INDIAN INSTITUE OF INFORMATION TECHNOLOGY, UNA

(An Institute of National Importance under MoE)
Saloh, Una, Himachal Pradesh - 177209

Date: 5/12/21

PRACTICUM-III

Project Report

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Batch:	2020-2024	**Semester:**	III
Branch:	ECE	**Supervisor Name:**	Dr. Shivdutt Sharma

1. **Broad Area of the Project** (Max. 10 words)

   Arduino Based pollution measuring system. Learning Arduino UNOR3 physically and Arduino IDE.

2. **Problem Definition** (Max. 20 words)

   To design a device using the Arduino UNOR3 to measure pollution and alert when AQI is increasing.

3. **Problem Significance** (Max. 50 Words)

   Navigation and daily routine work through the unfamiliar environment remain a significant issue for people living in North India.Despite various technological advancements, very little work has been done in this domain.We all know its important to control the pollution rising every other day. The proposed system performs a way so that we can measure and keep our selves aware of the fact that this issue needs to be controlled.

4. **Solution Details (**Max. 300 words, applicable as per the below given details, should be written precisely)**:**
   i. Category I: Hardware or S/W Development Project: Details of the various modules or functionality developed by the student.

      The work is purely based on Arduino and developing a system to measure the air quality index. AQI is an index used to measure the daily level of pollution in a layman language so that it can tell us how much harmful the air is and what effects it can put on our health. The five major air pollutants are nitrogen dioxide, Sulphur dioxide, carbon monoxide ,particle pollution, ground level ozone.

MQ 135 GAS SENSOR

We will be using the MQ 135 gas sensor to measure the air quality index. This sensor helps to detect harmful gases like Sulphur, ammonia (NH3), Alcohol, Benzene etc. The sensor has wide detecting scope, due to its fast response, high sensitivity, stability and long life. It is mainly utilized in office, buildings and homes for air quality control.

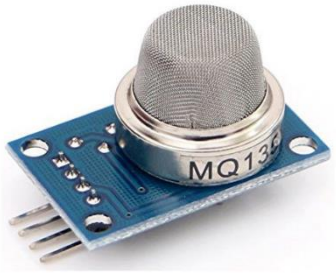
The concentration is calculated by using the following formulae,

$$R_s = \frac{V_c \times R_L}{V_{out}} - R_L$$

where V_c =5, R_s is the sensor resistance, R_L is load resistance.

$$C = [q/nV][1 - 1/ent] + (C_0 - C_i)/e^{nt} + C_i$$

C is the concentration in ppm of C_{O2}, q is emission of C_{O2} per minute. V is the volume of room. C_i is the outdoor CO2 concentration. C_0 is at time t=0.



Just like any other gas sensor MQ135 sensor has a digital and analog output pin. When the level of these gases go beyond a threshold limit in the air the digital pin goes high. This threshold value can be set by using the on-board potentiometer. The analog output pin, outputs an analog voltage which can be used to approximate the level of these gases in the atmosphere.

