DRAFT-4. Assignment, Introduction to Robotics WS17/18 - Ver 0.99

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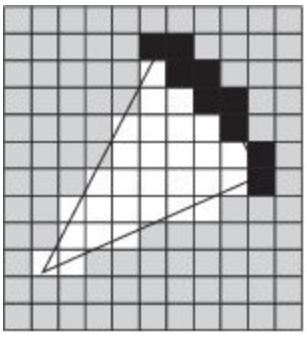
Submission: online until Tuesday, 21 Nov 2017, 11:55 a.m.

Please summarize your results (images and descriptions) in a pdf-document and name it, e.g., "RO-04-<surnames of the students - group name>.pdf".
Submit your python code
Only one member of the group must submit the necessary files.
Do not copy solutions to other groups.
Every group must contain two people.
Only submissions via KVV will be accepted.

1. (3 Points)

Write a ROS node which subscribes to the /scan topic of the lidar. In your subscriber's callback function create and publish an occupancy grid: (http://docs.ros.org/api/nav_msgs/html/msg/OccupancyGrid.html).



Cells which contain one or more measurement of the laser scan shall be marked as occupied, otherwise, if the laser did pass them without any they are marked as "free", if they could not have been observed, they shall be marked as "unknown". Find a good resolution and grid size to have a high similarity to the LaserScan visualization of the /scan topic in RViz.

You can use the following template: uebung7_scan_grid.tar.gz

Take a screenshot from your created occupancy grid shown in RViz.

2. (7 Points)

Calibrate the steering angle of the car (bicycle model) by using the lidar scan of a wall. Place the car orthogonal to the wall and calculate the angle of the wall to the car with the help of the distance two scans (plus and minus alpha; choose alpha, e.g. 10 degrees).

Then set a steering value (0°, 30°, 60°, 90°, 120°, 150°, 180° servo motor scale) and drive some centimeters backwards. Measure the distance the car has travelled as shown on the first sketch.

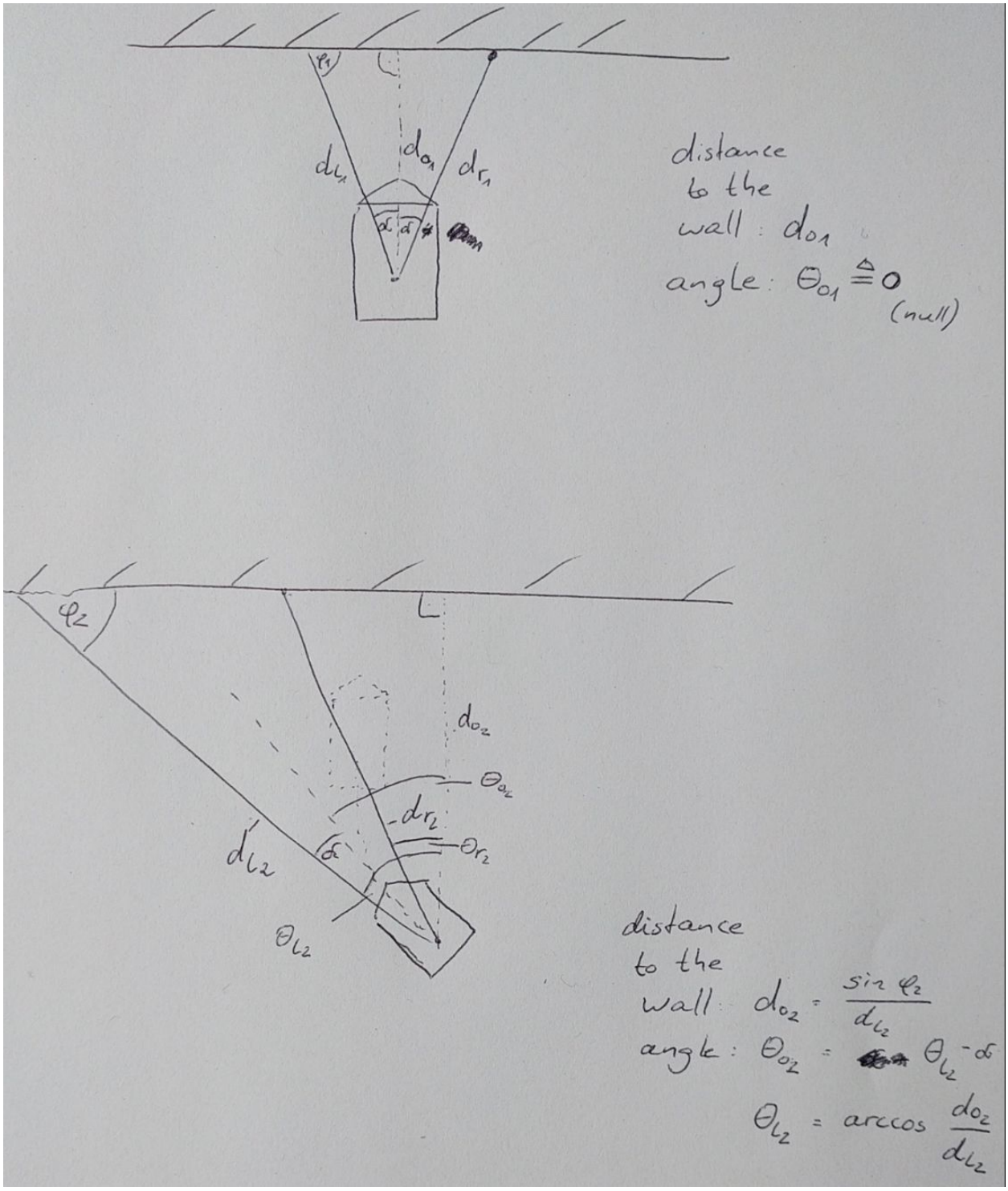
Calculate the turning radius R with respect to the center of the rear axle (for simplicity assume the lidar is on the rear axle center).

Hint: Calculate the distance to the wall, and the angle of the wall w.r.t. car using the law of cosines. With the distance change and the angular change you can calculate the radius R, see sketches 1-3

Now calculate the steering angle, while assuming again that the lidar is on the center of the rear axle, as shown in sketch 4.

Create a mapping of the current values which is sent to the /model_car/steering topic to the corresponding turning radius R and steering angle. Put the measured values into a table (step size 30° of servo motor degree value).

Sketch 1 and 2



Sketch 3 and 4