# Monitoring Sound and Air Pollution Using MQTT Protocol with Temperature and Humidity Sensor

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***Abstract:***

In recent day scenario, the incessant increase in air and sound pollution prove to be an alarming problem. It has become mandatory to control and appropriately monitor the situation so that the required steps to curb the situation can be undertaken.

In this project, an IOT-based method to monitor the Air Quality Index and the Noise Intensity of a region, have been proposed. The recommended technology comprises of four modules namely, the Air Quality Index Monitoring Module, the Sound Intensity Detection Module, the Cloud-based Monitoring Module and the Anomaly Notification Module. Firstly, the Air Quality Index is measured considering the presence of the five criteria air pollutants. Then the sound intensity is detected using respective sensor. After that, the Cloud-based Monitoring Module ensures the process of acquiring the data with the help of Wi-fi-module present in Raspberry Pi which fulfils the objective of analysis of information on a periodical basis. Finally, the Anomaly Notification Module alerts the user in case of an undesired condition.

***Index Terms - Raspberry Pi 3B, gas sensor, humidity sensor, temperature and sound sensor.***

## I. INTRODUCTION

Air and sound pollution is a growing issue these days. It is necessary to monitor the air and sound pollution levels to ensure a healthy and safe environment. With the rapid increase in infrastructure and industrial plants, environmental issues have greatly influenced the need of smart monitoring systems.

## II. LITERATURE APPROACH

*[1] L.Ezhilarasi, K.Sripriya, A .Suganya, K.Vinodhini, " A System For Monitoring Air And Sound Pollution Using Arduino Controller With Iot Technology." , International Research Journal in Advanced Engineering and Technology (IRJAET)*

This monitoring technique using a Zigbee wireless sensor network to monitor the various environmental parameters. It uses RFID means to store and retrieve data through electromagnetic transmission to an RF integrated circuit. The WSN gateway method is used to conveniently collect the data at any time and place.

*[2]Mahantesh B Dalawai, Siva Yellampalli, Pradeep S.V, "IOT Based Air and Noise Pollution Monitoring in Urban and Rural Areas, Important Zones like Schools and Hospitals in Real Time.", International e-Journal for Technology and Research-2017.*

Here, the authors have used a GPRS/GSM module and a web server to efficiently monitor the various pollution levels. In the module the smoke sensor and noise sensor will upload the data to the server or cloud at every instant of time so that the pollution level can be monitored using the internet.

*[3]Arushi Singh, Divya Pathak, Prachi Pandit1, Shruti Patil, P Priti. C. Golar , "IOT based Air and Sound Pollution Monitoring System." International Journal of Advanced Research in Electrical.*

Here, the authors have proposed a system which uses air and sound sensors to monitor the data constantly and then transmit the data. A raspberry pi module interacts with the sensors and processes the data thereby transmitting it to the application.

*[4]A. Sumithra, J.Jane Ida, K. Karthika , S. Gavaskar, "A Smart Environmental Monitoring System Using Internet Of Things." International Journal of Scientific Engineering and Applied Science (IJSEAS) – Volume-2, Issue-3, March 2016*

Here, the authors have proposed the concept of a smart city. Technology and communication is the basis of this smart city. Various sensors and modules have also been used to monitor the various environmental parameters. This system uses air and sound sensors to monitor the data and then upload the data on the cloud server as digital data. The cloud storage managers analyze the data and notify accordingly.

*[5]MohannadIbrahim ,AbdelghaforElgamri , ShariefBabiker . Ahmed Mohamed, "Internet of things based smart environmental monitoring using the Raspberry-Pi computer." Fifth International Conference on Digital Information Processing and Communications (ICDIPC), 2015*

Here, the authors have proposed the design of a cost effective environmental monitoring device using Raspberry pi. The information is collected by the sensors and uploaded to the internet where it could be accessed anytime. The system was found to be accurate in terms of measuring humidity, temperature etc.

