



Racing the Future,
One Tenth at A Time

AutoTenth

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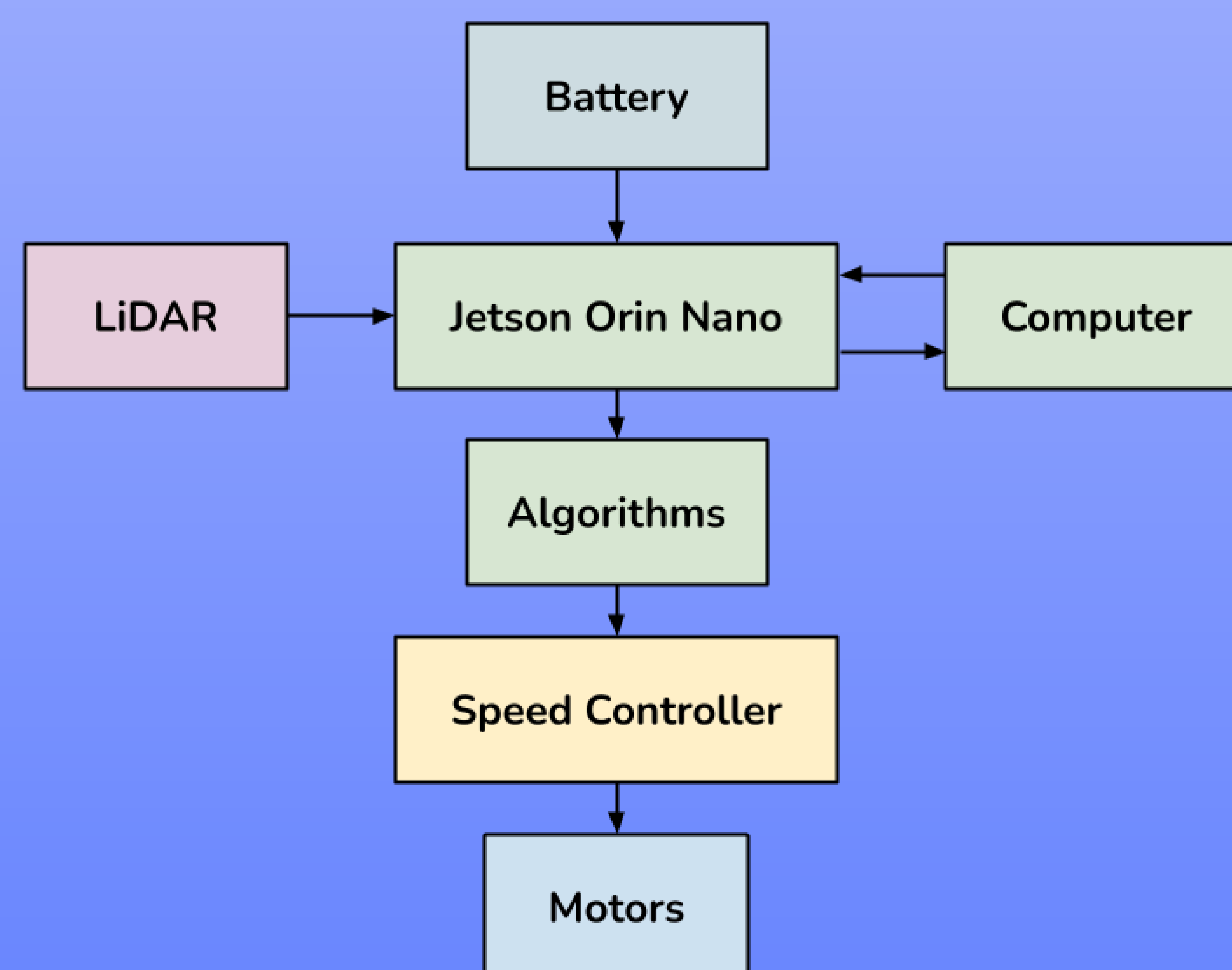
Background

This project investigates how a small-scale autonomous race car can effectively navigate complex tracks in real time by integrating advanced sensing and control technologies to enhance autonomous driving performance in a safe, efficient, and scalable manner.

