

# IOT BASED AIR QUALITY DETECTOR USING ARDUINO

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**ABSTRACT:** 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 an 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 CO<sub>2</sub>, smoke, alcohol, benzene and NH<sub>3</sub>. 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.

**Key Words:** Internet of things, air pollution, sound pollution, sensors, monitoring system, Arduino.

## I. INTRODUCTION:

It is now important to monitor AIR POLLUTION in real time in most of the urban areas. This project is aimed at developing an IOT device which can monitor air pollution in real time and log data to a remote server. Due to flexibility and low cost Internet of things (IoT) is getting popular day by day. Remote monitoring was facilitated using classical notes in the past, which has some pitfalls like limited memory, processing speed and complex programming strategies. 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. Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma. The IOT also helps monitoring the data in real time. This information can then be applicable in many ways. Analysis of monitoring data allows us to assess how bad air pollution is from day to day.

## II. EXISTING MODEL:

The commercial meters available in the market are Fluke CO- 220 carbon monoxide meter for CO, Amprobe CO<sub>2</sub> meter for CO<sub>2</sub>, ForbixSemicon LPG gas leakage sensor alarm for LPG leakage detection. The researchers in this field have proposed various air quality monitoring systems based on WSN, GSM and GIS. Now each technology has limited uses according to the intended function, as Zigbee is meant for users with Zigbee trans-receiver, Bluetooth. GIS based system is designed, implemented and tested to monitor the pinpoints of air pollution of any area. It consists of a microcontroller, gas sensors, mobile unit, a temporary memory buffer and a web server with internet connectivity which collects data from different locations along with coordinate's information at certain time of a day. The readings for particular location are averaged in a closed time and space. The Global Positioning System (GPS) module is attached to a system to provide accurate representation of pollution sources in an area. The recorded data is periodically transferred to a computer through a General Packet Radio Service (GPRS) connection and then the data will be displayed on the dedicated website with user acceptance. As a result large number of people can be benefited with this.

## III. WHY THIS PROJECT?

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 an alarm when the air quality goes down beyond a certain level, means when there are sufficient number of harmful gases are 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 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.

## IV. ABOUT:

**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 UNO:** 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.

## V. AIR QUALITY MONITORING EQUIPMENTS:

The different components of the equipment along with their intended purpose are discussed below:

**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. 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. 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.

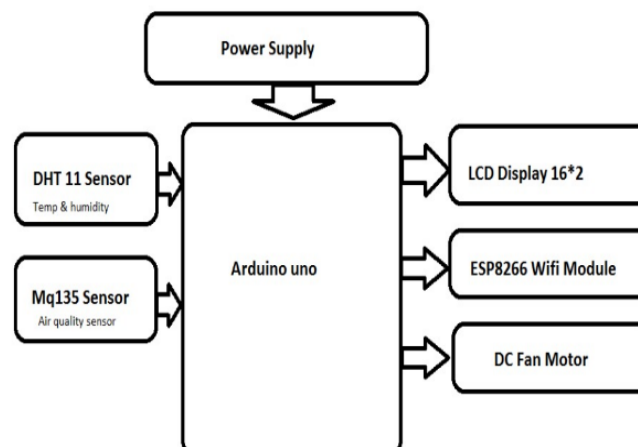
### ESP8266 Wi-Fi Module:

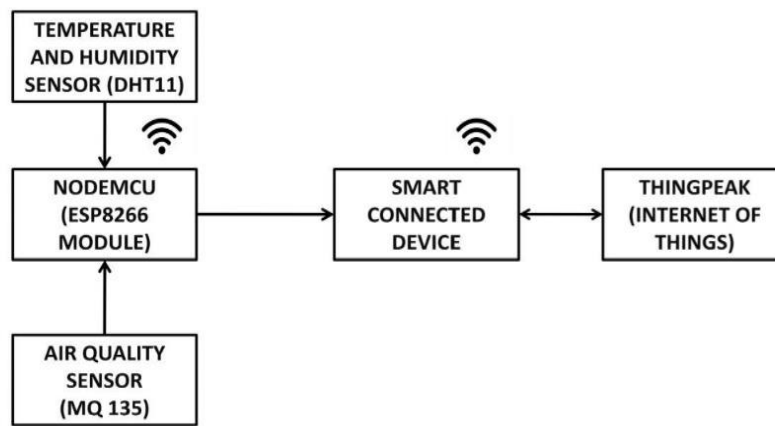
The ESP8266 Wi-Fi Module is a self contained SOC with integrated IP protocol stack that can give any microcontroller access to your Wi-Fi network. Wi-Fi module is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Every ESP8266 module comes pre-programmed with an AT command set firmware, meaning, we can simply connect to the Arduino device. The ESP8266 module is an extremely cost effective board.

