Smart Detection of Hazardous Gases and Overflow in Pipeline in Both Gaseous and Aqueous Level

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ABSTRACT: *Today's drainage system is not computerized. So whenever there is blockage it is difficult to figure out exact location of the blockage. Also we don't get early alerts of the blockage. Hence detection and repairing of the blockage becomes so time consuming. In this paper, we design effective monitoring system for sewage pipelines by identifying various hazardous gases and indicate the overflow by using different type of sensors. By using GPS the location will be detected. The system governing the flow of sewage from the pipes uses flow sensors to detect the variations in the flow. All the details and other records related to sewage will be stored using IOT application. It provide prior alerts message of blockages, and locate them using IOT.Moreover we will be analysingthe data and present concrete results based on it. This will be really helpful in tracking down the source of the problem and in providing a permanent solution to it..*

Key Words:

I. OVERVIEW

Hazardous gases such as hydrogen sulphide,methane and carbon monoxide can cause serious structural damages to the sewer pipelinesand also cause serious health problems since in most of the countries the cleaning of the drainage system is still done manually.Although various strategies have been adopted to allay the fears of the public,these strategies have actually been quite infeasible for the govermentfinacially thus prompting the question
on continuity of these strategies.In this paper we propose an an effective low-cost and flexible solution for condition monitoring and infrastructure management in the cities and provide alert to the users in case of danger.The proposed system consist of a gas sensor which determines the concentration of each gas and sends an alert in the web application if the concentration levels of a particular gas crosses the threshold limit i.e.safetylimit.The exact location can be detected by using the GPS module which presents us with the latitude and longitude of the location which inturn can help in determining the real time location.In addition to this,we have an aqueous sensor the can actually sense if the water levels in the sewer pipeline have actually crossed the threshold limit and sends an notification in the application inorder to warn the corporation workers that venturing inside the drain might be quite risky.This will a great asset for the workers especially during the monsoon season.On detection of the hazardous gases or overflow,the embedded system enabled device transmits data to the API.If unbalanced or values over threshold limit is detected,an notification is sent to API.So once API is opened in the whole area grids are available.Each Grid is labelled with meter number ,details,GPS location link and level of danger.Once the danger is sensed,the label turns red and details are sent if necessary.So,the concerned action team in municipal corporation can identify issues and solve it and the meter is reset in the API.All the data in the API are recorded for data analysis.By analysing data,we can get concrete results about Most overflow areas,frequent danger zones,areas where specific Gas leakage is more.These results might prove quite helpful for municipal corporations in identifying problematic areas and taking preventive measures.

1.1 RELATED WORKS

Literature survey was conducted for a broad range of fields including gas detection system for which the solution was obtained using intelligent computing techniques.However only a few focused onsewage gas detection and some noticable contributions are:Embedded system for Hazardous Gas detection and Alerting by V.Ramya and B. Palaniappan focuses on detection of toxic gases and alerting.The paper[1] discusses about designing a microcontroller based toxic gas detection system and alerting the user if the concentration limit of a particular gas crosses the threshold limit then alert is sent to the concerned person through GSM.It mainly deals with the detection of LPG gas and propane and concentrates mainly on determining the air quality which affects the surroundings.On the other hand our proposed project deals with monitoring of aqueous level as well as determining the presence of hazardous gases.Similarly paper[2]

by Selvapriya, Sathya Prabha, Abdulrahim and Aarthi K" deals only with the detection of LPG gas leakage and alerting the users who are using the LPG gas, as a result it's scope is restricted.On the other hand paper[3]i.e."Harmful gas detection system using wireless sensor by S. Sudharshanan and C. Balasundar deals with industrial emmison pollutants mainly carbon monoxide and nitrogen oxide which might evenlead to death if persons working are exposed to it for a long period oftime,butit does not identify the location where the problem lies as a result identification becomes a problem which inturn results in an increase in problem complexity.The paper[4] deals with employing CMOS gas sensor inorder to provide low cost effective gas sensor so that it can employed for diffrentuses.However it's main drawback is it's accuracy in sensing the gas and displaying it in a Lcd screen every second.

