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IRL04
11/10/17

Individual Progress Update

I worked extensively on the Power distribution board, making some final revisions to the schematic and choosing the final components as well as designing the board layout and submitting the gerber files on time for the board to get manufactured. The final design consisted of two 12V 5A power lines to power the Nvidia Jetson Computer and the Velodyne Lidar VLP16. I tried to make the board with as small a footprint as possible, since ultimately it will be part of the flight system when we test the drone in the air, and we are already approaching our maximum payload weight with the DJI Matrice 100 due to the fact that we have the heavier version of the Velodyne puck (as opposed to the Velodyne puck Lite). The regular Velodyne Puck is about 800g. Regardless, the power system is as streamlined as possible, but that means that efficiency of regulation is important. I went with a switching regulator on each line, and as I mentioned in the previous IRL, I used a LM2678 regulator, which requires an inductor to work. Working to get all the components in a tight package while still leaving plenty of room to assemble the board and route large power traces was a relatively time consuming challenge. In an effort to streamline the system, I removed the battery sensing capability from the board. Additionally, I briefly had a 5V and 3.3V line output on the board, but I discovered that I would be able to get all the logic level voltage outputs from the Jetson, so I removed those lines to conserve on space and part count.

In addition to completing the PDB PCB, I did some work in trying to debug some of our mapping problems. This week, Hari got access to an alternative mapping method from CMU's AIR lab with the hope that this code, when adapted to our purposes, would yield a better performance. However, we ran into difficulties with documentation, so that's where I stepped in to help when our schedule started to slip. I worked for a bit on helping to figure out some aspects of the code, and wrote a simple visualizer script so we could visualize the data coming out of the mapping algorithm in order to aid in our debugging efforts.

I also worked on the mechanical design of the Fall validation experiment test platform. We already had a simple concept design in place, but now that we are approaching integration, testing, and validation, we need to have a full platform to test with very soon. I did a design for the platform to hold the quadcopter and LIDAR, as well as a way to move it around according to our FVE test plan.

I did some work with the DJI drone to figure out how to mount the LIDAR as well as getting data from the quad (Shivang and I calibrated the Quad's GPS and magnetometer).

As always, I've been keeping a track of the schedule and making sure that parts get ordered on time in my duties as a project manager. We have had a few delays in some of the development

of certain subsystems, but I'm trying to allocate resources accordingly so we can catch up. I'll discuss some more of this specifically in the Challenges section.

Challenges

I had some initial challenges with the generation of the gerber files. I've ordered boards before through Bay Area Circuits, so I'm much more familiar with their tool for checking gerbers and visualizing where there are problems in the board. I wasn't able to get the same level of resolution with the Advanced Circuits tool for some reason, so I missed some mask errors near the drill holes on the initial submission.

Another main challenge for me this week was working on the mapping. While I wasn't directly involved with all of the work, recently I've joined in on the efforts to try to make some additional progress. The main problem we are working through right now is getting the AIRlab code to work, since it is not well documented and we haven't received a lot of help in trying to understand it. We have an internal deadline for later tonight to try to make progress, after which we will re-evaluate our options and perhaps revert back to a previous method and try to improve the problems we had with that.

Related to that, I've had difficulties as a project manager making sure tasks don't slip too far behind. We initially said that we would have more mapping and voice/sound done this week, but we had a couple setback in schedule, so I'm pushing those particular areas and helping out myself in the mapping area (after I finished the hardware designs) in order to kick-start some additional productivity.

As a team, we had some difficulty trying to get more data from Near Earth Autonomy with all the pose and odometry data included. Hari and Joao met with an engineer at NEA today to resolve this issue, and we are on our way to being able to use data in simulation form to test our algorithms during and prior to FVE.

Teamwork

Joao: Joao worked on creating the dynamic model to calculate the flight envelope as well as started on voice commands and sound warnings. He also did work with Nihar on how the user interface will look.

Nihar: Nihar continued his work on the user interface by developing a demo for the HUD and bird's eye view as well as integrating with the Jetson along with Shivang.

Shivang: Shivang set up the software framework for the system, continued working with integrating subsystems with the Jetson, as well as getting data off of the DJI quadcopter. He also

helped with Mapping debugging and created a filtering scheme for getting rid of extraneous points based on the dynamic window.

Hari: Hari continue work with the mapping. After getting octomapping to a point that was good but not great (with the NEA data), he spent a lot of time trying to get the gridmapping AIRlab code to work with our datasets.

