

# IOT BASED POLLUTION MONITORING SYSTEM BY USING RASPBERRY PI

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**Abstract** - With the tremendous increases in the level of population and mechanization pollution has increased many folds. This results in deterioration of individual health thereby directly affecting health of entire population. An IOT based Air, Noise and Water Pollution Monitoring System is proposed which will monitor the level of pollution and water quality over a web server using internet.

Noise pollution is major problem in cities around the world. Environmental noise consists of all the unwanted sound in our communities except that which originates in the workplace. Environmental noise pollution, a form of air pollution, is a menace to health and wellbeing. It is more severe and expensive than ever before, and it will continue to expand in magnitude and severity because of population growth.

Water covers to 70% of the Earth's surface. It is a very big resource for people and the environment. Water pollution affects rivers, drinking water, lakes and oceans all over the world. In many developing countries, it is usually a leading source of death, by people drinking from polluted water sources. More to this, water pollution affects not only individual living group, but also populations and entire functioning ecosystems that exist in the waters. Water pollution is the second most imperative environmental fear along with air pollution.

**Key Words:** Raspberry pi, Temperature sensor, Gas sensor, Internet of Things, Sound sensor.

## I. INTRODUCTION

Pollution is the introduction of harmful or toxic substances into the environment, resulting in adverse effects on the natural ecosystem and human health. There are several types of pollution, including:

a. Air Pollution: The release of harmful gases, particulate matter, and other pollutants into the air, often caused by industrial activities, vehicle emissions, and burning of fossil fuels. Air pollution can lead to respiratory problems, cardiovascular diseases, and environmental damage.

b. Water Pollution: The contamination of water bodies such as rivers, lakes, and oceans by pollutants like chemicals, sewage, agricultural runoff, and industrial waste. Water pollution can harm aquatic life, contaminate drinking water sources, and affect ecosystems.

c. Soil Pollution: The presence of toxic chemicals and pollutants in the soil, primarily due to improper waste disposal, agricultural practices, and industrial activities. Soil pollution can have detrimental effects on plant growth, contaminate groundwater, and impact the food chain.

d. Noise Pollution: Excessive noise levels in the environment, often caused by transportation, construction, industrial activities, and urbanization. Noise pollution can lead to hearing loss, stress, sleep disturbances, and impaired communication.

e. Light Pollution: The excessive or misdirected artificial light in urban areas that affects the natural visibility of the night sky and disrupts ecosystems and wildlife. Light pollution can interfere with astronomical observations, disturb animal behaviour, and have adverse effects on human health.

f. Thermal Pollution: The release of excessive heat into water bodies, usually from industrial processes or power plants, causing changes in water temperature that can harm aquatic life and disrupt ecosystems.

Addressing pollution requires collective efforts from governments, industries, communities, and individuals. Implementation of regulations, adoption of cleaner technologies, promotion of sustainable practices, and raising awareness about the importance of environmental protection are essential steps in reducing pollution and mitigating its harmful impacts.

Thus, in this project we are discussing about air, noise and water pollution.

An IoT-based pollution monitoring system using Raspberry Pi can be a great project to track and analyze environmental data in real-time. Raspberry Pi, a low-cost and compact computer, can be used as the central processing unit for collecting data from various sensors and sending it to the cloud for analysis.

### 1.1 Aim and Objective

The main aim & objectives of this project are as follows:

1. To design and develop an IoT-based air pollution monitoring system using Raspberry Pi (Model 3 or above), various sensors such as MQ5, MQ3, and LM30 to measure air quality parameters such as carbon monoxide, alcohol, and temperature.

2.The objective of this act is to provide for the preservation control and air pollution for the establishment

Overall, the objective of this project is to develop an affordable and easy-to-use air pollution monitoring system that can provide real-time data on air quality and temperature, enable authorities to make informed decisions on air pollution management and facilitate the participation of the general public in environmental protection efforts.

