Automated System for Air Pollution Detection and Control

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Abstract—Vehicles and Industries are the major sources of Environmental Pollution. Every vehicle and industry will have emission but the problem occurs, which is due to the improper maintenance. This emission from vehicles and industries cannot be completely avoided but, it definitely can be controlled. As a solution to the above problems we aim to build an automated control system for emission level detection in vehicles and industries. When the pollution/ emission level shoots beyond the already set threshold level, there will be a buzz in the vehicle or industry to indicate that the limit has been reached and this information has been send to environmental control room which includes vehicle number or owner details. If this information comes to control room more than some specified time by the government, challan has been generated and send directly to the owner. Initially when the pollution level increases a message is send to the owner so that he can take steps to control it. This paper, when augmented as a real time project, will benefit the society and help in reducing the air pollution.

Keywords—MQ 7 gas sensor, MQ4 gas sensor, MQ8 GAS sensor, pollution, GSM, Liquid crystal display, Buzzer.

I. INTRODUCTION

Air pollution is one of the critical ecological issues that have a direct impact on human health and ecological balance. It is also a major reason for many unexpected deaths. Air pollution is not only affecting people's health but affecting environment which leads to acid rain, smog, deterioration of the ozone layer and global warming [1]. Besides the health effects, air pollution also contributes to tremendous economic losses, especially in the sense of financial resources that are required for giving medical assistance to the affected people. The poor are often the most affected segment of the population as they do not have adequate measures to protect themselves from air pollution [2]. Air pollution is a risk factor for different health conditions, including eye and skin diseases, irritation of the nose, throat and eyes. Air pollution additionally causes genuine conditions like heart stroke, lung cancer, pneumonia, bronchitis, trouble in breathing and coughing because of asthma. As the quantity of vehicles and industries has increased year by year, they deplete contamination on urban air quality effect of a growing pollutant level into the atmosphere. To enhance the environment and air quality, we ought to take dynamic and powerful pollution control measures [3]. So, it is very crucial to monitor and control the air pollution.

The most ideal approach to control air pollution is to monitor exceeded levels of air pollutants and need to take suitable activities to control it.

II. COMPONENTS

The components used in this system are as described with its working and specifications.

A. MQ7 Gas sensor

This sensor is simple to use which is used to sense the concentration of carbon monoxide in air. The MQ7 can detect co gas in air between 20 to 2000ppm. This sensor gives quick response and is very sensitive to Co. The sensor gives output in analog form. To drive the sensor we have to apply 5V to the heater coil of sensor. This sensor has wide detection range, also it gives stable performance after it gets stable in the environment after some time. Its cost is low as compared to others. It is applicable for detecting domestic gas leakage, industrial co detection and portable gas detector. To calibrate this sensor we have to keep heating its heater coil for 48hours continuously. After this adjust the load resistance RL until u get a single value which is a response to a certain Co concentration and point of 90s. Then adjust other load resistance RL until we get a single value which responses to a Co concentration at the end point of 60s. After this the sensor is ready to use and calibration is done.

Sensitive material of MQ7 gas sensor is Sno2 which has long conductivity in fresh air.

There are 4 pins given for user. They are as shown in the above figure 2.1.

- The first pin is Vcc which is used to give supply. The voltage applied is 5V to sensor.
- The next pin is Aout which is used to get analog output from the sensor.
It gives analog output from 0 to 1023.

- The next pin is Dout which gives digital output.
- The last pin is ground pin.

**B. MQ4 gas sensor**

This sensor is simple to use which is used to sense the concentration of methane gas (Ch4) in air. The MQ4 can detect co gas in air between 200 to 10000ppm. This sensor gives quick response and is very sensitive to Ch4. The sensor gives output in analog form. To drive the sensor we have to apply 5V to the heater coil of sensor. This sensor has wide detection range, also it gives stable performance after it gets stable in the environment after some time. Its cost is low as compared to others. It is applicable for detecting domestic gas leakage, industrial combustible gas detection, in car which uses methane as fuel and can also be used in house. To calibrate this sensor we have to keep heating its heater coil for 48 hours continuously. After this adjust the load resistance RL until you get a single value which is a response to a certain Ch4 concentration and point of 90s. Then adjust other load resistance RL until we get a single value which responds to a Ch4 concentration at the end point of 60s. After this the sensor is ready to use and calibration is done.

Sensitive material of MQ4 gas sensor is SnO2 which has long conductivity in clean air. This is highly sensitive to methane and also is low sensitive for propane and butane gases.

The below figure 2.2 shows pin diagram of methane gas sensor.

![Pin Diagram of MQ4 Gas Sensor](image)

Figure 2.2

There are 4 pins given for user. They are as shown in the above figure 2.2.

- The first pin is Vcc which is used to give supply. The voltage applied is 5V to sensor.

- The next pin is Aout which is used to get analog output from the sensor.
- The next pin is Dout which gives digital output.
- The last pin is ground pin which is to provide ground to the sensor.

**C. MQ 8 gas sensor**

This sensor is simple to use which is used to sense the concentration of hydrogen gas (H2) in air. The H2 can detect co gas in air between 200 to 10000ppm. This sensor gives quick response and is very sensitive to H2. The sensor gives output in analog form. To drive the sensor we have to apply 5V to the heater coil of sensor. This sensor has wide detection range, also it gives stable performance after it gets stable in the environment after some time. Its cost is low as compared to others. It is applicable for detecting domestic gas leakage, industrial combustible gas detection, in car which uses methane as fuel and can also be used in house. To calibrate this sensor we have to keep heating its heater coil for 48 hours continuously. After this adjust the load resistance RL until you get a single value which is a response to a certain H2 concentration and point of 90s. Then adjust other load resistance RL until we get a single value which responds to a Ch4 concentration at the end point of 60s. After this the sensor is ready to use and calibration is done.

