

Self Driving Vehicular Project 2025

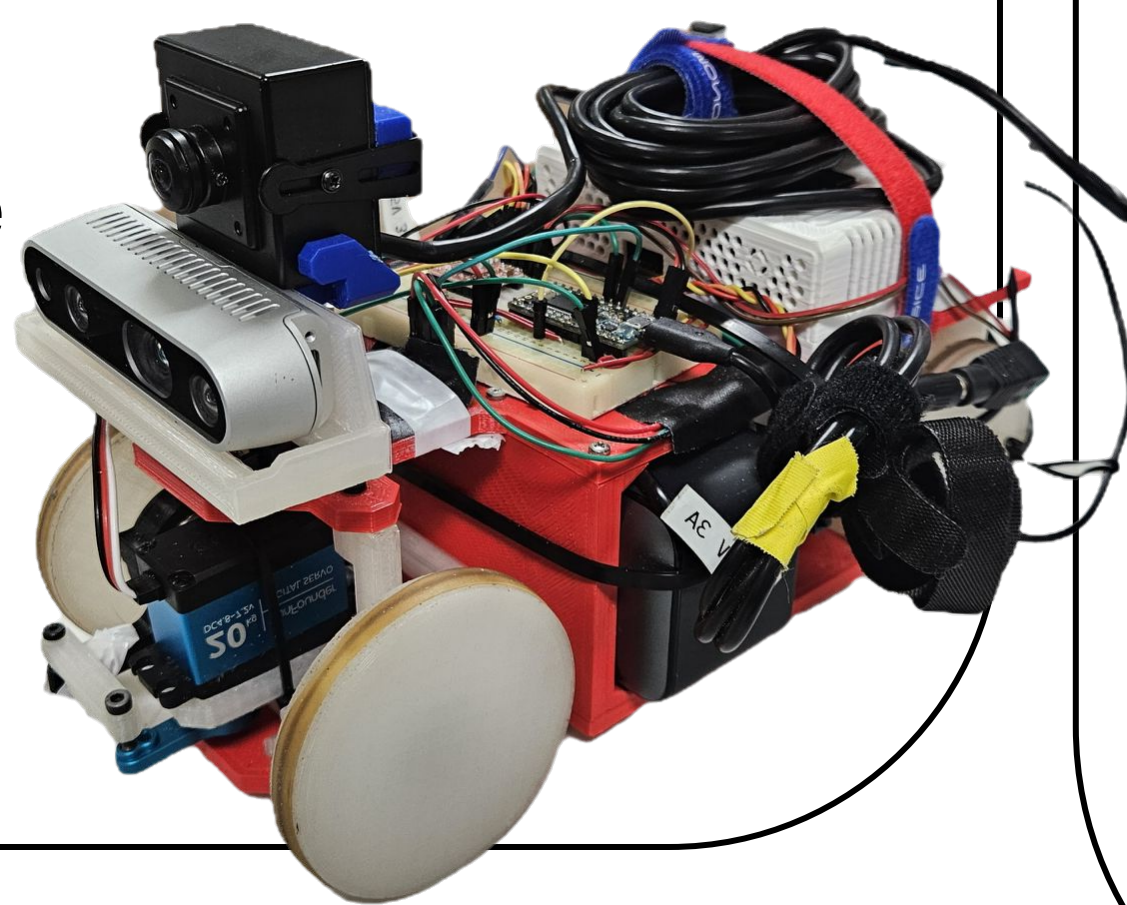
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Overview

Most autonomous vehicles use multiple cameras, radar, and LiDAR to detect road lines and objects. The goal of this project is to **explore and improve the reliability of more affordable and safer alternative** that maintains realism.

Using a custom made model car, we **trained a convolutional neural network** by driving it in the smart city environment.

Our focus was on **refining preexisting models** to help guide the car from a start point to the destination.

