January 10, 2022

Ann Carlson
Acting Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue SE
Washington, D.C. 20590

Re: NHTSA Safety Research Portfolio Public Meeting: Fall 2022 Docket No. NHTSA-2022-0091

The Lidar Coalition (the "Coalition") welcomes the opportunity to provide comments in response to the National Highway Traffic Safety Administration ("NHTSA") request for comments ("RFC") on The Safety Research Portfolio Public Meeting: Fall 2022. Specifically, NHTSA has requested comments on the current and future research projects undertaken by the Agency. We are encouraged to see NHTSA performing research on the use of lidar in a number of contexts, including in crash avoidance technologies. NHTSA should continue to expand the use cases in which the Agency studies lidar as a safety and performance enhancing technology.

The Coalition is comprised of a group of 13 leading companies in the lidar ecosystem focused on increasing safety, sustainability, and economic growth through the deployment of lidar. Membership includes a broad spectrum of companies, including lidar sensor manufacturers, semiconductor companies, Tier 1 automotive suppliers, and software integrators. The Coalition focuses on promoting safety for drivers and VRUs through lidar-based safety technologies. We welcome NHTSA's recognition of the developments in transportation technologies, including lidar. We highlight below how lidar can enhance and compliment vehicle safety as it pertains to topics NHTSA is researching.

I. Lidar Detection of Motorcycle and Bicycle Automatic Emergency Braking

NHTSA notes that the Agency is studying the performance of automatic emergency braking ("AEB") in the detection of motorcycles and bicycles. Lidar, as a component of a redundant sensor suite, can improve the safety for all road users, particularly vulnerable road users ("VRUs") such as bicyclists and motorcyclists. Lidar sensors have the unique advantage of being able to detect, identify, discriminate, differentiate, and track a large quantity of road users and moving objects at the same time.

NHTSA also noted that the performance of AEB systems detection of bicyclists and motorcyclists decreased at night. Lidar detects VRUs with precision in low-light and degraded visual conditions such as direct sunlight, fog, and dust. According to NHTSA 2020 Fatality Analysis Reporting System ("FARS") data, 77% of pedestrian fatalities in crashes with known

lighting conditions occurred after dark.[1] While other sensors provide important capabilities in both the automotive and infrastructure context, sensor suites that include lidar can be the most effective in addressing the VRU safety crisis because a large share of these fatalities happen in low light conditions. The graphics below illustrate how lidar, when compared to other sensors, can "see" from the raw sensing data in low-light conditions. For this reason, the most effective approach for any automotive safety technology is to include lidar as an essential component of the sensor suite.

