PROJECT TITLE: AIR QUALITY MONITORING

Phase 5: Project Documentation & Submission

INTRODUCTION:

The fundamental target of IoT air quality Monitoring System is that the Air contamination is a rising issue nowadays. It is obligatory to screen air quality and monitor it for a more beneficial future and solid living for all. Web of things (IoT) is picking up prominence step by step as it can change life making it simpler for people.
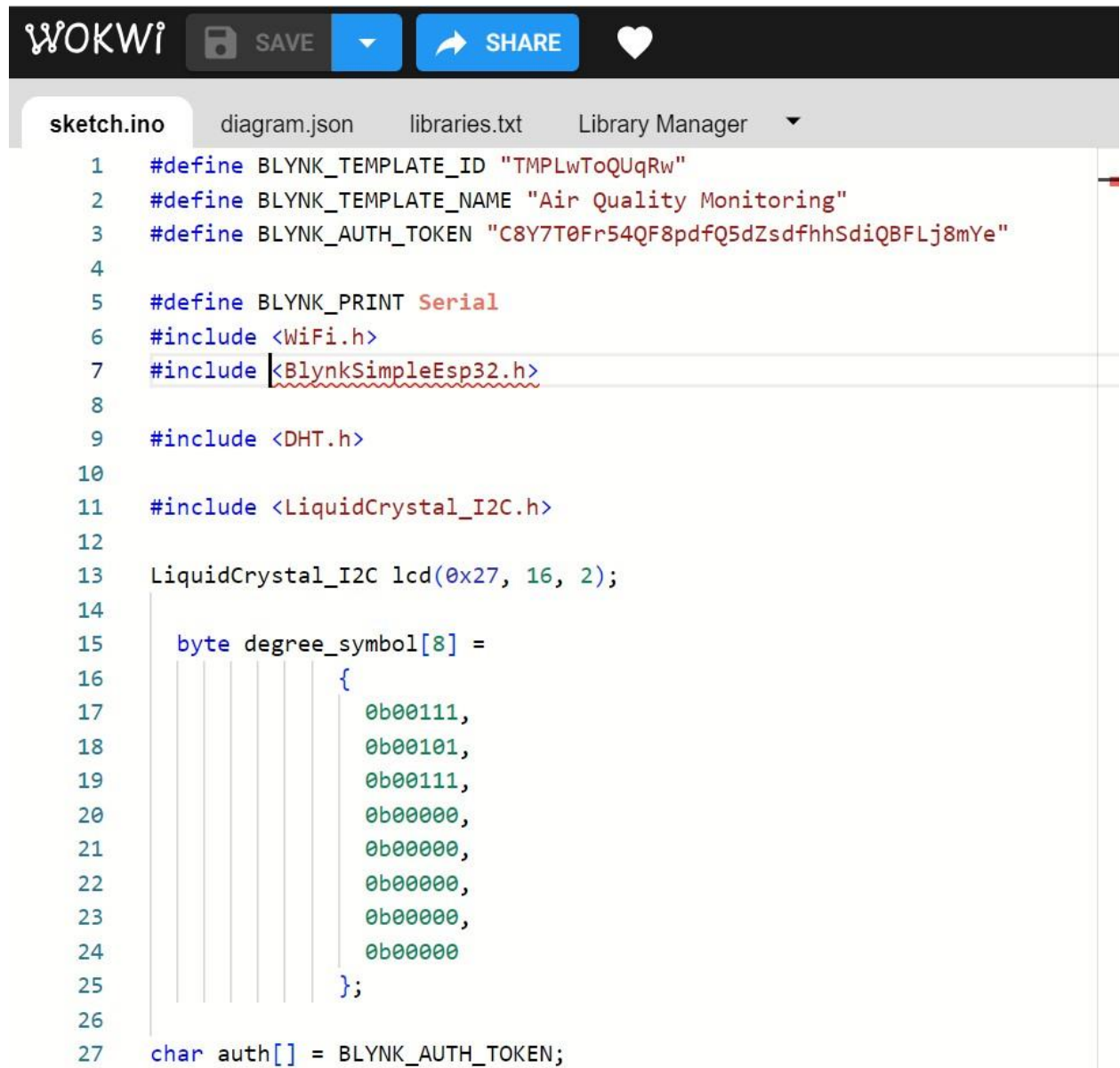
In this project we can measure air quality by using *Raspberry pi*, temperature and humidity sensor, gas sensor, dust sensor. Sensors have been used to detect the presence of harmful gases/compounds, which are continually transmitted to a controller. Air quality monitoring and controlling system is proposed in this project, which enable us to monitor and check real time quality or the air temperature, humidity in specific region through IOT . In this project we can also control the quality of air pollution by using air filtering which absorb the carbon in the air and produce a fresh air.

