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IOT Based Effective Data Collection and Cost Estimation (IEDE) On the Pollutant Particles in the Air

S.Shenbhagavadivu[1], M.Divya[2], V.Kalaithendral[3], V.Kiruba[4], R.Krithika[5]

Assistant Professor, Department of Information Technology, SRM Valliammai Engineering College, Chennai, India[1]

UG Students, Department of Information Technology, SRM Valliammai Engineering College, Chennai, India[2,3,4,5]

ABSTRACT: In today's world, the essential need of the human health is clean and fresh air. However, the WHO estimates that around 1.4 billion urban people are living in areas with air pollution, So there is a need to reduce the air pollution. Wireless sensors are used in most of the real time applications for collecting physical information. Atmosphere has six levels of air pollution each with one dedicated colour to find the air quality within surrounding area. The measurement of air quality is one of the difficult areas for researches. There are eight pollutants like ozone, suspended particulates, hydrogen nitride,SO2,CO. Major air pollutant is CO , which is increasing up to 50% due to transportation. Every vehicle has its own emission of gases, but the problem occurs when the emission is beyond standard values. The high inflow of vehicles causes more air pollution and decreases air quality that leads to severe health diseases .So, this proposed system is to create awareness about AQI to the common man.Thus monitoring the pollution based on sensor and vehicular tracking using IoE build on top of IoT network based on the web service approach. This sensor would be able to deduce all the pollutants from all the vehicles and would be able to detect which vehicle has the highest emission of the pollutants like CO. Thus, this system is to need to make the environment clean and healthy place to live in.

KEYWORDS: Air quality index, vehicular sensor network, data collection

I.INTRODUCTION

Increase in the environment problems which will affect the human health. In order to control the pollution ,the amount of air pollution needs to be monitored and vehicles responsible for polluting should be identified. IOT is very helpful for monitoring air pollution from vehicles and also data related to the amount of pollution on different regions can be gathered and analysed. This system is designed to operate the system using sensor network and gather the information about pollutant levels discharged by the vehicles The increase use of vehicles results in vital increase in the emission load of various.Air quality monitoring is usually done by placing a few monitoring stations on dedicated sites in a city. How- ever, this scheme has two limitations. First, it provides only coarse-grained monitoring, where the spatial resolution of air- pollution samplings is poor. Second, the scheme lacks flexibility. When the weather changes or the city develops, some old sites may become unnecessary. To relax the limitations, some studies suggest using vehicles (e.g., cars or bikes) to carry sensors, which are called vehicular sensor network (VSN) [3], to provide flexible monitoring. Since vehicles have GPS navigation and they may roam through the city, VSN can tactically collect data from different locations at different times. Moreover, sensors in a VSN are able to conduct stable, long-term monitoring, as vehicles can give them an abundant supply of energy

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II. PROPOSED ALGORITHM

FUZZY LOGIC ALGORITHM

- The input is given by the AQI value determination, pollution which is medium or high and overlap rateand the obstacles to reach the safe level are determined. Grid based decomposition is done end points are specified.
- FLA is implemented to find all the pollution emission level from start point to end point. Compute the path coverages using ultrasonic sensor, temperature and humidity with their respective sensors.

III.BACKGROUND WORK

3.1. Cost Effective IOT Based Air Pollution Monitoring and Air Quality Analysis

Air pollution causes negative effects to natural environments. The air pollution occurs due to Carbon monoxide (CO), Carbon dioxide (CO2), Nitrogen dioxide (NO2), Sulfur dioxide (SO2) and many other harmful pollutants[1]. It has hazardous effects on human health. Carbon monoxide reduces oxygen carrying capacity of the body's organs and tissues which may lead to cardiovascular disease. Carbon monoxideis a very toxic gas which produce harmful effects to human. So it becomes more and more important to monitor and control air pollution.Using laboratory analysis, empirical analysis conventional air automatic monitoring system has high precision, but large bulk, high cost make it impossible for large-scale installation. wireless sensor networks (WSNs) can automatically collect air quality data. Using IoT and WSN the concentration of air quality can be determined. Air quality can be analysed by calculating air quality index. The information will be displayed on the web page . This system is elligent which make its installation possible in various areas.

3.2. Analysis of the possibility of reducing the amount of air pollution using photovoltaic systems

The possibility of reducing the amount of pollution using photovoltaic systems. The analyses indicate the main sources of pollution. It was estimated how much pollutants are released during the energy production required to ensure the security of energy supply[2]. Simulations of the production of determined amounts of energy by photovoltaic panels were carried out. During the simulation of selected solar devices, the amount of avoided emissions was estimated. Ecological gains were calculated for electricity production from solar systems for a given time interval, the chosen technology and the location.

