Progress Review 8

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Team B / Auto Pirates

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1. Individual Progress

1. The path planning with variable velocity

Our path planning has been working with constant velocity setting until now. In the setting file with the extension cfg, there was nominalvel(mpersecs) parameter. For this parameter, we set the velocity as 5.0 m/sec. This made the boat's path with greater radius when the boat made a turn, which was sometimes the path close to the shore shown in the Figure 1. Although we used inflation setting in the costmap before, it didn't resolve the issue totally. Fundamentally, the higher value of nominalvel(mpersecs) parameter was the major reason to make the greater radius of path planning.

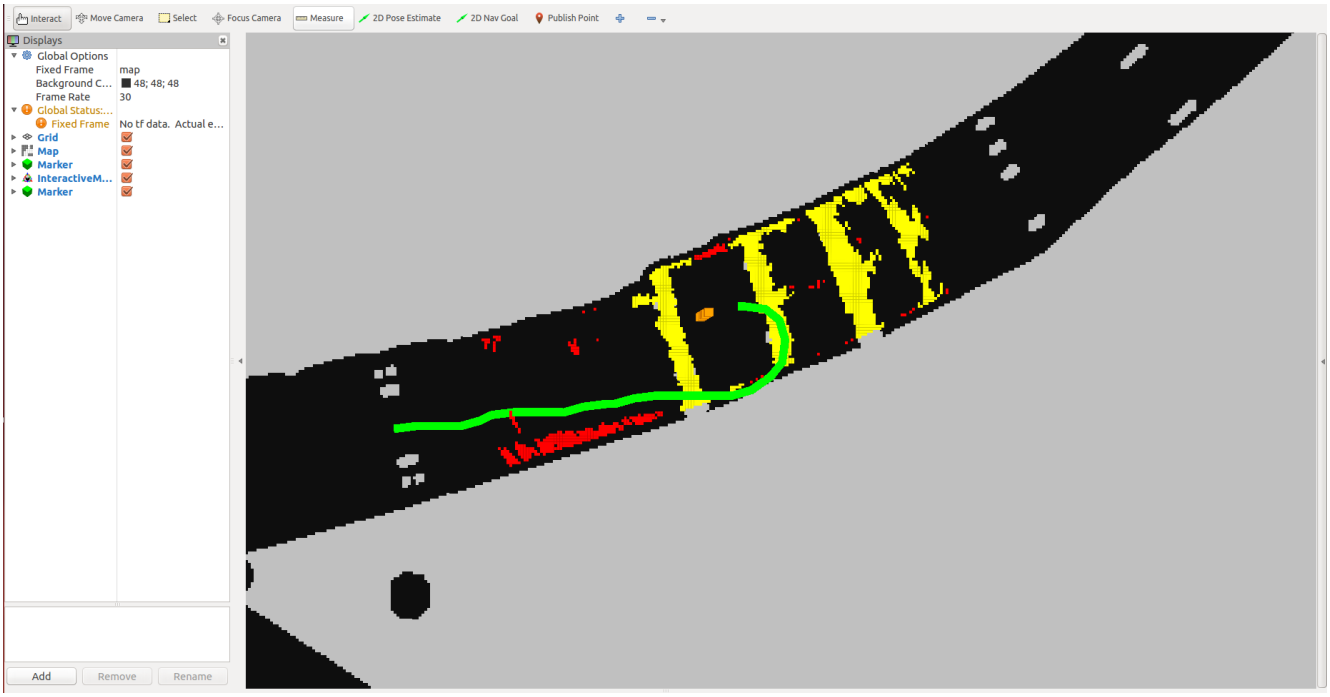

Figure 1. Path planning with nominal velocity 5.0 m/s

I experimented with path planning with a couple of velocity parameters. As the velocity parameter was greater, I observed that the path planning made the greater radius turning. As the velocity parameter was lower, path planning showed smaller radius in the Figure 2. As shown in the Figure 2, a path plan solution with smaller radius turn allowed the boat path determined to turn counterclockwise other than clockwise. Even for setting the velocity parameter to 0.1 m/s, the path plan turns on the spot without a little radius.

Path planning with velocity parameter which determines the turning radius is the crucial condition for right handed navigation following the rules of the road. A larger-radius turn could constrain the turning condition based on the location of the boat with regards to the

distance of the two sides of the shore. If the boat can turn with smaller radius, the boat has more path planning solutions which could be both turning clockwise and counterclockwise. Based on these observations, I discussed with team members how to apply variable velocity in the path planning.

