

MINI PROJECT (2020-2021)

IOT Based Pollution Monitoring System

MID TERM REPORT



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DECLARATION

We hereby declare that the work which is being presented in the Mini project “**IOT Based Pollution Monitoring System**”, in partial fulfillment of the requirements for Industrial Training viva voce, is an authentic record of my own work carried under the supervision of Mr. Amir Khan our technical trainer.

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ACKNOWLEDGEMENT

We owe our profound gratitude to our project supervisor Mr Amir Khan, who took keen interest and guided us all along in my project work titled — Air Pollution Monitoring through Internet of Things, till the completion of our project by providing all the necessary information for developing the project. The project development helped us in research and we got to know a lot of new things in our domain. We are really thankful to him.

ABSTRACT

Air Contamination is a major issue these days. It is essential to screen Air Quality and monitor it for future and sound living for all. So, we propose an Air Quality observing system that help us to find and check live air quality through IOT.

It utilizes air sensor to detect nearness of destructive gases found all around and transmits this information to microcontroller. The sensor associated with forms this information and sends it over to the web. This enables us to screen air contamination in various zones and make a move to combat it. In addition, there is a temperature sensor for estimating the temperature of a room.

– The level of pollution has increased with times by lot of factors like the increase in population, increased vehicle use, industrialization and urbanization which results in harmful effects on human wellbeing by directly affecting health of population exposed to it. In order to monitor 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 web server 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 very easily. In this IOT project, you can monitor the pollution level from anywhere using your computer or mobile.

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IOT Based Pollution Monitoring System

1.Introduction

1.1 General description to topic

In this project we will make an IOT Based Air Pollution Monitoring System in which we will screen the Air Quality over a web server utilizing web and it will trigger an alert when the air quality goes down past a specific level, implies when there are adequate measure of hurtful gases are available noticeable all around like CO₂, smoke, liquor and furthermore temperature.

It will demonstrate the air quality in PPM as on website page with the goal that we can screen it effectively.

The proposed project is an implementation of an application of the Internet of Things.

The undertaking is that is to give an implementation of IOT to estimate the room temperature as well as the air quality. The undertaking highlights the management of sensors to retrieve the data. The major advantage of using sensor is that the user will have a seamless experience; the user is not required to sanction to feed any marker for Internet of Things to work. Hence the efficiency is greater and here after the anticipation taken to execute, user interrogation is pity than distinctive mechanisms. The working of the application is also further more described in this documentation. The documentation furthermore lists out the requirements for the project implementation.

1.2. About IOT and Arduino

IOT

The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. IoT has evolved from the convergence of wireless technologies, micro-electro mechanical systems (MEMS), micro services and the internet. The convergence has helped tear down the silo walls between operational technology (OT) and information technology (IT), allowing unstructured machine - generated data to be analyzed for insights that will drive improvements.

ARDUINO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide

1.3. Air quality parameter

Carbon Dioxide (CO₂) – CO₂ is colorless, odorless gas and non-combustible gas. Moreover, it is considered under the category of asphyxiate gases that have capability of interfering the availability of oxygen for tissues. Carbon Dioxide is a gas essential to life in the planet, because it is one of the most important elements evolving photosynthesis process, which converts solar into chemical energy. The concentration of CO₂ has increased due mainly to massive fossil fuels burning. This increase makes plants grow rapidly. The rapid growth of undesirable plants leads to the increase use of chemicals to eliminate them.

Sulphur Dioxide (SO₂) - Sulphur Dioxide is a colorless gas, detectable by the distinct odour and taste. Like CO₂, it is mainly due to fossil fuels burning and to industrial processes. In high concentrations may cause respiratory problems, especially in sensitive groups, like asthmatics. It contributes to acid rains.

Nitrogen Dioxide (NO₂) – Nitrogen Dioxide is a brownish gas, easily detectable for its odour, very corrosive and highly oxidant. It is produced as the result of fossil fuels burning. Usually NO thrown to the atmosphere is converted in NO₂ by chemical processes. In high concentrations, NO₂ may lead to respiratory problems. Like SO₂, it contributes to acid rains.

Smoke-About 1 million people are in habit of tobacco smoking globally of which majority population is from developing countries. Every year nearly 4.9 million people died due to smoking according to 2007 report. In addition, second hand smoke is serious threat to the health of people of all age's causes 41000 deaths each year.

LPG-Liquefied petroleum gas (LPG) is an odorless and colorless liquid which evaporates readily into a gas. Leakage is normally detected by adding an odorant into it. It is considered under the category of highly flammable gases and it can be classified as a carcinogen and mutagen if Butadiene content is more than 0.1%. LPG may leak in the form of a gas or a liquid. If it leaks in the form of a liquid it evaporates quickly and will eventually form large cloud of gas in air which is relatively heavier than air thus drops to the ground. Whereas, LPG vapors travel along the ground for a long distance and gets collected in drains or basements. Gas leads to burn or explode after getting in touch with a source of ignition.