3.3. IoT Based Air Pollution Monitoring System

IoT Based Air Pollution Monitoring System in which the Air Quality gets monitored in a web server using internet and an alarm will be triggered when the air quality goes beyond some level. Harmful gases present in the air are CO2, smoke, alcohol, benzene and NH3. It will show the air quality in PPM on the LCD and as well as on web page so that we can monitor it very easily. In the existing system, LPG detector using MQ6 sensor and Smoke detector using MQ2 sensor but this time we have used MQ135 sensor which is the best choice as monitoring Air Quality will detects most harmful gases accurately[3]. In this IoT project, air pollution can be monitored from anywhere using your computer or mobile. We can install this system and also trigger the device when pollution goes beyond the certain level, like we can switch on the Exhaust fan or can send alert SMS/mail to the user.

3.4. Estimation of Health Impact Due to Air Pollution in Thiruvananthapuram City

The air quality of Thiruvananthapuram city is assessed to be moderately polluted. Suspended particulate matter is the principal component of pollution. The trends of API values show high fluctuations according to the season. Two wheelers are the major contributors of carbon monoxide, methane, particulate matter and hydrocarbons. Carbon dioxide is mainly contributed by cars and nitrogen dioxide and sulfur dioxide by buses[4].The health effects due to the exposure to PM10 of 75 (µg/m3) is evaluated using dose-response coefficient and it found that the mortality and morbidity effect is very severe and need immediate attention of authorities. According to studies conducted by Central Pollution Control Board (CPCB) 2010,cities like Delhi, Kanpur, Bangalore, Pune, Chennai and Mumbai transport sector contributes to more than 70% of the ambient air pollution.

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3.5. IOT Based Air Pollution Monitoring and Forecasting System Using ESP8266

Any activity involving burning things/fuels and mixing substances that cause chemical reactions may release toxic gases in the process and some activities like construction, mining, transportation, etc. produce large amounts of dust which has the potential to cause air pollution. As generation of toxic gases from industries, vehicles and other sources is tremendously increasing day by day, it becomes difficult to control the hazardous gases from polluting the pure air. Air pollution causes negative effects to natural environments. The air pollution occurs holds Carbon monoxide (CO), Carbon dioxide (CO2), Nitrogen dioxide (NO2), Sulfur dioxide (SO2) and many other harmful pollutants. This pollutant causes serious damage to environment. It also has hazardous effects on human health. Carbon monoxide reduces oxygen carrying capacity of the body's organs and tissues which may lead to cardiovascular disease. Carbon monoxide causes visual impairment, reduced manual dexterity, reduced work capacity, poor learning ability. Air pollution can be controlled by monitoring the concentration of air pollutants. Air automatic monitoring system has relatively complex equipment technology and high cost.

IV.ARCHITECTURE DIAGRAM OF THE PROPOSED MODEL

The components in the polluted air get determined. From the collected components, the quality of the air gets evaluated using AQI. Pollutants gets sent through the web services and the database for the cloud gets set up. The recorded pollutants gets monitored and compared with the coarse grained process. Using the Efficient Data Gathering and Estimation (EDGE) mechanism sampling rate of the car gets determined. After having estimation of the pollutants ,the user gets intimated about the AQI level .With the standard levels of pollution, available pollution level gets compared and the probabilistic report gets generated. Once the pollution level gets exceeded from some limit the user gets intimated by an alert message.

