Using Mini Cars to Test Autonomous Driving Algorithms for the Real Streets

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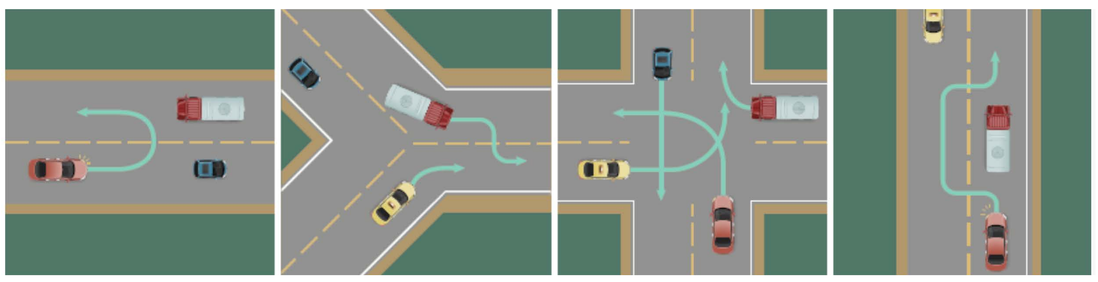
Objective

Testing autonomous vehicles in high risk situations is difficult and expensive. Small scale testing provides opportunities to safely and inexpensively test algorithms in real world conditions before implementing them on full scale vehicles. Our team has developed and testing algorithms to control small scale experimental cars for optimized traffic intersections and orderly highways with no slowdowns. This code will be scaled up to full sized vehicles summer of 2022.

The project used an off the shelf iPhone for raw data capture. The software stack implemented an iOS application that takes advantage of the onboard LiDAR for iPhone 13+, the Internal Measurement Unit (IMU) and the Camera for 3-D Simultaneous Localization and Mapping (SLAM)

Results

We developed code to execute an intersection with controlled velocity, and no stop light. The cars sense each other and pass the intersection while slowing their speed but not stopping. This code will be scaled up to full sized vehicles, and controlled vehicle following behavior will be tested at Richmond field station over the summer months. The example scenarios developed are shown in **04** below.



04 Several traffic scenarios (U-turn, Lane Merging, Intersection, Overtaking)

Future Work

Our research represents the first phase of effectively testing and scaling up code to full-sized passenger vehicles. We aim to identify pain points in adapting the code base, dynamics, and controls algorithms, and to streamline solutions. We seek to make these methods low cost and open source.

05 Robotic Autonomous Racing: 1/10 scale autonomous synchronized motorcade

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