EE565: MOBILE ROBOTICS

LAB # 2: INTRODUCTION TO A SIMULATION ENVIRONMENT – GAZEBO

DESCRIPTION & MOTIVATION

In this lab, we plan to introduce students to Gazebo – a standalone simulation environment for robotics applications, with built in physics engine. The students will be given Gazebo overview – basic components, urdf & sdf files, architecture, etc. We will use any available compatible Gazebo version with ROS. They will perform basic Gazebo tutorials on pre-configured lab PCs. By the end of lab, students will have written codes for building custom robot and world in Gazebo environment and understand the process of integrating ROS topics with gazebo models.

IN-LAB TASKS

1. Short introductory presentation about Gazebo.
2. Every student will perform the following Gazebo tutorials:
    a. Install and run Gazebo environment. {url}
    b. Build a Robot {url}
        i. Model structure and requirements
        ii. Make a model
        iii. Make a Mobile Robot
        iv. Import Meshes
        v. Attach Meshes
        vi. Add a Sensor to a Robot
    c. Build a World {url}
        i. Building a world
    d. Write a plugin
        i. Plugins 101
        ii. Model plugins
        iii. World plugins
    e. Sensors.
        i. Sensor Noise Model (Ray Laser noise)
    f. Connect to ROS {url}
        i. Installing gazebo_ros_pkgs
        ii. Using roslaunch
        iii. Gazebo plugins in ROS
            1. Adding Plugins
            2. Differential Drive
        iv. ROS communication
        v. ROS plugins

IN-LAB DELIVERABLES

- Building a robot
- Model Plugin (moving a box)
- Add Hokuyo and Differential drive plugins to SDF file

- Use roslaunch to run the world environment and verify using 'rostopic list', the topics for sensor and drive.
- Gazebo Subscribed & Published topics (ROS Communication tutorial)

LAB ASSIGNMENT (SHOW WORKING CODE BEFORE NEXT LAB)

- Create a wheeled mobile robot with a Hokuyo laser scanner attached on it.
- Use an existing plugin for the mobile robot drive system.
- **Bonus**: create your own plugin for the robot drive system
- Use Rviz to visualize odometry and laser scan topics.
- Create a ROS node to communicate with robot odometry and laser range scanner data. Use the robot wheel odometry to estimate the wheels velocity (Hint: inverse kinematics). To navigate the robot use existing teleop node.