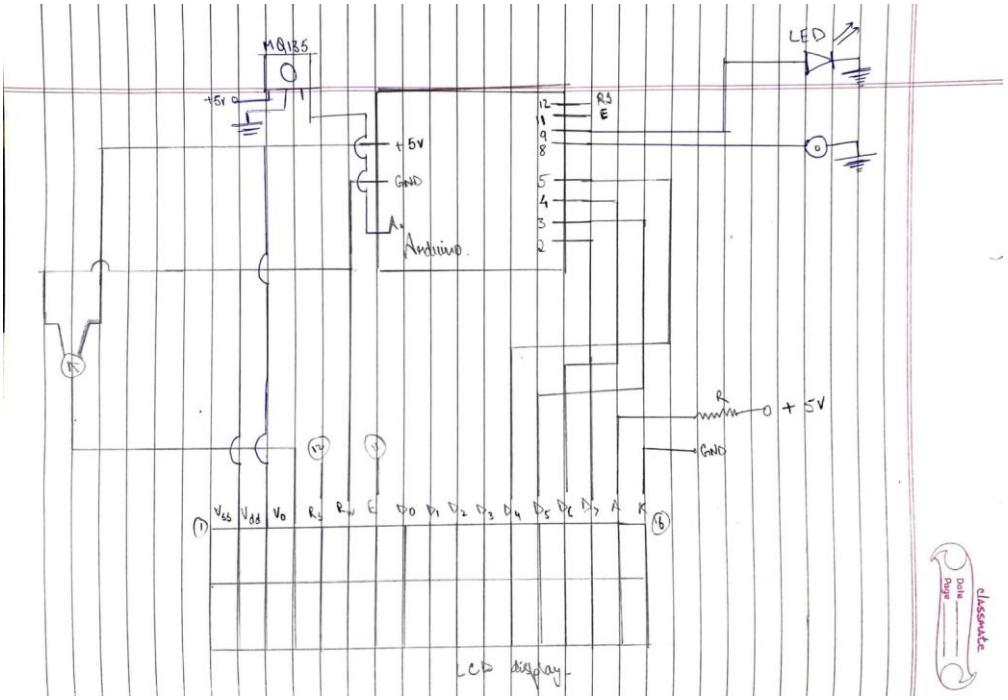
Detecting harmful gases using digital pin –

The digital output pin of the sensor can be used to detect harmful gases in the environment. The sensitivity of the digital pin can be controlled by using the 10k potentiometer. If the gas is detected the indicator LED D0 will turn on and the digital pin will go from logic high to logic low (0V). The LM393 Op -Amp Comparator IC is used to compare the actual gas value with the value set using the potentiometer. If the actual gas value increases than the set value then the digital output pin gets low.

Calculating PPM value using analog pin-
The Analog output pin of the sensor can be used to measure the PPM value of the required gas. To do this we need to use an external microcontroller like Arduino. The microcontroller will measure the value of analog voltage and perform some calculations to find the value of Rs/Ro where Rs is the sensor resistance when gas is present and Ro is sensor resistance at clean air. Once we find this ratio of Rs/Ro we can use it to calculate the PPM value of required gas using the graph below which is taken from the datasheet of MQ135 Sensor.

Project Kit –
Components used – Arduino UNOR3, Breadboard, Jumper Wires (Male-to-male, Male-to-female), LEDs, LCD Display, Resistors(220Ω,2KΩ),MQ 135 sensors. The code for Arduino is provided in the link below.