OBJECTIVES:

> Main objective of this project is to get a clean pure air. In this project will be designing a device which can detect air pollution in the environment.
> This IoT devices will be having microcontroller as well as air quality sensor charges mq2 sensor. This IoT device will be continuously monitoring air quality and upload the data to server.
> We will make a air purifier which works on dry air purifier concept. This air purifier will be started once the air quality has been

decreased.oncetheairqualityhasbeenrestoredthisairpurifier will be switched off.

CODE:

```
WOKWI    SAVE  ▾    → SHARE    ♥

sketch.ino    diagram.json    libraries.txt    Library Manager  ▾

1    #define BLYNK_TEMPLATE_ID "TMPLwToQUqRw"
2    #define BLYNK_TEMPLATE_NAME "Air Quality Monitoring"
3    #define BLYNK_AUTH_TOKEN "C8Y7T0Fr54QF8pdfQ5dZsdfhhSdiQBFLj8mYe"
4
5    #define BLYNK_PRINT Serial
6    #include <WiFi.h>
7    #include <BlynkSimpleEsp32.h>
8
9    #include <DHT.h>
10
11   #include <LiquidCrystal_I2C.h>
12
13   LiquidCrystal_I2C lcd(0x27, 16, 2);
14
15     byte degree_symbol[8] =
16                    {
17                       0b00111,
18                       0b00101,
19                       0b00111,
20                       0b00000,
21                       0b00000,
22                       0b00000,
23                       0b00000,
24                       0b00000
25                    };
26
27   char auth[] = BLYNK_AUTH_TOKEN;
```

```
29    char ssid[] = "WiFi Username";   // type your wifi name
30    char pass[] = "WiFi Password";   // type your wifi password
31
32    BlynkTimer timer;
33
34    int gas = 32;
35    int sensorThreshold = 100;
36
37    #define DHTPIN 2 //Connect Out pin to D2 in NODE MCU
38    #define DHTTYPE DHT11
39    DHT dht(DHTPIN, DHTTYPE);
40
41
42    void sendSensor()
43    {
44
45
46      float h = dht.readHumidity();
47      float t = dht.readTemperature(); // or dht.readTemperature(true) for
48
49
50        if (isnan(h) || isnan(t)) {
51      Serial.println("Failed to read from DHT sensor!");
52      return;
53    }
54     int analogSensor = analogRead(gas);
55    Blynk.virtualWrite(V2, analogSensor);
```

```
54      int analogSensor = analogRead(gas);
55    Blynk.virtualWrite(V2, analogSensor);
56    Serial.print("Gas Value: ");
57      Serial.println(analogSensor);
58    // You can send any value at any time.
59    // Please don't send more that 10 values per second.
60      Blynk.virtualWrite(V0, t);
61      Blynk.virtualWrite(V1, h);
62
63      Serial.print("Temperature : ");
64      Serial.print(t);
65      Serial.print("    Humidity : ");
66      Serial.println(h);
67
68
69  }
70  void setup()
71  {
72
73    Serial.begin(115200);
74