## III. PROPOSED WORK AND SYSTEM ARCHITECTURE

We propose an IOT-based method to monitor the Air Quality Index and the Noise Intensity of a region, have been proposed. The recommended technology comprises of four modules namely, the Air Quality Index Monitoring Module, the Sound Intensity Detection Module, the Cloud-based Monitoring Module and the Anomaly Notification Module. Firstly, the Air Quality Index is measured considering the presence of the five criteria air pollutants. Then the sound intensity is detected using respective sensor. After that, the Cloud-based Monitoring Module ensures the process of acquiring the data with the help of Wi-fi-module present in Raspberry Pi which fulfils the objective of analysis of information on a periodical basis. Finally, the Anomaly Notification Module alerts the user in case of an undesired condition.

**Advantages:**

Monitored Air and Sound pollution

Ensures a healthy and safe environment

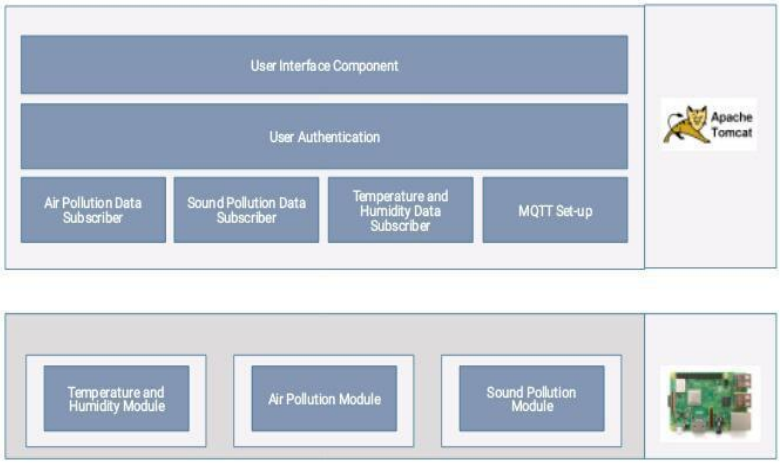


Fig. 1: System Architecture

A System Architecture is the conceptual model that defines the structure, behavior, and more view of the system.There will be two layers i.e, software part and Hardware part. Software part uses Apache Tomcat which is open source. Hardware part consists of temperature and humity sensor, air pollution sensor and sound sensor. Which collect the data from the data from the respective area where sensors are placed. Raspberry pi 3B is a series of small single-board computers developed in the United

Kingdom by the Raspberry pi Foundation.

## IV. TAXONOMY

**MQTT:** An MQTT system consists of clients communicating with a server often called a "broker". A client may be either a publisher of information or a subscriber. Each client can connect to the broker. Information is organized in a hierarchy of topics. When a publisher has a new item of data to distribute, it sends a control message with the data to the connected broker. The broker then distributes the information to any clients that have subscribed to that topic. The publisher does not need to have any data on the number or locations of subscribers, and subscribers in turn do not have to be configured with any data about the publishers. If a broker receives a topic for which there are no current subscribers, it will discard the topic unless the publisher indicates that the topic is to be retained. This allows new subscribers to a topic to receive the most current value rather than waiting for the next update from a publisher.