II. SYSTEM OVERVIEW

In this section,we will discuss about why the acquired data is analysed and also components that play an integral role in building our system.This will help us to understand the shortcomings of the proposed solutions and the side effects of the gases which might result in a devastating effect if our bodies are exposed to them for a long duration.

2.1 MQ GAS SENSOR

Hazardous gases such as hydrogen sulphide,methane and carbon monoxide can cause serious health problems.So inorder to curb this problem an MQ series gas sensor is used to detect the concentration level of each gas and notify the user in case if the concentration level crosses the threshold limit.MQ135 has high sensitity to Ammonia, Sulfide and Benze steam, also sensitive to smoke and other harmful gases. Similarly in our case MQ-9 Gas sensor used for the detection of carbon monoxide,MQ-136 for the detection of hydrogen sulphide and MQ-4 for detection of methane.If the gas concentration crosses the threshold limit,then in the API the particular gas concentration level is indicated with a red colour,similarly if it's bound to cross the danger level it is indicated with a yellow colour and if it is well below the danger zones it is indicated with a green colour.These colour patterns have been adopted inorder to make the application more user friendly.This gas sensor coupled with GPS make an effective combination in identifying the root cause of the problem and also simplifies the process of identifying issues.In our propose solution the scope of the gas sensor is not only limited to sensing and alerting but rather provide a meaningful data which can also be helpful in predicting solution.Gas sensor plays an integral role in our system and since it's scope is not restricted,there arises an oppurtunity where it can penetrate into new fields where new oppurtunities and problems are in store for it.Gas sensor whose primary application is to sense the concentration levels of each gas and represent the actual readings in our application might sometime confuse the users i.e.since danger levels vary for each gas,the classification of danger levels may sometime throw up different results for the diffrent gases even though the their concentration limit is the same.In that case,the users who do not have any prior knowledge about gases might be confused and they might be face a awkardsituation.To avoid this kind ofconfusion we provide a pictorial respresentation of the concentration limit of each gas so that the right message is sent to the users and users can extract some valuable information which otherwise is present in the form of rawdata.

2.2 AQUEOUS SENSOR

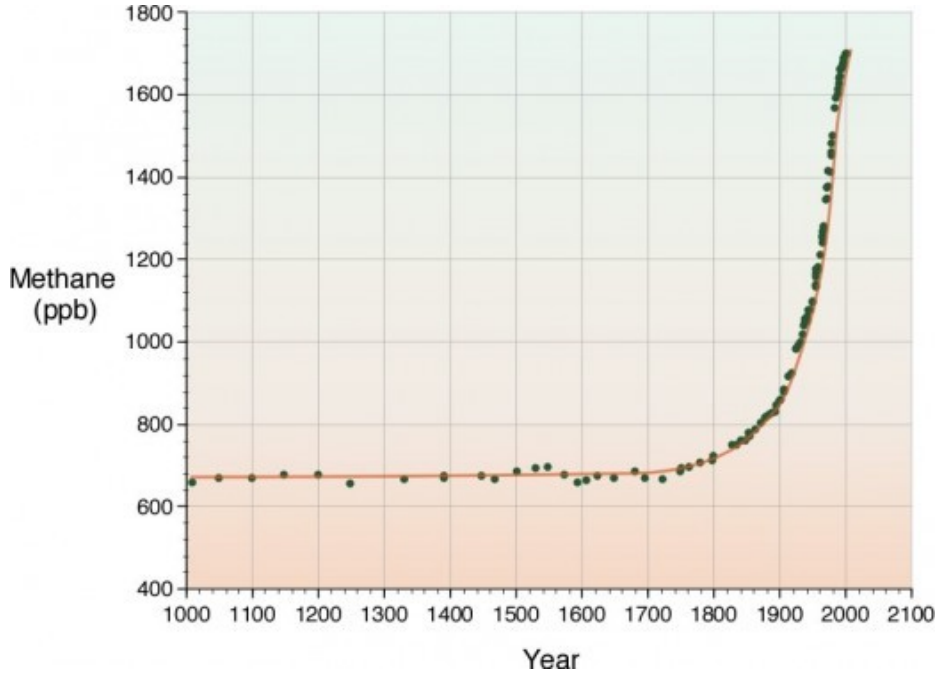
Aqueous sensor,otherwise called as level sensor determines whether the the water level is below the threshold limit or above the threshold limit.Since our project deals with a social problem and not a buisnessproblem,this component gives utmost priority to the safety of human resources and prioritizes the security aspect above the rest with respect to our proposed solution.The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place. While point-level sensors only indicate whether the substance is above or below the sensing point. Aqueous sensor levels are also indicated using colour patterninorder to make the application more user friendly.Water levels are also indicated in the form of graphs inorder to provide a pictorial representation as well as create an environment where the user is able to fetch more meaningful information from the acquired data.In the previously proposed solutions,aqueous sensor has been used for a wide range of applications but not with respect to sewer pipelines since in most parts of the globe,the process is yet to be digitalized and moreover this component can come in handy for corporations as well as workers mainly during catastrophic times such as flash floods where safety of the labourers is put at risk if this component has not been used.All these sensor reading at first are present in analog form which later is transformed to digital using the ADC(analog to digital converter).

