# Cloud Based Air And Sound Pollution Monitoring System And Weather Forecasting

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***Abstract-*** *Pollution is growing issue for these days and rapid change in infrastructure and industrial plant creating environmental issues like climate change, mal functioning and pollution has greatly influence for the need of an efficient, cheap, operational adaptable and smart monitoring system bring it under control its monitoring is majorly recommended and overcome this issue, we are introducing a system through which the level of sound and the existence of the harmful gases in the surroundings can be detected and growing pollution at such an alarming rate has started creating trouble for the living beings, may it be high decibels or toxic gases present in the environment leaves a harmful effect on human's health and thus needs a special attention. The system collects the air and noise quality levels at different sites and alerts authorities and forecast the environmental parameters solution includes the technology internet of things (IOT) which is outcome of merged field of computer science and electronics. In our project, a solution is proposed for pollution monitoring system using IOT which can be easily setup in any places in real time like hospital aria, residential area, school area or industrial area.*

***Keywords***- IOT,Pollution.

## I. INTRODUCTION

Internet of Things represents a general concept for the ability of network devices to sense and collect data from the world around us, and then share that data across the Internet where it can be processed and utilized for various interesting purpose.

The main objective of IOT Air and sound pollution is a major problem 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. Due to its low cost, high efficiency and versatility, Internet of Things (IOT) has become very popular now these days.

It uses Raspberry Pi, Gas Sensor, Sound Sensor, temperature and Humidity sensor & it send over the Dashboard. Air sensors are used in order to sensor pollution or physical quantity such as dust particles, polluted gases such as Carbon Monoxide, Methane, Ammonia such a hazardous gas. Sound Sensor are used in order to sense Sound level in decibels here we have used groove sensor collectors had to travel long distances to the various locations to collect data after which the analysis was done. This was lengthy and time consuming. But now, sensors and microcontrollers connected to the internet can make environmental parameter monitoring more flexible, accurate and less time consuming. When the environment merges with sensors and devices to self -protect and self -monitor it forms a smart environment. Embedded intelligence makes the environment interact with the objects. In this model, we are using a Raspberry-Pi which will have gas sensors and noise sensors connected to it, to monitor the fluctuating environmental parameter.

To build a robust system that can measure the industrial pollution and help to reduce it and to decrease human interference in monitoring the industrial pollution to reduce pollution and provide a healthy environment for the workers to work in. To make the industrial pollution monitoring a wireless system. To protect the environment from industrial pollution. To build a robust system that evaluates the industrial pollution continuously and indicates when there is an increase in the emissions and takes action to control it using wireless technology that is IOT. These improvements can be used to develop and implement its environmental policy and manage its environmental aspects.
Pollution of air and sound is increasing abruptly. To bring it under control its monitoring is majorly recommended. To overcome this issue, we are introducing a system through which the level of sound and the existence of the harmful gases in the surroundings can be detected. The growing pollution at such an alarming rate has started creating trouble for the living beings, may it be high decibels or toxic gases present in the environment leaves a harmful effect on human's health and thus needs a special attention.

The main objective of IOT Air & Sound Monitoring System is that the Air and sound pollution is getting larger these days. It is necessary to detect air quality and keep it under control for a better future and healthy living for all.

Therefore, we initiate an air and sound pollution system that allows us to assess and examine live air quality as well as sound pollution in an area through Internet of Things. Model uses air sensor to recognize presence of harmful gases present in the atmosphere and repeatedly convey the data. Also, system keeps measuring sound level and reports it. This allows authorities to monitor air pollution in different areas and act against it. Therefore, officials can keep a watch on the noise pollution near schools, hospitals and areas where noise is not allowed, and if system detects air quality and noise issues it alerts authorities so they can take measures to control the issue.

Some future consumer applications planned for IOT sound like science fiction, but some of the more practical and realistic sounding possibilities for the technology include receiving warnings on your phone or devices when IoT networks detect some physical danger is detected nearby.

