Individual Lab Report

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Team C – Column Robotics

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IRL 6

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Individual Progress

Manufactured and configured a complete backup Iris+ drone platform

I spent most of the past two weeks building and configuring a complete second Iris+ drone.

This included:

- Soldering and mounting the power distribution board
- Creating and attaching the power cabling
- Mounting the Odroid SBC
- Creating cabling and connecting the UART serial connection
    - Building and testing a UART level-shifter board
- Mounting and connecting the PX4 flow camera
- Stripping and mounting the Playstation Eye camera
- Mounting and connecting the RGBD sensor

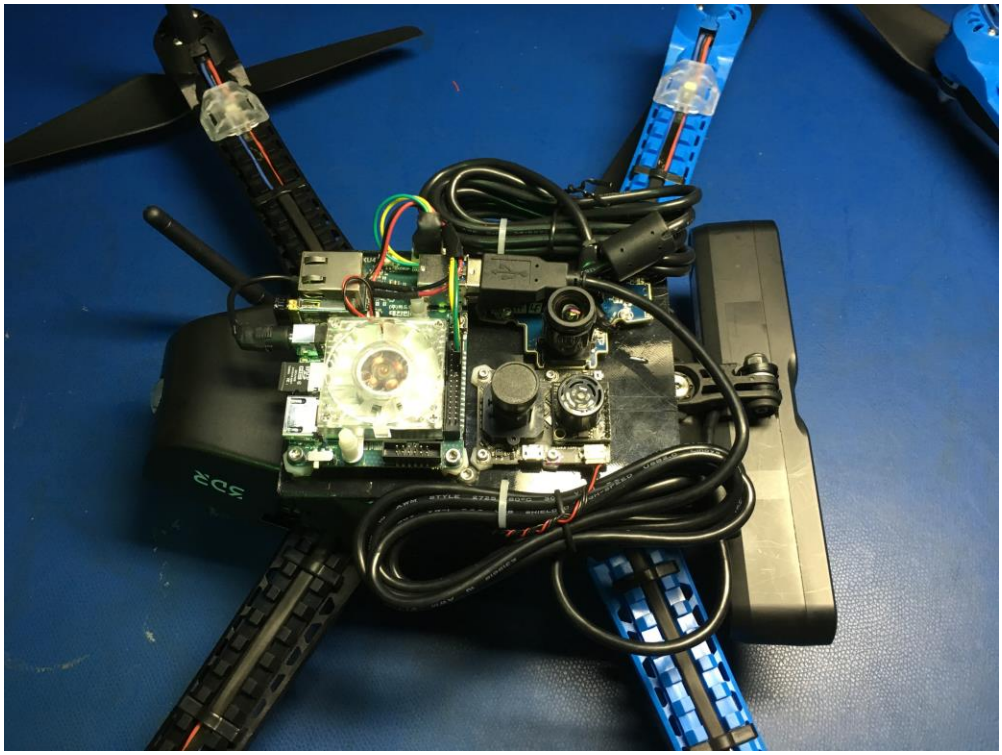

Figure 1: Completed Iris+ Unit #2 with mounted RGBD sensor

Tested alternate PX4 drone firmware and configured high-speed ROS integration

With the hardware complete, I then built an alternate set of firmware for the Pixhawk controller called “PX4” from source to see if this would help us get around the problems our team was having on the APM firmware that the drone came with. Fortunately, with this firmware I was able to get the high-speed ROS communication working as desired.

Configured emergency kill-switch functionality
In addition to working well with ROS, the new firmware provided support for a low-level kill switch which is able to immediately disable the quadcopters motors in the case of unexpected dangerous maneuvers. I spent 20 minutes or so researching and configuring this kill switch to be easily accessible on the remote control. In testing, the kill switch performed as expected and we now have another important layer of safety for our testing.

Verified flight dynamics of fully-loaded Iris+
After building and setting up the second Iris+, I proceeded to perform our first actual flight tests with the new firmware and full hardware loadout. The flight dynamics under manual control behaved surprisingly well and are well within the requirements of our system. A gradual forward drift does exist due to the front-heavy mounting of the RGBD sensor, however we should be able to overcome this with some tweaks to the controller setpoints.

Challenges

APM / PX4 firmware confusion
We ran into complications related to the ambiguous nature of the Pixhawk firmware situation during the configuration of our Pixhawk flight controller hardware. There are multiple teams developing partially-compatable firmware (APM and PX4), and when searching for instructions and/or documentation it's extremely common to run across conflicting information. In the end, we found that using the PX4 firmware together with switching the RF controller from the telem1 port to the telem2 port was the key to enabling high-speed ROS communication.

Incessant Low Battery Beeping!
One of our drones decided it's battery voltage monitor was seeing 10.5v instead of the actual 12.5v of the battery, resulting in unending, loud beeping of the drone. This seemingly minor issue required more than 4 hours to resolve by means of a complete firmware wipe and tweaks to various settings.

Teamwork

Splitting up the work into three teams was successful. Job was able to continue to reduce our programmatic risk by developing the capabilities of our AR.Drone backup platform, while Cole and Rohan worked on the critical flight integration. Meanwhile I was able to build a second dev platform, which has already increased our productivity by allowing two separate threads of work to proceed on our Iris+ platform.

Figure 2: Our drone platforms

We have enhanced our team's productivity by more clearly focusing our two-week development sprints around well-defined internal demos that we share with the rest of the team. Each team-member is responsible for delivering a visible, individually valuable chuck of functionality. This has focused work and created periodic deadlines that have significantly accelerated the pace of development work.

Plans for Upcoming Work

3D pose estimation and obstacle detection with RGBD sensor

The next task I will be focused on is enabling our stretch goal of autonomous navigation and obstacle avoidance using the RGBD sensor. This task will start with the evaluation of the RTAB-Map RGBD-SLAM package to determine the level of performance which is possible on our onboard Odroid XU4 SBC. If I am able to successfully install and run this package, the door is open to relatively advanced indoor mapping and search techniques.