Temperature and humidity- Measurement of temperature is important for safety of people and affects our life skills. Greenhouse effect can be monitored by measuring temperature and comparing temperature changes from historical to present time especially since the industrial revolution using climate data. Humidity is a type of gas that protects us from UV rays from the sun and helps trap heat on Earth, thereby making the climate on Earth, a pleasant one for living. But as humidity increases, the warmth on Earth also increases which makes our life uncomfortable.

1.4. hardware and software requirement

- hardware requirement

- MQ135 GAS SENSOR- The Sensitive material used in MQ135 gas sensor is SnO₂. The conductivity of this material is lower in clean air. The sensor conductivity increases with the increasing concentration of target pollution gas. MQ135 can monitor different kinds of toxic gases such as sulphide, ammonia gas, benzene series steam and CO₂. The detection range is 10- 10,000 ppm with the voltage rate of about 5.0V±0.1V AC or DC.
- Arduino Uno R3 microcontroller- It is the most flexible hardware platform used based on ATmega328P which can be programmed according to the function where it is to be used. It has 6 analog inputs, 14 digital input/output pins (6 pins of these can be used as PWM outputs), a USB Connection, a 16 MHz quartz crystal, SPI, serial interface, a reset button, a power jack and an ICSP header as shown in Fig.3. The Arduino microcontroller is not only for technical audience but is intended for designers and artists as well because of its focus to usability based on its design which helps to achieve the intended goal [6]. It is the primary component of the framework. In addition, it is an open source microcontroller device with easily accessible software/hardware Platform and is compatible with many sensors available. Everything needed for its working is present on the board; we only require a USB cable to directly connect it to the computer or give power using battery source or AC to DC adapter to get started.
- LCD
- MQ 6 LPG gas sensor
- Humidity Sensor SY-H5220
- Temperature Sensor LM35
- Buzzer
- Router

- Software requirement

- Arduino UNO Software
- Embedded C Language

2.Problem Definition

An effective natural observing framework is essential to screen and estimate the conditions in the event of surpassing endorsed level of parameter (for example, commotion, CO and radiation levels). At the point when the items like condition furnished with sensor gadgets, smaller scale controller and different programming applications turn into a self – securing and self-observing condition.

Amid past decades, as consequence of human advancement and urbanization there is a tremendous development in polluting businesses, open consuming of reject and leaves, monstrous amounts of development squander, generous loss of timberlands and vehicles (especially diesel driven autos) on streets that offer ascent to wellbeing imperiling contamination. Along these lines, it is important to consistently screen and report the unsafe effects from air contamination. To screen the nature of air, another system is recommended that screens the parameters of the earth around us, for example, CO₂, CO, nearness of smoke, liquor, LPG, temperature and dampness with the assistance of GSM, Bluetooth and WSN.

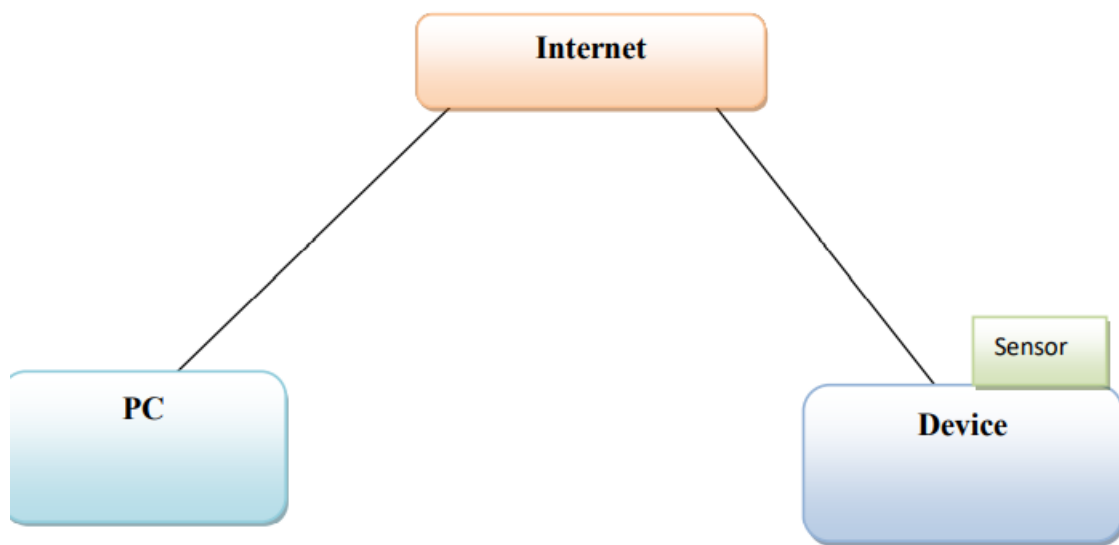
3.Objective

Short-term – The short-term objective of the project is complete understanding of the project assigned. The concepts related to the project should be clear and the objective behind the project should be known to the entire team. The focus should not be only on theoretical concepts but also on practical implications of them. The technology used to implement the projects should be familiar and also one should be able to apply them on our respective project.

