

# IoT Based Air Quality Monitoring System

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# Introduction

- The level of the pollution has increased with times by lot of factors like the increase in the population, increased vehicle use, industrialization and urbanization which results in harmful effects on human wellbeing by directly affecting the health of population exposed to it.
- In order to monitor in this project we are going to make an IOT Based Air Quality 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 beyond a certain level that means there are sufficient amount of harmful gases which are present in the pure air like CO<sub>2</sub>, smoke, alcohol, benzene and ammonia(NH<sub>3</sub>).

# ABSTRACT

- So, in this project it is necessary to constantly monitor the air quality index of a city to make it smart and livable. In this paper, we propose and develop an IoT based Air Quality Monitoring System for Smart Cities or even other small cities and towns.
- The real-time data of the air quality is accessed through the smart devices and analyzed to measure the impact on city dwellers.
- The smart devices are capable of measuring the Temperature, Humidity, Carbon Monoxide, LPG, Smoke and other hazardous particulate matters like PM2.5 and PM10 levels in the atmosphere. The gathered data is accessed globally through an Android Application or any cloud data server of IoT.

# LITERATURE REVIEW

- This paper presents a network for both indoor and outdoor air quality monitoring. The sensor response is strongly dependent on parameters such as temperature, humidity, and cross influence of the other gases.
- The ideal portable device is to have embedded sensors installed on subjects, e.g., a vehicle, a person, or an animal. Sensor device is an innovative integrated sensor system using novel design polymer modified tuning fork sensors. The device encompasses sample collection and transport, sample conditioning with interferon's removal and sample air zeroing capabilities for baseline establishments, thus enabling it to form a standalone and portable unit. Ambient air is being drawn into the device either through the particle filter (detection mode) or the zero filters (calibration mode).

# ORIGINALITY & INNOVATION

This project proposes an idea to install monitoring applications on smartphones. It is innovative because it provides easy access to the public to monitor real time air quality in their area.

It uses low cost and readily available devices such as a dust sensor, carbon monoxide gas sensor, carbon dioxide gas sensor, and nitrogen dioxide gas sensor.

For controlling these sensors, microcontrollers are used and the microcontrollers also act as transmitter to transmit the data to the cloud database. The information on air quality can be accessed through a smartphone app in real time.

# Existing System

- The commercial meters available in the market are Fluke CO220 carbon monoxide meter for CO, Amprobe CO2 meter for CO2, 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(Wireless Sensor Networks), GSM(Global System for mobile communications) and GIS(Geographic Information System).
- 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.

# IN CONTINUATION

- 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 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.
- The IoT based air pollution monitoring system can be produced by using sensors and microcontrollers present in the market. The microcontrollers are programmed to take the sensors as input and transmit the data to the cloud. An algorithm is developed to analyse the data and send it to the smartphones app.



# PROPOSED SYSTEM

The idea of our project is that to create a wireless distributed mobile air pollution monitoring system using General Packet Radio Service(GPRS) sensors.

Since the smart air has been already developed based on the iot technology to efficiently monitor the air quality and transmit the data to a web server via LTE in real time.

The device is composed of a microcontroller,pollutant detection sensor and a LTE modem.

