Individual Lab Report

Shiyu Dong
Team B – Auto Pirates
Teammates – Tushar Chugh, Bikramjot Hanzra, Tae-Hyung Kim, William Seto
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1 Individual Progress

For this progress review I mainly worked on two parts. Firstly I created new maps for our path planner in order to follow the "rules-of-the-road". Then I improved the GUI in RQT for more user inputs.

1.1 Creating new maps

As we mentioned in the team meeting, we'll focus on making the boat stay on the right side of the river. We already had the map with the middle line, as figure 1 shows. Our boat should stay on the right of the middle line unless their is no path found on the right side.
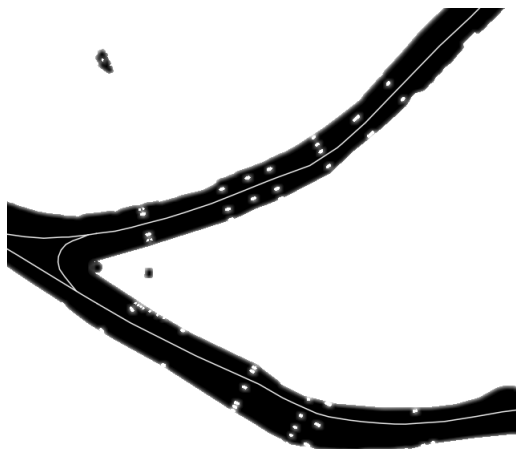

Figure 1: Part of the map with middle line

In order to improve the path planner to make the boat stay on the right, we decided to use two different maps for moving left and right respectively. The basic idea here is when the boat is moving to the left, one side of the river should have lower cost to make the boat stay on that side. When the boat is moving to the right, the other side of the river should have lower cost. Figure 2 shows the two version of the map I made (only part of the maps, the full map is too large).

In the map, the color black means 0 cost, while white means 255 cost where there are obstacles (including lands and shores). Tushar wrote the code to check the moving direction of the boat and switch maps according to the moving direction. For example, if we want to go from Monongahela River to Allegheny River, the path planner will plan a path like the left one in figure 2 according to the left map. Obviously only the first half of the path is staying on the right side of the river. Therefore our logic is to switch map when the boat starts to move to the right, as the red circle specifies in figure 2. After we switch the map, the right side of the river becomes lower cost, so the planner will plan a new path that works well for the next half of the path. This strategy may be not the best way to deal with the "rules-of-the-road", but it works well for the 3 river area.
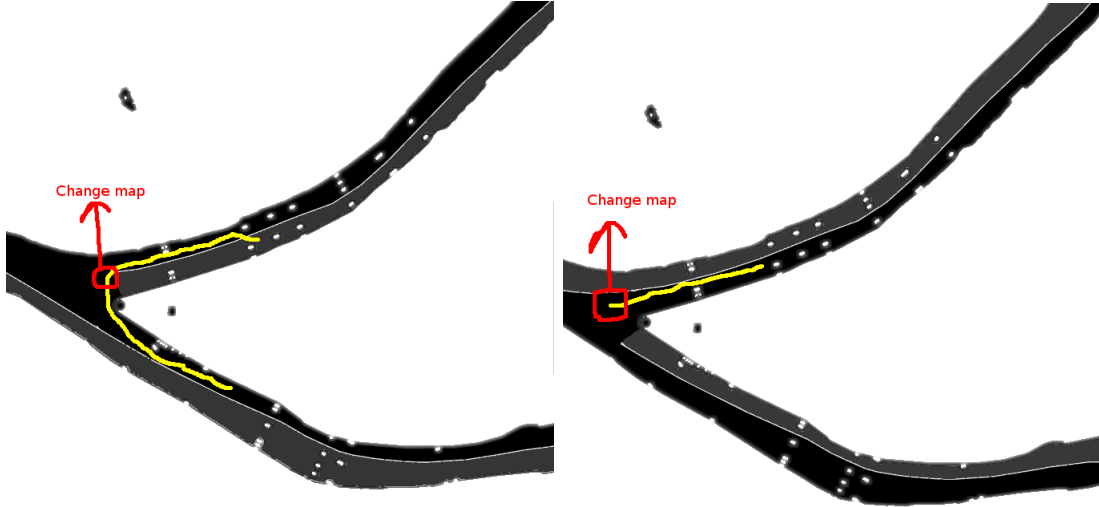
Figure 2: Left map

