



UNIVERSITY OF CALGARY

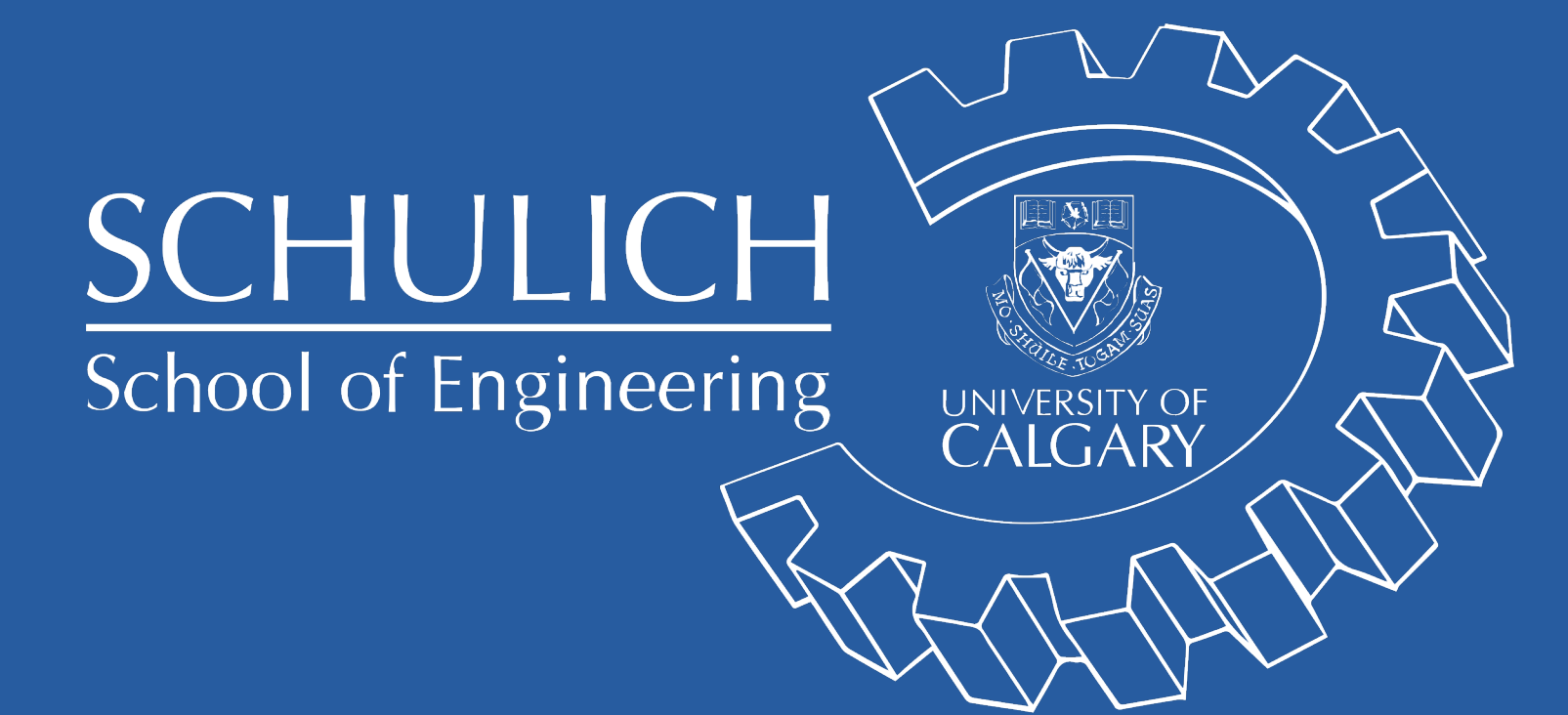
# Wayfinder

## A Differential Drive Autonomous Mapping Robot

Sponsor: Dr. Mahdis Bisheban

Team 14: Charlie Zheng, Elizabeth Tang, Lisa Cai, Mohammed Mustafa, Zhanhao Wang