Figures

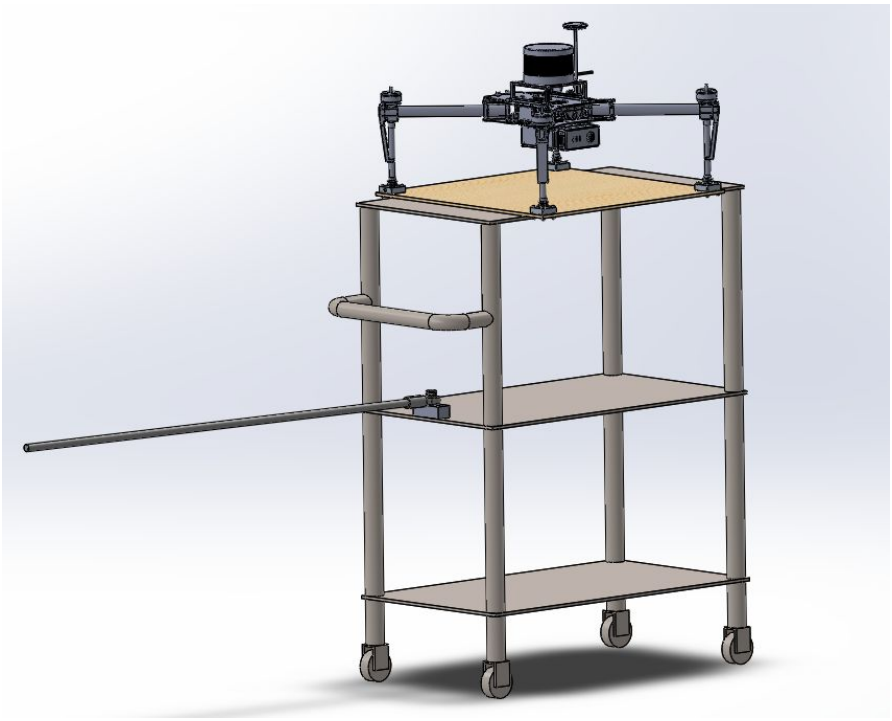

Figure 1: CAD screenshot of FVE test cart

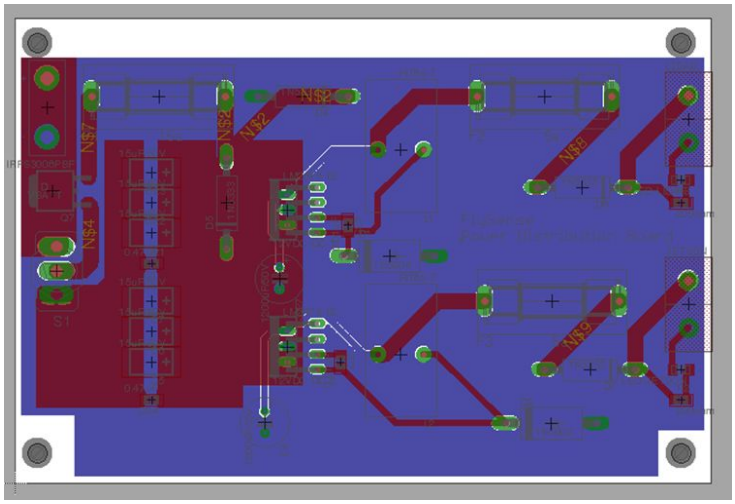

Figure 2: Screenshot of final EAGLE PCB layout

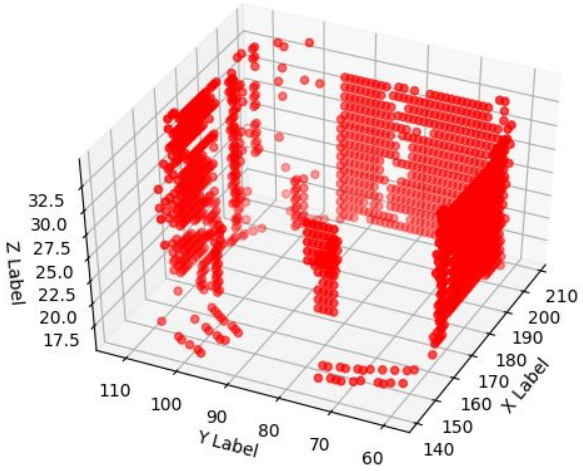

Figure 3: Visualization of part of the obstacle data

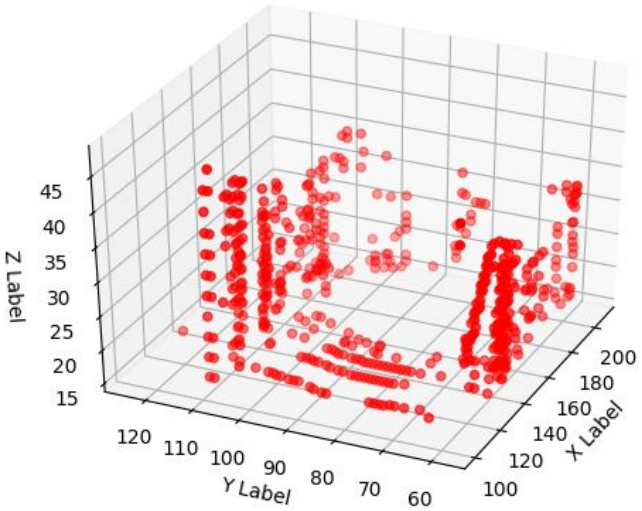

Figure 4: Visualization of some of the obstacle data. As you can see, the data is a lot sparser than in the previous frame, which we discovered was because what we were visualizing was in fact a set of obstacle updates, and the real updates to use were being stored to the shared memory of the gridmap.

Future Plans

Individually, I will continue to support on the mapping and integration, as well as do a chunk of the mechanical work to finalize the assembly of our FVE test system. When the PCB gets fabricated, I will assemble and test the board.

For the rest of the team, here as some of the main tasks going on, and who will be working on what:

- Refining obstacle mapping (Hari)
- Obstacle mapping to 2d (Hari and Shivang)
- AR interface work on Birds Eye view and HUD (Nihar)
- Sound warnings (Nihar and Joao)
- Voice commands (Joao)
- Jetson/integration (Shivang)