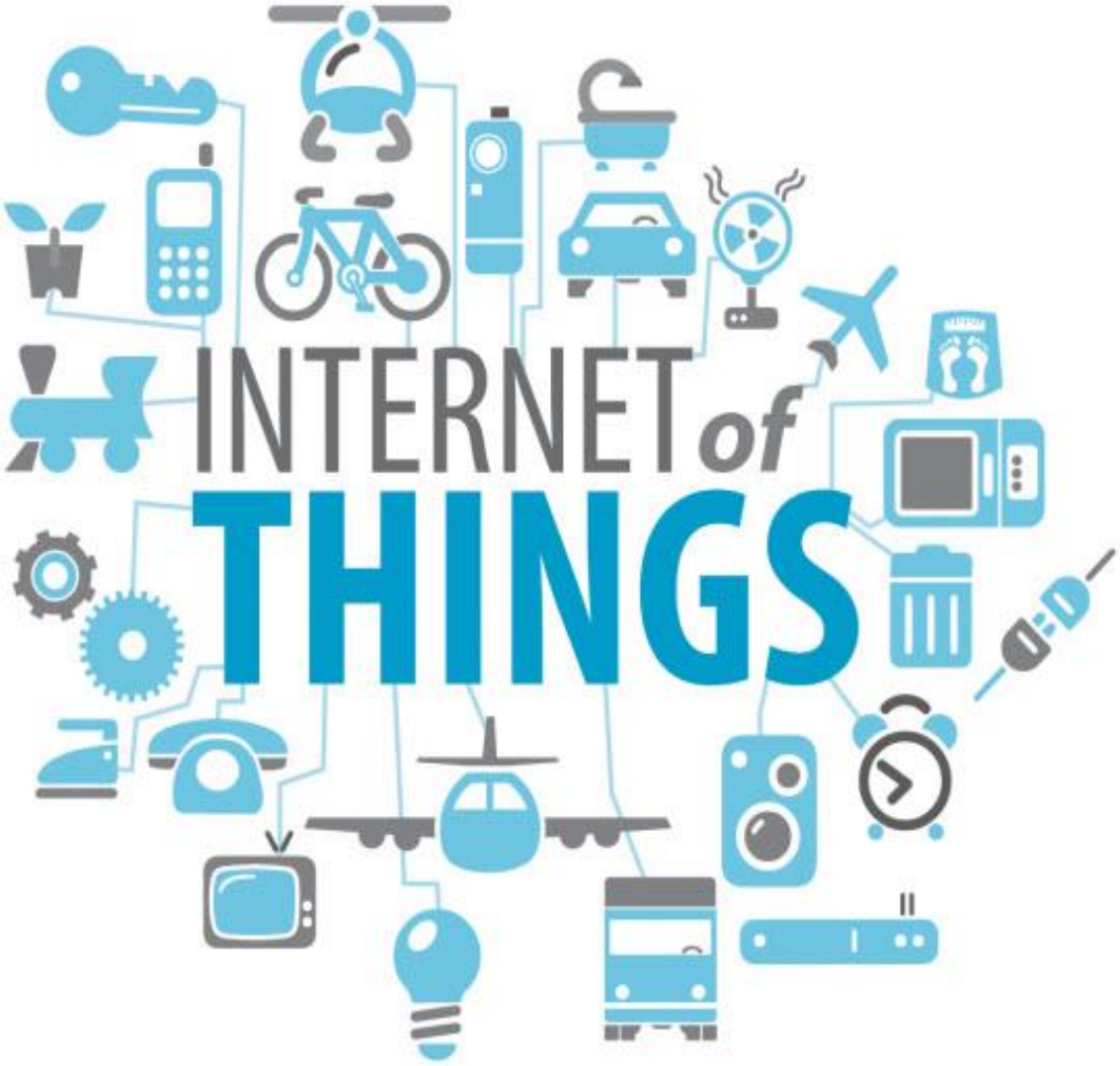
# AIR QUALITY MONITORING

## PHASE-3

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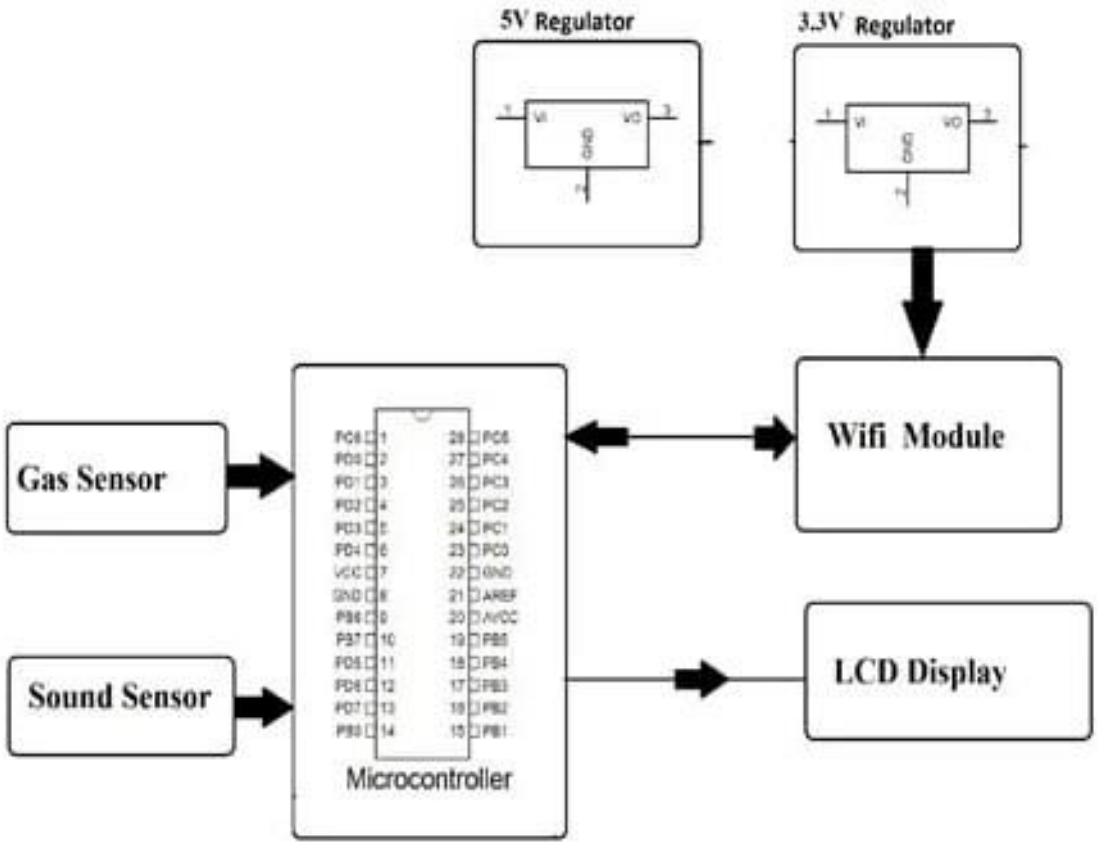
# INTRODUCTION

- Air Quality Monitoring Networks allow the measurement, operation and predictive analysis of the evolution of air pollution in different areas (urban areas, industrial areas, special nature conservation areas, etc.) Some stations are equipped with meteorological sensors and/or noise level meters to measure noise levels.

# BLOCK DIAGRAM




- An Air Quality Monitoring Station (AQMS) is a system that measures metrological parameters such as wind speed, wind direction, rainfall, radiation, temperature, barometric pressure and ambient parameters. The AQMS also integrates a series of ambient analyzers to monitor the concentration of air.
- Pollutants (such as SO2, NOx, CO, O3, THC, PM, etc.), continuously. HORIBA also provides mobile monitoring stations that can be used to monitor ambient conditions at multiple sites.

- HORIBA has more than 50 years experience providing ambient monitoring solutions, recognized around the world. HORIBA has supplied over 15,000 units with the major share in many regions. The monitoring station is tailor-made according to the customer's request. HORIBA can provide several types of stations, calibration equipment and more to meet your challenging monitoring requirements.
- The measured data can be remotely monitored and exported in various formats to the local central authorities. The data can be published via the Internet for easy public access to raise awareness on current air pollution levels. This way, the public can prevent outdoor activities and reduce health impacts during heavy polluted days.

