AIR POLLUTION MONITORING AND CONTROL FOR SMART CITY

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Abstract : Pollution has become a problem in our daily life. It affect human health, it also contributes major part in global warming. So somewhere it is important to have control over it in order to build a smart city. In this project we are making a system by which we can monitor real time air pollution. By measuring content of various polluted gases present in environment, and give a graphical results. With the help of graphical results we can predict the pollution in that particular area.

Index Terms **- ADC Co2, No2, CO gas sensor, Smoke detector sensor, Atmega 16, zigbee transmitter zigbee receiver.**

I. INTRODUCTION

Air pollution affects human health in many ways, affecting the lungs and the respiratory system. Many diseases are spread because of air pollution. Air pollution also causes the greenhouse effect, whose side effects are well known to all of us after the finding about holes in ozone layer. There are many sources of air pollution such as vehicles, industrial wastage, carbon sources. In this project we are measuring the content of gases which cause pollution. Mainly there are Carbon dioxide (CO2), carbon monoxide(CO), Nitrogen dioxide(NO2) gases which contributes in air pollution. So we use sensors such as MQ7, MQ135, MQ9 to measure Carbon dioxide (CO2), carbon monoxide(CO), Nitrogen dioxide(NO2) respectively. Firstly we measure range of output voltage levels of various gases sensors, then we calculated PPM(Parts per million) using software algorithm microcontroller. It is required to check quality of air in order to control pollution in urban area .There are many existing systems such as Waspmote Gas Sensor Board, which are so expensive that we cannot afford number of such systems.

The HazeWatch project described in this paper uses several low cost mobile sensor units attached to vehicles to measure air pollution concentrations, & user's mobile phones to tag & upload the data in real time[1]. This paper discusses the emission of multiple pollutants by coal & gas fired generators equipped with different emission control devices. This model considers the air quality index & how this index is affected by the weather[4].A system for monitoring & forecasting urban air pollution is presented in this paper. The system uses low cost air-quality monitoring motes that are equiped with an array of gaseous and meteorological sensors[3].

Aims and Goals:

- To measure real time air pollution.
- To give an accurate graphical analysis of pollution in order to build smart city.
- To analyse measured real time air pollutant and its content.

II. BLOCK DIAGRAM AND WORKING PRINCIPLE

A) Block diagram

The detailed block diagram is as shown in fig.1

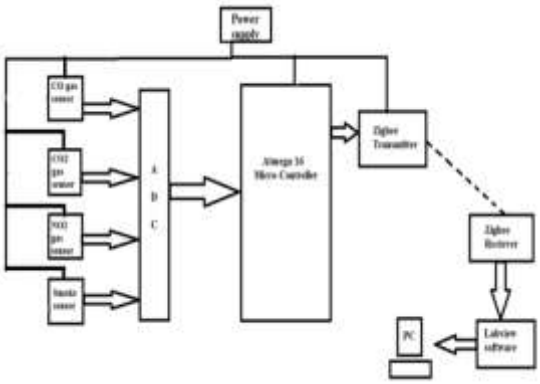

Fig 1.Block Diagram

B) Block Diagram Explanation

- The system architecture is as shown in fig.1 above. It consists of a microcontroller (Atmega16) and several gas sensors such as

- These sensor will provide an analog value which is then converted into a digital value by analog to digital convertor (ADC) to give it to microcontroller.
- It is possible by Atmega 16 which has 8 channel 10 bits resolution. 8 channels implies that there are 8 ADC pins. 10 bit resolution implies that there are 2^10=1024 steps.
- As per the observation table & the ADC value we got, for the sensor output voltage 0.3V the ADC value is 200, and 0.3V is the voltage in normal environment. In pure air, there is 9ppm of CO.
- We can calculate the sensor voltage as follows;
  Sensor Voltage = Analog Reading * 3.3V / 4095
- we can find the ppm values using formula as;
  PPM = 3.027*e^(1.0698*V_RL).
- The system is powered by 5V power supply.
- Zigbee module is used to transmit the measured data to the server. Zigbee can establish its network automatically with its range upto 100 meters.

