This sensors can be operated through the microcontroller to retrieve the data from them and analyze with the sensor data and update the data using internet through Wi-fi module connected with it. The ESP8266 Wi-Fi module is used, which is having TCP/IP protocol stack integrated on chip. So that it can provide any microcontroller to get connected with Wi-Fi network. ESP8266 is a pre programmed SOC and any microcontroller has to communicate with it through UART interface. It works with a supply voltage of 3.3v. The module is configured with AT commands and the microcontroller should be programmed to send the AT commands in a required sequence to configure the module in client mode. The module can be used in both client and server modes.



Fig 2: ESP8266 Microcontroller diagram

The Fig 2 described is the Node Device Board is based on widely explored ESP8266 System on Chip from Express if. It combined features of Wi-Fi access point and station microcontroller. ESP8266 offers Arduino-like hardware IO .Wi-Fi networking can be uses as access point and/or station, host a web server and connect to internet to fetch or upload data.



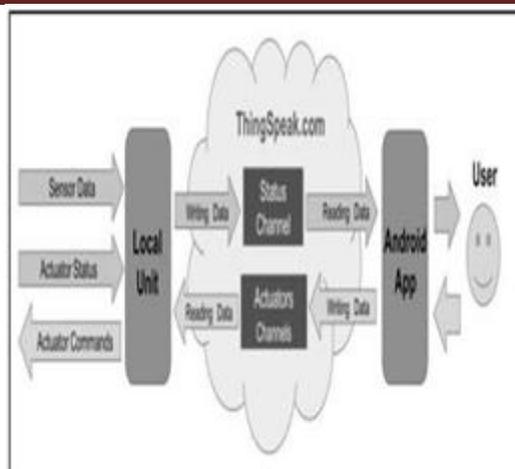
**Fig 3:** Temperature and Humidity Sensor DHT11

The DHT11 is an essential miniature temperature and humidity sensor. It is a low-cost digital temperature and humidity sensor which provides high reliability and long term stability. It is integrated with a high performance microcontroller. Each temperature and humidity sensor will give the accurate data and releases a digital data on the data pin (no analog information pins required). The main genuine drawback of this sensor is for every 2 seconds you will get new information because of environmental changes, so when utilizing our library, sensor readings can be up to 2 seconds old. It works on 3 to 5V power supply. Good for 20- 80% humidity readings with 5% accuracy and for 0-50°C temperature readings  $\pm 2^\circ\text{C}$  accuracy. It can be interfaced with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results.



**Fig 4:** CO Sensor

Carbon monoxide sensor, suitable for sensing CO concentration in air and can sense CO-gas concentration somewhere in the range of 20 to 2000ppm. This sensor has a high affectability and quick reaction time. The standard reference strategy for the estimation of carbon monoxide concentration in air depends on the ingestion of infrared radiation by the gas in a non-dispersive photometer. This technique is reasonable for stable establishments at fixed site monitoring stations. All the convenient carbon monoxide analyzers with datalogging have turned out to be accessible for individual presentation observing. These estimations depend on the electrochemical responses carbon monoxide, which are detected by exceptionally planned sensors. These days the determination, strength and affectability of the electrochemical analyzers are inside the details of the reference technique and, together with the data.



**Fig4.Thingspeak**

Thingspeak is an open source Internet of Things application and API to store and retrieve data from the sensors using HTTP Protocol over the internet. It is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. The main role of updating data continuously is done by Thingspeak, which has APIs for collecting data produced by sensors and APIs for reading that data from applications. The paper is divided into two parts. One part of the paper is where one has to program a thing to send data. And, the second part is where the other has to see the data. Thingspeak sits in the middle and makes it handy to do both. The paper uses easily accessible hardware to build a proof-of-concept IoT system to monitor air temperature, humidity, soil moisture, soil humidity etc. Further this can be modified with different sensors or actuators for building something for individual purposes. Thus a direct access to all the environmental parameters is given to the user after the above stated procedure is completed.

### 3. Conclusion

Thus the system demonstrates the functionality of the Arduino and the ESP8266 by showing their interaction with a real person. As future work, we will extend the Conversational interface to include a dialog support system, introduce new language modules, we intend to work on the possibility to create custom scenarios, improve data analysis, and concentrate on the safety aspects, to make the system more intelligent and safe. Future work will have to take into account the functioning of Personal Assistants in different scenarios and also the advancements that are bound to happen in the future.

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## Survey On Different Technologies for Sentimental Analysis

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**ABSTRACT:** Sentimental analysis is one of the upcoming text classification tool. There are many techniques for implementing Sentiment Analysis in an efficient way. We mainly concentrate on machine learning algorithms. There are many machine learning algorithms which have implemented Sentiment Analysis. Sentiment Analysis can also be implemented using natural language processing. The different Machine learning methods are Naive-Bayes, Support Vector Machines, Neural Networks and Decision Tree Classifiers.

**Keywords:** Sentimental Analysis, Text classification tool, Naive-Bayes Classifier, Support Vector Machines, Neural Networks, Decision Tree Classifiers, Machine Learning Algorithms.

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### 1. Introduction

Sentimental Analysis is analyzing the sentiment of an individual based on his/her opinion of a brand, product or service. Each and every person can have their own emotions about a product which should be analyzed in a proper way. The simplest of the sentiments that we can classify are as Positive, Negative or Neutral. This may vary based on where the sentiment analysis is being used. Sentimental Analysis can be used in movies for classification of positive or negative review, in products to understand what people think about the product, in prediction systems for predicting different market trends and election outcomes and many more. There are two levels of sentiment analysis – document level sentiment analysis and sentence level sentiment analysis. In document level sentiment analysis, the document as a whole is analysed and the sentiment is provided to the whole document whereas in sentence level sentiment analysis each and every sentence is analysed and sentiment is provided to only that sentence.

### Methodology

Sentimental Analysis can be implemented using many methods. The most commonly used methodologies are using machine learning approaches and natural language processing techniques. The machine learning approaches are Naive-Bayes Algorithm, Support Vector Machines, Neural Networks and Decision Tree Classifiers. In natural language processing technique we use is rule-based where the system performs sentiment analysis based on some set of rules. Automatic algorithms use machine learning for learning from data. Formulating the problem of Sentiment Analysis is:

Input: d - a document

C – a set of classes {c1, c2,...,cn}

Output: a class belonging to {c1,c2,...,cn}

Naive-Bayes: Technique

The Naive-Bayes algorithm is a classification algorithm. It can be used in sentiment analysis to obtain the review as either positive, negative or neutral. In Naive Bayes we use Bayes rule for classification problem. The Bayes rule is given by:

$$P(h|d) = \frac{P(d|h) \cdot P(h)}{P(d)}$$

P(h|d) – probability of hypothesis h given document d.

P(d|h) – probability of document d given hypothesis h. P(h) – probability of hypothesis h being true P(d) – probability of document d being true.

The naïve-bayes technique was implemented on movie reviews and hotel reviews. The training dataset had 4500 reviews. As the number of reviews increased, the accuracy of the model also increased. The accuracy of the model for movie reviews was found to be 84.09 and for hotel reviews was found to be 54.09[1]. The accuracy of system for twitter dataset was found to be 76.67% [5].

Support Vector Machines: Technique

Support Vector Machines are algorithms which are used to classify text as either positive or negative. It is a most powerful tool that makes use of the kernel. It is a very well-known tool and is used mainly for classification problems. In this algorithm, we draw number of points on the n-dimensional space and separate them using hyper-plane. The hyper plane divides the positive reviews against the negative reviews. The hyper plane used in SVM can be either linear, parabolic, circular etc.

By applying support vector machines to news articles of 5000 datasets collected by YouNet the accuracy of positive reviews was found to be 76.49%, negative reviews were found to be 70.49% and neutral reviews was found to be 83.32%. The overall accuracy was found to be 80.46% [4]. Accuracy of system trained on twitter dataset was found to be 76.92%. [5]

#### Decision Tree Classifier: Technique

A decision tree classifier is an algorithm where a tree is constructed where the internal nodes of the tree represent an attribute and the leaf nodes represents a class label. For constructing a decision tree[8],

1. we place the best attribute(feature) on the root node.
2. Divide the training set into subsets. Subsets should be made in such a way that each subset contains data with the same value for an attribute.
3. Repeat the step until a leaf node is present at all branches of the tree.

Algorithms for constructing decision trees usually work top-down, by choosing a variable at each step that best splits the set of items.

#### Implementation

1. Import all necessary libraries such as numpy, pandas, sklearn.
2. From sklearn import trees
3. Divide the dataset into training[train\_set] and testing sets[test\_set]
4. Assumed you have, X (predictor) and Y (target) for train\_set and testset
5. Create a tree object
6. Train the model using train\_set dataset and check the score using fit and score methods.
7. Test the model using predict method on test\_set dataset.

Decision tree classifier is implemented on 1000 reviews on a restaurant and the classes were 0 if the review was bad and 1 if the review was good. It provided the accuracy of 65% while the same dataset when used on Gaussian Naïve Bayes Classifier provides an accuracy of 73%[8]. The decision tree accuracy on twitter data was found to be 84.66%[7].

#### Neural Networks: Technique

Inspired by the biological brain, neural networks consist of information processing units known as neurons arranged in layers which works synchronously to represent obtained knowledge. As the number of layers in the network increases, the learning capacity of the network increases[10].

Neural networks are used to perform tasks such as classification by adjusting the connecting weights between them.

A layer of neuron does computation on the input and provides the output to the next layer. Every layer except the input layer does computation on the input.

The computational element of a neuron is known as an activation function. This function maybe probabilistic or deterministic, that is they may output a value as a probability function or a strict binary function[9].

Some of the activation functions include ReLu, sigmoid, hyperbolic tangent function, leaky ReLu. The activation equations are shown below[11].

Neural Networks was tested on 5000 datasets collected by YouNet media on news articles and traditional convolutional neural network and LSTM obtained an accuracy of 96.17% for positive dataset, 92.17% for negative dataset and 99.82% for neutral dataset. The overall accuracy of system was found to be 96.52%[4]. The neural network used with Tfidf vectors using keras on twitter data obtained an accuracy of 82.48%.

#### Technologies Used

There are various technologies used by the researchers to implement each of these machine learning techniques. There are many python packages which help in implementing these algorithms. The packages which were used are:

1. NumPy : It mainly provides N-dimensional arrays, derived object, assortment of routines on arrays which include mathematical, logical, shape manipulation, sorting, I/O, Basic linear algebra, Basic Statistical operations and much more.
2. Pandas : Pandas is a python package which is mainly used for manipulating the data which makes the analyzing of data easier.
3. Scikit-Learn: One of the most popularly used package for machine learning. It is a very robust library which was introduced by Google in 2007. Scikit learn is built upon the stack SciPy. It provides us with many built-in algorithms rather than the user to write each and every algorithm. Logistic regression, Support Vector Machines, Neural networks etc. have their own libraries.
4. Matplotlib: This package is mainly used for graphical purposes. To compare the accuracies of different models and plotting of points on the N-Dimensional space is the main reason behind this package.
5. Natural Language Toolkit(NLTK) : It is a platform which is built to work with human language data. The nltk is trained over 50 corpora and lexical resources.
6. Gensim : It is a free open source python library which is used for automatic extraction of semantics from documents which less pain and more efficiency.
7. Keras: Keras is python library which is mainly used for neural networks. It is an Api which runs on top of Theano, tensorflow and CNTK. It supports all the neural networks that is convolution neural network and Recurrent Neural Network.

#### 4. Analysis and Challenges:

Researchers over the years have been finding different ways to approach the problem of sentiment analysis. The graph below shows the accuracy of sentiment analysis for different machine leaning approaches.

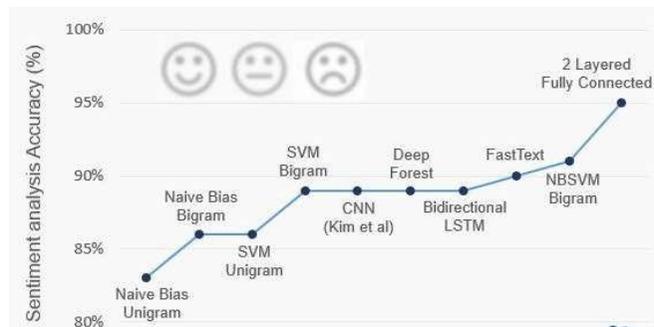


Fig.1: Accuracies of different models for sentiment analysis

We see that neural networks provide more accuracy compared to Support Vector Machines and Naïve – Bayes technique. As the technology in the world evolved, even the accuracies of sentiment analysis increased with time. There is almost 15% increase in accuracy from Naïve-Bayes to 2-Layer Fully connected networks. This is the reason why researchers prefer Deep learning these days in any classification of regression tasks.

Even though with time sentiment analysis got better, there are many challenges for sentiment analysis :

1. Dataset : The number of datasets for analyzing the data is very less compared to other fields of machine learning. It becomes harder for the machine to give accurate sentiment for a review with very less data. There are many datasets which are available but they are small.
2. Language: There are many languages other than English. The model has to be trained in such a way that it has to provide sentiment to all the language reviews. The problem is that the datasets are not present for other languages which makes it difficult for the researchers to do sentiment analysis on languages except English.
3. Providing wrong information: Sometimes the information, i.e., data might not always be correct. A person might give wrong information on a product without buying it. Data pre-processing becomes the biggest concern in such problems.
4. Balance Positive and Negative Reviews: The machine should be trained in such a way that it recognizes both positive as well as negative reviews.

5. Emojis: The use of emojis will not be understood by the machine. So it becomes very necessary to preprocess these emojis so that they don't decrease the accuracy of the system.

### Conclusion

This paper presents a survey on the machine learning approaches for sentiment analysis. The analysis of data is done on Naïve – Bayes classifier, Support Vector Machines, Neural Networks and Decision Tree Classifier. We find that the new deep learning models of neural network provide us with good and stable models with good accuracy than the traditional methods. There are lots of future work going on in this field which will lead to a good and accurate model for this problem.

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## **An NFC Featured Authentication System for ATM Transaction**

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**ABSTRACT:** *The flexible use of credit and debit card transactions has become increasingly found everywhere and so have the accompanied vulnerabilities that make them a common aim of an attack for cyber criminals. Using a three factor authentication scheme employing NFC (Near Field Communication: an emerging technology develop gradually from merging of contact-less identification and interconnection providing data exchange), Dash Matrix Algorithm and One-time password, we describe and define the application and the potential to overcome common transaction liabilities (brute force attack, shoulder surfing, skimming of ATM cards, etc.). The proposed system, therefore, provides both secure usage of ATM cards and cost effectiveness by utility of novel and increasingly common technology, when also at the same time providing to be user friendly..*

**Keywords:** *ATM transaction, Dash Matrix Algorithm, NFC, One-Time Password, Negative Pattern Password, Non-NFC enabled phones, NFC-Transmitter, NFC-Receiver, Microcontroller.*

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### **1. Introduction**

A fairly and increasingly common loss involving theft in digital commerce is stealing or skimming of ATM cards. Unlike most other means of theft, this is an natural vulnerability of the ATM system and network itself. In order to overcome this inherent fault, we give a detailed account of system using a relatively new technology called NFC to enforce security during transaction and usage. This paper's methodology aims at using both NFC enabled and non-enabled cell phones for designing a dedicated application that can communicate with the ATM machine. Due to inherently short range capabilities of NFC, cell phones can communicate with ATM machines only within close proximity. Our proposed system eliminates the requirement of a password Ease of Use or a PIN, which is entirely pivotal to keeping to memory or safe storage of an authentication key.

Essential functioning of our proposed system involves 4 key processes are mentioned one by one below:

- Secured ATM transactions using NFC
- NFC registration
- Blocking of lost ATM cards
- Facilitation of NFC using non-NFC mobile phones

### **Secured ATM Transactions using NFC**

This process is further divided into two sub segmented processes:

1) The first level of authentication involves ATM card swiping or manual ATM card number entry in case of card detection failure, damage to the card, or just its absence. The last mentioned is suggested as an optional method to avoid ATM card skimming.

2) The following others process features the use of an NFC enabled cell phone having an approach to Internet. The user is required to tap the cell phone on the NFC tag fixed on the ATM. Upon successful NFC tagging, a webpage on the Cell phone's browser requests for a pre-registered phone number as a user input. Following this step, the user is required to enter a Pattern Password that was previously registered online during the registration process to use NFC. The pattern password

(Fig. 2.), appears as a random set of numbers. The OTP is then generated on a following page, which is then entered on the ATM's screen before a preset timeout.

The above mentioned sub-segment processes makes use of the following procedures which are given in brief below:

#### **a) NFC Tag reading**

The user reads the NFC-TAG, by swiping the cell phone over the NFC tag on the ATM. The tag consists of limited in extent, URL designed for secured password input through the mobile device.

**b) Dash Matrix algorithm**

Once the user reads the NFC tag using the NFC enabled mobile phone, the mobile web browser opens the protected URL stored in the tag, wherein, the user is required to enter the preregistered mobile phone number as the first step. Upon phone number verification, the user is required to enter the replica values on the mobile device that appears on the screen, based on a pattern that was registered originally at a preset website. The Pattern Password concept involves a new algorithm called the Dash Matrix Algorithm (DMA), which is based on the location points of the registered pattern and its generated replica values. It appears as an unspecified set of 3\*3 matrix values called the Dash pattern. The Dash pattern of the 3\*3 matrix changes constantly every time the user tries to make a transaction. Only the values that appear on the matrix are to be entered as the input in the mobile device and it is called as the Pattern Value Password (PVP). The user need not draw the pattern on the screen. By this, the pattern cannot be reused from the system. The user has to, therefore, only temporarily remember the pattern and enter replica values, in accordance to the pattern he had recorded. This confirms the second step of the authentication procedure.

**c) One Time Password (OTP)**

Once the second step is successfully verified, a four digit One Time Password (OTP) is generated on the mobile screen with a timeout which is valid only for few seconds, say 60 seconds as in Fig. 3. If it exceeds the timeout, then a new OTP is generated. The OTP has to be entered on the second screen of the ATM which appears after swiping or entering the ATM card number. If both the passwords match, the user can continue his transactions further. This confirms for the third-level of authentication.

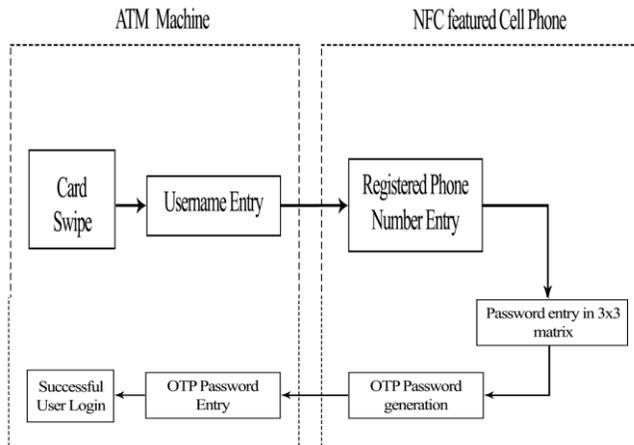


Fig: 1 System Overview



Fig. 2. Dash MartixE

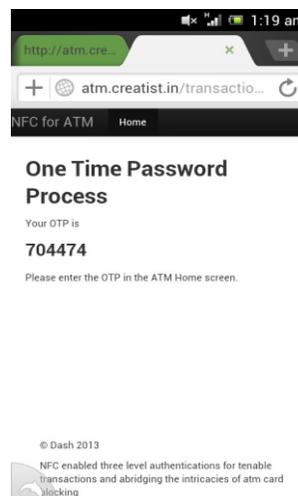


Fig. 3. OTP generation

### C. NFC Registration

The process of online registration to enable transactions Using NFC includes the following procedures:

- 1) A website for registration is developed for registering the personal details of the user.
- 2) During the transaction process while using NFC, the user has to register the Pattern Password which acts as the authentication key. The pattern is drawn by holding down a touch click, during which the cursor is moved along the path in a single stroke without being lifted until completion. It is the same as drawing the pattern on a mobile device as Fig. 8.
- 3) On completion of this process, the user will receive an acknowledgement to the registered e-mail id that will contain a negative pin which is a Negative Pattern Password (NPP) in this discussion as Fig. 9. This NPP is used to block the ATM card. In this way, card blocking is upgraded to feature greater ease of use and higher levels of safety.



Fig: 4 Register pattern

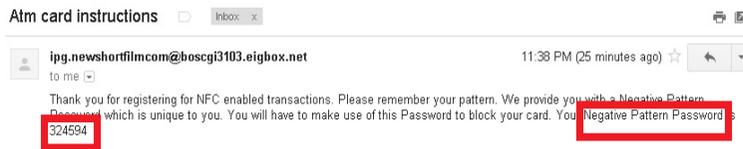


Fig: 5 e-mail sent with Negative Pattern Password

### D. Facilitation of NFC using non-NFC mobile phones

Issues concerning portability of the proposed system onto mobile devices, not having NFC, can be dealt with by a bridging system. A broken down, component-wise description of this system is described below:

#### 1) NFC Transmitter

A hardware kit which has an NFC transmitter, as given in Fig. 6 has a Microcontroller ARM 2103 and a receiver.

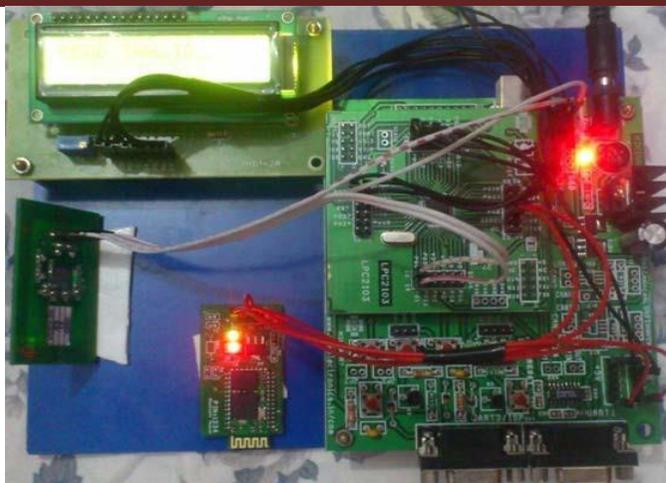


Fig. 6 NFC Transmitter Hardware Kit

## 2) NFC Tag(MIFARE Classic Card)

An NFC MIFARE card is used to write the private URL that the mobile application opens in a browser after NFC tagging.

The MIFARE Classic 1K tag (used for study) offers 1024 bytes of data storage

## 3) Mobile Bluetooth

Bluetooth is enabled in the kit once the tag is read and it triggers the Bluetooth of the mobile device. The URL written in the tag now opens in the web browser of the mobile device with an application. The hardware kit with the microcontroller

and the Bluetooth chip is shown in Fig. 10.

## Conclusion and Future Work

This new proposal is put forward to make less the concept of

PIN as a password for the process in an ATM system. As the future is still endangered to password attacks such as Peeping attacks, Brute-Force attack, Retrieving passwords from the systems, Skimmers, etc, all these aspects are subject to harsh by conveying this new method. On using NFC, it is easy to open a webpage without the wastage of browsing time. By the use of Replica password, i.e. PVP, the level of security is increased rapidly and avoids the inconsiderable percentage of attacks. Usually the acceptance of OTP through the former text messaging causes late in receiving it. To escape this issue, we generate an OTP on the webpage with a Timeout. Introduced here is an essential feature that reduce user's worry for blocking of ATM Card by proceeding towards the nearest ATM. This reduces the waiting time of the user on the customer care phone line, who may also be in a sense of sorrow.

The QR code generation is also consistently good in performance as it generates a different URL in accordance to the card number. The Negative Pattern Password will make strong the confirmation of the legal user. This scheme not only presents as an advantage to the user, but also aids the Bank. The notification received to

them from the proposed interface, can provide to deactivate the user's account by placing an additional phone call for Verification. As a result, the NFC technology and the DashMatrix concept can be eventually used for many relative fields. Thus, NFC usage is less time consuming, reasonable, Dependable and also cost efficient, given the cost of a single NFC MIFARE card being between \$1.75 to \$ 2.0 (1000 units).

Future proposals on increase or improvement in quality would be the usage of NTag21x family of tags, which is the latest development with more security features and faster read capacity. Also MIFARE DESFire EV2, MIFARE SAM AV2 cards can be used as they provide AES and secure storage for cryptographic keys. The tags can be tested for the NFC enabled phones while the latter can be used for non-NFC mobile devices.

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# Crime Scene Prediction by Detecting Threatening Objects Using Convolutional Neural Network

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**ABSTRACT:** Crime scene prediction without human intervention can have an outstanding impact on computer vision. In this paper, we present CNN in the use of detect knife, blood and gun in order to reach a prediction whether a crime has occurred in a particular image. We emphasized on the accuracy of detection so that it hardly gives us wrong alert to ensure efficient use of the system. This paper use Non linearity ReLu, Convolutional Neural Layer, Fully connected layer and dropout function of CNN to reach a result for the detection. We use Tensorflow open source platform to implement CNN to achieve our expected output. This system can achieve the test accuracy of 70%-80% for the datasets we have that is very much competitive with other systems for this particular task.

**Keywords:** Convolutional neural network, Tensor Flow

## 1. Introduction

Crime scene detection with the use of unsupervised machine learning techniques is still an open debate in the field of machine learning. Crime means the occurrence of events or behaviors which are unusual, irregular, unexpected and unpredictable and thus different from existing patterns. Detecting anomalies by learning from normal data can have important and different applications. And also, an Crime detection process is completely dependent on the environment, context and Crime scenario [3, 4]. In different scenarios, anomalies will accordingly be different. Existing supervised methods for Crime detection such as simple CNN based methods require labels which are difficult to attain due to the video high dimension information. High dimension of video affects representation and creation of a model. In this paper, Crime detection is based on videos of surveillance cameras. It should be noted that detection in videos is more difficult than in other data since it involves detection methods and also requires video processing as well. The processing of surveillance cameras information in crowded scenes poses serious challenges and difficulties. If this process is online, the complexity will even increase. One of the best approaches for processing this information and consequently achieving the goal-oriented pattern is the use of advanced machine learning techniques such as deep learning approaches. The advantage of these types of processes, which usually have a high dimensional data, can be traced back to the existence of an end-to-end system. End-to-end systems automate feature extraction. One of the main purpose of using deep learning is to extract information from high dimension data.

This paper introduces an Crime detection method based on deep learning techniques. The architecture of this method has two main phases which are called train network and detection classifier. The first phase aims for feature extraction and is consisted of five components with a deep structure. The aim of the second phase is detection. This phase is consisted of five deep neural network classifiers and reconstruction network. Each component in detection phase produces a detected class and a score. At last, by these detection classes and scores, the ensemble classifier performs the final detection and announces it.

The main contribution of this paper is the use of deep learning techniques in all phases of Crime detection.

## II. Problem Statement

As the title itself implies the problem statement is Crime Scene Prediction by Detecting Threatening Objects Using Convolutional Neural Network. This includes the detection of the anomalous activities and threatening objects that is captured in the surveillance videos. Once the anomaly is detected the person monitoring will receive a SMS.

## III. Objective

- Divide video into frames and divide test frames to defined patches
- Train the model to analyze the test data and detect the threatening object.

- Send SMS to the control station about detection of abnormal event.

#### IV. Proposed System

A block diagram the model is given on Figure, where feature extraction is a vital issue. The following subsections describe the different block diagram of the proposed model.

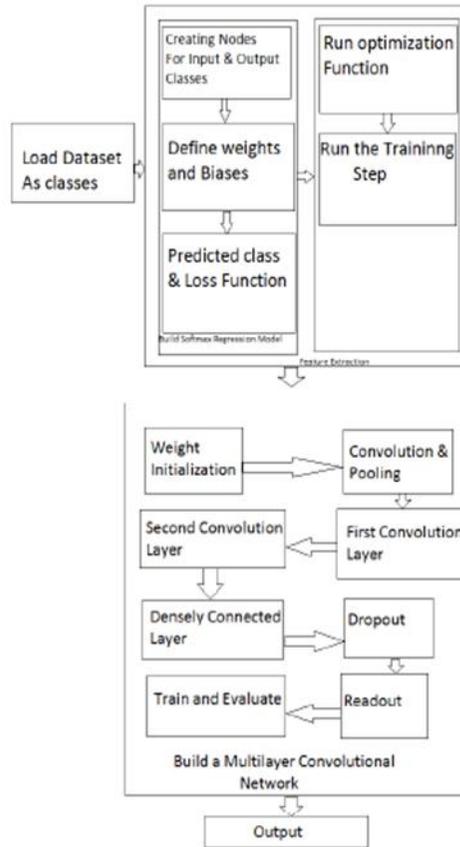


Figure: Proposed model

#### A. Load Dataset as Classes

The dataset that we use for validating our model consists of knife, gun (short gun, revolver and machine gun) and blood.

#### B. Feature Extraction

To extract features from the images, we use some steps to generalize the images and turn the images into certain pattern.

#### C. Build Multilayer Convolutional Model

To build multilayer convolutional network from the model we have created so far, we need to follow some steps like weight initialization, convolution and pooling, first convolutional layer, second convolutional layer, densely connected layer, dropout, readout, train and evaluate.

#### V. Research Methodology

The proposed method of this paper is based on deep learning techniques for detecting anomalies in video. Two main components are considered for this method. The first component is the extraction and learning of the feature and the second component is the detection of anomalies. Apart from these two components, there is a pre-processing step which is related to background estimation and removal. Like all machine

learning approaches, this method also has two main train phase and test phase. In train phase, features are trained by train parts of dataset which contains only normal frames, and trained model in test phase is used by other parts of dataset which contain abnormal frames.

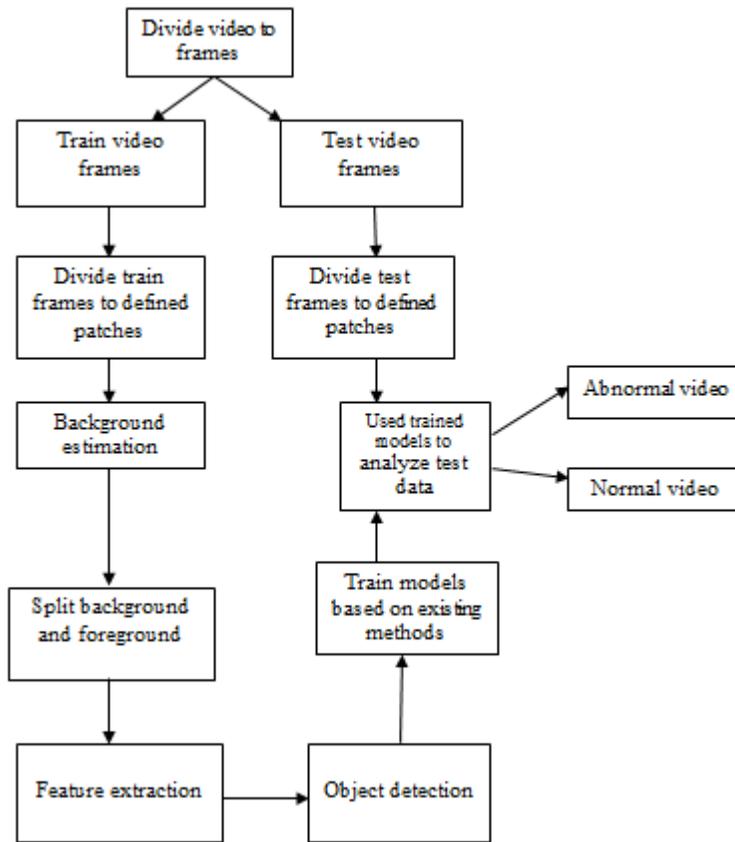


Figure: Video crime Detection Flow Diagram

As can be seen in the figure, learning features are of four main types. For some types, feature extraction processes are performed on single frames, and others are based on patch frames in order to reduce cost and training time. The first feature is appearance which is related to object detection in each frame; and by comparing each frame with previous and next frames the detection score is generated. The second feature is density which is about density of objects in each frame; the final score is generated based on frames comparison and average speed.

The third feature is motion which is based on the flow of objects between patch frames and it generates optical flow and a sequence of video then used for another score on anomaly. The last feature is scene which is based on patch frames and reconstructing a scene from learned model. The combination of these features is also used for detection and creation of scores.

**A. Pre-Processing**

The first step before starting extracting and learning features is to estimate and remove the background. The background is indeed different for different scenarios as there are various methods for its removal. For instance, the background might include empty spaces or street borders. In this method, the background estimation is based on most occurrence of frequency (MOF) between video frame patches [9]. For the background estimation steps at first, a histogram is generated for each frame of the video which is based on pixels and their location in the image. Then the histogram of the frames in each patch is compared with each other, and the maximum values per patch are identified as background and are thus grayed. Removing the background will reduce the cost of the computing and the processing time. This step is considered as a part of train network.

## **B. Feature Extraction and Learning Component**

In addition to background estimation, train network has four main components. The deep network for extracting appearance feature uses a stacked denoising auto-encoder (SDAE) with 6 encode layer and the same structure of decode layer. Each frame is convolving to network with 1\*1 window size and it includes stride and padding. All frames normalize in binary mode. This SDAE has 6 encode layers and 6 same structure in decode layer which is deeper than the existing methods. The output of this step is detected objects which are called appearance representation. This output is used in detecting phase and also is utilized as an input to density estimation component in order to increase the accuracy of estimation.

Density Estimation is carried out by convolutional neural network with 8 \* 8. Windows filter. This network is shown in Figure 4. The output of this component is feature map and the loss function is computed based on square error. In the estimation of the density, the sectors associated with the background are considered zero.

The third component is motion feature extractor. It performs a feature extraction based on the direction of moving objects in the scene of video patches. This deep network also has a similar structure to appearance feature extractor but it is based on frames patches. After entering the patch frame into the network, computing optical flow will be done based on comparison of frames in a patch. The output of this step is Motion Representation which is used for future detection.

The last component is Scene Reconstruction which is based on reconstruction network [26]. The structure of this reconstruction network is based on convolutional Auto- Encoder with the same CNN generator and discriminator networks. Generator part regenerate the scene which has 10 layers to reconstruct frames based on the previous and the next frame in same patch and the discriminator compares the generated scene with original one in order to compute the reconstruction error. It should be mentioned that discriminator part has the same structure as that of the generator. A high reconstruction error during test indicates anomalies. The reconstruction error in train network is low and this will be a measure for detecting anomalies.

At the end of the training step, a set of learned and combined features is created in order to achieve Crime detection.

## **C. Detection Component**

In the detection component, learned features which are generated in train network are given to a classifier with two classes of normal and abnormal. Features are given as individual and combined feature to these networks. Reconstruction error and appearance features are given to network as a combined feature since the appearance feature or object detection with a reconstruction error can be a strong feature for the detection of anomalies. The lower reconstruction error for the corresponding frame will make the detection more accurate.

Two other combination features are Motion Feature and density map. These are two complementary features and the direction of motion must be equal to the transfer of density direction.

## **VI. Conclusion**

In this paper, a new deep learning based for Crime detection of video surveillance cameras is introduced. One advantage of this method is the use of deep learning techniques in all train and detection components. The two main components of this method are evaluated based on some metrics and with UCSD dataset which is the most famous crime detection dataset. Another benefit of this method is the isolation of train network phase. So it can use as a pre-train

Network in similar works.

For further improvement, it is possible to add a component which can add descriptions to each detection classifier or to the last one, or it is possible to add a component in the detection phase which can localize the crime accurately.

## **VII. Future work**

- We work on a simple configured computer to implement the proposed model. In future, to fasten up the processing power it is needed to implement in high configured computer.
- The system has to be synced with surveillance camera and will try to implement very quickly in order to help law enforcement agencies.
- Detecting criminal using facial recognition along with this system will make the system more demanding.

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# **Performance Measurement of Open Shortest Path First (OSPF) Protocol in Kruskal's Algorithm**

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**ABSTRACT:** *Open shortest path first is broadly spread in the network for purpose of managing the intra-domain routing. The OSPF is a Link State Protocol that the reliably floods the router using link state advertisement (LSAs) which helps in building the consistent and global view of routing topology. Reliable performance links to routing stability, but the behaviour of huge operational OSPF network isn't properly understood. A case is examined where characteristics and dynamics of LSA traffic is considered for a large enterprise network. Numbers of routers are considered for the network. For construction of minimum spanning tree and the Kruskal's algorithm is used.*

**Keywords:** *Open Shortest Path First (OSPF) Protocol, Link State Advertisement (LSAs) Network, Kruskal's Algorithm.*

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## **1. Introduction**

OSPF is shortened form of Open Shortest Path First [1]. It is a dynamic routing protocol used in Internet Protocol networks. Specifically, it is a link-state routing protocol and falls into the group of interior gateway protocols, operating within a single Autonomous system. . OSPF was designed to support Variable-length subnet masking (VLSM) or Classless Inter-Domain Routing (CIDR) addressing models [2]. OSPF detects changes in the topology, such as link failures, very quickly and converges on a new loop-free routing structure within seconds. There are two types of routing-Link State routing and Distance Vector routing [3]. Kruskal's Algorithm is based on Link State routing. In Link State routing each router keeps track of its incident links and cost on the link, whether the link is up or down. Each router broadcasts the link state to give every router a complete view of the graph. Each router runs Kruskal's Algorithm to compute the shortest paths and construct the forwarding table. The topology of the network can be generated by collecting the OSPF messages.

## **II. Literature Survey**

Bilal Abdulhaq, et.al [1] proposed that a variety of routing protocols concerning QoS made in WIMAX atmosphere, used mesh mode, which allow client's nodes. It will not enable to converse with just the base node, but with other client's node also. Analysis of presentation depends on an end to end delay, throughput, packet drop and release ratio. It was also established that DSDV has the finest presentation in Wimesh network pursued by OSPF and bad presentation was OLSR, in terms of these limitations apart from throughput. As for the improved expansion of OSPF, the result expressed that it enhanced the presentation of Open SPF in an important way in terms of every factor utilized for analysis of presentation.

Rupali Bansal et.al [2] have put an attempt to determine network performance using the packet tracer. For different routing protocol, the result has been urbanized from own generated network scenario. The presentation metrics taken for assessment are an average end to end delay, the percentage of packet loss, normalized routing load and the ratio of packet delivery. The best protocol is, Packet Delivery Fraction (PDF) generated by EIGRP, among the three protocol discussed. The least is average End-to-End of OSPF protocol id. Most are Normalized Routing Load of Open SPF and minimum is Packet Loss Percentage for EIGRP.

Anto Premkumar et.al [3] introduced that, routing protocol of OSPF link state, will manage the delay and traffic by examining bandwidth at routing time. DHCP and VLSM, are utilized to reduce IP and address wastage and avoid the immovable nodes in the network that will guide to getting improved Re-routing. Lastly, EACL is improved to reject vampire attack and also to reject the not used TCP or IP services. Finally, this paper deals with bandwidth to control traffic and delay.

Chawanat Nakasan et.al [4] introduced a normal multipath open flow controller that routes MPTCP session by dividing them towards multiple paths. Test on both WAN SDN and LAN test give optimistic results, representing that their controller works as planned. For applications or host machines, variation is not attained, making their solution backward-compatible with an active system. This may result in a blockage

which restricts the network throughput. Hence, to confirm the smooth operation of MPTCP, a multipath routing system is needed. They produced smoc, an easy Multipath Open Flow Controller that will use only information of topology of the network to keep away from a crash.

Wei Gua et.al [5] proposed the planning and scheduling of large-scale and routing issue of a circulation network based on GIS technology. The invention begins from the research of calculation of workload with the intention to search nearer best possible vehicle routing plan to decrease cost, work efficiency improvement and customer service improvement. Result framework introduced here depends on the analysis of large-scale FMCG dispenser in a heavily peopled city with more clients. The restraints, intention function and assumption of model come from the actual distribution procedure. They suggest a heuristic algorithm to resolve TSP for every sub-region and then add the result to get the best solution for a complete distribution region. The planned method gives the complete solution framework for distribution issues of large scale. The effectiveness of the algorithm is replicated and confirmed. Performance developments are saving cost and improve the efficiency.

Tao Wan et.al [6] introduced that predictable networks and SDN split related security risks connected to control plane, but different in defenses. Conventional networks may describe a network boundary to sort control messages from end hosts, in END-HOST threat model. This approach is little successful in SDN, its control plane is executed in SDN controllers. They are generally associated to network edge; their connecting points are same as locations of the end host. They can change except there is a devoted control network divided from user networks. Hence, SDN mainly needs cryptographic security to avoid outsiders from involving in the control plane. Their actual protection analysis guides that a distributed SDN design that maintains mistake tolerance and stability check, is significant for SDN control plane protection.

### Outcome of Literature Review

From the literature review, it is clear that most of the methods proposed by researchers have considered the OSPF routing protocol and the quality of services. Also, some of the methods have discussed only throughput and delay for various cases of topology. For convergence, OSPF method takes a long time for the topological variations. There is a scope to tackle the scalability problem with respect to the overhead of router, by minimizing packet loss percentage for routing protocol, jitter, throughput, end to end delay packet loss from the replicated network, meeting time, link creation origin by discontinuous connectivity, energy, decrease the routing updates to the inheritance network and so on, to provide better performance

### III. Methodology and Purposed Scheme

Kruskal's algorithm is an algorithm used to find the minimum cost spanning tree. The algorithm uses greedy method to add the least cost edge to the spanning tree at each iteration. For a given source node in the graph, the algorithm finds the shortest path between that node and every other. It can also be used for finding the shortest paths from a single node to a single destination node by stopping the algorithm once the shortest path to the destination node has been determined. In graph theory, the Kruskal's algorithm is a greedy algorithm which finds an MST for an associated weight graph. It discovers a subset of edge that forms a tree that includes every vertex, where the overall weight of every edge in the tree is reduced. The structure of the hypothetical network is shown in Figure 1. Suppose the graph is not associated, then it discovers an MS forest (for every associated element).

Let  $G = (V, E)$  be an undirected, associated, weight graph by weight function  $w: E \rightarrow R$ . It begins every vertex being its own element. Frequently adds 2 components into one by selecting a light edge that joins them. Scans set of edges in monotonically rising order by weight.

Example

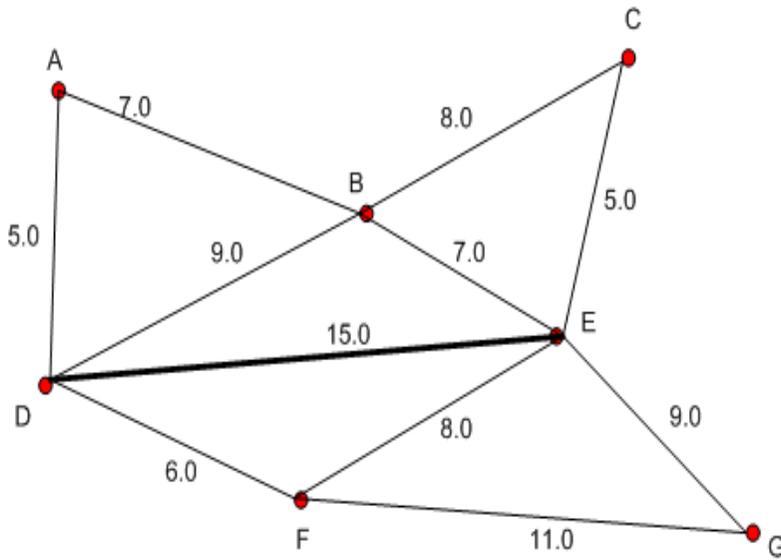


Figure 1 Hypothetical Network

1. **AD** and **CE** are short edges and they have a length of 5, and **AD** is randomly selected.
2. Now **CE** is the shortest edge that will not form a cycle and have the length of 5, therefore it gives the second edge.
3. Then next edge, **DF** by length 6, is selected utilizing a much similar process.
4. Then **AB** and **BE** were the next-shortest edges, both edges having a length of 7. **AB** depicts selected randomly. **BD** edge is avoided because there already exist path among **B** and **D**, they should form a cycle (**ABD**) if it is selected.
5. The procedure carries on to select next-smallest edge, **BE** by length 7. So more edges selected at this level: **BC** due to it will form loop **BCE, DE** because of form loop **DEBA** and **FE** due to the form **FEBAD**.
6. At last, procedure completes by edge **EG** having the length of 9, and MST is found is shown in Figure 2.

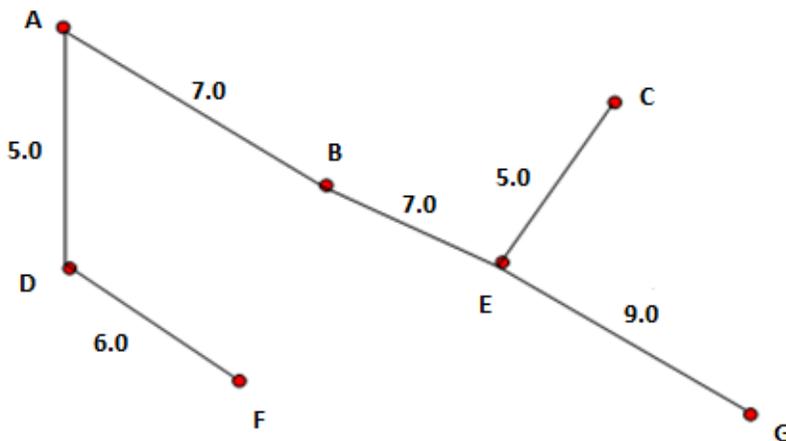


Figure 2 Minimum Spanning Trees

Algorithm: Packet Forwarding

Step 1: First the network initialization process is done.

Step 2: Source node will send Route Request message (RREQ) to the neighbor node.

Step 3: The node will collect the route replies from the neighbor nodes.

Step 4: Once the shortest path is identified, the source node will transfer the packet.

Step 5: The node will check the packet delivery ratio within the given time.

Step 6: Suppose every packet is received inside the given time interval, the loop will repeat, if not it will count a number of nodes.

Step 7: Compare the packet with the previous node if packets are equal to every node then it will send a positive pulse, if packets are not equal it will be understood that there is packet forwarding condition is there.

Step 8: Hence it will replace novel data packets.

#### IV. Purposed Scheme Set Up Parameters

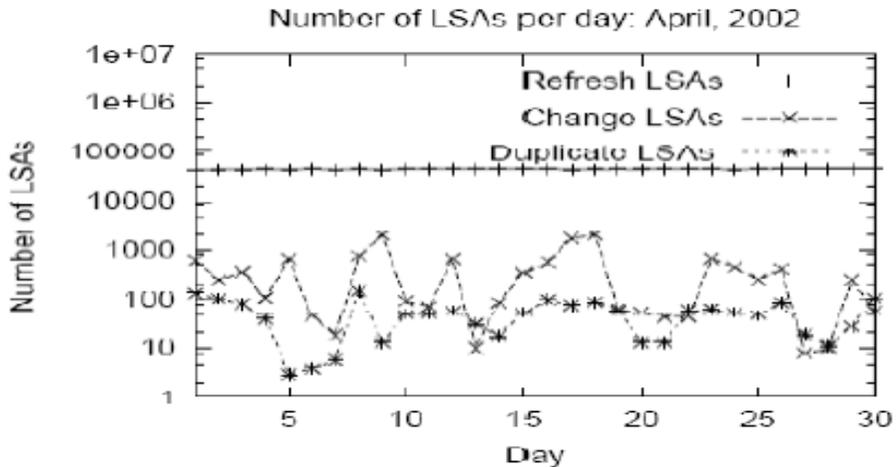
Table 1 Shows the values of various set up parameters used for simulation purpose

Set up parameter	Value
Tool Used	MATLAB 2013a (8.0)
Nodes position	Random
Number of nodes & Edges	6 nodes and 11 edges
Routing algorithm	Kruskal's algorithm
Graph Used	Directed & Undirected
Routing Protocol used	OSPF

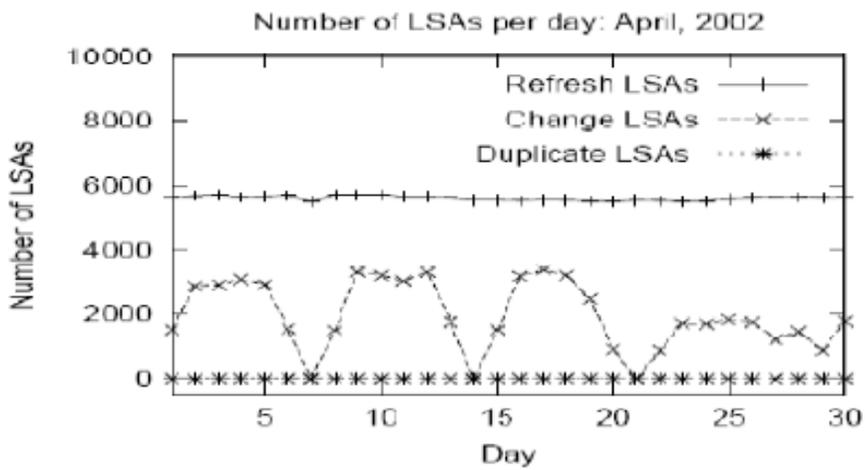
#### V. Simulation and Results Tool Used

Matlab is the programming language, which is used as a design apparatus for the task. MATLAB is a software package for high-performance calculation and representation. It gives an intelligent situation in several implicit capacities for specialized calculation, design and activity. It additionally furnishes extensibility with its own high-level programming language. The name MATLAB remains for Matrix Laboratory.

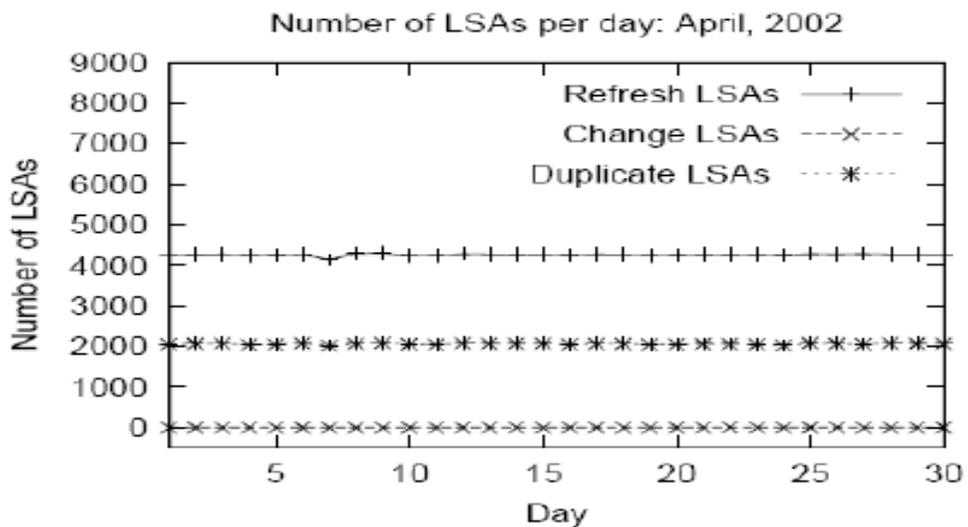
Matlab's inherent capacities makes it most suitable math calculations, information examination, signal preparing, enhancement, numerical arrangement of standard differential conditions (ODEs), Quadrature and numerous different sorts of logical calculations. There are various functions for 2-D Graphics, 3-D Graphics and in addition for movement. The client can compose his own particular capacities in MATLAB. There are likewise a few discretionary "toolkits" accessible from the designers of MATLAB. These tool stashes are accumulations of capacities composed for exceptional applications, such as, typical calculations, image processing, statistics and control system design, neural systems and so on. The fundamental building square of Matlab is the matrix. Vectors, scalars, real matrices & complex matrices are all naturally taken care of, as unique instances of the fundamental information sorts. MATLAB gives various components for archiving and sharing work. Matlab code can be incorporated with different dialects and application. MATLAB Desktop basically works on the following subwindows.



(a) Area 0



(b) Area 2



(c) Area 3

## VI. Conclusion

In this paper, OSPF behaviour is described in operational network. A general method is used to predict the refresh LSA traffic rates. It was found that topological change of LSA is due to external changes. As network will import customer reach ability information into domain, there is chances that customers may get added, or may be dropped or change in the connectivity. Duplicate-LSA traffic was also observed, a simple change in configures helps to reduce duplicate traffic, without affecting the physical structure of network.

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# **Implementation and Analysis of BCH Codes using Forward Error Correction in VHDL**

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**ABSTRACT:** *Communication is the transfer of information from one point to another. As the technology advanced, communication also became an important aspect of our routine. In communication, error correction plays a major role even though there are many coding techniques; BCH codes have gained a priority due to their performance in various application like satellite communication, compact disc players, DVDs, disk drivers, solid state drivers, and two-dimensional bar codes. This project is to design and implement a BCH encoder and decoders based on the FPGA and simulate it. There were design methodologies that had been followed in order to achieve the task of the implement of this project. These methodologies mainly, were applied to the programming techniques of the FPGA and ModelSim simulator, which the design of the BCH encoder and decoder was done on it. Finally, an implementation of the BCH encoder and decoder with constraint BCH (15, 7) showed that it can be efficiently implemented on the commercially available FPGA platforms (Modelsim).*

**Keywords:** BCH, FPGA, Modelsim

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## **1. Introduction**

Digital communication system is used to transport an information bearing signal from the source to a user destination via a communication channel. The information signal is processed in a digital communication system to form discrete messages which makes the information more reliable for transmission. Channel coding is an important signal processing operation for the efficient transmission of digital information over the channel. It was introduced by Claude E. Shannon in 1948 by using the channel capacity as an important parameter for error-free transmission. In channel coding the number of symbols in the source encoded message is increased in a controlled manner in order to facilitate two basic objects at the receiver: error detection and error correction.

## **II. Objective**

The aim of this project is to design and construct an encoder and decoder for BCH codes. FPGA is the recommended hardware platform.

- I. Understand what are the types of error correcting codes are and how they operate.
- II. Understand the parameters and limitations of error correcting codes.
- III. Gain a deep understanding of the encoding and decoding processes.
- IV. Design and implement a system to achieve the encoding and decoding.
- V. Learn how to implement a system on FPGA.

## **III. Literature Survey**

Error detection and correction or error controls are techniques that enable reliable Delivery of digital data over unreliable communication channel. Many communication channels are subject to channel noise, and thus errors may be introduced during transmission from the source to a receiver. Error detection techniques allow detecting such errors, while error correction enables reconstruction of the original data.

Mohamed Elsir Ibrahim proposed a report based on the topic "IMPLEMENTATION AND ANALYSIS OF FORWARD ERROR CORRECTION TECHNIQUES" in which a brief explanation is given about automatic repeat request (ARQ).[1]. Automatic repeat request (ARQ) (sometimes also referred to as backward error correction): This is an error control technique whereby an error detection scheme is combined with requests for retransmission of erroneous data. Every block of data received is checked using the error detection code used, and if the check fails, retransmission of the data is requested – this may be done repeatedly, until the data can be verified. Usually, when the transmitter does not receive the acknowledgment before the timeout occurs (i.e., within a reasonable amount of time after sending the data frame), it retransmits the frame until it is either correctly received or the error persists beyond a

predetermined number of retransmissions. Three types of ARQ protocols are Stop-and-wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ. ARQ is appropriate if the communication channel has varying or unknown capacity, such as is the case on the Internet. However, ARQ requires the availability of a back channel, results in possibly increased latency due to retransmissions, and requires the maintenance of buffers and timers for retransmissions, which in the case of network congestion can put a strain on the server and overall network capacity. Two-way channels are required for transmission of the data which acquires larger bandwidth. Hence will go with next proposed method i.e., Forward Error Correction.

#### IV. Proposed Method

Digital communication system is used to transport an information bearing signal from the source to a user destination via a communication channel. A code is the set of all the encoded words, the code word that an encoder can produce. When actual set of data encoded it becomes a code. Forward error correction (FEC) is a digital signal processing technique used to enhance data reliability. It does this by introducing redundant data, called error correcting code, prior to data transmission or storage. FEC provides the receiver with the ability to correct errors without a reverse channel to request the retransmission of data.

##### i. Forward Error Correction (Error Correction Code)

An error-correcting code (ECC) or forward error correction (FEC) code is a system of adding redundant data, or parity data, to a message, such that it can be recovered by a receiver even when a number of errors (up to the capability of the code being used) were introduced, either during the process of transmission, or on storage. Since the receiver does not have to ask the sender for retransmission of the data, a backchannel is not required in forward error correction, and it is therefore suitable for simplex communication such as broadcasting. Error-correcting codes are frequently used in lower-layer communication, as well as for reliable storage in media such as CDs, DVDs, hard disks, and RAM.

Error correction code (ECC) checks the read or transmitted data for errors and corrects them as soon as they are found. ECC is similar to parity checking except that it corrects errors immediately upon detection. ECC is becoming more common in the field of data storage and network transmission hardware, especially with the increase of data rates and corresponding errors.

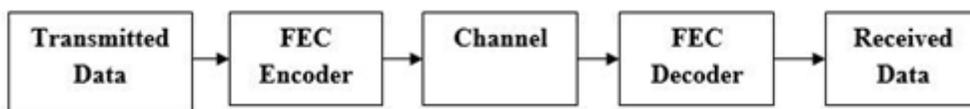


Figure.1: Forward Error Correction model.

From figure 1 we can analyze before data transmission; the encoder attaches parity symbols to the data using a predetermined algorithm before transmission. At the receiving side, the decoder detects and corrects a limited predetermined number of errors occurred during transmission. Transmitting the extra parity symbols requires extra bandwidth compared to transmitting the pure data. However, transmitting additional symbols introduced by FEC is better than retransmitting the whole package when at least an error has been detected by the receiver.

##### ii. General block diagram of decoder

The syndrome calculation is the first step in the decoding process. For a  $t$ -error correcting BCH code, there are  $2t$  syndromes that must be calculated. The syndrome computation for the codes can be simplified to a great extent. Once the syndrome is calculated if there are any errors found then using Peterson algorithm, we find the position of the error and correct it. The block diagram of a Decoder is shown in the figure 2.



Figure 2. Decoder General Block Diagram

#### V. Design Flow

**i. Design Considerations**

There are some principles and concerns taken into hand while designing this project to maintain the required goals of the project system, this project has many parameters and features that affect the performance speed and functionality of its processing, most important considerations are:

- Extensibility: the system can be expanded, and improved by capability of error correcting.
- Modularity: this system consists of separated blocks in its construction and every module treats the incoming signals from the other as an output source.
- Usability: the BCH code is very widely used in satellite communication and mobile systems used with other decoders as a concatenated encoding.

**ii. Description of the design parameters**

Table.1 Parameters of system design

Parameter	Description
BCH(n, k)	BCH(15,7)
Generator polynomials	$p(x): x^4+x+1=0$
Number of correcting errors	$t=2$

**iii. Flowchart of Encoding and Decoding**

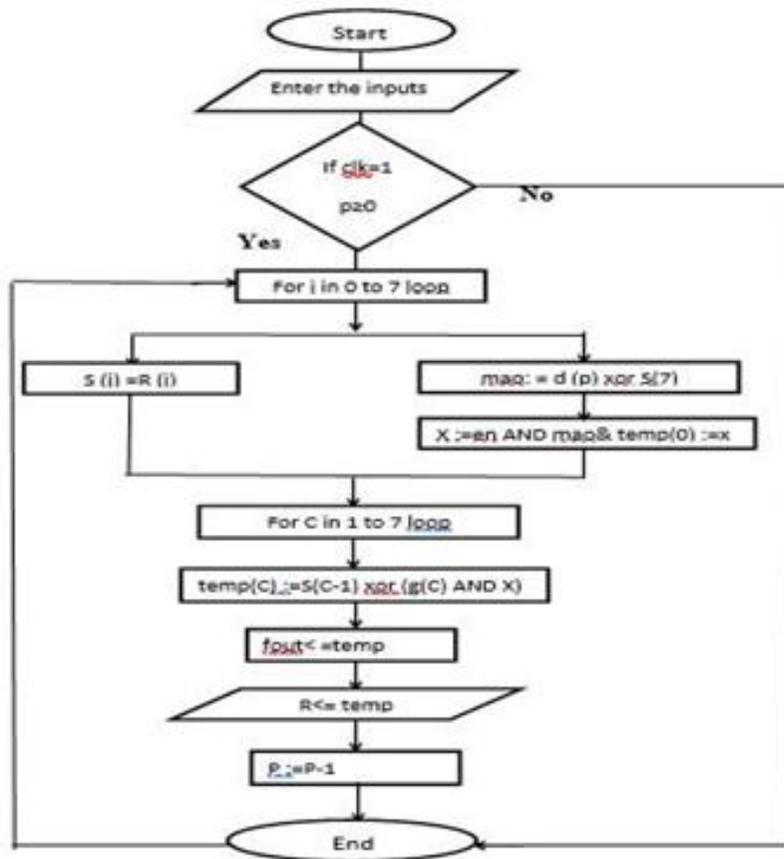


Fig 3. Flow chart of Encoding

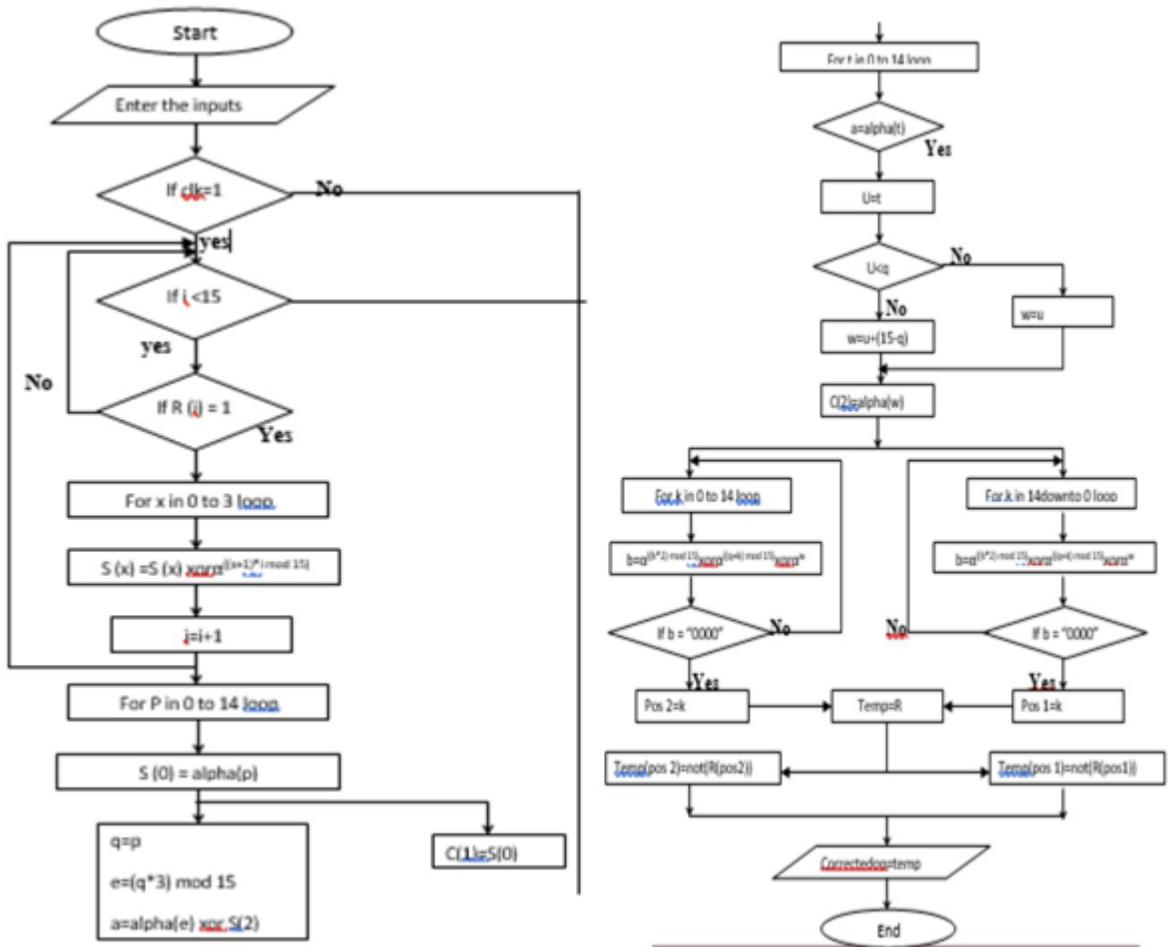


Fig 4. Flowchart of Decoding

## VI. System Implementation

System implementation is the process of defining how the information system should be built (i.e., physical system design), ensuring that the information system is operational and used, ensuring that the information system meets quality standard.

System implementation is divided into

- Implementation using Modelsim software.
- Implementation using FPGA using Altera Quartus II software.

### i. Implementation using Modelsim software.

Encoding: Source Encoding is the process by which the output of an instantaneous code is converted into R-array sequence, where 'R' is the number of different symbols used in transformation process.

➤ Encoding using (n-k) bit shift register

In order to obtain remainder polynomial  $R(x)$ , we have to perform division of  $x^{n-k} D(x)$  by generator polynomial  $g(x)$ . This division can be accomplished using the dividing circuit consisting of feedback shift register as shown in below figure 5.

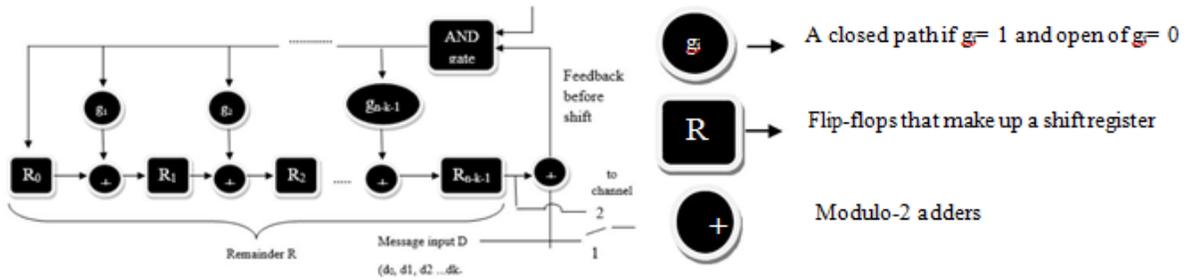


Figure 5. Block diagram of Encoding using (n-k) bit shift register

**Operation:**

Initialization - AND gate is turned on by keeping enable signal (en) high and switch in position 1.  
 Transmission - AND gate is turned off and switch is moved to position 2.

**Decoding**

Decoding is the process of converting code into plain text or any format that is useful for subsequent process. Decoding is the reverse operation of encoder and also corrects the default message by calculating syndromes. Based on the syndromes result we detect whether error is present or not. Syndromes are calculated using the alpha table which is constructed using the primitive polynomial.

Primitive polynomial  $p(x)$ :  $x^4+x+1=0$  ..... (1)

Alpha table: Alpha ( $\alpha$ ) is a primitive element in Galois field ( $2^m$ ). If  $g(x)$  is a generator polynomial for a BCH code with 't' error correcting capability then  $\Phi_i(x)$  is a minimum polynomial of  $\alpha^i$ , such that  $g(x)$  is the least common multiple of  $\Phi_1(x), \Phi_2, \Phi_3, \dots, \Phi_{2t}(x)$  that is,  $g(x) = \text{LCM}\{ \Phi_1(x), \Phi_2, \Phi_3, \dots, \Phi_{2t}(x) \}$

Let,  $\Phi_1(x)=1 + x + x^4$

The first four values of alpha table are constant:

$\alpha^0=0001, \alpha^1=0010, \alpha^2=0100, \alpha^3=1000$  next by substituting the alpha power in the equation (1)(primitive polynomial)

Table 2: Alpha table

Alpha Index	Binary Description
$\alpha^0$	0001
$\alpha^1$	0010
$\alpha^2$	0100
$\alpha^3$	1000
$\alpha^4$	0011
$\alpha^5$	0110
$\alpha^6$	1100
$\alpha^7$	1011
$\alpha^8$	0101
$\alpha^9$	1010
$\alpha^{10}$	0111
$\alpha^{11}$	1110
$\alpha^{12}$	1111
$\alpha^{13}$	1101
$\alpha^{14}$	1001
$\alpha^{15}$	0001

Repeats from here →

### VII. Experimental Results

The experimental results are obtained based on software and hardware implementation.

VHDL Implementation of BCH Encoder (15, 7, 2) cyclic code i. Model Sim Simulation of BCH Encoder

The output is obtained and the test bench waveform for the encoder using Modelsim is as shown in the figure 6.

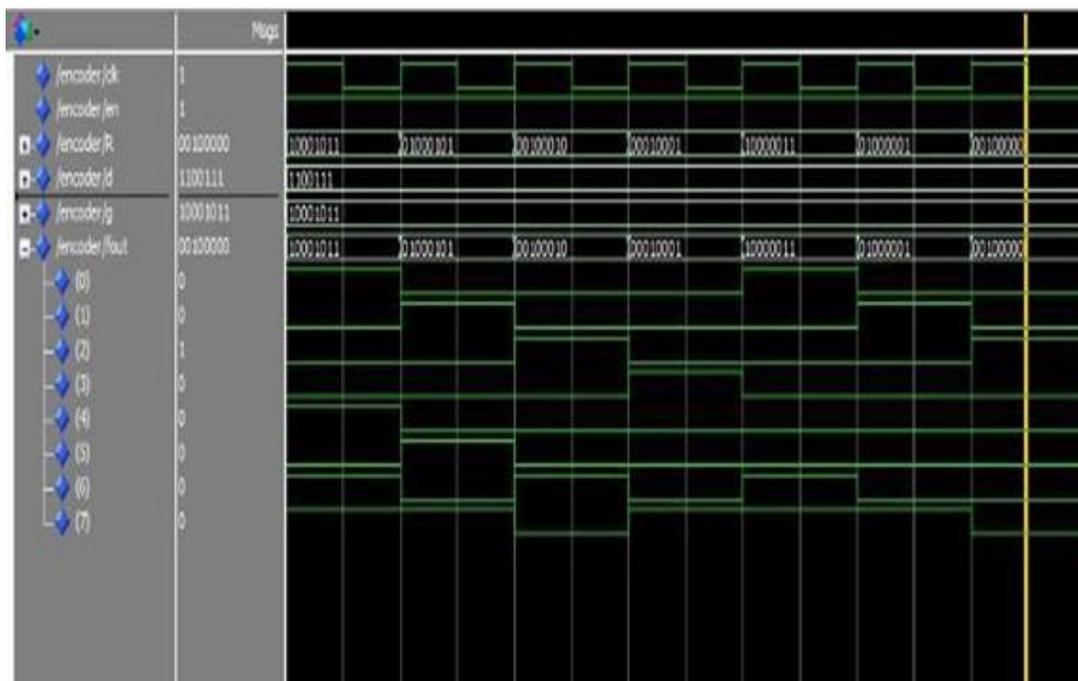


Figure 6. Test bench waveform of encoder.

ii. Simulation of Encoder by FPGA using Altera Quartus II software.

The output waveform obtained for the encoder using the Altera Quartus II is shown in the figure 7.

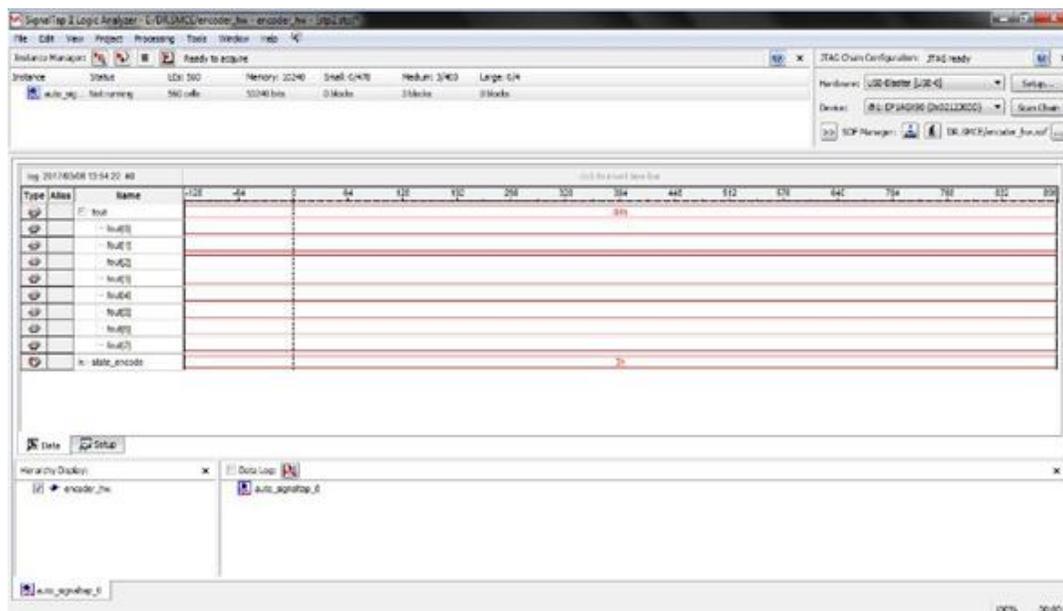


Figure 7. Output waveform of encoder using Altera Quartus II software.

VHDL Implementation of BCH decoder (15,7,2) cyclic code i. ModelSim Simulation of BCH decoder

The output is obtained and the test bench waveform for the decoder using Modelsim is as shown in the figure 8.

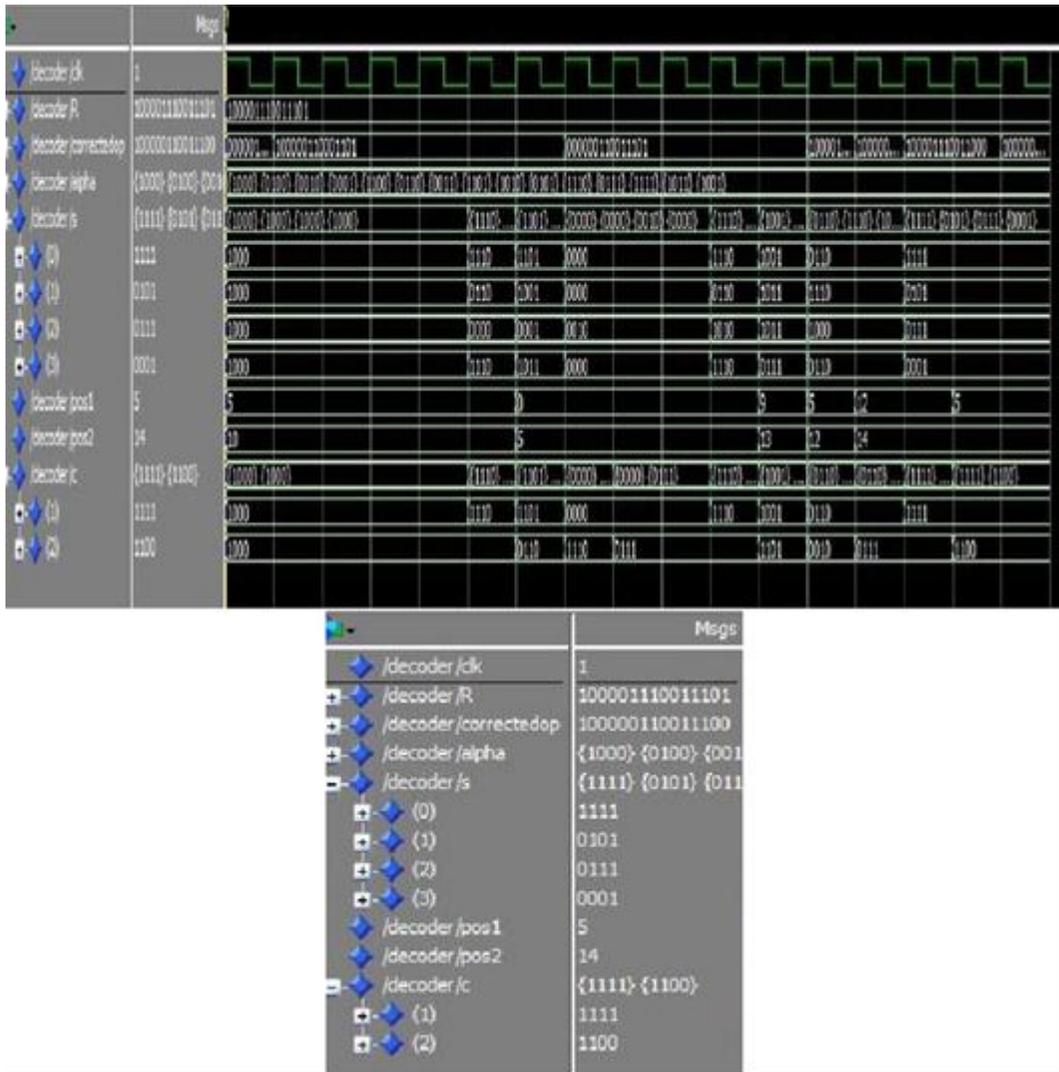


Figure 8. Test bench waveform of decoder.

ii. Simulation of Decoder by FPGA using Altera Quartus II software.

The output waveform obtained for the decoder using the Altera Quartus II is shown in the figure 9.

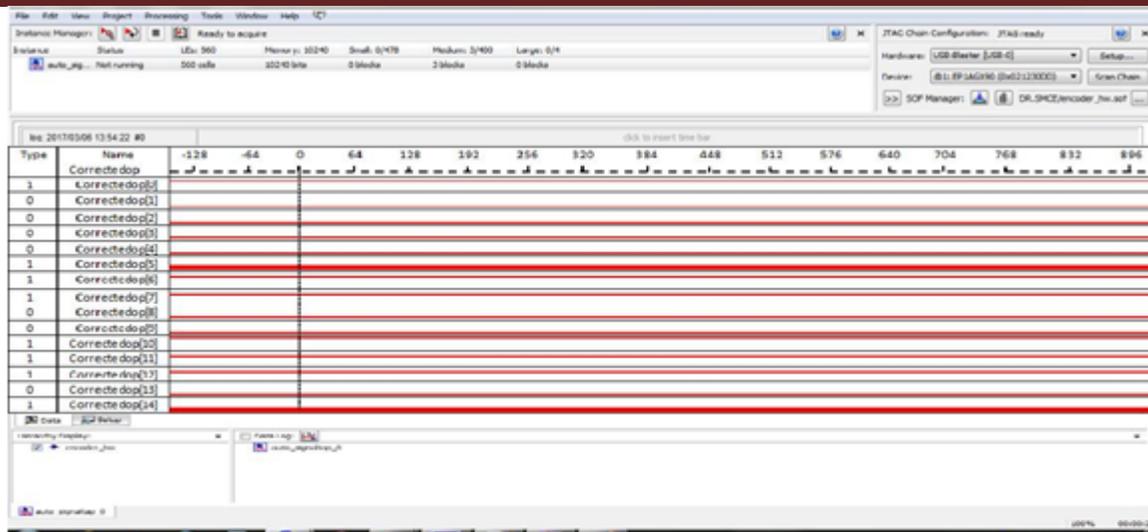


Figure 9. Output waveform of decoder using Altera Quartus II software.

**VIII. Conclusion**

In this thesis, error detection and correction techniques have been used which are essential for reliable communication over a noisy channel. The effect of errors occurring during transmission is reduced by adding redundancy to the data prior to transmission. The redundancy is used to enable a decoder in the receiver to detect and correct errors. Cyclic linear block codes are used efficiently for error detection and correction. The encoder splits the incoming data stream into blocks and processes each block individually by adding redundancy in accordance with a prescribed algorithm. Likewise, the decoder processes each block individually and it corrects errors by exploiting the redundancy present in the received data.

The encoder is designed with symbol length 5 bits per cyclic clock and the number of symbols which are encoded equal 7 symbols then add 8 parity check symbols to encoded data to make code word .The BCH decoder design in order to decode the codeword trough calculation the syndromes numbers and then passed to chain search to calculate correction factor and correct error data. Finally, an implementation of the BCH encoder and decoder with constraint BCH (15, 7) showed that it can be efficiently implemented on the commercially available FPGA platforms (Modelsim).

**Future scope**

The CD player is just one of the many commercial, mass applications of the BCH codes. The commercial world is becoming increasingly mobile, while simultaneously demanding reliable, rapid access to sales, marketing, and accounting information. Unfortunately, the mobile channel is a problematic environment with deep fades an ever-present phenomenon. BCH codes are the best solution to this problem. There is no other error control system that can match their reliability performance in the mobile environment.

The optical channel provides another set of problems altogether. Shot noise and a dispersive, noisy medium plague line-of-sight optical system, creating noise bursts that are best handled by BCH codes. As optical fibers see increased use in high speed multiprocessors, BCH codes can be used there as well. There features make BCH codes an apparent choice for deep space probes. They have been efficiently used in the image communication system of NASA’s Voyager mission. BCH codes will continue to be used to force communication system performance ever closer to the line drawn by Shannon.

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# An Air Gesture Interface for Physically Challenged

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**ABSTRACT:** *The aim of this paper is to design and development air gesture interface for wheel chair motion home access for the physically disabled people who face difficulty in moving from one place to another in day today life. These days joystick controlled wheelchair is available in the market whose cost range is more expensive. We have prepared this air gesture interface for wheelchair motion home access with low cost effective. The web camera which is fixed to the side of the wheelchair that allows to depth sense, like the kinect they will be able to pick up on detailed hand movements. This means you can modify any gadget to respond to gestures. The camera works, by picking up infrared light which, combined with algorithms, show depth. Accuracy appears high enough to draw in the air with a finger and have it picked up, or pinch hand mid-air to zoom on screen. Arduino Uno microcontroller is used for transmitting and receiving the signal, it is fed to with some set of code. The gestures are measured using image processing and which are translated to move the wheelchair in forward, backward, left, right, switching on/off light and closing and opening of door.*

**Keywords:** *Image Processing, Wheelchair, Home access, Door opening, Arduino*

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## 1. Introduction

Paralysis is the loss of muscle function in the part of one's body. It happens when something goes wrong with the way messages pass between brain and muscles. Paralysis can be either complete or partial. It may occur either on one or both sides of the body. It also can occur in just one area or it can also be widespread.

Recently most of the people are facing the problems of paralysis such that they cannot walk while the upper part of the body is unaffected. Such people use wheelchair to move from place to place. Wheelchairs are useful for people for whom walking is difficult or impossible due to paralysis or some accidents or disability.

These are different types of wheelchairs manual wheelchairs which are pushed with their hands or with someones help Joystick driven wheelchairs which are motorised. Most of the wheelchairs bourne patients either push the wheelchair manually or afford someones help even to navigate around in their own house which make them feel inferior.

In recent years, human-computer interfaces with humanitarian focus have been employed to ease the lives, such as sign language interpretation and other human welfare applications.

One of the important areas of research in such fields is to help disabled people in their movements. Although wheelchairs provide a means for independent movement from one place to another, turning the wheels by own hands is a challenge if the person possesses limited movement capability. However, in most cases, such a person may be able to move very light loads by the hands or even in the worst case, only the fingers on a small arena can be moved for giving instructions towards intended direction of movement. Accurate real-time detection of such gestures can assist them to control the movement of wheelchairs or other movable/flexible instruments such as the flexible part of the bed of a patient or a trolley (for bed ridden patients). The idea here is to capture the finger motion and interpret the images for further control of devices. Over the years, several approaches have been adopted in order to design such precise finger movement recognition systems for different applications. Among them, some techniques rely on specially designed gloves for collecting the input image, such as special electronic gloves proposed in [5] or using input from specially marker gloves, or marked hands reported in [6]. The inconvenience and discomfort of marker-based systems makes them unsuitable for regular use as human computer interfaces. Another system reported in [7]-[8] is based on the extrapolation of complex representation of hand shapes. However, due to complex computations involved, it lacks suitability for real-time and wireless applications.

Color based segmentation of hand and fingers was proposed in [9], but its performance degrades in presence of external objects with similar color. In [10], a curvature space approach is proposed, yet it is extremely computationally demanding and requires extensive off-line testing. Again, in [11], a multisystem camera is used to locate the finger tips as farthest points from the center of gravity of the hand. The performance of this method degrades in presence of noise and variation of external conditions. In [12], depth information is extracted by a special camera is utilized. Some other relevant methods have employed

principal component analysis [13]–[14], orientation histograms [15], neural networks [16], support vector machine [17] etc.

However, in general, it would be difficult to implement these methods in real-time robust applications where there are constraints in computational time.

## II. Proposed Method

Basic steps involved in the proposed finger movement detection scheme for wheelchair control are shown with the help of a simplified block diagram in Fig. 1. The various segments of the approach are discussed in details next.

### A. Image Acquisition

To keep the method cost-effective and to simulate worst real-time conditions, high-resolution cameras have been avoided. Rather a cell phone camera with 5 MP resolution, 720p@30fps has been used. The cell phone is situated at a certain height over the white background where the person is supposed to move his finger for directional control. Continuous video is captured and the camera is synchronized with webcam of the PC so that the video is captured in the computer. Then frames are taken for subsequent processing.

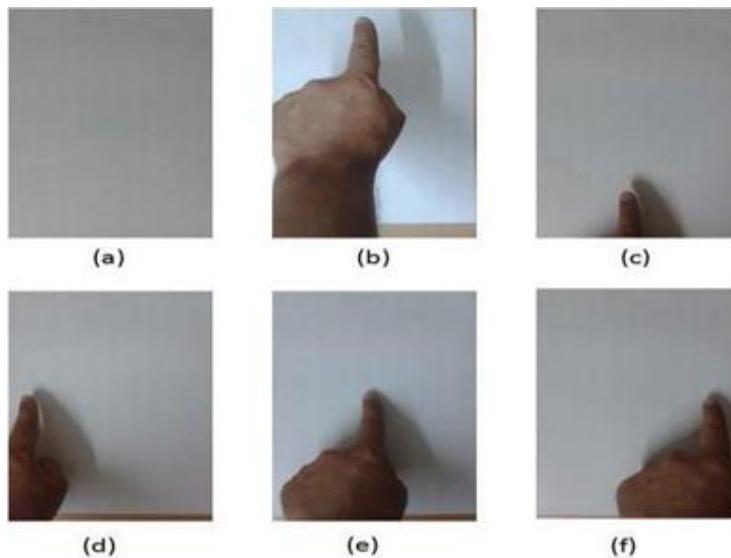


Fig. 2. (a) background, movement directions- (b) forward, (c) reverse, (d) left, (e) stop, (f) right.

### B. Proposed Approach for Fingertip Detection:

In this subsection, proposed fingertip detection algorithm is explained using which the intended direction of the disabled person is detected. Considering the constraints of movement of such a person, we assume a single finger movement directed vertically on a small area over a white background on a resting board placed on the wheelchair or alongside the bed of a patient for specific applications. The background and some sample finger positions are shown in Fig. 2. In what follows, we discuss the steps performed for fingertip detection.

### C. Color Normalization:

The lighting conditions during image capture may vary widely depending upon surrounding environment and lighting equipments. As can be seen from Fig. 2 (a) and (b), there is variation in light intensity which may cause error. To minimize such effects, for each pixel, the mean of values in the three color plane at that particular pixel is calculated (Lavg). Then, every pixel in the three color planes is replaced as-

$$X_{norm}(i, j) = \frac{X(i, j) - L_{avg}(i, j) + 1}{2}; X = R, G, B \quad (1)$$

where the mean Lavg at that pixel location is same for all three color planes.

**D. Background Subtraction:**

Continuous images are taken as snapshots from the video capture and grayscale image is obtained. Then the background saved in memory is subtracted. One such image is shown in Fig. 3(a).

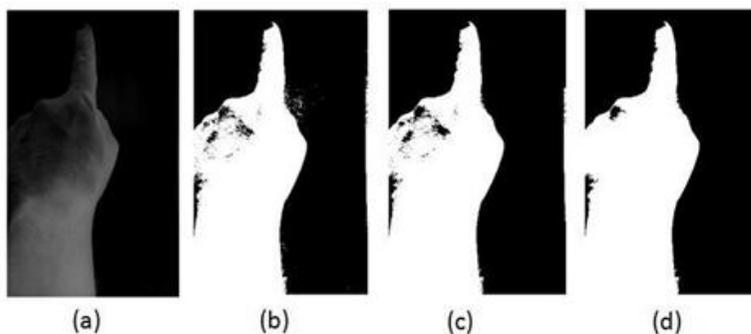


Fig. 3. (a) background subtracted grayscale image, (b) binary image, (c) output of median filtering and morphological opening, (d) output of morphological hole filling.

**E. Obtaining Binary Image:**

The grayscale image is then converted into a binary image using Otsu’s method [18]. Such thresholding operation nullifies the effect of shades to a great extent. Fig. 3(b) displays the binary image obtained from Fig. 3(a). Let, this image is A.

**F. Median Filtering and Morphological Opening:**

Next we perform median filtering operation on the binary image A to reduce salt and pepper noise and obtain image C. Then, morphological opening operation [19] is performed using a square structuring element B to get rid of sparse noisy pixels which are of dimensions lesser than 10000 pixels. Let the obtained image is D. As can be seen

from Fig. 3(c), such operation has successfully removed some noisy points from Fig. 3(b).

$$D = C \circ B \quad (2)$$

**G. Morphological Hole Filling:**

To further enhance the image and fill up some points which have been erroneously detected as black pixels, hole filling [19] is done on image D. The result of it on sample image is shown in Fig. 3(d) where some of the holes have been filled containing the hand region.

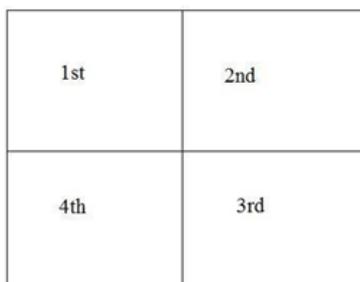


Fig. 4. Total background divided into four quadrants.

**H. ROI Extraction and Finger Location:**

To reduce computational load, we divide the total area of  $2M \times 2N$  dimensions into 4 quadrants of  $M \times N$  pixels to determine our region of interest (ROI) as shown in Fig. 4. Since the fingertip will be located in one

of these 4 blocks, it is convenient to determine the block beforehand and then perform the location search. The grayscale image from the original image is obtained and then we perform mean filtering using a 3x3 square kernel. Then the average intensity of each of the 4 blocks is obtained using-

$$A_p = \frac{1}{MN} \sum_{i=1+(q-1)*M}^{M+(q-1)*M} \sum_{j=1+(r-1)*N}^{N+(r-1)*N} I(i, j); p = 1 - 4 \quad (3)$$

where  $A_p$  is the average intensity of the  $p$ th block,  $q = 1$  for  $p = 1, 2$  and  $q = 2$  for  $p = 3, 4$ ,  $r = 1$  for  $p = 1, 4$  and  $r = 2$  for  $p = 2, 3$  and  $I_{i,j}$  is the intensity at  $(i, j)$  pixel of the total image, thus giving us the finger location.

### I. Control Signals for Motor Driver:

The direction towards the location of the finger is obtained with respect to the desired direction of movement of the vehicle. This detected location information center pixel. This is the detected is transmitted to Arduino.

### III. Block Diagram

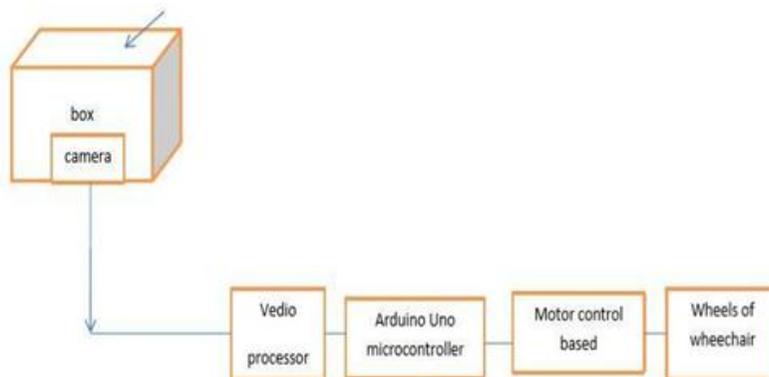


Fig. 5: Block diagram of air gesture interface for wheelchair motion home access

In the above block diagram air gesture is shown to the camera. Camera captures the hand motion and finger location is found using the processing unit. The gesture corresponds to wheelchair motion, this information is sent to motor controlling the wheelchair.

### IV. Conclusion

By using this system physically handicapped persons finds easy way to navigate within house using this automatic control wireless wheelchair without any external support, also this gives operation very friendly and simple as well as small in size. If this sensor replace with another sensor, it can control the chair by fingertip movements respectively. This wheelchair could make a handicapped one independent and also there is no any need to depend on another person for his day to day work in life. This automatic wheelchair helps handicapped one, which are not able to move and cannot stand alone effectively.