2.3GPRS-IOT MODULE

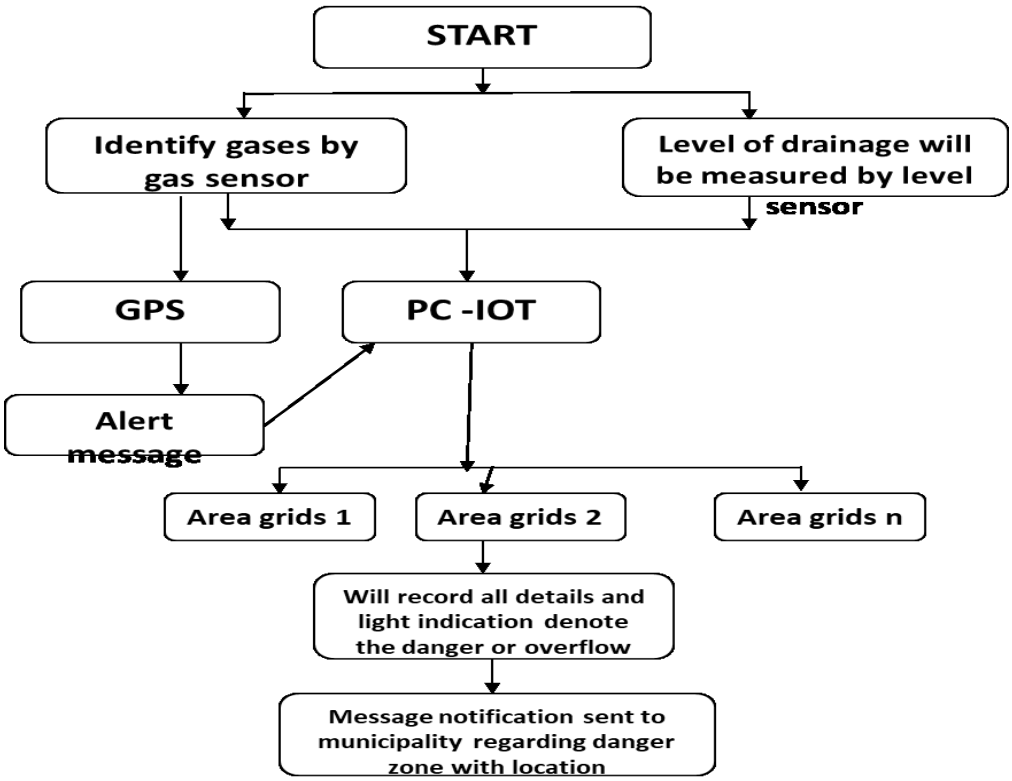
IoT board featured with SIM900 GPRS modem to activate internet connection also equipped with a controller to process all input UART data to GPRS based online data. Data may be updated to a specific site or asocial network by which the user can able to access the data..It is with the help of this device we are able to be connected to the Internet.Due to network connection,we are able to post updates or alerts or