## II. LITERATURE REVIEW

**Uppugunduru Anil Kumar, G Keerthi (2017) IOT Based Air and Noise In this paper a resolution for monitoring the noise and air pollution levels in Pollution Monitoring using Raspberry Pi [1]**

Industrial environment or particular area of interest using in this a wire embedded computing system is proposed. The resolution includes the technology Internet of Things (IOT) which is outcome of merged field of computer science and electronics. The sensing devices are connected to the embedded computing system to monitor the fluctuation of parameters like noise and air pollution levels from their normal levels. Model is flexible and distributive for any infrastructural environment that needs continuous monitoring, controlling and behavior analysis. The working routine of the proposed model is evaluated using prototype implementation, consisting of raspberry pi, sensor devices and python software support package.

The implementation is tested for two or three parameters like noise, CO and radiation levels with respect to thenormal behavior levels or given specifications which provide a control done the pollution monitoring to make the environment smart.

**Arushi Singh, Divya Pathak, Prachi Pandit1, Shruti Patil, P Priti. C. Golar , "IOT based Air and Sound Pollution Monitoring System" [2]**

In this research, a real time monitoring of three gases are simulated in real environment. Gases that are monitored in this implementation are Carbon monoxide, carbon dioxide & Sulphur dioxide. In this replication these three gases are successfully tested in four areas. Then extended the simulated results to update in web. The expertise increase, the degree of automation (minimizing the manpower) in the almost all sectors are also increasing. Wireless Sensor Networks (WSN) are gaining the ground in all sectors of life; from homes to factories, from traffic control to environmental monitoring. They simulated the three air pollutants gases including carbon monoxide, carbon dioxide & Sulphur dioxide in air because these gases decide the degree of pollution level.The main aim of this paper was to design and implement an efficient monitoring system through which the required parameters are monitored remotely using internet and the data gathered from the sensors are kept in the cloud and to project the estimated trend on the web browser. A solution for monitoring the noise and CO levels i.e., any parameter value crossing its threshold value ranges, for example CO levels in air in an area exceeding the normal levels etc.

**Dr.T.Menakadevi, Ashwini.K, Chaithanya. M,Chaithra. N,Chandrakala "Design and Implementation of a Surveillance System to monitor Air and Noise Pollution through IOT and GPS"[3]**

Environmental Air Pollution Monitoring System for monitoring the focuses of major air pollutant gases has been designed, developed, and tested complying with the wireless standard. This system measures concentrations of gases such as CO, NO2 and SO2, and using semiconductor sensors. The hardware unit participates a single-chip microcontroller, air pollution sensors array, a GSM-Module. The Central-Server is a high-end personal computer application server with internet connectivity. The hardware unit gathers air pollutants levels (CO, NO2, and SO2), and packs them in a frame with the GPS physical location, time, and date. The frame is subsequently uploaded to the GSM-Modem and transmitted to the Central-Server via wireless network. In this paper, environmental air pollution has significant influence on the concentration of constituents in the atmosphere leading to effects like global warming and acid rains. Avoid such adverse imbalances in the nature, an air pollution measuring system is utmost important. The traditional air quality monitoring system, controlled by the Pollution Control Department, is extremely expensive. Wireless Sensor Networks are a new and very interesting research field for embedded system design automation, as their design must enforce stringent constraints in terms of power and cost. This paper tries to develop an effective solution for pollution measuring using wireless sensor network.

**Miss. Ratika R. Damrekar, Miss. Priyanka U. Bhopale, Miss. Riya M. Kode, Mrs.Prakruti P. kulkarni, "IOT based Air and Sound Pollution Monitoring System"[4]**

1. IOT based Air and Sound Pollution Monitoring The air pollution monitoring system contains sensors to monitor the interested pollution parameter in environment. They simulated the three air pollutants gases including carbon monoxide, carbon dioxide and sulphur dioxide in air because these gases decidethe degree of pollution level. They also applied the method in various applications like leaking cooking gas in our homes, to alert the workers in oil &gas industry to detect the leakage etc.

