DELHI TECHNOLOGICAL UNIVERSITY
(Formerly Delhi College of Engineering)
Bawana Road, Delhi-110042

Air Quality Monitoring System

Submitted by:

Neha Chawla(2K20/CE/98)

Nidhi Yadav(2K20/CE/99)

Under the Supervision of

Dr. Manjeet Chhillar

Dept. of Electronics & Communication Engineering

EC-251

[Basic Electronics & Instrumentation]

August 2021 - November 2021

DELHI TECHNOLOGICAL UNIVERSITY

(FORMERLY Delhi College of Engineering)

Bawana Road, Delhi-110042

Declaration

We, Neha Chawla(2K20/CE/98) and Nidhi Yadav(2K20/CE/99), hereby certify that the work, which is presented in the Project entitled **Air Quality Monitoring System** in fulfilment of the requirement for the award of the Degree of Bachelor of Technology in Civil Engineering submitted to the Department of Basic Electronics & Instrumentation, Delhi Technological University, Delhi is an authentic record of our own, carried out under the supervision of **Dr.Manjeet Chhillar.** The work presented in this report has not been submitted and not under consideration for the award for any other course/degree of this or any other Institute/University.

Place: Delhi

Neha Chawla (2K20/CE/98)

Nidhi Yadav (2K20/CE/99)

DELHI TECHNOLOGICAL UNIVERSITY
(FORMERLY Delhi College of Engineering)
Bawana Road, Delhi-110042

Abstract

Air pollution has become a common phenomenon everywhere. Nowadays air pollution is a real-life problem and specially in the urban areas. Only because of air pollution a lot of people get sick. The main causes of air pollution is increased number of petrol and diesel vehicles in the urban areas and the presence of industrial areas at the outskirts of the major cities are. In the metropolitan cities this problem is seriously intensified. All around the world the governments are taking every measure in their capacity. Also, the impact of daily emissions of gaseous and particulate pollutants of machines and industries on human health and the environment has attracted increasing concerns.

Therefore, for a safer future air quality monitoring and creating public awareness are important.The aim of this project is to build an Air Quality Monitoring System Using Arduino in which we will monitor the Air Quality and when the air quality goes down beyond a particular level system will trigger an alarm.

DELHI TECHNOLOGICAL UNIVERSITY

(FORMERLY Delhi College of Engineering)

Bawana Road, Delhi-110042

Acknowledgement

In performing our major project, we had to take the help and guidelines of some respected persons, who deserve our greatest gratitude. The completion of this assignment gives us much pleasure. We would like to show our gratitude to Dr. Manjeet Chhillar, Mentor for major project for giving us a good guideline for the report through numerous consultations. We would also like to extend our deepest gratitude to all those who have directly and indirectly guided us in writing this assignment.

In addition, we would like to thank the Department Basic Electronics & Instrumentation, Delhi Technological University for giving us the opportunity to work on this topic.

Contents

1. Introduction

1.1 Basic Set-Up

It consists of the LCD and the Piezo Buzzer as its main output blocks, and the Gas sensor (MQ2) (as available in online tinker CAD simulators) as the input block. It also contains the potentiometer which is used on an LCD to adjust the bias level of the LCD - that is the contrast, Breadboard, Arduino Uno and resistors.

2. Component Required and Their Uses

1.Piezo Buzzer – It is used to produce an alarming sound

2.Resistor – It is used to limit the electric current flow and divide voltage in the circuit.

3.16×2 LCD – The LCD module is used for displaying the readings and the status of the design.

4.Arduino Uno – It is an open-source electronic platform or board. (Microcontroller Unit)

5.Gas Sensor (MQ2) – Gas sensors are electronic devices that detect and identify different types of gases (Sensing unit).

