Intelligent Robotic Systems - Assignment 1

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Question 1 [12 pts]

Define and explain the following terms [3 pts/term]:

- Euler Angels & Quaternions
- Sensor Fusion
- Deliberative Paradigm
- Reactive Paradigm

Question 2 [20 pts]

You implemented a robot that follows a path using Pure Pursuit. You tested with three different look-ahead distances L: 0.3, 0.6, an 0.9. In Figure 1 you see the results from trying to follow a given path (the dotted black line) given the three different values of L (the lines A,B,C). Motivate which are the most probable values of L for the three lines.

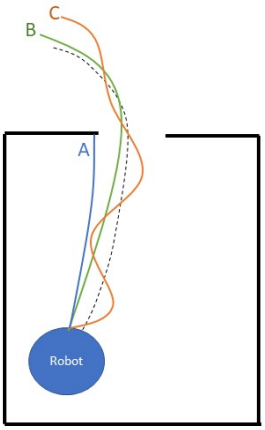

Figure 1: Results from trying to follow a given path (the dotted black line) given the three different values of L (lines A,B,C)

Question 3 [50 pts]

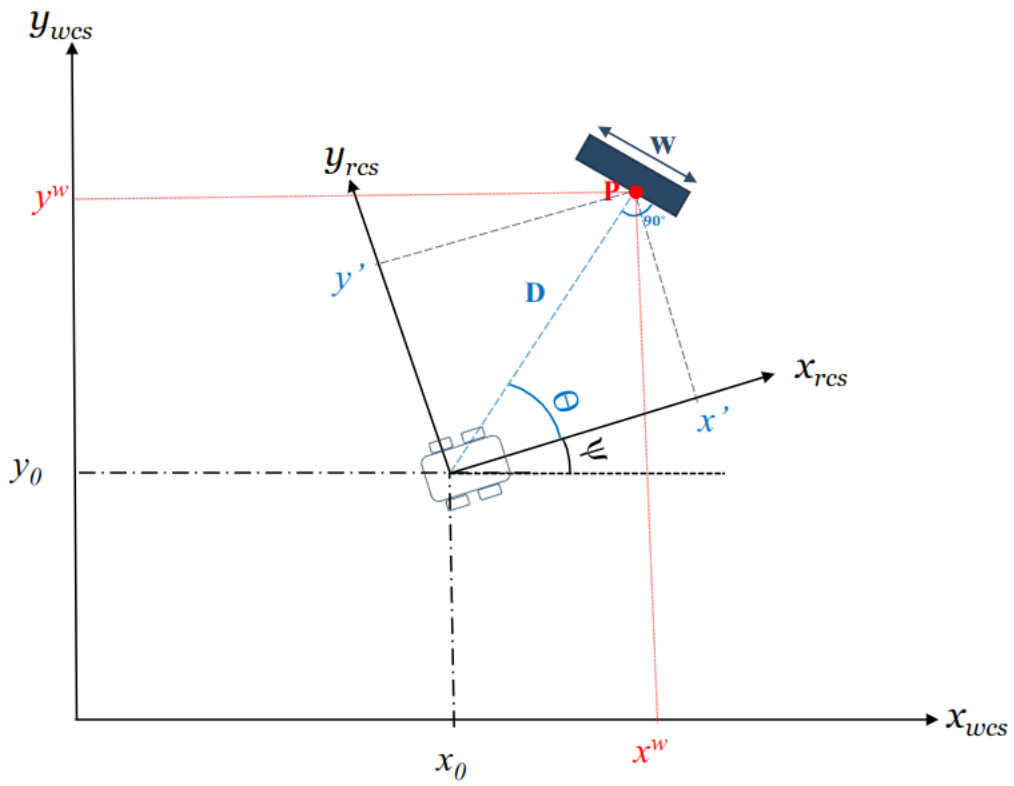

Figure 2: A robot and an object in a 2D space

A robot is located in a 2D space as presented in Figure 2. The robot is equipped with a 2D laser scanner placed on the robot, with its own coordinate system RCS defined by X_{RCS} and Y_{RCS} axis. The laser is directed such that the 0 reading coincides with the X_{RCS} direction. The scanner was reading several 2D scans while the robot and the environment were static. Attached to this assignment is a .csv file with 100 readings from the scanner.

- Plot the data in the CSV file, including adequate legend and units. Explain the values on the resulting graph. Use any program (e.g., Matlab, Python). [5 pt]
- Find values D, W, and θ shown in Figure 2, using the provided data. Explain your decisions and assumptions [15 pt]
- Find the coordinates of point P (the closest point on the face of the object facing the scanner) in the robot coordinate system RCS, (i.e. find x' and y') [15 pt]
- The origin of the world coordinate system WCS is defined by the axes X_{WCS} and Y_{WCS}. The transformation between WCS and RCS is defined by $x_0 = 30cm; y_0 = 40cm; \Psi = 30°$. Find the coordinates of p in the world coordinates (i.e., x_w and y_w) [15 pt]

Question 4 [18 pts]

Your robot is using potential fields to reach the goal and avoid obstacles on the way. You are using attractive potential fields for the goal and repulsive fields for the obstacles. Describe two problems that could occur in the situation in Figure 3 and how you can solve them.

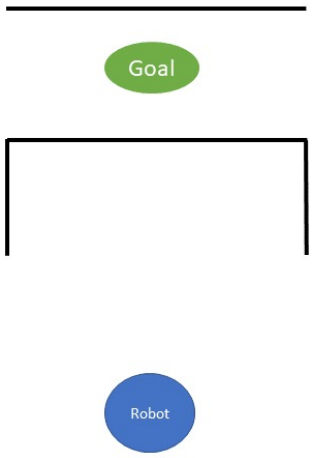

Figure 3: A setup with a robot and trying to reach a goal using potential fields

Submission

A report should be submitted through Moodle no later then 18/11/2021.