PROGRESS REVIEW #4

INDIVIDUAL LAB REPORT [ILR05]

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INDIVIDUAL PROGRESS

This week I updated static occupancy grid map created earlier, added the functionality (waypoints input) in GUI, ran path planner from SBPL on occupancy grid map and soldered the components on PCB.

Path Planning

a. Occupancy Grid Map with QGIS and Open Street Map
   Last week I created the occupancy grid map (OGM) from google maps. I explained in the last ILR that resolution of (OGM) extracted from google map was not up to the mark. This week, William found out the a new tool QGIS which uses 'open street map' from which we can select only 'waterways' and 'rivers' options to extract 'three rivers' of Pittsburgh. I also converted into a format that can be used with SBPL library (explained in last ILR). Instructions for creating the map from QGIS are mentioned in appendix.

b. Path planner on Occupancy Grid Map
   We were getting exceptions while trying to run SBPL path planners on our OGM (.cfg) and motion primitive files (.mprim). This week I enabled the debugging in the code of SBPL by which I was able to spot where the code was failing. I used ARA* planner with inputs as the motion primitive file which I generated from Matlab and occupancy grid map (in SBPL format as explained in last ILR). The result is shown in figure 1. At present, perimeter and motion primitives of boat are not configured.

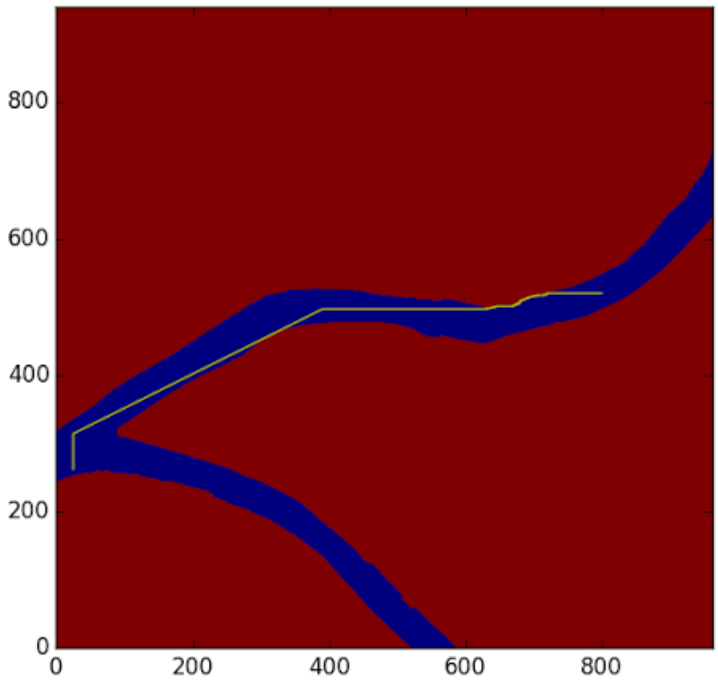

Figure1: Planned path on Occupancy Grid Map

c. Graphical User Interface

We require a way to input waypoints to low level controller in order to test path planning algorithms. NREC provided us the code of GUI but it didn't had any way to input waypoints (UTM coordinated). This week, I added functionality to GUI to add waypoints in UTM coordinates. The two text boxes can be seen on bottom left of figure 2.

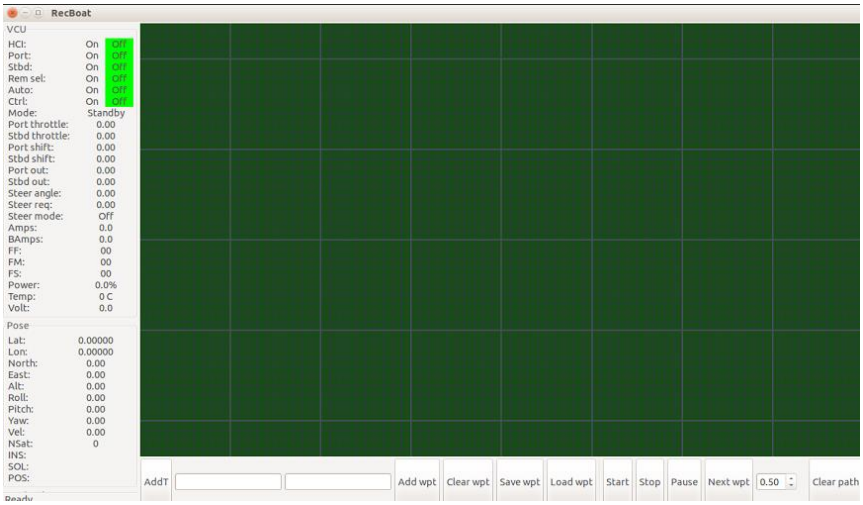

Figure 2: Graphical User Interface

d. PCB Development

We received the PCB and the components last week. I soldered the components on PCB but haven't tested the PCB yet.

e. Field Test

We had our first field test on 17th Nov which was successfully. From path planning point of view, Tae-Hyung and I collected a lot of IMU, GPS and GUI logs which would be using to test path planning algorithm and simulations.