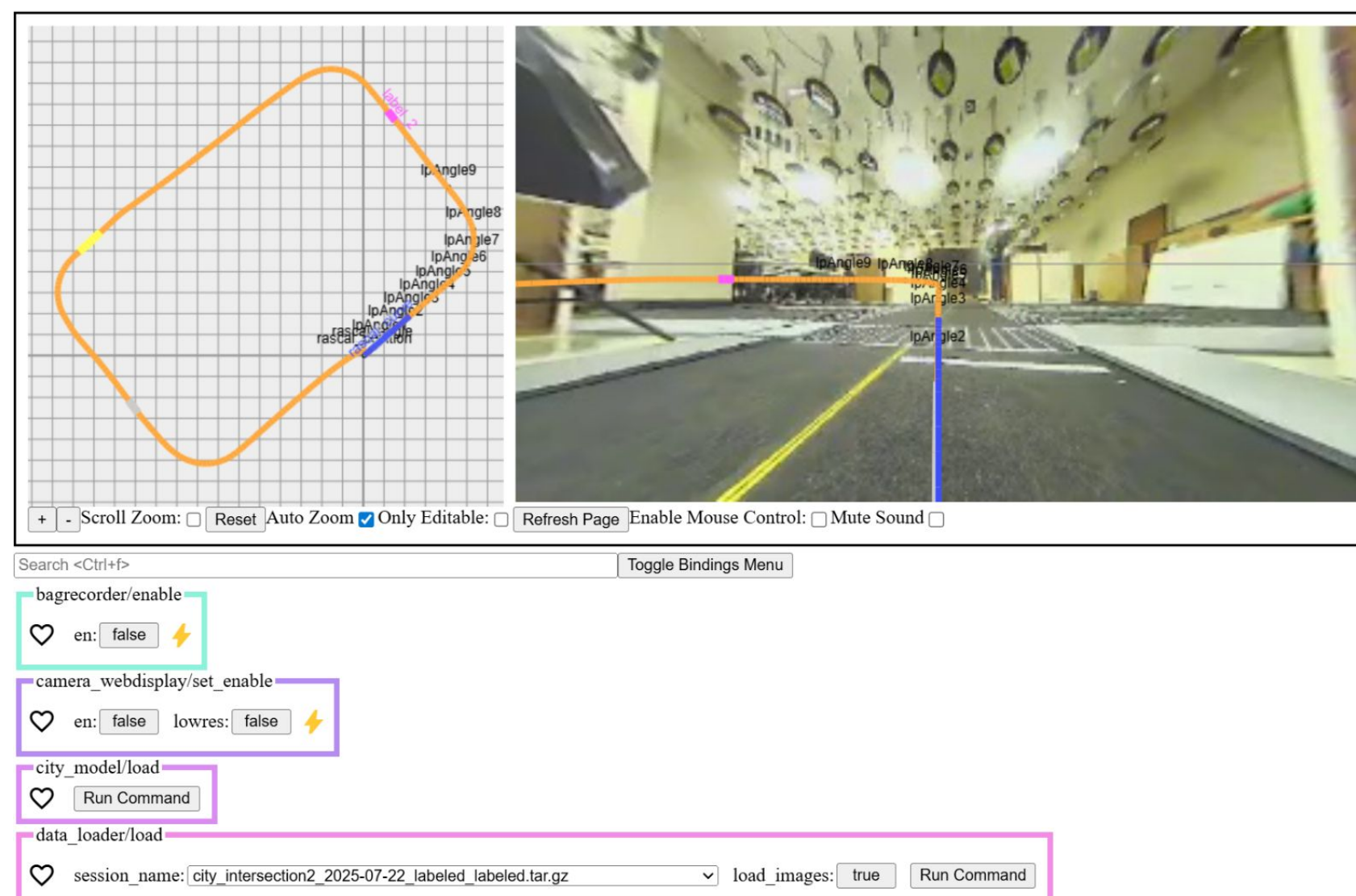


Data Collection

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

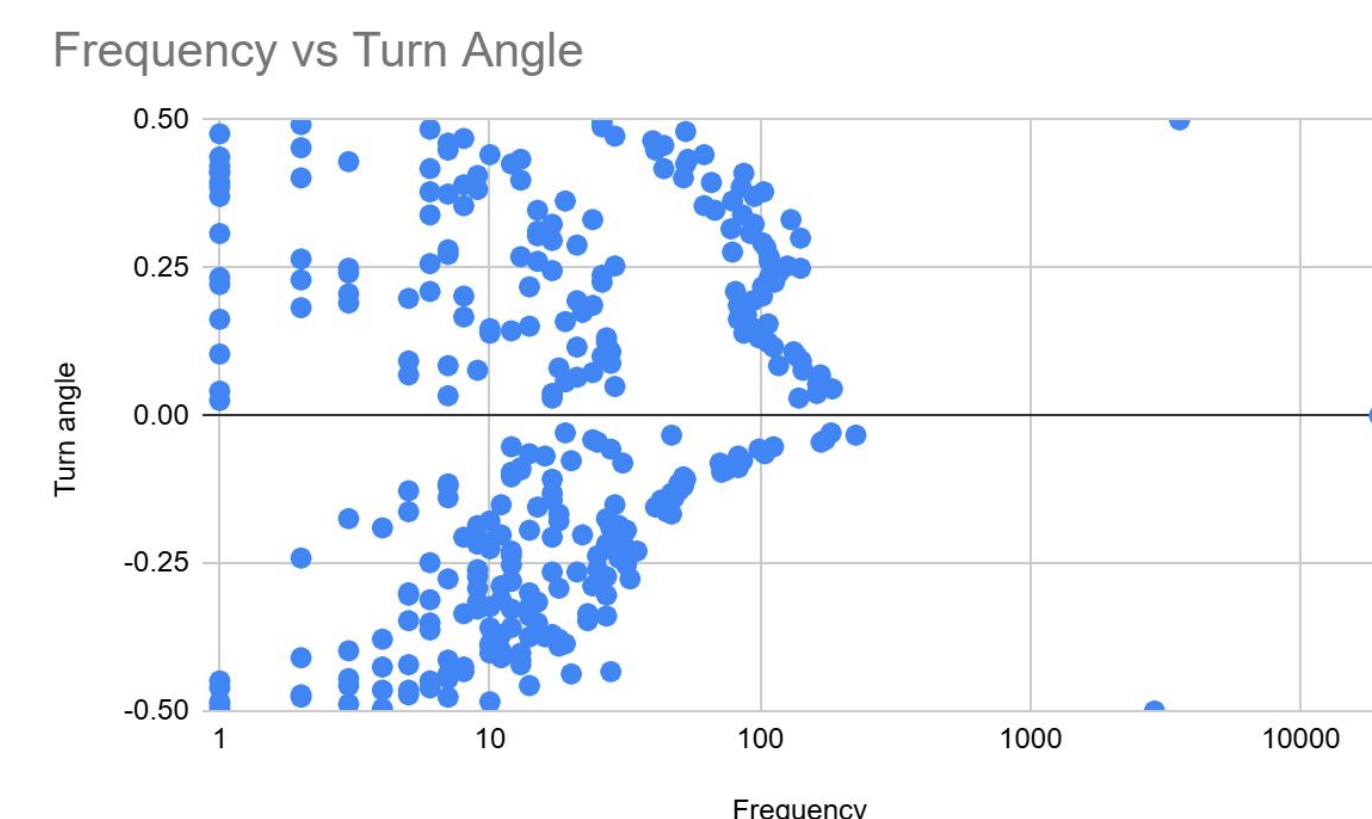
Replayed and edited the data using a **web display** where we can:

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



Discrete Waypoint Model

- Improved upon previous model, **Discrete Waypoint**, which uses **three bin detection** for intersection recognition
- improved the training pipeline: **data is now sorted without bias towards the right bin** at a split intersection making labeling more even between left and right turns
- Added **two more inputs** to the linear layer of the Convolutional Neural Network to allow for more precise turning
- Threshold for new inputs was determined using all training data

