EE 451 Intro. to Robot Control
Bogazici University, Electric Electronic Eng.,

27.12.2022
Due date: Part (1) 4.1.2023 t:19:00
Due date: Part (2) To be announced

Final Project

The aim of this project is to familiarize you with mobile robot control. You are asked to implement a control algorithm on a real Turtlebot robot furnished with a RGB-D camera. The code should be written in C++ (template project will be provided).In this project, you will do your project in a group of 2 as assigned to you.

In this project, the task is to form a linear formation and move accordingly as shown in Fig.1. Your robot can have one of the two tasks. As such you need to write code for both.

- Leader: The first robot will be a leader robot. Its goal is detect an obstacle in front of it and move around it and then move in a straight line for 20 meters until the goal position.
- Follower: The remaining robots will be followers. Each follower robot needs to follow the robot in front of it from a distance of 1 mt. If the robot in front of it stops, it should stop too. It should move until the robot in front of it stops.

The obstacle will be disk-shaped red object with radii ρ known a priori. The control inputs of the robot are τ_1 (right wheel motor) and τ_2 (left wheel motor).

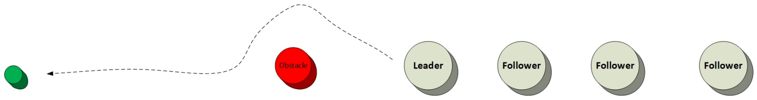

Figure 1: A slalom path.

Part 1: Gazebo simulation: The first part is to design the robot in Gazebo so that it is able to move through all the obstacles without any collisions along the way in a slalom manner. In your algorithm, you can use the encoder information, the localization data provided through a ROS node available to you and the position and size of the obstacles as detected by the RGB-D camera. I suggest that for navigation, you use APF (artificial potential field) approach - as this will possibly deliver the best obstacle avoidance performance. The task success is evaluated according to the following criteria:

- Leader: Successful completion without hitting the obstacle.
- Followers: Successful completion without hitting the obstacle or other robots.
- Deviation of final goal position.

We provide you with template code for this part - as available in the course moodle site. Pls write your code as to print a report of the three criteria.

Part 2: Implementation on the mobile robot Turtlebot: Once you are done with simulation part, you should come together with your teammates. Each team member should run his/her algorithm and and discuss his/her approach. As a group, you decide on how to implement the algorithm. Then, you should get together in the designated times (as determined in class) and program the solution on the (given) robot. The programming of the robots will be done in C/C++. We also provide you with a shell C/C+ code for this part - as to get you started. Pls refer to the Turtlebot Manual as given in the course website as to how to use the robot. On the demo day, you will make a demo with real mobile robot on a given demo scenario. Each group will have 3 trials and the best performance will be noted. The performance of the groups will be ranked based on the average of these performance criteria.