2. Implementation of an Efficient Noise and Air Pollution Monitoring System Using Internet of Things (IOT) A Smart City is one with at least one initiative addressing one or more of the following six features: Smart Governance, Smart People, Smart Living, Smart Mobility, Smart Economy and Smart Environment. In this simulation these three gases are effectively tested in four areas. Thenextendedthe simulated results to update in web.

3. An IoT Based Automated Noise and Air Pollution Monitoring System: 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.

**P. Sai Chandana, K. Sreelekha, A. Muni Likith Reddy, M. Anil Kumar Reddy , R. Senthamilselvan, "IOT air and sound pollution monitoring system." [5]**

The goal of building a smart city is to recover quality of life by using technology to improve the efficiency of services and meet residents' needs. Information and Communication Technology allows city officials to interact directly with the public to tell what is happening in the city, how the city is evolving, and how to enable a better quality of life. A smart City is one with at least one creativity addressing one or more of the following six characteristics: Smart Governance, Smart People, Smart Living, Smart Mobility, Smart Economy and Smart Environment. In this system, an application was developed that is going to bear a hand in this campaign. An area that is being graphed for assessing how much the area is affected by pollution.

The constituents of air along with its proportion are are intimated about it. Then the people are evacuated to a safe place. The description about the integrated network architecture and the interconnecting devices for the reliable measurement of parameters by smart sensors and transmission of data via internet is being presented. The air pollution monitoring They simulated the three air pollutants gases including carbon monoxide, carbon dioxide and Sulphur dioxide in air because these gases decide the degree of pollution level. They also applied the gas inour homes, to alert the workers in oil & gas industry to detect the leakage etc.

**Choodarathnakara A.L, Punitha S. Vinutha, Shwetha B D, Abhishek H J, Sinchana G. .S. Government Engineering College, Kushalnagar-571234, Karnataka india "real time iot based air and noise pollution monitoring system"[6]**

Noise and air pollution are the important risk factor for numerous health conditions including skin infection, eye infection, throat irritation and headache. It also causes serious conditions like lung cancer, difficulty in breathing, heart disease and many more Timely monitoring of air and noise pollution levels and preventive action is the need of an hour to reduce the pollution. In this paper a solution is proposed for pollution monitoring system using IOT which can be easily setup in any places in real time. The system collects the air and noise quality levels at different sites and alerts authorities so that they can take necessary measures to control the issue. In addition, it also interfaces a web service for querying and traffic planning based on air quality levels successfully. The proposed system will work at real time and trips can also be planned based on the air quality level.Environment. In this system, an application was developed that is going to bear a hand in this campaign. An area that is being graphed for assessing how much the area is affected by pollution.

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## III. PROPOSED WORK

System Description:

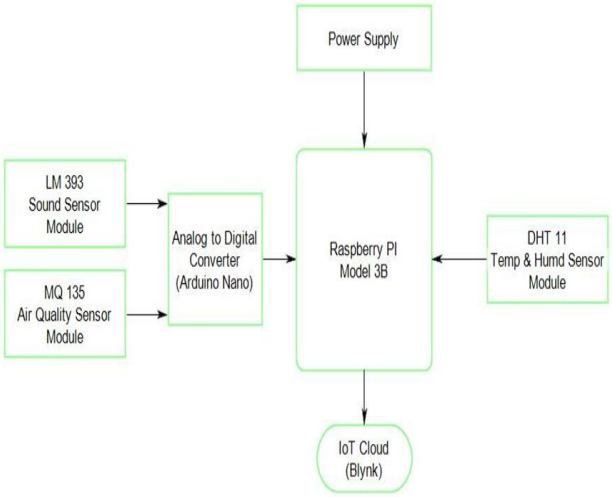


**Fig.1 System Block Diagram**

The objective of our work is monitoring the air quality of a region and the detection of noise intensity to curb the problem of sound pollution. The proposed method involves cloudbased monitoring of the required parameters with the help of internet. The alert system ensures that the user is notified about any unfavorable condition which demands instant action.