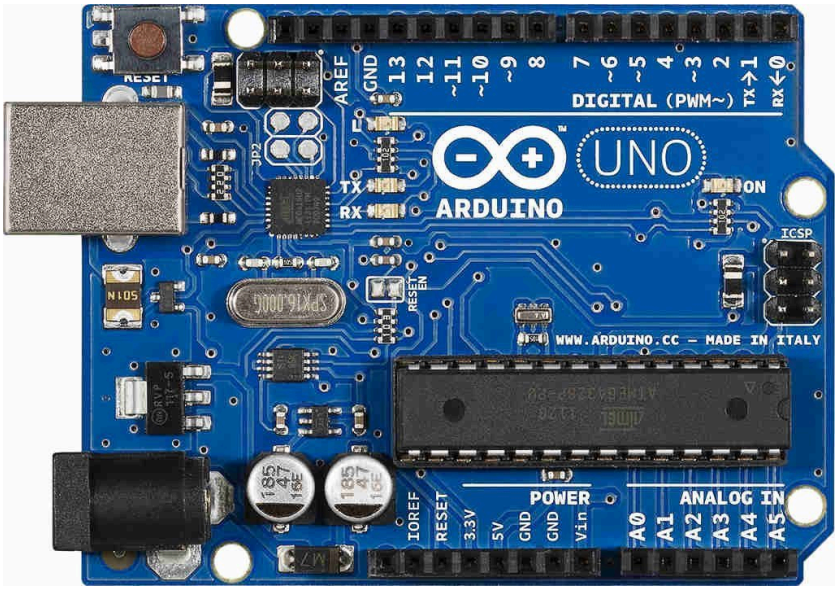
6.BreadBoard – It is used for the connecting all the components.

7.Potentiometer – It is used to adjust the bias level of the LCD - that is the contrast.

3. Function of Components

3.1 Arduino Uno

- Arduino Uno is a microcontroller in which ATmega328 microprocessor is used.



- It has analog input pins and 14 digital input or output pins which can be used as PWM (Pulse Width Modulation) output. It has its own programming language.16MHz is the crystal oscillator frequency of this microcontroller. It has USB cable which can simply connect with computer, power barrel jack, reset button and ICSP (In Circuit Serial Programming). Each pin of the Arduino Uno is operated at 5V.

- Pins (3.3, 5, GND, Vin)
- 3.3V (6) – Supply 3.3 output volt
- 5V (7) – Supply 5 output volt
- Most of the components used with Arduino board works fine with 3.3 volt and 5 volts.
- GND (8) (Ground) – There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- Vin (9) – This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.
- Analog pins
- The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.

3.2 16 × 2 LCD Monitor

- LCD stands for liquid crystal display, is an electronic device which is used for data display.

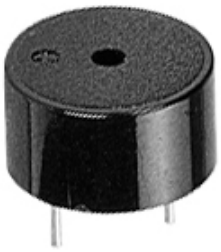
- This module has two operating modes, which are the 8-bit and 4-bit modes. Here the interface of the LCD in 4-bit mode.
- 16x2 LCD (parallel interface) with Arduino Uno
- The data display is stored in the data register whereas the command register stores the commands sent to the display. The data of the intended image are stored in the data register and the instructions in the command register to control the display.
- The contrast of the display is adjusted by using a potentiometer connected across the VEE pin.

3.3 MQ2 Gas Sensor

- For gas leakage detection in the home as well as in the industries the MQ2 module of the gas sensor is used. In the atmosphere it observes the level of gases present. Operates Voltage for this gas sensor is 5V and 800mW. When the concentration of gas increases the output voltage from the Gas sensor also increases.