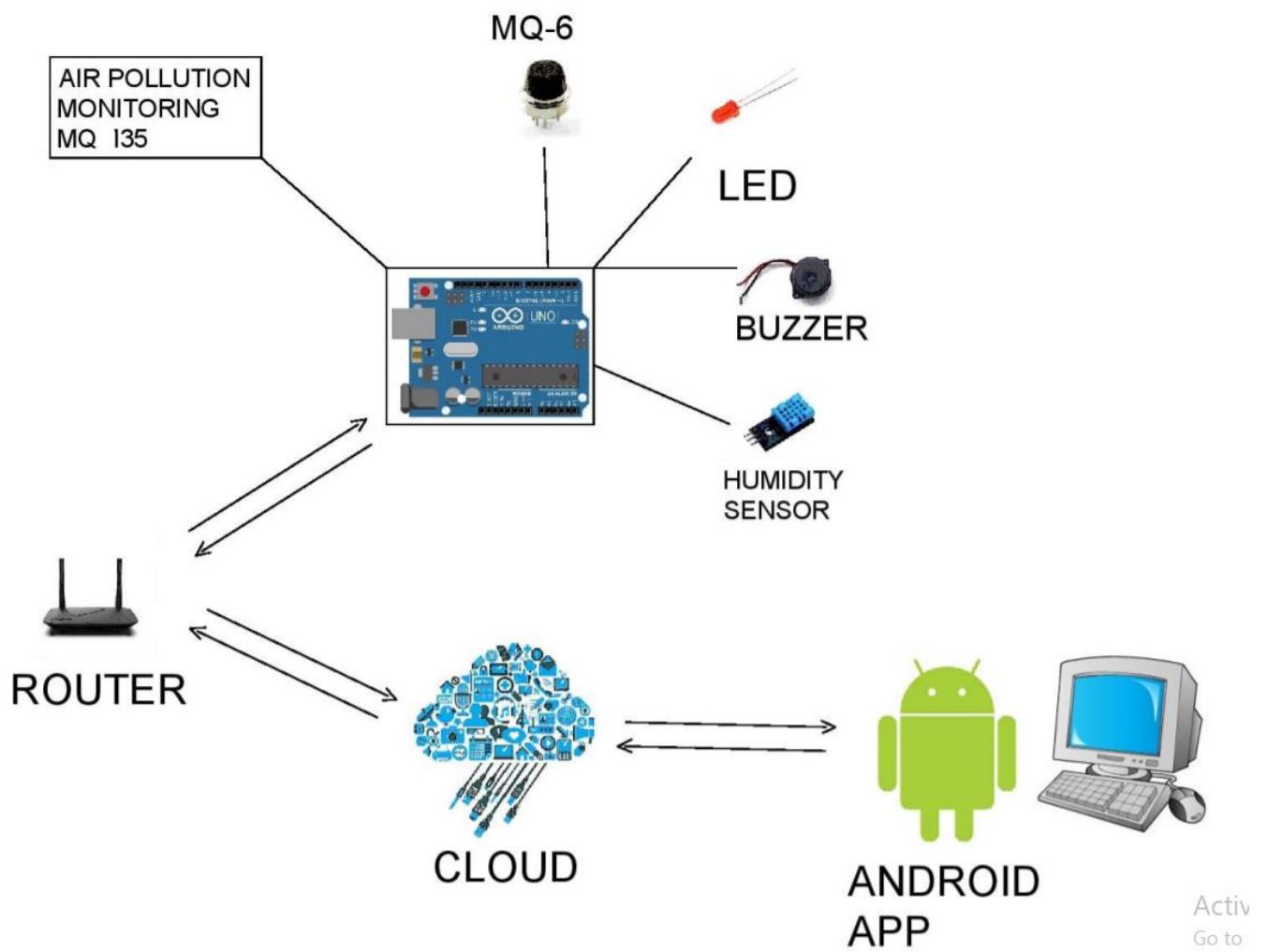
Long-term – Long-term objective includes that students are exposed to the industrial environment which should help us in future when we will work in real-time projects. One should gain experience of working with a team and learn to cooperate with our team members.

