EE565: Mobile Robotics

Lab # 9: Using iRobot Create to make environment grid map with laser

Description

This lab introduces the students to the slam_gmapping node, whose function is to do Simultaneous Localization and Mapping (SLAM) from the data acquired from a laser scanner equipped iRobot. SLAM has been one of the most widely researched topics in robotics community. Students will be implementing SLAM algorithm to make a 2D map of an environment.

In-Lab Work

This lab is composed of two components that are to be completed in lab time. There's no lab assignment.

Simulation Component:

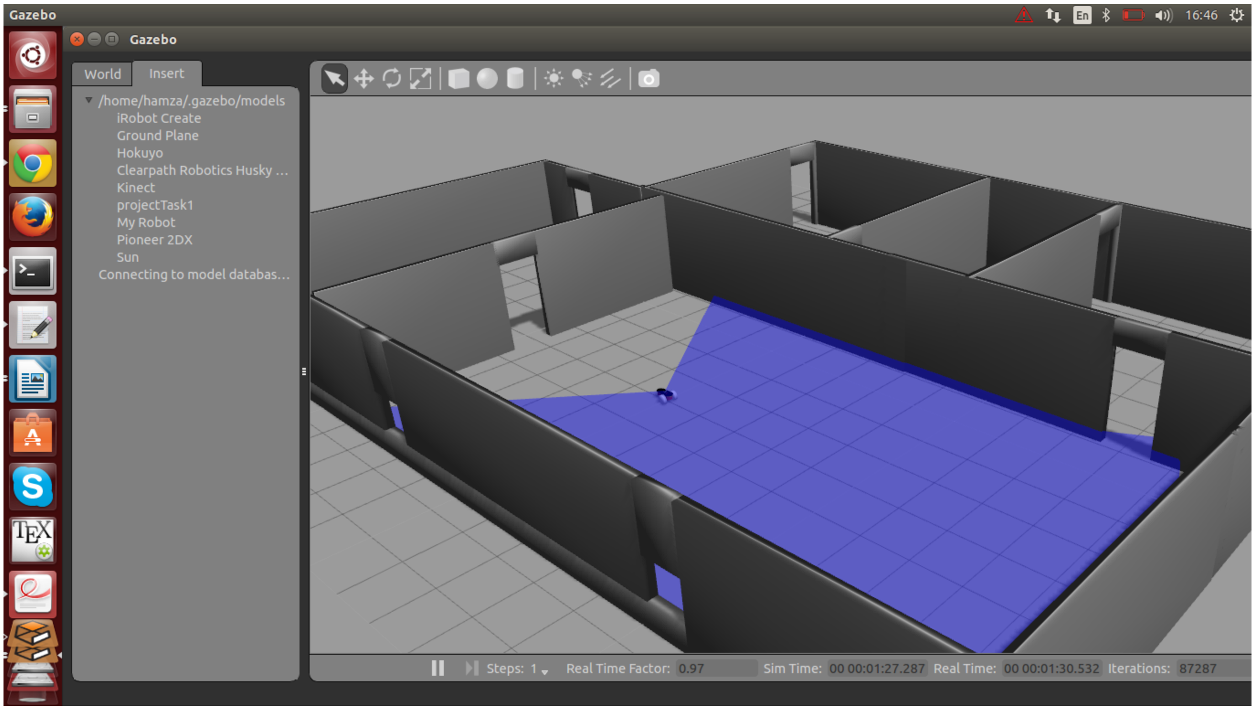
In this component, you have to perform SLAM using a robot in Gazebo with hokuyo sensor mounted on it. You are provided with gazebo model files of the maze (See figure) and the robot with laser and odometry plugins attached.

1. Download the files from LMS and import the maze and robot models in gazebo environment.
2. Open up gazebo and place the models. Ensure that the topics /tf, /odom and /scan are being published.
3. Run: rosrun tf view_frames. This will show you the information of which transforms are being published inside the /tf topic. As requirement of the gmapping package, you require the hokuyo to base_link transform and the base_link to odom transform.
4. Uptil now, the transformation between the hokuyo sensor frame ("hok_frame") and the robot frame would not be their in /tf topic. So, to add that, you have to manually publish this transform.
5. For this, run the following command:

rosrun tf static_transform_publisher 0 0 1 0 0 0 Test_Robot/base_footprint hok_frame 0.001

6. Now verify the tf transform by again running view_frames node.
7. Once you are done with this, the final step is running the gmapping node and creating the map of the environment.
8. Run the slam_gmapping node with the following parameter values (note that these are not the default values):
    1. base_frame : "Test_Robot/base_footprint"
    2. odom_frame : "Test_Robot/odom"
    3. temporalUpdate : "0.5"
    4. map_update_interval : "1.0"
9. Move the robot around using turtlebot_teleop and visualize the complete 2D grid map in rViz. It will be similar to the one shown in figure.

rosrun turtlebot_teleop turtlebot_teleop_key /turtlebot_teleop/cmd_vel:=/Test_Robot/cmd_vel



Hardware Component:

You will be provided with a rosbag file that has odometry and laser scan data, recorded by moving iRobot (w/scanner). You are required to map the environment as a 2D grid map by using gmapping ROS package.

To make a bag file:

10. Install hokuyo-node and gmapping packages.
11. Connect the hokuyo laser scanner with 12V power, and the USB data cable with the PC.
12. Open the port: sudo chmod 777 /dev/ttyACM0
13. Set the port: rosparam set hokuyo_node/port /dev/ttyACM0
14. Run the laser scanner: rosrun hokuyo_node hokuyo_node
15. Visualize the laser data topic "/scan" in rViz.
16. Now, connect the iRobot Create. Launch minimal_launch and turtlebot_teleop_key nodes.
17. Verify if all topics are being published and the robot is able to move with the help of controller.
18. Record using rosbag with the laser mounted on iRobot and traverse around the target environment that you want to map.
19. Once you have the recording, continue with the map building process.

Running gmapping:

20. Run the slam_gmapping node, with the default parameter values.
21. Play the recorded bag file that has the desired topics (/tf, /scan, /odom, etc.)
22. Launch rViz and visualize the "map" topic.
23. As the bag file keeps playing, you'll see the map keeps updating.
24. Get your map checked.