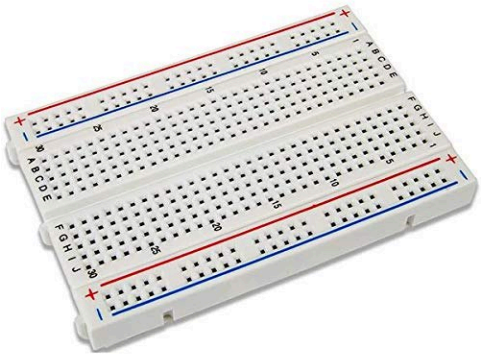
- A basic gas sensor has 6 terminals in which 4 terminals (A, A, B, B) acts input or output and the remaining 2 terminals (H, H) are for heating the coil.2 terminals of these 4 terminals from each side can be used as either input or output (as shown in the circuit diagram these terminals are reversible) and vice versa.
- The sensor observes the potential difference depending on the level of concentration and this changes the resistance of the material inside the sensor. The type of gas is given by the output voltage.
- When the concentration of the gas is above the threshold value the digital pin will go high only then. To detect the concentration of the gas the sensor will work in analog mode.

3.4 Piezo Buzzer



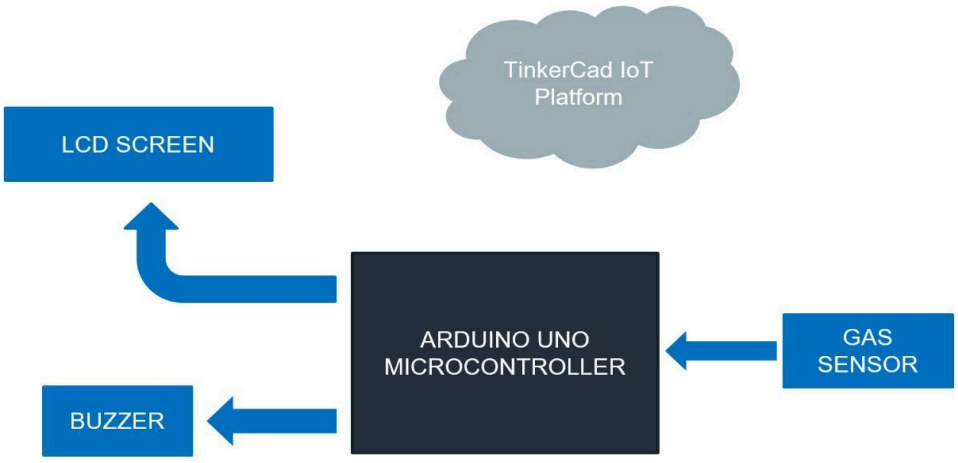
It is a type of electronic device that's used to produce a tone, alarm or sound. They work by using piezo crystal. If the crystal pushes against the diaphragm, it can generate a pressure wave which the human ear picks up the sound.