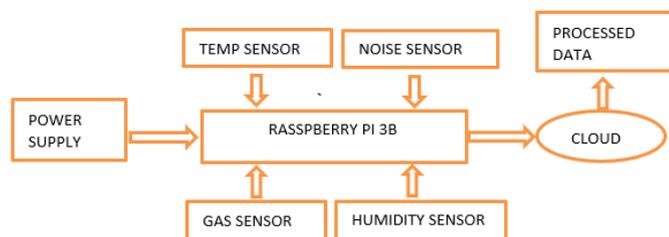
**1.2 Aim and Objective**

- To cry out perfect air, water and noise pollution models namely specific research air, water and noise management and decision-making pollution control environmental impact and pollution episodes continuous pollution monitoring using sensor network.
- To identify available gases in air by using different sensors.

**II. LITRATURE REVIEW**

Anjaiah Guthi “Efficient Noise, Air and Water Pollution Monitoring System” [2016]- In his paper discussed about the smart sensor networks that are a new field of research which combines different challenges of wireless communication, computer science and electronics. In this paper we conclude the solution for monitoring the noise, air and water pollution levels in industrial environment or any other area of interest using wireless embedded computing system is proposed. Navindra ramsarop , 2017 Environmental Science for the Caribbean.he rapid increase in pollution levels has become a pressing global concern, leading to a growing demand for efficient pollution monitoring systems. The Internet of Things (IoT) offers a promising solution by enabling the collection, analysis, and dissemination of real-time environmental data. This research paper aims to explore the development and implementation of an IoT-based pollution monitoring system using Raspberry Pi, a versatile and affordable single-board computer.

**III. PROPOSED SYSTEM DESIGN**



**Fig -1:** Block diagram of system.

The Air & Sound Pollution Monitoring System consists of Raspberry Pi 3 Which is integrated by power supply, temperature sensor, noise sensor, gas sensor and humidity sensor. All of these sensors used in cloud format to identify aim of the project.

**IV. PROBLEM STATEMENT**

The problem at hand is the need for an IoT-based pollution monitoring system that utilizes Raspberry Pi to effectively monitor and analyze pollution levels in a given environment. Traditional pollution monitoring systems often lack real-time data collection and analysis capabilities, limiting their effectiveness in providing timely and accurate information about pollution levels. Therefore, there is a requirement for a cost-effective and efficient system that can continuously monitor various pollutants and provide actionable insights for pollution control and management.

The specific challenges to be addressed include:

**Real-time Monitoring:** Designing a system that can collect real-time data on pollutants such as particulate matter (PM2.5 and PM10), carbon monoxide (CO), nitrogen dioxide (NO2), and ozone (O3) from multiple locations.

**Data Accuracy and Reliability:** Ensuring the accuracy and reliability of the collected data by utilizing calibrated sensors and establishing proper data validation techniques.

**Data Transmission and Connectivity:** Developing a reliable and secure communication protocol to transmit the collected data from Raspberry Pi to a central server or cloud platform for storage and analysis.

**Data Analysis and Visualization:** Implementing effective data analysis techniques to derive meaningful insights from the collected data and presenting it in a user-friendly visualization format for easy interpretation.

**Alerting and Notification System:** Developing a mechanism to generate alerts and notifications in real-time based on predefined thresholds or pollution index levels to inform relevant authorities and individuals about high pollution events.

**Scalability and Cost-effectiveness:** Designing a system that can be easily scaled to monitor pollution in multiple locations simultaneously while keeping the hardware and maintenance costs reasonable.

By addressing these challenges, the proposed IoT-based pollution monitoring system using Raspberry Pi aims to provide an efficient, accurate, and cost-effective solution for monitoring and managing pollution levels, thereby contributing to better environmental sustainability and public health.

**V. HARDWARE & SOFTWARE REQUIREMENT**

**Hardware:**

**Raspberry Pi:** Choose a Raspberry Pi board (e.g., Raspberry Pi 3 or Raspberry Pi 4) as the main controller.

**Sensors:** Select sensors to measure different pollution parameters such as air quality, temperature, humidity, particulate matter (PM), etc. Some common sensors include gas sensors (e.g., MQ-135 for air quality monitoring), temperature and humidity sensors (e.g., DHT11 or DHT22), and PM sensors (e.g., SDS011).

