Progress Review 8

Individual lab report – 07 || February 10, 2016

Team Daedalus
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1. Individual Progress

- ❖ Implementing waypoint navigation on the platform
- ❖ Creating mounts for Laser Rangefinder and IR Sensor
- ❖ Development of Visualization Tool

Navigation Subsystem

Our platform comes with a Telnet API through which we can pass waypoints to the ROS Navigation Stack. The platform then uses the pre-loaded map to localize itself and plan a path.

I worked on a Python Script which accepts waypoints from Multi-Agent Planner and sends them to the platform. While in motion the locomotion node tracks the active state of the platform, checking whether or not it has reached the destination. In a parallel thread, it also ensures that the platform comes to a halt as soon as an emergency is raised. The working of the node can be seen in Figure 1.

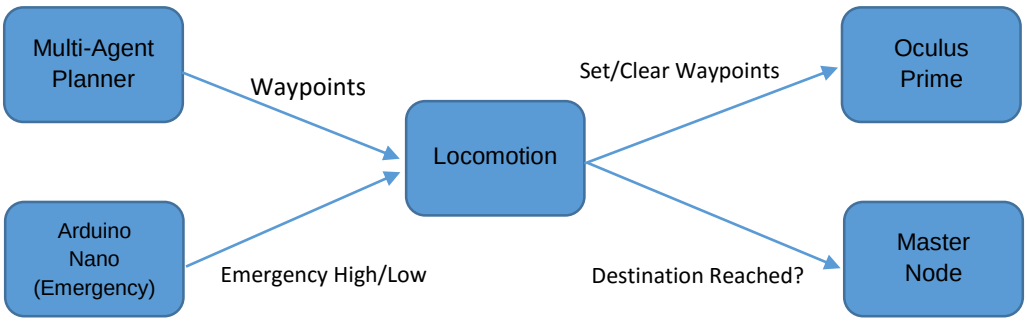

Figure 1: Working of Locomotion Node

Mounts for Laser Rangefinder and Infrared Sensor

The range sensor being used for close range obstacle detection is the Parallax Laser Range Finder, as seen in Figure 2. The sensor will be mounted on a servo motor so that it to sweep the area in front of the vehicle, in a yaw motion, to ensure the way ahead is clear. Shivam and I created a setup for the sensor and the servo. This required a mount for the servo and a base plate to couple the Range Finder to the servo so that it can be rotated.

Figure 2: Parallax Laser Range Finder, www.robotshop.com

The final design for the setup can be seen in Figure 3. There are two standoffs to mount the servo and a mounting plate which connects the servo arms to the range sensor.

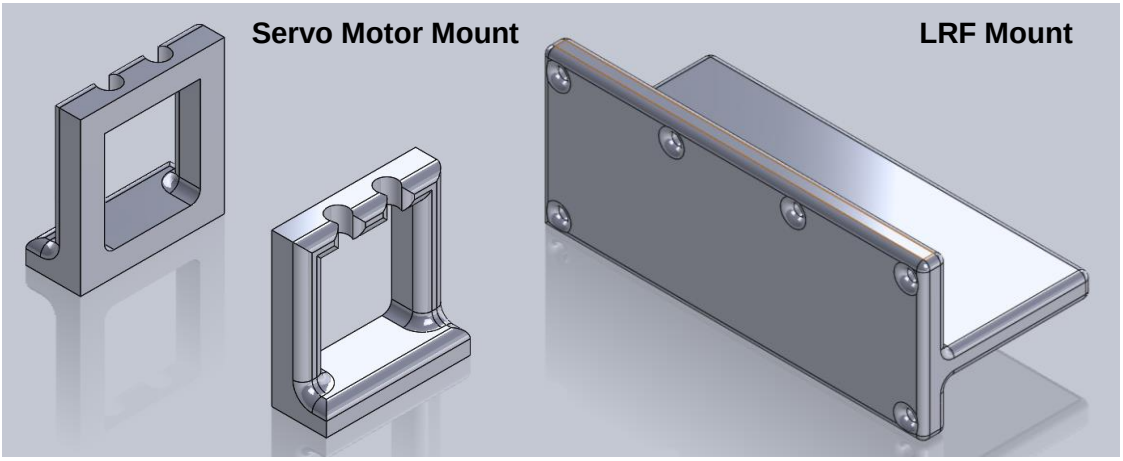

Figure 3: Mounts for Servo Motor and Laser Range Finder Sensor (Photo by Shivam Gautam)

The mounts used for IR sensors last semester weren't aligned properly with the platform. This was fixed by increasing the offset angle so that the IR sensors don't point towards ground and thereby give proper readings. As seen in Figure 4, the angle between the front section and back plate has been increased in the latest iteration.