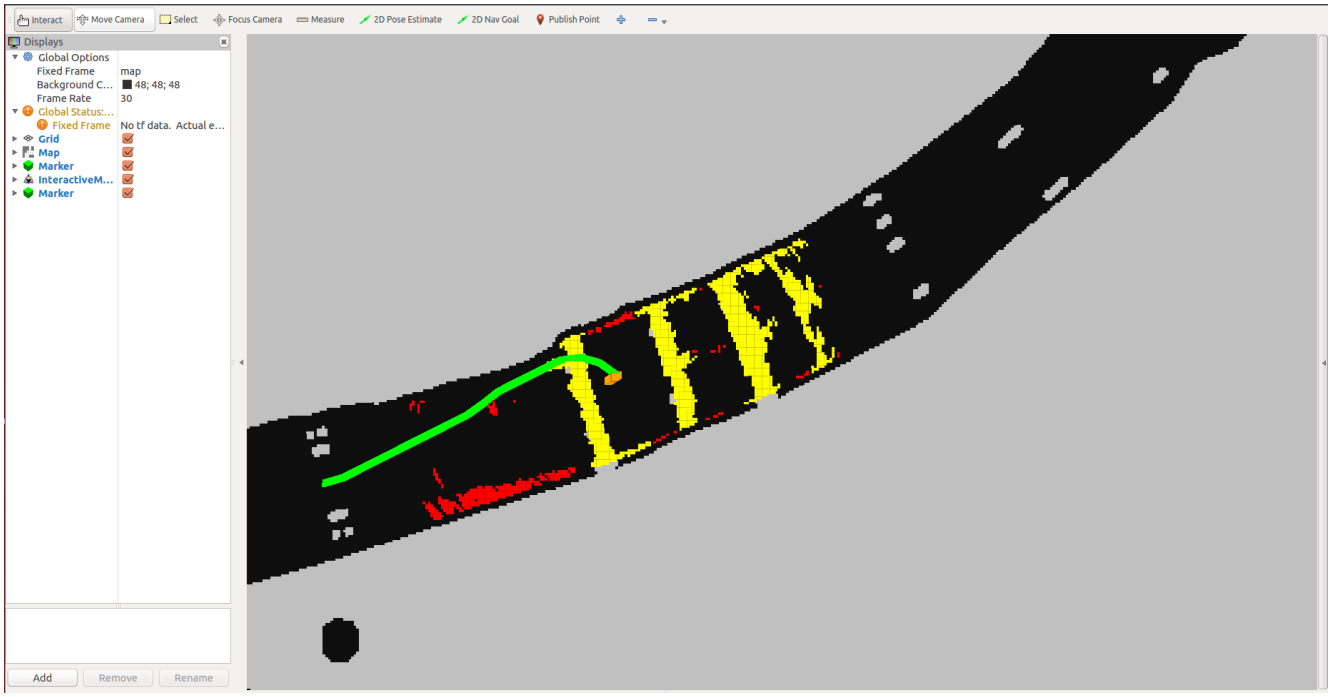

Figure 2. Path planning with nominal velocity 1.0 m/s

Figure 3. Path planning with nominal velocity 0.1 m/s

2. Right handed navigation following rules of the road.

For implementing path planning following rules of the road, I proposed the path planning use case which includes three case scenarios. First, for case 1, this case is most of the navigation path planning which allows the boat to turn counterclockwise. For case 2 and 3, boat has radius R which determines whether the boat crosses the mid-line for going backward in the same right section. For case 3, if the destination is in the radius, the boat could go there directly without crossing the mid-line because crossing mid-line path plan would be wasteful. Currently, case 1 is implemented in the path planning software courtesy of William. I think that case 2 and 3 should be implemented afterward.