75    //pinMode(gas, INPUT);
76    Blynk.begin(auth, ssid, pass);
77    dht.begin();
78    timer.setInterval(30000L, sendSensor);
79
80    //Wire.begin();
81      lcd.begin();
```

```
78    timer.setInterval(30000L, sendSensor);
79
80  //Wire.begin();
81    lcd.begin();
82
83
84  //  lcd.backlight();
85   // lcd.clear();
86    lcd.setCursor(3,0);
87    lcd.print("Air Quality");
88    lcd.setCursor(3,1);
89    lcd.print("Monitoring");
90    delay(2000);
91    lcd.clear();
92    }
93
94  void loop()
95  {
96    Blynk.run();
97    timer.run();
98   float h = dht.readHumidity();
99    float t = dht.readTemperature(); // or dht.readTemperature(true) for
100     int gasValue = analogRead(gas);
101    lcd.setCursor(0,0);
102    lcd.print("Temperature ");
103    lcd.setCursor(0,1);
104    lcd.print(t);
```
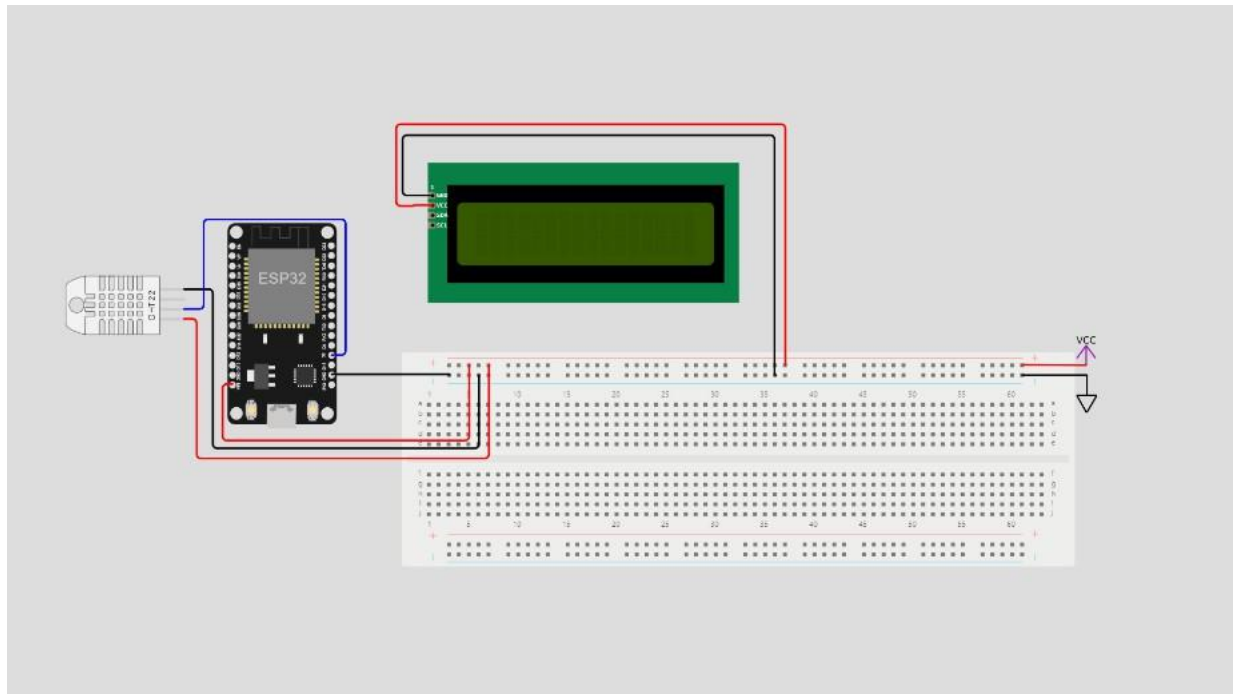
```arduino
105    lcd.setCursor(0,1);
106    lcd.write(1);
107    lcd.createChar(1, degree_symbol);
108    lcd.setCursor(7,1);
109    lcd.print("C");
110    delay(4000);
111    lcd.clear();
112    lcd.setCursor(0, 0);
113    lcd.print("Humidity ");
114    lcd.print(h);
115    lcd.print("%");
116    delay(4000);
117    lcd.clear();
118    //lcd.setCursor(0,0);
119    // lcd.print(gasValue);
120    // lcd.clear();
121    Serial.println("Gas Value");
122    Serial.println(gasValue);
123    if(gasValue<1200)
124    {
125       lcd.setCursor(0,0);
126       lcd.print("Gas Value: ");
127       lcd.print(gasValue);
128       lcd.setCursor(0, 1);
129       lcd.print("Fresh Air");
130       Serial.println("Fresh Air");
131       delay(4000);
132       lcd.clear();
```

```
129        lcd.print("Fresh Air");
130        Serial.println("Fresh Air");
131        delay(4000);
132        lcd.clear();
133      }
134      else if(gasValue>1200)
135      {
136        lcd.setCursor(0,0);
137        lcd.print(gasValue);
138        lcd.setCursor(0, 1);
139        lcd.print("Bad Air");
140        Serial.println("Bad Air");
141        delay(4000);
142        lcd.clear();
143      }
144
145       if(gasValue > 1200){
146        //Blynk.email("shameer50@gmail.com", "Alert", "Bad Air!");
147        Blynk.logEvent("pollution_alert","Bad Air");
148      }
149    }
```

SETUP:

PROJECTDESCRIPTION:

MQ135sensorcansenseNH3,NOx,alcohol,Benzene,smoke,CO2and some other gases, so it is perfect gas sensor for our Air Quality Monitoring System. When we will connect it to Arduino then it will sense the gases,and wewillget the Pollution level in PPM (parts per million).MQ135gassensorgivestheoutputinformofvoltagelevels and we need to convert it into PPM. So for converting the output in PPM,herewehaveusedalibraryforMQ135sensor,itisexplainedin detail in "Code Explanation" section below.