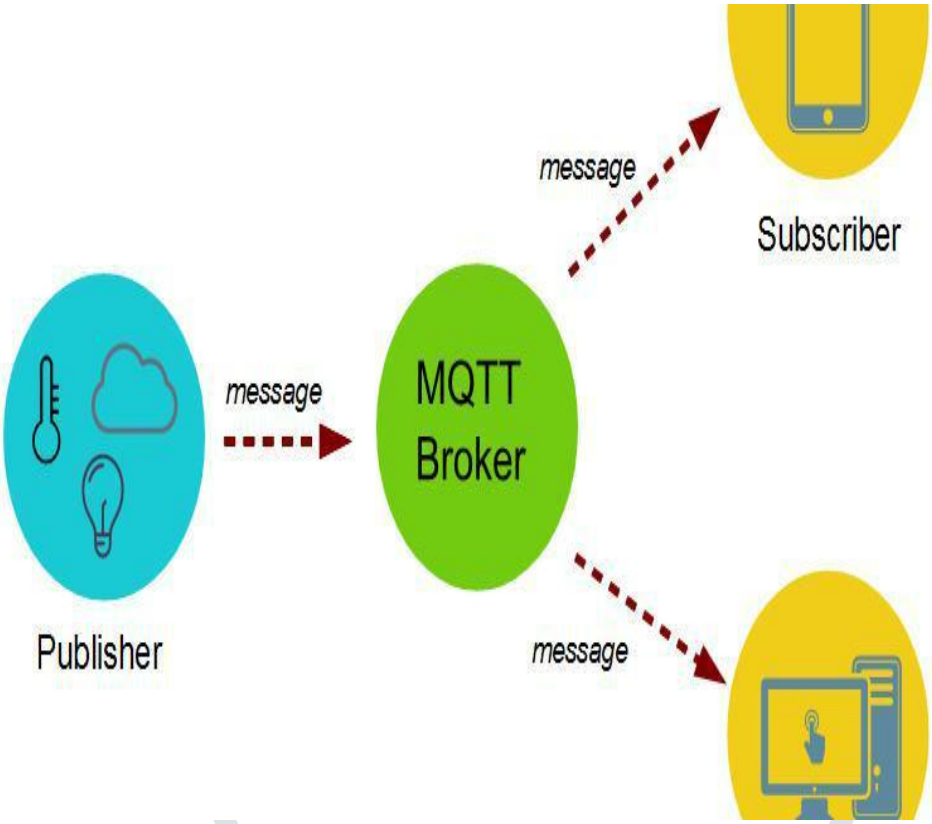


Fig. 2 : Working of MQTT

When a publishing client first connects to the broker, it can set up a default message to be sent to subscribers if the broker detects that the publishing client has unexpectedly disconnected from the broker. Clients only interact with a broker, but a system may contain several broker servers that exchange data based on their current subscribers' topics. A minimal MQTT control message can be as little as two bytes of data. A control message can carry nearly 256 megabytes of data if needed. There are fourteen defined message types used to connect and disconnect a client from a broker, to publish data, to acknowledge receipt of data, and to supervise the connection between client and server. MQTT relies on the TCP protocol for data transmission. A variant, MQTT-SN, is used over other transports such as UDP or Bluetooth. MQTT sends connection credentials in plain text format and does not include any measures for security or authentication. This can be provided by the underlying TCP transport using measures to protect the integrity of transferred information from interception or duplication.

**Air Quality Index:** It is a value that is communicated by the government to the public as to how polluted the environment is or will become. As the AQI increases, various health hazards come up. The AQI can be computed by calculating the average pollutant concentration over a specified period. The formula for calculating AQI is,

$$I = \frac{I_{high} - I_{low}}{C_{high} - C_{low}}(C - C_{lo}$$

**Noise Pollution Level :** Noise pollution has the most harmful impact on human or animal life. Noise pollution generally occurs due to the sound coming from honking cars, industries, factories, heavy machinery etc. Certain noise standards are prescribed by the government that need to be maintained.

The proposed model consists of the following modules, namely, the Air Quality Index Monitoring Module, the Sound Intensity Detection Module, the Cloud-based Data Monitoring Module and finally the Anomaly Notification Module.

