Section:-K19GK **Group-2**

Summary

IOT based Air Pollution Monitoring System using Arduino

As a project work for Course

ENVIROMENTAL STUDIES (CHE110)

Submitted By

S.NO	NAME	REGISTRATION NUMBER	ROLL NUMBER	MARKS OBTAINED	TOTAL MARKS
1	Devansh Agarwal	11908637	61		
2	Neeraj Kumar Sharma	11908580	63		
3	Ankit Gupta	11903499	67		

Submitted By Dr. Prachi Saxena

Lovely Professional University,
Jalandhar, Punjab, India.

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Introduction :-

In this project we are going to make an IOT based air monitoring system in which we will monitor the air quality over a webserver using internet and will trigger a alarm when the air quality goes down beyond a certain level, means when there are sufficient amount of harmful gases are present in the air like CO_2, smoke, alcohol, benzene and NH_3. It will show the air quality in PPM on the LCD and as well as on webpage. So, that we can monitor it very easily. You can monitor the pollution level from any-where using from computer or mobile we can install this system anywhere and can also trigger some device when pollution goes beyond some level, like we can switch on the exhaust fan or can send alert/SMS/E-mail to user.

Required Components :-

i) MQ 135 gas sensor
ii) Arduino Uno
iii) Wifi module ESP8266
iv) 16×2 LCD
v) Bread board
vi) 10k potentiometer
vii) 1K ohm resistors
viii) 220 ohm resistor
ix) Buzzer

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Circuit Diagram And Explanation :-

First of all we will connect ESP8266 with 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. Connect the Vcc and the CH_PD to the 3.3V pin of arduino. The RX pin of ESP8266 works on 3.3V and it will not communicate with the arduino when we will connect it directly to the arduino. So, we will have to make a voltage divider for it which will convert the 5V into 3.3V. This can be done by connecting 3 resistors in series like we did in the circuit. Connect the TX pin of ESP8266 to the pin 10 of the arduino and RX pin of the ESP8266 to the pin 9 of arduino through the resistors.

ESP8266 wifi module gives my project access to wifi and internet. It is a very cheap device and makes my project very powerful. It can communicate with any micro-controller and it is the most leading device in the IOT plate form.

Then we will connect the MQ135 sensor with the arduino. Connect the Vcc and ground pin of the sensor to the 5V and ground of the arduino and the Analog pin of the 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.

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In last, we will connect LCD with the arduino. The connections of the LCD are as follows:-

