

Individual Lab Report #5

Progress Review 4

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Jet Situ

Team B

Teammates: Gweneth Ge, Lance Liu, Yi Wu, Joshua Pen



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1 Individual Progress

1.1 PCB Assignment

My work on the PCB assignment consisted of the final production of the PCB board once it came in, as well as defining the test plan. While I did not directly solder the PCB board, I validated the component orientation, and performed the power supply setup at AirLab with the multimeter setup that demonstrated the core functionality of the PCB.

Specifically, I tested whether or not the diode system worked to effectively allow only one battery to discharge at a time, implementing the auxillary battery system required for drone hotswapping. Then, I tested the buck system, probing to see whether or not the buck effectively worked in reducing both the current and voltage to the 5V segment.

1.2 MRSD Project

For the MRSD project, my primary contribution was in three specific prongs - software support, logistical support, and flying the drone for data collection.

In terms of software support, we collectively decided as a team that we would refactor our codebase once we were able to take a breather after a series of pressing deadlines. I worked on reorganizing the two broad forks of the code, one based on the autonomous flight planner and systems, and one based on the gimbal control. I reorganized these two into hierarchical classes, which then allows a modular level of control over individual subroutines, instead of the original hard coding that was implemented in order to meet deadlines. I also wrote the gimbal control hierarchical class following this, allowing the Foxglove UI to properly switch between gimbal states and process gimbal data in an organized fashion through the ROS network.

I then worked on logistical support - specifically, I participated in meetings between ourselves and the Lockheed Martin team, and coordinated with the City of Pittsburgh representatives in order to secure flying privileges at the Hawkins site. I also worked to coordinate meetings and flight days at Mill 19, and coordinate remaining tasks that involved the collection of data and the integration of AirLab's initial perception modules and the additional training data that was left to collect.

Finally, I participated in nearly every flight day of the drone, acting as the primary pilot for data collection, as it was easier than setting a route, then acting as a safety pilot during autonomous drone flight.

2 Challenges

2.1 PCB Assignment

The challenge within the PCB assignment laid within a mismatch between the parts requested and the parts received. On our bill of materials, we laid out specifically for the purchase of a 4.3K Ohm resistor and a 1k Ohm resistor, and an adjustable buck to support this. Unfortunately, we received a fixed buck, alongside a mismatch in the resistances. This led to our board not performing fully as intended, as the resistances were required for a feedback loop to go back into the buck to calculate the correct output voltage. The other challenge was in the diodes we ordered - which had a lower current

limit than we expected. Therefore, during testing, we had to limit the current on the power supply unit side to ensure that our board didn't burn out.

2.2 MRSD Project

The challenges this time in the MRSD project laid in delays. We had significant flight delays due to some parts being unavailable, and flight delays due to weather, which slowed down our progress on the evaluation of our autonomous flight algorithms. We furthermore had delays in obtaining the perception algorithms which we gathered data for, resulting in us striking some of our initial PR4 goals as they proved to be infeasible at the moment. The next delay we had was with scheduling the area to fly in for SVD, we reached out a bit late in our process, and unfortunately, we were only able to schedule SVD Encore to be at the Hawkins site, which was our preferred location for demos.

The next challenge we faced was a drone crash - while I wasn't present for a caged flight, the drone unfortunately suffered a GPS loss while in the air, and the abort routine wasn't able to act in time. This led to a few days of delays while we evaluated the damage and repaired the drone to operational condition, and furthermore delayed our ability to evaluate the autonomous flight algorithm.

3 Team Work

3.1 MRSD Project

Name	Contribution
Jet Situ	Aided with test flying and software redistribution and reorganization work in preparation for SVD. Coordinated the software redesign process, which provides a modular framework that allows all team members to contribute to future features while achieving code maintainability and stability. Contributed code toward the gimbal core autonomy framework. Drafted, and aided with the testing of the final PCB design. Met with Lockheed and coordinated test site approvals and future plans.
Joshua Pen	Contributed to creating the Progress Review 4 Slides and updated the MRSD website. Designed and integrated inter-UAV de-conflict planner. Re-organized components and wire layout on drone for weight reduction to improve flight time. Designed NVIDIA Orin, Rajant DX2 Radio, and DX2 24V PoE Mount. Helped with task distribution, team logistics, code review, test flight set up, and data collection.
Lance Liu	Routed the pipeline for full triage autonomy. Implemented visual servo for target lock-on. Optimized streaming-detection-GPS estimation + visual servo sub-pipeline to achieve real time performance. Attempted test flights.
Gweneth Ge	I'm primarily responsible for Progress Review 4 slides, test flights arrangement and setup, organizing collected data/files from test flights, issue logging, components tracking and ordering, and MRSD website design and updates. In addition, I helped with weight reduction, and Inter-UAV deconflict by publishing dummy UAVs GPS information through Foxglove.
Yi Wu	Software: Debugged the lock-on code with other team members. My part focused on double-checking the GHadron Gimbal PayloadSDK's detection code and following mode code, and debugging the tracking function. Integrated the pose estimation code into the drone's perception module. Worked with AirLab staff to adapt the 3D pose estimation code to conform with their code structures. Test flights: attended some of the test flights and acted as patients.

Table 1: Team Members and Their Contributions

4 Plans

4.1 MRSD Project

Name	Contribution
Jet Situ	Will aid in test flying and integration of features prior to SVD. Will meet with Lockheed and continue to coordinate future features for project in the leadup to Triage qualification deadlines in June. Will also write and debug the autonomy core of the drone, which will allow implementation of fully autonomous routines for the triage competition.
Joshua Pen	Mainly help with test flight and feature integration for full SVD demonstration. Make any mechanical modifications required for SVD. Organize test flights and tasks for SVD preparation.
Lance Liu	Run "Test-Debug-Refine-Test" procedure until system is fully ready for SVD
Gweneth Ge	Prepare for SVD mainly in logistics aspects including test flights arrangement and components issue tracking/backup. Catch up software code base and help with Wuyi or Lance if needed. Prepare for the Dapra Triage Challenge mini competition in June.
Yi Wu	Mainly about upgrading the pose estimation algorithm. Will conduct some ablation experiments to check the algorithm's accuracy on real data collected from the test flights. Will project the 3D poses into the real-world frame. Will try to enhance the model's performance by changing the way it interacts with the people detection model. Will try to speed up the inference latency.

Table 2: Team Members and Their Plans