# ABSTARCT

This project deals with measuring Air Quality using MQ135 sensor.Measuring Air Quality is an important element for bringing IoT of awareness in the people to take care of the future generations a healthier life.Based on this,Government of India has already taken certain measures to ban ‘Single Stroke’ and ‘Two Stroke’ engine based motorcycles which are emitting high pollutions comparatively.This paper attemps to develop an effective solution for pollution monitoring using sensor on a real time basis.Already,New Delhi is remarked as the most pollution city in the world recording Air Quality above 300PPM(Parts Per Million).We have corrected the other papers where they have wrongly calibarated the sensor and wrongly projecting the PPM values.We have also used easiest platform like ‘Cool Term’.Also,we have reduced the cost of components used on comparing with the papers reffered where we can collect reliable source of real time fine-grain pollution data.

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# CHAPTER 1

## INTRODUCTION

**A**ir is getting polluted because of release of toxic gases by industries, vehicle emissions and increased concentration of harmful gases and particulate matter in the atmosphere. The level of pollution is increasing rapidly due to factors like industries, urbanization, increasing in population, vehicle use which can affect human health. Particulate matter is one of the most important parameter having the significant contribution to the increase in air pollution [1]. This creates a need for measurement and analysis of real time air quality monitoring so that appropriate decisions can be taken in a timely period. This paper presents a real-time standalone air quality monitoring. Internet of Things is nowadays finding profound use in each and every sector, plays a key role in our air quality monitoring system too. The setup will show the air quality in PPM in webpage so that we can monitor it very easily. In this IOT project, you can monitor the pollution level from anywhere using your computer or mobile [2]. The setup will show the air quality in PPM in webpage so that we can monitor it very easily. In this IOT project, you can monitor the pollution level from anywhere using your computer or mobile. Air condition is much polluted. In recent years, car emissions, chemicals from factories, smoke and dust are everywhere. That is the reason why now air condition is much polluted. The effect of air pollution is very bad for our health, especially for place where the air in our body is taken for breathing. In our lungs may cause some diseases, such as asthma, cough, lung disorders [3].The air pollution cannot be detected by human feelings. The air pollution may contain a lot of dangerous substances, such as LPG gas, carbon monoxide, and methane [4]. Substances in the polluted air are very dangerous. For example, if the carbon monoxide is above 100ppm, it makes human feel dizzy, nauseous, and within minutes they could die.

## 1.1 About Internet of Things (IOT)

The **Internet of things** (**IOT**) describes physical objects (or groups of such objects) with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. Internet of things has been considered a misnomer because devices do not need to be connected to the public internet, they only need to be connected to a network and be individually addressable.

The field has evolved due to the convergence of multiple technologies, including ubiquitous computing, commodity sensors, increasingly powerful embedded systems, as well as machine learning. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), independently and collectively enable the Internet of things.[10] In the consumer market, IOT technology is most synonymous with products pertaining to the concept of the "smart home", including devices and appliances (such as lighting fixtures, thermostats, home security systems, cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers. IOT is also used in healthcare systems.

# CHAPTER 2

# LITERATURE SURVEY

The difficulty of the conventional monitoring instruments is their large size, heavy weight and extraordinary costlier. These lead to inadequate deployment of the monitoring stations. In order to be effective, the locations of the monitoring stations need careful placement because the air pollution situation in urban areas is highly related to human activities.

## 2.1 IOT Based Air Pollution Monitoring System:

In India Air pollution is the biggest problem of every nation, whether it is developed or developing. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants. 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. According to survey, due to air pollution 50,000 to 100,000 premature deaths per year occur in the U.S. alone. Whereas in EU number reaches to 300,000 and over 3,000,000 worldwide. IOT Based Air Pollution Monitoring System monitors the Air quality over a web server using Internet and when there are sufficient amount of harmful gases present in the air l. It will show the air quality in PPM on the LCD and as well as on webpage so that it can monitor it very easily.