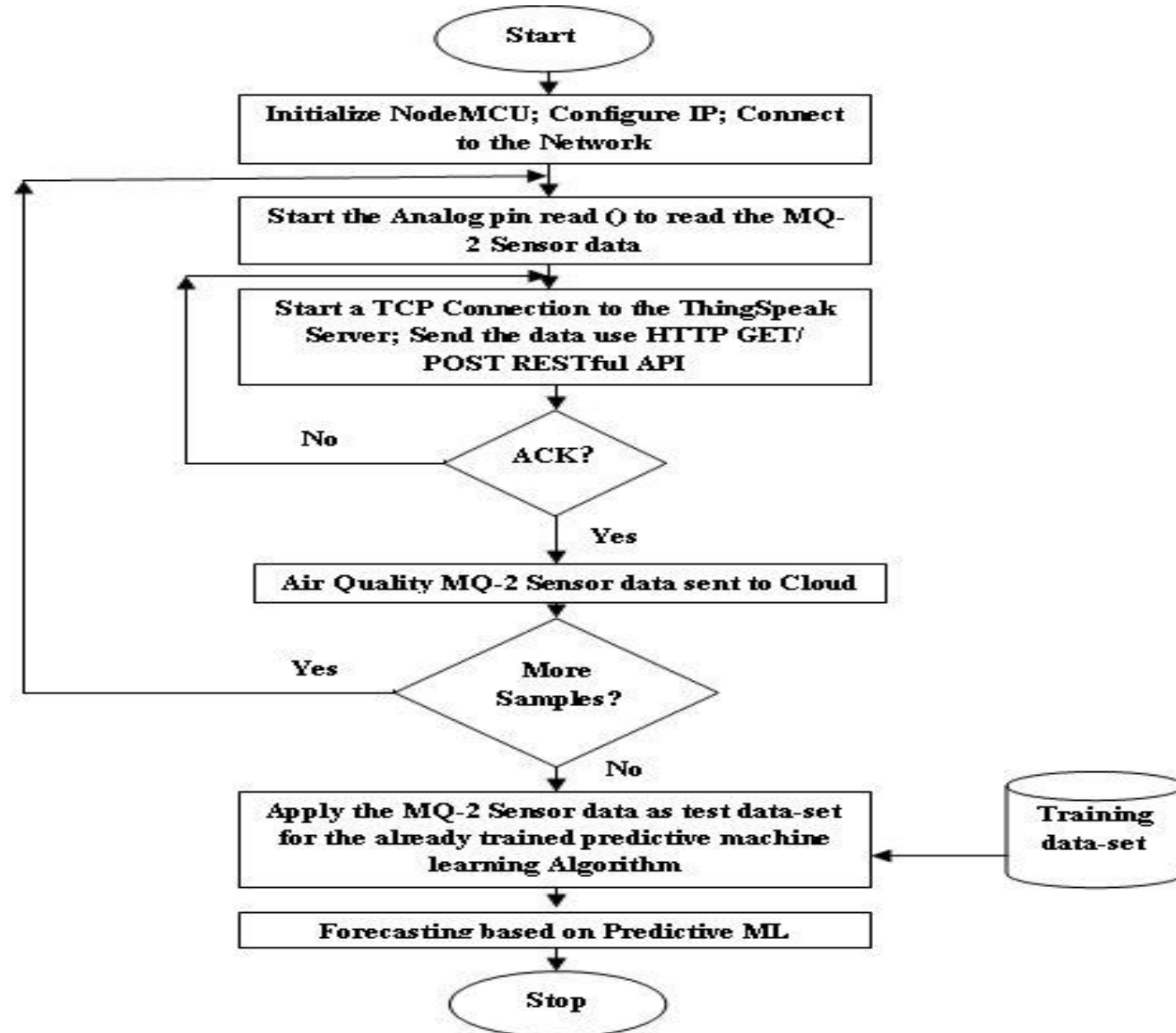
We am thinking about the new idea that we may display the information and graph levels of the pollutants present in the pure air about temperature ,humidity,various pollutants level such as methane,carbon dioxide ,alcohol level,liquified gases ,carbon monoxide level etc.

and on both the cloud server called as thingspeak as well as on the television using HDMI cable,VGA adapter.

# BLOCK DIAGRAM



# FLOWCHART



# COMPONENTS (HARDWARE)

MQ135 Gas sensor

Wi-Fi module ESP8266

Breadboard

Buzzer

10K potentiometer

1K ohm resistors

220 ohm resistor

MQ 6 LPG gas sensor

Temperature & Humidity Sensor(DHT-11)

# COMPONENTS (SOFTWARE)

Arduino UNO 1.6.13 Software

Embedded C programming Language

ThingSpeak cloud data server for displaying the output  
of the project.

# FUNCTIONING

Arduino UNO:-Arduino Uno is a microcontroller board based on the ATmega328P It has 14 digital input/output pins 6 analog inputs, a 16 MHz quartz crystal, a USB Connection, power jack, an ICSP header and a reset button.

MQ135 sensor:-The MQ135 sensor can sense NH<sub>3</sub>, NO<sub>x</sub>, alcohol, Benzene, smoke, CO<sub>2</sub> and some other gases.It gives the output in form of voltage levels.

WIFI Module (ESP8266/Node MCU):-The ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack and MCU (microcontroller unit) capability. It runs on 3.3V and gives our system access to Wi-Fi or internet.

