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Subj.: Rodolfo's Course Project Proposal – Hiwonder JetAuto LiDAR SLAM



INTRODUCTION

Simultaneous localization and mapping (SLAM) is a critically necessary step in autonomous driving. It allows systems to keep track of their position as they map new or changing environments. This project's goal is to implement SLAM through a 2D LiDAR sensor in a Hiwonder JetAuto Pro. The significance of this project is twofold: first, it implements and demonstrates the real-world application of SLAM using LiDAR (a common approach); second, it establishes a baseline to support research on efficient methods for machine perception.

After completing the project for this course, the working solution will be part of active research on an alternative approach to machine perception. Specifically, it will serve as a comparison to the OWL (Orthogonal, ω , L) method, a fundamentally different approach to handling perception during motion that uses fewer computational resources.¹

PROBLEM FORMULATION

For this specific project, the baseline goal is for the Hiwonder JetAuto Pro robot to navigate through a predefined path while performing SLAM. As input, the robot will use a 2D LiDAR, and the path is provided to the robot as velocity commands (e.g., move forward at 0.10 m/s for 3 seconds, turn left at 0.5 rad/s for 2 seconds, etc.) to complete a predefined closed-loop path in a room. Once the robot returns to the initial point and maps the environment, I will provide three points in the room for the robot to reach (based on the map).

As time permits, an extended goal is to use the built-in camera to find AR tags as waypoints and to actively use the mapped environment to avoid static obstacles. That will increase the system's autonomy, as a person won't have to manually direct the bot for the initial map. Additionally, avoiding obstacles demonstrates a realistic modern application of SLAM.

EVALUATION METHOD

The robot must successfully complete the following tasks:

- Baseline tasks:
 - It must closely map the environment (e.g., correctly map the 3–4 purposefully placed objects along the path).
 - It must successfully reach the three target points provided after mapping the environment.
- Extended tasks:
 - The bot should autonomously navigate and use AR tags as waypoints the first time, during mapping.
 - The bot should stay collision-free during the navigation, avoiding obstacles on the route.

¹ See: <https://arxiv.org/abs/2603.05686>