### V. Future Scope

To develop a wheel chair control which is useful to the physically disabled person with his hand movement or his hand gesture recognition. With the help of the wheel chair physically disabled person would able to move himself to the desired location with the help of hand gestures which controls the movement of the chair. This aims to provide a feasible solution to those who are handicapped people who do not have the ability to control the wheelchair by themselves. These include people with serious paralytic condition. Wheelchair is an automated control system which proves to be a versatile tool for many problems in human computer interface systems. Basically, they are used for providing better usability of a computer or a system for people, including disabled people.

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# A DFT Methodology: Scan Insertion and Compression for Scan DRC Violation

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**ABSTRACT:** Design for Testability (DFT) is a modern technique that is used to detect the faults in a chip after the manufacturing process to get high quality. Scan insertion is done to get good controllability and observability without any DRC violations and compression reduces test time and test data volume. The design undergoes scan insertion and compression for clock and reset DRC violation to get maximum test coverage. Violations may occur during the test which leads to less coverage, here the clock and reset rule violation is focused and fixed. The tool used to test is Mentor Graphics-Tessent to check how scan and compression are used to reduce test time and test data volume of silicon under test.

**Keywords:** Scan Insertion, Compression, EDT, DRC, Coverage

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## 1. Introduction

Today the fast-growing electronic industries requires the ability to test the chips so that the chips with no errors or zero faults reach the customers. This can be done by Design for Testability (DFT) [1], which gives maximum controllability and observability [2,3] which yields high test coverage. Controllability is the ability to change the signal values to logic from the inputs and observability is the ability to observe the given vales at the output. In the paper structured DFT technique is used.

To do this extra logic is added to the design without changing the functionality of the design to get error free chips. The design under test has to pass through all tests so that error free chips are delivered to the customer. DFT operates in two modes depending on the test\_enable pin.

If test\_enable = 0; it is in the functional mode,

If test\_enable = 1; it is in the DFT mode.

In the functional mode, the output is from the combinational logic and in the DFT mode the output is from the combinational path and from shift path. In this way DFT checks for all the faults at each and every node to produce chip of high quality in less time. In this paper the clock and reset rule violation fix is done by scan insertion and scan compression to get fault free chip after manufacture. The clock and reset violation come under S1 DRC rules. Design Rule Check are the constraints that a logic circuit, IC or a board undergoes to give all possible violation which needs to be fixed either manually or through command. It makes sure that the design functions properly and is reliable with high yield.

Failing to fix any DRCs in the design results in the faulty chip being delivered to the customer, this is a loss to the company and its reputation. The implementation is done using Tessent tool Mentor Graphics.

## B. Introduction To Scan Insertion

Scan is technique [3,4], which uses the idea of controllability to set the inputs at the gates and flip-flops inside a chip and observe the same output from the flip-flops in a pre-planned way. The scan design modifies the internal sequential circuit without changing the functional design. The goal is to make a difficult-to-test sequential circuit to behave like easy-to-test combinational circuit. To achieve this normal sequential flip-flop is converted to a scan flip-flop (scan cell) and the stitch the scan cells together to form a scan shift registers or the scan chains. A normal flop converted to a scan flop by adding a multiplexer to the flip-flop as shown in figure 1.

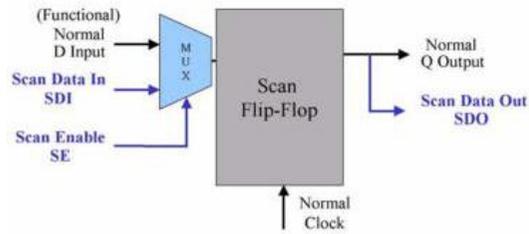


Fig.1. Scan flip-flop

The multiplexed scan flip flop has the following pins,

- Scan Input
- Scan Enable
- Scan Output.

Scan insertion operates in two modes, shift and capture depending upon the Scan\_Enable input which acts as a select line to choose between shift mode and capture mode.

If scan\_enable = 0; the path is capture path

If scan\_enable = 1; the path is shift path.

In the capture mode is path from a combinational logic through D input to Q output, the tool test the complete functional path for fault free output. In the shift mode the path for testing is from SI to Q (scan output), this path acts like shift register which shifts the scan input data in the scan flops and gives the value at the output. The path from SI to Q forma chain of shift registers which are called as scan chain. Figure.2. shows the arrangement of a scan chain with shift and capture modes and its waveforms. The basic scan pattern is as follows:

- Load scan chains
- Force primary inputs
- Measure Primary outputs
- Pulse capture clock
- Unload scan chains

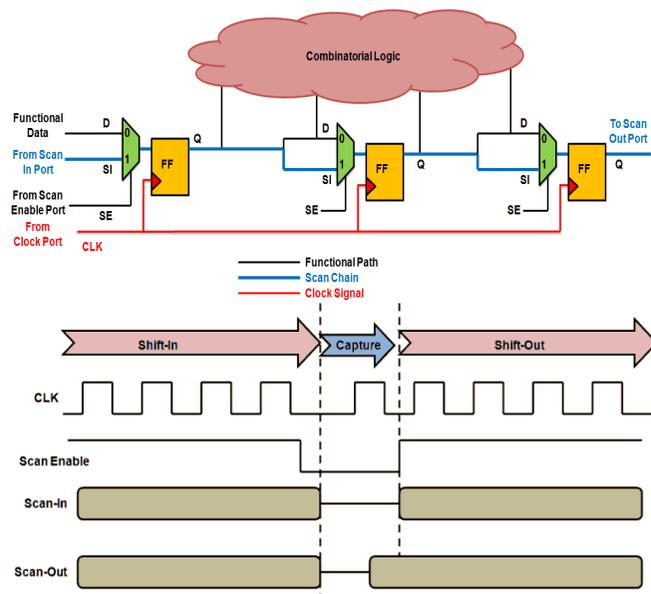


Fig. 2. a. Scan chain with 3 Flip-flops [3] Fig.2. a. Waveforms with Shift and Capture operations [3]

### C. Introduction To Scan Compression

Larger designs which required more test patterns increasing in data volume and rising of tester costs made the companies realize the need for the compression. Test compression or scan compression reduces the test data volume and test time in the process of testing an integrated circuit. This is done by increasing the number of scan chains with shorter length and small number of scan channels. This is accomplished by compression ratio which is give as the ratio of total number of internal scan chains to the external channels. There are several methodologies that can be used for compression but only Tessent TestKompress' Embedded Deterministic Test (EDT) [8,9,10], is capable of simultaneously addressing the required high data and time compression, it is also able to handle X states and still maintains the same high quality after compression like an uncompressed ATPG. Using this one can get test coverage of about 99%. The architecture of an EDT contains a decompressor logic ant the input side and compactor logic [6,7,14,15], at the output that is embedded onto the chip. The decompressor drives the inputs into the scan chains and compactor is connected to the scan chain outputs. The logic is sent only during the scan path as shown in figure 3.a.

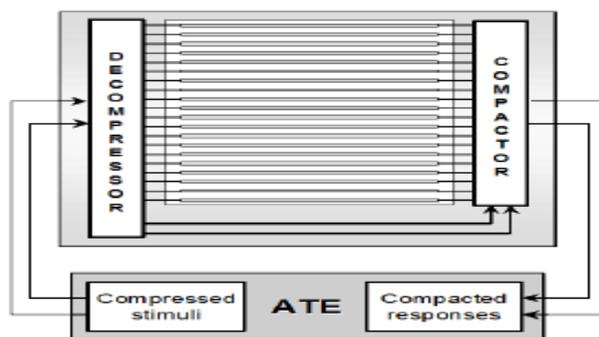


Fig.3. a. EDT Architecture diagram [15]

These patterns here are generated ina deterministic way, hence a high-test coverage with a smaller number of patterns are obtained. The decompressor consists of a continuous flow ring generator such as a Linear Feedback Shift Register (LFSR) to generate the patterns as shown in figure 3.b. as an example.

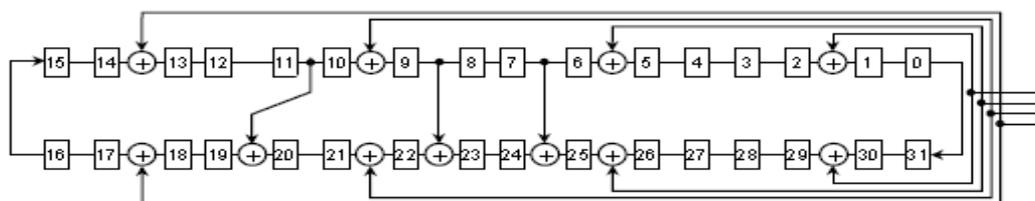


Fig.3. b. Ring Generator with the polynomial  $x^{32} + x^{18} + x^{14} + x^9 + 1$  [15]

The output of the compactor consists of a tree of XOR gates and the masking logic. The masking logic is made up of a pattern mask register, a decoder, and AND gates preceding the XOR tree. This masking logic along with XOR tree is cabable of handling any number of unkown (Xs) [8], values coming from the scan chains without making any alterations in the functional logic. The figure 3.c. shows the comparator logic. After inserting EDT logic, it is verified for DRC violations again through tool commands again, if any found has to be fixed through scan stitching.

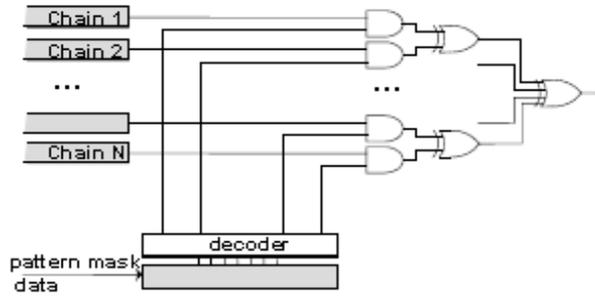


Fig.3. c. Comparator with automated masking logic.

## II. Proposed Methodology

This section of paper presents the techniques for scan insertion and compression to fix S1- rule violation which is a part of scannability rules. The rules define that a non-scan cell must not capture data when all of the specified clocks (including set/reset) are set to their respective off states. In the case considered in this paper the clock pin is being set to X (don't care). To pass S1 DRC, the clock pin must be tied to its off-state value 0.

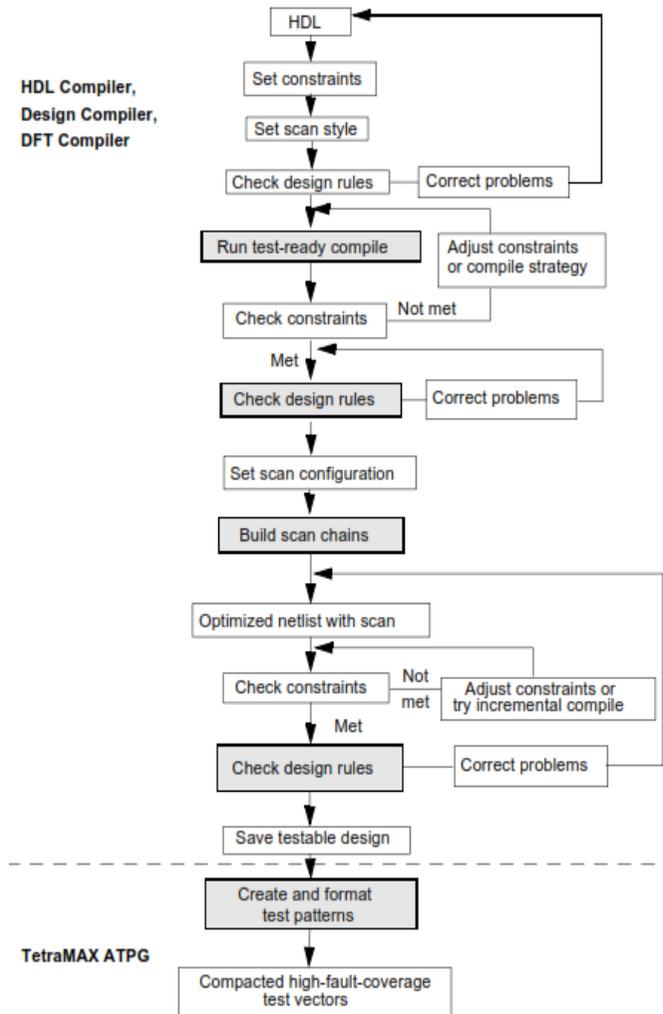


Fig.4 Scan insertion and Compression flow [4]

Tessent tool is used for scan insertion and compression where a normal flip-flop is converted multiplexed scan flop and is stitched. The various commands are run to check for DRC violations, at the point after adding clocks and running in the DFT mode, 4 S1- violations occur.

```
// -----
// Begin gating checking
// -----
// Checking clock set and reset for 4 non-scannable sequential instances
// -----
// 4 sequential instances can be gated to be scannable
// 0 sequential instances remain non-scannable
// Note: There were 4 S1 violations that will be fixed by adding test logic.
// -----
// Checking test clocks
// -----
// Number of test clocks required = 1
// -----
// Begin shift register identification process for 40 sequential instances.
// -----
```

Fig.5. S1 violation error during setup mode

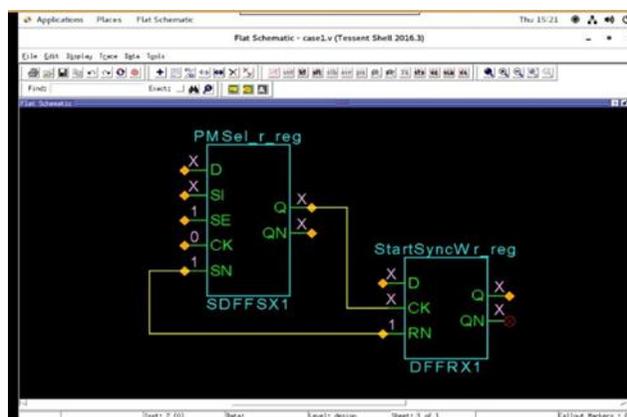


Fig.6. S1 violation error in visualizer

It can be seen in figure.6 that the clock to the flop StartSyncWr\_reg is coming from output of another scan flop Q, hence there is X present on the flip-flop which is not converted to a scan flop and not stitched. This is DRC S1- rule violation and need to be fixed. There are 4 such violations in the design which has to be fixed using commands. Giving the proper commands in the dofile, fixes the issue and thus the same can be viewed in visualizer. The following figure 8 shows the violation being fixed. The important command which does this is set\_test\_logic -clock on -set on -reset on. It can be seen in fig 7 that mux logic eliminates the propagation of X to the clock and all clocks, set and resets are in their off-state values.

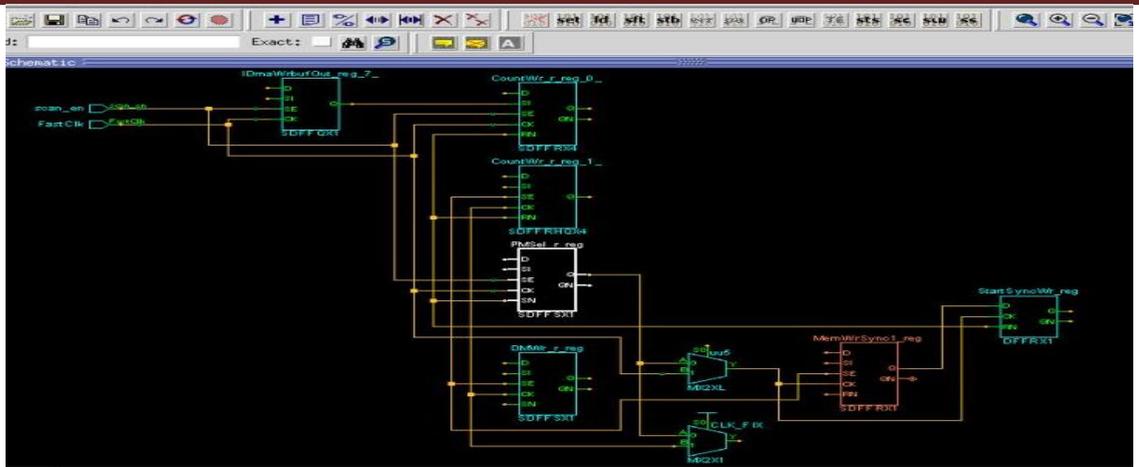


Fig.7 Mux logic eliminates unknown value propagating to clock.

The compression logic or the EDT logic is applied to this case so as to convert gate level netlist to RTL. The scan inserted netlist undergoes a process of compression in which all the files like dofile, test procedure files are inserted with EDT logic and the reports are dumped in the output directory. A run file with the obtained script is run in the synthesis process by invoking Synopsys tool.

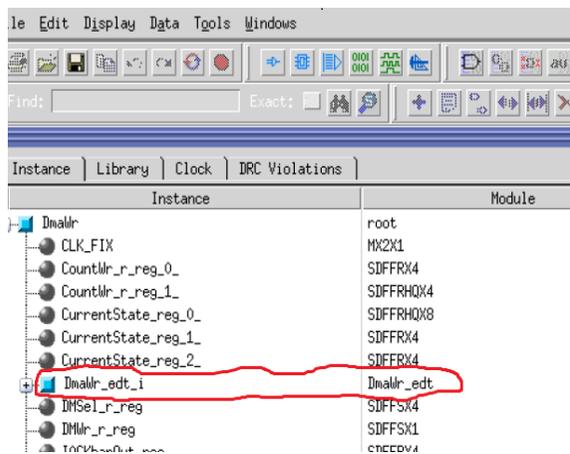


Fig.8. EDT insertion

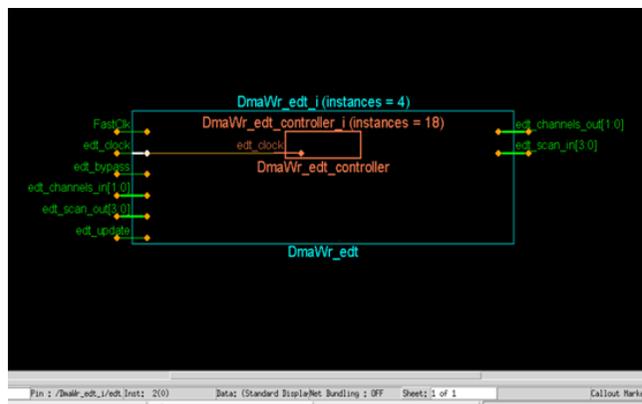


Fig.9 EDT logic block

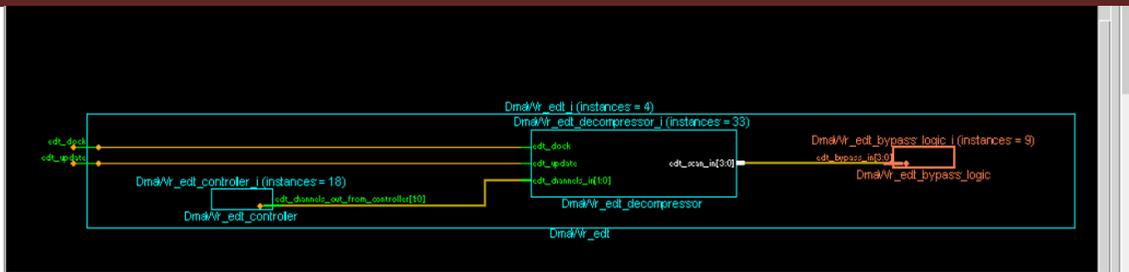


Fig.10. EDT decompressor logic

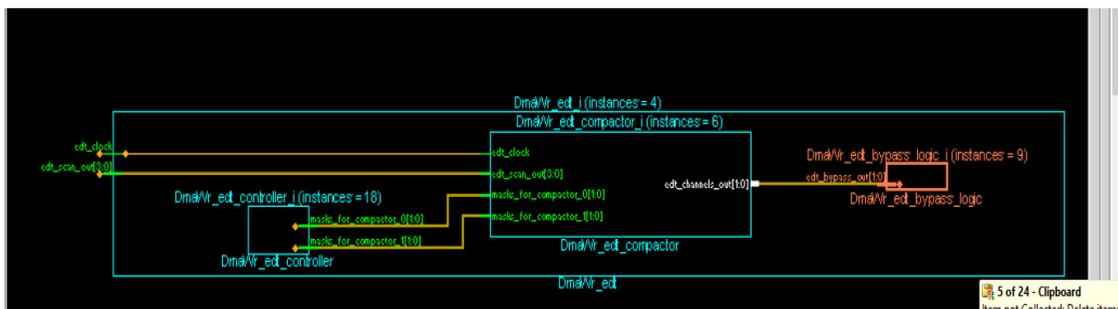


Fig.10. EDT compactor logic

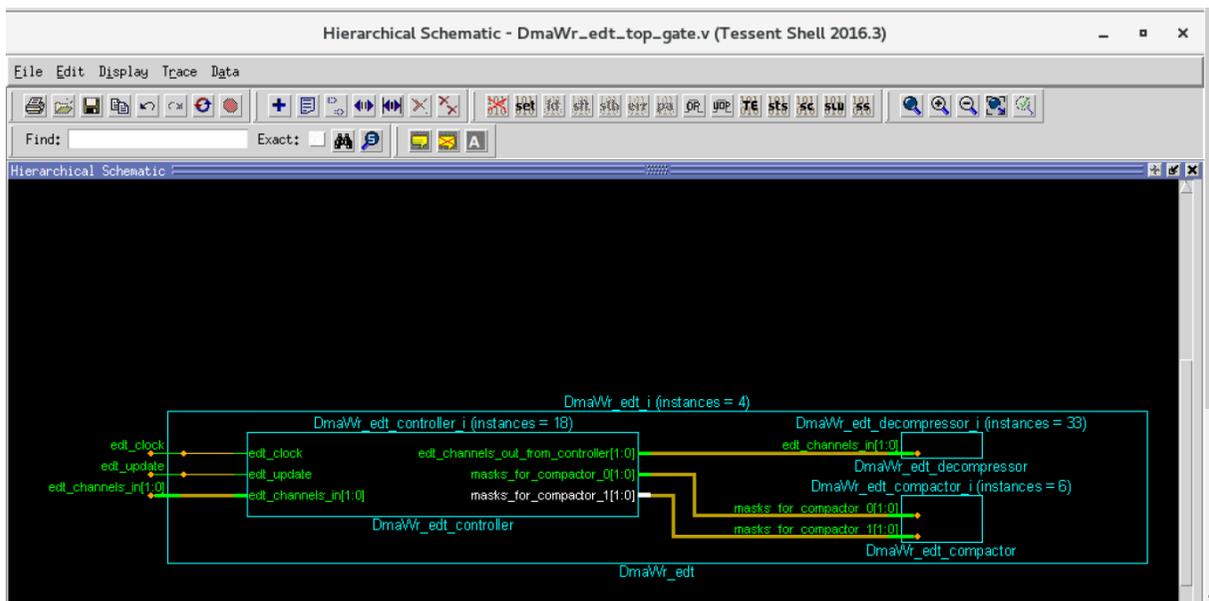


Fig.10. EDT controller block

#### IV. Conclusion

In this paper a DFT methodology for scan insertion with scan stitching and EDT logic for compression is being carried out for a violation where a data is captured from a non-scan cell even when all the clocks including set and reset are in their off state or an unknown value X propagates through the clock. The scan stitching added an extra logic to the design without functionality being altered and the scan compression reduces the test time by using decompressor and compactor blocks with XoR implementation.

#### **V. Future Work**

As a part of future work, the total coverage obtained can be calculated by generating patterns for the faults using ATPG and thus can be verified using simulation. The work can be further continued using better DFT tools to check the coverage for MBIST, LBIST and JTAG.

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## 3D- Discrete Wavelet Transform for Image Compression using Medical Imaging

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**ABSTRACT:** An efficient architecture is proposed in this paper for high speed 3D - Discrete Wavelet Transform computing. Volumetric data sets produced by various 3D image acquisition devices such as computed tomography (CT) and magnetic resonance imaging (MRI) are processed in the wavelet filters (3D-DWT) with a efficient PSNR and Compression ratio

**Keywords:** Computed tomography (CT), Position emission tomography (PET), Magnetic resonance imaging (MRI), Discrete Wavelet Transform, PSNR, MSE.

---

### 1. Introduction

Image processing methods, which are possibly able to visualize objects inside the human body, are of special interest [1]. Advances in computer science have led to reliable and efficient image processing methods useful in medical diagnosis, treatment planning and medical research. In clinical diagnosis using medical images, integration of useful data obtained from separate images is often desired[2]. The images need to be geometrically aligned for better observation

3D DWT has been used in various image and video compression and processing applications[3]. Encoding volumetric data sets produced by various 3D image acquisition devices such as computed tomography (CT), position emission tomography (PET) and magnetic resonance imaging (MRI) are a number of 3D DWT applications. Scalable video coding and noise reduction between frames of a video are the applications that we can name for 3D DWT in the field of video coding and processing [4,5]. DWT is one of the most computationally intensive parts in these image and video coding applications.

The available DWT architecture can be divided broadly into two schemes named as convolution scheme and lifting scheme. Normally convolution scheme is used to implement DWT filters. But this scheme uses huge number of multipliers which is very difficult to implement and take a large amount of resources in hardware. To eliminate those problems lifting schemes is used. This scheme uses the basic convolution equations in such way that the numbers of multipliers are drastically reduced [6]. Due to this reason lifting scheme is widely used to build chip than convolution scheme.

In this paper, a novel approach for the fusion of computed tomography (CT) and magnetic resonance images (MR) images based on wavelet transform has been presented. The rest of the paper is structured as follows. Section 2, computed tomography (CT) magnetic resonance imaging (MRI) with respect to DWT. In section 3 and 4, the high efficient architecture for the (5, 3) filter based 3D - DWT followed by the implementation and performance analysis in section 5, and section 6 concludes the work.

### 2. Medical Imaging - Magnetic resonance imaging (MRI) and Computed tomography (CT)

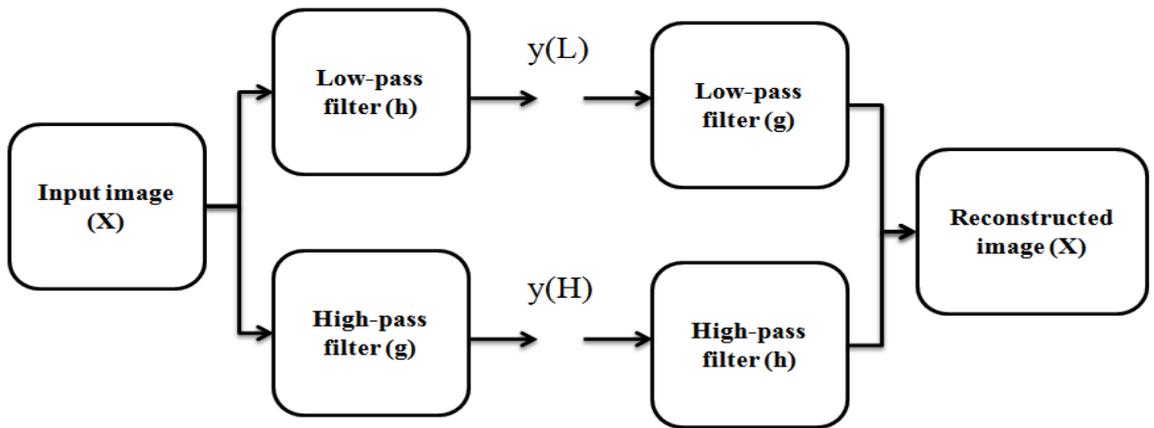
Magnetic resonance imaging (MRI) of the body uses a powerful magnetic field, radio waves and a computer to produce detailed pictures of the inside of your body. It may be used to help diagnose or monitor treatment for a variety of conditions within the chest, abdomen and pelvis. If you're pregnant, body MRI may be used to safely monitor your baby.

Computed tomography (CT) of the body uses special x-ray equipment to help detect a variety of diseases and conditions. CT scanning is fast, painless, noninvasive and accurate [7]. In emergency cases, it can reveal internal injuries and bleeding quickly enough to help save lives.

Medical imaging provides a variety of modes of image information for clinical diagnosis, such as CT, X-ray, DSA, MRI, PET, SPECT etc. Different medical images have different characteristics, which can provide structural information of different organs. For example, CT (Computed tomography) and MRI (Magnetic resonance image) with high spatial resolution can provide anatomical structure information of organs. And PE (Positive electron tomography) and SPECT (Emission computed tomography) with relatively poor spatial resolution, but provides information on organ metabolism. Thus, a variety of imaging for the same organ, they are contradictory, but complementary and interconnected

### 3. Architecture of DWT – General structure

The best way to describe discrete wavelet transform is through a series of cascaded filters. We first consider the FIR based discrete transform. The input image  $X$  is fed into a low-pass filter  $h'$  and a high-pass filter  $g'$  separately. The output of the two filters are then sub sampled, resulting low-pass sub band  $y(L)$  and high-pass sub band  $y(H)$  as shown in the figure 1.



**Figure 1:** DWT general structure

The original signal can be reconstructed by synthesis filters  $h$  and  $g$  which take the up sampled  $y(L)$  and  $y(H)$  as inputs. To perform the forward DWT the standard uses a 1-D sub band decomposition of a 1-D set of samples into low-pass samples and high-pass samples[8]. Low pass samples represent a down sampled low-resolution version of the original set. High-pass samples represent a down sampled residual version of the original set, needed for the perfect reconstruction of the original set.

### 4. Proposed Architecture of 3D-DWT

The one-dimension (DWT) filter bank consists of two analysis filters, a low pass filter (LPF) and a high pass filter (HPF), which separate the frequency contents of input signal into the approximation (low frequency) coefficients and the details (high frequency) coefficients[9]. The two dimensional (DWT) can be obtained by applying the one dimensional (DWT) along the rows and columns of the input image.

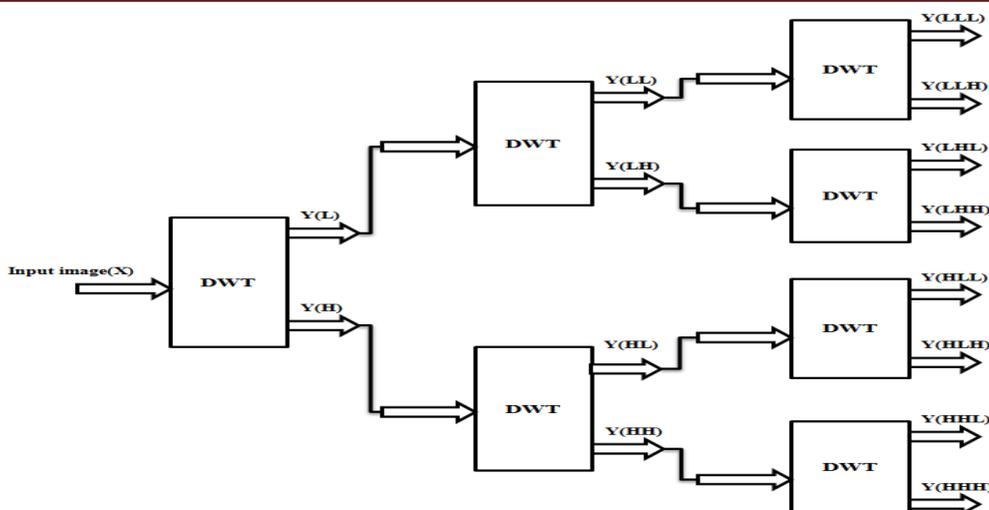


Figure 2: Architecture of 3D-DWT

the first level of computation, the input image is decomposed horizontally by applying one-dimensional (DWT) on each row to get two coefficients (y(L) and y(H)), then it is decomposed vertically by applying one-dimensional (DWT) on each column to get four wavelet coefficients y(LL), y(LH), y(HL), and y(HH). Further these co-efficient are processed for 3D-DWT and produce eight co-efficient as, y(LLL), y(LLH), y(LHL), y(LHH), y(HLL), y(HLH), y(HHL) and y(HHH) as shown in Fig. 3.

**5. Analysis of 3D - DWT design with medical imaging applications**

PSNR is used to measure the quality of reconstruction compression codec. MSE is a measure of error between original I(i,j) and reconstructed image K(i,j). When comparing compression codecs, PSNR is an estimate to human perception of reconstruction quality [10-11].

$$PSNR = 10 \log_{10} \left( \frac{255^2}{MSE} \right)$$

Where

$$MSE = \frac{1}{mn} \sum_{i=0}^{m-1} \sum_{j=0}^{n-1} [I(i,j) - K(i,j)]^2$$

I (i,j) : Original Image

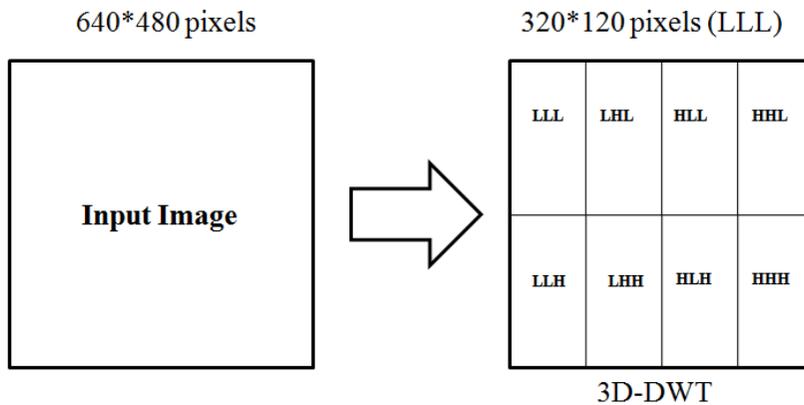
K (i,j) : Reconstructed Image and

m x n : Total number of Pixels in the Original image.

Table 1: Comparison of Quality of Reconstructed Images

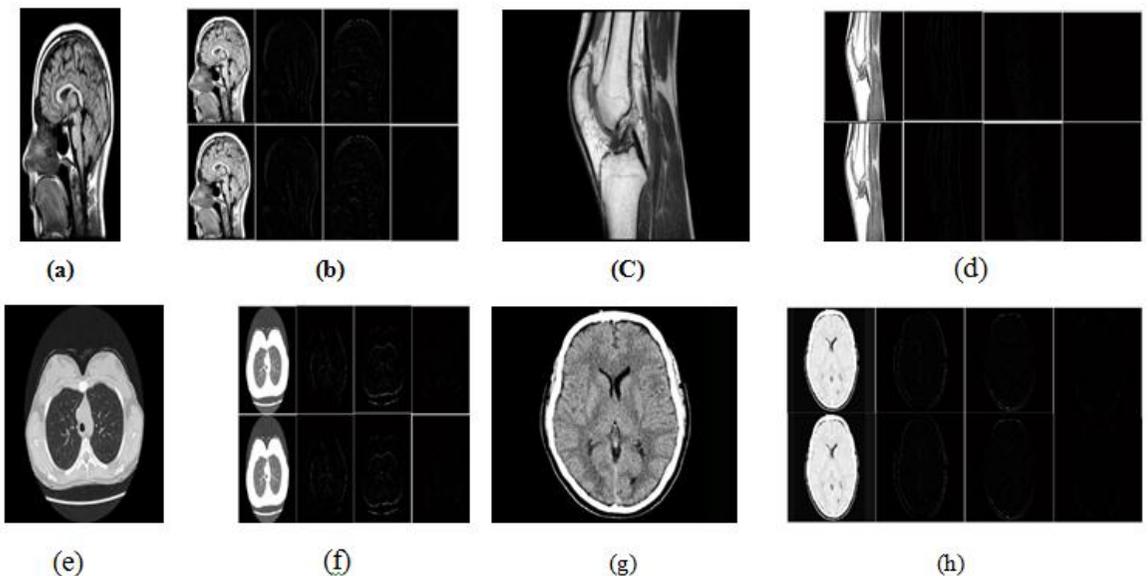
Input Image	PSNR for 3D-DWT in dB	MSE for 3D-DWT
Human_Brain.jpg	53.0	0.2
Elbow.jpg	52.3	0.3
Ct_Lungs.jpg	51.8	0.4
Ct_Neuro.jpg	53.0	0.3

**6. Decomposition levels of image in 3D-DWT**



**Figure 3:** Image decomposition in 3D-DWT

The one-dimension (DWT) filter bank consists of two analysis filters, a low pass filter (LPF) and a high pass filter (HPF), which separate the frequency contents of input signal into the approximation (low frequency) coefficients and the details (high frequency) coefficients. The two dimensional (DWT) can be obtained by applying the one dimensional (DWT) along the rows and columns of the input image. At the first level of computation, the input image is decomposed horizontally by applying one-dimensional (DWT) on each row to get two coefficients ( $y(L)$  and  $y(H)$ ), then it is decomposed vertically by applying one-dimensional (DWT) on each column to get four wavelet coefficients ( $y(LL)$ ,  $y(LH)$ ,  $y(HL)$ , and  $y(HH)$ ). Further these co-efficient are processed for 3D-DWT and produce eight co-efficient as,  $y(LLL)$ ,  $y(LLH)$ ,  $y(LHL)$ ,  $y(LHH)$ ,  $y(HLL)$ ,  $y(HLH)$ ,  $y(HHL)$  and  $y(HHH)$  as shown in Fig. 3.



**Figure 4:** Decomposition of images (MRI and CT) in 3D-DWT

- |   |  |
|---|--|
| (a) MRI - Human brain(500*500)<br>(c) MRI - Elbow ( 1280*720)<br>(e) CT - Lungs (480*360)<br>(g) CT - neuro (960*720) | (b) Decomposition of human brain(250*125)<br>(d) Decomposition of elbow (640*180)<br>(f) Decomposition of lungs (240*90)<br>(h) Decomposition of neuro (480*180) |
|---|--|

The Block based scheme was implemented in Matlab. As examples, four “standard” test images were chosen for the experiment. All these test images have different dimensions [12-13]. As per the requirements of JPEG2000 standard, one can select blocks of size 4x4 pixels or more. Smaller the block size, smaller will be the computation time required for processing transforms DWT and IDWT.

## 7. Conclusion

We successfully implemented the 3D- discrete wavelet transformation on the DSP as applied to lossless image compression. We also implemented the transformation and its inverse in Matlab and compared the results to verify that our algorithm was working correctly. PSNR and Mean square error (MSE) for the Human brain, elbow, lungs and neuro system has been tabulated for the quality of the image reconstructed. Image compression and de-compression levels of MRI and CT images with respect to its size are described.

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# Development of a smart ROV for visual inspection in underwater archaeology

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**ABSTRACT:** Remotely operated underwater vehicles (ROVs) are remote control underwater robots driven by an individual on the surface. These robots are connected by a series of wires that send signals between the operator and the ROV. The ROV is equipped with a video camera, propulsion system and lights and a manipulator arm. In this project intends to recreate such ROV in order to describe preliminary performance experiments for survey and collect the samples of underwater cultural heritages using a ROV.

**Keywords:** Remotely Operated Underwater Vehicle (ROV), Propulsion System, Manipulator Arm.

---

## 1. Introduction

Remote Operated Vehicle (ROV) is in the Unmanned Underwater Vehicle (UUV) that are used for underwater exploration for carrying out several challenging tasks underwater [1]. The large historical heritage is lying on the seabed of the Earth represents an important resource that need to be protected and valued. It stand as an opportunity for development of tourism in coastal areas. In particular, underwater archaeological sites and the shipwrecks or sunken cities, are considerably fascinating for the public, both for the sense of mystery that surrounds them, and the symbiosis between the artifacts and the sea creatures that live in the marine environment. In many case the underwater archaeological sites are spread around the world have become veritable underwater archaeological parks which is preserved and made accessible on-site, on that are protected Underwater Cultural Heritage[2]. When underwater statements concerned within Indian marine archeology the most talked about would be the ancient city dwarka and Mahabalipuram the which was sunk in the sea due to massive natural disaster. There are several sites under the ocean where the coastal areas have the large tide difference, rocks and fast currents, the sailings were not always safe to continue the research activity in such condition. These areas are supposed to have artifacts such like kettle, cup, pottery, etc[3].

Traditional underwater excavation has been conducted by human divers. If there are fast flow and low visibility, the human activities become very restricted. It is also very limited to perform marine archaeology under 50m water depth. Then, to overcome these restrictions, use of ROVshas been raise[4]. The ROVs consisting of the camera and the manipulator arm which is used for the visually inspect and collect the samples of the ancient artifacts. Use of the ROVs minimizing environmental disturbances which can be caused by thrusters such as propellers[5]. The preliminary performance experiments described in this paper were accomplished to verify usefulness of the ROV for survey of underwater cultural heritage.

## II. System Description

### A. Platform for remotely operated underwater vehicle

Since the purpose of the project is to develop ROV for the use of research in the marine archaeology, the camera used is a Logitech camera that can capture high resolution images and The camera is modified to waterproof feature. As for the floats are used to stabilise the ROV. The frame of the ROV is made of polyvinyl chloride (PVC) pipe as it is lightweight and an less expensive material. Four 12 volts DC motors are used as thrusters for the navigation of the ROV. Two thrusters are used to control the direction while another two is used to control the level of depth of the ROV underwater[1-2]. Following the standard category 5 cable (CAT5) of length 15 meters is used as an umbilical cable to withstand the maximum load current of the DC motors. Fig. 1 shows the ROV.



Fig.1. Remotely Operated underwater Vehicle

### B. Architecture of the Remotely Operated Underwater Vehicle

Fig. 2 illustrates the block diagram of the ROV. Only the camera manipulator arm and DC motors are attached directly on the ROV. These components are the only ones that would be submerged under the water so they are modified to waterproof. As for the base station, important electronics components are located. One Arduino UNOs attached with AtMega328p microcontrollers are used in the ROV. The microcontroller is used for navigation control. The base station also consists of a Bluetooth module which is used for the communication between the operator and the ROV. The 11.1v battery is used for accessing the motors.

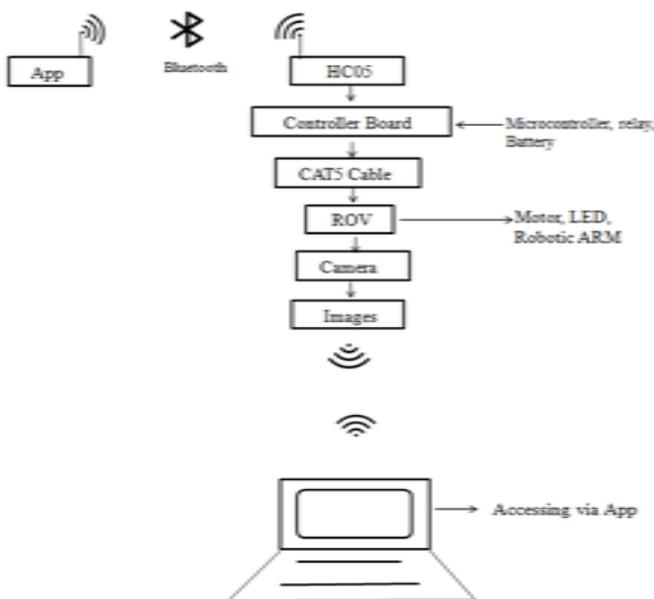


Fig. 2. Block diagram of ROV System

### III. Design

Following a multistep approach has used for the design process and allowed estimation of the end result. The first step in the designing process is to identify the various subsystems as shown in Figure 1. The best way to designs is by determining the weighing factors such as size, weight, effectiveness, cost, complexity, ease of manufacturing and safety. Based on the chosen designs, proof of concept product is made with PVC pipes create physical models[2].

### G. Frame

The frame of our ROV is in the form of a rectangular prism. It is 13.5 inch long, 11.2 inch wide and 9.5 inch high. There is an inner frame to secure the payload, and an outer frame to attach the thrusters, camera and

manipulator arm . The frame is designed with a wide face so that the valve can be hit easily, but with a minimal height to reduce drag.



Fig. 3. Frame of ROV.

The LED light system is also connected for the ROV as shown in fig.3.

#### **H. Thruster**

The thruster is configured of marine to an Underwater Robot as a propulsion device. These give the robot movement and maneuverability against water resistance. The two of the thrusters are located in two of the corners and the other two are connected in the center of the frame. The thrusters in the four corners are controlled individually, and allow the ROV to be easily turned and pitched[3]. The thruster is controlled by Bluetooth electronics app. The thrusters have an operating voltage of 12 V and a maximum operating current of 20 A and can deliver up to 300 watts at peak.



Fig. 3. Thruster

#### **C. Buoyancy**

For buoyancy, we added two buoys to each side of the ROV. We also placed two empty 20 fl oz. This allows the center of buoyancy to be above the center of gravity, resulting in a stable vessel.

#### **D. Camera**

The camera is located in the front corner of the frame on the ROV, to provide a good viewing angle and to protect it from collisions. The camera is secured to the frame of the ROV with the help of zip-ties in such a way that there is minimal movement. This helps in maximizing the quality of our video feedback. The camera used in this paper has the resolution of 8 MP Image Resolution.

#### **E. HC-05**

Bluetooth is a technology for wireless communication. It is designed to replace cable connections. . It uses the 2.45GHz frequency band. The connections can be point-to-point or multi-point where the maximum range is 10 meters. The transfer rate of the data is 1Mbps. The Dimension of the HC05 model is 26.9mm x 13mm x 2.2 mm as shown in fig.4.

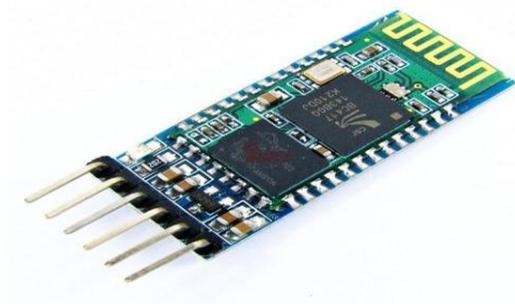


Fig. 4. HC05 Bluetooth module

### F. Manipulator Arm

A robotic arm is a type of [mechanical arm](#), that is [programmable](#), with similar functions to a human [arm](#). Here the manipulator arm is used to pick and placing the samples collected in the deep waters by the marine archeologists during the research. The manipulator arm is as shown in fig.5.



Fig. 5. Manipulator Arm

### G. Relay

A relay is an electrically operated switch. Many of the relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. The Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The trigger voltage across coil is 5V, DC Trigger Current or Nominal current is 70mA, the Maximum AC load current is 10A and the Maximum DC load current: 10A. the given fig .6 shown below represents a relay.



Fig. 6. Four Channel Relay Modules

### H. IP Webcam App

IP Webcam is an app that allows you to convert your Android device into an internet camera with multiple view options that can see any platform using VLC player or an internet browser.

IP Webcam allows the user to record videos in webm, MOV and MPEG4. The detection of movement options allow you to leave the phone pointing somewhere and when something moves in front of it, it will start recording. This mode, of course, consumes a large amount of battery[3].

IP Webcam is a tool that allows the user to convert the android device in to a video surveillance tool where we can just leave the device connected to the charger and keep track of what's happening anywhere.

### **I. Bluetooth Electronics App**

Control the electronic project with an Android device. This app communicates using Bluetooth to a HC-05 Bluetooth module in this project. This app comes with a library containing 10 Bluetooth examples for Arduino Prototyping system in which you have included a suitable Bluetooth module to the project.

Library of 10 Arduino are used is given below :

- LED Brightness - PWM with a Slider control
- RC Car demo – Basic Button controls
- Persistence of Vision – Text control
- Repeater Demo – Send and Receive Terminals
- Ultrasonic Distance Sensor - Light Indicator
- MEGA Monitor – Graphs
- UNO Monitor – More graphs
- Temperature and Humidity – Temperature Gauge
- Configure HC-06 Demo – In-case you want to change Baud rate
- Motor Control Demo – Accelerometer and pad controls

The Size of this app is 5.0MB and Version: 1.1. which is developed by the Keuwlsoft. The Application Permissions are given below:

- Open network sockets
- Discover and pair Bluetooth devices
- Connect to paired Bluetooth devices
- Read from external storage
- Write to external storage

### **IV. Algorithm for Navigation System**

The programming algorithm used for controlling the proposed ROV is basic and easy to understand. It is a polling method that waits for an input from the user. Once the controller receives any input, it analyzes the input using switch function then it responses to the input accordingly. Fig. 7 shows the basic flow chart of the navigation system of the ROV[5-8].

- a) Start
- b) Power up the control system by connecting to 11.1volt battery.
- c) Initialize the Bluetooth connectivity between the Mobile App and HC05.
- d) Switch on the LED's on the button click
- e) When the second button is clicked the central motors get active and help in sinking the vehicle deep inside the water.
- f) The Vehicle is rotated left or right using the other control buttons.
- g) Once the vehicle has reached the desired destination.
- h) Images are Captured using a camera . These images can be retrieved back on an mobile application
- i) Once the operation is performed the centralized motors are switched off.
- j) The vehicle automatically rises up and ready for the next operation
- k) Stop

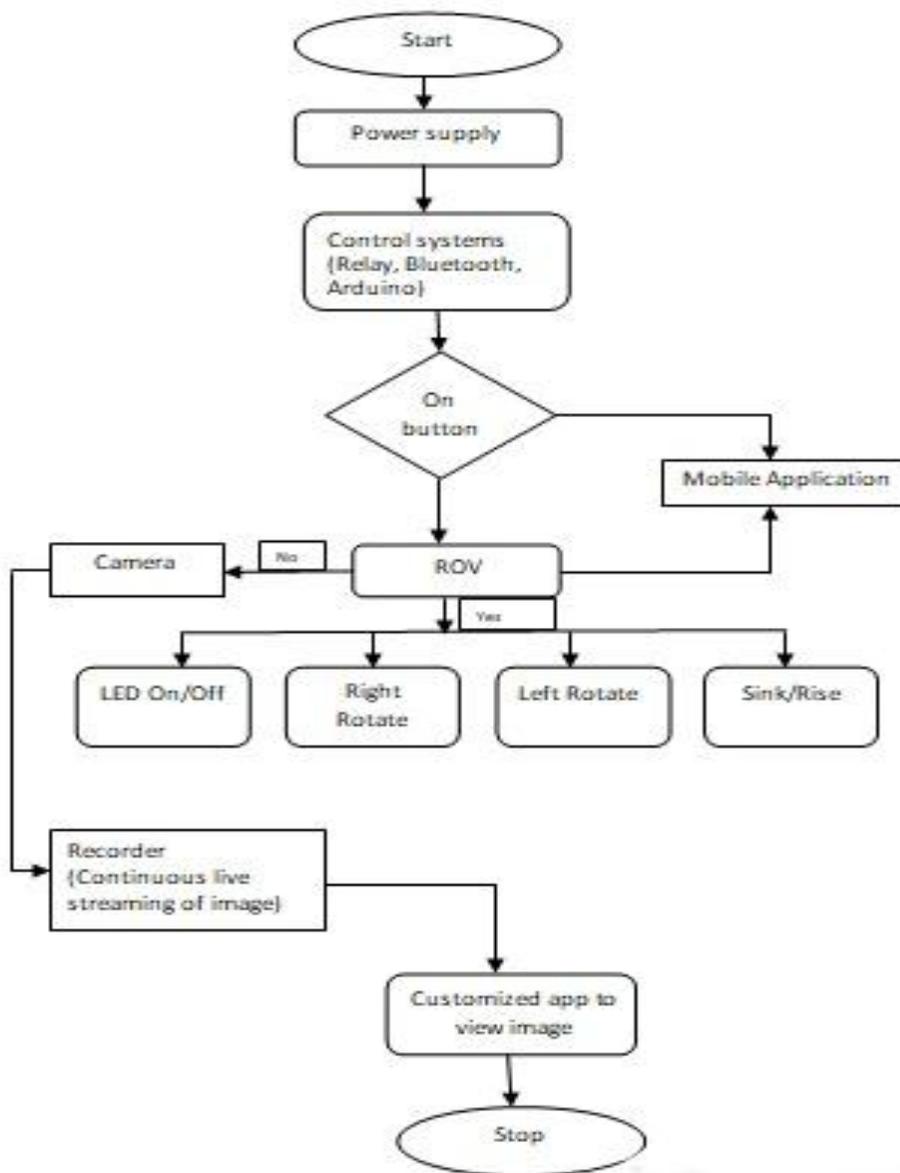


Fig. 7 Flowchart of navigation system of ROV.

### V. Conclusion and Recommendation

We introduced preliminary experiments of the smart ROV to verify its performance in sea and how to use for the survey of underwater cultural heritages. The proposed ROV was designed and developed successfully. Most of the equipment are in affordable price. The cost of the ROV can be easily reduced if normal components were to be used rather than the In the final design, 4 DC motors were used, 2 for controlling direction and headings while other 2 for controlling buoyancy. The ROV was able to capture the images and also collect the samples present in under water.

The recommendations for future improvements for the proposed ROV can be summarized as follows:

- An auto battery monitoring system would be useful improvement.
- For the motors used in the ROV, out-runner brushless thruster is a better choice compare to the normal DC motors that are used in the ROV due to its higher speed, smaller size, reduce torque ripple and higher the output power.

## **VI. Acknowledgment**

The authors wish to thank all team members for their financial and logistic support. Furthermore, the authors would like to extend their sincere gratitude to M S Engineering college, Bangalore, India for the support and motivation for the development of the smart ROV.

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# INDUSTRIAL POLLUTION MONITORING USING IOT

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**ABSTRACT:** Water pollution is one of the biggest fears for the green globalization. So to ensure the safe supply of the drinking water the quality of water has to be monitored in real time. This paper presents, design and development of a low cost real time monitoring system, which checks the water quality through IOT(Internet of Things) and also air pollution which contains dangerous gases like eathane and methane. This system consists of several sensors which is used to measure physical and chemical parameters of the water & air. The parameters that can be measured are temperature, PH and turbidity flow sensor of the water. The measured values from the sensors can be processed by the core controller. Finally, the monitored data can be viewed on internet using WI-FI system.

**Keywords:** Arduino, ATmega328, Turbidity Sensor, Temperature Sensor, Buzzer, PH Level Sensor, Gas Sensor, LCD Display.

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## 1. Introduction

Any adverse change in the environment which affects abiotic(lithosphere, hydrosphere and atmosphere) and biotic (flora and fauna) is termed as pollution. Basically pollution can be classified into water pollution, air pollution and noise pollution. As 70% of the earth is covered with water. Primary environmental issue that we are facing is the water pollution and secondary is the air pollution. The main cause for water pollution is from water bodies (like oceans, seas, lakes, rivers, aquifers and groundwater). Industries will release chemicals, oil spills and hot water into lakes and river. Air Pollution is one of the biggest threats for the biggest threats for the environment and affects humans, animals, crops, forests and aquatic ecosystems. Manufacturing industries release a large amount of carbon monoxide, hydrocarbons, organic compounds, and chemicals into the air thereby depleting the quality of air.

### 1.1 Literature Review

Nikhil Kedia entitled "Water Quality Monitoring for Rural Areas-A Sensor Cloud Based Economical Project". Published in 2015. 1st International Conference on Next Generation Computing Technologies (NGCT-2015) Dehradun, India. This paper gives the entire information regarding water quality monitoring methods, sensors, embedded design, and informational procedure, role of government, network operator and villagers in ensuring proper information . It also explores the Sensor Cloud domain. Mean while improving the water quality is not feasible at this point, efficient use of technology and economic practices can help improve water quality and awareness among people.[1]

Sonal O Talokar, Dr. Jagdish W. Bakal entitled "Wireless Air Pollution Monitoring System". In this paper an efficient study on the environmental pollution with the major concern how to deal the air pollution is done. The paper emphasizes on the Data Flow Diagram(DFD) for Air Pollution Monitoring System in Wireless Mode of Communication. This system is monitored with sensor nodes which are interconnected with each other. They use radio waves or infrared waves as a wireless medium for communication. Method of WSN network neighbourhood is used, which can be monitored upto certain range.[2]

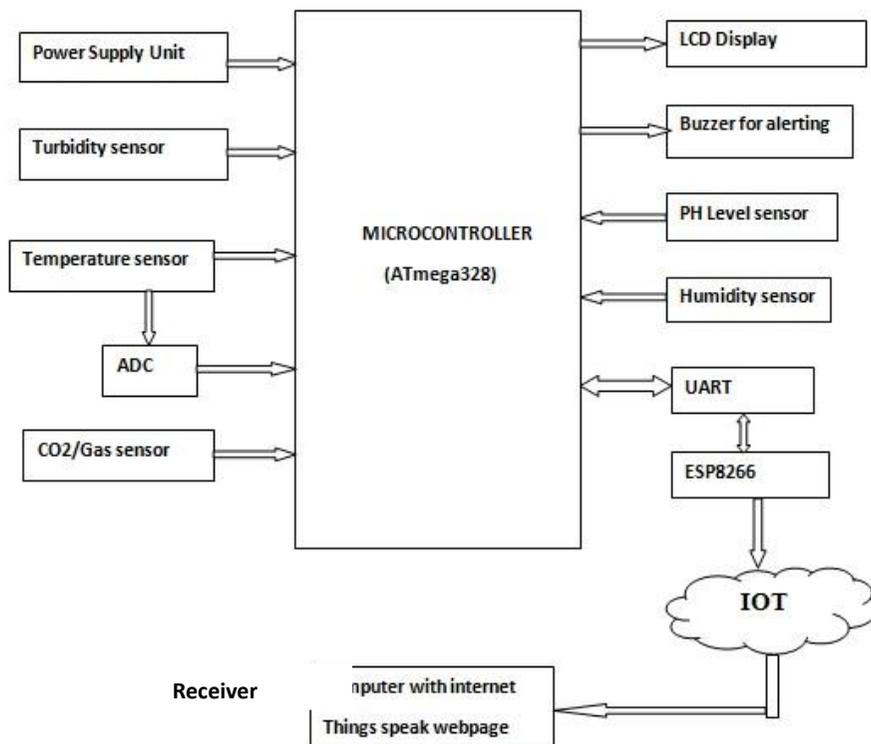
Jayti Bhatt,Jignesh Patoliya entitled "Real Time Water Quality Monitoring System". This paper describes to ensure the safe supply of drinking water the quality is monitored in real time, a new approach IOT (Internet of Things) based water quality monitoring has been proposed. This paper presents the design of IOT based water quality monitoring system that monitors the quality of water in real time. This system consists sensors which measure the water quality parameter such as PH, turbidity, conductivity, temperature. The measured values from the sensors are processed by microcontroller. Finally, sensors data can view on internet browser application using cloud computing.[3]

**1.2 Summary of Literature Review**

Sl. no	Authour	Title	Year	Advantages	Disadvantages
01	Nikhil Kedia	Water Quality Monitoring for Rural Areas	2015	Good efficiency of water quality and soil moisture with high performance	Accuracy of the values depends upon the sensors used.
02	Sonal O Talokar & Dr. Jagdish W. Bakal	Wireless Air Pollution Monitoring System	2016	Compares energy consumption with and without recursive covering quartiles (RCQ) data aggregation algorithm.	Limited battery life, low processor power, small memory.
03	Jayti Bhatt, Jignesh Patoliya	Real Time Water Quality Monitoring System	2016	Flexible network structure, low cost, long battery life.	<ul style="list-style-type: none"> <li>Low complexity, and low data speed. Its high maintenance cost, lack of total solution, and slow materialization</li> </ul>

**2. Methodology**

This paper deals with the monitoring of industrial waste water and air letting out from industries, this generates an alert/alarm through the IOT (Internet of Things). An access to the webpage is allowed to the corporative offices. Monitoring the water and air from industries with different sensors, the quality of water is measured through ph sensor, turbidity sensor and quality of air is measured with gas sensor, humidity sensor and temperature sensor. The information is sent to the webpage with IOT technology. The measured values from the sensors can be processed by the core controller. The Arduino model can be used as a core controller. Finally, the sensor data can be viewed on internet using WI-FI system.



**Fig :** Architecture of Monitoring System

### 2.1 Arduino:

The Arduino UNO is an open-source microcontroller board based on the [Microchip A Tmega 328P](#) microcontroller and developed by [Arduino.cc](#). The board consists of 14 Digital pins, 6 Analog pins, and programmable with the [Arduino IDE](#) (Integrated Development Environment) via a type B USB cable. It could be powered by a USB cable or by an external 9 volt battery, it accepts voltages between 7 and 20 volts. The Arduino UNO equipped with sensors such as the temperature sensor, humidity sensor, PH sensor, co2/gas sensor, turbidity sensor collects the data and these data are send through cloud platform for which a server database required. The IOT module in which the WI-FI module using the data can be send through website on internet server database.



Fig 2: Arduino Board

### 2.2 ATmega328

The ATmega328 is a single-[chip microcontroller](#). The high-performance Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.



FIG 3: ATmega328 microcontroller

### 2.3 CO2/Gas sensor:

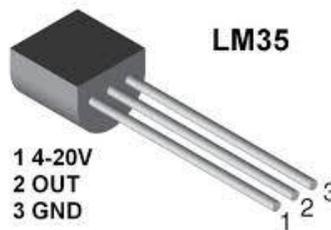
In today's lifestyle monitoring of gases plays a vital role. From home appliances to industries monitoring of gases is very important. The carbon dioxide gas sensor, senses gases that is produced from the carbon dioxide. When the gas interacts with the sensor it is absorbed by the sensing element and it conveyed through the processor through output pins in the form of current. This changes the resistance values, as the resistance values changes it alters the current.



**FIG 4:** CO2 Gas Sensors

#### **2.4 Temperature sensor:**

Temperature sensor is used to measure the ambient temperature. It has three pins positive, ground and signal. LM35 can measure the temperature more accurately than the Thermistor. The Celsius temperature (°C) is the output voltage for LM35 temperature sensor. Low self heating capability is the another advantage of this sensor and it draws 60µA from its power supply. By simple conversion the output voltage is converted to temperature. The general equation is given below  
Temperature (°C) =  $V_{out} * (100^{\circ} C/V)$  (1)  
For example, if  $V_{out}$  is 1V then temperature = 100° C



**FIG 5:** Temperature sensor

#### **2.5 Turbidity sensor:**

Turbidity is a measure of the cloudiness of water. Turbidity has indicated the degree at which the water loses its transparency. It is considered as a good measure of the quality of water. Turbidity blocks out the light needed by submerged aquatic vegetation. It also can raise surface water temperatures above normal because suspended particles near the surface facilitate the absorption of heat from sunlight.



**FIG 6:** Turbidity sensor

### 2.6 PH sensor:

The pH of a solution is the measure of the acidity or alkalinity of that solution. The pH scale is a logarithmic scale whose range is from 0-14 with a neutral point being 7. Values above 7 indicate a basic or alkaline solution and values below 7 would indicate an acidic solution. It operates on 5V power supply and it is easy to interface with arduino. The normal range of pH is 6 to 8.5



FIG 7: PH sensor

### 2.7 Humidity sensor:

Humidity is defined as the amount of water present in the surrounding air. This water content in the air is a key factor in the wellness of mankind. If the temperature is 0°C with less humidity i.e. the air is dry. But if the temperature is 100°C and the humidity is high i.e. the water content of air is high. In industries like refineries, chemical, metal, or other industries where furnaces are used, high humidity will reduce the amount of oxygen in the air.

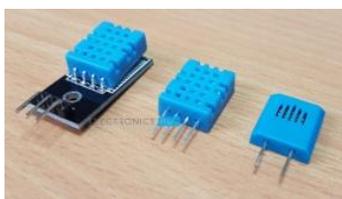


FIG 8: Humidity sensor

### 2.8 ESP8266:

The ESP8266 WiFi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware. The ESP8266 module is an extremely cost-effective board with a huge, and ever-growing, community.

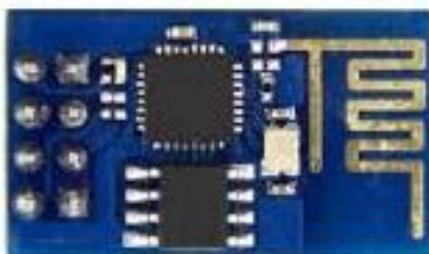


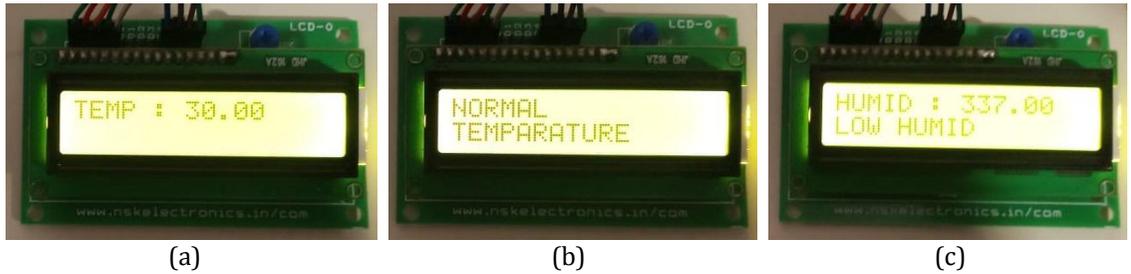
FIG 9: ESP8266 Wi-Fi Module

## 3. Results and Discussion

This monitoring system includes sensors which measure the parameters causing pollution. The sensors are temperature sensor, gas sensor, humidity sensor, pH sensor, turbidity sensor. Whenever there is an increase in the level of these parameters the sensors sense the situation and an alarm or indication is given and the message is displayed in the LCD display. Even an alert message is displayed on the webpage and an

alert message is sent to the nearby public phones. The system is operated through wireless system using the concept of IOT. The status of sensors of particular industry can be accessed anywhere from anyplace by corporate officers. According to that particular actions are taken.

Sl.no	SENSORS	NORMAL	LOW	HIGH
01	Temperature	30	--	>35.00
02	PH	Netural(ph=7)	Alkaline(ph<7)	Acid(ph>7)
03	Humidity	>420 && <=490	<=420	>=490



**FIG 10:** Measuring of Temperature and Humidity sensor

#### 4. Conclusion

Pollution is one the greatest headache of mankind. Due to pollution, the society is getting infected by diseases, viruses, bacteria etc... To keep safe ourselves, we need to take some actions. In this paper, we are dealing with how to prevent air pollution and noise pollution causing from industries. We are using some sensors, which can detect temperature, moisture contain in air, time in which flow of water undertaken, CO2 content in air. The sensors will sent the collected data to the cloud. Analyzing the data, a report will be generated. Based on that report, the action will be taken against pollution.

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# Blind Navigation and Object Detection

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**ABSTRACT:** *The aim of this project is to develop a navigation aid for blind and visually impaired people. This project is based on a microcontroller with speech output. Visually impaired people find themselves challenging to go out independently, this navigation system is applied to guide the visually impaired people at indoor and outdoor environment. To provide an efficient and user-friendly navigation tools this navigation system build using passive RFID networks. The idea of this project is to provide direction and to identify the objects through the voice commands which help them to have a better experience.*

**Keywords:** MATLAB, Microcontroller, Blind, Navigation.

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## 1. Introduction

World Health Organization (WHO) has released the statistics in 2014 that shows 10% of the world's population have a disability, with 80% of them located in developing countries. This global data on visual impairments shows the people with visual impairment globally is around 285 million which 39 million are fully blind and 246 million are having low vision problem. There are number of people worldwide who have lost vision. This total figure does not reflect to the real number of a people with disabilities in this world since the visually impaired people are cannot independently travel by themselves.

Moreover, a disability that may cause danger to the individual is blindness. Conventionally, blind people rely on a white cane or human or a guide dog to assist them in reaching their desired destination safely. Since blind people use the white cane as their most common and affordable assistive tool to detect obstacles and path surrounding them. Difficulties still occur when using the white cane for visually impaired people as they are only able to detect path and obstacles from the front by swinging the white cane at the same time trying to feel the tip of the white cane that touches the ground. this approach is only useful if the place is already known to them. But they find difficulty if the destination is new. They do not receive much information with only the tip of the white cane as feedback. Lack of aid signs built for visually impaired people seems to be one of the difficulties for them. It is hard and also impossible to recognize the place by themselves to travel from one to another destination without proper navigation. Therefore, the advanced technology benefits the blind people to move independently.

There are some equipment's tools or robots which have been developed to assist the visually impaired people. The assistive and rehabilitation technologies that have been researched and built are such as Guide Cane, Nav Belt, My 2nd Eye, SMART EYE, and others. One of the mobile robots is developed for the blind which is designed to help the blind in shopping mall. Without the state of the art of these technologies, the visually impaired people only count on the conventional white cane to detect surrounding obstacles and sense the road in front of them. The arrangement of this paper presents an introduction to navigation system and problem and challenges that have been faced by visually impaired people. And also, this paper expresses previous studies related to the travel aid for visually impaired people and deliberates on the developed navigation system with the proposed control system for navigation purpose. Other section contains experimental setup involved in this study while and elaborates the results that obtained through the developed navigation system and lastly the conclusion and future tasks of this study.

## II. Literature Survey

Ultrasonic blind stick for completely blind people to avoid any kind of obstacles done by Arnesh sen, kaultav sen, Jayoti Das [1] Uses a stick equipped with ultra-sonic sensors, GPS and audio output system. The blind stick contains GPS which will have memory card which used to store different locations. The user will set the location by voice and the GPS will guide the person to their distention. This system will also provide the speed and the remaining distance to reach the distention. When the ultra-sonic sensors detect any obstacle directly the voice system will activate the caution voice.

Intelligent blind cane system done by Mouhamad D, Mashat, Abdulaziz A, [2] system done for using smart stick for blind people: obstacles detections and real time assistance via GPS. This system operates by using

GPS, obstacle detection and voice circuit. The camera will be use an algorithm to identify the highs and obstacles in front the blind person. this system includes GPS system is to reach the required destination. However, the designing complexity of the system makes it difficult to design and understand.

Developing mobile applications to navigate blind people using sensors done by Kiruthithika[3], Sheela proposed a smart cane assisted mobility for the visually impaired. The system is based on normal ultrasonic sensors and ATMEL microcontroller. It operates with two rechargeable battery (7.4v) it can be recharged using USB cable or AC adaptor. The control unit is programed using ATMEL AVR microcontroller ATMEGA328P microcontroller. If any obstacles are detected vibration and buzzer will start to indicate the blind person about obstacle. This system is a non-complex system to use.

Another study Object detection and identification for the blind people in the video scene done by Hanen jabnoun, Faouzi benzati, Hamid amiri [4]. This system identifies and recognize the surrounding objects. This method is based on the local feature's extraction concept. The simulation results using SFIT algorithm and key points matching showed good accuracy for detecting objects. The idea of a visual substitution system based on features extraction and matching to recognize and locate objects in images.

Advanced GPS & GSM Based Navigation System for Blinds done by Arijit Datta [5]. This system is based on nerve stimulation and ultrasonic distance measurement by using GSM and GPS technology. This system will send the obstacle detection through the nerves stimulation circuitry where the nerve stimulation uses EMG electrodes as a feedback.

Visual impairment and blindness by world health organization [6]. They have made a systematic review meta-analysis of the population based on blind people globally. They have set a hierarchical model to estimate the age country and sex of mild vision impairment and blind people.

Blind user wearable audio assistance for indoor on visual markers and ultrasonic obstacle detection done by W.C.S.S. Simoes and V.F. de Lucena [7]. It is the system build for indoor navigation for blind. In this system visual markers identifies the points These points are the distances and directions where a blind user where a glass built by the sensors like RGB camera.

Voice assistant navigation system for the blind done by Ananth noorithaya, M. Kishore Kumar, A. Sree devi [8].

In this system the object will be detected from the ultrasonic sensors and gives out the audio institutions. The algorithm developed is made available in MP3 module which is inbuilt in the system the object will be detected only if it is of 4 cm and resolution of 15 centimetre of obstacle distances can be detected.

### III. Methodology

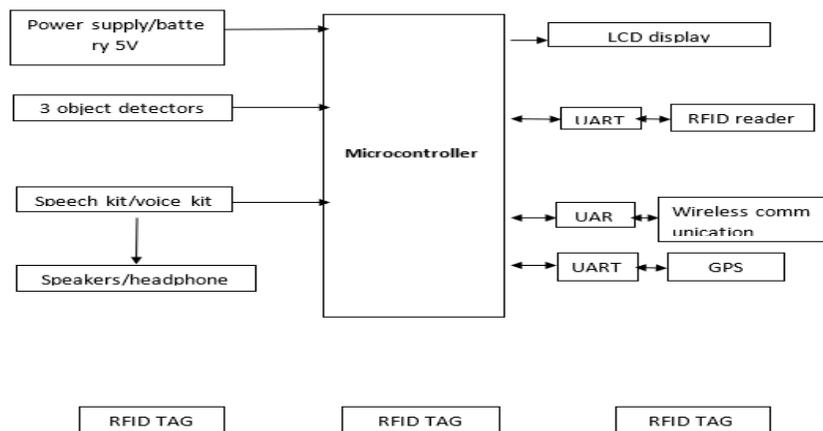


Fig3.1., Block diagram of Blind navigation system and object detection.

Here, the above Fig. 3.1 shows the block diagram of the project which mainly includes different models the software used in this project includes MATLAB and Keil programming for navigation and object detection. Speech kit is used to provide the information through voice, object detection is done by capturing the object images from camera and compare reference image and original image. Extraction is done on the basis of

object position change detected object is captured and software sends the command to microcontroller, once the object recognizes same information will be given to the blind person through voice kit.

#### IV. System Analysis

##### A. Microcontroller LPC 2148



Fig. 4.1., ARMLPC2148 Microcontroller

LPC2148 is the arm7 based microcontroller it is of 16bit or 32-bit microcontroller and it is available in a small LQFP64 package. It is the system on chip microcontroller, where it has 8kb-40kb and flash memory is of 32kb-512kb, the wide interface is 128bit, or accelerator allows 60MHz high speed operation. For erasing the data in full chip, it takes 400milliseconds and 1 millisecond time for 256 bytes of programming. It consists of 2kb of endpoint RAM and USB of 2.0 full speed device controller. Further, it offers 8kb on-chip RAM which is near to USB with DMA. The ADCs which is of one or two 10-bits, which offers 6 or 14 analogs inputs with low conversion time as 2.44 $\mu$ s/channel. The CPU CLK-clock is of 60MHz obtainable from the programmable on the chip phase is locked loop by resolving time by 100 $\mu$ s. The oscillator on the chip will work by an exterior crystal that have a range from 1MHz-25MHz.

##### B. Audio Playback Board (APR3383)



Fig. 4.2., APR33A3 Audio playback board

Audio playback board using APR33A3 IC for 8channels of recording Total 11 minutes of recording time each channel (M0 to M7) having 1.3minutes of recording time. It is Single chip, high quality voice recording and playback solution. Audio playback record is Non-Volatile flash memory, it does not require any battery backup, Audio output to drive a speaker or audio out for public address system It can record voice with the help of on-board microphone.

### C. RFID READER

RFID or Radio Frequency Identification System is a technology which is based on identifying the objects just through the tags which is attached to them. These tags do not require any light between the tags and the tag reader. They need the radio communication between the tag and the reader.

Main Components of a RFID System are,

RFID tag: RFID tag consists of a silicon microchip to which a small antenna is attached and it is mounted on a substrate and encapsulated in different materials like plastic or glass and with an adhesive on the back side to be attached to objects.

Reader: Reader consists of a scanner with antennas where it transmits and receives signals and it is responsible for communication with the tag and receives the information from the tag.

Processor or a Controller can be a host computer with a Microprocessor or a microcontroller which receives the reader input and process the data.

### D. UART

UART stands for Universal Asynchronous Receiver and Transmitter. It is a serial communication protocol in which data is transferred serially bit by bit at a time. Asynchronous serial communication is widely used for byte-oriented transmission. A byte of data is transferred in asynchronous serial communication at a time. UART communication protocol uses a defined frame structure for their data bytes. Frame structure in Asynchronous communication consists an asynchronous serial communication frame consists of a START bit which is 1 bit followed by a data byte which contains 8bits and then a STOP bit which is 1 bit, that forms a 10-bit frame.

### E. GPS

The United States air forces as owned a Navstar GPS. It is a satellite-based radio navigation system where provides geo location and time information to the GPS receiver. It does not require the user to transmit any of the data, where it can operate independently through any of the telephonic or internet reception. GPS satellites can transmit a radio signal where it contains current location and time of the user. This system consists of 24 satellites in space, where 4 of the satellites are accessible through direct line of sight. Each satellite broadcasts a message that includes the satellites correct location and the information. The GPS receiver combines the broadcasts from the multiple satellites by the process of triangulation. Most of the GPS devices are also used for some type of location. GPS technology is not an ideal for indoor. It can be used for smartphones mobiles and tabs often it is used for determining the location.

## V. Results and Discussion

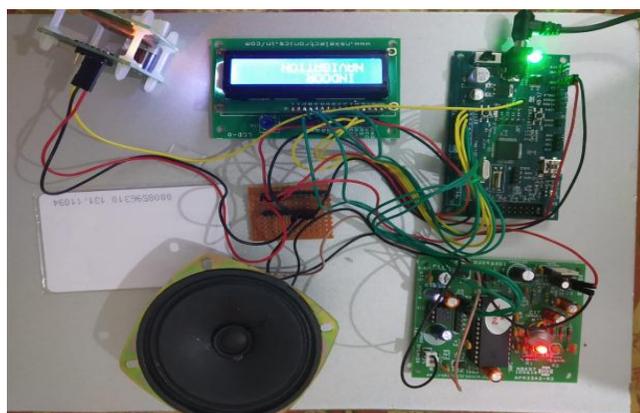


Fig.7.1., Working model of blind navigation system

The experimental setup consists of microcontroller ARM7(LPC 2148), speech kit, LCD display, RFID reader RFID tags in this model. The microcontroller plays a major role to which 5 volts of power supplied. LCD display is used for the project convenient purpose to display the characters.

The working model, firstly, the RFID tags are tapped on the RFID reader. This RFID reader which is connected to the microcontroller will identify the unique digits of the RFID tags. The RFID reader will

transmit the information to the microcontroller. The microcontroller which receives the information will transmit the information to the speech kit. In the speech kit the information will be again a transmitted to the to the speaker and speaker tells the information through the voice commands.

## VI. Expected Outcome

The Smart Stick acts as a basic platform for the coming generation of more aiding devices to help the visually impaired to be safer. It is effective and afford. It helps in detecting the objects at different position, detecting at What exact place he/she is by using RFID tags and navigating a blind person using GPS. This system is a low-cost, reliable, low power consumption and portable for navigation with obvious short response time. Though the system is hard-wired with reader, micro controller, speaker and other components, it's light in weight. Further this system can be improved via wireless connectivity between the system components, thus, increasing the range of RFID reader and implementing a technology for determining the speed of approaching obstacles. To develop a solution for visually impaired and blind people in all developing countries were on top of our priorities.

## VII. Conclusion

The project proposed the design and of a new concept of smart electronic guiding stick for blind people. The advantage of the system lies in the fact that it can prove to be very low-cost solution to the millions of blind people worldwide. It aims to solve the problems faced by blind people in their daily life.

## VIII. Acknowledgment

The authors wish to thank all team members for their financial and logistics support. Furthermore, the authors would like to extend their sincere gratitude to M S Engineering college, Bangalore, India for the support and motivation for the development of the Blind navigation system and object detection.

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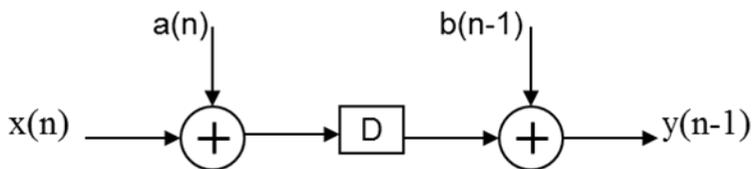


Fig. 2.1 (b)

**2.2 Parallel Processing :** It is of interest to note that parallel processing and pipelining techniques are duals of each other, and if a computation can be pipelined, it can also be processed in parallel. Both techniques exploit concurrency available in the computation in different ways. While independent sets of computations are computed in an interleaved manner in a pipelined system, they are computed using duplicate hardware in parallel processing mode.

**2.3 Unfolding :** Unfolding is a transformation technique that can be applied to a DSP program to create a new program describing more than one iteration of the original program. More specifically, unfolding a DSP program by the unfolding factor J creates a new program that describes J consecutive iterations of the original program. Unfolding is also referred to as loop unrolling and has been used in compiler theory.

