lab 2: IoT Programming For Data Communication With And Without MQTT

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Selected Actuators and Sensors

In Lab 2, a combination of actuators and sensors was utilized to create an IoT (Internet of Things) system.

Sensor

The DHT11 is a digital temperature and humidity sensor. It measures the ambient temperature and relative humidity, offering a simple interface with a microcontroller. In our setup, the DHT11 sensor was connected to a Raspberry Pi 3, which acted as a data collection and transmission unit.

Actuator

As an actuator in our system, the LED represents a simple yet effective output device. The LED's state (on or off) is controlled based on the humidity data received. It serves as a visual indicator, providing immediate feedback based on sensor data.

Interactions Between Them:

The DHT11 sensor continuously monitors the environmental temperature and humidity. This data is processed by the Raspberry Pi 3 programmed in python, which then publishes the humidity readings to an MQTT Mosquitto broker under a specific topic. The ESP32, programmed in C with Arduino, subscribes to this topic on the MQTT broker. Upon receiving the humidity data, the ESP32 activates or deactivates the LED. The LED turns on when humidity exceeds a certain threshold, at 30% humidity, indicating that the sensor data was succesfully communicated.

Communication Protocols

For the IoT system in lab 2, two communication protocols were used.

MQTT (Message Queuing Telemetry Transport)

MQTT is a lightweight and efficient messaging protocol, ideal for IoT applications with bandwidth constraints. It follows a publish/subscribe model, making it highly scalable and suitable for scenarios where multiple devices need to communicate asynchronously.

Wi-Fi

We used Wi-Fi as the network protocol to connect both the Raspberry Pi 3 and the ESP32 to the local network. Wi-Fi's widespread availability and high data transfer rates make it well-suited for IoT applications that require quick data transmission over a network. Also as our devices were operating with short distance, the local wifi connection remained steady.

Relevance to the IoT System

MQTT

Its lightweight nature minimizes the network bandwidth usage, which is crucial for IoT devices often limited by power and processing capabilities. By using MQTT, we ensured

reliable message delivery even in cases of intermittent network connections, which is typical in IoT environments.

Wi-Fi

The choice of Wi-Fi allowed for easy and efficient communication between the Raspberry Pi 3 and ESP32. Given that both devices are capable of Wi-Fi connectivity, it enabled a seamless integration and data exchange within the local network, without the need for additional hardware like Ethernet cables or adapters. Also it was required in the lab instructions to use a wireless protocol

In conclusion, the combination of DHT11 and LED, controlled via MQTT over a Wi-Fi network, created an efficient and responsive IoT system. This setup demonstrates the integration of sensors and actuators with modern communication protocols, showcasing the potential of IoT in environmental monitoring and automated response systems.