## 2.2 Air Quality Monitoring System IEE paper:

High population and urbanization growth rate raises the issue of air pollution in recent years. Air quality monitoring is one of the major concerns due to its influence on human health. With the advancement in sensing and embedded technology, Internet of Things (IOT) becomes one of the economic alternatives to implement air quality monitoring system (AQMS)compared to costly and fixed air quality monitoring stations. In this paper we present the ample review of candidate enabling technology for IOT based AQMS architecture. Specifically, we start with overview of major low-cost air pollutant sensors classification, typical error sources and calibration methodologies. Then we present analysis and comparative study of infrastructure protocols and application layer protocols to support IOT based architecture for AQMS. We also review existing system and categorized them based on deployment strategy employed. Finally, challenges involved in building such systems are discussed in detail.

# CHAPTER 3

## EXISTING SYSTEM

Nowadays, the air condition is much polluted. In recent year's cars, emission, chemicals from factories smoke, and dust are everywhere. That is the reason why now air condition is much polluted. The effect of air pollution is very bad for our health, especially for a place where the air in our body is taken for breathing. Air pollution cannot be detected by human feelings. Air pollution may contain a lot of dangerous substances. The existing system used a wireless sensor network with Arduino Uno and gas sensor. Which made it complex and costly. These devices were may be and not economical to install at many places. Periodically collection of data was difficult.

### 3.1 Disadvantages of existing system

- **Cost**: Air quality monitoring equipment and technology can be expensive to purchase and maintain.
- **Limited coverage:** Air quality monitoring equipment can only be placed in certain locations and may not provide a comprehensive view of the overall air quality.
- **Data interpretation:** Interpreting the data collected by air quality monitoring equipment can be complex and requires trained personnel.
- **False readings:** Air quality monitoring equipment can be affected by factors such as humidity and temperature, leading to false readings.
- **Maintenance:** Air quality monitoring equipment requires regular maintenance and calibration to ensure accurate readings.
- **Limited to certain pollutants:** Different types of air quality monitoring equipment are needed to measure different pollutants, such as particulate matter and gases, which can be costly.
- **Power source:** Some air quality monitoring equipment require a power source and may not be feasible in remote locations.

# CHAPTER 4

## PROPOSED SYSTEM

In recent years, the environmental problems have become considerably big issues throughout the world. For knowing the environmental problems, we have to measure the environment quality and get the data by monitoring the environment. Currently there are many researches are going on in this area. Those researches are using big and expensive environmental measurement equipment. In this reason, they cannot install enough equipment to measure micro-scale area. The senor data are displayed in PPM (parts per million) value.

### 4.1 Advantages of proposed system

- **Identification of sources of pollution:** Air quality monitoring can help identify the sources of pollution, such as factories, power plants, and transportation, so that appropriate measures can be taken to reduce emissions.
- **Compliance with regulations:** Air quality monitoring can be used to ensure compliance with national and international air quality standards.
- **Protection of public health:** Air quality monitoring can help protect public health by identifying and addressing sources of pollution that can cause respiratory and other health problems.
- **Planning and policy-making:** Air quality monitoring can provide data that can be used for planning and policy-making, such as for transportation and land-use planning.
- **Improving air quality:** By identifying sources of pollution and implementing measures to reduce emissions, air quality monitoring can help improve air quality overall.