**3. Design Flow**

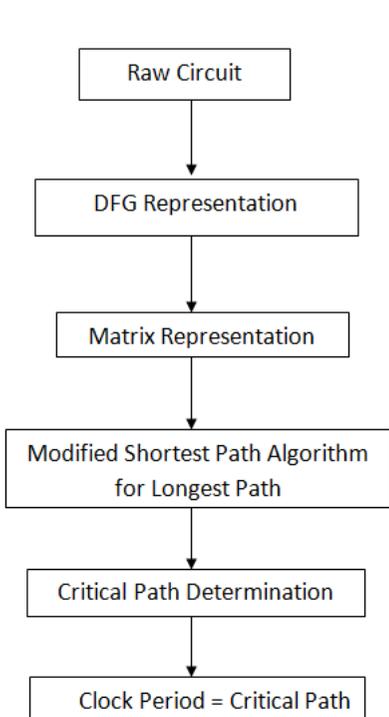


Fig 3.1 Speed determination of given circuit

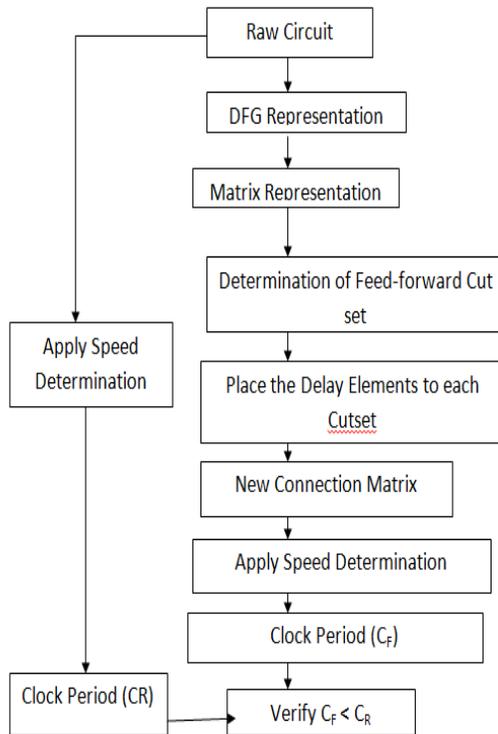


Fig 3.2 Speed determination by pipelining

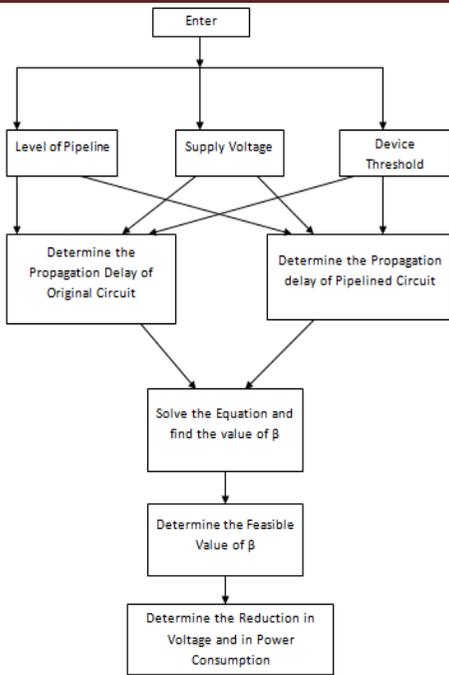


Fig 3.3 Power consumption reduction with pipelining

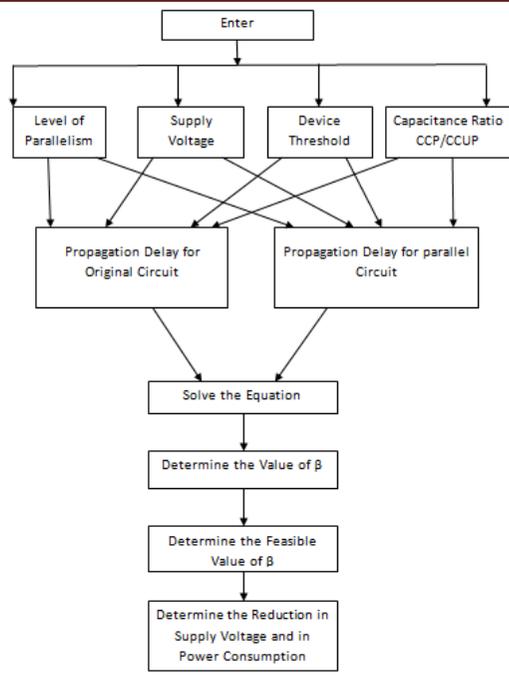


Fig 3.4 Power consumption reduction with parallelism

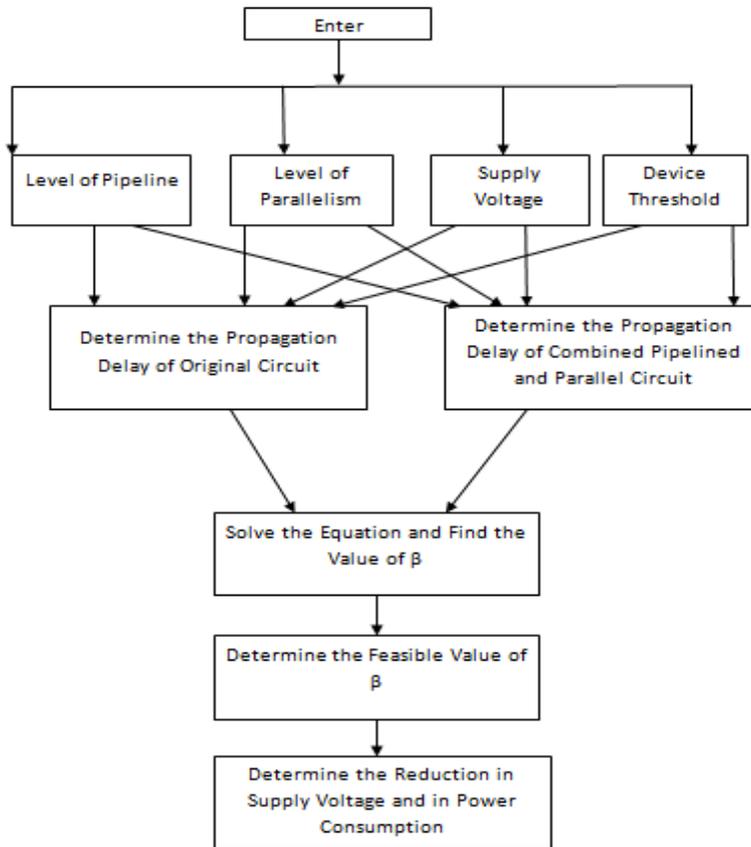


Fig 3.5 power reduction with pipelining and parallelism

#### 4. Results



Fig 4.1 Order of implementation

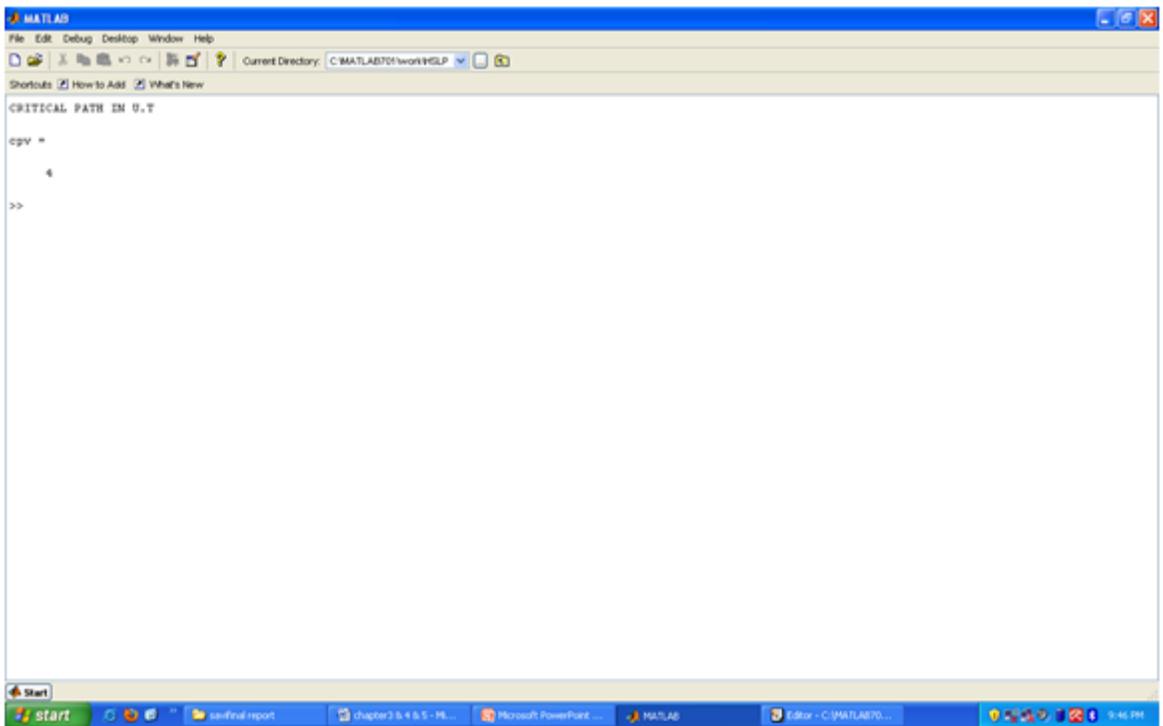


Fig 4.2 Output window before pipelining

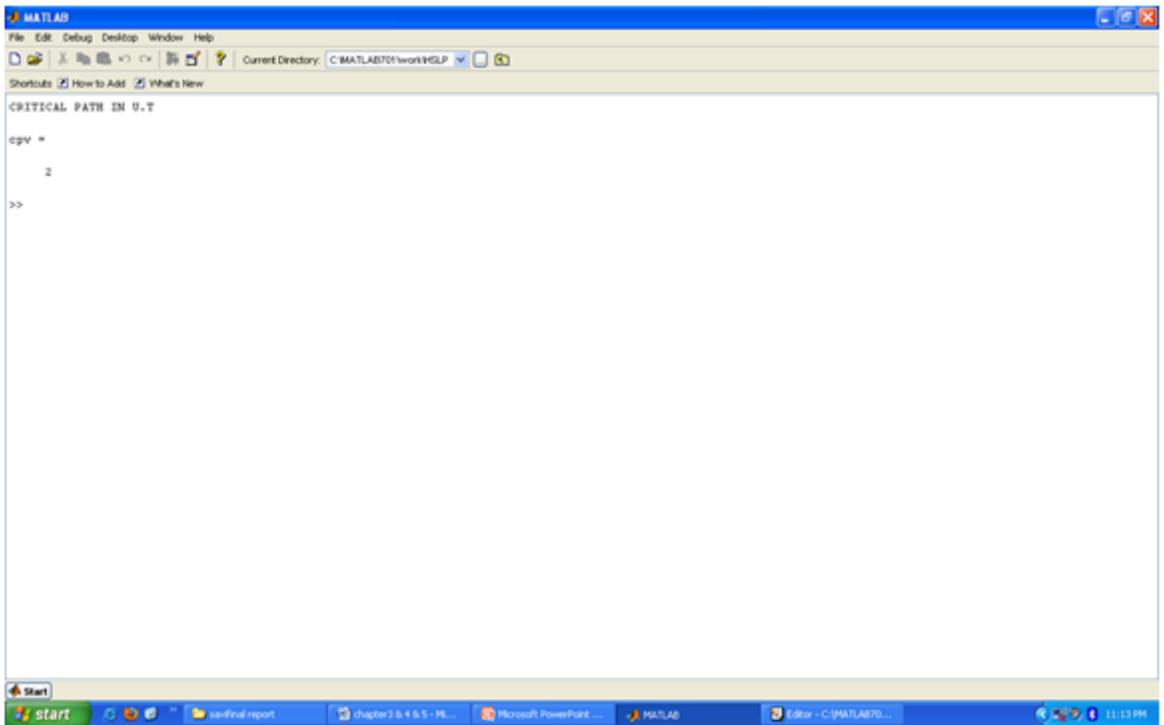


Fig 4.3 Output window of pipelined circuit

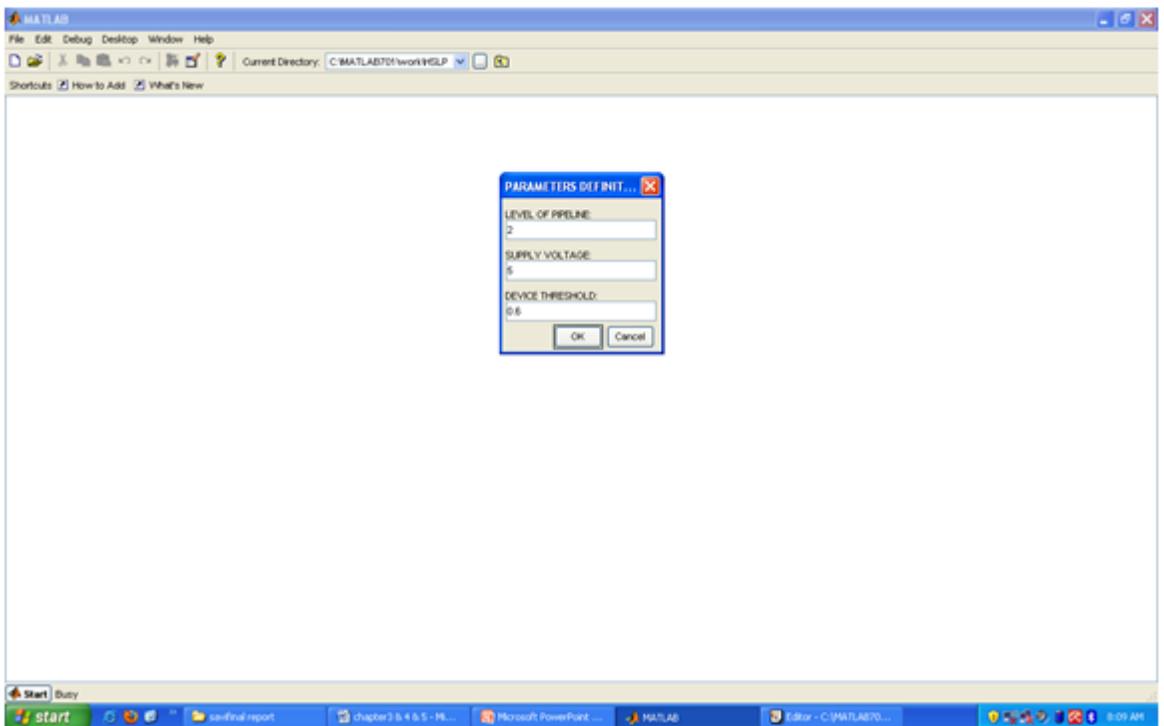


Fig 4.4 Power consumption before pipelining

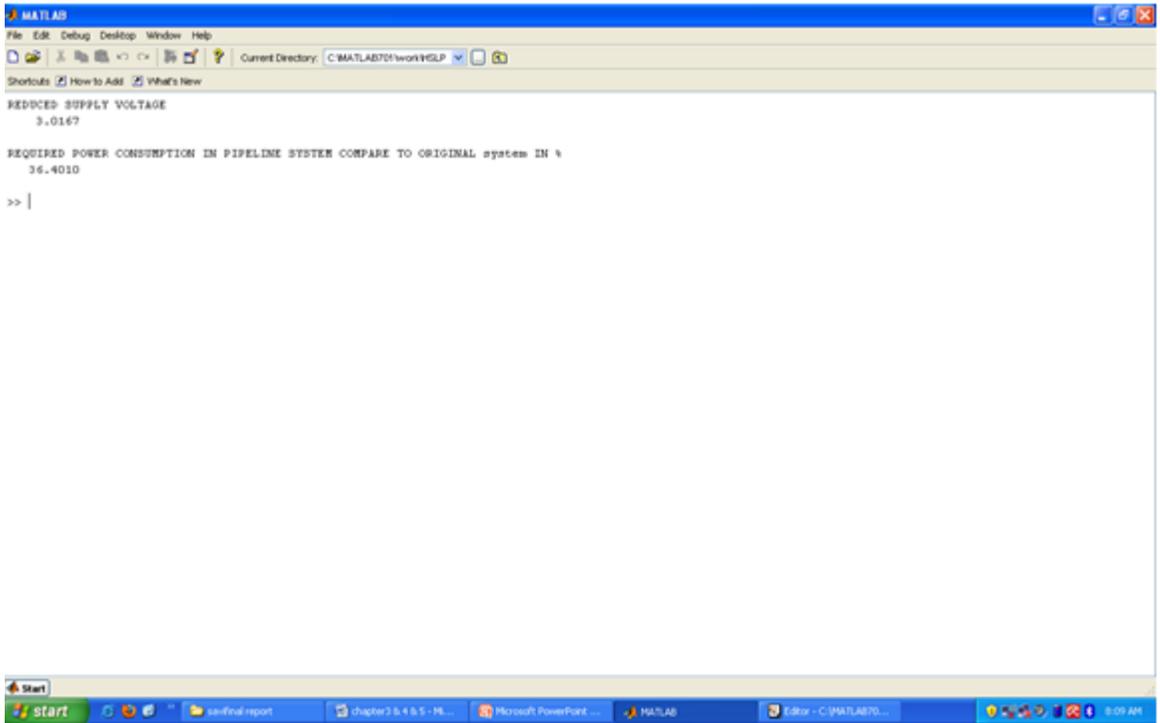


Fig 4.5 Power consumption after pipelining

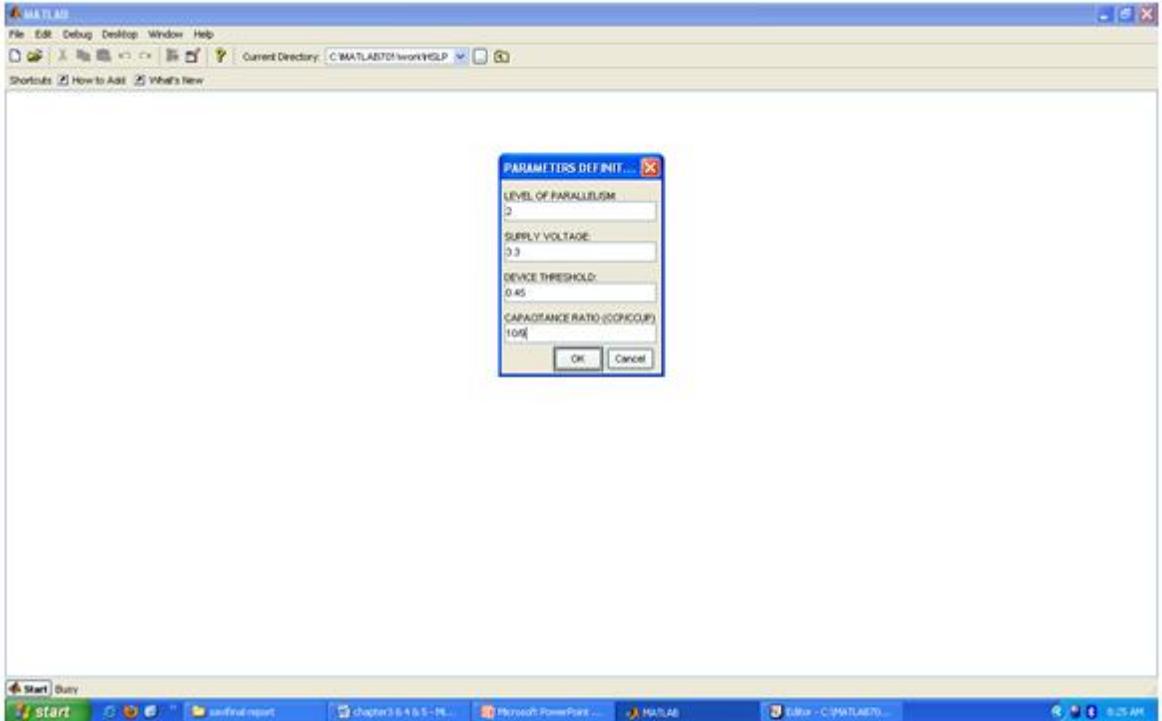


Fig 4.6 Power consumption before Parallelism

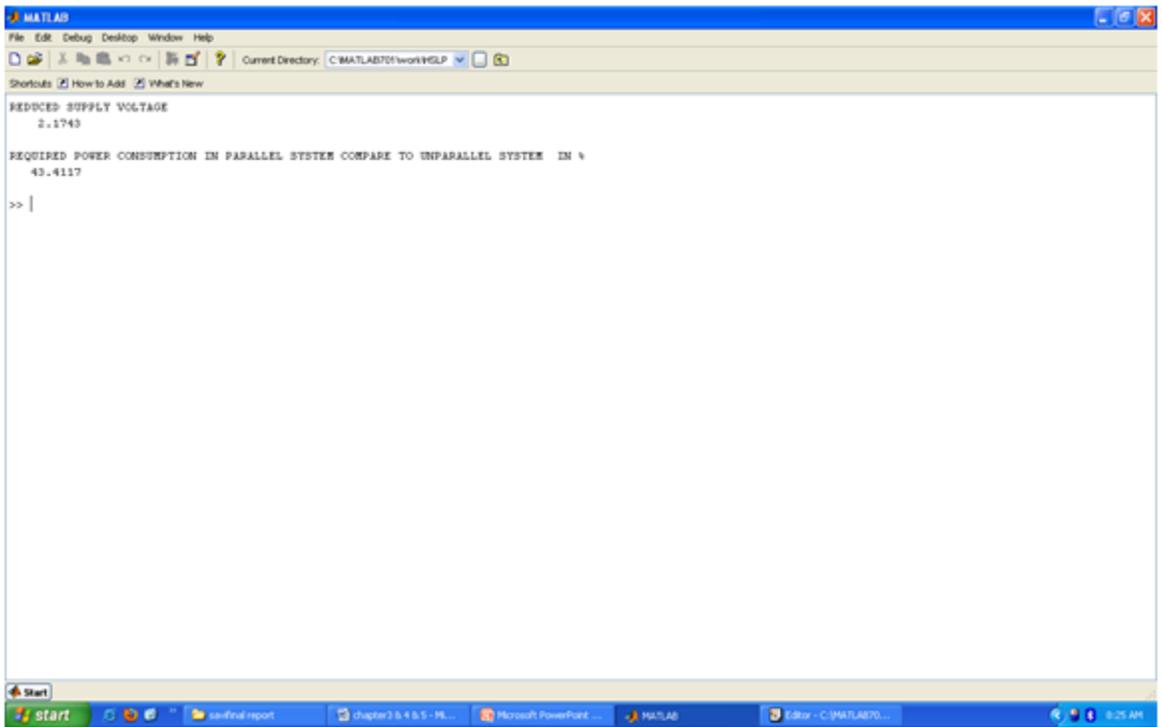


Fig 4.7 Power consumption after Parallelism

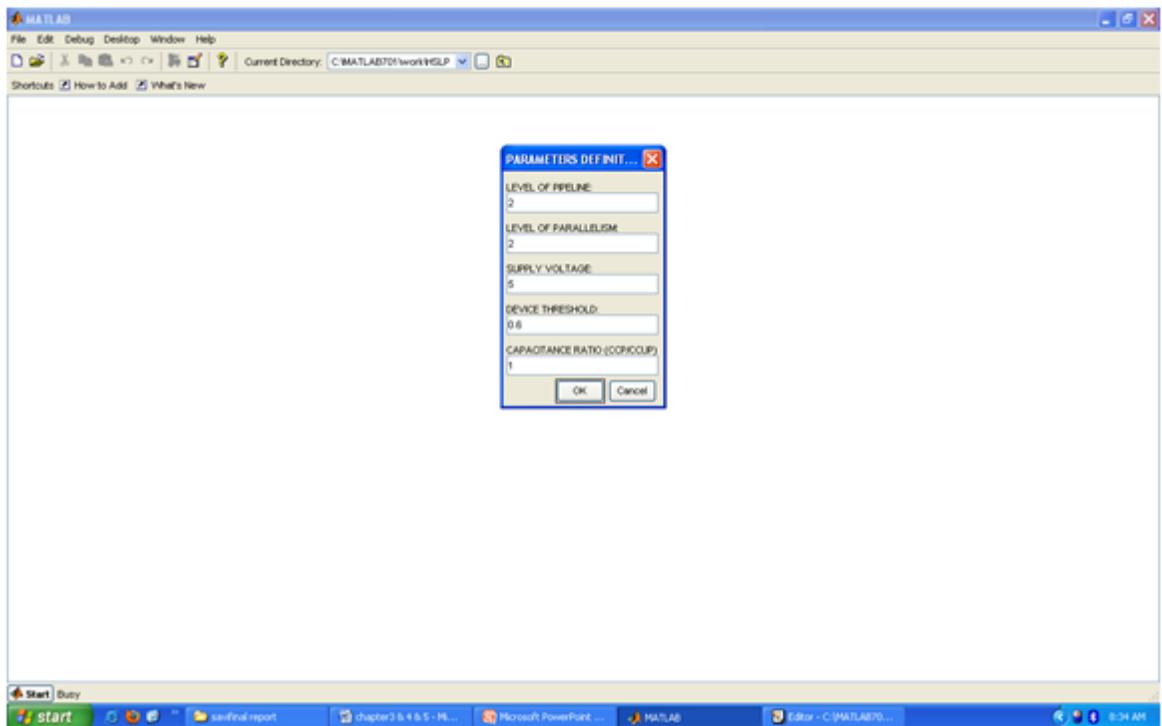


Fig 4.8 Power consumption before pipeline and parallelism

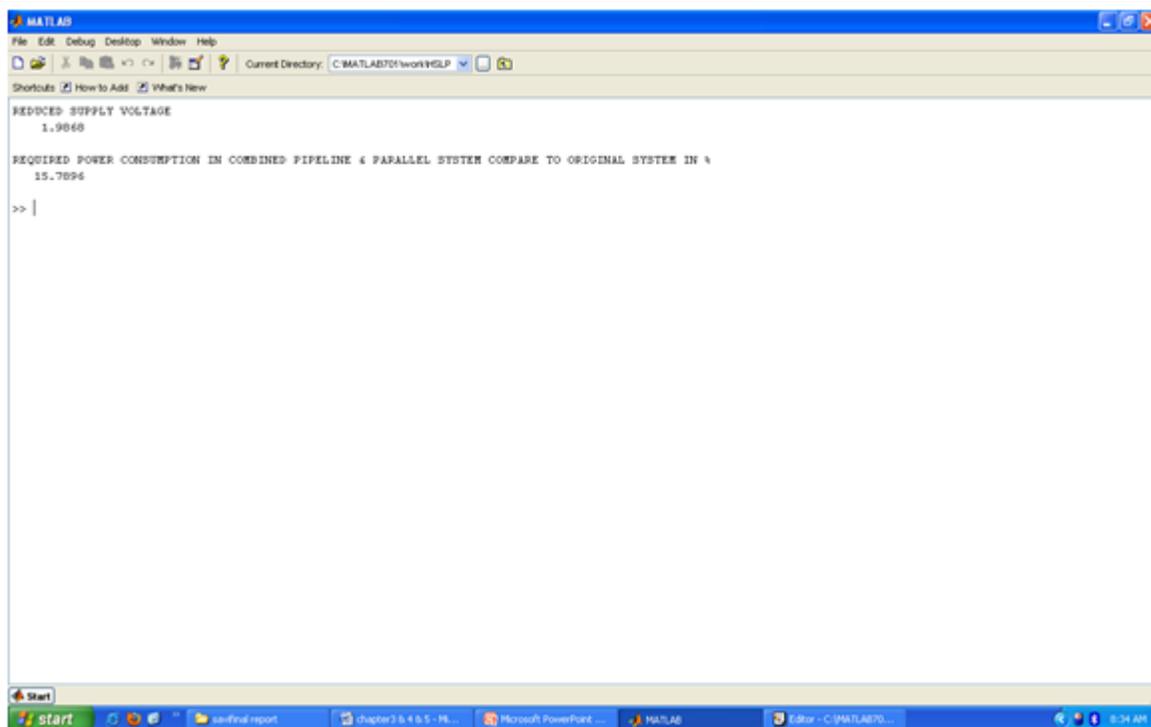


Fig 4.9 Power consumption before pipeline and parallelism

## 6. Conclusion

From the designing perspective of VLSI chip always there is a demand of higher speed and lower power consumption. With my research we have proven application of pipelining and parallel processing are efficient means to achieve the desired objective. It has been shown even power consumption can be reduced by 1/3rd which is very appreciable.

Even with combination of pipelining and parallel processing much power consumption can be saved. Designing of parallel architecture is not a easy task but the methodology shown in my research with the utilization of unfolding generated a very ease means to develop the parallel architecture. In cases the edge may contain the switching activity which can also parallelize by use of unfolding.

With the given research it is hoping the presented solution independently can be applied to achieve the high speed and low power consumption or this can be integrated with the other facilities of VLSI design.

## 7. Future Scope

Unfolding is a methodology which is very much suitable for various kinds of applications available inside the VLSI design. There is a requirement to find out the iteration bound of a particular circuit and times it is not possible to achieve the iteration bound because of fractional values of the iteration bound or any node computation time more than the iteration bound or both. This required the modification in the circuit which may be possible by application of unfolding.

Iteration Bound: DSP Algorithms such as recursive and adaptive digital Filters contain feedback loops, which impose an inherent fundamental lower bound on the achievable iteration or sample period. This bound is Referred to as the iteration period bound, or simply the iteration bound.

The iteration bound is a characteristic of the representation of an algorithm in the form of a data flow graph (DFG). Different representation of the same algorithm may lead to different iteration bound. It is not possible to achieve an iteration period less than the iteration bound even when infinite processors are available

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## Study of Biosensors

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**ABSTRACT:** Biosensor is a device in which the biological sensing element is coupled with a detector element with the help of a transducer. Biosensors have a greater sensitivity and selectivity compared to other diagnostic devices that are currently available. These biosensors are of different types and perform many applications ranging from disease diagnosis to environmental pollution control. An important feature for the use of biosensors is its low cost, high stability, selectivity and sensitivity. In this paper a detailed discussion of various biosensors that are developed in nanohub.org is simulated considering physical structure and biological parameters. The comparison of various biosensors is carried out considering settling time, maximum current and sensitivity.

**Keywords:** Biosensor, Types of biosensors, Sensitivity, Selectivity, Settling time.

### 1. Introduction

Diseases cause continuous danger to human life and cancer is one of the major deaths causing disease. Early stage detection of any disease helps in improving the survival rate of the patients. Since there are chances of reoccurrence of the disease frequent screening must be done [10]. A reliable, fast, low cost method which can be used by unprofessional person such as a biosensor is to be developed. For early stage detection of any disease the human body must respond to any kind of infections and by producing or fluctuating the levels of biomolecules and these biomarkers can be used for early stage diagnosis of the diseases. Biosensor is basically an analytical device which detects the biological response and converts it into electrical signal. Biosensors are of different types, electrochemical biosensor (potentiometric, amperometric, impedimetric, and voltammetric), piezoelectric biosensor, and optical biosensors. Electrochemical biosensor and optical biosensors are of high sensitivity, and easy to fabricate hence, they can be used for biomarker detection [11]. In this paper we focus on the different types of biosensors, their properties and their simulation results obtained using Biosensor Lab tool from nanohub.org.

### II. Biosensor LAB:

Biosensor Lab is a numerical simulator tool used to predict the performance metrics of different types of electronic biosensors (as shown in Figure1). Only the sensors which can detect the presence of biomolecules on the surface of the sensor by electrostatic interaction can be accessed using this tool. To avoid parasitic response, the surface of electronic biosensors like the planar Insulated Gate FET or ISFET, are first functionalized with receptor molecules (blue Y in the Figure below) of known identity. When unknown target molecules (marked red) are introduced to the sensor volume, they diffuse throughout the sensor volume. These molecules will be 'captured' by the receptors only if the target is a specific and exclusive complement to the receptor ('lock and key' principle). Bio-molecules like DNA carry negative charge under normal physiological conditions, while the net charge of a protein molecule depends on the pH of the solution. The excess charge of the receptor-bound target biomolecule modulates the conductivity of FET channel electrons via coulomb interaction. And this change in conductivity signals the presence of complementary target molecules in the solution.

Biosensor Lab provides access to 9 types of biosensors: Planar biosensor, Cylindrical nanowire biosensor, Nanosphere biosensor, Double-gate FET biosensor, Extended-gate FET biosensor, Magnetic particle sensor, DGFET pH biosensor, Extended gate FET pH biosensor, Flexure FET sensor

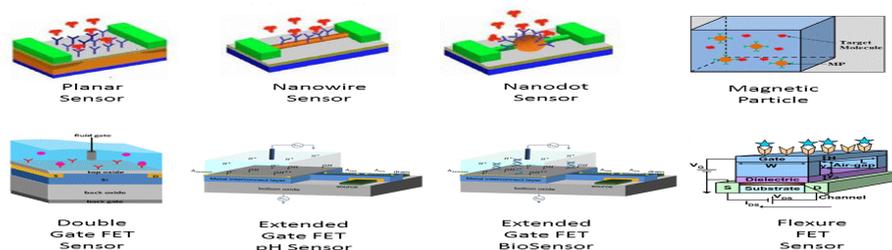


Fig. 1 Types of Biosensors

The sensor response is characterized based on its sensitivity, selectivity, and settling time.

**Sensitivity:** It corresponds to the relative change in sensor characteristics upon attachment of target molecules on the sensor surface. This is determined mainly by the geometry of the sensor as well as characteristics of the fluidic environment.

**Selectivity:** It denotes the ability of receptors to bind with the desired target in the presence of various other (possibly similar) biomolecules and is entirely determined by the functionalization schemes.

**Settling Time:** It is the time taken by the sensor to produce a stable signal change. It is determined by the concentration of the analyte bio-molecules their diffusion coefficients in water, and their conjugation affinity (ability to bind) to the receptor molecules.

### III. Construction of Biosensor

#### 3.1a Planar Biosensor:

Sensor Structure of planar biosensor is shown in Figure1 has three main properties Device Parameters, Biological Parameters, and Ambient Condition. Under Device Parameters select the type of sensor as Planar biosensor. Set the parameters for Oxide Thickness as  $1e-07$ cm, doping as  $1e+20$ /cc, Length and Width to  $3e-06$ cm. Biological parameters specify the rate constant for target receptor conjugation, receptor density, ionization constant for surface groups like  $-OH$ ,  $-NH_2$ , etc. Specify the Target receptor as DNA or Protein (Type of Analyte). If the type of analyte used in DNA set the surface conjugate parameters for  $k_f$  (forward reaction constant) as  $3e+06$ ,  $k_r$  (reverse reaction constant) as 1, and receptor density as  $1e+12$ . For DNA parameters set the strand length as 12, diffusion parameter as diffusion coefficient and its value as  $1e-06$ . For ambient condition set incubation time as 60 min and its temperature as 300K.

#### 3.1b Cylindrical Nanowire Biosensor:

Sensor Structure of cylindrical nanowire biosensor is shown in Figure1 has three main properties Device Parameters, Biological Parameters, and Ambient Condition. Under Device Parameters select the type of sensor as cylindrical nanowire biosensor. Set the parameters for radius as  $5e-06$ cm, length as 0.0005cm, Oxide Thickness as  $1e-07$ cm, doping as  $1e+19$ /cc. Biological parameters specify the rate constant for target receptor conjugation, receptor density, ionization constant for surface groups like  $-OH$ ,  $-NH_2$ , etc. Specify the Target receptor as DNA or Protein (Type of Analyte). If the type of analyte used in DNA set the surface conjugate parameters for  $k_f$  (forward reaction constant) as  $3e+06$ ,  $k_r$  (reverse reaction constant) as 1, and receptor density as  $1e+12$ . For DNA parameters set the strand length as 20, diffusion parameter as diffusion coefficient and its value as  $1e-06$ . For ambient condition set incubation time as 60 min and its temperature as 300K.

#### 3.1c Nanosphere Biosensor:

Sensor Structure of Nanosphere biosensor is shown in Figure1 has three main properties Device Parameters, Biological Parameters, and Ambient Condition. Under Device Parameters select the type of sensor as Nanosphere biosensor. Set the parameter for radius as  $3e-06$ cm. Biological parameters specify the rate constant for target receptor conjugation, receptor density, ionization constant for surface groups like  $-OH$ ,  $-NH_2$ , etc. Specify the Target receptor as DNA or Protein (Type of Analyte). If the type of analyte used in DNA set the surface conjugate parameters for  $k_f$  (forward reaction constant) as  $3e+06$ ,  $k_r$  (reverse reaction constant) as 1, and receptor density as  $1e+12$ . For DNA parameters set the strand length as 20, diffusion parameter as diffusion coefficient and its value as  $1e-06$ . For ambient condition set incubation time as 60 min and its temperature as 300K.

**3.1d Double Gate FET Biosensor:**

Sensor Structure of Double- gate FET biosensor is shown in Figure1 has three main properties Device Parameters, Biological Parameters, and Ambient Condition. Under Device Parameters select the type of sensor as Double- gate FET biosensor. Set the parameters for top oxide Thickness as  $4e-07$ cm, back oxide thickness as  $1.5e-05$ cm, silicon body thickness as  $8e-06$ cm, doping as  $1e+19$ /cC, Length and Width to  $1\mu$ m. Biological parameters specify the rate constant for target receptor conjugation, receptor density, ionization constant for surface groups like  $-OH$ ,  $-NH_2$ , etc. Specify the Target receptor as DNA or Protein (Type of Analyte). If the type of analyte used in DNA set the surface conjugate parameters for  $k_f$  (forward reaction constant) as  $3e+06$ ,  $k_r$  (reverse reaction constant) as 1, and receptor density as  $1e+12$ . For DNA parameters set the strand length as 20, diffusion parameter as diffusion coefficient and its value as  $1e-06$ . For ambient condition set incubation time as 60 min and its temperature as 300K.

**3.1e Extended Gate FET Biosensor:**

Sensor Structure of Extended- gate FET biosensor is shown in Figure1 has three main properties Device Parameters, Biological Parameters, and Ambient Condition. Under Device Parameters select the type of sensor as Extended- gate FET biosensor. Set the parameters for top oxide Thickness as  $4e-07$ cm, back oxide thickness as  $1.5e-05$ cm, silicon body thickness as  $8e-06$ cm, let sensor area be fixed and the area of sensing layer is 1, doping as  $1e+15$ /cC, Length and Width to  $0.0001$ cm, and area of interconnect as 100. Biological parameters specify the rate constant for target receptor conjugation, receptor density, ionization constant for surface groups like  $-OH$ ,  $-NH_2$ , etc. Specify the Target receptor as DNA or Protein (Type of Analyte). If the type of analyte used in DNA set the surface conjugate parameters for  $k_f$  (forward reaction constant) as  $3e+06$ ,  $k_r$  (reverse reaction constant) as 1, and receptor density as  $1e+12$ . For DNA parameters set the strand length as 20, diffusion parameter as diffusion coefficient and its value as  $1e-06$ . For ambient condition set incubation time as 60 min and its temperature as 300K.

**3.1f Magnetic Particle Sensor:**

Sensor Structure of Magnetic particle sensor is shown in Figure1 has three main properties Device Parameters, Biological Parameters, and Ambient Condition. Under Device Parameters select the type of sensor as Magnetic particle sensor. Set the parameter for radius as  $0.0001$ cm and density as  $1e-15$ . Biological parameters specify the rate constant for target receptor conjugation, receptor density, ionization constant for surface groups like  $-OH$ ,  $-NH_2$ , etc. Specify the Target receptor as DNA or Protein (Type of Analyte). If the type of analyte used in DNA set the surface conjugate parameters for  $k_f$  (forward reaction constant) as  $3e+06$ ,  $k_r$  (reverse reaction constant) as 1, and receptor density as  $1e+12$ . For DNA parameters set the strand length as 20, diffusion parameter as diffusion coefficient and its value as  $1e-06$ . For ambient condition set incubation time as 60 min and its temperature as 300K.

**3.1g DGFET pH Sensor:**

Sensor Structure of DGFET pH sensor is shown in Figure1 has three main properties Device Parameters, Biological Parameters, and Ambient Condition. Under Device Parameters select the type of sensor as DGFET pH sensor. Set the parameters for top oxide Thickness as  $5e-07$ cm, back oxide thickness as  $1.5e-05$ cm, silicon body thickness as  $8e-06$ cm, Length and Width to  $0.0001$ cm. Biological parameters specify the rate constant for target receptor conjugation, receptor density, ionization constant for surface groups like  $-OH$ ,  $-NH_2$ , etc. Specify the Target receptor as DNA or Protein (Type of Analyte). If the type of analyte used in DNA set the surface conjugate parameters for  $k_f$  (forward reaction constant) as  $3e+06$ ,  $k_r$  (reverse reaction constant) as 1, and receptor density as  $1e+12$ . For DNA parameters set the strand length as 20, diffusion parameter as diffusion coefficient and its value as  $1e-06$ . For ambient condition set incubation time as 60 min and its temperature as 300K.

**3.1h EGFET pH Sensor:**

Sensor Structure of EGFET pH sensor is shown in Figure1 has three main properties Device Parameters, Biological Parameters, and Ambient Condition. Under Device Parameters select the type of sensor as EGFET pH sensor. Set the parameters for top oxide Thickness as  $5e-07$ cm, back oxide thickness as  $1.5e-05$ cm, silicon body thickness as  $8e-06$ cm, let sensor area be fixed and the area of sensing layer is 1, doping as  $1e+15$ /cC, Length and Width to  $0.0001$ cm, and area of interconnect as 100. Biological parameters specify the rate constant for target receptor conjugation, receptor density, ionization constant for surface groups like  $-OH$ ,  $-NH_2$ , etc. Specify the Target receptor as DNA or Protein (Type of Analyte). If the type of analyte used in

DNA set the surface conjugate parameters for  $k_f$  (forward reaction constant) as  $3e+06$ ,  $k_r$  (reverse reaction constant) as 1, and receptor density as  $1e+12$ . For DNA parameters set the strand length as 12, diffusion parameter as diffusion coefficient and its value as  $1e-06$ . For ambient condition set incubation time as 60 min and its temperature as 300K.

### 3.1i Flexure FET Biosensor:

Sensor Structure of Flexure FET biosensor is shown in Figure1 has three main properties Device Parameters, Biological Parameters, and Ambient Condition. Under Device Parameters select the type of sensor as Flexure FET biosensor. Set the parameters for Length to  $4e-06$ cm, Width to  $1e-06$ cm, thickness as  $4e-08$ m, set air gap to  $1e-07$ m and the dielectric thickness as  $5e-09$ m. Biological parameters specify the rate constant for target receptor conjugation, receptor density, ionization constant for surface groups like  $-OH$ ,  $-NH_2$ , etc. Specify the Target receptor as DNA or Protein (Type of Analyte). If the type of analyte used in DNA set the surface conjugate parameters for  $k_f$  (forward reaction constant) as  $3e+06$ ,  $k_r$  (reverse reaction constant) as 1, and receptor density as  $1e+12$ . For DNA parameters set the strand length as 20, diffusion parameter as diffusion coefficient and its value as  $1e-06$ . For ambient condition set incubation time as 60 min and its temperature as 300K.

## IV. Modelling of Biosensors

In the "Type of simulation" parameter select settling time, using this feature we can calculate the 'Settling time V/s Analyte concentration' and time 'dependent capture for target molecules'. For both the parameters keep all the values same as the default for lower value, upper value, number of intermediate concentration steps and minimum number of molecules same as the default values for planar <sup>[1]</sup>, cylindrical nanowire <sup>[2]</sup>, nanosphere <sup>[3]</sup>, double gated FET <sup>[4]</sup>, and magnetic particle biosensors <sup>[5]</sup>. [Extended gate FET, DGFET pH sensor, EGFET pH sensor does not have the parameter of settling time]. [Refer figures 2,3,6,7,11,12,13,14,19,25,26]

Select 'Sensitivity', in this feature keep all the values same for planar biosensor. For cylindrical nanowire biosensor, sensitivity has different features like 'pH parameters', 'conductance modulation v/s Analyte concentration'<sup>[6]</sup>, 'conductance modulation v/s buffer ion concentration'<sup>[7]</sup> and 'conductance modulation v/s pH'<sup>[8]</sup>. All the values for cylindrical nanowire biosensor are set same as the default. Apart from the above mentioned parameters Double gated nanowire biosensor has additional parameters such as (Voltage forward and back gate)  $V_{fg}$ ,  $V_{bg}$  and pH whose values are set as 1, 0, and 4 respectively. Extended gate nanowire biosensor's parameters are set pH value is 2, electrolyte concentration is 0.1M, DNA surface density  $1e13$ , surface density  $5e14$ , protonation constant -2, de-protonation constant as 6,  $V_{ds}$  0.1V,  $V_{fg}$  starting point and ending point as 0.4V & 1V respectively, and  $V_{fg}$  step size 0.01V. DGFET pH sensor has two different parameters for sensitivity pH parameters and DGFET transfer characteristics. Under pH parameters surface density is  $5e14/cm^2$ , protonation constant is -2, deprotonation constant as 6, pH starting and ending point as 4 and 7 respectively, pH step length as 1, electrolyte concentration as  $150e-3$ M. DGFET characteristics have two modes of operation front gate and back gate operation. Electrical parameter  $V_{ds}$  is 0.1V,  $V_{bg}$  is fixed and its value is 0. Set the  $V_{fg}$  range,  $V_{fg}$  starting and ending point as 0.3V and 1V respectively,  $V_{fg}$  step length as 0.1V. For back gate operation pH parameters remain same as front gate, only the  $V_{bg}$  range changes  $V_{bg}$  starting and ending point is 1V and 5V respectively,  $V_{bg}$  step length is 0.1V. EGFET pH sensor has a few added parameters such as pH starting point 4 and pH ending point 8, pH step size is set to 1, electrolyte concentration is 0.1M, rest of the parameters and its values are same as DGFET pH sensor. Flexure biosensor has sensitivity parameters same as the default values. [Nanosphere biosensor and magnetic particle biosensor do not have the sensitivity feature]. [Refer figures 4,8,9,10, 15,16,17,18,20,21,22,23,24,27].

Selectivity <sup>[9]</sup> is another type of simulation available, values for all the parameters remain same for all the sensors available, using the molecular parameter feature set the size of the molecules to  $2e-07$ cm, size of the parasitic molecules to  $1e-07$ cm, concentration of target molecules  $1e-12$ M, concentration of parasitic molecules  $1e-6$ M, charge of the individual target molecule as 10, and charge of the parasitic molecule as 1. Other parameters such as maximum surface coverage is set as 0.54, lower value of the receptor density as  $1e+11/cm^2$ , upper value of the receptor density as  $5e+12/cm^2$ , set the number of steps to 50, and rate constant to  $1e-1$ . [Selectivity feature is only available for planar, cylindrical nanowire, nanosphere, extended gate pH biosensor and flexure biosensors as these sensors simulation give the electrical response of the sensor to various analyte parameters]. [Refer figure 5].

V. Results and Discussion

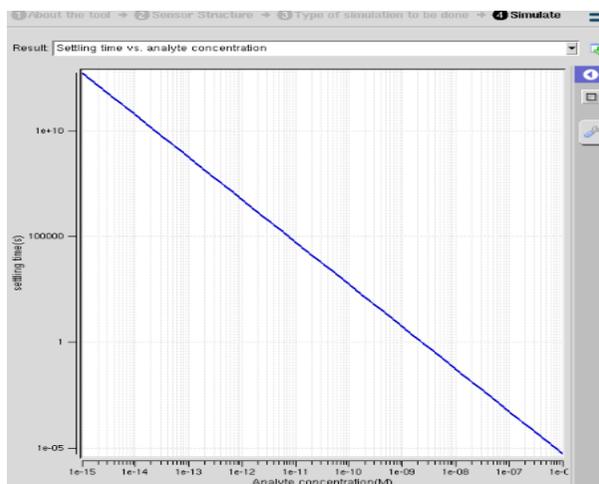


Fig. 2 settling time v/s Analyte concentration (planar biosensor)

At the settling time of 2.11356s the concentration of analyte was found to be 1.61026e-09M, at 195226s the analyte concentration was found to be 5.29832e-12M, at 1e+09s the analyte concentration was 1.80324e-14M. Hence, a decrease in the analyte concentration was observed with an increase in settling time.

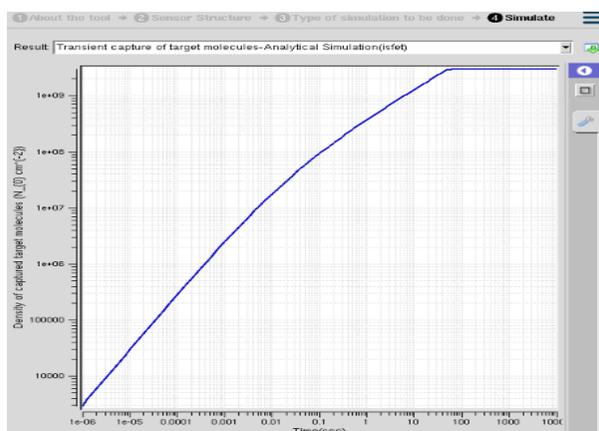


Fig. 3 Time dependent capture Vs Capture molecule

At 3.19927e-06s the density of the captured target molecule was found to be 9478.38N<sub>(0)</sub>cm<sup>-2</sup>, at 0.000422924s density of the target molecule was 1.10823e+06 N<sub>(0)</sub>cm<sup>-2</sup>, and at 5.85702s the density was 9.73599e+08 N<sub>(0)</sub>cm<sup>-2</sup>. As the time increased the density of the captured target molecule also increased and after a time instance of 59.9484s the density of the captured molecules remained constant i.e., 2.99103e+09 N<sub>(0)</sub>cm<sup>-2</sup>.

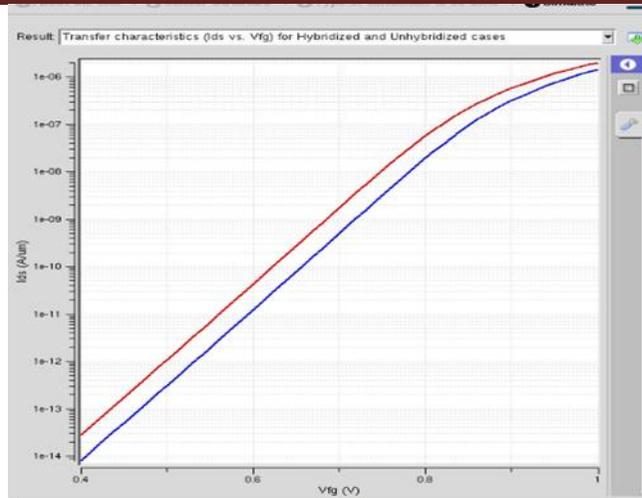


Fig. 4 Transfer characteristics for hybridized (blue) and unhybridised (red) cases

For a forward gate voltage (Vfg) of 0.4V, current (Ids) for hybridized case was found to be  $8.22284 \times 10^{-15}$  A/um and unhybridised was found to be  $2.81901 \times 10^{-14}$  A/um. At 0.6V current (Ids) for hybridized case was found to be  $1.21926 \times 10^{-11}$  A/um and unhybridised was found to be  $4.26124 \times 10^{-11}$  A/um. And at a Vfg of 1V current (Ids) for hybridized case was found to be  $1.45204 \times 10^{-6}$  A/um and unhybridised was found to be  $2.01511 \times 10^{-6}$  A/um. The I-V characteristics for both hybridized and unhybridised cases were obtained and an increase in the current with respect to voltage was observed.

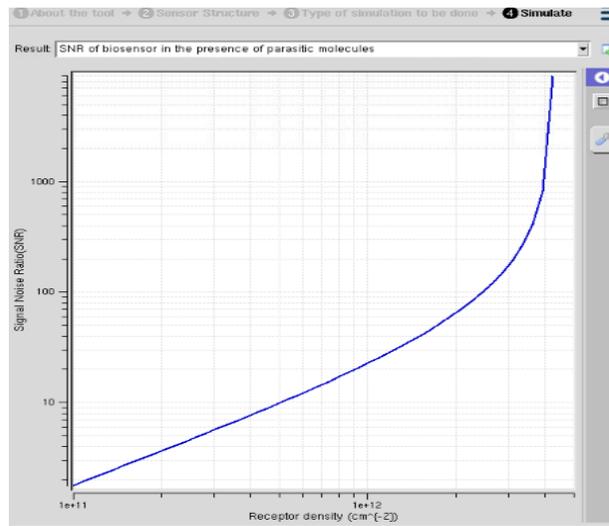


Fig. 5 SNR of biosensor in the presence of parasitic molecule

Signal to Noise Ratio remains same for all the biosensors (planar, cylindrical nanowire, nanowire, extended gate pH biosensor and flexure biosensors). At SNR of 9.735 the receptor density observed was  $4.93693 \times 10^{11} \text{ cm}^{-2}$ , at 82.4538 the receptor density was  $2.25031 \times 10^{12} \text{ cm}^{-2}$ , at 814.999 the receptor density was  $3.9506 \times 10^{12} \text{ cm}^{-2}$ .

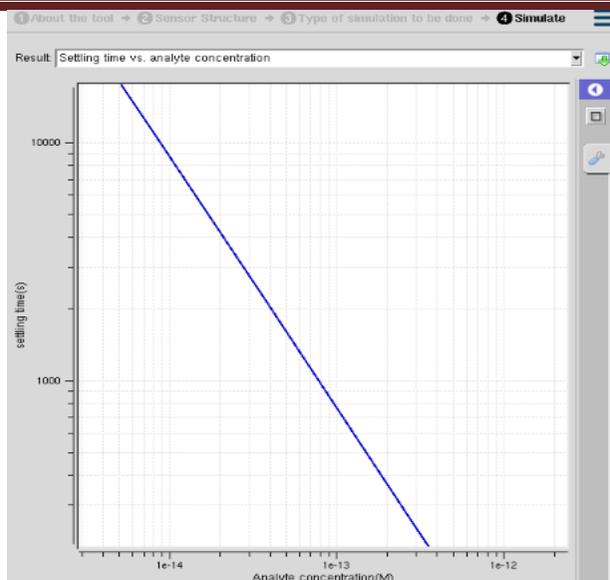


Fig. 6 settling time v/s Analyte concentration

At settling time of 1081.71s the analyte concentration was  $7.27895 \times 10^{-14} \text{M}$ , at 4874.94s the analyte concentration was found to be  $1.74333 \times 10^{-14} \text{M}$ , at  $1 \times 10^9 \text{s}$  the analyte concentration was  $8.53168 \times 10^{-15} \text{M}$ . Hence, a decrease in the analyte concentration was observed with an increase in settling time.

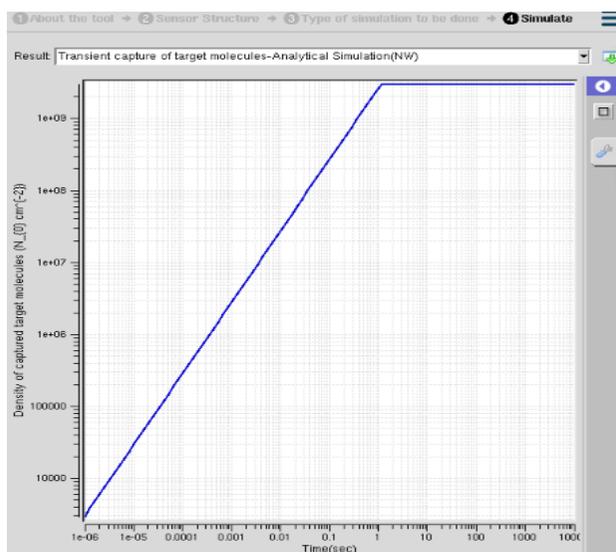


Fig. 7 Time dependent capture Vs Capture molecule

At  $3.1927 \times 10^{-6} \text{s}$  the density of the captured target molecule was found to be  $9470.51 \text{ N}_0 \text{cm}^{-2}$ , at  $0.00033516 \text{s}$  density of the target molecule was  $955078 \text{ N}_0 \text{cm}^{-2}$ , and at  $0.0443062 \text{s}$  the density was  $1.196 \times 10^8 \text{ N}_0 \text{cm}^{-2}$ . As the time increased the density of the captured target molecule also increased and after a time instance of  $59.9484 \text{s}$  the density of the captured molecules remained constant i.e.,  $2.99103 \times 10^9 \text{ N}_0 \text{cm}^{-2}$ .

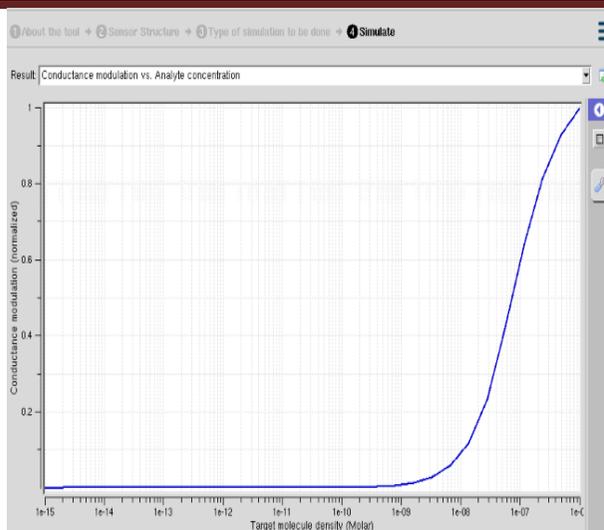


Fig. 8 Conductance v/s Analyte concentration

At (normalized) conductance modulation of 0.23461 the density of the target molecule was found to be 2.80722e-06M, for a conductance modulation of 0.63954 the density of target molecule was 1.1721e-07M, at conductance modulation of 1 the density was 1e-06M.

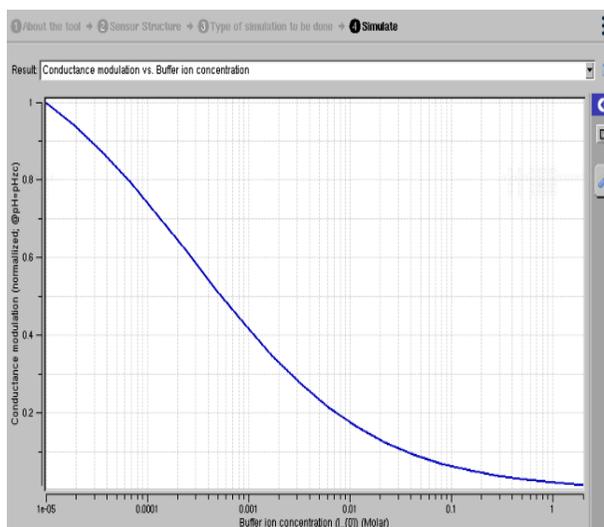


Fig. 9 Conductance modulation v/s Buffer ion concentration

At conductance modulation of 0.068307 the buffer ion concentration was found to be 0.0805419M, for a conductance modulation of 0.520292 the buffer ion concentration was found to be 0.000472073M, for a conductance modulation of 0.871636 the buffer ion concentration was found to be 3.61412e-05M. Concentration of buffer ion decreased with the increase in the conductance modulation.

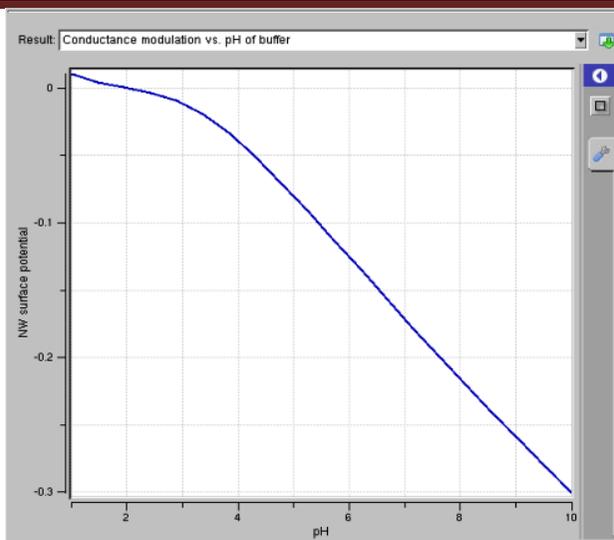


Fig. 10 Conductance modulation v/s pH of buffer

At surface density of  $-0.300279$  pH of the buffer observed was 10, for a surface density of  $-0.15677$  the pH of the buffer was 6.68421, at a surface density of  $0.0109654$  pH of the buffer observed was 1. Hence, as the surface density increases the pH of the buffer decreases.

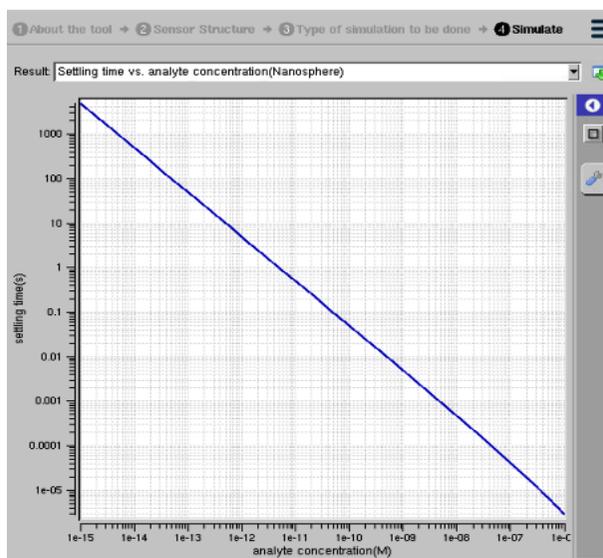


Fig. 11 settling time v/s analyte concentration

At the settling time of  $2.8965e-06s$  the concentration of analyte was found to be  $1e-06M$ , at  $6.9491-06s$  the analyte concentration was found to be  $4.8939-07M$ , at  $1192.9s$  the analyte concentration was  $4.17532e-15M$ . Hence, a decrease in the analyte concentration was observed with an increase in settling time.

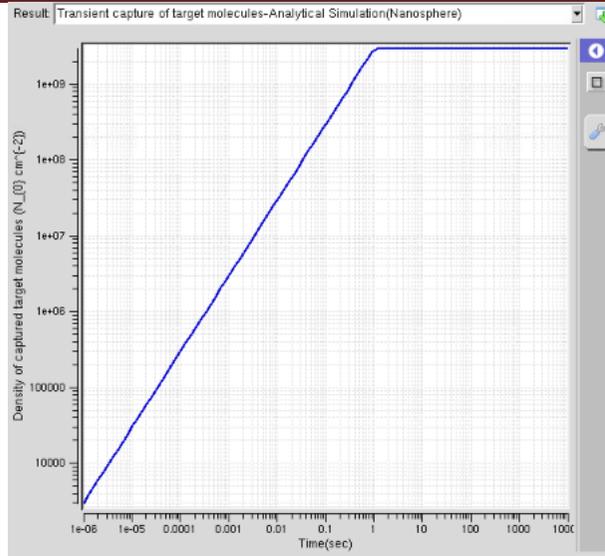


Fig. 12 Transient capture of target molecule

At a time period of 3.19927e-06s the density of the captured target molecule was found to be 9513.42  $N_{(0)}\text{cm}^{-2}$ , at 0.00033516s density of the target molecule was 991593  $N_{(0)}\text{cm}^{-2}$ , and at 0.0351119s the density was 1.03795e+08  $N_{(0)}\text{cm}^{-2}$ . As the time increased the density of the captured target molecule also increased and after a time instance of 1.14976s the density of the captured molecules remained constant at a value of 2.99103e+09  $N_{(0)}\text{cm}^{-2}$ .

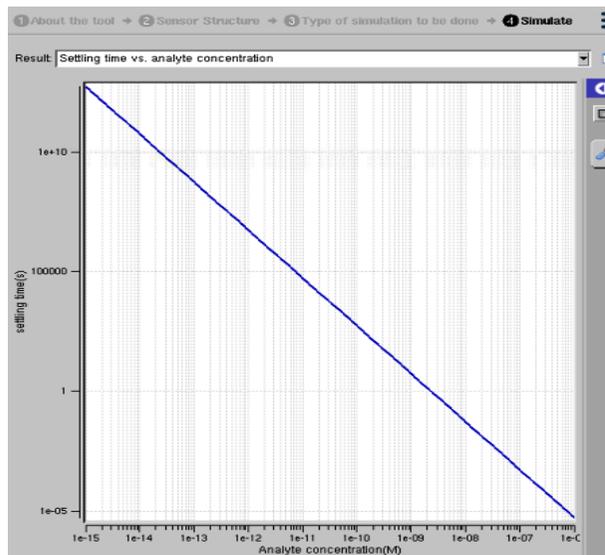


Fig. 13 settling time v/s analyte concentration

At the settling time of 2.11358s the concentration of analyte was found to be [1.61026e-09M](#), at 195226s the analyte concentration was found to be [5.29832e-12M](#), at 1.80324e+10s the analyte concentration was 1.74333e-14M. Hence, a decrease in the analyte concentration was observed with an increase in settling time.

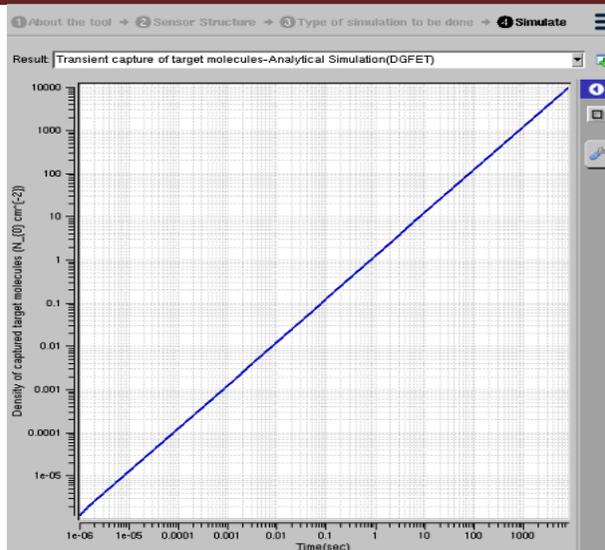


Fig. 14 Transient capture of target molecules

At a time period of  $3.19927 \times 10^{-6}$ s the density of the captured target molecule was found to be  $2.53536 \times 10^{-6} N_0 \text{cm}^{-2}$ , at 977.01s density of the target molecule was  $774.264 N_0 \text{cm}^{-2}$ , and at 7924.83s the density was  $10000 N_0 \text{cm}^{-2}$ . As the time increased the density of the captured target molecule also increased.

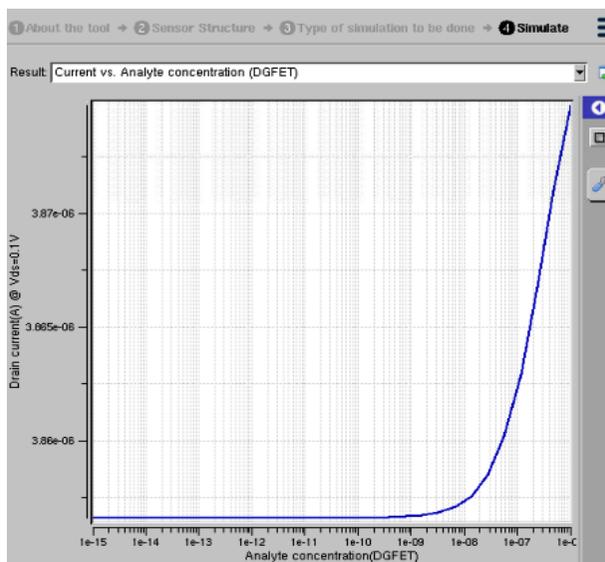


Fig. 15 Current v/s analyte concentration

Drain current remains constant  $3.75822 \times 10^{-6} \text{A}$  (@ $V_{ds}=1\text{V}$ ) for the change in analyte concentration till  $1.88739 \times 10^{-10}$  and then starts increasing slightly. For drain current of  $3.76062 \times 10^{-6} \text{A}$  the concentration of analyte was observed to be  $2.39503 \times 10^{-7}$ , at  $3.77039 \times 10^{-6} \text{A}$  the analyte concentration was  $1 \times 10^{-6}$ . As the analyte concentration increases the drain current also increases.

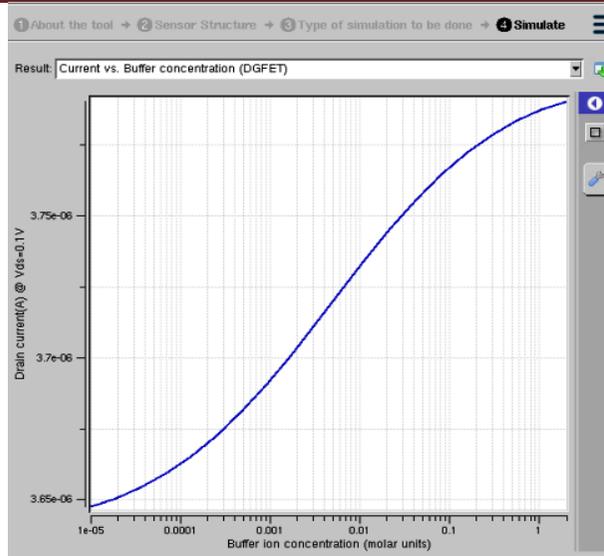


Fig. 16 current v/s Buffer concentration

For drain current of  $3.64769 \times 10^{-6} \text{ A}$  the concentration of buffer concentration was observed to be  $1 \times 10^{-5} \text{ M}$ , at  $3.70095 \times 10^{-6} \text{ A}$  the buffer concentration was  $0.00170613 \text{ M}$ , at  $3.7906 \times 10^{-6} \text{ A}$  the concentration of the buffer was  $2 \text{ M}$ . As the buffer concentration increases the drain current also increases.

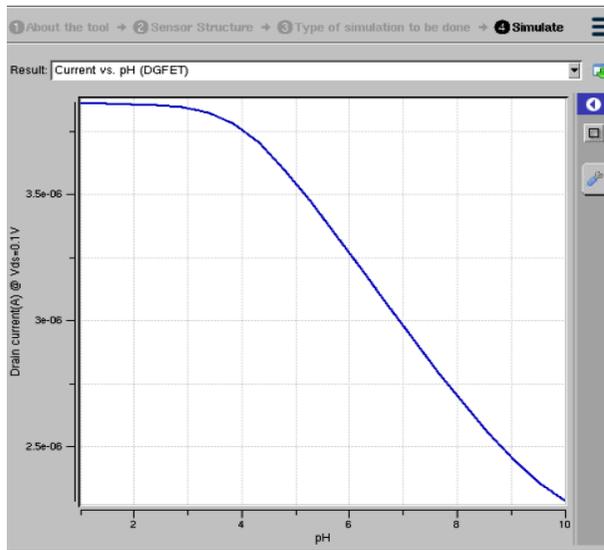


Fig. 17 Current v/s pH

At drain current of  $2.2859 \times 10^{-6} \text{ A}$  the pH observed was 10, at  $2.80001 \times 10^{-6} \text{ A}$  the pH was 7.6315.8, at  $3.8652 \times 10^{-6} \text{ A}$  the pH obtained was 1. Hence, with increase in the drain current ( $I_{ds}$ ) a decrease in pH was observed.

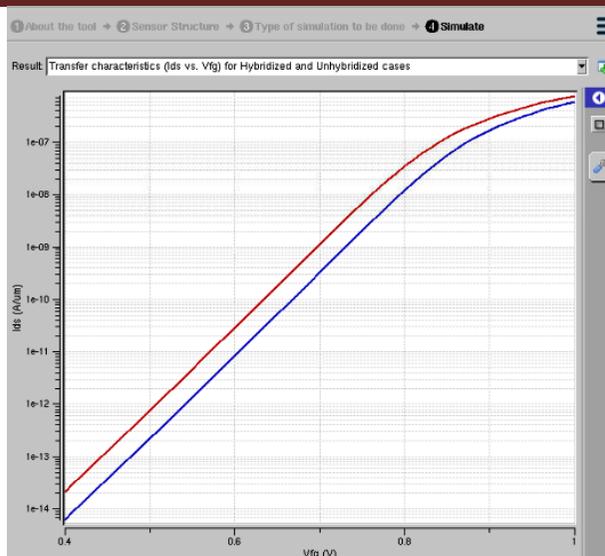


Fig. 18 Transfer characteristics v/s hybridized and unhybridised cases

For a forward gate voltage ( $V_{fg}$ ) of 0.4V, current ( $I_{ds}$ ) for hybridized case was found to be  $6.3203e-15A/\mu m$  and unhybridised was found to be  $2.11708e-14A/\mu m$ . At 0.6V current ( $I_{ds}$ ) for hybridized case was found to be  $8.35222e-06A/\mu m$  and unhybridised was found to be  $2.87119e-11A/\mu m$ . And at a  $V_{fg}$  of 1V current ( $I_{ds}$ ) for hybridized case was found to be  $5.98846e-07A/\mu m$  and unhybridised was found to be  $7.77937e-07A/\mu m$ . The I-V characteristics for both hybridized and unhybridised cases were obtained and an increase in the current with respect to voltage was observed.

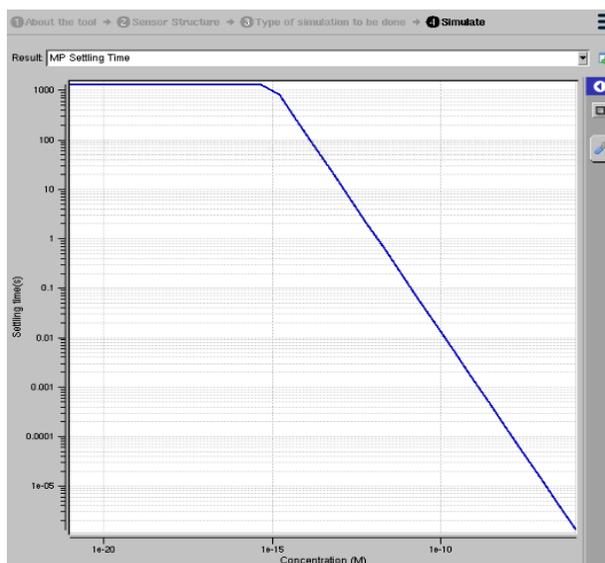


Fig. 19 MP settling time

For settling time of  $1.32123e-06s$  the concentration was found to be  $1e-06M$ , at  $0.0597241s$  the concentration was  $2.21222e-11M$ , at  $75.7876s$  the concentration observed was  $1.74333e-14M$ . Once the settling time reaches  $1321.23s$  the concentration remains constant i.e.,  $4.8939-16M$ .

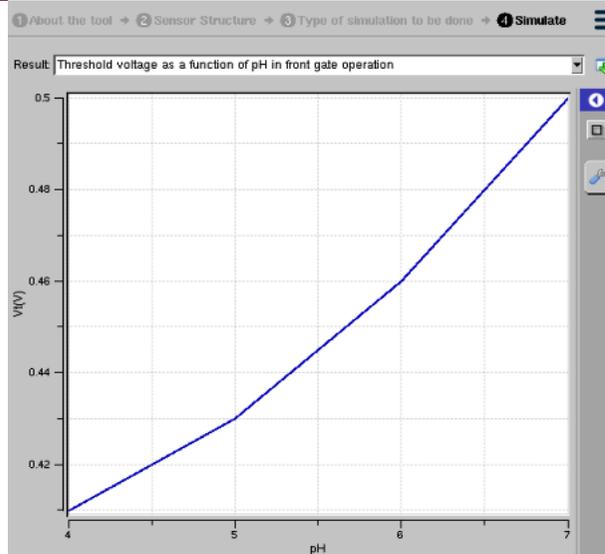


Fig. 20 Threshold voltage as a function of pH in front gate operation

For a threshold voltage of 0.41V pH 4 was obtained, similarly at 0.46V a pH of 6 was obtained and at 0.5V pH obtained was 7. Hence with the increase in the threshold voltage an increase in the pH value was obtained.

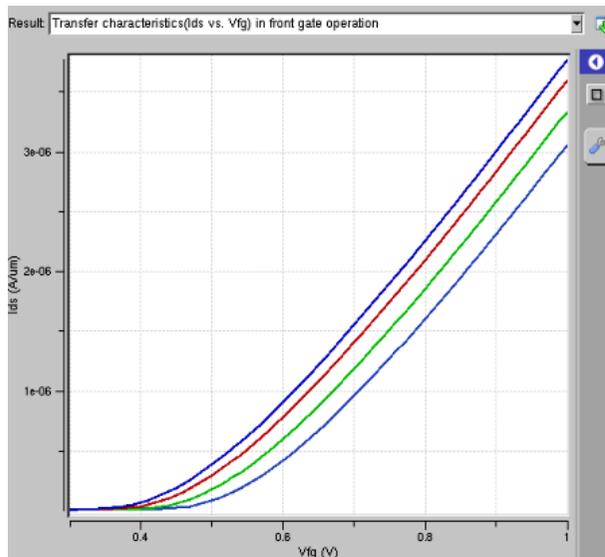


Fig. 21 Ids v/s Vfg (front gate)

At a forward voltage (Vfg) of 0.4V current at different pH levels were observed at pH4 the current obtained was 6.95753e-08A/um, similarly at pH5 current observed was 4.03111e-08A/um, at pH6 current observed was 1.84274e-08A/um, and at pH7 current observed was 1.11759e-08A/um. At 0.6V current at different pH were observed at pH4 the current obtained was 9.09193e-07A/um, similarly at pH5 current observed was 7.83869e-07A/um, at pH6 current observed was 1.84274e-07A/um, and at pH7 current observed was 4.23675e-07A/um. At 1V current at different pH were observed at pH4 the current obtained was 3.77194e-06A/um, similarly at pH5 current observed was 3.59672e-06A/um, at pH6 current observed was 3.33411e-06A/um, and at pH7 current observed was 3.054242e-06A/um. With the increase in pH current Ids also increases.

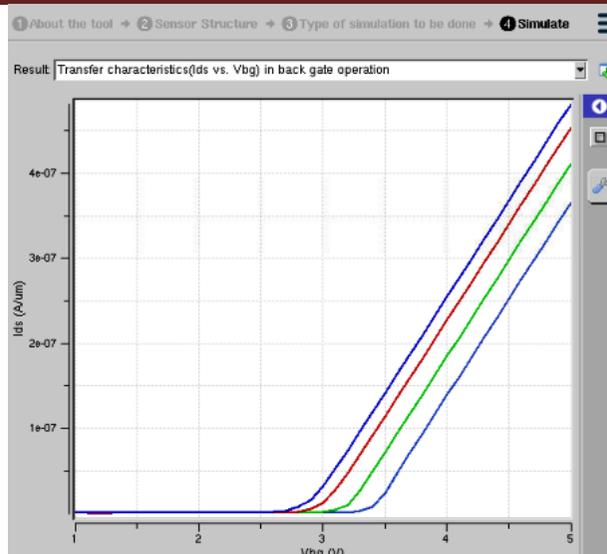


Fig. 22 Ids v/s Vfg (back gate)

At a back gate voltage (Vbg) of 3V current at different pH levels were observed at pH4 the current obtained was  $4.90041e-08A/um$ , similarly at pH5 current observed was  $2.43569e-08A/um$ , at pH6 current observed was  $4.70718e-08A/um$ , and at pH7 current observed was  $5.78992e-08A/um$ . At 4V current at different pH were observed at pH4 the current obtained was  $2.74026e-07A/um$ , similarly at pH5 current observed was  $2.47472e-07A/um$ , at pH6 current observed was  $2.06483e-07A/um$ , and at pH7 current observed was  $1.62151e-07A/um$ . At 5V current at different pH were observed at pH4 the current obtained was  $5.01533e-06A/um$ , similarly at pH5 current observed was  $3.59672e-06A/um$ , at pH6 current observed was  $4.74779e-06A/um$ , and at pH7 current observed was  $3.89391e-06A/um$ . With the increase in pH current Ids also increases.

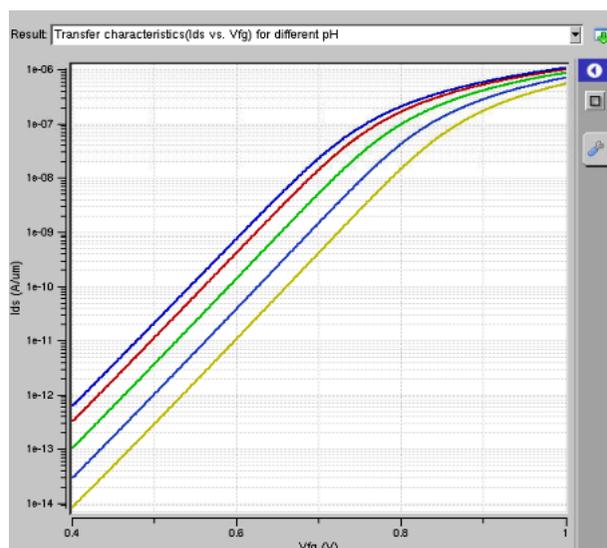


Fig. 23 Ids v/s Vfg

At a forward voltage (Vfg) of 0.4V current at different pH levels were observed at pH4 the current obtained was  $6.7465e-13A/um$ , similarly at pH5 current observed was  $3.47567e-13A/um$ , at pH6 current observed was  $1.12036e-13A/um$ , at pH7 current observed was  $3.12138e-14A/um$ , and at pH8 current observed was  $8.898405e-15$ . At 0.6V current at different pH were observed at pH4 the current obtained was  $8.76304e-10A/um$ , similarly at pH5 current observed was  $4.82242e-10A/um$ , at pH6 current observed was  $1.60023e-$

10A/um, and at pH7 current observed was 4.40419e-11A/um and at pH8 current observed was 1.22163e-11. At 1V current at different pH were observed at pH4 the current obtained was 1.30309e-06A/um, similarly at pH5 current observed was 1.22549e-06A/um, at pH6 current observed was 1.05756e-06A/um, and at pH7 current observed was 8.53702e-07A/um and at pH8 current observed was 6.58691e-07. With the increase in pH current  $I_{ds}$  also increases.

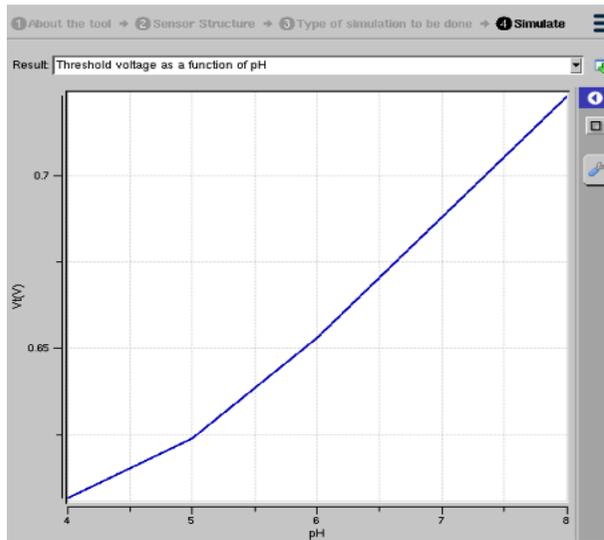


Fig. 24 Threshold voltage as function of pH

At threshold voltage of 0.624V the pH observed was 5, at 0.653V pH 6 was observed, and at 0.688V pH observed was 7.

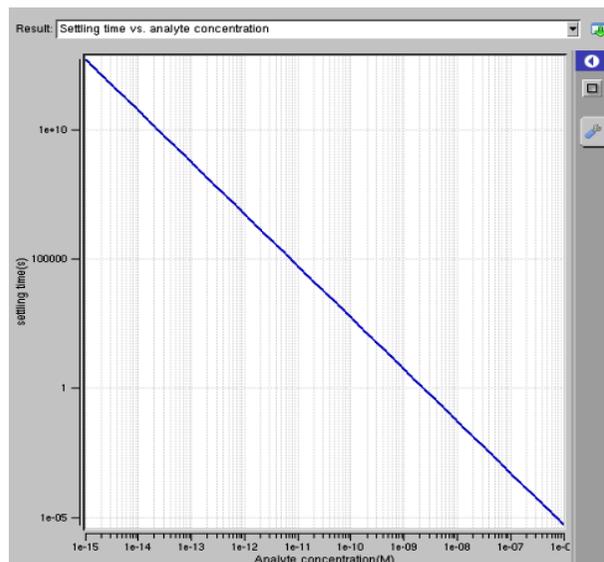


Fig. 25 settling time v/s Analyte concentration

At the settling time of 5.4804e-06s the concentration of analyte was found to be [1e-06M](#), at 815129s the analyte concentration was found to be [2.59294e-12M](#), at 5.4804e+12s the analyte concentration was 1e-15M. Hence, a decrease in the analyte concentration was observed with an increase in settling time.

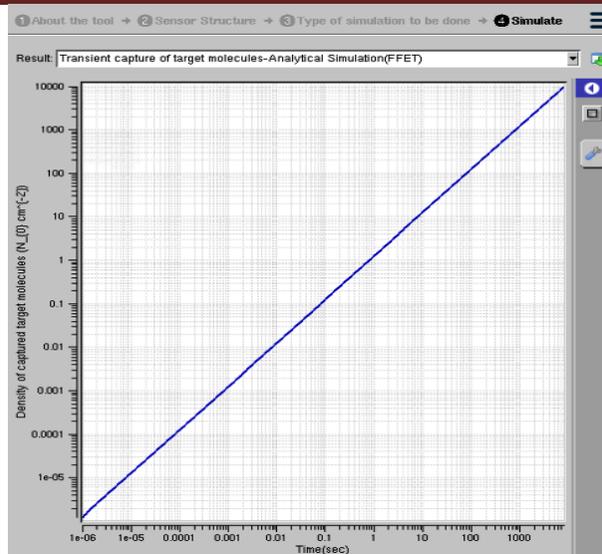


Fig. 26 Transient capture of target molecule

At 7924.83s the density of the captured target molecule was found to be  $10000N_0\text{cm}^{-2}$ , at 4.464159s density of the target molecule was  $5.85702N_0\text{cm}^{-2}$ , and at  $6.42807e-06\text{s}$  the density was  $8.11131e-06N_0\text{cm}^{-2}$ . As the time increased the density of the captured target molecule also increased.

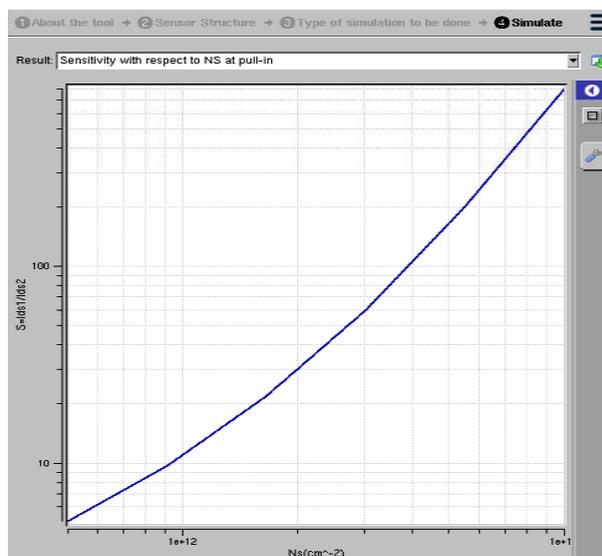


Fig. 27 Sensitivity with respect to NS at pull-in

At  $5e+11\text{cm}^{-2}$  the sensitivity of the device was observed to be 5.11094, at  $3.01709e+12\text{cm}^{-2}$  the sensitivity observed was 59.9239, and at  $1e+13\text{s}$  the sensitivity observed was 801.702.

**4.1 Comparison table for different types of biosensors**

Table 4.1 Comparison table

Type of property	Planar biosensor	Cylindrical nanowire biosensor	Nanosphere biosensor	Double gate FET sensor	Extended gate FET sensor	Magnetic particle sensor	DGF ET pH sensor	Extended gate FET pH sensor	Flexure FET sensor
Settling time v/s analyte concentration at settling time =1e-05s	2.28824e-05 @ 4.8939e-07	4.52663e-05 @ 2.39503e-07	6.94919e-06 @ 4.8939e-07	2.28824e-05 @ 4.8939e-07	—	2.12752 @ 6.21017e-13	—	—	2.11358 @ 4.8939e-07
Transient capture v/s target molecule	94430.1 @ 3.27455e-05	95407.6 @ 3.27455e-05	97042 @ 3.27455e-05	10000 @ 7924.83	—	—	—	—	10000 @ 7924.83
Transfer characteristic	<a href="#">7.8272e-11@0.65(hyb)</a> 2.72155e-10@0.65(unhyb)	—	—	—	5.21961e-11@0.65(hyb) 1.79306e-10@0.65(unhyb)	—	—	—	—
Current v/s analyte concentration	—	0.903441 @4.8939e-07	—	3.76789e-06@.48939e-07	—	—	—	—	—
Current v/s buffer ion concentration	—	0.520321 @0.000472073	—	3.68071e-06@0.000472073	—	—	—	—	—
Current v/s pH	—	0.0109654 @1	—	3.8652e-06@1	—	—	—	—	—

Sensitivity w.r.t. NS pull-in	--	--	--	--	--	--	--	--	5.11094 @5e+11
Ids v/s Vfg and Ids v/s Vbg	--	--	--	--	--	--	$\frac{3.77 \times 10^{-6}}{1}$ (pH4)	$1.30309 \times 10^{-6}$ (pH4)	--
Threshold voltage as pH	--	--	--	--	--	--	0.43 @5 (front gate) $\frac{3.4 \times 10^{-5}}{1}$ (back gate)	0.62@5	--
SNR of Biosensor in the presence of parasitic molecules	23.1269 @1.0127 7e+12	23.1269@1.01277e+12	23.1269 @1.0127 7e+12	23.1269 @1.0127 7e+12	--	--	--	23.1269 @1.0127 7e+12	23.1269 @1.0127 7e+12

## VI. Conclusion

Biosensors research is being carried out by most of the scientific community to support medical applications. With development of technology and scaling of nano devices compatible to the sizes of biological particles it is easier to detect biological matter and interface with. The electronic circuitry which is of nano device size can be integrated with sensing device for lab on chip development. In this paper, nine different sensors have been modeled in biosensors lab configuring structural properties, biological properties and simulation modes. From the simulation results the working of all biosensors are compared and a detailed discussion is carried out. Most of the biosensors have similar property in terms of settling time and sensitivity. It is required to fabricate the sensors and evaluate its performances.

## VII. Acknowledgement

We acknowledge nanohub.org for giving access to biosensor simulation lab. The resources for teaching and experimentation at nanohub.org were helpful to understand biosensors and carry out simulation results. We thank the contributors of nanohub.org.

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# Animal Detection Using Deep Learning

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**ABSTRACT:** Most serious problem nowadays in nation is road accidents which cause high fatal death and injuries. The interferences of both animal and vehicles on lanes of the roads and ghat regions are increased. The proposed system is trained over 900 images with positive and negative images tested. The driver gets a caution displaying about the animal on road and this way we prevent the collision occurring between the animal and vehicle.

**Keywords:** Preventing animal and vehicle collision on roads.

## 1. Introduction

Road accidents is increasing day by day due to an increase of vehicles and lack of intelligent highway safety and alert system. The swiftness of vehicles in the Indian States are continuously strikes the animals on the lanes of the highways in which most of the animals both vertebrates and invertebrates are killed and injured often. The more often animals which are killed during these road accidents are forest mice, deer, hyenas, rabbits, elephants, reptiles, and the night time animals such as civets, skunks, and sambar deer and cathemeral species such as fossa's, lions, tigers and cheetahs. Collisions of animals and vehicle occur due to extremely high rates. In USA alone, around a million deer and car collisions occur each year, which results around 200 human deaths and \$1 billion of properties are damaged per year. Because of these incidents, many animals are killed. Added to these all the animal and car collisions that take place in other countries (for a count taken, around 219,800 such animal and vehicle collisions are counted in German countries annually), and the number is extremely vast.



Fig. 1 Animal and Vehicle collision.

## II. Evidence of an Animal and Vehicle Collision

Animal militants have held the police and the bovine possessor responsible for their lack of action for the rise in death of the bovines in road accidents in Tiruchirappalli cities and other cities of India. When the livestock animals are feeding on the plants which grows on roads of the median of the city lanes and highways, where the driver loses control on the vehicle when the animals suddenly encounters on the road. Both the animals and humans fall prey to these fatal accidents.

## III. Literature Survey

Applications that are built to detect animals play the momentous role in giving a deduced explanation to difficult world complications. On the basis of the certain requisition in detecting, the animals either in an image or a video. The final measures must be taken by the drivers while driving, whether their actions can control to prevent their vehicle from the destruction in given a quick time of less than a hundred

microseconds or fewer. The root cause for the accidents occurring is because that the driver's eyes gets worn out quickly and needs immediate rest, i.e., is why this idea has to be brought into force. Few scientists and researchers have approached an idea that demands the animals to stand in front of the camera so that they can have a clear image of the animals for the identification and face recognition of the animal. The main drawback of the approached idea is that for identification and face recognition of the animals, they need to look the camera which can be continuously captured by a camera during a travel. Animals can approach from a different scenes from various directions and in different sizes and poses.

#### IV. Different Scenarios and Consequence of Animal and Vehicle Collision on Highway

Animal and vehicle collision is of two ways:

Direct and Indirect collision of animal and vehicle

Direct animal vehicle collision: It happens when the vehicle strikes the animal directly. Following cases and outcome may occur depending on the speed of the vehicle and the speed of the animal.

Condition 1: When the driver in the vehicle strikes the animal on the road and the animal is swept aside to the other end of the road. This sequence may be a less threatening, but causes less harm to both.

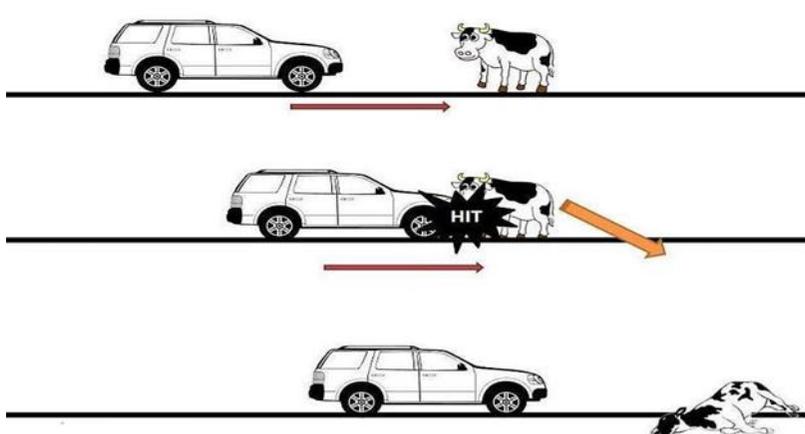


Fig. 2 Condition 1 instance.

Condition 2: In this sequence when the animal on the lane strikes the vehicle, the animal runs over the vehicle and hits the vehicle back. This condition proven to be more threatening which causes harm to each other.

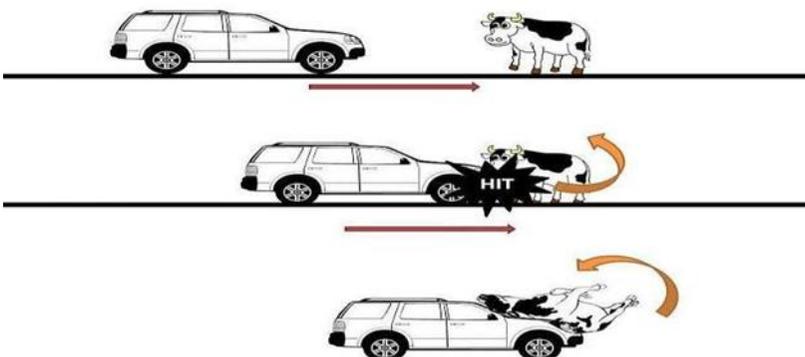


Fig. 3 Condition 2 instance.

Condition 3: When the vehicle strikes the animal and runs over the animal. This sequence, animal is injured. In some extreme conditions, the vehicle gets turned over due to the crash of the accident and may cause severe injury to the people present in the vehicle.

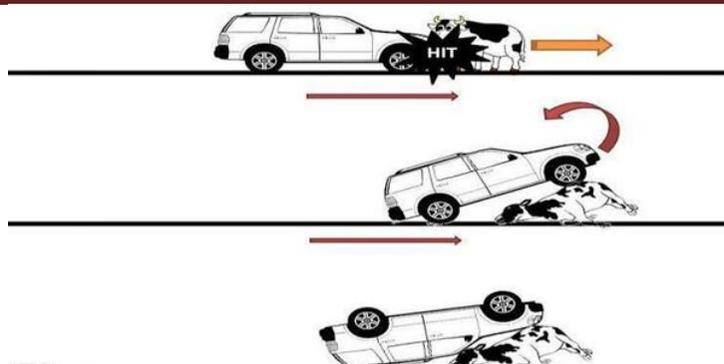


Fig. 4 Condition 3 instance.

Indirect animal and vehicle collision: In this sequence, an accident happens because of animals both directly and indirectly. The driver spots the animal on the lane and tries to divert the vehicle to the other side, the vehicle crosses the barrier and hits the vehicle approaching from the other side of the road. In order to reduce or decrease, the above-mentioned animal and vehicle collision of all the above sequence, if the vehicle has some automatic embedded system for animal detection system in the highway lanes, then it is viable to some extent to avoid injuries and strikes between vehicles.

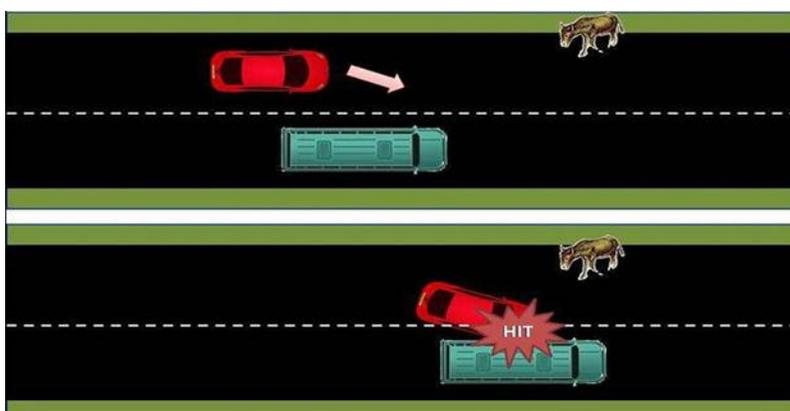


Fig. 5 Indirect animal vehicle collision sequence.

## V. Objective and Scope

Researchers who carried out the surveys have helped to decrease the amount of accidents that has been encountered by animal and vehicle interferences. The roads of our country is always been covered by humans, cattels, stray dogs and bovines compared to any other animals. The main objective of the work carried out is to reduce the animal vehicle accidents on the highway lanes and city roads, is by creating a precautionary action by deducting the animal ahead and alerting both the driver and animal in order to avoid fatal accidents. The precise intention of the work carried out is:

- 1) To create or build a cost effective system for an automated animals identification system for Indian lanes.
- 2) To calculate and predict the exact distance of animal and vehicle by the cameras present in the lanes.
- 3) To develop an alert system, which warns the driver when the animals get recognized on the road which alerts the driver to apply brakes or take other necessary actions to prevent accidents.

## VI. Design and Methodology

New models of computing to perform pattern recognition tasks are inspired by structure and performance of our biological networks. Some attractive features of biological neural network which makes it superior to even the most sophisticated AI computer system. Considering an artificial neural network (ANN) as a highly simplified model of biological neural network. The model of the processing unit consists of a summing part followed by an output part. The summing part will receive  $N$  input values that weight each value and

computes a weighted sum. The weighted sum is called as an activation value. Whereas the output part produces a signal from the activation values. The sign of the weight for each input  $\varnothing$  determines whether; the input is positive weights or negative weights. The inputs may be discrete or continuous. The input and output could also be deterministic, stochastic or fuzzy. The activation value determines the output from the output function unit, i.e., the output state of the unit. Activation dynamics determines the activation value of all the units, i.e., the activation state of the network of the function of time. The output values and other external inputs determine the activation and output states of the other units. The activation dynamics of the output state of the other states. The process of adjusting the weights is referred to as learning. Once the learning process is completed, the final set of the weight's values correspond to the long-term memory function of the network. The procedure incrementally updates each of the weights are called learning algorithm.

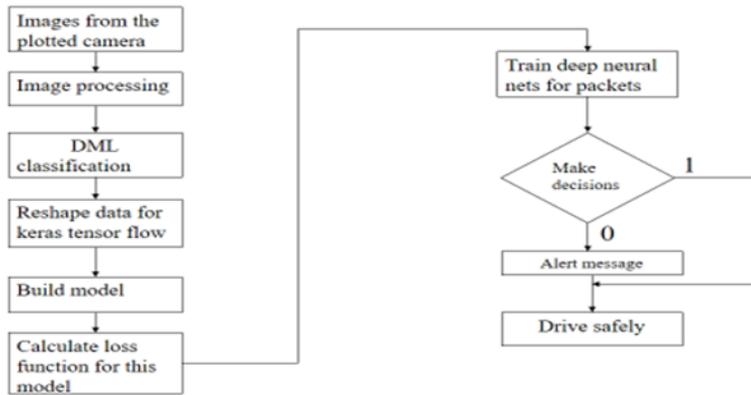


Fig. 7 Block diagram for database creation.

### VII. Convolution Neural Network

A convolutional neural network is more often applied to analyse visual images. The computational units of neural networks are called neurons and are organized into multiple layers. Neurons in adjacent layers are connected with weights. These neural networks are proposed to reduce the number of parameters and adapt the network architecture specifically to the vision task. They are usually composed by a set of layers that can be grouped by their functionalities.

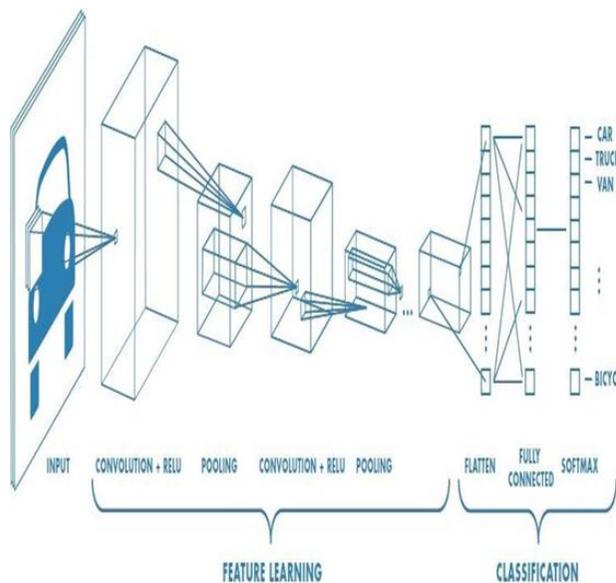


Fig. 6 Architecture of Convolutional neural network.



## **X. Conclusion**

The proposed algorithm can spot animals in different conditions on highways. The system created can achieve a precision of about 67.25% on animal detections. The proposed method can distinguish between animals and non-animals and classes of animal in processing the datasets. The built in methods can be upgraded with other existing inventions, for animal vehicle detection systems and can provide a complete solution, reduce loss of human and animal life.

## **Acknowledgement**

We would like to thank all, who had involved in data collection research, and analysis stage of this project. We express our gratefulness to our head of department and our guide for supporting and guiding us throughout the project work. We express our sincere thanks to M S Engineering College, Bengaluru, India for the support and motivation.

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# Mobile Charging Station for Electric Vehicles with Green Power

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**ABSTRACT:** As a measure to tackle the rising energy requirements we have witnessed the concept of electric mobility and a prototype shift from conventional vehicles to electric vehicles (EVs). But increasing in number of EVs is again a major risk we face in power distribution network. This rise in demand of power required by EVs to get charged may create a hindrance in its performance. Therefore, to overcome this dispute we generate power by the renewable means (solar energy) as a source to generate power and the idea is to harvest solar energy by placing the floating module on the surface of the lake which can also reduce small amount of water loss by reducing evaporation rate, another idea is to place solar panel on top of electric pole or as a solar tree where each branch holds a solar panel that takes 4sqft of space and produce about 3KW of power, where normal solar panel occupy 200sqft of space to produce same amount of power and design a solar controller to charge 7V lead acid battery with input voltage 12.6V and charging time for 6 hours which intern is used to charge Electric Vehicles.

**Keywords:** Solar panel, Solar charge controller, Inverter, Batteries, Charging station, Electric Vehicle.

## 1. Introduction

Because of environmental issues related with the automobiles which are driven by Internal Combustion Engine (ICE), there is a rapid growth of EVs in current market. EVs play a major role in prevention of air pollution and emission of greenhouse gases. EVs are still gaining popularity despite of few drawbacks associated with it. EVs have become widespread because of their negligible fuel gas emission and lesser reliance on oil. It is estimated that by 2022, EVs will be rising over 35 million in the world. However a major drawback associated with EVs is that a heavy electricity demand to the power grid.

To overcome this issue an efficient approach to relieve the effect is to integrate renewable energy for the local power generation into the EV charging infrastructure [1, 2, 3, 4].

There is a lack of studies considering the integration and interaction of EVs with renewable energy, the charging infrastructure and the strategies to decrease air pollution, the power grid, all together. This work seeks to investigate the integration of EVs with renewable energy for defensible mobility in largely reducing pollution.