Sensorwasgivingusvalueof90whentherewasnogasnearitandthe safe levelof air quality is 350 PPM anditshould not exceed 1000PPM. Whenitexceedsthelimitof1000PPM,thenitstartscauseHeadaches, sleepiness and stagnant, stale, stuffy air and if exceeds beyond 2000 PPM then it can cause increased heart rate and many other diseases. Whenthevaluewillbelessthan1000PPM,thentheLCDandwebpage will display "Fresh Air".

Whenever the value will increase 1000 PPM, then the buzzer will start beeping and the LCD and webpage will display "Poor Air, Open Windows".Ifitwillincrease2000thenthebuzzerwillkeepbeepingand the LCD and webpage will display "Danger! Move to fresh Air".

Thecodehasbeencomputedsuccessfully.Itisuserfriendly,andhad required options, which can be utilized by the user to perform the desiredoperationsThecodeneedtobedumpedintheArduinoIDE software. The goals that are achieved by the code.

- Lessnumberofhumaninvolvement

- Efficientmanagementofwaterusage

- Costeffective

PYTHONCODE:

```python
from MQ135 import MQ135
import serial
import time
import RPi.GPIO as GPIO
import Adafruit_DHT
import requests

GPIO.setmode(GPIO.BCM)
GPIO.setwarnings(False)

DHT_SENSOR = Adafruit_DHT.DHT11
DHT_PIN = 4

MQ135_PIN = 17

GPIO.setup(MQ135_PIN, GPIO.IN)

ser = serial.Serial('/dev/ttyS0', 9600, timeout=1)

def sendData(command, timeout, debug):
    ser.write(command.encode('utf-8'))
    if debug:
        print('Sent: ' + command)
    time.sleep(timeout / 1000)
    while ser.inWaiting() > 0:
        if debug:
            print('Response: ' + ser.readline().decode('utf-8').strip())

def readDHT():
    humidity, temperature = Adafruit_DHT.read_retry(DHT_SENSOR, DHT_PIN)
    return humidity, temperature

def readMQ135():
    return GPIO.input(MQ135_PIN)
```

```python
def sendToServer(air_quality):
    url = 'http://your_server_url'
    data = {'air_quality': air_quality}
    response = requests.post(url, data=data)
    print(response.text)

def setup():
    sendData('AT+RST\r\n', 2000, True)
    sendData('AT+CWMODE=2\r\n', 1000, True)
    sendData('AT+CIFSR\r\n', 1000, True)
    sendData('AT+CIPMUX=1\r\n', 1000, True)
    sendData('AT+CIPSERVER=1,80\r\n', 1000, True)

def loop():
    air_quality = readMQ135()
    sendToServer(air_quality)
    time.sleep(1)

if __name__ == '__main__':
    setup()
    while True:
        loop()

