# IoT Enabled Proactive Air Quality Monitoring System

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## Abstract –

**This paper puts forward a methodology for IoT enabled air monitoring system to determine the air quality at a particular place. Air pollution is one of the largest Environmental health risks in world. Air pollution causes because of release of harmful gases by industries, automobile emissions and those air pollutants increases concentration of environmentally unfriendly gases. These pollutants can cause damages in human health. This system is integrated with Mobile Application also its communication with ESP32. Internet of Things is nowadays finding profound use in each and every sector. This paper proposes a kind of real-time air pollution monitoring in which we are using different gas sensors. The use of multiparameter IoT enabled air quality monitoring systems makes it possible to determine level of major air pollutants.**

**Keywords- IoT (Internet of Things)**

## 1. Introduction

Due to the fast development of the industries and urban areas in the world, pollution is now a common problem in most of the countries. Environmental pollution includes; air pollution, water pollution, plastic pollution noise pollution, and soil pollution. Air pollution can be defined as the existence of dangerous or pollutant substances in the air that interfere with human health or welfare, or introduce other harmful environmental effects. An air pollutant is a substance in the air that can have disadvantageous effects on humans and the ecological community. So there is increasing demand for observation and monitoring air quality because of rise in polluted gases Therefore, to track the effect of this pollution on environment and health of individual it is mandatory to track the air quality in sub urban and urban areas.

Internet of Things (IoT) has become a very popular paradigm in the modern wireless communication era. , we are implementing this project using Mobile Application, ESP32, and various gas sensors. This various sensors can do the sensing of emitted gas like CO (carbon monoxide), $NH_3$ (Ammonia) Smoke and temperature. For this project we are employing MQ-2, MQ-7and MQ-135.

This paper suggests an idea, which is expected to help in reducing the pollution in air. Paper also includes a present model idea to implement the same as a real time project for air quality detection and monitoring.

The main mission of air quality monitoring system is to record the concentration of pollution and other parameter related to the pollution and deliver these information or data to the user.

## 2. Need of Monitoring

Clean air is primary need for every human being. Air pollution can cause precarious effects on health and many people are concerned about pollution in the air that they use to breathe. Therefore to take any step forward to controlling the pollution rate it is important to monitor the air quality which will help us to make a decision for controlling air quality. There are various causes of increasing the pollution such as smoke automobile exhaust, harmful effluent industrial discharge, etc. these are main reason of air pollution. Carbon monoxide (CO), Ammonia ($NH_3$) and smoke are the main gases which directly affect the human health and the main contribution of these gases are pollutant emission. Tremendous efforts are required to decrease air pollution in both indoor and outdoor environments.

Polluted air also causes global warming. Global warming occurs when air pollutants like carbon monoxide (CO) and other introduce in the atmosphere and soak up sunlight and solar radiation that have rebounded off the earth's surface.

Acid rain is caused by the chemical reaction of Ammonia ($NH_3$), and carbon monoxide (CO) and air which increase the acidity of precipitation.

Air pollutants called chlorofluorocarbons. Chlorofluorocarbons are chemicals containing atoms of carbon, fluorine and chlorine they are destroying the parts of the ozone layer. The ozone layer is located in the atmosphere of Earth's, which contain $O^3$ molecules help shields our planet from the ultraviolet radiation. The portions of narrow ozone are called ozone holes. Ultraviolet radiation enters in Earth's atmosphere from this ozone holes which causes skin problems and damages wildlife and plants.

## 3. Air Quality Index

An air quality index (AQI) is used by government agencies to interface to the common people how air polluted currently is or how polluted it is predict to become. As AQI level increases, percentage of air pollutants also increases. The AQI is an index for describe daily air quality. It tells us how air clean or polluted is, and how it is related our health. The AQI focuses on health consequence you may occurrence within a few hours or days after breathing unclean and polluted air.