4. METHODOLOGY

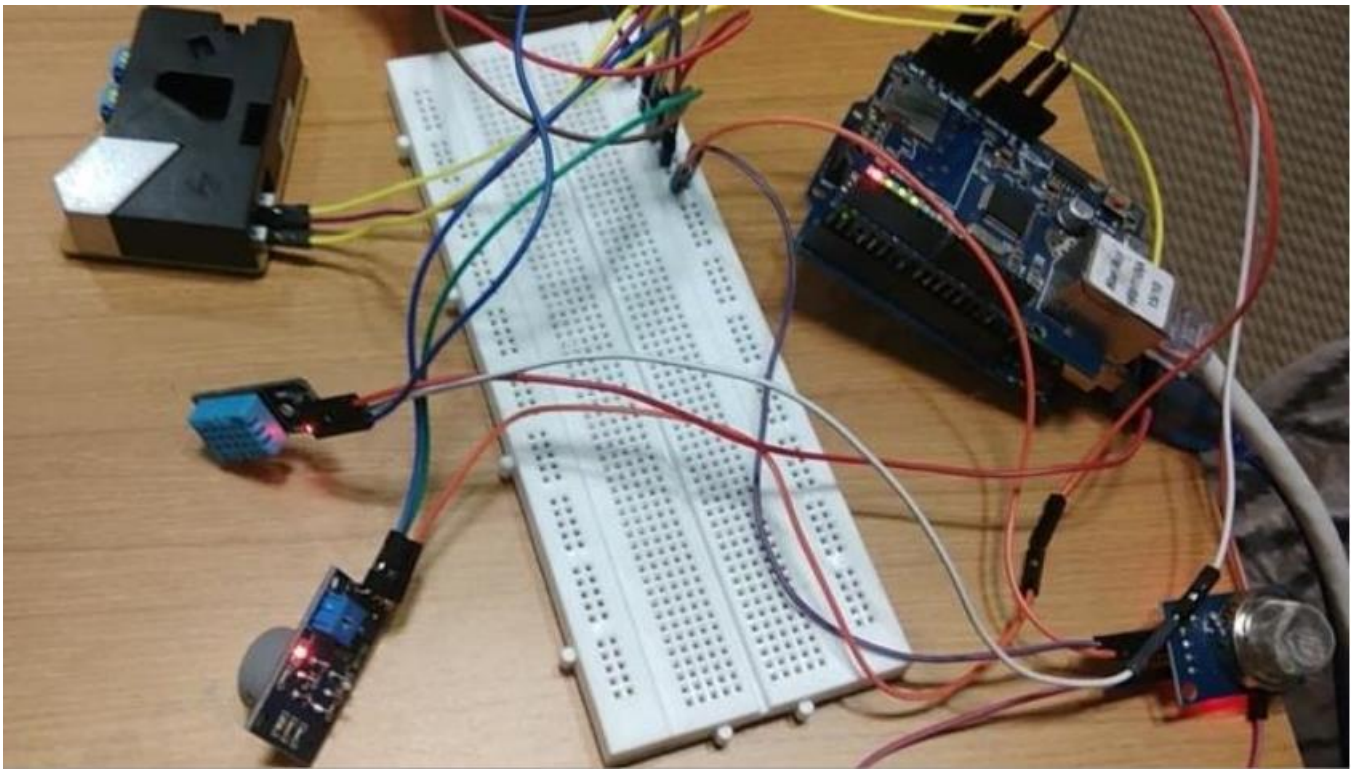
To alleviate the effects of air and clamor contamination on human wellbeing, worldwide condition and overall economy, governments have set up enormous endeavors. With nitty gritty data of the air and clamor contamination circumstance, researchers, arrangement creators and organizers can settle on educated choices on overseeing and enhancing the living condition. An answer for checking the clamor and air quality levels utilizing inserted registering is proposed. The inserted framework used to screen the vacillation of parameter like clamor and air contamination level from typical levels.



5. AIR Model



6. Hardware setup



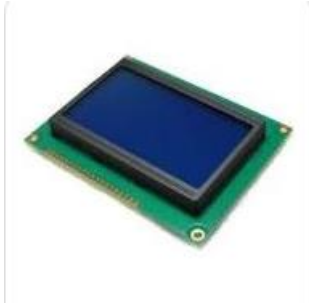
Gas detector



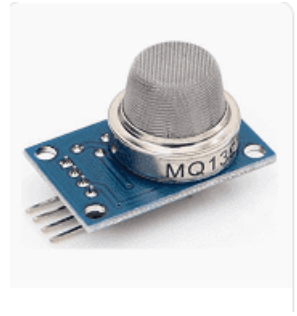
Arduino Uno



LCD



MQ 6 LPG gas sensor



Humidity sensor SY-H5220



Temperature sensor LM35



LM35 is a **temperature** measuring device having an analog output voltage proportional to the **temperature**. It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry. The sensitivity of **LM35** is 10 mV/degree Celsius.