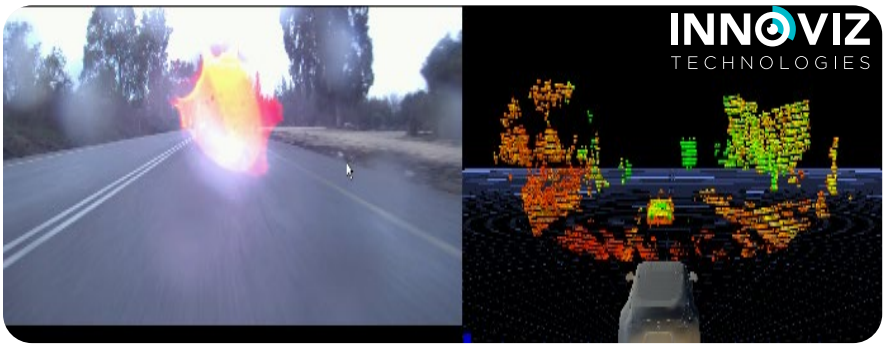


Figure 1 Camera vs. lidar detection in direct sunlight

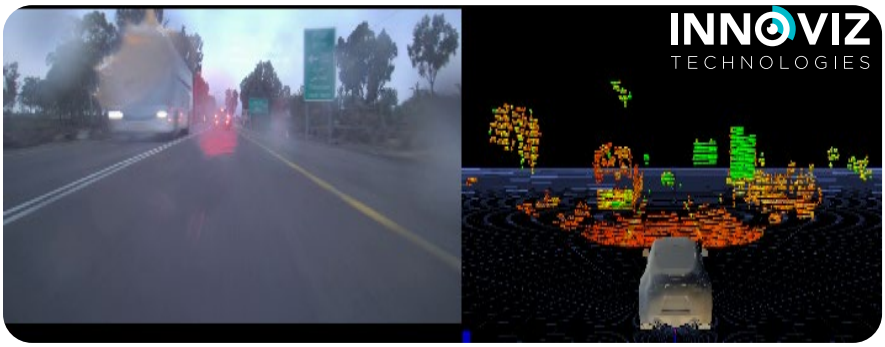


Figure 2 Camera vs. lidar detection in rain conditions

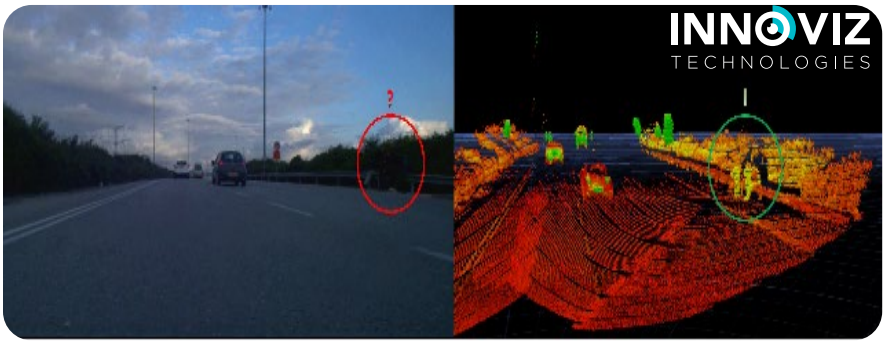


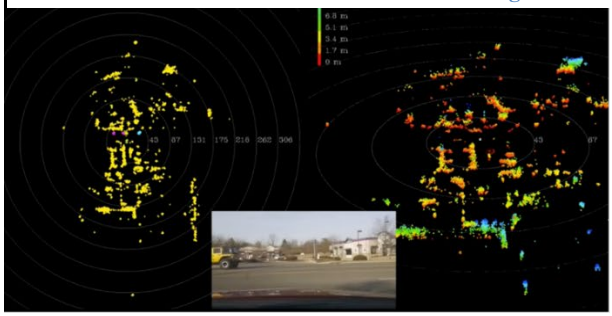
Figure 3 Camera vs. lidar detection in low light conditions

[1] NHTSA, Traffic Safety Facts: 2020 Data: Pedestrians (2022).

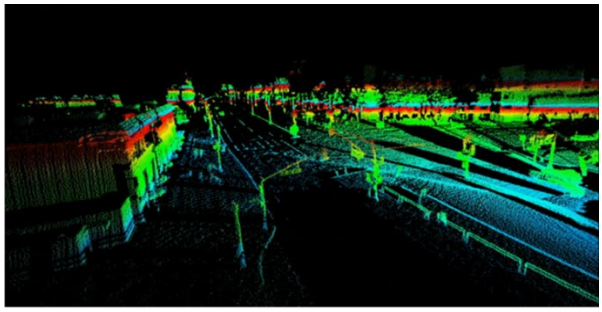
Figure 4 pedestrian detection camera versus lidar

Lidar has an innately high resolution due to the concentration of data points created by lasers. This high resolution allows lidar to distinguish between objects that are close together, as well as detect slow moving and stationary objects, such as the standing bicycles or motorcycles studied by NHTSA. Furthermore, lidar not only detects and distinguishes between moving objects, but can also monitor multiple moving objects, large and small, simultaneously. High resolution and simultaneous monitoring are critical components of safety particularly in neighborhoods where a higher portion of residents do not own a car, thereby relying on walking, public transportation, or other modes of travel to reach their destination. A study of workers living in Oregon found that workers living below the poverty line were twice as likely to use walk, transit, or bike modes to commute than those living 150% above the poverty line.[2] Vehicles equipped with redundant sensor systems including lidar would increase vulnerable road user safety in such neighborhoods because of enhanced VRU detection capabilities.