## RESOURCES REQUIRED

- Gas sensor
- Potentiometer
- 16x2 LCD Panel
- Arduino Uno R3
- Wires
- Piezo
- 220Ω Resistor
- 4.7 kΩ Resistor
- 1 kΩ Resistor
- Wokwi software

## COMPONENT DESCRIPTION

- **Gas sensor**:

  Air quality click is suitable for detecting ammonia (NH3), nitrogen oxides (NOx) benzene, smoke, CO2, and other harmful or poisonous gases that impact air quality. The MQ-135 sensor unit has a sensor layer made of tin dioxide (SnO2), an inorganic compound that has lower conductivity in clean air than when polluting gases are present. To calibrate Air quality, use the onboard potentiometer to adjust the load resistance on the sensor circuit.

Pin Description:

- the VDD power supply 5V DC
- GND used to connect the module to system ground
- DIGITAL OUT, you can also use this sensor to get digital output from this pin, by setting a threshold value using the potentiometer

ANALOG OUT, this pin outputs 0–5V analog voltage based on the intensity of the gas.


- **Potentiometer:**

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat. The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name.

- **16x2 LCD Panel:**

A liquid-crystal display (LCD) is a flat-panel display or another electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead of using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays.

Pin Description:

- Connect pin 1 (VEE) to the ground.
- Connect pin 2 (VDD or VCC) to the 5V.
- Connect pin 3 (V0) 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. A potentiometer of values other than 10K will work too.
- Connect pin 4 (RS) to 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 pin 11 of the Arduino. The RS and E pin are the control pins that are used to send data and characters.

- The following four pins are data pins that are used to communicate with the Arduino.

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

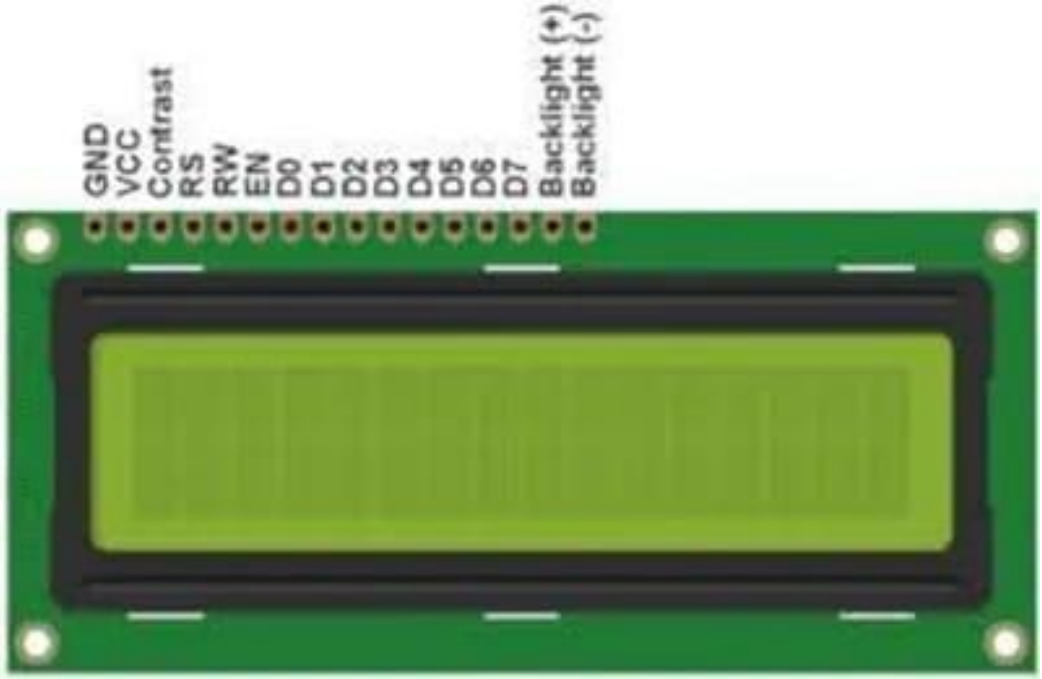
- Connect pin 12 (D5) to pin 4 of Arduino.

- Connect pin 13 (D6) to pin 3 of Arduino.

- Connect pin 14 (D7) to pin 2 of Arduino.

- Connect pin 15 to the VCC through the 220-ohm resistor. The resistor will be used to set the backlight brightness. Larger values will make the backlight much darker.

- Connect pin 16 to the Ground.