notification about the gaseous or aqueous levels and at the same time trace the exact location of the problem which reduces the problem complexity considerably and also help us to come up with a time bound efficient solution.

2.4ANALYZE U MODULE



Here the data is analyzed so that we can identify the frequently occuring problem at the same time this paves the way for path breaking solutions All the data in the API are recorded for data analysis.By analysing data,we can get concrete results about Most overflow areas,frequent danger zones,areas where specific Gas leakage is more. These results help us in identifying the frequently occuring trends by which we can arrive at some conclusions which might be very helpful in preparing the roadmap for the future.These trends can help us in taking preventory measures especially during catastrophic times since we are able to retreive some meaningful inputs from the above listed trends. Safety limit for each sewer pipeline gas is defined seperately.As a result while analyzing the data and classifying each gas concentration according to the danger levels of diffrentgases,the results might seem to contradict each other which is not true. This component is designed keeping in mind user friendliness of the application.The fact that we are able to convert raw data to a meaningful information with the help this component is a big asset for it. All the readings from the sensor are present in analog form which is then converted to digital.The concentration limit is mentioned in the application we created.From the application,we match the data present with that of historical data which gives rise to form trends.In the above figure,a pictorial representation is provided about methane concentration levels to the user,this is done to provide the workers a detailed understanding regarding the complexity of the problem and also forms the basis the action to be taken to overcome the problem.This unique feature enables to provide the user an enriching experience which otherwise in most of the cases the user is presented only with the data which is disorted and provides no scope of future analysis which if provided can lead to optimized solutions which is both time bound and at the same time uses optimal number of resources.Analyze u module provides a platform that integrates raw data which is provided in form of readingswith processed information that provides the user a complete view of the problem and also these trends may not only help the user in predicting solution to the current problem but these trends may form the basis of solution of all the problems that might occur in future.Moreover a readymade solution is provided to frequently occurring problems which not only reduces time but also provide you with a proven and tested solution.This factor becomes important as it can also help users who do not have a adequate knowledge and at the same time help them to implement solutions without an iota of doubt as these solutions are already tested and their effects are well known.