1.2 Improving the GUI

I also worked on the GUI and improved its functionality to allow user to choose some predefined location when taking the water taxi. As our visualization till now is based on RQT and RViz in ROS, so I wrote a RQT plugin that allows user input and is compatible with the current visualization, as figure 3 shows.
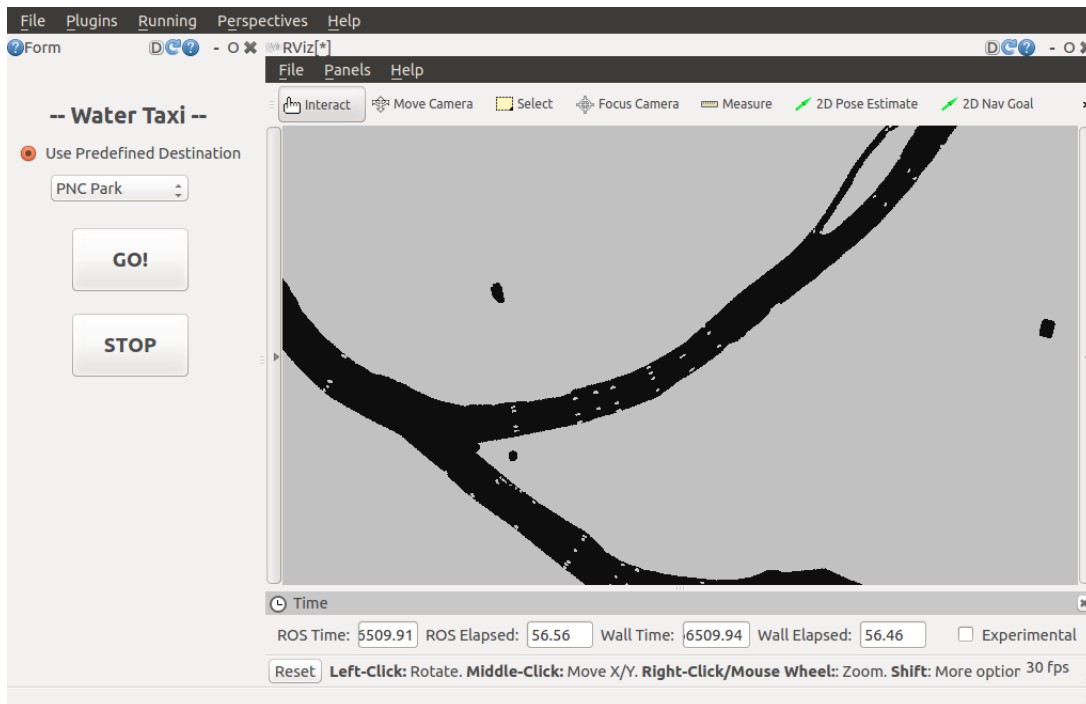

Figure 3: Improved GUI

In this simple GUI, we can check the radio button to choose to use predefined waypoints. In the drop down list below, there are some predefined locations like southside, PNC park and NREC. By clicking GO! button, we initialize the system and publish the ROS message for the corresponding GPS location to the planner. When the radio button is unchecked, we can use the 2D Nav Goal tool in RViz to choose the goal by click somewhere in the map.

2   Challenges

We spent a long time in finding a good way to follow the rules-of-the-road, and finally used the two-map way as solution. This requires extra edition to the map and will cause confusion when the boat is moving straight up or down in the map (when it's not going left nor right). It works okay for now because we don't have a straight up or down path in 3 river area.