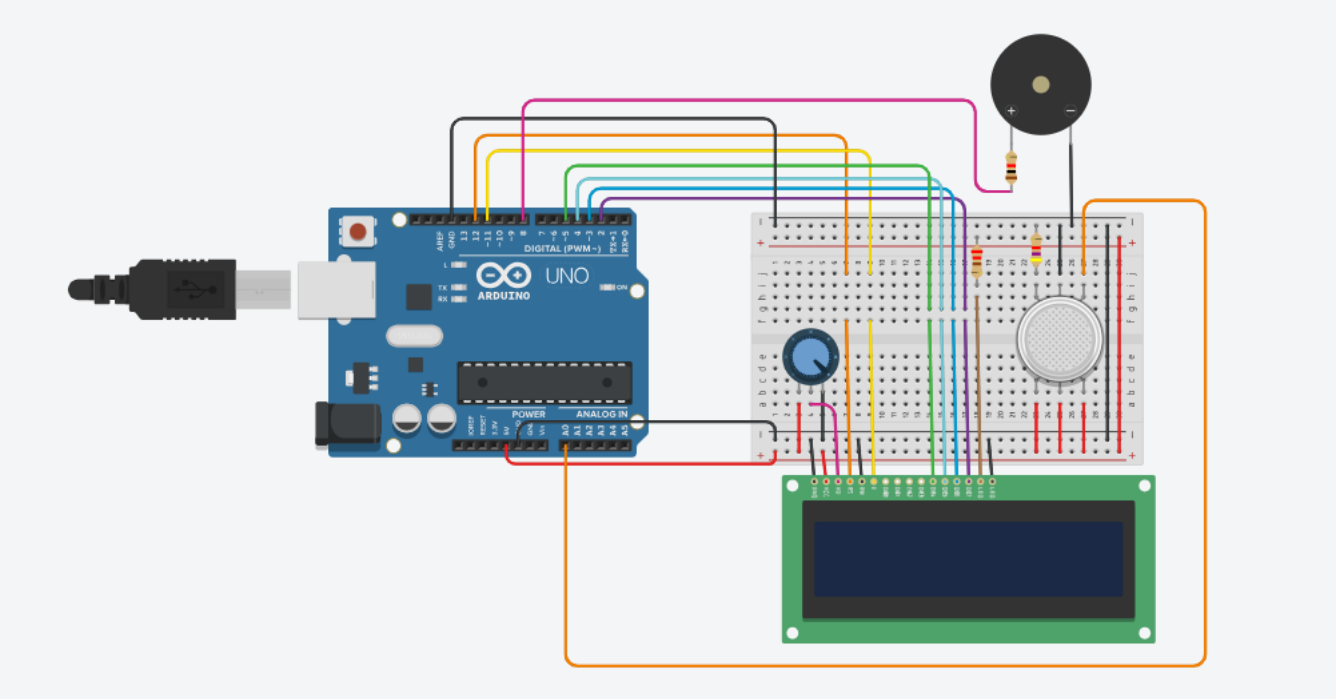
## ➢ Arduino:

Arduino is an open-source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

Pin Description:


| | | |
|---|---|---|
| Power | Vin, 3.3V, 5V, GND | Vin: Input voltage to Arduino when using an external power source.<br>5V: Regulated power supply used to power microcontroller and other components on the board.<br>3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA.<br>GND: ground pins. |

# CIRCUIT DESIGN




# PROGRAM

```
// include the library code:
#include <LiquidCrystal.h>

// initialize the library with the numbers of the interface pins
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

int pin8 = 8;
int analogPin = A0;
int sensorValue = 0;        // store the value read

void setup() {
  pinMode(analogPin, INPUT);
  pinMode(pin8, OUTPUT);
  // set up the LCD's number of columns and rows:
```

```
  lcd.begin(16, 2);
  // Print a message to the LCD.
  lcd.print("What is the air ");
  lcd.print("quality today?");
  Serial.begin(9600);
  lcd.display();
}

void loop() {

  delay(100);
  sensorValue = analogRead(analogPin);     // read the input pin
  Serial.print("Air Quality in PPM = ");
  Serial.println(sensorValue);            // debug value

  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");
   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) {
   // Activate digital output
   digitalWrite(pin8, HIGH);
 }
 else {
   // Deactivate digital output
   digitalWrite(pin8, LOW);
 }
}
```