Udacity Home Service Robot Project

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Course: Nanodegree in Robotics Software Engineer

I. Introduction

The objective of this project is to simulate a home service robot using Gazebo simulator in ROS (Robot Operating System). Three important concepts namely localization, mapping and navigation have been applied in this project:

1) Created a world using Building editor in Gazebo.
2) Turtlebot2 has been used and is loaded into the world.
3) Pick up location of an object is specified to Robot and is marked using marker in Rviz.
4) While avoiding any obstacles on its way, the robot plans its trajectory from the initial position to the final position (object's location).
5) The robot navigates to the pick up location and picks the virtual object.
6) After the object is picked up the robot is provided with a drop location.
7) The robot plans a path from its pickup location to drop off location. Drops the object at the drop location. Successfully achieving its purpose.

The ROS packages that have been used in this project are used for localization, Mapping and Navigation described briefly in the below sections.

II. Localization and Mapping

SLAM- Simultaneous localization and Mapping has been used in this project. Used gmapping package that provides full SLAM as a ROS node namely *slam_gmapping*. Using this node, a two dimensional occupancy grid map has been created from pose data and laser data collected from the robot. A shell script namely test_slam.sh listed under scripts in catkin workspace is created and used to launch multiple nodees at once, a gazebo simulator with my world and turtlebot at the initial position and slam_gmapping node. When the robot is moved around inside the world using teleop (keyboard) package, the laser scanner attached to the robot scans the surroundings and localize itself in the map and simultaneously creates the map of the world. AMCL node has been used to provide the created map to the Robot while performing navigation.

III. Navigation

Used ROS Navigation Stack in order to navigate from a given point to its destination. Used Dijkstras algorithm for path planning to move the robot to a set waypoint while avoiding obstacles along its path. It is a variant of Uniform Cost search algorithm which plans a path from initial position to goal position. A goal has been set using the 2D Navigation goal icon in the Rviz toolbar to check the workings of the algorithm and it travelled to the location successfully.

IV. Home Service Robot In Action

Two custom nodes namely pick_objects and add_markers have been created to communicate with each other and perform the pick and place task.

Fig. 1. My Robot World

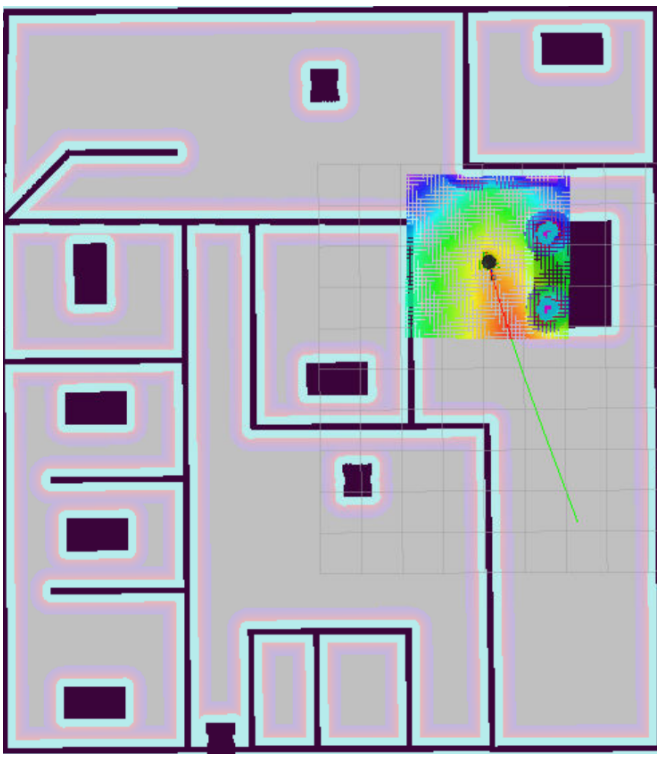

Fig. 3. Robot picked the object and travelling towards drop location

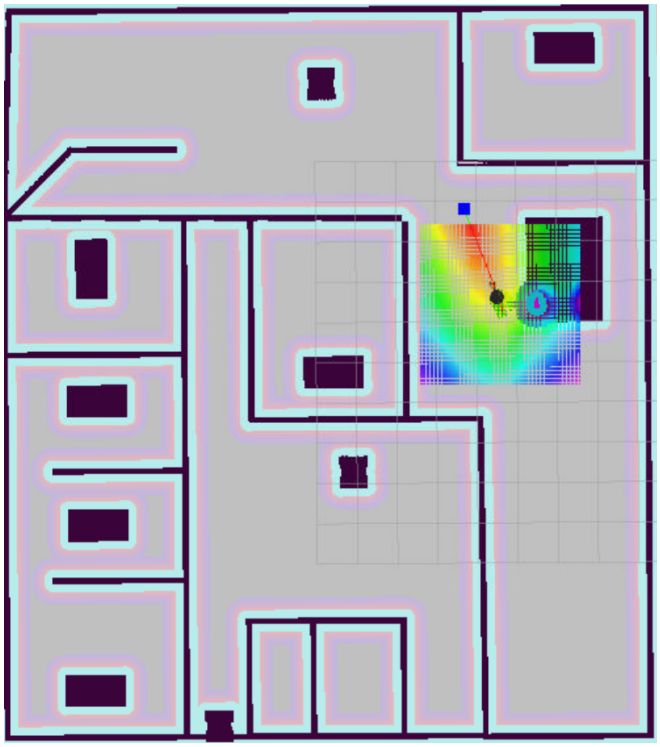

Fig. 2. Robot moving to pick up the object

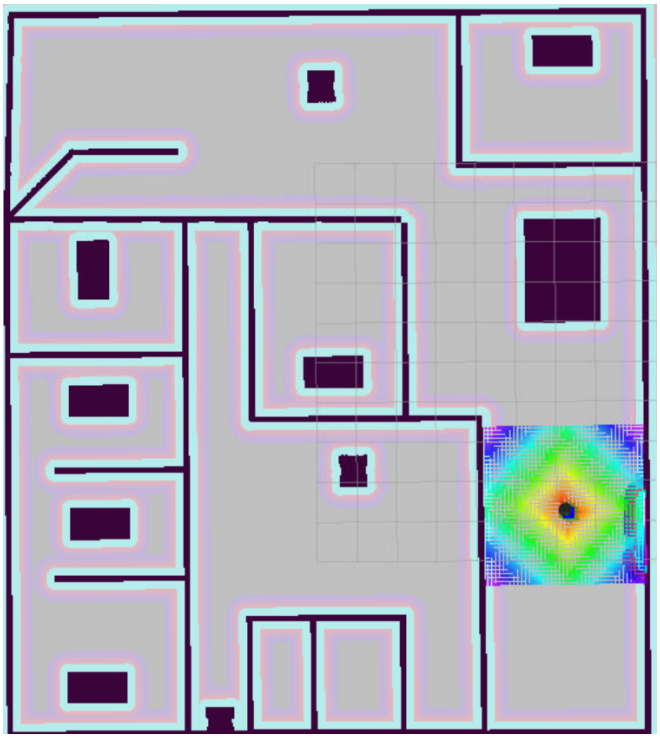

Fig. 4. Robot dropped the object at Drop location