Progress Review 1

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Team B / Auto Pirates

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1. Individual Progress

I've worked ROS assignment and surveyed path planning library. First, I did ROS assignment with Shukai. I learned how to install ROS packages, how to write node, how to configure ROS network and how to setup launch file for running ROS nodes to simplify the procedures. Through this assignment, I thought that I could organize ROS setting.

Next, I researched the path planning algorithms and libraries. The path planning algorithm is important for implementing autonomous boat. I've known that the most of robots are using A*, D* path planning algorithms so far. I've been focusing on grasping those algorithms theoretically. However, I felt it wouldn't allow us to study algorithm theoretically in enough time. In this context, I've been surveying and researching what the path planning library would be useful for our project practically. Most of all, the most critical factors are how easily we could integrate path planning to our autonomous boat system and how stably path planning algorithm works.

I narrowed down two path planning libraries, SBPL (Search Based Planning Library), OMPL (Open Motion Planning Library). I've noticed that SBPL was used in application of PR2 and quadcopter and OMPL was used in various manipulators in factory automation industry. Lastly, I sent a question email to a PhD student in SBPL lab and got a presentation document from him. After reviewing it, I decided to study SBPL. Specifically, I thought that our team could get some supports and advices from SBPL lab led by Prof. Maxim Likhachev. Above all, when we use SBPL, we could ask some technical issues with SBPL lab nearby our class.

I started to study the SBPL in standalone application through without ROS dependency. I followed path planning example of PR2 path planning simulation. This example is the planning example with SBPL in X, Y, Theta state space. At first, I made mprim files which are motion primitives like the following figure 1. I fed motion primitives into path planning algorithm with map information. After running path planning, I got some path planning solutions able to plot graphs in continuous and discrete data.

As I followed this example of SBPL, I could grasp the comprehensive path planning roughly. I expected that I hopefully understood A* and D* path planning algorithm and grasped its software structure to integrate into our system.