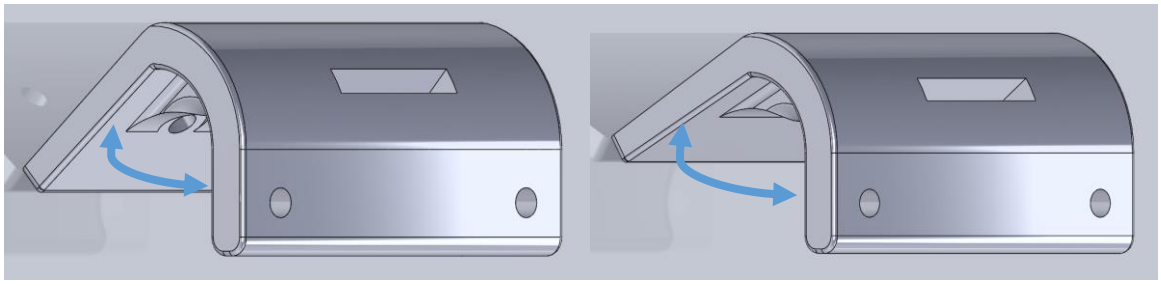

Figure 4: Old IR mount vs New IR mount

Visualization Tool

The visualization tool is now close to completion and requires slight tweaks to be ready for integration with the communication subsystem. It has been developed using Python and OpenCV. As seen in Figure 5, a template image of the parking lot is used as the background and is overlaid with shapes and numbers based on the data received from the communication network. Virtual vehicles can be added and removed using the UI. This will be used to simulate complex parking scenarios for debugging and testing. Figure 5 shows Vehicle 1 and 2 parked in spots and Vehicle 3 and 4 in the entrance queue.

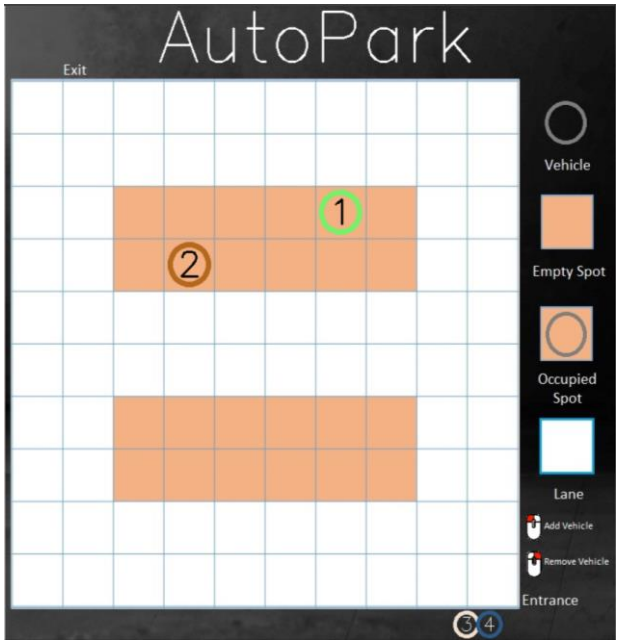

Figure 5: User Interface displaying vehicles in the parking lot

When a vehicle enters the queue of the parking lot, it is shown at bottom right corner of the lot. Once that vehicle determines the optimal parking spot, the ID of that vehicle is displayed on that spot, signifying that it is now reserved for a specific vehicle, even though the spot isn't physically occupied. Once the vehicle physically claims that spot, a circle is drawn in that cell to display that.

Double left-clicking on an empty spot, adds a parked vehicle in that spot and double right-clicking removes on a vehicle removes it from the spot. When a vehicle is added or removed from the lot, this information is also relayed to the communication network so that other

platforms can be made aware of these changes. If the user incorrectly clicks on a spot, an error message pops up, letting the user know of the issue.

2. Challenges

Since we are coming close to integration now, it's imperative for us to closely work together as this will greatly ease the task of integration. The downside of this is that there are more bottlenecks to deal with due to difference in everyone's schedule.

The delay in arrival of platforms has affected our plans and caused schedule delay. The situation is further aggravated by our current platform not working properly. We hope to make up for the lost time in the coming weeks and get back on track.

Lastly, the User Interface has stayed a moving target for quite some time making it require frequent rework. This led to me spending more time on it than anticipated thereby affecting my work schedule. In the coming week, we aim to integrate the Communication Subsystem and the User Interface which will hopefully settle this matter.

3. Teamwork

As per the task distribution, Shivam and I worked on creating the mounts for the Laser Range Finder. I also collaborated with Shivam to ensure that the Obstacle Detection Subsystem is well integrated within our ROS Framework. Richa and Dorothy completed the communication subsystem. Mohak completed a multi-agent planner that processes the current state of the parking lot via a distance based cost function to rank the spots based on how far they are from the exit.

4. Plans

As per the schedule, the next major task that lies ahead of us are testing and integration of all the subsystems. We plan to carry this out in small steps, integrating two subsystems at a time. This will help us in fixing the issues early on in the integration process. I'll be working on the Master Node which will act as the central node for all the subsystems. All the data in our framework will flow through this node so that we can keep a track of the

current state of the system. Richa and Dorothy are working on the testing and integration of the communication subsystem with the mobile app. Dorothy will work on the fabrication and assembly of the mock parking lot, which will be used for testing of the final localization and navigation. The design for this parking lot will be set as per the guidelines designed by Mohak after testing the Xtion. Shivam and Richa will work on rigging up our additional platform, as and when it arrives, with all the necessary PCBs and USB hubs.