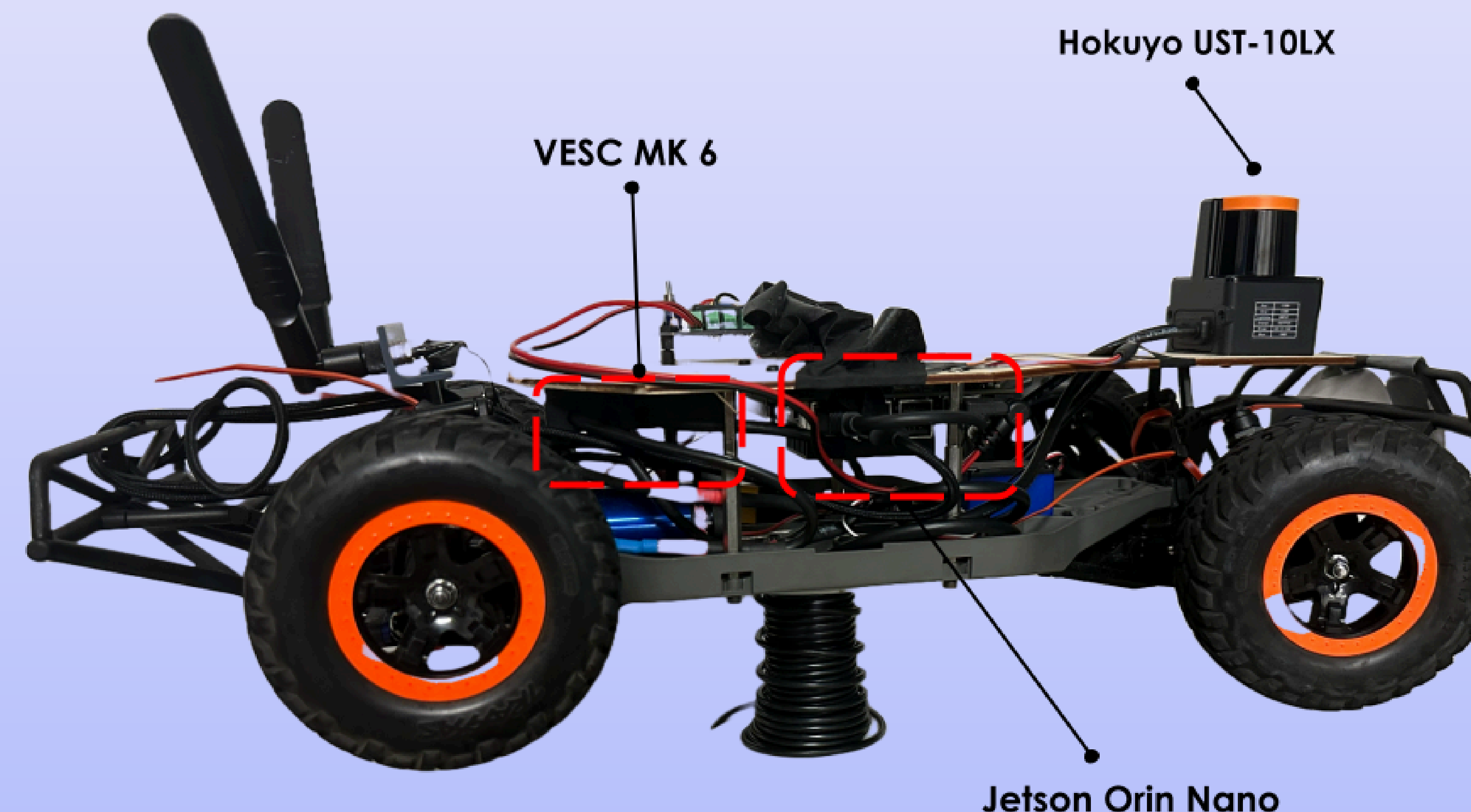
Overview

AutoTenth is a fully autonomous race car equipped with a Hokuyo UST-10LX LiDAR, Nvidia Jetson Orin Nano, and a VESC 6 speed controller. The LiDAR sensor data is processed in real time utilizing ROS2, enabling path-planning through reactive algorithms and mapping with SLAM. These algorithms were tested in simulation environments (Gazebo), providing a controlled platform to validate performance before deployment on the physical vehicle.