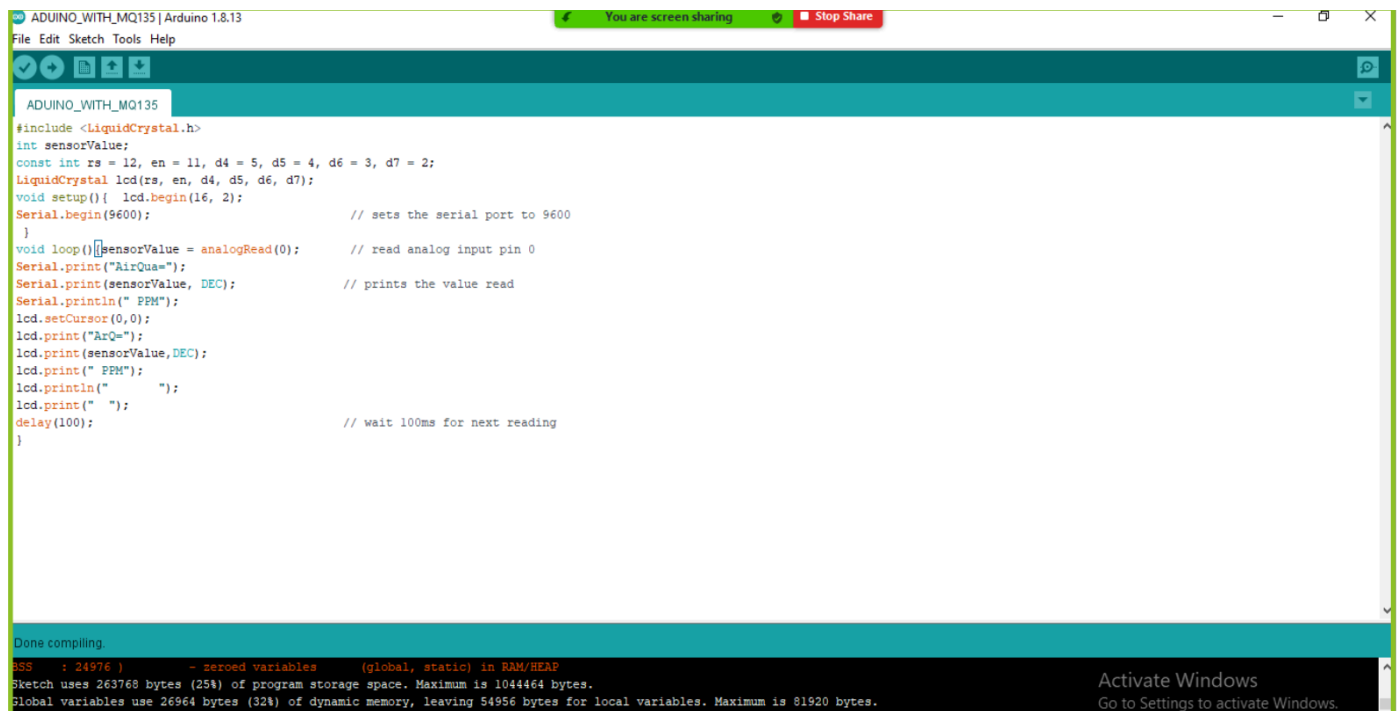
Buzzer



A **buzzer** or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of **buzzers** and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

7. Some Screenshot

1.



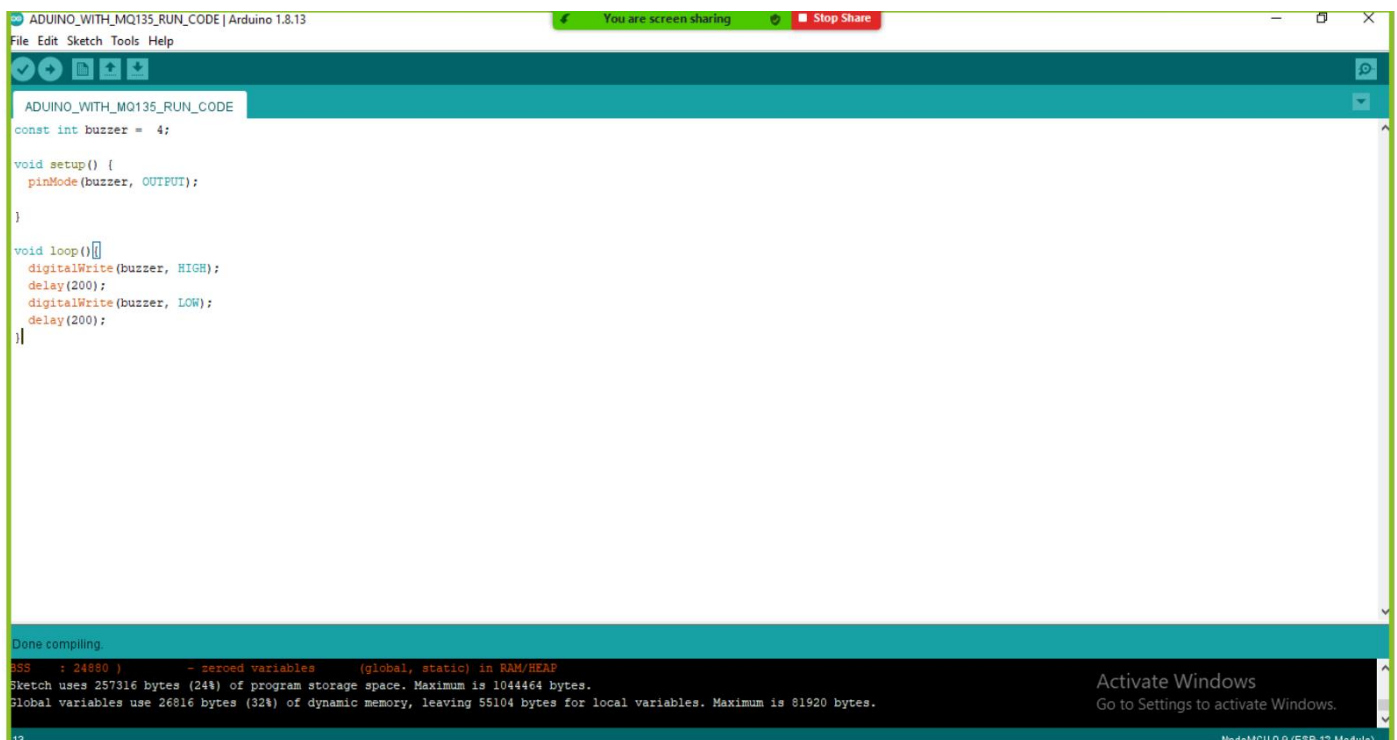
```
ADUINO_WITH_MQ135
#include <LiquidCrystal.h>
int sensorValue;
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
void setup() { lcd.begin(16, 2);
Serial.begin(9600);           // sets the serial port to 9600
}
void loop() { sensorValue = analogRead(0);    // read analog input pin 0
Serial.print("AirQua=");
Serial.print(sensorValue, DEC);              // prints the value read
Serial.println(" PPM");
lcd.setCursor(0,0);
lcd.print("ArQ=");
lcd.print(sensorValue, DEC);
lcd.print(" PPM");
lcd.println(" ");
lcd.print(" ");
delay(100);                                // wait 100ms for next reading
}
```

