PROGRESS REVIEW #11

INDIVIDUAL LAB REPORT [ILR10]

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INDIVIDUAL PROGRESS

The major highlight for this week is the success that we had during the field test 5. This week, I fixed a couple of bugs which we identified in field test 4 and worked on 'rules of the road' feature. Here is the summary:

a. Bugs Fixed/Features Added:

Here is the list of bugs fixed and the new features that I worked on after the field test 4.

1. *Rules of the road*: Implementing 'rules of the road' is listed in the stretch goal of our requirements but we were keen to deliver this feature. It is to be noted that out of rules of the road, we have only implemented the rule which says that the vessels as far as possible should be on the right hand side of the river.

   Details of Maps: For this implementation, the planner is using three copies of the map. First is the original copy that we used to use in the previous implementation of the planner. In second map, the cost on the left hand side of the river is inflated (in direction of southside boat launch to PNC Park). The third map has the cost inflated on the opposite sides as compared to the second map.

   Algorithm: Whenever a new destination (goal) is given to the planner, it first planes on the first map (without inflation on sides). It then calculates where the boat will head toward to determine whether the right map or the left map needs to be used. It then changes the map accordingly. The algorithm also keeps monitoring if the path that the boat has to take has changed to other direction. In this case also, the planner changes the map accordingly. Figure 1, shows the planned path wherein it lies only in the right hand side of the river. William helped me with this and Shiyu created the maps.
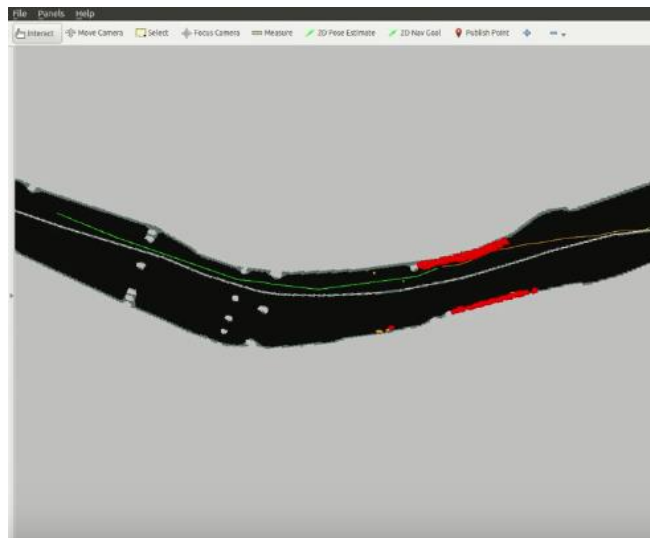

Figure 1: Rules of the road (Boat is heading toward the left of the figure)

2. *Inflation of obstacles*: It was identified in the last field test that the boat was taking the path quite close to the obstacles. So, now we increased the cost of obstacles by Gaussian blurring. Bikram wrote the code using OpenCV and I integrated it in the class of the path planner which handles the updates to the environment.

3. *Warning while running the planner code*: The planner was trying to plan the code even when no goal was given to the planner and hence was giving the warning. I fixed the issue before the field test.

b. Field Test 5

1. *Rule of the road*: The algorithm for rules of the road worked as expected. In fact, we made some tweaks to the maps and now the boat almost takes the path near the navigation line (kind of the center). The path now appears to be quite smooth and also away from the shores. Figure 2, shows the successful run. It can be seen from Part A and Part B of figure 2 that the planned path shifts from one map to the other when the direction of the boat changes.
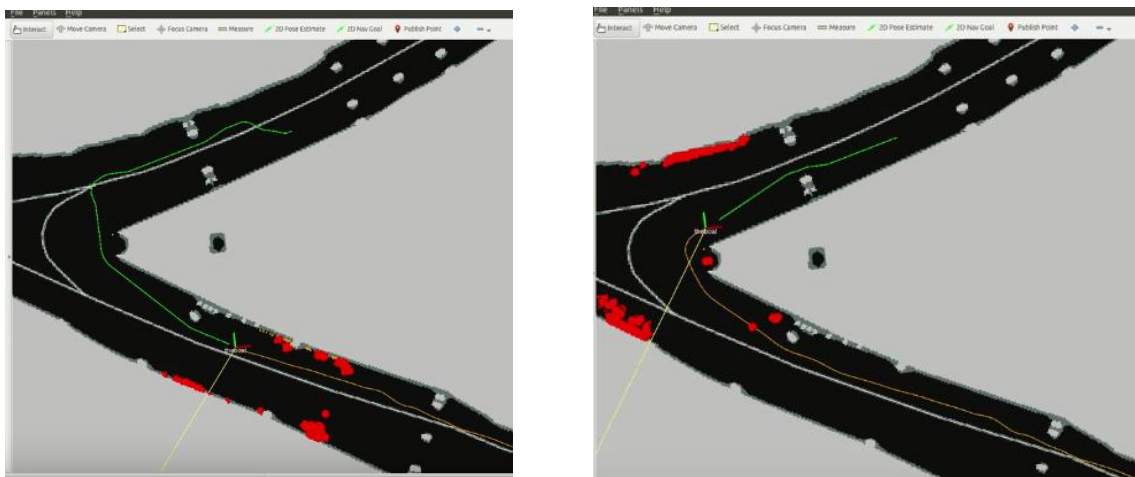

Figure 2: Parts A   Field test 5 | Rules of the road   Part B

2. *Inflation of the obstacles*: Inflation of the obstacles also worked fine. Red markers in figure 2 are the inflated cost of the objects (here more of them are objects near the shored). This can be done in an even better way as compared to Gaussian by inflating it more towards the heading of the river. William would be trying this idea.

CHALLENGES

a. Number of way-points to be missed

As explained in the earlier ILR's that we have to miss first few way-points given by the planner. The reason for this is, planner takes time to plan the new path and the initial way-points which it gives lie behind the location of the boat (as boat is no longer at the same position). Now, as we have added the new costs in the map, sometimes it even take 5-12 seconds to

plan the path. In these cases, 1 or 2 new way-points are locating behind the boat and because of which boat takes the U-turn to reach them. Though I can solve this problem by skipping a couple more way points but this hack will create problems again if we change the speed. I would be writing the algorithm to check if the way-points are in forward or backward direction of the boat. Based on that the planner would be skipping the way-points.

TEAM WORK

All of us went for the field test and other than that our team worked on the following:

a. **Shiyu Dong:** Shiyu worked on editing the maps and also improved GUI for predefined locations.
b. **Bikram Hanzra:** Bikram worked with me on inflating the cost of the obstacles. In addition to it, he also integrated the simulator code with the new path planning code.
c. **Tae-Hyung Kim:** Tae-hyung worked on storing data received from Novotel Span INR sensor as the ROS bag files.
d. **William Seto:** William helped me to implement rules of the road. He also added the google maps like visualization to RViz (requested by the sponsor) and also created the test plan for the field test.

FUTURE WORK

a. **Notification when the goal arrives**
   - At present, there is no notification given when the boat reaches the goal. In fact, the code doesn't even calculate that if we have reached the goal or not. I would be adding this feature to the code and would be publishing the ROS message so that the rqt GUI knows if we have reached the goal.
b. **Number of way-points to be missed**
   - As explained in challenges, I would be fixing this issue
c. **Field Test 6**
   - We would be having our next field test on 6th April 2016.
d. **Website Check**
   - I also need to update the website for the upcoming website check (tomorrow).