William Seto

Team B: Auto Pirates

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Individual Progress

For this progress review, I focused on experimenting with the costmaps to try and elicit better paths from the path planner.

During our field test, we focused on testing the path planner in isolation, without any perception data. For the most part, the test went well, although there were a few times that the generated paths caused the boat to end up rather close to the bridge pylons. For my part, I tried two approaches: inflating the costs of the bridge pylons by increasing their size in the static map using QGIS. Next, we were thinking that if we could somehow bias the path planner to generate paths on the right side of the river, we could avoid potentially dangerous situations where the path planner might want to cut diagonally across a pylon, shown in Figure 1 below, because the path is shorter. Also, this would get us closer to our goal of achieving “rules of the road” functionality. I implemented a rudimentary approach by adding a line in the middle of the river with some cost (shown in Figure 2), so that the path planner would avoid crossing from right to left, or vice versa, unless necessary. Figure 3 shows a sample path that waits until we are past the objects before crossing to the destination.

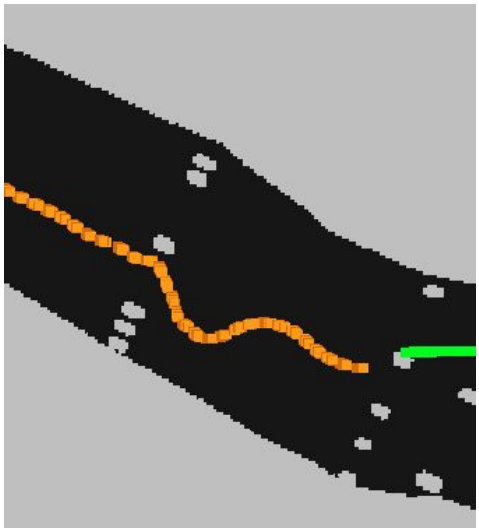

Figure 1: This is where Mike, our safety driver, had to take control

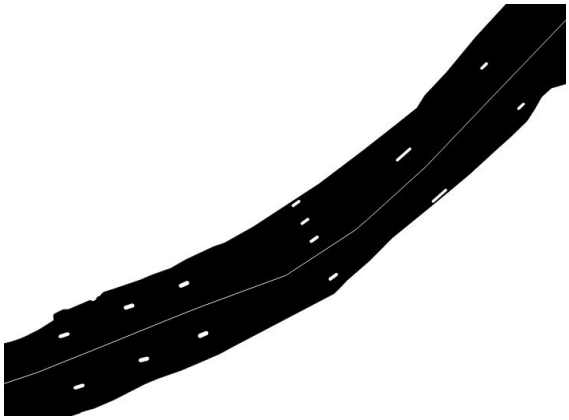

Figure 2: This should bias the boat to stay on whatever side it's currently on

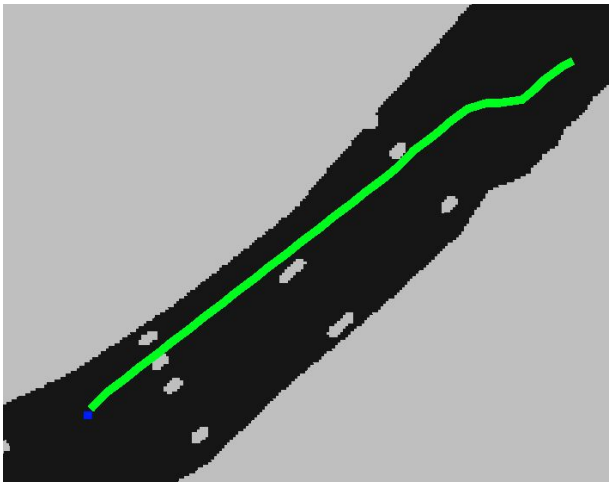

Figure 3: In this case the boat is on the left, but the principle works, it stays on the current side until it needs to cross

Challenges

We're now at a phase where things are mostly working, at least in simulation. And during the field test, we had a couple of good runs, but there is a lot of room for improvement. The primary challenge with path planning is that the planned path looks mostly reasonable in simulation, but it's only during the field test that we realize that even minor of issues can cause big problems. The "fixes" I implemented did not take much time at all, but even after staring at the simulated paths for hours, I can only hope that the boat will adhere to these paths better.

Although I did not mention working on filtering of the radar data in my individual progress, I did play around with it a little bit. The reason being that there was no progress. I tried tuning the parameters of the binomial filter. The results were

unremarkable. If we filter aggressively, we can remove a lot of the clutter, but this seriously hinders detecting actual obstacles. We have a basic framework ready to integrate our whole system (path planning with perception), but at this time we feel the radar data is still too noisy to use. The challenge going forward is to find better filtering strategies.

Teamwork

Shiyu Dong

Shiyu worked on manipulating the motion primitives to generate smoother paths as well improve the turning. I also worked with him on playing around with the radar filter.

Bikramjot Hanzra

Bikram worked on extending the fake obstacle functionality with interactive markers. He added dynamic motion to the obstacles so that we can better test our path planner.

Tae-Hyung Kim

Tae-hyung experimented with path planning with variable velocity, which would help during turns. I collaborated with him on how we could achieve right handed navigation.

Tushar Chugh

Tushar worked on improving the replanning functionality of the path planner. The planner now can replan for a specified amount of time before clearing its memory. This would theoretically improve our paths over time.

Plans

I will continue to look into how we can improve the filtering of the radar data. One approach I'm looking at now is to utilize the Octomap package in ROS. Octomap is a framework for probabilistic occupancy grid mapping. While this is slightly tangential to our primary objective of filtering, I hope that the probabilistic techniques that underlie the framework can help remove the clutter that we are dealing with. The work would involve tuning the parameters of the framework to see if we can get a nice result.