Done compiling.

Sketch uses 263768 bytes (25%) of program storage space. Maximum is 1044464 bytes.
Global variables use 26964 bytes (32%) of dynamic memory, leaving 54956 bytes for local variables. Maximum is 81920 bytes.

Activate Windows
Go to Settings to activate Windows.

2.



```
ADUINO_WITH_MQ135_RUN_CODE
const int buzzer = 4;

void setup() {
  pinMode(buzzer, OUTPUT);
}

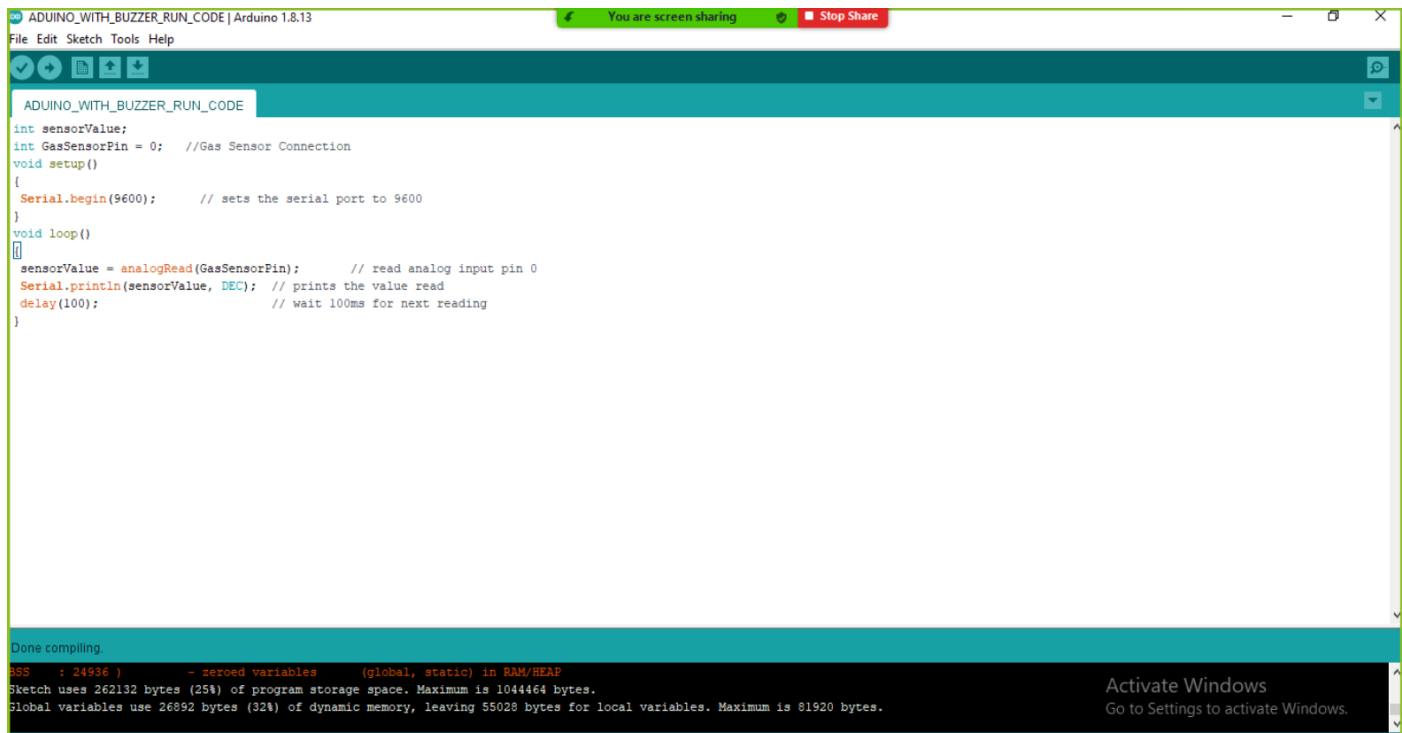
void loop() {
  digitalWrite(buzzer, HIGH);
  delay(200);
  digitalWrite(buzzer, LOW);
  delay(200);
}
```

Done compiling.

