EE346 - Mobile Robot Navigation and Control

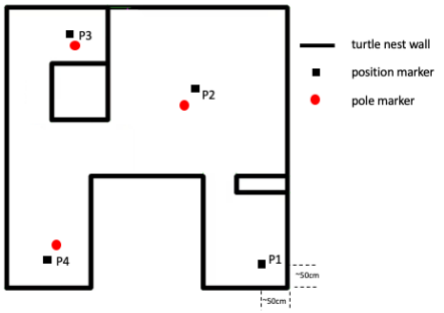
Fall 2024
Laboratory #6 (4%)
Due Date: Wednesday December 11, 2024
TurtleBot3 Task Integration with Smach

Objectives:

- Study of Smach as a way to structure a ROS solution to a robot problem
- Integration of previous robot motion control, target homing and autonomous navigation functions of your TurtleBot3 with ROS

Details:

In this lab, you will integrate the tasks that have been built in previous two labs for the robot into a comprehensive task. Specifically, in Part I (20%), you will first learn how ROS package Smach works as a way of expressing the solution to a robot problem in terms of a (finite) state machine. Study the Smach tutorial to become familiar with the Smach package. Then duplicate the example in this tutorial and show it to your TA.



In the second part (80%), refer to the environment shown in the right figure for which you have built a map already. In addition to the static map, there are three poles placed near P2, P3, and P4, shown as red circles in the figure. Their locations are not known a priori. The overall task of your robot is to visit P1, P2, P3 and P4 in turn and stop at the three poles, as you did in Lab 4. For a visit to a pole to be considered successful, your robot must come to a full stop **within 15cm** of the pole for at least **two seconds** to indicate that it has parked. The complete task requires your robot to, starting from P1, visit the four location markers and three poles before coming back to P1. When you have completed and tested your solution to Part II, demonstrate it to *the instructor* and a TA. Be prepared to answer questions regarding your implementation of the solution.

Please note that we strongly encourage you to consider using Smach in designing the solution for Part II although this is not mandatory. Just for your reference, Lab 7 will be a repeat of Lab 6 but on a competitive basis where the time of completion in executing the navigation task will be used to determine the rank of a student group and subsequently the final mark of the lab. So, it is to your advantage to build a solution that is easy to understand, tune, and optimize.

Marking:

Part I will be 20% and Part II 80%. Of the 80% in Part II, each successful visit to Pi is worth 20%. If your robot did not come to a stop within 15cm of a pole, it is a deduction of 10%. Failure to stop for two full seconds results in a reduction of 5%. Each external manual intervention of your robot for it to continue its operation results in a reduction of 10%.

If you are not able to complete any parts of the demo before the due date, you will get a 20% penalty, and an additional 20% for each day of delayed demo.

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.