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ITAI 3377

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**Reflective Journal: IIoT Protocols Project**

**Introduction**

This project focused on implementing and analyzing three key Industrial Internet of Things (IIoT) communication protocols: MQTT, CoAP, and OPC UA. I aimed to gain hands-on experience setting up these protocols, simulating sensor data, and visualizing the collected information. Initially, I expected the process to be straightforward, install the necessary libraries, write the scripts, and see the data flow seamlessly. However, I quickly realized that setting up and troubleshooting these protocols was far more complex than anticipated.

**Personal Contributions**

I set up the development environment throughout the project by installing dependencies and configuring the virtual environment. I attempted to implement the MQTT sensor simulation and set up the Mosquitto broker, but I faced difficulties verifying whether data was being published and received correctly. I also ran the CoAP and OPC UA simulations, but getting consistent responses proved challenging. Finally, I tried to visualize the collected sensor data, but some parts of the implementation did not work as expected, which made debugging frustrating.

**Learning Outcomes**

Despite the challenges, I learned a lot about how these protocols function. MQTT follows a publish-subscribe model, making it lightweight and efficient for IoT applications, but I struggled with ensuring that messages were received correctly. CoAP operates over UDP and is designed for constrained devices, yet I had difficulty getting a stable response from my requests. OPC UA turned out to be the most complex, as it required setting up a structured client-server model, and while I managed to start the server, integrating it with data visualization was not as smooth as I had hoped.

One of my biggest takeaways from this experience is that working with IIoT protocols is not just about writing code but also about troubleshooting network configurations, understanding dependencies, and ensuring smooth communication between different components. I also realized real-world implementations require extensive testing, debugging, and patience.

**Challenges and Solutions**

One of my biggest challenges was setting up the Mosquitto MQTT broker. Although I followed the installation steps, I was unsure if messages were being transmitted correctly. I tried adjusting the port settings and rechecking the broker’s status but could not fully confirm the message flow. Another challenge was working with CoAP, where I struggled to get consistent responses from the server. I reviewed the aiocoap documentation and experimented with different request formats, but the results were still unpredictable. Similarly, OPC UA required setting up a local server, and while I got it running, I was not confident that the data visualization was pulling the correct values.

On the visualization side, I encountered errors when plotting the sensor data. I attempted to debug by printing raw data before processing it, but some values did not appear as expected. This made me realize that data formatting and handling are as important as writing the main script.

**Future Applications**

Although I did not achieve all the expected outputs, this project gave me valuable insight into the complexities of IIoT communication. If I were to do this again, I would spend more time understanding the specific configurations required for each protocol before running the simulations. I would also implement logging to track data flow and identify where the process fails. In the future, I hope to refine these skills and apply them in real-world IoT applications, such as smart factories, remote monitoring systems, or industrial automation.

**Conclusion**

While this lab was challenging and frustrating, it reinforced the importance of patience and problem-solving when working with modern technologies. Even though I did not get all the expected results, I now understand better what to look out for when working with IIoT protocols, and I look forward to improving my approach in future projects.