Sensors and Motors Lab

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Team C: Column Robotics

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ILR05

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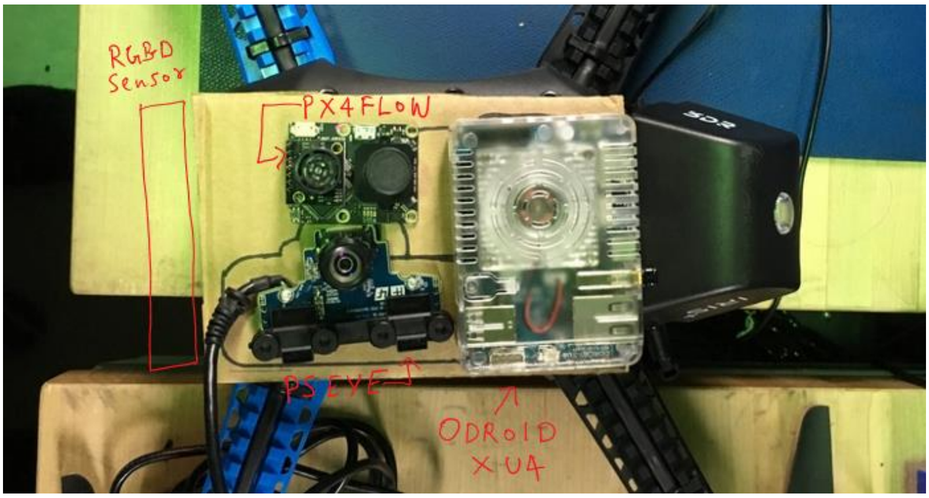

Figure 1: Placement of the sensors and SBC

1) Individual Progress

For this sprint, I was responsible for the hardware setup of the IRIS+ quad-copter. Since the last progress review, I have been able to complete the following tasks:

Decided placement of hardware on the IRIS+

The following shows the list of hardware that is required to be mounted on the IRIS+:

1. PX4Flow Sensor [2]: This sensor gives visual odometry updates to the PIXHAWK.
2. SONY PS EYE Camera [3]: The camera feed on the PX4Flow sensor cannot be accessed by the single board computer. Hence, we cannot use it to detect the wellhead or a tag on the docking station. To resolve this issue, we are using SONY PS EYE camera.
3. ODROID-XU4 [4]: This is the single board computer that we will be using to run our perception and planning algorithms.
4. RGB-D Sensor: We want the mount design to have provision to attach a RGB-D sensor like ASUS-XTION-PRO-LIVE. This will be a fall-back if we are not able to achieve good results from the monocular camera.

Figure 1 shows the design that Erik and I made for the placement of the sensors and SBC. To select the optical placement of the sensors and SBC we also had to consider routing of the cables. The orientation of the ODROID was selected such that the USB 3.0 port is close to the SONY PS EYE camera and the RGB-D sensor. Further, the power port of the ODROID was kept closer to the battery of the IRIS+. The cameras positions were chosen to be as close to the centre as possible, so that the field of view covers equal areas in all directions with respect to the quad-rotor.

Designed the bracket to mount the hardware

The objective was to design a bracket so that hardware can be mounted in positions as shown in figure 1. I designed the bracket so that it can be fabricated using a 3-d printer. Hence,

