

# IOT BASED AIR QUALITY MONITORING SYSTEM

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## Abstract

Air pollution is a mixture of solid particles and gases in the air. Car emissions, chemicals from factories, dust, pollen and mold spores may be suspended as particles. Effect of air pollution has many bad things and the others may cause problems to our health, for instance, asthma, cough, and lung disorders. In addition, the pollutant can cause global warming, acid rain, and disturbing plant growth. Basically, a human cannot determine whether the air is good or not. Hence, it is necessary to have a tool that can

measure the air quality. This research is purposed to design an air quality monitoring system by utilizing esp8266 module. Here we are building our own Air quality reporting system which would give us the information about present temperature, humidity, barometric pressure BMP180, air quality sensor MQ135 etc. The system also alerts through SMS messages to the authorities when the air quality parameters exceeds beyond threshold limits using GSM modem device. The smart way to monitor environment this device is an efficient low cost embedded system. This research makes human find out which content of the air is polluted. With module esp8266, we can monitor the air pollution remotely. This makes the air condition can be monitored every time.

**Keywords:** ARDUINO Microcontroller.

ESP8266 Wi-Fi module, GSM, MQ135 Air quality sensor, BMP180 Barometric pressure sensor, DHT11 (Temperature, HUMIDITY) sensor, LCD module.

## 1. Introduction

In the recent years wireless technology has increasing for the need of upholding various sectors .In these recent years IoT graped the most of industrial area specially automation and control. Biomedical is one of recent trend to provide better health care. Not only in hospitals but also the personal health caring facilities are opened by the IoT technology. So having a smart system various parameters are observed that air quality monitoring remotely. In according to this smart system, this paper is reviewed.

Now a day's many Air quality reporting applications are available which gives us information for protection about climatic changes that are going to take place by which man can be aware of present and future climatic changes. Most of the Air quality reporting applications extracts the data from accurate Air quality system.

Air pollution is the biggest problem of every nation, whether it is developed or developing. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants. 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. According to a survey, due to air pollution 50,000 to 100,000 premature deaths per year occur in the U.S. alone. Whereas in EU number reaches to 300,000 and over 3,000,000 worldwide. IOT Based Air Pollution Monitoring System monitors the Air quality sensor data in thingspeak cloud through WI-FI.

Using GSM technology works from anywhere in the world. It sends the alert message if the air quality parameters exceeds beyond threshold limits.

## 2. Literature Survey

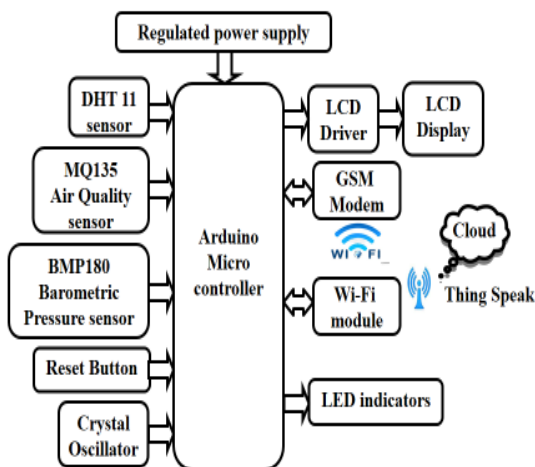
[1] The drawbacks of the conventional monitoring instruments are their large size, heavy weight and extraordinary expensiveness. These lead to sparse deployment of the monitoring stations. In order to be effective, the locations of the monitoring stations need careful placement because the air pollution situation in urban areas is highly related to human activities (e.g. construction activities) and location-dependent (e.g., the traffic choke-points have much worse air quality than average).

[2] The air pollution cannot be detected by human feelings. The air pollution may contain a lot of dangerous substances, such as LPG gas, smoke, carbon monoxide, methane. Substances in the Polluted airs are very dangerous. For example, if the carbon monoxide is above 100ppm, it makes human feel dizzy, nauseous, and within minutes they could die.

The system will show the air quality on the LCD DISPLAY and as well as on THINGSPEAK webpage so that it can be monitored very easily. Barometric pressure, Temperature and Humidity is detected and monitored in the system.

## 3. Implementation:

### IOT BASED AIR QUALITY MONITORING SYSTEM



The controlling device of the whole project is Arduino Microcontroller. By keeping the Air quality station in the environment for monitoring

enables self protection to the environment. Micro controller forms the controlling module and it is the heart of the device. The controller performs the functionality of receiving data from the different sensors connected to it like temperature, barometric pressure, and air quality sensors. The received data can be monitored and displayed on LCD. The system also alerts when the air quality or weather parameters exceeds beyond threshold limits using GSM modem via SMS messages to the authorities. The smart way to monitor environment this device is an efficient low cost embedded system. The Microcontroller is programmed using Embedded C language.