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, the Anomaly Notification Module and finally forecasting weather according to Air and Sound Quality of region.

In the Air and Sound pollution monitoring system. The monitoring of pollution is done by system as shown above as described below.

To monitor the air pollution and to determine the air quality index, a gas sensor, MQ135 is used. MQ135, gas sensor operates at 5V voltage and 40 mA current. It efficiently detects the Nh3, NOx, smoke and CO2 level in air. This sensor is chosen for its wide detecting scope, fast response, high sensitivity, stable and long life and lastly, a simple drive circuit. It is used in air quality monitoring devices in buildings and homes.

To monitor the sound pollution, a sound sensor, LM393 is used. This device consists of two independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages. Operation from dual supplies also is possible if the difference between the two supplies is 2 V to36 V, and VCC is at least 1.5V more positive than the input common-mode voltage. When sensor detects sound, it processes the output signal voltage which is sent to Raspberry Pi which again performs the necessary processing required for monitoring the parameter.

DHT11 is a humidity and temperature sensor. It can be used to monitor the temperature and humidity levels in a region. It can be interfaced with a Raspberry Pi moduleand can give immediate results. We are using this sensor to monitor the varying humidity and temperature levels

We are using a Raspberry Pi 3B module. It is an ARM based credit card sized SBC (Single Board Computer) created by Raspberry-Pi Foundation. A Wi-Fi and Bluetooth module are already present in the Raspberry Pi 3B. Using this module, we can send the acquired converted digital counter parts of the parameters, over the internet, to a Cloud based storage area. The saved data is not only used for monitoring purposes, but for analyzing the information acquired, on a periodical basis

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**MQ 135 Gas Sensor:**

To monitor the air pollution and to determine the air quality index, a gas sensor, MQ135 is used. MQ135, gas sensor operates at 5V voltage and 40 mA current. It efficiently detects the Nh3, NOx, smoke and CO2 level in air. This sensor is chosen for its wide detecting scope, fast response, high sensitivity, stable and long life and lastly, a simple drive

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**Fig.2 MQ135 Gas Sensor**

**LM 393 sound detection sensor:**

To monitor the sound pollution, a sound sensor, LM393 is used. This device consists of two independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages. Operation from dual supplies also is possible if the difference between the two supplies is 2 V to36 V, and VCC is at least 1.5V more positive than the input common-mode voltage. When sensor detects sound, it processes the output signal voltage which is sent to Raspberry Pi which again performs the necessary processing required for monitoring the parameter.

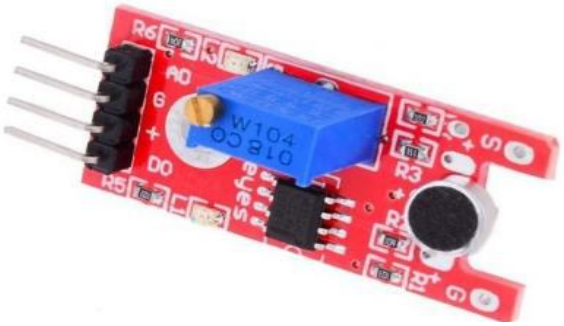


**Fig.3LM393 Sound Sensor**

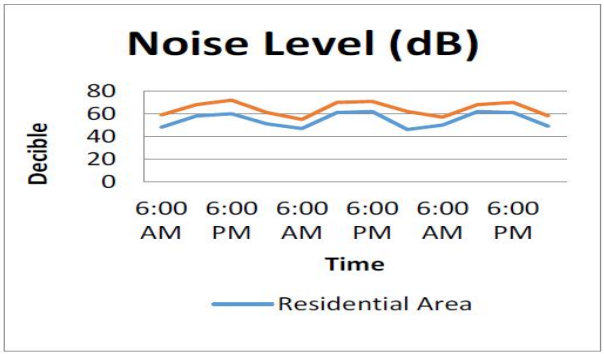


**Fig.4 Noise level in Decibel in two different places for 72 hours DHT11**

**Temperature and Humidity Sensor:**DHT11 is a humidity and temperature sensor. It can be used to monitor the temperature and humidity levels in a region. It can be interfaced with a Raspberry Pi module and can give immediate results. We are using this sensor to monitor the varying humidity and temperature levels

