EGN 4905 Autonomous Systems

Laboratory Exercise 2-B Module 2: Getting Familiar with RACECAR Simulator

In this module you will be running Gazebo along with ROS to simulate a model of the RACECAR with a LIDAR mounted on it as well as visualize the laser scan data.

Before starting the simulator, you will need to download and run `simulator_setup.sh` script using the following commands in a terminal (make sure you are connected to the internet):

- `wget http://peris.mit.edu/rss/software/RACECAR_VM/simulator_setup.sh`
- `./simulator_setup.sh`
- `sudo apt-get install ros-indigo-controller-manager`
- `gazebo`

A Gazebo instance should come up with an empty world. Kill this process before continuing.

Task 1: Open-loop control the model

Considering you have forked and cloned the `racecar_simulator` package as discussed in Module 1 followed by building the team workspace using `catkin_make`, you should be able to run the simulator using the command:

- `roslaunch racecar_gazebo racecar.launch`

In this task you will have to use `rostopic pub` command similar to the one used in Turtlesim tutorial of Lab 2-A.

Necessary information:

- Topic name: `/racecar/ackermann_cmd_mux/input/teleop`
- Message type: `ackermann_msgs/AckermannDriveStamped`
- Example input argument: {`drive:{steering_angle:0.0,speed:0.0}`}

Play around with input arguments to see how the robot moves.

Task 2: Open-loop control with joypad

In this task you will start a new instance of the simulator with the RACECAR in one of MIT's intricate tunnels and run it using the joypad. For this, plug in the joypad receiver (attached to the physical RACECAR USB hub) to your computer and make sure the device is connected to the VM by using the settings under `VM->Removable Devices`. Run:

- `roslaunch racecar_gazebo racecar_tunnel.launch`
- `roslaunch racecar_control teleop.launch`

Ignore the warning messages. If you take a look at the list of topics using `rostopic list` you will see topic names `/ackermann_cmd_mux/input/teleop` and `/racecar/ackermann_cmd_mux/input/teleop`. Your task is to write a `launch` file which remaps `/ackermann_cmd_mux/input/teleop` to `/racecar/ackermann_cmd_mux/input/teleop` such that when you use the joypad the RACECAR moves. You could also try to instantiate the `racecar_tunnel.launch` and `teleop.launch` from the same file to consolidate launches.

Task 3: Visualize laser scan data in RViz

In a new terminal open RViz by running the command `rviz`. Follow the steps below to visualize the RACECAR, the transformation frames and the laser scans:

1. In the `Displays` box on left side of the GUI, choose `chassis` option for `Fixed Frame`.
2. Click `Add->RobotModel->OK`
3. Click `Add->TF->OK`
4. Click `Add->By Topic->LaserScan(under /laser/scan)->OK`

You should now be able to visualize the laser scans while moving the RACECAR using joypad.