CHALLENGES

a. Figuring out exception with SBPL library

Till last week we were getting errors and exceptions with SBPL library and there were no error messages. This week I changed the configurations in the code of SBPL to enable debugging and downloaded GDB debugger to find out the issues. After this, I was able to resolve all the errors and exceptions that we were getting earlier.

b. Path following through ROS

We didn't had a mechanism to give boat a list of waypoints to follow. So, we weren't able to estimate how the boat would be behaving when our path planning algorithm sends a list of waypoints to boat. So, I modified GUI to add this functionality.

TEAM WORK

The entire team went for the field test. Perception team (Shiyu, Bikram and William) did a tremendous job in logging 6GB of relevant data including radar, camera and IMU logs.

a. **Shiyu Dong:** Shiyu worked on plotting the gps coordinates data on OGM in rviz. He also helped me in soldering the components (handling the components and equipment).
b. **Bikram Hanzra:** Bikram wrote the code to display the radar data on the occupancy grid map using the OpenCV (\cite{opencv}) library.
c. **Tae-Hyung Kim:** Other than preparing for the field test Tae-Hying worked on compiling sbpl lattice planner to interface with ROS navigation package.
d. **William Seto:** William was instrumental in leading the team for the field test. He coordinated both from technical and management fronts. He also created the map in qgis which I used to create the occupancy grip map.

FUTURE WORK

a. **Configuring motion primitive, perimeter of the boat and the minimum distance to be avoided by boat**
   - Next week, I will work on tuning the motion primitives, getting the perimeter of the boat right and configuring minimum distance between obstacle and the boat.
b. **Updating OGM and planner**
   - I will work on updating the OGM by overlaying with obstacles. It is to be noted that SBPL doesn't have a stable code for this and last commit on this was done a couple of years ago. So this step will take time. But this is something that we haven't committed for FVE.

Appendix

Here are the *instructions* to create occupancy grid map:

1. Download and install QGIS software [https://www.qgis.org/en/site/forusers/download.html]
2. Open QGIS desktop software and install following plugins:
   - Geosearch
   - OSM place search
   - Quickosm
3. Go to web -> Openlayers Plugin ->Openstreetmap (You should see the map on screen now)
4. Go to plugins->geosearch->"Enter location (like Pittsburgh)"
5. Zoom in to the area of interest
6. Go to web -> quick OSM ->quick query
7. Try key: natural and value: water | key: waterway and value: river. You should see the rivers now. Figure 3 shows the options

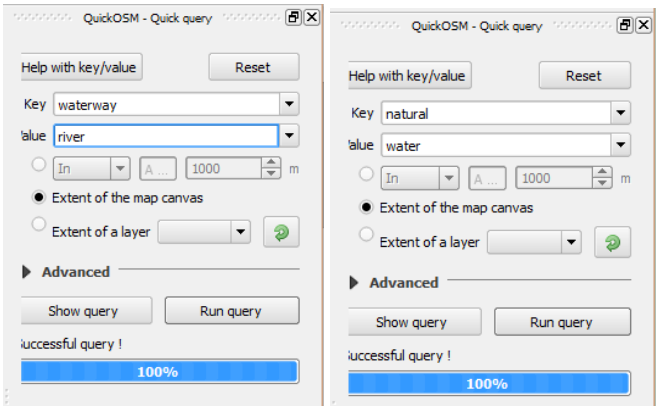

Figure3: Quick query on TQGIS

8. Only select the layers: 'natural water and waterway_riverback' as shown in figure4.

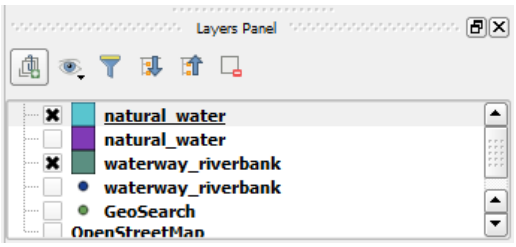

Figure4: Layer Panel of TQGIS

9. You should see something like in figure 5

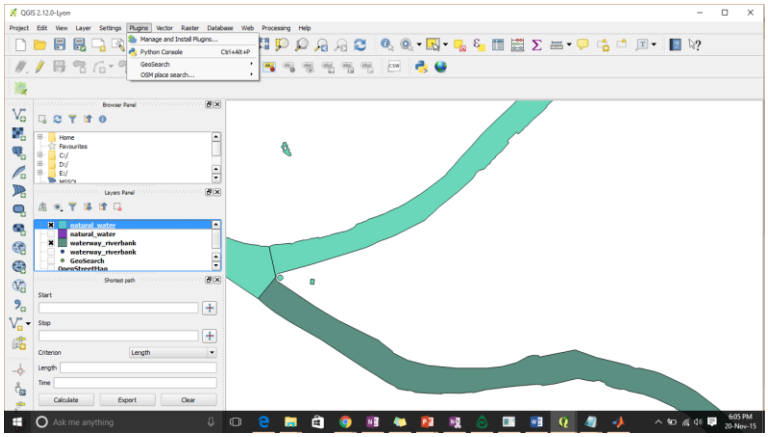

Figure5: Map created from QGIS

10. Go to Project -> save as image -> change the file extension to .bmp

11. Use matlab to convert it into .bmp format. Please note that in occupancy grid obstacles are denoted by 1 which is white color in bmp.