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Workshop on scenarios databases for ADS safety validation under UNECE fora

May 6-7, Paris

Introductory input from experts from France

In cooperation with :

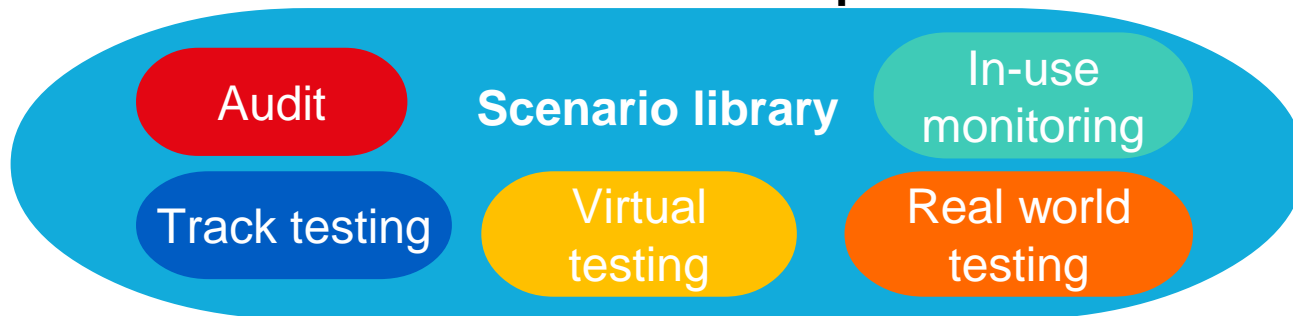*Website : https://www.ecologie.gouv.fr/en/automated-vehicles*

Outline

1. Context

2. On-going activities in France

3. Possible ways forward for international cooperation

Context

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- Scenarios are at the forefront of safety assessment / test methods
  - by the industry / by certification third parties / by public authorities
- Scenarios have the potential to address the complexity of assessing ADS performance across the diversity of possible ODDs
- The scenario approach is part of the EU ADS regulation
  - "*free from unreasonable risks [through] scenario specific approach showing that the ADS will not increase the level of risk compared to a manually driven vehicle*"
- The scenario approach is covered in the ADS integrated document
  - "*The guidelines recommend the development of a scenario catalogue for use across five validation pillars*"
- Industry and R&D initiatives : *ADScene + MOSAR (FR), SafetyPool (UK), SAKURA (JP), PEGASUS (DE), StreetWise (NL), Fortellix (private),…*

Context (continued)

- Scenarios are the **cement of the # validation pillars**

- Scenarios **capitalization** (e.g. based on real world drivings, simulation) is necessary

- Scenarios capitalization is a **learning process**

- Scenarios are partly **region-dependent** (driving style, law, road features, weather..)

- Scenarios' **diversity** favours the seek for **completeness of foreseeable risks**

- **Public authorities use of scenario** in type-approval still needs to be fine-tuned

  - Assessing industry's validation processes

    - (e.g. completeness, edginess, representativeness ?)

  - Setting mandatory scenarios for test or simulation (pre-defined ? randomized ?)

On-going activities in France

- Three parallel and articulated workflows

1. Methodology and guidance for the production and use of scenarios
   - ➢ *from generation to selection*

2. Scenario taxonomy
   - ➢ *coherence between ODD and scenario descriptors*

3. Scenario data-bases and governance

   - ➢ *# public authorities / industry / research needs*

On-going activities in FR : methodology and guidance

- Rationale for scenario approach and articulation with other validation pillars
  - *https://www.ecologie.gouv.fr/sites/default/files/DGITM_Approche-par-scenarios-fevrier-2022-EN.pdf*
  - *https://www.ecologie.gouv.fr/sites/default/files/DGITM-Articulation-GAME-SOTIF-scenarios-2023.pdf*
- Scenario generation process
  - *https://www.ecologie.gouv.fr/sites/default/files/DGITM-L1-septembre_2022-EN.pdf*
- Scenario selection process
  - *https://www.ecologie.gouv.fr/sites/default/files/DGITM-Approche_selection_scenarios-2024.pdf*
- Scenarios for interactions with first responders (inception)
  - *https://www.ecologie.gouv.fr/sites/default/files/DGITM-Scenarios_AFO-juillet_2022.pdf*
- *Forthcoming :*
  - *Scenario approach addressing carefulness and etiquette responses*
  - *Scenarios for interactions with first responders (detailed)*
  - *ODD's-taylor-made lists of relevant scenarios*

