Exercise 2: Particle Filter Localization
Intelligent Robotics
Intelligent Robotics (Extended)

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Objective

The objective of this exercise is for you to implement, analyze and understand the working of a particle filter. You will program this filter for the P3DX robot using ROS. You will also use the map you created in the first exercise.

Task

Implement a version of the particle filtering (Monte Carlo Localization, MCL) algorithm for localization. You may use the map you created for the first lab exercise, or use a revised version of that code to generate a map for this exercise. In addition to the basic implementation, you may attempt extensions such as adaptive MCL. You should compare the performance of your implementation to that in the ROS nav-stack (AMCL). You should also investigate methods for obtaining a single estimate of the robot's pose.

You will submit (on Canvas) a two-page report (11-point font, single-space) documenting the design choices made and the results of experimental analysis. Demos will be due in your assigned lab session on November 7 or 8.

Marking Scheme

The following marking scheme will be used for this exercise[1]:

1. Task performance (**5 marks**): how well does that the robot localize in the map of the domain?

2. Design choices (**5 marks**): what design choices were made during the implementation of the algorithm? was an adaptive version of MCL implemented and how good is the performance?

3. Pose estimation (**5 marks**): how is the single pose estimate computed during each iteration of the algorithm? how does this approach deal with multi-hypothesis tracking?

4. Viva (**5 marks**): do team members demonstrate a good understanding of the algorithm and the related trade-offs?

5. Report (**10 marks**): does the report clearly describe the design choices and results of experimental analysis? are the experiments and results presented properly?

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[1]These marks will be scaled suitably for the students in the "extended" section of the module.