Individual Lab Report 6

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Team B: Arcus

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Individual Progress

For the past couple of weeks I have been primarily responsible for managing the hardware refresh. At the end of last semester, we had all of our hardware installed on the drone, but there was still some tidying up to be done. Many of our cables were too long, so I measured the rough distance from where the sensors were mounted to the computer, which powered most of them. This resulted in us purchasing 1.5 ft cables for the IMU and RGB camera and a 1 ft cable for the GPS.

Another task that I worked on was installing a new GPS onto the drone. Our sponsor recently provided us with a better GPS as we were having difficulties getting RTK lock with the Piksi-provided GPS when we were at the Lafarge Quarry, which will be our testing location for Spring Validation. Because the new GPS did not come with its own grounding plane, we needed to drill holes into the grounding plane according to its hole pattern. I also had to source new screws to mount the GPS. The old GPS compared to the new one can be seen below in Figure 1a and 1b, respectively.

(a)   (b)
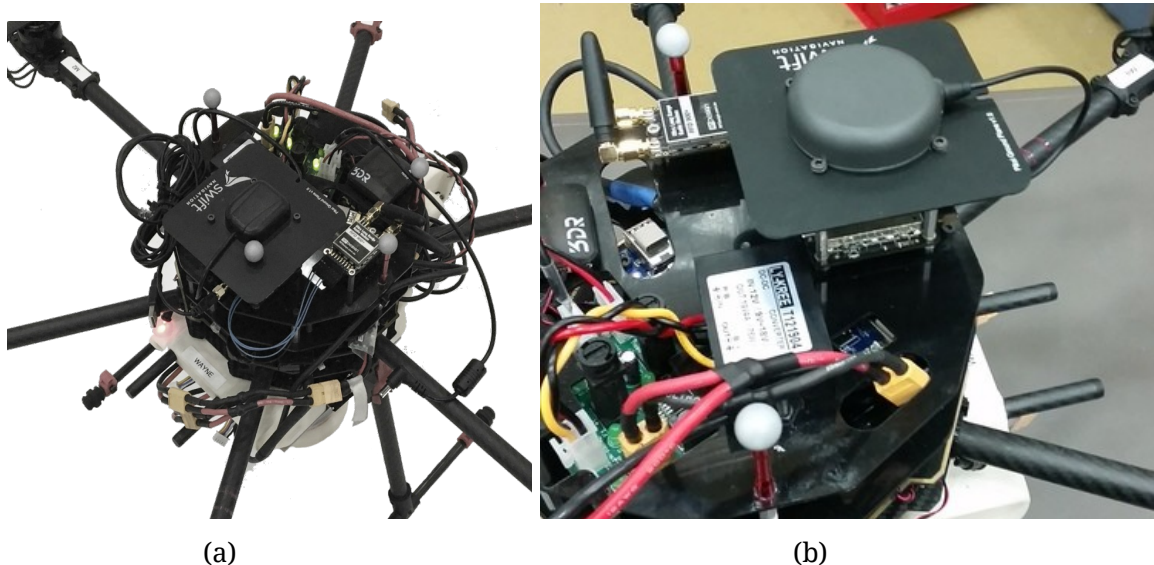
Figure 1: (a) Old GPS mounted on UAV and (b) New GPS installed on previous grounding plane.

We were also advised by a postdoctoral researcher in the Planetary Robotics Lab that our Pixhawk flight controller might be experiencing some technical issues, so he suggested that we switch to the Pixracer, a controller made by the same company that will likely be more reliable. The Pixracer is much more compact and has a set of mounting holes. Because it needs to be mounted precisely in the center of the drone, I made a mount for it that will be laser cut. This is also an improvement over the Pixhawk, where we just taped it down to the spot that we thought was approximately center. The "X" shape of this mount

will allow us to align to the edges of the bases using the edges of the arms. We will fasten the mount to the board using foam tape since this seems to have worked well for the Pixhawk and there is plenty of surface area on the mount. The pattern for laser cutting can be seen in Figure 2.
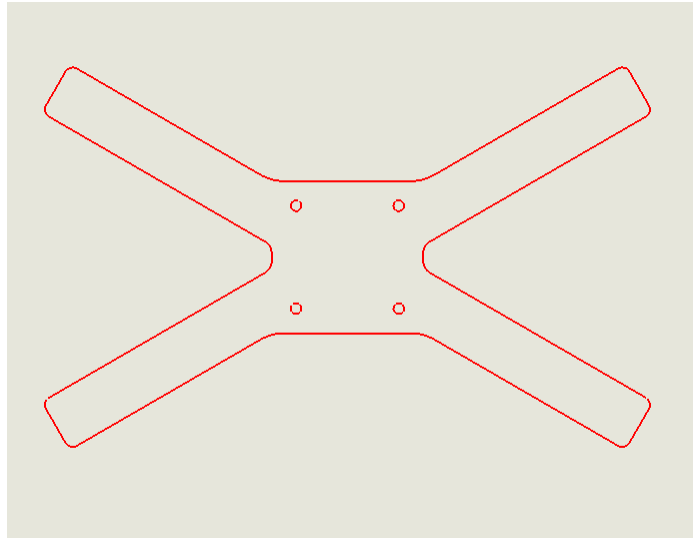
Figure 2: *Pattern Pixracer mount. Lines are red to indicate what needs to be cut through for the laser cutter settings.*

In addition to the mechanical side, I have been starting to get caught up with the programming work that Angad did last semester so that I can begin working on it myself. After getting all the correct drivers installed – which was not a trivial task – Angad provided a brief overview of some of the scripts that he wrote. I was also able to successfully play a rosbag of the offline point cloud map being generated at Lafarge.

Challenges

I have not had too many issues with my tasks this past week. We ran into a slight issue with mounting the antenna onto the ground plane because, while we were drilling, the plane was bowing in the vice, which prevented us from getting the hole pattern exactly centered on the plane. This mattered because the diameter of the antenna was almost the length of the holes that mounted the plane to the GPS module itself. Luckily, however, we were able to tighten the bolts down, although there might be some artificial damage to the exterior of the antenna.

Another challenge that I am anticipating is getting into the details of the code after having walked through some of it with Angad. This is largely because I have not had to use C++ for much of my undergraduate experience. To aid in my transition, I will be brushing up on C++ further and directing questions to my teammates that are fluent in this language.

Teamwork

Logan Wan: Logan worked on organizing a new schedule for the team, CAD model clean up, and familiarization with our code base.

Angad Sidhu: Angad handled IMU pre-integration and is working on improving it from its more naïve state from last semester.

Maitreya Naik: Maitreya conducted the PDB power check with Logan, did the Pixhawk integration cable, did flight controller recalibration and permanent mounting on the UAV, and he conducted a full electrical load test with generation of a LiDAR point cloud on the Brix done simultaneously with the motors at full throttle.

Future Plans

For the next progress review, I will be cleaning up the loose ends with the hardware, including installing the Pixracer mount and new cabling. I will also be working alongside Logan to familiarize myself with the mapping so that we can begin the transition from octree mapping to occupancy grid mapping.