**Intelligent Sensing and Monitoring using Raspberry Pi and MQTT**

Repository link: <https://github.com/mariammmramy/SIC_Team5_Monitoring>

Team 5: Mariam Ramy, Nada Mostafa, Basant Tarik

1. **Introduction**

This project implements a **Raspberry Pi 4–based IoT monitoring and security system**. It integrates multiple sensors and actuators to provide real-time environmental data and security alerts. The system processes sensor data locally and communicates with an IoT platform via **MQTT protocol**, enabling remote monitoring and visualization.

1. **Problem Statement**

Conventional monitoring systems are either expensive or limited in functionality. There is a need for a **low-cost, flexible solution** that can detect environmental changes, identify potential hazards, and provide immediate alerts while supporting remote supervision.

1. **System Components**

**Raspberry Pi 4** – Central controller

**Sensors**:

* DHT11 (temperature & humidity)
* Ultrasonic sensor (distance/object detection)
* Smoke sensor MQ-2 (via MCP3008 ADC)
* Microphone module (sound detection, digital & analog outputs)
* Camera Module (image capture)

**Actuators**:

* LEDs (status indication)
* Buzzer (alerts)

**IoT Platform**: Blynk (MQTT integration)

1. **System Design**

* **Sensing**: Collect data from multiple sensors.
* **Processing**: Raspberry Pi interprets data and applies thresholds for alerts.
* **Action**: Trigger LEDs and buzzer when abnormal events occur.
* **Communication**: Publish telemetry to **ThingsBoard** dashboard via MQTT.
* **Visualization**: Users can view live graphs, alerts, and images remotely.

1. **Implementation Details**

* **Wiring**: Each sensor connected to Raspberry Pi GPIO pins or MCP3008 ADC for analog input.
* **Programming**: Python scripts handle sensor reading, actuation, and MQTT communication.
* **Version Control**: Git branching strategy used for collaborative development.

1. **Applications**

* Home safety and security.
* Laboratory and classroom monitoring.
* Scalable base for smart environment and IoT research projects.

1. **Conclusion**

This project demonstrates the integration of **IoT sensing, communication, and actuation** using Raspberry Pi 4. It provides a reliable, affordable solution for monitoring and security applications, with real-time alerts and IoT platform connectivity.