INTERNSHIP REPORT ON

"IOT BASED AIR QUALITY MONITORING SYSTEM USING RASPBERRY PI"

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Apurva Gangarde

Abstract

Air pollution has become a significant environmental issue, posing serious health risks to millions of people worldwide. Traditional methods of monitoring air quality are often expensive, limited in coverage, and lack real-time data accessibility. This paper presents an IoT-based air pollution monitoring system using Raspberry Pi that addresses these challenges by providing a cost-effective, scalable, and real-time solution for monitoring air quality.

The system utilizes a set of sensors, including the MQ-135 sensor, to detect various pollutants such as CO2, CO, NH3, and benzene in the environment. The data collected by these sensors is processed by a Raspberry Pi and transmitted to a cloud platform using MQTT protocol, where it is stored and visualized on a real-time dashboard.

The system enables users to remotely monitor air quality from anywhere, providing immediate insight into pollution levels. Additionally, it raises alerts when pollutant concentrations exceed safe thresholds, allowing users or authorities to take necessary action. The proposed system is flexible and can be deployed in multiple locations, from urban areas to industrial zones, helping to mitigate air pollution and protect public health. The results demonstrate the effectiveness of the system in providing real-time data, enabling better air quality management and decision-making.

List of figures

1. Introduction

COMPONENTS OF THE SYSTEM

1.1 Hardware Components

- 1. MQ-135 Gas Sensor
- 2. MCP3008 Analog-to-Digital Converter (ADC)
- 3. Raspberry Pi
- 4. Wiring and Resistors
- 5. Power Supply

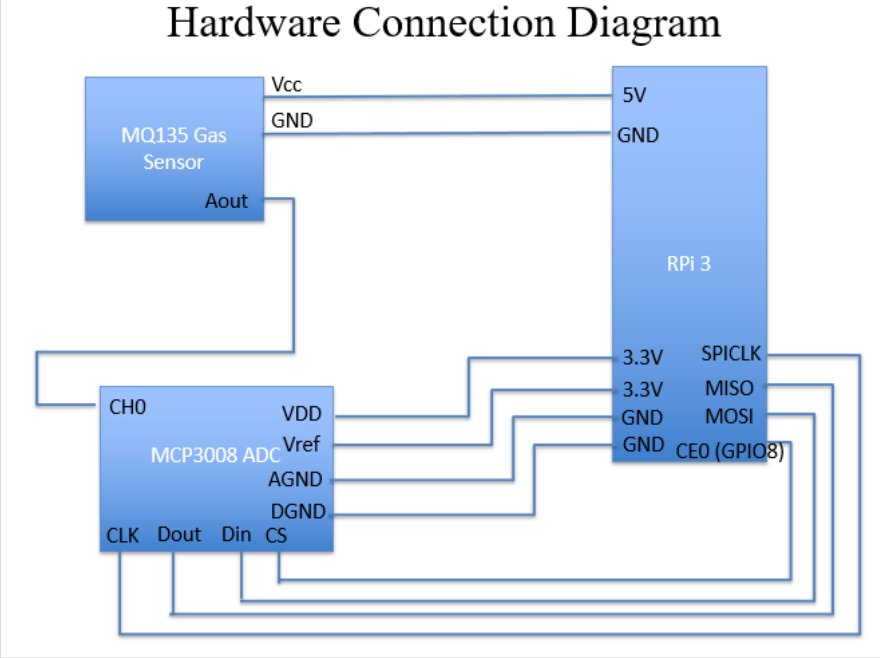

Fig 1.1

1.2Software and Platform:

- Python Script
- ThingsBoard IoT Platform

2. ThingsBoard Integration

1. Real-time data monitoring: AQI, sensor voltage, and PPM values are visualized.

2. ThingsBoard Cloud: Data sent via HTTP API to the ThingsBoard cloud server.

3. Visualization Widgets: Real-time graphs, gauges, and widgets.

4. Data History: Storing and visualizing historical air quality data.

3. Aim of Project

"IOT Based Air Pollution Monitoring System using Raspberry Pi" is to design and implement a cost-effective, real-time system for monitoring air quality by detecting harmful gases and pollutants in the environment.

The system leverages IoT technology to continuously collect air pollution data using sensors, processes the data on a Raspberry Pi, and transmits it to a cloud platform for visualization and analysis i.e. ThingsBoard.

