

AIR QUALITY MONITORING BASED ON IoT

A DISSERTATION
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FOR THE COMPLETION OF COURSE THEORY OF COMPUTATION (TOC CO-303)
IN
COMPUTER ENGINEERING

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Abstract

Air pollution has become a common phenomenon everywhere. Especially in the urban areas, air pollution is a real-life problem. A lot of people get sick only due to air pollution. In the urban areas, the increased number of petrol and diesel vehicles and the presence of industrial areas at the outskirts of the major cities are the main causes of air pollution.

The problem is seriously intensified in the metropolitan cities. Also, the climate change is now apparent. The governments all around the world are taking every measure in their capacity

It is now imperative to supervise air pollution in actual time. This project is aimed at developing an IOT device which can monitor air pollution in real time.

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 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.

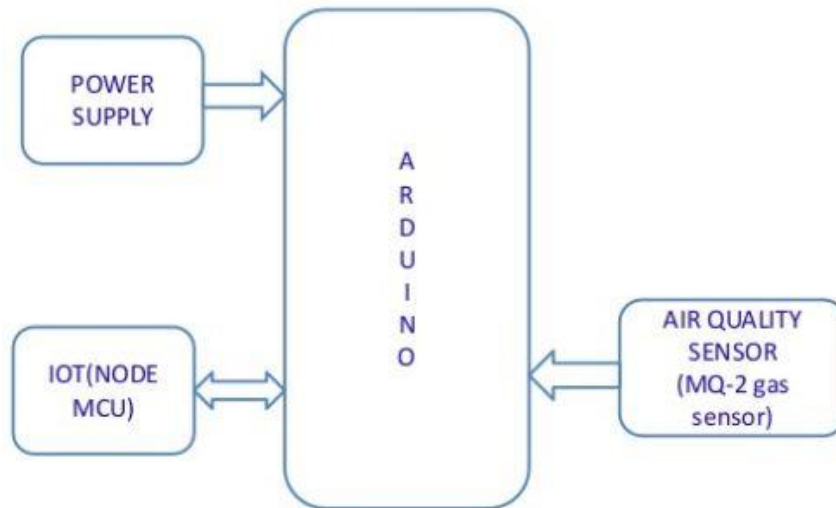
By using Internet of Things and recording sensor data to a remote server, the limitations of memory in the monitoring devices and manual collection of data from the installed devices can be overcome. The IOT also helps monitoring the data in real time.

Required Components:

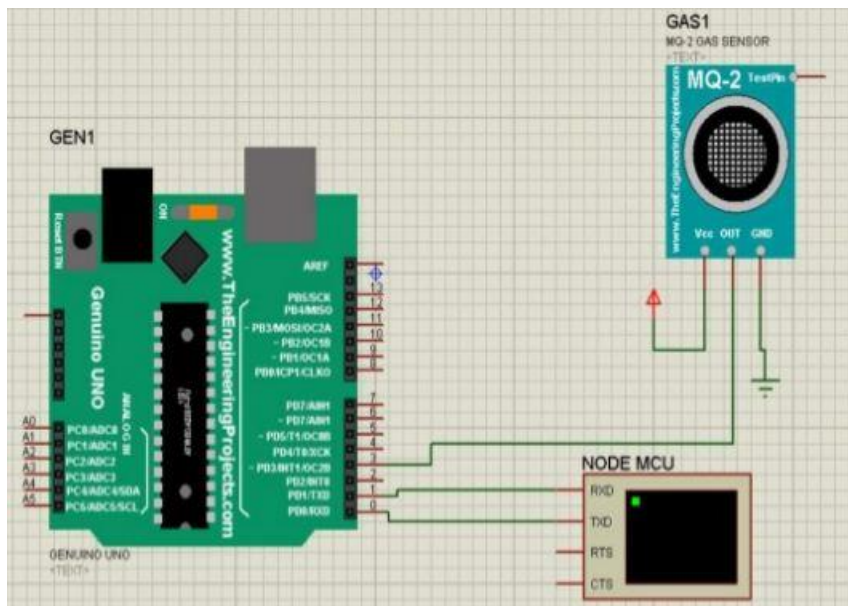
- MQ135 Gas sensor
- Arduino Uno
- Wi-Fi module ESP8266
- 16X2 LCD
- Breadboard
- 10K potentiometer
- 1K ohm resistors
- 220 ohm resistor
- Buzzer