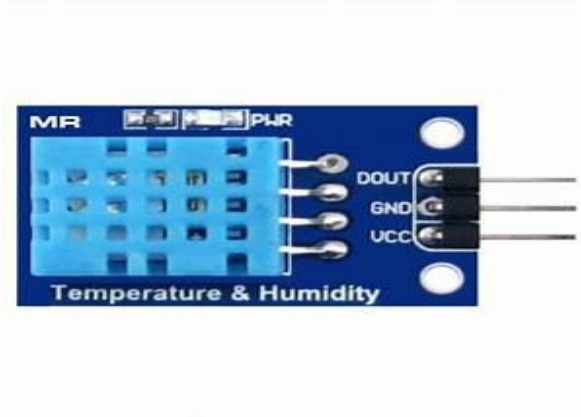


**Fig.5 DHT11 Temperature and Humidity Sensor**

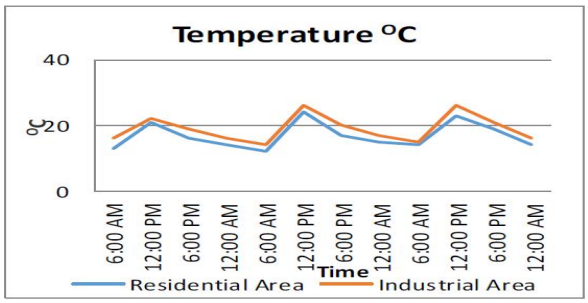


**Fig.6 Temperature of two difference places for 72 hours**

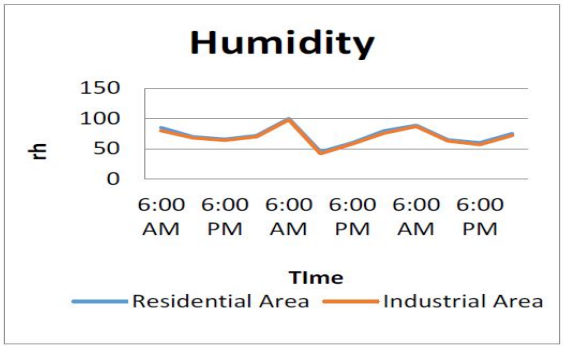


**Fig.7 Humidity of two different places for 72 hours**

**Raspberry Pi Module:**

We are using a Raspberry Pi 3B module. It isan ARM based credit card sized SBC (Single Board Computer)created by Raspberry-Pi Foundation. A Wi-Fi and Bluetooth module are already present in the Raspberry Pi 3B. Using this module, we can send the acquired converted digital counterparts of the parameters, over the internet, to a Cloud based storage area.

The saved data is not only used for monitoring purposes, but for analyzing the information acquired, on a periodical basis