Department of Mechanical Engineering, University of Calgary



### Project Goal

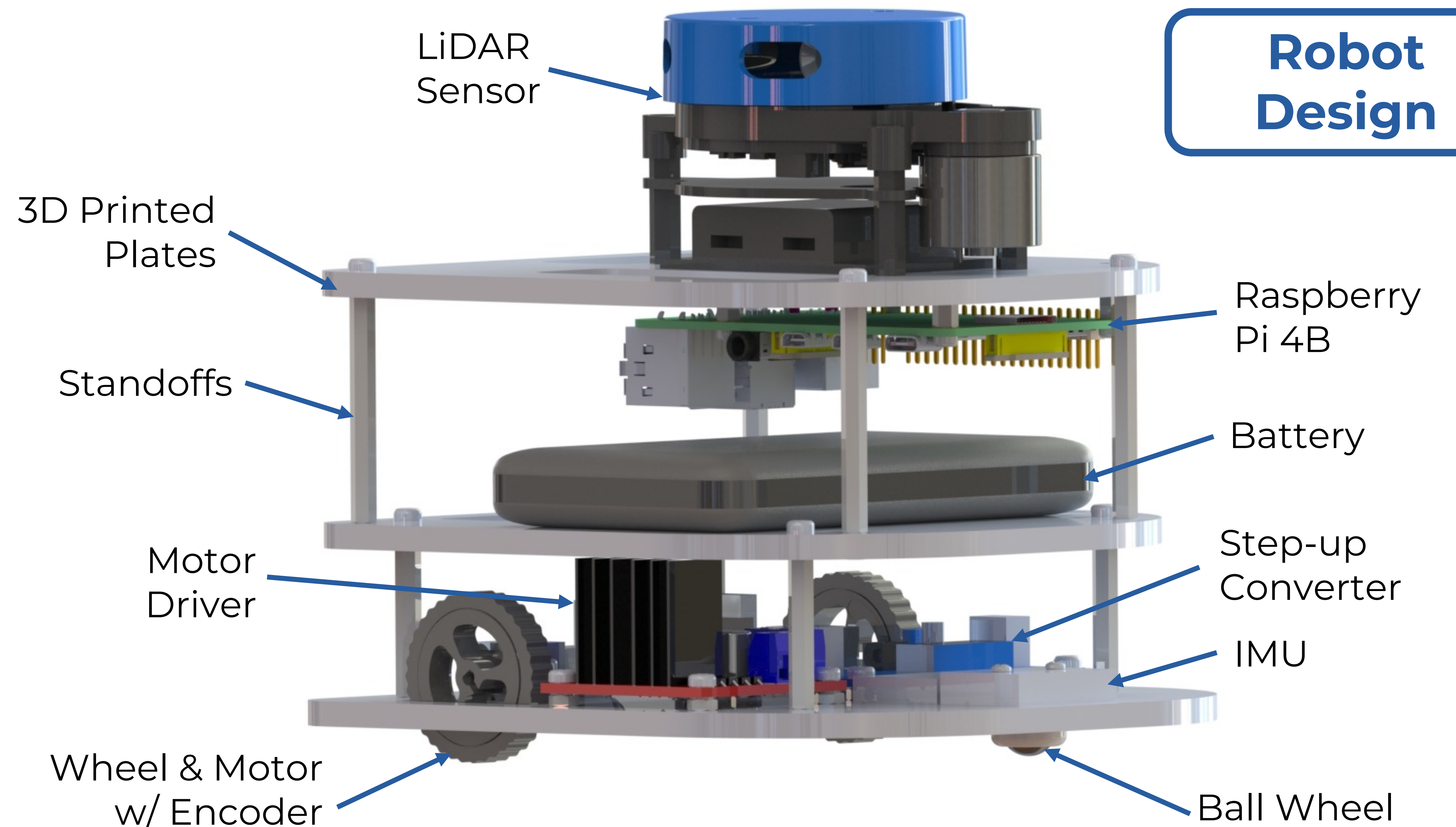
Design and prototype a differential robot that can autonomously navigate and map a maze.