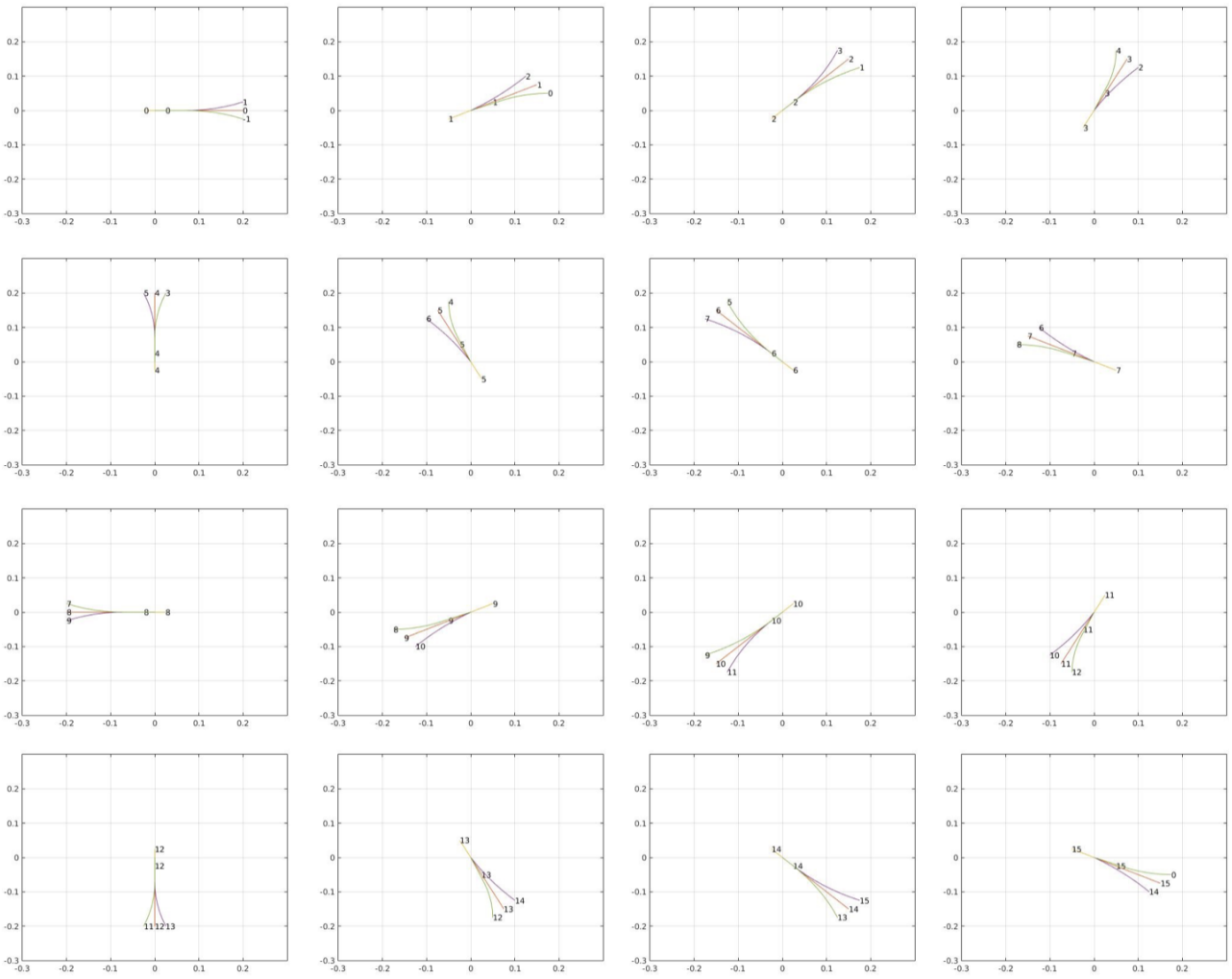

Figure 1. Plots of Motion Primitives

Figure 2. PR2's continuous solution plot of path planning simulation

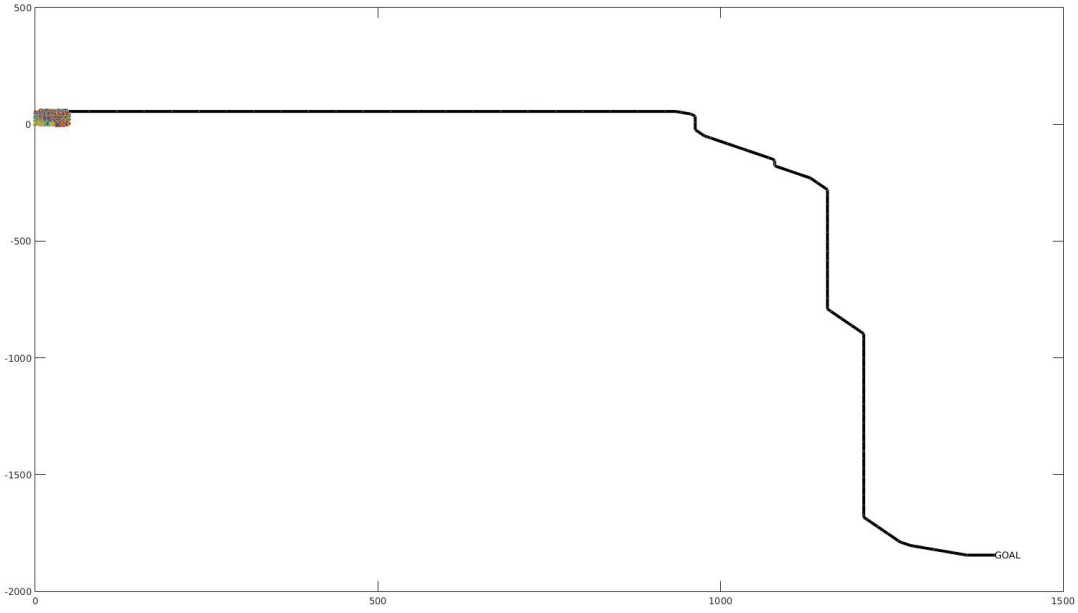

Figure 3. PR2's discrete solution plot of path planning simulation

2. Challenges

I doubted the feasibility of SBPL into autonomous boat because there had not been some cases in which SBPL was applied in unmanned surface vessels. After asking inquiry email to the researcher in SBPL lab, I resolved my doubt about that more or less.

3. Teamwork

1) Shiyu Dong: Shiyu worked with William on understanding and compiling the OpenCPN library that we are going to use for getting the data from radar. He also updated the risk management and spring validation experiments of CoDR document.

2) Bikram Hanzra: Bikram worked on frame transformations using tf package provided by ROS. In addition to this, he published the content on the website and corrected grammatical mistakes of CoDR.

3) William Seto: William worked with Shiyu on understanding and compiling OpenCPN library that we are going to use for radar. William also updated the CoDR section (description, requirements, and use case study).

4) Tushar Chugh: He updated functional and cyber physical architecture in CoDR. Also, he studied SBPL in the path planning part.

4. Future Plans

First, I plan to meet with Jonathan Butzke, PhD student advised by Prof. Maxim Likhachev to discuss with some issues of feasibility of applying SBPL to autonomous boat and how to adjust the SBPL to our software structure.

Second plan is to study some parameters needed to feed into SBPL and grasp different points of parameters between robots, the SBPL-applied PR2, quadcopter and our autonomous boat.

Moreover, I'll study and analyze the software structure of SBPL in standalone and ROS.

Lastly, I'll make specific plans of testing path planning algorithm in a unit test of path planning. (Ex. laptop with GPS)