Block Diagram

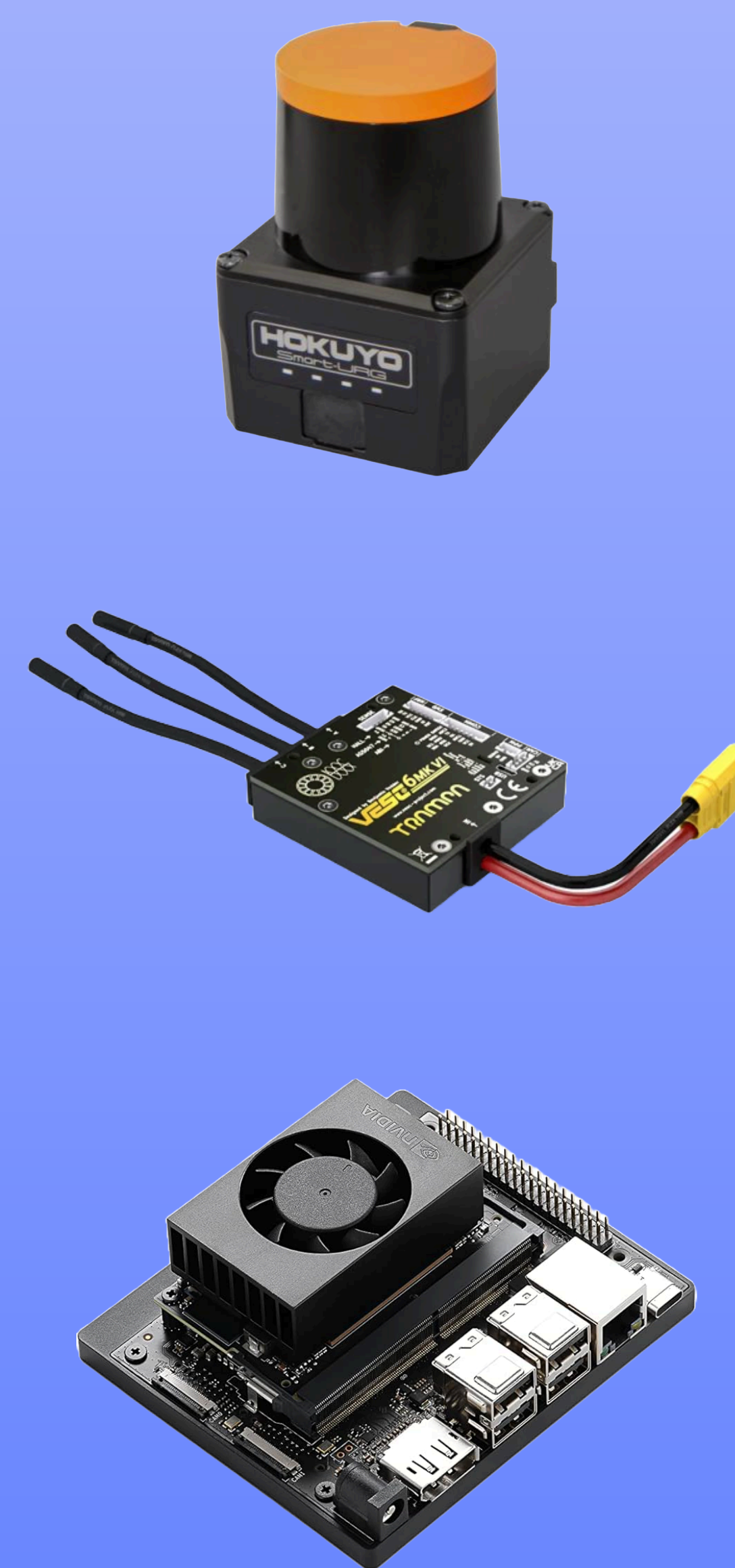


Final Design



Our completed racecar with optimal component placement for data collection and protection.

