Exercise Session 2

Theory

- ROS publisher
- rpt User Interface
- TF Transformation System (Optional)
- Robot models (URDF) (Optional)
- Simulation descriptions (SDF) (Optional)

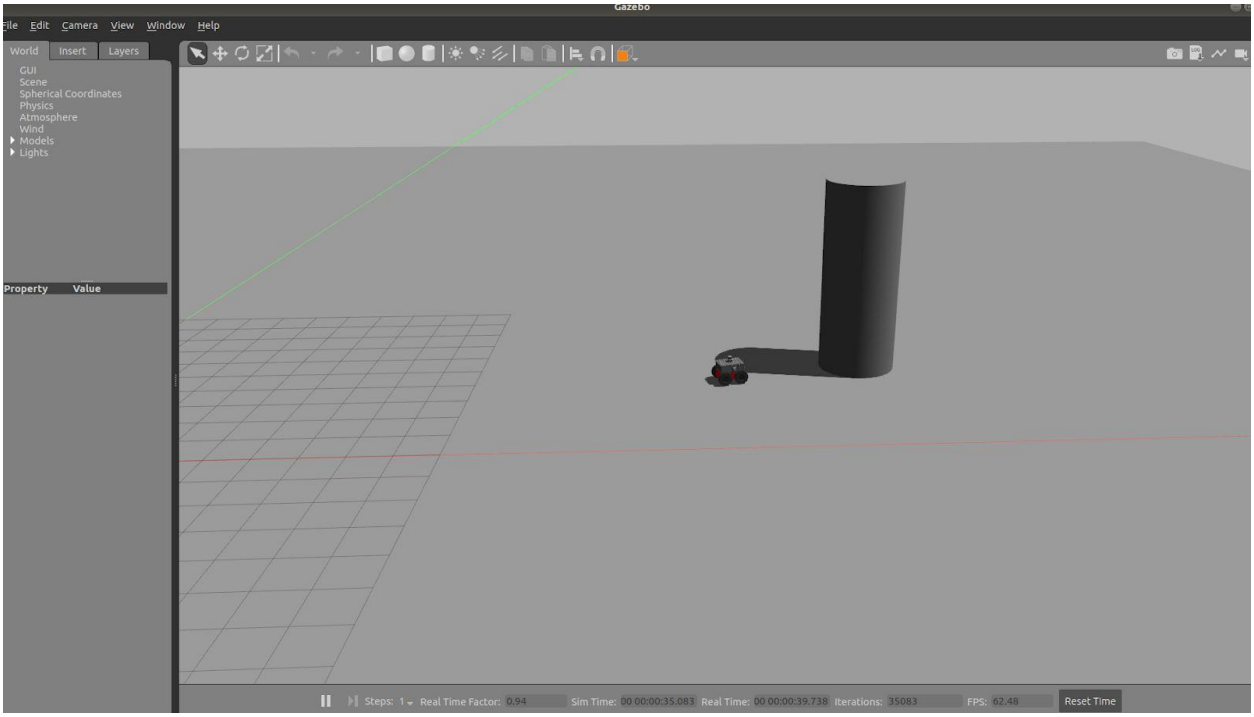
Exercise

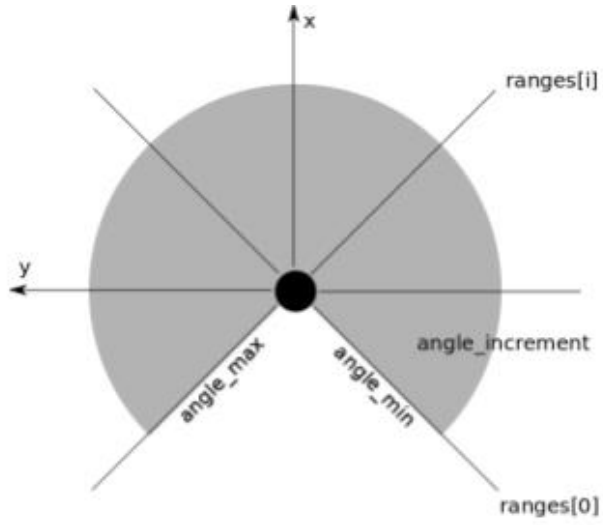
The goal of this exercise is to close the control loop for the SMB robot. You will extract the position of a pillar from the laser scan and then control the robot such that it drives into the pillar.