This project aims to provide an accessible solution to help monitor and manage air quality, enabling timely actions to mitigate pollution and safeguard public health.

4. Scope and Objectives

Real-Time Monitoring: The system provides continuous, real-time monitoring of air quality by measuring various pollutants such as CO2, CO, NH3, Benzene, and particulate matter.

Scalability: The system can be easily expanded to monitor air quality in multiple locations by deploying additional sensor nodes connected to the central cloud platform.

Remote Access: Leveraging IoT, the system allows users to access and visualize air quality data remotely through a cloud-based dashboard (e.g., ThingsBoard), making it suitable for urban planning, public health authorities, and individual users.

Cost-Effective: The project uses low-cost sensors and components like Raspberry Pi, making it an affordable solution for small and large-scale deployments.

Objectives:

Data Collection and Transmission: Ensure accurate data collection from the sensors and transmit the data to a cloud server for storage and analysis using IoT protocols (e.g., MQTT).

Visualization of Data: Develop a user-friendly dashboard (e.g., ThingsBoard) for visualizing air quality data in real time, allowing users to monitor pollution levels remotely.

5. Implementation and Testing

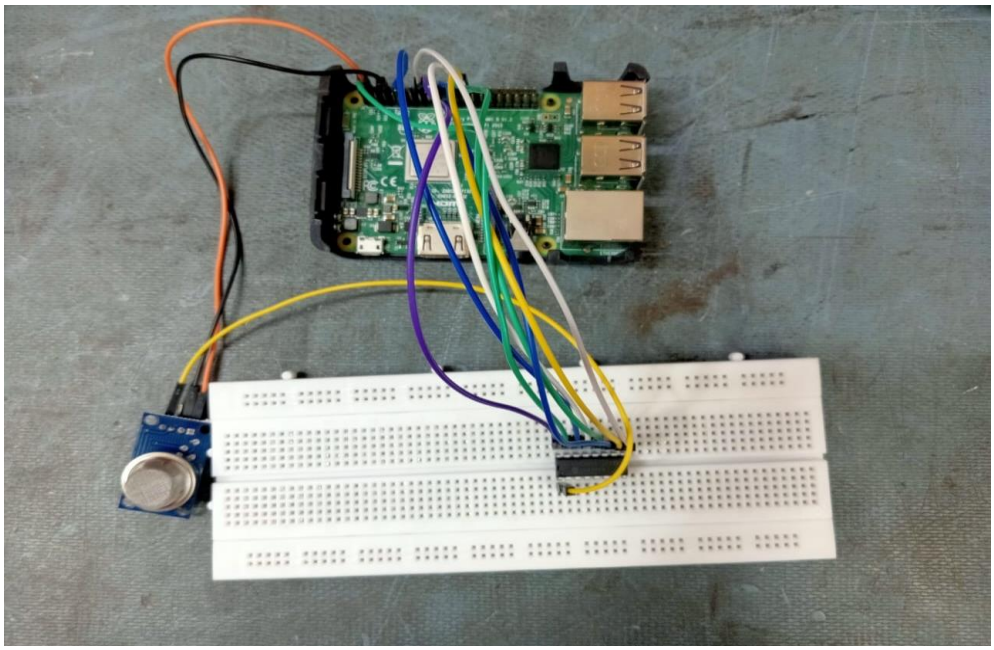

Fig 5.1

Dashboard Reading:

