SONY

Sony Depthsensing Solutions response to NHTSA Framework for Automated Driving System Safety

Docket No. NHTSA-2020-0106

https://www.federalregister.gov/documents/2020/12/03/2020-25930/framework-for-automated-driving-system-safety

&

https://www.federalregister.gov/documents/2021/01/29/2021-01150/framework-for-automated-driving-system-safety-extension-of-comment-period

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[1] INTRODUCTION

a. NHTSA Request

Following the request of NHTSA:

NHTSA is requesting comment on the development of a framework for Automated Driving System (ADS) safety. The framework would objectively define, assess, and manage the safety of ADS performance while ensuring the needed flexibility to enable further innovation. The Agency is seeking to draw upon existing Federal and non-Federal foundational efforts and tools in structuring the framework as ADS continue to develop. NHTSA seeks specific feedback on key components that can meet the need for motor vehicle safety while enabling innovative designs, in a manner consistent with agency authorities.

b. Sony Answers

In the following document Sony will reply on the NHTSA

Questions about a Safety Framework:

- Question 1
- Question 2
- Question 6 & 7
- Question 8

Question About NHTSA Research:

- Question 14

c. Terms, Abbreviations and Definitions

Term or Abbreviation	*Definition*
ADS	Automated Driving System
MRM	Minimum Risk Manoeuvre
SDS	Sony Depthsensing Solutions

[2] SONY REPLY TO NHTSA

Questions About a Safety Framework

Question 1.

Describe your conception of a Federal safety framework for ADS that encompasses the process and engineering measures described in this document and explain your rationale for its design.

Answer:

Present automated driving technologies are continuously evolving, and further improvement is still expected to occur. Although the technology for automated vehicles has reached a relatively satisfactory level when used under certain conditions, it will still take a long time until the automation will surpass the human capability to handle every unexpected and unpredictable situation. However, if an ADS would be used in combination with elaborated participation of a human driver, the amount of used ADSs could increase in future. The driver would complement the ADS at driving tasks and conditions where automation is not capable to take over fully yet. The ADS could complement in undesired situations like sudden sickness and others.

The key to this complementary and collaborative operation between the ADS and the driver, is to enable an Automated Driving System with the driver being partially involved in the driving task and continuously monitoring the driver readiness and responsiveness. Currently not enough statistical data available to support this concept and prepare a clear guidance to take next steps in that direction. The understanding how the driver (and the passengers) will be involved in the whole process within the automated vehicles in long term use is not fully clear. To get more insights, a driver model should be involved in the whole automated driving concept pipeline, to investigate the behaviour and interaction of the driver. It is not only important to understand how the driver interacts with the system today, but also how the interaction might change on the mid-long-term time. This idea is based on following three aspects.

First-of-all, it could happen that drivers abuse automated systems above the limitations. An understanding should be available under which conditions that happens and if done intentionally or un-intentionally. With that information preventive measures could be proposed by NHTSA.

A second aspect are parallel driver activities or incapability of the driver, when the driver would not interact with the ADS as required by the situation. Current regulatory and market developments for driver status monitoring include driver drowsiness, sleepiness and sudden sickness detection as well as driver attentiveness monitoring. The status detection is currently mostly based on detecting the eyes and face. To detect the driver engagement in non-driving related tasks, while still having gaze direction on the road (which is difficult to detect with current DMS) a wide field of view camera system, with full body tracking is recommended (see also Sony answer to: RFI Impaired Driving Technologies, Docket No. NHTSA-2020-0102).

It is important to understand the activity that the driver is involved in, to monitor his readiness for taking over control in safety critical situations. The driver and In-Cabin activity monitoring as such are an important factor. As conclusion, a better understanding and analysis of the driver behaviour and full body activity is needed, to improve the safety of the ADS and prepare the vehicle for admission to the mass market.

The third aspect is the higher trust in the ADS that drivers get with their experience in using the ADS. When the driver overreliance on the ADS increases, the risk due to driver disengagement is also increasing. The driver will be less active and therefore less capable to fully understand and promptly take counter measures in unexpected situations. This would create unexpected situations which drivers today, in L0-L2 cars could still be able to handle. This information is currently missing but necessary to have to better understand and define which countermeasures should be achieved or developed. Collecting this data and setting boundaries is a first step leading into L3-L5.