Section II presents the background theory of EV charging infrastructure. Section III shows a review of impact on EV charging station based on different parameters of power grid. Section IV discusses the key findings of the work. Section V concludes the work.

## EV Charging Infrastructure

Charging stations are noted as the point of fueling EVs. The key equipment's of charging stations are cords, connectors, and interface with the power grid. One of the key factors for deployment of EVs are a good charging infrastructure. The Electric Power Research Institute (EPRI) has described the charging levels as follows- [5], [6]

1. Level 1 AC
2. Level 2 AC
3. Fast charging DC

Table I shows a comparative analysis of distinct charging levels input current, input voltage, charging time, and application. A wireless mode of charging EVs is also attracting many EV users apart from the above mentioned charging levels [7]-[10] which uses electromagnetic field to transfer the electricity to EV batteries.

Table I. Comparative Analysis of Distinct Charging Levels

Type	Input Current	Input Voltage	Charging Time	Application
Level 1 (AC)	15 A	120 V	(10-13) hr.	Home or office
Level 2 (AC)	40 A	240 V	(1-3) hr.	Private or commercial
Level 3 (DCFC)	80 A	208 V	(0.5-1.44)hr.	Public

### Impact of Renewable Energy on EV Charging Infrastructure

Although the electrification of automobiles have many favorable impacts like reduce pollution, less CO2 emission as well as less global warming, but we cannot neglect the detrimental impacts on EV chargers by power distribution, To overcome this effect an efficient approach to relieve is to integrate renewable energy for the local power generation into the EV charging infrastructure (figure 1).

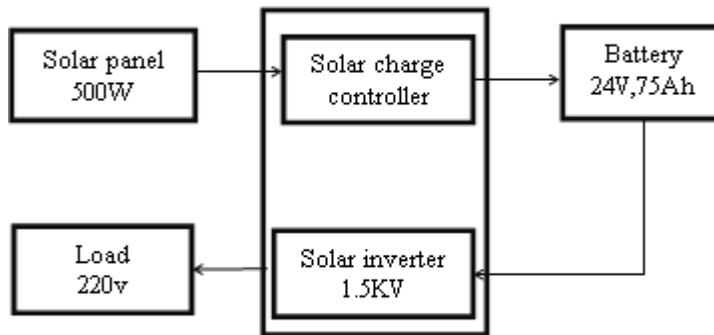


Figure 1: Impact of renewable energy on EV charging infrastructure

#### A. Solar Panel

Solar panel is also known as modules which is a collection of solar cells. These solar cells are arranged in parallel-series method to produce enough electricity. It produces more electricity when exposed to more light. By using photovoltaic effect solar cell an electric device converts energy of light directly into electricity. Solar panel or module are designed by combining individual solar cell devices. Solar cell is described as photovoltaic and they are used as photodetector, detecting light near visible range.

The three basic attributes required to operate a photovoltaic (PV) cell are given below.

- Absorbing light and generating electron-hole pairs.
- Separating the charge carriers of opposite type.
- Extracting those carriers separately to an external circuit.

Photovoltaic module have a sheet of glass facing towards sun, that allows light to pass through it. Solar cells can be connected either in series or parallel, solar cells connected in series yields high voltage and solar cells connected in parallel yields high current

Construction and Working of Solar Cell: It consists of a Si PN junction diode with a glass window on top surface layer of P material. This material is made of extremely thin so, that it is easy for incident light photons to reach the PN junction. These photons collide with valence electrons, which gives sufficient energy to leave their parent atoms. By this, free electrons and holes are generated on both sides of the junction. Due to these electrons and holes current are produced, the current produced by this is directly proportional to illuminations (mw/cm<sup>2</sup>).

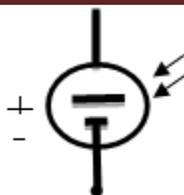


Figure 2: Solar cell symbol

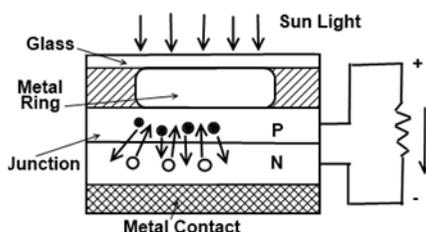


Figure3: Solar cell construction

The solar cell shown in the above figure2 is similar to ordinary diode, which consists of silicon, germanium PN junction with a glass window on the top surface layer of P-type. The positive output terminal (anode) here is the P nickel-plated ring around the P layer and the metal contact at the bottom acts as a cathode.

The most widely used semiconductors materials for solar cell are silicon and germanium. Silicon being a great conductor of heat speeds up the heat building in solar cells on hot sunny days. Nowadays even gallium arsenide and Indium arsenide are also being used.

The south-facing direction of a solar panel provides optimum potential. There is tracking and non-tracking PV system, in tracking system the panel is oriented in the direction of sun’s rays and in non-tracking PV system panel should be inclined at an angle equal to the site’s latitude to absorb the maximum amount of energy. Cells in solar panel produces direct current electricity.

There are mainly two types of solar cells: monocrystalline silicon solar cell and polycrystalline silicon solar cell.

Monocrystalline silicon solar cell: monocrystalline cells are unique as they are made up of a very pure silicon. The efficiency of the cell in converting sunlight into electricity is more, the silicon which is formed into bars and cut into wafers are called monocrystalline to indicate that the silicon used is single-crystal silicon.

Polycrystalline silicon solar cell: fragments of silicon is melted together to form wafers is called polycrystalline solar cell, there are many crystals in each cell. Electrons have less freedom to move , as a result lower efficiency.

Table II. Types of Solar Cells:

Material	Efficiency (%)
Monocrystalline Silicon	17-20%
Polycrystalline Solar Cells	13-15%
Amorphous Solar Cells	5-7%

Table III. Solar Cell Manufacturers From India:

Company Name	Cell Type
BEL	Monocrystalline
Indosolar	Monocrystalline, Polycrystalline
KL Solar	Monocrystalline, Polycrystalline
Tata Power Solar	Monocrystalline, Polycrystalline
Websol Solar	Monocrystalline

XL Energy	Polycrystalline
USL	Monocrystalline, Polycrystalline

## B. Solar Charge Controller

The fundamental component in solar panel installation is solar charge controller. A solar charge controller also known as charge regulator, regulates the voltage and current coming from solar panel and protects the battery from overvoltage, which may reduce the battery performance or lifespan. The designed internal circuit diagram of solar charge controller is shown in figure 4, they also control the reverse power flow. The earmark of a solar charge controller are:

- Protecting the battery from overcharging.
- Reducing the system maintenance and increasing the battery lifetime.
- Monitors the reverse current flow.

There are mainly two different types of solar charge controller, they are:

1. Pulse Width Modulated (PWM)
2. Maximum Power Point Tracking (MPPT)

**Pulse Width Modulation (PWM):** PWM controller connects a solar array to a battery; the voltage of the array will be pulled down near to that of the battery. It is a good low cost solution for small system only, when solar cell temperature is moderate to high (between 45 and 75 degree Celsius).

**Maximum Power Point Tracking (MPPT):** MPPT will adjust its input voltage to harvest the maximum power from the solar array and transforms this power to supply the varying voltage requirement, of the battery. To fully utilize the potential of MPPT controller, the array voltage should be considerably higher than the battery voltage. The MPPT controller is the solution for higher power system, they also harvest substantially more power when the solar cell temperature is low (< 45 degree Celsius) or very high (> 75 degree Celsius).

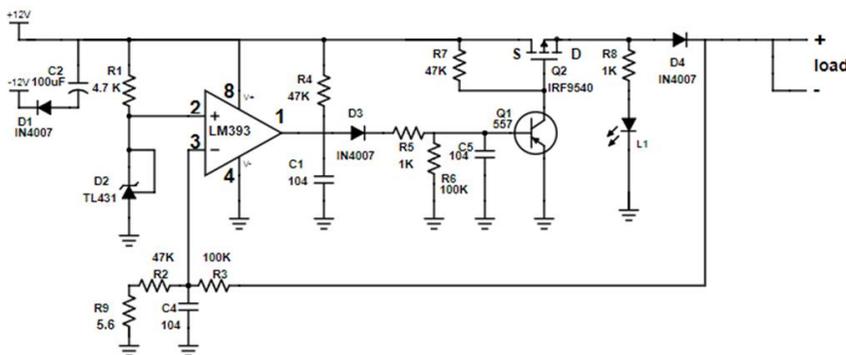


Figure 4: Circuit diagram of solar charge controller

## C. Solar Inverter

An inverter function is to convert DC voltage to an AC voltage. In most cases, the input DC voltage is usually lower while the output AC voltage is greater than the supply voltage of either 120v, 240v.

The conversion of DC to AC is achieved by converting energy stored in the dc source such as the battery or rectifier into AC. This is achieved by using switching devices which are continuously turned on and off, and then the signal is stepped up and stepped down using the transformer to get the desired output.

The input voltage (DC) is switched by the power devices such as MOSFETs or transistors and the pulses are fed to the primary winding of the transformer. The varying voltage in the primary winding induces an alternating voltage at secondary winding of the transformer. The transformer also acts as an amplifier which increases the output voltage at a ratio determined by the turn's ratio of the transformer. In most cases the output voltage is increased from the standard 12 volts supplied by the batteries to either 120 volts or 240 volts AC.

The inverters are classified based on their output waveforms which we get from the transformer. There are 3 types: Square wave, Pure/True Sine wave and Modified Sine wave.

The square wave inverter is simple and cheaper, however, it has a low power quality compared to the other two types. The output waveform is represented in figure 5.

The modified square wave inverter provides a better power quality (THD~ 45%) and is suitable for most electronic devices. The output of this inverter is the rectangular pulses that have dead spots between the positive half cycle and the negative half cycle (THD about 24%). The output waveform is represented in figure 5.

The pure sine wave inverter has the best waveform with the lowest THD of about 3%. However, they are expensive and used in many applications such as medical equipment, stereos, laser printers and other applications requiring sinusoidal waveforms. They are also used in equipment's which uses grid. The output waveform is represented in figure 6.

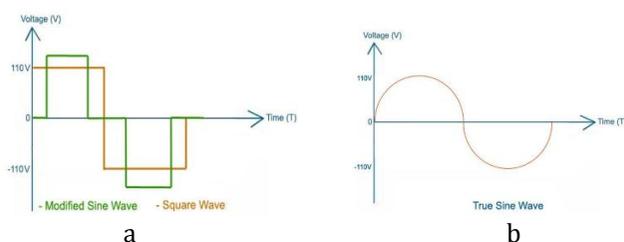


Figure 5: a - Output waveform of modified sine and square wave; b - Output waveform of true sine wave (Google pictures).

#### D. Battery

Lead-acid batteries are made up of a lead-dioxide as cathode, a sponge metallic lead as anode and a sulphuric acid solution as electrolyte. This heavy metal element makes the battery toxic and improper disposal can be hazardous to the environment. The cells present in a 12v battery is 6.

During discharge of battery, lead dioxide (positive plate) and lead (negative plate) react with electrolyte of sulphuric acid to form sulphate, water and energy.

During charging of battery, cycle is reversed i.e. lead sulphate and water are electro-chemically converted to lead, lead oxide and sulphuric acid by external charging source.

The battery is rechargeable type, it should not be overcharged, and if it is done so then the battery is completely sealed, maintenance-free and leak proof. It was rated as 12v and 75Ah. It should not be discharged below 80%.

Basic rules followed during charging the lead-acid battery (6cells, 12v):

- Disconnect the load when battery voltage decreases below 10.5v when loaded.
- It is safe to charge most of lead-acid batteries by current up to  $C/10h$ , where C is the battery capacity in Ah.
- It is not good to charge battery beyond the gassing voltage (about 14.4v) for longer time.

It is important to recharge the battery to 100% due to self-discharge the voltage may reduce when it is actually in use.

In a 12v battery system the voltage vary between 10.5v and 14.4v, depending on the actual state of charge of the battery, charge current, discharge current, type and age of the battery.

Normal full loaded battery which has no charging or discharging current flowing then the voltage present in battery is 12.v to 12.7v, when battery is charging the voltage jumps to a higher value e.g. 13.7v and when loads are connected the voltage drops down to 12v or 11.8v.

PV module produces energy which is flowing into the battery via charge controller then the voltage increases up to the range of 14.7v in the battery, the excess voltage is cut off by using an overvoltage protection circuit to reduce the voltage.

#### E. Load (Charging Station)

An individual charging point can be extended to up to 195 kW, with the dimensions of 900 mm x 700 mm x 2200 mm (WxHxL), achieving the industry leading entire power density. When an individual charging point is extended to 195 kW, twelve 15 kW modules are installed in the cabinet, which effectively improves the capacity of the individual cabinet. The C module of charging station is shown in figure 6.

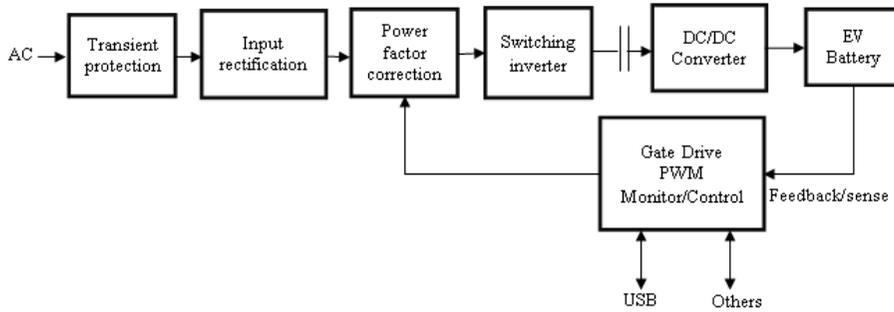


Figure 6: C module of charging station

**Transient protection:** it's a module design to protect electronic system against high or over voltage transients that can occur on an input bus line.

**Input rectification:** is an electrical device consisting of one or more diodes that convert AC to DC.

**Power factor correction:** technique used for increasing the power factor of power supply. It shapes the input current in order to maximize the real power from the ac supply.

**Switching inverter (power inverter):** converts DC to AC.

**DC to DC converter:** developed to maximize energy harvest for photovoltaic system.

**Gate driver:** the lower power input from a controller IC is accepted by power amplifier and for the gate of high power transistor a high current drive input is produced.

Initially the battery is fully empty and it has a voltage of 0.5V when measured by a multimeter, then using the charging circuit designed we will charge the battery. The input to the charging circuit is the solar energy from the solar panel and the voltage of the battery is checked frequently while charging.



Figure 7: Output voltage of battery Initially (before charging)



Figure 8: Output voltage of battery while charging

## I. Discussion

Charging infrastructure technology is changing quickly in electric vehicle industry. New developments are making their way out of laboratories such as superfast and inductive charging and could further change the industry. The major findings in this paper are discussed in this section.

The 500 Watt solar panel produces approximately 41.5 volt based on the climatic conditions, the obtained input voltage is given to the designed solar charge controller that regulates the voltage and current received from solar panel and is stored in batteries, here for this work we use lead acid battery of 24 volt capacity 12 volt each connected in series with C10 rating and the charging time is 3.5 hr. to 6 hr. depends on the voltage produced by the solar panel which is intern given to the charging station that is basically in 3 levels – level 1 that takes AC has input, For level 2 input given should be in AC, level 3 is a fast charging station and it takes DC as input, thus the more suitable charging level used in general is level 2 since it can be used for both private and commercial purpose based on the requirement. All the research work concludes that introduction of electric charging station degrades the operating parameter in power consumption required for charging vehicles. Despite of few negative impacts on EV charging load, EVs must be welcomed as the positive impacts of integrating renewable energy and producing power to the station cannot be neglected.

The future direction of this work includes-

1. To design a solar charge controller circuit for commercial application which gives better efficiency and performance.
2. To increase the input power and voltage of around 7v to 34 volts.
3. To increase the Battery voltage from 24v to 48v.

## II. Conclusion

We cannot permit definitive, universal conclusions about such a quickly moving industry with so many differences across the various markets. However we can give conclusions about the status of charging infrastructure and exemplary practices that help point toward the path forward. At a local level charging model availability varies dramatically, and there is no universal benchmark for the amount of charging infrastructure required. Demand for increase in load due to establishment of charging station is indeed a big threat, to overcome this problem implementing a renewable energy (solar energy) will bring a major difference as renewable energy are inexhaustible. Thus the operating parameters must be taken into account. This paper attempts to give the qualitative as well as quantitative work as how to integrate the renewable energy into the charging infrastructure.

## III. Acknowledgment

Our sincere thanks to Mr. Ramprasad, co-founder of the Friends of Lakes organization for supporting us by sharing the valuable ideas. Furthermore we extend our gratitude to M S Engineering College, Bengaluru, India for the support and motivation in developing our project.

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# Feature Recognition using Deep Machine Learning

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**ABSTRACT:** As a major advantage, deep learning has received very impressive ideas in solving difficult challenges in many fields including audio recognition, feature extraction, image processing. This paper provides an overview of deep learning and focus on its applications in object recognition, feature extraction, and image classification. Basically, this paper provides a new approach to flower species recognition. By using convolutional neural networks, deep machine learning, and image classification. Firstly, this paper selects features from database model and characterize the flower species, which improves the efficiency of algorithm. This paper presents a stacked simple neural network algorithm based on the deep learning which improves the neural network model. The experiment indicates the comparison of real data with desired data. Thus, reconstruction is achieved by training the data and testing data by using supervised machine learning algorithm.

**Keywords:** Deep machine learning, Neural network, Convolutional Neural network, Image preprocessing.

## 1. Introduction

Feature recognition is the process extracting features from the flower species database, and reconstructing an original data with high efficiency and accuracy. It has numerous applications in the area of biodiversity, image processing. The dataset contains 2 different species of flowers. The resolution of images is different and it is difficult for computation. The preprocessing has been done to bring all the images into 32x32 resolution. A feed forward neural network has been utilized to build the classifier model using machine learning algorithm.

### 1.1 Deep machine learning:

Deep neural networks contain multiple non-linear hidden layers relationships between their inputs and outputs. feature recognition is the process extracting features from the plant species database, and reconstructing an original data with high efficiency and accuracy which has numerous applications in the area of biodiversity image processing. The dataset contains 2 different species of plants. The resolution images are different and it is difficult for computation, so preprocessing has been done to bring all the images into 32\*32 resolution. A feed forward neural network has been utilized to build the classifier model using machine learning algorithm.

The techniques used in feature recognition may depend on convolution neural network (CNNs) and deep machine learning. This project basically uses discriminative type of architecture. Hence it is user friendly, modularity, easy extensibility. a part of python programming which is highly object oriented and capable of running on top tensor flow. Even if one was able to train many different large networks, using them all at test time is infeasible in applications where it is important to respond quickly as shown in Fig 1.

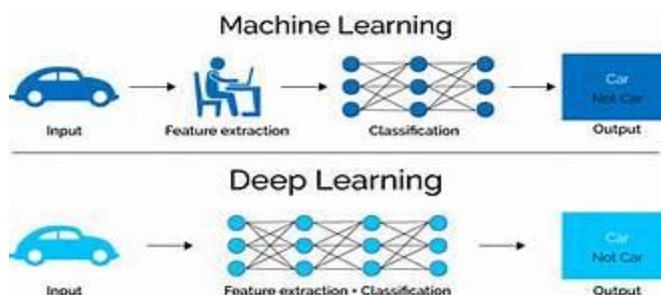


Figure 1. Deep machine learning network.

This paper provides a historical overview of deep learning and focus and on is applications in image classification, feature recognition, which are the key challenges of computer vision and have numerous applications to images and videos. The discussed topics on feature recognition include image classification on imagenet, feature recognition, and feature extraction. the classification part includes image preprocessing, rescaling, and reconstruction of an image. The methods which are used are feed forward operation and back propogationalgorithm. This entire process comes under neural networks. The dataset which we are giving is trained and tested. The supervised neural network is used to provide an analyzed training data that maps with the desired output. hence the trained data is compared with desired data to get high accuracy. This paper provides a historical overview of deep learning and focus and on is applications in image classification, feature recognition, which are applications to images and videos. The discussed topics on feature recognition include image classification on imagenet, feature recognition, and feature extraction. the classification part includes image preprocessing, rescaling, and reconstruction of an image. The methods which are used are feed forward operation and back propogationalgorithm. This entire process comes under neural networks. The dataset which we are giving is trained and tested. The supervised neural network is used to provide an analyzed training data that maps with the desired output. hence the trained data is compared with desired data to get high accuracy. Deep models are neural networks with deep structures. The history of neural networks can be traced back to the 1940s.It was inspired by simulating the human brain system and the goal was to find a principled way to solve general learning problems.it has been widely used to train neural networks until now. In the following sub sections, we will introduce the structure of multilayer neural network, feedforward operation used to predict output from input, and backward propagation

### 1.2 Neural networks:

In the following sub sections, we will introduce the structure of multilayer neural network, feed forward operation used to predict output from input, and backward propagation. However, neural networks were eventually taken up by most researches because of multiple advantages. It is an inter connected group of nodes inspired by a simplification of neurons in a brain.

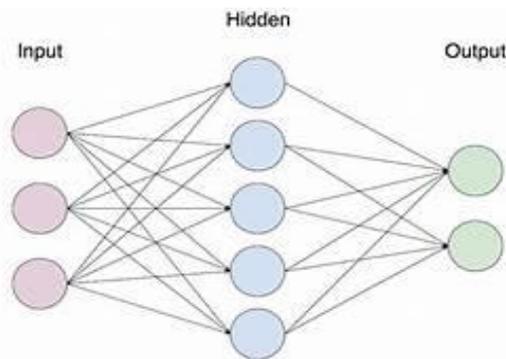


Figure 2. Basic neural network

Different types of neural networks are multilayer neural network, convolution neural network, Recursive neural network, feed forward neural network.

#### 1.2.1 Multilayer neural network

The computational units of neural networks are called neurons and are organized into multiple layers. Neurons in adjacent layers are connected with weights. However, neurons in the same layer are not connected. In feedforward operation, neurons in a lower layer pass signals to neurons in upper layer. A neuron is activated if it's received signals are strong enough. Similar to the brain, some connections between neurons are stronger, while some are weaker, by different weights. fig show s an example of a three-layer neural network with an input layer, a hidden layer, and an output layer.

$$x = (x_1, \dots, x_i, \dots, x_d) \quad (1)$$

is a d dimensional input data vector.

$$h = (h_1, \dots, h_j, \dots, h_k) \quad (2)$$

are responses at nH hidden neurons.

$$z = (z_1, \dots, z_k, \dots, z_c) \quad (3)$$

are the predicted outputs at c output neurons of the neural network. In the training set, each sample x is associated with a target vector t. It is expected that output y predicted by the learned neural network is close to the target as possible.

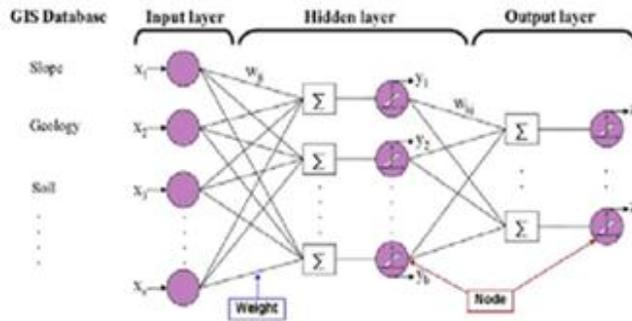


Figure 3. Multilayer neural network

**1.2.2 Convolutional neural network:** It is most commonly applied to analyzing visual imagery.

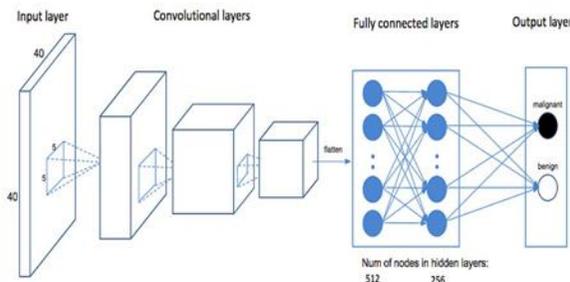


Figure 4. Convolution neural network

**1.2.3 Recursive neural network:**

Basic RNNs are a network of neuron like nodes organized into successive “layers”, each node in a given layer is connected with a directed connection to every other node in the next successive layer.

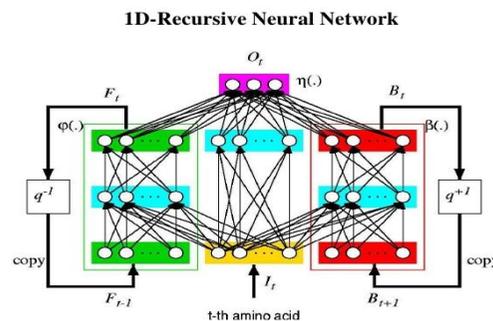
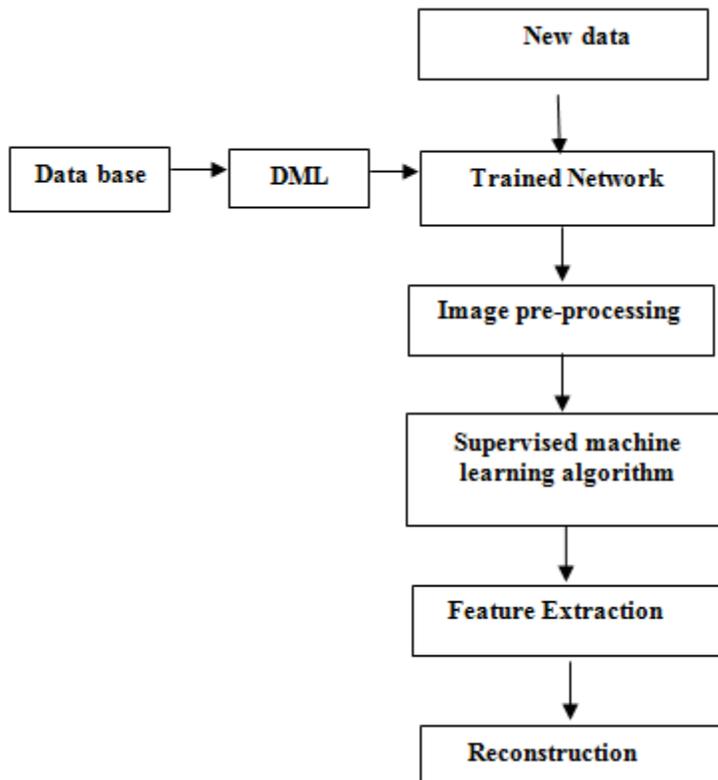


Figure 5. Recursive neural network

## 2 Design and Implementation:

Design and implementation process include feed forward operation and back propagation operation. First step includes the processing of data with DML techniques, and classify the images which are required. Once the images are classified data should be trained to analyse. the supervised machine learning algorithm is used to train the data and analyse the data, such that the images should be pre-processed and converted into standard size that is 32x32 resolution. Which is easy for computation. the trained data should be tested to check the accuracy and efficiency.

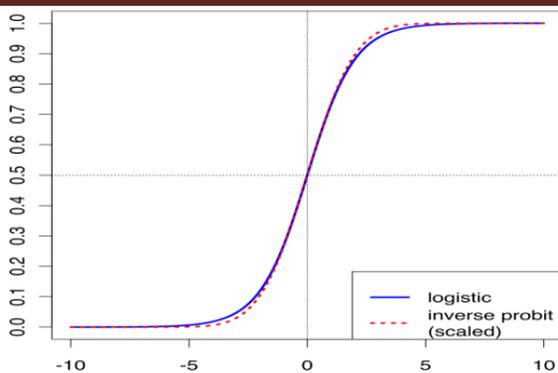
### 2.1 Block Diagram



## 2.2 Methods

### 2.2.1 Feed Forward operation:

At each hidden neuron  $j$ , the weighted sum of input neurons is first computed as  $net_j = \sum_{i=1}^d x_i w_{ij} + w_{j0}$ .  $net_j$  is considered as the net activation of the hidden neuron.  $w_{ji}$  are the weights of connections between the input layer and the hidden layer, and  $\{w_{j0}\}$  are the bias terms. The hidden neuron emits an output  $y_j$  through a nonlinear activation function, i.e.  $y_j = g(net_j)$ . Tanh is also known as the hyperbolic tangent activation function. Similar to sigmoid, tanh also takes a real-valued number but squashes it into a range between -1 and 1. In practice, tanh is preferable over sigmoid.



**Figure 7.** Non-Linear Activation Graph

**2.2.2 Back propagation:**

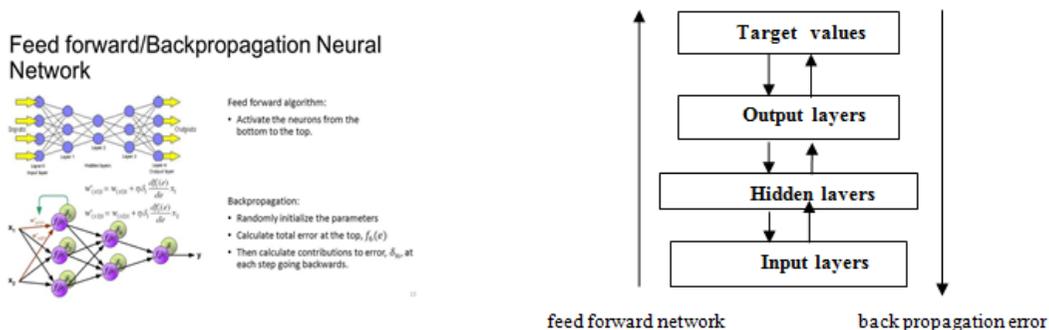
Training a neural network is to find an optimal set of weights  $W$  to minimize an objective function  $J(W)$ , such that the predicted outputs  $z$  of training samples is close to the targets as possible. Back propagation (BP) [120] proposed in 1980s is still the most widely used method for supervised training of neural networks. It is a gradient descent algorithm

$$W \leftarrow W - \eta \nabla J(W) \quad (4)$$

Training of neural networks. It is a gradient descent algorithm. Weights are randomly initialized and then updated iteratively. At each iteration, weights are changed in a direction to reduce the objective function.

$$J(W) = \sum_{p=1}^n J_p(W) \quad (5)$$

where  $\eta$  is a hyper parameter of learning rate and  $\nabla J(W)$  is gradient of the objective function weights training samples are fed in the input layer of the neural network, where  $\eta$  is a hyper parameter of learning rate. It is assumed that rise in inflation is inversely associated to security prices because Inflation is at last turned into nominal interest rate and change in nominal interest rates caused change in discount rate so discount rate increase due to increase in inflation rate and increase in discount rate leads to decrease the cash flow's present value (Jecheche, 2010). The purchasing power of money decreased due to inflation, and due to which the investors demand high rate of return, and the prices decreased with increase in required rate.



**Figure 8.** Feed forward and backpropagation networks

**III. Proposed algorithm: steps for the algorithm**

Input: raw image; output: enhanced image.

1. Add noise to the input image.
2. Divide the input image into RGB components.



```

(base) C:\Users\shivon@kumar A Hok:
(base) F:\used plantspeciesclassification
(base) F:\plant-species-classification\neuralnets
(neuralnets) F:\plant-species-classification\python_test\deeplearning.py -d test
Using TensorFlow backend.
[2019-04-24 12:06:47.125150: ] C:\tf_jenkins\home\workspace\rel-win\Windows\TPU\tensorflow\core\platform\cpu_feature_guard.cc:117] Your CPU supports instructions that this TensorFlow binary was not compiled to use: AVX AVX2
loaded model from disk
[2] [-----] - 0s
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(neuralnets) F:\plant-species-classification>

```

Figure 11. Testing phase result

## V Conclusion

Presenting a complete pre processing frame work for flowers species images. As a result, many techniques have developed known as image enhancement techniques to recover information in an image. this paper aims to enhance the flower species images and process image and classify flower species images as rose or not rose using DML and further classify the species using same algorithm.

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## Optimum Architecture for DML

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**ABSTRACT:** According to the recent digital technologies, the availability area of deep learning has emerged, and has demonstrated. In particular, convolution neural network (CNN) have been recognized their usefulness in image detection and recognition applications. However, they concentrated CPU operations and memory bandwidth that make general CPUs have been failed to achieve accurate performance level. hardware accelerators that use application specific integrated circuit (ASICs), field programmable gate array (FPGAs), and graphic processing unit (GPUs) have been employed to improve the results of CNNs. The improved optimal architecture for DML based upon the Wallace multipliers, Kogge-stone adders and registers type concept. The most important aspect of present design is to minimize the architecture on DML. Multiplication is one of the most commonly used operations in the arithmetic. Multiplier based on Wallace reduction tree provide an area-efficient strategy for high speed multiplier. Many modifications has been proposed in the literature to optimize the area of the Wallace multiplier. This project proposed a reduced area Wallace multiplier without compromising on the speed of the original Wallace multiplier.

**Keywords:** Convolution Neural Networks (CNNs), Deep Machine Learning, Field Programmable Gate Arrays (FPGAs), Wallace Tree multiplier Architecture, Kogge-Stone adder Architecture

### 1. Introduction

Deep learning is named as deep structured learning and it is a part of a broader family in machine learning methods for learning data representation rather than task specific algorithm [1]. Learning can be supervised, semi-supervised or unsupervised. In different fields like speech recognition, drug-design, bioinformatics, natural language processing, audio recognition, computer vision, medical image analysis. Deep learning architectures such as deep neural networks, deep belief networks and recurrent neural networks have been applied [2]. Deep learning is a class of machine learning algorithm, it uses many layers of nonlinear processing units for feature origin and transformation. Deep learning can be supervised or unsupervised. these models are indistinctly inspired by information processing and uses in biological nervous systems, we have differences from the structural and functional properties of Biological brains, which make them incompatible with neuroscience [3].

### A. Disclosure of Deep Neural Networks

Convolution neural networks considered as one of the most innovations in computer vision [4]. It is used to evaluate the performance of object detection and image classification algorithms. It consists of different million images, then large companies started using CNNs at the core of the services. A typical CNN is a multi-layered feed forward ANN with a pipeline-like architecture. Each layer performs a well known computation on the outputs of previous layer to generate the inputs of the next layer. CNN's has two types of inputs; the data to be classified or tested, and the weights. Images, audio files, and recorded videos are examples of the thought's data to be classified using CNN's. Fig.1. Shows the accuracy loss for the winners of imagenet competitions before and after the emergence of deep learning algorithms [5].

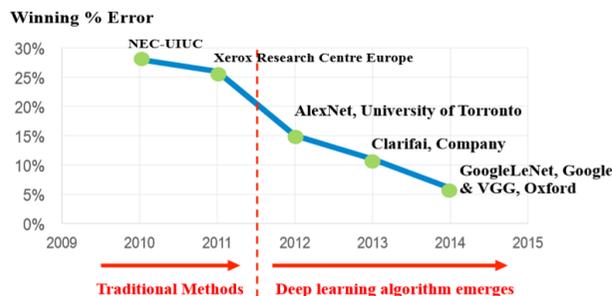


Fig.1. ImageNet Competition Results.

## B. Applications of Deep Neural Networks

Nowadays, widely used Convolution Neural Networks (CNNs) [6,7] and Deep Neural Network (DNNs) [8,9] now, it is possible to solve in various domains where knowledge is not easily expressed, solutions to problems in the domain of Sciences, Business, Technology etc., it has been applied in various fields like Machine translation, Bioinformatics, Natural language processing, audio recognition, social network filtering, drug design, medical image analysis, Computer vision, speech recognition material inspection and board game programs, robot navigation [10], gesture recognition[11], aerospace and defensetime many object tracking [12], industrial automation, financial forecasting [13], face detection and recognition [14].

## II. Background and Terminology

It summarizes the structure of Field Programmable Gate Arrays (FPGAs) and how deep learning methods can be benefited from the capabilities of FPGAs [15].

### A. Examples of Deep Learning Networks

**AlexNet**–It is a Convolutional Neural Network consisting of 5 convolutional layers, interspersed by 2 normalization layers, and 3 fully connected layers [16]. Each convolutional layer performs the activation function using Rectified Linear Unit. Even, 3 pooling layers are employed with the first, second, and last convolutional layers.

**VGG** - It is a Convolutional Neural Network model similar to AlexNet in on the number of fully connected layers. However, it consists of 5 groups of convolutional layers [17]. The exact number of CONV layers in each group depend on the version of the VGG.

**ResNet** -these are Deep Residual Networks with extremely irregular and complex structures compared to AlexNet and VGG CNN [18]. This event is due to having more types of layers, where non-adjacent layers incorporate shortcuts to compute the residual.

### B. Field Programmable Gate Arrays (FPGAs)

FPGAs are Programmable devices that provide a Flexible platform for implementing custom hardware functionality at a low development cost. They consist mainly of a set of programmable logic cells, called Configurable Logic Blocks (CLBs), a programmable interconnection network, and a set of programmable input and output cells around the device [19]. Even they have arich set of embedded components such as Digital Signal Processing (DSP) blocks that are used to perform arithmetic-intensive operations such as multiply-and-accumulate, Block RAMs (BRAMs), Look-Up Tables (LUTs), Flip-Flops (FFs), clock management unit, high speed I/O links, and others. Fig.2. Shows a structure of FPGA.

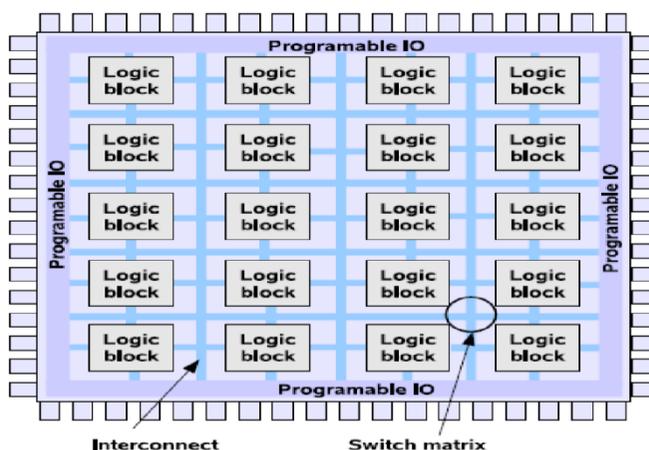


Fig.2. FPGA Basic Structure[19]

### C. Convolutional Neural Networks (CNNs)

A Convolution Neural Network is commonly applied to analyzing visual imagery. CNN is a legalized version of multilayer's. Multilayers are fully connected networks, that is, each neuron in one layer is connected to all neurons in the next layer. CNN takes a different approach towards legalization, they exploit the hierarchical

patterns in data and assemble more complex patterns using smaller and simpler patterns. Convolution operation can be thought of as the production of a matrix smaller than the original image matrix, representing pixels, by sliding a small window of size  $k$  over the image, to produce an output feature neuron value [20], the filter is many numbers called weights or parameters. These weights are computed during the training phase. As the filter slides over the feature map, it multiplies the values in the filter with the original pixel values, that is, it first performs element-wise multiplication, and then sums the products, to produce a single number. Fig.3. AlexNet won the 2012 imagenet challenge by classifying  $224 \times 224$  opinioncolor images to 1,000 different output classes.

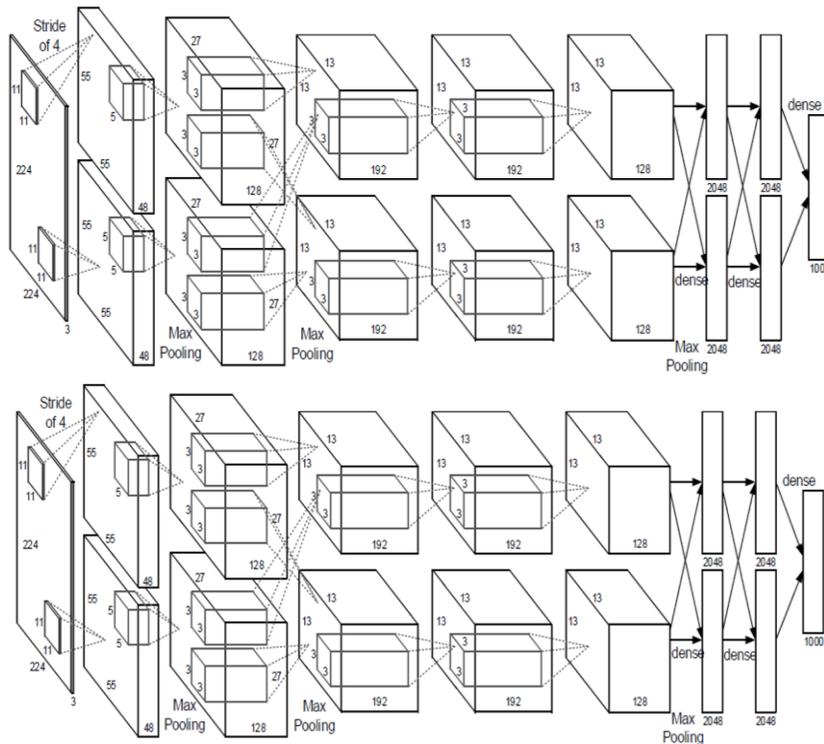


Fig.3. AlexNet CNNs Architecture [21]

## II. Complexity of DML Architecture

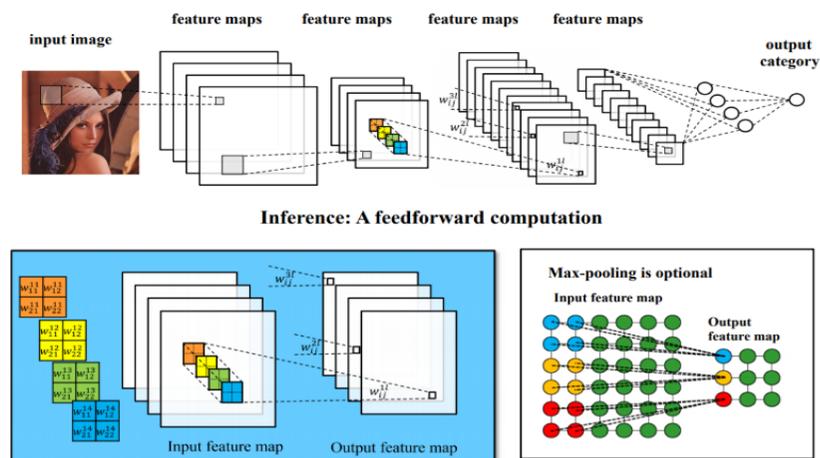


Fig.4. Convolution Neural Networks [22]

Convolution Neural Networks relates ordinary Neural Networks. They are made up of neurons that have learnable weights and biases. Convolution Network, architectures makes the explicit assumption that the inputs are images, which allow encoding certain properties into the architecture. Neural Network receives an input and transforms it through a series of hidden layers. Each layer is made by a set of neurons, in which every neuron is connected to all other neurons from the previous neurons from the previous layers. Numbers of cores taken are 16K cores. Cost is around 5 billion dollars. Memory complexity is 1.907MB/iteration or 8512MB/ second. Fig.4. Illustrates the loop unrolling of CONV loop's level's. Table 1. Illustrates the classification of a deep network in which AlexNet is made up of 650,000 neurons, 8 layers and it costs around 60million. Whereas, VGG16 is made up of 14,000,000, neurons, 16 layers and it cost is 140 million and Google net is made of 8,300,000 neurons, 22 layers and its cost is 4 million.

Table 1. Image classification with deep convolution neural network<sup>22</sup>

Real life CNNs	Neurons	Layers	Parameter
Alex Net	650,000	8	60 Million
VGG16	14,000,000	16	140 Million
Google Net	8,300,000	22	4 Million

**IV. Single Neuron Network**

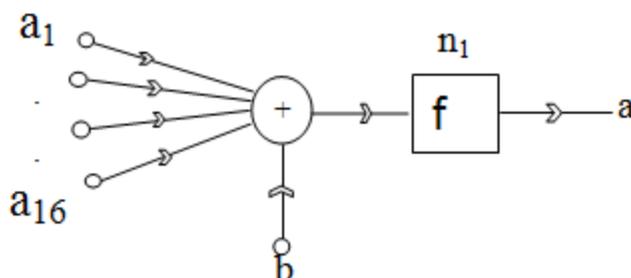


Fig.5. Single Neuron Structure.

A single neuron network is a circuit of neurons made up of artificial neurons or nodes thus a neural network relates to a biological neural network contains biological neurons for problem solving in artificial intelligence issues of the modern world. The connections of the biological neurons are modeled as weights. A positive weight reflects as a excitatory connection while negative value means inhibitory connections. Fig.5. Shows the structure of a single neuron which consists of inputs is modified by weights and summed. This event is called as a linear combination. Finally, the functions control the amplitude of the output.

**Mathematical Model for the Neuron**

$$a = f(n1) \dots\dots\dots(1)$$

$$n1 = a_1b_1+a_2b_2+a_3b_3 +\dots\dots\dots+a_{16}b_{16}+b\dots\dots\dots(2)$$

Where  $a_1, a_2, a_3 \dots\dots\dots a_{16}$  are inputs,  
 $b_1, b_2, b_3 \dots\dots\dots b_{16}$  are weights, and  
 $f$  is the function of  $n1$ .

**V. Wallace Tree Multiplier**

In Digital Signal Processors, Multiplier makes the most Important role. There are many ways for designing multipliers, and architectures. It is an logical hardware that multiplies two integers. It multiplies each bit of one of the influences, by each bit of other, yielding results. Depending on a position of multiplied bits, the wires carry weights. Fig.6. Shows the block diagram of Wallace Tree Multiplier, it performs the generation of partial products and reduce the Number of partial products to two the layers of full and half adder. Group the wires in two numbers and add them a conventional adder [23]. As making the partial products be  $O(1)$  and the final addition is  $O(\log n)$ , the multiplication is only  $O(\log n)$ , not much slower than addition. The adding partial products with regular adders would require  $O(\log^2n)$  time. These computations only consider gate



### VI. Kogge-Stone Adder

Kogge-stone, adder is a parallel prefix form carry look adder. It creates the carry signals in  $O(\log n)$  times, and is widely considered the debauched adder design possible, it is the common design for high-performance adders in the industry. It takes more area to contrivance then the Brent-Kung adder, but has a lower fan-out at each stage, which increases performance. The tree also contains more PG cells, while this event may not influence the area, if the adder layout is on a systematic grid, it will increase power consumption. Apart accounting for more area Kogge-stone adder is generally used for wide adders because it shows the lowest delay among other erections [25] Fig.10. Shows the 8-bit Kogge-stone adder architecture. The below Fig.11. Shows the RTL schematic structure and Fig.12. Shows the simulation of Kogge-Stone adder.

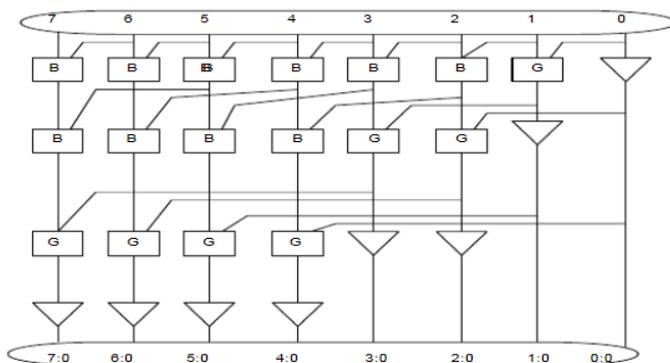


Fig.10. Kogge-Stone Architecture.

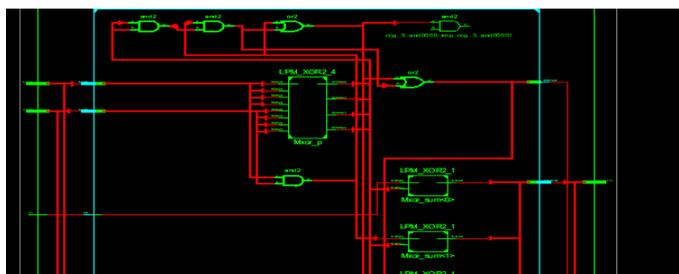


Fig.11. RTL Schematic structure of Kogge- Stone Adder.



Fig.12. Simulation Results of Kogge-Stone Adder.

Table.2 Comparison between Wallace Tree Multiplier and Kogge-stone Adder

		SPARTAN-3	SPARTAN-6	VIRTEX-5
Wallace Tree	Time Delay	4.04ns	3.597ns	2.826ns
	Bonded IOBS	33 out of 66	33 out of 102	33 out of 172
	Supply Power	0.034	0.014	0.321
Kogge	Time Delay	10.695ns	6.604ns	4.98ns

Stone	Bonded IOBS	26 out of 124	26 out of 102	26 out of 172
	Supply Power	0.027	0.034	0.0327

### Conclusion

In this paper, we slotted recent development some deep learning networks and Convolution Neural Networks (CNNs) on field programmable gate arrays (FPGAs). This paper gives an overview of deep learning techniques with their important features and application on CNN. Special emphasis is given on CNN as they have a wide application for image detection and recognition and require both CPU and memory intensive operation that can be effectively accelerate using FPGA innate ability to maximize the parallelism of operations. This paper briefly explains about the formation of a single neural network, multi-neural network for the reduction of complexity architecture of DML using the Wallace-Tree multiplier and Kogge-stone adder on FPGA.

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## **Despeckling of Underwater Images using Adaptive Filters**

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**ABSTRACT:** *The Sound Navigation And Ranging and synthetic aperture radar images are perturbed by the multiplicative noise called speckle noise. The presence of speckle noise in sar images leads to incorrect analysis and has to be handled carefully. Images have a strong variation from one pixel to another which reduces the efficiency of the algorithms for detection and classification. In this paper, some of the most well-known filters are analyzed by using underwater images. It is shown that the filters are based on a test related to the local coefficient of variation of the observed image, which describes the scene heterogeneity. Linear models can remove noise but cannot preserve edges of the images in an efficient manner. But non linear models can handle edges in a better manner compared to linear models. It is also found that the linear filters and nonlinear filters can remove noise from small area objects and homogeneous areas but not in heterogeneous areas. This limitation is overcome by using Adaptive filters which are used to remove noise not only from homogeneous area but also from heterogeneous areas. This paper presents a comparative analysis of linear, non linear and adaptive filters to prove that adaptive filters are advantageous compared to linear and non linear filters. Adaptive filters results in computational complexity. Hence an optimum filter is designed by using locally estimated parameter values to provide minimum mean square error in order to smoothen the sonar images and reduce the complexity. The performance of this adaptive filter is compared with other filters using the performance metrics mean square error and peak signal to noise ratio and found that the complexity of the frost filter is reduced.*

**Keywords:** *Speckle Noise, mean square error, linear filters, nonlinear filters and frost filter.*

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### **1. Introduction**

Image restoration is a an area in image processing which deals with removal of noise. The field of image restoration is concerned with the reconstruction or estimation of the uncorrupted image from a blurred and noisy one .Image restoration is done by restoration filters. Restoration filters are used to reduce the degradations .The degradations occur due to sensor noise, blur, camera misfocus, relative object-camera motion and random atmospheric turbulence..

Restoration is a process of removal or minimization of known degradations in an image. This includes de-blurring of images degraded by the limitations of a sensor or its environment, noise filtering and correction of geometric distortion or non-linearity due to sensors fundamental result in filtering theory. There are two techniques in removing speckle noise[1]. The first one is multi-look process and second is spatial filtering[12]. Multi-look processing is used at the data acquisition stage whereas spatial filtering is used after the data is stored. These filtering methods not only remove the speckle noise but should preserve radiometric information, edge information and spatial resolution. Spatial filters are in two general groups ,i.e., non- adaptive and adaptive filters. Non-adaptive filters neglect the local properties of the terrain backscatter or nature of sensor. Non adaptive filters are of two types linear and non linear filters. However, adaptive filters can accommodate the change in the local properties of the terrain backscatter. Linear filters are averaging(mean)filter and wiener filter[9]. Nonlinear filters are median filter[8][12][2].

### **II. Filtering methods**

There are two types of filters adaptive and non adaptive filters. There are two types of non adaptive filters, linear and non linear filters. Linear filters are averaging and wiener filter, nonlinear filters are median filters. Adaptive filters are Lee filter, kuan filter, GMAP and frost filter..

#### **2.1 Wiener Filter**

Wiener Filter[9]is used to filter noise from the corrupted signal. It is based on a statistical approach. These filters are designed for a desired frequency response. The Wiener filter approaches filtering by finding the spectral properties of the original signal and the noise. Hence obtains the LTI filter whose output would come as close as possible to the original signal.

The Wiener filter is:

$$G(u,v) = \frac{H^*(u,v)P_s(u,v)}{[H^*(u,v)]^2 P_s(u,v) + P_n(u,v)} \quad (1)$$

Dividing throughout by  $P_s$

$$G(u,v) = \frac{H^*(u,v)}{[H^*(u,v)]^2 + \frac{P_n(u,v)}{P_s(u,v)}} \quad (2)$$

where

$H(u,v)$  = Degradation function and  $u,v$  are picture elements(pixels) of an image.

$H^*(u,v)$  = Complex conjugate of degradation function

$P_n(u,v)$  = Power Spectral Density of Noise

$P_s(u,v)$  = Power Spectral Density of un-degraded image.

The term  $P_n / P_s$  can be interpreted as the reciprocal of the signal to noise ratio.

## 2.2 Averaging Filter

Averaging Filter (mean filter) is a method of 'smoothing' images by reducing the amount of intensity variation between neighboring pixels. The average filter works by moving through the image pixel by pixel, replacing each value with the average value of neighboring pixels, including itself. Linear filtering is used to remove certain types of noise. The Mean Filter is a linear filter in which a mask is used over each pixel in the signal. A single pixel is formed by averaging each of the components of the pixels which fall under the mask. Hence mean filter is also called as average filter. The Mean Filter does not perform edge preservation.

$$\hat{f}(x,y) = \frac{1}{MN} \sum_{(s,t) \in S} g(s,t) \quad (3)$$

## 2.3 Median Filter

Median filtering is a nonlinear method used to remove noise from images. It is widely used as it is very effective at removing noise while preserving edges. It is particularly effective at removing 'salt and pepper' type noise. The median filter works by moving through the image pixel by pixel, replacing each value with the median value of neighboring pixels. The pattern of neighbors is called the "window", which slides, pixel by pixel over the entire image. The median is found by first sorting all the pixel values from the window into numerical order, and then replace the pixel with the middle (median) pixel value.

$$\hat{f}(x,y) = \text{median} \{g(s,t)\} \quad (4)$$

$(s,t) \in S_{xy}$

## 2.4 Adaptive Filter

An adaptive filter is a linear filter which has a transfer function which is controlled by variable parameters and a means to adjust those parameters according to an optimization algorithm. An adaptive filter iteratively adjusts its parameters during scanning the image to match the image generating mechanism. Adaptive Filters reduces speckle noise in homogeneous areas, preserves the texture and high frequency information in heterogeneous areas[12]. Adaptive filters considers local image statistics during the filtration process, and hence they are not only remove the noise but also preserves the texture. Some of the adaptive filters are lee Filter[3], Kuan Filter[5][6], Frost Filter[4][13], MAP(Maximum A Posteriori)[10], Modified Lee[13], Modified Frost filters[13] and SRAD(Speckle reducing anisotropic diffusion)[14] Filter. The Lee and Kuan filters have the same formation, although the signal model assumptions and the derivatives are different. The Frost filter also strikes a balance between averaging and the all pass filter. In this case, the balance is achieved by forming an exponentially shaped filter kernel that can vary from a basic average filter to an identity filter on a point wise adaptive basis. Compared to all the adaptive filters, frost filter gives best results. It reduces the noise not only in homogeneous areas but also in heterogeneous areas. This results in computational complexity. The computational complexity is reduced.

### III. Performance parameters for comparative analysis

**3.1 Mean Square Error:** It is the ratio of the square of difference between the input and output image to the size of the image

$$MSE = \frac{1}{MN} \sum_1^M \sum_1^N (f_1(i, j) - f_2(i, j))^2 \quad (5)$$

Here  $f_1, f_2$  are the input and output images respectively.  $M$  and  $N$  are the sizes of the images. The MSE should be less, which means that the pixel intensity of the input and output image should be as close as possible.

**3.2 Peak Signal to Noise Ratio:** It is the logarithmic value of the ratio of size of the image and the mean square error of the image.

$$PSNR = 10 \log \frac{255^2}{MSE} \quad (6)$$

PSNR should be as large as possible which means that the content of signal in the output is large and the noise is less.

### IV. Adaptive filters

Contrary to the standard filters, the adaptive filters take local image information into consideration while carrying out the filtration process. Adaptive filters can reduce speckle noise in homogeneous areas while preserving texture and high frequency information in heterogeneous areas. The design of each speckle suppression filter is based on different criteria and parameters. The performance of each speckle filter may vary from one sonar to another. Since, no generic de-speckling algorithm exists [09]. Hence selecting the right de-speckling filter for a specific environment and sensor is a difficult task. Frost [13] filter gives best results, but it was not used for real time processing and was computationally complex. The proposed algorithm reduces computational complexity which in turn reduces the elapsed time. The Frost filter reduces speckle noise as well as preserves important image features at the edges with an exponentially damped circularly symmetric filter that uses local statistics within individual filter windows.

Some of the Adaptive filters are described below.

**4.1 Lee Filter:** Lee applied Minimum Mean Square Error (MMSE) criterion [13] by making the filter linear. Then an adaptive filter was formulated as

$$R(x, y) = I_b(x, y)(1 - W(x, y)) + W(x, y) I(x, y) \quad (7)$$

where  $I$  is the acquired image,  $I_b$  is the average of an acquired image in a filter window, and  $W$  is a weighting function given by

$$W(x, y) = 1 - \{C_u^2 / C_l^2(x, y)\} \quad (8)$$

$C_u = \sigma_u / u_b$ ,  $C_l(x, y) = \sigma_l(x, y) / I_b(x, y)$ , are the variation coefficients of the noise and the acquired image..

$\sigma_u$  and  $u_{bar}$  is noise standard deviation and mean.

$\sigma_l(x, y)$  and  $I_{bar}(x, y)$  is the image standard deviation and mean in the area around  $(x, y)$ .

**4.3 Frost Filter:** This filter does estimation of the observed scene by convoluting the acquired image with the impulse response of the imaging system. The imaging system impulse response is obtained by using the minimal mean square error (MMSE) criterion. Then the resulting filter can be defined by a convolution of the acquired image with the filter kernel.

Weighting Function

$$W(x, y) = K_1 e^{-K_2 d C_l(x, y) \sqrt{x^2 + y^2}} \quad (9)$$

Csi-standard speckle index(measure of speckle reduction)

CI-varied standard speckle index

$K_d$  --damping Factor-defines the extent of smoothing-default value 1

$$C_{si} = \frac{\mu}{\sigma} \tag{10}$$

Filtering Formula

$$R = I * W \tag{11}$$

**4.4 Modified Frost Filter: Optimum Filter**

The frost filter increases the computational complexity. This is due to more number of computations. From equation 2.2.1

Computational complexity is due to following operations involved in calculating in weighting function

- 1) 2 squares, square root, 3 multipliers, exponent, multiplier
- 2) Square root replaced by x+y
- 3) Exponent function replaced by using taylor's series

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots, -\infty < x < \infty \tag{12}$$

Hence it takes more elapsed time for execution. This elapsed time is reduced by modifying the window function as given below.

$$W(x,y) = K_f [1 - K_d C_i(x,y)(X+Y)] \tag{13}$$

This reduces the number of computations and hence computational complexity is reduced.

**V. Experiments and Analysis:**

The experiments are performed on following underwater images

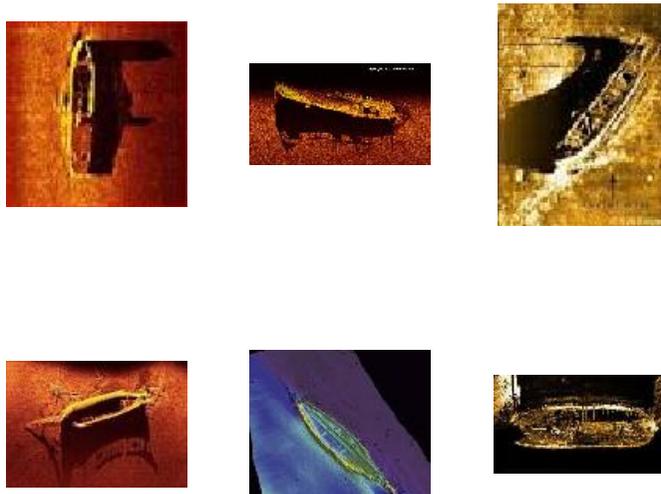


Figure 1: Underwater images

Table 1.Comparison of filters with respect to mse and psnr.

Filter	MSE	PSNR
Linear filter-mean filter or averaging filter	7502	9.1
Non Linear filter-median filter	201	25

Non Linear Filter-Wiener Filter	128	27
Adaptive Filter- Lee Filter	306.6	23.2
Adaptive Filter- Frost Filter	165.5	24.7

From the Table 1, wiener filter has the least mean square error. It is observed that the linear filters and nonlinear filters can remove noise from small area objects and homogeneous areas but not in heterogeneous areas. Adaptive filters are used to remove noise not only from homogeneous area but also from heterogeneous

Table.2.Comparison of Frost filter and proposed filter results.

Image	Frost Filter- MSE	Frost Filter- Elapsed time	Optimized Filter: MSE	Optimized Filter: Elapsed time
Image 1	165	2.35 secs	165	0.205 secs
Image 2	221	109 secs	221	3.99 secs
Image 3	539	2.18 secs	539	0.255 secs
Image 4	161	2.7 secs	167	0.27 secs
Image 5	35	20 secs	35	1.5secs
Image 6	241	24 secs	241	1.509 secs

From the Table 2, it is observed that mean square error and power signal to noise ratio for two images using frost filter. The complexity of frost filter is due to more number of computations which is reduced modifying the frost filter. This reduces the number of computations hence the elapsed time for execution is reduced.

Original gray image and Frost Filtered output

- Elapsed time is 0.462370 seconds.

- mse1 = 165.5576

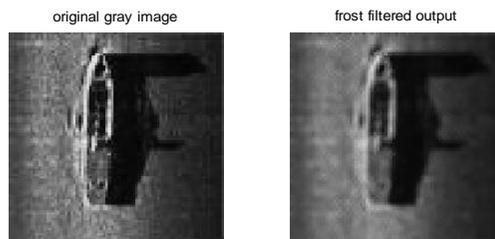


Figure2: original image and frost filtered image

Original gray image and frost filtered output after reducing the computational complexity

- Elapsed time is 0.127528 seconds.

- mse1 = 165.5576

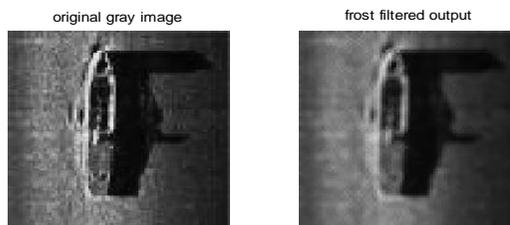


Figure 3: original image and optimum filtered image

## VI . Conclusion

In this work all the classical filters like Lee, Frost, Kuan, GMAP filters, SRAD, linear and nonlinear filters were compared with MSE and PSNR for identifying a best filter. Frost filter was proved to be best but it was found to be computationally complex. Here frost filter is designed with less complexity and reduced elapsed time. The existing filters do not enhance edges-they only inhibit smoothing near edges.

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## Medical Image Registration using DWT

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**ABSTRACT:** Image registration algorithms that are used for 3D images are also analyzed for their performances, suitable algorithms for image registration based on Wavelet Transform approaches will be identified and implemented using 3D architectures optimizing for area, power and speed performances - Component, formatting, style, styling, insert. 3D image registration of CT and MRI data is carried out using DWT sub bands by considering the features from all 8 bands. The features are selected by considering Mattes Mutual Information Metric and the optimizer algorithm estimates the optimum transformation parameters from all the 8 bands.

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### 1. Introduction

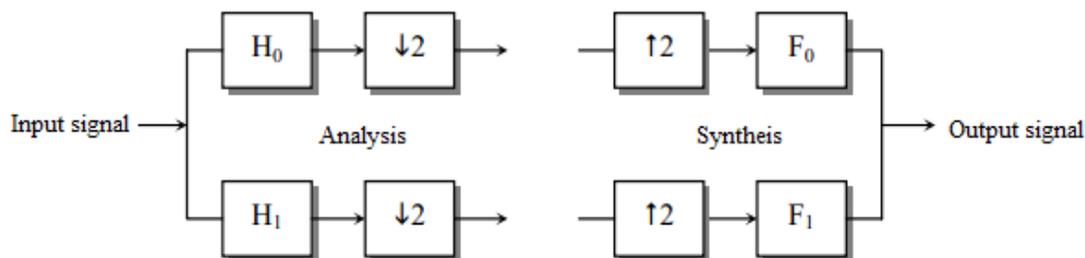
Medical image registration is the process of aligning digital medical images so that corresponding features can be compared [1]. By registering these images, a doctor can observe changes in a patient's condition over time (e.g. intra-subject) or compare a healthy patient to a diseased patient (e.g. inter-subject). Image registration has evolved from the mid-1980s from a minor niche into a major sub-discipline [2]. It now applies fully automated algorithms. Its main uses are [3]:

- **Multiple imaging modalities** – Relating functional images from PET scans to anatomy images from MRI.
- **Intra-patient monitoring** – Monitoring changes in size, shape, or image intensity over time for dynamic perfusion studies, neuronal loss in dementia or tumor size, for example.
- **Guided surgery** – Relating preoperative images and surgical plans to the actual patient in the operating room.
- **Standardization** – Relating a patient's anatomy to a standardized atlas.

Medical image registration allows for a number of important techniques that are impossible without it. Image registration can be used for serial imaging to monitor subtle changes due to disease progression or treatment; perfusion or other functional studies where the subject cannot be relied upon to remain in a fixed position during the acquisition period (e.g. MRI); image-guided interventions [4]. Image registration has become a valuable technique in research, especially in neuroscience [5].

### II. Design

DWT decomposes image into multiple sub bands of low and high frequency components. Encoding of subband components leads to compression of image. DWT along with encoding technique represents image information with less number of bits achieving image compression. Image compression finds application in every discipline such as entertainment, medical, defense, commercial and industrial domains. The core of image compression unit is DWT. Other image processing techniques such as image enhancement, image restoration and image filtering also requires DWT and Inverse DWT for transformations. Designing DWT-IDWT as an IP core is one of the major challenging aspect of this research work. The two-dimensional DWT is becoming one of the standard tools for image fusion in image and signal processing field. The DWT process is carried out by successive low pass and high pass filtering of the digital image or images. This process is called the Mallat algorithm or Mallat-tree decomposition. Fig. 1 shows an implementation structure of the DWT-IDWT. Input signals is filtered using high pass and low pass filter and are down scaled to obtain the approximation and detail coefficients of the image. The reconstruction process further uses the high pass and low pass filters to obtain the original image. The filter coefficients need to be chosen such that there is perfect reconstruction.



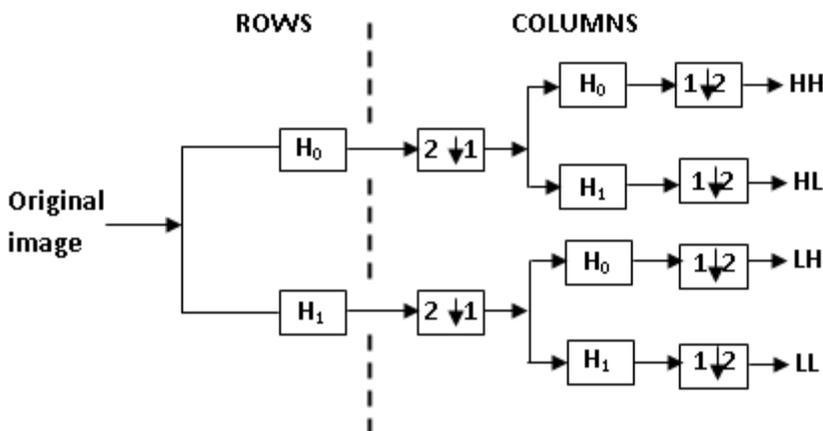
**Fig. 1** Filter bank structure of DWT

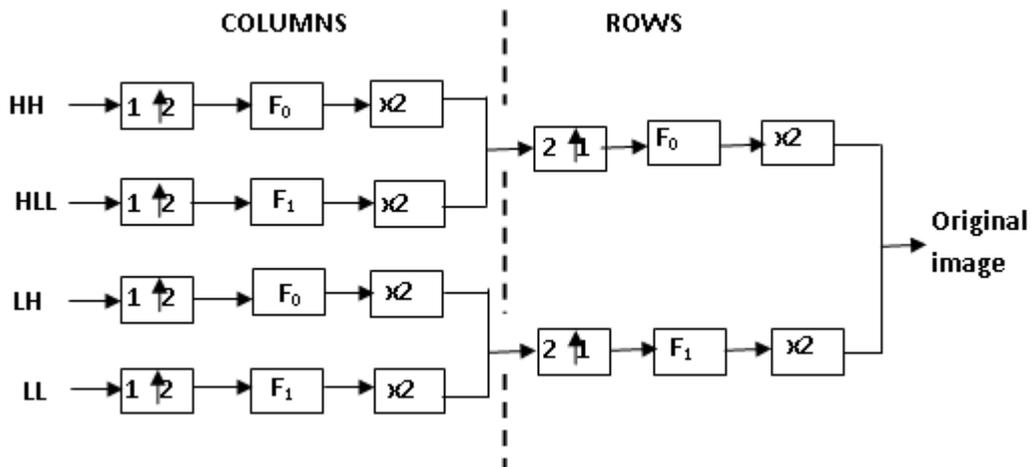
The filter coefficients of high pass and low pass sub bands need to satisfy the property are shown in Eq. 1 and Eq. 2 respectively for perfect reconstruction [6].

$$\frac{1}{2} \left[ H_0 \left( Z^{\frac{1}{2}} \right) \times \left( Z^{\frac{1}{2}} \right) + H_0 \left( -Z^{\frac{1}{2}} \right) \times \left( -Z^{\frac{1}{2}} \right) \right] \dots\dots\dots 1$$

$$\frac{1}{2} \left[ H_1 \left( Z^{\frac{1}{2}} \right) \times \left( Z^{\frac{1}{2}} \right) + H_1 \left( -Z^{\frac{1}{2}} \right) \times \left( -Z^{\frac{1}{2}} \right) \right] \dots\dots\dots 2$$

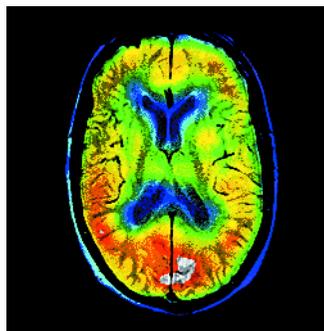
For processing 2-Dimensional signals such as images, the original image is passed through high pass and low pass filter for first level of decomposition. The transformed image is transformed further passed through a pair of low pass and high pass filters to achieve 2 level decomposition of original image as shown in Fig. 2. The first level of transformation is performed along the rows and the second level of transformation occurs along the column. The four sub band components (LL, LH, HL and HH) capture the low frequency components (DC component), high frequency components (edges along vertical, horizontal and diagonal axis). On the reverse process, the original image is reconstructed based on inverse transformation process using IDWT.





**Fig. 2:** Analysis filter bank structure of DWT

Medical imaging is the technique and process used to create images of the human body (or parts and function thereof) for clinical purposes (medical procedures seeking to reveal, diagnose or examine disease) or medical science (including the study of normal anatomy and physiology). Although imaging of removed organs and tissues can be performed for medical reasons, such procedures are not usually referred to as medical imaging, but rather are a part of pathology. Medical imaging uses state-of-the-art technology to provide 2D- or 3D images of the living body. Medical Image Registration generally refers to the process of identifying and subsequently aligning corresponding structures or objects from two medical images. To register two images, correspondence and a transformation (spatial mapping) must be found so that each location in one image can be mapped to a new location in the second. This mapping should “optimally” align the two images wherein the optimality criterion itself depends on the actual structures or objects in the two images that are required to be matched. The need for image registration arises as a practical necessity in many diverse fields. Image registration has a significant impact on a wide range of various research fields, such as computer vision, pattern recognition, medical image analysis and remotely sensed data processing. Integration of information from different images of different modalities is one of the basic uses of registration which is shown in Fig. 3



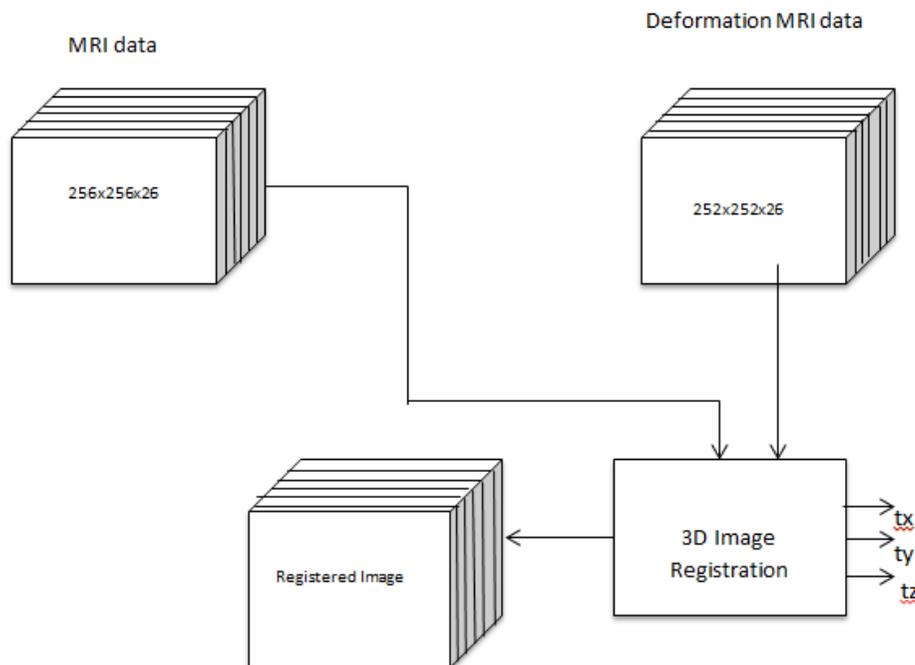
**Fig. 3** Co registered SPECT-MRI image

In medical image registration process accuracy and efficiency is highly required to get exact and timely results. Medical image registration problem can be categorized mainly in two categories (i) using geometrical features and (ii) using pixel or voxel intensity values. So in this process finding out the correspondences in features or intensity values is a main issue of consideration.

### III. Proper Design

For evaluation of Image registration algorithm standard data sets from Vanderbilt University with prior permission from Creative Commons, 171 Second Street, Suite 300, San Francisco, California, 94105, USA that

comprises of 20 sets of MRI and CT data with 52 frames per 3D data is considered for analysis. The MRI (fixed data) and CT (moving data) is transformed into DWT sub bands considering 10-tap symmetric filter coefficient and the low pass sub bands of fixed image and moving image are presented for frames 1, 4 and 8.



**Fig. 4** Experimental setup for IR algorithm evaluation

From 3D input images considered for registration, it is observed that the intensity, orientation, position and size of objects and regions vary frame to frame. In order to evaluate the performances of registration results only the MRI data is considered with frame size of 256 x 256 x 26 and the MRI data is transformed with possible deformations in the X, Y and Z directions. The transformed MRI data with multiple deformations is considered as input image and the MRI data from the data base is considered as the reference image. Both of these images are processed by the developed IR algorithm based on DWT and the results are evaluated to obtain the transformation parameters. The obtained transformation parameters are compared with the initial deformation parameters to evaluate the IR algorithm results. Fig. 4 presents the experimental setup for evaluation of IR algorithm.



Table 3 Optimum transformation parameter selection (ty)

	LLL1	LLH1	LHL1	LHH1	HLL1	HLH1	HHL1	HHH1
R1	X	X	X	X	X	X	X	X
R2	X	X	X	X	X	X	X	X
R3	X	X	X	X	X	X	X	X
R4	X	X	X	X	X	X	X	X
R5	X	X	X	X	✓	X	X	✓
R6	X	✓	✓	X	✓	X	X	X
R7	✓	✓	✓	✓	✓	✓	X	✓

Based on the estimated transformation parameters and selection of optimum parameters from the selected sub band IR is carried out and the results are presented in Fig. 6 obtained in the Wavelet domain.

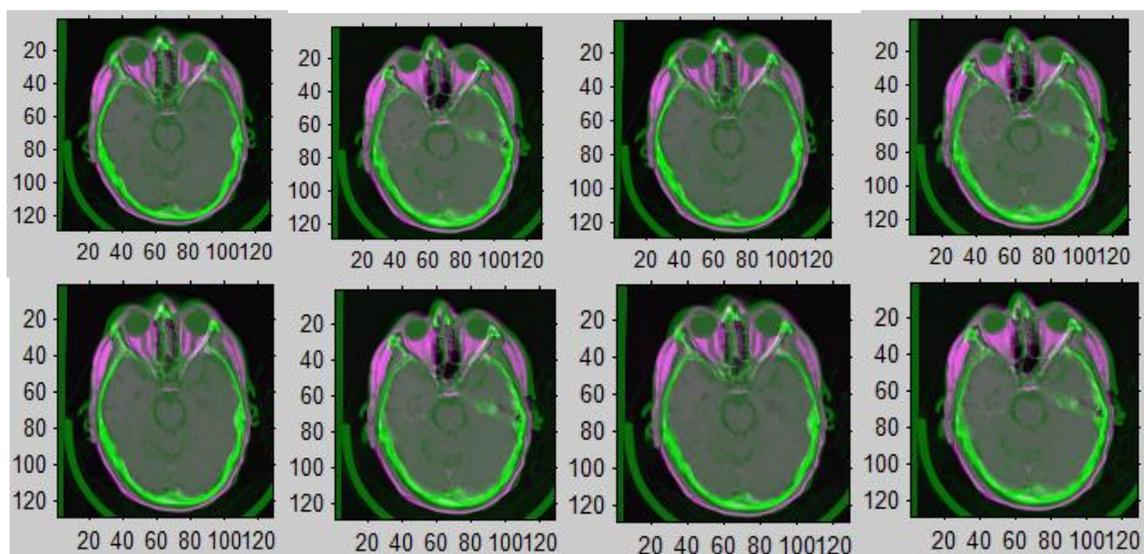


Fig. 6 Low pass bands registration results

**V. Conclusion**

3D image registration of CT and MRI data is carried out using DWT sub bands by considering the features from all 8 bands. The features are selected by considering Mattes Mutual Information Metric and the optimizer algorithm estimates the optimum transformation parameters from all the 8 bands. Transformation parameters from eight low pass bands from each octave are averaged to identify optimum registration parameters.

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# Evaluation of Preprocessing Algorithm for EEG Signal

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**ABSTRACT:** *Brain Computer Interfaces is a communication system between human brain and machines or devices without physical contact by using EEG signals from brain activity. Processing techniques of the EEG signals is very important for the BCI system. This paper presents the adaptive filters, PCA, ICA algorithm for removing noise from the EEG signal. Filtering of EEG signals requires a filter which automatically adapts to changing input and noise. Adaptive filtering reduces the noise using LMS algorithm. NLMS filter, RLS filter, PCA and ICA methods are compared and evaluated using Amylateral Multiple sclerosis EEG signal among which PCA algorithm gives the best performance.*

**Keywords:** BCI, PCA, ICA, EEG signal

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## 1. Introduction

One way to interact with the environment is using mental imagery and this can be done by thinking. BCI (Brain Computer Interface) is developed to interact people's thought with computer. This technology is especially used to assist disabled patients whose motor function has taken by the diseases but their mental functions are not affected much by such diseases. BCI is the only way to communicate their thoughts with the outside world using EEG (electroencephalograph) signals. EEG is the powerful measuring technique for brain computer Interface since the electroencephalogram (EEG) was first measured in humans by German scientist Hans Berger in 1929 to study neurological activities of brain signals. Electrical impulses generated by nerve firings in the brain diffuse through the head and can be measured by electrodes placed on the scalp, & is known as electroencephalogram (EEG) (Samuel Boudet et al, 2006).

Brain activity is characterised by the passing of electrical impulses along neurones and postsynaptic responses as neurons communicate with one another. Electrodes attached to the head detect the cumulative electric fields associated with these impulses, and the potential differences produced can be amplified and stored giving characteristic representations of brain activity. (ChiZhang et al, 2015). The nervous system of human brain must encode and process the signal from brain to remove noise and interference and signal encoded have specific properties. The main challenging Task is to detect, enhance and localize non stationary waves and noise corrupted brain signals[4]. Real-time solutions for noise reduction and signal processing represent a central challenge for the development of Brain Computer Interfaces. (Nadia Mammone et al, 2012). Many methods are available for removing artifact from eeg. Nadia Mammone et al proposed a Automatic Wavelet Independent Component Analysis for removal of artifact components while reducing the loss of residual informative data, the components related to relevant EEG activity are mostly preserved. (Nadia Mammone et al, 2012). Samuel Boudet et al (2006) artifact removal method using Independent component Analysis (ICA) on signals cut in frequency bands. ICA and band frequency decomposition seems to be more efficient than all method, global filter thus enabling to filter all type of artifacts (muscular and ocular) and reducing computation time and reduces computation Time but limited to less than 30 Hz. Christopher J. James et al (2003) proposed constrained-ICA (cICA) applied to automatic artifact extraction in EEG and MEG which can extract signals that are statistically independent, but are constrained by some reference signal, this way bringing prior information into the extraction process. In this way, a single Independent Component can be extracted based upon prior expectation of desired signal. [Viola FC et al \(2009\)](#) proposed clustering independent components on the correlation of ICA inverse weights that was able to find independent components that are similar to an user-defined template. [Barbanoj et al \(2008\)](#) introduced an automatic procedure of Blind Source Separation (BSS) based on logical rules related to spectral and topographical information in order to identify the components related to ocular interference. [Chi Zhang, et al \(2015\)](#) proposed combination of discrete wavelet transform and independent component analysis (ICA), wavelet-ICA, was utilized to separate automatic EOG and EMG artifact removal using individual a priori artifact information acquired online in advance. [G.Geetha et al \(2012\)](#) proposed Spatially-Constrained Independent Component Analysis (SCICA) to separate the Independent Components (ICs) from

the initial EEG signal. As the next step, Wavelet Denoising (WD) is applied to extract the brain activity from purged artifacts, and finally the artifacts are projected back and subtracted from EEG signals to get clean EEG data. Laura Frølich et.al (2018) Compared three of the most commonly used ICA methods (extended Infomax, FastICA and TDSEP) with two other linear decomposition methods (Fourier-ICA and spatio-spectral decomposition) suitable for the extraction of oscillatory activity. Rahul Kher et.al (2016) proposes a method for removing the EOG artifacts contained in EEG signal based on least mean square adaptive filtering., adapts its coefficients to produce an output which matches the reference input.

## II. Electroencephalogram

The EEG represents the electrical activity of the brain. The main parts of the brain are the cerebrum, the cerebellum, the brain stem the thalamus. The cerebrum is divided into two hemispheres separated by a fissure which are connected by corpus callosum and outer surface called cerebral cortex is composed of neurons. When brain cells (neurons) are activated, local current flows are produced. EEG measures mostly the currents that flow during synaptic excitations of the dendrites of many pyramidal neurons in the cerebral cortex. Differences of electrical potentials are caused by summed postsynaptic graded potentials from pyramidal cells that create electrical dipoles between soma (body of neuron) and apical dendrites (neural branches). Brain electrical current consists mostly of  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{++}$  ions that are pumped through channels in neuron membranes in the direction governed by membrane potential (Samuel Boudet et al, 2006). The detailed microscopic picture is more sophisticated, including different types of synapses involving variety of neurotransmitters. Only large populations of active neurons can generate electrical activity recordable on the head surface. Between electrode and neuronal layers current penetrates through skin, skull and several other layers. Weak electrical signals detected by the scalp electrodes are massively amplified, and then displayed on paper or stored to computer memory (Christopher J. James et.al, 2003) Due to capability to reflect both the normal and abnormal electrical activity of the brain, EEG has been found to be a very powerful tool in the field of neurology.. EEG patterns form wave shapes that are commonly sinusoidal. Usually, they are measured from peak to peak and normally range from 0.5 to 100  $\mu\text{V}$  in amplitude, which is about 100 times lower than ECG signals. By means of Fourier transform power spectrum from the EEG signal is derived. In power spectrum contribution of sine waves with different frequencies are visible. Although the spectrum is continuous, ranging from 0 Hz up to one half of sampling frequency, the brain state of the individual may make certain frequencies more dominant. Brain waves have been categorized into four basic groups: beta (>13 Hz),  $\alpha$  (8-13 Hz),  $\theta$  (4-8 Hz),  $\delta$  (0.5-4 Hz).

## III. Preprocessing of EEG signals

Signal preprocessing is also called as signal enhancement. A preprocessing aids in improving the system performance by separating the noise from signal. The acquired EEG signals are contaminated by noise and artifacts. The artifacts are eyeblinks, eye movements (EOG), Heart beat (ECG). In addition to these muscular movements and power line interferences are also mixed with brain signals. Many methods are available for removing the artifacts from EEG signal like Common average referencing, Surface Laplacian (SL), Independent Component Analysis (ICA), Principal Component Analysis (PCA), Common Spatial Pattern (CSP), Single Value Decomposition (SVD) etc.

In the proposed paper Normalised Least Mean Square with adaptive filter, Normalised Least Mean Square with Butterworth filter, Recursive Least Mean Square, Independent component analysis and Principle component analysis algorithms were applied to EEG signal for preprocessing.

### 3.1 Adaptive filters

Noise removal using filters removes noise along with important information. If the signal and noise are overlapping then filters will remove the signal of interest. This problem can be overcome by the adaptive filters. Adaptive filters have the ability to modify signal properties according to the specific characteristics of the signals being analyzed. Figure shows the block diagram of an adaptive filter. There is a primary signal  $d(n)$  and a secondary signal  $x(n)$ . The linear filter  $H(z)$  produces an output  $y(n)$ , which is subtracted from  $d(n)$  to compute an error  $e(n)$ . The objective of an adaptive filter is to change (adapt) the coefficients of the linear filter, and hence its

equency response, to generate a signal similar to the noise present in the signal to be filtered. The adaptive process involves minimization of a cost function, which is used to determine the filter coefficients. Initially, the adaptive filter adjusts its coefficients to minimize the squared error between its output and a primary signal.

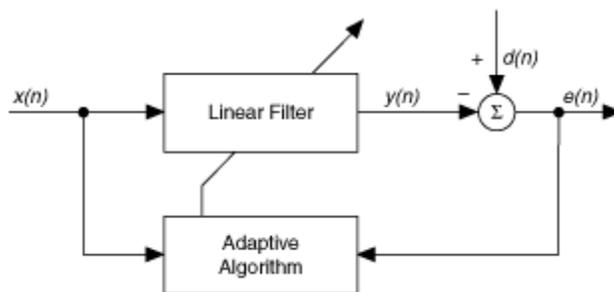


Fig. 1 Adaptive filter

In an adaptive filter, there are basically two processes:

T1. A filtering process, in which an output signal is the response of a digital filter. Usually, FIR filters are used in this process because they are linear, simple and stable.

T2. An adaptive process, in which the transfer function  $H(z)$  is adjusted according to an optimizing algorithm. The adaptation is directed by the error signal between the primary signal and the filter output.

### 3.1.1 Least Mean Square (LMS) Algorithm

The Least Mean Square (LMS) algorithm was first developed by Widrow and Hoff in 1959 through their studies of pattern recognition. The LMS algorithm is a type of adaptive filter known as a stochastic gradient based algorithm as it utilizes the gradient vector of the filter tap weights to converge on the optimal Wiener solution. It is well

known and widely used due to its computational simplicity. With each iteration of the LMS algorithm, the filter tap weights of the adaptive filter are updated according to the following formula.

$$w(n+1) = w(n) + 2\mu e(n)x(n) \tag{1}$$

Implementation of the LMS Algorithm

Each iteration of the LMS algorithm requires 3 distinct steps in this order:

1. The output of the FIR filter,  $y(n)$  is calculated using equation

$$y(n) = \sum_{i=0}^{N-1} w(n)x(n-i) = w^T(n)x(n) \tag{2}$$

2. The value of the error estimation is calculated using equation

3. The error signal is

$$e(n) = d(n) - y(n) \tag{3}$$

4. The tap weights of the FIR vector are updated in preparation for the next iteration, by equation

$$w(n+1) = w(n) + 2\mu e(n)x(n) \tag{4}$$

The main reason for the LMS algorithm's popularity in adaptive filtering is its computational simplicity, making it easier to implement than all other commonly used adaptive algorithms. For each

Iteration the TLMST algorithm requires  $2N$  additions and  $2N+1$  multiplications (NT for calculating the output,  $T_y(n)$ , one for  $T_{\mu}(n)$  and  $N$  additional NT for the scalar by vector multiplication.

### 3.1.2 Normalised Least Mean Square (NLMS) Algorithm

One of the primary disadvantages of the TLMST algorithm is having a fixed step size parameter for every iteration. This requires an understanding of the statistics of the input signal prior to commencing the adaptive filtering operation. Even if we assume the only signal to be the input to the adaptive echo cancellation system is speech, there are still many factors such as signal input power and amplitude which will affect its performance. The normalised least mean square algorithm (NLMS) is an extension of the TLMST algorithm which bypasses this issue by calculating maximum step size value. Step size value is calculated by using the following formula.

$$\text{Step size} = \frac{1}{\text{product}(\text{input vector}, \text{input vector})}$$

This step size is proportional to the inverse of the total expected energy of the instantaneous values of the coefficients of the input vector  $x(n)$ .

The recursion formula for the NLMS algorithm is stated in equation

$$w(n+1) = w(n) + \frac{1}{x^T(n)x(n)} e(n)x(n) \quad (5)$$

### 3.1.3 Recursive Least Square Algorithm (RLMS)

The RLST filter computes the temporal statistics directly at each time-step to determine the optimal filter coefficients. The RLST filter is adaptive and can adjust to time varying input statistics. Under most conditions the RLST filter will converge faster than a TLMST filter.

Input sample  $x(n)$ , and desired output value  $d(n)$ , the algorithm is implemented with following steps

1. Update the input vector  $x(n)$ .

2. Compute the filter output using the previous set of filter coefficients  $b(n-T-1)$

$$y(n) = x^T(n)b(n-1) \quad (6)$$

3. Compute the error

$$e(n) = d(n) - y(n) \quad (7)$$

4. Compute the Kalman gain filter

$$k(n) = \frac{R^{-1}(n-1)x(n)}{\lambda + x^T(n)R^{-1}(n-1)x(n)} \quad (8)$$

5. Update the matrix  $R^{-1}(n)$  for next iteration

$$R^{-1}(n) = \lambda \{ R^{-1}(n-1) - k(n)x^T(n)R^{-1}(n-1) \} \quad (9)$$

### 3.2 Independent Component Analysis

The Independent Component Analysis (ICA) was first applied to EEG by Makeig et al. in 1996. Independent Component Analysis splits the artifacts from the EEG signals into independent components based on the characteristics of the data without depending on the reference channels. The ICA algorithm decomposes the multi-channel EEG data into temporal independent and spatial-fixed components.

Assume  $n$  linear mixtures  $x_1, \dots, x_n$  of  $n$  independent components, each independent component  $s_k$  is a random variable

$$T = a_{j1}s_1 + a_{j2}s_2 + \dots + a_{jn}s_n, \text{ for } T \text{ all } j. \quad (10)$$

The equation for independent component analysis is given by

$$x = \sum_{i=1}^n a_i s_i \tag{11}$$

Inverse of independent component

$$ST = TWx \tag{12}$$

### 3.3 Principal Component Analysis

The TPCAT transforms the correlated vectors into linearly uncorrelated vectors. These uncorrelated vectors are called as "Principal Components".

It depends on decomposition of covariance matrix. Feature dimensions can be reduced using pca.

### III. Data sets:

The 8 EEG signal was measured with no known medical or neurological diseases using a bio signal amplifier and active Ag/AgCl electrodes (g.USBamp, g.LADYbird, Guger Technologies OG, Schiedlberg, Austria) at a sampling rate of 512 Hz. The electrodes placement was designed for obtaining three Laplacian derivations. Center electrodes at positions C3, Cz, and C4 and four additional electrodes around each center electrode with a distance of 2.5 cm[19] and 8 ALS EEG datasets from BNCI-Horizon -2020 has taken for analysis. [20]. The data acquired is filtered with NLMS butter filter, NLMSfirfilter, RLSfirfilter, PCA(Principal component Analysis) algorithm for evaluation of preprocessing method.