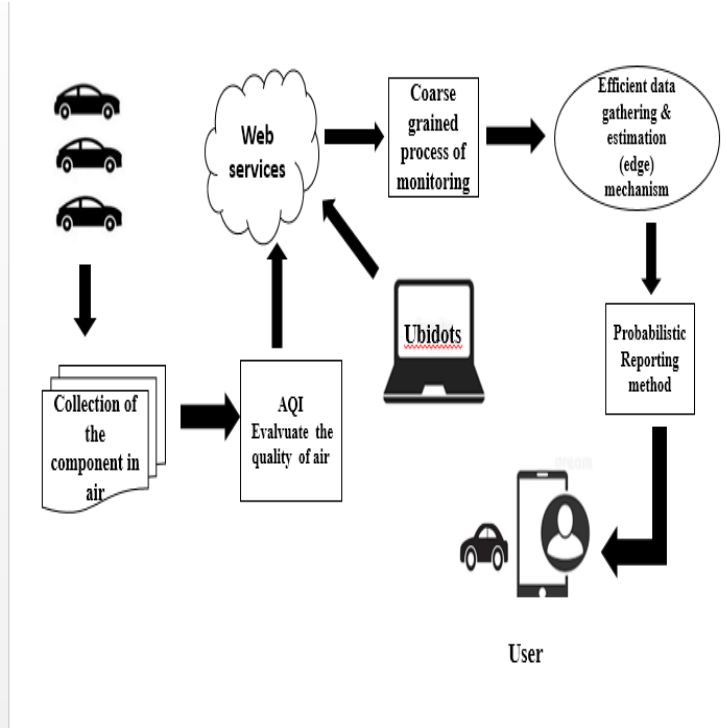

Fig 4.1: Architectural view of IEDE

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V.DETECTION OF POLLUTANTS

The CO sensors are used to monitor the amount of CO present in the atmosphere to maintain the quality of air in a Particular region. Gas sensor is connected to the Nodemcu board by a set of instructions. This system uses a network stimulator for measuring pollutant information from sensor nodes. The air quality index is calculated to evaluate the health level in a specific area. There are six levels of air pollution each with one dedicated color to find the air quality within a particular surrounding area. The air quality depends on air quality index measure.

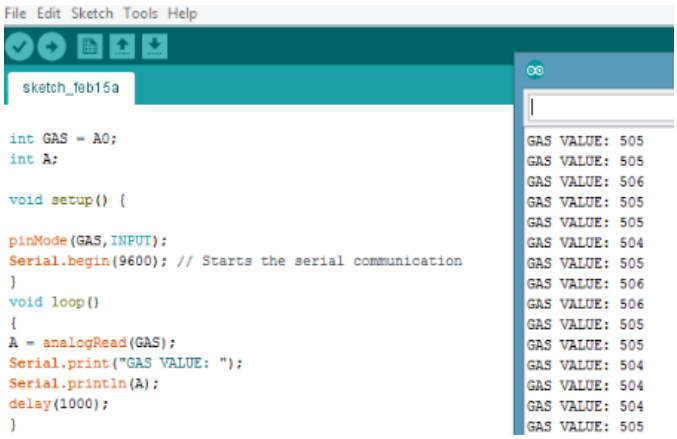

Fig -3: Coding for gas sensor

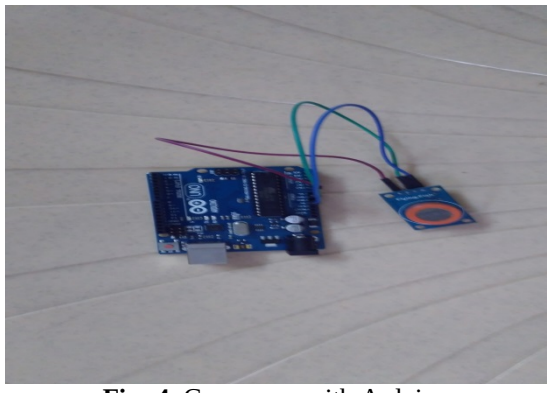

Fig- 4: Gas sensor with Arduino

VI.COMPUTING AQI

There are eight pollutants such as Ozone[O3],Suspended particulates[PM10],Suspended particulates[pm2.5],carbon monoxide[CO],Sulphur Dioxide [SO2],Nitrogen Dioxide[NO2] are considered in proposed AQI.The air quality index is a piecewise linear function of the pollutant concentration. To compute AQI the formula will be given as:

$$I_k = \frac{I_{high} - I_{low}}{B_{high} - B_{low}} \times (C_k - B_{low}) + I_{low},$$

Fig- 5: Formula for computing AQI

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Where,
2`
I – the air quality index.
C – the pollutant concentration
I(high)- the index value corresponding to C(high).

If the AQI, level is estimed to be <=50 then its level is decided to be **good, >50,** it is decided to be in **moderate** level, 150 for **unhealthy sensitive groups**, 200 for **unhealthy** and 300 for **hazardous.**

VII.DISTANCE EVALUATION

Ultrasonic sensors are devices that use electrical–mechanical energy transformation, the mechanical energy being in the form of ultrasonic waves, to measure distance from the sensor to the target object. Ultrasonic waves travel as a succession of compressions . The fraction of the incident energy is reflected back to the transducer is detected.

