

## Iot Based Air Pollution Monitoring System

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**ABSTRACT:** we are making an IOT Based Air Pollution Monitoring System to monitor the real time air quality of the specific area. In this project we will monitor the Air Quality over a web server using internet. We are also going to trigger an alarm when the air quality goes down beyond a certain level so that we can warn the people of the respective area. Air Quality going below the optimal value is representing that there are exceed amount of harmful gases, present in the air like CO<sub>2</sub>, smoke, alcohol, benzene and NH<sub>3</sub>. It will show the Air Quality in PPM (Parts per Million) on the LCD display and as well as on webpage so that we can monitor it very easily. Earlier we have built the LPG detector using MQ6 sensor and also Smoke detector using MQ2 sensor. In this project we are using MQ135 sensor which is the best choice for monitoring Air Quality as it can detects mostly all harmful gases and also can measure their amount accurately at an extent. In this IOT project, we can monitor the pollution Level from anywhere using our Computer, Laptop or Mobile. We can install this system anywhere and can also trigger some device when we observe the air quality is much polluted that can harm the people in that particular environment.

**Keywords:** arduino uno, mq135 gas sensor, wi-fi module, esp8266 16x2 lcd

### I. INTRODUCTION

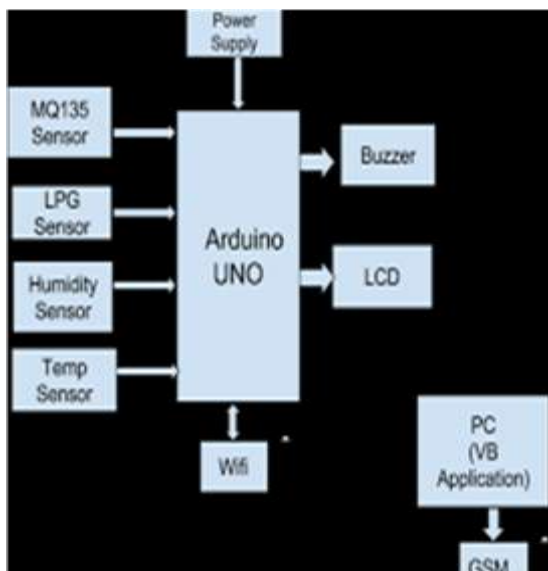
The main objective of the project is to control the air quality of a specific area so that we can take action according to present requirements of that particular area for living/working there without any headache of our health issue. The goal of **IOT BASED AIR QUALITY MONITORING SYSSYTEM** is to protect the health of people of respective areas in which they are working or living, so that we can reduce the polluted environment and as it gives the real time air quality it also enables us to make some effort to reduce the air pollution of a particular area. We can also attach

various devices with it which will be enabled on the basses of Air Quality to reduce the present pollution instantly.

The **Arduino Uno is a microcontroller board based on the ATmega328P**. It has **14 digital input/output pins** (of which 6 can be used as PWM outputs), **6 Analog inputs**, a **16 MHz quartz crystal**, a **USB connection**, a **power jack**, an **ICSP header and a reset button**. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. We can tinker with our UNO without worrying too much about doing something wrong, worst case scenario we can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

The **ESP8266 Wi-Fi Module** is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to our **Wi-Fi** network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

The basic block diagram of proposed model is shown in figure 1. This shows the connectivity of each component with each other. By looking at the block diagram of the proposed model of system the connection is done according to the block diagram. The block diagram helps to see the interconnection of the components with each other for forming the model.



**Figure 1:** Basic block diagram of proposed model

The block diagram of the Air Quality Monitoring System generally shows the interconnection of all the components with each other. The 12V power supply is given to the Arduino.