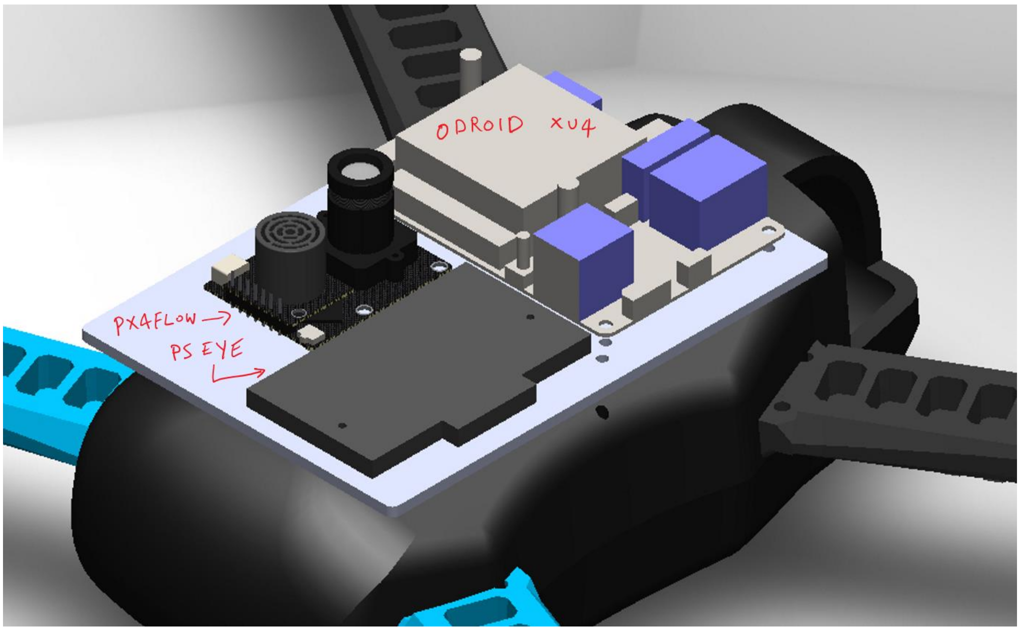

Figure 2: CAD Model of sensors and SBC with mounting bracket

we will be able to fabricate it in the MRSD lab. Figure 2 shows the CAD model of the sensors and SBC with the mounting bracket. The RGB-D sensor (not shown in the figure) will be connected to a separate mount which attaches to the bracket that is provided by the manufacturer for the gimbal. This can be designed and fabricated if we require the RGB-D sensor during the spring semester. The mounting bracket of the sensors and SBC was designed to avoid obstruction with the gimbal mount.

2) Challenges

- Our implementation of FVE test stage 1, experiment to validate the locomotion of the ARDrone, was too sensitive to the initial orientation of the drone. Even slight deviation from the ideal angle causes large deviation in position from the target location. In terms of doing search, this won't affect us. Hence, we decided to change our FVE goal to performing a lawn-mover search. This is much more relevant to the problem that we are solving.
- We are using the APM Power Module [1] to power the ODROID XU-4. This was designed to connect to the battery with XT-60 connector and hence occupied lot of space. It was not possible to fit the entire module along with the battery inside the drone. Hence, we decided to remove the power cables from the module and directly solder the wires to the PCB of the IRIS+. By doing this, we can fit the power module right next to the battery.
- SONY PS EYE camera was too bulky to fit to the base of the IRIS+. This camera was selected because of its support for high frame rate (100 Hz) and low cost. We fixed this issue by removing all the plastic casing of the camera and using just the bare PCB.
- The CAD models of the sensors and ODROID were not provided by the manufacturers, hence I downloaded those parts from www.grabcad.com. However, I had to spend a lot of time validating the dimensions of these parts. In-spite of that, this was quicker

than designing every single part on my own. I couldn't find a CAD model for the PCB of the SONY PS EYE camera. Hence, I designed a lumped model of the part as shown in figure 1.

3) Teamwork

Our team has made good progress on all 3 parts of our FVE: ARDrone demo, IRIS+ hardware setup and dock prototype. We are on track to complete the required tasks on time.

As for individual teammates, Job was leading the final design and fabrication of our dock prototype. We were able to execute our initial test with the soccer cones. Erik worked on implementing waypoint navigation on ARDrone and testing it several times. Cole was responsible for the power distribution board design and he placed the order for all the required parts. Erik and I had a brainstorming session to decide the placement of the sensors and SBC for IRIS+. I made the final design and CAD model of our assembly.

4) Plan

Erik and I will be working on completing the hardware setup of the IRIS+ for the FVE. I will be working on fabrication and assembly of the hardware. Erik will be working on interfacing of the sensors. Job will be working on fabrication of the final dock design, with help from the entire team. Since we are on track for most of the tasks that we require for the FVE, we decided to dedicate one person to work on the things that are not a part of our FVE, but we will require them in the spring semester. Hence, Cole will work on APRIL Tag detection using the front facing camera feed of the ARDrone. He will also help the rest of the team in hardware setup and fabrication of the dock prototype.

5) References

[1] https://store.3drobotics.com/products/apm-power-module-with-xt60-connectors

[2] https://pixhawk.org/modules/px4flow

[3] https://en.wikipedia.org/wiki/PlayStation_Eye

[4] http://www.hardkernel.com/main/products/prdt_info.php