Individual Lab Report #2

Progress Review 1

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Team B

Teammates: Jet Situ, Lance Liu, Yi Wu, Joshua Pen

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1 Individual Progress

1.1 PCB Assignment

While my involvement in the PCB assignment was minimal, I collaborated closely with Yi Wu and Lance on developing the Spring Test Plan and Progress Review. To ensure our test plan and validation procedures met Airlab Team Chiron's requirements, we organized meetings with Basti, Yaoyu, Lockheed team and other faculties in airlab who has experienced in UAS, and thoroughly reviewed their documentation. Jet and Josh worked on the initial draft, and then our whole team reviewed it together before submitting.

1.2 MRSD Project

In the MRSD project, I focused on three main areas: managing communications with NREC for test flight and Airlab for our team's schedule in the March DTC workshop; working with Josh on gimbal control issues; and remounting drone components after resolving the radio and gimbal problems.

For the workshop, we chose Jet to participate in both practice and test courses since he has the most UAS experience in our team and his US citizenship made logistics easier. Although we might only serve as substitutes in this year's DTC due to our extended setup time, we wanted to experience the workshop firsthand, collect data for our perception models, and learn about gimbal and camera control in competition settings.

Our team worked on multiple tasks simultaneously: Yi Wu handled perception, Lance and Jet tackled the radio system, while Josh and I tested the new Yawman flight controller, mapping its button outputs. We also experimented with MAVLink and various QGroundControl parameters to communicate with the gimbal. Though we could receive orientation data when moving the gimbal manually, we couldn't fix the command sending issue until the Lockheed team helped Jet and Lance configure it with GTune.

During debugging, we had to remove several drone components to access the Orin, gimbal, and radio more easily. Once the issues were resolved, Josh and I worked together to remount all components back onto the drone.

2 Challenges

2.1 PCB Assignment

Although I did not participate much, reviewing the work of my teammate helped me understand the key challenges in this PCB assignment. Firstly, dense trace placements made routing quite complex. My teammate Jet used net classes to properly separate critical and non-critical components, which I could also use for reintegration of our drone. Secondly, choosing between the MIC29300 voltage regulator and the Murata DC-DC converter required extensive datasheet analysis and custom footprint creation. My teammate Josh encountered this problem, and he made a custom part in EAGLE for the Murata one, which was the only one he could find. In the future drone development, I would

attach more importance of understanding datasheets thoroughly to ensure the stability of circuits and safety.

2.2 MRSD Project

The key challenges are gimbal control and radio communication, and I mainly worked on debugging the gimbal control. (Gimbal control requires a ROS node to subscribe to requested gimbal angles, and the integration with Gremsy SDK to achieve a designed Roll-Pitch-Yaw, then a ROS node as a publisher to back the active gimbal angles.)

While the attached camera data stream works well, the gimbal remains locked. We tried all the methods we could. I tried to control the gimbal through MAVLink, USB cable, setting different parameters in QGroundControl, and my teammates have also tried installing Gremsy to directly control the gimbal. However, we can only read its message, such as orientation, when we move it manually, but not when sending control commands. Almost all instructions and tutorials for it involve Herelink, but we could not use it due to the NDAA compliance restrictions.

After spending around 40 hours debugging the gimbal with some help from other faculty members in AirLab, we asked Basti and Yaoyu for help, and they helped us reach out another team who has quite similar system as we do. The gimbal issue was finally resolved by downloading GTune Desktop, creating a profile for the gimbal, and calibrate the motors.

Although we from time to time ask help from faculty members in AirLab and hold bi-/weekly progress meeting, we should have reported issues to Basti and Yaoyu sooner. They have extensive DTC experience as well as the information about the expertise in the lab, which can help us resolve the issues more efficiently.