Buzzer:-A Buzzer or beeper is an audio signaling device.Whenever the air pollution goes above the threshold level the Buzzer starts beeping indicating Danger

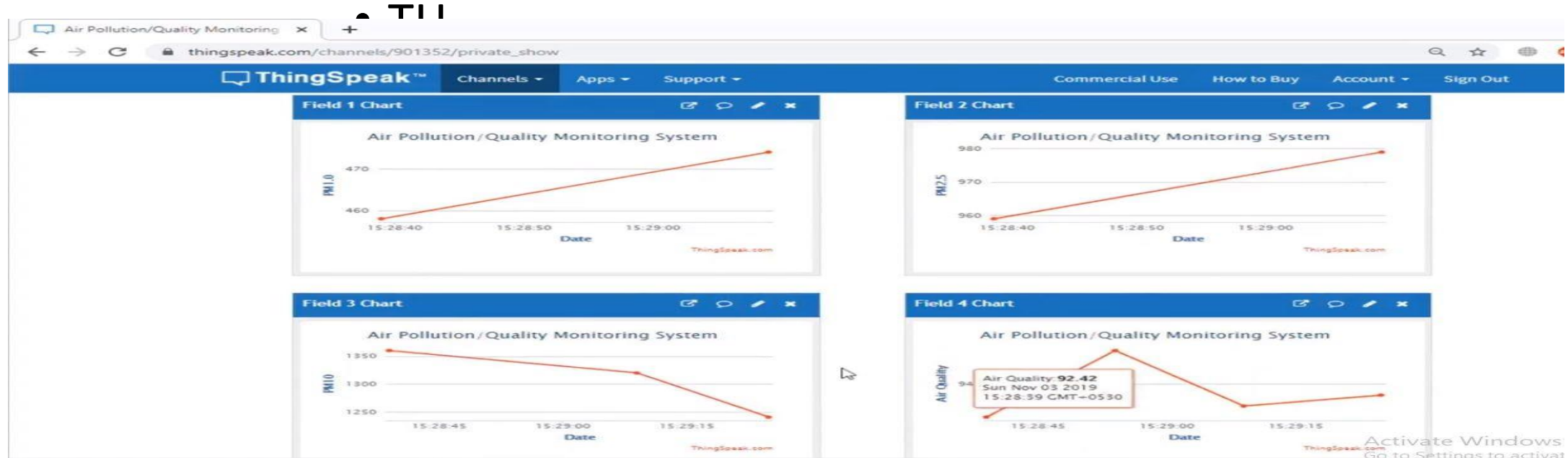
LCD (Liquid Crystal Display):- This is a basic (16x2) 16 character by 2 line display. Black text on Green background. It is used to indicate the Air and Humidity in PPM.

# IN CONTINUATION

LPG Sensor:- MQ-6 sensor is a simple-to-use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm.

DHT-11 Temperature & Humidity Sensor:- DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc. to measure humidity and temperature instantaneously.

# RESULTS (GRAPH 1)





# ADVANTAGES & APPLICATION

There are many cities around the world facing air quality issues. The contaminated air results in death every year and decline in health conditions as people are exposed to unhealthy air quality.

Awareness of the contaminated air enables the community to take precautionary steps. With this project the community can enjoy cleaner air and improved health conditions.

- The use of this project is limited upto some extent only. Some of them are

1. Industrial perimeter monitoring.
2. Indoor air quality monitoring
3. Site selection for reference monitoring stations.
4. Making data available to users.

# CONFERENCE/JOURNAL COMMUNICATION

- IEEE PAPER (IOT BASED AIR QUALITY MONITORING SYSTEM)
- Air Quality Index of India :-  
<https://www.aqi.in/>
- **SAFAR-India** System of Air Quality and Weather Forecasting And Research  
Ministry of Earth Science, Govt. of India.  
Indian Institute of Tropical Meteorology, Pune.
- 1]<https://store.arduino.cc/arduino-uno-rev3>
- [2]<https://www.arduino.cc/>
- [3][www.iotwebplanet.com](http://www.iotwebplanet.com)
- [4][content/uploads/2008/04/5v-r](#)

# COST

MQ135 Gas sensor-	300RS
Wi-Fi module ESP8266 -	600RS
Breadboard -	300RS
Buzzer -	150RS
10K potentiometer-	200RS
1K ohm resistors-	150RS
220 ohm resistor-	500RS
MQ 6 LPG gas sensor-	400RS
Temperature & Humidity Sensor(DHT-11)-	200RS

ESTIMATED TOTAL COST - 2800RS (500RS LESS OR MORE)

# CONCLUSION & FUTURE SCOPE

- The system to monitor the air of environment using Adriano 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 Adriano 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.
- Internet of Things (IoT) has been identified as one of the emerging technologies in IT.
- Future of IoT is very bright as this is feeding and empowering Data Science and Artificial Intelligence in a big way.
- Data from IoT network enables us to have better tracking, monitoring, prediction, management and control of various systems in different industries.