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MOBILE POLLUTION MONITORING SYSTEM WITH REAL TIME INTERFACE AND CELLULAR UPDATES

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***Abstract*— In today's life, we all have some health problems because of the increasing prevalence of pollution. Knowing the current conditions of pollution in a particular area or room is not possible in every one. In addition, there are no such programs available to alert the user when the amount of harmful gases is increasing in the environment. There is therefore a need for such a system to control dangerous gases inside or in the room. The proposed system handles all mentioned issues, such as indicating and displaying the pollution levels, and gives a user warning notice when the amount of harmful gases exceeds the specified limit. This system can provide real-time pollution of certain room values, such as oxygen level, temperature, and humidity in the air. The Hardware Kit works in conjunction with the Arduino WeMOS microcontroller, which can transfer sensor data to the server via Wi-Fi. In the alert state, the system can notify the user. Also, the kit powers the buzzer, which alerts the user.**

Keywords— **Air pollution monitoring system, air quality index (AQI), air-pollution, Android, sensors.**

I. INTRODUCTION

In today's life, we all have some health problems due to pollution. We did not know about the current conditions of pollution in any particular area or room. Also, there are no systems that alert the user when raising the level of harmful gases. Therefore, there is a need for a system that controls harmful gases in or out of the room.

The occurrence of particles, chemicals or biological resources in the environment that cause an unexpected, human death, or disease, a source of income loss or damage to the natural environment. In reality, the amount of air pollution is one of the most important environmental problems in developed and urban cities. The environment is affected in terms of adverse effects on plants and ecosystems due to global climate change and urbanization in recent years.

Various human activities, SO2, Particulate Matter (PM), NO2 [11], Carbon Oxide, CH4, Organic matter Pollution in the atmosphere or due to it is increasing rapidly.

Causes discomfort, disease or death to humans, harms other living organisms such as food crops or harms the natural environment or the built environment.

Harmful air pollutants have hazardous effects on the human ecological system such as disease, malaise or death to humans, harming other organisms so it is very important to control the pollution and avoid these problems.

Here we proposed an E-nose system that can help detect. We are developing a system that can help detect and monitor harmful gases; A fire extinguisher was found in a certain room.

II. LITERATURE SURVEY

1.SELDA GUNEY: Developing an electronic nose that balances the chemical elements in the air and separates different odors. Compounds of chemicals are represented by the decision tree whose numbers are developed by partners such as Support Vector Machines and K-Nearest Neighborhood.

2. PABLO GOMEZ: Design and manufacture of an electrical nose, which was used to classify and identify hazardous gases produced in underground coal mines. A list of electrochemical sensors was used to detect toxic gases in indoor environments. This paper provides a 97% success rate using principal component analysis (PCA) and 24 Linear Discriminant Analysis (LDA).

3.KEA-TIONG TANG: Developed the classic electronic nose (E-Nose) that includes a list of eight commercially available sensors. The program is used to show the aroma of three fruits, namely bananas, lemons and litchi.

4.ANDREY SOMOV: Create a complete wireless sensor-actuator system for the detection of hazardous gases based on the wireless sensor paradigm. The author used a long-lasting refresh sensor for safety requirements.

5.NITIN SADASHIV: Develop an air pollution rate and forecasting system using smart city IoT that stores data in the cloud. Cloud data is used to analyze data that can be used to decide how to reduce pollution and minimize the effect of pollution.

6.MEO VINCENT: Create a design hardware that will detect air pollution and look for items in archives in Pandacan, Manila. The design firm will send an email notification to the registered email addresses of barangay officials whenever sensors receive high readings on any standard or carbon monoxide item. The components included in this Hardware are the Dust Sensor that will be able to measure the flower in place, the Carbon Monoxide Sensor for measuring the gas received, the microcontroller, and the Raspberry Pi for sending information via email.

7.SHIVANI BIST: Provides automated room temperature control devices and an air pollution detection system. The system can serve as a detector; one also knows the levels of pollution in a room between normal, dangerous and safe. The system is built with a microcontroller. Temperature sensor: LM 35: is used to get room temperature and MQ 7 is used to get Air Quality Index in room.

8.CHAITANYA H P: Monitor and control vehicle emissions through the pollution control cycle. This pollution control cycle consists of various sensors such as gas sensors, heat sensor, GSM, Pulse wide modulator (PWM) and all are integrated and connected to the controller. When a vehicle reaches above a certain threshold pollution limit the speed of the system automatically decreases and when the temperature reaches above a certain amount of fan speed. DC motor speed control of the system is performed using PWM. It is displayed and uses MATLAB Simulink simulation using PID and PWM.

III. EXISTING SYSTEM

Air quality is the most crucial topic in urban areas because it closely affects on the health of the citizens. Recent studies have shown that the exposure to polluted air can increase the incidence of diseases and worsen and deteriorate the quality of life.