Sensitive material of H2 gas sensor is SnO2 which has long conductivity in clean air. This is highly sensitive to methane and also is low sensitive for propane and butane gases.

The below figure 2.3 shows pin diagram of methane gas sensor.

![Pin Diagram of MQ4 Gas Sensor](image)

Figure 2.3
There are 4 pins given for user. They are as shown in the above figure 2.3.

- The first pin is Vcc which is used to give supply. The voltage applied is 5V to sensor.
- The next pin is Aout which is used to get analog output from the sensor.
- It gives analog output from 0 to 1023.
- The next pin is Dout which gives digital output.
- The last pin is ground pin which is to provide ground to the sensor.

**D. Micro controller (Arduino Uno)**

It is used for receiving data from the three above sensor and it stores one of the sensor value in the EEPROM. This receives analog value from the sensor and then it processes the analog value to convert it into parts per million. After converting this value both analog and ppm value are displayed on the Liquid crystal display. The command is given by the control to display this values.

Some of its main features are:

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<th>Table 2.1 Features of Arduino</th>
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**E. Liquid crystal display**

This is the element that is used to display the concentration of gases present in the around atmosphere. This is a 16*2 display it has 16 characters to display in one line and it has total 2 line i.e. it can display total 32 characters. In this system we have displayed the values of all the gases in analog and its corresponding value in ppm. At a time the value of one gas is displayed in the first line analog value is displayed and in the second line concentration of gas is shown in ppm.

**F. GSM**

This is the component which is used to communicate as the concentration of gas goes beyond the threshold value set in the controller it sends a message to the owner and other message to the central governing body. So that both of them are informed to take the necessary steps to reduce the concentration of gas emitted. In this way we can reduce the amount of pollution.

**III. WORKING**

The working starts with the sensing of the sensor in this system there are three sensor which are MQ7, MQ4 and MQ8. They senses carbon monoxide, methane, hydrogen respectively. They give analog output as per the concentration of gas present near by the environment and gives analog output to Arduino. The Arduino takes the analog input from the sensor and then according to the programming done in it. It processes the data and converts the analog value into its corresponding value in volts and parts per million. This conversion is done by the equations as given below:-

1) To convert analog to volts = \( \frac{5 \times \text{analog value from the sensor}}{1023} \)
2) To convert analog value to ppm = \( \{x \times \text{analog value}\} \)
Where x is the multiplying factor calculated as per the sensor by calibrating it in our own environment.

After this Arduino gives command to the liquid crystal display to print the analog and ppm value on it. And there is a limit specified in the program of these gases of its concentration. If the limit of concentration of these gases cross the specified limit then a buzzer sounds. The command to buzzer is given by the Arduino. After the buzzer sounds the Arduino gives command to the GSM which is used to inform the owner of the industry or vehicle. By this the owner gets a message on his mobile and he has to control the level of pollution. Another message goes to the central environmental section so that they are informed about the particular owner who is emitting more pollution which is harmful for humans. Thus in this way we can maintain less pollution and we can keep our surrounding safe.
By taking the values from different source’s we have made the following graph of ppm vs time. The comparison can be done of different sources from the graph and the table is also given to show the values.

A. For hydrogen gas

From the above graph we can say that as the pure form of hydrogen is not much present in the environment as there is not much change in the value of hydrogen when it is subjected to different sources. But as we know that in many industrial places hydrogen is used for cooling purpose such as in cooling of generator. Hence if this system is subjected to such place and if there is leakage then we can easily know about the leakage. Also we know that hydrogen catches fire very easily at atmospheric temperature so its leakage has to know if it is there. If it is not known then it can be a big problem as the temperature near the generator in power plant is somewhat high than the normal temperature. So at such places it can easily catch fire which may lead to a big fire.

B. For Methane gas

As we can see that the value of methane goes up to 4 ppm in case of leakage form the gas lighter. As this gas is used as a fuel for cooking in home so this can be used in homes so that if there is a leakage we can easily come to know and we remain safe as this gas is also flammable.

C. For Carbon monoxide gas

The value of co comes maximum from the bike as it emits the maximum gas is its filter are not strong enough as that of car and lighter gas.
This is the gas due to which many disease are caused and we have to reduce the amount of co emitted as it is very harmful for humans and environment too. As it is a global warming gas we have to keep concentration of this gas as low as possible.

V. CONCLUSIONS

From this proposed system we can ensure that we are living in a safe environment and we can reduce the amount of pollution which is going on increasing day by day. As we are aware of the effects of pollution which is very dangerous for all of us so we all should try to maintain the level of pollution in a safe limit. As we can see that the bike emits more pollution than the car so we should try to use it less as compared to car and prefer such transportation that emits less pollution and which is affordable. If we do not control this level of pollution the adverse effects can be seen easily as the water level is increasing due to melting of gassier. And also the temperature of earth’s atmosphere is increasing leading to many problems.

Not only has this due to release of these gases many diseases are caused among them the major is lung cancer. The number of patients are increasing day by day due to this emitting of gases. So we can control this level of pollution by using such system in industries and vehicles. Also the gases which catches fire easily their leakage in industries is also to be known quickly otherwise it can make a big problem if it catches fire.

REFERENCES