webpage = "<h1>IOT Air Pollution Monitoring System</h1>"
webpage += "<p><h2>"
webpage += " Air Quality is "
webpage += str(air_quality)
webpage += " PPM"
webpage += "<p>"
if air_quality <= 1000:
    webpage += "Fresh Air"
elif air_quality <= 2000 and air_quality >= 1000:
    webpage += "Poor Air"
elif air_quality >= 2000:
```

```python
        webpage += "Danger! Move to Fresh Air"
webpage += "</h2></p></body>"
cipSend = "AT+CIPSEND="
cipSend += str(connectionId)
cipSend += ","
cipSend += str(len(webpage))
cipSend += "\r\n"
sendData(cipSend, 1000, DEBUG)
sendData(webpage, 1000, DEBUG)
cipSend = "AT+CIPSEND="
cipSend += str(connectionId)
cipSend += ","
cipSend += str(len(webpage))
cipSend += "\r\n"
closeCommand = "AT+CIPCLOSE="
closeCommand += str(connectionId)
closeCommand += "\r\n"
sendData(closeCommand, 3000, DEBUG)

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)
elif air_quality >= 1000 and air_quality <= 2000:
    lcd.print("Poor Air, Open Windows")
    digitalWrite(8, HIGH)
elif a
lcd.print("Danger! Move to Fresh Air")
digitalWrite(8, HIGH)    # turn the LED on
```

```
lcd.scrollDisplayLeft()
delay(1000)

def sendData(command, timeout, debug):
    response = ""
    esp8266.print(command)  # send the read character to the esp8266
    time = millis()
    while (time + timeout) > millis():
        while esp8266.available():
            # The esp has data so display its output to the serial window
            c = esp8266.read()  # read the next character.
            response += c
    if debug:
        Serial.print(response)
    return response
```
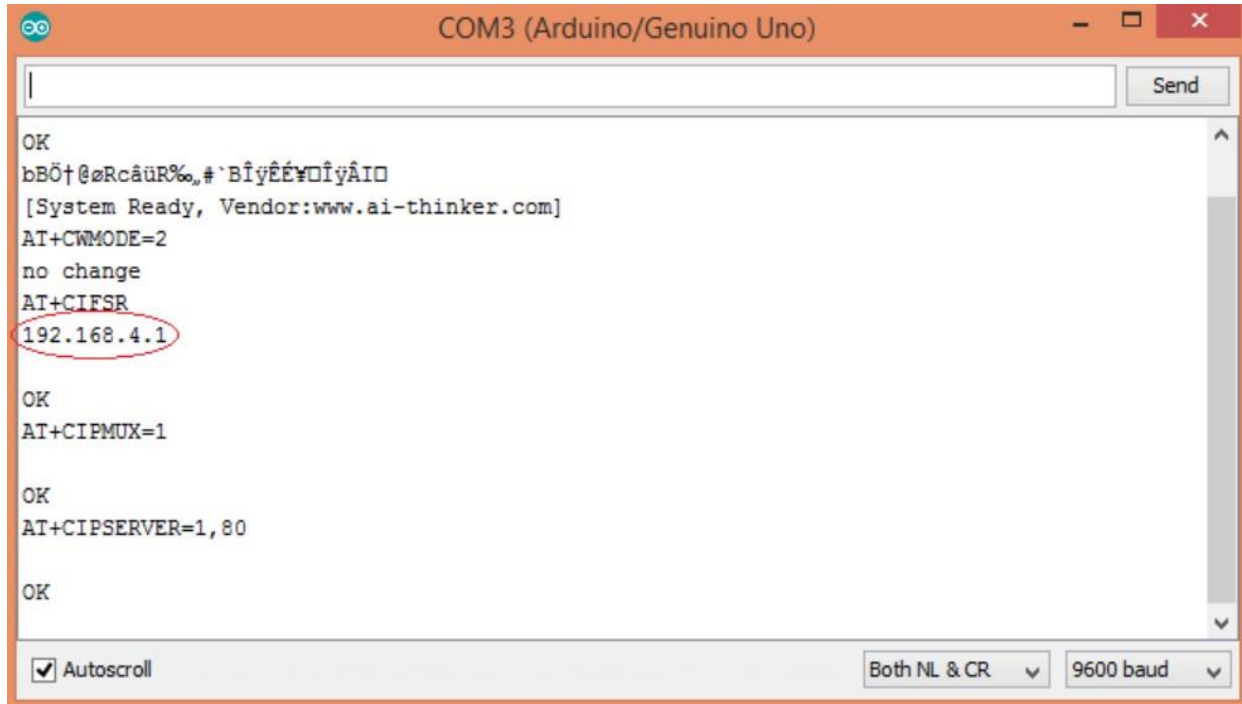
TestingandOutputoftheProject:

Beforeuploadingthecode,makesurethatyouareconnectedtotheWi- Fi of your ESP8266 device. After uploading, open the serial monitor and it will show the IP address like shown below.

The critical got the opportunity to screen air quality is very obvious, in light of expanded mechanical exercises over the previous years. Individuals got the chance to perceive the degree that their exercises affect air quality [4]. This undertaking proposes air contamination observing framework. The framework was created utilizing the Arduino microcontroller.Thecontaminationrecognitionframeworkwasintended towatchanddissectairqualityinperiodandlogdatatoafarawayserver, keeping the data refreshed over the net.

