

SIP-adus Workshop 2020

ISO/TC22/SC39/WG8 TS5283

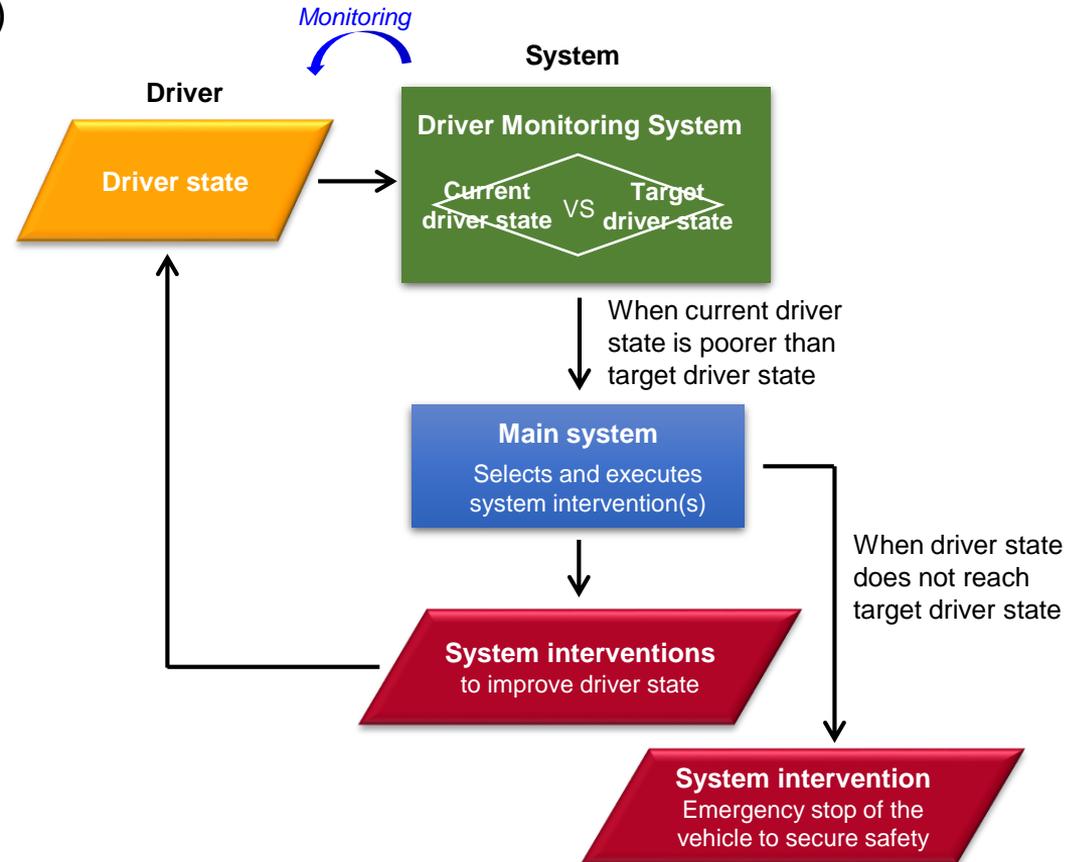
Ergonomic aspects of driver monitoring and system interventions in the context
of automated driving

Satoshi Kitazaki

National Institute of Advanced Industrial Science and Technology (AIST)

A concept of driver monitoring and system interventions

- The driver monitoring system (DMS) monitors metrics of driver state.
- The DMS compares the current driver state and the target driver state.
- When the current driver state is found to be poorer than the target driver state (i.e. the metrics become below thresholds), the DMS reports to the main system.
- The main system selects and initiates intervention(s) to improve the driver state or further safety-related measures such as emergency stop of the vehicle.



■ Proposed scope

- This document describes relevant [terms and a concept](#) for driver monitoring and system interventions with respect to SAE [level 2 and level 3](#) automation features based on/related to the concept of driver readiness/availability.
- This document focuses on driver monitoring and corresponding system interventions for [safe transitions](#).
- This document provides information on ergonomic aspects of driver [readiness/availability, possible metrics to monitor, determining thresholds, and effective system interventions](#). Some recommendations are included.
- [Alcoholic impairment and medically impaired driver states \(both acute and chronic\) are not included](#) in this document.

■ Purpose and justification of the proposal

The purpose of this document is to [provide information and recommendations](#) on ergonomic aspects of driver monitoring and system interventions [for developers to help them with designing a driver monitoring system and system interventions for safe transitions](#). There is a strong and urgent need to standardize /regulate a driver monitoring system, considering activities at UN-ECE, SAE and other ISO SCs. This document provides information and recommendations for specific questions such as [\(1\) What driver states are to be monitored](#), [\(2\) How they can be measured](#), [\(3\) When system interventions are to be activated](#), and [\(4\) How system interventions can be designed to be effective](#).