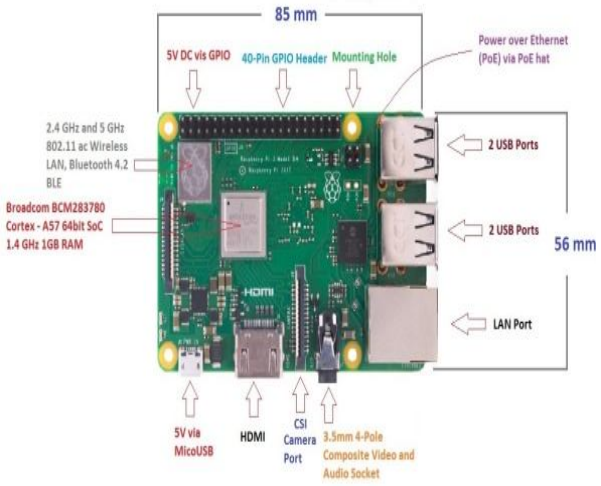


**Fig.8 Raspberry-pi 3B Module**

**3.2 Data Flowchart:**

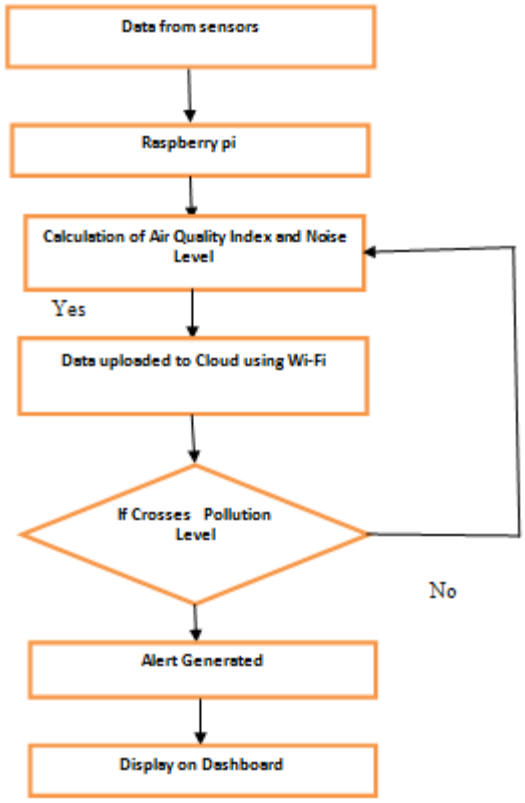


**Fig.9 Data Flowchart**

In above working flow diagram, first acquire data from all sensors connected to raspberry pi kit, we have air quality sensor MQ135 and LM 393 sound sensor and DHT 11 temperature and humidity sensor. Then calibrate and calculate the equivalent calibrated values from sensor to air quality index and noise level. After getting values, raspberry will upload or transfer data to IoT cloud server using MQTT protocol with the help of internet that will be provided by Wi-Fi. And at the same time, if air quality index and noise level crosses some threshold or polluted value limit, then it'll generate alert or notification to websites or application. Also, whatever real time calibrated data generated from sensors are displayed in application or cloud service dashboard.

**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=(Ihigh-Ilow /Chigh-Clow) *(C- Clow) + Ilow
I= Air Quality Index
C= The Pollutant Concentration
Clow= Concentration breakpoint that is<C
Chigh= Concentration breakpoint that is>C
Ilow= Index breakpoint corresponding to Clow
Ihigh= Index breakpoint corresponding to Chigh

The air quality index and its impact on health as prescribed by the government is given below with proper color code.

**Table.1Air quality index, health impact and color code.**

| Air Quality Index | Health Impacts | Color |
|---|---|---|
| Good (0-50) | Minimal Impact | |
| Satisfy (51-100) | Mild Breathing Distress | |
| Moderately Polluted (101-200) | Breathing Distress and discomfort to people with heart disease | |
| Poor (201-300) | Breathing discomfort to people on prolonged exposure | |
| Very poor (301-400) | May cause respiratory illness | |
| Severe (401-500) | Severe respiratory impact on people with lungs and heart disease | |

**Noise 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.

**Table.2 Standard noise level limit in different area**

| Code | Area | Day Time | Night Time |
|---|---|---|---|
| A | Industrial Area | 75 | 70 |
| B | Commercial Area | 65 | 55 |
| C | Residential Area | 55 | 45 |
| D | Silence Zone | 50 | 40 |

The objective of our work is monitoring the air quality of a region and the detection of noise intensity to curb the problem of sound pollution. The proposed method involves cloud-based monitoring of the required parameters with the help of internet.