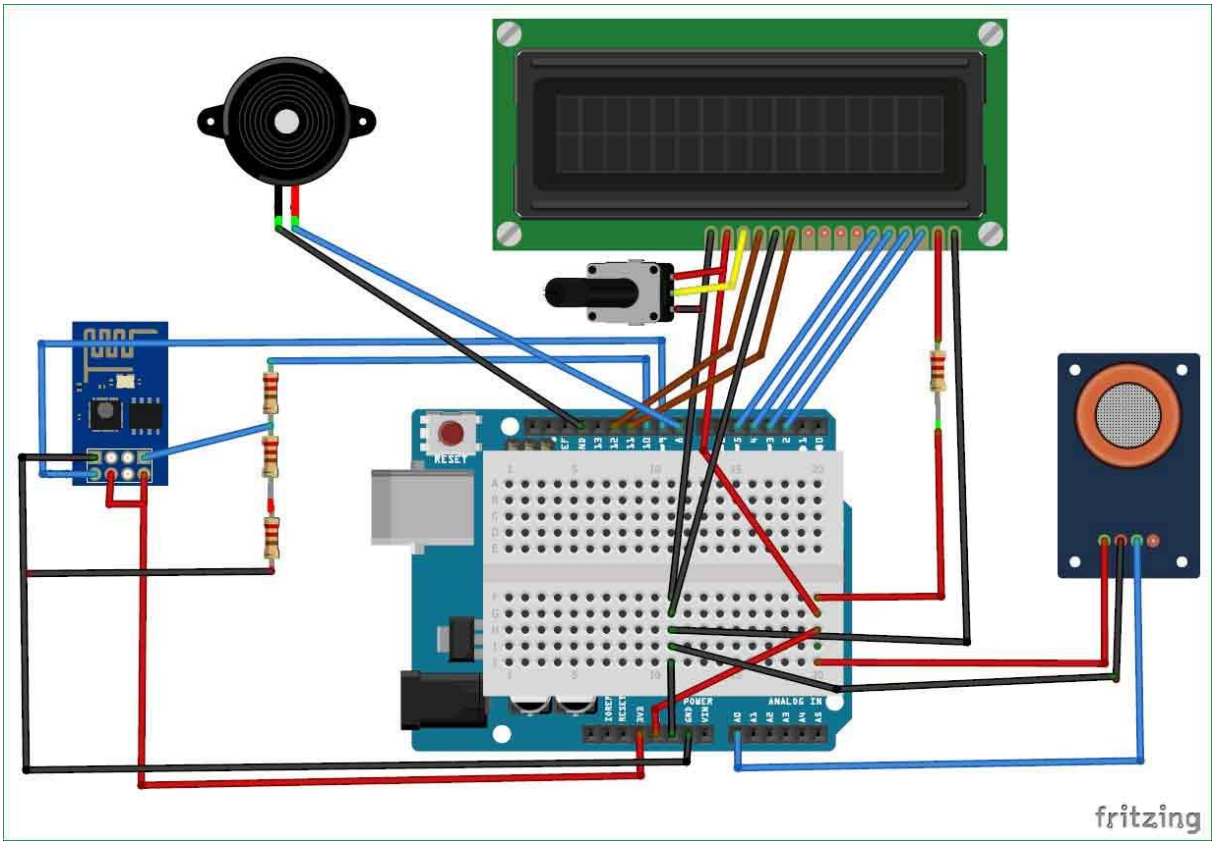
→ Connect pin 1 (VEE) to the ground
→ Connect pin 2 (VDD or VCC) to the 5V
→ Connect pin 3 (Vo) to the middle pin of the 10K potentiometer and connect the other two ends (this is for the contrast of the LCD potentiometer of values other than 10K will work too)
→ Connect pin 4 (RS) to the pin 12 of the arduino
→ Connect pin 5 (Read/Write) to the ground of arduino. This pin is not often used so will connect it to the ground
→ Connect pin 6 (E) to pin 11 of the arduino. The RS & E pin are the control pins which are used to send data and characters
→ The following 4 pins are data pins which are used to communicate with the arduino:-

