Exercise Session 3

Theory

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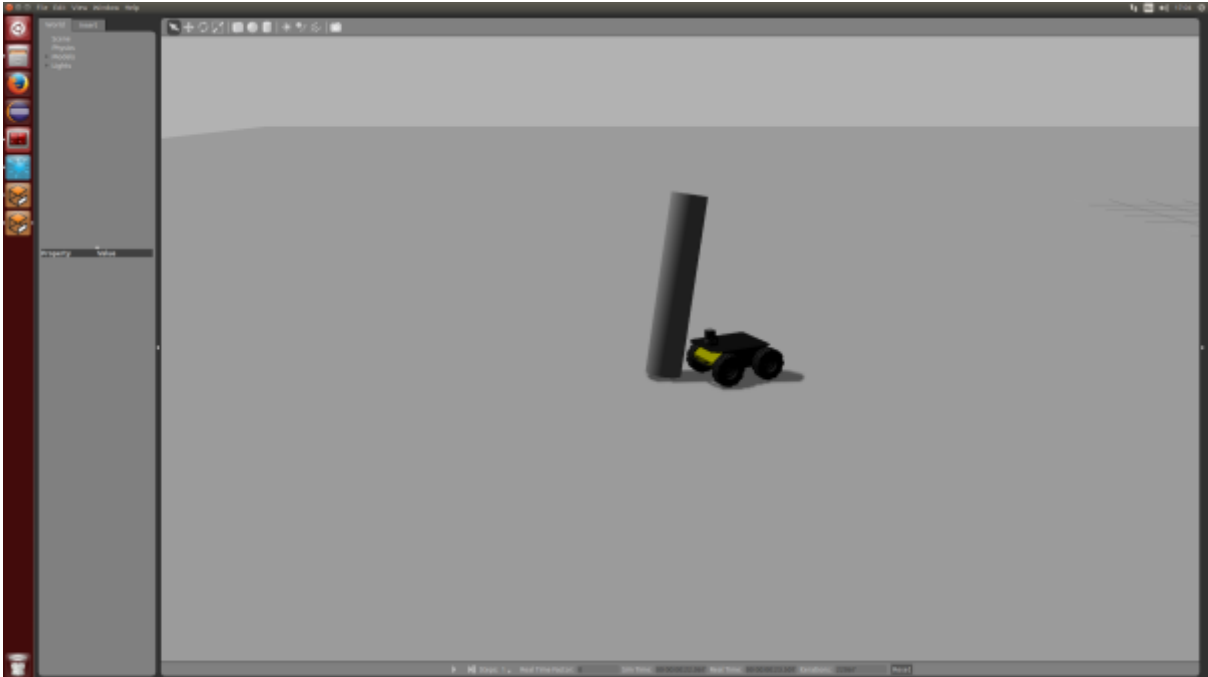- Simulation descriptions (SDF) (Optional)

Exercise

The goal of this exercise is to close the control loop for the Husky 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.
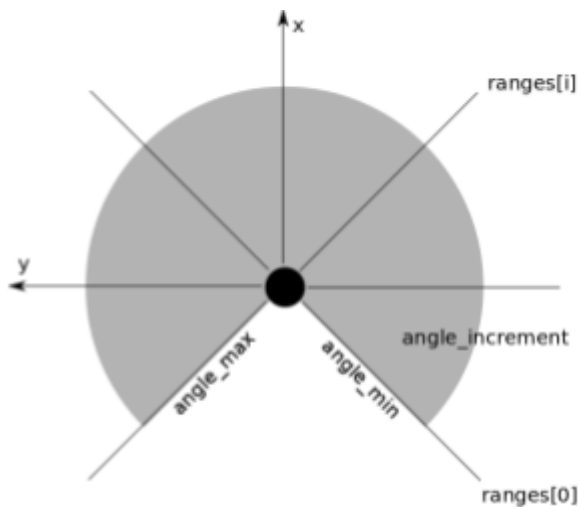
1. Adapt the launch file from the last exercise such that:
   a. The keyboard twist node is removed.
   b. `$(find husky_highlevel_controller)/worlds/singlePillar.world` is loaded as the world and thus copy the `singlePillar.world` file from the Zip provided on our RSL homepage to that folder.

2. Extract the position of the pillar from the laser scan with respect to the robot.

3. Create a publisher on the topic `/cmd_vel` to be able to send a twist to Husky. You need to add `geometry_msgs` as a dependency to your `CMakeLists.txt` and `package.xml` (same structure as with `sensor_msgs`). (Lecture 2, Slide 18)

4. Write a simple P controller that drives husky towards the pillar. Remember to use ROS parameters for your controller gains (Lecture 2, Slide 21)! Write the code in the callback method of the laser scan topic.

5. Add a RobotModel plugin to RVIz to visualize the Husky robot. (Lecture 3, Slide 17)

6. Add a TF display plugin to RViz. (Lecture 3, Slides 7)

7. Publish a visualization marker for RViz that shows the estimated position of the pillar.
   > (easy) Publish the point in the *laser frame* as a 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

Publish the point in the *odometry frame* as a RViz marker.
http://wiki.ros.org/rviz/DisplayTypes/Marker
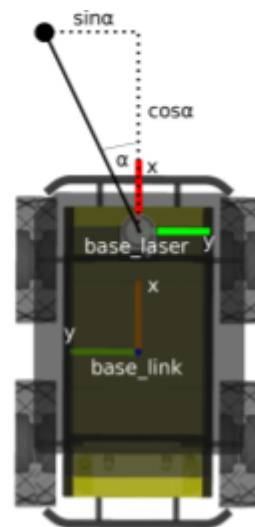

Husky drives into the pillar.

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. Note the rotated frame of the laser!

Evaluation

- ❏ Start the launch file. Husky should drive into the pillar.
  - ❏ Husky drives   [20%]
  - ❏ Husky hits the pillar   [30%]
- ❏ Check the RViz configuration (TF's, Robot Model and Laser Scan shown).   [20%]
- ❏ The visualization marker is correctly shown in RViz.   [30%]