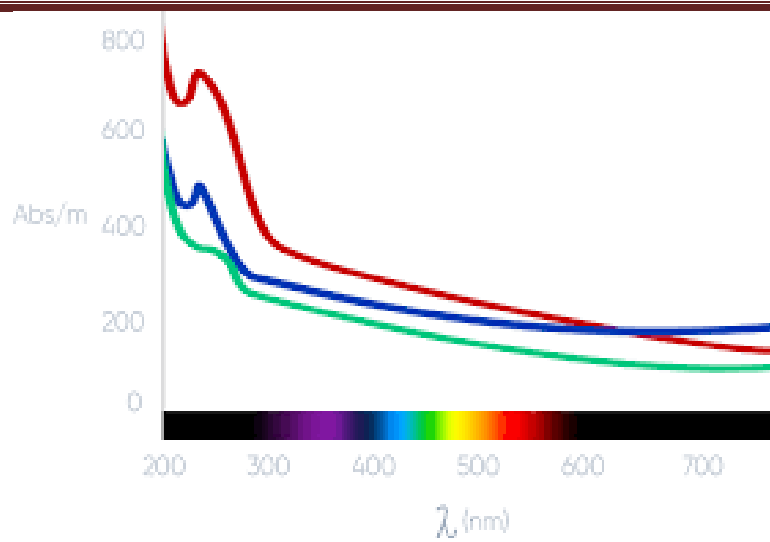


The above figure provides a sequential view of the events to occur.First,we identify the concentration limit of the gases with the help of gas sensor and the level sensor,which is otherwise known as aqueous sensor is used to check whether the water level is below the threshold limit or above the threshold limit.All these details are fed into the iotapplication.Ifincase the water level or the gaseous concentration is above the threshold limit,an alert is sent to the users in the application.The exact location can be determined with the help of GPS which provides both the latitude and longitude of the area.In our project we divide the sewage pipelines into a grid like system,each grid corresponds to a particular location.If any unbalanced value is detected i.e.if any grid is indicated with a red colour in our application,then concentration limit of the gas or the aqueous level is above the threshold limit,that particular area needs specific attention.Colour patterns are used to classify the danger levels accordingly.

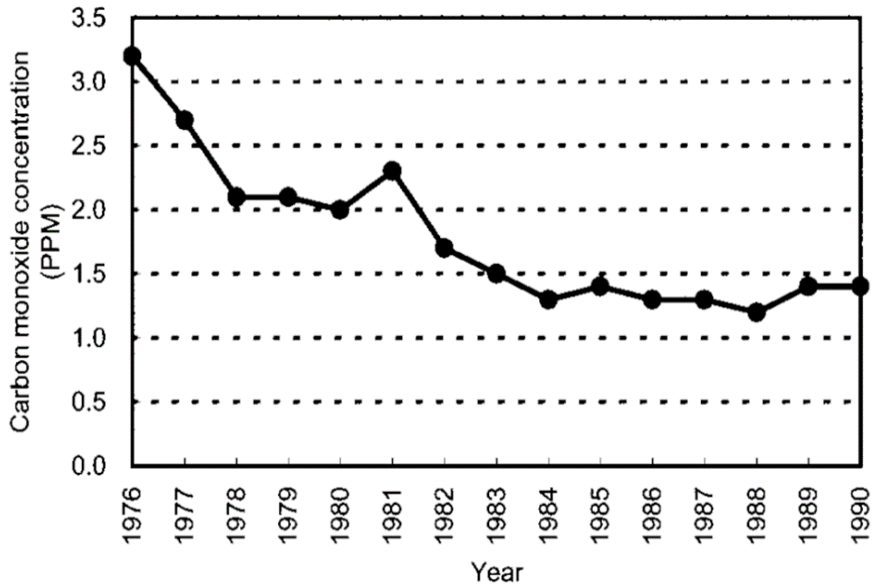
Red colour indicates high danger,Yellow colour indicates that it is just above danger level but not entirely hazardous and green colour indicates it is well below the threshold limit and it is safe.Also a pictorial representation is provided for the above data to make the application more user friendly in nature.Another added advantage is we have an separate provision for analysing data which can give lead to some definite conclusions about Most overflow areas,frequent danger zones,areas where specific Gas leakage is more.

III. EXPERIMENTAL RESULTS

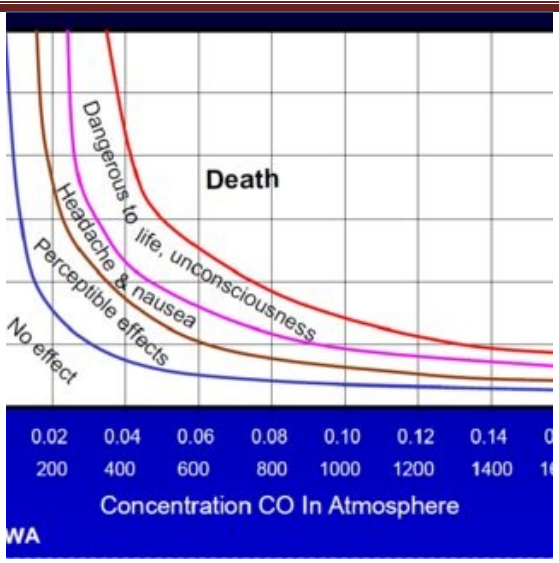
The system which is developed was able to respond usually between 20-30 seconds.The system usually requires low power consumption,hence it is generally considered to be more Eco-friendly as it is a power effective device.Another important feature of this system is it's accuracy.The deviation in the concentration of the gases is less compared to rest of the proposed solutions.Hence,this system is able to sense the ground reality and predict solutions accordingly.Another asset is since it specifies the location i.e source of the problem it significantly reduces the complexity of the problem.Moreover,our proposed solution not only just senses the concentration levels of the gases and aqueous level but also analyzes the data acquired and matches that with historical data which results in some significant conclusions.These conclusion can help us in a futuristic perspective and also help a wide range of users to employ these conclusions for a wide range of applications to cater to their needs.