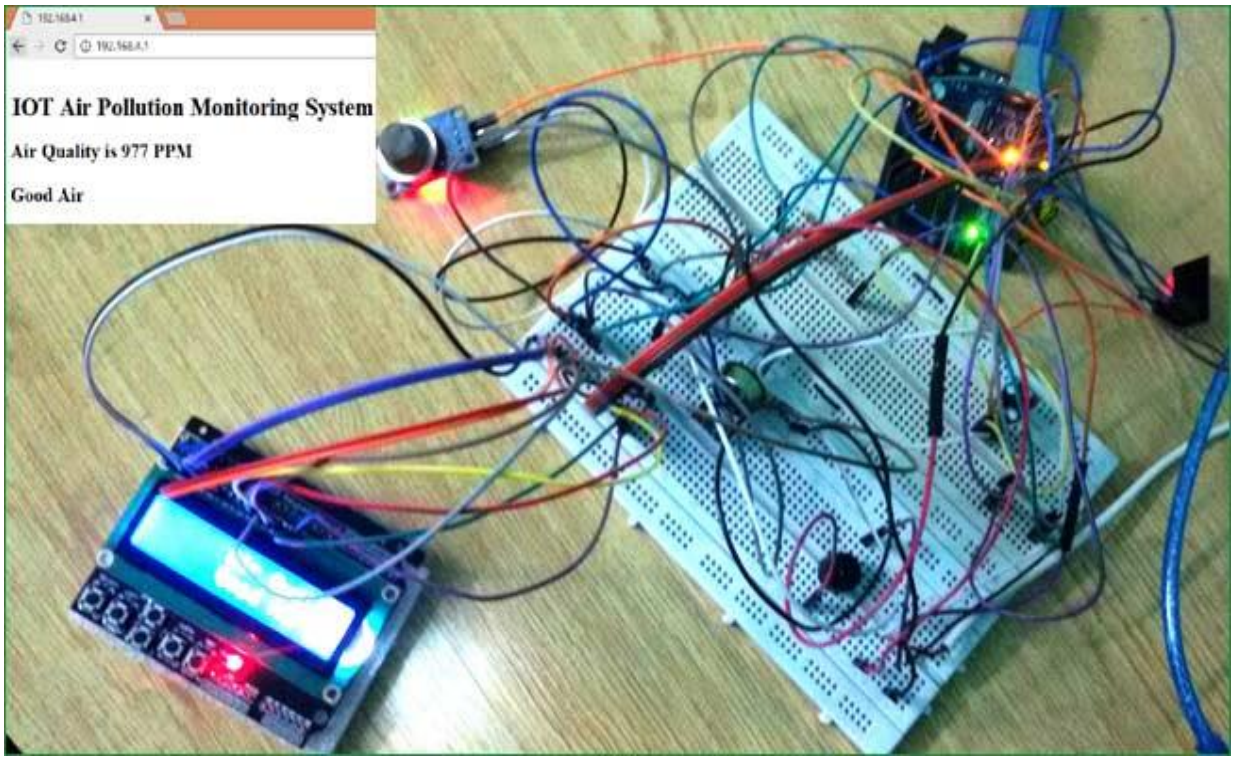
- Connect pin 12 (D5) to pin 4 of arduino
  Connect pin 13 (D6) to pin 3 of arduino
  Connect pin 14 (D7) to pin 2 of arduino

→ Connect pin to the Vcc through the 220-ohm resistor. The resistor will be used to set the back-light much darker.

→ Connect pin 16 to the ground

Circuit Diagram





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Working Explanation

The MQ135 sensor can Sense NH_3, NOx, Alcohol, Benzene, Smoke, CO_2 and some other gases. So, it is perfect gas sensor for our air quality monitoring project. When we will connect it to arduino then it will Sense the gases and we will get the pollution level in PPM (parts per million). MQ135 gas sensor gives the output in form of voltage levels and we need to convert it into PPM. So, for converting the output in PPM, here we used a library for MQ135 Sensor.

Sensor was giving value of 90 when there was no gas near it and the safe level of air quality is 350PPM and it shouldn't exceed 1000PPM. When it exceeds the limit of 2000PPM, then it starts cause headaches, sleepiness and stagnant, stale, stuffy air and if exceeds beyond 2000PPM then it can cause increased heart rate and many other diseases.

When the value will less than 1000 PPM then the LCD and webpage will display "Fresh Air". When ever the value will increase 1000PPM then the buzzer will start beeping and LCD and webpage will display "poor air, Open windows". If it will increase 2000 then the buzzer will keep beeping and LCD and webpage will display "Danger! Move to fresh air".

