QUARTERLY AV TESTING REPORT

1st QUARTER 2018

© 2017 nuTonomy

BACKGROUND

nuTonomy develops autonomous vehicle (AV) technology. Since January 2017, we have been testing our AVs on the public roads in Boston. In November, we joined forces with Aptiv, a global mobility technology company. nuTonomy and the City of Boston have agreed to a Test Plan, which asks nuTonomy to report on our AV testing quarterly. This Report covers our progress during the First Quarter of 2018.

The First Quarter was nuTonomy's second winter testing in Boston, and our first winter testing in the expanded Seaport area. The current state of our AV technology allows us to safely test AVs, under certain conditions, in light and moderate rain and fallen or lightly falling snow. This winter we gained more experience driving on roadways covered to varying degrees in snow, roadways with obscured lane markings, and roadways partially obstructed with snowbanks. Fully autonomous driving in winter weather conditions remains a difficult technical challenge. We are committed to overcoming that challenge, and our testing in Boston is critical to that goal.

Our public road testing in Boston proceeds in tandem with our closed-course testing. At the end of the First Quarter, nuTonomy executed a license agreement to access a new closed-course testing facility in Devens, Massachusetts. The Devens facility includes a former airfield and a network of unused roads that previously served a military residential community, called Salerno Circle. We will be using the Salerno Circle area to conduct safety and maneuver tests in a realistic, but low risk environment, as part of our road release process.

SUMMARY

Miles Driven

As we stated in our Third Quarter Report, nuTonomy has exceeded the 600 autonomous miles required for Phases B1, B2, C1, and C2 of the Test Plan. As always, it is important to note that our autonomous driving in Boston represents a small fraction of the total amount of our autonomous miles driven globally, due to the larger fleet, operations team, and testing area we have available in Singapore. But we view our Boston testing as high leverage—each mile on the Seaport's complex and traffic-dense roadways provides significant technical feedback for developing our AV software.

Locations Driven

We operate our AVs on Drydock Avenue, Summer Street, Dorchester Avenue, Congress Street, Tide Street, Northern Avenue, Black Falcon Avenue, and various small connector streets. We operate in manual mode on certain streets in the Seaport owned by Massport. Additionally, we conducted safety testing of our AVs in a closed course environment on a private test track and will do so going forward at the Devens facility.

Crash Reports

We have not produced any crash reports, because our AVs have not been involved in any collisions during our testing in Boston.

Failures with Autonomous Mode

We did not experience any unanticipated failures with or disruptions while driving in autonomous mode. As we explain below in greater detail, in certain traffic scenarios our safety drivers take over manual control because of known limitations of the current state of AV software.

© 2017 nuTonomy

SUMMARY

Takeovers

nuTonomy's safety drivers take over manual control in any situation in which they feel uncomfortable or unsafe. During the First Quarter, our safety drivers took over manual control of our AVs in the following situations:

1. in certain situations when pulling over to the curb for simulated or actual passenger pickup or dropoff;
2. when emergency vehicles were in active operation (e.g., sirens and lights activated) in the roadway;
3. when law enforcement officers were manually directing traffic in intersections through which our AVs were travelling;
4. in certain situations in which construction vehicles were obstructing our lane of travel;
5. in certain situations in which oncoming vehicles or bicycles violated lane boundaries;
6. when other vehicles were exhibiting erratic behavior near our AVs;
7. when the roadway was flooded; and,
8. in certain situations in which large snowbanks obstructed the lane of travel.

A safety driver's decision to take over manual control in a given situation does not necessarily indicate that continued autonomous operation in those situations would be unsafe. Because we instruct our safety drivers to err on the side of caution, we expect that takeovers will occur in many situations in which the AV would have handled the situation without incident. We are continuously improving our AV software, and we are confident that our AVs will be able to handle each of these situations without a takeover after further development.

LEARNING

What We Have Learned

During the First Quarter, nuTonomy began to integrate our operations with Aptiv's pre-existing AV research and development program. Aptiv is testing AVs on the public roads in Las Vegas and Pittsburgh, in addition to nuTonomy's testing in Boston and Singapore. As we have learned more about those sites, we have more insight into local differences in traffic behavior and the extent to which those differences matter for AV testing.
We have observed important differences in:

1. traffic light patterns;
2. local rules for stopping on the roadway for passenger pick up and drop off (e.g., prohibited in Las Vegas);
3. local techniques used for double parking (a source of surprising and interesting variation);
4. the volume of cyclists—and motorcyclists; and,
5. the presence of new personal mobility devices (e.g., electric scooters).

nuTonomy's mission is to radically improve the safety, efficiency, and accessibility of transportation in cities worldwide. To fulfill that mission, we need to build technology that can scale and adapt to a variety of driving conditions. There are only a few companies around the globe testing in such a diverse set of environments as Boston, Las Vegas, Pittsburgh, and Singapore. We are grateful to Governor Baker and Mayor Walsh for making Massachusetts a critical part of our global AV testing program.

IMAGES

Closed course testing in snow

Aptiv testing in Las Vegas