Real Time Based Air Quality Monitoring System

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Abstract: Air quality is an important issue in our daily life, by the means of this paper the author is trying to focus and show the development of air quality monitoring system which operates automatically. This system focuses our concern on the factors which are affecting the quality of air and help us to improve it. System uses gas sensors to check the amount of harmful gases present in the air and simultaneously transmits the values to the microcontroller. The sensor attached to the microcontroller, processes this data and transmits it over Bluetooth. The whole system is a combination of these components like Arduino Uno, MQ-135 sensor, MQ-7 sensor, HC-05 module, ATmega 328, mobile phone.

I. INTRODUCTION

As we know that air quality in Delhi is degrading day by day. Hence, we propose a system which helps to improve and monitor the quality of air in particular areas. System uses gas sensors to check the amount of harmful gases present in the air and simultaneously transmits the values to the microcontroller. The sensor attached to the microcontroller, processes this data and transmits it over Bluetooth. We have used GAS SENSOR MQ-135 to measure Carbon dioxide and GAS SENSOR MQ-7 to measure Carbon monoxide. HC-05 is our Bluetooth module which will send the serial data from Arduino. We have assembled these modules on the Arduino Uno-board via cables. It will show the air quality value in analog that we will have to convert into PPM .We will then integrate these values to an android app which will show real -time graphs of the live sensor data and also previous saved values. The values are being saved in the MYSQL database along with the current date and time. All these values will be showed on our android app in both real-time and trend analysis.

II. METHODOLOGY

Air Monitoring: Air quality refers to the amount of dust particles, harmful gases present within our surrounding. Good air quality means the air is clean and pollutant free such as smoke, smog and other harmful impurities present in the air. The quality of air can be determined by using the various types of sensor and other devices which are developed for it. Good air quality pertains to stablish or maintaining the balance of life on earth for all the living things and natural resources.

Detecting pollution: The Gas sensors are interfaced with the arduino module as it a sensing element which is arduino based. The pollution detection is done by the sensors which we are using. The sensors give us an accurate amount of the pollutants such as carbon monoxide, LPG, nitrogen oxide,etc.up to the accuracy of 80-90%.

1) Monitoring Pollution: Similarly, Bluetooth module is also interfaced with the arduino as it will helps in monitoring the data observed by the sensors. The Bluetooth module will gives the data captured by the sensors to our smartphones with the help of IOT. We can observe the data in the graphical form which is available on our smartphones through a mobile application.
2) Mobile Application Mode: In this mode, we can see the amount of pollution caused by the several pollutants

which are present in that particular environment. In the application, we can see a graphical representation of pollution causing pollutants in PPM. We can save the data and compare with few more readings.

3) Constructional Details: The real time based air pollution monitoring system consists of following parts:

   a) Major Components:
      - Arduino Uno
      - Gas Sensor(MQ-7)
      - Gas Sensor(MQ-135)
      - Bluetooth Module(HC-05)
      - PM 2.5 Sensor
      - Smartphone

   b) Minor Components:
      - Jumper Wires (Male to Male & Male to Female)

The construction is explained by following the various steps:

Step 1: Microcontroller board: The microcontroller board is used as the basic requirement for the project:
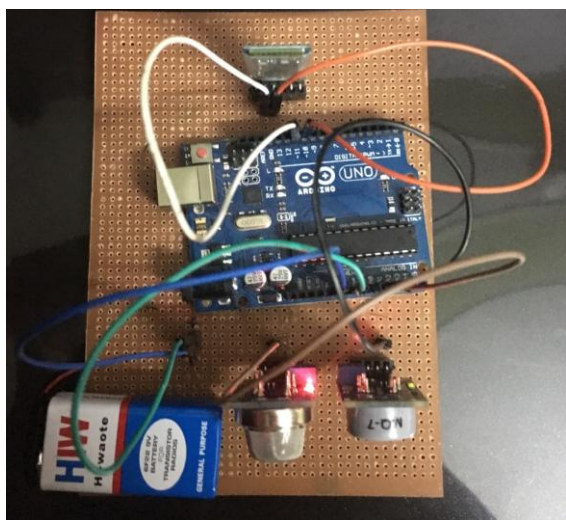
Arduino Uno: The Arduino Uno is a board that contains ATmega328 which is a single chip microcontroller. It contains 6 analog inputs, 14 digital Input /Output pins (6 of those can be employed as PWM outputs), USB connection, a 16MHz ceramic oscillator, a power jack and a reset button. It can be powered from a battery, a USB cable connected to a computer or a wall power supply. The code on this board is loaded using a USB cable.

Step 2: Sensors: It is used to sense the amount of pollutants in PPM, proper readings should be sensed by the sensors. In this, we have used 2 sensors:

1. MQ-135: MQ-135 sensor is used to determine the pollutants present in the air. The sensor has the lowest conductivity in air. When it sense the pollutants exist, the conductivity of sensor is increased along with the rise in pollutants concentration. MQ-135 sensor has higher sensitivity for smoke, Ammonia, Sulphide, Benzene and other harmful gases. It is cheaper and well suitable for different applications such as harmful gases/smoke detection.
2. MQ-7: MQ-7 sensor is used for detecting the carbon monoxide in clean air. It has higher sensitivity for carbon monoxide. It is measured by the part per million (ppm) units. The total concentration natural atmosphere is 0.1 to 0.2ppm. 0.4 to 5 ppm is the average level in homes. The level is adjusted by the gas stoves in homes and from the exhaust emission of automobiles is 8 to 16ppm. The exhaust from the various metro cities is goes beyond the level of 200ppm. The amount of carbon monoxide is generated by the combustion of wood fire and plastic fire is more than 5000ppm. Concentration below 600 ppm may convert 50% of body's hemoglobin to carboxyhemoglobin which cause much illness like leisure, fatality and coma.

Step 3: Communication & Monitoring

1. Bluetooth Module: Bluetooth module HC-05 is a module which is used for wireless communication. It is used on master and slave configuration which makes it more useful in wireless communication. This module can be used as Bluetooth SPP serial port protocol which can modulate at the rate of 3Mbps. It can use the CSR Blue-core04 external single chip module with adaptive frequency hopping feature and CMOS technology. HC-05 can be master or slave module but by default factory setting it is slave. The specific role of module can be configured according to command. The slave can't initiate the connection but can accept the connection but master can initiate the connection with other devices. The user can use it to make a wireless connection with other devices like MCU, PC to our models or projects.

2. Android Application: The android application will show us the examined values which are observed by the sensors. In the application, a graph is shown with the current and the pat values of the given environment. By doing this, we can compare the environment weather the pollution is increasing or decreasing.

III. VARIOUS APPLICATIONS IN POLLUTION MONITORING

Such type of real time based air pollution monitoring can be used in various types of applications such as:

- It can be used in home for checking the LPG gas leakage.
- It can be used to detect the poisonous gases left by the industries.
- Can be used in Offices, Schools, Colleges, Hospital premises.

CONCLUSION

Air Pollution is constantly increasing in the past few years. By this device, we cannot overcome the pollution in the open environment, but we can control it by avoiding the pollution causing elements. On the other hand, we can control it in the close environment like schools and offices by turning the exhaust on so that the pollutants will go out from it.

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