



# PROGRESS REVIEW #10


INDIVIDUAL LAB REPORT [ILR09]

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## PROGRESS REVIEW #10

### INDIVIDUAL PROGRESS

The major highlight for this week is the success that we had during the field test 4. We encountered some minor bugs during the test run and most of them have been already fixed. Here is the summary of the Field test and the bugs that were encountered.

#### a. Field Test 4

We had our fourth field test this Monday (14<sup>th</sup> March 2016). Overall, the field test was quite successful and we were able to test most of the features that were listed in our field test plan. Below is the test analysis of the features that I was involved with:

1. *Re-planning*: Since the last field test, there were a lot of improvements that were made to make re-planning more robust. During this field test, re-planning worked as expected and the path was planned after the interval of 5 seconds. It is also to be noted that re-planning was done without deleting the objects/instances of environment and the planner.
2. *Integration of perception and path*: Integration was also successful and worked as expected. As explained in the previous section, we were re-planning after the time interval of 5 seconds. During this time period of 5 seconds, the information about the obstacles observed by the radar was aggregated in the environment variable. William upgraded the perception sub-system using octomap server which has made perception subsystem quite robust and the data less noisy.

Figure 1 shows the path that the system planned during one of the tests (total path length of more than 3 miles {in green color}), trajectory of the boat (light yellow color: behind green color) and obstacles detected by the perception subsystem (dark yellow and red: 2 different time frames).



Figure 1: Successful test run

Here are some of the features that still we need to tune to make the system more efficient.

1. *Motion Primitives*: There is still a scope for improvement to make boat take better turns (turning sharper for U-turns and taking a smooth curve while taking smaller turns). This can be solved by adding more motion primitives with different costs for turning. We need to take help from Andrew from SBPL lab as we weren't able to figure out how to add more motion primitive (we were changing the existing ones till now).
2. *Inflation of cost around the obstacles*: The boat is taking the path quite near to the obstacles (around 5-10 meters from obstacles). It feels scary when the boat takes a path that close to the obstacles. We need to inflate the cost around the obstacles while adding values to the environment. We would be targeting the minimum distance to be kept in between the obstacle and the boat to be 20-30 meters.

**b. Fixing the minor bugs during and after the field test**

1. *Number of waypoint to skip*: As explained in the previous ILR, we had to skip (not sending to low level controller) a few initial waypoints that are given by the planner in order to make sure that the initial waypoints are not behind the present location of the boat. We tuned this number by experimenting with different velocities (8-12 MPH) and with different turning radius (small turns and U-turns). Finally, we decided to skip only 3 initial waypoints.
2. *Number of waypoints to send to low level controller*: There were cases during the field test wherein the boat was not following the planned path at all. This was mostly happening for longer paths. After the field test, we investigated the reason and found out that the buffer that the low level controller has for waypoints is 100 and we were sending a lot of waypoints to it (more than 300). As a result, the low level controller was discarding some of the points at random. Figure 3, depicts the error with planned path of right hand size and GUI on left hand side. I have fixed this issue in the planner code and now the planner will not send more than 100 waypoints.

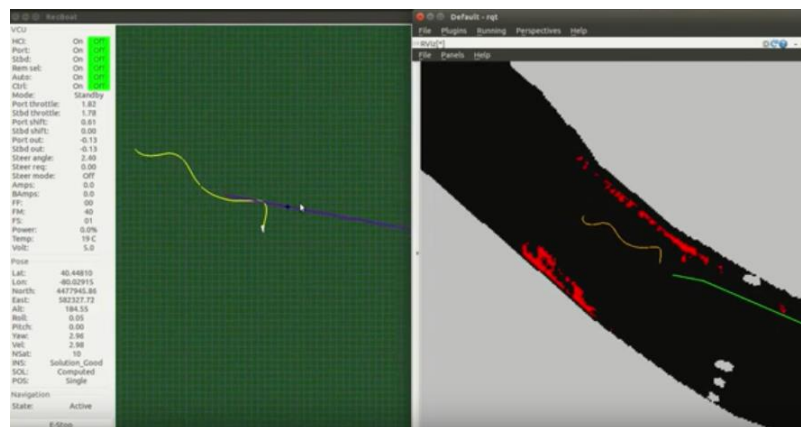


Figure 2: Boat not following the planned path

## CHALLENGES

### a. Delay in the field test and testing time

The boat was under repair for almost a month and because of that we weren't able to test re-planning and integration. Also, our field test are for half days as we need to come and attend the classes in the afternoon. We will try to work with Mike to find a solution which enables us to get more time on river.

## 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 with William to create the test plan for the field test and also to get the system ready for the field test. In addition to this he also created the videos of field tests depicting success and failure instance which were presented during PR.
- b. **Bikram Hanzra:** Bikram added the joystick control for simulating the fake obstacles and integrated that to the system.
- c. **Tae-Hyung Kim:** Tae-hyung tested robot localization package using bag file (recorded during the field test) in ROS.
- d. **William Seto:** William and Shiyu worked together to get the entire system ready for the field test which included generating launch files, maps and configurations. In addition to this, he also fixed bugs related to addition of obstacles to the environment.

## FUTURE WORK

### a. Delivering new features requested by Jeremy

- Jeremy has asked for some new features like adding the capability to accept more destinations, using google maps instead of binary map for better visualization and keeping a minimum distance from shored and obstacles (including rules of road). We need to discuss within the team to see what all features we can take on our plate. Based on that, I will have to work on a feature or two.

### b. Field Test 5

- We have fixed and would be fixing the bugs identified in Field test 4. We would be going for a field test next week to verify the fixes. (I fixed the bug related to buffer size of waypoints and I need to test that).
- We would be giving another shot at 'rules of the road' for next field test.

### c. Preparing for SVE

- SVE is coming quite close. I would be coordinating with Mike for the dates he is available, the obstacles we need to get on boat and other related logistics.

### d. Website Check

- I also need to update the website for the upcoming website check.