Circuit Diagram and Explanation

- Block diagram



- Schematic diagram

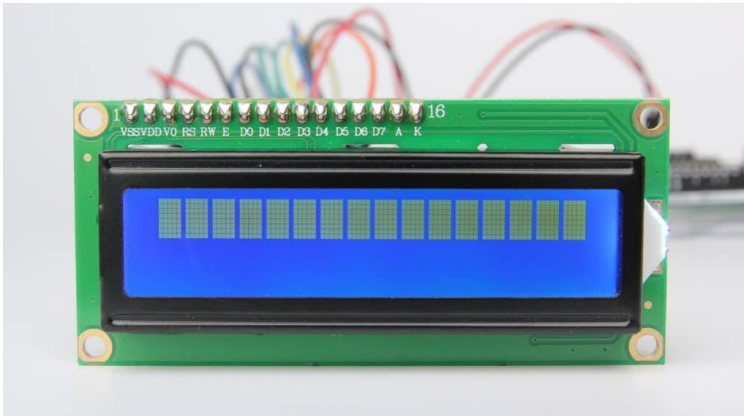


- Hardware and software requirements

Arduino UNO – Arduino UNO is one of the most popular prototyping boards. It is small in size and packed with rich features. The board comes with built-in Arduino boot loader. It is an Atmega 328 based controller board which has 14 GPIO pins, 6 PWM pins, 6 Analog inputs and on board UART, SPI and TWI interfaces. In this IOT device, 9 pins of the board are utilized.



16X2 Character LCD – The 16X2 LCD display is used to monitor the sensor values read by the Arduino board from MQ-135. It is interfaced with the Arduino UNO by connecting its data pins D4 to D7 with pins 6 down to 3 of the controller respectively. The RS and E pins of the LCD are connected to pins 13 and 12 of the controller respectively.



ESP8266 Wi-Fi Module – The ESP8266 Wi-Fi Module is used to connect with any available internet hotspot and transfer sensor data to ThingSpeak Platform via Wi-Fi. The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to a Wi-Fi network.

MQ-135 Sensor – MQ-135 is a gas sensor which is used to measure the concentration of combustible gases. It has lower conductivity in clean air while its conductivity increases with the presence of the combustible gases in the air. The sensor is highly sensitive to gases like Ammonia, Sulphide and Benzene steam. The sensor can detect the concentration of combustible gases in range from 100 PPM to 1000 PPM.



Power Supply – The Arduino board and the Wi-Fi module require 3.3 V while LCD and MQ-135 sensor need 5V DC for their operation. The Arduino can be powered by connecting it to a USB connection. Since the voltage supply and ground pins of the other modules are connected with the common VCC and ground respectively, the rest of the components draw power from the 5V output of the Arduino board itself.

Working

The MQ135 sensor can sense NH₃, NO_x, alcohol, Benzene, smoke, CO₂ and some other gases, so it is perfect gas sensor for our **Air Quality Monitoring Project**. When we will connect it to Arduino then it will sense the gases, and we will get the Pollution level in PPM (parts per million). MQ135 gas sensor gives the output in form of voltage levels and we need to convert it into PPM. So for converting the output in PPM, here we have used a library for MQ135 sensor.