**Air Quality Index Monitoring:**

Air Quality Index is measured depending on five criteria pollutants, namely, ground-level ozone, particulate matter, Carbon monoxide, Sulphur Dioxide and nitrogen dioxide. In this project we are using MQ -135 AIR QUALITY or GAS DETECTION SENSOR. It efficiently detects the NH3, NOx, smoke and CO2 level in air. This specific sensor is chosen for its expansive detecting scope, fast response, reliability and long-term stability.


**Fig.10Air Quality index at a fixed Position for 72 hours**

**3.3MQTT Protocol:**

The IOT MQTT (**Message Queue Telemetry Transport**) library provides a lightweight publish/subscribe (or Pub Sub) messaging protocol that runs on top of TCP/IP and is often used in Machine to Machine (M2M) and Internet of Things (IOT) use cases. The IoT MQTT library implements a subset of the MQTT 3.1.1 protocol standard and uses the IoT Task Pool library for threading.

An MQTT connection to a broker can be established in a non-secure and secure manner. Especially in IoT use cases, TLS (Transport Layer Security) is used to provide a secure communication protocol between a client and server. In TLS, the client and server establish a secure connection through a handshake protocol to prevent eavesdropping from any malicious parties. Hence these features are ideal for the IOT purpose as we need to transmit mostly status of one machine to another. It was originally developed by IBM and now an open standard.

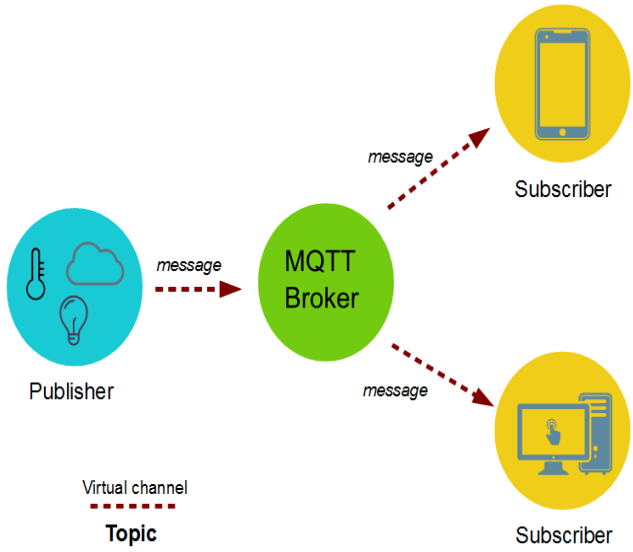


**Fig.11 MQTT Protocol**

## IV. APPLICATION AND ADVANTAGES

**Application**

**Industries**

The proposed system can be used by industries to identify or to examine how much they are polluting or contributing the harmful gases to the environment. This can reduce the pollution from individual industries.

**Advantages**

- Sensors are easily available.
- Simple and easy to handle.
- Sensors have long lifetime and less cost and low power consumption.
- Simple Drive circuit.
- System is Real time.
- Visual output.
- Continues updates of change in percentage of quality.
- Detecting a wide range of gases including NOx, CO2, CO etc. also detecting various noise levels.

## V. CONCLUSION

It becomes very dependent and efficient for the Municipal Corporation officials. The Automatic Air & Sound management system is a step forward to contribute a solution to the biggest threat. The air & sound 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. To implement this need to deploy the sensor devices in the environment for collecting the data and analysis. Then the collected data and analysis results will be available to the end municipal corporation through the Wi-Fi. Moreover, to achieve real-time monitoring, the data of CO concentration in a particular place could be reviewed from mobile communication devices, such as PDAs, smart phones, and tablet PCs to help keep air quality in check.

## VI. FUTURE WORK

With the Increase in urbanization and need of healthy environment, the scope of improvement in waste management systems in our country is immense. A lot of improvement could be done to our current system. The lifespan of battery could be extended by using renewable energy as well as solar energy. The scope of a universal module could be increased from urban sector to industrial sector.

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