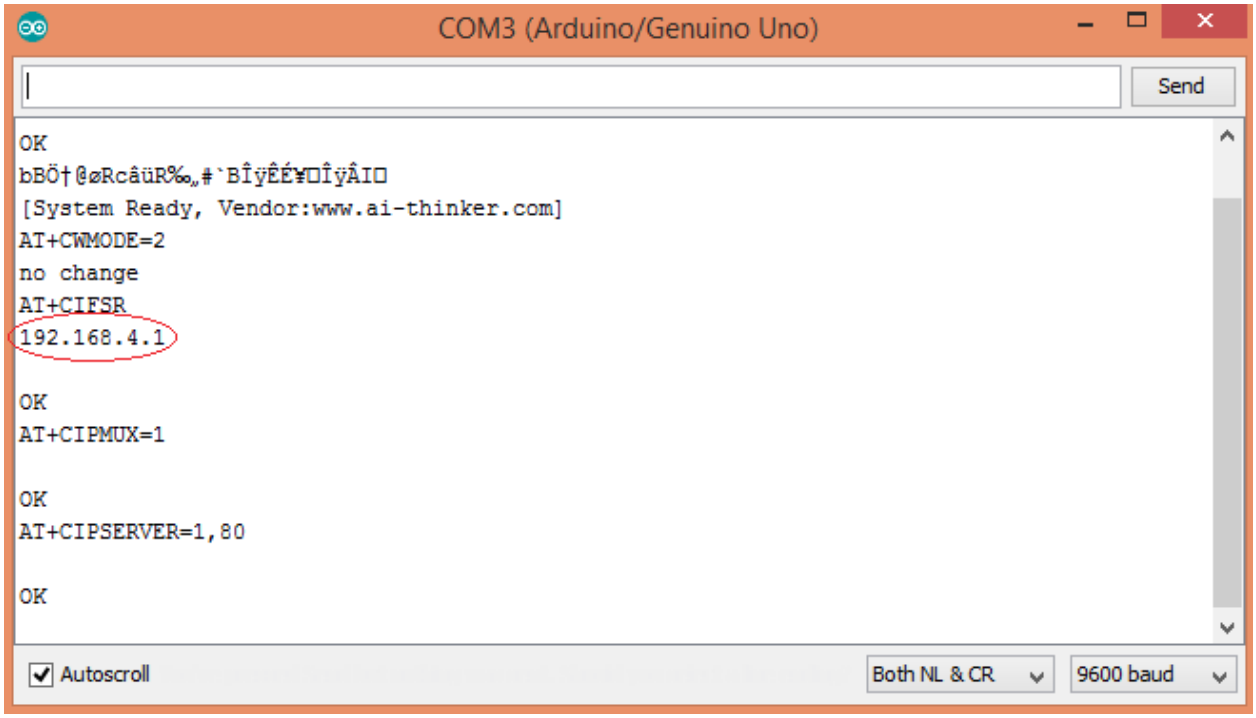
CODE-

```
MQ135 gasSensor = MQ135(A0);
float air_quality = gasSensor.getPPM();
#include "MQ135.h"
void setup (){
Serial.begin (9600);
}
void loop() {
MQ135 gasSensor = MQ135(A0); // Attach sensor to pin A0
float rzero = gasSensor.getRZero();
Serial.println (rzero);
delay(1000);
}
#include <SoftwareSerial.h>
#define DEBUG true
SoftwareSerial esp8266(9,10);
#include <LiquidCrystal.h>
LiquidCrystal lcd(12,11, 5, 4, 3, 2);
const int sensorPin= 0;
int air_quality;
pinMode(8, OUTPUT);
lcd.begin(16,2);
lcd.setCursor (0,0);
lcd.print ("circuitdigest ");
lcd.setCursor (0,1);
lcd.print ("Sensor Warming ");
delay(1000);
Serial.begin(115200);
esp8266.begin(115200);
  sendData("AT+RST\r\n",2000,DEBUG);
  sendData("AT+CWMODE=2\r\n",1000,DEBUG);
  sendData("AT+CIFSR\r\n",1000,DEBUG);
  sendData("AT+CIPMUair_quality=1\r\n",1000,DEBUG);
  sendData("AT+CIPSERVER=1,80\r\n",1000,DEBUG);
pinMode(sensorPin, INPUT);
```

