# Individual Lab Report

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Team C – Column Robotics

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IRL 5

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# Individual Progress

**Implementation and through testing of FVE flight experiment**

I spent a considerable amount of time polishing the final implementation of our FVE flight demo with the AR.Drone platform. This included updating flight scripts, correcting scaling issues, troubleshooting problems, and in the end coming up with an enhanced version of our FVE that better reflects the requirements of our system and demonstrates our capabilities.

After working out the kinks in our original precision movement demonstration and actually performing our original FVE plan (which consisted of moving to a precise location up to 6m away from the take-off zone), it became clear that the primary challenge would be in the precise alignment of the drone itself before issuing the movement command. Because this need for a precise initial alignment does not reflect the requirements of our system, I have proposed a grid-search demonstration which is significantly more meaningful and applicable to our project.

Instead of moving to a single point, our enhanced FVE will consist of a grid-based movement pattern covering the majority of the open area on the B-level. This will demonstrate a high level of control over the drone, enabling us to produce a downward-facing video feed which can be used to detect the dock we will subsequently be landing on.

**Layout and preparation of the Iris+ hardware configuration**



Figure 1: Iris+ with hardware layout

Working together with Rohan Thakker, I prepared the specific configuration of our actual hardware to be mounted and integrated on the Iris+ drone platform. This includes the Odroid SBC, PX4Flow optical flow camera, Playstation Eye camera, Asus Xtion Live Pro RGBD sensor, as well as the power delivery board. Beyond the mounting configuration, I also worked to identify the specific routes for electrical connections and the steps needed to integrate all of the electronics into a lightweight, integrated system.

**Systems engineering presentation preparation**
I also took the lead on preparing our final presentation for the Systems Engineering course. This consisted of summarizing our progress to date, as well as updating and presenting our project management status.

## Challenges

**Precise initial alignment of AR.Drone in air**
The most significant challenge I ran into was the need to precisely align the AR.Drone in order to achieve our original precision movement FVE demo. We planned to hit a 1m target up to 6m away, and upon detailed experimentation it turns out that our ability to complete this task is primarily influenced by the accuracy with which we can precisely control the initial alignment of the AR.Drone while it is hovering in the air.

To help with alignment, I attached fiducial marks to the chain-link fence across the room from the AR.Drone launch position, however due to the coarse heading adjustments which are possible with our manual control scheme, it was still very difficult to align the drone within the few degrees necessary to hit a target 6 meters away. This drove home the significant nonlinear dependencies that rotational movement imparts on robotic systems.

In the end, it became clear that it is much more important for us to achieve coverage of the target search area than it is to ensure our search area is precisely aligned with the initial frame of reference. As a result, I was able to propose an enhanced FVE which better demonstrates our capabilities while at the same time removing the dependence on precise rotational alignment.

**Wiring and connectors**
In the process of designing our Iris+ hardware configuration and hooking up all of the electronics, it has become clear the difficulty involved in physically wiring together disparate pieces of custom hardware. I did not expect the amount of effort required to shorten cables, crimp connectors, and generally ensure that all of the details are correct.

## Teamwork

This week our team experienced issues getting the entire team making progress.

An MMC assignment surprised the team during the week of Nov 9th, and resulted in very little progress during that week.  Subsequently Rohan and I were able to make progress largely as planned, but due to other factors Cole and Job were unable to make much progress on their assigned tasks. As a result, Rohan and I will be spending more time than we'd planned during Thanksgiving break making up for the lost progress of the last week.

During our sprint wrap-up, we identified specific gaps in communication and expectations that lead to this result, and we're hopeful that in the future this can be avoided. Fortunately Rohan and I will be able to make up for most of the lost time, and we still feel we're in a good position for the fall FVE.

## Plans for Upcoming Work

**Fall flight demo preparation and execution**
During the final week and a half until the fall demo I will be focused primarily on completing and polishing our newly updated autonomous flight demonstration which comprises a major part of our FVE. I will be utilizing our accurate relative odometry to perform a grid-based search pattern while displaying the downward-facing camera feed. This will demonstrating our ability to find our dock within the search area.

**Iris+ hardware configuration**
There is still a considerable amount of work remaining on the Iris+ hardware setup, and I will be stepping in to assist Rohan with the physical work of assembling connectors and configuring the various electronics interfaces between our pixhawk controller, single board computer, and camera systems.