### IV. RESULTS:

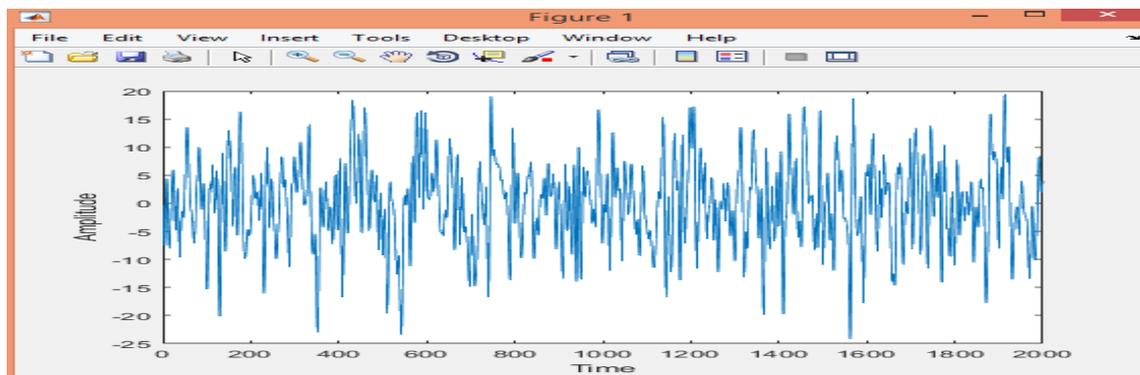


Fig. 2 Input EEG signal

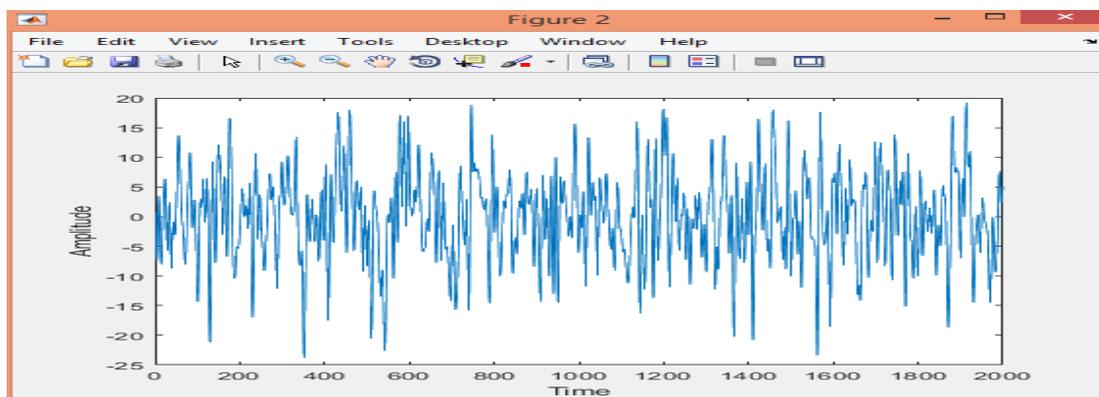


Fig. 3 EEG signal with Noise

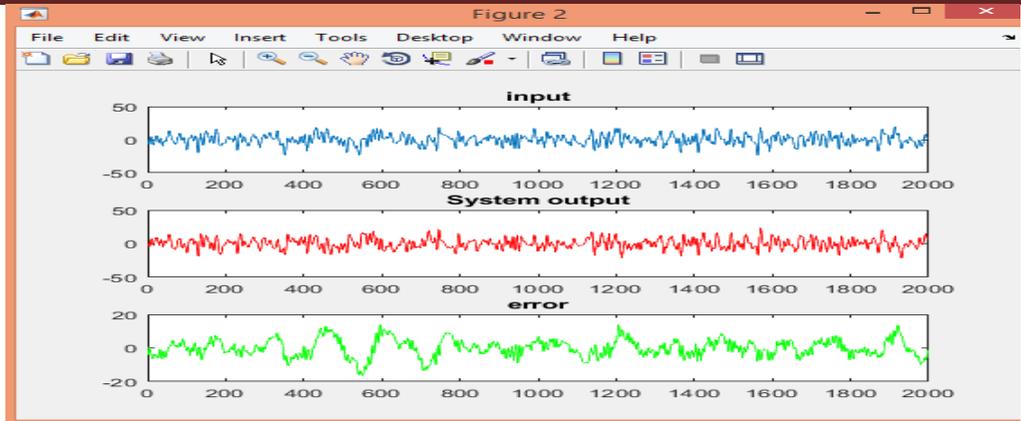


Fig. 4 Input eeg signal, Output eeg signal and Error signal

Five EEG signal for cz and pz channels are evaluated with adaptive filters ,ICA and PCA algorithm and Results are as shown in the following Tables.

Table. 1 MSE of eeg signal in cz channel

Sr.No	NLMS Butter filter	NLMS Fir filter	RLS Fir filter	ICA	PCA
1	22.38	127.616	127.78	0	0
2	23.95	125.73	127.78	0	0
3	30.91	567.69	568.08	0	0
4	19.61	121.64	121.99	0	0
5	12.62	89.62	89.61	0	0

Table. 2 MSE of eeg signal in pz channel

Sr.No	NLMS Butter filter	NLMS Fir filter	RLS Fir filter	ICA	PCA
1	70.12	147.96	148.06	0	0
2	29.03	134.18	148.06	0	0
3	7.52	155.154	53.76	0	0
4	19.9	110.97	109.97	0	0
5	13.78	93.888	94.28	0	0

Table. 3 PSNR of eeg signal in cz channel

Sr.No	NLMS Butter filter	NLMS Fir filter	RLS Fir filter	ICA	PCA
1	15.13	7.576	7.57	322.2	330.48
2	25.98	16.81	16.75	332.61	330.92
3	28.69	16.05	16.04	337.68	327.64
4	18.93	11	10.99	339.79	329.28
5	5.96	2.54	-2.54	329.79	319.467

Table. 4 PSNR of eeg signal in pz channel

Sr.No	NLMS Butter filter	NLMS Fir filter	RLS Fir filter	ICA	PCA
1	6.1	6.11	9.35	320.54	322.07
2	8.42	8.43.	15.09	338.49	331.49
3	12.41	12.435	-1.34	342.36	333.01
4	9.41	9.41	16.82	333.12	328.86
5	-2.68	-2.66	5.66	329.42	315.54

The graphs of five eeg signal for MSE and PSNR are shown below.

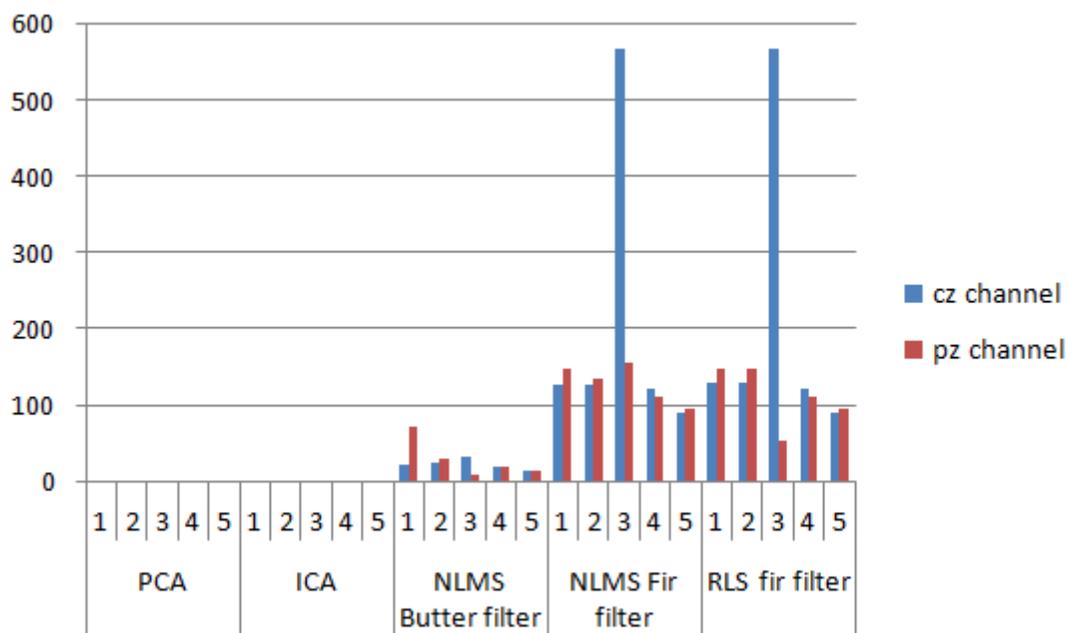


Fig. 5 Graph of mean square error of eeg signal of cz and pz channel

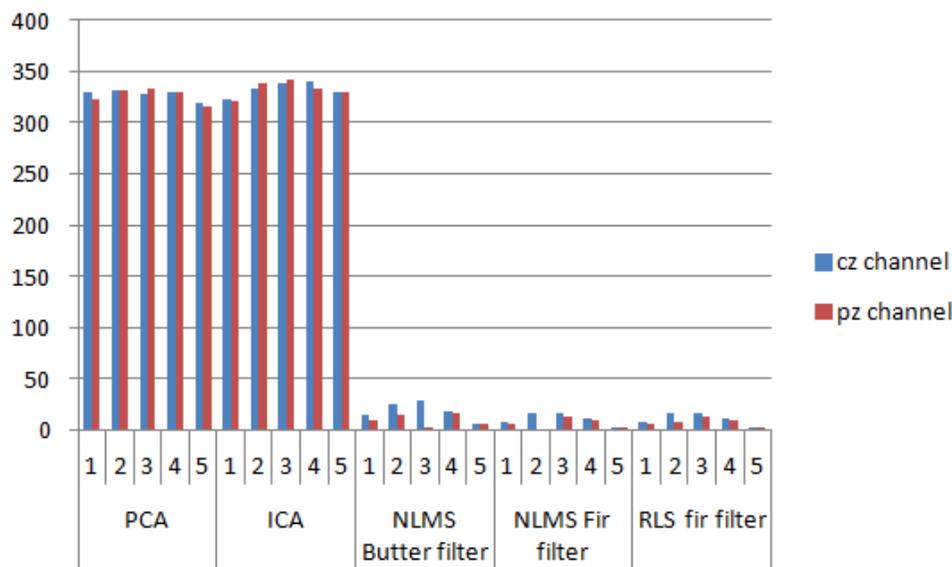


Fig. 6 Graph of PSNR of eeg signal of cz and pz channel

**V. Conclusion**

This paper presents adaptive filter using NLMS and RLS filter algorithm, PCA, ICA for reducing noise in the Electroencephalograph signal and to generate a signal with minimum noise level. The Algorithm has been tested for 5 eeg signal with two different channels . NLMS , RLS filter was tested for different step size. MSE is minimum for PCA and ICA algorithm but gives the best performance with less computation time.

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# Agent Based Load Balanced Data Gathering in Wireless Sensor Networks

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**ABSTRACT:** Efficient usage of sensor node battery is one of the critical issues in Wireless Sensor Networks (WSNs). It is the prime requirement to conserve the energy of sensor node. In periodic data gathering of WSN, intermediate sensor nodes energy is drained in drastic manner. To tackle this problem in this work we have proposed agent based load balancing in WSN. Proposed scheme works well for periodic data gathering. The proposed scheme operates in the different phases namely, (i) construction of hexagon geometry for periodic data gathering, (ii) Finding the multiple path for data gathering, (iii) scheduling the data transmission at different instant of time over the multiple path, which conserve the energy of sensor node and in turn load is balanced to prolong the network life of WSN. For testing the effectiveness of the proposed scheme, it is simulated using C. The effectiveness of the proposed scheme is evaluated in turns of energy consumption, delay, throughput, network life time, etc.

**Keywords:** Load Balancing, Wireless Sensor Networks, Multiple paths routing

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## 1. Introduction

Recent development in technology of MEMS (Micro Electro Mechanical System) has enabled the development of many large scale tiny sensors, which are suitable for many applications like military, environment monitoring etc. The networking of deployed sensors monitor the area of interest, facilitates the required information, and transmits it to the sink node. [1]. Some of the applications of WSNs are detection and monitoring of disasters, environmental monitoring and biodiversity mapping, intelligent building, precision agriculture, monitoring and maintenance of machinery, various applications in medical fields, intelligent transports and logistics. It is widely accepted that energy limitation is an inevitable question in the design of WSNs because it imposes strict constraints on network operations. The maximum amount of energy is spent in transmitting or receiving data. Hence, to conserve the battery of sensor node one of the techniques that can be applied is load balancing in WSN.

The overall load of the network is balanced by spreading the load across the network, which can improve the network lifetime of WSN. Load balancing is one of the major concerns, which helps in reducing the congestion hot spots, thereby reducing wireless collisions. If the entire traffic is routed in the same path the nodes involved in that path die sooner when compared to other Nodes in the network, hence load balancing is important for the enhancement of the network lifetime. Some of the related works are as follows. Load Balancing routing Protocol (LBRP) given in [2] minimizes the traffic encountered by each node. Load balanced clustering is performed to cluster sensor network efficiently around few high-energy gateway nodes. Load on the gateway network configuration is performed in two stages, bootstrapping and clustering [3]. Load balancing scheduling algorithm uses the scheduling mechanisms for packet forwarding in WSNs. Scheduling algorithm provides the balanced load in polynomial time [4]. Probabilistic and heuristic techniques are used for data transmission through the various alternate routes [5]. An analytical model is presented in which, each sensor node generates the routing report and is upgraded to the sink node. Sink node selects the optimal paths [6]. To distribute the load uniformly on the network, the work given in [7] and [8] computes the multiple paths by considering unused sensor nodes (nodes which are not involved in communication). A shortest path routing, heuristic path routing and equiproportional routing to balance the traffic within the network are given in [9].

In multipath algorithm uses directed diffusion that reinforces multiple routes with high link quality and low latency. A novel routing protocol for WSN with a built-in load balancing scheme is given [10]. By imposing a special structure on the collection tree, privileging longer hops, and accounting for network load in the route selection process.

The drawbacks of the existing work includes non-uniform traffic pattern putting high burden on the specific nodes, which makes the nodes to die sooner. To overcome the limitations of existing work, we propose agent based hexagon structure based load balancing in WSN.

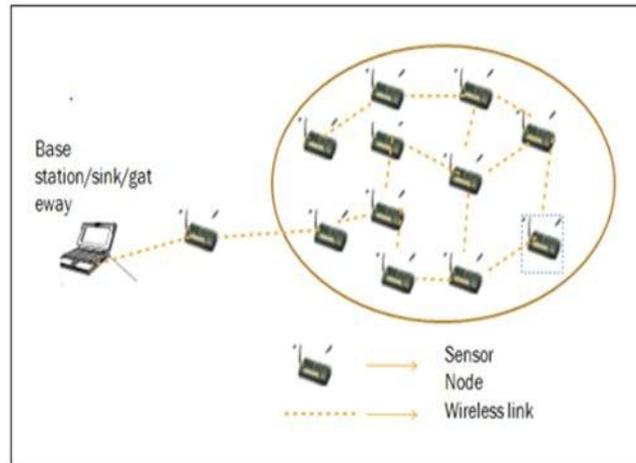
Rest of the paper is organized as follows. Section 2 presents agent based load balancing and section 3 depicts the simulation models, simulation inputs, and procedure and performance parameters and finally section 4 concludes the work.

## 2 Load Balancing and Data Gathering

This section presents the network environment, agency used in the proposed scheme and the proposed scheme.

### 2.1 Network environment:

The network environment considered for load balancing and periodic data gathering in WSN is shown in figure1. It comprises of several sensor nodes and a sink node. Sensor nodes are randomly distributed. They sense the data periodically. The nodes sense and send the data to sink node using wireless multi hop communication. Assume that all the nodes in the network (sensor nodes and sink node) are static. During deployment phase, all sensor nodes have same energy. All the sensor nodes are equipped with Global Positioning Systems (GPS), processor and transceiver for communication. Each sensor node consists of an agent platform with security features to coordinate the inter-agent communication.



**Figure 1:** Network environment

Edge sensor nodes participate in the construction of hexagon structure. Each hexagon is considered as a each cluster, hexagon shape clustering of nodes will cover the entire area without leaving any nodes in the isolated state.

### 2.2 Agency:

The proposed work uses a set of static and mobile agents for creation of hexagon structure and multiple path computation. Various agent defined are part of the sink node and sensor node agency. This section presents the sink and sensor node agencies.

#### Sink node agency

Sink node consists of Sink Manager Agent (SMA), Edge Node Selection Agent (ENSA), Path Computing Agent (PCA), Data Gathering Agent (DGA) and Sink Black Board (SBB). Sink node agency is as depicted in figure 2

#### Sink Manager Agent (SMA)

It is a static agent residing in sink node that monitors and maintains hexagon edge nodes information. SMA creates the ENSA for the creation of hexagon. SMA also updates the edge node information to the SBB. It creates PCA for computing the direct and alternate paths for load balancing. SMA gets the path information from the SBB and using load balancing strategy it allocates the path need to be traversed for information gathering. SMA creates the DGA for the gathering of information along the different paths. SMA

also maintains the threshold values of the edge angle and path angle for the creation of the hexagon and paths respectively.

**Edge Node Selection Agent (ENSA):**

This is the mobile agent. It is responsible for the selection of hexagon edge nodes for the creation of hexagon. Edge nodes are selected based on the angle, Euclidian distance, and residual energy of the node. It updates the threshold edge angle for the creation of edges of hexagon. It provides the node id of all the edge nodes to SBB.

**Path Computing Agent (PCA):**

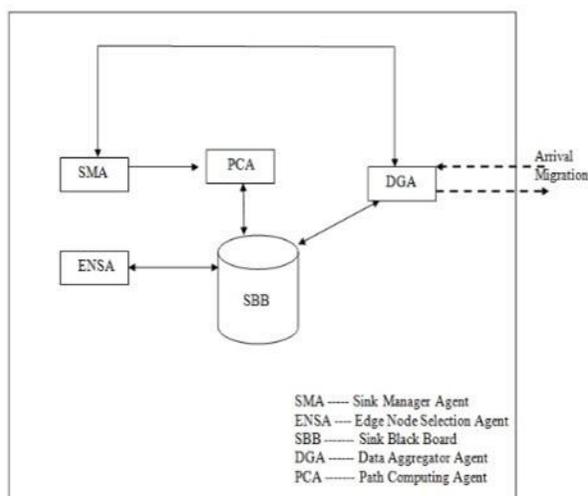
This is the static agent that resides in the Sink node. It gets the path information from the SBB and computes the optimal path based on the weight factor of the direct and alternate paths. PCA updates SBB with the possible multiple paths.

**Data Gathering Agent (DGA):**

It is a static agent, triggered by SMA based on optimal path efficiency and load balancing strategy. DGA gets the paths facilitated by SMA and creates the clones of DGA for information gathering along the paths to be traversed. The clone of DGA gets the gathered information along the path and updates the SBB.

**Sink Black Board (SBB):**

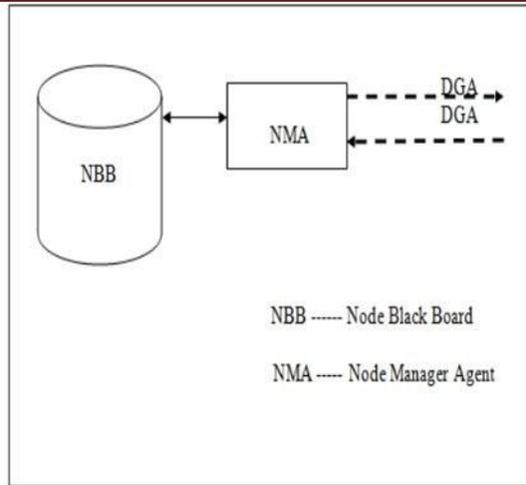
It is the knowledge base that can be read and updated by SMA, ENSA, PCA and DGA. It consists of node id, residual energy of the nodes, threshold angle of the alternate paths, neighbor count, Number of rounds, threshold angle of the alternate paths, and number of possible paths in hexagon structure.



**Figure 2:** Sink Node Agency

**Sensor node agency:**

It comprises of Node Manager Agent (NMA), Node Black Board (NBB) for inter agent communication. The components of the sensor node agency and their interactions are depicted figure.



**Figure 3: Sensor Node Agency**

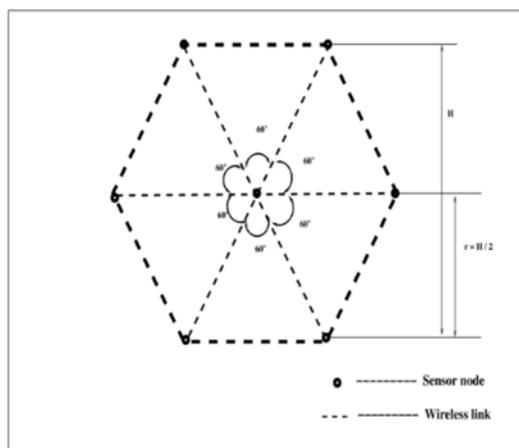
**Node Manager Agent (NMA):** It is the static agent. It resides in all the nodes of WSN, It creates NBB. It senses the information and updates the NBB. It also monitors the information such as residual energy, neighbouring nodes, time of sensing and periodically updates the NBB.

**Node Black Board (NBB):** it is the knowledge base which can be read and updated by the NMA. It comprises of node id, residual energy, Number of rounds, neighbouring nodes, weight factor, location information, time of sensing, etc.

**2.1 Proposed scheme**

The proposed scheme operates for periodic data gathering. It operates with following phases. Construction of hexagon structure, gathering the path information of all the hexagon structures, computation of paths, and gathering of data using the mobile agent in the specified paths are operational scheme of the proposed work. Paths are facilitated by the SMA to DGA for traversal and gather the data along the specified paths. In load balancing strategy, SMA monitors the residual energy of the multiple paths and decides the paths to be selected for gathering of information

Hexagon construction:



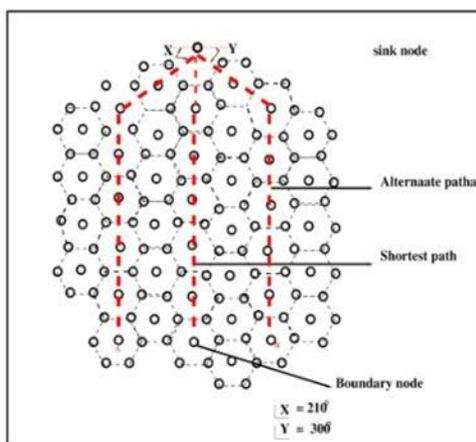
**Figure 4: Hexagon construction CASE 1: Usage of shortest Paths**

It is assumed that location, node id and residual energy of the sensor nodes which are involved in the construction of the hexagon are known to the sink node. In Case1 load is balanced by two paths i.e, shortest

path and Alternate path. Shortest path is the direct path from sink node to boundary node. Alternate paths are constructed at the 30' and 210' to that of the sink node.

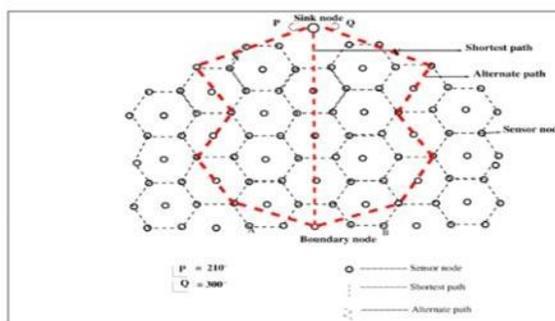
**CASE 2: Node disjoint path**

In Case 2 It is assumed that location of the boundary nodes are known to the sink node.



**Figure 5:** case 1 path computation

Alternate paths are computed by the path computing agent of the sink node agency. Alternate path is computed at 210' and 300' to that of the sink node. Direct path is computed to the 270' to that of the sink node.



**Figure 6:** Case2 path computation

**3 Simulation and Results**

We have simulated proposed scheme for various network scenarios using C programming language with a confidence interval of 95%. In this section simulation procedure, performance parameters and result analysis are presented.

**3.1 Network model**

WSN is generated in an area of l\*b square meters. It is assumed that number of nodes are N and all are static, placed randomly. Each node is associated with initial energy E int joules, transmission range R meters, node id, node location i(x,y). The communication environment is assumed to be contention free. The transmission of packets is assumed to occur in discrete time. It is assumed that the location of all the boundary sensor nodes is known to the sink node.

**3.2 Simulation procedure:**

To illustrate some results of the simulation, we have taken L = 100, B= 200 meters and N

= 50-300, path angles for case1 are X = 210' Y= 300' and for case 2 P = 208', Q= 300' . for the hexagon construction angle between the adjacent nodes of the hexagon are taken as 60'.

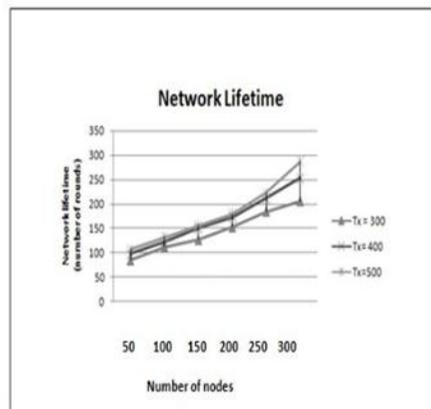
### Begin

- Deploy the sensor Nodes Randomly
- Construct the Hexagon Structures
- Apply the proposed scheme for the path discovery
- Compute performance parameter

### End

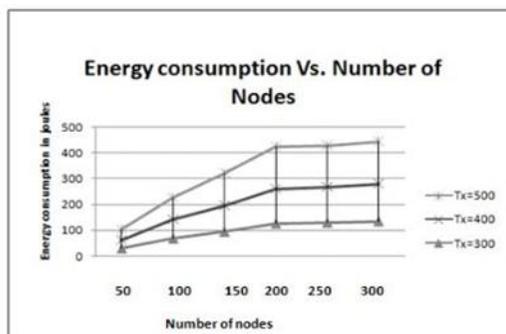
Some of the following performance parameters are:

- Network Life Time: It is the number of rounds taken to die the first node in WSN. Delivery Ratio (DR): It is the ratio of total number of packets received and total number packet sent.
- Hexagon Structure Energy Consumption: It is total energy consumed for formation of hexagon structure.
- Path Discovery Energy Consumption: It is the total energy consumed for discovering the multiple path for load balancing.



**Figure 7:** Graph indicating the network lifetime

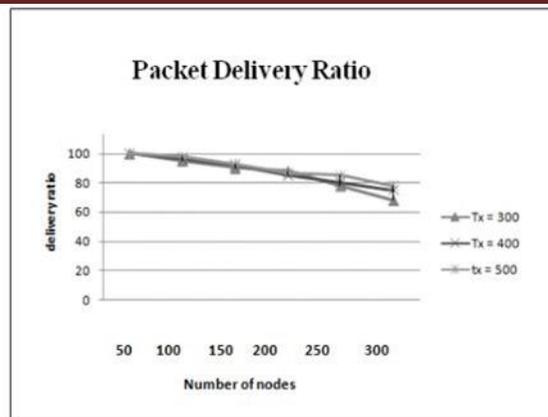
Figure 7 shows the network lifetime Vs number of rounds. From the figure we can notice that as transmission range increases, the available bandwidth for the transferring the packets is more hence the lifetime of the network increases.



**Figure 8:** The energy consumption Vs number of nodes.

Figure 8 shows the energy consumption Vs number of nodes. From the result we can notice that as the number of nodes increases the energy consumed to create hexagon increases.

Figure 9 presents the packet delivery ratio in percentage versus the number of nodes. As the number of nodes increases the packet delivery ratio decreases as it involves interference in the transmission channel.



**Figure 9:** Packet delivery ratio

#### 4. Conclusions

In this paper we have proposed hexagon structure for load balancing and data gathering. Multiple paths are computed using the different paths along the radii of the hexagon structure. To improve the network lifetime of the proposed scheme different paths are chosen for data gathering, at different instant of time which conserve the sensor nodes energy and avoids the drainage sensor node energy on single path. The proposed work performs better in terms of network life time and packet delivery ratio.

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## **Correction of high power factor using buck boost converter with ZVS**

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**ABSTRACT:** *The power factor correction for dc-dc converters at the front end is important as the increases in usage of electronics devices like laptops, cell phones, electric vehicles etc., Here a new integrated boost and buck converter is proposed. buck converter take cares of output voltage regulation. Without any auxiliary switch or circuit, the zero voltage transition is made the circuit naturally. MATLAB is used for the making the simulation. A low voltage prototype is done for testing. results of the Experimental circuit verify the feasibility and with satisfactory performance of proposed circuit*

**Keywords:** *Boost converter, buck converter, power factor correction (PFC), zero voltage switching*

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### **1. Introduction**

Switching-mode ac/dc converter have been used in many off-line applications, such as dc uninterruptible power supply, telecommunications power supply, LED driver etc.[1-2]. The increasing amount urges researchers to develop more efficient, smaller size, and low cost ac/dc converters. In order to achieve the standards of harmonic regulation such as a power-factor corrector is usually required. The advantages of simple circuit topology and easy control, boost or buck-boost converters have been widely used as power-factor correctors[3-6]. In order to achieve power factor unity, it requires the output voltage of both converter to be higher than the amplitude of the ac line voltage. Therefore, high-power-factor ac-dc converters usually consist of two stages.

The first is an ac to dc stage which performs the function of Pfc. and second is an dc to dc stage used to supply stable dc voltage to the load [7-9]. In spite of their good performance, the circuit efficiency of two-stage approaches is impaired since it takes two energy-conversion processes which inevitably introduce some losses including switching loss, conduction Loss and magnetic core loss. Besides two stage approaches, the Cuk and the Sepic converters can also achieve high power factor and regulate the output voltage [10]. Both converters have the advantage of simple circuit topology since they only use one active switch and one diode. High power factor can be achieved by operating the boost converter either at DCM or continuous conduction mode (CCM). The buck or buck boost converter can further regulate the output voltage of the boost converter to obtain a smooth dc voltage. However, the output voltage of the boost converter is usually higher than the amplitude of the AC line voltage. Before turning on the active switch, the output voltage is across its parasitic capacitor. The energy stored in the parasitic capacitor is discharged at turning on the active switch, resulting in high switching losses and a high spike current. The boost, Cuk and Sepic converters can also be operated at critical conduction mode to obtain high power factor. Synchronous rectification (SR) technique is popularly applied while operating these converters at CRM [11]. A MOSFET is used to replace the freewheel diode, and the conduction loss is effectively reduced. by extending the turn-on time of the synchronous switch.

### **Configuration of Circuit Operation**

A high-power-factor ac/dc converter with a two-stage circuit topology is shown in Fig.1. It consists of a boost and buck converter. This two-stage converter can realize high-power factor with a wide load range. both active switches of the converter operate at hard-switching condition, resulting in high switching losses and high current and voltage stresses.

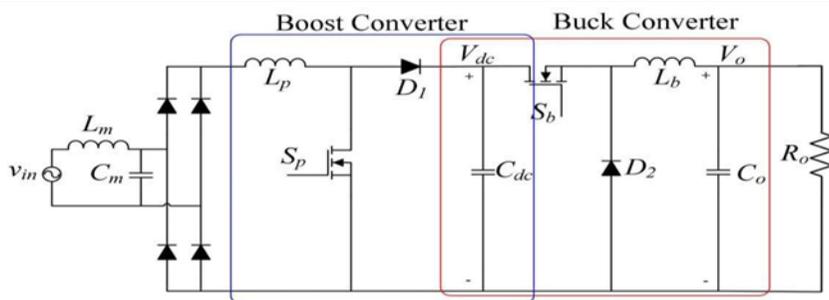


Fig.1. Two-stage ac/dc converter.

solving the problem resulting from hard switching, a new ac/dc converter is proposed, as shown in Fig. 2. The circuit topology is derived by relocating the positions of the semiconductor devices in Fig. 1. MOSFETs S1 and S2 play the roles of active switches and the antiparallel diodes DS1 and DS2 are their intrinsic body diodes, respectively. The proposed circuit mainly consists of a low-pass filter ( $L_m$  and  $C_m$ ), a diode-bridge rectifier (D1D4), a boost converter and a buck converter. The boost converter is composed of  $L_p$ , DS1, S2 and  $C_{dc}$  and the buck converter is composed of  $L_b$ , D5, DS2, S1 and  $C_o$ . Both converters operate at a high-switching frequency,  $f_s$ . The boost converter performs the function of PFC. When it operates at discontinuous-conduction mode (DCM), the average value of its inductor current in every high-switching cycle is approximately a sinusoidal function [5]. The low pass filter is used to remove the high frequency current of the inductor current. By this way, the boost converter can wave shape the input line current to be sinusoidal and in phase with the input line voltage. In other word, high power factor and low total current harmonic distortion (THDi) can be achieved. The buck converter further regulates the output voltage of the boost converter to supply stable dc voltage to the load. It is also designed to operate at DCM for achieving ZVS based on the reason that will be discussed in the final of this section.

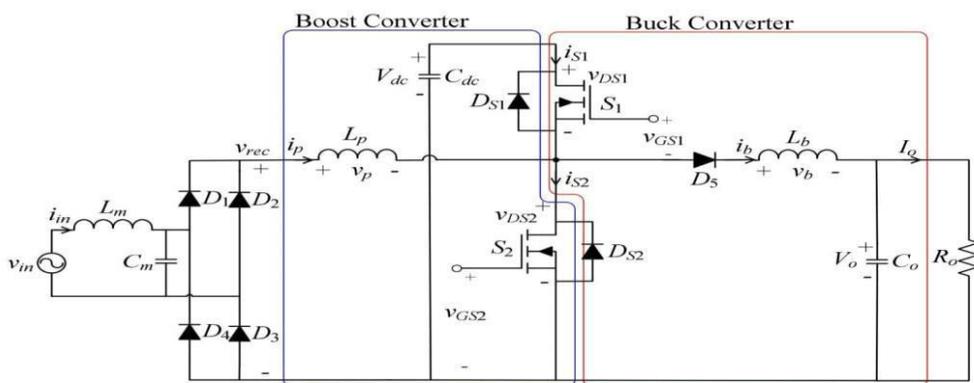


Fig. 2. Circuit topology of the proposed ac/dc converter

### III. Operation Modes

For simplifying the circuit analysis, the following assumptions are made: 1) the semiconductor devices are ideal except for the parasitic output capacitance of the MOSFETs. 2) The capacitances of  $C_{dc}$  and  $C_o$  are large enough that the dc-link voltage  $V_{dc}$  and the output voltage  $V_o$  can be regarded as constant. At steady state, this operation is divided into eight modes in every high-frequency cycle. Fig. 3 to Fig 3.8 shows the equivalent circuits for each of the operation modes. In these equivalent circuits, the low-pass filter and the diode rectifier are represented by the rectified voltage  $v_{rec}$ . Fig. 4 illustrates the theoretical waveforms in each mode for the operating the converter as DCM mode. The circuit operation is described as follows

A. Mode I : S1 is at "ON" state. The boost-inductor current  $i_p$  is zero and the dc-link capacitor supplies the buck inductor current  $i_b$  which flows through  $D_5, S_1, D_5, L_b$  and  $C_o$ . This mode starts when S1 is turned off

by the gate voltage, vGS1. The time interval of this mode is the turn-off transition. beginning of this mode, ib is diverted from S1 to flow through the output capacitors CDS1 and CDS2. CDS1 and CDS2 are charged and discharged, respectively. As voltage across CDS2 decreases to be lower than the rectified input voltage V\_rec the boost current ip starts to increase. When vDS2 reaches -0.7 V, DS2 turns on and Mode I end.

B. Mode II : At the beginning of this voltage vDS2 is maintained at about -0.7 V by the antiparallel diode DS2. After the short dead time, S2 is turned on by the gate voltage, vGS2. If the on-resistance of S2 is small enough, most of ib will flow through S2 in the direction from its source to drain. Neglecting the small value of vDS2, the voltage across Lb and Lp are equal to

$$\begin{aligned} v_b(t) &= -V_o & (1) \\ v_p(t) &= v_{rec}(t) = V_m \sin(2\pi fL t) & (2) \end{aligned}$$

Where fL is frequency and Vm is amplitude of the input line voltage, Since the time interval of mode1 is very short, ib can be expressed as:

$$i_b(t) = i_b(t_0) - \frac{V_o}{L_b} (t - t_0) \quad (3)$$

From (3), ib decreases from peak vp value. The boost converter is designed to operate at DCM, therefore ip increases linearly from zero with a rising slope that is proportional to vrec.

$$i_b(t) = \frac{V_o}{L_p} (t - t_0) = \frac{V_o}{L_p} (t - t_0) \quad (4)$$

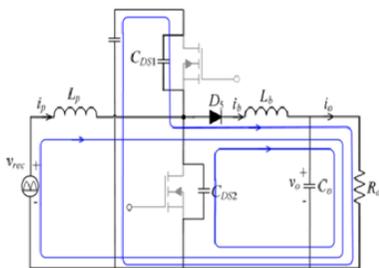


Fig: 3.1 Mode I

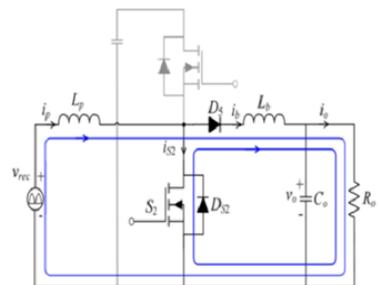


Fig: 3.2 Mode II

C. Mode III : In this mode, ip is higher than ib. Current ip has two loops. Parts of ip are equal to ib and flow into the buck converter, while the rest flow through S2. The current direction in S2 is naturally changed, i.e. from drain to source. The voltage and current equations for vb, vp, ib and ip are the same as (1) – (4). Current ib decreases continuously. On the contrary, ip keeps increasing. Since the buck converter is designed to operate at DCM, ib will decrease to zero at the end of this mode.

D. Mode IV : In this mode, S2 remains on to carry ip. Because ib is zero, the buck converter is at “OFF” state and the output capacitor Co supplies current to load. When S2 is turned off by the gate voltage vGS2, Mode IV ends.

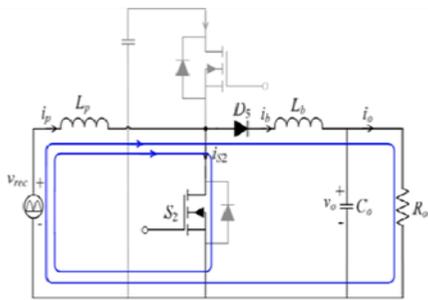


Fig: 3.3 Mode III

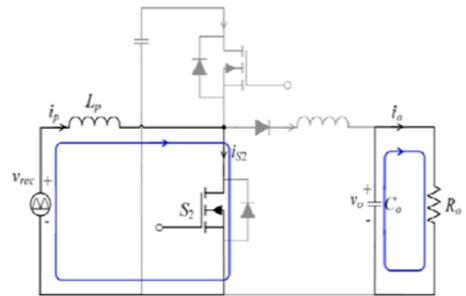


Fig: 3.4. Mode IV

E. Mode V : Current  $i_p$  reaches a peak value at the time instant of turning off  $S_2$ . For maintaining flux balance in  $L_p$ ,  $i_p$  will be diverted from  $S_2$  to flow through  $C_{DS1}$ ,  $C_{DS2}$  when  $S_2$  is turned off. Both  $C_{DS1}$  and  $C_{DS2}$  are discharged and charged, respectively. Current  $i_b$  is zero at the beginning of this mode, and will start to increase when the voltage across  $C_{DS1}$  decreases to be lower than  $V_{dc}-V_o$ , that is the voltage across  $L_b$  becomes positive. As  $v_{DS1}$  reaches  $-0.7$  V,  $DS_1$  turns on and Mode V ends.

F. Mode VI : at the beginning of this Mode  $v_{DS1}$  is maintained at about  $-0.7$  V by the antiparallel diode  $DS_1$ . After the short dead time,  $S_1$  is turned on by  $v_{GS1}$ . If on-resistance of  $S_1$  is small enough, most of  $i_p$  will flow through  $S_1$  in the direction from its source to drain. Neglecting the small value of  $v_{DS1}$ , the voltage imposed on  $L_p$  and  $L_b$  can be respectively expressed as

$$V_p(t) = v_{rec}(t) - V_{dc} = V_m |\sin(2\pi f L t)| - V_{dc} \quad (5)$$

$$V_b(t) = V_{dc} - V_o \quad (6)$$

For a boost converter, the dc-link voltage  $V_{dc}$  is higher than the rectified voltage  $v_{rec}$ . Neglecting the short turning off transition of  $S_2$ ,  $i_p$  can be expressed as:

$$i_p(t) = i_p(t_4) - \frac{m}{L} \frac{\sin(2\pi f L t) - V_{dc}}{(t - t_4)} \quad (7)$$

$$i_b(t) = \frac{V_{dc} - V_o}{L_b} (t - t_4) \quad (8)$$

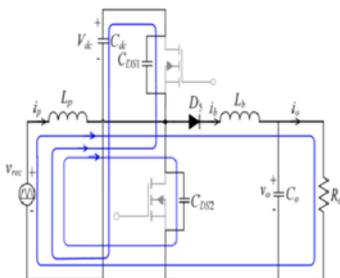


Fig:3.5 Mode V

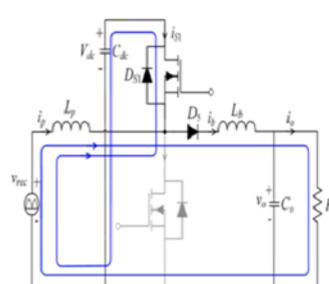


Fig:3.6. Mode VI

G. Mode VII In this mode,  $i_b$  is higher than  $i_p$ . There are two loops for  $i_b$ . Parts of  $i_b$  are equal to  $i_p$  and flow into the boost converter, while the rest flow through  $S_1$ . The current direction in  $S_1$  is naturally changed, i.e.

from drain to source. The voltage and current equations for  $v_p$ ,  $v_b$ ,  $i_p$  and  $i_b$  are the same as (5) to (8). Current  $i_b$  increases continuously while  $i_p$  keeps decreasing. The circuit operation enters next mode as soon as  $i_p$  decreases to zero.

H. Mode VIII : S1 remains on and  $i_b$  keeps increasing. This mode ends the time when  $v_{GS1}$  becomes a low level to turn off S1 and, the circuit operation returns to Mode I of the next high frequency cycle. Based on the circuit operation, prior to turning on one active switch, the output capacitance is discharged to about 0.7 V by the inductor current. Then, the intrinsic body diode of the active switch turns on to clamp the active voltage at nearly zero voltage. By this way, each active switch achieves ZVS operation.

The reason for operating the buck converter at DCM is explained below. In operation Mode 2,  $i_p$  rises and  $i_b$  decreases. It should be noted that  $i_p$  rises in proportional to the input voltage and has a small peak in the vicinity of zero-cross point of the input voltage. If the buck converter is operated at continuous-conduction mode (CCM),  $i_b$  could keep higher than  $i_p$ . On this condition, the circuit operation would not enter into Mode III and Mode IV, and  $v_{DS1}$  is maintain at about  $V_{dc}$ . When S1 is turned on,  $i_b$  is diverter from S2 to S1. CDS1 is discharged at a high voltage of  $V_{dc}$ , resulting a spike current and high switching losses.

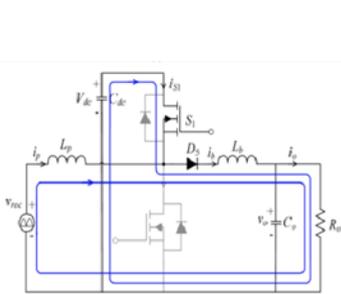


Fig:3.7. Mode VII

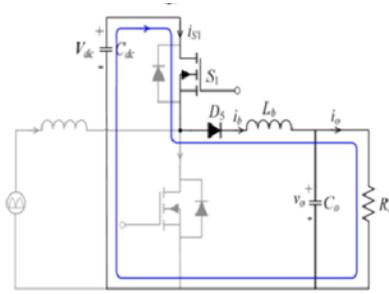


Fig:3.8. ModeVIII

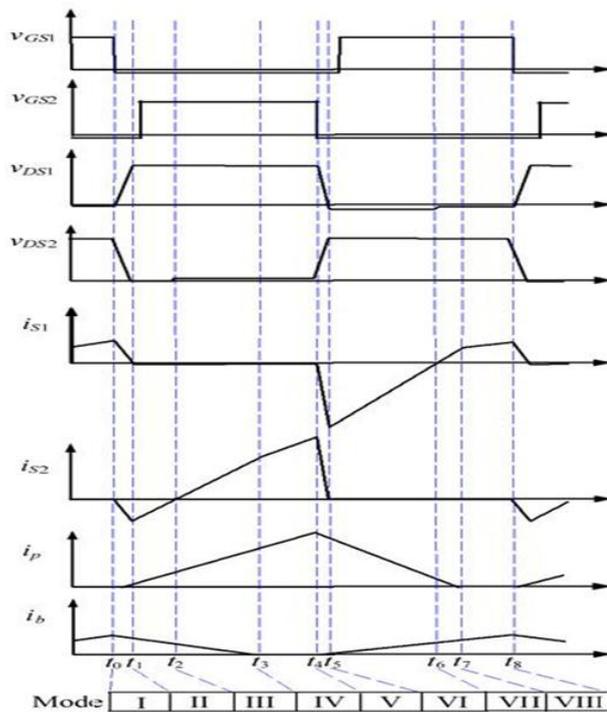


Fig .4. Theoretical wave form of proposed converter

### IV. Simulation and Results

The proposed zvs high power factor converter with integrated buck and boost converter is implemented using MATLAB/SIMULINK. The simulation model of the proposed converter as shown in fig:5. The converter is designed such as to convert a AC voltage source into a DC source. The input voltage provided to the converter is 110 V. The output power obtained is 30 W. The output voltage obtained is 220 V and as shown in figure. Voltage across switch S1 and S2 are captured and as shown in fig.7. The power factor correction, is input current and voltage is depicted is shown in Fig. 8. The simulation waveform is in good agreement with theoretical analysis.

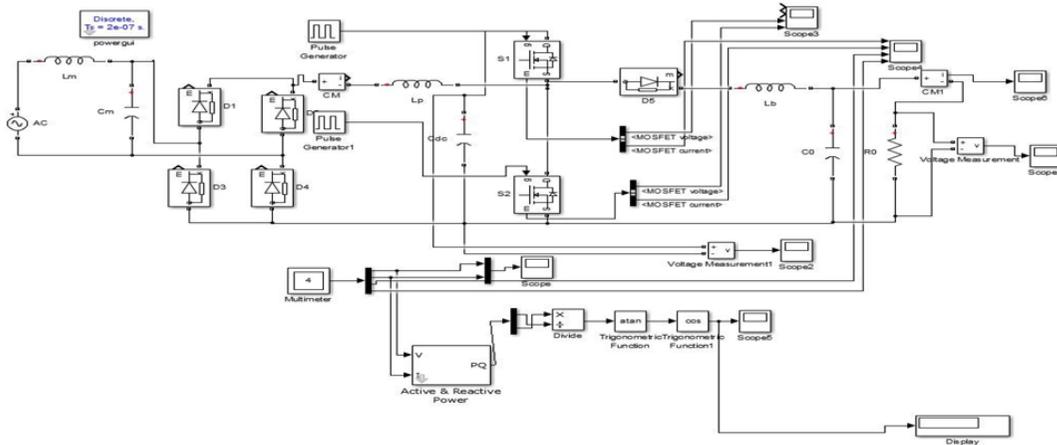


Fig: 5 Simulation Design of Proposed System

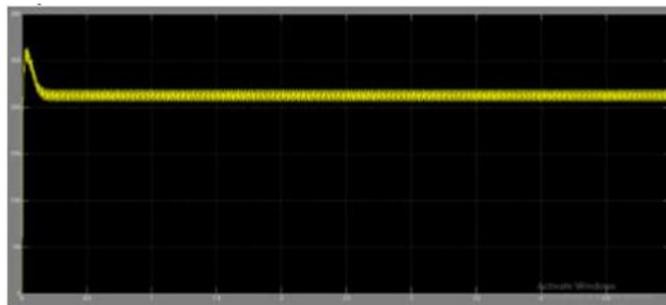


Fig. 6 Output voltage

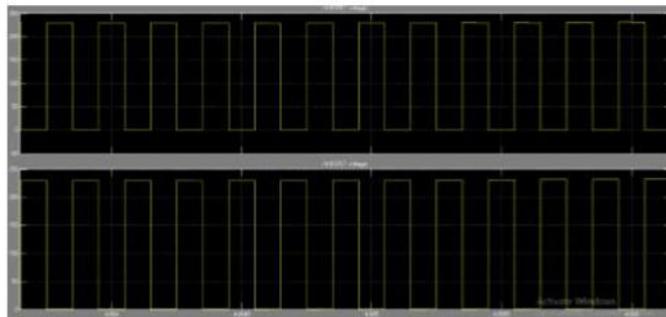


Fig.7. Voltage across switch S1 and S2

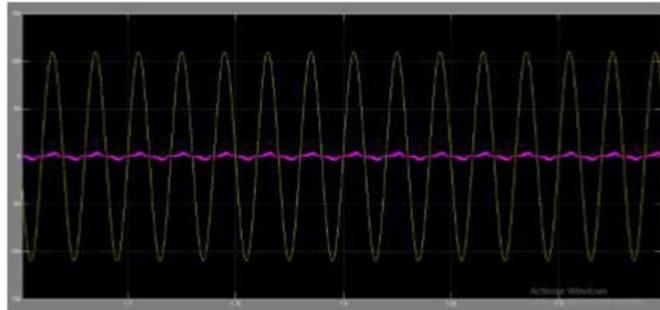


Fig.8. Input voltage and current

## V. Conclusion

A high efficiency ZVS ac-dc converter. The integrated buck-boost converter is proposed. By freewheeling the inductor currents of the converters to flow through each of the intrinsic diodes of the MOSFETs, active switches are turned on at ZVS. It assures high circuit efficiency. The boost converter designed is operating at DCM to perform the function of Power factor correction. Boost converter requires dc link voltage should be higher than two times of the amplitude of input voltage. The buck converter further regulates the dc link voltage to obtain a stable dc voltage with low ripple. results based on the 60W prototype circuit show that high circuit efficiency, high power factor and low THDi can be achieved over wide load range. A circuit efficiency is 94.8%, power factor is 0.995 and THDi of 9.25% are measured at rated output power.

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# Sliding Mode Control of DC Motor

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**ABSTRACT:** Power consumption is an important consideration for unmanned aerial vehicle(UAV) applications. With high power density and high efficiency, brushless DC motor offers lower energy consumption than other motors, allowing the UAV to remain airborne for longer periods of time. Controlling the position or speed of a DC motor is a pivotal issue. DC motor are generally controlled by conventional Proportional-Integral-Derivative (PID) controllers. For effective implementation of PID controller it is necessary to know system's mathematical model for tuning PID parameters. However, for complex and vague systems that have no precise mathematical models, it has been known that conventional PID controllers generally do not work well. Sliding mode control (SMC) is designed for avoiding uncertainties due to non-linear factors that affect the output of the system which cannot be eliminated by the conventional controllers in real time. It has many advantages over PID controller. Some of them are robustness, disturbance rejection and independent of the system parameters. This paper focuses on the study of Sliding Mode Control of DC motor. Sliding mode control (SMC) is a nonlinear control technique featuring remarkable properties of accuracy, robustness, and easy tuning and implementation. MATLAB Simulink model for PID and SMC controller of DC motor was constructed. The results were compared and conclusion was drawn.

**Keywords:** DC motor, PID controller, SMC controller.

## 1. Introduction

Electrical drives involving various types of DC motors turn the wheel of industry. More than 50 percent of the generated electrical energy is consumed in motor drives in the developed countries. DC motors are comprehensively used in various industrial applications such as electrical equipment, computer peripherals, robotic manipulators, actuators, steel rolling mills, electrical vehicles, paper machine etc. Its applications spread from low horse power to the multi-megawatt due to its wide power, torque, speed ranges, high efficiency, fast response, simple and continuous control characteristics. Controlling the position/speed of a DC motor is a pivotal issue. Conventionally armature control method has been used for controlling the speed of the dynamic system, but the controllability, being economical and their compatibility with the novel mechanical and electrical equipment's like digital systems are the factors which have made its use widespread. DC motors are widely used in robotic and industrial equipment where high accuracy is needed. In some cases, the uncertain conditions encounter the DC motor control to some difficulties. Hence, DC motor control has been stimulated a great deal of interest from several decades ago up to now. DC motors are identified as adjustable speed machines for many years and a wide range of options have evolved for this purpose. Inherently straightforward operating characteristics, flexible performance and efficiency encouraged the use of D.C motors in many types of industrial drive application. Most multi-purpose production machines benefit from adjustable speed control, since frequently their speeds must change to optimize the machine process or adapt it to various tasks for improved product quality, production speed. The Proportional-Integral (P-I) controller is one of the conventional controllers and it has been widely used for the speed control of dc motor drives

The proportional-integral-derivative (PID) controller is extensively used in many industrial control applications due to its simplicity and effectiveness in implementation. The three controller parameters, proportional gain  $K_p$ , Integral gain  $K_i$ , and derivative gain  $K_d$ , are usually fixed. The disadvantage of PID controller is poor capability of dealing with system uncertainty, i.e., parameter variations and external disturbance. In recent years, there has been extensive research interest in robust control systems, where the fuzzy logic, neural network and sliding-mode based controllers.

DC motor are generally controlled by conventional Proportional-Integral-Derivative (PID) controllers. For effective implementation of PID controller it is necessary to know system's mathematical model for tuning PID parameters. However, it has been known that conventional PID controllers generally do not work well for non-linear systems, particularly complex and vague systems that have no precise mathematical models. To overcome these difficulties, various types of modified conventional PID controllers such as auto-tuning and adaptive PID controllers were developed lately. The non-linear factors do affect the output of the system

that cannot be eliminated by the conventional controllers in real time. SMC is designed for avoiding such uncertainties. It has many advantages over PID controller. Some of them are robustness, disturbance rejection and independent of the system parameters.

Sliding mode control (SMC) is one of the popular strategies to deal with uncertain control systems. Sliding mode control (SMC) is not sensitive to the matched uncertainties and external disturbances[1]. The main feature of SMC is the robustness against parameter variations and external disturbances and is widely used to obtain good dynamic performance of control systems. Various applications of SMC have been conducted, such as robotic manipulators, aircrafts, DC motors, chaotic systems etc.

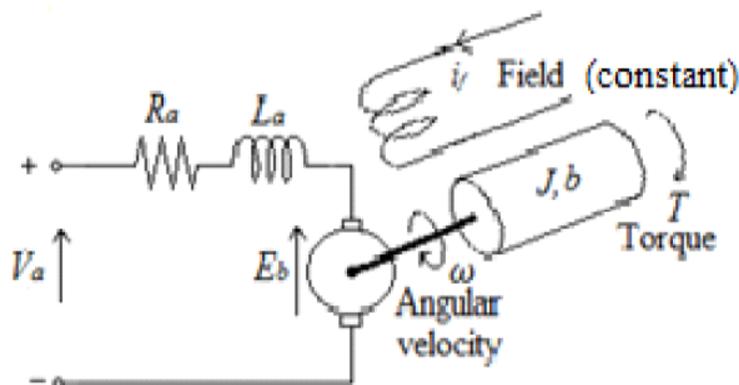
A sliding mode controller works by switching the trajectory of the system from one structure to the other and in between sliding on a specific line, plane or surface in state space[2]. The motion of the system trajectory along a chosen path in state space is called the sliding mode and the controller designed with the aim to achieve the sliding motion is called the sliding mode controller. The path such chosen is called the sliding surface or switching surface. While we choose the sliding surface, there are some requirements that to be taken care of. The system stability has to be confined to the sliding (switching) surface. Also, the system trajectory should converge to the sliding surface within finite time[3-5].

The main ideas in sliding mode control are:

- Designing the switching function so that 0 manifold (sliding mode) provide the desired dynamic.
- Finding a controller ensuring sliding mode of the system occurs in finite time.

## II. Mathematical Modelling of dc servo control

Dc servo motor is broadly utilized for modern and domesticated reason. It is important to build the numerical model of DC servo motor here we are utilizing armature control DC motor to control speed and position of Dc motor. In armature control of DC motor the resistance and inductance connected in series and voltage is representing the back Electromotive force of DC servo motor. Consider armature control dc motor shown in figure1.



**Fig.1** Schematic Diagram of a DC Motor

$R_a$ -armature resistance,  $L_a$ -armature inductance,  $i_a$ -armature current,  $e_b$ -back emf,  $v_a$ -armature voltage,  $I_f$ -field current,  $\omega$ -angular position,  $J$ -moment of inertia,  $b$ -viscous coefficient friction,  $T$ -torque

The air gap flux is

$$\phi \propto i_f \quad (1)$$

$$\phi = k_f i_f \quad (2)$$

where  $k_f$  is a constant

$$T \propto i_a \quad (3)$$

$$T = K_1 k_f i_f i_a \quad (4)$$

Where  $K_1$  is the constant

The field current is kept constant in armature control dc motor, then

$$T = K_T i_a \quad (5)$$

Where  $K_T$  is motor torque constant

Now,

$$e_b \propto \omega \quad (6)$$

$$\omega = \frac{d\theta}{dt} \quad (7)$$

$$e_b = K_b \quad (8)$$

Where  $K_b$  is the back emf constant

Apply KVL in the circuit

$$v_a - e_b = L_a \frac{di_a}{dt} \quad (9)$$

The torque equation is given as

$$J \frac{d^2\theta}{dt^2} + b \frac{d\theta}{dt} = T \quad (10)$$

Taking Laplace transform of equation, assuming zero initial condition, we get

$$(L_a s + R_a) I_a(s) = V_a(s) - E_b(s) \quad (11)$$

$$(J s^2 + b s) \theta(s) = T(s) = K_T I_a(s) \quad (12)$$

Where  $s$  denotes the Laplace operator. From (7) we can express  $I_a(s)$

$$I_a(s) = \frac{V_a(s) - E_b(s)}{L_a s + R_a} \quad (13)$$

and substitute it in (12) to obtain:

$$(J s^2 + b s) \theta(s) = K_T \left( \frac{V_a(s) - E_b(s)}{L_a s + R_a} \right) \quad (14)$$

The transfer function from the input voltage,  $V_a(s)$ , to the angular velocity  $\omega$  is:

$$\frac{\omega(s)}{V_a(s)} = \frac{K_T / L_a J}{(s + \frac{R_a}{L_a})(s + \frac{b}{J}) + \frac{K_b K_T}{L_a J}} \quad (15)$$

The state space model of DC motor is as follows

$$\dot{x} = Ax + Bu = \begin{bmatrix} -\frac{b}{J} & \frac{K_T}{J} \\ -\frac{K_b}{L_a} & -\frac{R_a}{L_a} \end{bmatrix} x + \begin{bmatrix} 0 \\ \frac{1}{L_a} \end{bmatrix} u \quad (16)$$

### III. Sliding Mode Control of DC Motor

In the context of modern control theory, any variable structure system like a system under SMC, may be viewed as a special case of a hybrid dynamical system. Intuitively, sliding mode control uses practically infinite gain to force the trajectories of a dynamic system to slide along the restricted sliding mode subspace. Trajectories from this reduced-order sliding mode have desirable properties (e.g., the system naturally slides along it until it comes to rest at a desired equilibrium). The main strength of sliding mode control is its robustness. Because the control can be as simple as a switching between two states, it need not be precise and will not be sensitive to parameter variations that enter into the control channel. Additionally, because the control law is not a continuous function, the sliding mode can be reached in finite time (i.e., better than asymptotic behaviour). There are two steps in the SMC design. The first step is designing a sliding surface so that the plant restricted to the sliding surface has a desired system response. This means the state variables of the plant dynamics are constrained to satisfy another set of equations which define the so-called switching surface. The second step is constructing a switched feedback gains necessary to drive the plant's state trajectory to the sliding surface. These constructions are built on the generalized Lyapunov stability theory[5].

The parameter of DC motor is given in the table 3.1

Table 3.1 DC motor parameters

Parameter	Value
R	0.6 ohm
L	0.012 H
J	0.0167 kg-m <sup>2</sup>
b	0.0167
K <sub>b</sub>	0.8 Vs/rad
K <sub>t</sub>	0.8 N-m/A

Equation (15) in time domain form is written as

$$\ddot{\omega}(t) + 51\dot{\omega}(t) + 3243.61\omega(t) = 3992.015V_a(t) \quad (17)$$

Now consider  $x_1 = \omega(t)$  and  $U = V_a(t)$ .

This system is converted into controllable canonical form:

$$\left. \begin{aligned} \dot{x}_1 &= x_2 \\ \dot{x}_2 &= -3243.61x_1 - 51x_2 + 3992.015U + d \\ y &= x_1 \end{aligned} \right\} \quad (18)$$

Where  $d$  is the time varying disturbance.

The error between reference speed and actual speed is given as

$$e(t) = \omega_{ref}(t) - \omega(t) \quad (19)$$

$$\dot{e}(t) = \dot{\omega}_{ref}(t) - \dot{x}_1 \quad (20)$$

$$\ddot{e}(t) + 51\dot{e}(t) + 3243.61e(t) = 3992.015U \quad (21)$$

Now, the sliding surface is defined as,

$$s = ce(t) + \dot{e}(t) \quad (22)$$

$$\dot{s} = c\dot{e}(t) + \ddot{e}(t) \quad (23)$$

$$\dot{s} = 0 \quad (24)$$

The equivalent control law is,

$$U_c = 3243.61e(t) - (c - 51)\dot{e}(t) \quad (25)$$

The total control law is,

$$U = U_c + U_d \quad (26)$$

Where  $U_d = k \text{sign}(s)$ , where  $k$  is a constant.

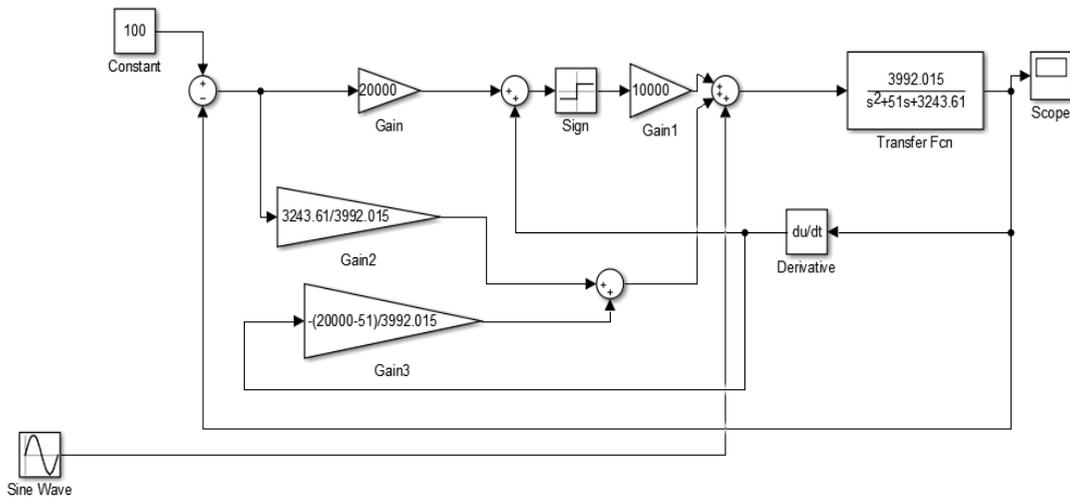
Thus the control law is,

$$U = \frac{1}{3992.015} (3243.61e(t) - (c - 51)\dot{e}(t) + k \text{sign}(s)) \quad (27)$$

#### IV. Simulation Results

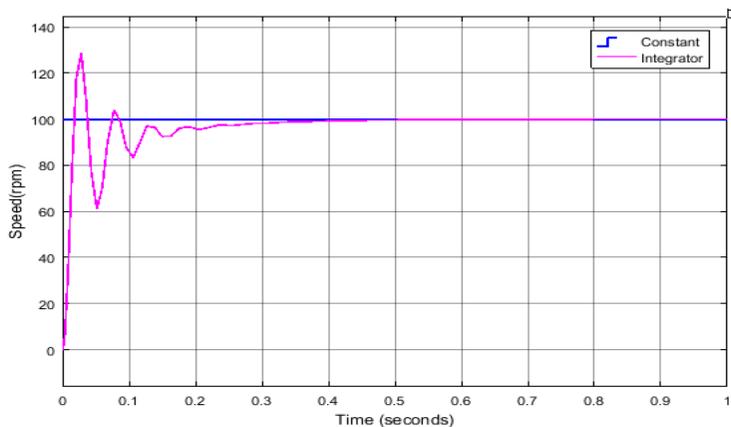
The simulation for DC Motor was done according to the Control structure defined earlier. The simulation was done in Simulink using the parameters given in table 1. To prove the robustness of this simulation, we

compared it with simulation for control of system using PID controller. Manual-tuning in Simulink was used to find the gain values for PID controller. A disturbance of  $d=10\sin(t)$  was added to SMC to check the disturbance rejection.

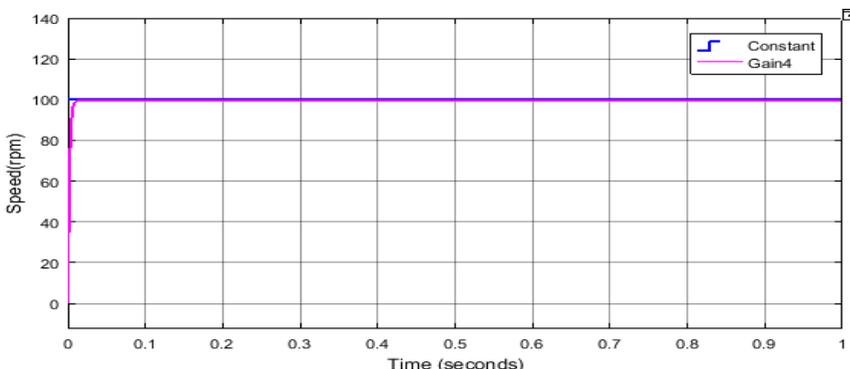


**Fig.2:** Simulink Model of SMC Control of DC Motor

Figure 2 shows the Simulink Model of SMC Control of DC Motor which is designed using the control law given in equation (34). The DC motor is represented by its transfer function given by equation (15).



**Fig.3:** Output waveform of PID Control of DC Motor



**Fig.4:** Output waveform of SMC Control of DC Motor

From figure 3 and 4 it is clear that the output of PID controller has peak overshoot, oscillations and longer settling time over SMC controller. The comparison of PID and SMC controllers are shown in table 4.1.

Table 4.1 comparison

	PID	SMC
Peak Overshoot(%)	0.286	0
Rise time(s)	0.025	0.006
Settling time(s)	0.4	0.01
Steady state error(s)	0.7	0.5

## V. Conclusion

In this paper PID controller and SMC are applied for the speed control of DC motor. The PID controller is very simple to design and very easy to implement and also gives moderate performance under undisturbed conditions. Performance of both controllers are evaluated it is observed that performance of Sliding Mode controller is better over PID controller when settling time, peak overshoot, and steady state error are considered. It would be possible to get better performance of PID controller by increasing proportional and integral coefficients but it will be a problem in real time implementation of PID controller for changes in the parameters of plant. Also Sliding Mode controller has less influence to external disturbances and more robust.

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# Opportunities of Fourth Industrial revolution: Smart Water to Sustainable Water Management

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**ABSTRACT:** The fourth industrial revolution or "Industry 4.0" is profoundly different from the other past industrial revolutions because this technology is the fusion of the technologies and their interaction across physical, digital and biological domains where virtual systems cooperate with each other globally. Some of the new technologies of fourth industrial revolution are artificial intelligence, internet of things, virtual sensors, robotics, advanced computing and virtual sensors. Water sector in India is facing mounting crisis due to rapid industrialization, urbanization and rising demand. The low efficiency in delivery of freshwater is widespread be it irrigation or public water supply in urban and rural areas. The water governance is in crisis leading to unsustainable water management across India which only requires infusion of technologies to make a turn around. This paper looks for areas and opportunities in water sector where the benefits of technology derived out of fourth industrial revolutions are utilized for improving water management sustainably.

## 1. Introduction

The first industrial revolution occurred during the period between 1760 and 1840 with the invention of steam engine and railroads (Klaus Schwab, 2017). The second industrial revolution with mass production of goods began in late 19th century and early 20th century with the invention of electricity. The advent of digital technology of late 20th century that encompasses advent of computers, programming, semi-conductors and transistors is termed as the third industrial revolution.

The fourth industrial revolution or "Industry 4.0" was coined at Hannover Fair in 2011 in Germany is profoundly different from the other three revolutions because it is the fusion of the technologies and their interaction across physical, digital and biological domains where virtual systems cooperate with each other globally (Klaus Schwab, 2017). Table 1 shows the technologies that can potentially interact across physical, digital and biological domains. Some of those technologies are virtual sensors, artificial intelligence (AI), robotics, internet of things (IoT) etc., which have potential applications across various sectors.

The development of enabling technologies such as semiconductor electronics, communications, sensors, smart phones, embedded systems, cloud networking, network virtualization and software in 20th century and early 21st century now allow physical devices to operate in changing environments & be connected all the time everywhere (Patel, 2016). According to Rouse (2019), artificial intelligence, virtual sensors, robotics which are part and intertwined with Internet of Things (IoT) covers "Smart" environments/spaces in domains such as, transportation, buildings, city, lifestyle, retail, agriculture, industry, supply chain, emergency, healthcare, culture and tourism, environment and energy. Fig 1 shows the IoT architecture.

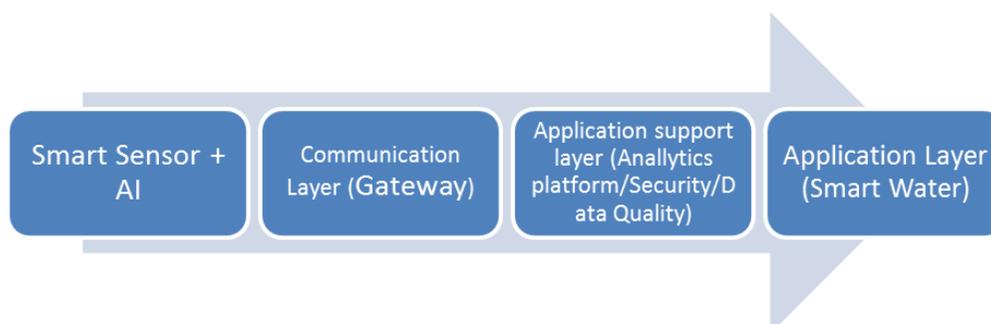


Fig 1 Architecture of Internet of Things (IoT) Source: Patel (2016)

According to Morgan (2014), the IoT is a giant network of connected "things" (which also includes people). It is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people

that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction (Rouse, 2019). The relationship will be between people-people, people-things, and things-things (Morgan, 2014).

Table 1 Components of fourth industrial revolution

Sl No	Fourth Industrial Revolution technology applications
1.	The internet of Things (IoT)
2.	Advance materials
3.	Advanced sensor platforms
4.	Artificial intelligence
5.	Bio-technologies
6.	Drones and autonomous vehicles
7.	Robotics
8.	Virtual, augmented and mixed realities
9.	New computing technologies

## 2. How does fourth industrial revolution benefit water sector?

Hydrological processes occur as a non-linear process in the nature (Tayfur, 2017). Studies have shown that the artificial intelligence in modeling approaches give close results to the real data as solution to linear, non-linear, and other systems when algorithms and parameters of AI are formed appropriately. The Internet of things (IOT) being a network of physical objects has evolved into a network of devices of all type and sizes, vehicles, smart phones, home appliances, cameras, instruments and industrial systems, animals, people, buildings, all connected, all communicating & sharing information based on stipulated protocols so as to achieve smart reorganizations, positioning, tracing, safe, control, personal real time online monitoring (Patel, 2016). AI methods have been successfully used to predict sediment in width section of a river, evaporation and evapotranspiration, rainfall-runoff, stream flow, water quality variables and modeling of dam or lake water levels. Amongst AI, the artificial neural network (ANN), fuzzy based models and their hybrids are widely utilized for prediction of water variables such as rainfall-runoff, evapotranspiration, stream flow, sediment, dam or lake or river water levels and water quality parameters (Ay and Özyıldırım, 2018). The ANN is a mathematical model based on features of human brain and nervous system that stores and deals with information. It has an ability to capture a relationship from giving patterns, and hence is suitable for application in the solution of complex problems, such as classification, non-linear modeling, forecasting, fitting, control and identification (Tang et al, 2010). The sensors have the capacity to take measurements such as temperature, air quality, speed, humidity, pressure, flow, movement and electricity etc. AI is used as an intermediate control element, for example in the design of the valve system of the reservoir of the dam, the flow and precipitation forecasts for flood analysis, the design of the irrigation systems (Ay and Özyıldırım, 2018). Therefore, a combination of fourth industrial revolution technologies like internet of things, virtual sensors, robotics, artificial intelligence etc., offers considerable scope for creating “Smart Water” systems for efficient and sustainable water management (Fig 2). The probable applications in water sector can be visualized in irrigation systems, water distribution systems, monitoring water quality, hydrological and meteorological data collection, and disaster management.

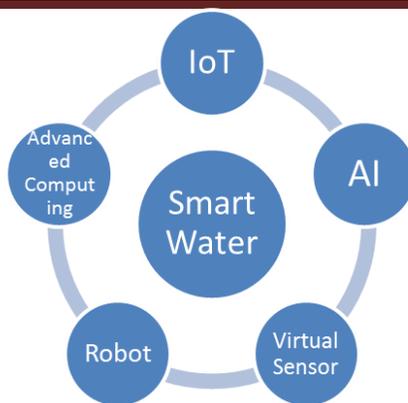


Fig 1 Creation of “Smart Water” by fourth industrial revolution

### 3. What is sustainable water management?

Brundtland Report defines sustainable development as, “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987). And American Society of Civil Engineers, (2019) defines sustainability as, “a set of economic, environmental and social in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality or the availability of economic, environmental and social resources”.

Therefore, in accordance with Brundtland Report and American Society of Civil Engineers (ASCE), sustainable water management can be defined as the management of water resources with a set of economic, environment and social set of objectives in such a manner that it meets the needs and improve the quality of life of present generations without degradation of the resources and compromising the needs and quality of life of future generations.

India’s national water policy (2012) too outlines sustainable development as the basis of future water management in the country. According to national water policy (2012), “Water needs to be managed as a common pool community resource held, by the state, under public trust doctrine to achieve food security, support livelihood, and ensure equitable and sustainable development for all.”

### 4. The water crisis: Limitation of existing technology

The world is facing severe water crisis. And India is not far behind. With an estimated population of 1.4 billion by 2024, India’s per capita water availability will decline to 1335 m<sup>3</sup>/capita from a high of 5191 m<sup>3</sup>/capita in 1951 (Central Water Commission, 2018; Population data: Census of India, 2011). The per capita availability of fresh water is now dangerously close to Falkenmark criteria of water stress i.e. 1000 m<sup>3</sup>/capita. Despite such a looming water crisis coupled with variability’s of rainfall due to climate change, India’s water management has been a complete let down. According to erstwhile Planning Commission (2009), the water use efficiency of Indian irrigation stands precariously at 35 % - 40 %. The efficiency of public water utilities that supply domestic water in urban and rural areas stands at 60 % and 70 % respectively (Central Water Commission, 2014). Ground water continues to be overexploited, whereas the water bodies and streams across urban and rural areas run as toxic streams. There seems no control on the water quality in water bodies. Thus, the manual and/or analog methods of water management in India have been drawback that has only manifested in increasing the contribution towards the unsustainable water management. Poor water governance has enhanced the water mismanagement in India leading to poor disaster preparedness.

### 5. Scenario of implementation of fourth industrial revolution technologies across the world

Fourth industrial revolution technologies such as artificial intelligence, internet of things, advanced sensors, drones, advanced computing techniques and robotics are already finding its applications in water sector across the world. The areas of application include finding water quality, ground water level prediction, rainfall-runoff modeling etc. In Turkey, artificial neural network (ANN) has been used to analyze nitrate content in the ground water wells with the help of parameters such as temperature, electrical conductivity, and Ph levels of groundwater as vectors for ANN (Adibhatla, 2018). In Singapore, determination of coastal

water quality using back propagation algorithm of ANN and virtual sensors has been attempted using parameters such as pH, salinity, temperature, dissolved oxygen which are real data available at nearby sites. Similarly, benefits of artificial intelligence have been adopted in Texas, USA to forecast groundwater level. In Utah, USA, stream flow prediction has been attempted using the latest technology. Sanction driven Iran also has developed ANN model for rainfall-runoff (Adibhatla, 2018)

Though there are some attempts of adopting artificial intelligence in India, for example, finding water quality of Gomti river in India, the overall adoption of technologies in its highly inefficient water sector is dismal. Therefore, Indian water sector which is facing mounting water crisis right from demand to poor water governance must derive the benefits out of the technologies of fourth industrial revolution for sustainable water management.

## **6. Opportunities of fourth industrial revolution technologies in India's water sector**

### **6.1 Improving Irrigation efficiency**

India's irrigation network at present consists of both open channels and piped network. The main canal takes off from the reservoir or rivers and possesses highest discharge capacity. From the main canal, branch or distributaries take off. They generally possess with less discharge capacity. The water from branch/distributaries is taken to fields or farms through field irrigation channels or pipes. The present status of operation of canal network is largely manual, where representatives of canal network section operates the sluice gates manually i.e. opening during release of water into canals and closing after sufficient water is let into the fields and farms. Indian irrigation system suffers from lack of proper operation and maintenance, incomplete distribution system, non-completion of command area development, changes in cropping pattern and diversion of irrigation land to residential or industry (Planning Commission, 2009). According to Planning Commission (2009), India's irrigation efficiency stands at lowly 35 - 40 %, which means nearly 60 -65 % of water diverted and delivered will not be used in consumptive use. Plate 1 shows the condition of a manually monitored irrigation canal and another canal flowing with water in full.



Plate 1. Irrigation canal in Karnataka

It is here the technologies evolved under fourth industrial revolution come to the rescue of India's irrigation. The technologies such as robotics, artificial intelligence, internet of things (IoT), drones and virtual sensors offers tremendous scope in overcoming the limitations of current level of manual irrigation water management. Wu (2018) has developed a robot called Daisy. This robot travels along with the flow in water pipes to detect and gather data on water leaks. This robot with modifications can help detect the failure of concrete lining and hence the seepage losses in open channel flow. Robots can be deployed both inside the flow as well as outside the flow for monitoring the open channel flow. The artificial intelligence coupled with virtual sensors and internet of things can completely replace the manual operation of sluices and other reservoir gate operations.

Artificial intelligence modeling system developed for managing the water resources, for channel networks works, is based on the database, an ANN sluice gate operation model and a hydrodynamic model. The function of the database, obtained by generalizing past successful sluice gate operation schemes is used to provide learning samples for training the sluice gate operation model. The trained sluice gate operation model is used to provide the sluice gate operation procedures based on the water levels at both the outer and inner rivers, and the hydrodynamic model is used to simulate the flow within the whole channel

network. The robots while detecting the leakage in open channels and pipe flow also possess the capability to communicate instantly due to the internet of robotics that is connected with master control room. The internet of robots with Global Positioning System (GPS) enables it to display the visuals of leakage precisely with the co-ordinates of the location. Thus, the rectification can be undertaken and the efficiency of water delivery can be enhanced. Similarly, with the help of drones and other autonomous vehicles, the damage to the field irrigation channels and hydraulic disconnect can be detected. The modern drones equipped with internet can communicate the visuals of hydraulic disconnect to the master control room so that the remedial measures to restore hydraulic connectivity can be initiated immediately.

Thus fourth industrial revolution technologies possess tremendous scope in improving and automating the entire irrigation water management and hence enable maximum efficiency in the water diverted. As the agriculture is the largest consumer of freshwater, the increase in irrigation water efficiency enables management of water sustainably.

## 6.2 Water Quality: Toxic water bodies

India's economic growth coupled with industrialization, urbanization and population growth has caused immense damage on the quality of water in the rivers, streams, lakes and ponds (Sharma et al, 2016). Today, rivers across urban areas run as toxic streams with unknown consequences on the health and hygiene of the population consuming such polluted surface and ground water resources. According to Das, (2011), about 1.3 billion litres of sewage, 260 million litres of industrial waste, runoff with 6 million tons of fertilizers along with pesticides and solid waste are discharged daily into the river. Efforts to clean Ganga through various Ganga Action Plans since 1980s and Clean Ganga mission since 2014 are underway, but have yielded very little results. The scenario of other rivers and streams, and water bodies across India are no different from that of Ganga. Plate 2 shows the Lake Bellandur in Bengaluru covered with foam due to the discharge of effluents into the lake.

At present, the monitoring of water quality in rivers and water bodies has been largely manual deployed with devices to measure various parameters of water quality. The limitations of the man-power, limit the spatial variation of data collection at different locations across the rivers and water bodies. Sometimes, water quality isn't measured owing to the shortage of man-power. Then, the quality of data depends on the quality of manpower. Further the limitations in treatment of sewage being discharged into the rivers cause poor water quality. Hence, there is considerable scope to improve sewage treatments plants such as membrane technology using artificial intelligence that can analyze the data from various types of flow and pressure sensors leading to better treatment of sewage (World Economic Forum, 2018). Deployment of artificial intelligence and sensors in combination with internet of things will enable communication of water quality to the control stations automatically where the right treatment required for the sewage will be analyzed by artificial intelligence in the servers housing the data. The internet of things such as robots, virtual sensors and physical sensors can completely replace the manpower thus transforming sewage water into "Smart Water". The fourth industrial revolution saves considerable manpower expenses. The technology of virtual sensors can compute the water quality virtually at any location equivalent to the physical sensors where setting up of sites or physical sensors is restricted owing to terrain inaccessibility thus saving considerable capital costs. The deployment of robots overcomes the deficiencies of human monitoring of the water quality at sites or in control room. Thus, it is high time, fourth industrial revolution technologies are to be deployed for cleaning Ganga and other rivers, water bodies across India. The treatment of waste water and reuse of the same due to the use of better technology saves water considerably leading to sustainable water management.



Plate 2: Lake Bellandur in Bengaluru

### 6.3 Water supply and sanitation

The technologies of fourth industrial revolution can be used to increase efficiency of the water supply in rural and urban areas. In India, the efficiency of water supply through piped water distribution in rural and urban areas is about 70 % and 60 % respectively (Central Water Commission, 2014), which means nearly 40 % of precious potable water resources get wasted (Plate 3). In Saudi Arabia, the most expensive water market in the world, up to 30 percent of the country's water is lost due to leaks and maintenance issues (Sprinkle, 2018). The technology such as robotics, Internet of Things and virtual sensors can help reduce the water losses in the public distribution system and increase their efficiency.



Plate 3: Leaking water pipes

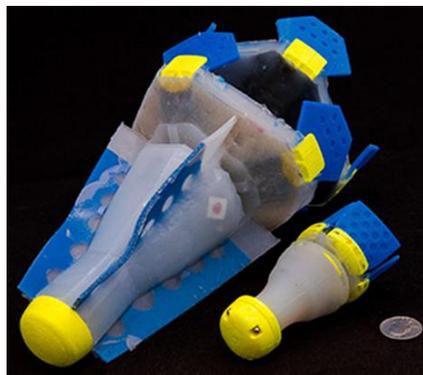


Plate 4: Leak detecting Robot developed by WatchTower (Source: Sprinkle, 2018)

WatchTower Robotics through a scientist You Wu has built a robotic device called 'Daisy' that can travel through water pipes and "feel" for leaks, notifying authorities so that they can fix it immediately (Sprinkle, 2018). The robot shown in Plate 4 is conical and built with a series of small "wings" on all sides. Sensors are attached to these wings. When the robot is deployed in the pipe, it travels through the pipe and whenever a leakage is detected the wings pull in the direction of a leak due to the force of the water leaving the pipe. The robot's internal tracking mechanism then geo-tags the location and stores it for later analysis. According to Sprinkle (2018), traditional GPS technology doesn't work since most water pipes are underground, but upon the tracking this robot using the sensors, a leak down to an area can be pinpointed for every 500 feet of travel.

#### 6.4 Hydrological-meteorological observation and flood forecasting (Overcoming data scarcity)

Hydrological observation constitutes measurement of water level of a river or tributary, measurement of discharge of a river, stream or rivulet, measure water quality and sediment content. The meteorological observation involves measurement of the quantity of rainfall, temperature, humidity, wind speed etc. The meteorological data currently is collected with the help of physical sensors and devices installed at a particular site. The current practices of hydrological observation involves setting up of suitable sites with installation of gauge posts for measuring the water level or manually measure the river bed level using digital echo sounders; use current meters or Acoustic Doppler Current Profiler (ADCP) for discharge measurements and collect water samples for measuring water quality and sediment measurement.

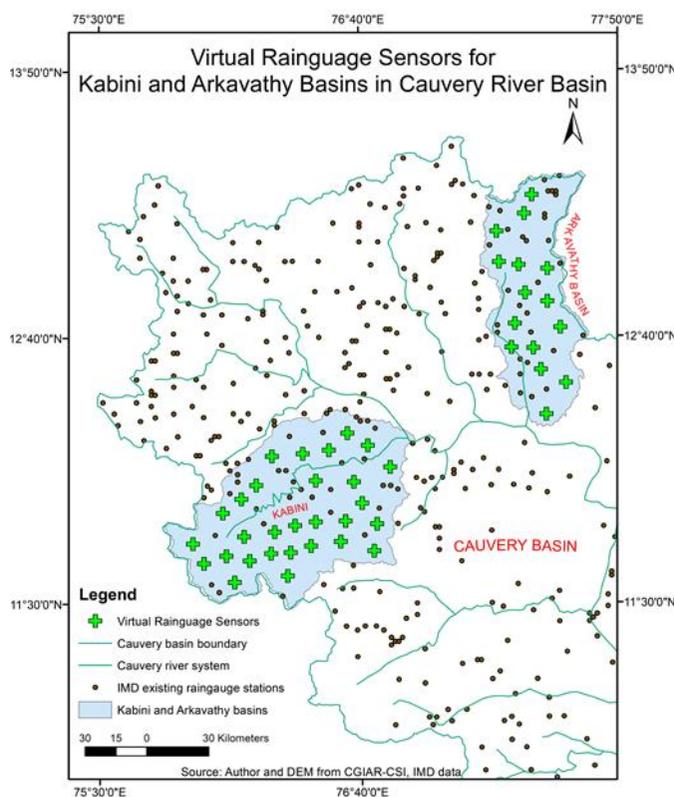


Plate 5: Physical meteorological sites and virtual meteorological sites set up in Kabini and Arkavathy basin with the help of virtual sensors (Green colored plus symbol represent virtual sites)

The setting up of hydrological-meteorological observation site involves considerable cost that includes instrument cost, maintenance cost and cost for maintaining man-power. Setting up of hydrological observation site involves terrain limitations as the river path flows through mountains, forests and undulating terrain. Therefore, hydrological observations sites cannot be set up at all places and at all time. The fourth industrial revolution technologies find its applications here and revolutionize the way the hydrological-meteorological data is collected across the different parts of the country in 21st century.

In India, there are about 878 hydrological observation and 199 flood forecasting sites (Central Water Commission, 2017). Not every stretch of a river is covered under these 878 hydrological and 199 flood forecasting sites. Plate 6 shows the network of hydrological observation and flood forecasting sites in India (India WRIS). From the figure it is clear that several stretches of a river is devoid of any site as it is not feasible to set up and monitor the hydrological parameter at stretches such as forests, hilly terrain etc. This causes limitations in hydrological observation and flood forecasting at several locations of a river. For example: Cauvery river runs through dense forests and it is not feasible to set up man-power and instruments in a jungle. The yellow star spot in Plate 6 shows location of physical sensors of hydrological observations sites.

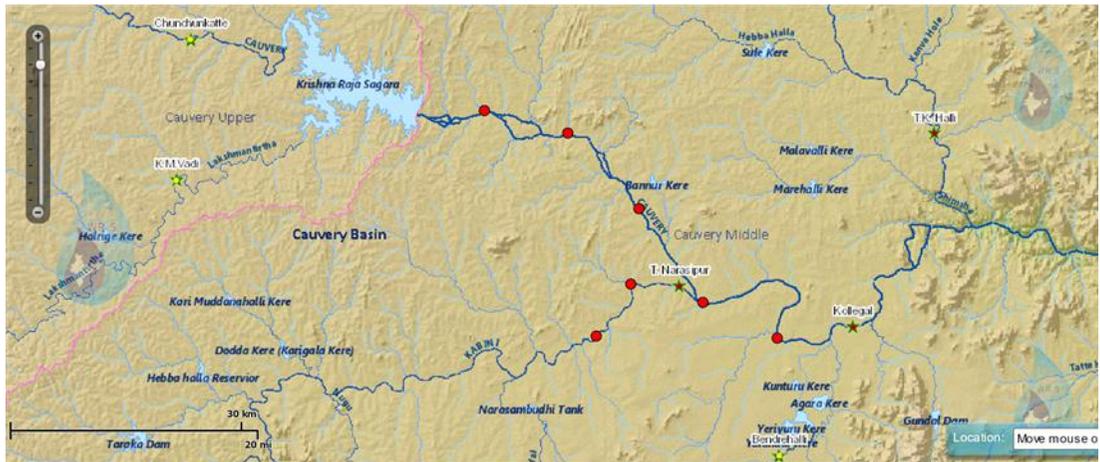


Plate 6: Limited number of hydrological observation sites and virtual hydrological observations sites set up using virtual sensors (shown in red dots) Source: India WRIS and Author

So, the limitations of data collection can be overcome by setting up combination of components of fourth industrial revolution such as virtual sensors, robotics, drones and Internet of Things for both hydrological observation and flood forecasting. Virtual sensors can be set up across many locations of a river based on the data input of physical sensors set up at existing sites. Plate 6 shows the application of virtual sensors across several locations of a river at stretches even in difficult terrain for collecting data related to hydrology of a river and flood forecasting that could offset the limitations of higher cost of setting up of physical sites and man-power in those stretches. The setting up of virtual sensors reduces the risk of damage to the physical sites (if set up at the same locations as virtual sensor). The AI deployed within virtual sensors learns from the data collected at two different physical sites and in accordance with the pattern, it validates the data and collects hydrological observation and flood data from virtual sites of a river or stream. Due to the deployment of components of fourth industrial revolution, new data from hitherto inaccessible stretches of a river or stream can be generated and the same used for the advancement of science of water management in India. The artificial intelligence modeling system can be applied to a flood risk control operation in the channel network. Dam rule curves will be applied automatically that will enable control on outflow depending on the inflow data supplied by sensors. Therefore, the scope of inundation downstream of dams will be reduced or managed more scientifically and efficiently than the manual methods currently being followed.

## 6.5 Conclusion

Indian water management has to quickly adopt the technology derived out of fourth industrial revolution against the backdrop of mounting water stress and poor water governance. Fourth industrial revolution has the potential to transform the way India's water is managed. Water will be transformed into "Smart Water", channels will be transformed into "Smart Channels" and pipes will be transformed into "Smart pipes", all of which communicate each other and with people for better water management. To enable fourth industrial revolution in water sector, Patel (2016) has pointed that there need Local Area Network (LAN) such as Ethernet and Wi-Fi connections or Personal Area Network (PAN) such as ZigBee, Bluetooth and Ultra Wideband (UWB). These networks can be in the form of a private, public or hybrid models which are built to

support the communication requirements for latency, bandwidth or security. So, in order to take advantage of the developments in fourth industrial technologies, India has to urgently put in the electronic infrastructure requisite for latest technologies across all of the water infrastructure be it irrigation canal network or public water supply or water quality and hydro-meteorological data collection or flood forecasting or disaster management. Capacity building and skill development needs to be imparted for the work force that deploy such technologies such as artificial intelligence, virtual sensors, internet of things, robotics etc., across water infrastructures. Sufficient investment has to be made on the electronic infrastructure to overcome the security and privacy issues so as to reap the benefits of the latest technologies. With the electronic infrastructure in place, India's water management will truly leap into domain of fourth industrial revolution from the present domain of third or even second industrial revolution. With the implementation of technologies of fourth industrial revolution, India's water management will set for profound transformation leading to "Smart Water" management leading to greater efficiency in water delivery, greater reuse of waste water, reduction in pollution of water bodies, better disaster preparedness due to large amount of data and therefore enable water management true to the tenets of Bruntland Report, ASCE and various National Water Policies.

