Summary

Over the past four weeks, I have been focused on developing a prototype system that enables real-time image retrieval from the DJI Zenmuse P1 camera mounted on the DJI Matrice 300 RTK drone and transmits the captured data to cloud storage via a Raspberry Pi 5. This work has required integrating DJI’s Payload SDK (PSDK) and Onboard SDK (OSDK) to establish a robust and efficient pipeline, allowing seamless communication between the drone, the onboard computing system, mini-computer (Raspberry Pi 5), and the remote cloud storage platform at Pawsey Acacia S3.

To achieve this, I first set up the Raspberry Pi 5 with the Intel Wi-Fi 6 AX210NGW module, its own RaspOS and essential drivers, ensuring high-speed wireless connectivity and configuring the necessary network settings to enable efficient data transmission. Establishing a stable connection between the Raspberry Pi and the drone was a critical early milestone. This involved integrating the DJI E-Port development kit with RaspOS, which serves as an interface between the Raspberry Pi and the drone’s OSDK via both USB and UART connections. Ensuring the correct hardware interfacing and communication protocols required extensive debugging, as well as configuring the SDK environment to properly communicate with the drone. A significant technical challenge was enabling real-time access to the SD card within the Zenmuse P1 camera, which does not allow direct file system access. Instead, I implemented a application solution which leverage PSDK APIs and RaspOS system Application interface to retrieve image files while ensuring minimal latency in the polling mechanism. Following this, I developed a C++/C application that continuously monitors the SD card, detects new images as they are captured, and transmits them from the drone to the Raspberry Pi 5 for further processing.

Once the image retrieval pipeline was established, the next phase involved designing an efficient wireless data transmission architecture. To facilitate this, I developed a lightweight Python-based background application that runs persistently on the Raspberry Pi, monitoring the local storage for newly retrieved images and synchronizing them with the cloud. This application dynamically constructs the transmission pathway between the Raspberry Pi and Pawsey Acacia S3, ensuring that any new image files detected in the storage directory are automatically uploaded. I implemented optimizations to handle large multispectral images efficiently, prioritizing reliable transmission while managing network constraints such as bandwidth fluctuations and intermittent connectivity. To further enhance the system’s performance, I incorporated file integrity checks and synchronization strategies to prevent data duplication and ensure lossless transfers.

Throughout the development process, I encountered and resolved a series of hardware and software challenges. One of the primary issues was ensuring compatibility between the Raspberry Pi’s operating system and DJI’s SDK, which required modifications to certain dependencies and adjustments to the build environment. Additionally, Wi-Fi connectivity posed intermittent issues, particularly in maintaining stable transmission over extended distances. To mitigate these, I fine-tuned the network parameters, adjusted the system’s power management settings to optimize throughput, and implemented failover mechanisms to ensure robust data transfers even under variable connectivity conditions.

By systematically addressing these challenges and refining the software components, I successfully deployed a functional prototype capable of real-time image retrieval and wireless transmission from the drone to the cloud. This system provides a scalable and adaptable framework that can be extended in future phases of development. The next steps involve integrating Starlink Wi-Fi for enhanced field-based operations, further optimizing transfer rates, and refining the overall system for deployment in real-world aerial surveying missions. This foundational work ensures that future iterations of the project will be more resilient, efficient, and capable of supporting large-scale data acquisition in dynamic operational environments.