## II. DESCRIPTION OF COMPONENTS USED IN PROPOSED MODEL

### 2.1 Arduino Uno:

The **Arduino Uno** is a microcontroller board which is an open source microcontroller based on the Microchip ATmega328P. This board consists of digital and analog input/output (I/O) pins that may be interfaced to various external devices and boards. The board has 14 digital I/O pins of which six (6) are capable for PWM Output and it also consists of 6 analog I/O pins, and this board is programmable with the Arduino Integrated Development Environment (Arduino IDE), which requires a type USB cable. This board may be powered by the USB cable or we have an option to power it by an external 9-volt battery, as because it accepts voltages between 7 and 20 volts. The word "Uno" represented as "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards.



**Figure 2:** Arduino Uno

### 2.2 MQ 135 Sensor (Gas Sensor)

MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benzene steam, also sensitive to smoke and other harmful gases. It is with low cost and perfectly suitable for Air quality monitoring application. So we have used the MQ-135 Gas sensor in our project to detect or measure of NH<sub>3</sub>, NO<sub>x</sub>, Alcohol, Benzene, Smoke, CO<sub>2</sub>. The MQ-135 sensor module having a Digital Pin which helps us to making this sensor able to operate even without a microcontroller and it comes in handy when we are just only trying to detect one particular gas.

If we wish to measure the Gas in PPM we have to use the Analog Pin of this Sensor. This analog pin is TTL driven and works on 5V voltage and so it can be easily used with the most common microcontrollers. If we are searching for a sensor to detect or measure common air quality gases such as CO<sub>2</sub>, Smoke, NH<sub>3</sub>, NO<sub>x</sub>, Alcohol, Benzene then this sensor is the right choice for you.



**Figure 3:** MQ 135 Gas Sensor

### 2.3 ESP8266 Wi-Fi Module

The **ESP8266** is a low-cost Wi-Fi microchip, based on a full TCP/IP stack and also having microcontroller capability. This chip first came to the attention of Western makers about in August 2014 having the **ESP-01** module, it is made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. The cost of this module is very low and there is a fact that there were very few external components built on the module, which suggested that it could eventually be very inexpensive in volume and may attract many hackers to explore this module, the chip and the software used on it, as well as to translate the Chinese documentation. The ESP8266 of built-in flash, allowing the building of single-chip devices capable of connecting to Wi-Fi.

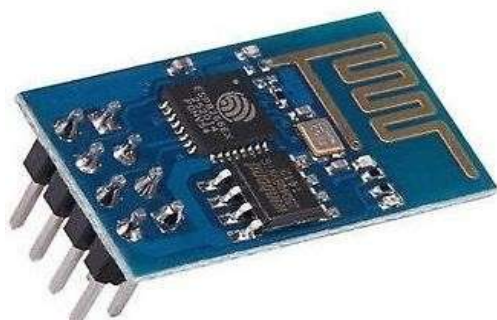


Figure 4: ESP8266 Wi-Fi Module

### 2.4 LCD 16X2

The term LCD stands for liquid crystal display. This is like as one kind of electronic display module, which is used in a variety of applications like various circuits & devices such as mobile phones, calculators, computers and TV sets, etc. These type of displays are mainly used rapidly for multi-segment light-emitting diodes and seven segment displays. The very main benefit of using this module is that it is inexpensive. This module is used here as it is simply programmable, ease for animations, and there are no limitations for displaying various characters, special and even animations, etc. We are using this module to display the observed air quality on the screen for further use.

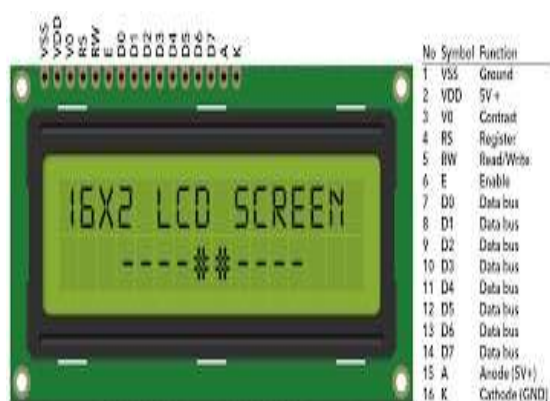


Figure 5: 16X2 Liquid Cristal Display

### 3. OPERTATION AND WORKING OF CIRCUIT:

As show in the figure 6, a 12V rechargeable battery as supply is used which is connected to Arduino Uno. As we discussed above MQ135 sensor can easily sense NH3, NOx, Alcohol, Benzene, Smoke, CO2 and some other gases, so this is most perfect gas sensor for our Air Quality Monitoring System. When we connects this

