Intelligent Systems Project

1. Robot Localization & Navigation

1. 1. Simulation description

A two-dimensional (2D) map is given, where black area represents obstacles and white area represents navigable space. The robot is equipped with a 2D laser scanner that outputs range data about the environment i.e. the relative positions of its surrounding objects in the environment. The robot is also equipped with a Bei-Dou GPS that outputs absolute positioning measurements of the robot in the global reference.

The robot needs to localize itself in the map based on range data, absolute positioning measurements, and certain a priori map info. Based on the localization result, the robot should be able to plan a path and navigate autonomously from an arbitrarily-given start point to an arbitrarily-given destination point.

1. 2. Algorithm coding

Proactively study course materials and extra-course literature, proactively think and reflect, and proactively design and implement an algorithm to fulfill above project task as better as possible.

- Do not modify any part of simulation configurations or any of the auxiliary files that support simulation. Write code only in the areas "**WRITE NAVIGATION PREPROCESSING CODE HERE**" and "**WRITE NAVIGATION CODE HERE**" in the main Matlab script.
- Code only in **Matlab language** so that your script can be directly executed in Matlab.
- At each iteration in the control loop, you **cannot** modify the robot state (i.e. variable **robotState**) or simulation parameters directly. Instead, you can only modify the variable claimed explicitly in the "**Control Input**" list, though you can take advantage of whatever information to compute a new value for the control input to-be-modified.
- At each iteration in the control loop, you **cannot** use the robot state (i.e. variable **robotState**) directly. Instead, the robot state needs to be estimated based on range data [xR, yR], absolute positioning measurements [xA, yA], and certain a priori map info.

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%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% WRITE NAVIGATION PREPROCESSING CODE HERE



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%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% WRITE NAVIGATION CODE HERE
% Range Data
%   [xR, yR] : 2D point cloud represented in the robot coordinates system
% Absolute Positioning System (APS)
%   [xA, yA] : 2D absolute positioning measurement of the robot in the global reference
% Control Input:
%   1) yawrateIn :  steering angle control (lateral control)
%   2) speedIn : speed control (longitudinal control)
%
% ATTENTION:
%   CANNOT USE robotState DIRECTLY !! robotState IS TO BE ESTIMATED

yawrateIn = 0.8; speedIn = 5; % Naoive demo of autonomous control law


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1.3. Paper-style report writing

Write a report following the standard technical paper format (not survey format) of 《自动化学报》(English version)
https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6570654
For paper example, “Traffic signal timing via deep reinforcement learning” by L. Li et al.

- At least six pages in the specified paper format are required for the report.

1.4. PPT presentation and peer evaluation

At the end of this semester, an internal course conference will be organized for all the students to present their project works. The presentation of a student will be scored by all other students and such kind of peer evaluation also plays a considerable role in the final evaluation result. Some “mysterious” guest professors might also be invited as audience at the course conference and give their evaluation.

- Each team gives an oral presentation of 15 minutes and leave 5 minutes for Q&A.

2. Timeline

2022-12-31 (Sat)	Initial submission of PPT & Code
2023-01-04 (Wed)	Course conference
2023-01-06 (Friday)	Final submission of PPT & Code & Paper-style report