Type this IP address in your browser, it will show you the output as shownbelow.Youwillhavetorefreshthepageagainifyouwanttosee the current Air Quality Value in PPM.
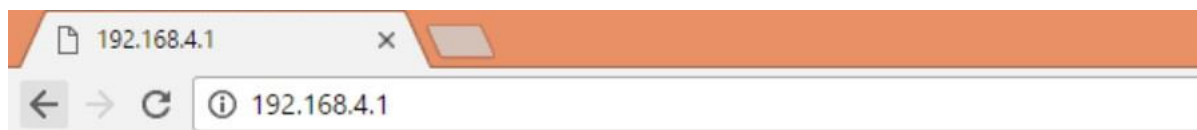
IOT Air Pollution Monitoring System

## Air Quality is 977 PPM

Good Air

Wehavesetupalocalservertodemonstrateitsworking,youcancheck the **Video** below. But to monitor the air quality from anywhere in the world, you need to **forward the port 80 (used for HTTP or internet) to your local or private IP address** (192.168*) of you device. After port forwardingalltheincomingconnectionswillbeforwardedtothislocal address and you can open above shown webpage by just entering the publicIPaddressofyourinternetfromanywhere.Youcanforwardthe port by logging into your router (192.168.1.1) and find the option to setuptheportforwarding.

OVERVIEW:

