IOT BASED - ENVIRONMENTAL FACTORS MONITORING: AIR AND SOUND POLLUTION METER.

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ABSTRACT: *With the evolution of technology and population there is a rapid growth in infrastructure and industrial plants which is degrading environment and issues like climate change, malfunctioning and pollution. Hence there is an urgent need of a device to overcome these problems, we are proposing a system for monitoring the noise and air pollution levels in industries, mines or any particular polluted area. The presented project contains the technology IOT and modules, the Air Quality Index monitoring module, Sound Intensity detection module, Cloud based monitoring module, Alerting module. All of these modules are interfaced with Raspberry pi, respective sensor devices for detecting the presence of air pollution and noise intensity level, cloud-based monitoring with the help of Wi-Fi module present in Raspberry pi. The collected information is analyzed repetitively and when there is an undesired situation it alerts the user.*

Key Words: *Raspberry Pi, Air Pollution Sound Pollution, Sensors Monitoring, Cloud.*

I. INTRODUCTION

Air pollution has become a serious environmental problem of the 21st century and possessed threat not only to the humans but all the living things in general. It includes activities like construction, mining, industrial work, agriculture, also natural causes like volcanic eruptions and wildfires but their occurrence is rare and have less effect. All these causes contribute to the global air pollution every single day. Air pollution means presence of chemicals or compounds in the air which are usually not present and lessen the quality of air or cause detrimental changes to the quality of life such as causing global warming or depletion of ozone layer. The chemicals or compounds are found in the air in either gaseous form (as gases) or in solid form (as particulate matter of suspended particles). Gases causing air pollution are sulphur oxides, nitrogen oxides, carbon monoxide, carbon dioxide, ammonia, mercury (in gaseous form), etc. Some of these pollutants are responsible for greenhouse effect which is the reason behind the melting of glaciers and thus increasing the water level as well as increasing the temperature of the planet earth. Depletion of ozone layer has become another serious as without ozone layer the harmful UV rays of the sun are causing skin cancer. Thus air pollution needs to be monitored and tackled for the progress and survival of our civilization.

Sound pollution or noise pollution can be described a regular exposure the elevated sound levels that may have serious health effects to humans or living organisms. As per the World Health Organization, sound levels less than 70 dB are not damaging to human organisms, regardless of how long the exposure is but exposure of sound levels greater than 85 dB constantly for more than 8 hours may turn out to be hazardous. Causes of air pollution are enormous such as street traffic sounds, construction sounds, air ports with constant elevated sounds from air traffic, workplace sounds, constant loud music in or near commercial venues, industrial sounds, train stations traffic, and events involving fireworks, firecrackers, etc. Noise pollution can cause health issues like Hypertension, Hearing loss, sleep disturbances, cardiovascular dysfunctions, and psychological dysfunctions. Noise pollution thus has to be death with. It needs to be monitored and measure for its reduction need to be taken.

Over the last couple of decades technology has gone through revolutionary innovation leading to development of Internet of Things (IOT), Data Science, Cloud Computing, Block chain Technology and many more. Among all these great technologies, Internet of Things is helping in developing products which are making lives of humans easier as well as automating manufacturing industry. IOT consist of "Things" connected over the cloud/internet, these things can be sensors, actuators, relays, transducers, etc. IOT devices communicate the sensor data they collect by connecting to IOT gateway or other device where data is either sent to cloud to be

analysed or analysed locally. These devices communicate with each other to get information and then to act on the acquired information. Application of IOT include Smart Home, Smart Wearables, Connected Cars, Industrial Internet, Smart Cities, Energy Engagement and many more.

Our aim is to use the advances in Internet of Things to build a system which would be helpful in monitoring air and sound pollution. Levels of different gases in the air will be sensed using the sensors which will be then processed using a micro controller and the data will be stored on the cloud. Similarly sound sensor will be used to sense the sound levels (in decibels). The environment will be frequently sensed and data will be processed and stored in real time.

II. LITERATURE SURVEY

"IOT Based Air and Sound Pollution Monitoring System" from IJAREEIE proposed model states that : The system consists of IOT components such as Sensors and Arduino and an android application to provide a user-friendly interface. MQ2 sensors detect levels of gases in the environment and sensors to detect air pollution. The sensed data is processed by Arduino to determine the severity of air and sound pollution. The results are sent to the Android application with the help of the Wifi module. There is also a buzzer which beeps when air pollution levels reach a severity level similarly an LED glows in case of sound pollution.

