6. Assignment, Introduction to Robotics WS18/19 – Ver 1.03

https://github.com/AutoModelCar/AutoModelCarWiki/wiki/Steering-Calibration

1. (10 Points)

Write a ROS node which subscribes to the /scan topic of your lidar.
Calibrate the steering angle of the car (bicycle model) by using the lidar scan of two perpendicular walls. Place the car facing a wall. Calculate the distance to the walls (as in the picture). Calculate the turning radius R with respect to the center of the Lidar.

Then set a steering value (0°, 30°, 60°, 90°, 120°, 150°, 179° servo motor scale , i.e., 7 values) and drive a couple of centimeters backwards.

A) (3 Points) calculate the distance of the car w.r.t. the wall:

- Filter scan points related to a wall and find the minimum distance to the wall, which shall be your approximated distance of the car to the wall.
- Or Fit two perpendicular lines through the scan points and find the distances of the lines to your vehicle.

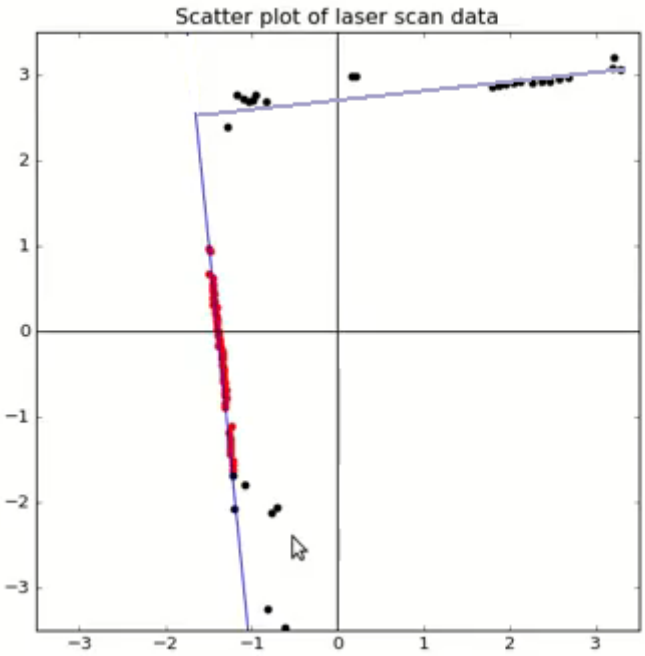

Fig. 1: Fit two perpendicular lines on laser scan points.

B) (2 Points) Calculate the turning radius R of the laser scanner using three measurements.

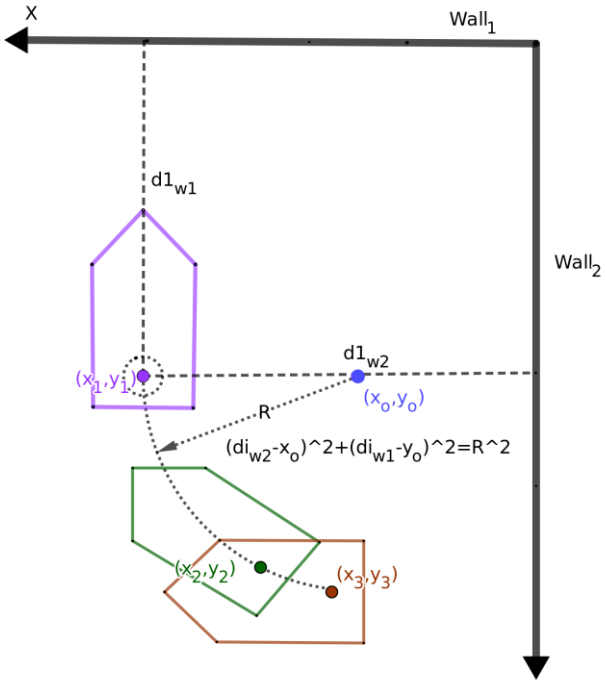

Fig. 2: Calculate the turning radius R of the laser scanner.

C) (3 Points) Calculate the steering angle of the virtual front wheel.

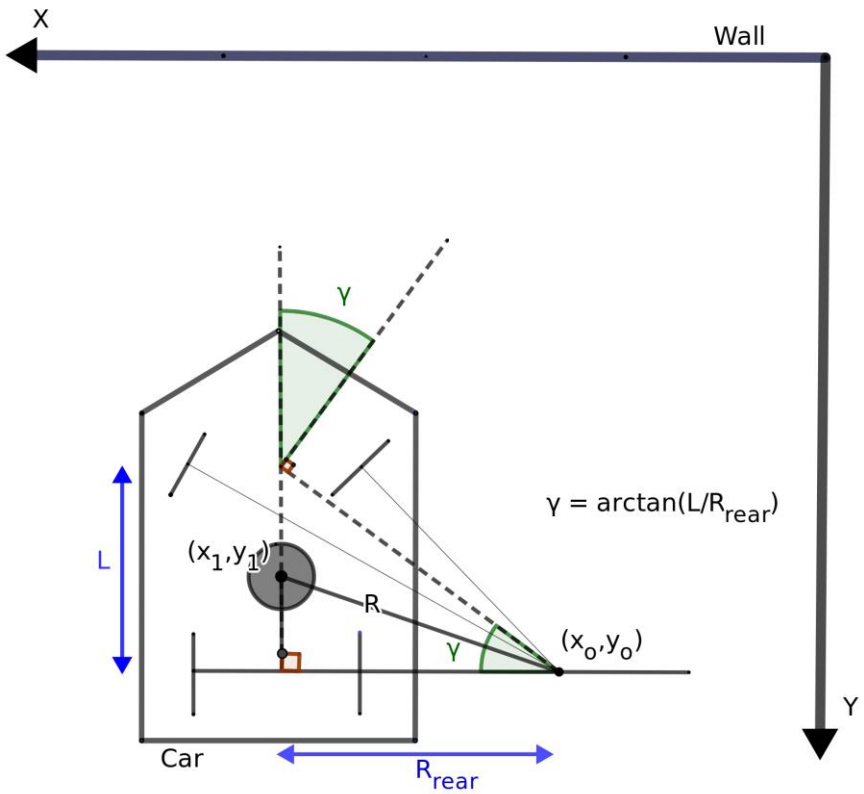

Fig. 3: The steering angle γ calculation.

Your code should allow the car to 1. take a measurement at the starting position, 2. to drive and 3. to take the second and third measurements, 4. finally to calculate the steering angle - all that without human interference. You will perform 7 experiments (for the 7 steering values 0, 30, ...), after each you can place back the car to its starting position.

Write the measured values into a table (step size 30° of servo motor degree value). The first column should contain the 7 steering values (0, 30, ...), the second column contains the measured steering angles. Paste that table into your Pdf.

D) (2 Points) Create a mapping function which gets angles of the front wheel in deg as an input and returns values from 0 to 179 . Upload the python code which performs the above experiments as well as the code which takes care of the steer angle mapping.