#### Requirements:

1. ROS-compatible autonomous mapping
2. Localization within  $\pm 2.0$  cm
3. PIDF velocity controller (steady-state error less than  $\pm 0.5$ cm/s with no overshoot)
4. Physical envelope: 15 cm x 15 cm x 15 cm
5. Total cost below \$200

# ROS

### Robot Design



### Applications

- Search & Rescue
- Autonomous exploration
- Mapping of indoor areas
- Indoor delivery
- Academic research

### Framework

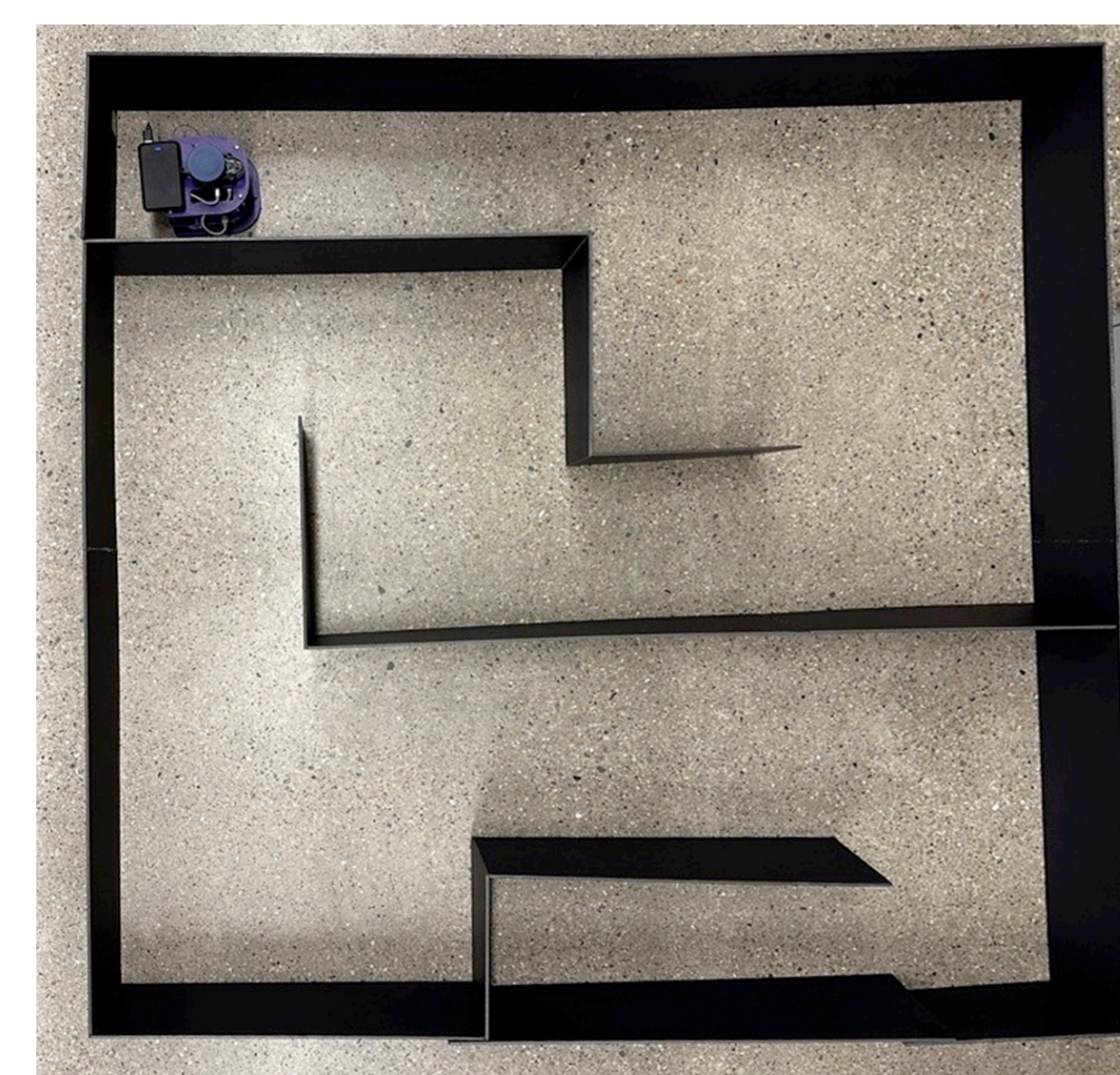
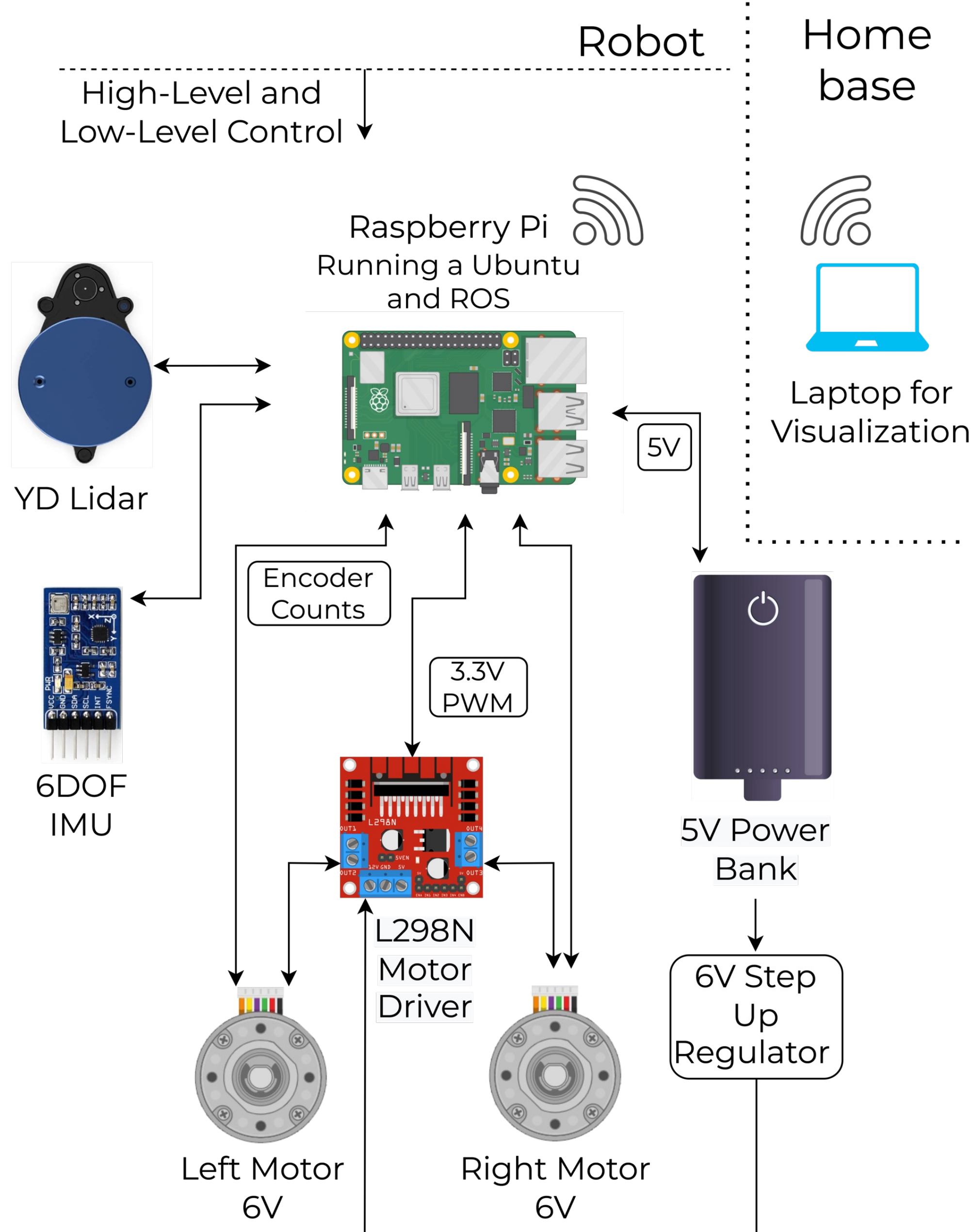
ROS runs on the Raspberry Pi 4B which use peripheral sensors to allow the robot to map and localize. The motors are both controlled via PWM signals and encoder counts are read back to the Pi. The homebase displays a live map of the surroundings.