**Internet connectivity:** Ensure the Raspberry Pi has a Wi-Fi or Ethernet connection to communicate with the internet and send data to a cloud platform.

**Software:**

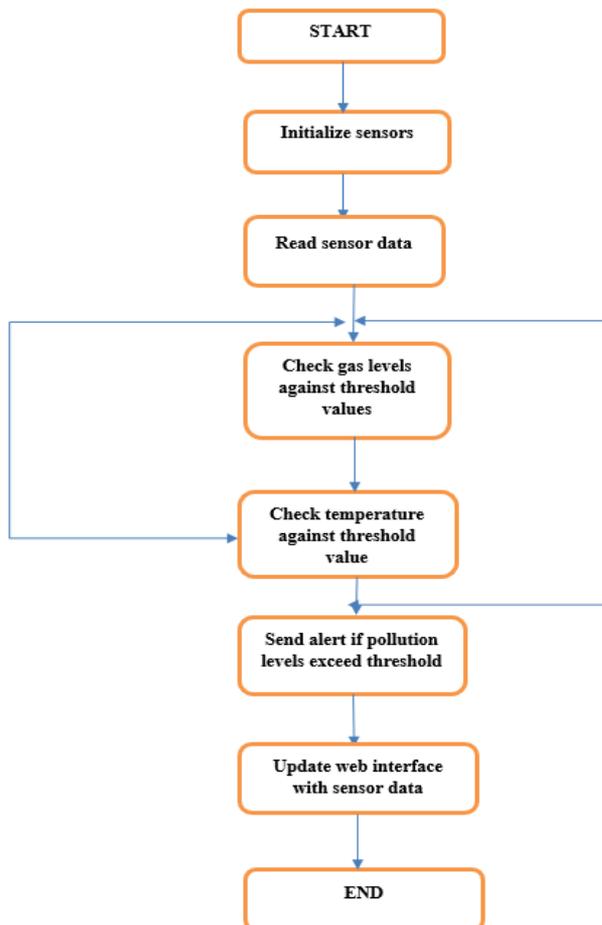
**Raspbian OS:** Install Raspbian, the official operating system for Raspberry Pi, on your board.

**Python:** Use Python as the programming language for data acquisition and processing.

MQTT: Implement the MQTT (Message Queuing Telemetry Transport) protocol for efficient communication between the Raspberry Pi and the cloud platform.

Cloud Platform: Choose a cloud platform (e.g., AWS IoT, Azure IoT, or Google Cloud IoT) to store and analyze the collected data.

## VI. FLOW CHART



## VII. EXPERIMENTAL SETUP AND RESULT DISCUSSION

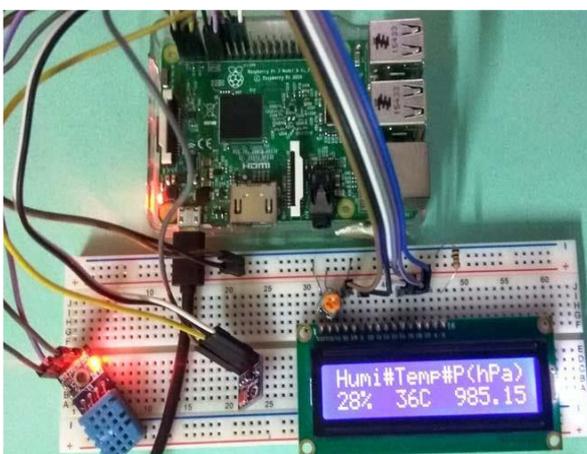
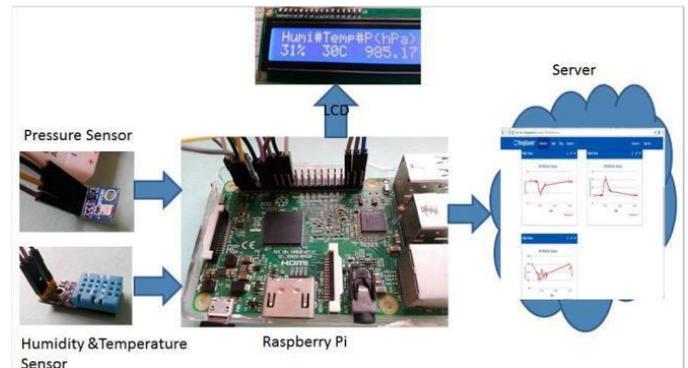