3.5 Breadboard

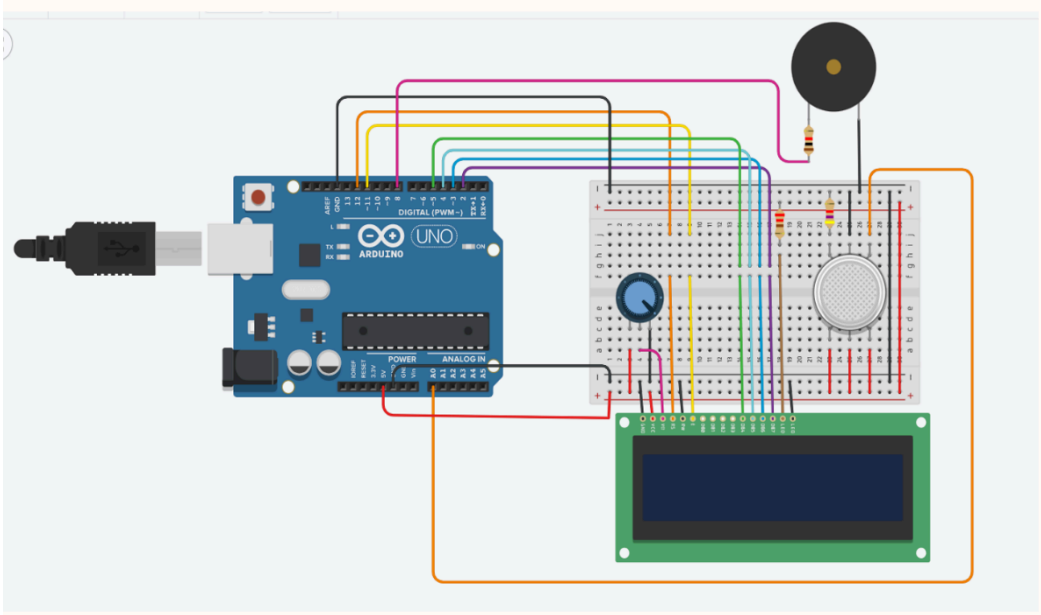


It is use to make a quick electrical connection between the components. It has many holes into which circuit components like ICs and resistors can be inserted usually without having to do any soldering.

4. Block Diagram and Circuit Diagram



Block Diagram of the system



Circuit Diagram

5. Working

5.1 Internal Working

1. The necessary Code required for the working of Arduino Uno (For whole system) can be done using Basic C or C++ Language (Using if else statement).

Code Explanation

```
include <LiquidCrystal.h>                # Library which will be needed to
                                           control the LCD

LiquidCrystal lcd(12, 11, 5 , 4, 3, 2);  # Pins which connects the
                                           arduino to the LCD

int pin8 = 8;
int analogPin = A0;                      # Variables to ease the process of
                                           controlling the arduino
int sensorValue = 0;

void setup() {
  pinMode(analogPin, INPUT);
  pinMode(pin8, OUTPUT);                 # These two command will
                                           give input to the variables
                                           that we have chosen above
  lcd.begin(16, 2);
  lcd.print("What is the air ");         # these line will display the
                                           message in the LCD
  lcd.print("quality today?");
  Serial.begin(9600);
```

```
 lcd.display();
}

void loop() {                          # loop start

 delay(1000);
 sensorValue = analogRead(analogPin);
 Serial.print("Air Quality in PPM = ");
 Serial.println(sensorValue);              # Input that is given by the
                                             sensor to the arduino

 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print ("Air Quality: ");
 lcd.print (sensorValue);

 if (sensorValue<=500)
{
 Serial.print("Fresh Air ");
  Serial.print ("\r\n");
  lcd.setCursor(0,1);
  lcd.print("Fresh Air");
  }
 else if( sensorValue>=500 && sensorValue<=650 )
  {
  Serial.print("Poor Air");
```

If else statement for the true conditioning of senor and for displaying message in the LCD.

```
  Serial.print ("\r\n");
  lcd.setCursor(0,1);
  lcd.print("Poor Air");
  }
 else if (sensorValue>=650 )
  {
  Serial.print("Very Poor Air");
  Serial.print ("\r\n");
  lcd.setCursor(0,1);
  lcd.print("Very Poor Air");
  }

 if (sensorValue >650) {
   digitalWrite(pin8, HIGH);
 }
 else {
   digitalWrite(pin8, LOW);
 }
}
```

2. MQ2 gas sensor is connected with the Arduino and the Bottom three terminals (B1, H2, B2) of the sensor are connected to the 5V and top two terminals (A1 and H1) are connected to the ground pin of the Arduino and the Analog pin of sensor(A2) is connected to the A0 of the Arduino to give the output of the sensor. When it will be connected to Arduino then it will sense concentration of

gas, and it will give the Pollution level in PPM. (Parts per million). MQ2 gas sensor will give the output in form of voltage levels and we have to convert it into PPM. **So, for converting the output in PPM, we have used a library for MQ2 gas sensor.**

Variable resistor is used to adjust the output voltage and to maintain high sensitivity.

3. The LCD is connected to the microcontroller. The LCD is connected with the Arduino as follows

Pin 1(VEE) is connected to the ground.

Pin 2 (VCC) is connected to the 5V of Arduino which is the power source of LCD.

Pin 3 (V0) is connected to the middle terminal of the 10KΩ potentiometer and the other two ends of the potentiometer is connected to the VCC pin and the GND pin of the terminal. To control the screen contrast of the LCD potentiometer is used.