In this paper proposed by IRJET system is similar to the above system with some differences. Using Arduino and Raspberry Pi the system is divided into a 4-tier model; 1st tier deals with the information regarding the parameters which are to be monitored; 2nd tier consists of the characteristics of air and noise pollution sensors, these sensors are operated and controlled based on their levels of sensitivity and range of sense; Between 2nd and 3rd tier the sensing takes place, certain actions are taken based on the conditions; Tier 3 deals with data acquired from sensors and making decisions based on the data; and lastly Tier 4 deals with the intelligent environment which identifies the variations in the sensor data and fixed the threshold value, data is processed and then stored on the cloud.

The system used in this paper proposed by Kulkarni Chaitanya in ISSN consists of different air quality sensors (MQ135, MQ2, MQ7), microphone as a sound sensor, Arduino Uno for data processing, LCD display, and GSM modem. Sensed data from these sensors is processed and the result is displayed on LCD and can also be communicated with other devices using the GSM modem.

III.PROPOSED SYSTEM

The Air and Sound Pollution Monitoring System consists of Raspberry Pi 3 Bwhich is integrated ARM based central processing unit (CPU) and on-chip graphics processing unit (GPU), sensors like air quality sensor (MQ135), gas sensor (MQ9), sound sensor (LM135), temperature sensor (LM35).

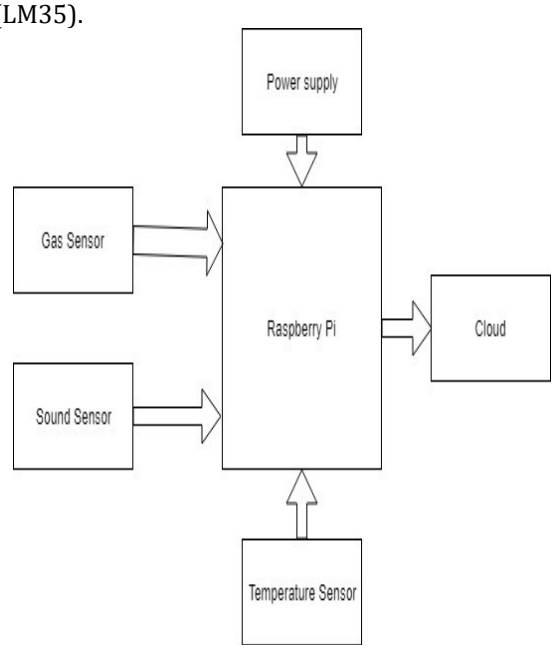

Fig. 1 Overall design of system.

Raspberry Pi is SoC (System On- Chip): Broadcom BCM2837,1.4GHz 64bit Quad-Core Processor, Dual band Wireless LAN, Bluetooth. Using these sensors, we can detect the presence of harmful gases consisting of polluting contents, excessive noise generated due to vehicles, industries which affects the human life and as well as animal life adversely. The sensors interact with raspberry pi which processes the collected data from the sensor and transmits it over the application. The data is stored on the Cloud through which we can check live air quality and noise level. Thus, everything in this system is controlled by Raspberry Pi also system keeps measuring sound level, air quality, temperature continuously over the internet. While monitoring data if it is observed any increase in noise level, air quality or temperature above provided threshold or the standard value then the notification is displayed on the system and the user is alerted. This allows authorities to take necessary actions and any preventive measures for future.

The recommended system comprises of following

modules:

1. **LM393 Sound Sensor**

In the presented project LM393 sound sensor is used to monitor the sound intensity. It recognizes the availability of sound.

It operates on the voltage of 3.3V to 5V and operating current is 4mA to 8mA, Microphone sensitivity is 52-48dB and its frequency is 16 to 20 kHz. It uses a microphone from which the input is given to the amplifier. The sound is detected and fed to the op-amp. A sound level threshold is adjusted via on-board potentiometer, whenever the sound level exceeds the threshold the output is sent low. When the sensor detects sound, it sends the collected data to Raspberry pi which then cleanses and analyses the data further.

2. **MQ135 Gas Sensor**

MQ 135 Gas sensor is used to detect the air quality index and is also used to detect polluting gases like NH3, NOx, Smoke, CO2 in air. MQ135 operates at 5V DC 40mA current. This sensor gives fast response, high sensitivity and stable long life. Especially it is sensitive to Ammonia, Sulphide and Benzene Steam.