3 Team Work

3.1 MRSD Project

Name	Contribution
Jet Situ	Worked on primary integration of the gimbal control and camera interface. Was able to tune, calibrate, and control the gimbal via integration of the Gremsy SDK, in collaboration with Lockheed Martin. Worked on ROS2 integration with the ground station, validating communication infrastructure to onboard MAVROS system. Removed Doodle Labs Radio and electronic infrastructure, replaced with Rajant Breadcrumb radio, and actively working on the electrical section to integrate the newer radio. Held meetings with Prof. Scherer and Yaoyu Hu to realign timelines and priorities in preparation for the DARPA March workshop.
Joshua Pen	Assisted in integrating and configuring the Hadron 640R payload with Cube Blue ArduPilot and NVIDIA Orin NX. Initiated development of a GeoFence path planner, creating an algorithm for generating lawnmower-style waypoints within a bounding box and filtering out those outside the geofence to establish an initial drone search path post-launch. Replaced the Rajant Breadcrumb radio on the drone, upgraded the gimbal attachment plate to reduce weight, and renewed the rubber padding on the drone's legs. Contributed to project management and logistics.
Lance Liu	Worked on radio, IssacSim, and gimbal integration. Primary work was on configuring the new RFD900 radio and integrating for use as a primary RC link between the CubePilot and the ground station. Work was done on integrating our design and the MAVROS behavior tree into IsacSim, where simulation of the drone and tree can be done in a safe environment.Contributed to attempted test flight and follow-up analysis of the drone's new payload configuration. Assisted in gimbal configuration process and debugging the SDK system.
Gweneth Ge	Primarily worked on communication with AirLab and lockheed team for the overall plan of our team participating the workshop in March, and the role to the DARPA Triage Competition this year. Additionally, worked on the Spring Test Plan, settling down the milestones for each Progress Review with other team members. Assisted in reintegration of the drone after gimbal control and Radio system issues resolved.
Yi Wu	Created a pull request for the AirLab/HumanFlow GitHub repository, implementing two ROS2 packages for 3D&2D pose estimation and pose visualization. The package enables human pose visualization in RViz2 and includes NLF algorithm (https://github.com/isarandi/nlf) testing on DARPA datasets. Additionally, started to implement YOLOv11 for comparative analysis of 2D joint pose detection performance.

Table 1: Team Members and Their Contributions

4 Plans

4.1 MRSD Project

Name	Contribution
Jet Situ	Will work on coordinating all key features needed for the March workshop, developing software psuedocode and baseplates needed to aid other team members in developing feature packages. Will assist with IssacSim simulation of drone behavior to develop safety features needed to qualify the drone for the workshop. Will redevelop the electrical configuration of the drone to appropriately route power to the motors and all newer subsystems, and test tuning to ensure that the ESCs produce the expected output. Will work on mechanical integration of newer drone components and hardening in preparation of outdoor test flights.
Joshua Pen	Collaborate on developing gimbal control protocols and implement mechanical enhancements. Design and code a GeoFence path planner, creating algorithms for lawnmower-style waypoint generation within a bounding box and filtering out waypoints outside the GeoFence to establish an initial search path for drone deployment. Contribute to developing the IsaacSim pipeline for testing path planners. Additionally, manage project logistics and oversee project management tasks. Will also replace boken motors on drone.
Lance Liu	Will work on integrating the new control protocols for the RFD900, and the Rajant Breadcrumb radio, and work on setting up the ROS2 communication and router nodes between them. Will continue to work on IsaacSim integration and develop a simulated environment to test the behavior tree in, integrating Josh's software code and testing it within the virtual environment. Will also assist in overall code architecture and structuring for deployment within ground station, Docker containers, and deployment onto aerial computer.
Gweneth Ge	Now that the gimbal and radio issues resolved, I will continue working on on Inter-UAV collision logic and planner launch. Moreover, I will assist gimbal control and sensor nodes development, detection launch, visualization and clicking interaction. I will continue supporting on project management and logistics, including the plan for the DTC workshop in March, as well as the demo and space setup for National Robotics Day in April.
Yi Wu	Deploy the current pose estimation algorithm (NLF) on the Jetson Orin, and test its performance. Finalize the YOLOv11 pose estimation ROS2 packages. Initiate development of pose estimation algorithms for thermal camera data. Implement gimbal control functionality by tracking a designated target patient point within the camera frame.

Table 2: Team Members and Their Plans