Air Quality Monitoring System

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Abstract - The main objective of this project is to control air pollution by designing and implementing an Air Quality Monitoring (AQM) system. To reduce air pollution, and also to reduce the health issues caused by air pollution, the air quality monitoring system plays a major role. The air quality monitoring should be capable of measuring the air quality parameters. The parameters to be considered are temperature, humidity, carbon monoxide, low concentration ozone gas, and dust particles. Finally, all the sensor data will be processed by the PIC Microcontroller and the output can be displayed with the help of LCD Display. This air quality system also alerts when the air quality level is greater than the normal value using a buzzer.

Keywords - Air Quality, Pollution, Ozone gas, Carbon Monoxide, Dust Monitor.

I. INTRODUCTION

The main source for the human surrounding is Air. The Atmosphere of the earth consists of Nitrogen, Oxygen, Carbon Monoxide and some rare elements. Human needs air which is free from contaminants. This is very crucial for human life and health. Any change in the natural composition of air may cause harm to life forms on earth. Air pollution is the presence of one or more contaminants in the atmosphere such as gases that can harm humans, animals, and plants. Air pollution is the reason for the death of 7 million people each year. Almost 570000 children under the age of 5 die because of respiratory infection and second-hank smoke. Children who were exposed to air pollution have chronic respiratory problems like asthma. In the monitoring of air pollution, several researchers worldwide have developed models to monitor many of the pollution gases such as Sulphur Dioxide (SO2), Carbon Monoxide (CO), Carbon Dioxide (CO2), Nitrogen Oxides (NO), etc. The main objective of this project is to design a smart air pollution monitoring system that can monitor, analyse and data about air quality to a remote server and keep the data up to date over the internet.

II HARDWARE DESCRIPTION

The proposed air quality monitoring system consists of an LCD Display, Temperature and Humidity Sensor, Carbon Monoxide sensor, Low Concentration ozone sensor and Grove particle sensor. The block diagram of the proposed model is shown below. The above figure consists of PIC Microcontroller which accepts all the sensor data. The microcontroller processes all the accepted input and produces an output. The output can be viewed with the help of LCD display. In case the obtained sensor value is higher than the fixed value/normal level, the microcontroller passes the output to the LCD Interface.

PROGRAMMABLE INTERFACE CONTROLLER

The PIC microcontroller is the main basic component among all the other components. It controls all the inputs given and produces the appropriate outputs.

It accepts the input from the Temperature and Humidity Sensor, Carbon Monoxide Sensor, Ozone gas sensor. It processes all the sensor data and displays the output through LCD Display.

LIQUID CRYSTAL DISPLAY

The Liquid Crystal Display (LCD) screen displays the command received to ensure whether the command given by the user is correct. It is also helpful in displaying the error messages. The LCD Display helps to display the processed output of the Microcontroller. It alsodisplays an alert message when the output data is higher than the normal value.

TEMPERATURE AND HUMIDITY SENSOR

It operates at 3.3 to 5.5-volt DC supply and its operating range is 0 to 100% and 20 to 80 degrees Celsius. Its average sensing period is 2 seconds. It uses a polymer humidity capacitor to sense the humidity. It senses the temperature and

humidity level and sends it to the Microcontroller. It operates at 3.3 to 5.5-volt DC supply and its operating range is 0 to 100% and 20 to 80 degree Celsius. Its average sensing period is 2 seconds. It uses polymer humidity capacitor to sense the humidity. It senses the temperature and humidity level and sends to the Microcontroller.

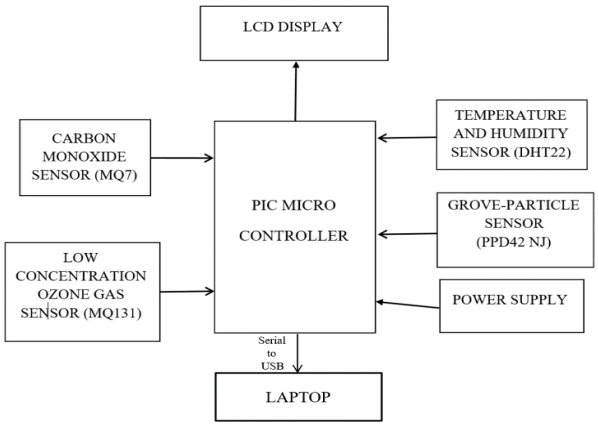

Fig. 1 Block Diagram of Proposed Mode

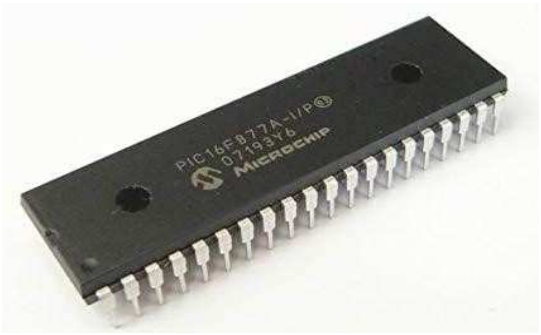

Fig. 2 PIC Microcontroller

CARBON MONOXIDE SENSOR

The MQ-7 gas sensor is a low conductivity sensor in clean air. It has higher conductivity along with a higher concentration of air. It has more sensitivity to natural gases like CO2, O2 etc.