## 4. Related Work:

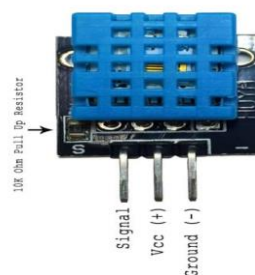
The brief introduction of different modules used in this project is discussed below:

### ARDUINO UNO:

The **Arduino Uno** is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, 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 a AC-to-DC adapter or battery to get started.



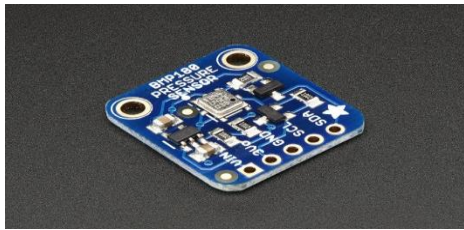
### DHT11(Temperature, HUMIDITY) sensor:



DHT11 digital temperature and humidity sensor is a composite Sensor contains a calibrated digital signal output of the temperature and humidity. Application of a dedicated digital modules collection technology and the temperature and

humidity sensing technology, to ensure that the product has high reliability and excellent long-term stability. The sensor includes a resistive sense of wet components and NTC temperature measurement devices, and connected with a high-performance 8-bit microcontroller.

#### Barometric Pressure sensor(BMP180):



Barometric pressure (also known as atmospheric pressure), is the pressure caused by the weight of air pressing down on the Earth. Imagine a column of air rising from the Earth's surface to the top of the atmosphere. The air in the atmosphere has mass, so gravity causes the weight of that column to exert pressure on the surface. The SI unit for pressure is the Pascal (Pa). One Pascal is defined as one Newton of force per square meter. The BMP180 measures both pressure and temperature, because temperature changes the density of gasses like air. At higher temperatures, air is not as dense and heavy, so it applies less pressure on the sensor. At lower temperatures, air is more dense and weighs more, so it exerts more pressure on the sensor. The sensor uses real-time temperature measurements to compensate the pressure readings for changes in air density.

#### MQ135:



Air quality **sensor** for detecting a wide range of gases, including NH<sub>3</sub>, NO<sub>x</sub>, alcohol, benzene, smoke and CO<sub>2</sub>. Ideal for use in office or factory. **MQ135** gas **sensor** has high sensitivity to Ammonia, Sulfide and Benzene steam, also sensitive to smoke and other harmful gases. The **MQ135** Air Quality **Sensor** consists of a small **sensing** material whose conductivity is lower in clean air and higher in polluted air, thus

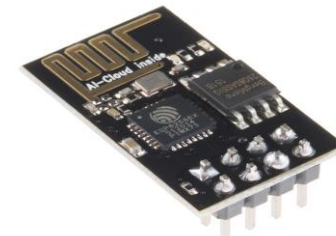
making the **sensor** very useful while detecting dangerous gases. The **sensor** ionizes the gases which come in its contact, making changes in the resistance of the **sensing** material

#### GSM(SIM800A):



SIM800 is a quad-band GSM/GPRS module designed for the global market. It works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM800 features GPRS multi-slot class 12/ class 10 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. With a tiny configuration of 24\*24\*3mm, SIM800 can meet almost all the space requirements in users' applications, such as M2M, smart phone, PDA and other mobile devices. SIM800 has 68 SMT pads, and provides all hardware interfaces between the module and customers' boards. SIM800 is designed with power saving technique so that the current consumption is as low as 1.2mA in sleep mode. SIM800 integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful for data transfer applications.

#### ESP 8266 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 your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed



with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

### LCD (LIQUID CRYSTAL DISPLAY) :



One of the most common devices attached to a micro controller is an 16x2 LCD display. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively. The project status will display on LCD.

### Thing speak:

**Thing Speak server** is an open data platform and API for the Internet of Things that enables you to collect, store, analyze, visualize, and act on data from sensors.

### 5 RESULTS:

Thus the project **“IOT BASED AIR QUALITY MONITORING SYSTEM”** has been successfully designed and tested.

### 6. CONCLUSION:

The existing model presents an Integrating feature of all the hardware components which has been used and developed in it with ARDUINO UNO ATMEGA328P MICROCONTROLLER. The Presence of each and every module has been reasoned out and placed very carefully. Hence the contributing to the best working unit for **“IOT BASED AIR QUALITY MONITORING SYSTEM”** has been designed perfectly. An air quality detector is very important because nowadays air pollution is easy to find. For the air pollution which cannot be easy detected by human, it requires a device as a reader of the air quality. By this research, we can avoid air

pollution through monitoring the air quality regularly. Thus, the project has been successfully designed and tested.

### 7. ACKNOWLEDGEMENT

We would like to thank all the authors of different research papers referred during writing this paper. It was very knowledge gaining and helpful for the further research to be done in future.

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