■ Proposed project term: 24 months

■ Outline of the document

Part 1: Driver Monitoring

Introduction

1. Scope
2. Terms and definitions
3. Normative references
4. Purpose
5. A concept of driver monitoring and system interventions
6. Operational domains of driver monitoring
 - 6.1 Driver monitoring in the steady state
 - 6.2 Driver monitoring in the transition
7. Driver readiness/availability and associated metrics
8. Receptivity
9. Thresholds of readiness/availability metrics
 - 9.1 Thresholds in the steady state
 - 9.2 Thresholds in the transition
10. Differences in driver monitoring for Level 2 and Level 3
 - 10.1 Levels of the thresholds
 - 10.2 Safety and NDRAs
11. Other considerations for successful takeovers

Part 2: System interventions

Introduction

1. Scope
2. Terms and definitions
3. Normative references
4. Purpose
5. The concept of system interventions and escalation protocols prior to this document and L2 and L3 entry assumptions
6. Conceptual framework
7. Theoretical and practical frameworks for system interventions and escalation protocols
8. System logic and formal models
9. Objective of the intervention
10. Process of an intervention
11. Interventions types and consequences
12. Other considerations for system interventions and escalation protocols

■ Result

Approved: Agree 16, Disagree 2 (France, US), Abstain 16

July 28, 2020

■ Comments received (extracted)

- 1) The document should change the type from **TS to TR**. (**Germany, France**)
- 2) **Level 2 automation features should consider different subcategories of features and how they might affect monitoring specifications** (e.g., hands on/off; limited ODD; systems that discourage disengagement through performance). (**US**)
- 3) There is **not enough research** to provide system intervention guidance **for level 3** automation features. The document should **focus on Level 2**. (**US**)
- 4) “Receptivity” is one of the important requirements which German law directs to the driver when operating a SAE L3 AV. **Term “receptivity” should be considered in the metrics chapter** (**Germany**)

Activities after the official kick-off in August 2020

1. Information sharing with UN-ECE, Euro NCAP, and NHTSA were held (Satoshi and Natasha participated).
 - Availability recognition and attentiveness detection defined in UN-ECE (Informal document GRVA-06-02-Rev.4 proposed by ACSF) were relevant to ISO driver monitoring.
 - Information on driver monitoring from Euro-NCAP were about general driver monitoring and did not include much information on driver monitoring for automated vehicles.
 - NHTSA launched a call for proposals for research.
2. Editing Committee meetings and leaders meetings were held several times.
 - EC members
Project leaders: Satoshi Kitazaki (Japan, ASIT), Natasha Merat (Univ. of Leeds, UK)
Germany, academia 1, supplier 1, Korea, academia 1, France, industry 1, Israel, industry 1, Japan, industry 1
3. The outline was NOT agreed by the EC members.
4. Draft#0 was written and collected comments from the TF members.
 - The comments suggested a need for discussing purpose of the document and understanding expectations of potential readers of the document (engineers and researchers in the automotive industry).
5. Expectations and current understandings of the relevant issue were surveyed among the industry-related TF members and their colleagues.

Summary of the important comments on Draft#0

Responses from 10 TF members (7 from EC members)

- The document should focus on L2, hands-off L2, L3, L3 for jam, L3 for high speeds.
- The document should change its category from TS to TR.
- Readiness/availability should be defined more clearly.
- Clear information needed for measurements and thresholds.
- Consideration for individual differences needs to be included.
- Information should be based on scientific evidences.
- The document should provide information about minimum requirements.
- More concrete information on thresholds of readiness is needed.
- Information on how to determine metrics and thresholds is needed.
- It will be good to have information on recommendations and options, considering the cost.
- Emotional aspect of driver state is missing.
- The scope is too narrow if the scope limits transitions as L3→L0 and L2 → L0.
- Structure the document “System intervention → Driver monitoring” instead of vice-versa
- Define the target states

Expectations of potential readers

Responses from 6 OEMs and 6 suppliers

- No need for ISO for L2 because there is an UN-ECE regulation.
- Guidance on what to monitor and why for each level.
- References (papers) on DMS for L3.
- Conceptual definitions and guidelines/specifications
- Measurable indicators of driver state and levels of indicators for “fallback ready”.
- Driver states to be measured and their criteria.
- Types of system interventions and their requirements, and necessary driver monitoring.
- Clear and reasonable criteria.
- Mandatory and optional specifications.
- Value of time budget.
- Criteria.
- Driver states to be monitored, evaluation method of detection performance,
- Methods to determine thresholds and time budget.
- Concept of timing and decision criteria for handover from the driver to the system.
- Detection method, ground truth, criteria, evaluation method of readiness with L2 and L3

Key words

- L2 and/or L3
- What to monitor
- How to measure, Criteria/Thresholds
- Evaluation methods
- Interventions
- Time budget
- Evidence

Factors causing this situation

- Driver monitoring and system interventions are extremely important functions to secure safety of automated systems.
- Need for consistency with an existing regulation and a standard
 - UN-ECE regulation (GRVA-06-02-Rev.4 proposed by ACSF)
Availability recognition, attentive detection
 - SAE J3016
Fallback ready, receptivity
- Need for consistency with products in the market
 - For L2
Products are already in the market
Hands-on and hands-off systems
 - For L3
There are not products in the market yet and it is difficult to assume system functions
- Lack of scientific evidence

We plan to organize a series of workshops with presentations by TF members and also external experts.

- to share evidence
- to narrow down the scope and clarify the purpose of the document.

**SIP-adus
Workshop
2020**

Thank you

**Satoshi Kitazaki
Satoshi-kitazaki@aist.go.jp**