1. Setup the SMB simulation with the updated robot simulation (you can remove the old one). Download the *smb_common_v2* zipped folder on the course website. Unzip it and place it in the *~/git* folder. Navigate into *~/Workspaces/smb_ws/src* and make a symlink. Compile the *smb_gazebo* package with catkin.
2. Adapt the launch file from the last exercise such that:
   - The keyboard twist node is removed.
   - *$(find smb_highlevel_controller)/worlds/singlePillar.world* is loaded as the world.
3. Extract the position of the pillar from the laser scan with respect to the robot.
4. Create a publisher on the topic */cmd_vel* to be able to send a twist command to SMB. You need to add *geometry_msgs* as a dependency to your *CMakeLists.txt* and *package.xml* (same structure as with *sensor_msgs*).
5. Write a simple **P** controller that drives SMB towards the pillar. Remember to use ROS parameters for your controller gains! Write the code in the callback method of the laser scan topic. To ensure that the pillar is well visible in the laser scan, set the

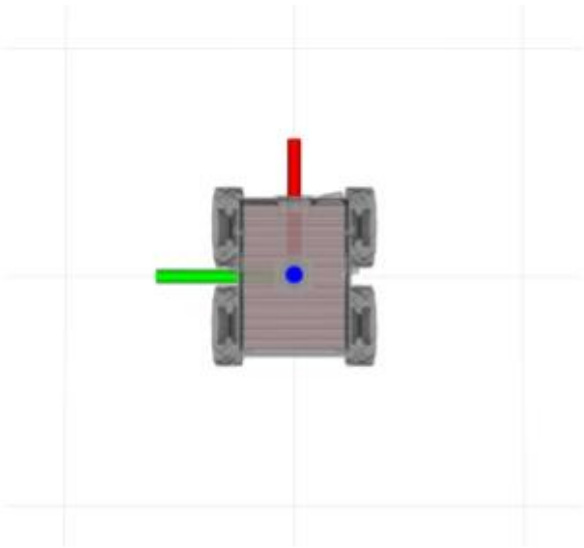
laser_scan_min_height to -0.2 and *laser_scan_max_height* to 1.0. You can pass them as arguments to the *smb_gazebo.launch*.

6. Add a RobotModel plugin to RViz to visualize the SMB robot.
7. Add a TF display plugin to RViz.
8. Publish a visualization marker for RViz that shows the estimated position of the pillar.
    - (easy) Publish the point in the sensor frame (rslidar) as an RViz marker. RViz will automatically transform the marker into the odom frame. http://wiki.ros.org/rviz/DisplayTypes/Marker
    - **OR** (more difficult) Implement a TF listener to transform the extracted point from the laser frame to the odom frame. http://wiki.ros.org/tf/Tutorials/Writing%20a%20tf%20listener%20%28C%2B%2B%29





The angles of the single rays of a laser scanner range from angle_min to angle_max with an angle_increment. Each of this rays have a range measurement.



The base_link coordinate system of husky is aligned such that x is forward, y is to the left and z is up.

Evaluation

- Start the launch file. SMB should drive into the pillar.
  - SMB drives [20%]
  - SMB hits the pillar [30%]
- Check the RViz configuration (TF's, Robot Model and Laser Scan shown).
  - TF [6%]
  - Robot Model [7%]
  - Laser scan [7%]
- The visualization marker is correctly shown in RViz.
- If the position of the marker's coordinates are determined correctly [15%]
- If the markes visualizes near the pillar (i.e. all the visualization parameters are correct)