Pin 4 (RS pin means Register select pin) is connected to the pin 12 of the Arduino.

Pin 5 (Read/Write) to the ground pin of the Arduino. We will connect it to the ground because it is not often used.

Pin 6 (E- Enable pin) is connected to the pin 11 of the Arduino. Here to send data and characters, control pins (RS and E) are used.

Four pins (11,12,13 and 14) are data pins which are used to communicate with the Arduino.

- pin 11 (D4) is connected to digital pin 5 of Arduino.
- pin 12 (D5) is connected to digital pin 4 of Arduino.
- pin 13 (D6) is connected to digital pin 3 of Arduino.
- pin 14 (D7) is connected to digital pin 2 of Arduino.

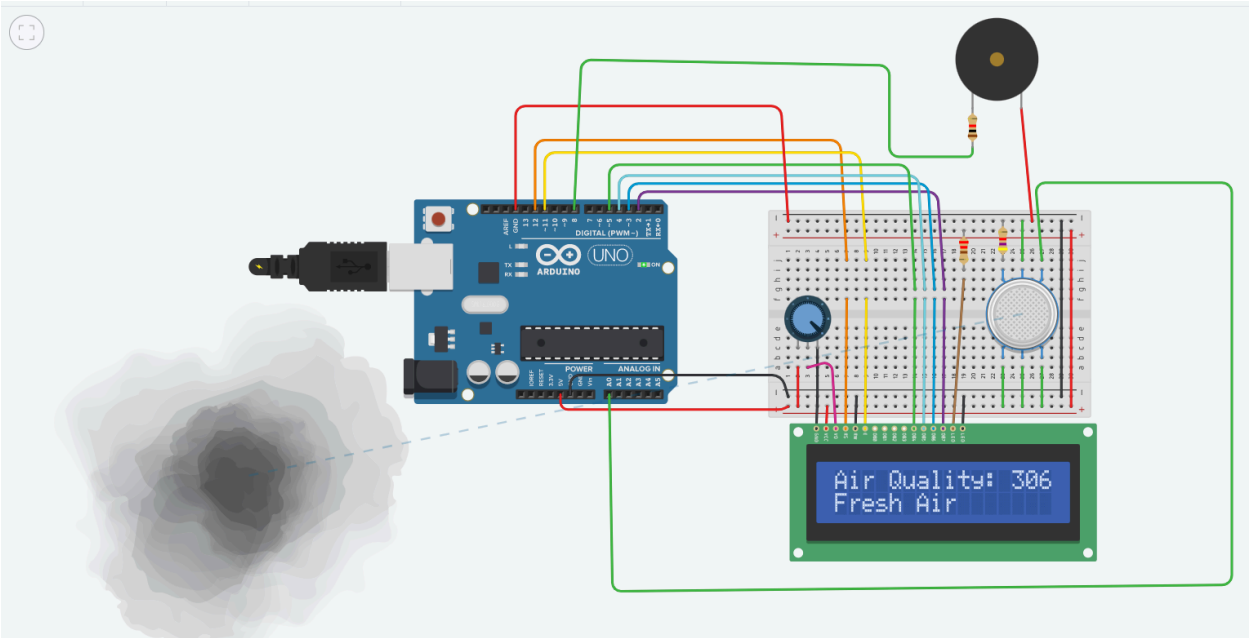
Pin 15 is connected to the VCC pin through the 220-ohm resistor this resistor will be used to set the back light brightness. And pin16 is connected to the Ground pin of Arduino.