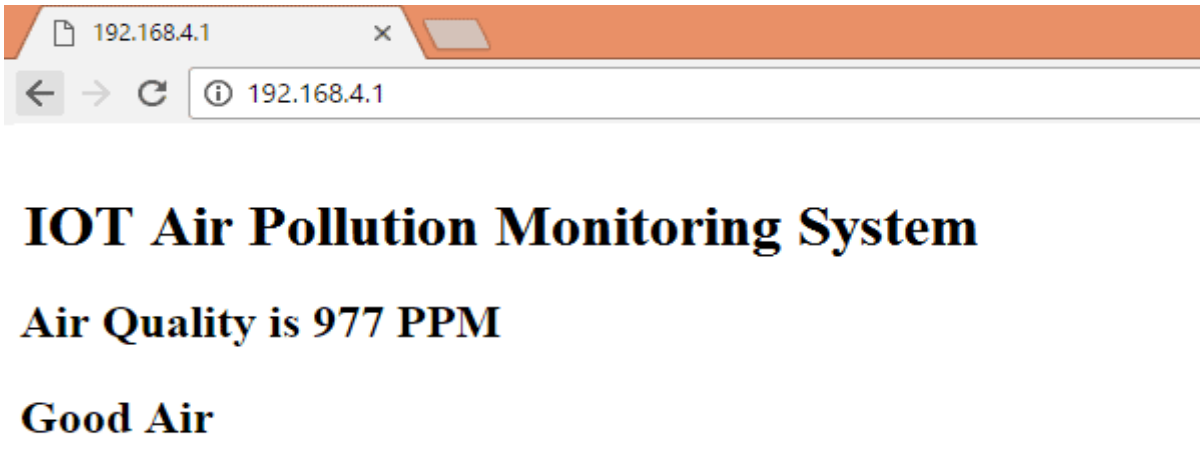
```
lcd.clear();
if(esp8266.available())
  {
    if(esp8266.find("+IPD,"))
    {
     delay(1000);
     int connectionId = esp8266.read()-48;
     String webpage = "<h1>IOT Air Pollution Monitoring System</h1>";
       webpage += "<p><h2>";
       webpage+= " Air Quality is ";
       webpage+= air_quality;
       webpage+=" PPM";
       webpage += "<p>";
sendData(cipSend,1000,DEBUG);
     sendData(webpage,1000,DEBUG);

     cipSend = "AT+CIPSEND=";
     cipSend += connectionId;
     cipSend += ",";
     cipSend +=webpage.length();
     cipSend +="\r\n";
lcd.setCursor (0, 0);
lcd.print ("Air Quality is ");
lcd.print (air_quality);
lcd.print (" PPM ");
lcd.setCursor (0,1);
if (air_quality<=1000)
{
lcd.print("Fresh Air");
digitalWrite(8, LOW);
String sendData(String command, const int timeout, boolean debug)
{
    String response = "";
    esp8266.print(command); // send the read character to the esp8266
    long int time = millis();
    while( (time+timeout) > millis())
    {
      while(esp8266.available())
      {
        // The esp has data so display its output to the serial window
        char c = esp8266.read(); // read the next character.
        response+=c;
      }
    }
    if(debug)
    {
      Serial.print(response);
    }
    return response;
}
```

Output-



Type this IP address in your browser, it will show you the output as shown below. You will have to refresh the page again if you want to see the current Air Quality Value in PPM.



DECLARATION

I had already submitted the hard copy of final report of my project before Holi holidays i.e. before 6th of march 2020. I reserved my seat to return to the university on 14th of march 2020 by night train but on the same day due COVID-19 pandemic university had declared holidays up to 31st march 2020 and due to seriousness of this pandemic our honourable PM declared total lockdown through out the country and due this university finally declared summer vacations up to 3rd week of the June 2020. So, I could not provide required survey, photos and videos related to my project. And I am sorry for that and I am requesting you to consider my project favourably.