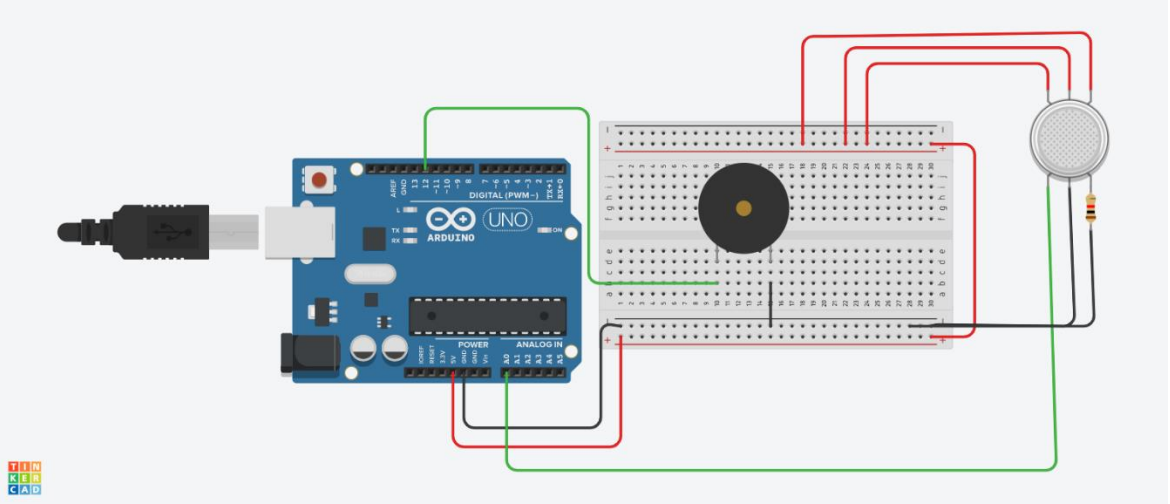
Block Diagram –

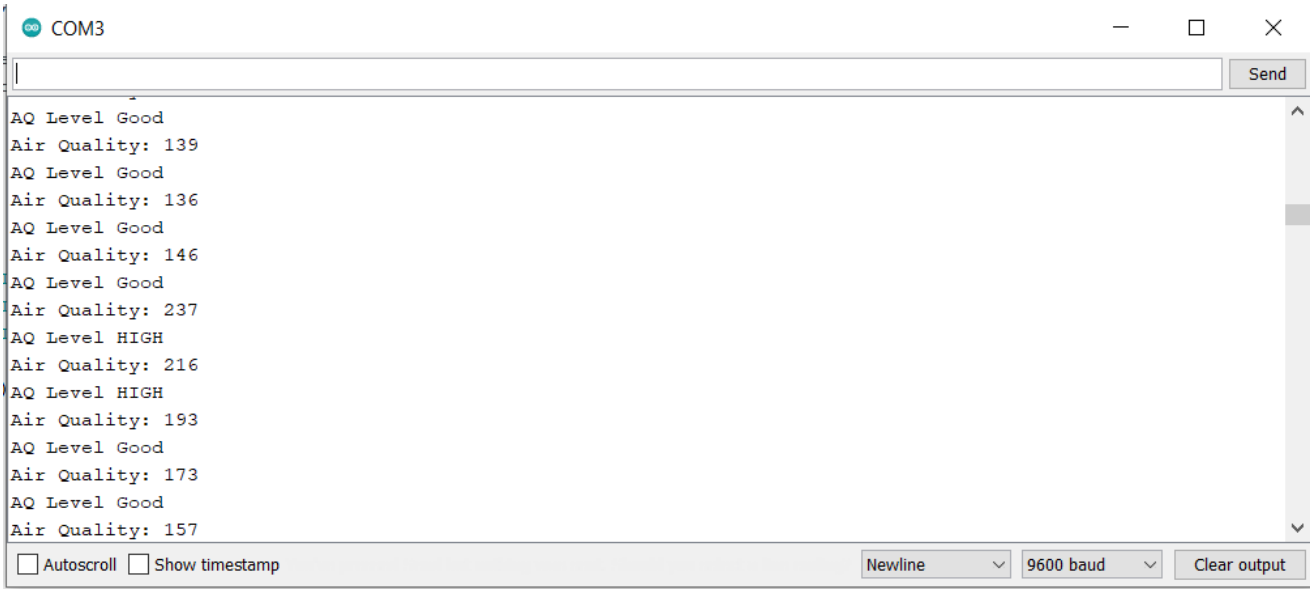


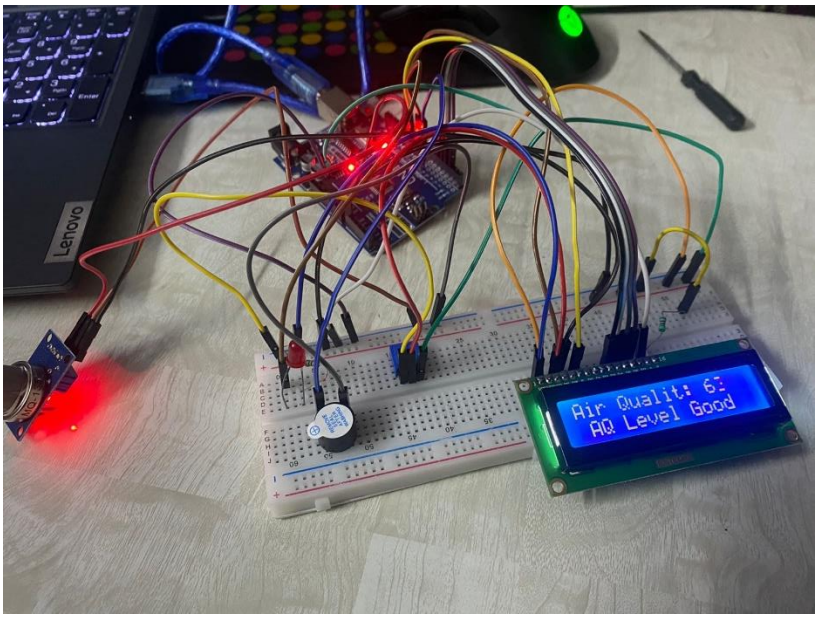
5. **Project Outcome:** (Max. 50 words or 1 page in case of screen shots, etc.)