Key Components



Hokuyo UST-10LX

2D LiDAR with high-speed and accurate measurement data with its 40 Hz sampling rate in a 270° field-of-view up to 10 meters.

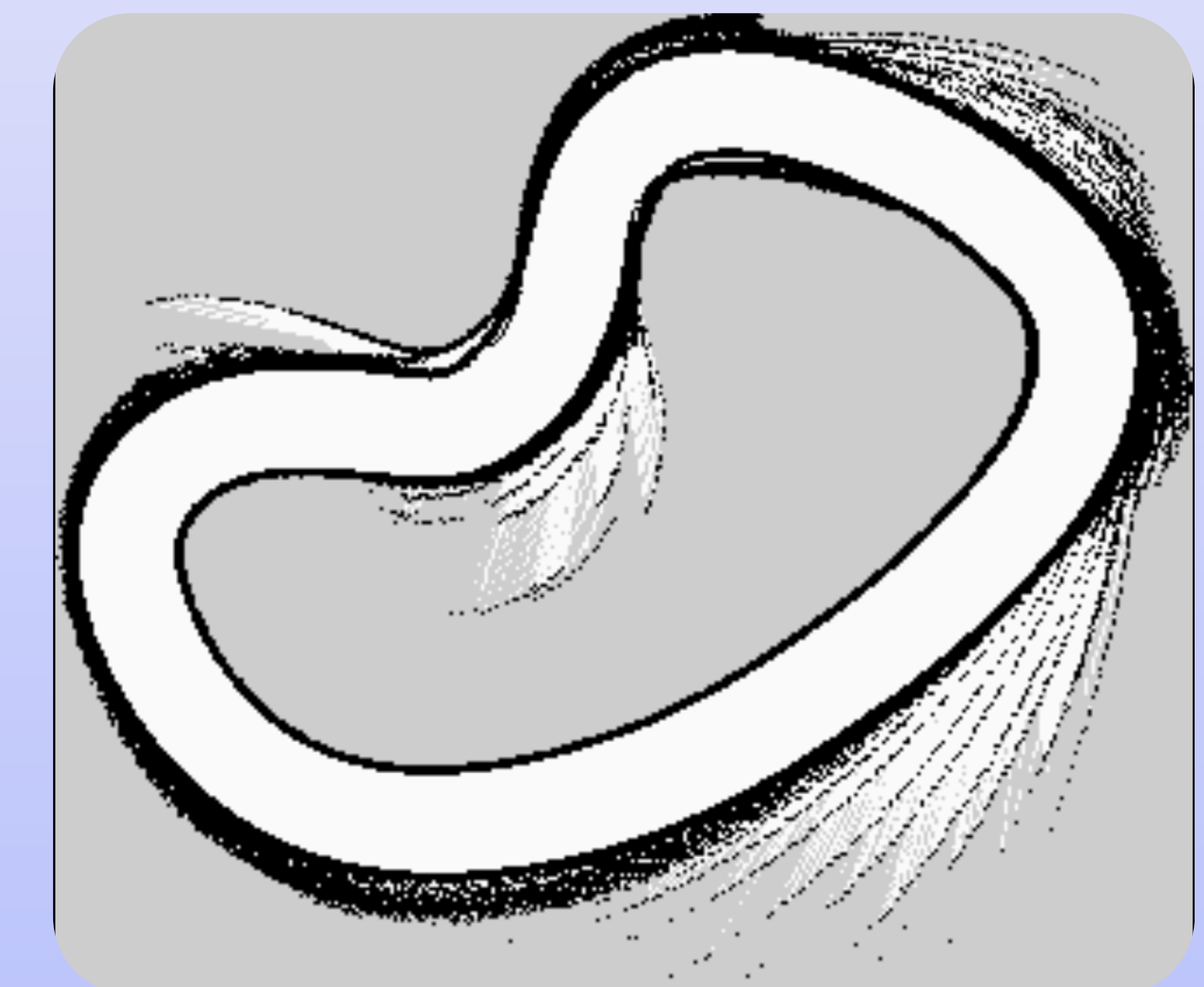
VESC MK 6

The Vedder Electronic Speed Controller controls the speed and torque of the brushless DC motor and the servo motor for steering.

