**Phase 3**

**Project title: Air Quality Monitoring**

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**Introduction**:

In this project we are going to make an IoT Based Air Pollution 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 CO2, smoke, alcohol, benzene and NH3. It will show the air quality in PPM on the LCD and as well as on webpage so that we can monitor it .

1.Sensors:ioT devices equipped with air quality sensors (eg, particulate matter, carbon monoxide, nitrogen dioxide, ozone, etc) are deployed in the target area. These sensors collect real-time data on air quality.

2.Data collection: The sensors continuously measure air quality parameters and transmit this data to a central data collection point, often via wireless technologies like Wi-Fi, cellular networks, or LoRaWAN

3.Data analysis: The collected data is then analyzed to assess the air quality in the

monitored area. This analysis can be done locally on the loT device or in the cloud. 4.Data Visualization The analyzed data is usually presented in a user friendly manner through web-based dashboards or mobile apps. This allows users to access real-time and historical air quality information

5.Alerts and Notifications: Based on predefined thresholds or air quality standards, the system can send alerts and notifications to relevant parties, such as local authorities or the general public, when pollution levels become hazardous

6.Remote Monitoring: Users can access air quality information remotely, which is especially valuable for decision-making in situations like managing pollution sources, responding to environmental incidents, or protecting public health

7.Data Storage: The data is stored for historical analysis and can be used for research, policy-making, and urban planning.

Air Quality Monitoring System using Arduino

**COMPONENTS AND SENSORS:**

The project involves the use of several components and sensors:

Arduino Board

-Air Quality Sensor (MQ135 Gas sensor)

- Display (16X2 LCD)

-W-Fi Module (ESP8266)

-Power Supply

-Breadboard and Jumper Wires

-Buzzer (optional)

-10K potentiometer- 220 ohm resistor

-TK ohm resistors

**CIRCUIT DIAGRAM AND EXPLANATION:**

First of all we will connect the ESP8266 with the 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 three resistors in series like we did in the circuit. Connect the TX pin of the ESP8266 to the pin 10 of the Arduino and the RX pin of the esp8266 to the pin 9 of Arduino through the resistors.

ESP8266 Wi-Fi module gives your projects access to Wi-Fi or internet. It is a very cheap device and make your projects very powerful It can communicate with microcontroller.

Then we will connect the MQ135 sensor with the Arduino. Connect the VCC and the ground pan of the sensor to the SV and ground of the Arduino and the Analog pin of sensor to the AD of the Arduino.

Connect a buzzer to the pin 8 of the Arduino which will start to beep when the condition becomes true

**CONNECT LCD WITH ARDUINO**:

The connections of the LCD are as follows,

•Connect pin 1 (VEE) to the ground.

• Connect pin 2 (VDD or VCC) to the SV

• Connect pin 3 (VO) to the middle pin of the 10K potentiometer and connect the other two ends of the potentiometer to the VCC and the GND. The potentiometer is used to control the screen contrast of the LCD Potentiometer of values other than 10K will work too

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 of the potentiometer to the VCC and the GND. The potentiometer is used to control the screen 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 we will connect it to the ground.

• Connect pin 6 (E) to the pin 11 of the Arduino. The RS and E pin are the control pins which are used to send data and characters • The following four pins are data pins which are used to communicate with the Arduino

•Connect pin 11 (D4) to pin 5 of Arduino.

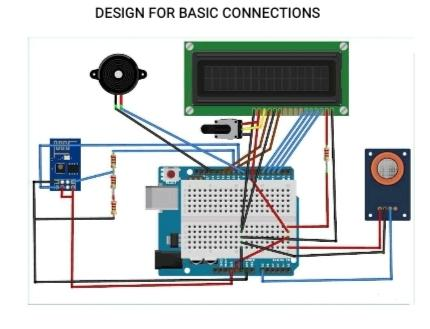
•Connect pin 12 (05) to pin 4 of Arduino.

• Connect pin 13 (06) to pin 3 of Arduino.

• Connect pin 14 (07) to pin 2 of Arduino.

•Connect pin 15 to the VCC through the 220 ohm resistor. The resistor will be used to set the back light brightness. Larger values will make the back light much more darker

• Connect pin 16 to the Ground.



**Sensors for pollution levels:**

**1.Particulate Matter (PM) Sensors**: These sensors measure the concentration of fine particulate matter in the air, such as PM2.5 and PM10, which can be harmful to health.

**2.Gas Sensors**: Gas sensors detect specific pollutants like carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), and ozone (O3).

**3.VOC Sensors:** Volatile Organic Compound (VOC) sensors detect organic chemicals that can contribute to air pollution and indoor air quality issues.

**4.Air Quality Index (AQI) Sensors**: These sensors calculate an overall air quality index based on data from various pollutant sensors.

**5.Dust and Smoke Sensors**: These sensors are designed to detect the presence of dust or smoke particles in the air.

**6.Weather Stations**: They can provide information on environmental conditions that affect pollution, such as temperature, humidity, and wind speed.

**Measuring air quality monitors:**

**1.Particulate Matter (PM)**: Sensors for PM2.5 and PM10 can measure fine particulate matter concentrations in the air.

**2.Gases**: Sensors for gases like carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), ozone (O3), and volatile organic compounds (VOCs) provide data on gas pollutants.

**3.Temperature and Humidity**: Monitoring temperature and humidity levels is essential as they can influence air quality.

**4.Air Pressure**: Air pressure sensors can help assess atmospheric conditions, which can affect pollution dispersion.

**5.Wind Speed and Direction**: These sensors provide information on how pollutants are transported in the environment.

**6.Light Sensors**: Measuring ambient light levels can be useful for understanding the impact of weather and time of day on air quality.

**7.Noise Level Sensors:** Noisepollution can also affect overall environmental quality.

**8.Air Quality Index (AQI)**: AQI sensors calculate an index based on the concentrations of multiple pollutants, giving a comprehensive measure of air quality.

**Code:**

From pyfirmata import Arduino, util

From time import sleep

# Define the Arduino board and port

Board = Arduino(‘COMX’) # Replace ‘COMX’ with your Arduino port

# Define the LCD pin numbers

Rs = 12

E = 11

D4 = 5

D5 = 4

D6 = 3

D7 = 2

# Initialize the LCD object

From pyfirmata import util

Import pyfirmata

# Set up the LCD

Lcd = pyfirmata.util.LCD(board, rs, e, d4, d5, d6, d7)

# Clear the LCD screen

Lcd.begin(16, 2)

Lcd.clear()

# Display a message

Lcd.setCursor(0, 0)

Lcd.print(“Hello, LCD!”)

Sleep(2)

# Clear the LCD screen

Lcd.clear()

# Display another message

Lcd.setCursor(0, 0)

Lcd.print(“LCD with Python”)

# Wait for a few seconds

Sleep(2)

# Clear the LCD and close the connection

Lcd.clear()

Board.exit()