## 4.2 System Architecture

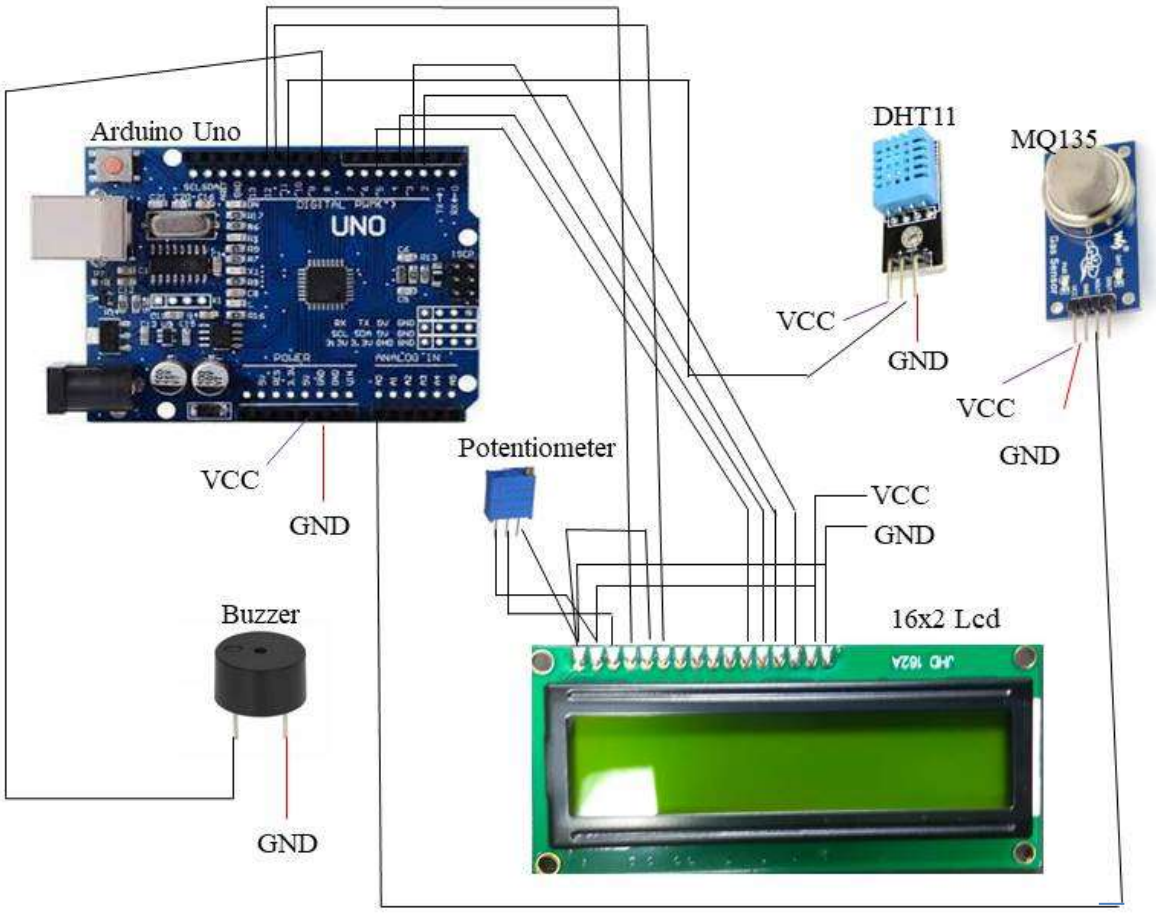



**Fig 4.2: Air Quality Monitoring and Alert System Architecture**

# CHAPTER 5

## SYSTEM DESIGN

The system architecture specifies the full operation of the air quality monitoring system, where MQ-135 sensor are a family of sensor which are used to detect a wide variety of gases like hydrogen, smoke. We use DTH11 sensor for sensing humidity and temperature. The board is equipped with set of digital and analog inputs/outputs pins that may be interfaced to various expansion boards and other circuits and it consists of 16x2 LCD it is a basic 16 character by 2 line display in yellow/green backlight. Potentiometer which is an instrument used for measuring the unknown voltage with known voltage, and a buzzer used for audio signaling devices in monitoring system.

## 5.1 Requirement Analysis

**Hardware Requirements:**

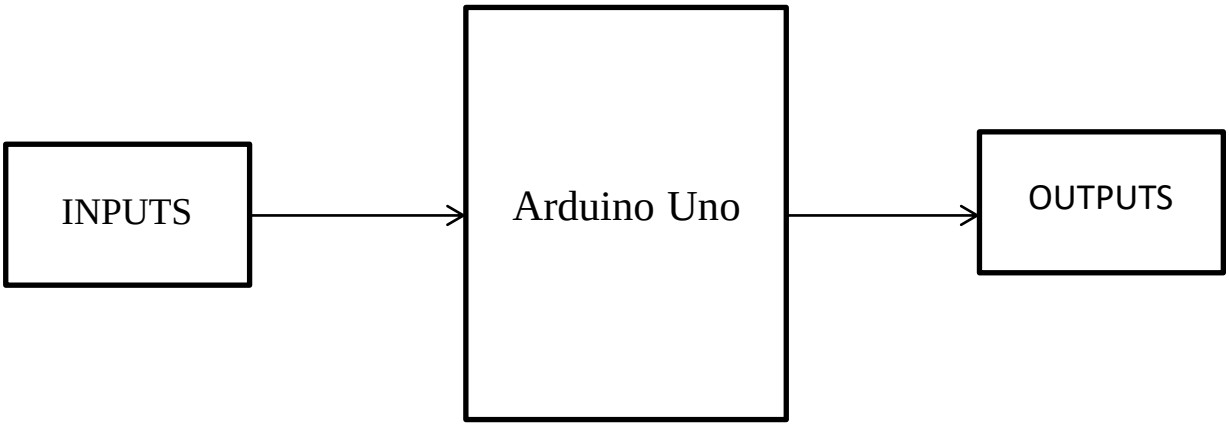
- Arduino Uno Board
- DHT11 sensor
- MQ135 sensor
- 16x2 LCD
- Potentiometer
- Buzzer
- Breadboard
- Jumper wires
- Windows 10
- 16 GB RAM