3. **MQ9 Gas Sensor**

MQ9 is a Gas sensor used to detect carbon monoxide with the increase in the carbon monoxide gas in the air. Also, detection of combustible gases like methane and propane. It operates on 0-5V analog output voltage, higher the concentration higher the voltage

4. **LM35 Temperature Sensor**

For monitoring the temperature variations in a particular region LM35 is used. Thus,we are using this sensor in order to monitor varying temperature levels. It operates on voltage 4-30V.

5. **Raspberry Pi 3 B**

In this project we are using a Raspberry Pi 3 B module as a processor. It has a Broadcom system on a chip (SoC) with an integrated ARM based central processing unit (CPU) and on-chip graphics processing unit (GPU). It is a credit card size SBC (Single Board Computer) developed by raspberry pi foundation. Its speed ranges from 700MHz to 1.4GHz for this model, on board memory ranges from 256MB to 1GB RAM. Secured Digital (SD) cards in Micro-SDHC form factor are used to store the operating system and program memory. Raspberry Pi 3 B has a Wi-Fi and Bluetooth module in-built. As sensors are interfaced to the Raspberry Pi module thus the monitored and accumulated data is analysed and processed using this module and send the acquired converted data over the internet to Cloud. Thus we can store and save the data here and use it for monitoring periodically.

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V. RESULT AND DISCUSSIONS

1. Air Quality Index

Air quality index comprises standard values as per set by the government depending on which we can measure and calculate how polluted the environment is or will become. Therefore, if the value of AQI increases, health hazards increases. It is calculated by calculating the average of pollutants present in a period. AQI is,

I=[(Ihigh-Ilow)/(Chigh-Clow) *(C-Clow) +Ilow]

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health alert: everyone may experience more serious health effects.
Hazardous	301 to 500	Health warnings of emergency conditions. The entire population is more likely to be affected.

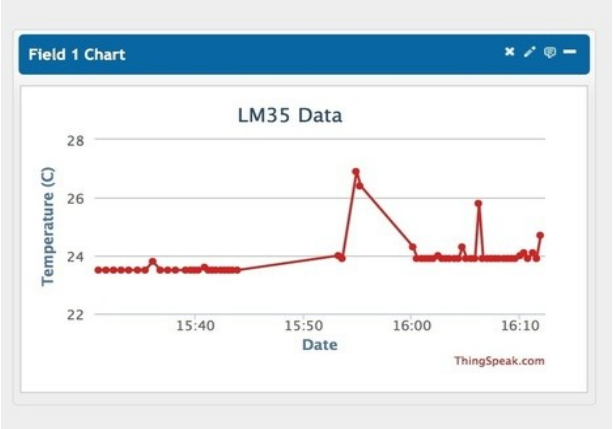
2. Noise Pollution Level

As Noise pollution creates harmful impact on animal and human life. Noise standards prescribed by government as given:

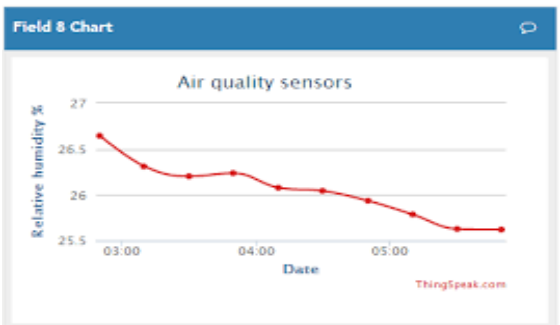
Table 5 : Indian Standards for ambient noise levels

Area	Noise Limits, Leq, dB (A)	
	Day Time	Night Time
Silence zone	50	45
Residential area	55	45
Commercial area	65	55
Industrial area	75	65

3.Temperature Detection



4.Air Quality Index Monitoring



V. CONCLUSION

As the pollution is the major concern for the whole world. This IOT based air and sound pollution monitoring system is providing a smart way to monitor various environmental factors using Raspberry Pi. Thus, we can monitor the pollution due to air and sound by monitoring the level of noise, temperature, air quality index. The accumulated data is sent to the cloud, monitored lively about various patterns in environment and analysed, from where we can notify the user about the environment.