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# Rainfall-Runoff relationship for Hulimavu Watershed

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**ABSTRACT:** *Urban catchments becoming more impervious, leads to decreased potential for infiltration, and loss of natural depression storage changing the response to runoff due to rainfall. The study area is Hulimavu Lake situated in the south east part of Bengaluru of Pennar River Basin, Bellandur / Varthur Series and Madivala sub series at an average elevation of 922 m above MSL spread out in area of about 0.566 km<sup>2</sup>. The catchment area of 11.11 km<sup>2</sup> is located between Latitudes 12°50'00" N and 12°52'45" N and Longitudes 77°34'30" E and 77°37'00" E. The lake area is being encroached for urban activities, decreasing the surcharge storage capacity thereby inundating downstream areas. Literature review has been carried out pertaining to the study. Study area details have been taken from the SOI Topo map, and data is collected from IMD, KRSAC and NBSSLUP for the work. Runoff is estimated using SCS-CN method. Rainfall-Runoff relationship is developed to know their inter dependence on each other thereby giving a scope for taking up further hydrological studies.*

**Keywords:** *Urban Watershed, Hulimavu Watershed, SCS-CN method, Rainfall-Runoff relationship*

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## 1. Introduction

Increasing urbanization has led to significant changes in the natural systems. These changes include alterations in the hydrologic flow regime as well as shifts in the chemical and biological makeup of storm-water runoff from these developing areas. As an area is developed, the natural ability of the catchment to withstand natural hydrologic variability is removed. Infiltration capacity is decreased due to the increase in impervious surface and disrupted native soils and vegetation. Natural retention and detention capabilities of a catchment are removed through channelization of natural waterways and the installation of formal drainage systems such as pipes and gutters (Kulkarni and Ramachandra, 2006).

An urban or urbanizing watershed is one in which impervious surfaces cover or will soon cover a considerable area. Impervious surfaces include roads, sidewalks, parking lots, and buildings. Natural flow paths in the watershed may be replaced or supplemented by paved gutters, storm sewers, or other elements of artificial drainage. Hydrologic studies to determine runoff and peak discharge should ideally be based on long-term stationary stream flow records for the area. Such records are seldom available for small drainage areas. Even where they are available, accurate statistical analysis of them is usually impossible because of the conversion of land to urban uses during the period of record.

It therefore is necessary to estimate peak discharges with hydrologic models based on measurable watershed characteristics. Only through an understanding of these characteristics and experience in using these models can we make sound judgments on how to alter model parameters to reflect changing watershed conditions. Urbanization changes a watershed's response to precipitation. The most common effects are reduced infiltration and decreased travel time, which significantly increase peak discharges and runoff. Runoff is determined primarily by the amount of precipitation and by infiltration characteristics related to soil type, soil moisture, antecedent rainfall, cover type, impervious surfaces, and surface retention. Rainfall is converted to runoff by using a runoff curve number (CN). CN is based on soils, plant cover, amount of impervious areas, interception, and surface storage. Runoff can then be transformed into a hydrograph by using unit hydrograph theory and routing procedures that depend on runoff travel time through segments of the watershed.

## II. Literature Review

With the purpose of creating a comprehensive and consistent database of past and present studies, a literature review of factors affecting climatic changes, mitigation and adaptation practices was undertaken by keyword searches on the major databases of abstracts, and by tracking citations to earlier and related studies. The database is drawn from several publications and reports.

The SCS curve number method is a simple, widely used, and efficient method for determining the approximate amount of runoff depth from a rainfall event in a particular area. For drainage basins, where no runoff has been measured, the curve number method can be used to estimate the depth of direct runoff from a measured rainfall amount over the study area. The Soil Conservation Service Curve Number (SCS-CN) method was originally developed by the Soil Conservation Service (US Department of Agriculture) to predict direct runoff volumes for given rainfall events and for the management of water resource in the United States for agricultural development and it is documented in the National Engineering Handbook, Sect. 4: Hydrology (NEH-4) (SCS, 1956, 1964, 1971, 1985, 1993, 2004). The SCS-CN method was soon adopted for various regions, land uses and climate conditions (Elhakeem and Papanicolaou, 2009; King and Balogh, 2008; Mishra and Singh, 1999; Romero et al., 2007).

Samah Al-Jabari et al. (2009) have used SCS method with GIS to estimate the runoff from Wadi Su'd watershed as a case study for agricultural watershed. The Wadi is located in Dura area of the Hebron District-West Bank. The rainfall and land use data were used along with the experimental data of soil classification and infiltration rate for the estimation of the runoff for the study area.

### III. Study Area

The study area is Hulimavu Lake (Fig 1) situated in the south east part of Bengaluru of Pennar River Basin, Bellandur/Varthur Series and Madivala sub mSeries at an average elevation of 922 m above MSL spread out in area of about 0.566 km<sup>2</sup>. The catchment area of 11.11 km<sup>2</sup> is located between Latitudes 12°50'00" N and 12°52'45" N and Longitudes 77°34'30" E and 77°37'00" E. The lake area is being encroached for urban activities, decreasing the surcharge storage capacity thereby inundating downstream areas. Since the catchment is urbanized, the time to peak decreases, increasing the peak discharge (Sumaiyah et al, 2015).

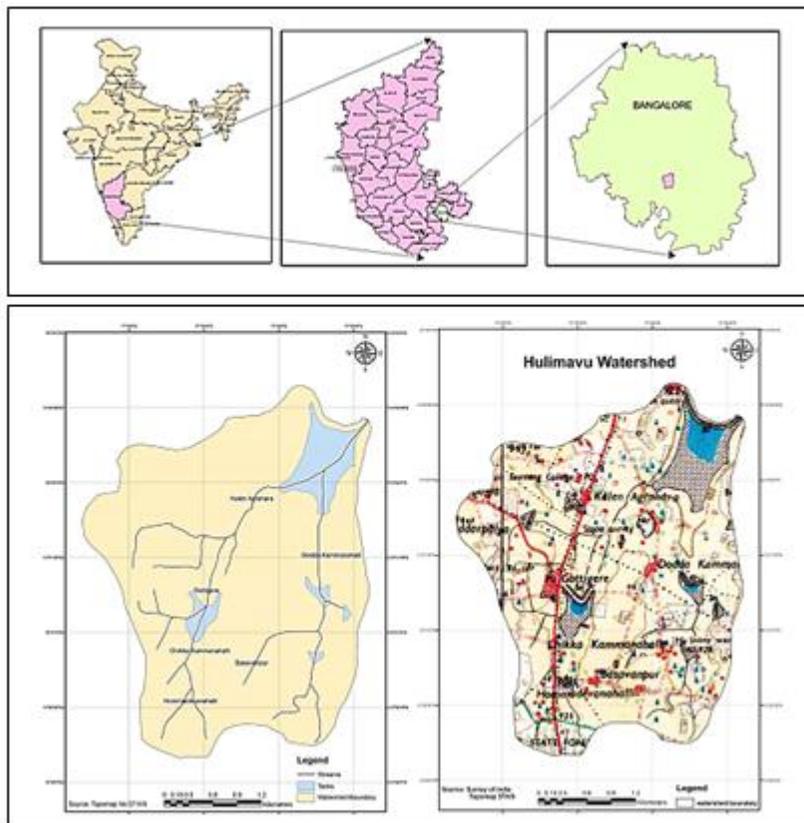


Fig. 1: Location map of the study area (Source: SOI Topomap 57H/9)

In the past, this rain-fed water body was used as a storage pond primarily for agricultural purpose, fishing, drinking water source, etc., Rapid urbanization and change in the land use pattern in the surrounding vicinity has stressed the existing infrastructure facilities which has aggravated due to improper maintenance

and lack of awareness. To meet the increasing demand, the lake area is being encroached by public and the service providers for urban activities. Raw sewage is getting mixed with rainwater and finding its way into the lake, polluting the groundwater. In addition, unhygienic activities are seen at several places on the foreshore of the lake and dumping of solid wastes into the lake.

Change in land use pattern in the catchment area, modification in the original alignment and blockages in the inlet channels have reduced the runoff into the lake. This runoff gets diverted resulting in bringing raw sewage from un-sewered area. During peak monsoon, the water surcharges into low-lying residential areas.

#### IV. Data Analysis

The daily 24 hour rainfall data for the years 1994 to 2011 was collected from IMD for Jigani station, as the study area falls under this station, the location of which is shown in Fig 2.

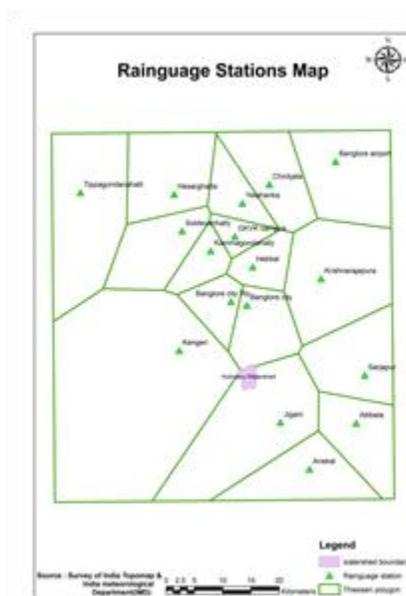


Fig. 2. Location of Jigani station

#### A. Land Use and Land Cover Classification

Knowledge of land use and land cover is important for any planning and management activities and is considered as an essential element for modeling and understanding the earth as a system. The term land use refers to the human activities associated with a piece of land for e.g., cultivation, urbanization, etc. The term land cover refers to the features presents on the earth surface for e.g., natural vegetation, water bodies, rock, soils, etc. Since both land use/land cover are closely related and are not mutually exclusive they are inter changeable as the former can be inferred based on the land cover and on the contextual evidence (Lilles, et al.,2004).

Table I. LU/LC Classification

Sl No	Land use/Land cover	Area(km <sup>2</sup> )	% Area
1	Agricultural Plantation	0.52	4.69
2	Kharif + Rabi (Double Crop)	0.63	5.64
3	Kharif crop	2.99	26.97
4	Lake / Tanks	0.65	5.89
5	Land with scrub	0.04	0.38
6	Mining / Industrial Wasteland	0.25	2.30
7	Scrub Forest	0.36	3.24
8	Town / Cities	5.61	50.58
9	Village	0.04	0.32

Sl No	Land use/Land cover	Area(km <sup>2</sup> )	% Area
	Total	11.11	100

Table I shows the spatial distribution of land use/ land cover classification and Fig 3 shows the land use/ land cover map of the study area.

### B. Soil Classification

Among the natural resources, soil resources play significant role in development of both agricultural and non-agricultural sectors. Information on types of soils, their limitations and capabilities are needed to be evaluated for their suitability to different crops for optimum land use planning. Soil survey provides such information in the form of soil maps and attributes information in terms of physical, chemical and morphological properties. Though the traditional surveys provide such information, they have limitations like cost, high labor intensity and time. The development of modern technology enables to obtain the information on natural resources in time and cost effective manner.

Soil categories found in the study area consists of negligible amount of Gravelly Sandy Loam, Sandy Clay Loam, and Sandy Loam. Loamy and sandy soils generally occur on hilly to undulating land slope on granite and gneissic terrain. The soils are light textured and are highly leached in nature with good infiltration rate. For the present study, soil map prepared by the National Bureau of Soil Survey and Land Use Planning (NBSS and LUP), Bangalore on 1:250,000 scale and Karnataka State Remote Sensing Application Centre (KSRSAC), Bangalore on 1:50,000 are used. The maps have been geo-referenced with respect to the major towns, and projected, relevant soil classes pertaining to the catchment area have been digitized. Boundaries of different soil textures were digitized in ArcGIS and the polygons representing soil classes were assigned different colours for reorganization of hydrologic soil groups. The soils of the study area are classified into four Hydrologic Soil Groups based on their minimum infiltration rate (SCS, 1972).

Fig 3 shows the soil map of study area. Table II shows the spatial distribution of soil series of the study area.

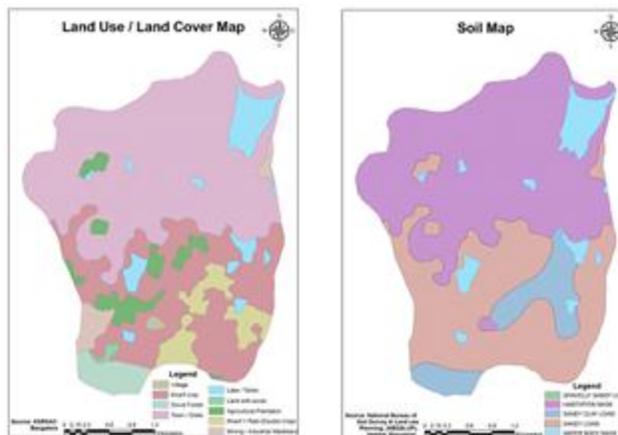


Fig. 3. LU/LC and Soil Map

Table II. Soil Classification

Sl No	Soil Classification	Area(km <sup>2</sup> )	% Area
1	Gravelly Sandy Loam	0.00	0.00
2	Habitation Mask	5.65	50.90
3	Sandy Clay Loam	0.99	8.89
4	Sandy Loam	3.83	34.51
5	Water body Mask	0.63	5.71
	Total	11.11	100.00

### C. Estimation of Surface Runoff

By using the data of soil classification and infiltration rates, Hulimavu watershed was classified into four hydrological soil groups: Group D with infiltration rate (0-1) mm/hr, Group C (1-4) mm/hr and Group B (4-8) mm/hr based on grade condition of the soil (poorly or well graded). This logical condition is applied in ArcGIS.10, and the hydrologic soil group classification are given in Table III and displayed in Figure 4.

Table III. HSG Classification

Sl No	HSG Classification	Area(km <sup>2</sup> )	% Area
1	B	4.11	37.07
2	C	6.35	57.22
3	D	0.63	5.71
Total		11.11	100.00

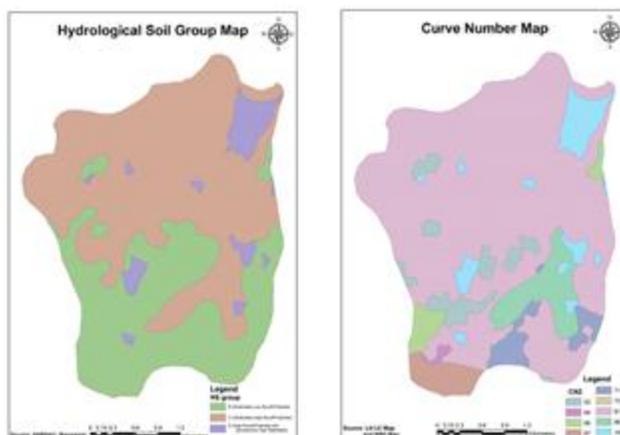


Fig. 4. HSG and Curve Number map

To create and detect the curve number values for each classified area; the hydrological soil group and the land use and land cover results were used. By applying expression in ArcGIS.10 and evaluating this expression, the curve number can be determined. The values of curve number for each area are presented in Table IV.

Table IV. Values of Curve Number

Land Use	Hydrological Soil Group	CN	Area(km <sup>2</sup> )	% Area
Agricultural Plantation	B	53	0.52	4.69
Kharif + Rabi (Double Crop)	B	71	0.38	3.45
	C	88	0.24	2.20
Kharif Crop	B	81	2.55	23.02
	C	88	0.44	3.95
Lakes/Tanks	C	100	0.02	0.18
	D	100	0.63	5.71
Land with Scrub	B	60	0.04	0.38
Mining/Industrial wasteland	B	66	0.25	2.30
Scrub Forest	B	67	0.36	3.24
	C	73	0.00	0.00
Town/Cities	C	81	5.61	50.58
Village	C	81	0.04	0.32
			<b>11.11</b>	

Based on the data given in Table IV, the composite or the weighted curve number was found by using the following equation, (USDA, 1985):

$$CN = \frac{\sum A_i * CN_i}{\sum A_i}$$

Where,

CN is the composite curve number, Ai is the area for each curve number.

The composite curve number for the study area is:

CN=80.01

The CN is 80.01 as the normal condition (AMCII), CN for the other two condition; the dry condition (AMCI) and the wet condition (AMCIII) were obtained using equations

$$CN_1 = \frac{CN_2}{2.281 - 0.01281CN_2}$$

$$CN_3 = \frac{CN_2}{0.427 + 0.00573CN_2}$$

The values of curve number for the three antecedent moisture conditions are listed in Table V.

Table V. Curve Number for Three Antecedent Moisture Conditions

AMC	<i>I</i>	<i>II</i>	<i>III</i>
CN	63.70	80.01	90.36

To calculate the surface runoff depth, apply the hydrological equations (For Q and S). These equations depend on the value of rainfall (P) and watershed storage (S) which calculated from adjusted curve number. As a result of the calculations based on the SCS-CN method, it was found that the average annual surface runoff rate (depth) for the last 18 years in the study area is equal to 323.84 mm multiplied by the net area of the watershed (which is the area of the watershed minus the tanks area) (A = 10.33 km<sup>2</sup>) gives the total average volume of runoff as 3.35 Mm<sup>3</sup>. The annual rainfall and runoff during (1994-2011) in the study area are shown in Table VI.

Table VI. Average Annual Runoff Depth and Volume of Runoff

Year	<i>Annual Rainfall(mm)</i>	<i>Annual Runoff(mm)</i>	<i>Runoff%</i>	<i>Vol of Runoff (Mm<sup>3</sup>)</i>
1994	627.10	85.70	13.67	0.89
1995	850.50	344.91	40.55	3.56
1996	1003.40	277.70	27.68	2.87
1997	942.80	351.19	37.25	3.63
1998	1387.30	599.61	43.22	6.20
1999	1518.40	<b>657.99</b>	43.33	6.80
2000	1374.00	501.93	36.53	5.19
2001	886.60	364.65	41.13	3.77
2002	669.90	242.33	36.17	2.50
2003	617.80	79.73	12.90	0.82
2004	1111.20	298.30	26.84	3.08
2005	1204.20	409.84	34.03	4.24
2006	471.20	<b>55.58</b>	11.79	0.57
2007	1076.60	307.47	28.56	3.18
2008	1079.80	381.28	35.31	3.94
2009	1196.50	444.96	37.19	4.60
2010	898.80	206.44	22.97	2.13
2011	903.20	219.55	24.31	2.27

Year	Annual Rainfall(mm)	Annual Runoff(mm)	Runoff%	Vol of Runoff (Mm <sup>3</sup> )
Avg	989.96			

Fig 5 and 6 gives the relationship between the rainfall and runoff for the study area.

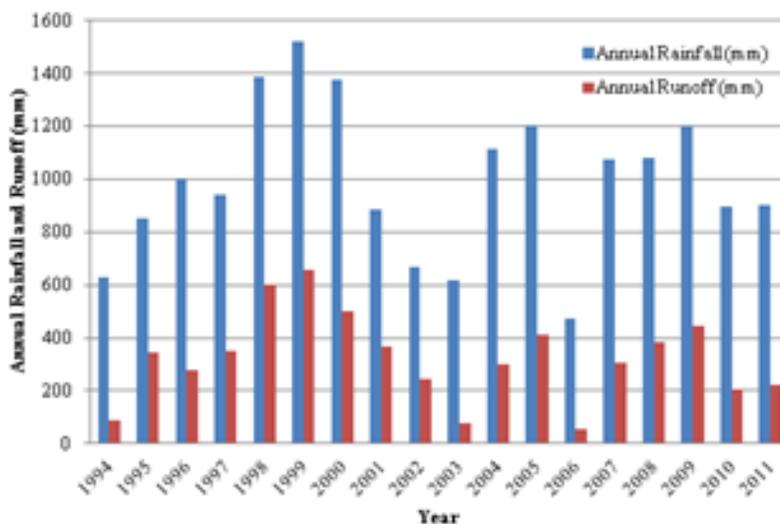


Fig. 5. Annual Rainfall-Runoff V/s Time

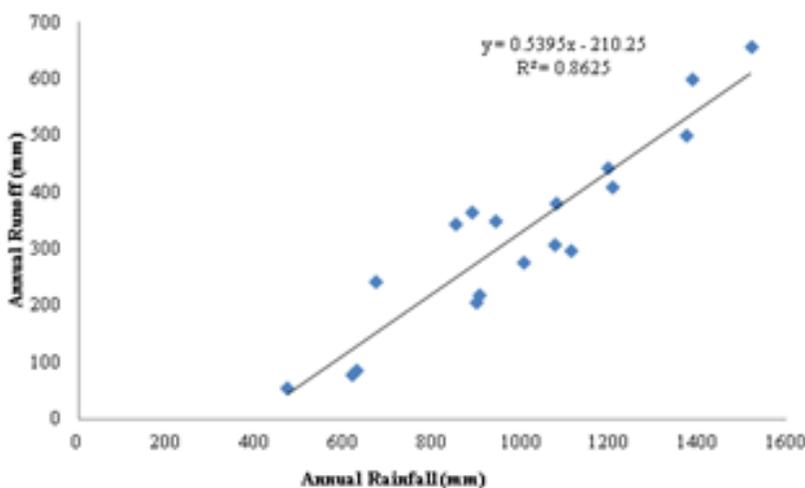


Fig. 6. Annual Runoff V/s Rainfall

### V. Discussions

The Hulimavu Lake is a rain-fed water body which was used as a storage pond primarily for agricultural purposes, fishing, drinking, etc. It has now a densely built-up catchment area on the western and southern sides, quarry area with sparse vegetal cover on the eastern side. Due to rapid urbanization, change in land use pattern, modification in the original alignment of the inlet channels and blockages, the runoff into the lake is getting diverted carrying heavy load of silt, debris, organic sludge and raw sewage from un-sewered areas.

Runoff calculated by SCS-CN method shows that the watershed is characterized by high rainfall, with irregular and erratic rainfall pattern. From the Table VI it is observed that during the year 1999 maximum runoff of 657.99 mm has occurred in the watershed. It was also observed that the minimum runoff of 55.58 mm has occurred in the year 2006 for the watershed. It is also observed that in the year 1995, for a rainfall

of 850.5 mm the runoff generated is 344.91 mm and in the year 1996, for a rainfall of 1003.4 mm the runoff generated is 277.7 mm. This is due to the change in the temporal distribution of rainfall over the catchment. The scope of this study was to derive a relationship between the rainfall and runoff of Hulimavu watershed so that further hydrological studies can be carried out.

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# Design and Fabrication of Foot Step Power Generation by Using Rack and Pinion Arrangement

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**ABSTRACT:** Power is being one of the serious topics to be discussed. There for possible solution for this to provide sufficient amount of power using renewable energy. Among these resources, human population is the only far and away and all weather resource that has not been utilized .we can use proper method required amount of power can be obtain from this resource. We thought the idea to utilize human on foot power to produce electricity and, we designed a method named foot step power generation stage, when people walk on the raised area, electricity is generated in this system, the pressure due to weight of the person walking on the platform and stored using batteries. A 5-level three phase cascaded hybrid multilevel inverter and H-bridge in series with each inverter leg with separate DC voltage sources, 24V and 48V. The control signals for this hybrid multilevel inverter are implemented by a using signal modulated technique and digital technique.

**Keywords:** Renewable energy, Gears, electric power, Inverter, Battery, DC Motor.

## 1. Introduction

Man has required and used energy at an increasing speed for his sustenance and well-being ever since he came on the earth a few million years ago. Ancient man required energy mainly in the form of food. He derived this by eating plants or animals, which he sought. Subsequently he exposed fire and his energy needs increased as he in progress to make use of wood and other bio mass to supply the energy needs for cooking as well as for keeping himself warm.

With further demand for energy, man began to use the wind for marine ships and for driving windmills, and the force of declining water to turn water for marine ships and for driving windmills, and the force of falling water to turn water wheels. Till this time, it would not be wrong to say that the sun was supply all the energy needs of man either directly or indirectly and that man was using only renewable sources of energy.

### 1.1 Working Principle

The complete diagram of the foot step electricity generation is given below. Only one step is inclined in certain small angle which is used to generate the power. The compressive power is converted into electrical energy by proper driving arrangement.

The rack & pinion, spring arrangement is fixed at the apt step. The spring is used to return the inclined step in same position by release the load. The pinion shaft is coupled to the supported by end bearings as shown in fig. The larger sprocket also keyed with the pinion shaft, so that it is running the same speed of pinion. The larger sprocket is keyed to the small cycle sprocket with the help of chain (cycle).

This larger sprocket is used to transform the rotation force to the smaller sprocket. The smaller sprocket is running same path for the forward and turn around direction of rotational movement of the larger sprocket. This action locks like a cycle pedaling action.

The fly wheel and gear is also coupled to the smaller sprocket shaft. The flywheel is used to boost the rpm of the smaller sprocket shaft. The gear wheel is keyed to the generator shaft with the help of a further gear wheel.

The generated voltage is 12Volt D.C. This D.C voltage is store to the Lead-acid 12 Volt battery. The battery is connected to the inverter. This inverter is used to exchange the 12 Volt D.C to the 230 Volt A.C. This working principle is already explain the above chapter. This 230 Volt A.C voltage is used to turn on the light, fan and etc.

By increase the capacity of battery and inverter circuit, the power rating is increased. This arrangement is integral in shopping complex, college and wherever the large people walking on the footsteps at the same time.

## II. Specification of Foot Step Arrangement

### Spur Gear

No. of teeth = 70  
Thickness of Gear = 12mm  
Dia of Gear = 100mm

### Shaft

Length = 550mm  
Dia = 15mm

### Battery

Voltage = 12V DC  
Material = Plastic  
Type = Lead Acid Battery

### Spring

Dia of wire = 3mm  
No of turns = 14  
Pitch = 10mm  
Length = 110mm

### Rack

No of teeth = 32  
Length of rack = 180mm

### Pinion

Dia of pinion = 20mm  
No of teeth = 14  
Pitch = 5mm

## III. Fabrication of Foot Step Arrangement



Fig. 1. Foot step arrangement



Fig. 2. Mechanism

The main components of this project are,

- Foot step arrangement
- Rack and pinion arrangement
- Chain sprocket
- Fly wheel
- D.C generator
- Battery
- Inverter Circuit and
- Light Arrangement

### 3.1 Foot Step Arrangement

This is made up of mild steel. Its arrangement looks like a foot step. The power generation arrangement is made in only one step for demo purpose. In future, we have to implement in the all the steps.

### Block Diagram

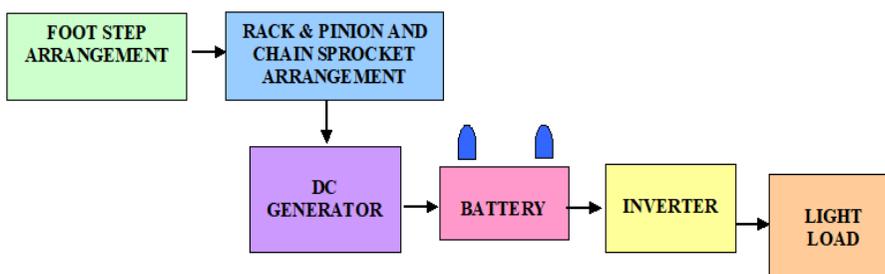


Fig. 3 Block Diagram

### 3.2 Rack and Pinion Arrangement

The rack and pinion attachment gives the rotary motion to the chain sprocket. This block converts linear motion into rotary motion.

- **Pinion:** This is a gear wheel which is provided to get mesh with rack to translate the linear motion into rotary motion. They are made up of Cast iron.
- **Rack:**

Rack teeth are cut horizontally about the required length. This is made up of Cast iron.

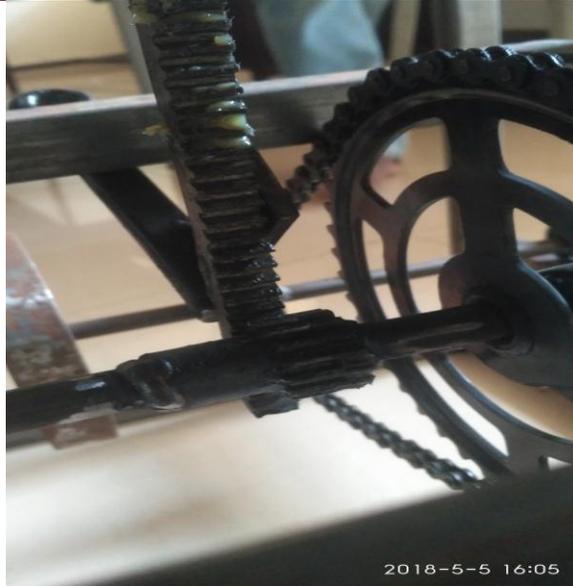


Fig. 5. Rack and Pinion Arrangement

### 3.3 Chain Sprocket

The chain sprocket is coupled with another shaft, which converts rotational power to pulling power, or pulling

power to rotational power, by engaging with the sprocket.

The sprocket look like a gear but differs in three important ways:

1. Sprocket have many engaging teeth.
2. The teeth of a gear touch and slip against each other there is no slippage in a sprocket.
3. The shape of the teeth is different in gears and sprockets.

### 3.4 Types of sprockets



Fig.6 Sprockets

### 3.5 Fly Wheel

Fly wheel is used to increase the rpm of the system. The generator is coupled with this shaft, so that increase the RPM of the generator.

### 3.6 Permanent Magnet D.C. Generator

#### • Voltage Production

1. A magnetic field
2. A conductor
3. Relative motion between the two.

- **Theory of Operation**

A basic DC generator has four basic parts:

- (1) A magnetic field;
- (2) A single conductor, or loop;
- (3) A commutator and
- (4) Brushes

The magnetic field may be supplied by either a permanent magnet or an electromagnet, use a permanent magnet to describe a basic DC generator.

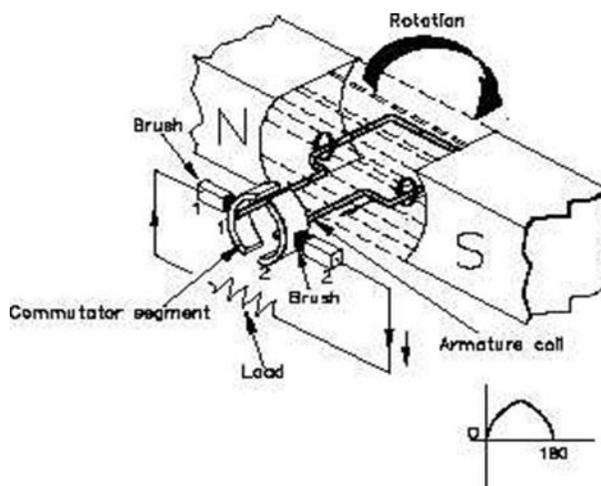


Fig. 7 cross section of DC Generator

Basic Operation of a DC generator, shaped in the form of a loop, is positioned between the magnetic poles. As long as the loop is motionless, the magnetic field has no effect (no relative motion). If rotate the loop, the loop cuts through the magnetic field, and an EMF (voltage) is induced in the loop.

When relative motion between a magnetic field and a conductor the direction of rotation is such that the conductor cuts the lines of flux of an EMF is induced in the conductor. The magnitude of the induced EMF depends on the field of strength and the rate at which the flux lines are cut.

The stronger the field the more flux lines cut for a given period of time, the larger the induced EMF.

$$E_g = KFN$$

Where  $E_g$  = generated voltage

$K$  = fixed constant

$F$  = magnetic flux strength

$N$  = speed in RPM

### 3.8 Battery

In isolated systems away from the grid, the batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated load such as irrigation pumps or drinking water supplies for storage. For small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage. Since both the photo-voltaic system and batteries are high in capital costs.

The lead acid cell is a secondary cell or storage cell, which can be recharged. The charge and discharge can be repeated many times to restore the output voltage. As long as the cell is in good physical condition. However, heat with excessive charge and discharge currents short ends the useful life to about 3 to 5 years for automobile batteries. The different types of secondary cells, in which lead-acid type has the highest output voltage, which allows cells for a specified battery voltage.

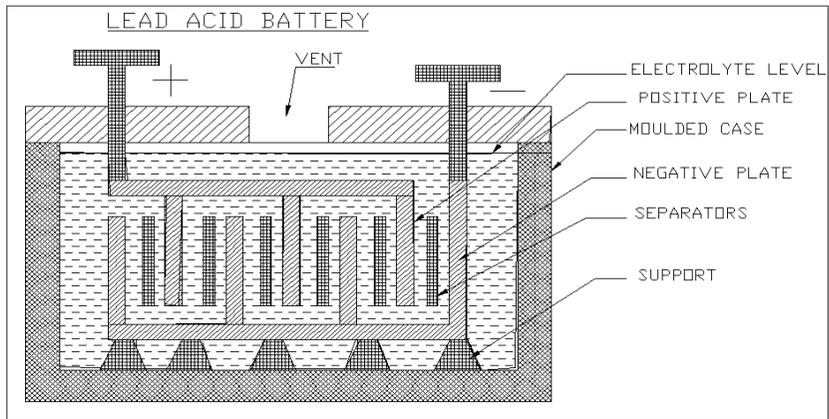


Fig. 8 Parts of Battery.



Fig. 9. Battery used in Foot Generation.

### 3.9 Inverter

The process of converting D.C. into A.C. is known as INVERSION. In other words, it may define it as the reverse process of rectification. The device, which performs this process, is known as an INVERTOR. Inversion is, by no means, a recent process. In olden days gas-filled tubes and vacuum tubes are used to develop inverters. Thyratron inverter is commonly used as a large power device. Vacuum tube inverters are generally used for high-frequency applications.

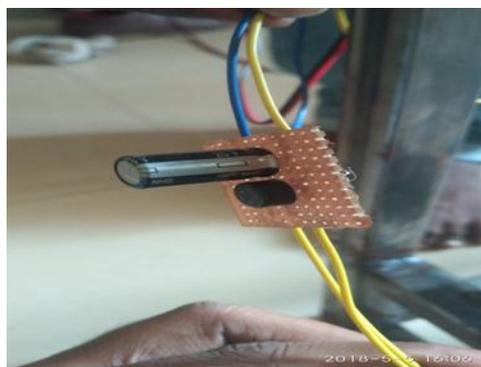


Fig. 10. Inverter

#### **IV. Result**

After the conduction of test for one foot step following result are obtained:

1. 13.6volts & 0.58amps is produced
2. From this power bulb of 7w is lightened

#### **V. Application**

It can be use where steps are available.

1. Hospital
2. Bus stop
3. Parking place
4. School and colleges
5. Temple

#### **VI. Conclusion**

In concluding the words of our project, since the foot step power generation get its energy requirements from the Non renewable source of energy. There is no need of power from mains and there is less pollution in this source of energy. It is very useful to the places like college, railway station, shopping complex etc.

The aim of this arrangement is to introduce another innovative method of green Power generation in order to contribute towards developing the world by enriching it with utilization of available resources in more useful manner.

This arrangement can extend in all the steps so that increase the power production rate.

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## **Tool condition monitoring in metal cutting industry by using indirect methods - A Recent Survey**

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**ABSTRACT:** *Tool condition monitoring is one of important factor we have to keep in observation in advanced manufacturing industries such FMS to know life of the tool based on their wear process. A wide variety of monitoring techniques have been developed for the online detection of tool wear. Direct or offline measurement methods provide very accurate results but are not suitable for the practical applications due to the limitations such as difficulty of accessing, use of cutting fluid, and illumination. The results obtained from indirect or online measurement methods are more suitable for the practical applications. This paper reviews some of the indirect methods which are used for tool condition monitoring during the period of 2010 to 2016.*

**Keywords:** *Flexible Manufacturing System (FMS), Tool condition Monitoring (TCM), Acoustic Emission (AE), Flank wear, signal acquisition and processing*

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### **1. Introduction**

Metal cutting tools are subjected to extremely arduous conditions, high surface loads, and high surface temperatures arise because the chip slides at high speed along the tool rake face while exerting very high normal pressures (and friction force) on this face.

The forces may be fluctuating - due to the presence of hard particles in the component micro-structure, or more extremely, when interrupted cutting is being carried out.

Hence cutting tools need:

Strength at elevated temperatures

High toughness

High wear resistance

High hardness

During the past 100 years there has been extensive research and development which has provided continuous improvement in the capability of cutting tool.

Accurate online tool condition monitoring is important for improving process efficiency, ensuring product quality, and reducing unnecessary tool change costs as well as machine downtime. The ability to disengage the tool prior to catastrophic failure reduces manufacturing costs and excessive machine deterioration. Therefore, tool condition monitoring, especially online tool wear assessment, has been the subject of considerable research

### **II. Tool condition monitoring- Indirect methods**

Direct or offline measurement methods provide very accurate results but are not suitable for the practical applications due to the limitations such as difficulty of accessing, use of cutting fluid, and illumination. The results obtained from indirect or online measurement methods are less accurate than the direct ones but are more suitable for the practical applications.

Indirect methods are based on the measurement of flank wear using calibration procedures. This involves measuring process parameters which are correlated with flank wear such as cutting force, vibration, sound, acoustic emission (AE), temperature, and surface roughness. Fig.1-3 provides the number of publications (during 2010 to 2016) which have measured different process parameters in order to obtain flank wear. Tables 1 in the "Appendix" provide details and year span of those publications.

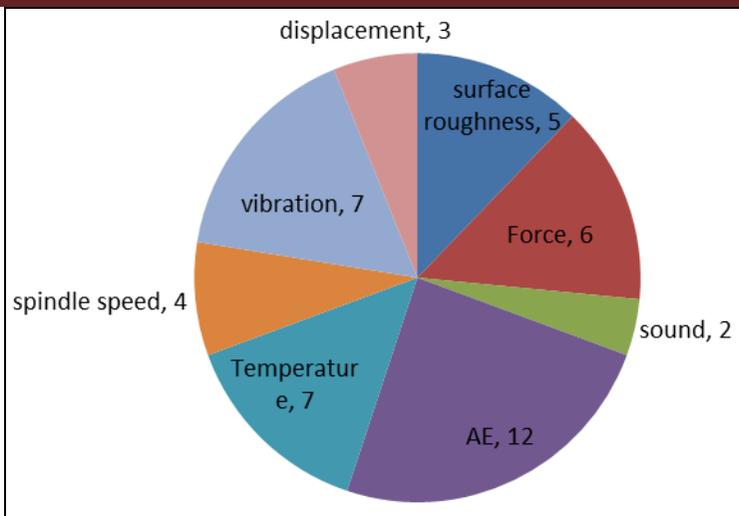


Fig.1 No. of publications featuring indirect measurement approach [1-34]

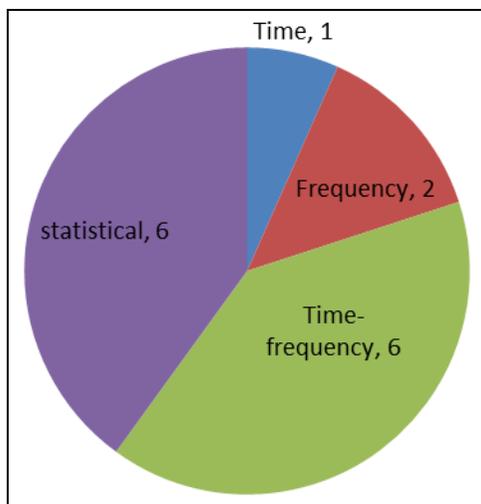


Fig.2 No. of publications featuring Feature domain approach [1-34]

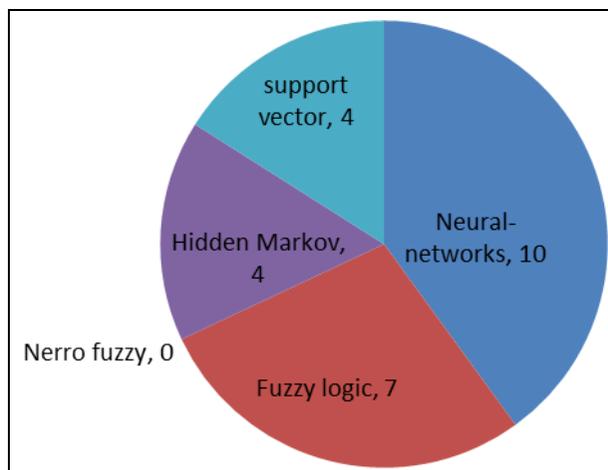


Fig.3 No. of publications featuring classifier approach [1-34]

### ***A. Acoustic Emission***

Acoustic emission can be defined as the transient elastic energy spontaneously released in materials undergoing deformation or fracture or both. The energy contained in an AE signal and the rate at which it is dissipated are strongly dependent on the rate of deformation, the applied stress, and the volume of the participating material. A metal cutting process itself is a very well-known source of AE.

A. Siddhpura et al. [1] reviewed various AE techniques [until 2010] applied for tool wear monitoring and proposed that due to a wide sensor dynamic range, AE can detect most of the phenomena in machining, although significant data acquisition and signal processing is required.

Martín P. Gómez et al. [2] (2010) proposed the correlation between the AE parameters and torque measured during the drilling process. Torque was measured as a control parameter to follow the dynamic behavior of the drill bit. An alternative AE feature, called Mean Power (MP) showed a good correlation with torque when the moving average (MA) was computed. In the second part, the AE mean power (MP) was related to different degrees of wear in drill bits. Clusters for the different levels of wear in a 2-D plot were obtained. In that plot the moving variance of the MP vs. the moving average of the MP, for each case of wear, were represented. The next steps of this work are to add new measurements in different conditions to corroborate the validity of the method, and to include the results obtained from the waveforms study.

Krzysztof Jemielniak et al. [3] (2010) presents a new efficient method of evaluation of relevancy of signal features extracted from the wavelet coefficients of raw AE signal while rough turning of Inconel 625. Wavelet transform of raw acoustic emission signal provides useful signal features, which can be exploited in TCM system.

Karali Patra et al. [4] (2011) described the development of a tool wear monitoring system using AE signals acquired during drilling on mild steel work-piece. Here they are experimented and concluded that drill wear prediction of ANN model based on wavelet packet features is more accurate compared to that based on time domain features for automated drilling process.

Jun-Hong Zhou et al. [5] (2011) are used the acoustic emission from an embedded sensor for computation of features and prediction of tool wear. Their experimental results using AE sensors have shown significant reduction in both MSEs and MREs when a dynamic ARMAX model with the ELS technique is employed, which is promising in replacing force sensors and conventional non dynamic models for effective online TCM and tool wear prediction. The future works include improving the signal-to-noise ratio of the AE signals, as well as their corresponding signal processing and spectral analysis.

Md. Sayem Hossain Bhuiyan et al. [6] (2011) are presents a new technique using acoustic emission (AE) to monitor the tool condition by separating the chip formation frequencies from the rest of the signal which comes mostly from tool wear and plastic deformation of the work material. A dummy tool holder and sensor setup have been designed and integrated with the conventional tool holder system to capture the time-domain chip formation signals independently during turning. The signals from the dummy setup clearly differ from the AE signals of the conventional setup. The AE signal from the dummy setup describes the tool wear, plastic deformation, and chip formation occurrences more clearly and without any ambiguity. The values remaining below the offset of the transient AE signal of the dummy setup presents the plastic deformation and tool wear. The offset signal shows the chip formation occurrences in turning. Hence, the dummy setup has made it possible to predict tool wear progression. The next challenge is to separate the frequency of plastic deformation from the tool wear so that on line tool condition monitoring becomes much more effective.

Qun Ren et al. [7] (2013) are proposed a micromilling fuzzy tool condition monitoring system based on multiple AE acoustic emission signal features. One limitation of the results obtained in this paper can be that the tool life determination is carried out solely using the AE SF information during the micromilling process. For high precision machining, cutting force could be combined with AE to effectively determinate cutting tool life at a higher precision scale.

### ***B. Cutting force***

As soon as the tool starts cutting, due to the relative motion between the tool and workpiece, various wear modes become active and the tool starts becoming blunt. Worn tool requires more force to remove the same amount of material than the sharp tool. So, the cutting force increases with increasing wear and is thus considered as one of the parameters that can be measured easily to monitor tool wear. The nonlinear relationship was observed between friction force, friction coefficient, and tool wear. The cutting force measurement techniques have been used by many researchers for tool wear monitoring.

Jaharah A. Ghani et al.[8] (2010) are presented a new method for detecting the cutting tool wear based on the measured cutting force signals using the regression model and I-kaz method. The detection of tool wear was done automatically using the in-house developed regression model and 3D graphic presentation of I-kaz 3D coefficient during machining process. The I-kaz 3D coefficient number decreases as the tool wear increases. This method can be used for real time tool wear monitoring. In this new method the maximum permissible flank wear on turning process can be determined. In future this system is expected to be applied in the real machining industry to monitor the cutting tool life.

Ning Fang et al.[9] (2011) are investigated the effect of tool edge wear on the cutting forces and vibrations in 3D high-speed finish turning of nickel-based superalloy Inconel 718. A carefully designed set of turning experiments were performed with tool inserts that have different tool edge radii ranging from 2 to 62  $\mu\text{m}$ . The experimental results reveal that the tool edge profile dynamically changes across each point on the tool cutting edge in 3D high-speed turning. Tool edge wear increases as the tool edge radius increases. As tool edge wear dynamically develops during the cutting process, all the three components of the cutting forces (i.e., the cutting force, the feed force, and the passive force) increase.

Zhu Kunpeng et al. [10] (2011) are introduced a novel approach for tool condition monitoring (TCM) in micromilling, which is based on the analysis of singularity of cutting force waveforms and the statistical distribution of the singularity measure. It is a multiscale approach with both localized and global cutting force analyses. The proposed approach is independent of working conditions and overcomes the problem related to the variation of different dynamic ranges because of different cutting conditions. The drawback of this approach is its computational complexity.

### **C. Vibration**

In turning, vibrations occur due to rubbing between the workpiece and chip against the tool. These vibrations provide a tool signature which varies as tool wear increases. The performance of a machine tool greatly depends on the vibration free cutting processes. The rate of deterioration and inaccuracies developing with time in a machine tool can be easily determined by vibration monitoring.

Hamed Rafezi et al.[11] (2012) presented a research on features of vibration signals in drilling process are recorded and analyzed in order to detect tool wear. Signal statistical features are extracted in time domain, and the features trends as the tool becomes worn are extracted. Frequency spectrum of signals is calculated and wavelet packet decomposition (WPD) is applied to focus on specific frequency bands. The results showed that the wavelet packets features make a better contrast between the sharp and the worn tool compared to the primary time domain signal.

B. H. Aghdam et al. [12] (2015) are investigated the correlation between vibrational features of tool/holder assembly and tool major flank wear in a turning process. During cutting, 3D tool acceleration signals are recorded by an accelerometer. Then, based on the dynamics of the tool/holder system that manifests itself in natural frequencies/modes, wear sensitive features are determined and derived from autoregressive moving average (ARMA) model of the recorded signals.

The method obtained here can be utilized for development of an online real-time tool wear estimation algorithm in turning. The results obtained in this paper justify the effectiveness of natural vibration mode/frequency-related wear-sensitive features in the reliable prediction of major flank wear. The advantage of these methods over the others is their independence from cutting conditions since they employ eigenvalues that are mostly dependant to geometrical configuration of tool/holder and holder support conditions that generally do not change with cutting conditions.

Wafaa Rmili et al.[13] (2016) are proposed the mean power analysis to extract an indicator parameter from the vibratory responses, to be able to describe the state of the cutting tool over its lifespan. Finally, an automatic detector was proposed to evaluate and monitor tool wear in real time. This detector is efficient, simple to operate in an industrial environment and does not require any protracted computing time. The results obtained with mean power analysis indicate that the proposed automatic detector is a promising tool for the development of a wear monitoring system for use in an industrial environment.

### **D. Temperature**

Tool wear rate is a function of the cutting temperature. Ihsan Korkut et al. [14] (2011) are proposed the RA and ANN model for prediction tool-chip interface temperature and mathematical equations derived for tool-chip interface temperature prediction. The results show that the tool-chip interface temperature equation derived from RA and ANN model can be used for prediction of tool wear. It is shown that ANN and RA

models can be used as an effective and an alternative method for the experimental studies and can contribute with regard to both time and economical optimisation of the machining.

S. Bagavathiappan et al.[15] (2013) are reviewed on the advances of IRT as a non-contact and non-invasive condition monitoring tool for machineries, equipment and processes. Various conditions monitoring applications are discussed in details, along with some basics of IRT, experimental procedures and data analysis techniques. This review would also enable non-specialist in industries to adopt this technique for various condition monitoring applications, which would reduce down-time, maintenance cost, risk of accidents and enhance the productivity and growth.

S Bagavathiappan et al.[16] (2015) are showed that the tool temperature increases with increasing spindle speed and feed rate because of a larger amount of frictional heat generated at the interface between the tool and the workpiece. The maximum increase in tool temperature in the case of the aluminium alloy workpiece is found to be 1.18 times higher than that of the steel workpiece, which is attributed to the larger thermal diffusivity of the aluminium alloy and the reduced frictional heat generation due to the lower hardness and shear strength compared to the steel workpiece. The material removal rate calculated for various process input conditions is used to optimise the material removal rate with respect to tool temperature, which will be helpful to achieve an increased material removal rate without temperature-induced tool damage.

### ***E. Some other Miscellaneous methods for TCM***

Yi Liao et al.[17] (2010) This work presents a new way to determine the condition of a cutting tool based on 3D texture parameters of workpiece surface. Recently, a laser holographic interferometer has been developed to rapidly measure a large workpiece surface and generate a 3D surface height map with micron level accuracy. This technique enables online surface measurement for machined workpieces. By measuring the workpiece surface texture taking advantage of this new method, the interaction between the tool's cutting edges and the workpieces can be extracted as a spatial signature, which can then be used as a warning alert for tool change.

Samik Dutta et al.[18] (2015) proposed a method for predicting progressive tool flank wear using extracted features from turned surface images has been proposed. Acquired turned surface images are analyzed by using texture analyses viz. gray level co-occurrence matrix, Voronoi tessellation and discrete wavelet transform based methods to obtain information about waviness, feed marks and roughness from machined surface images for describing tool flank wear.

Sebastian Bombiński et al. [19] presents algorithms for fully automatic detection of actual cutting (elimination of air cutting), selection of relatively stable signal segments representative of the tool condition and elimination of the overabundance of signal data in case of long operations or tool lives.

### **III. Appendix**

The following tables 1, 2 and 3 gives detail description of indirect measurement methods, Feature domain selection and Different classifiers used by various publications [1-34] respectively.

Table 1: Publications which have used indirect measurement methods [1-34]

Sl No	Parameter	Publications
1	Cutting force	Jaharah A. Ghani et al. [8], Ning Fang et al. [9], Zhu Kunpeng et al. [10]
2	Vibration	Ning Fang et al. [9], Hamed Rafezi et al. [11], B. H. Aghdam et al. [12], Wafaa Rmili et al. [13], Raghavendra M J et al. [34].
3	Sound/ultrasound	Li Jia et al. [23], Hamed Rafezi et al. [11],
4	Acoustic Emission	Krzysztof Jemielniak et al.[03], Karali Patra et al. [04], Jun-Hong Zhou et al. [05], Md. Sayem Hossain Bhuiyan et al.[06], Qun Ren et al. [07], Javad Soltani Rad et al. [31], Raghavendra M J et al. [34].
5	Temperature	Ihsan Korkut et al. [14], S. Bagavathiappan et al. [15], S Bagavathiappan et al. [16],
6	Surface roughness	Yi Liao et al.[17], Nagaraj N. Bhat et al. [33], Samik Dutta et al. [18].
7	Displacement	J.A. Ghani et al. [22].

Table 2: Feature domain selection used by different publications [1-34]

Sl No	Domain	Publications
1	Time domain	Krzysztof Jemielniak et al.[03]
2	Frequency domain	Shi Jianming et al. [32]
3	Time-frequency domain	Krzysztof Jemielniak et al.[03], Javad Soltani Rad et al. [31], Shi Jianming et al. [32].
4	Statistical domain	Martín P. Gómez et al. [02], Jun-Hong Zhou et al. [05].

Table 3: Different classifiers used by various publications [1-34]

Sl No	Classifier	Publications
1	Neural networks	Karali Patra et al. [04], Ihsan Korkut et al. [14], Amir Mahyar Khorasani et al. [24], Xiaolin Liu et al. [29]
2	Fuzzy logic	Qun Ren et al. [07], M. Chandrasekaran et al. [20], Qun Ren et al. [25]
3	Neuro fuzzy	Kamran Javed et al. [30].
4	Hidden Markov model	Omid Geramifard et al. [21], Omid Geramifard et al. [26], Bin Li et al. [27]
5	Support vector machine	Bulent Kaya et al. [28].

#### IV. Conclusion

Various methods & techniques used in various publications to carry out condition monitoring of cutting tools along with their benefits and limitations have been discussed. The following points and future scopes can be summarized from this discussion:

- For signal acquisition, optical measurement, force measurement, vibration measurement, and AE measurement are promising techniques which can be used to develop a universal approach.
- Research must be carried out in the direction of smart sensor development which can be an integral part of the intelligent decision-making system.
- Hence, the research will contribute toward the implementation of a more universal approach for tool condition monitoring.

#### V. Acknowledgment

The authors are thankful to R&D of M.S Engineering College and staff; and also to Dr. K.S.Badarinarayan, Principal, M.S.Engineering College, Bangalore and to all reference Journal paper authors for providing the necessary facilities for the preparation of this review paper.

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## **Design, Modelling and Fabrication of Pick and Place Robot**

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**ABSTRACT:** *This journal paper deals with the design, modelling and fabrication of pick and place robot. The main aim of this project is to develop economical, simple library robot which can make use of pick and place application. The process of picking and placing is automated and controlling of the robot has done by using Arduino microcontroller. The robot is designed in such a way that it follows a predefined path arrangement. Here the robot pick and place the book by matching the RFID number identically. The use of this robot helps to reduce the user effort and the daily routine followed by the librarian. The paper concludes on the advantage, disadvantage and some related information of library robot and how this latest technology will lead the upcoming future.*

**Keywords:** *Arduino, predefined, RFID, technology.*

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### **1. Introduction**

Robots are indispensable in many manufacturing industries. The reason is that the cost per hour to operate a robot is a fraction of the cost of the human labour needed to perform the same function. More than this, once programmed, robots repeatedly perform functions with a high accuracy that surpasses that of the most experienced human operator. The automation is playing important role to save human efforts in most of the regular and frequently carried works. One of the major and most commonly performed works is picking and placing of jobs from source to destination.

To avoid this type of problems and reduce manpower requirement we need other types of automation like battery operated smart library robot for the ease of use even in indoor conditions without the need of human interaction. The microcontroller is used to control the robot path automatically and deliver the object to the desired location.

In addition to the microcontroller the robot is also equipped with various other parts like relay, motor, motor driver, RFID sensor, RFID tag along with an ultrasonic sensor. The ultrasonic sensor is used to measure the distance from the obstacle to the sensor in order to place the robot accurately and effectively.

### **Research Methodology**

Following the commencement of the project, research and background study was conducted in order to thoroughly understand the concept and the working of an automated pick and place robot capable of handling the object when needed to and placing it to the desired location. During this phase there were various steps involved for the completion of this research to a certain extent. The details are as follows:

### **Literature review**

Ashana joy [1] proposed a highly developed fully automatic storage and retrieval system. The performance of this system is enhanced by using PLC integration where it coordinates the operation and control of ASRS. ASRS is complex in design and fabrication which needs exclusive study of transmitting devices, power circuitry.

Javad Majrouhi Sardroud [2] et.al portrayed that even in the rough industrial floors; the automated gain vehicle should be robust enough to travel, so that the performance requirement can be met. To track the position of vehicle they can be monitored using several sensors or by simple CCD cameras.

Raunak Sethiya [3] et.al proposed track location of target object by using LCS tracker. By the optimization of "Cubature Kalman Filter" (CKF) on the controller it is seen that the robotic arm is capable of reaching at critical locations.

Khin Moe Myint [4] et.al the aim of this journal is to eliminate manual control for object sorting system by controlling position of robot arm with kinematic control methods. Metal detector is also incorporated to differentiate between metal and non-metal in the automated sorting systems. Usage of pressure sensor is integrated at the end effectors' fingers to get optimum grip.

Arka Sain [5] explained in this paper that explores the possibility of wireless control of robotics arm using self-developed android application and HC-05 Bluetooth module. The android app enables to control robotic arm at a simple click of a button designed specifically as a part of interface of android application.

Deepak L Rajnor[6] et.al presents the smart approach for real time inspection and selection of object in continuous flow. Image processing procedure senses the object in an image capture in real time by web camera and then identifies a colour and then the information. It is shown that there are mainly 2 steps in sensing parts- object detection, and identification.

Ashly Baby [7] proposed a robotic arm obeys the command given by the user via android based smart phone through Bluetooth. The proposed system is capable of lifting only small weight, though when integrated with high torque producing motor lifting up large weight is possible.

**Background study**

During the background study we came across wide variety of robot and their configuration. The configuration is based on the work volume in which the robot can manipulate the object. The work volume indicates the shape the working space from the base to the end effector. The configurations include:

**1. Cartesian Coordinate Configuration..**

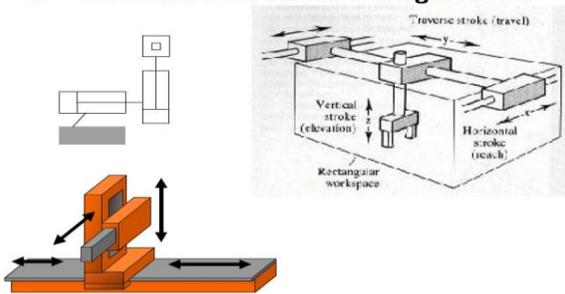


Fig 1:- Cartesian Coordinate Configuration

**2. Cylindrical Configuration..**

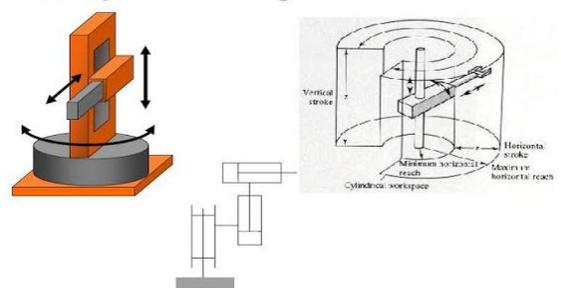


Fig 2:- Cylindrical Configuration

**3. Polar or Spherical Configuration..**

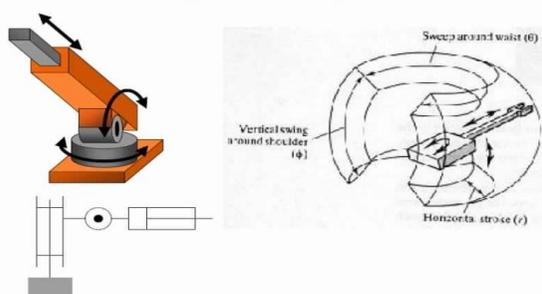


Fig 3:- Polar Configuration

**4. Jointed Arm Configuration..**

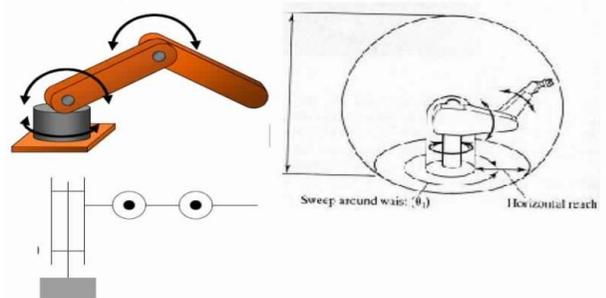


Fig 4:- Jointed Arm Configuration

**5. SCARA Configuration..**

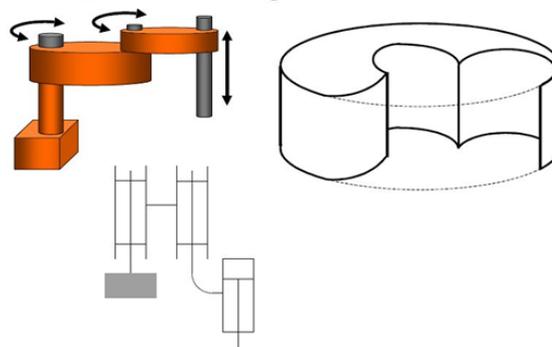


Fig 5:- SCARA Configuration

**II. Block Diagram & Working Principle**

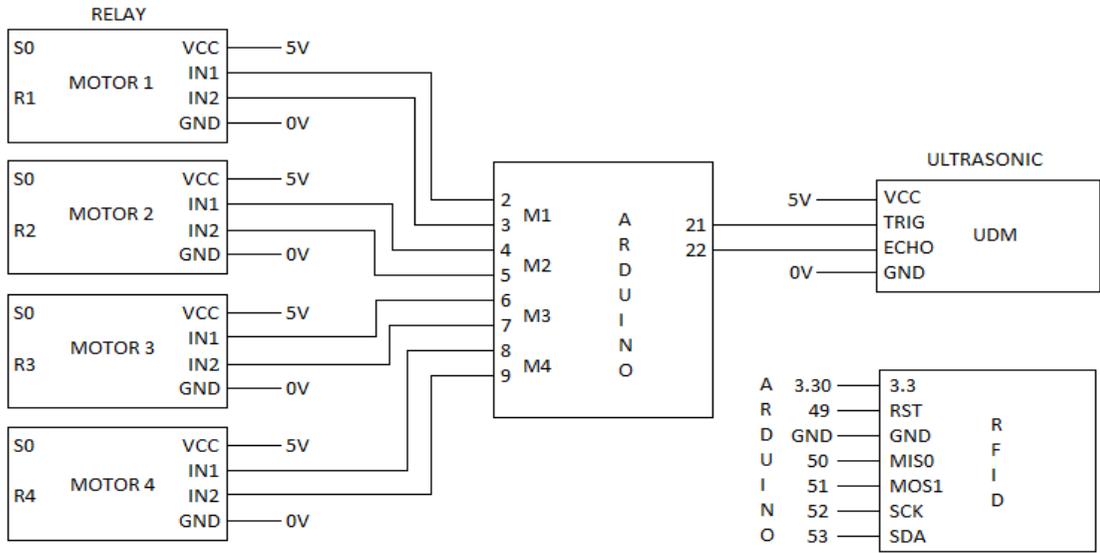


Fig 6:- Block Diagram

Working of system is as follows:-

1. Location of home position:  
Home acts as the initial as well as the final position of the robot. Once the robot moves to do the task given by the user, at the end of the task, the robot should be able to return to its home position.
2. Location of input/output area:  
The arm of robot acts as the initial position during the placing of the object. While it plays the role of output area when retrieving the book.
3. Storage rack:  
It is the location for the robot to neatly arrange the object into storage rack. It has two slots (2x1). The object is either placed/retrieved in/from this rack.
4. Movement of robot:  
The robot must be able to move in horizontally and vertically. Separate motors are used for different moving mechanism.

**Components and Description**

Number of components has been used in the robot, which are:-

- Microcontroller:



Arduino Uno microcontroller with 64kb flash and 1024 bytes data ram. The flash program memory supports both parallel programming and in serial in-system programming. Operating voltage is 5V and frequency from 0 to 40 MHZ.

- Battery:



Lead acid wet battery with capacity of 12V and 1.3Ah. The battery can be recharged with the help of the cable through the power outlet.

- Motor:



Wiper motor with capacity of 12V. The motor is capable of generating power up to 10-20 Watts. Suitable for low and medium speed.

- RFID:



Passive RFID tag is a tag that does not contain a battery. The power is supplied by the reader. The frequency is of 125 KHz.

### III. Design Considerations

Table 1:- Main characteristics of robot

Main Characteristics of Robot	
Number of degree of freedom	6
Configuration	Cartesian coordinate
Mobility	Yes
Reach	780 mm
Microcontroller	Arduino ATmega 2560
Number of motor	4
Number of relay drivers	8
Nominal load capacity	5 kg
Power required	0.0416 KW

In order to find the torque generated by the robot to raise the load, the following formula has been used,  
 $T_r = Fdm/2 (L + \pi\mu dm / \pi dm - \mu L)$

Where,

F= Load on the robot (N),

d= Major diameter of lead screw (m),

m= Mean diameter of lead screw (m),

L= Lead (m),

$\mu$ = Coefficient of friction.

Using the formula the torque to raise the load by the lead screw was found to be 1495.28 N-mm.

Power required by the robot was found using the formula,

T (Torque) = M\*g\*R

&

$P = 2\pi NT / 60000$

Where,

M= Mass on the robot (kg),

g= Acceleration due to gravity ( $m/s^2$ ),

R= Distance from the vertical structure (m),

T= Torque (N-m)

N= Speed (rpm)

P= Power required to lift the load (KW)

The power required was found to be 0.0416 KW.

#### IV. Modelling & Analysis\

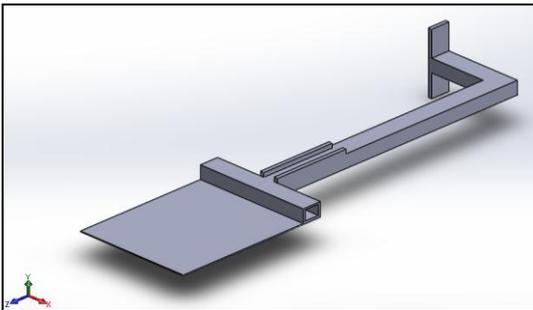


Fig 7:- Arm

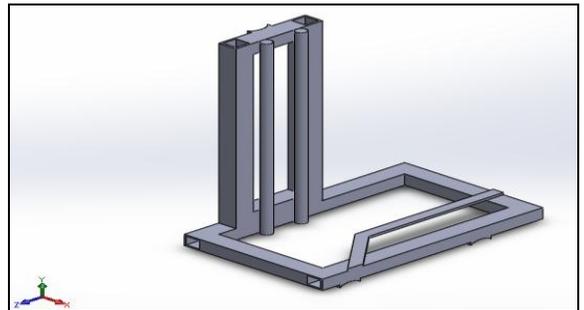


Fig 8:- Vertical Support

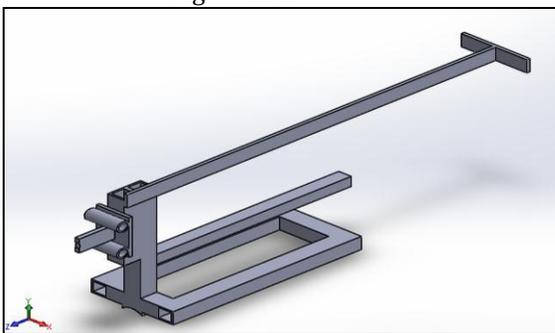


Fig 9:- Horizontal Structure

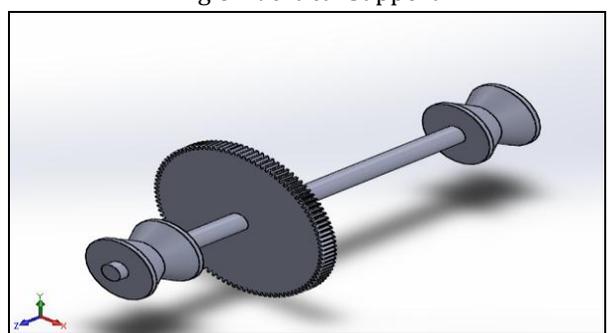


Fig 10:- Wheel Mechanism

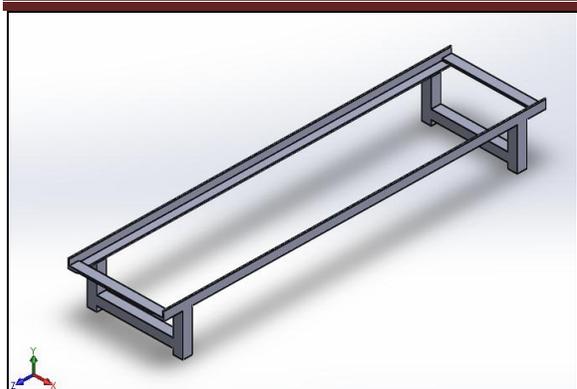


Fig 11:- Robot Ramp

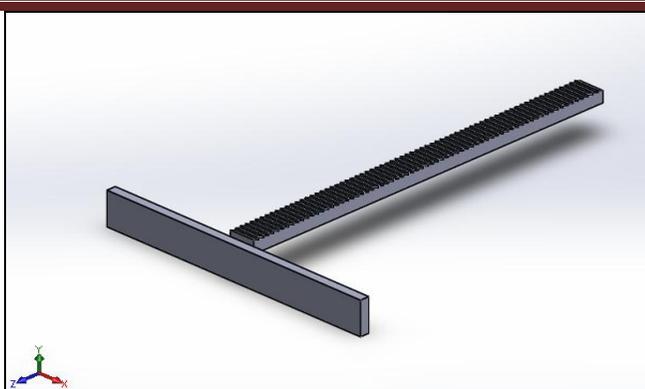


Fig 12:- Rack mechanism

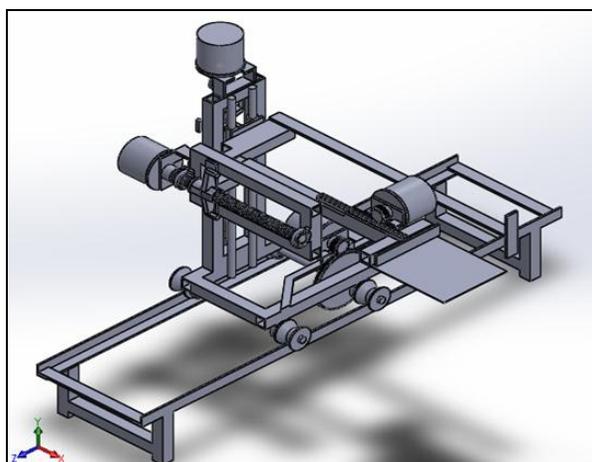


Fig 13:- Assembled robot

Modelling of the robot was done using *DS Solidworks*. The modelling section in this paper consists of various important parts as well as the assembly of the robot itself. This stage is very crucial since the changes either big or small can be made without affecting the actual model even before the fabrication of the robot parts.

#### 4.1 Analysis

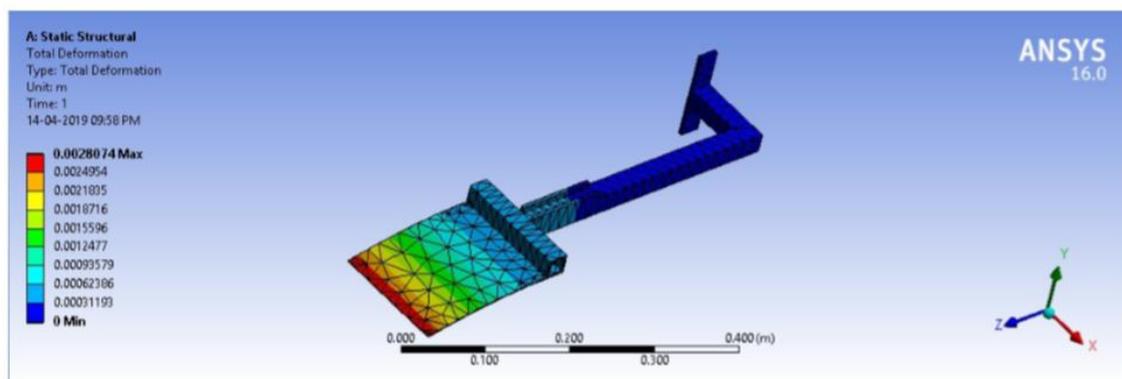


Fig 14:- Analysis of Arm

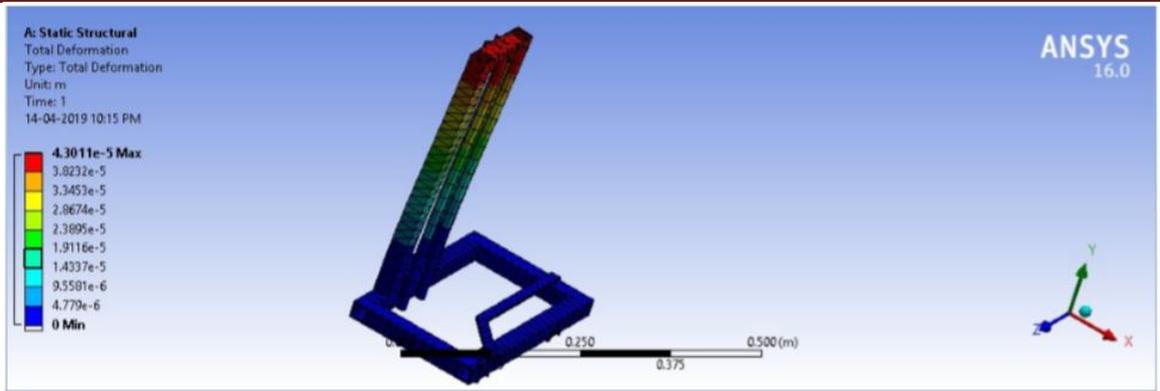


Fig 15:- Analysis of Vertical Structure

## V. Conclusion

Implementation of this pick and place robot has been done using RFID application via book detection and manipulation, which is used to work in variety of environment. The predefined path enables the robot to move efficiently to its destination without any drawback. The RFID used in the system accurately identifies the object and where it has to be placed, the whole process is automated and there is no human interaction whatsoever.

## VI. Future Scope

There are many unsolved problems and fundamental challenges for robotics. This project can be further developed by incorporating it with various ideas, such that it is capable of manipulating number of books simultaneously. Its effectiveness can be increased by certain degree with the increase of interaction with the environment on the sensor level. A wireless camera can also be used in order to observe the robot movement during the placing operation.

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# Zigbee Based Automatic Vehicle Over Speed Controlling System

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**ABSTRACT:** At the present traffic rules are repeatedly violated by drivers for over speeding which happens due to bad driving performance. But sometimes it may not be possible to view the signboards placed by the highway department to alert the drivers in such kind of places and there is a chance for a accident. The main objective of the paper is to design and develop a system which can efficiently identify speed violations on the road and wires the driver to follow traffic rules while driving by maintaining the speed of vehicle according to the given speed limit at particular zone. It will use Zigbee technology the proposed system regulates the speed of the vehicle automatically as the vehicle enter the zone. As for Indian road transport scenario is concerned, accidents are becoming a day to day cause an attempt has been made in this project to reduce such mishaps. In our project a high speed indication is given and automatic braking is applied by cutting off the fuel supply to the engine when the setup speed is exceeded. In our project, we have used a DC Motor and Zigbee transceiver to effectively regulate and over speeding of vehicles. The alternations to be made to implement this project in the vehicles are also discussed. The Zigbee transmitter and receiver circuit is used for this project. The ZIGBEE receiver circuit is fitted in the vehicle. The Zigbee transmitter is fixed in the colleges/school, hospitals and wherever you want the accident prevention

**Keywords:** Drum Brake, Zigbee Transmitter and Receiver, I R Sensor

## 1. Introduction

In this fast moving world accidents are becoming proportional to high speed. In this project we are dealing with over speed of vehicles. As we all know controlling the speed of vehicles can be done in many ways but we are concentrating on breaking mechanism as the over speeding vehicle enters the zone where the zigbee transmitter is placed the zigbee receiver in the vehicle receives a signal from the transmitter, this receiver then sends signal to the motor which will apply break and reduces the speed of the at the profound traffic signals. This will have an adverse effect on the economy of the country plus the loss of life. These road accidents can be prevented by adopting some rules such as Traffic management and improving the road network.

Traffic administration on the road has become bigger issues for today's society since the growth of the urbanization, industrialization and population. With increase in traffic, there are too many problems and these problems include traffic jams, accidents and traffic rule violation etc. Due to this it will have an adverse effect on the economy of the country and the loss of life [1]. The above problem will become much worst in the future.

## II. Materials and Methods

### A. Mechanical Component

#### Engine



### Specification Of Four Stroke Petrol Engine

Type : four strokes

Cooling System : Air Cooled

Bore/Stroke : 50 / 50 mm

Piston Displacement : 70cc

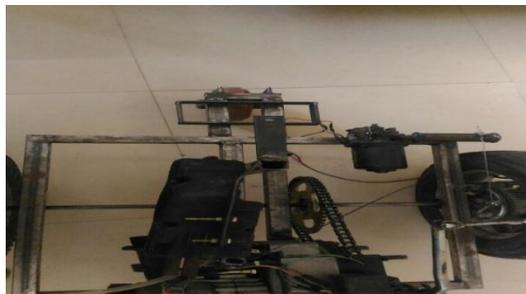
Compression Ratio : 6.6: 1

Maximum Torque : 0.98 kg-m at 5,500RPM

An engine is a power generating machine which converts potential energy of the fuel into heat energy and then into motion. It produces power and also runs on its own power.

The engine generates its power by burning the fuel in a controlled combustion process. The combustion process involves many sub-processes which burn the fuel efficiently and results in the smooth running of the engine

### Frame



Material:- Mild steel

Function:- To hold the load of the vehicle

Specifications:

- 1) MS 18 gauge 1 inch square pipe.
- 2) Thickness:-5 mm.

A main vehicle frame, also called as [chassis](#), is the main supporting [structure](#) of a [motor vehicle](#), to which all other components are attached, similar to the [skeleton](#) of a system or structure.

### Carburettor



A carburetor or carburetor is a device that mixes air and fuel for internal combustion engines in the proper ratio for combustion.

- Function:- Used to mix air and fuel with required proportion.

- Material:- aluminum alloy.

### Fuel tank



A fuel tank (or petrol tank) is a safe container for [flammable](#) fluids. Though any [Storage Tank](#) for fuel may be so called, the term is typically applied to part of an engine system in which the [fuel](#) is stored and propelled ([fuel pump](#)) or released (pressurized gas) into an [engine](#).

Fuel tanks range in size and complexity from the small plastic tank of a [butane lighter](#) to the multi-chambered [cryogenic Space Shuttle external tank](#).

- Function: To store fuel.
- Material: polymer fiber

### Wheels



A wheel is a circular component that is intended to rotate on an [axle bearing](#). The wheel is one of the key components of the [wheel and axle](#) which is one of the [six simple machines](#). Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. Wheels are also used for other purposes, such as a [ship's wheel](#), [steering wheel](#), [potter's wheel](#) and [flywheel](#).

- Function:- for rotation motion
- Material: cast iron rim
- Tyre: MRFzlo.

### Air Filter



A particulate air filter is a device composed of fibrous or porous materials which removes solid particulates such as dust, pollen, mold, and bacteria from the air. Filters containing an absorbent or catalyst such as charcoal (carbon) may also remove odors and gaseous pollutants such as volatile organic compounds or ozone. [1] Air filters are used in applications where air quality is important, notably in building ventilation systems and in engines.

### Breaking system

A brake is a mechanical device which inhibits motion

- A common misunderstanding about brakes is that brakes grip against a drum or disc and the pressure of the squeezing action slows down the vehicle.
- Brake uses friction of brake shoes and drums to convert kinetic energy generated by the vehicle into heat energy and when brakes are applied, the pads or shoes that press against the brake drums or rotor convert kinetic energy into thermal energy through friction.
- Thus brakes are essentially a mechanism to change energy types
- Types of Breaks
- Mechanical brakes
- Drum brakes
- Disc brakes
- Hydraulic brakes
- Power brakes
- Air brakes
- Air hydraulic brakes
- Vacuum brakes
- Electric brakes

### Drum Brake Working Principle



Fig. 1 Break Drum

Two-wheeler such as scooters, commuter bikes, three wheeler including auto-rickshaws widely use Drum Brake system for braking. This type of brake system is used on the rear wheels of most hatchback cars, entry-level sedans & MUVs. It is also widely used on both front & rear wheels of trucks, buses and other commercial vehicles in combination with hydraulic / pneumatic (either air-pressure or vacuum) brake actuating systems.

### Sprocket and chain drive

In this chain sprocket is coupled with another generator shaft. It can convert rotational power to pulling power or pulling power to rotational power by engaging this with the sprocket.

The sprocket may look like a gear but can differ in some important ways:-

Sprockets contain many engaging teeth's but gears usually have only one or two teeth.

- a) In gear, teeth can touch and slip against each other but here there is no slippage in a sprocket.

## B. Electrical Component

### Zigbee Transmitter and Receiver

- Zigbee is a standard based wireless technology. Zigbee is used to create a personal area network with small radio waves
- It enables low power wireless machine to machine connection
- Range:- 50 -100 m

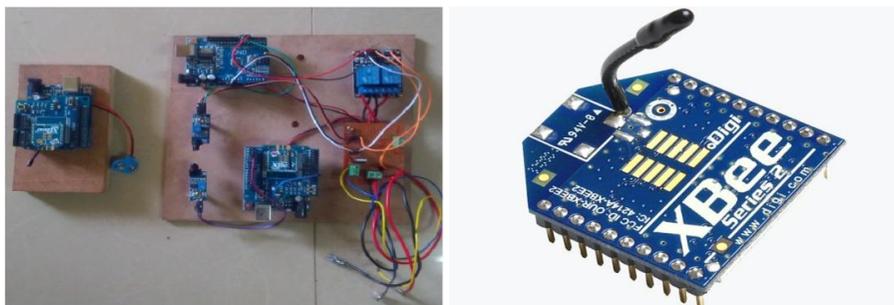


Fig 2: Zigbee Transmitter and Receiver

- Zigbee is a suite of high-level communication protocols which is used to create [personal networks](#) with small and low-power [digital radios](#), and other low-bandwidth is designed for a small scale projects which require wireless connection. For this reason, Zigbee is a low-power and close proximity [wireless network](#).
- This ability is defined by the Zigbee specification is proposed to be simpler and very less expensive than the other [wireless personal networks](#) (WPANs), such as [Bluetooth](#) or [Wi-Fi](#) networks. Some applications comprises of wireless light switches, [home energy monitors](#), traffic management systems,
- Its low power consumption limits conduction and distances goes up to 10–100 meters [line-of-sight](#) depending upon power output and environmental characteristics.
- Zigbee can send out data over long distances by passing data all the way through a [mesh network](#) of intermediate devices. It is secured by 128 bit encryption keys. It has a definite rate of 250 Kbit/s, top suited for intermittent data transmissions from a sensor or input device.

### DC Motor (Wiper Motor)



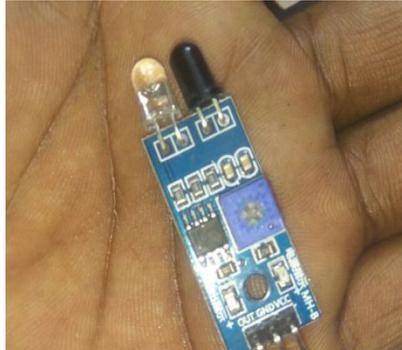
Fig 3 DC Motor

- 12 volt DC
- DC current - 2 Amp
- Weight - 240 gm
- Torque: 23.7 Nm
- A DC motor of rotary electrical machines which converts direct current electrical energy into mechanical energy. The most common types rely on the forces is produced by a magnetic fields. Almost all types of

DC motors have some internal mechanism, either electromechanical or electronic; which periodically changes the direction of current flow in some parts of motor.

- DC motors are widely used, because they could be powered from existing direct-current lighting power distribution systems. Its speed can be controlled by using either a variable supply voltage or by changing the strength of current in the field windings. Small DC motors can be used in tools, appliances etc.
- This [motor](#) can be operated on direct current but will be a lightweight motor which is used for portable power tools and appliances. Larger DC motors can be used in propulsion of electric vehicles, elevator or in drives for steel rolling mills. The arrival of power electronics has made replacement of DC motors with [AC motors](#) in every possible manner.

### IR Sensor



- It is an electronic device which can detect motion by receiving the infrared radiation.
- 2 sensors are used one for transmitter and another for receiver.
- Infrared sensor is an electronic device that emits signals to the surroundings. Sensor can measure this heat from an object and also detects the motion from it.
- Some sensors measure only infrared radiation, while emitting it and this is called as a passive IR sensor. Generally in the infrared spectrum, all the objects emit some type of thermal radiations.
- This type of radiations is invisible to our eyes, and can be detected by an infrared sensor. The emitter is merely an IR LED (Light Emitting Diode) and the detector is just an IR photodiode which is sensitive to IR light of the same wavelength which is emitted by the IR LED. While IR light falls on this photodiode, the resistances and the output voltages change in fraction to that magnitude.

### Circuit representation and Working Principle of IR Sensor:-

- Infrared sensor circuit is one of the basic sensors in [electronic device](#). Sensor is similar to human's visionary senses, which can be used to detect obstacle and this is one of the most common applications in real time. This circuit comprises of the following components
- [LM358 IC](#) 2 is the IR transmitter and receiver pair
- Resistors are in the range of kilo ohms.
- Variable resistors and Light Emitting Diode(LED)

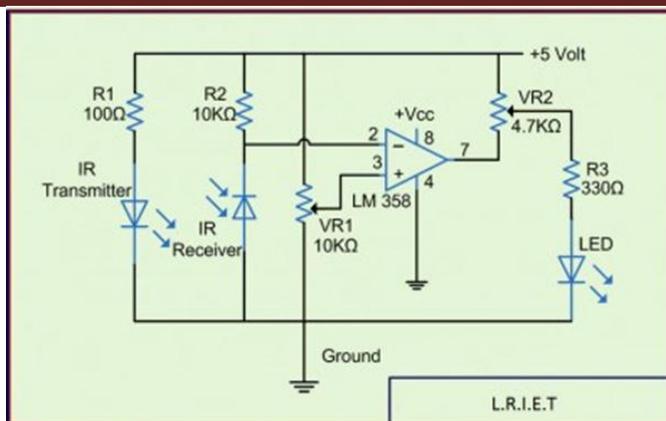


Fig. 4 IR Sensor

- In this task, the transmitter section includes an IR sensor, which transmits continuous IR rays which is received by an IR receiver unit. Since this difference cannot be analyzed, subsequently this output is fed to the comparator circuit. In this paper [operational amplifier](#) (op-amp) of LM 339 is used as comparator circuit.
- When this IR receiver do not receive any signal, the potential at the inverting input go higher than that of non-inverting input of the comparator IC (LM339). Hence the output from comparator goes small, but the LED does not glow. When this IR receiver module receives a signal to potential, the inverting input go small. Hence the output of the comparator (LM 339) goes high and the LED starts radiant.

**RELAY:-**



Fig. 5 Relay

- The relay is the device that opens or closes the contacts to cause the operation of the other electric control. It detects the intolerable or undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area. Thus protects the system from damage.

**Working Principle of Relay**

- It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current it energizes the electromagnetic field which produces the temporary magnetic field.

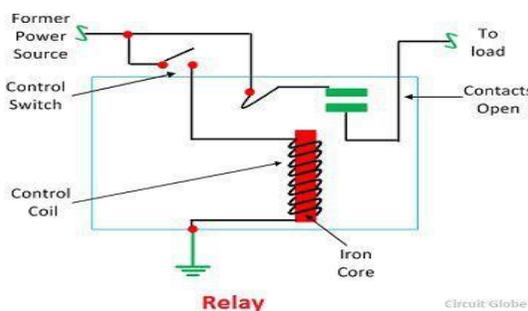


Fig.6 Relay Working Principle

- This magnetic field moves the relay armature for opening or closing the connections. The small power relay has only one contact, and the high power relay has two contacts for opening the switch.
- The inner section of the relay is shown in the figure below. It has an iron core which is wound by a coil. This power supply will be given to the coil during the contact of the load and the control switch. The current flows through the coil produce the magnetic field around it.
- Due to this magnetic field, the upper arm of the magnet attracts the lower arm. Hence close the circuit, which makes the current flow through the load. If the contact is already closed, then it moves oppositely and hence opens the contacts.



Fig.7 UNO Board



Fig.8 Battery

### III. Methodology Working

This model is used to control the speed of the vehicles in a particular zone or a region such as schools, colleges and hospital etc. Heavy human and vehicle traffic will be present over these zones. The speed limits of these zones are transferred to vehicles with the Zigbee transceiver.

ZIGBEE consists of transmitter section and a receiver section, transmitter section is placed at zones and receiver section is placed in vehicle.

#### Transmitter section

The authorities can set the speed of a particular zone using keypad. The speed of the zone is different for different zones. The Zigbee will continuously transmit this signal in a range similar to a mobile hotspot.

The Zigbee transmitter is connected to aarduino board which is powered by a DC source (Battery). The transmission will be continuous so that all vehicles which are fitted with a Zigbee receiver will receive the signal as soon as it enters the zone.



Fig.9 Block Diagram of Transmitter

#### Receiver Section

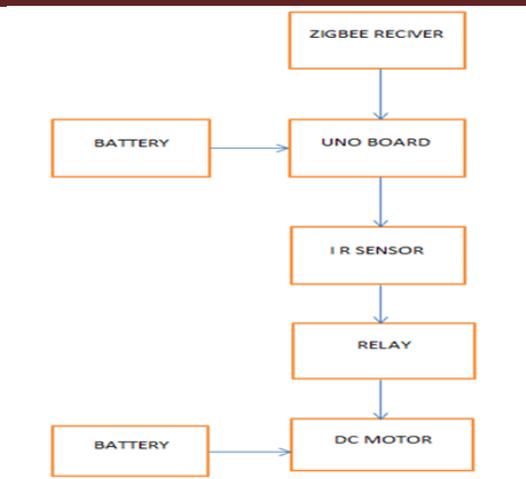


Fig. 10 Receiver Section

When the vehicle enters into a particular zone the zigbee receives the speed of the zone. At the same time microcontroller informs the driver about the particular zone, through notification light, after informing if the rider ignores and keeps his speed then the receiver sends signal to UNO board This will send signal to the DC motor which will apply break to the wheels which will reduce the engine speed. As soon as the speed decreases the UNO board sends signal to DC motor and the break is released and vehicle moves normally. By this process the automatic over speed of vehicles can be controlled.

**IV. Testing and Result**

We know that

Average time taken for Deceleration = total time taken/distance travelled

Table 1

Trail No.	Initial Speed in km/h	Final Speed in km/h	Time taken In Sec
1	15	10	5.6
2	15	10	6
3	15	10	5.8

Therefore, Average time for deceleration is given by

$$= 5.6+6+5.8/3$$

$$= 5.8\text{Sec}$$

**V. Product Output Images**



## **VI. Conclusion and Future Work**

This paper solve the trouble of over speeding vehicles due to environmental conditions and bad driving performance near the speed limit zones such as near hospitals, school etc. This device can compare the speed of vehicle with the speed limit zone and involuntarily adjusts the speed according to the limit, where additional attribute is maintained at database of vehicles on the server side. Thus it will eventually help us to improve bad driving performance of driver, Traffic management, road safety, violation management. Wireless transmission can be achieved with the help of Zigbee; it provides a low cost transmission of data. A LCD display unit can be made so that it can fit in vehicle dash board, notifying the driver about zones and its speed limits. All the data about upcoming zones and their limits is also made available with the help of LCD monitor. Future advanced breaking mechanisms can reduce time required for deceleration.

## **VII. Acknowledgment**

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# Effect and Mechanical Behaviour of Natural Ageing Treated Aluminium 6061 Under T4 Conditions

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**ABSTRACT:** *The aim of this research paper is to focus on the effect of natural ageing on the microstructure and mechanical properties of aluminium 6061. The primary objective is to understand the degree to which mechanical behavior has shown improvement with aluminium grades being treated under T4 conditions on the specimens. Secondly mechanical behavior experimental investigation has been carried out on aluminum 6061 with natural ageing for 75 days at room temperature. The natural ageing hardness has almost equal, but 0.4 % of Peak load has decreased and 1.45 % of wear rate resistance has increased when compared to wear of non-treated specimen. The Natural ageing treatment was carried out under three loading different timings for three different speeds under varying loads. This research paper also studies the micro structural changes under these varying conditions. The experimental investigation of this paper clinches that natural ageing treated aluminium shows increase in wear resistance of nearly 1.467%.*

**Keywords:** *Natural ageing, Hardness, Tensile, Wear, Microstructure.*

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## 1. Introduction

Aluminum and addition its alloys offer a wide range of properties that can be contrived accurately to the need and demand of specific applications, for example in Aircraft fittings, camera lens mounts, couplings, naval fittings and hardware, electrical fittings and connectors, decorative or misc. hardware, hinge pins, magneto parts, brake pistons, hydraulic pistons, appliance fittings, valves and valve parts, bike frames., concluded the optimal of alloy, temper and condition process by numerous amalgamations of its advantageous properties are as strength, light in weight, corrosion and resistance to wear, formability and recyclability, aluminum is being working in an ever-increasing number of applications. This array of products ranges from structural materials through thin packaging foils [1]. Aluminum alloys have been active as a cladding material for some research reactors, because of its small cross section for neutron fascination, good corrosion resistance against cooling water, good toughness even later long term exposure in a neutron field, and short life-time of the radioactive nuclei produced by nuclear reactions [2].

Treatments that are carried out to change the profile and achieve a desired mechanical properties in aluminum alloys may also modify its corrosion resistance, largely through their effects on both the quantity and the distribution of micro-constituents [3].