4. And the buzzer is connected to the pin 8 of the Arduino which will start to beep when the condition becomes true.

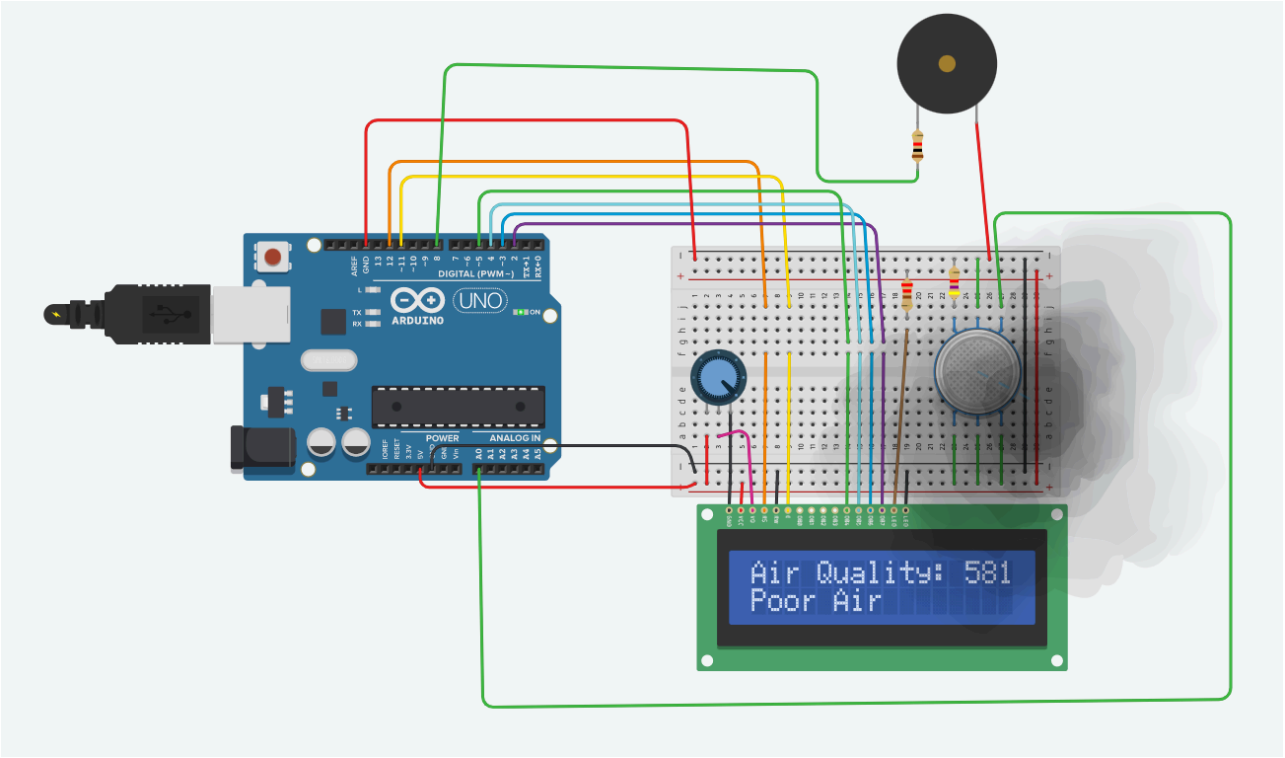
5.2 External Working and Simulation Result

Now the Sensor is given a safe air level value of 350PPM and it should not exceed 650PPM.

