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Progress Report - Phase B Completion

Summary

As discussed in the Application to Test Highly Automated Vehicles (HAVs) on Public Ways in Massachusetts that was approved on 05/31, Optimus Ride is committed to sharing key data publicly so as to ensure public transparency of the results of the testing that is occurring. During the period of 06/06/17 - 09/15/17, Optimus Ride autonomously drove well over 100 miles on public roads. As of 09/15 our total driving mileage within the Marine District is 184 miles.

This testing allowed us to experience the unique challenges of the Marine District such that we can ensure safe driving specific to our location. These datasets were collected with three of our five approved vehicles.

The public roads used for these data collections are the roads listed in our Application to Test Highly Automated Vehicles (HAVs) on Public Ways in Massachusetts, which are also listed below:

- 6th Street
- Ballard Way
- Black Falcon Ave
- Channel Street
- Design Center Pl
- Drydock Ave
- Fid Kennedy Ave
- Harbor Street
- Northern Ave
- Seafood Way
- Silver Line Way
- Tide St

All of the above roads are located in the Raymond Flynn Marine Park, Boston's designated autonomous vehicle testing zone. The testing occurred in a variety of environmental conditions including, but not limited to, the following:

- sunny, fair weather conditions
- overcast conditions
- light rain (<2.5 mm/hour) conditions
- high sun and low sun conditions
- light and heavy traffic conditions

In Phase B, we ensured safety by taking the necessary measures in order to have successful testing. This measured approach was implemented by executing tests in a staged process. We began our testing at relatively low speeds, in a constrained area, and with attention to high traffic periods. This allowed us to perform the necessary tests on the public roads while ensuring safety and robustness before increasing complexity. After robustness was achieved within lower complexity operations, we were able to ramp our testing appropriately by increasing the speed, expanding the testing area, and testing at higher peak periods. This measured approach has enabled us to execute test safely, without any accidents.

As for driver disengagements, many of our disengagements were due to poor road conditions, generally around construction zones. While developing our vehicles, we aim to first train the platform on nominal conditions with low complexity. From the nominal conditions, our approach is to introduce complexity while staying within the guidelines set by the MassDOT Driving Manual. Construction activities created an environment that drastically deviated from nominal, creating complex traffic conditions. Such conditions include construction activities that occupied over half of the lane of travel, requiring our vehicle to travel across double yellow lines into the opposing lane of traffic. Road conditions in or around construction zones include significant dust covering on lane markings rendering them unable to be seen, large steel plates on top of the road surface and over lane markings, and unsurfaced roads with significantly uneven surfaces. An example of poor road conditions due to construction is the current state of Harbor St as of September 5, 2017. In these sorts of conditions, we have trained our safety drivers to disengage from autonomous mode. As such, we are able to amass a large wealth of data on these edge case conditions in order to stress test our platform in simulation. To help improve our testing, detailed correspondence regarding construction zones and lane closures would be incredibly beneficial.

Research Achievements

Phase B, the outdoor testing phase, was and continues to be a significant asset in our testing cycle. Interactions with other vehicles and imperfect road conditions serve to teach our vehicle about the realities of driving on public roads. There are many pieces of our technology that greatly benefit from autonomous driving on public roads to assess how different components and subsystems contribute to overall ride comfort. Some metrics that define ride comfort include longitudinal jerk, lateral jerk, and estimation error. Driving on public roads also allows us to encounter a multitude of scenarios organically, including edge-case scenarios. Some of these scenarios have led us to add different features to our technology that address these issues and overall improve our system and our ride comfort. Examples of such scenarios include intersection handling with vehicles that do not come to a stop or respect right of way, handling trucks that make significantly wide turns or cut across our lane during turns, and double parked cars that obscure the field of view for oncoming traffic. These scenarios have allowed us to make great advances in our technology that address real events, resulting in an increasingly sophisticated product.