Once the aluminum exteriors are exposed to the atmosphere, a thin invisible oxide skin forms instantly, this protects the metal from further oxidation and this self-protecting characteristic gives aluminum its high resistance to corrosion. Unless exposed to some substance or condition that destroys this protective oxide film, the metal remains fully protected against corrosion [5]. But the oxide film is not homogeneous and contains weak points. Breakdown of the oxide film at weak points leads to the onset of localized corrosion. The oxide film becomes more nonhomogeneous with increasing alloying content, and on heat-treatable alloys as opposed to non-heat-treatable alloys [6].

Lastly, thermal behavior of aluminium alloys (duration, temperature, and rate of temperature change) can alter the its type, amount, size, and distribution intermetallic particles.

The objective of the present investigation is to indicate how certain simple but important variations in the thermal processing, such as the aging parameters, as affect the corrosion characteristics of 6061. It also aims to investigate the boundaries of microstructure zone and pitting zone in order to have a clear picture about the localized mechanical behavior of this alloy.

Table.1 Physical Properties of 6061[7]

Sl. No	Property	Value
1	Density	2.70 g/cc
2	Hardness,	Brinell 95 , Rockwell A 40 Rockwell B 60, Vickers 107
3	Tensile Strength	310 MPa (Ultimate) 276 MPa(Yield)
4	Modulus of Elasticity	68.9 GPa
5	Poisson's Ratio	0.330
6	Fatigue Strength	96.5 MPa
7	Fracture Toughness	29.0 MPa-m <sup>1/2</sup>
8	Electrical Resistivity	0.00000399 Ω-cm
9	Thermal Conductivity	167 W/m-K
10	Melting Point	582 - 651.7 °C Solidus 582 °C Liquid's 651.7 °C

Table.2 Component Elements Properties of 6061

Element	Al	Cr	Cu	Fe	Mg	Mn	Other each	Other Total	Si
Percentage	95.8 to 98.6	0.040 to 0.35	0.15 to 0.40	<= 0.7 0	0.80 to 1.20	<= 0.15	<= 0.050	<= 0.15	0.40 to 0.80

## II. Experimental Procedure

The base matrix chosen in the present study is the aluminium 6061 because it is one of the most extensively used 6000 series aluminium alloys. These alloys have high strength to weight ratio, good formability, age hardenability and other suitable properties. Among different aluminium alloys, Al 6061 has high machinability, high hardness and also light in weight. Table 1 and 2 gives the physical and chemical composition of Al 6061 respectively. The sample composition proportionate was prepared according to Standards of Aluminium Industry 101[10]. The sample treatment was conducted at room temperature in Heat Treatment Laboratory for 75 days and specimens were cut to standard dimensions to prepare the samples for Hardness, Tensile, SEM and Wear tests.

**2.1 Hardness:** Indenting Samples that were used for hardness indentation were sectioned using the HardnessHRB setup employed in the sectioning of the specimen of 20mm diameter and 6mm thickness and a load of 500Kgf is applied for a period of 30 seconds. The four trial results are as follows

Table. 3 Hardness Results

Specimen Sample	Sample No.	Hardness HRB	Average
T4	1	46	46.75 HRB
	2	47	
	3	47	
	4	47	



Fig.1 Hardness specimen before Test



Fig. 2 Hardness specimen after Test

**2.2 Tensile Testing:** The main form of characterization employed was the use of a Universal Tensometer with a load 3.069 KN to 4.45KN under ASTM Standard B557. Test Methods of Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products was used to determine tensile test results are shown in Table. 4.

Table. 4 Tensile Test Results

Specimen	Sample No.	Peak Load N		Ultimate tensile strength N/ mm <sup>2</sup>			
			Average	Engg. UTS	Average	True UTS	Average
T4 condition	1	3069.6	4106.475	96.9	129.625	101.5	137.825
	2	4530		143.0		153.5	
	3	4373.9		138.1		148.0	
	4	4452.4		140.5		148.3	



Fig. 3 Tensile specimen before Test

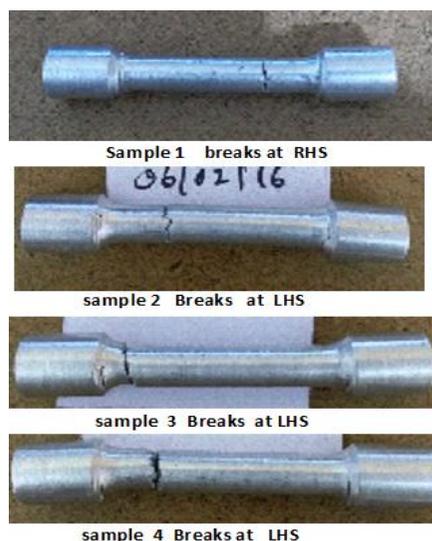


Fig. 4 Tensile Test Samples after Test

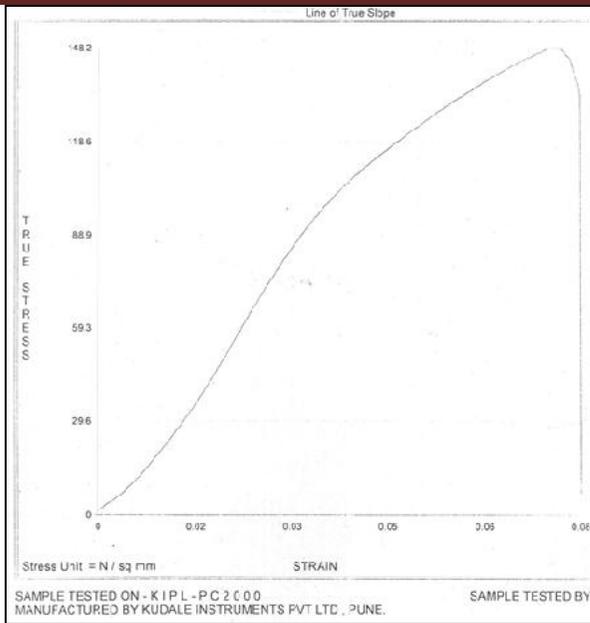


Figure. 5 True Stress versus Strain

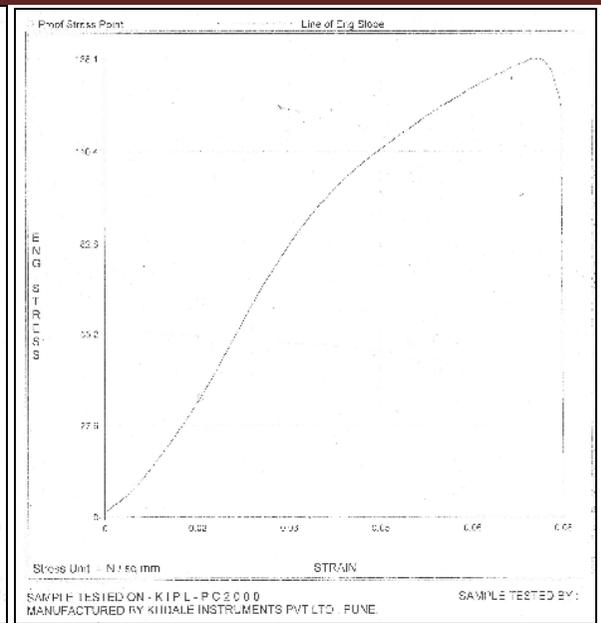


Figure. 6 Engineering Stress versus Strain

**2.3 Wear rate Test:** The Wear resistance tests was conducted on pin-on-disc meter under dry sliding conditions. The test were conducted on 8 mm diameter, 25 mm long cylindrical specimens (ASTM G-99) against a rotating EN-32 steel disc having hardness of 63Rc. Attention should be taken to note that the test sample's end surfaces were flat and polished metallo-graphically prior to the testing. Conservative aluminium alloy polishing techniques were used to get ready the contact surfaces of the monolithic aluminum test specimen for wear test. This method involves grinding of aluminium surfaces manually by 240, 320, 400, and 600 grit silicon carbide papers and fine polishing was done in a rotating disc polishing machine with velvet cloth impregnated with diamond paste. The track diameter was kept constant at 60mm. The tests was conducted for three different varying load and speed (15 N, 30 N and 45 N, 500, 600 and 700 rpm). Initial weight of the sample was noted down for a individual load at a particular speed the test was run for 1 hour at an interval of 15 minutes the loss of weight is noted by weighing the sample.



Fig.7 Wear specimen before Test

**Condition.1.** Varying speed (constant load and time), Time =5 min, load = 2kg Under T4 condition.

Table. 5 Wear Test Results

Varying speed in RPM	Initial weight in gms	Final weight in gms	Weight loss in gms	Sliding distance $\times 10^3$ m	Wear rate $\times 10^{-6}$ ingm/ m
500	2.2627	2.2506	0.0121	1.021	0.1852
600	2.2506	2.2427	0.0079	1.225	6.4489
700	2.2427	2.2328	0.0099	1.429	6.9279

**Condition. 2.** Varying load (Constant time and speed), Time =5 min, Speed = 500rpm UnderT4 condition.

Table.6 Wear Test Results.

Varying load in kg	Initial weight in gms	Final weight in gms	Weight loss in gms	Sliding distance $\times 10^3$ m	Wear rate $\times 10^{-6}$ in gm/m
1	2.2909	2.2890	0.0019	1.021	1.864
2	2.2890	2.2857	0.0033	1.021	3.2321
3	2.2857	1.2811	0.0046	1.021	4.5053

### 2.4 Microstructure

Metallographic specimens generally requires five major operations are

- a. Sectioning
- b. Mounting
- c. Grinding
- d. Polishing
- e. Etching



Fig. 8 Micro-structure specimen

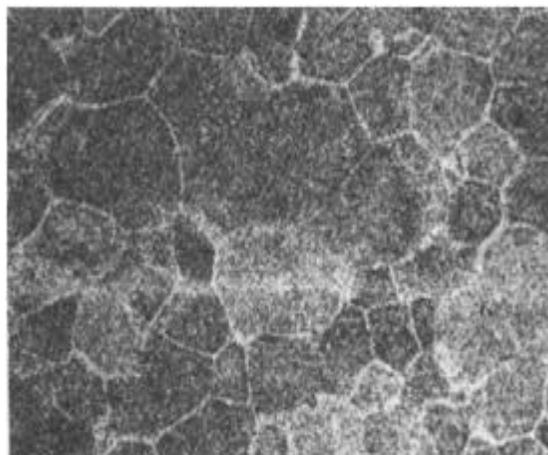


Fig. 9 Standard Micro-structure of Al6061

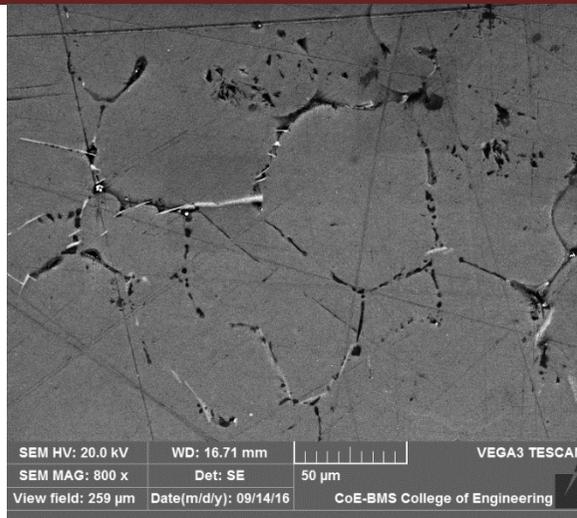


Fig.10. SEM micrographs of Al 6061 alloy

### III. Experimental Results and Discussions

From Hardness test we observed 46.75 HRB under varying loads. This is contrary to expectations as it was expected under T4 Conditions

In tensometer they all break in a “brittle” manner, as the curve is linear until it breaks or fractures with no bending of the curve at high loads and it is found that UTS of 129.625 and 137.825 N/ mm<sup>2</sup> for Engineering and true respectively. From the result stress analysis it is observed that the Engineering stress and True stress curves are almost nearer and as shown in fig.11

From figure 12 it is observed that as the wear load increases wear rate of material also increases proportionately and from figure 13 as the wear speed increases wear rate also increases up to 600 rpm and it becomes slowly saturation.

Microstructure of the specimen is almost same as that of standard alloy as shown in fig 10

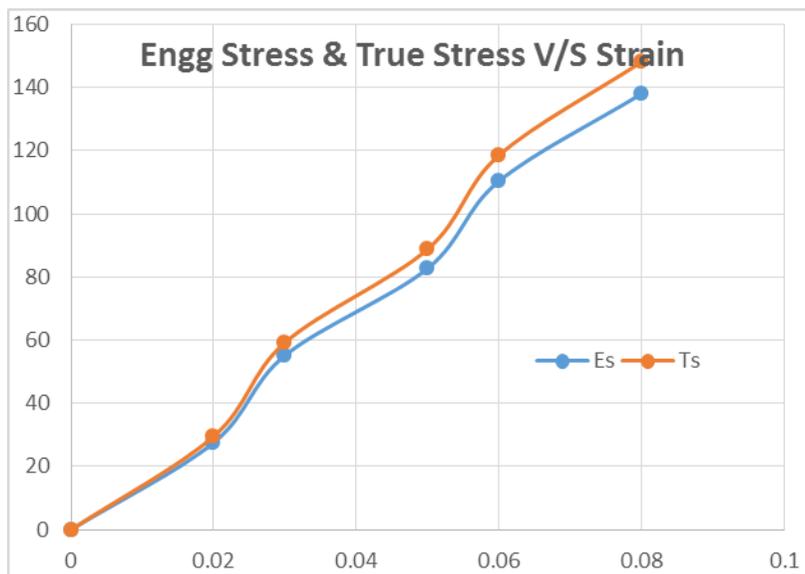


Fig.11. Engineering stress and True stress of Al 6061 alloy

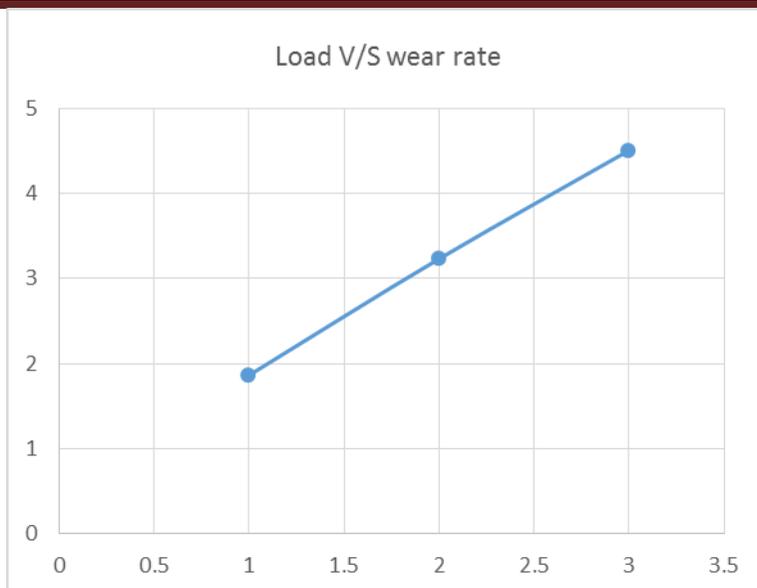


Fig.12.Load V/S Wear rate of Al 6061 alloy

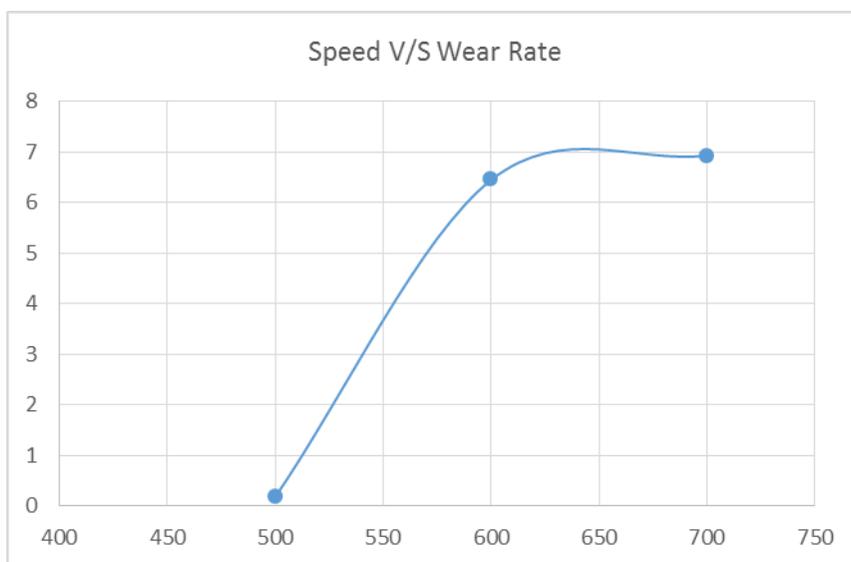


Fig.13.Speed V/S Wear rate of Al 6061 alloy

**IV. Discussion**

The hardness of 46.75 HRB is observed in lesser duration compared to lower aging condition. This increase in the peak hardness is due to the secondary precipitation of intermetallic phases with number of intermediate stages. During the formation of intermediate phases, the matrix lattice is strained, which increases the peak hardness value.

The dry sliding wear behavior of the alloy is analyzed. At constant speed of the disc, the wear rate versus sliding distance graphs are drawn at different loads (15N, 30N and 45N). In all the load conditions as the sliding distance increases wear rate decreases after the initial severe wear. Severe wear mode is observed in all the load conditions upto 3.4 kms of sliding distance. At 15N load conditions, where the load on the pin is very small the wear rate is almost maintained constant in all the aging conditions at higher sliding distances, but sensitive at lower sliding distance. This may be due to the rough contacting surface of specimen during the initial period of run. As the load on the pin increases the wear rate decreases with increase in sliding distance. This is due to the strain hardening phenomena. At lower loads the intensity of strain hardening are

small, accordingly the wear rate is not so sensitivewith sliding distance and aging conditions. But appreciable changes are observed at higher loads. Higher the load, strain hardening is also higher, thus wear rate is lower. But higher the aging temperature higher is the wear rate. At higher aging temperature coarser the grain, lesser is the hardness or higher is the wear rate and lesser number of intermediate zones in the formation of coherent precipitates that is lesser is the strain on the matrix.

## V. Conclusions

The Al6061 alloy positively responds for age hardening treatment. There is improvement in hardness strength and wear resistance of the alloy, if the treatment is tailored efficiently.

- In all the aging conditions peak hardness is observed in significant durations with the two fold increase in the hardness value at lower aging temperatures.
- The wear resistance is better at higher sliding distances and higher loads. Surprisingly higher rpm of the disc also contributes to the increased wear resistance.
- Higher the aging temperature lower is the strength of the peak aged specimen with increased toughness.
- SEM micrographs at lower aging temperature records the precipitation of large number of evenly distributed inter-metallic (Mg<sub>2</sub>Si) within and along the grain boundary as finer precipitates

Tensile testing generated stress curves as a function of sample extension. These figures are visual representations of the effect that thermal treatments may or may not have had on mechanical properties

Scanning Electron Microscope (SEM) Analysis The SEM micrographs of the Al6061 alloy in the peak aged condition. The precipitates (intermetallic) are observed along the grain boundary as well as inside the grain. More number of evenly dispersed precipitate are observed. At the same time finer grains are observed. The finer grains, homogeneously distributed large number of finer secondary phases and closer inter-particle distances are responsible for higher strength and hardness of the specimen. Micro analysis result also matches with the chemical composition of the alloy. The SEM analysis records the precipitation of finer Mg<sub>2</sub>Si inter-metallic along the grain boundary as well as within the grain condition at lower temperature aging.

## VI. Acknowledgements

I would like to thank the FENPIN Metals Bangalore for providing facility to make castings, also R and D Centre, Department of Mechanical Engineering MSRIT, in facility for Pin on Disc friction equipment for carrying out this research to find the wear behavior of the materials. And Also I will thank to the R & D Centre BMS college of Engineering for providing SEM Facility . The Natural treatment was carried out at Laboratory.

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# Stress Analysis of Crane Hook and Validation by Photo-Elasticity

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**ABSTRACT:** Crane hook is very significant component used for lifting loads with the help of chain or wire ropes. Crane hooks are highly predisposed components and are always subjected to bending stresses which leads to the failure of crane hook. To diminish the failure of crane hook, the stress induced in it must be studied and are tabulated. A crane hooks are subjected to uninterrupted loading and unloading. This may perhaps structural failure of the crane hook.

The design of the hook is done by analytically based on the requirements of Polari scope setup and design is done for the photo-elastic material in Acrylic sheet. After the analytical design, modelling of hook by using solid-edge and solid-works. The analysis of hook is completed by using FEA tool. This result leads us to the determination of stress in existing model. And these values are compared with analytical and experimental values obtained from photo-elasticity. By predicting and modification of the stress concentration area, the hook working life increase and reduces the failure of hook

**Keywords:** Crane Hook, Finite Element Method, Curved Beam, Winkler's Theory, Photo-elastic materials.

## 1. Introduction

Cranes are industrial machines that are mainly used for material movements in constructional sites, production halls, assembly lines, storage areas, power stations and similar places. Crane hooks are the components which are used to lift heavy loads using wire ropes and cranes in constructional sites and industries.

It is basically a hoisting fixture with pulley elongated by a rope or a chain designed to engage a ring or link of a lifting chain or the pin of a shackle or cable plug and has to follow the health and safety guidelines provided by the manufacturer. Consequently, such an important constituent machine element in any industry has to be manufactured and designed in a way so as to deliver maximum performance without failure and cause to any human being. Crane hooks are amid trapezoidal, elliptical, circular, rectangular and triangular cross sections are commonly used. Crane hooks are highly predisposed components and are always subjected to failure due to accumulation of large amount of stresses during loading.

Cranes hooks undergoes continuous loading and unloading, which causes fatigue of the crane hook. If the crack is developed in the crane hook, it can cause fracture prophogonda of the hook and leads to serious accident. In ductile yieldinjhg fracture, the crack propagates incessantly and is more easily detectable and hence preferred over brittle fracture, this brittle fracture is sudden propagation of the crack and the hook fails suddenly. This type of fractures is very hazardous as it is difficult to detect at the time of an event. The control of lifting hooks can prevent the fall of the shipment during service and minimize the risk to which people are exposed in the danger zone. Bending stresses combined with tensile stresses, weakening of hook due to wear, plastic deformation due to overloading, and excessive thermal stresses are some of the other reasons for failure. The continuous exercise of crane hooks which increases the magnitude of stresses and eventually results in failure of the hook may be prevented if the stress concentration areas are well predicted and several design modifications is made to decrease the stresses in those stress concentration areas.

Thus the aims of this work is to design a crane hook using CAD and assign Material properties of commonly used materials for hooks using ANSYS and calculate the total deformation and von -misers stress distribution and etc for budding engineers.

## II. Stress Analysis of Curved Beams Using Winkler"S Theory

The Winkler"s theory following assumptions are made

- 1) The cross section of the axis is symmetry in the plane of symmetry.
- 2) Plane cross sections remain plane before and after bending.
- 3) The modulus of elasticity is same in tension and compression.

According to Winkler's Theory, the bending stress at any section in the curved beam is given by,

$$\sigma = \frac{M \times y}{A \times e(r_n - y)}$$

where,

M = Bending moment;

y = Distance of any fibre from the neutral axis;

A = Area of Cross - section;

e = Eccentricity = distance between centroidal axis and neutral axis;

r<sub>n</sub> = Radius of Neutral axis

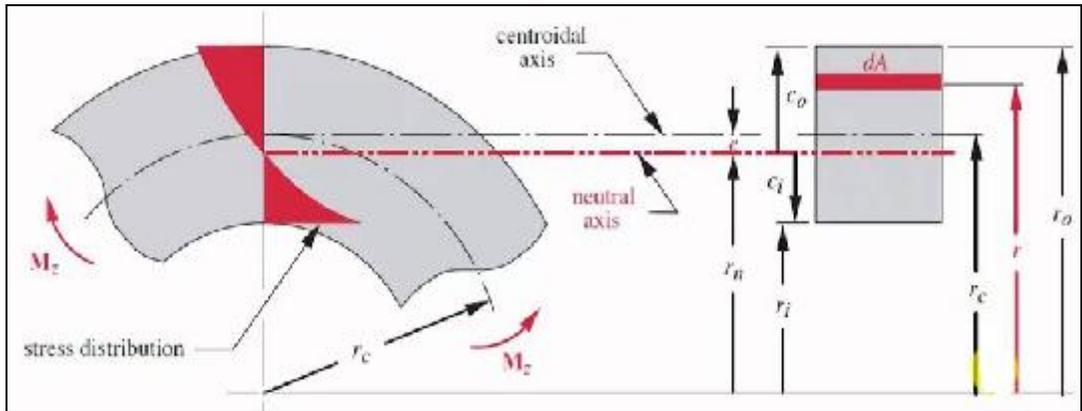


Fig. 1 Curved Beam Subjected to Bending Moment and its Related Parameters

In the above figure 1,

h = Depth of cross - section in mm

C<sub>o</sub> = Distance from neutral axis to outer fibre in mm

C<sub>i</sub> = Distance from neutral axis to inner fibre in mm

r<sub>n</sub> = Radius of neutral axis in mm

r<sub>c</sub> = Radius of centroidal axis in mm

e = Eccentricity = distance from centroidal axis to neutral axis in mm

M = Bending moment in Nmm

### III. Modelling

Based on the requirements of the our polari-scope set up, basic dimensions of hook like height, width, hole diameter are collected. And a proto type model was created by using CAD tool and the same is manufactured in wood as well as 3D printing and tested in the setup and same dimensions were adopted for Acrylic material.

The Designed Crane hook are modelled in SOLID EDGE and SOLID WORKS and exported to ANSYS for simulation .

By using same dimensions key points are created in Ansys and developed it into a 2d model. This model is meshed and used for simulation.

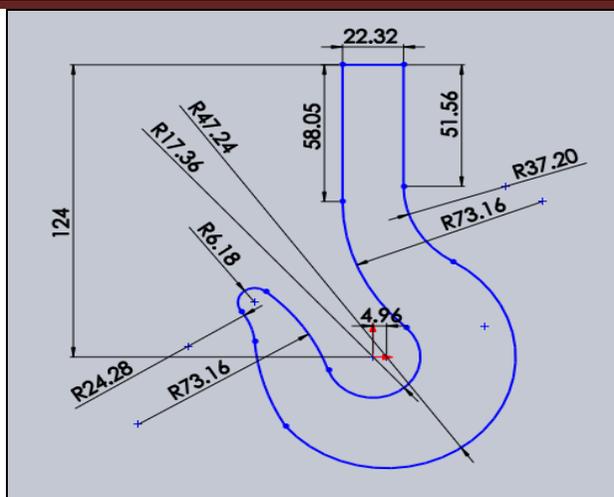


Fig 2: Detailed drawing of crane hook

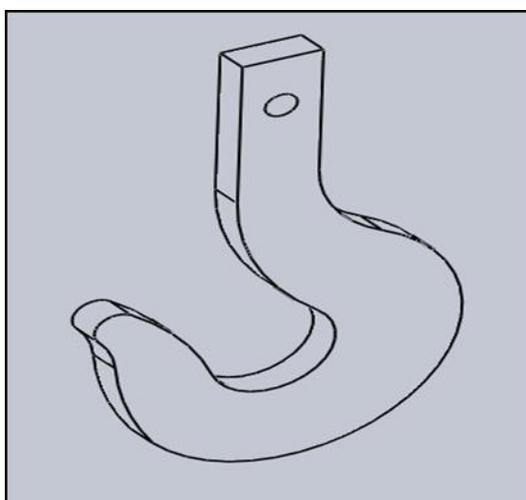


Fig 3: DModel rectangular section

#### IV. Methodology

##### 1. Material Selection and Preparation of Specimen

###### a. Material selection:

As we are conducting experiment in polari-scope, we require specimen of photo-elastic material.

An ideal photo-elastic material should have following properties:

- \* Transparent to light used in Polari scope.
- \* It should have high optical sensitivity as indicated by low fringe value.
- \* It should have linear characteristics with respect to stress-strain, stress-fringe order and strain-fringe order properties for model to prototype scaling
- \* It should have both mechanical and optical isotropy and homogeneity.

###### b. Laser cutting process:

The acrylic sheets are to be cut into hook of design we developed, hence opted laser cutting.

The design should be saved in dxf format and should be copied to Corel draw software.

Then laser cutting machine cuts according to the profile given.

As above characteristics are resembled in ACRYLIC, hence we selected acrylic as photo-elastic material.

Mechanical properties of ACRYLIC material:

1. Modulus of elasticity,  $E=2.76 - 3.30$  GPa
2. Poisson's ratio,  $\gamma = 0.370$
3. Hardness, Rockwell =  $94.02 - 105$  HRB

Optical properties of ACRYLIC material:

1. Refractive index =  $1.49$
2. Transmission, visible =  $50.02\% - 93.0\%$

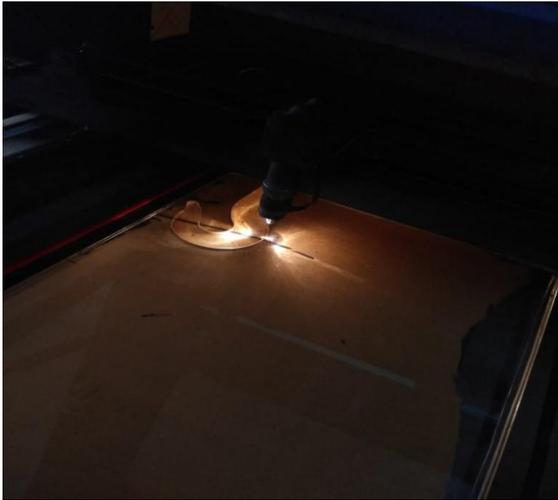


Fig:4 Laser Machine cutting



Fig:5 Finished product

## 2. Experimental setup:

The Polari-scope setup shows in it. We can load in required amounts. And it is inbuilt with analyzer, polarizer and sodium light which all in combine enables us to study fringes formed in photo-elastic material under loaded condition



Fig:7 Photo elasticity experimental Setup

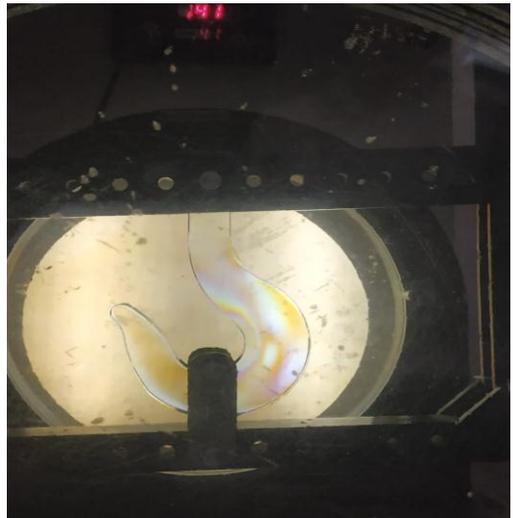


Fig 8 Fringe Pattern on Hook

### 3. Analytical Procedure of Stress Analysis

The stress analysis of the crane hook specimen is done analytically by using Winkler's theory. Three load cases corresponding to 30Kg, 60Kg and 90Kg are considered. The following shows a representative calculation for the load case of 30Kg.

$$r_i = 16.39\text{mm}$$

$$r_o = 49.18\text{mm}$$

$$h = 33\text{mm}$$

$$r_n = \frac{h}{\ln\left(\frac{r_o}{r_i}\right)} = 30.30\text{mm}$$

$$r_c = r_i + \frac{h}{2} = 32.89\text{mm}$$

$$e = 2.86\text{mm}$$

$$R = \text{Distance from centroidal axis to Force} = 32.89\text{mm}$$

$$A = 330\text{mm}^2$$

$$\text{Load} = 30\text{kg} = 294.3\text{N}$$

#### Calculation of Stress

$$\text{Direct stress, } \sigma_d = F/A = 294.3/330 = 0.890 \text{ N/mm}^2$$

$$\text{Bending stress, } M_b = 986.7 \text{ Nmm}$$

$$\text{Bending stress at inner radius, } \sigma_{bi} = \frac{M_b \times C_i}{A \times r_i} = 0.8700 \text{ N/mm}^2$$

$$\text{Total bending stress} = \sigma_d + \sigma_{bi} = 1.76 \text{ N/mm}^2$$

$$\text{Stress concentration factor} = \frac{\sigma_{max}}{\sigma_{Nom}} = 1.97$$

### 4. Analysis

Analysis of crane hook is carried out in ANSYS. Initially the model is created using key-point -line-Area and then it is free-meshed.

Boundary conditions are applied and simulated are as shown in Figures 9, 10, 11, 12 below

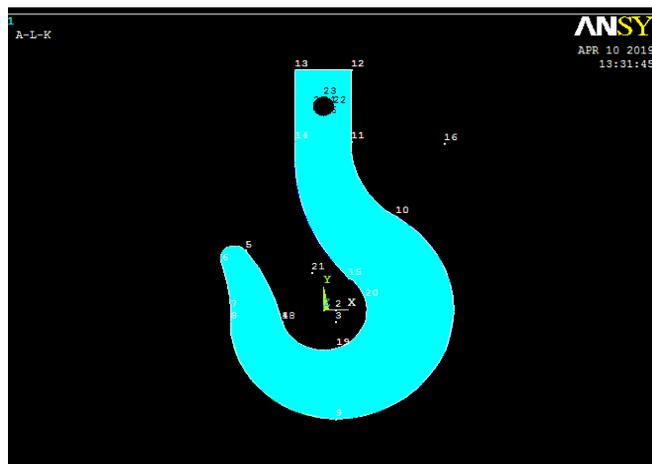


Fig 9: crane hook created using key-point method

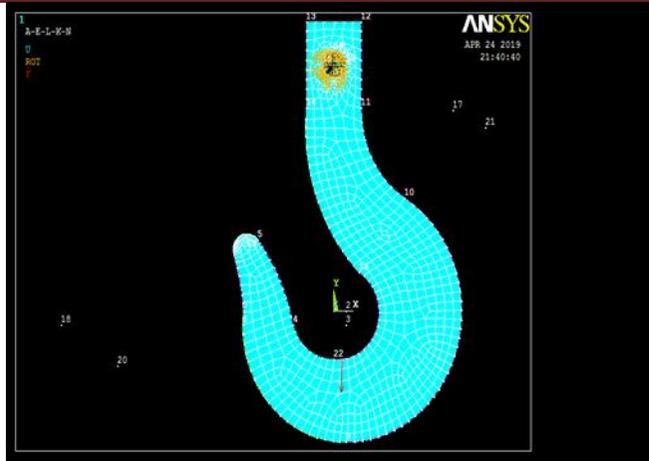


Fig 10: meshed hook under load and boundary conditions

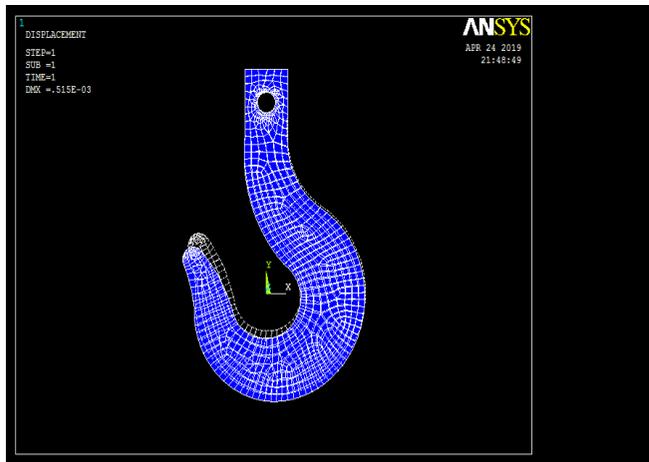


Fig 11: deformed and un-deformed hook

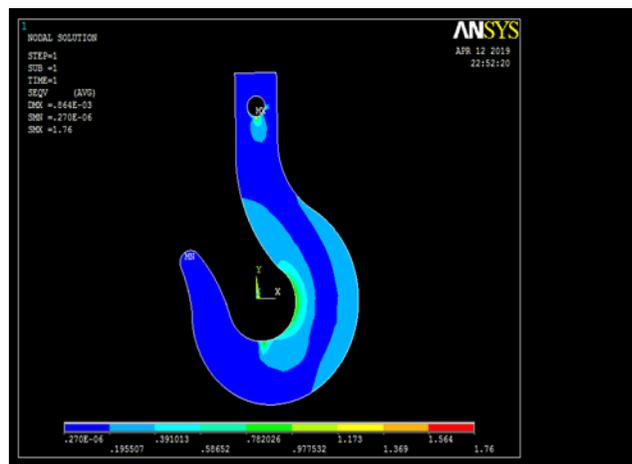


Fig 12: von misses stress for 30 kg

## V. Results

The results obtained from the analytical procedure of stress analysis using Winkler's theory, FEA tool of stress analysis and plori-scope setup tabulated in the following table.

Table. 1

Sl.no	Load In kg	Load in N	Analytical $K\sigma$	Von misses $K\sigma$	Experimental $K\sigma$
1	30	294.3	1.97	1.97	1.05
2	60	588.6	1.97	1.973	1.0092
3	90	882.9	1.97	1.9016	1.0024

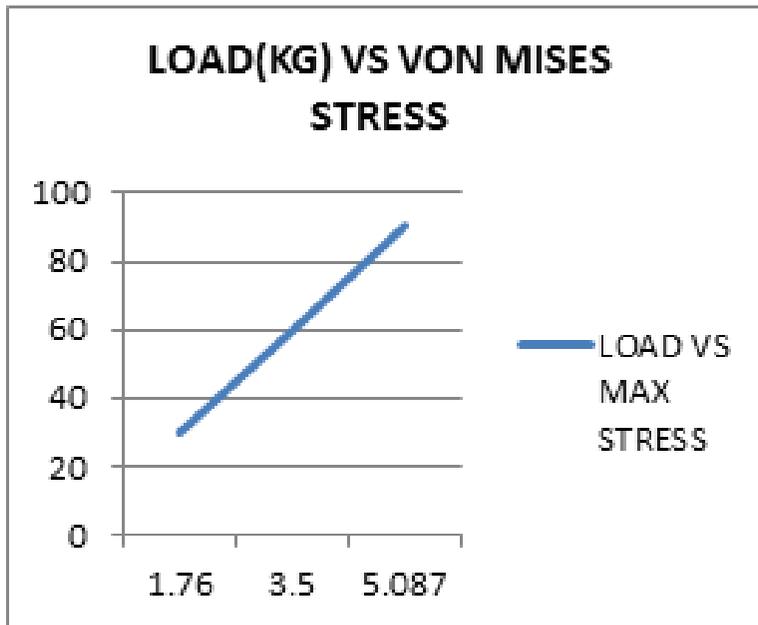


Fig13: Graphical representation for load vs von misses stress

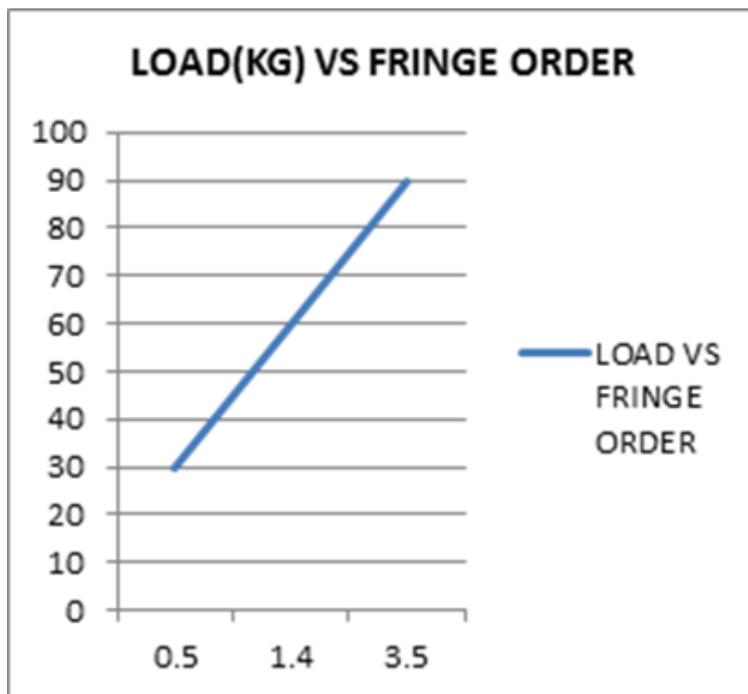


Fig14: Graphical representation for load vs fringe order

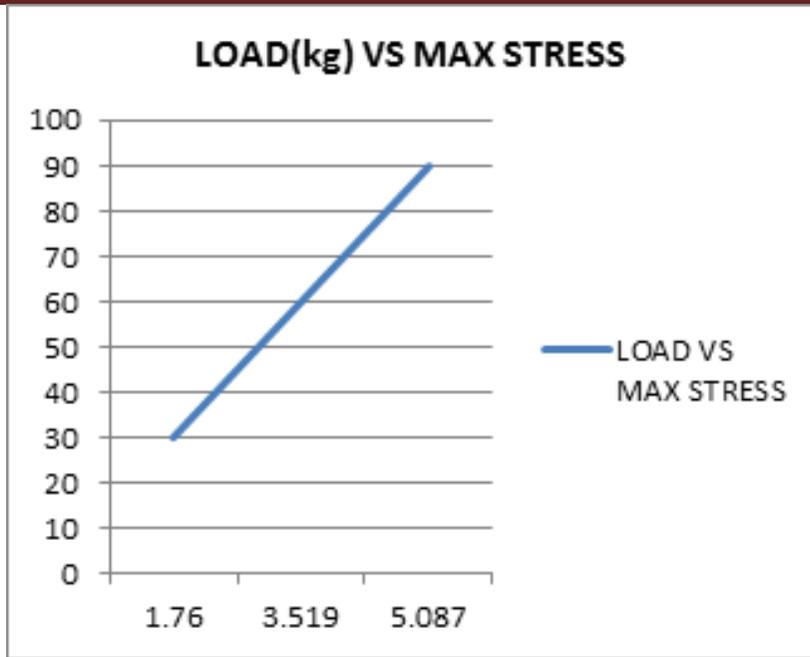


Fig15: Graphical representation for load vs max stress

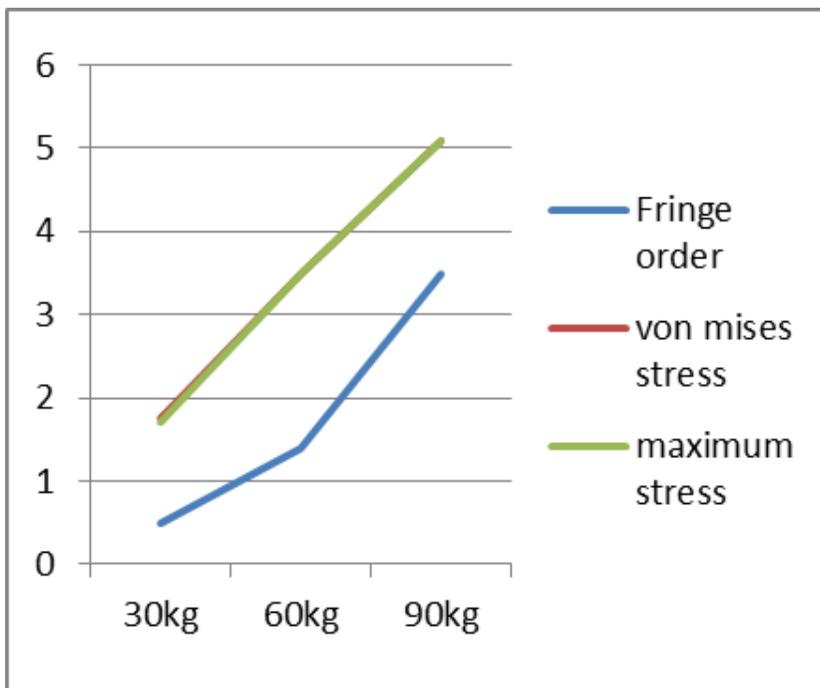


Fig16: Graphical representation for load vs fringe order, von Misses stress, maximum stress

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# **Analyzation of Phase Change Materials Based on Thermal Energy Storage System Using CFD Tool**

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**ABSTRACT:** *The paper is proposed to study the primary physical performance of phase change energy materials (PCEMs) and provide a comprehensive overview of the state of the art in their design and applications for thermal energy storage. Between many types of base materials, the phase change energy materials are the most adequate mediums to store and release the thermal energy. This Phase change materials encompass high latent heat of fusion and low thermal conductivity, therefore, nanomaterials are used as additives to enhance the properties of base materials as PCMs. In Thermal Energy Storage (TES) system phase change energy material is packed in different shape capsules which are made of stainless steel. This paper in attendance with exhaustive classification of Phase change materials and nanomaterials used in thermal energy storage technologies in addition an assessment about their modeling through computational fluid dynamics (CFD). My objective is to highlight CFD use as an effective tool to increase engineering development of thermal energy storage technologies*

**Keywords:** *Thermal Energy Storage System, Phase Change Energy Materials, Computational fluid dynamics (CFD).*

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## **1. Introduction**

Thermal Energy Storage (TES) has become one of the most pressing topics worldwide. The serious concern of public regarding greenhouse gases emissions, limited reserves of fossil fuel, and rapid growth of global energy have shed the light on the effective utilization of thermal energy. According to the U.S energy information administration, the global world energy use is estimated to increase from  $1.7 \times 10^{11}$  MWh in 2015 to  $2.2 \times 10^{11}$  MWh in 2040, an increase of 29%. Thermal energy storage provides a key method to reduce energy consumption and dependency on fossil fuels. Efficient utilization of energy can be achieved by matching the energy supply with demand by means of thermal energy storage systems. For instance, power plants can run at maximum power, and excess heat from production can be transferred to thermal storage systems where it is stored for later utilization during peak demand, increasing efficiency and reducing the mismatch between energy supply and demand. In this context, thermal energy storage using Phase Change Materials present a unique opportunity to reduce the need to fossil fuel and suppress greenhouse gases emission. Thermal energy storage is a key technology for an effective utilization of energy. The applications of phase change materials for thermal energy storage have been the focus of extensive research in recent decades. Their use can reduce the size and cost of the system, offering higher thermal storage capacity and the ability to be used as a thermal management tool. The following sections present the fundamentals of phase change materials including the details of their physical behavior, design issues, and applications for thermal energy storage. CFD utilization is expected to be a valuable way to keep funds and time and to deliver optimization tools for maximum efficiency of these systems. Article focuses on the enhancement of TES by using nanomaterials as additives to the base storage materials. It critically reviews the existing studies dealing with the use of nanocomposites in TES applications. First, classifications of PCMs and of the nanomaterials were presented and discussed and then CFD utilization to study nanocomposites are analysed. objective is to emphasize CFD tool as an effective tool to increase engineering development of thermal energy storage technologies.

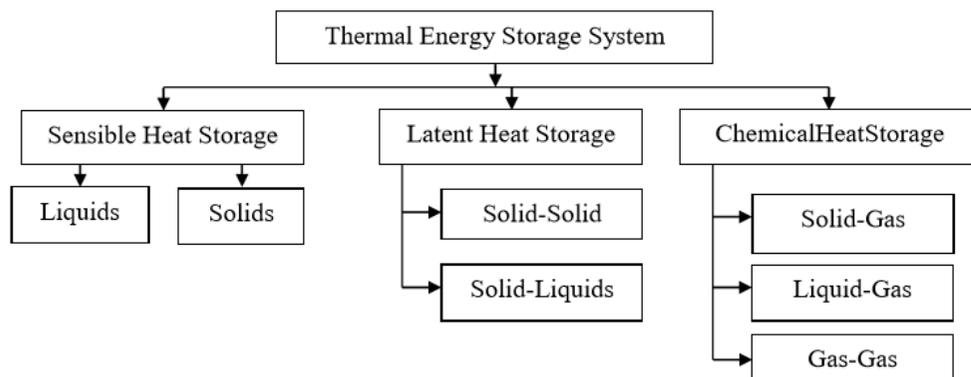
## **II. Thermal Energy Storage System Using Solar Energy**

Thermal Energy Storage (TES) is the missing link to sustainable and reliable power generation via solar thermal energy. The use of TES will improve the overall solar thermal system ability to handle sudden increases of demand at constant sun radiation, and improve the system economics by allowing larger production capacity. Solar Energy is the energy so as to is formed by the sun in the form of heat and light. It is one of the most renewable and readily available sources of energy. The information that it is available in ample and at no cost of charge and does not belong to anybody makes it one of the most important of the non-conventional sources of energy. Mostly, the used solar energy can be worn to swap it into heat energy

or it can be converted into electricity. Solar energy be able to be convert into electricity by means of solar thermal energy and photovoltaic. On the other hand, Solar heat energy can be used to heat water or space heating and can be broadly categorized as active or passive solar energy depending on how they are captured and utilized. In lively solar energy special solar heating apparatus is used to convert solar energy to heat energy whereas in passive solar energy the mechanical equipment is not present. Active solar include the use of mechanical equipment like solar thermal collectors, photovoltaic cells and fans to trap the solar energy.

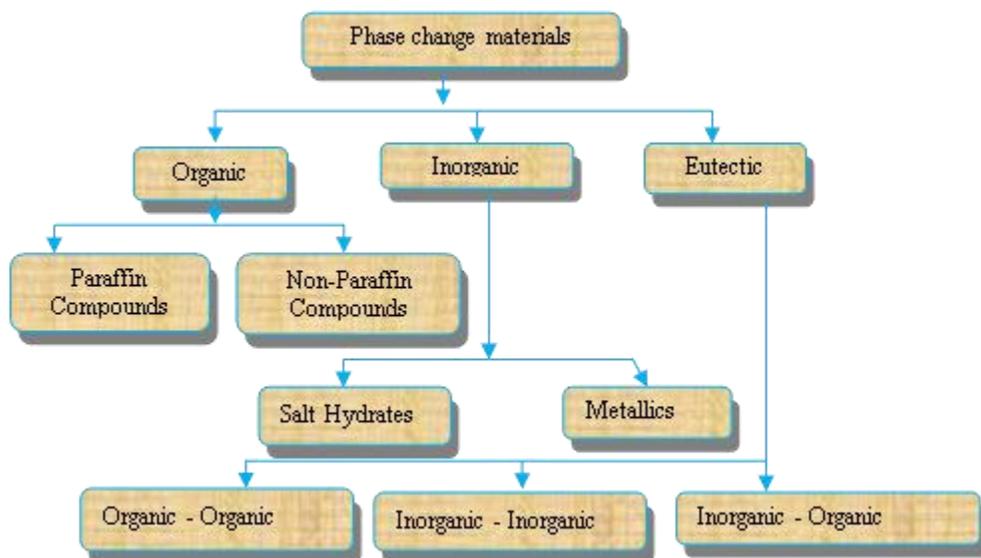
**Methods of Thermal Energy Storage System**

Readily available are three ways to store thermal energy: sensible heat, latent heat and thermo-chemical energy. In sensible heat, energy is stored/released by raising/reducing the temperature of a storage material without changing the phase. An overview of major technique of storage of thermal energy is shown in below.



**III. PCMs Classifications**

A large number of phase change materials (organic, inorganic and eutectic) are available in any required temperature range. A classification of PCMs is given below.



In general, organic PCMs are the most popular type of PCMs, classified as Paraffin(C<sub>n</sub>H<sub>2n+2</sub>) and the non-paraffin such as fatty acids (CH<sub>3</sub>(CH<sub>2</sub>)<sub>2n</sub>COOH). Depending on the hydrocarbon chain structure, each PCM has its particular phase transition temperature and latent heat of fusion. Most organic PCMs are characterized by excellent thermal stability, non-corrosiveness, non-toxicity, and little or no supercooling. Their major limitation is the very low thermal conductivity, relatively higher cost, and flammability. Inorganic PCMs are classified as salts and metallic alloys. Salt hydrates consist of a crystal matrix of water and salt solution. The high latent heat of some mixtures, low cost, ease of availability, high specific heat, and high thermal

conductivity of salt hydrates are very attractive for practical application, however the supercooling and poor thermal stability upon cycling due to phase separation and dehydration are their main drawbacks. Metallic alloys possess attractive thermo-physical properties such as high thermal conductivity and specific heat, however they are mostly available with very high phase transition temperatures, limiting their applications.

#### **IV. Computational Fluid Dynamics(CFD):**

Computational fluid dynamics is fretful with obtaining numerical solution to fluid flow problems by using computers. The advent of high-speed and large-memory computers has enabled CFD to obtain solutions to many flow problems including those that are compressible or incompressible, laminar or turbulent, chemically reacting or non-reacting. Computational fluid dynamics is the discipline of predicting fluid flow, heat and mass transfer, chemical reactions, and related phenomenon by solving numerical set of governing mathematical differential equations like Conservation of mass, momentum, energy, species, etc.

The results of CFD analyses are relevant in:

1. Conceptual studies of new designs.
2. Detailed product development.
3. Troubleshooting
4. Redesign

The set of equations leading the fluid flow dilemma are the continuity conservation of mass), the Navier-Stokes (conservation of momentum), and the energy equations since non-linear terms in these equations, analytical methods can yield very few solutions.

Computational fluid dynamics is the sculpture of replacing the differential equation governing the Fluid Flow, with a set of algebraic equations (the process is called discretisation), which in turn can be solved with the support of a digital computer to get an approximate solution. There are some sole advantages of CFD over experiment-based approaches to fluid system design:

- a. Substantial reduction of lead times and costs of new design.
- b. Facility to study systems where controlled experiments are difficult or impossible to perform.
- c. Ability to study arrangement hazardous conditions at and beyond their normal limits.
- d. Practically unlimited level of detail of results.

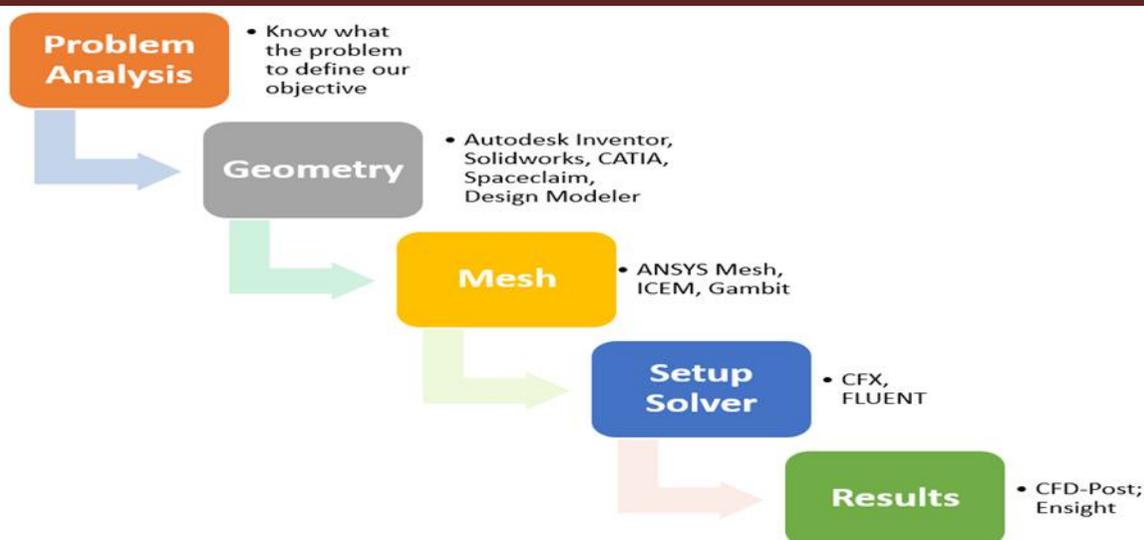
#### **Steps In CFD**

CFD codes are prearranged around the numerical algorithm that can tackle fluid flow problems to present easy access to their solving power all commercial CFD packages include sophisticated user interfaces to input problem parameters and to examine the results. Hence all code contains three elements: (a) a pre-processor, (b) a solver and (c) a post-processor.

#### **Methodology for the Analysis**

The TES system is closed system and it consists of various components like flat plat collector, hot water storage tank, capsules, header and riser. Same steps should follow for simulation of TES system with PCM. This section will outline the basic methodology described. The following Steps summarize the methodology used:

- In geometry physical boundaries of the problem is defined.
- The volume engaged by the liquefied is divided into discrete cells (the mesh). The mesh may be uniform or non-uniform.
- The substantial modelling is defined – for example, the equations of motion + enthalpy + convection + species conservation.
- Boundary conditions are defined and involves specifying the fluid behaviour and properties at the boundaries of the problem.
- The mock-up is started and the equations are solved iteratively as a steady-state and transient.
- At last, a postprocessor is used for the analysis and visualization of the resulting solution.



### Defining the computational domain/geometry

It is the first step. FLUENT has the facility to create the geometry of fluid domain of cylindrical shape tank. The geometry can also be imported from various CAD tools available for creating geometry. FLUENT module called ANSYS 16.0 has in built feature for creating geometry as well as mesh generation.

### Discretisation of computational domain/meshing

The second step is the discretisation of the physical system of interest which divide the geometry in to number of finite volumes (cells), called grid or mesh. The ANSYS has the facility to generate the meshing simultaneously with the geometry as well as also use to generate volume grids from surface grids imported from CFD Fluent. FLUENT uses unstructured meshes in order to reduce the amount of time one can spend generating meshes, to simplify the geometry modeling and mesh generation process, to allow modeling of more complex geometries than one can handle with conventional, multi-block structured meshes, and to let adapt the mesh to resolve the flow-field features. It can also use bodyfitted, block-structured meshes (e.g., those used by FLUENT and many other CFD solvers). It is able of handling triangular and quadrilateral elements in 2D, and tetrahedral, hexahedral, pyramid, wedge, and polyhedral elements (or a combination of these) in 3D. As the computational domain of geometry is cylindrical in shape.

### Boundary Condition

Boundary-type specifications, such as WALL, INLET, OUTLET. define the characteristics of the model at its external or internal boundaries. Continuum-type specifications, such as FLUID or SOLID, define the characteristics of the model within specified regions of its domain.

### Output parameters

In the simulation the last step is the visualization of results. The contours of all the parameters such as; temperature, pressure, density, velocity etc. can be well plotted. From these values the profiles of any parameter can be plotted by graphically.

### Result and Discussion

Simulation has been carried out and it has been confirmed that the predicted average temperature is within the acceptable limits.

### V. Conclusion

Paper shows exhaustive classification of PCMs used in thermal energy storage system and an assessment about their modeling through computational fluid dynamics (CFD). Goal was to emphasize CFD use as an effective tool to increase engineering development of thermal energy storage technologies. The application of CFD in designing PCM thermal storages is a feasible method because of the highly accurate results. CFD also delivers optimization tools to help users achieve maximum efficiency while saving time and money.

Results showed that although phase change material due to dispersion of nanoparticles have great potential for demanding thermal energy storage applications, the selection of proper PCM, nanoparticles and its concentration is essential to improve the heat transfer performance.

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# Study of Mechanical Properties on Mulberry Fibre

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**ABSTRACT:** Natural fiber reinforced polymer composite is the composite material in which natural fibers are used to reinforce the polymer matrix so as to improve its mechanical properties. These are environmental friendly and cost effective to synthetic fiber reinforced composites. The availability of natural fiber, low cost and ease of manufacturing have urged researchers worldwide to try locally available inexpensive Mulberry fiber and to study their properties for reinforcement purposes and to what extent they satisfy the required specifications of good reinforced polymer composite for Industrial and Structural applications. Natural fibers need to be treated chemically so as to improve interfacial adhesion between fiber surface and polymer matrix. This review aims at explaining about properties of Mulberry fibre reinforced polymer composites along with its application.

**Keywords:** Natural Fibre, Mulberry Fibre, Resin, Chopped Method, Laminate

## 1. Introduction

Natural fibres can be defined as bio- based fibres or fibres from vegetables and animal origin. Based on their origin, natural fibres can also be classified as cellulosic (from plants) and protein (from animals).

The natural fibres can be used to reinforce for both thermosetting and thermoplastic matrices. Thermosetting resins, such as epoxy, polyester, polyurethane, phenolic, etc, are commonly used today in natural fibre composites, in which composites requiring higher performance applications. They provide sufficient mechanical properties, in particular stiffness and strength, at acceptably low price levels. Considering the ecological aspects of material selection, replacing synthetic fibres by natural ones is only a first step. Restricting the emission of green house effect - causing gases such as CO<sub>2</sub> into the atmosphere and an increasing awareness of the finiteness of fossil energy resources are leading to developing new materials that are entirely based on renewable resources. Natural fibres include those made from plant, animal and mineral sources.

Natural fibres can be classified according to their origin.

- Animal fibre
- Mineral fibre
- Plant fibre

### Animal fibre

Animal fibres generally comprise proteins, examples mohair, wool, silk, alpaca, and angora.

- Animal hair (wool or hair): fibre taken from animals or hairy mammals.  
E.g. Sheep's wool, goat hair (cashmere, mohair) alpaca hair, horse hair, etc.
- Silk fibre: fibre collected from dried saliva of bugs or insects during the preparation of cocoons. Examples include silk from silk worms.
- Avian fibre: fibres from birds, e.g. feathers and feather fibre.

### Mineral fibre

Mineral fibres are naturally occurring fibre or slightly modified fibre procured from minerals. These can be categorized into the following categories

- Asbestos: the only naturally occurring mineral fibre. Variations are serpentine and amphiboles, anthophyllite.
- Ceramic fibres: Glass fibres (Glass wool and quartz), aluminum oxide, silicon carbide, and boron carbide.
- Metal fibres: Aluminum fibres.

## **Plant fibre**

Plant fibres are generally comprised mainly of cellulose: examples include cotton, jute, flax ramie, sisal, sidaacuta and hemp. Cellulose fibre serves in the manufacture of paper and cloth.

## **Mulberry Fibre**

In India, most states have taken up sericulture as an important agro-industry with excellent results. The white mulberry (*Morus alba* L.) plants are generally dioecious and wild-growing deciduous woody perennialsericulturalplantswithadeeprootsystem.Theyareextensivelycultivatedtoprovideleavesas food for silkworms. Mulberry leaves are the only nourishment for larvae of the mulberry silkworm (*Bombyxmori* L.) and are grown under diverse climatic circumstances ranging from temperate to tropical and have a direct bearing on the quality and quantity of cocoon harvest. *Morus alba* L. stem is a sericulture waste, and is rich in fiber content in its bark as well as in its stem. Thousands tons of mulberry branches consisting of bast and stalk are harvested for firewood or agrowastes every year. The branches from which the leaves have been removed are a by-product that is currently mostly used as firewood or discarded as agricultural waste; however, medicinal uses for the bark of these branches have been described (Du et al. 2003). Moreover, utilization of the bark's pectin, cross-linking heteroglycans, and cellulose may be used. The mulberry bark is also used as an herb for removing internal body heat from the lung, relieving asthma and inducing diuresis, and has anti-HIV, antioxidative, antihypotensive, and cytotoxic activities (Du et al. 2003). Cellulosic nanofibers were extracted from mulberry branch bark by high-temperature alkali treatment followed by the sulfuric acid hydrolysis for mass utilization (Li et al. 2009). Pectin solution from bark without epidermis showed higher apparent viscosity, suggesting its higher gelation ability. Thus, the mulberry branch bark is a potential source of pectin with different degrees of esterification (Liu et al. 2010). Mulberry trees are extensively grown for their leaves as food for silkworms. The bark of mulberry tree is fibrous and used for papermaking. Currently, thousand tons of mulberry stems are harvested for firewood or agro-wastes every year. Utilizing this as a fiber reinforcement for making composites and provides an opportunity for green environment. Till date, there is no characterization work on the stem fibers extracted from this plant.

## **Objective**

- To study the mechanical properties of fibre extracted from Mulberry plant (*Morus alba* L Stem)
- To develop laminate specimen using extracted fibre from Mulberry plant by Hand layup process using epoxy as a resin

Characterization of Mulberry Fibre laminate is subjected to

Tensile test

Flexural test

Impact test

Compression test

Hardness test

The purpose of project methodology is to prepare the composite of the mulberry fiber and to conduct experiment on the mulberry fiber. Then testing is done on the prepared fiber and check the various mechanical properties of the mulberry fiber and to compare these results with the synthetic fibers.

## **II. Methodology**

### **1. Mulberry Stem Extraction**

*Morus*, a genus of flowering plants in the family Moraceae of deciduous trees commonly known as mulberries, grows wild and is under cultivation in many temperature world regions. Mulberry is a fast-growing deciduous woody perennial plant. White mulberry (*Morus Alba* L.) is a fast growing, small to medium-sized mulberry tree. It is an aggressive, often weedy tree native to China. The mulberry plants are allowed to grow tall with a crown height of 1.5 to 1.8 m from ground level and allowed to grow with a maximum of 8–10 shoots at the crown. They are specially raised with the help of well-grown saplings 2–3 months old. It could be harvested mechanically with tree shaking systems. The leaves were originally exported for the silkworm industry. They are the only food for the silkworm (*Bombay mori*). Particularly, a significant amount of stems are used as firewood. The *Morus alba* L. stems are common agro-waste and are collected from Chikkaballapur district in Karnataka India. The collected stems were washed with water at a temperature of 25°C. The chopped stems were soaked in water for 1 month to undergo microbial

degradation. They were washed in water and dried in natural sunlight to remove moisture content. Then, they were ground using a mechanical slow-speed pulverized and then passed through a sieve.



## 2. Mulberry Fibre Extraction

After collection of the mulberry stems from the agro sericulture waste the stems were soaked in the water for 25-30 days to undergo microbiological Degradation .and then fibre will be extracted from the stem according to the dimensions and then fibre will be cut for the chopping method for the dimensions 3-5 mm .



## 3. Chopped Method

This is the method which is used to make a laminate for required dimensions. In this method the mulberry fibre will be cutted into 3-5mm size (according to ASTM standard for chopping method) then it will be dry in a atmospheric condition. after undergone a atmospheric degradation the fibre will be chopped to required dimensions.



#### 4. Making Laminate

The chopped fibres are used to make a laminate. To make a laminate the required materials are Resin LY556, Hardner HY951, 30\*30 Die which having a thickness of 5mm. The resin LY556 and Hardner HY951 is mixed with appropriate calculations. First one layer of resin is applied on the bottom base metallic box and then chopped fibre will be placed on the resin then after again one layer resin is applied on the fibre which makes good bonding between them. After that the top die will closed on that. The weights are placed on the top die to get a more strengthened laminate. Then it will cooled under atmospheric condition for 8-12 hours.

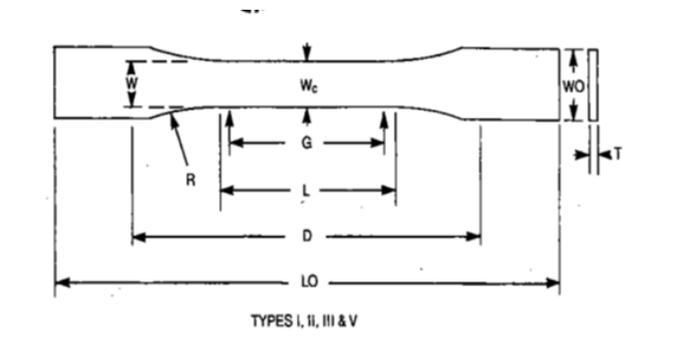


#### 5. Testing Conducted On The Specimen

After making an laminate it will be cutted into the according to the ASTM standards as follows:

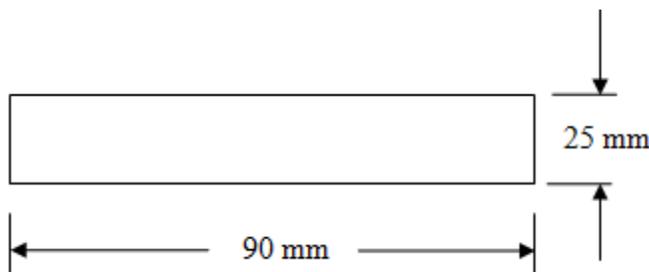
##### 1. Tensile test specimen

According to ASTM D638-02a, the specimen was cut into required dimension (165 mm×13 mm×5.5 mm) using diamond wheel and emery paper. Glass fibre tabs are mounted at the both ends of the specimen for the purpose of gripping. The geometry of the test specimen is shown in fig.



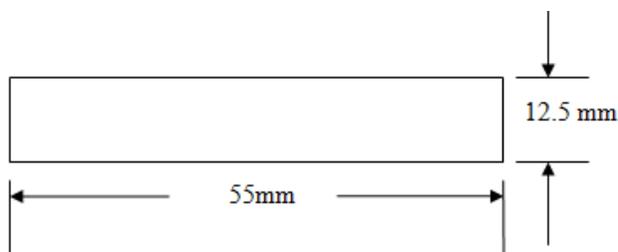
## 2. Flexural test specimen

According to ASTM 3039-76, the specimen was cut into required dimension (90 mm×12.5 mm×5.5 mm) using diamond wheel and emery paper. The geometry of the test specimen is shown in Fig..



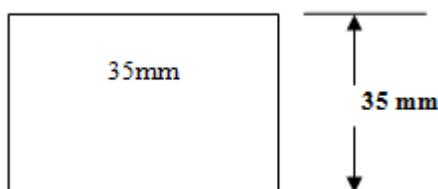
## 3. Impact (charpy test) test specimen

According to ASTM E23, the specimen was cut into required dimension (55 mm×10 mm ×10 mm) using diamond wheel and emery paper. The geometry of the test specimen is shown in Fig.



## 4. Hardness test specimen

According to ASTM D256, the specimen was cut into required dimension (35mm×25mm×5.5mm) using diamond wheel and emery paper. The geometry of the test specimen is shown in Fig.



## Expected result

- ❖ Compare various mechanical properties with the synthetic fibers and to show that the natural fiber has better mechanical properties than synthetic fibers.
- ❖ Replace the synthetic fibers with the Natural Fibers to reduce the disadvantages caused by synthetic Fibers.

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# Intervention of Sludge Removal Machine to Discourse Blind Spot of Manual Scavenging

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**ABSTRACT:** Manual scavenging is the degrading and illegal task of cleaning human excrement from sewage, drainage of India's roads and dry latrines. Scavengers use not more than a broom, a tin plate, and a basket, make clear of faeces from public and private latrines as well as carry them to dumping yards/ disposal sites. 1.2 million Scavengers in the country are involved in the sanitation of our surrounding. These workers are commonly exposed to gases like ammonia, hydrogen disulfide, carbon monoxide and methane. The workers who handle human waste and sewage are at high risk of becoming ill, even in some case it caused death. As many municipalities of India are not equipped with latest machine to clean the sewage system, it adds difficulties to the workers. This paper represents the study of manual scavenging in India and a preventive method to save the life, this sludge removal machine is a modified screw conveyor, the sewage waste consists of 60% of water and 40% of sludge, liquid drain out to the system from small holes, remaining sludge are out from the pipe. This is the equipment/machine which simplifies the life of the workers; it avoids entering into the manhole. In a technology-driven world where India aspires to become a super power, must have access to dignified sanitation facilities. The benefit of this research is design of sludge removal machine that could reduce the number of workers required for the waste removal process. This research may contribute to improve the safety of the manual scavengers.

**Keywords:** Manual Scavenging, Screw conveyor, Sludge.

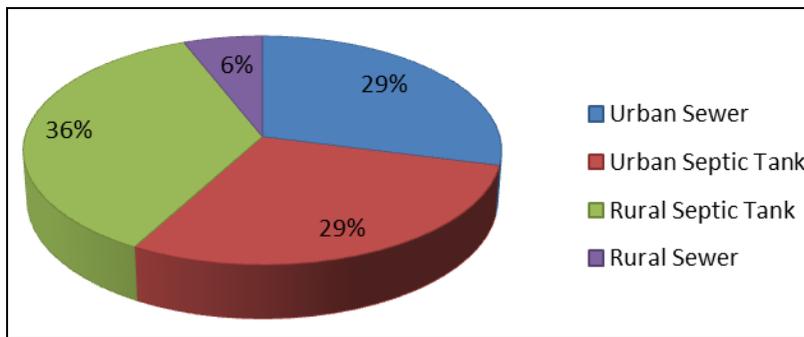
## 1. Introduction

Manual scavenging is a hereditary, caste-based occupation that predominantly involves forced labour. More than a livelihood, it has been a custom or practice that has continued unremitting despite of all the available technology and alternatives. It is also the most dehumanising and degrading practice in the country and is undertaken mostly by Dalits [1]. Manual scavenge means a person employed on regular or frequent basis by an individual or local authority, private or public agencies for manual cleaning, carrying and disposing of human excreta on a railway track or insanitary latrines, open drain or a pit before excreta decomposes [2]. Social bias against scavengers is also out of control. While women usually clean dry toilets, men and women clean excrement from open defecation sites, gutters, and drains, and men are call upon to do the more physically tough work of cleaning sewers and septic tanks. In brief, the manual scavengers are considered to be the most subjugated and disadvantaged of community in India. They have been rendered so powerless and defenceless that they are neither aware of the rights conferred upon them nor they are competent enough to fight for their rights like the rest of the citizens of the India. The news of the deaths of manual scavengers just shows us that nothing has changed in recent times [3]. As per the data of National safai karmachari ayog (NSKA) it has found as many as 1,720 manual scavengers in six of the 30 districts of Karnataka. And in addition, there are as many as 21,480 manual scavengers in the country including the close to two thousand in the state. A central body said to all states for taking up more mechanised cleaning practice in the country rather than depend upon the manual scavenging. There was as much as Rs 120 crore available with the Karnataka State Commission for Safai karmacharies. The Rs 120 crore was allocated for the safai karmacharies in the state to provide loans up to Rs 25 lakhs per eligible beneficiary for setting up his or her own business [4]. 1.2 million Manual scavengers are estimated in the country are occupied in the sanitation. The working condition of these sanitary employees hasn't changed virtually over a period of a time. The Basu Committee made survey report in 1991, noted that in spite of all the governments' of rehabilitation, recommended to focus on the improvements in the living and working condition of scavengers, by including technological interventions to improve their working conditions, such as wheelbarrows, or receptacles that did not leak [5]. The fig.1 shows the rural-urban share of septic tank and sewer which require cleaning as per the size of pit and type of latrines. It is decisive to note that these data is of households whereas the researchers have identified incidents of death in hotels and factories. Sludge production cannot be avoided, and as sewage quality standards are heightened to reduce nutrient emissions,

sludge production is unavoidably increasing. Sludge production cannot be cut down although there are technologies which reduce the mass of sludge for disposal like dewatering, drying, volatile solids destruction. The study says that some ambiguity as in practice sludge is, a waste or a product. Sludge is defined as a waste and therefore should be disposed of in the region of origin in accordance with the propinquity, up till now sludge occurs which is a product or secondary raw material [6].

## II. Methodology

This paper is based on the field studies and literature review and designing of new product. Firstly, detailed discussion was carried out with field workers during site visit to understand the status, challenges and difficulties in cleaning sewer/septic tanks in Bengaluru, particularly focusing on the technology, equipments used during cleaning process. Different aspects were critically analyzed to understand the system and extract maximum information. During this process pitfalls were also identified. Thereafter to visualize what is happening in India several literatures reviewed. Finally based on the literature finding and case study outcomes, a sustainable sludge removal machine design is proposed.



**Figure 1:** Percent of Sewer and Septic Tank Connection in urban and Rural Area as per Census 2011[5]

## III. Designing Process

**3.1 Inception of concept:** As per the study of screw conveyor, this is oldest method of conveying materials well-known to the mankind back to more than two thousand years with the original designs. Since the screw conveyor came into general use a little over a century ago for moving grains, fine coal and other bulk material of the times, it has come to occupy an exclusive place in an industrial revolution area of material handling techniques. The screw conveyor is one of the most efficient and economical methods of moving bulk material in modern technology [8]. Vertical conveyors are a very proficient method for uplifting a variety of immensity materials at very steep inclines or completely vertical [9]. The concepts for removal of sludge from septic tanks / sewer are generated based on the morphological image below. Screw conveyor is a type of a mechanism that uses a rotating helical screw blade, which is located within a tube, to move liquid, semi solid even a granular material. The helix rotates around the systems longitudinal axis and conveys bulk material in axial direction inside a stationary tube. Screw conveyors works on the principle of Archimedes screw.

### Advantages of Vertical Screw Conveyors

- Screw conveyors are compact in size and easily adapted in heaving locations.
- These can be prepared out of a multiplicity of materials to resist corrosion, heat or abrasion, depending upon the product being conveyed.
- Model for handling semi-fluid materials.
- Capacities up to 30 feet per hour.
- Ability to elevate sludge up to 30-feet.
- Totally covered design for dust and air tight desires.

**Pitch:** The product has a variable pitch; the pitch of the screw varies from longer to shorter as the screw headway toward the discharging chamber of the screw conveyor ref fig 3(a). This unique vertical screw conveyor is designed to use in sewer hole treatment facilities for elevating sludge.

**Sludge:** A sludge contains 1 per cent dry solids (moisture content, PM = 99 per cent), 10 kg of dry solids is associated with 990 kg of water. The average density of water sludge solids is 1400 kg/m<sup>3</sup> and the density of water is 1000 kg/m<sup>3</sup>.

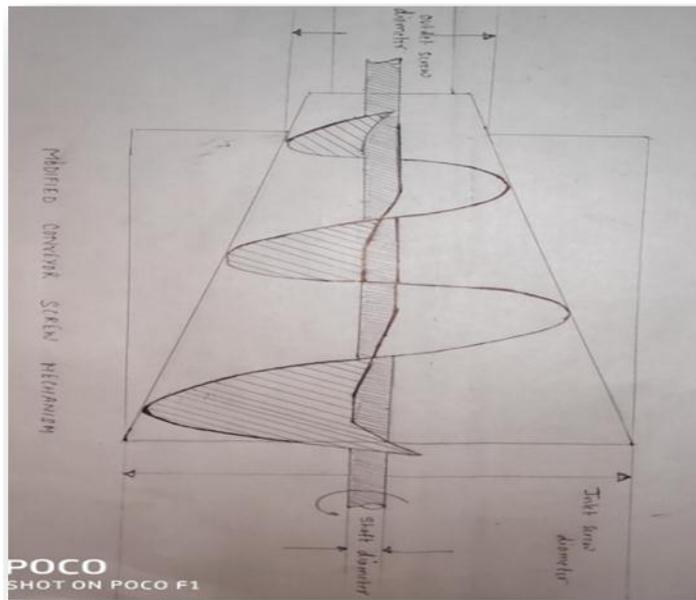
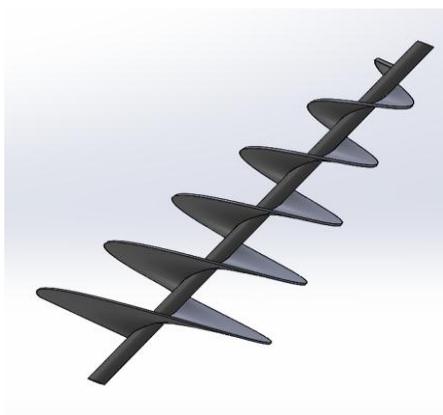


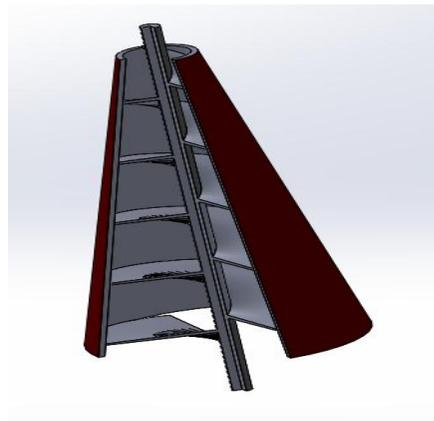
Fig 2. Schematic diagram of screw conveyor

### 3.2 Solid Modelling

The selected concept is designed into solid works and material selected based on its density.



(a)



(b)

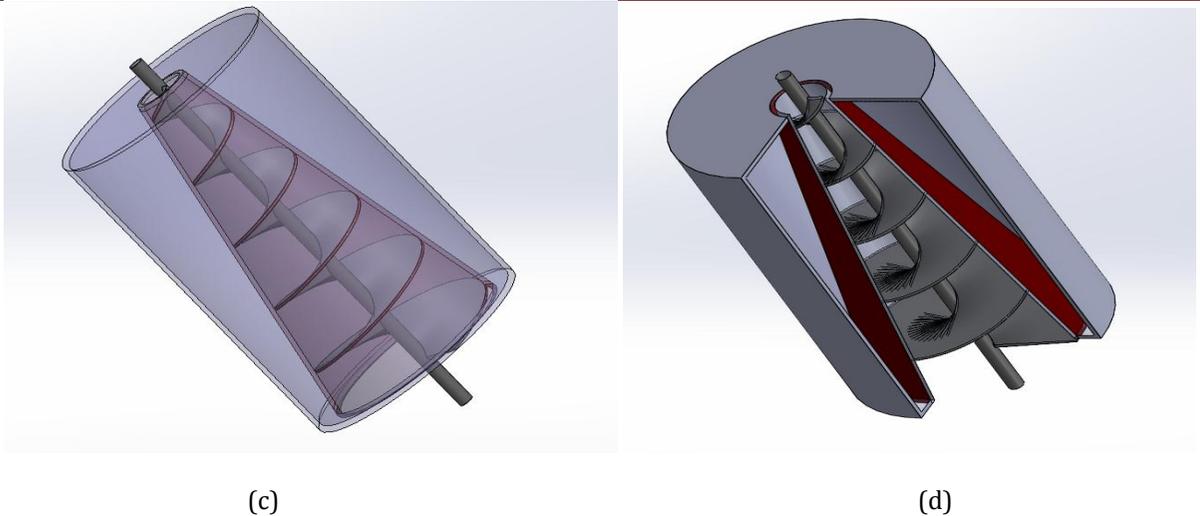


Fig. 3(a) Screw conveyor (c) fully assembled Sludge removal machine (d) Cross sectional View

### 3.3 Working of Sludge Removal Machine

- ❖ The mixing of the sludge with the flocculent solution must be optimal to obtain the best floc size.
- ❖ This modified screw conveyor mainly it consists of helical screw, respecting a conveyor blade which turns over the axis of the shaft is connected to the driving motor.
- ❖ The larger diameter of machine enters into sewage and gets linear volume reduction as the orifice diameter decreases linearly as well shown in the fig3.
- ❖ As it's known, the sewage consists of 60% of water and 40% of solid particles (sludge). Sludge creep (squeeze out) happens frequently on sludge which is difficult to dewater.
- ❖ The faster water is released, the sludge is when reaching the compression zone through a small holes; remaining sludge is out from smaller diameter from the pipe.
- ❖ And remaining water return back to the channel.
- ❖ This device can be attached to the JCB arms as well.

### IV Conclusion

We need to plan multiple interventions to reduce and eventually eradicate the inhumane, undignified, and unsafe practices in manual sanitation work. The development of Sludge Remover helps to simplify the sewage sludge removal procedure as well as reduce the manpower required for the process. It also helps to increase the safety of the workers as well as the efficiency in retrieving the drainage sludge from the machine. The objective of this product has been achieved, which is to design and develop a Sludge Remover that can help to simplify the removal operation. Material Selection, Finite elemental analysis, conveyor speed based on the capacity, horse power requirement calculation, verification of torque rating of components, fully automated Sludge Removal machine also be the next part of this research as well as the intelligent hazardous gas indicator sensor also can be implemented. Eradicating of manual scavenging can successful elimination of the mismanagement lobby would help in solving the scavenging problem in any city.

### V Acknowledgement

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## Three Way Self Charging Electric Vehicle

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**ABSTRACT:** *In this present time fuel resources availability is running down the state and the price of fuels are high compare to electricity and also the pollution content in atmosphere due to fuel used automobile is increasing day by day to overcome this problems the automobile industries concentrating on electric vehicle. Electric vehicle driven by using battery as a source of energy the batteries can be charged only during the static condition and the process is more time consuming. This is the main disadvantage of existing electric vehicle.*

*In this project our attempt is to reducing pollution and dependency on recharging from main supply and also increasing mileage or efficiency of present electric vehicle by using a self charging mechanism. the batteries used to drive the motor. it is recharged by three auxiliary power sources. One power source is **dynamo** which is directly coupled to the driving motor, second power source is horizontal **wind mill** placed in the front of the vehicle, another power source is **solar panel** at the top of vehicle this power sources are managed by means of current regulator for charging the battery. The batteries which are used to transmit the energy source to motor, receives back the adequate voltage source to recharge it.*

**Keywords:** Batteries, Motor, Dynamo, Wind mill, Solar panel.

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### 1. Introduction

Casting Global warming are becoming major problems in the current scenario. Therefore people try to move towards clean energy. transportation is one of the source of pollution or global warming because the type of vehicle work on fuel (petrol, diesel) it burn and produce harmful gases in air due to that pollution is increases and this source of energy is imitate therefore today's need to move other clean source of energy for transportation. that free from pollution and it easily available. Electrical vehicle is one of the ways to reduce this type of problem. Electrical vehicle called as e-vehicle. In the 1890s, electrical vehicles were documented within U.S. Patents. In this paper no gears and the motor are up to 100 amperes from a 10-volt battery. This type of e-vehicle is modified day by day but this is also having some limitation just like it having charging by externally. if the battery discharge in travelling it create problem that means it use for small distance only. So some modification required in the design of e-vehicle. This modified design is cheap for the common people in our country afforded to buy it. Need Of Self Power Generating Electrical Vehicle We know that today word is so fast this is possible only because of fast transportation? Now days all the vehicle work on fuel but storage of fuel is imitated that means when the storage of fuel is totally finish that time transportation is totally stop. There for today's need is self power generating electrical vehicle that bike generate own power and work on self power without effect on working of operation and this is not having any type of external energy it is free from pollution.

### II. Understanding Requirement

#### 3.1 Motor

Torque and power requirement

Torque  $T = Fc \times r$

Where,  $Fc$  - Circumferential force

Motor shaft is connected to the sprocket

$\therefore Tc$  - Centrifugal tension in the sprocket =  $Tc = m \times v^2$

Where,

$V$  - Velocity of the chain

$M$  - Mass of the chain per unit length

$m = \text{Area} \times \text{length} \times \text{density} = b \times t \times l \times \rho$

Where,  $b$  = Breadth of the chain = 0.015 m,  $t$  = Thickness = 0.007 m,  $l$  = Length = 1m,  $\rho$  = Mass density = 1140 kg/m<sup>3</sup>

So,

$$m = 0.1197 \text{ kg/m}$$

$$\text{Now, } v = (3.14 \times d \times n) / 60 = (3.14 \times 0.2286 \times 3000) / 60 = 35.90 \text{ m/sec}$$

$$T_c = m \times v^2 = 0.1197 \times (35.9)^2 = 154.27 \text{ N}$$

$$F_c = T_c \text{ (Circumferential force on the motor is the centrifugal tension in the chain)}$$

Now

$$\text{torque} = F_c \times \text{radius of sprocket in the motor} = 154.27 \times 0.1143$$

$$= 17.633 \text{ N-m}$$

### Power rating of the motor

Torque at the reduction gear = 5.289 N-m to carry weight of 150 kg = torque of motor

$$\text{Power of the motor} = \text{Torque} \times (2 \times 3.14 \times N) / 60$$

$$= (5.289 \times 2 \times 3.14 \times 650) / 60$$

$$= 360 \text{ Watts}$$

## 3.2 Experimental Setup and Parts

### 3.2.1 Motor

An electric motor is a machine which converts electrical energy to mechanical energy. The principle states that, when a current-carrying conductor is placed on a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule. When a motor is in action, it develops torque and this torque can generate mechanical rotation.

Specification of motor

Material: Aluminium

Input Voltage : 24 Voltage

Power : 350 watts

Ampere : 20 Ampere

Rated R.P.M : 3000 R.P.M

After reduction : 300 R.P.M

### 3.2.2 Battery

These are used for storage of excess solar energy which in turn converted into electrical energy. The only exceptions are isolated convertor such as irrigation pumps or drinking water supplies for storage Batteries are seem to be the only technically and economically available storage resource. Since both photo-voltaic system and batteries are high in capital costs, it is necessary that overall system has to be optimized with respect to available energy and local demand. To be economically smart the storage of solar electricity requires a battery with a particular combination of properties. These two batteries are connected in series and in turn it is connected to a motor with controller of 24v 500w dc as shown in figure 2.

Specification of battery

Battery type : lead acid battery

Voltage : 12v

Ampere : 18 Ah

Number of battery : 2

### 3.2.3 Dynamo

A dynamo is an electrical generator which produces direct current with employ of a commutator. It is an first electrical generators which is capable of delivering power for industry, and many other. This devices were based, including the electric motor, the alternating-current alternator, and the rotary converter. In today's world, the simpler alternator dominates large scale power generation for more efficient, reliable and cost effective. It has an disadvantage over a mechanical commutator but also converting alternating to direct current using power rectification devices (vacuum tube or more recently solid state) is effective and usually

economical. It is connected to shaft which in turn connected to a motor by using chain mechanism. In this the used dynamo is of 12v.

### 3.2.4 Solar

It works on the principle of photo-voltaic, the photo-voltaic solar energy conversion is one of the most striking non-conventional energy sources which is more reliable and can be converted from the micro to the Mega watt level. Photovoltaic solar panels absorb rays as a resource of energy to generate electricity. A photovoltaic (PV) module is a connected assembly of photovoltaic solar cells. It constitutes the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications as shown in figure 3.

Specification of solar panel

Peak power (25°C) : 35 watts

Open circuit voltage : 21volts

Short circuit current : 2.4Amp

Number of panels : 2

### 3.2.5 Wind Mill

A windmill is a structure that converts the energy of wind into rotational energy by means of vanes called sails or blades. Centuries ago, windmills usually were used to mill grain (gristmills), pump water (wind pumps), or both. There are windmills that convert the rotational energy directly into heat. The majority of modern windmills take the form of wind turbines used to generate electricity. In this project wind mill is placed front side of vehicle to produce the electricity to avoid the deep discharging of battery, used wind mill is 12v 20Amps, it as shown in figure 4.

### 3.2.6 Controller

It is a device which improves the performance of an electric motor in a predetermined manner. It can include an automatic or manual means for starting/stopping the motor, forward/reverse rotation, selecting and controlling the speed, modifying or limiting the torque, and protecting against faults and overloads. The main constituents of electric vehicle systems are the motor, power supply, controller, drive train and a charger. An electric vehicle motor controller is a machine that is engaged to regulate the torque generated by an motor by means of modifying the energy flow from the power sources to the motor and consecutively it is connected to motor and battery to control the charge supply as shown in figure 5.



Figure 1: motor



Figure 2: battery



Figure 3: solar panels



Figure 4: wind mill



Figure 5: controller

### III. Modelling & Analysing

#### 3.1 Modelling

Design process was carried out using Solidworks software and the model was developed and it is presented. The design of components started from scrap defining dimensions for each and every component. A number of models were developed before actually confirming the final design. Due to several reasons such as material wastage, cost effectiveness, time involved in fabrication, difficulties in manufacturing a number of design changes were made and obtained as final model



Figure 6: 3d design of vehicle

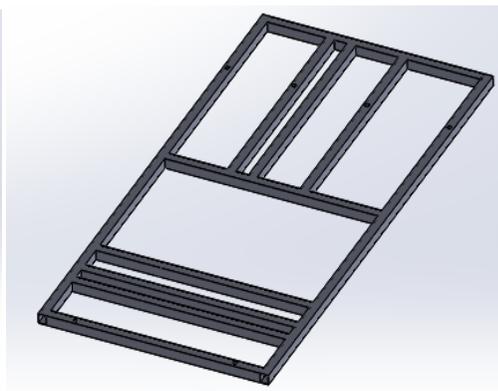


Figure 7: 3d design of chassis

#### 3.2 Analysing

With the help of ANSYS 2016 software, the schematic diagram of the chassis were drawn and analyzed by applying various forces as shown in the figure. The load is applied on the particular area based on the real time application and their results are noted down. Chassis is analyzed by applying total load acting on it, also seat is also analyzed by applying one man weight.