## V.EXPERIMENTAL SETUP AND RESULTS

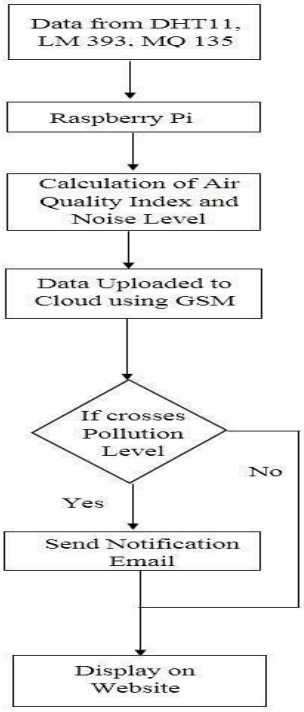


Fig. 3 Working flowchart

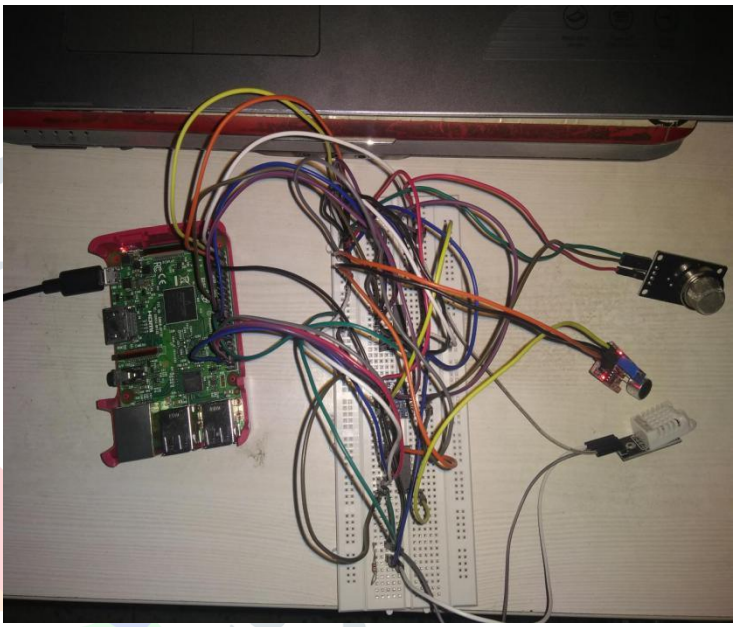

Fig. 4 Experimental Setup

The proposed embedded device for monitoring noise and air levels in atmosphere to make the environment intelligent or interactive with object. The proposed model is adaptable and distributive in nature to monitor the environmental parameters.

The architecture is developed for noise and air pollution monitoring. Anomaly Notification, it acts as an alert system in the Raspberry pi 3B, we use control statements for the incorporation of anomaly notification. If one of the parameters exceeds the desirable range of its digital value, steps are taken to send an Email to the specific authorities involved.