ThisShowsthecompletesetupoftheAirQualityMonitoringSystem Basedon the IotUsing Raspberry pi that contains Mq-2 Gas sensor , Mq-7 Gas Sensor and Mq-135 Gas Sensor and finally placed on the board for easy to use and Convince
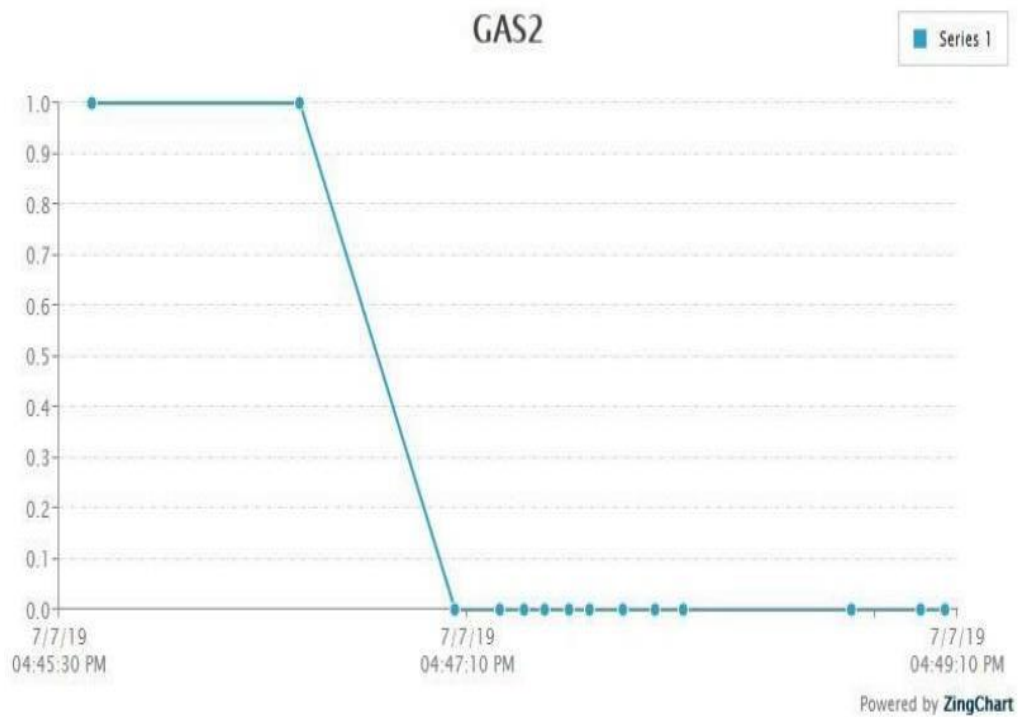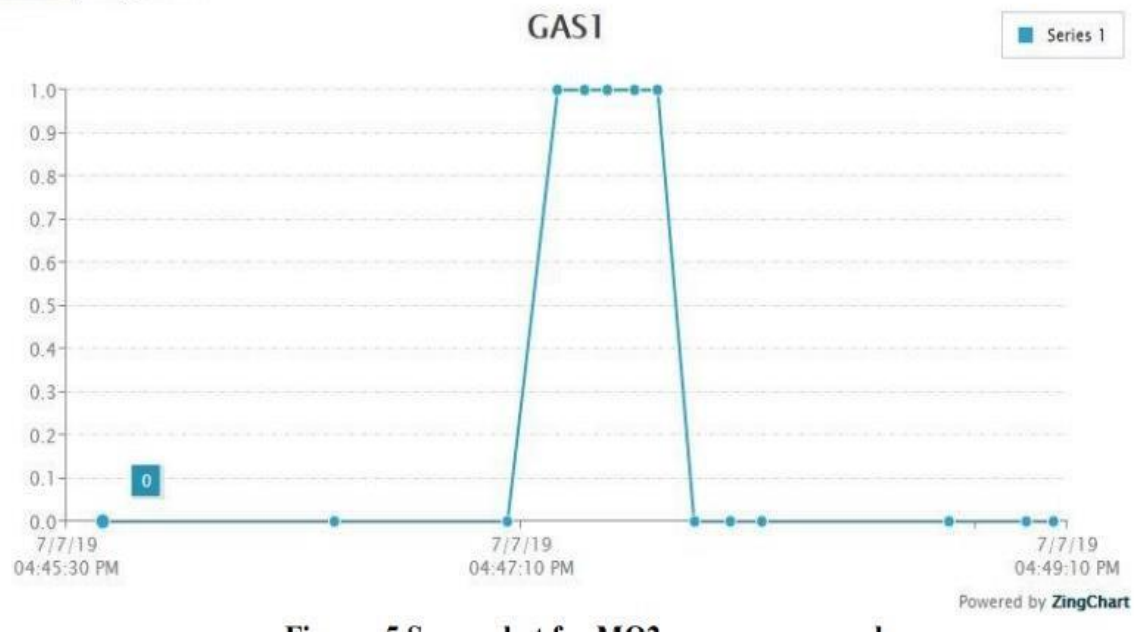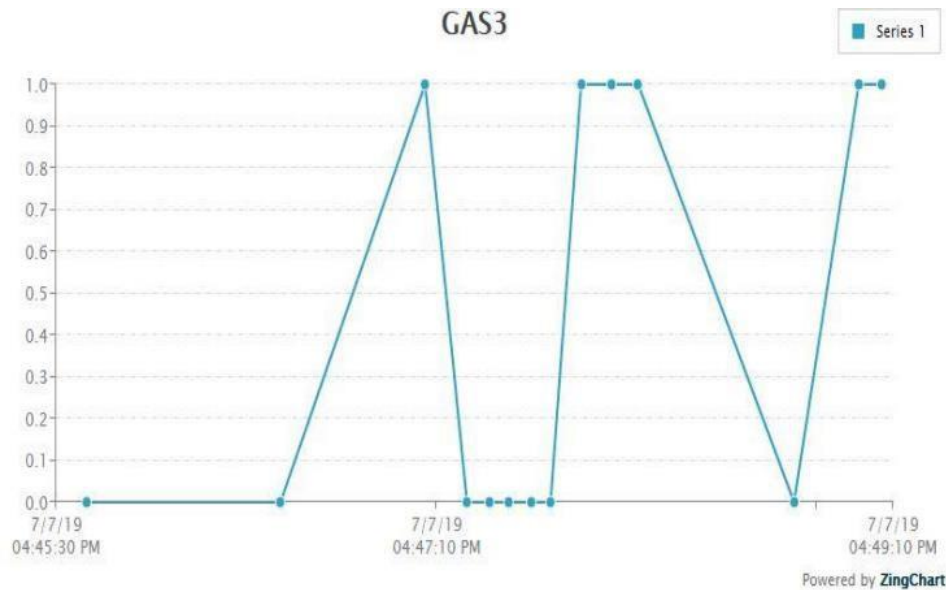
GAS1