Figures 5 source images below AEye



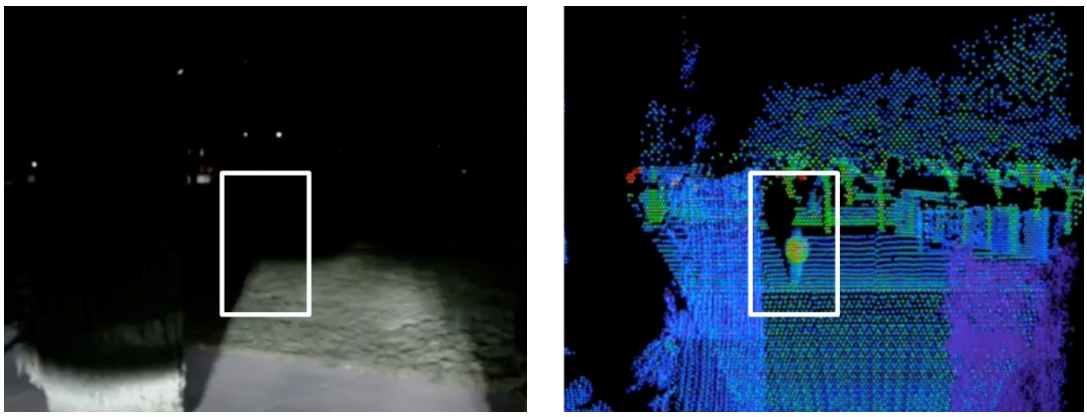
4D Radar



Lidar

[2] JOSH ROLL, OREGON DEPARTMENT OF TRANSPORTATION, ANALYSIS OF PEDESTRIAN INJURY, BUILT ENVIRONMENT, TRAVEL ACTIVITY AND SOCIAL EQUITY 4 (2021).

Camera Lidar



II. Truck Trailer Strikable Target Development

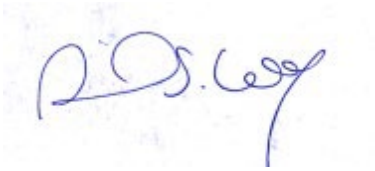
NHTSA stated during the Public Meeting that the Agency is studying how AEB performs in detection of truck trailers turning in front of a vehicle. Including lidar sensors in AEB would increase accuracy in detection of trailer. Lidar enhances the system's ability to capture the field of view in front of the sensor, generating 3D point cloud and intensity maps of the scene up to 30 frames per second. This precision data can be segmented, clustered, and used to discriminate humans, animals, fixed objects, and a wide variety of vehicles including trucks, trailers, motorcycles, bicycles, animals, etc.

Figure 6 detailed vehicle profiling by lidar

With this 3D data, tracking, path prediction and other functions are enabled, typically tuned to the specific application. If a trailer is in the field of view of the sensor, the trailer will be captured, profiled and tracked, even in degraded visual environments such as fog, low-light or direct sunlight. The same lidar technology is used and deployed in multi-modal sense systems for autonomous vehicle operation and AEB type applications by many of the largest automobile OEMs on the planet (*e.g.,* Toyota, Mercedes, NISSAN, Volvo, VW, etc.).

Thank you for the opportunity to submit comments on NHTSA's Safety Research Portfolio. The Lidar Coalition looks forward to continued engagement with the Agency on the safety benefits and innovation of lidar technology.

Sincerely,



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