**Software Requirements:**

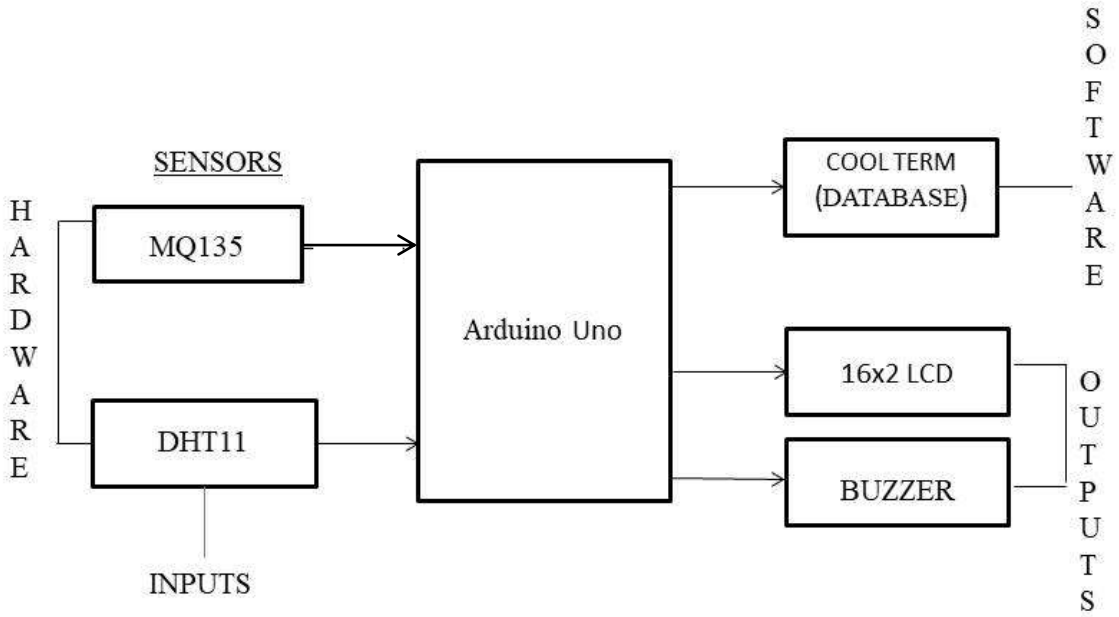
- Arduino IDE
- Cool Term

## 5.2 Data Flow Diagram

### Level 0




### Level 1



# CHAPTER 6

## CODING

```
#include <SimpleDHT.h>
#include <LiquidCrystal.h>      //Header file for LCD
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2; //pins of LCD connected to Arduino
LiquidCrystal lcd(rs, en, d4, d5, d6, d7); //lcd function from LiquidCrystal

int buz = 8;  //buzzer connected to pin 8
int pinDHT11 = 10;
SimpleDHT11 dht11;


const int aqsensor = A0;  //output of mq135 connected to A0 pin of Arduino
int threshold = 200;      //Threshold level for Air Quality

void setup() {

  pinMode (buz, OUTPUT);    // buzzer is connected as Output from Arduino
  pinMode (aqsensor, INPUT); // MQ135 is connected as INPUT to arduino

  Serial.begin (9600);      //begin serial communication with baud rate of 9600

  lcd.clear();              // clear lcd
  lcd.begin (16, 2);        // consider 16,2 lcd
}

void loop() {

  int ppm = analogRead(aqsensor); //read MQ135 analog outputs at A0 and store it in ppm

  Serial.print("Air Quality: ");  //print message in serail monitor
  Serial.println(ppm);           //print value of ppm in serial monitor


  lcd.clear();

 lcd.setCursor(0, 0);            // set cursor of lcd to 1st row and 1st column
  lcd.print("Air Quality: ");      // print message on lcd
  lcd.print(ppm);                // print value of MQ135

  if (ppm > threshold)            // check is ppm is greater than threshold or not
  {
    lcd.setCursor(1, 1);        //jump here if ppm is greater than threshold
    lcd.print("AQ Level HIGH");
    Serial.println("AQ Level HIGH");
```

```
    digitalWrite(buz, HIGH);    //Turn ON Buzzer
   }
   else
   {
    digitalWrite(buz, LOW);  //Turn off Buzzer
    lcd.setCursor(1, 1);
    lcd.print ("AQ Level Good");
    Serial.println("AQ Level Good");
   }
   delay (4000);
   byte temperature = 0;
   byte Humidity = 0;
   int err = SimpleDHTErrSuccess;

   if ((err = dht11.read(pinDHT11, &temperature, &Humidity, NULL)) !=
SimpleDHTErrSuccess)
   {
    delay(1000);