### Path Planning, Localization, and Navigation

Wayfinder uses motor encoders, an IMU, and data from the LIDAR for localization. Additionally, the data from the LIDAR is used to build a map of the explored regions. The explore\_lite ROS node is then used to autonomously determine a new frontier and the move\_base ROS node plans a path to avoid obstacles and reach the target location.

### What's Next?

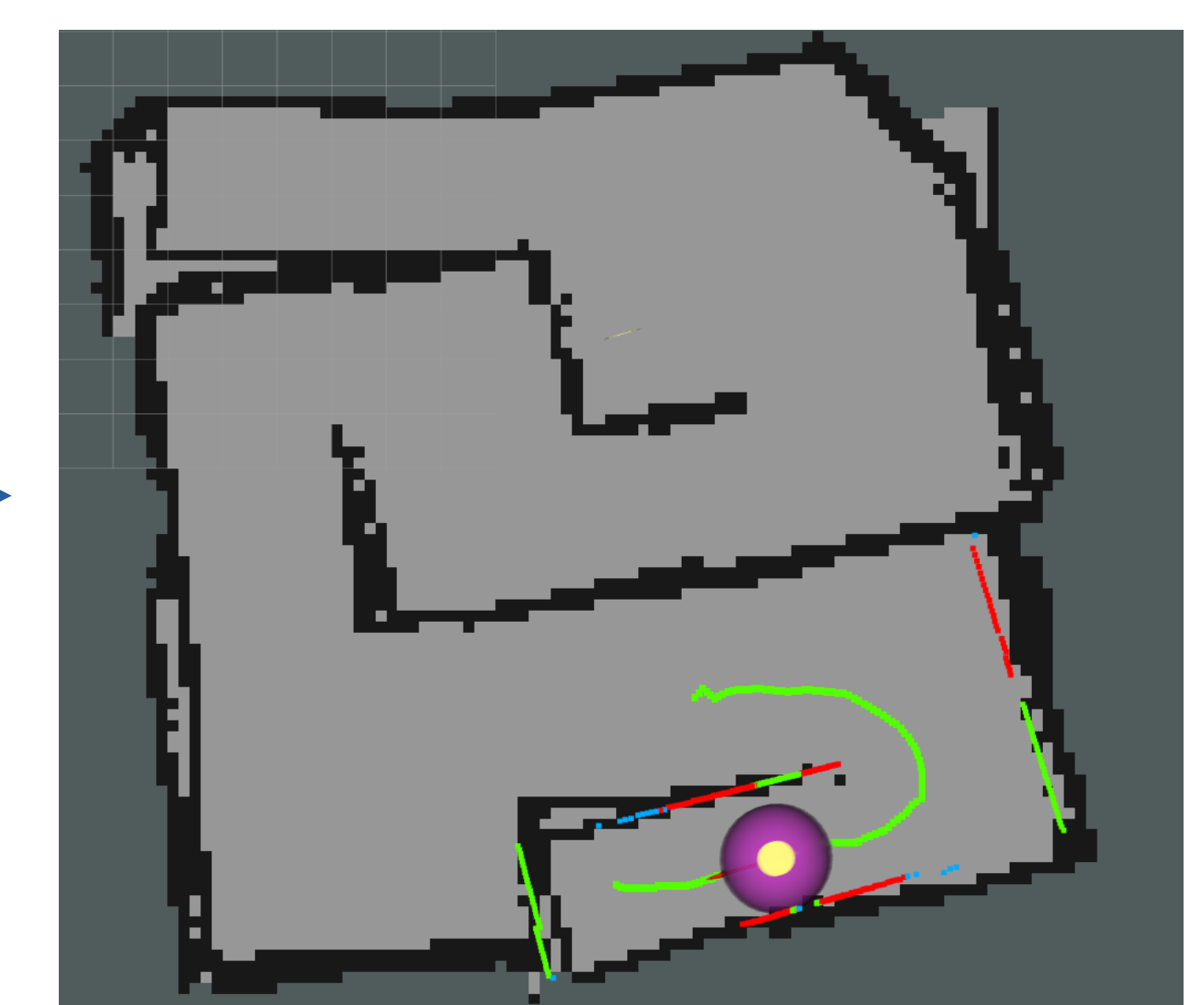
- Integrating multiple robots to produce a shared global map
- Optimizing localization and path planning algorithms



Physical Maze



Partial Exploration



Completed Exploration