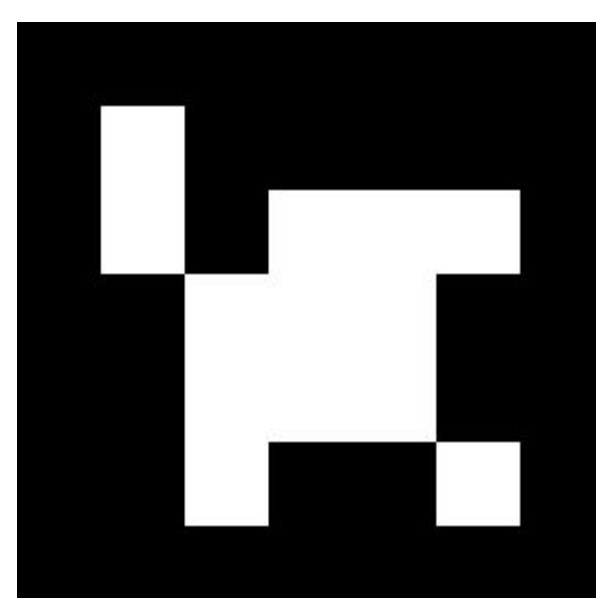
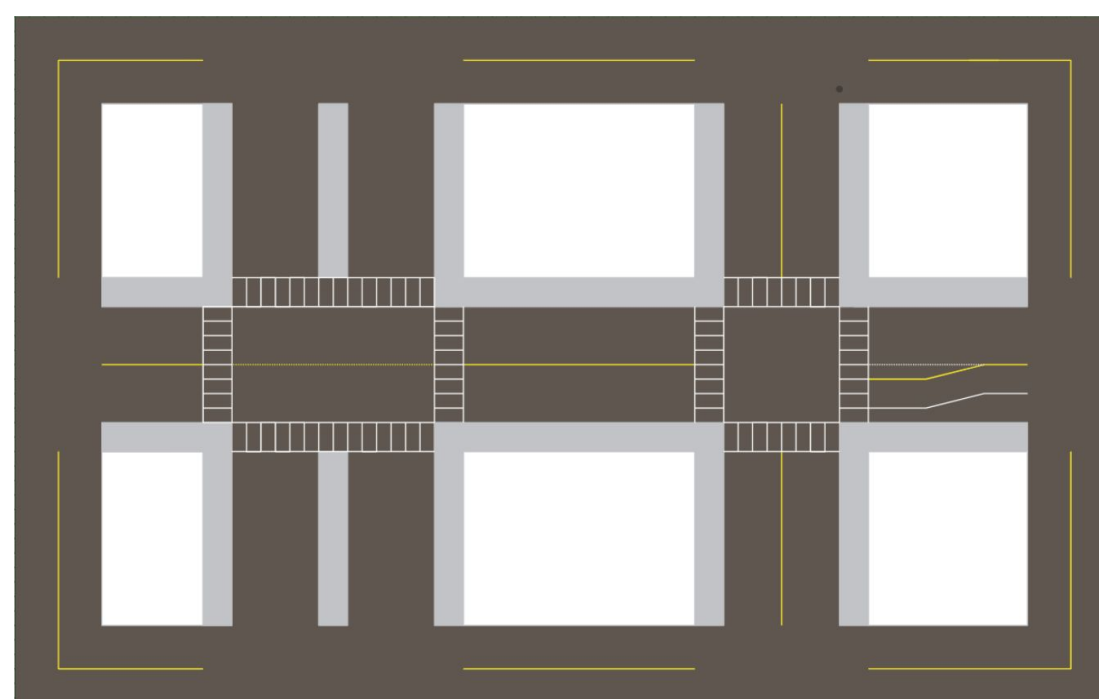


- When the bins diverge by more than 30 degrees, the car has reached an intersection and stops
 - The user would **select a bin** for the car to follow

ArUco Detection

The upward facing RealSense camera detects ArUco markers placed on the orbit nodes. This allows the **car to determine its location** in the city.

- **Scaled map** of the city was created at 6-inch resolution

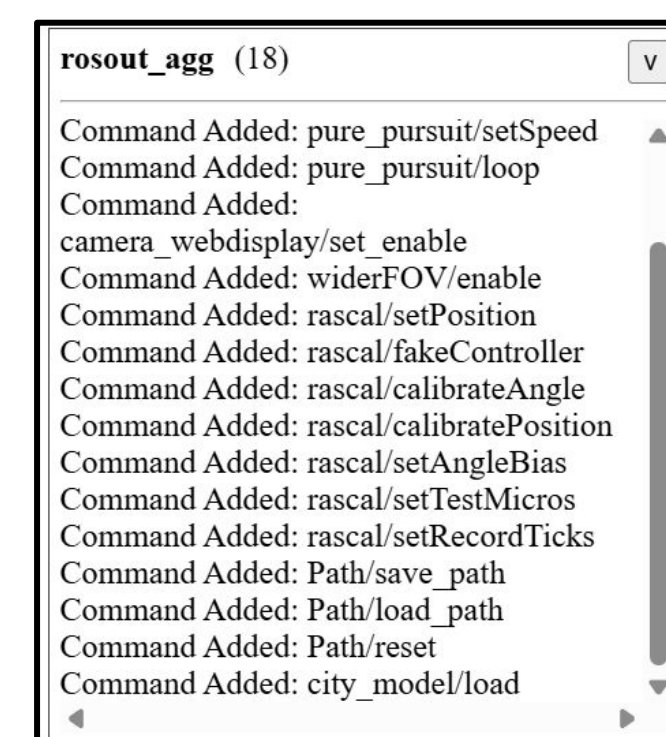


- ArUco markers placed in a 3 ft grid, allows for **localization** and **global positioning**
- Position averaged from multiple markers

Results

Car drives along a path → Reaches intersection and stops → User picks a direction for car to follow

Continues along a path until next intersection ← Turning flag activated until turn completed



Future Work

- **Label streets and buildings** with names corresponding to intersection in real life
- Update model to be able to follow a **preprgorameed route**
- create a new model to use **global location from ArUco markers to make turns**, rather than using bin detection
- Implement lane changing