Air Pollution Monitoring System using Raspberry Pi

Presented By: Apurva M. Gangarde

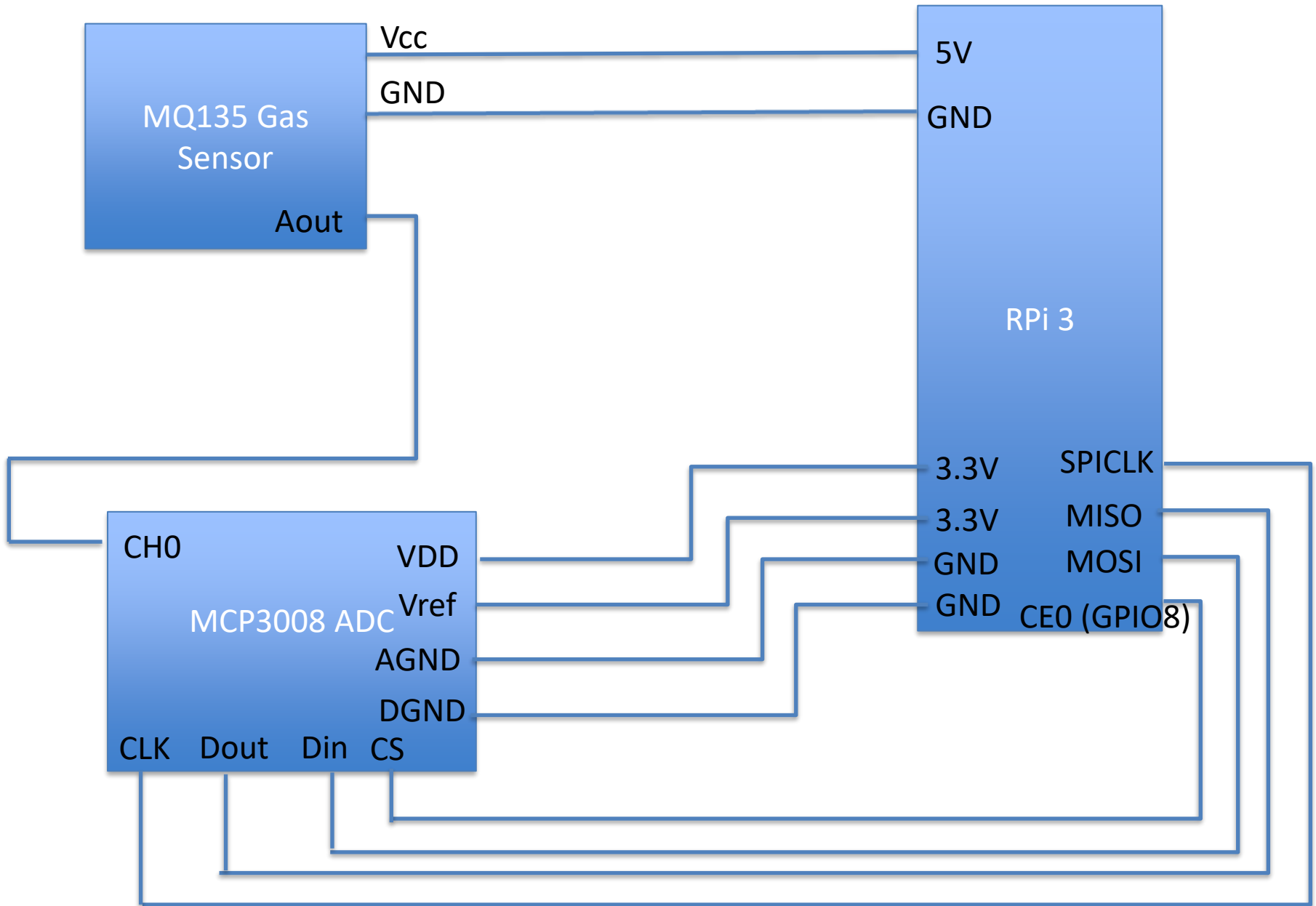Date: 25/10/2024

Components of the System

Hardware Components:

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

Software and Platform:

- Python Script
- ThingsBoard IoT Platform

Hardware Connection Diagram

Hardware Connection Diagram

Hardware Setup

- MQ-135 Sensor: Connected to the MCP3008 ADC.

- MCP3008 ADC: Connected to Raspberry Pi via SPI protocol.

- Power Supply: Provides 3.3V/5V to MQ-135 and MCP3008.

Connection Details:

- SPI Pins (MISO, MOSI, SCLK, CE)

- Analog Pin (MQ135) connected to CH0 of MCP3008.

Code Breakdown

- Key Components of the Code:

1. SPI Initialization

2. Reading Sensor Data

3. PPM Calculation

4. AQI Calculation

5. Sending Data to ThingsBoard

Air Quality Index (AQI):

Range: Typically, between 0 and 500.

Interpretation:

0-50: Good

51-100: Moderate

101-150: Unhealthy for sensitive groups

151-200: Unhealthy

201-300: Very unhealthy

301-500: Hazardous

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.

Conclusion

➢ **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.

➢ **Future Improvements:**

• Adding more sensors for enhanced environmental monitoring.

• Implementing alerts for hazardous AQI levels via ThingsBoard.

Future Scope

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.