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("ERROR");
    return;
   }
   lcd.clear();
   lcd.setCursor(0, 0);
   lcd.print("temp: ");
   lcd.print((int)temperature);
   lcd.print((char)233);
   lcd.print("C");
   Serial.print("temperature: ");
   Serial.println(temperature);


   lcd.setCursor(0, 1);
   lcd.print("Humidity: ");
   lcd.print((int)Humidity);
   lcd.print("%");
   Serial.print("Humidity: ");
   Serial.println(Humidity);
   delay(3000);

  }
```

# CHAPTER 7

# TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of the components, sub-assemblies, assemblies and /or a finished product.it is the process of exercising software with the intent of ensuring that the software system meets its requirements and user expectations and does not fail in an unacceptable manner. The system has been verified and validated by running the test data and live data.

## 7.1 Types of Testing

1. Unit testing
2. Integration testing
3. Validation testing
4. System testing
5. Acceptance testing

1. **Unit Testing:**

   Unit testing involves the design of test cases that validate that the internal program logic functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application.

2. **Integration testing:**

   Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

3. **Validation Testing:**

   To uncover functional errors, that is, to check whether functional characteristics confirm to specification or not specified.

4. **System Testing:**

   System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration-oriented system integration test. System is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

5. **Acceptance Testing:**

   When the system has no measure with its accuracy. The system passes through a final acceptance test. This test confirms that the system needs the original goal, objective and requirements established during analysis. If the system fulfills all the requirements and ready for operations.

## 7.2 Testing Results

| RUN | EXPECTED DATA | ACTUAL DATA | RESULT |
|---|---|---|---|
| | < > **200** | **195** | **Pass** |
| | | **250** | **Fail** |

