COMP47130 Potential Field Assignment

Code Submission Deadline: 04/04/14 00:00

Project Competition: 04/04/14 11:00

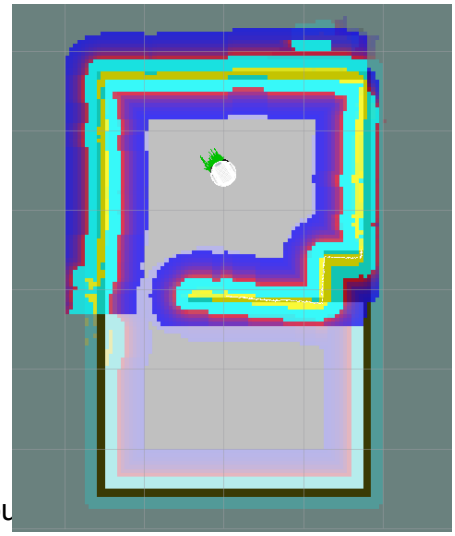
This assignment requires you to implement a Potential Field algorithm using the Turtlebot to provide a simple point-to-point navigation task. The assignment will involve the following elements:

- Localization
    - Functionality to accurately localize the Turtlebot within the arena
- Navigation
    - Functionality to allow the Turtlebot move from one location to another reliably

Localization

The task for implementing the localization is not an easy one, and will not be feasible before the deadline. In order to aid in this, we are permitting the use of the ROS amcl to provide you with an accurate method of localizing the Turtlebot. This will provide you with (x, y, theta) values (Pose).

A map of the arena will be generated by the TA and provided to you along with the .world configuration. You will also be able to import this map into your simulators for testing.



The Turtlebot stack comes with a package that will include many of the launch files and packages that you will need, this packages is called turtlebot_navigation. Though no changes to the Turtlebot will need to be made by the student.

List of ROS Topics for Utilization:

- In Simulation
    - /base_pose_ground_truth
- In Turtlebot
    - /amcl_pose

Navigation

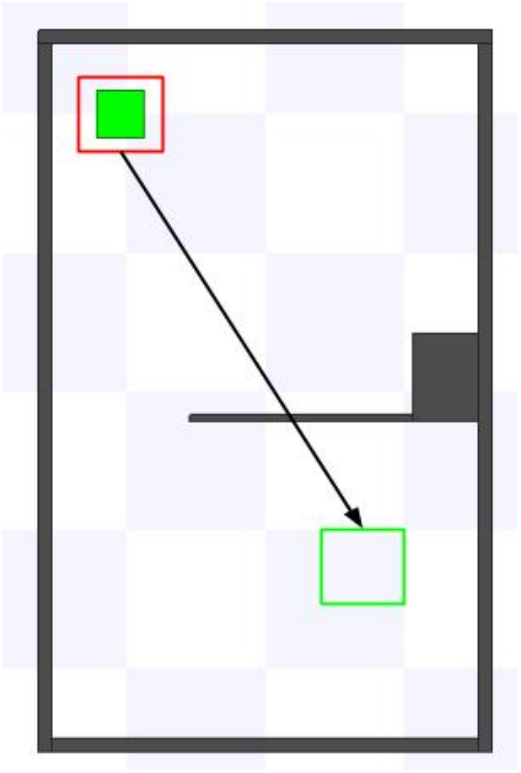
A navigation algorithm will be designed and implemented by you to allow the Turtlebot to move from one location to another. The Potential Field code implemented provide functionality to guarantee no collisions with the arena walls and allow for rudimentary path finding. You are **not** permitted to use the ROS Navigation stack for this functionality. You may however use material from the lectures as well as methods described by other sources to implement an algorithm of your choosing.
Note: Your code will be inspected for any inclusion of third-party code.

List of ROS Topics for Utilization:

- In Simulation
    - /base_scan
    - /cmd_vel
- In Turtlebot
    - /scan
    - /cmd_vel_mux/input/teleop

The Challenge

The Turtlebot will be placed at the position illustrated in the top left of the arena (0.0,0.0,0.0), the Turtlebot will have to navigate it's way from that initial position to a second position also illustrated in the bottom right (1.8, -3.0,0.0).



The Turtlebot must complete it's task within 10 minutes. No collisions or sliding glances allowed. Three opportunities to demonstrate your algorithm will be allowed. No modification of code will be allowed during the demonstration. It has often been the case in previous years that students make modifications to an already partially working solution only to make it not work at all. Tested 10 times? Test it 3 more times.

Setup

A arena_map.world file has been generated by the TA in order to provide you with a fidelity map of the arena you will be demonstrating your algorithm in. Download this from the Moodle and run it on your workstation with the following:

$ rosrun stage_ros stageros arena_map.world

In order to run the Turtlebot from your workstation, you'll need to set a few environmental variables. Add the following to your .bashrc file:

export ROS_MASTER_URI=http://192.168.1.110:11311
export ROS_HOSTNAME=<WORKSTATION-IP>

Once you have that done, source your .bashrc:

$ source .bashrc

A single roslaunch file has to be run in order to make available all of the Turtlebot features, you can do that with:

$ ssh turtlebot@192.168.1.110
$ pwd: 'turtlebot'
$ roslaunch turtlebot_bringup all.launch map_file:=/home/turtlebot/arena_map.yaml

If there are errors after running this script, run the following script in the home directory:

$ sudo sh serial.sh

Then check the base is powered on with a green light lit.

Once the all.launch file is running, on your workstation, run the following to check connectivity:

$ roslaunch turtlebot_teleop keyboard_teleop.launch

If you are able to move the Turtlebot around the arena, everything else should be OK.

Now, run rviz on your workstation, it is configured to show you all the Turtlebot details:

$ roslaunch turtlebot_rviz_launchers view_navigation.launch