Jetson Orin Nano

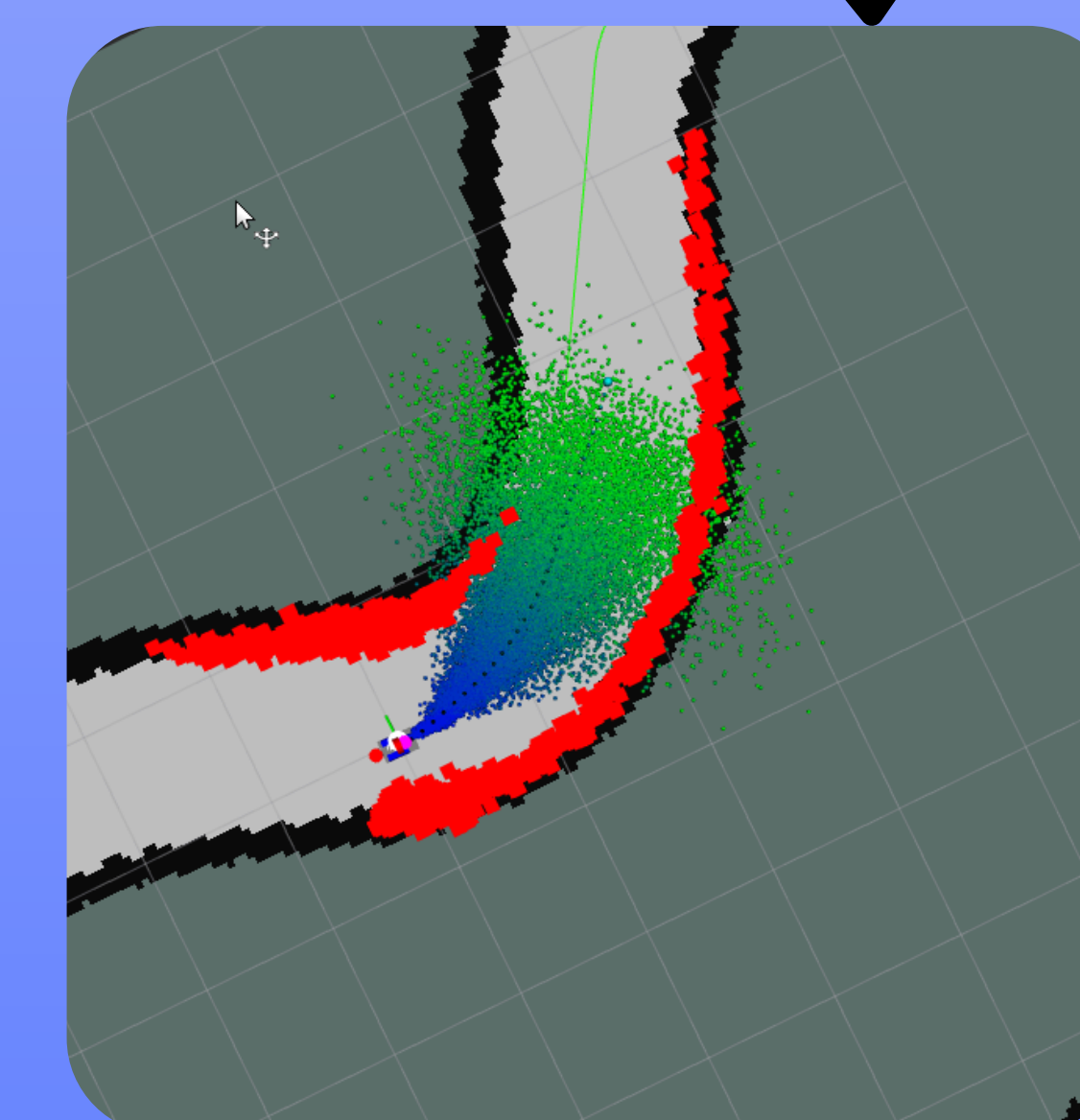
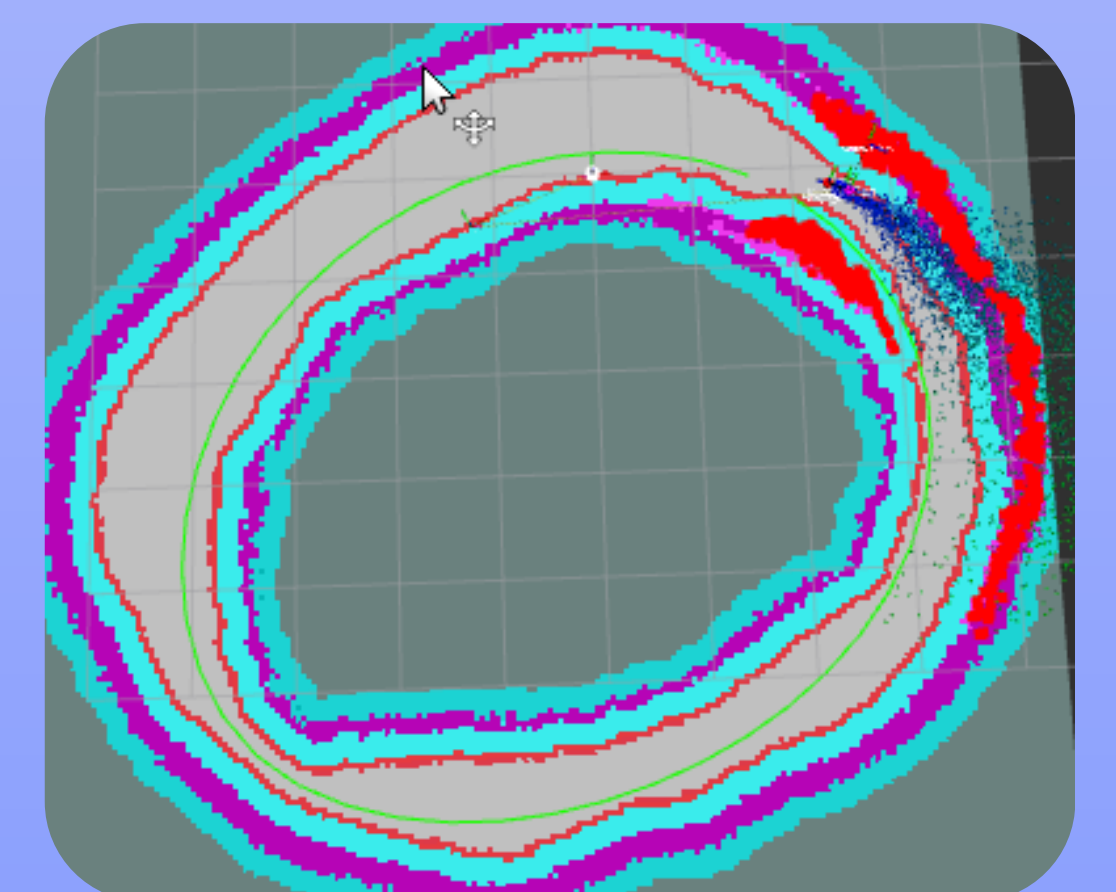
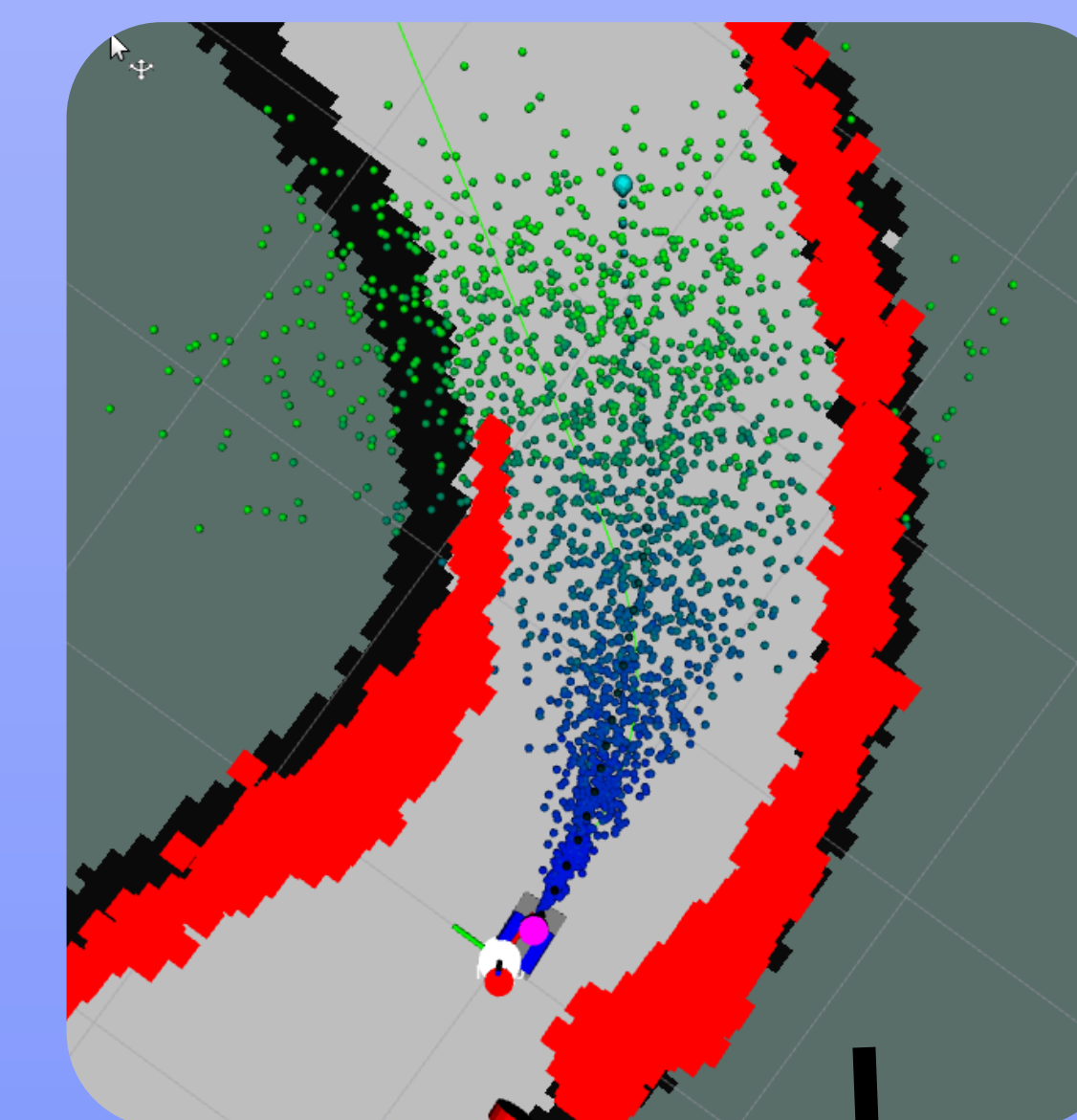
A powerful GPU focused computing device with 6 core ARM CPU and Jetpack (Custom Ubuntu based operating system).

Simultaneous Localization and Mapping (SLAM)



- ROS2 gives us access to essential tools like the SLAM Toolbox
- Enables us to create maps of the tracks and the car's location within it
- Sensor fusion allowed for the best estimate of the car's odometry

Nav2 and Raceline Optimization



- Nav2 includes global planner and local controller
- Provides car with optimal route of the map created from SLAM
- MPPI controls the car by sampling trajectories — more samples improve tracking and responsiveness

Acknowledgements

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