Sketch uses 257316 bytes (24%) of program storage space. Maximum is 1044464 bytes.
Global variables use 26816 bytes (32%) of dynamic memory, leaving 55104 bytes for local variables. Maximum is 81920 bytes.

Activate Windows
Go to Settings to activate Windows.

3.

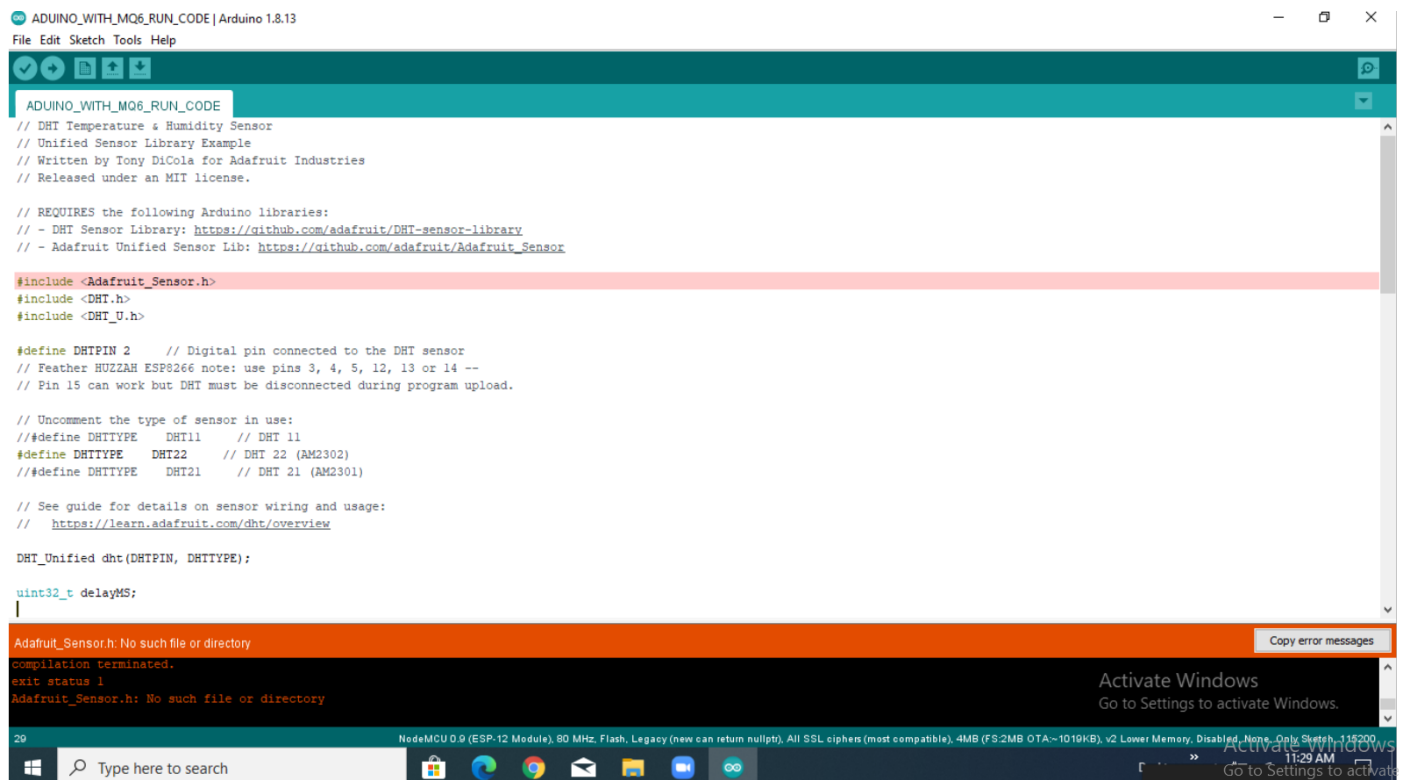


```
ADUINO_WITH_BUZZER_RUN_CODE
int sensorValue;
int GasSensorPin = 0; //Gas Sensor Connection
void setup()
{
  Serial.begin(9600); // sets the serial port to 9600
}
void loop()
{
  sensorValue = analogRead(GasSensorPin); // read analog input pin 0
  Serial.println(sensorValue, DEC); // prints the value read
  delay(100); // wait 100ms for next reading
}
```

Done compiling.

Sketch uses 262132 bytes (25%) of program storage space. Maximum is 1044464 bytes.
Global variables use 26892 bytes (32%) of dynamic memory, leaving 55028 bytes for local variables. Maximum is 81920 bytes.

