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FABRICATION OF AIR POLLUTION MONITORING SYSTEM

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Abstract: The objective of this project is to measure the purity in the air. This project is designed with air purity sensor analog to digital converter, amplifier and micro controller with LCD Display. In this project we are using air purity sensor to measure the purity in the air. So it measures the purity in the air and generates the corresponding voltage pulse these pulses are in the milli voltage level. Component, Internet of Things (IoT) may be a worldwide system of "smart devices" which will sense and connect with their surroundings and interact with users and other systems. The level of pollution has increased with times by lot of things like the increase in population, increased vehicle use, industrialization and urbanization which ends up in harmful effects on human wellbeing by directly affecting health of population exposed to it. Air quality goes down when enough amount of harmful gases present in the air like carbon dioxide, smoke, alcohol, benzene, NH3, and NO2. In order to analyses we are developing an IOT Based pollution Monitoring System which we'll monitor the Air Quality over an internet server. It will show the air quality in PPM on the LCD and also as on webpage in order that we will monitor it very easily. In this IOT project, you can monitor the pollution level from anywhere using your computer or mobile device.

Index Terms **–Air purity, analog, digital, lcd display, micro controller, iot, arduino**

I. INTRODUCTION

Air pollution sensors are devices that monitor the presence of air pollution in the surrounding area. They can be used for both indoor and outdoor environments. These sensors can be built at home, or bought from certain manufactures. Although there are various types of air pollution sensors, and some are specialized in certain aspects, the majority focuses on five components: ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrous oxide. The sensors were very expensive in the past, but with technological advancements these sensors are becoming more affordable and more widespread throughout the population. These sensors can help serve many purposes and help bring attention to environmental issues beyond the scope of the human eye. The EPA maintains a repository of air quality data through the Air Quality System (AQS), where it stores data from over 10,000 monitors in the United States. While use of these sensors was expensive in the past, the 2010s saw a recent trend towards the development of cheaper portable air-quality sensors that can be worn by individuals to monitor local air quality levels. These sensors, can then, in turn, help measure the spatiotemporal coverage and variety of chemical species, and empower individuals and communities to better understand their exposure environments and risks from air pollution. The main objective of IOT Air & Sound Monitoring System is that the Air and sound pollution is a growing issue these days. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all. Due to flexibility and low cost Internet of things (IoT) is getting popular day by day. With the urbanization and with the increase in the vehicles on road the atmospheric conditions have considerably affected. Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma. Monitoring gives measurements of air pollutant and sound pollution concentration.

II. BLOCK DIAGRAM

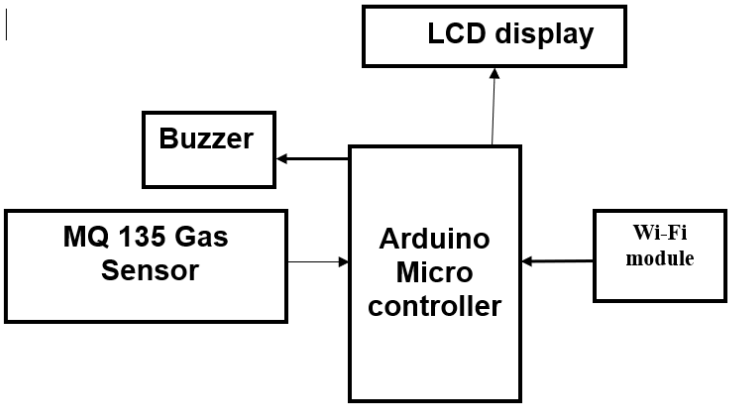

Fig 1 :Block Diagram of Air Pollution Monitoring System

III. HARDWARE COMPONENTS

This air pollution monitor circuit is designed by using a MQ 135 Gas Sensor, Arduino UNO, Wi-Fi module, LCD display, Buzzer and few other electronic components like resistor capacitor etc.

3.1 MQ 135 Sensor

MQ-13 gas sensor can be implementation to detect the smoke and other harmful gases. It has potential to detect different harmful gases, including NH3, NOx, alcohol, benzene, smoke and CO2. MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benzene steam, also sensitive to smoke and other harmful gases. This Module makes use of the MQ-135 air quality detector and hazardous gas detector chip.