On-going activities in FR : scenario definition and taxonomy

- Descriptive layers

  1. Static traffic environment
  2. Nominal driving manoeuvre
  3. Hazards
     - Collision precursor events
     - Technical system failure

  5. Hazards affecting system's response
     - Visibility
     - Other road users' behaviors
     - Failures

  4. System's response

- Hierachical layers

  1. Functional
  2. Logical (unfolded generic)
  3. Contrete (parameterized)

https://www.ecologie.gouv.fr/sites/default/files/ DGITM-ODD_dezscriptors-juin_2022-EN.pdf

Through French funded projects, a standard data format, and the framework a library of scenarios have been defined, as a basis for the MOSAR / ADScene plateform

https://cahiers-transformation-numerique.irt-systemx.fr/accueil/designing-the-digital-world/meeting-the-challenge-of-validating-the-autonomous-vehicle-2/?lang=en

On-going activities in FR : scenario database

- 2018 : Launch of research projects on behalf of French Automotive industry platform (PFA) supported by French Ministry for Transport

- 2019 : Work with LAB & CEESAR on accidentology

- 2020 : Start of industrialisation (Renault & Stellantis)

- 2021 : PFA work with UTAC for Regulatory & NCAP scenarios storage

- 2022 : Audit of ADScene scenario database by TüV Sud

- 2023 : ADScene V1.0 used

ADSCENE scenario database : 1 platform, 3 ambitions

ADSCENE FOR RESEARCH	ADSCENE FOR INDUSTRY	ADSCENE FOR REGULATION
Open framework to develop & integrate innovative features	Scenarios, use case, test protocol libraries and tools for systems design, validation & homologation	Shared subset of scenarios, and tools for regulation and standartisation compliance
Users : Academics, research institutes	Users : OEMs, Tiers Ones	Users: Technical services, Administrations
Usage : Innovation	Usage : Design, validation, homologation	Usage : certification, type approval, in-use monitoring, safety demonstration

Possible ways forward : need for a phased approach

i. Better assess public authorities' and industry's needs (present and future) towards scenario catalogues and databases

ii. Better assess the need for selection / qualification of scenarios, namely for public authorities

iii. Review governance patterns of existing catalogue / databases (namely for the interaction with public authorities)

iv. Review interoperability gaps among existing national (public / private) databases

v. Assess (SWOT) of different international coordination approaches, e .g.

   a) Subset of scenarios published by # national authorities

   b) Mutual access among national authorities to national autorities' databases ?

   c) Unique UN database

Possible ways forward : phased approach (continued)

v. Assess feasibility and administrative costs of different international coordination approaches, regarding e.g. :

- Access « depth »

  - Access to functional or concrete scenarios ?

  - Access to generation / combination / selection modules ?

  - Access to scenario's qualification ?

- Access management towards specific autorities (e.g type-approval, certification third parties, accident enquiry bureau, prosecutors ?)

- Pricing principles

- Standardized interfaces / APIs ?

Opportunities for a "mutual access" approach

- Diversity of ongoing national (public / private) initiatives
  - different ODDs, different approaches for scenario generation / selection
- Learning process (e.g. scenario selection still needs to be addressed)
- Decentralised databases likely to better address :
  - seek fo representativeness (e.g. exposure's factors) and criticity (unknown-unsafe)
  - cost sharing
  - continuous need for innovation
- Possible # layers for "mutual accessibility" could be explored, e.g.
  - Functionnal, logical or concrete scenarios ?
  - Representativeness (~ exposure) and criticity (~severity ?) of a given scenario
  - Generation / combination / selection modules ?
  - Qualified scenarios (e.g. for testing purposes) ?
- Pre-requisite for mutual access / interoperability : **common scenario descriptors**