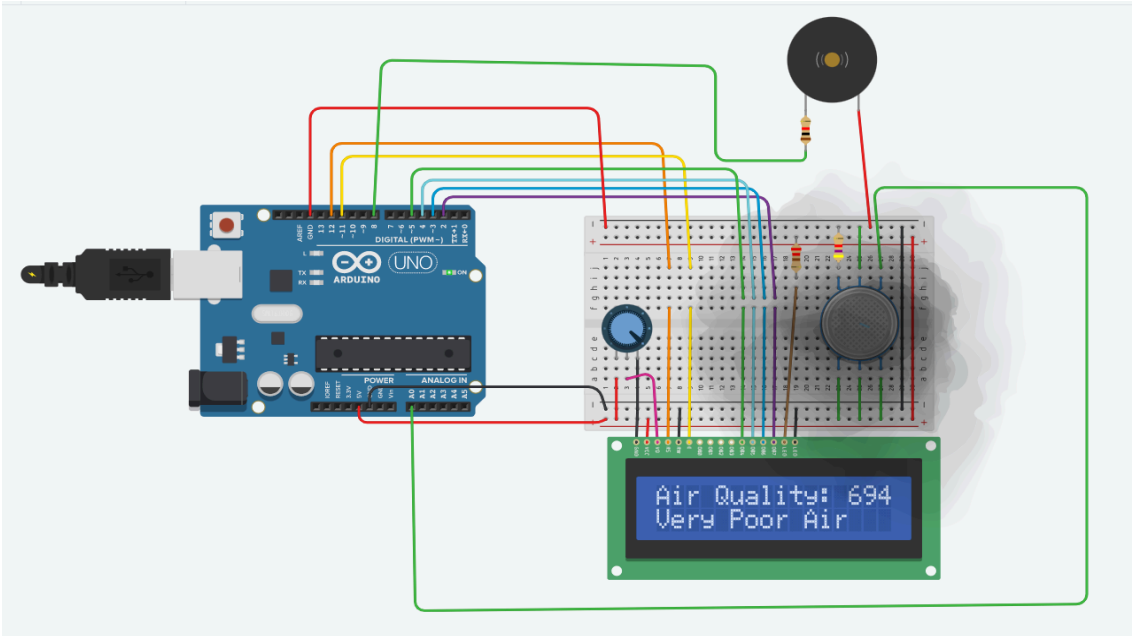
1.When the value will be less than 500PPM, then the LCD webpage will display “Fresh Air”.



2. When the value will increase 500 PPM, the LCD webpage will display “Poor Air”.



3. And whenever the value will increase 650 PPM then the buzzer will start beeping and the LCD and webpage will display “Very Poor Air,”.



- **Tinker CAD Link for the Simulation of Air Quality Monitoring System**

  https://www.tinkercad.com/things/86ynAsLQNFy-air-quality-monitoring-system/editel

- **Simulation Video link**

  https://drive.google.com/file/d/1H0fni62PuYgpcmd4VpC2LF1NyECjsacs/view?usp=sharing

6. Advantages

1. The data collected from air quality monitoring helps us assess impacts caused by poor air quality on public health.
2. Sensors are easily available.
3. Simple, compact, easy to handle.
4. Sensors have long life and less cost.
5. Quality of air can be checked indoor as well as outdoor.
6. To overcome the issues of toxic gas poisoning in the surroundings, the development of an air quality monitoring system capable of providing notification updates on the air quality levels is very important.

7. Future Scope

- Interface a greater number of sensors to know detail content of all gases present in air.
- Design Webpage and upload data on webpage with the data and time Interface.

- Interface GPS module to detect the air quality or air concentration at exact location and upload on the webpage for people.

8. Applications

- It can be used as Indoor and outdoor air quality monitoring.
- Gas Detection (Industrial perimeter monitoring)
- Roadside pollution monitoring.
- To make this data available to common man

9. Conclusion

The project proposed a smart air pollution monitoring system that constantly keeps track of air quality in an area and displays the air quality measured on an LCD screen the system helps to make awareness of the standard (Quality) of air that one breathes daily. This monitoring device can deliver real-time Measurements of air quality. The system to monitor the air of environment using Arduino microcontroller proposed to improve quality of air.

10.References

[1] *Interface 16x2 LCD (parallel interface) with Arduino Uno.* (2020, May 2). Retrieved from create.arduino.cc: https://create.arduino.cc/projecthub/akshayjoseph666/interface-16x2-lcd-parallel-interface-with-arduino-uno-2e87e2

[2] Poonam Pal, Ritik Gupta, Sanjana Tiwari, Ashutosh Sharma (Oct, 2017). *IoT Based Air Pollution Monitoring System Using Arduino.* Retrieved from https://www.irjet.net/archives/V4/i10/IRJET-V4I10207.pdf