Fig 2 : MQ 135 Sensor

3.2 Arduino UNO

Arduino is an opensource devices stage in light of simple to operate equipment and programming. Arduino comprise of both physical programmable circuit board (microcontroller and bit of programming or IDE Development Environment) that keeps running on our PC, used to compose and transfer PC code to the physical board. An Arduino stage has turned out to be very well known with individuals simply beginning with gadgets and for good reasons. Arduino can communicate with catches, LED, engines, speakers, GPS units, cameras, the web and even our advanced cell or our TV. Arduino Uno is the model board for getting started with electronics. Through entertaining and attractive hands-on projects. This board is our entry to the unique Arduino experience: great for learning the basics of how sensors and actuals measurement and an essential tool for our rapid prototyping needs. Arduino Uno is the maximum used and documented board in the Arduino intimate

Fig 3 : Arduino UNO

3.3 Wi-Fi module ESP8266

The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to

occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts

Fig 4 : Wi-Fi module ESP8266

3.4 LCD display

The liquid crystal display uses the property of light monitoring of liquid crystal and they do not emit the light directly. The Liquid crystal display is a flat panel display or the electronic visual display. With low information, content the LCD' s are obtained in the fixed image or the arbitrary image which are displayed or hidden like present words, digits, or 7 segment display. The arbitrary images are made up of large no of small pixels and the element has larger elements.

Fig 5 : LCD Display

3.5 Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronics, automotive electronic equipment, telephones, timers and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to "plug and play.

Fig 6 : Buzzer

Circuit Explanation

First of all we will connect the **ESP8266 with the Arduino**. ESP8266 runs on 3.3V and if you will give it 5V from the Arduino then it won't work properly and it may get damage**.** ESP8266 Wi-Fi module gives your projects **access to Wi-Fi or internet**. It is a very cheap device and make your projects very powerful. It can communicate with any microcontroller and it is the most leading devices in the IOT devices. Then we will connect the **MQ135 sensor with the Arduino**. Connect the VCC and the ground pin of the sensor to the 5V and ground of the Arduino and the Analog pin of sensor to the A0 of the Arduino. Connect a buzzer to the pin 8 of the Arduino which will start to beep when the condition becomes true.

Mathematical Analysis of Proposed air Quality Detection and Monitoring System

Pollutants make up a small percentage of air we breathe and their level of concentration is measured in parts per million (ppm) or percentage. Conversion factors include the following:

1 ppm = 1.145 mg/m3
1 mg/m3 = 0.873 ppm
1% = 1/100
1 ppm = 1/1000000
1 ppm = 0.0001%

Parts per Million (ppm)	Percent (%)
0	0
5	0.005
50	0.005
500	0.05
1000	0.1

Table 1: Shows Conversion of PPM to Percentage

RESEARCH METHODOLOGY

The model was designed using an Arduino Uno microcontroller, Wi-Fi module 8266, MQ135 Gas Sensor and a 16 by 2 liquid crystal display (LCD) Screen. Figure 1 shows the proposed system overview and the functional block diagram is depicted in figure 2. The proposed flow chart is presented in figure 3. The system overview procedure was classified into Five (5) layers as shown in figure 1. The first layer was the environmental parameters which are obtained by measurement. The second layer was the study of the characteristics and features of the sensors. The third layer was the decision making, sensing, measuring, fixing of the threshold valve, periodicity of sensitivity, timing and space. The fourth layer was the sensor data acquisition. The fifth layer was the ambient intelligence environment. The sensor collected data when operated by the microcontroller and forwarded it over the internet for analysis via the Wi-Fi module. Users were able to monitor measured parameters on their smartphones. The design specification of the proposed system is described.