Figure 5 Screenshot for MQ2 gas sensor graph

GAS2
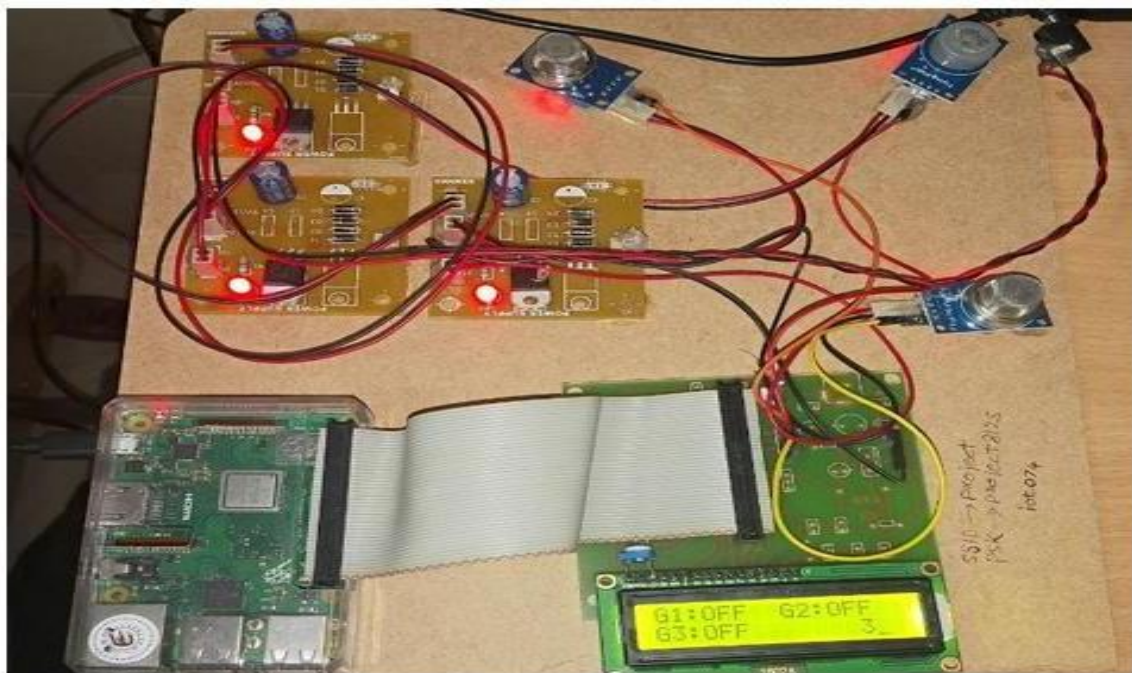
APPLICATIONS:

- **Preventsmogdangers:**Thisisoneofthemostimportantreasons why people use the air pollution control.
- **Protecttheirhealth:**Thisispartofthereasonwhymostpeople install the air pollution control. Most of these chemicals could damagethelungs.
- **Improvetheirindoorairquality:**Peopleuseittoimprovetheair when they are indoors.

ADVANTAGES:

- **Airpollutioncontrolhelpstoprotectthehumanhealth:**Toevery human on earth, health is wealth; health is paramount for the runningofourdaytodayactivities,withoutwhichwewouldhave to rely on others to live. Air Pollution Scrubber Suppliers come to help protect our health, which is very valuable.

- **Airpollutioncontrolhelpspreventeconomicwastes**:Withair pollutioncontrol,thewastesaccruedfromdeadcropsandbad water will be limited or stopped.
- **Increasedworkerproductivity:**Nomatterhowstrongthe immunesystemis,therearetimeswhenitfails,especiallywhen thereisexcessairpollution.Aspollutioniscontrolled,workerscan now work for a longer period of time.
- **Helpsimproveindoorairquality:**Airpollutioncontrolhelpsto secure the quality of the air inside your house.
- **Preventsmogdangers:**Thisisoneofthemostimportantreasons why people use the air pollution control. Smog can be very hazardous,whichiswhyairpollutioncontrolshouldbeinstalledat an early stage to prevent smog.
- **Protecttheirhealth:**Thisispartofthereasonwhymostpeople install the air pollution control. Most of these chemicals could damagethelungs.
- **Improvetheirindoorairquality:**Peopleuseittoimprovetheair when they are indoors.

CONCLUSION:

Inthisproject,theintegratedIoTairqualitymonitoringsystemis developedtoovercometheissuesinairquality.Thesensorsmainly sense the various dangerous gases present in the environment. Safetyeffortscanbeupgradedtosecuretheinformationthatis beingsentthroughthesegmentsbypresentingnewconventions.

Theairmonitoringsystemcanhelpintheinnovationofnew practices to overcome the problems of the highly-polluted areas, whichisamajorissue.Itsupportsthenewtechnologyandeffectively supports the healthy life concept.