### MQ135 Gas Sensor:

The Sensitive material used in MQ135 gas sensor is SnO<sub>2</sub>. 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 CO<sub>2</sub>. The detection range is 10- 10,000 ppm with the voltage rate of about 5.0V±0.1V AC or DC.

## VI. PROPOSED BLOCK DIAGRAM:





## VII. COMPONENTS:

**Hardware:** 1) Power Supply  
 2) Temperature and Humidity Sensor (DHT11)  
 3) Air Quality Sensor (MQ135)  
 4) Arduino Uno  
 5) ESP8266 WIFI Module  
 6) DC Fan Motor  
 7) LCD Display 16\*2  
 8) Wires

**Software:** 1) Arduino Uno  
 2) THINGSPEAK website

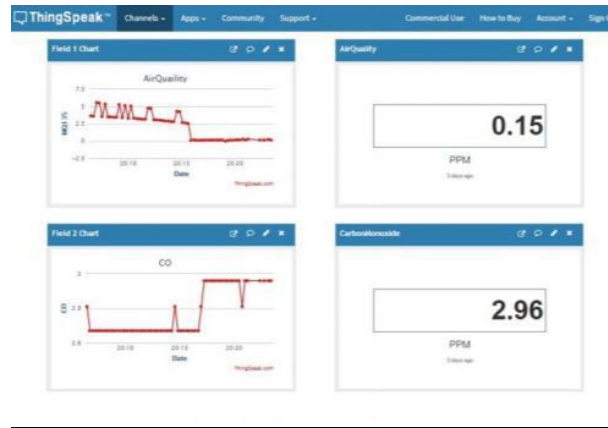
## VIII. WORKING:

We start with connecting 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 makes your projects very powerful. It can communicate with any microcontroller and it is the most leading devices in the IOT platform. Learn more about here. Then we will connect the MQ135 sensor with the Arduino. Connect the VCC and the ground pin of the sensor to the 5V and ground of the Arduino and the Analog pin of sensor to the A0 of the Arduino. Connect a buzzer to the pin 8 of the Arduino which will start to beep when the condition becomes true. The MQ135 sensor can sense NH<sub>3</sub>, NO<sub>x</sub>, alcohol, Benzene, smoke, CO<sub>2</sub> 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 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.

We used Thingspeak IoT platform and we clearly defined the derivations that mentions the correct ppm on the screen with correct calibration. We have implemented it with less cost i.e., when we are pushing the data to the cloud, no need to see the output on LCD which adds more cost to the project. When we are targeting IoT as a platform, our intension should be to present the idea on internet using the platforms like thinger.io or Thingspeak or Cayenne website which are beautifully designed to present the output and even able to download the dataset. When doing an experiment air quality monitoring, no need to use LPG or methane detecting sensors as it is used for Home/office safety. We have used WiFi to push the data onto the cloud rather using GSM or GPRS module.

## IX. OUTPUT:



After connecting the wifi successfully to the ESP-01, it gets established with Thingspeak account with the help of the API key of our account provided. Thingspeak needs 15 seconds of refresh interval to push to the data. Fig 1 shows the field charts of MQ135 sensor values which made to convert to PPM. Fig 2 showing the graphical analysis of the values collected with time on X axis and AirQuality PPM on Y axis.



## X. CONCLUSION:

The system to monitor the air of environment using Arduino microcontroller, IOT Technology is proposed to improve quality of air. With the use of IOT technology enhances the process of monitoring various aspects of environment such as air quality monitoring issue proposed in this paper. Here the using of MQ135 gas sensor gives the sense of different type of dangerous gas and Arduino is the heart of this project which controls the entire process. Wi-Fi module connects the whole process to internet and LCD is used for the visual Output. The Automatic Air quality management system is a step forward to contribute a solution to the biggest threat. The air quality monitoring system overcomes the problem of the highly-polluted areas which is a major issue. It supports the new technology and effectively supports the healthy life concept. This system has features for the people to monitor the amount of pollution on their mobile phones using the application.

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