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AI for autonomous robotics(SoSe24)
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Task Sheet 7

Deadline: 10:00am June 14, 2024

Task 7.1 Theoretical questions

a) Explain the concept of odometry in your own words (4 points).

Odometry is the location measuring method used in robotics to estimate the relative position from the starting point based on data collected by motion sensor. While GPS determines the absolute position of robot, odometry can only make an estimation of the robot's or sensor's location relative to its initial location. Usually, an encoder is attached to motor (wheel) and collects angle and distance data, thereby calculating the robot's current location.

b) Explain why a robot cannot rely on odometry alone for localization (3 points).

Odometry has its limitations such as:

1. Range Error: Inaccuracies in measuring the distance travelled by the robot. It is the sum of the wheel movement over time. Even small measurement errors accumulate, leading to significant discrepancies in the estimated distance travelled.
2. Turn error: For example, if one wheel slips or if there is an inconsistency in wheel rotation measurement, the calculated angle of turn will be incorrect and over multiple turns, these errors can significantly misrepresent the robot's orientation.
3. Drift error: If the right wheel's measurement is slightly more accurate than the left wheel's, the robot orientation will slowly drift over time, causing a gradual but significant error in heading to the goal.

c) Explain how we can reduce the uncertainty of the final position of the robot (3 points).

We can reduce the uncertainty of the final position of the robot by following ways:

1. Kalman filtering: this algorithm uses series of measurements observed over time, containing noise and other inaccuracies. It can significantly reduce the uncertainty by combining multiple sensor inputs to refine the position estimates.
2. SLAM (Simultaneous Localization and Mapping): This algorithm builds amap of an unknown environment while simultaneously tracking the robot's position.
3. Improved Odometry: Adding visual odometry such as using camera data to track the movement by comparing changes in the scene,

Task 7.2 Simple odometry

Check the files in the zip folder.