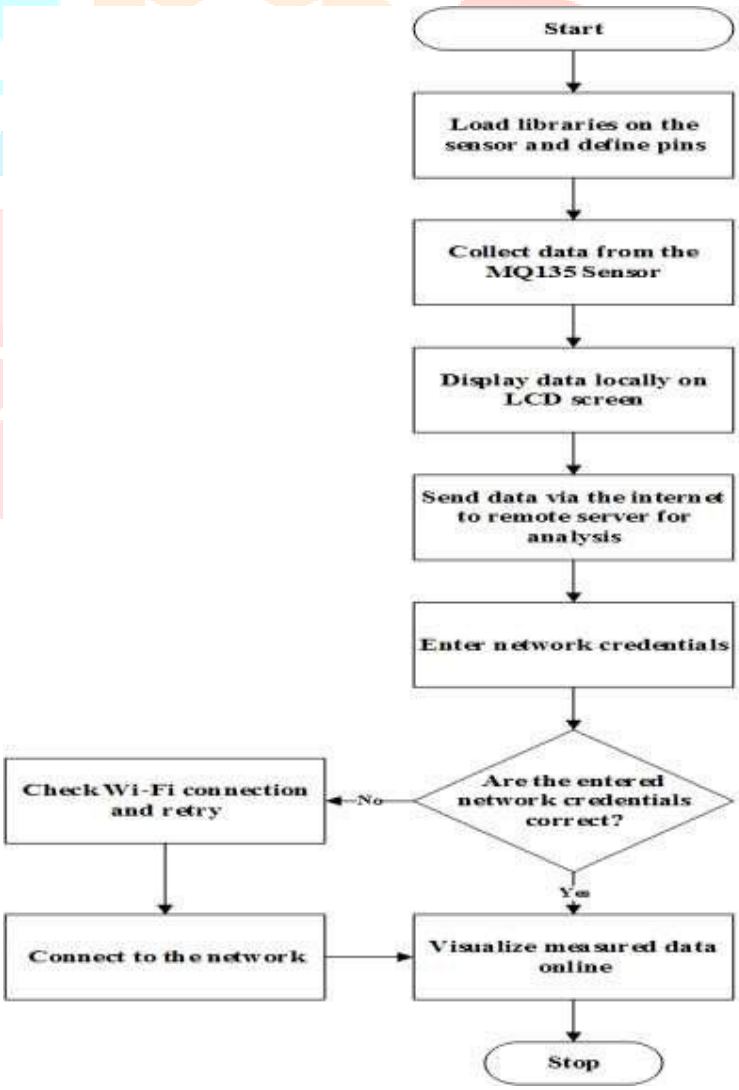

Fig 7: Flow chart of Research Methodology

3.1 Working Principle of Proposed System

As described by Figure 3, the library in the Arduino was loaded and a message was sent to the LCD. Air quality data was collected using the MQ135 sensor. The calibrated sensor made the analog output voltage proportional to the concentration of polluting gases in Parts per Million (ppm). The data is first displayed on the LCD screen and then sent to the Wi-Fi module. The Wi-Fi module transfers the measured data valve to the server via internet. The Wi-Fi module is configured to transfer measured data an application on a remote server called "Thing speak". The online application provides global access to measured data via any device that has internet connection capabilities. Data collected from the sensor was converted into a string and used to update the information sent to the remote server.

3.2 System Design

The MQ135 Gas sensor was used to collect air data. The sensor was calibrated to ensure that the analogue output from the sensor is proportional to the concentration of the pollutants being measured in parts per million (ppm). The data is transmitted via WIFI module using the internet to the cloud servers, this information can be retrieved via Smart phone or web enabled devices. The transmission and retrieving of data happen in near real time. The data of the parameters being measured are displayed on a 16*2 LCD screen. An alarm would sound in the event that any pollutant reaches dangerously high levels or if the WIFI module fails to transmit information collected to the Cloud.

IV. RESULTS AND DISCUSSION

Results of Air Quality

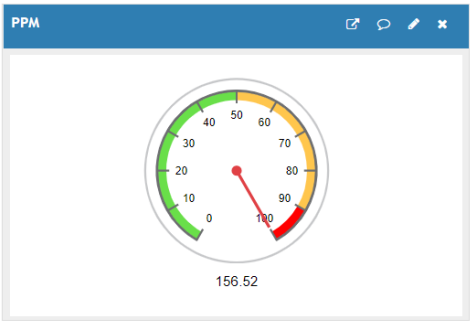

Fig 8 : Analog and Digital Reading of Air Quality

If the level of pollution is below 50PPM green color indicates in the digital reading, it means the pollution level is minimum in the atmosphere, if it exceeds above minimum range i.e.,>50PPM and <100PPM moderate level will be there and >greater than 100PPM the level is high.

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