III. III.TEST AND RESULT

When Carbon monoxide comes in contact with MQ7, it reacts with a chemical present inside sensor and semiconductor layer is formed so that current start to flow through a sensor. Then output voltage of sensor is compared with reference voltage by the comparator(LM358). Two output pins are available i.e. analog and digital.Two LEDs are present on circuit out of which LED1 indicates supply is ON while LED2 indicates the detection of Carbon monoxide.

The fig.2 shows the testing of MQ7 sensor with the help of atmega16. We took the readings under two conditions; firstly under normal environment then secondly under polluted environment. Under normal condition, we kept our sensor in normal environment for few minutes then we observed and took few readings including the output voltage given by the sensor & ppm value converted by microcontroller & observed on the monitor. By taking the readings we have plotted the graph on Microsoft excel. The graph contains voltage measured on output of sensor on X axis & ppm value on Y axis as shown in fig.3. the ppm value varies between 530 to 600ppm as shown in fig.3.

Fig 2.Testing of MQ7 sensor

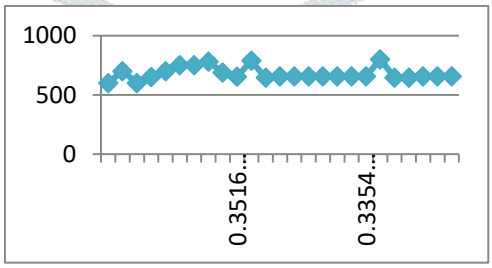

Fig3. CO2 response in normal environment

Secondly, we have taken readings for polluted environment. For testing purpose we created polluted area by using Lighting Joss Sticks (agarbatti). we got the voltage values from the microcontroller and we plotted the graph of voltage versus ppm values for the polluted area which is shown in fig.4. The fig.4 shows the measured values which varies from 4800ppm to 10000ppm.

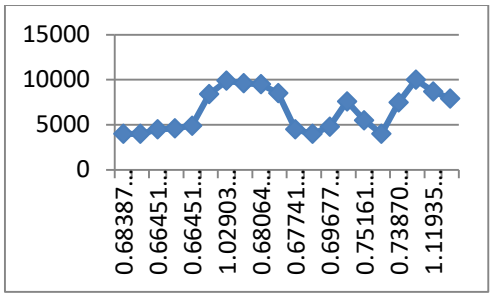

Fig 4. CO2 response in polluted area

The fig.5 represents the sensitivity of co2 sensor which keeps on varying from 2000 to up to 10000ppm and this graph is obtained by comparing the given graph in datasheet of co2 sensor with the measured values and this graph is almost similar to the theoretical value of the sensor.

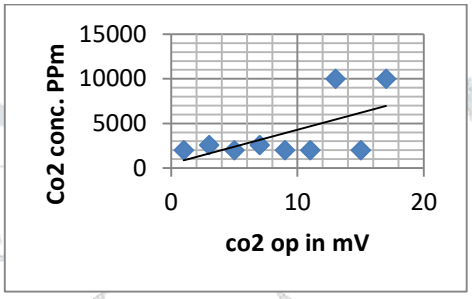

Fig 5. Co2 sensitivity graph

Advantages:

- It is cheaper than other systems.
- Can be easily mounted anywhere to get the air quality.
- We can get results continuously in a day.
- It does not require external power supply as it is portable.

Disadvantages:

- Sensor calibration is complex.

IV. CONCLUSION

In this paper, we have proposed the design of air pollution monitoring system. This module can be easily installed along with different gas sensors to calculate the pollution, with which we will get the graphical values of pollution levels of different polluted areas. We will get pollution level in that area at different time interval in a day. The objective behind this project is to monitor environment and give some results by which controlling action can be taken.

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