As a safety backup for above aspects, and specifically for L3-L5 vehicles, a Minimum Risk Manoeuvre (MRM) is often proposed as fallback in critical situations, when automated vehicles cannot resolve the road situation. Minimum risk condition is always required to be available in an ADS system, but additional attention should be given to cases where such operation is applicable. It is for example important from a social and environmental perspective to understand where to bring the ADS vehicle to stop. Stopping in the middle of the road may affect the traffic flow or even might cause dangerous situations. Related to this, the interactive involvement of driver will become of high interest to keep a good social acceptance of the ADS, preventing not accepted situations. Including a human driver model in the safety framework for automated vehicles could increase the safety by complementing the MRM scheme.

Because of this, a reference driver model development and its meaningful introduction into the smart automated system is of crucial importance. The escalation in critical situations could be adapted to specific scenarios and as such also include several driving conditions from the surrounding environment in various levels of autonomy. As this development needs to be based on evaluated data, data collection is one important step. Creating an initial guideline for collecting data on driver involvement with the automated system, in various conditions, is necessary. That will enable earlier analyses of the actual ADS in terms of safety and giving path to preventive procedures in an early stage. Aviation and railway industry can give valuable input in scenarios as over the past years it is common to have human working collaboratively, for example when using an autopilot in a plane.

Question 2.

In consideration of optimum use of NHTSA's resources, on which aspects of a manufacturer's comprehensive demonstration of the safety of its ADS should the Agency place a priority and focus its monitoring and safety oversight efforts and why?

Answer:

This answer may partially overlap with the answer in the previous question. One of the challenges in the development of a full Automated Driving System is whether the system could or should cover all corner cases. There might be various opinions on this, but possibly the solution is having a driver involved in the

driving task according to different needs and situations and NTHSA being able to properly assess those driver involvements for further analyses.

The proposal is to put additional focus and effort on how automated system will be used by the driver (or passengers) over the evolution and what possible interactions will they have with the system (e.g. dependency on HMI). Comprehensive data collection of the driver interaction and interpretation of different cases would be highly recommended. This initial effort taken will ease the later analyses for better understanding on the way a driver interacts with the ADS.

Question 6. & 7.

Do you agree or disagree with the core elements (i.e., ''sensing'', ''perception,'', ''planning'' and ''control'') described in this document? Please explain why. Can you suggest any other core element(s) that NHTSA should consider in developing a safety framework for ADS? Please provide the basis of your suggestion.

Answer:

In general, Sony agrees with the core elements and the proposed classification. However, if the driver remains in the loop, in some complex situation of the journey with the ADS, the driver re-engagement in the driving activities might be challenging to apply without introducing one additional 5th element – human driver model and engagement. This additional core element represents the driver interaction model and would define the procedure for driver engagement in future ADS systems.

Question 8.

At this early point in the development of ADS, how should NHTSA determine whether regulation is actually needed versus theoretically desirable? Can it be done effectively at this early stage and would it yield a safety outcome outweighing the associated risk of delaying or distorting paths of technological development in ways that might result in forgone safety benefits and/or increased costs?

Answer:

In principle determining every corner case is not the answer to the problem due to the infinity of combinations. But it is also true that minimum guideline is required as otherwise the solutions might vary too much. As the design and use of the ADS may largely differ by each development concept, it seems to be difficult to develop a single unified prescription at this early stage which could fit to all ADS developments. Transparent procedures to verify the design and operation of the ADS is necessary to not limit the technological development and at the same time taking early countermeasures when necessary.

Question About NHTSA Research

Question 14.

What additional research would best support the creation of a safety framework? In what sequence should the additional research be conducted and why? What tools are necessary to perform such research?

Answer:

The safety framework should consider how the mental model of a driver changes when using lower and high automation vehicles. Furthermore, the availability/ accessibility to broader amount of In-Cabin driver activity monitoring data should be given. This data, ideally combined with data collected from exterior sensing, would provide better insights and allow adaptation of the system to future needs.

Current technologies are designed primarily to detect the driver's drowsiness or disengagement and not to analyse the possible activities that a driver may do in parallel. Even if the driver abuses the system for a while, the automation keeps (or at least tries to keep) the safety to maximum level without exposing the user to an apparent risk. In that case no one around the vehicle will even realize if users may starts violating the limits of allowance or regulations. Here the regulation should consider taking the full body and In-Cabin as necessary input to evaluate the driver state and driver capabilities.