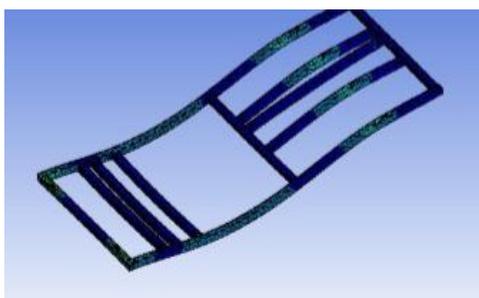


Figure 8: Chassis analyses

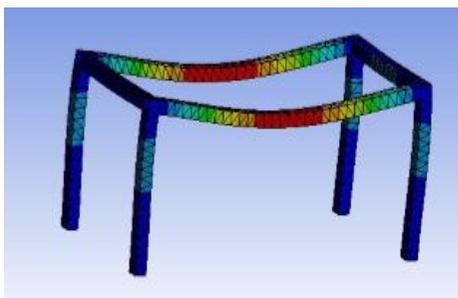


Figure 9: seat analyses

### IV. Fabrication

The frame is made by using mild steel square pipe of 18 gauge 1 inch, length of chassis is 5\*2.5 inches, it is welded by using arc welding, the frame is as shown in figure. The selected element is assembled on the fabricated frame, motor, battery, controller arrangement is made, wind mill is placed in front side of vehicle and solar panel at the top of the vehicle. The fabricated prototype is as shown in figure 10.

Specification of frame

frame of vehicle is made by mild steel square pipe of 18 gauge

thickness in millimetre = 1.27

weight per square meter in kg = 9.765



Figure 10: fabricated prototype

### VII. Result

By testing we got the following results

A full charged battery runs the vehicle 22 km at 12 km/h speed.

### VIII. Conclusion

It is clearly seen that the Self charging vehicle gives a clean and more economical solution to the energy crisis. People use S-vehicle and fuelled vehicles for even travelling short distances without making use of S-charging and other non - fuelled vehicles. Most number of people from the list have been those which think driving a S-vehicle is equivalent to providing extra effort for driving. In order to avoid this electric assistance has been provided to the S-vehicle that will easy the user to drive the unit with the help of a motor. All these aspects are available keeping in mind the factor of pollution being affected at all. The factors that our prototype design of S-vehicle provides to the raider are: • Simplified driving with minimal effort on flat roads.

### IX. Acknowledgment

We sincerely thank M.S. Engineering college, Bangalore for providing necessary facilities, work force and infrastructure for the successful completion of this project.

Further we would like to thank Dr. Vijendra Kumar, Professor & Head, Dept. of Mechanical engineering, MSEC, Bengaluru and our faculty in-charge Mr. Shivakumara. P, Assistant professor, Dept. of Mechanical engineering, MSEC, Bengaluru for the immense support and help provided by them in the completion of the project.

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8. International Journal Of Engineering Applied Sciences And Technology, 2017 . Vol. 2, Issue 9, Issn No. 2455-2143, Published Online January 2018 In Ijeast([Http://Wwww.Ijeast.Com](http://Wwww.Ijeast.Com)) .Design And Fabrication Of Self charging Bicycle By Prof S.B. Thakre.

## Unmanned Ground Vehicle (UGV)

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**ABSTRACT:** Unmanned ground vehicle is also called as remote-controlled vehicle which play an important role in military purposes. However the demand for manual robots are in rise, UGV work in more efficient way to counter terrorism and in war fields .UGV supports and augment soldiers life in battle fields. The capability of this robot mainly depends on protecting the soldiers or at least reduces the death tolls in wars. After survey on existing staircase climbing systems we propose a different approach on efficient, economical, less weight unmanned ground vehicle.

**Keywords:** Unmanned ground vehicle, support soldiers, remote controlled, counter terrorism, staircase climbing.

### 1. Introduction

In the present scenario, the recent increase in terrorism has carved the way to develop self-controlled robots tremendously. This motivation has challenged the research scholars to invent an efficient robot for the war fields. This self-controlled robots counter the emergency problems that present day people and soldiers are facing. For example, self-robots work in handy parallel with the soldiers in tracking the terrorist activities and can also work with police to help them find illegal activities and other antisocial activities occurring in the city. Many countries are now aware of the serious issues and are investing in this development of the self-controlled robots to safeguard citizens from terrorism.

An unmanned ground vehicle (UGV) is a tactical military robot used in betterment of soldier's capability. This type of robot is generally capable of operating outdoor environment over a different variety of terrain, functioning in place of humans. UGVs play a major role in defence warfare (Army, Navy, and Air Force). UGVs are actively being developed for both civilian and military use to perform dull, dirty, and hazardous activities.

The design purpose of Unmanned Ground Vehicles (UGV) is to reduce the risk of casualty while travelling through dangerous areas such as mined area, bio-chemical battlefield, steep terrain and soft terrain. In addition, the compact design of mechanism will lead to easy maintenance and repair service, and the integration of intelligent control software system as the assistance to operation of unmanned vehicle can also be done.

### II. RESEARCH METHODOLOGY

- Selection of appropriate and durable material for the vehicle chassis.
- Design of the metal frame of the vehicle
- Development of associated circuitry for the smooth function of the camera, robotic arm, signal transmission and reception unit.

### OTHER UGV'S

1. Variable Geometry Vehicles.
2. Tracked Robots.
3. Variable geometry single tracked robots.
4. Robots with not-deformable tracks

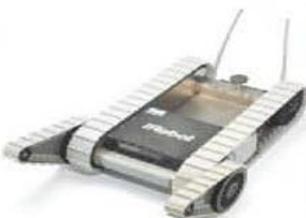


Fig 2.1 Packbot



Fig 2.2 Robu ROC



Fig 2.3 Helios VII



Fig 2.4 Micro VGTV



Fig 2.5 B2P2prototype



Fig 2.6 VGSTV mechanism



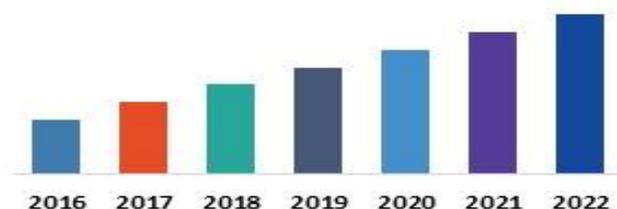
We know that each category have its own capacity and reliability. As example, a not variable geometry robot is theoretically, able to climb a maximum step twice less high than its wheel diameter. Obviously, important dimensions are necessary to ensure a large clearing capability. This conception probably presents a high reliability but those robots cannot be easily used in unstructured environments like after an earthquake (Casper and Murphy (2003)). UGV's compact design will allow the robot to bypass in narrow region. For general purpose missions we believe that the best compromise between design complexities, reliability, cost and clearing capabilities is the Variable geometry single tracked robots category (Kyunet al. (2005)).

The Unmanned Ground Vehicles (UGVs) market is projected to grow from USD 2.7 billion in 2018 to USD 7.0 billion by 2025, at a CAGR of 14.81% during the forecast period. The need for increasing operational efficiency, reduced human intervention, and growth in terrorist activities around the world are the major factors which leads to the design and development of advance UGVs.



Based on application, the UGVs market has been segmented into commercial, military, law enforcement and federal law enforcement. The military application segment is projected to grow at a higher CAGR during the forecast period as compared to the commercial segment. The growth of the military segment can be attributed to the rising automation in various military applications such as ISR, EOD, transportation, and combat support.

Unmanned Ground Vehicle (UGV) Market Value, 2016-2022 (\$Million)



Geographically, North America dominated the unmanned ground vehicle market driven by higher demand and use of UGVs in defence and commercial applications. North America was followed by Asia-Pacific and Europe as the second and third largest market for unmanned ground vehicle. Asia Pacific is projected to have the fastest growth, owing to rapidly increasing defence budget in the region especially in developing nations such as china and India in this region.

This research shows the global unmanned ground vehicle market size in for the year 2014-2016, and forecast of the same for year 2022. It highlights the market drivers, restraints, growth indicators, challenges and other important aspects& considerations with respect to global unmanned ground vehicles.

### III. System Architecture of UGV

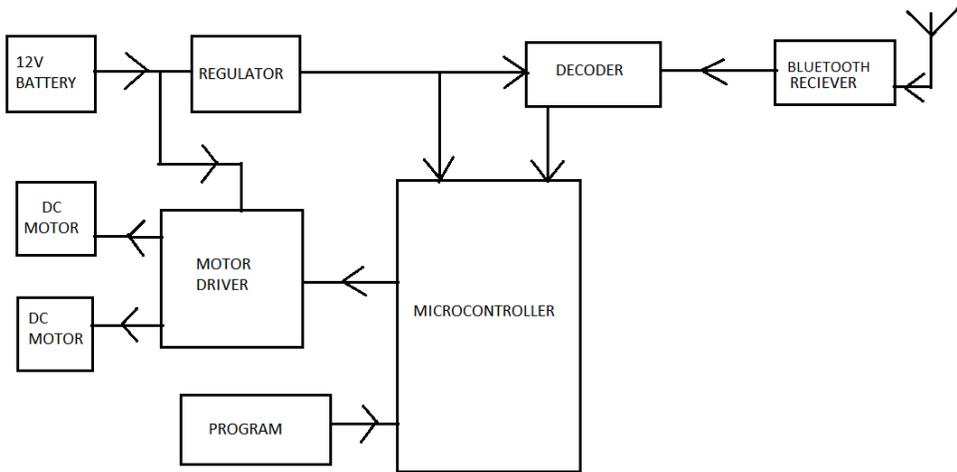


Fig3.1: Architecture of system

## VI. Operation & Mechanism

### 4.1 Stair climbing mechanism and components

According to the proposed mechanism, the robot is manually controlled by Bluetooth signal. In this, the signal is sent to the robotic system from the Bluetooth enabled mobile application. The user navigates the robot according to the desired direction and need. The LIVE video coverage can be obtained by using a wireless Wi-Fi camera and which also serves as a reference for navigation. When the stairs approach, the front end inclined track wheel gear will be first to be in contact with the inclined stairs. As the robot advances forward, the inclined track belt helps the robot to self- incline itself according to the angle of the stairs with respect to the ground surface. The continuous power supplied by the motor will propel the vehicle forward and hence the stairs are climbed successfully.

### 4.2 Entries of the System

The system should be able to react differently in regards to the stair climbing. So, entries have to differ according to the stage (first step, middle steps, and final step). The chassis inclination measurement allows to check out the first stage (if the ground is plane) but does not help to conclude about the two others stages. Distance sensor could check out the last stage. So considering that the robot is always parallel to the step in front of it, the inclination and distance sensors could be sufficient to achieve an autonomous staircase climbing.

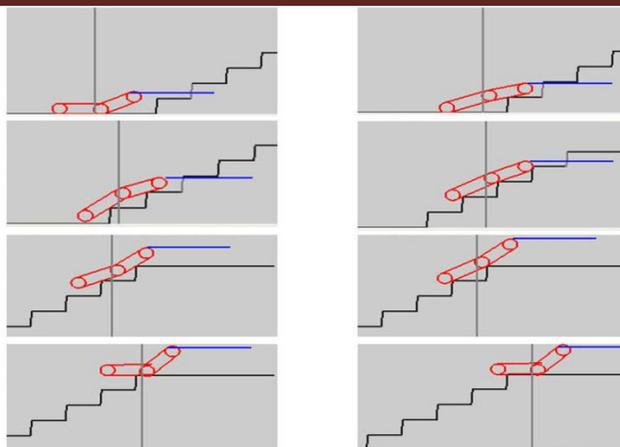
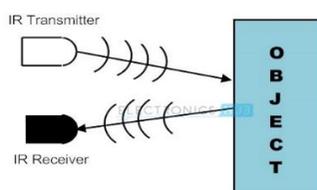


Fig4.2: Stair climbing mechanism.

## V. Components of UGV

### 5.1 Sensors

Several IR distance sensors are mounted on a mobile system coupled with the inclination sensor in order to always measure the distance between the robot and the step in front of it. Side Sensors are used to keep the vehicle parallel to the steps. Front sensors allow direct measurement of the distance. Sensors' measurements can be merged to increase the accuracy. Besides, interval analysis algorithms could be used as in Sliwka and Jaulin (2008) to prevent a breakdown and to increase the system reliability.



### 5.2 Controller

- Microcontroller ATmega328
- Operating Voltage (logic level): 5 V
- Input Voltage (recommended): 7-12 V
- Input Voltage (limits): 6-20 V
- Digital I/O Pins : 14 (of which 6 provide PWM output)
- Analog Input Pins: 8
- DC Current per I/O Pin: 40 mA
- Flash Memory 32 KB (ATmega328) of which 2 KB used by boot loader
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz
- Dimensions: 0.73" x 1.70"
- The Arduino Nano can be powered via the Mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is automatically selected to the highest voltage source.



### 5.3 DC Motors



- 30 and 10RPM Centre Shaft Economy Series DC Motors are high quality low cost DC geared motor.
- It has steel gears and pinions to ensure longer life and better wear and tear properties.
- The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing.
- The whole assembly is covered with a plastic ring. Gearbox is sealed and lubricated with lithium grease and require no maintenance. The motor is screwed to the gear box from inside.
- Although motors gives 10 and 30RPM at 12V but motor runs smoothly from 4V to 12V and gives wide range of RPM, and torque.
- The Set of wheels for inclined angle is of 10rpm and the remaining motors are of 30rpm

### 5.4 Camera

- A smart camera or intelligent camera is a [machine vision](#) system which, in addition to image capture circuitry, is capable of extracting application-specific information from the captured images, along with generating event descriptions or making decisions that are used in an intelligent and automated system.
- A smart camera is a self-contained, standalone vision system with built-in image sensor in the housing of an industrial video camera.

## VI. Design Considerations

Table 1 Specifications of UGV

length of the frame	550mm
Breadth of the frame	350mm
Height of the frame	50 3mm
Thickness of the frame	12mm
Wheel diameter	65mm
Angle of rotation of the arm	360deg
Length of chain belt	300mm
Thickness of chain belt	25mm
Size of bracket holder	33*1*43mm
Length of arm	25mm
Height of reach through arm	400mm

Table 2 Motor1 Specification

Voltage	12v
Current	1Amp
Speed of Motor	10rpm

For the rated specification the torque generated is 1.2 N-m

Table 3 Motor1 Specification

Voltage	12v
Current	1Amp
Speed of Motor	30rpm

For the rated specification the torque generated is 0.4 N-m

**VII. Modelling and Von-Mises Stress and Strain Analysis**

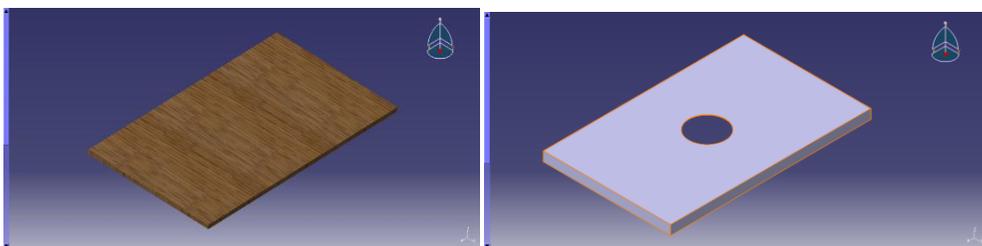


Fig 7.1 Base and Top Cover

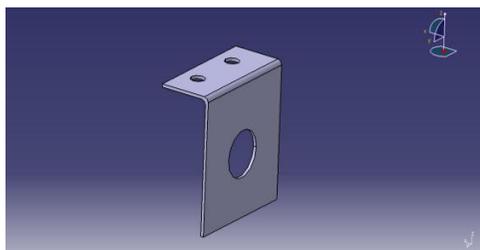


Fig 7.2 Holding Bracket

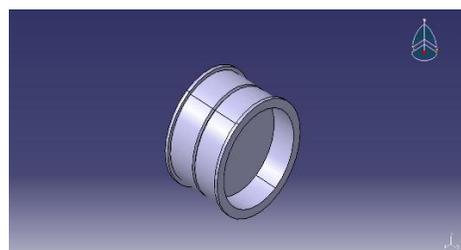


Fig 7.3 Wheel

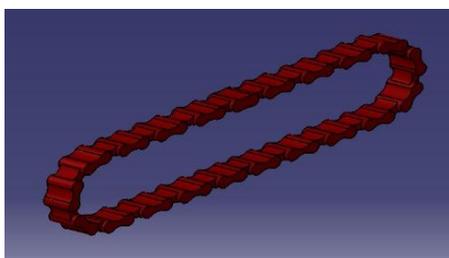


Fig 7.4 Belt drive

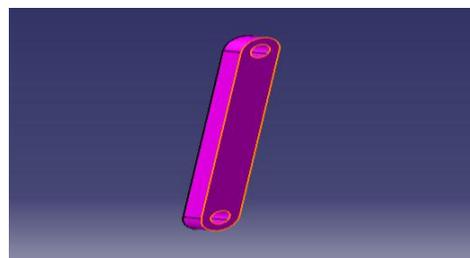


Fig 7.5 Arm

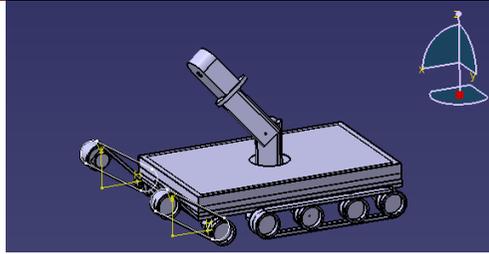


Fig 7.6 Assembly Model



Fig 7.7 Fabricated Model

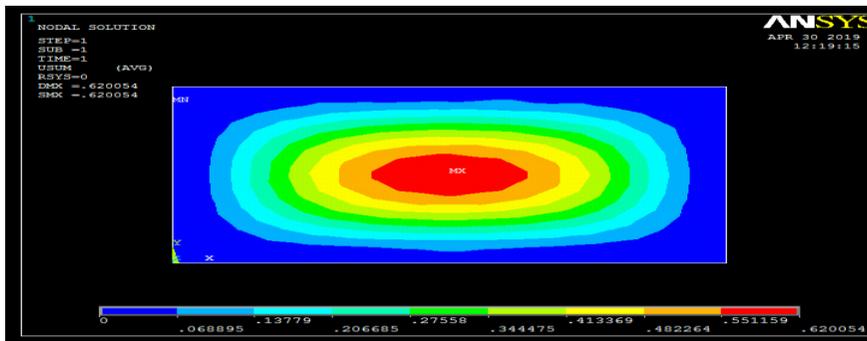


Fig 7.8 Displacement Vector Sum

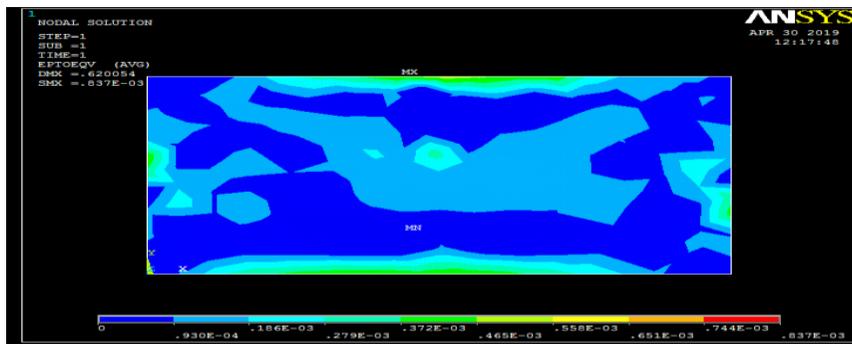


Fig 7.9 Equivalent (Von-mises) Stress Analysis

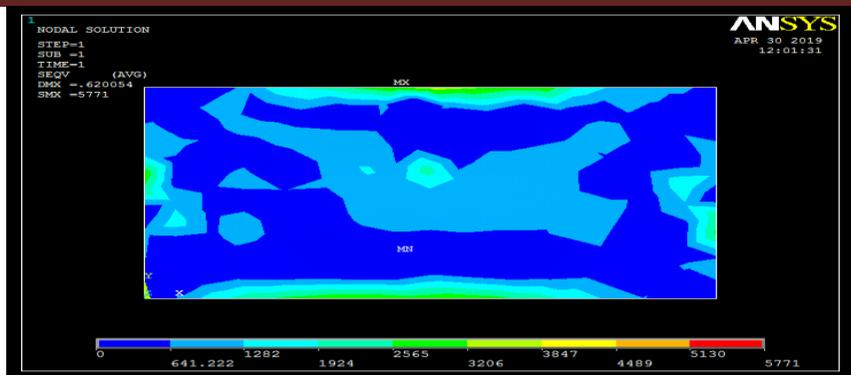


Fig 8.0 Equivalent (Von-mises) Strain Analysis

Table 3 Analysis Report

	DMX	SMX
VON Mises Stress	0.620054	5771
Von mises strain	0.620054	0.837E-03
Elemental solution	0.620054	6742
Displacement Vector Sum	0.620054	0.620054

**VIII. Result**

In this project we have calculated Von-misses Stress and Strain analysis of the base frame of the robot according to the design specification and came to conclusion that the robot will climb the stairs of certain design specification satisfactorily and work in terrain region while carrying the self-load.

**IX. Conclusion**

This paper presents a way to climb staircases with classical UGV's by using their ability to modify their geometry in order to adapt themselves to the ground. This controller could be used concurrently to classical UGVs staircase climbing algorithms which guaranty the steering during climbing and improve its efficiency. We are currently working on the implementation of this results on our prototype. If experimental results are satisfactory, then more developmental ideas could be thought in order to increase the reliability and the adaptability of the system.

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# The construction and operation of simwool incorporated electric furnace

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**ABSTRACT:** Casting is an prehistoric technique used for making numerous parts. There are different types of furnaces used for melting metals and alloys, waged on diverse principles. This study is to reduce the high cost of electricity observed in the use of electric furnace. An electric furnace uses electricity as the fuel to heat the heating elements in the furnace so as to melt the metal. When the refractory brick is replaced with a material called **simwool**, there is an observable change in the fuel ingesting whilst giving the same output as with the use of refractory brick. Simwool is a ceramic fibre blanket made of high quality needled blanket, which can be used at high temperature insulation. A ceramic fibre blanket is a fibrous light-weight refractories. The advantages of a ceramic fibre blanket is that is it light-weight, good thermal stability, low thermal conductivity, low specific heat, great mechanical strength and mechanical vibration resistance.

**Keywords:** Electric furnace, refractory, ceramic fibre, simwool, melting furnace, aluminium melting, low-cost furnace

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## 1. Introduction

Casting is a manufacturing in which a metal in solid form is taken and melted in a furnace to liquid form. The mold contains an empty cavity of the desired shape, and then allowed to solidify. The solidified part is called as casting, which is taken out to complete the process. Casting is regularly employed for production of multipart shapes that would be generally wearisome or extravagant to make by dissimilar strategies [1].

In electric furnaces, as electric current flows through conductor, some energy is lost in the form of heat. This heat is produced due to the resistance obtainable by the material counter to the flow of current. This mode of heating metals comprises a good, clean and effortlessly manageable source of heat, which is possible to use on a large-scale heating.

Electric furnaces have plentiful advantages required in furnaces for metallurgical research. Such features include close temperature and controlled heat, melt accurately, high thermal efficiency. But on the other hand the high manufacturing cost. The main objective of this research work is to design and develop an electric furnace for melting of aluminum by replacing refractory bricks with a more effective material simwool which decreases the amount of electricity intake. There by increasing the efficiency and decreasing the heating period of the furnace

## II. Research Methodology

The approach towards the design and fabrication of the furnace was drawn in by researching other ways to fabricate a cost efficient furnace resulting in a conclusion that a cost efficient furnace can be manufactured.

Bala [2] stated that for a nation to advance technologically, it must be able harness, convert its mineral resources and fabricate most of its equipment and machines locally. In these lines, the work presented in this paper is aimed at design and fabrication of low-cost electrical resistance based metal melting furnace to fulfil the metal melting requirements in the research and academic laboratories. Metals are flexible components whose fields of use are wide in human lives. Ostwald and Munoz [3] and Gilchrist [4] found that the melting and heat treatment of metal in foundries is very important in manufacturing process. Oyawale and Olawale [5] designed and constructed an electric arc furnace to melt 5kg of steel/cast iron scraps, using locally produced Soderberg electrodes. Authors carried out tests on the furnace and conformed that it has taken 60 minutes to heat up the furnace to 1200 °C. Further, the furnace took about 95 minutes to melt the first charge of 2kg resulting in a melting rate of 21.05g/minute.

Bayindir [6] designed and constructed an electrical furnace with an automatic control to fire ceramic products. Abed [7] manufactured a gas furnace using locally sourced materials which had a heating rate of 25 °C/min and attained temperature in the heating zone as high as 1000 °C in the burning chamber and 700 °C in the inner pot, while Bala [2] carried out the design analysis of an electric Induction furnace for melting of aluminium scrap. Sahoo, Rout [8] expressed that there are various heating methods are available. There

might be numerous strategy for providing heat to the stock but heat is delivered either by ignition of fuel or electric resistance. By considering cost, security, effortlessness and simplicity of fabrication authors have gone for an electrical resistance heating furnace with indirect heating provisions. Further authors extended their work for fabricating stir casting furnace for melting aluminium.

Sekar, Allesu [9] presented the design and fabrication of stir casting setup for preparing the aluminium, magnesium and copper-based metal matrix composites. In this setup, a nano particle preheating attachment at the top of the furnace was incorporated. It is a direct result of red hot condition with consistent temperature of nano particles infused by pusher into the liquid metal. The stirrer rod composed by variety of speed (0-2000rpm) for blending purpose. Naher, Brabazon [10] designed a novel fast quenched stir caster for handling Al-SiC composites in fluid and semisolid state.

Ariff and Zakaria [11] designed an electric furnace based on the analysis of conceptual design. Authors have considered the appearance, the cost included, the heating method, the static weight, the most extreme temperature and the portability of the furnace. From the simulation, it was found that the heat flow due to convection collects the whole space in the furnace and is able to totally melt the aluminium. The process of melting 1kg of aluminium taken is under 45 minutes, it is 62.5 % quicker contrasted with the ordinary 2 hours from utilizing conventional technique. The cost of producing this revised plan of electric heater is considerably less expensive since the aggregate cost of materials expected to manufacture this heater is just RM 5160. It gives the most temperate and moderate cost for an effective electric heater (with proficiency of 78.53%) to be utilized as a part of the little scaled craft industries.

Nandy and Jogai [12] stated that the melting furnace life and energy efficiency relies on the proper selection of refractory materials and its performance in the heating conditions. The properties and effectiveness of the refractory decide the degree of heat lost during state condition and storage heat loss during transient condition. The stoppage of furnace operation brought about by refractory failure because of corrosion and mechanical wear prompts to significant effect on energy saving. The decrease in downtime, because of refractory failure, raises the energy saving and it can be accomplished by utilizing phosphate bonded hard refractory materials. A multi-layer lining with optimized execution of layers with the service condition and appropriate establishment enhances the energy effectiveness of a furnace in future. A good quality commercially available furnaces costs from ₹1.5 lakhs to 5 lakhs depending the size and features.

In this current project, the aim is to fabricate a low-cost electrical based metal melting furnace to facilitate the melting of metals in small quantities needed for applications like metal casting, metal matrix composites, etc.

### **III. Construction of Simwool incorporated electric furnace (SIEF)**

#### **3.1 Methodology**

The following are the basic steps involved in the design and fabrication of the simwool furnace.

- 1) **Specifications of the furnace** : The goal was to obtain a furnace with a heating capacity of 4kW. It should be capable to produce heat till 1300 °C. It enables the furnace to melt any metal having melting point less than 1300°C.
- 2) **Materials required** :
  - a. Sheet metal cabin
  - b. Heating wire (heating coil)
  - c. PID controller
  - d. Refractory cement
  - e. Heat resistant wire
  - f. Ceramic wool – Simwool
  - g. K-type thermocouple
- 3) **Layout of furnace**: Layout of the furnace is to be made to integrate the elements with desired properties in to the furnace.
- 4) **Fabrication of the furnace**: Fabricate the furnace. Give the electric connections to the PID controller and the k-type resistor through heat resisting wire.
- 5) **Heating of the furnace**: Heating the furnace to about 1300°C, and withholding the heat for up to one hour by covering the top of the simwool furnace by a lid, and cooling at a normal temperature without any external source.

6) **Experimental run of the furnace:** Melting of aluminum metal at 700°C ,by heating the simwool furnace for one 45 minutes.

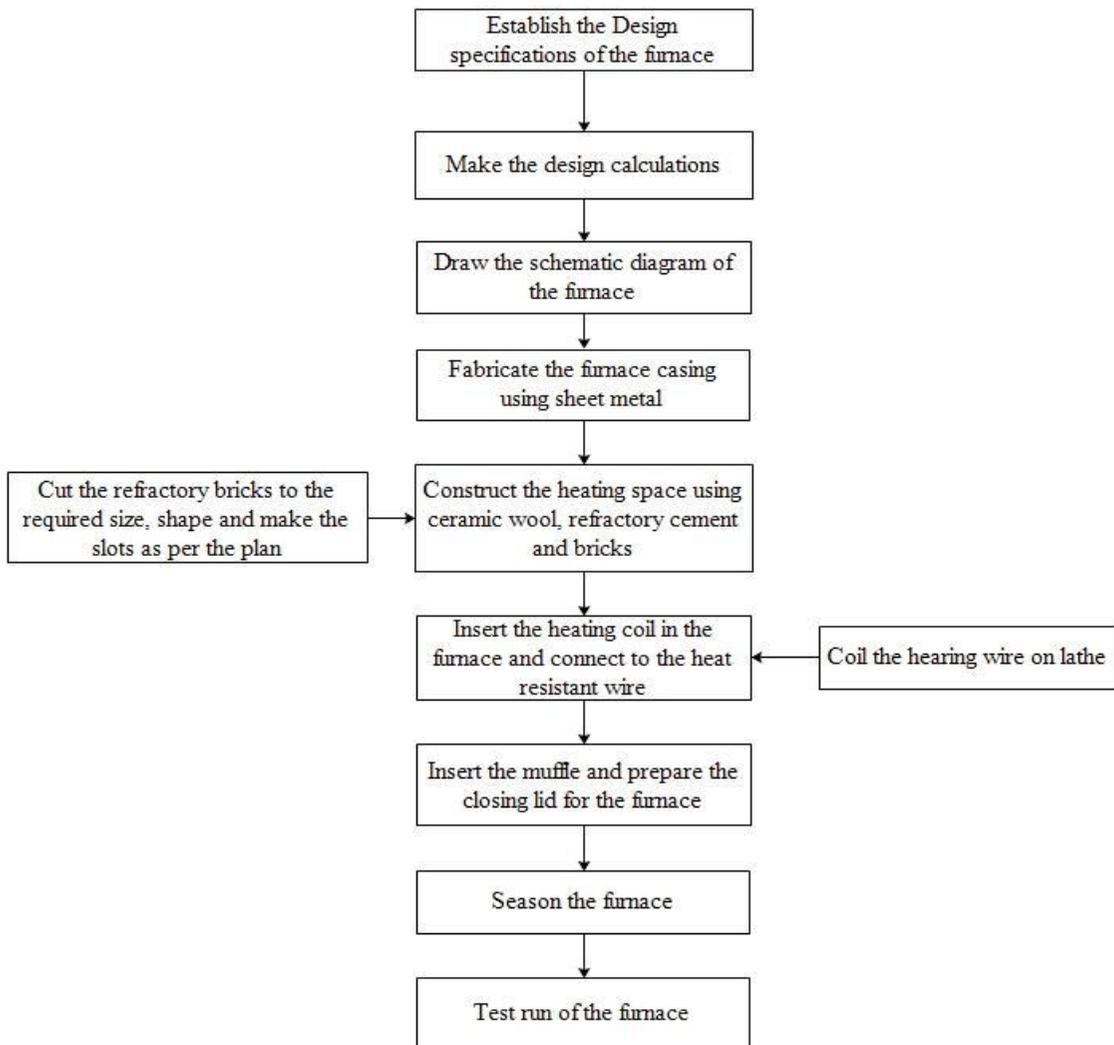


Figure 1: Process overview

### 3.2 Furnace outline

The sectioned front view of the simwool furnace which consist of ,metal sheet , simwool , graphite crucible , PIDis as shown in the figure 2.

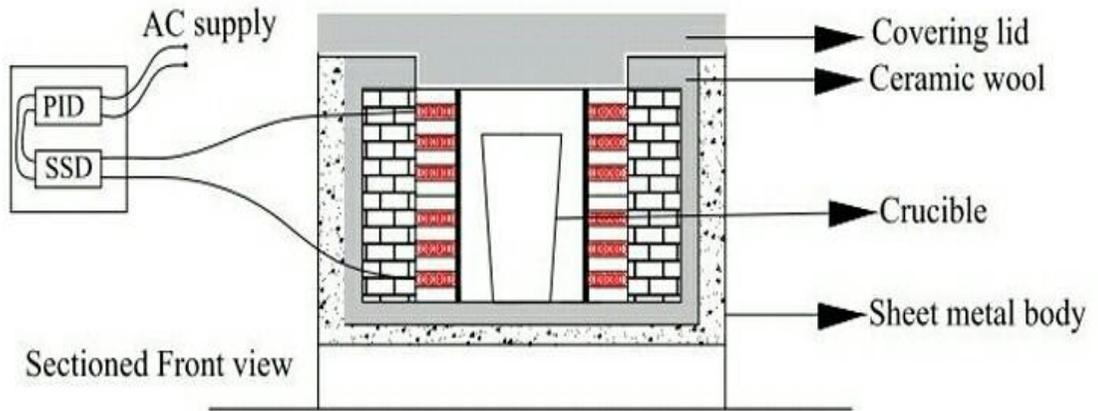


Figure 2: Sectioned front view of the furnace

### 3.2.1 Heating wire

The furnace was strategic to operate up to 1300 °C. Thus, Kanthal wire was selected as the heating wire for the electrical furnace. Kanthal is a ferrite-iron-chromium-aluminium alloy. It is a resistance based electrical heating wire which can be used to heat things up to 1400°C. Kanthal has high electrical resistivity and very good corrosion resistance. It is commonly used as electrical heating elements in high-temperature furnaces for heat treatment, ceramics, electronics, steel, and glass industries. Kanthal wire used in our furnace has a diameter of 2mm.



Figure 3: Braided Kanthal wire

The furnace of 4 kW furnace was built based on the following calculations.

The over-all amount of current drop essential across the heating wire for a 4 kW furnace is calculated using Eq.1

$$P = V * I \quad (1)$$

Here, P - power (in Watts), V - voltage (in Volts), and I - current (in Amperes)

17.4A was the over-all current drop across the heating wire as calculated from Eq.1. As specified by the manufacturer, the electrical resistance of the Kanthal wire is 0.446 Ω/m. Then, the total length of the wire essential to use as heating wire in the furnace for the drop of 17.4 A in the furnace is to be resolved.

$$L = \text{Electrical resistance} * I \quad (2)$$

The over-all length of the wire was found as 38.72 m i.e., about 39 meters, from Eq.2. It was strategic to lay down this 39 m of wire in turns around the square heating chamber in the furnace.

### 3.2.2 Ceramic wool

The ceramic needle like minute particles form the ceramic wool or ceramic fibre blanket. It possesses desired properties such as light in weight, flexible, outstanding in fire protection, very low thermal conductivity and less heat stored, thermal shock resistant and resistant to corrosion. It is commercially accessible in various densities, thicknesses, widths and lengths. The ceramic blanket used in the current furnace is 1 inch thick. Simwool is the ceramic fibre or ceramic blanket is used here.

The composition of the simwool used is as shown in the table below:

Table 1: Chemical composition of Simwool

Chemical composition	Percentage (%)
Al <sub>2</sub> O <sub>3</sub>	32-47
SiO <sub>2</sub>	49-57
ZrO <sub>2</sub>	14-18
Fe <sub>2</sub> O <sub>3</sub>	0.1 Max
Other	Traces

The properties of the Simwool is as shown in the table below:

Table 2: Properties of simwool

Parameters	Values
Classification temperature	1425 °C
Colour	White
Melting Point	1760 °C
Density	128 kg/m <sup>3</sup>
Fiber Diameter	2.5 mm
Non Fibrous content by weight	20 %
Permanent Linear Shrinkage after 24 hrs. soaking heat at 1400 °C	3.25 % Max
Thermal conductivity at 600 °C	0.12 W/mK

### 3.2.3 Miscellaneous elements

Refractory cement or furnace cement is a specially designed and mixed cement product that will resist extremely high temperatures while maintaining its structure. Refractory cement was layered around the simwool as shown in Figure 2. A sheet metal cubicle of size 23 x 16.5 x 14.5 in. was prepared to place the elements of the furnace as shown in Figure 2.



(a) Simwool



(b) Refractory cement



(c) K-type thermocouple



(d) PID controller

Figure 4: Elements used in the furnace

A K - Type thermocouple (Figure 4 (c)) is used to measure temperatures up to 1300 °C. It was used to measure the internal temperature of the furnace and fed it to the PID controller. The thermocouple was inserted in place inside the furnace. A PID controller device has a feedback control mechanism. Based on the feedback i.e., temperature from thermocouple. The PID controller used in the furnace is made of Unistar is shown in Figure 4 (d).

#### IV. Operation of Simwool incorporated electric furnace (SIEF)

##### 4.1 Fabricated setup

The completely fabricated furnace is shown in Figure 6. The furnace was heat seasoned before the use for the first time. The furnace top was closed using a lid without loading it and heated to 1300 °C followed by cooling it down normally to room temperature. The removal of any water content or moisture content occurs in this process and it hardens the heating coil and permanently fix their shape. Inspection for leakages can also be done by the user.

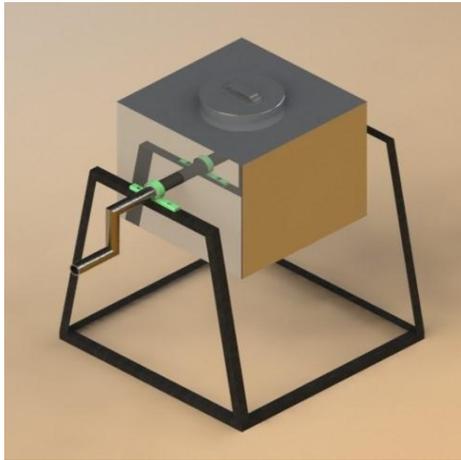


Figure 5: Solidworks model



Figure 6: Fabricated furnace

#### V. Result and discussion

##### Furnace performance

Aluminium was melted in the furnace to test the performance of the furnace. The heat-characteristic curve i.e., heating time vs. furnace temperature was obtained. Primarily, 0.5 kg of aluminium was fed to the furnace. With the rise in the temperature, time was recorded for the corresponding temperature. The heat-characteristic curve was plotted between them as shown in the Figure 7.

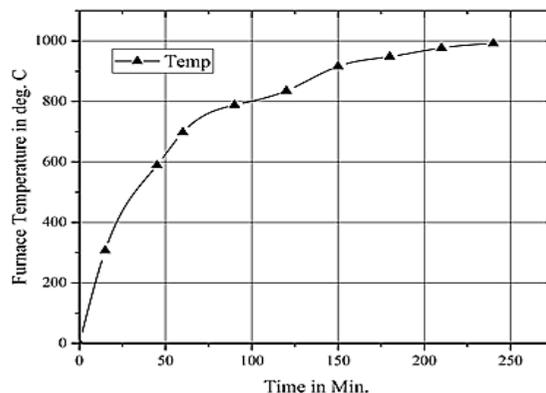


Figure 7: Heating trend of fabricated electrical furnace

Any metal whose melting temperature is less than 1300 °C can be melted in our furnace. When the molten metal reacts with oxygen, metals form oxides. Hence, suitable precautions must be taken in order to prevent the formation of metal oxides during the use of the furnace.

The cost of the equivalent furnace commercially available is around ₹2,00,000/- so, the aim was to fabricate a furnace which would cost lesser than that. The cost of our furnace fabricated was about ₹20,000/-. The aim of reduction in cost was achieved with a reduction in 90% of the cost of commercially available furnace. The fabricated furnace also weighs way less than that of the equivalent commercially available furnace.

## VI. Conclusion

The electric furnace fabricated met the expectations of lower cost and lighter weight. In the designing of the furnace mechanical and electrical parameters were considered. The fabricated furnace is appropriate for melting and holding small quantities of metals whose melting points are less than 1300 °C like Al, Zn, and their alloys for research and laboratory purposes.

Aluminium was melted in the furnace to conduct the heating tests. The furnace heating performance was analyzed by plotting heat-characteristic curve. The rate of heating and melting are comparable to existing equivalent furnaces attaining a temperature of well over 500 °C within 30 minutes and melting the first charge in about 90 minutes.

## VII. Acknowledgment

We sincerely thank M.S. Engineering college, Bengaluru for providing necessary facilities, work force and infrastructure for the successful completion of this project.

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## **Automatic Pneumatic Jack With Rack and Pinion Mechanism**

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**ABSTRACT:** *It has been conceived having studied the difficulty in lifting any type of four-wheeler vehicles like cars, lorry, tempos etc. This project has mainly worked on this difficulty and thus a suitable device has to be designed in such a way that the vehicle can be lifted from the floor land without application of any impact force. The fabricated part for this paper has been considered with utmost care for its simplicity and economy, such that this can be accommodated as one of the essential tools on automobile garages. We have made the project on the pneumatic jack lifting the four wheelers i.e. light weight four wheelers especially cars.*

**Keywords:** *Pneumatic jack, Rack and Pinion Mechanism.*

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### **1. Introduction**

Here the necessity lies in reducing the human effort applied during manual operation of the jacks and hence the need of the invention. In day to day life it is very tedious job to operate the jack manually and it is also a very time consuming work as well so to make it easier for everyone especially for aged person and for lady drivers. To provide a safe and simple automatic pneumatic jacking system without manual effort. To provide a novel jacking system that can be operated from within the vehicle by means of a dashboard control panel. There are certain mechanisms already available for the same purpose which has a definite capacity to lift the car on 2 wheels, a screw jack. But the general idea of the project is to minimize the human effort while operating the jack. To provide a novel pneumatic jacking system that is directly and permanently incorporated into the vehicle frame in such a way as to prevent the additional risk of damage or weathering. The automatic pneumatic jack for light vehicle garages has been developed to later the needs of small and medium automobile garages. In most of the garages the vehicles are lifted by using screw jack. This needs high man power and skilled labors. In order to avoid all such disadvantages, this automatic pneumatic Jack has been designed in such a way that it can be used to lift the vehicle very smoothly without any impact force. The operation is made be simple that even any person can handled, by just pressing the button. While driving a four wheelers the problems we faced related to the tyres there is a confused manual procedure which is used to lift a vehicle that means use of manual or hydraulic operated jack which requires extra human effort and time has to be placed in a jack to a manageable position then by applying muscular force to screw onto the jack for spherical and transitional motion to lift vehicle. By doing this we can save the effort and time we provide to a fabricated model based on Pneumatics. This automation can be achieved by computers, hydraulics, pneumatics, robotics, etc, and pneumatics forms a striking medium for low cost automation.

Degrees of automation are of two types namely:

- Full automation.
- Semi automation.

In semi automation an arrangement of manual effort and mechanical power is necessary whereas in full automation only human contribution is very small.

### **II. Objectives**

- The automobile vehicle is being atomized in order to protect the human being. The automobile vehicle is being atomized for the following reasons.
- To achieve high safety
- To reduce man power
- To reduce the work load
- To reduce the fatigue of workers
- Less Maintenance cost

### III. Methodology

In this system pneumatic jack with rack and pinion mechanism is operated by toggle switch which is connected to battery and DC motor .compressor air cylinder is connected to hand lever/ flow control valve so as to control the rat of flow of compressed air in to the cylinder through which the piston head of the cylinder is actuated.

Pinion is engaged with Dc motor and piston cylinder so as to carry the pinion and the piston cylinder is carried along with the motor .that the rotational motion of the pinion is converted into liner motion

Simultaneously Toggle switch and DC motors operated by the battery which is inter connected with each other .After moving the piston cylinder to the required region i.e. Dc motor they air is passed into the piston cylinder through hand lever valve at required pressure of about 5-6 bar.

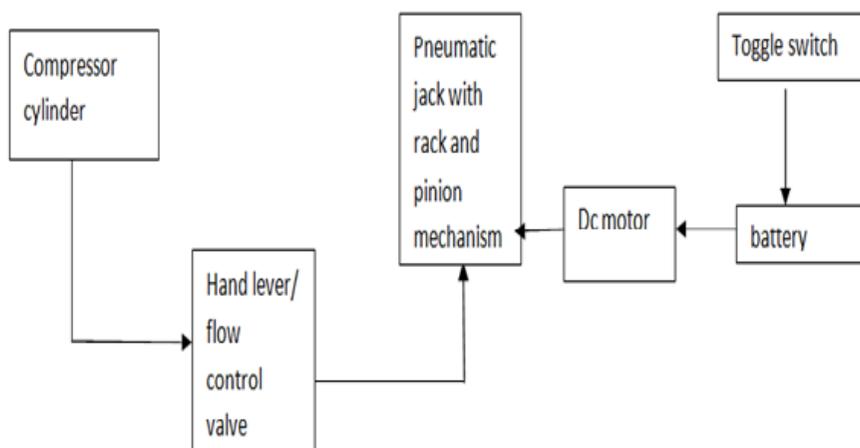


Figure 1: block diagram.

#### 3.1 Working Principle

Generally we construct the frame like car setup with 4 wheels. The rack and pinion mechanism attached with the pinion to travel along the rack from one end to the other end i.e., from front to back through dc motors controlled by the toggle switch.

The working medium in this is compressed air. This compressed air can be transmitted through tubes to pneumatic cylinder where power is converted into reciprocating motion. This reciprocating motion is obtained by an electrically controlled solenoid valve. The input to this solenoid valve is given by the control unit. The reciprocating motion is transmitted to the jack by a piston onto the cylinder. This jack is placed underneath the vehicle chassis, where the vehicle has to be lifted. This vehicle is lifted when the solenoid valve is switched on. The vehicle above the jack gets the reciprocating motion through piston which is connected to the jack. Thus using this pneumatic jack the vehicle can be lifted with without difficulty.

In order to have an effect on mechanical motion, pneumatics employ compression of gases and as based on the working principles of fluid dynamics in the concept of pressure. Equipment which employs pneumatics uses an interconnecting set of components. A pneumatic circuit consists of active components such as gas compressor, transition lines, air tanks, hoses etc. This Compressed air is then supplied to the compressor and then transmitted through a series of hoses. Air flows can be regulated by valves and this pneumatic cylinder transfers the energy provided by the compressed gas onto the mechanical energy. Apart from compressed air, inert gases can also be applied predominantly for self-contained systems. Pneumatics can be applied in a wide range for industries, even in mining too. In all major industries gas pressures of about 80 to 100 pounds per square inch is used. Hence leaks will be of less concern since the working fluid of pneumatics is air which is not like oil in hydraulics. The working fluid is also extensively available and most of the factories are pre-plumbed for compressed air distribution and hence pneumatic equipment is much easier to set-up. To control this system, only ON and OFF are used as the system consists only of standard cylinders and other components, making it as a simpler compared to hydraulics. These pneumatic systems require low maintenance and provide long operating life. Finally the working fluid of this pneumatic system

absorbs excessive force which leads to less damage to the equipment. Compressible gases are also easy to store and safer; no fire hazard is presented and machines could be made to be overload safe

- Power is easily transmitted and small loss in transmission
- A single compressor can provide power to as many as pneumatic Jacky.
- Low cost and easy to work and also reduces the manual stress produced in it.

#### IV. List of Components Used

1. Pneumatic double action cylinder
2. Hose pipe and collar
3. Rack and pinion
4. Dc motor
5. Battery 12v
6. MS square hollow pipe
7. 4 wheels
8. Solenoid non return valve
9. Toggle switch
10. Connecting wires, bolts and nuts, washers, screws etc.

#### V. Design and Specifications

##### 5.1 Design of piston rod

Load due to air Pressure

Diameter of the Piston (d) = 40mm

Pressure acting (p) = 6kgf/cm<sup>2</sup>

Material used for rod = C 45

Yield stress ( $\sigma_y$ ) = 36 kgf/mm<sup>2</sup>

Assuming factor of safety = 2

Force acting on the rod (P) = Pressure X Area

$$= p \times (\pi d^2 / 4)$$

$$= 6 \times \{(\pi \times 4^2) / 4\}$$

$$P = 73.36 \text{ Kgf}$$

Design Stress( $\sigma_y$ ) =  $\sigma_y / FOS$

$$= 36 / 2$$

$$= 18 \text{ Kgf/mm}^2$$

$$= P / (\pi d^2 / 4)$$

$$d = \sqrt{4 p / \pi [\sigma_y]}$$

$$= \sqrt{4 \times 73.36 / \{\pi \times 18\}}$$

$$= \sqrt{5.33} = 2.3 \text{ mm}$$

∴ Minimum diameter of rod required for the load = 2.3 mm

We assume diameter of the rod = 15mm.

##### 5.2 Design of cylinder thickness:

Material = Cast Iron

Assuming Internal Diameter of the cylinder = 40mm

Ultimate Tensile Strength = 205 N/mm<sup>2</sup>

Working stress = Ultimate Tensile strength/Factor of safety

##### Assuming Factor of Safety = 4

Working Stress ( $f_t$ ) = 2500/4

$$= 625 \text{ Kgf/mm}^2$$

According to 'Lames Equation'

$$\text{Minimum thickness of cylinder (t)} = r_i \{ \sqrt{(f_t + p) / (f_t - p)} - 1 \}$$

Where,

$R_i$  = Inner diameter of cylinder in cm

$f_t =$  Working stress (Kgf/cm<sup>2</sup>)

$p =$  Working pressure in Kgf/cm<sup>2</sup>

$\therefore$  Substituting values we get,

$$t = 2.0 \left\{ \sqrt{(625 + 6) / (625 - 6)} - 1 \right\}$$

$$t = 0.019 \text{ cm} = 0.19 \text{ mm}$$

We assume thickness of cylinder=2.5mm

Inner diameter of barrel= 40cm

Outer diameter of barrel= 40+2t

$$= 40 + (2 \times 2.5) = 45 \text{ mm}$$

### 5.3 Length of piston rod:

Approach stroke= 160mm

Length of threads = 2 X 20 = 40mm

Extra length due to front cover = 12mm

Extra length of accommodate head 20mm

Total length of the piston rod = 160+40+12+20

$$= 232 \text{ mm}$$

By standardizing, length of the piston rod = 230mm

## Specifications

### 5.4 Double acting pneumatic cylinder

Stroke length : Cylinder stoker length 160 mm = 0.16 m

Quantity : 1

Seals : Nitride (Buna-N) Elastomer

End cones : Cast iron

Piston : EN - 8

Media : Air

Temperature : 0-80 ° C

Pressure Range : 8 N/m<sup>2</sup>

### 5.5 Single acting pneumatic cylinder

Stroke length : Cylinder stoker length 80 mm = 0.08 m

Quantity : 2

Seals : Nitride (Buna-N) Elastomer

End cones : Cast iron

Piston : EN - 8

Media : Air

Temperature : 0-80 ° C

Pressure Range : 8 N/m<sup>2</sup>

#### 5.5.1 Solenoid Valve

Max pressure range : 0-10 x 10<sup>5</sup> N/m<sup>2</sup>

Quantity : 3

#### 5.5.2 Flow control Valve

Port size : 0.635 x 10<sup>-2</sup> m

Pressure : 0-8 x 10<sup>5</sup> N/m<sup>2</sup>

Media : Air

Quantity : 1

#### 5.5.3 Connectors

Max working pressure : 10 x 10<sup>5</sup> N/m<sup>2</sup>

Temperature : 0-100 ° C

Fluid media : Air

Material : Brass

**5.5.4 Hoses**

Max pressure :  $10 \times 10^5 \text{ N/m}^2$

Outer diameter :  $6 \text{ mm} = 6 \times 10^{-3} \text{ m}$

Inner diameter :  $3.5 \text{ mm} = 3.5 \times 10^{-3} \text{ m}$

**VI. Drawing**

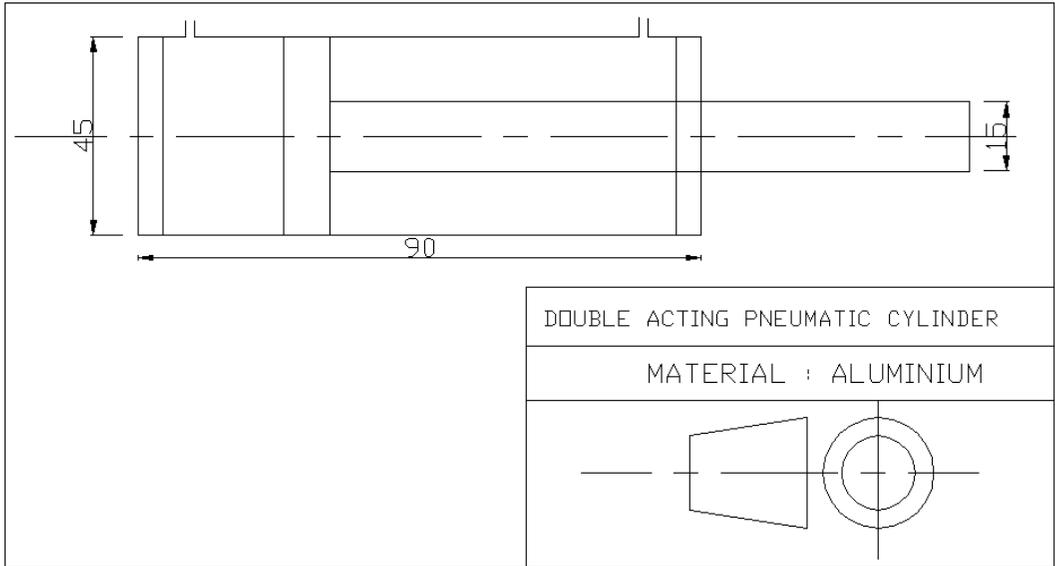


Figure 2: Double acting pneumatic cylinder.

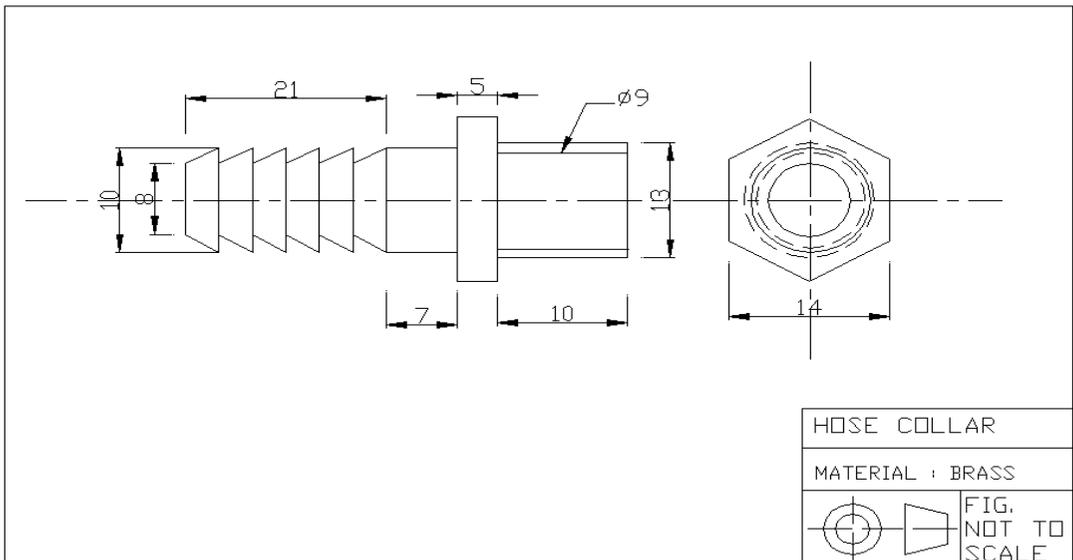


Figure 3: Hose collar.

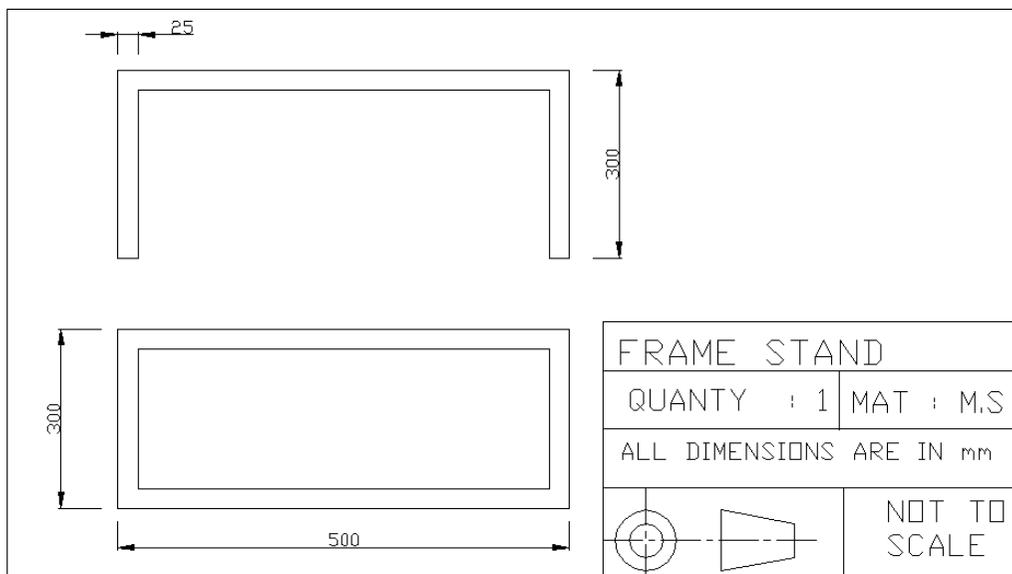


Figure 4: Frame stand.

**VII. Fabricated Model**

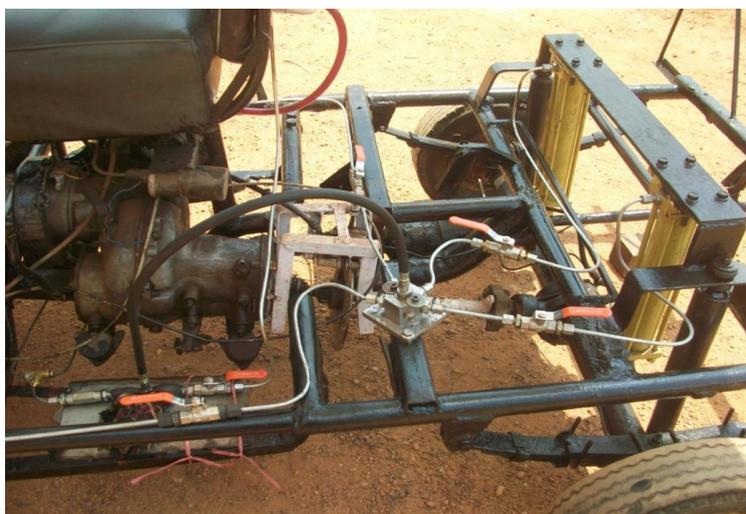


Figure 5: Photo of the automatic hydraulic jack system.

**VIII. Results**

From our project the following results came

- We can lift the weight of 100 kg at 327 kPa.
- Volume of the air can be stored in the storage tank is 66.05m<sup>3</sup>.
- Pneumatics working fluid is also widely available and most factories are pre-plumbed for compressed air distribution, hence pneumatic equipment is easier to set-up than hydraulics.
- To control the system, only ON and OFF are used and the system consists only of standard cylinders and other components, making it simpler than hydraulics.
- The working fluid of the pneumatic system absorbs excessive force, leading to less frequent damage to equipment.

### **IX. Conclusion**

Following are the conclusion made from the project:

- In this paper we have come to the conclusion that pneumatics jacks can perform in the place of hydraulic jacks proficiently.
- The air required for operating the jack is easily accessible in nature.
- Cost of this project is not high when compared to other jacks.
- As jack is inbuilt in this paper, the fatigue is fewer and if made in the group the cost can reduced further.
- It is much improved compared to hydraulic jacks which are used for lifting up the vehicle chassis.

### **X. Future Work**

- The system pressure is quite low due to compressor design limitation (less than 17.2 bar)
- The understanding of inbuilt pneumatic jack system is well designed for small car in this project work, but this arrangement can be widely used in future with some more modifications for heavy vehicles.

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# Trouble Shooting and Calibration of RAC

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**ABSTRACT:** In present era, Refrigeration and air conditioning machine are used as a basic requirement. In this project we are going to find out the effectiveness for a refrigerator and air conditioner system and also will draw the performance curve with respect to calculations and obtained results

**Keywords:** Refrigerator, Air Conditioning Machine.

## 1. Introduction

In the process to resolve the issues of a machine in day today life our team found some machines which were not in the working condition, by the guidance of our respective sir's our team got the opportunity to *troubleshoot and calibration* of the refrigeration tutor and air conditioner tutor (Duct type).

The refrigeration is a process by which the temperature of a given space is reduced below that of atmospheric temperature it can be realized by several methods, for example, ice refrigeration, dry ice refrigeration, air refrigeration, vapour compression refrigeration ... etc. the modern refrigeration uses the vapour compression method. In this method, a closed system (the refrigerant) experiences a thermodynamic cycle; by virtue of doing network on the system in such a cycle, it is possible to extract heat from a low temperature source (the refrigerated space) and to reject heat to a higher temperature sink (the atmosphere or cooling water). The performance of refrigerators and heat pumps is expressed in terms of coefficient of performance (COP), defined as  $\text{COP} = \frac{\text{desired output}}{\text{required input}}$ .

The science of air condition deals with maintaining a desirable internal air conditions irrespective of external atmospheric conditions. The factors involved in any air conditioning installation are: Temperature, Humidity, Air movement and circulation, Air filtering, cleaning and purification. The simultaneous control of these factors within the required limits is essential for human comfort or for any industrial application of the air conditioning system. In any air condition system, temperature and humidity are controlled by thermodynamic processes. Depending on the season, the air condition processes involve cooling, heating, humidification and dehumidification of air. Other aspects such as air movements, circulation, purification, etc. are obtained by installing suitable fans, blowers, ducting and filters. This equipment is designed to demonstrate different air conditioning process such as cooling, heating, humidification, etc. required for different seasons of the year.

## II. RESEARCH METHODOLOGY

Following the commencement of the project, research and background study was conducted in order to thoroughly understand the concept and the working of an refrigeration and air conditioning machine. During this phase there were various steps involved for the completion of this research to a certain extent. The details are as follows

### 2.1 Literature review:

MukundPande, Atul A patil and Vijay H Patil [1] - They did the Evaporator having eight passages was more effective due to increased length of path for the refrigerant. It was causing effective utilization of surface area and increasing time for which refrigerant was in the evaporator. Refrigerating effect was increased by 17.61% for eight passages evaporator with relatively less increase in compressor work (5.8%). It was observed that COP improved from 1.76 to 1.95.

Madhuri Maheshwari, Gaurav Shrivastava, Bhanu Choubey [2] - In this paper study on refrigeration system designed for low temperature which has Zero-Ozone depleting point better heat transfer characteristic gives greater refrigerant effect. In this paper we study the main function part like compressor, evaporator, refrigerant, fan and motor, Technical Details of the components.

B. Devaraj Naik, Subba Reddy. Mundla [3] - This paper highlights the review and critiques of Earth Pipe Air Conditioning System. On the basis of literature review, the findings show the importance of Air Conditioning System in terms of cost effectiveness and power consumers. The Earth Pipe Air Conditioning System not

only improves the Air Conditioning System but also significantly reduce the needed maintenance in today's highly competitive world, and thereby reducing concerned cost.

A multi pass earth pipe air conditioned system was installed and study its performance in cooling mode. EPAC was able to reduce the temperature of hot ambient air by 10 to 12 degree Celsius.

S. B. Nadaf, Prof. D. D. Bhoge , Dr. B. K. Sonage [4] - This paper shows the Experimental tests showed that power consumption and performance of EATHE assisted air-conditioner improved significantly as compared to the air-conditioner having its condenser tubes cooled by ambient air. The power consumption of system is increases as the ambient temperature increases because for higher temperature cooling load on system increases. Therefore without using earth air tunnel heat exchanger the actual COP of system decreases and power consumption increases. The results are improved when the earth air tunnel heat exchanger is coupled with air conditioner which increases the coefficient of performance of the system by nearly 11%. The energy consumption of conventional 1TR air conditioner tutor is found to be reduced by 16 % when cold air from EATHE is completely used for condenser cooling.

Prateek D. Malwe, Bajirao S. Gawali and Shekhar D. Thakre [5] – This paper gives Energy analysis of refrigeration tutor. The results show that performance of system and hence energy efficiency are affected due to change in evaporator and condenser temperature. Conclusions have been made. It is found that second law efficiency of the system is 58% which is low and shows that system is not performing effectively. This is because of may be gas leakages, internal irreversibility's present in the system and component wise energy losses. Second law efficiency increases with the decrease in evaporator as shown in fig 6. Reason for above is that, at lower evaporator pressures and temperatures, load on evaporator is more, thus it has to absorbs more heat, more refrigerating effect is obtained, COP increases. Moreover, energy loses as we know reduces at lower pressures and temperatures. Thus, it got highest component wise energy efficiency value.

Ali Khalid Shaker Al-Sayyab [6] – This paper shows a computational model based on thermodynamic energy and energy analysis with experimental work are presented for the investigation of the best alternative refrigerant for R134a working in refrigerator. After the successful investigation on the performance of the new refrigerant mixture as alternative refrigerant, the following conclusions based on the results obtained can be list below: The compressor work of all tested refrigerant is decreased as the evaporation temperature increased, due to saturation pressure rising that's lead to the compressor pressure ratio and specific volume of compressor inlet decreasing. The tested refrigerant required more work than that of R134a, so the compressor with Mix1 needed 26.14% more than R134a, with Mix2 required 23.98%, with Mix3 required 42.33% and with Mix4 required 33.15%. The theoretical model show that the refrigerant mixtures give closer value of COP to that of R134a with reduction of 0. 6284% Mix1, 0.0739% Mix2, 0.7189% Mix3 and 0.3497% for Mix4, where in experimental work all refrigerant give reduction more than that of theoretical model because of the refrigerator, is design to work with R134a.

Bo Huang, Xiyuan Zhu, Hong Tao, Da Shi [7] - This paper With the simulation tools and the new work process, the experiments of the performance matching of inverter room conditioner become more efficient. After optimization and final test validation, the COP of intermediate cooling increases by about 4.66%, intermediate heating COP increases by about 7.00%, and as well as rated heating rises about 2.96%. In general, this method will greatly shorten the test time, reduce the workload, and cut the cost.

### **Problem Statement**

In Refrigeration and air conditioning machine the effectiveness of machine gets depleted and in order to increase this effectiveness of the machine we have to refill the refrigerant in gas chamber, check for leakages present in supply tube and to troubleshoot the system.



Fig 1:- Air Conditioner Tutor (Duct Type)

### III. Block Diagram & Working Principle of AC

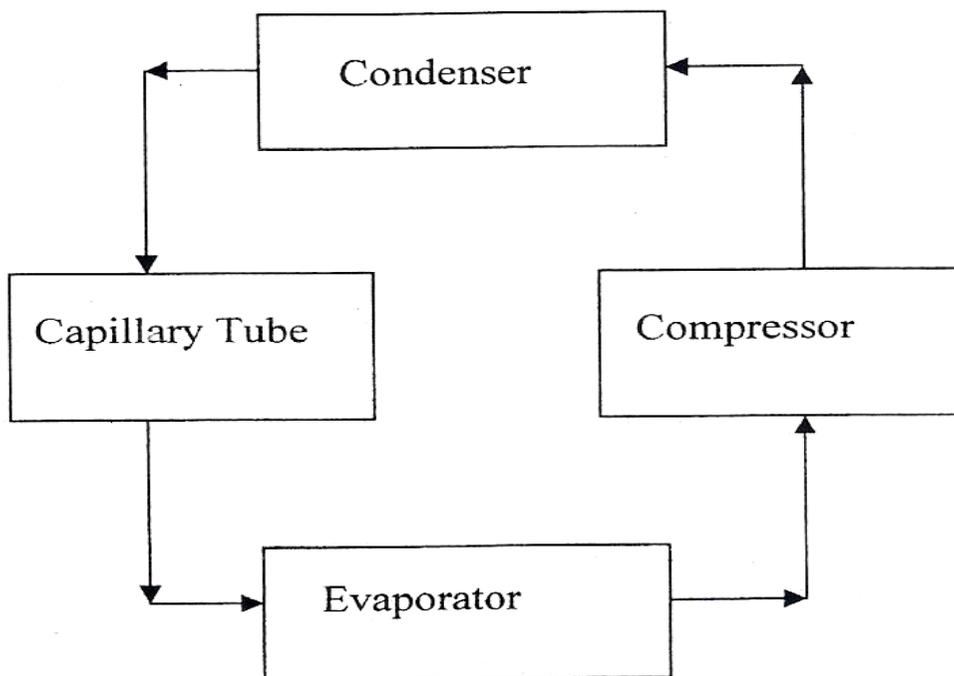


Fig 6:- Block Diagram of AC

Figure shows the schematic diagram of simple vapour compression refrigeration system.

Working of AC is as follows:-

It (often referred to as **AC**, **A/C**, or **air con**) is the process of removing heat and moisture from the interior of an occupied space, to improve the comfort of occupants. It can be used in both domestic and commercial environments. This process is most commonly used to achieve a more comfortable interior environment, typically for humans and other animals; however, it is also used to cool/dehumidify rooms filled with heat-producing electronic devices, such as [computer servers](#), [power amplifiers](#), and even to display and store some delicate products, such as artwork.

Air conditioners often use a fan to distribute the conditioned air to an occupied space such as a building or a [car](#) to improve [thermal comfort](#) and [indoor air quality](#). Electric refrigerant-based AC units range from small units that can cool a small bedroom, which can be carried by a single adult, to massive units installed on the roof of office towers that can cool an entire building. The [cooling](#) is typically achieved through a [refrigeration cycle](#), but sometimes [evaporation](#) or [free cooling](#) is used. This kind of systems can also be made based on [desiccants](#) (chemicals which remove moisture from the air) and subterranean pipes that can distribute the heated refrigerant to the ground for cooling. In the most general sense, it can refer to any form of technology that modifies the condition of air (heating, (de-) humidification, cooling, cleaning, ventilation, or air movement). In common usage, though, "air conditioning" refers to systems which cool air. In [construction](#), a complete system of heating, [ventilation](#), and air conditioning is referred to as [HVAC](#).

#### IV. Components and Description

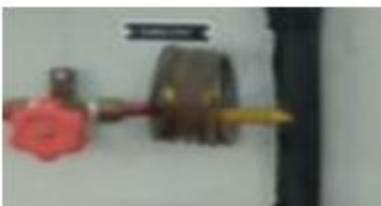
Number of components has been used in the robot, which are:-

- Condenser:



Finned Tube type air cooled condenser with fan

- Capillary tube:



Capillary tube expansion device.

- Compressor:



RECHI PRECISION sealed compressor

- Evaporator:



Suitable for above compressor immersed in duct. Fins and Copper tube type cooling coil.

**V. Observation & Calculation Table:**

- ❖ Electricity Supply: Single Phase, 230 V AC Supply , 50Hz, 5-15Amp.
- ❖ Inlet air duct area:250\*250mm = 62500mm<sup>2</sup>=0.0625 m<sup>2</sup>

Table 1:- Main characteristics of AC

Sl No.	Compressor Pressure (PSI)		Temperature of Refrigerant °C					Temperature of Air (DBT) °C		Time taken for 1 Revolution.
	P <sub>1</sub> Suction	P <sub>2</sub> Discharge	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	Inlet	Outlet	
1.	40 psi	250 psi	30	42	-3	33	32	25	21	8

$$\begin{aligned}
 1. \text{ Refrigeration effect} &= m_2 C_p (T_{db1} - T_{db2}) \\
 &= 0.5 * 1.005 * (25 - 21) = 2.01 \text{ KJ/s}
 \end{aligned}$$

$$\begin{aligned}
 2. \text{ Compressor Input} &= \frac{\text{No of revolutions} \times 3600}{\text{Time} \times \text{Energy meter constant}} = \frac{7 * 3600}{8 * 8.6 * 10^3} \\
 &= 0.366 \text{ KW/s}
 \end{aligned}$$

$$\begin{aligned}
 3. \text{ Actual C.O.P.} &= \frac{\text{Refrigeration effect}}{\text{Compressor Input}} = \frac{2.01}{0.366} \\
 &= 5.491
 \end{aligned}$$

$$4. \text{ Theoretical C.O.P.} = \frac{H_3 - H_1}{H_2 - H_1}$$

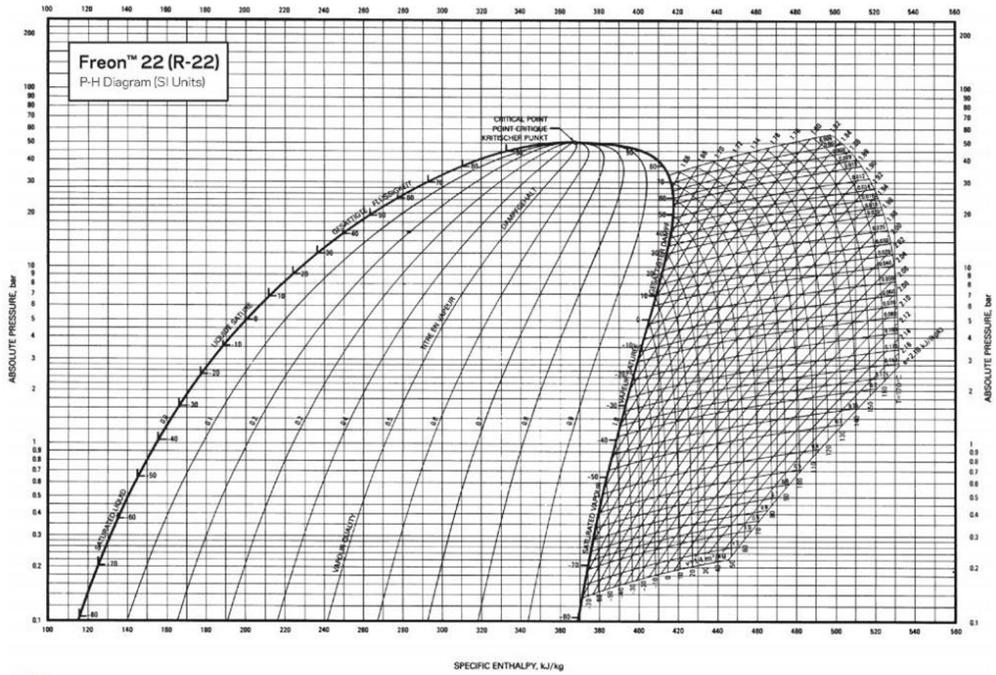
Mark points 1, 2, 3 using (P<sub>1</sub>, T<sub>2</sub>), (P<sub>2</sub>, T<sub>3</sub>), (P<sub>2</sub>, T<sub>4</sub>) respectively on P-h diagram from refrigeration chart and read H<sub>1</sub>, H<sub>2</sub> and H<sub>3</sub> (where H<sub>3</sub> = H<sub>4</sub>).

H<sub>1</sub> = 390, H<sub>2</sub> = 405, H<sub>3</sub> = 418.

$$\begin{aligned}
 &= \frac{418 - 390}{405 - 390} \\
 &= 1.866
 \end{aligned}$$

$$5. \text{ Relative C.O.P} = \frac{\text{Actual C.O.P}}{\text{Theoretical C.O.P}} = \frac{5.491}{1.866} = 2.9426$$

### 5.1 Pressure v/s Enthalpy chart



### VI. Modelling

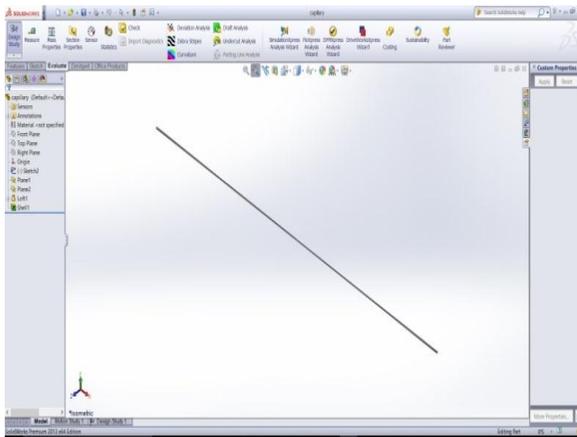


Fig 7 Capillary tube

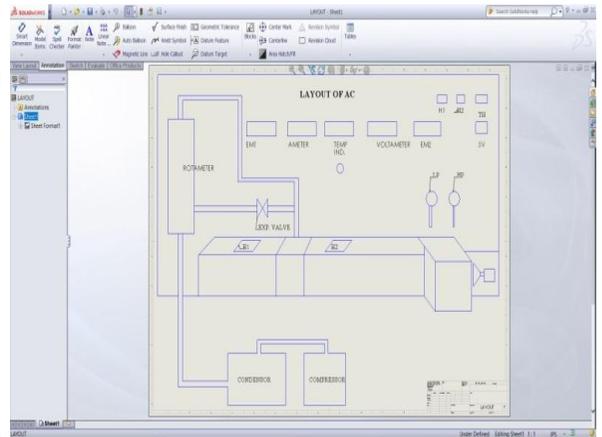
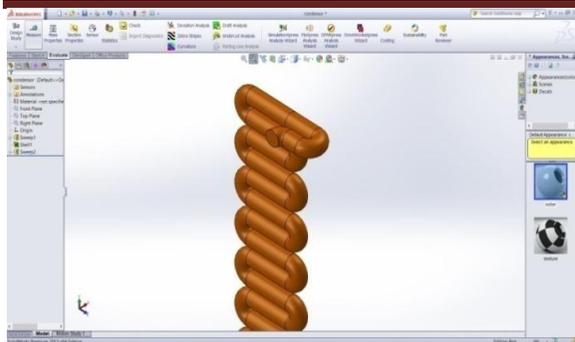


Fig 8:- Layout



9:- Evaporator

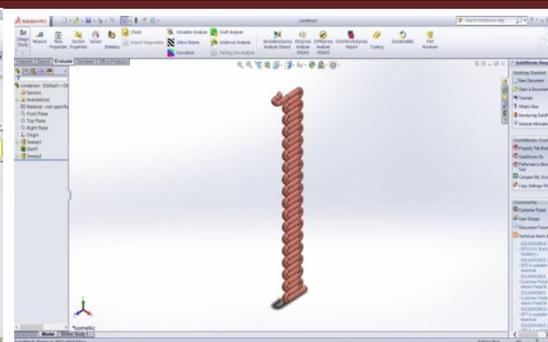


Fig 10:- Condenser

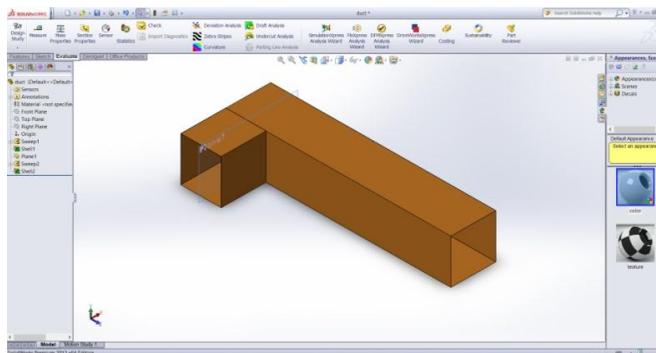


Fig 11:- Duct.

Modelling of the ac was done using *DS Solidworks*, The modelling section in this paper consists of various important parts of itself.

## VII. Conclusion

The air conditioning and refrigerator tutor is in working condition, the co-efficient of performance of the air conditioning and refrigerator of duct type has been calculated.

## VIII. Future Scope

There are many unsolved problems and fundamental challenges for refrigeration and air conditioning. This project can be further developed by incorporating it with various ideas, such that it is capable of further increase in efficiency simultaneously. Its effectiveness can be increased by certain degree with the increase of interaction with the environmental and room conditions.

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## **Value Addition of Marine Propeller Using Numerical Simulation**

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**ABSTRACT:** *In current paper, the working of the marine propeller under non-cavitating condition is evaluated numerically using computational fluid dynamics (CFD) method approach. The main objective of this paper is to review physics involved in fizz dynamics and prediction and control cavitation that have been recommended in the literature. This mechanisms are evaluated with noticed that are available from marine propeller, where cavitation has leads to erosion damage on the marine propeller. A second objective is to review physical model and its characteristics from the prediction of the risk of cavitation erosion. A detailed of phenomenon of cavitation and description of the method leading to tip vortex cavitation and its effects on marine propeller working is hypothesized.*

**Keywords:** *Marine propeller, Simulation, Cavitations, Steady state analysis*

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### **1. Introduction**

Cavitation is phenomenon of change of mode from liquid to gaseous state. This mode change occurs due to vapour fizz formation. The water pressure drops below the vapour pressure of surrounding fluid then that leads to cavitation. The characteristic of this phenomenon is periodic, means, initially vapour will form then it will grow in to larger size and collapse at high pressure region. This performance of phenomenon occurs usually in marine propeller, water pump and pipes of power plant. Cavitating flow leads to vibration in a body, damage of material, loss of power and efficiency. Cavitation involved in mode transition from liquid to gaseous state, which is as explained below.

#### **1.1 Phase Transition**

The water usually exist in three state; solid, liquid and gas. This mode change from liquid and change from vapor to water is called condensation. These cavitations and boiling phenomenon are different. If the mode change occurs due to increase in temperature is boiling. If the mode change occurs due to decreasing in pressure, the phenomenon is called cavitation. In marine propeller, evaporation occurs by sudden change of local pressure in water due to dynamic action of propeller. Cavitation is violent action of fluids due to its nature of rapid mode change process, which involved in the condensation and evaporation of cavitation fizzes. Then fizz will form small cavity based on vapor, this cavity again comes and collapse at high pressure region. The growth and collapse of bubbles obtains very high pressure. Flow velocity is also causes cavitation is changes from increased by decreasing pressure by any dynamic action. Performance of cavitations is described by the parameter is called cavitation number. It is defined by the following equation.

$$\sigma = \frac{(p_a - p_v)}{(1/2 \rho v^2)} \quad 1$$

#### **1.2 Bubble dynamics**

The Water Bubbles are formed from small fizz filled with gas or vapor or it may combination of both. The region where cavity is present, that region forms vapor cavity. The outside the dust particles forms a nucleus to form a cavity. Hence cavitation does not insert in pure liquid.

#### **1.3 Tip Vortex Cavitation**

Tip vortex cavitations is most among the types of cavitation which are occurs at blade tip and hub. Usually present near blade tip and hub. These type cavitation initially behind the tip of the blade region and unattached to the blade tip, because velocity is changing from lower and higher and pressure is dropping further. With smaller cavitation number it will move to blade tip and attaches to it. Due to any dynamic action if there is any further reduction in pressure around blade surface, the tip vortex cavitation will cover little more area.

**1.4 Cavitation Effects**

Cavitating flow leads to damage of material, vibration in a body, loss of power and efficiency. Cavitation not only occurs due to change in pressure but also happens due to dissolved gases, dust, and dent present in water. Hence prediction and control of cavitation is very important aspect for revolving bodies in liquid. With development of high computational power made possible to simulate this complex phenomenon. Numerical analysis study on cavitating flow has been carried out from 1960's onwards for different propeller geometries using Reynolds Averaged Navier Stokes (RANS) solver. A study shows, CFD gives good understanding in comparing with experimental one, but requires more CPU-hour. Earlier day's propeller performance was predicted by lifting line theory and later on, with advanced technology of computability makes to simulate cavitating flows effectively. In the present paper SC/Tetra v12 (Software Cradle Co.,Ltd) CFD software is used.

**1.5 Cavitation physical model**

To calculate cavitating flows physical model is required, in order to predict better tip vortex cavitation and cavity pattern, proper model is elected for numerical simulation. From literature survey it is found that Singhal's full cavitation model gives better results. Features of this model are discussed below. This model considers formation of bubble, collapse of bubble and non-condensable gas.

$$P = \frac{dP(P+P_c)p}{K(1-Y-Y_g)P+(T+T_0)\rho_g+RY(P+P_c)T\rho_g+Y_gP(P+P_c)} \tag{2}$$

In full cavitation model condensation and vaporization term are solved in following equation.

$$\frac{\partial (\rho Y)}{\partial t} + \frac{\partial (\rho u_j Y)}{\partial x_j} = R_e - R_c \tag{3}$$

The evaporation term;

$$R_e = C_e \left(\frac{\sqrt{K}}{\sigma}\right) \rho_1 \rho_v \sqrt{\left(\frac{2 P_v - P}{3 \rho_1}\right)} (1 - Y - Y_g) \quad \text{if } P < P_v \tag{4}$$

The condensation terms;

$$R_c = C_c \left(\frac{\sqrt{K}}{\sigma}\right) \rho_1 \rho_1 \sqrt{\frac{2 P - P_v}{3 \rho_1}} (Y) \quad \text{if } P > P_v \tag{5}$$

Where,

$C_e = 0.02$  and  $C_c = 0.01$  are model constant

$$P_v = P_a + 0.39 \rho \frac{h}{2} \tag{6}$$

**Nomenclature**

Propeller diameter	D
Advance coefficient $J = V_a / nD$	J
Rotational speed	n
Thrust	T
Torque	Q
Number of blades	Z

**II. Numerical Methodology**

SC/Tetra v12 commercial CFD software has been used for the numerical simulation analysis, which employs finite volume method on unstructured mesh. The simulation is performed with RNG k-epsilon turbulence models. Characteristic of the marine propeller under non-cavitating condition is calculated for different advance coefficient. Capacity of marine propeller is measured in terms of thrust coefficient and torque coefficient. Mathematically, thrust coefficient and torque coefficients are as follows.

$$K_T = \frac{T}{\rho n^2 D^4} \quad (7)$$

$$K_Q = \frac{Q}{\rho n^2 D^5} \quad (8)$$

### III. Computational Methodology

#### 3.1. Geometric Modeling

A controllable pitch type of smp11 propeller software model is used for the numerical analysis. Same experimental dimensions are used for non-cavitating flow analysis. Propeller with five blades having diameter  $D = 0.250\text{m}$ , skew angle  $18.8^\circ$  and pitch ratio at  $0.7R$  1.635. Thrust coefficient is calculated for three advance coefficient. Dimension and computational domain are as same as experimental towing tank set up. Fig.1. (a) shows Potsdam Propeller Test Case (PPTC) of smp11 and fig. (b) Shows geometric part for cavitating and non cavitating cases. Revolving region is modelled with moving element condition and assigned specified rotating speed of the propeller. Stationary and rotating parts are connected discontinuously using discontinuous mesh approach method. Inlet is gives with inflow velocity and outlet with static pressure zero. The Free slip condition to walls of the computational domain.

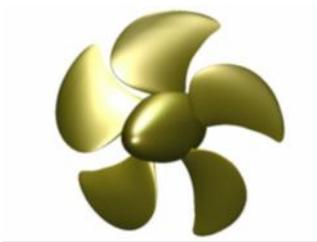


Fig.1 (a) PPTC propeller

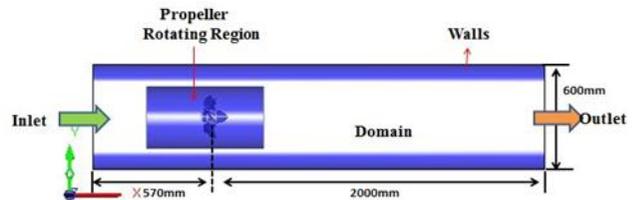


Fig.1 (b) Computational Domain

Table1. Test Conditions

Test cases		case1	case2	case3
Rate of revolutions (1/s)	n	25.897	25.986	26.014
Water Temperature ( $^\circ\text{C}$ )	T	24.2	24.2	24.2
Water Density ( $\text{kg}/\text{m}^3$ )	$\rho$	997.44	997.4	997.37
Vapor Pressure (pa)	$P_v$	2818	2818	2869
Kinematic viscosity of water ( $\text{m}^2/\text{s}$ )	$\nu$	9.34e-07	9.4e-07	9.73e-07
Advance coefficients	J	1.019	1.269	1.408
Inlet Velocity (m/s)	$V_A$	6.4	8.27	9.05
Thrust coefficient (non cavitating)	$K_T$	0.387	0.245	0.167
Cavitation Number	$\sigma$	2.124	1.438	2.000

#### 3.2. Mesh Generation

The octree is generated initially; it transformed into unstructured tetrahedral mesh using progress front method. Polygon features were used for more mesh refinement. The region around tip of blade is refined larger to capture pressure and shear forces. The numbers of tetrahedral mesh elements were about 18

million. Prism layer are insert to capture boundary layer phenomenon to maintain  $y^+ \leq 30$ . Control of  $y^+$  gives better results. The convergence criteria for all residual  $1e-5$  were used in the present study.

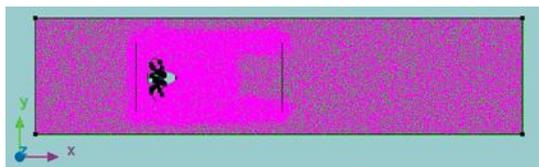


Fig 2(a) Mesh sectional view

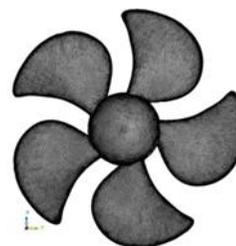


Fig 2 (b) Mesh generation

**IV. Results**

Fig.3a. Shows pressure distribution at pressure side of the blade surface and fig.4b shows pressure distribution at suction side of the blade surface. The Water at which cuts the blades surface at Blade tip, root and hub are with more pressure compared to other regions.

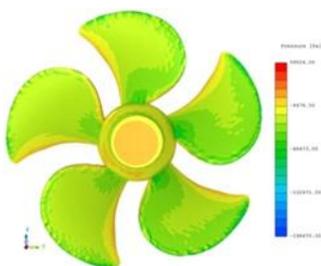


Fig.3a Pressure distribution at pressure side of the blade surface

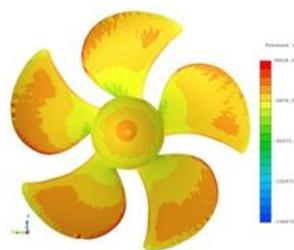


Fig.3b Pressure distribution at suction side of the blade surface

Fig.4a. Shows  $y^+$  value for the present numerical simulation i.e. 28.63 which indicates quality of the mesh elements are good to predict improved results with RNG k-epsilon part. Fig.4.b shows comparison of propeller features in terms of thrust coefficient at different advance ratio between experimental and simulation analysis results, shows are in good agreement. And also observed that thrust coefficient decreases as the advance coefficient increases. Thrust coefficient was evaluated at advance ratio of 1.016, 1.269, and 1.408, as shown in table2, and percentage of error of difference in thrust coefficient was also tabulated. From Table2 it is observed that numerical result shows good agreement with experiment results (Experimental results are available in literature survey). Percentage of error between experimental and analysis result is less than 2% in all three conditions.

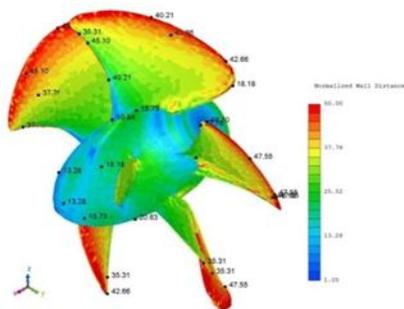


Fig.4a. Normalized wall distance

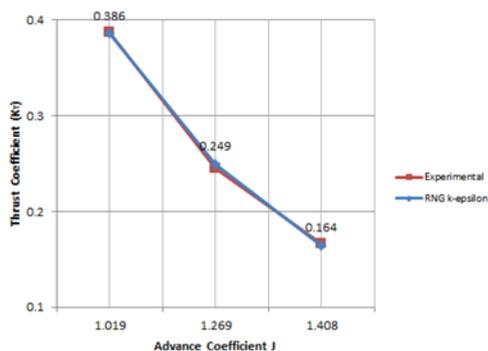


Fig.4b. Propeller performance

Table 2 Predicted non-cavitating performance of propeller

Results	Thrust Coefficient ( $K_T$ )			Error (%)		
	Case1	Case2	Case3	Case1	Case2	Case3
Experimental (Non-cavitating)	0.417	0.315	0.227			
Analysis (RNG k-epsilon)	0.426	0.329	0.214	-0.3	2.6	-0.82

## V. Conclusions

A detailed description of the cavitation phenomenon and its procedure leading to tip vortex cavitation erosion is discussed. The detailed description is based on experiments and remarks published in open literature. Steady state numerical simulation analysis has been carried out on PPTC propeller. The simulation was carried under non-cavitating flow condition from different advance coefficient. A numerical result shows good agreement with experimental result. Research and study shows that RNG k-epsilon prototype model gives better predictions due to its near wall turbulence effects. And also this prototype model has better reattachment flow capability. Hence this prototype model is chosen for cavitating flow analysis in future work.

## VI. Acknowledgements

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