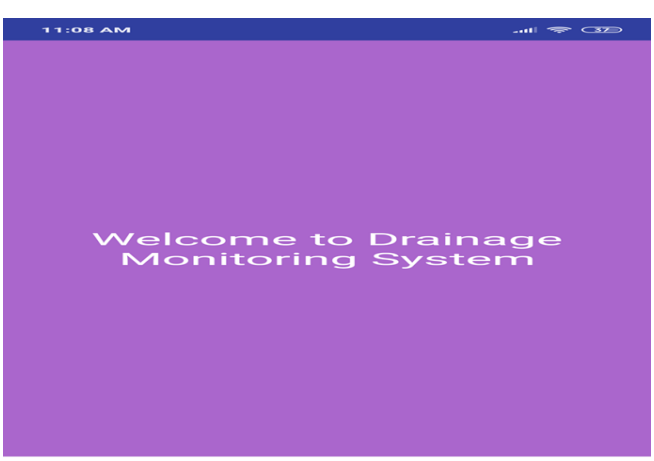
In the above figure,we are providedwith a pictorial representation of hydrogen sulphide levels in the sewer pipeline,the PH levels determine the form in which the hydrogen sulphide gas is present.They can be present in water in either molecular form or in a gaseous form.If the ph value is low,hydrogen sulphide molecule is generated ,as result efficient monitoring of PH value of water is important in order to control the generation of the hydrogen molecule.Additionally,spectroscopy combined with PH analysis is also considered to be an effective method for the monitoring of levels of hydrogen sulphide in sewer pipelines.This pictorial representation provided makes the
application more user friendly and ensures that right message is sent to the users and also a complete perspective of the issue is presented to the user.This unique feature enables to provide the user an enriching experience which otherwise in most of the cases the user is presented only with the data which is disorted and provides no scope of future analysis which if provided can lead to optimized solutions which is both time bound and at the same time
uses optimal number of resources.



In the above figure we can notice the concentration of carbon monoxide is on an upward trend.Usually MQ-9 gas sensor is used for the detecton of carbon monoxide.Usually a lot of health effects are accompanied with exposure to carbon monoxide for long duration.The figure below indicates and classifies the danger levels accordingly:



In an otherexperiment,they have used colour patterns to classify the hazardous health effects of exposure to carbon monoxide.Increased exposure may even lead to death.As a result alerting the user as well as providing the worker a complete view is necessary to prevent the damages at the same time presenting a amicable solution to resolve the problem.Our proposed solution not only provides alert and predicts solution but this data is stored in the iot application for future analysis.This analysis might even lead to a significant breakthrough in finding a permanent solution to this problem.



IV. CONCLUSION

The goal of this study is to demonstrate the capabilities of this gas and aqueous level monitoring system which analyses the acquired data inorder to convert raw data to meaningful information.Our proposed solution also provides a pictorial representation of the concentration levels so that users can easily interpret some meaningful inputs from the data which can be used to arrive some conclusive results.In a futuristic point of view,this project can be embedded with some added implementations like:customized setting of levels in API for diffrentzones,data report and print whenever needed,distributed messaging to sewage department of specific zones,the records of linemen who actually solved the issue can be added.

V. ACKNOWLEDGEMENT

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