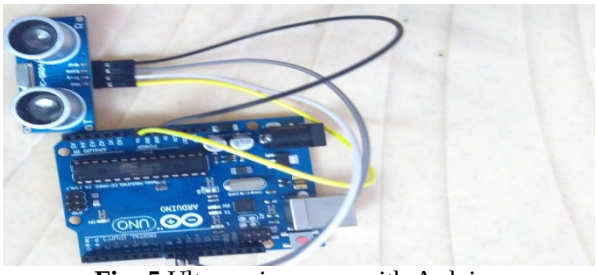

Fig -5 Ultrasonic sensor with Arduino

Using Arduino IDE software embedded C language is used for the ultrasonic sensor and gas sensor. The distance of the object gets determined using this module. This module gets efficiently used inorder to avoid accidents, user will also receive an alert when an object approaches the user with the intension to attack, during this the user will have the awareness about the hidden object and safeguard themselves.

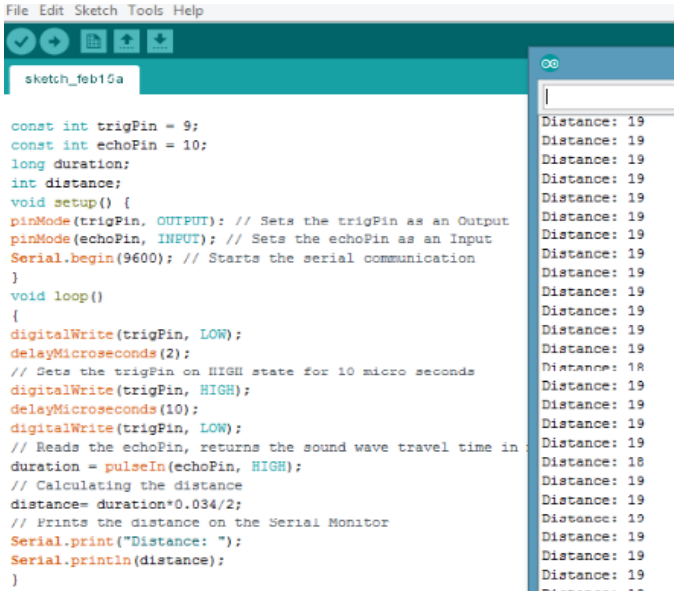

Fig-6 Coding for ultrasonic sensor

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VIII.PROBABILISTIC REPORT

Cloud storage is a data storage in which the digital data is stored in pools. The physical storage spans multiple serversand the physical environment is typically owned and managed by a hosting system. Each and every dataset used for this system gets stored with the database on the cloud, as many free clouds are available on the internet, trail data gets tested on that particular cloud. For, simulation With the Wi-fi module the trail can be tested. After getting compared with the available and framed standard value, user will receive an alert message when the value of the pollution is found to exceed above the certain level (>50-100) of AQI, FLA technique is used here for the effective pollution monitoring.

Fig-7 Actual structure of the Ubidots cloud

Once if the pollution level gets exceed, user will receive an alert message. The below figure will gives the representing content.

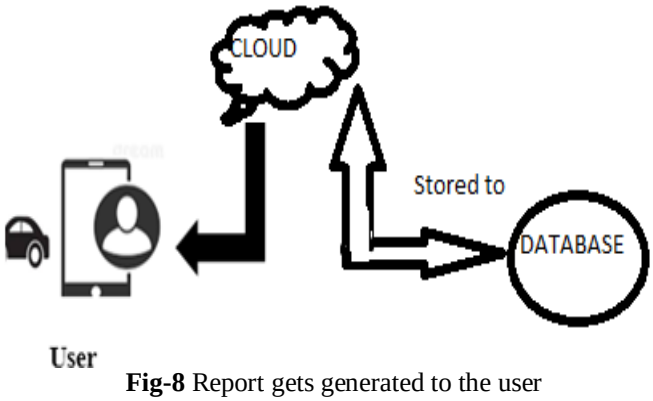

Fig-8 Report gets generated to the user

IX.CONCLUSION

In this project, we presented a generic model to reduce air pollution caused by the vehicles. This project proposed designed & developed a vehicle with self-pollution monitoring sensors. Gas sensors are used to detect the pollution in vehicles. Recent development promises a wide scope in developing vehicles with the efficient pollution monitoring system. Thus, the proposed system presents vehicle with gas sensors where AQI level gets estimated and sends an alert message or signal to the user. Database gets maintained in the cloud effectively. Once the user gets an alert message he/she will search for a nearby service station and heals the problem temporarily.

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