In the GUI part, RQT is QT-based so I can use QT design tool to design the interface as figure 4 shows. So I can focus mostly on the click callback function instead of the interface design.
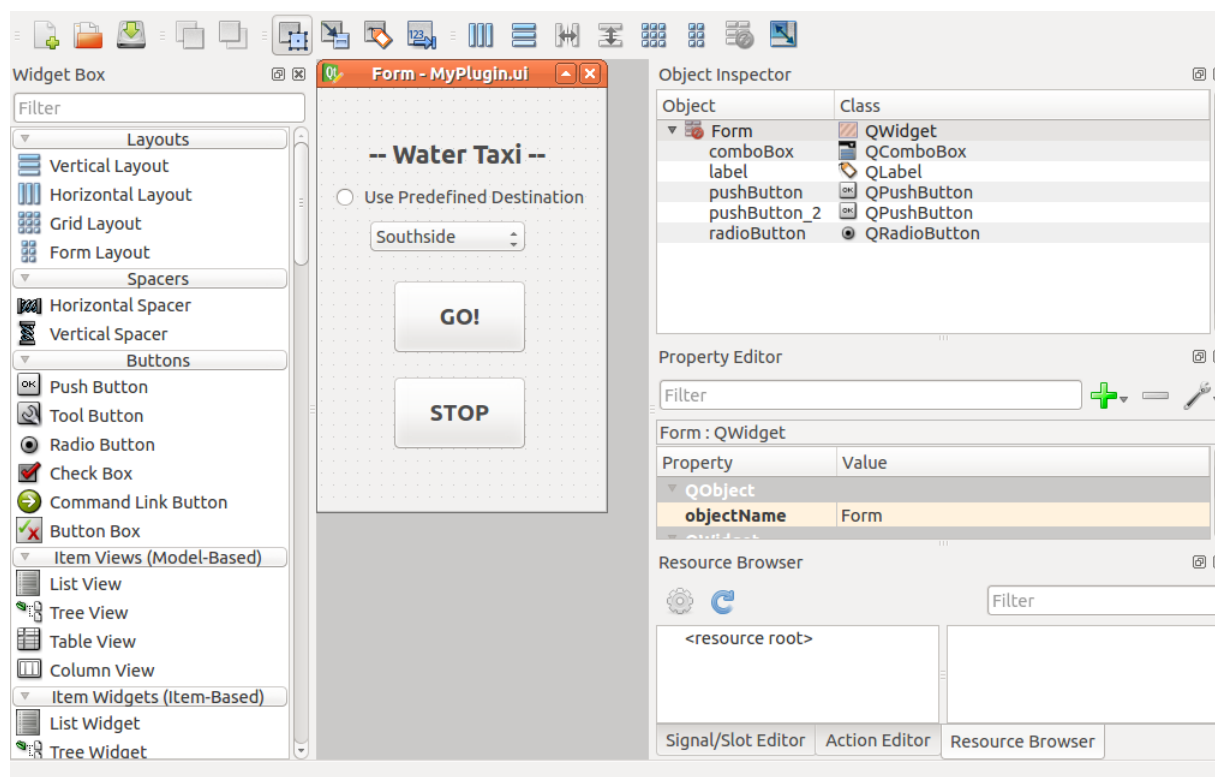

Figure 4: Qt design tool

We successfully inflated the cost near the obstacles. Then we are faced with new problems. Basically now not only the obstacles are got inflated, but the noise is also got inflated. This becomes a big problem for some noise near the bridge.

3   Teamwork

- Tushar: Tushar worked with Bikram on inflating the cost of obstacles and he worked with William to write the code for rules-of-the-road.

- Tae-Hyung: Tae-Hyung got direct access to the Novatel span INS and recorded ROS bag files for the INS on the field test.

- Bikram: Bikram worked with Tushar on the inflation of obstacles using opencv. He also integrated the simulator with new path planner with rules-of-the-road.

- William: William worked with Tushar to implement the rules-of-the-road. He also did a lot of work in integrate the code and prepare for the field test.

4   Future Plan

For the team:

- Inflate the cost near shore more so we can keep safe distance to the shallow water area.

- Add stop condition so the planner will stop automatically when it's close enough to the destination.

- Decide the final test location for SVE and practice it in field test.

For myself: I will integrate the GUI with the system and analyse the data we recorded on field test to improve our system.