Traditionally, pollution measurements are performed using expensive equipment in fixed locations or in specialized mobile equipment laboratories. This is a coarse and expensive approach, where pollution measurements are few and far between. The current system of predicting pollution values using the offline method is again but not precise. The existing system does not detect acurate pollution levels in the neighborhood. Simone Brienza et al. [13] gives the uSense, provides a low-cost co-op monitoring tool that allows real-time concentrations of pollutant gases in different parts of the city.

So our implemented system is more effective than the existing system because we can eliminate the offline process and turn them into a completely automated process using IoT.

A. Drawbacks of Existing System

1. Pollution measurements are made using expensive equipment.
2. Measuring repeat pollution can only be done at fixed locations or specialized mobile equipment laboratories.
3. All of the current systems for predicting pollution values are an issue in the accuracy of such system in offline system and measurement.

IV. IMPLEMENTED SYSTEM

The purpose of the implemented system is to detect real-time hazardous gas values, which can transmit sensor data to the server via Wi-Fi and notify the system user if the limit is exceeded. Kit enables the buzzer to alert the user. The implemented system is more effective than the existing system because we can eliminate the offline process and convert them to a fully automated process IoT.

Data can be collected using a computer hardware kit and sent to the server using a WIFI based Arduino WeMos Microcontroller. Kit includes oxygen sensor, temperature sensor, humidity sensor, MQ7 sensor (for CO2) and IR sensor. The system checks the sensor values against previous sensor limits. If the sensors exceed the values limit, the system can send a response to the kit and notify the user by SMS on the registration number. User by SMS on the Registered Number of Users.

User Registration: The user will be able to be enrolled in the program. They can add their information such as Name, phone number, username, password etc.

Get Sensor Data: The system can collect data through a hardware kit and send it to a server using WiFi-supported Arduino WeMos Microcontroller.

The Hardware Kit contains the following sensors:

O Oxygen Sensor - Find the amount of O oxygen in the air.

Temperature Sensor- Find the current temperature value.

The temperature sensor is used to determine the temperature by detecting an equilibrium physical condition, such as electrical resistance, electromagnetic field (EMF), or radiation. How the temperature sensor works depends on the material being measured.

Humidity Sensor - Gets the current humidity in the air. Sensors, measures and reports both humidity and air temperature.

MQ7 Sensor (For CO2) - Determine the level of Carbon in the air. The MQ-7 is a Carbon Monoxide (CO) sensor, suitable for sensing Carbon Monoxide (PPM) sensors in the air. The MQ-7 sensor can estimate CO concentrations from 20 to 2000ppm. This sensor has very much sensitivity and fast responsive time. The output of the sensor is analog resistance.

-IRSensor - Used for calculations in a room.

The infrared sensor is an electronic tool, which emits you so you can hear some of the surroundings. An IR sensor can measure the temperature of an object and detect movement.

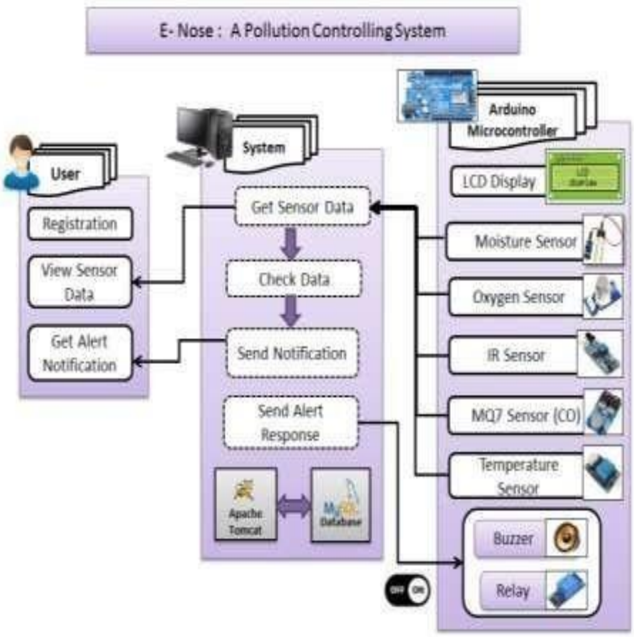
These types of sensors measure only infrared radiation, rather than emitting it called infrared IR.

View Sensor Data: The user can view sensor data programmatically. The program displays the current sensor data obtained from the hardware kit with the help of a server. The IR sensor finds the perfect person in the room.

Check Sensitivity Data: The system checks the sensor data and provides the correct response. Checks sensor values against predefined sensor parameters. If the sensor values exceed the limit then the system can send a response kit again and notify the user via SMS.

Send Alert System: If the sensor falls within a normal range the system can then send an alert to a registered user number. User receives notification via SMS.

Fig:- System Architecture



V. MATHEMATICAL MODEL

{V, I, A,SS,B}, where

V= {V1, V2, V3……...Vn | V is a Set of all ENDUSERS} There may be a number of users per program. Hence this is the Infinite Set.

I= {I1, I2, I3...In | I is a data from the hardware kitchen} Most of the sensor information comes from the system. So this is the Infinite Set.

