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Individual Progress

Recently, I've been working on getting our project management system off the ground and determining plans for how to de-risk some of our high risk items. I create an FMEA for the Fall semester detailed over 30 potential risks associated with the project, and determined risk mitigation strategies for each of those and assigned a risk owner for each one (see Table 1).

I set up this risk table by analyzing all the features we plan on working on over the course of this semester (and beyond), and assigning both a rating of likelihood (1 being less likely, and 10 being more likely), as well as a severity rating (with 1 being least severe, and 10 being a project-ending severity). The important thing here was to recognize our high risk items, whether they be in design, process, or relationship, and come up with a way of mitigating that risk. Our high risk items right now are primarily associated with AR and User interface, so one thing we did to mitigate that was have meetings with a number of HRI experts and ordered a second AR headset to test with.

This week I also helped Hari and Shivang test the Velodyne LIDAR we were able to borrow from the lab to take preliminary data on. On this topic, I've also written up a few test procedures to test the limits of the LIDAR's ability to produce a detailed and robust enough obstacle map for us to use in our system, a document that I've continued to update as we come up with more tests that we consider important to run in order to determine whether we will meet our end requirements. I participated in the testing by moving an object around in the scene while Hari and Shivang recorded data.

In support of our mapping progress, I've started to get feedback from some NEA engineers on how best to solve the mapping problem, and whether more sensors will be needed. One recommendation that was given for pursuing is to create a buffer of data to fill in sparse parts of the point cloud, since even with 64 lasers on the best Velodynes, when they are mounted up in the air, the spread of all the laser lines inevitably creates a fairly sparse map. It might be good enough for our purposes, but adding a buffer or fusing with camera data makes for finer detection, but a significantly more difficult perception and mapping problem. We haven't come to a firm conclusion on this yet but are looking to resolve this as soon as possible, pending further analysis of the dataset.

I have also started concept work on the Power distribution board PCB. I have identified possible components to use as well as the general specifications that we need to meet for using the board in our FVE, as well as started collecting similar design topologies that I can reference for our board design (I've designed a DC-DC buck converter during an undergraduate project).

Challenges

One of the biggest challenges we have faced this past week is difficulty in accessing the NEA datasets. We had a workstation set up for us at the NEA office, but when we went in to start working on analyzing the data, we could not visualize the data as we could normally do in the lab. After a couple of sessions there working with their engineers, we were eventually able to figure out the problem, but delayed our development schedule by about a week.

We are also limited in our ability to get our own data since we are still waiting on the Velodyne for us to use from NEA, but that should hopefully be in the lab sometime next week.

Teamwork

Joao: Joao has been working on developing the user experience and has taken multiple meetings with experts and faculty members in user experience and HRI (Pilots at NEA, Prof. Jean Oh, Prof. Aaron Steinfeld).
Nihar has been working on AR development on the Hololens and working with Joao on user interface research.
Shivang is working on LIDAR and obstacle mapping. He also helped me on identifying some components for the PDB and has identified some additional sensors to order for our general sensor suite.
Hari is the lead on the LIDAR and obstacle mapping.

Figures

Reduced access to NEA dataset	limited or no access to NEA dataset	cannot build extensive simulations/mapping system from real flight data	3	8	Government regulations	24	Train US Person(s) on data in case there are ITAR/US gov limits, plan to generate our own data to use	2	7	14	Nick
NEA Dataset	difiiculty in visulaizing NEA data for use in mapping	cannot build extensive simulations/mapping system from real flight data	5	8	lack of direction on how to process the data	40	Get direct help on the data from NEA engineers	2	8	16	Nick
AR Headset procurement	time delays or bugetary limits on	cannot get different AR headset for project	4	10	out of stock products	40	use microsoft hololens	4	5	20	NIhar
Flight hardware procurement	difficulty in obtaining drone for flight testing	cannot meet key test parameters for SVE	7	10	expense of drone, cannot get hardware sponsored	70	get flight hardware from NEA	2	10	20	Nick

Table 1: Sample of Risks identified for project, along with mitigation strategies and risk owners

Figure 1: Test setup that we constructed for testing the LIDAR with a moving object. I rolled the lecturn across the basement level while Hari and Shivang gathered data to get a gauge of how the Velodyne LIDAR performed at different distances.

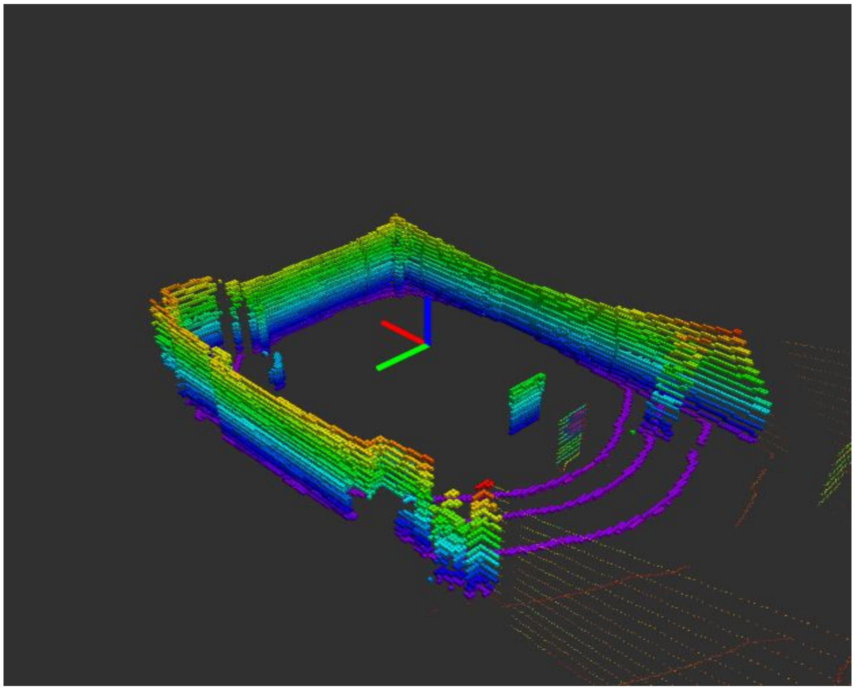

Figure 2: Occupancy map generated from the test depicted in Figure 2, with the TF indicating the location of the LIDAR sensor.

Plans

In the time from now until our next progress review, we plan on focusing our efforts in the following areas:

Work more with NEA dataset: NEA has a lot of data from helicopter flights that we want to use to build obstacle maps and develop segmentation code. We also need to identify whether the LIDAR gives us a fine enough resolution. This won't necessarily be directly transferrable to

Refine obstacle mapping: When we first did tests with the octomapping with the Velodyne puck LIDAR in the lab, we found that the generation of the obstacle map was lagging significantly with the default level of detail. We need to refine our segmentation strategy to find the balance between our latency requirements and our obstacle detection requirements by seeing how much detail we can take away while still maintaining the functionality.

3d sound and AR on Epson AR Glasses: We just recently purchased an Epson AR Glass headset to work with on our AR interface after significant testing with the Microsoft Hololens left us disappointed in it's weight and slumsiness in operation. We will also obtain hardware to start programming 3D sound to generate warnings for pilots as part of our continued user experience development.