- The sensitivity range of these sensor is measured by using theformula

$$\text{Sensitivity Range(s)} = \frac{\text{Rs(in air)}}{\text{Rs(100ppm CO)}} \geq 5$$

These sensors have long life and available at lowcost.

OZONE GAS SENSOR

The MQ131 gas sensor is low conductivity in clean air. When ozone gas exists, the sensor conductivity gets lower along with the gas concentration rising. Users can convert the gas concentration to correspond output based onthe change of conductivity. The major advantage of the sensor is sensing in a wide range. It is widely used in domestic ozone concentration alarm and also in industrial ozone

GROVE-DUST SENSOR

The dust sensor measures the particulate matter level in the air by counting the Low pulse occupancy time (LPO time) in a given timeunit.

Fig. 3 LCD Display

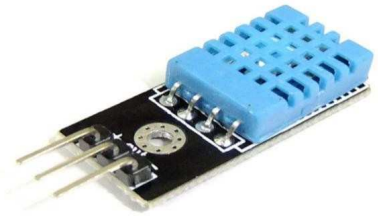

Fig. 4 Temperature and Humidity Sensor

Fig. 5 Carbon Monoxide Sensor

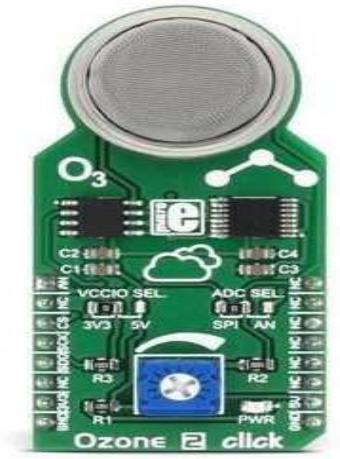

Fig. 6 Ozone Sensor

Fig. 7 Dust Sensor

This sensor can provide the reliable data for air purifier system because it is responsible to particulate whose diameter is 1µm. It operates at4.75 to 5.25-volt DC supply.

III FLOWCHART

The whole process of the proposed modelcan be discussed with the help of below flowchart.

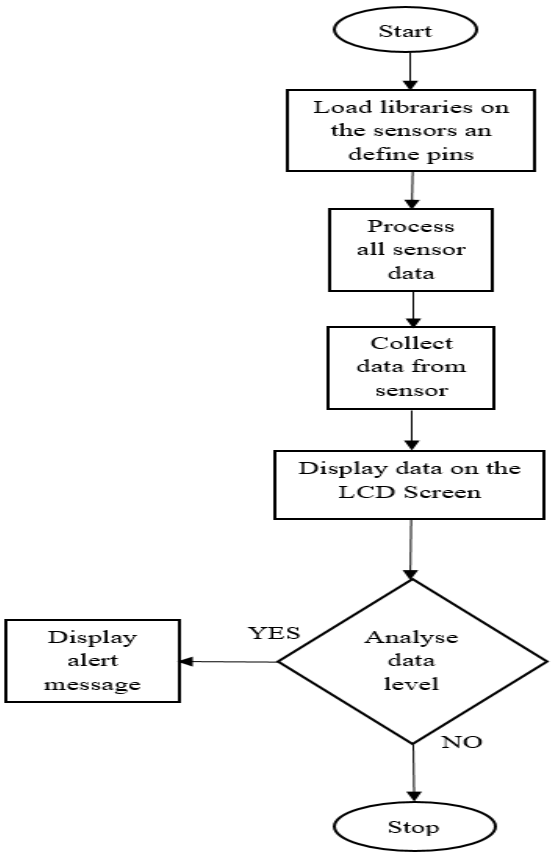

Fig. 8 Flowchart of Proposed Model

Initially, the PIC Microcontroller is loaded with code and allocate pin for all sensors. After switching on the power supply the microcontroller collects all the sensor data as an input and processes all the data. Finally, it displays the output on LCD Screen. It also analyzes the level and displays an alert message in case the output level is higher than the normal value.

IV SOFTWARE DESCRIPTION

MPLAB is an Integrated Development Environment (IDE) that integrates the toolset for the development of embedded applications. MPLAB IDE runs on a 32-bit application on MS Windows and it is easy to use. It also serves as a single or unified graphical user interface for additional Microchip and third-party software and hardware development tools. With the help of this software, the code can be dumped on the Microcontroller.

V CONCLUSION

This proposed model helps to monitor air pollution that constantly keeps track of air quality in an area and displays the air quality measured on an LCD screen. This system helps to create awareness of the quality of air that one breathes daily. This device can deliver real-time air quality measurements. With the help of this system, the accidents and death rate of the living things can be reduced. In the future, with the help of this model, a report is generated over a region and it helps to reduce pollution.

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