There are six Air Quality Index classified as follow Good, Moderate, Moderately polluted, Unhealthy, Very unhealthy, and Hazardous.

| AQI level | Numerical value | Meaning |
|---|---|---|
| Good | 0 to 50 | Air quality is satisfactory. |
| Moderate | 51 to 100 | Air quality is acceptable. |
| Moderately polluted | 101 to 150 | Group of sensitive category may experience health effects. |
| Unhealthy | 151 to 200 | Everyone may experience health results. |
| Very unhealthy | 201 to 300 | Everyone may experience more serious health effects. |
| Hazardous | 301 to 500 | Health warning of emergency condition. |

# 4. System Design

The field of IoT has developed rapidly in the recent years due to advance mode in many areas such as hardware, sensor and networking. IoT is a network of physical and also virtual object that transmit and receive information with each other over the Internet. In this project we are taking help of ESP32 and some gas sensors. We are using an Android app to show output.

Sensors scan the air and get reading of different gases at processing node, with the help of Internet access Device those reading sanded to the server and that sanded data and information is fetch by the Android application.

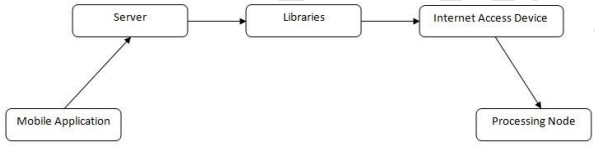


Fig. 1. Architecture of the Air Monitoring System.

## A. Components

1) EPS32:- ESP32 is a chip with single 2.4 GHz Wi-Fi and Bluetooth combination designed for low cost, low power system. It has CPU Xtensa® 32-bit LX6 microprocessors with internal memory of 128Kbytes ROM and 416 Kbytes of SRAM. It used to perform IoT operations.

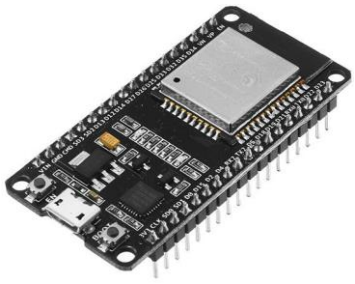

Fig. 2: ESP32

2) MQ135 sensor:- The MQ135 sensor is used to sense the gases like NOx, Benzene, alcohol, smoke, NH3, CO2 and some other gases. It gives the output in form of analog signal which indicate the concentration of gasses. Following fig shows the sensor MQ135.


Fig. 3: MQ135

MQ-2 Gas sensor: - MQ-2 Gas sensor can sense or measure the concentration of gasses like CO LPG, Propane, Alcohol, Hydrogen and even methane. This sensor contains sensitive material ($SnO_2$) and it is help to sense gasses. This sensor has simple drive circuit and it is low cost sensor.


Fig. 4: MQ-2

MQ-7 Gas Sensor: - This sensor is simply used for sensing Carbon Monoxide (CO), suitable for determine the concentrations of CO in the air. The MQ-7 can detect CO gas concentration in range of 20 to 2000ppm.MQ-7 is very sensitive and it has fast response time. The sensor's output is an analog signal.


Fig. 4: MQ-7

8) Temperature Sensor: - The DTH11 is temperature sensor which is also uses for sensing Humidity. It gives output digital signal on data pin. It runs on single power supply on VCC pin. Fig.9 shows LM35 sensor for Temperature.

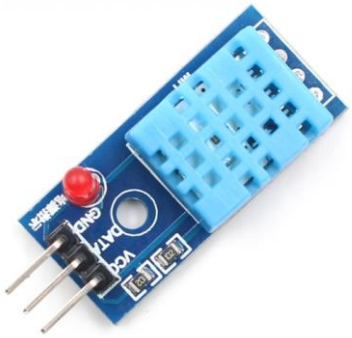


Fig: DHT11

## 4. Conclusion

This system made up of the sensors that detect the air quality and concentration of air pollutants which causes air pollution. The sensors are MQ 2, MQ 7, MQ 135 and LM 35 sensors for scanning CO (carbon monoxide), $NH_3$ (Ammonia), Smoke and temperature respectively. The proposed IoT Enabled Proactive Air Quality Monitoring System provides only real-time statistics about the concentration of air pollutants in these regions.

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