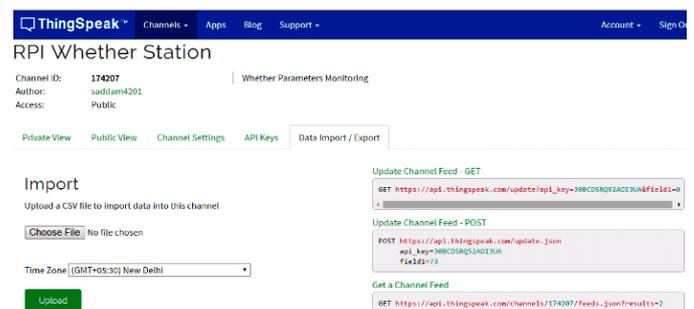
Fig: Hardware module of project

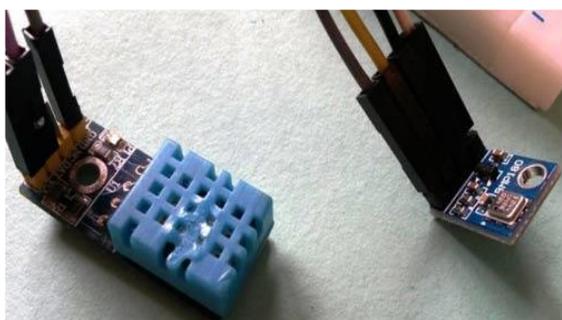
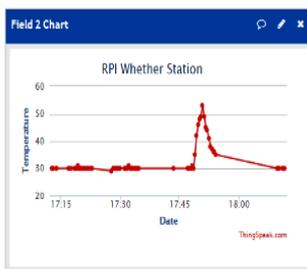
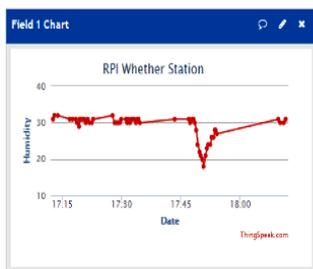
### Working and Thing Speak Set-up:

In this IoT based system has four parts. First one is DHT11 sensor it is used for the Humidity, Temperature Data and BM180 sensor scale the atmospheric pressure. Second one is Raspberry Pi is measuring the BM180 pressure sensor's output by using I2C protocol & DHT11 sensor module's final output result by using single wire protocol extracts the, millibar (pressure), Celsius scale (temperature), sensors value into a suitable number in percentage humidity. Third one is, the values are sent to Thing Speak server by using fixed Wi-Fi of the Raspberry Pi 3. & finally, Thing Speak evaluation the data showing it in a graphical form. An LCD we can also use to show these values locally.



Thing Speak supply is a very good and effective tool used in the IoT based projects. By using Thing Speak website, we can control our data and monitor our system over the Internet, by using the webpages and channels provided by Thing Speak. Thing Speak is Collected the data from the sensors, 'Visualize and Analyze' the data and 'Acts' by produce a reaction. We have already discussed about sending data to Thing Speak in detail, you can find there. Here we are in brief explaining to use Thing Speak for this Raspberry Pi POLLUTION MONITORING SYSTEM.





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**VIII. CONCLUSION**

1. An air, water and noise quality detector is very important because nowadays pollution is easy to find for the air, water and noise pollution which cannot be easy detected by human, it requires a device as a reader air, water and noise quality. By this research, we can avoid pollution through monitoring air, water and noise quality regularly.
2. The paper presented and iot base pollution monitoring system for smart cities.
3. It support new technology and healthy life concept.
4. Noise disturbance or noise pollution is the disturbing or excessive noise that may harm the activity or balance of human or animal life. The source of most outdoor noise worldwide is mainly caused by motor vehicles, machines and transportation systems, aircraft and trains.
5. Water pollution is very serious problem and it can be controlled by providing proper escape to swage and industrial waste water.

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