William Seto

Team B: Auto Pirates

Teammates: Bikramjot Hanzra, Shiyu Dong, Tae-Hyung Kim, Tushar Chugh

ILR08

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# Individual Progress

For this progress review, I focused on improving the filtering of the radar data through the use of the Octomap package in ROS.

Octomap is a framework for probabilistic occupancy grid mapping. Although it seems a little counterintuitive, we are attempting to use the mapping framework for its implicit filtering functionality. In order to begin using the package, I first had to prepare the radar data as a point cloud, since Octomap was designed for laser scans in a 3D environment. This was relatively painless, as all we had to do was publish points which corresponded to the radar data on a flat plane (z=0). One hack I had to do was create a fake bounding box around the radar data to simulate the maximum range (shown in Figure 1). If there is some noise which appears, there should be a “scan” that projects further out and can clear up the noise in subsequent frames.

After getting Octomap up and running, the next thing to do was to tune the sensor model. Because the package was designed for creating static maps from scans over time, I had to play around with the sensor hit probabilities and cap the maximum likelihoods, so that the “map” would be more responsive to changes in the environment. Finally, in order to extract the “filtered” obstacles, I just query the map that the package outputs. Since I did the hack previously to create a fake box around the radar data, I queried a slightly smaller range to ignore the box. An example of the final filtered output is shown in Figure 2.

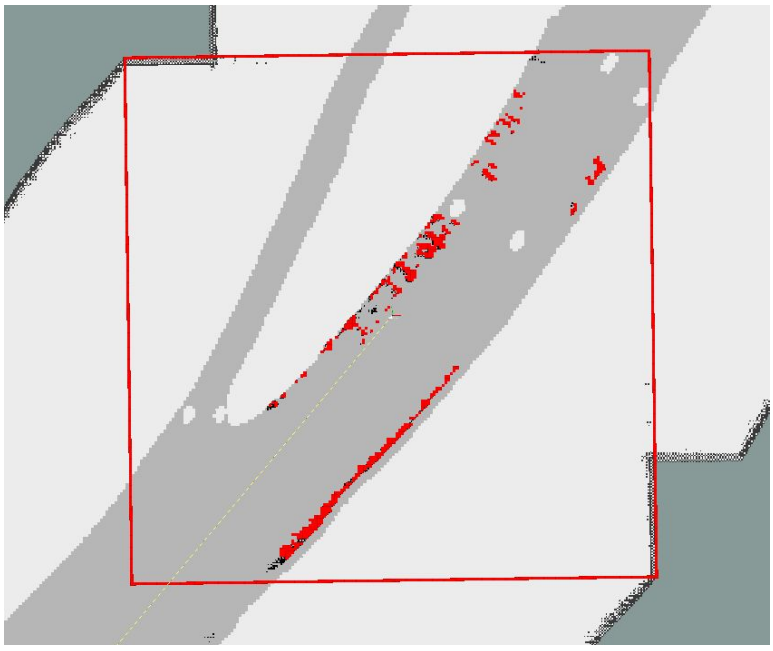

*Figure 1: Radar data (with bridges removed) converted to “laser scan”. Also the black points show the map being generated by Octomap*

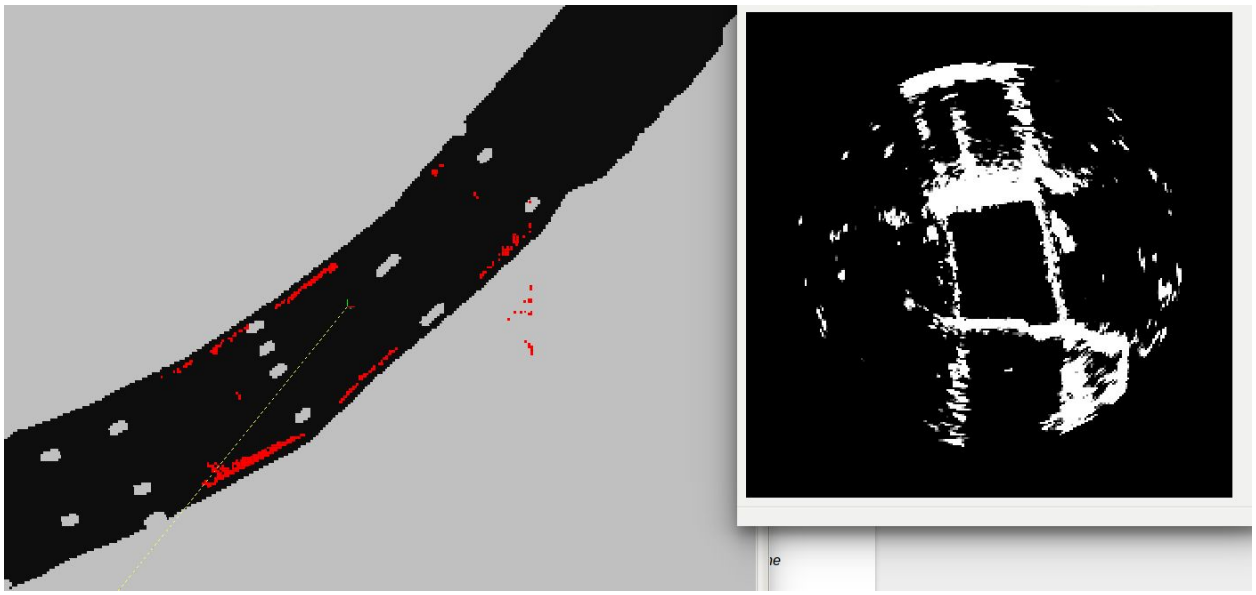

*Figure 2: Most of the noise right in front of the bridge is removed*

# Challenges

Even though I mentioned that it was relatively painless to set up and plug into the Octomap package, there were still minor issues that took longer than it should have.

Initially, I didn't know that I had to publish the point cloud with all z = 0 for the points. I had it set at some arbitrary value and I proceeded to experiment with all the different settings and parameters such as the sensor model. Also, it took me a while to figure out I had to use the hack of drawing a box around the obstacle data so that the noise could eventually clear up. I initially thought that obstacles would persist or go away if there was no reading at a certain position, but then I remembered that we are assuming laser scans, so a cell can only be marked as free if a scan travels further than that cell.

Finally, I had to set up some frame transformations in order to properly perform the mapping. Up until now, all our code was structured to operate in world coordinates and because I had to make the change to publish the radar data in a relative frame using a tf Transformation in ROS, I had to refactor some of our earlier code which was hardcoded to use world coordinates.

# Teamwork

## Shiyu Dong

Shiyu worked on improving the simulator, allowing us to set the start point and update the location of the boat based on the calculated waypoints.

## Bikramjot Hanzra

Bikram worked on improving the fake obstacle functionality in the simulator. He extended the functionality by allowing us to control the obstacle with the keyboard.

## Tae-Hyung Kim

Tae-hyung worked on interfacing the GPS with the computer. We can now receive the GPS messages through a ROS package.

## Tushar Chugh

Tushar worked on updating the website, and helping TaeHyung with setting up the GPS to interface with the computer.

# Plans

Since we weren't able to go out on a field test for this progress review, the major plan for our team is to integrate the perception with the path planner and test it. Since I was working on the filtering stuff this progress review, I plan to spend some time to integrate it with the rest of the code, run some simulations with it, and then hopefully try it during a field test.