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WINLAB | Wireless Information Network Laboratory

Self Driving Vehicular Project 2026

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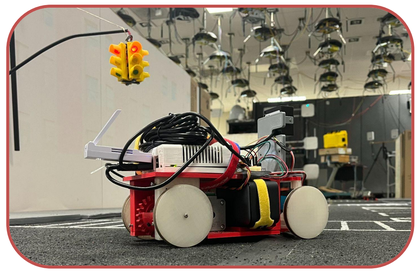
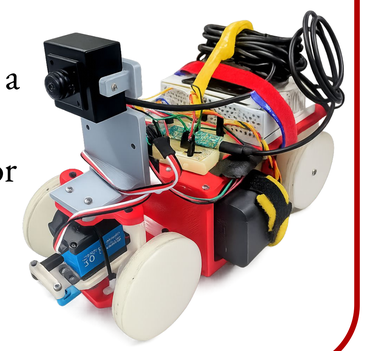
Overview



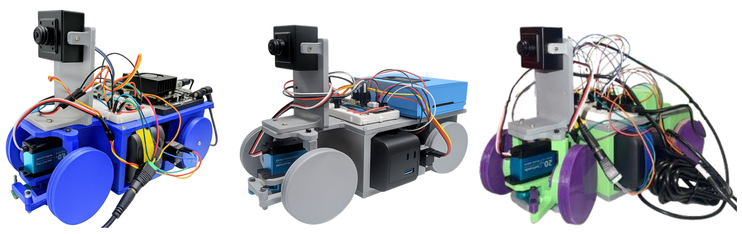
This project explores a cost effective, reduced scale platform for autonomous vehicle development.

- Trained a convolutional neural network using a custom-built model car in a smart city environment.
- Developed a framework for simultaneous training of multiple autonomous vehicles.



New Cars and Software

- Built 3 New Cars
  - Bandit: Uses NVIDIA Jetson Orin Nano
  - Scamp: Uses NVIDIA Jetson Orin Nano
  - Brat: Uses Raspberry Pi 5

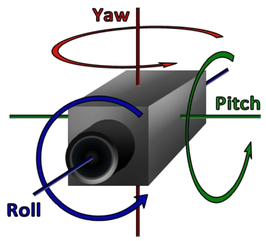


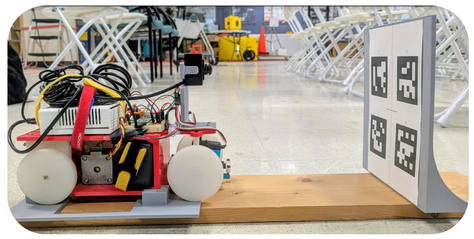
- Migrated from ROS 1 to ROS 2
- Repurposed old Sunfounder Picar-X to behave as NPC car
  - Experimented with Raspberry Pi 5 and line-following feautre
  - Developed premade paths to mimic traffic

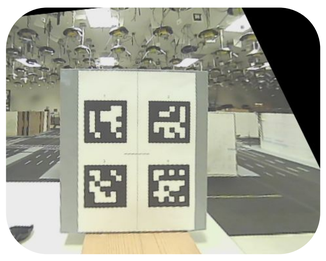
Camera Calibration

Extrinsic calibration is used to standardize the camera's position and angle.

- Extract camera position (x, y, z) and angles (roll, pitch, yaw)
- Perspective transform to ideal position/angle

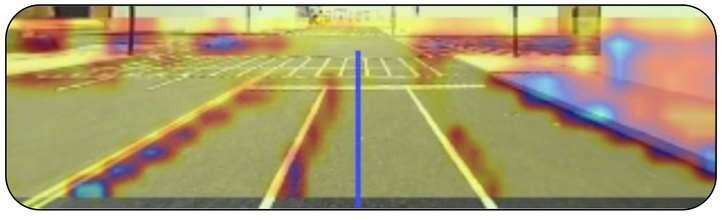






Training Pipeline

- Expanded the training framework to enable multiple cars to be trained with a common dataset and training pipeline.



- Improved upon previous model, Discrete Waypoint, which uses three bin detection for intersection recognition.

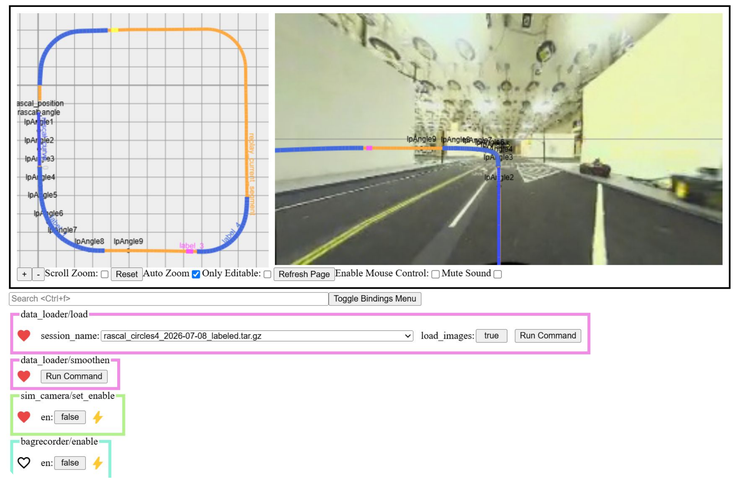
Editing Data

Recorded video of the car driving around all paths in the city.

Replayed and edited the data using a web display where we can:

- Delete unwanted segments of data
- Label intersections
- Label turns
- Add lookahead points along path

ROS Web Display



Future Work

- Create new wallpaper with exact images of Amsterdam Avenue and Broadway on the model city.
- Implement object avoidance capabilities, including autonomous stopping for pedestrians and other vehicles, and lane changing protocols.

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