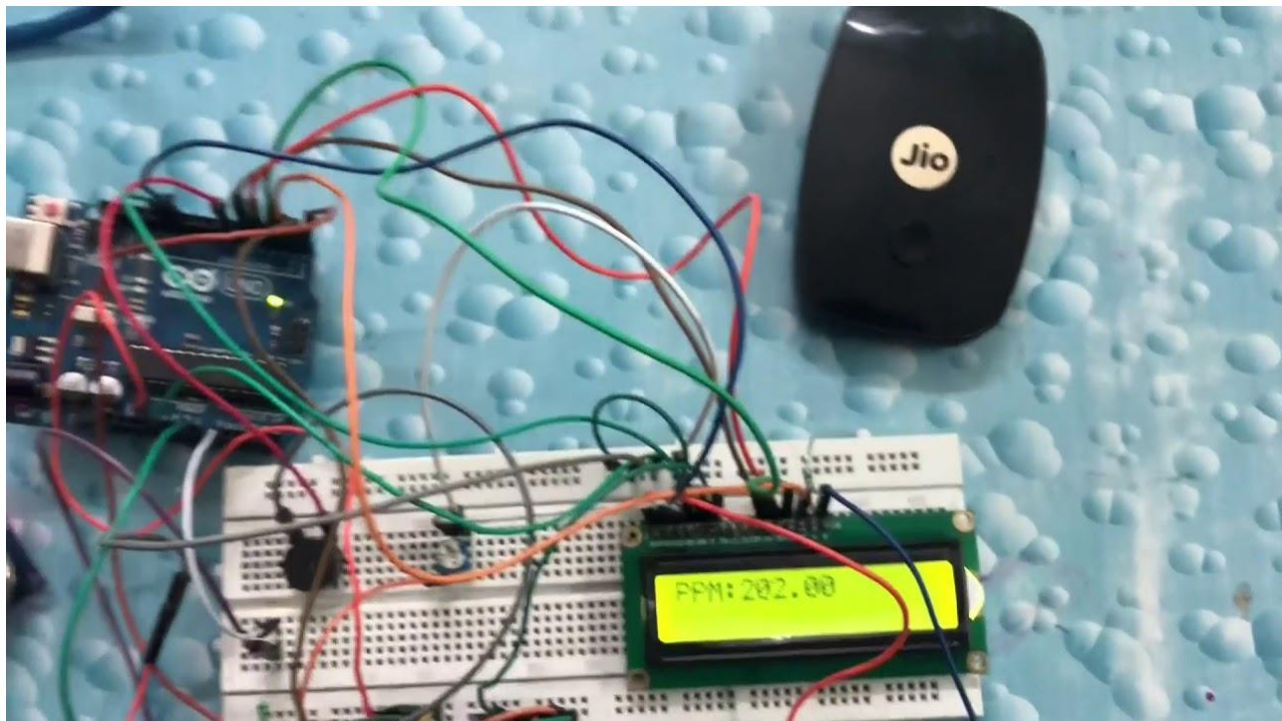
Sensor was giving us value of 90 when there was no gas near it and the safe level of air quality is 350 PPM and it should not exceed 1000 PPM. When it exceeds the limit of 1000 PPM, then it starts cause Headaches,

sleepiness and stagnant, stale, stuffy air and if exceeds beyond 2000 PPM then it can cause increased heart rate and many other diseases.

When the value will be less than 1000 PPM, then the LCD and webpage will display “Fresh Air”. Whenever the value will increase 1000 PPM, then the buzzer will start beeping and the LCD and webpage will display “Poor Air, Open Windows”. If it will increase 2000 then the buzzer will keep beeping and the LCD and webpage will display “Danger! Move to fresh Air”.

Results

After the functions and role of each module is well understood they are connected through the arduino UNO board for the working in the following manner.



Once the connections are made, a simple code is implemented on the arduino 1.8.9. It will provide the necessary power supply to the sensors via board and then display the result of the sensors on the LCD screen.



IOT Air Pollution Monitoring System

Air Quality is 977 PPM

Good Air

Advantages and Applications

ADVANTAGES

- Sensors are easily available.
- Detecting a wide range gases like CO₂, CO etc.
- Simple, compact and easily handle.
- Continuous update of change in percentage of quality.

APPLICATIONS

- Roadside pollution monitoring.
- Industrial perimeter monitoring.
- Site selection for reference monitoring stations.
- Indoor air quality monitoring.

Future scope

- In future the project can be upgraded in more ways than one.
- Interface more number of sensors to know gases present in air.
- Design webpage and upload data on webpage.
- Interface SDCARD to store data.
- Interface GPS module to monitor the pollution.
- Record the data for a long duration and analyze it with respect to time.

Conclusion

- The system to monitor the air of environment using arduino micro controller has been developed.
- Gas sensor gives the sense of different type of dangerous gases.
- It supports new technology and healthy life concept.

References

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- <https://www.engineersgarage.com/contributions/arduino-based-air-quality-monitoring-iot-project/>