A={A1,A2,A3 | A is response getting from the kit} After sending a notification to the users, the systems also send the response to the kit.

T={T1,T2,T3 | T is a set of data mining techniques} There may be n number of recommendations of the system. So this is a finite set.

DS = {SENSOR DATA INFO, AIR QUALITY info, | DS is a Set of data table for permanent storing of data on server }

SS = {SREG, SLOGIN, | SS is a Set of Storage Service } STORAGE SERVER will be providing two services such as registration and login. As this set also has some finite qualities, so this is also a Finite Set.

EVENTS/ACTIVITIES:

- EVENT 1

User will make registration on SYSTEM and Storage Server
Let f(U) be a function of User
Thus, f(U) → {Ss}

- EVENT 2

System can gather the data through the hardware kit and send it to the server Let f(S) be a function of System.
Thus, f(S) → {D1,D2,D3. Dn}

- EVENT 3

System checks the sensor data and provides us with the proper response
Let f(S) be a function of Systems.
Thus, f(D) → {D1,D3,D3. Dn}ε R
c is the condition whether parameters cross the particular limit or not. If D > L → R (to kit)
If D cross normal range → Alert to user

VI. RESULTS

Figure:- (a)Experimental Set Up (b)Output

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Sr. No	Available Sensors	Gases
1	MQ 135 Air Quality Sensor	NH3, NOx, Alcohol
2	MQ 3	CH4, Hexane, LPG, CO.
3	IR Sensor	Carbon Dioxide, Methane and Nitric Oxides
4	MQ-2 Gas sensor	MQ-2 Gas sensor, Methane
5	Hydrogen Sensor	ammonia and hydrogen cyanide
6	MQ 4	Methane, CNG Gas
7	MQ 5	Natural gas, LPG
8	MQ 6	LPG, Butane gas
9	MQ 7	Carbon Monoxide
10	MQ 8	Hydrogen gas
11	MQ 131	Ozone

VII. ALGORITHM USED IN THE PROJECT

ID 3 (Iterative Dichotomiser 3) Algorithm

ID3 creates a decision tree from a fixed set of instances. The resulting tree is used to classify future specimens. The leaf nodes of the decision tree have a class name, while the leaf node is the decision node. The decision node is a feature test because each branch (for the second decision tree) has a possible value of the attribute. ID3 uses information to help make the decision that goes to the node.

Algorithm:

1. Install taxonomy attribute (in Table R) Calculated classification entropy.
2. For each feature in R, calculate the data retrieval using the classification feature.
3. Select the attribute with the highest benefit to be the next node in the tree (starting from the root node). Remove the node attribute by creating a reduced table RS.
4. Repeat steps 3 until all attributes have been used, or the same classification value will be retrieved for all rows in the reduced table.

ENTROPY:

$$H(X) = -\sum_{i=1}^{n} p(x_i)\log_b p(x_i)$$

INFORMATION GAIN:

$$\textit{For Set } S\textit{, Attribute } A$$
$$\textit{Where } S \textit{ is split into subsets based on values of } A$$
$$\subset_S^A = \text{Subset A of S}$$
$$I_E = Entropy,\ p(\subset_S^A) = \frac{\text{size}(\subset_S^A)}{\text{size}(S)}$$

$$I_G(S,A) = I_E(S) - \sum^{n} \left(p(\subset_S^{A_i}) * I_E(\subset_S^{A_i})\right)$$

VIII. FUTURE SCOPE

Technology in India is bigger which can able to detect the harmful gases up to the large extents. The current system can detect other gases such as Liquefied petroleum gas, Alcohol, Propane(C_3H_8), Hydrogen(H), CO and methane. Again existing systems are more expensive and need huge equipment to detect gases.

So it still requires technology and algorithm to detect harmful gases. Below the table provides details of the available sensors for specific gases and also the research needed to find more gases in advanced sensors.

The table above provides the available sensors used for gas detection. There are still some gases not available using this available sensor.

Catalytic sensors mentioned above table are not sensitive enough to detect toxic gas present in the atmosphere at very low concentrations. So there is need to detect a highly sensitive catalytic sensor which will be able to detect accurately toxic gases in concentrations ranging from as low as 100 ppm to several ten thousand ppm.

IX. CONCLUSION

Hazardous gases or unwanted gases pose major challenges as they create many harmful effects on the human system. It is therefore necessary to monitor these gases in the room to maintain the required oxygen level. Carbon emissions have increased significantly from cities.

Here we present a groundbreaking low cost sensing system for monitoring the quality of cooperative air in urban areas. The proposed system can monitor room air using an Arduino microcontroller. The program helps improve air quality in addition to the development of a process for monitoring various aspects of the environment. The MQ7 sensor is used to monitor Air Quality as it detects extremely harmful gases and can accurately measure its value.

Air quality data obtained using such sensing models can provide a variety of applications. Patients with respiratory or cardiovascular diseases may find our results useful to identify toxic alternatives.

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