EE346 - Mobile Robot Navigation and Control

Fall 2023
Laboratory #6 (4%)
Due Date: Wednesday December 13, 2022
LiDAR-Based Navigation with TurtleBot3

Objectives:

- Study ROS basic concepts in ROS service and action
- Study ROS navigation stack and use its move_base package to perform navigation of your Turtlebot3 robot, in the form of a ROS action.

Part I: ROS Services and Actions

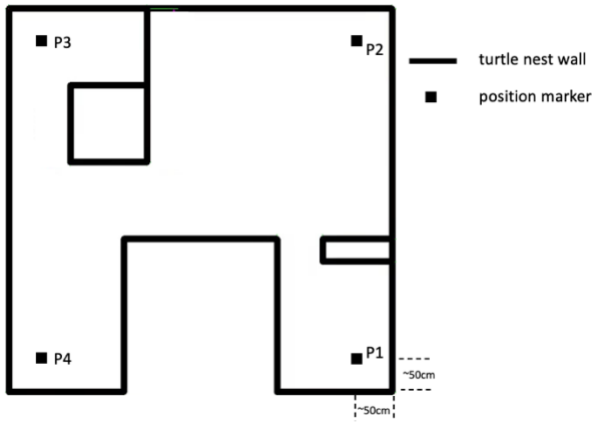
Read this ROS tutorial on ROS service and client to understand how ROS nodes can communicate with ROS services. Copy and paste the code into your own ROS catkin workspace. Follow the procedure on this page to run the ROS service and client you have created, so that your client can add two arbitrary numbers with the help of the server. What happens when you enter non-integer inputs when running the client?

Similarly, read this page to create a simple ROS action server that computes Fibonacci numbers. Also, read this page to create a ROS Action client that can request an action from the Fibonacci action server. Test the desired the action and client to produce the expected results.

Once done with both the service and the action tutorials, demonstrate them to a TA and be prepared to answer questions.

Part II: TurtleBot3 Navigation with the ROS Navigation Stack

In this part of the lab, you will program TurtleBot3 to perform navigation in the robot environment in the lab with the help of the LiDAR sensor. First, build a grid map of the robot environment in the lab with GMapping, as has been done in Lab 5. Make sure that the map is of satisfactory quality. Manually refine the map if necessary. Second, study this example or this example in Python to understand how to create a ROS "action client" node that uses the move_base package to navigate your robot to any desired position of a given map. Third, modify the example so that your robot can start from P1 and visit P2, P3, and P4 in turn, before returning to P1, with the help the map built.



Marking: Part I of this lab is worth 20%. Fort Part II, each successful visit to a Pi is worth 16%. A visit is considered successful if the robot can cover the black marker on the floor with any part of its body. Failure to do so will result in a reduction of 4%.

Submission

Within the GitHub site (which belongs to either of the two group members), create a directory for Lab 6. Inform the TA's of the URL of your GitHub by the due date.