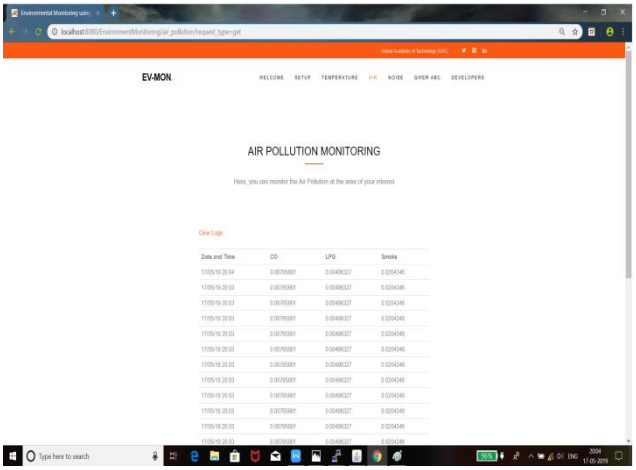


Fig. 5 Air pollution web results

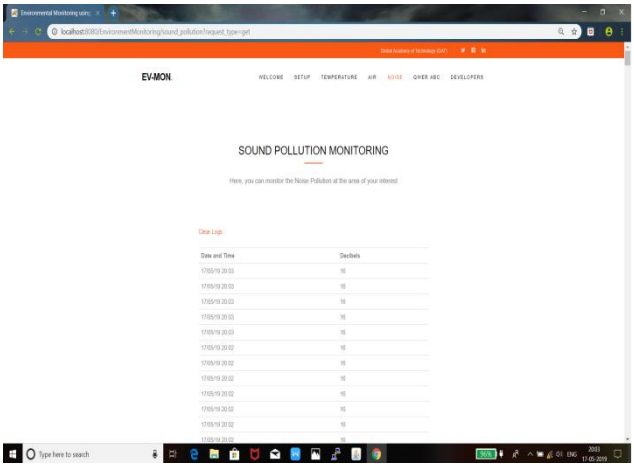


Fig. 6 Sound pollution web results

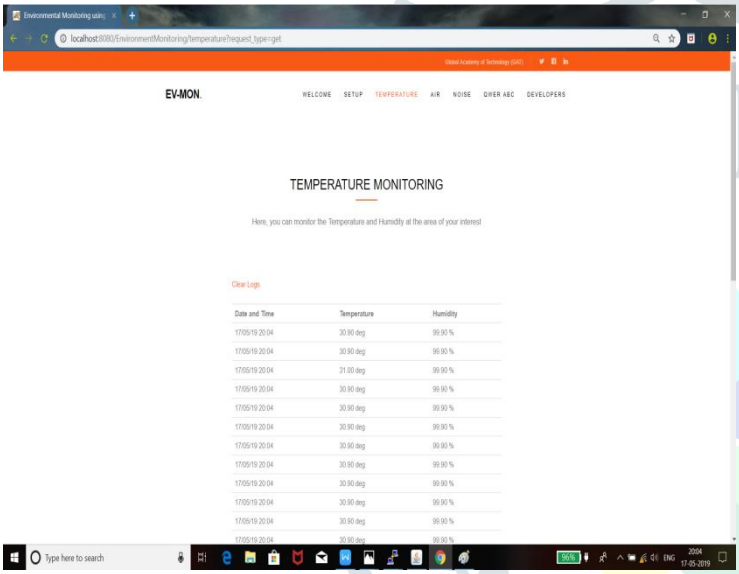


Fig. 7 Temperature and Humidity web results

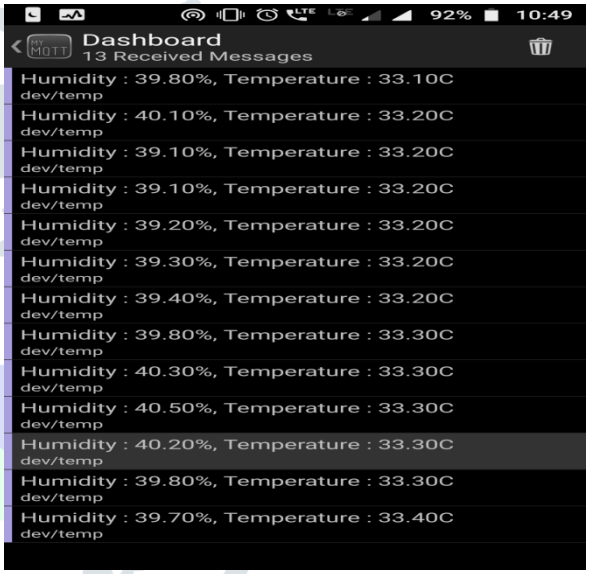


Fig. 8 Mobile App Results

## VI. CONCLUSION AND FUTURE SCOPE

Humans are considered responsible for this polluted and dangerous environment. This is a major concern for the whole world. Thus, a smart way to monitor the various environmental parameters using a Raspberry Pi module has been discussed in this paper. The concept of IoT helps improve the quality of air, monitor the level of noise, temperature and humidity [12][13].It is a low-cost, precise and efficient method of monitoring. The monitoring of accumulated data in the cloud storage helps to analyze the various patterns in the environmental parameters and accordingly notifies the public.

## REFERENCES

[1] L.Ezhilarasi, K.Sripriya, A .Suganya, K.Vinodhini, " A System For Monitoring Air And Sound Pollution Using Arduino Controller With Iot Technology." , International Research Journal in Advanced Engineering and Technology (IRJAET)

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