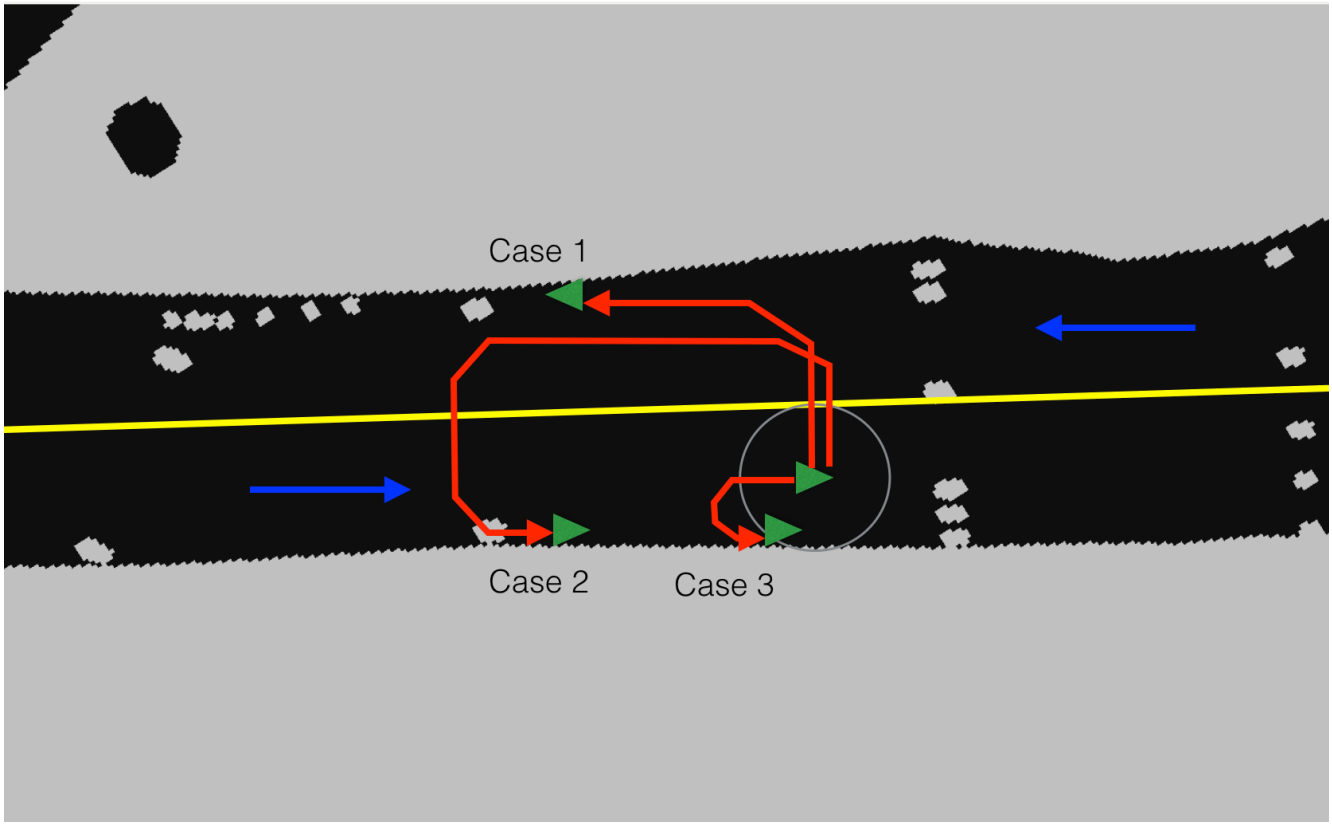

Figure 4. Navigation scenario showing the rules of the road

2. Challenges

For implementing path planning with variable velocity and right-handed navigation following rules of the road, we need to test it in our software. If it doesn't allow the function based on existing software architecture, these functions could not be integrated. I assumed that our software architecture is not flexible because we couldn't consider all the use cases and classes at the starting point.

3. Teamwork

1) Shiyu Dong: Shiyu worked on tuning motion primitives to plan a smoother path.

2) Bikram Hanzra: Bikram worked on adding dynamic obstacle to the simulator.

3) William Seto: William implemented the cost map to try and follow the rules of the road and worked on filtering the radar data.

4) Tushar Chugh: Tushar worked on improving continuous re-planning that enables incremental planning. Our team doesn't need to delete environment and planner objects now.

4. Future Plans

1) GPS test
Interfacing GPS with ROS navsat_transform node to change location into world frame.
Testing ROS robot_localization package fed by GPS data.
Testing SBPL_lattice_planner package to get the path plan.

2) Variable velocity parameter setting test on the field test
Testing several velocity parameter value to compare planned path and actual one.