**Test Results:** All the test cases mentioned above passed successfully. No defects encountered

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# CONCLUSION

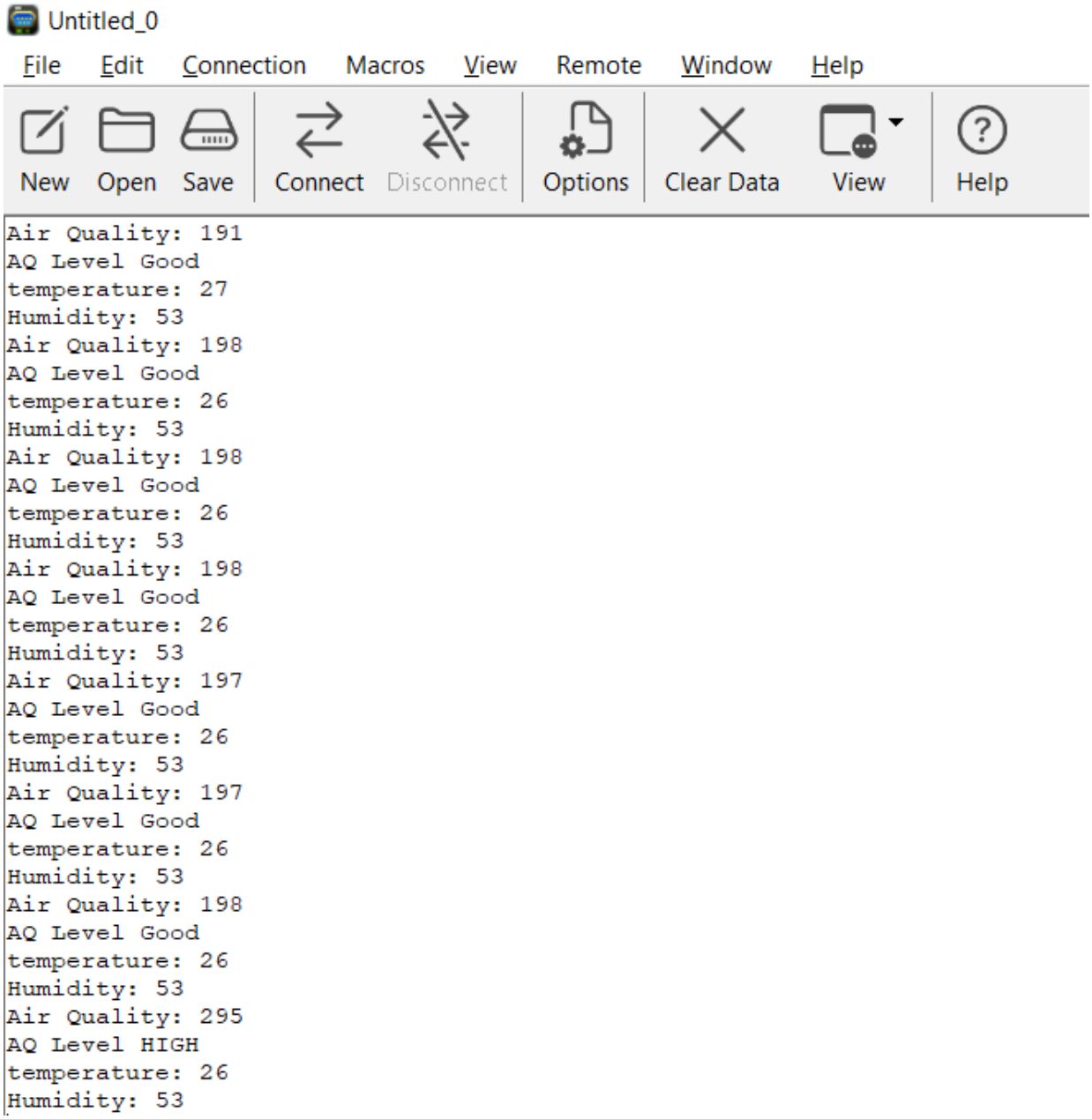
In conclusion, air quality monitoring is an essential tool for understanding and addressing air pollution. The advantages of air quality monitoring, such as identification of sources of pollution, compliance with regulations, protection of public health, and planning and policy-making, are crucial for promoting clean air and protecting public health. However, it also has some disadvantages, such as cost, limited coverage, data accuracy, limited understanding, public awareness, and compliance monitoring. Despite these challenges, air quality monitoring remains a crucial aspect of efforts to improve air quality and protect public health. It is important for government agencies, organizations, and individuals to continue to invest in and support air quality monitoring systems and to use the data collected to inform effective solutions to improve air quality.

# FUTURE ENHANCEMENT

Air quality monitoring system is developed for human beings to achieve maximum efficiency in monitoring air quality. It is an affordable product which has a good scope in the future as the world is witness sudden climate changes. This device may help to monitor air quality and take quick decisions.

# SCREENSHOTS

**1.**



# REFERENCES

[1] Monitoring System Based On Frequency Hopping System 2010 IEEE.

[2] Pollution Monitoring Viatomography".Vol.4/ March 1979 /

[3] OPTICS LETTERS.

[4] Yajie Ma, Mark Richards, Moustafa Ghanem, Yike Guo, And John

[5] Hassard, "Air Pollution Monitoring And Mining Based On Sensor"

[6] Array For Air Pollution Monitoring, Sensors Journal, IEEE,

[7] Vol.10, No.10, Pp.1666, 1671, Oct. 2010.

[8] Raja Vara Prasad Y1, Mirza Sami Baig2, Rahul K. Mishra3, P.

[9] www.google.com

[10] www.youtube.com

[11] www.github.com