4.



```
ADUINO_WITH_MQ6_RUN_CODE
// DHT Temperature & Humidity Sensor
// Unified Sensor Library Example
// Written by Tony DiCola for Adafruit Industries
// Released under an MIT license.

// REQUIRES the following Arduino libraries:
// - DHT Sensor Library: https://github.com/adafruit/DHT-sensor-library
// - Adafruit Unified Sensor Lib: https://github.com/adafruit/Adafruit\_Sensor

#include <Adafruit_Sensor.h>
#include <DHT.h>
#include <DHT_U.h>

#define DHTPIN 2 // Digital pin connected to the DHT sensor
// Feather HUZZAH ESP8266 note: use pins 3, 4, 5, 12, 13 or 14 --
// Pin 15 can work but DHT must be disconnected during program upload.

// Uncomment the type of sensor in use:
// #define DHTTYPE DHT11 // DHT 11
#define DHTTYPE DHT22 // DHT 22 (AM2302)
// #define DHTTYPE DHT21 // DHT 21 (AM2301)

// See guide for details on sensor wiring and usage:
// https://learn.adafruit.com/dht/overview

DHT_Unified dht(DHTPIN, DHTTYPE);

uint32_t delayMS;
|
```

Adafruit_Sensor.h: No such file or directory
Compilation terminated.
exit status 1
Adafruit_Sensor.h: No such file or directory

5.

ADUINO_WITH_MQ6_RUN_CODE | Arduino 1.8.13

File Edit Sketch Tools Help

```

ADUINO_WITH_MQ6_RUN_CODE
// DHT Temperature & Humidity Sensor
// Unified Sensor Library Example
// Written by Tony DiCola for Adafruit Industries
// Released under an MIT license.

// REQUIRES the following Arduino libraries:
// - DHT Sensor Library: https://github.com/adafruit/DHT-sensor-library
// - Adafruit Unified Sensor Lib: https://github.com/adafruit/Adafruit\_Sensor

#include <Adafruit_Sensor.h>
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uint32_t delayMS;

```

Adafruit_Sensor.h: No such file or directory
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 exit status 1
 Adafruit_Sensor.h: No such file or directory

NodeMCU 0.9 (ESP-12 Module), 80 MHz, Flash, Legacy (new can return nullptr), All SSL ciphers (most compatible), 4MB (FS:2MB OTA~1019KB), v2 Lower Memory, Disabled, None, Only Sketch, 115200

11:29 AM

6.

ADUINO_WITH_MQ6_RUN_CODE | Arduino 1.8.13

File Edit Sketch Tools Help

```

ADUINO_WITH_MQ6_RUN_CODE
// Set delay between sensor readings based on sensor details.
delayMS = sensor.min_delay / 1000;
}

void loop() {
  // Delay between measurements.
  delay(delayMS);
  // Get temperature event and print its value.
  sensors_event_t event;
  dht.temperature().getEvent(&event);
  if (isnan(event.temperature)) {
    Serial.println(F("Error reading temperature!"));
  }
  else {
    Serial.print(F("Temperature: "));
    Serial.print(event.temperature);
    Serial.println(F("°C"));
  }
  // Get humidity event and print its value.
  dht.humidity().getEvent(&event);
  if (isnan(event.relative_humidity)) {
    Serial.println(F("Error reading humidity!"));
  }
  else {
    Serial.print(F("Humidity: "));
    Serial.print(event.relative_humidity);
    Serial.println(F("%"));
  }
}

```

Adafruit_Sensor.h: No such file or directory
 compilation terminated.
 exit status 1
 Adafruit_Sensor.h: No such file or directory

NodeMCU 0.9 (ESP-12 Module), 80 MHz, Flash, Legacy (new can return nullptr), All SSL ciphers (most compatible), 4MB (FS:2MB OTA~1019KB), v2 Lower Memory, Disabled, None, Only Sketch, 115200

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8.CONCLUSION

The framework to screen the demeanor of condition utilizing Arduino IDE and Node MCU, IOT Technology is proposed to enhance nature of air. Utilization of IOT innovation upgrades the way toward observing different parts of condition, for example, air quality checking issue. Utilizing of MQ135 gas sensor gives the feeling of various kind of perilous gas and Node MCU is the core of this undertaking which control the whole procedure. Wi-Fi module associates the entire procedure to web and yield is shown on the website page.

It is particularly important to mindful the general population with Air Pollution data. It is effectively conceivable by IOT applications. The present hardware and software engineering innovation makes conceivable to build up a few IOT applications. By utilizing these Air Pollution Monitoring IOT applications individuals can lead glad life. These applications give the air contamination data as well as make the general population to consider the air contamination lessening.

The different information and specialized particular of segments required for the framework are talked about with the guide of pseudo-code and framework outline work process. The proposed framework encourages the worry contamination board specialists to take important choice and impart the deliberate PPM esteems to different government and non-legislative associations in a quick and effective way for the advantages of open to have a contamination free life.

9. FUTURE SCOPE:

- This could be further improved by designing for global server and designing apps for the real time monitoring.
- To make more advancements by testing the gas sensor with harmful gases and to portray the constituents of the gases.
- To make attempts to measure Noise Pollution and to detect the safe level of sound in decibels.

10. References

➤ <https://www.tinkercad.com/>

➤ <https://circuits.io/>

➤ <https://www.arduino.cc/>



<https://circuitdigest.com/microcontrollerprojects/iot-air-pollution-monitoring-using-arduino>