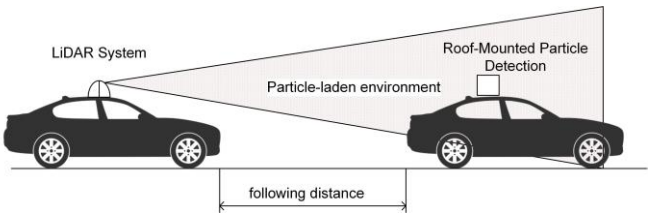
Can Automated Vehicles "See" in Minnesota? Ambient Particle Effects on LiDAR Systems



Background

MnDOT needs assistance researching ambient particle effects on Light Detection and Ranging (LiDAR) systems. This contract will use a combination of laboratory experimentation and road demonstration to better understand the reduction of LiDAR signal and object detection capability under adverse weather conditions found in Minnesota. It will also lead to concepts of improving LiDAR systems that adapt to such conditions through advanced signal-processing image recognition software. In a recent Bloomberg News article entitled; "Self-Driving Cars Can Handle Neither Rain nor Sleet nor Snow", it was stated that; "The ultimate hurdle to the next phase of driverless technology might not come from algorithms and artificial intelligence—it might be fog and rain."

Project Goals

- Advance technology in the CAV industry by developing better equipped vehicles capable to navigate through winter conditions, rainy and misty weather, and other semblance of non-water particles.
- Cultivate results that assist in developing regulations, policies, and safe route systems for operating AVs in all Minnesota environments and communities throughout its annual seasons.
- Promote value, experience, education, and training for institutions engaged in AV research and development.

Scope

Two separate experimental campaigns are implemented. During first experiment, an inflated chamber is installed at the University of Minnesota, where known particle size and concentration are entrained in the air. Instruments are used to sample and measure the particles, and the LiDAR is placed in position to determine how different particles affect the signal. For the second experiment, two vehicles will be driven, one in front of the other through adverse weather conditions. The lead vehicle measures the concentration of particles, using a roof-mounted opacity instrument. The following vehicle is equipped with a LiDAR sensor on the roof. As both vehicles drive through ambient particles, LiDAR images of the lead vehicle is compared to clean air in real time to evaluate impact on signal quality. Experiments done in second campaign are needed to strengthen controlled tests from the particle chamber and address unforeseen particle types found on Minnesota roadways.

For more information visit: mndot.gov
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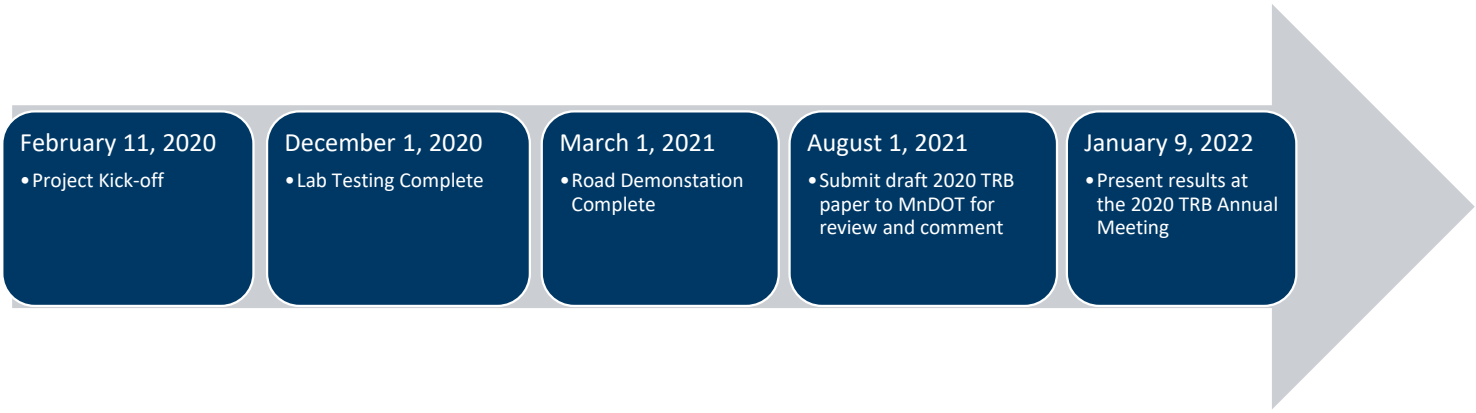
Key Milestones



Project Stakeholders & Areas of Expertise

1. **Luminar Technologies, Inc.**
2. **MnDOT Connected and Automated Vehicles Office:** Management, CAV And Intelligent Transportation System (ITS) Leads, Project Management
3. **MnDOT Metro District:** Operations and Maintenance, Regional Transportation Management Center (RTMC) Traffic Operations, Freeway Management Systems Design, Asset Management Programs
4. **MnDOT Office of Land Management:** Management, State Utility Engineer, Surveys and Mapping, Permits
5. **MnDOT Office of Traffic Engineering:** Management, Traffic Safety
6. **University of Minnesota**: Department of Mechanical Engineering, Research Staff
7. **Vision Systems Intelligence (VSI) Labs**