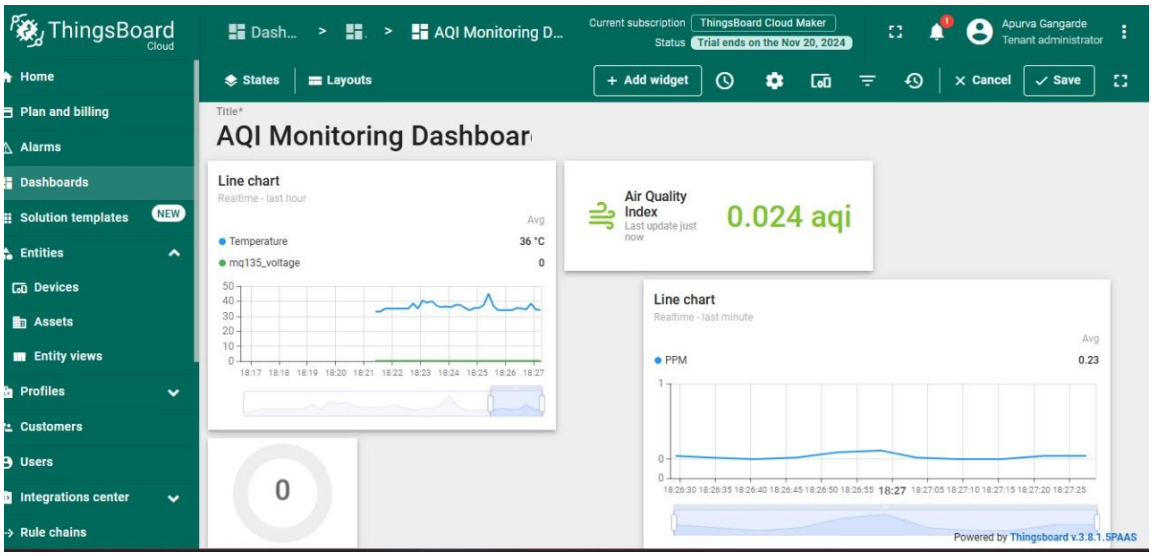

Fig 5.2

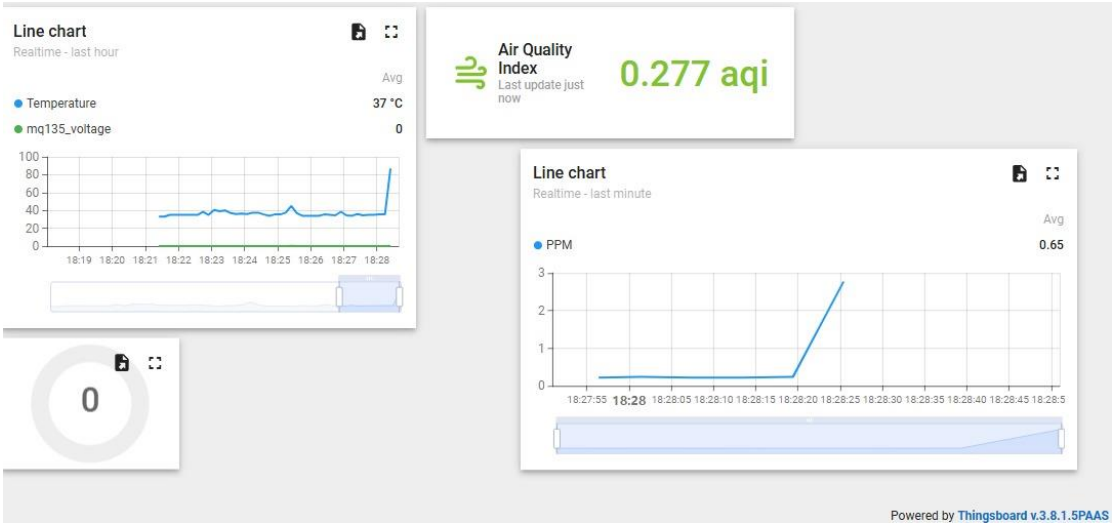

Fig 5.3

PPM Reading

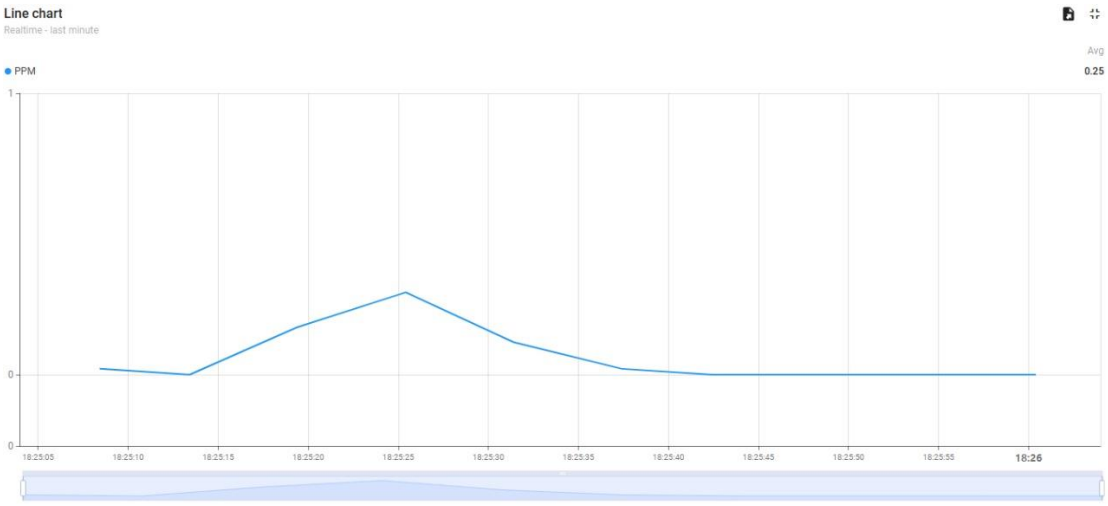

Fig 5.4

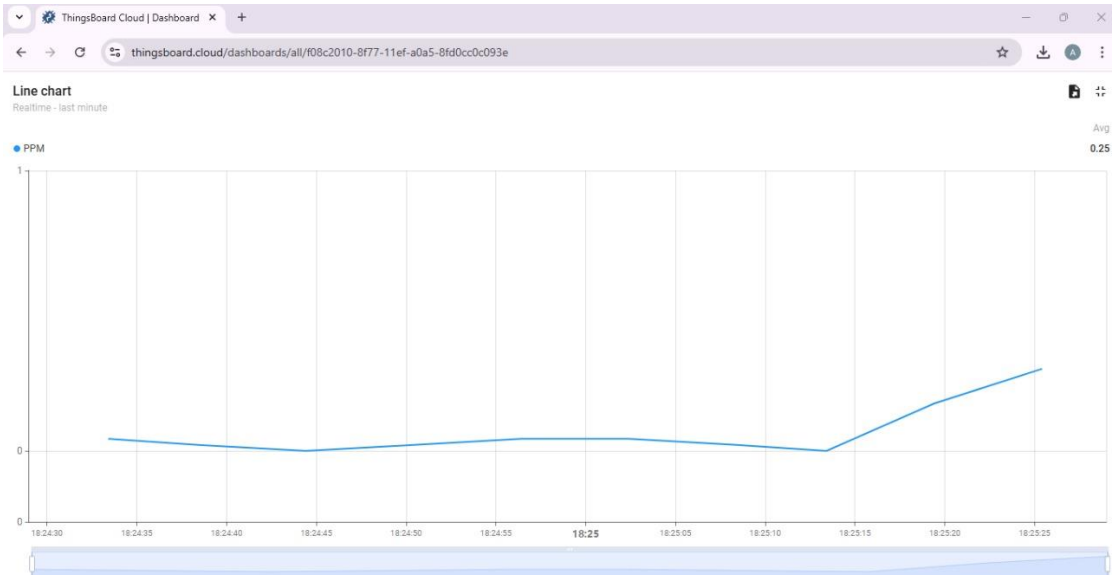

Fig 5.5

6. Conclusion

The Air Quality Index (AQI) monitoring project, integrating the MQ-135 sensor and ThingsBoard platform, holds significant potential for future expansion. By incorporating advanced data analytics, multi-sensor integration, cloud-based monitoring, mobile applications, and IoT enhancements, the project can evolve into a comprehensive air quality management system. These advancements would not only offer real-time monitoring and improved accuracy but also provide valuable insights for public health, smart cities, and environmental sustainability. The project has the capacity to contribute to research on pollution impacts and drive innovation in energy-efficient, data-driven environmental solutions.

Key Takeaways:

- Real-time air quality monitoring using the MQ-135 sensor.
- PPM and AQI calculations are essential for understanding gas concentration.
- Integration with ThingsBoard allows remote monitoring and data visualization.

7. Future Scope

Future Improvements:
Adding more sensors for enhanced environmental monitoring.
Implementing alerts for hazardous AQI levels via ThingsBoard

IoT Expansion:

Extend the project into a smart city context by integrating your AQI system with other IoT-enabled environmental sensors (e.g., temperature sensors).

Mobile Application:

Develop a mobile app that syncs with the AQI monitoring system, allowing users to monitor air quality on-the-go and receive notifications about poor air quality.

Smart Alerts:

Set up automatic notifications or alerts for users when AQI exceeds safe levels, promoting proactive action.

References

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