Category-I: Project Screen Shot/Project demo Link/etc.
The link of the hardware implementation Simulation:

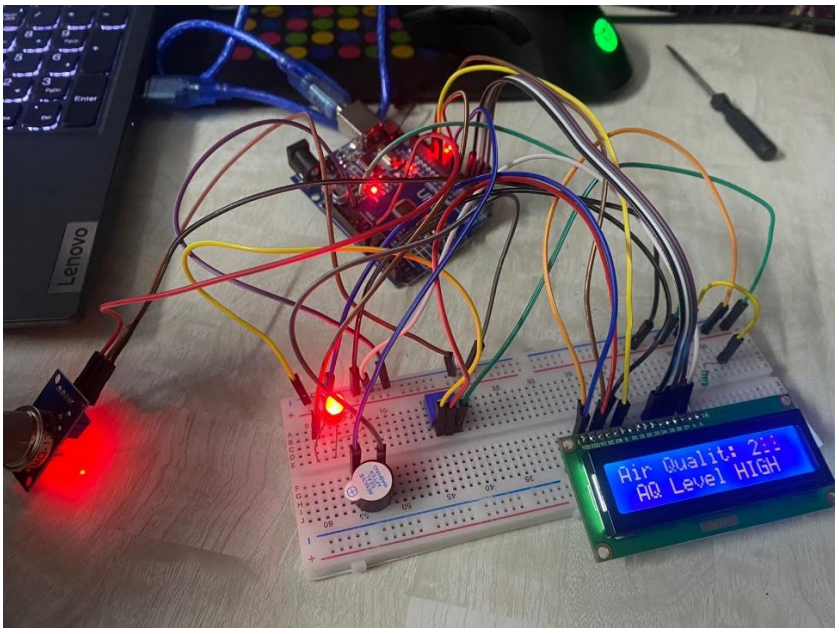
https://www.tinkercad.com/things/556MiWSnmna-aqi-measuring-system/editel







AQI LEVEL GOOD-61



AQI LEVEL HIGH -211 (red light blinking)

Arduino IDE code-

```
#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 led = 9;  //led connected to pin 9

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 (led,OUTPUT);     // led 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.setCursor(0,0);             // set cursor of lcd to 1st row and 1st column
  lcd.print("Air Qualit: ");      // 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");
      tone(led,1000,200);         //blink led with turn on time 1000mS, turn off time 200mS
      digitalWrite(buz,HIGH);     //Turn ON Buzzer
    }
  else
    {
      digitalWrite(led,LOW);   //jump here if ppm is not greater than threshold and turn off LED
      digitalWrite(buz,LOW);   //Turn off Buzzer
      lcd.setCursor(1,1);
      lcd.print ("AQ Level Good");
      Serial.println("AQ Level Good");
    }
  delay (500);
}
```

6. **Future Scope of the Work:** (Max. 50 words)
    - This project can be integrated into more viable gadgets that would help in future.
    - As this is very cost efficient can be fitted in metro stations, bus stands, railway stations etc. to increase the awareness amongst the people.

7. **Skillset acquired in this Project:** (Max. 50 words)

    - Developed a concrete understanding of how to work with basic devices such as Arduino UNO R3, physically as well as on Arduino IDE.
    - Learnt and read more about sensors.

Signature of the Student

Ketan Srivastava

Comments of the Supervisor, if any.

Signature of the Supervisor