module to Arduino then it starts sensing the gases, and it gives the Pollution level in PPM (parts per million). MQ135 gas sensor gives the output in form of voltage levels and we convert it into PPM.

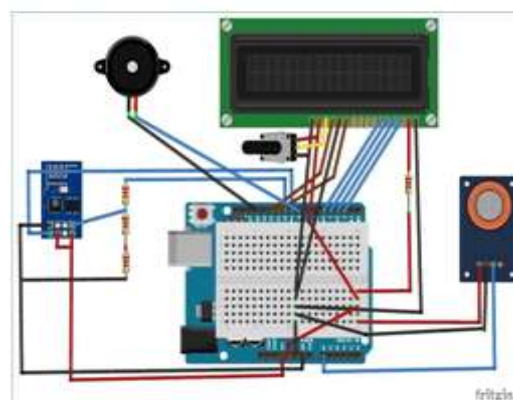


Figure 6: Shows the Circuit Diagram

For converting obtained output in PPM, we have used here 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 must not exceed 1000 PPM value. 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”.

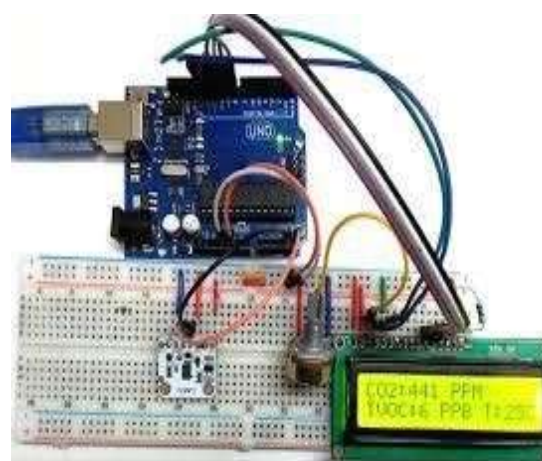


Figure 7: IOT based Air Quality Monitoring System

### Features of the Proposed Project:

- This project can be established in any Remote area and also it is a real time measurement monitoring system.

- This gives the most accurate data for further calculations and also helps in decision making as it gives the actual data about the air quality.
- It also requires less human interaction to operate it hence it can be inherently used in the areas where human can't interact as these are very risky areas.
- It helps in making the quality of the air good for health and very good quality of the air is ensured by this and also helps in preventing the pollution as it gives the real time values of the air and if it crossed

The limit set by the operator it gives the alarm so that we make some effort to maintain the good quality of the air.

### III. CONCLUSION:

The project “**IOT Based Air Pollution Monitoring System**” was designed as a real time monitoring device such that the model can be operated using Android mobile phone/laptop/desktop. The data is measuring using the gas sensor and the measured values are shown at the LCD Display and also we are getting the values on the server using Wi-Fi Module so that we can monitor and control the system from a long distance.

### IV. ACKNOWLEDGEMENT:

Before we get into thick of things, I would like to add few heartfelt words for the people who are part of our team as they have been unending contribution right from the start of construction of the project. Apart from the team, I can indebted to the number of person who have provide helpful and contributed guidance in the draft of material. I acknowledge with deep sense of gratitude towards the encouragement in the form of substantial assistance provided each member of my team. I would like to extend my sincere thanks to our guide Prof. Neeraj Jain, Project coordinator Prof. V.K Agarwal and Head of Department of Electronics and Communication Department Dr. R P S Chauhan.

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