Lab 5
Navigation and Path Planning with the Turtlebot

March 21, 2022

Learning Objectives

1. Utilize the Gazebo simulation environment.
2. Utilize the RViz visualization environment.
3. Learn the principles of Robot Navigation and Path Planning.
4. Research and compare/contrast at least 3 Navigation techniques.
5. Utilize the Linux operating system, including its command line interface (CLI).

Overview

For this lab, you will implement Navigation and Path Planning on the Turtlebot. Navigation and Path Planning are core-functions in any robot - the ability to determine its initial pose estimation, use a given map, plan paths to a final pose goal, and avoid obstacles.

Much of the background for Navigation on the Turtlebot can be found in this ROS Navigation tutorial. The first requirement will be to download the appropriate packages for the Turtlebot3 if not already installed.

Then configure your .bashrc to export the correct Turtlebot3 model.

```
$ export TURTLEBOT3_MODEL=waffle_pi
```

Now execute Virtual Navigation. You will need to open multiple terminal windows. For virtual navigation in Gazebo, instead of running the actual robot, you can select the various environments and robot models mentioned in the tutorials, and the Navigation-related commands will use the ROS packages used in the Navigation section.

The following commands are examples of using the TurtleBot3 Waffle Pi model and the turtlebot3_world environment:

```
$ roslaunch turtlebot3_gazebo turtlebot3_world.launch
$ roslaunch turtlebot3_navigation turtlebot3_navigation.launch
map_file:=$HOME/map.yaml
$ roslaunch turtlebot3_teleop turtlebot3_teleop_key.launch
```

Estimate Initial Pose of the robot on the map. The initial position only needs to be set once.

Send Navigation Goal to set the destination end goal of your choosing.

Record (screen capture or related tool) the virtual robot in the simulated world (Gazebo). Do at least two end goals.

Lab Requirements

Perform Navigation and Path Planning on the physical Turtlebot and save the generated path and end goal. Write a lab report and perform a survey of 3 different navigation techniques.

Deliverables

- Demonstrate the robot successfully performed navigation by including a link to a video demonstration (i.e. Youtube).
- Do research on navigation and path planning and compare and contrast three navigation algorithms.
- Write a lab report IAW lab write-up procedures.
- In accordance with DAW, include any applicable documentation with your lab report.