Report on the work of VMAD SG2 on Simulation/Virtual Testing

VMAD-17

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List of outstanding issues

Subgroup	Outstanding questions/issues/activities to address/develop	Target Completion date
Subgroup 2 (Simulation and virtual testing)	**1. Provide an example of a simulation toolchain for virtual testing**	January 2021
	2. Define requirements and methods for simulation tool-chain validation. This includes: i) defining different approaches for ADAS and ADS (in case SG2 will also need to deal with ADAS virtual testing); ii) defining appropriate metrics evaluating toolchain accuracy; and iii) defining the type of scenarios used for toolchain validation	April 2021
	3. Define documentation requirements for vehicle manufacturers and ADS developers (including the establishment of a clear link with the audit pillar)	June 2021
	4. Define standardization requirements to allow authorities performing in-house virtual testing (following activities carried out by ASAM and other associations)	December 2021+

Simulation toolchain example (January 2021) ✓

- A first complete example of virtual testing toolchain has been presented to the SG2
- Its inclusion in the Master Document will be discussed at a later stage

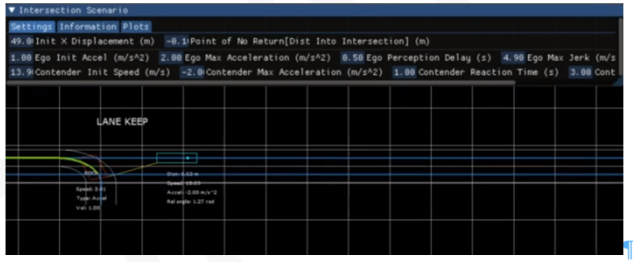
Virtual Testing Toolchain example

6.18. Virtual testing can be used to assess the ADS' compliance with a number of functional requirements. The scenarios used in the assessment are decoupled from the virtual testing tools so developers can design a toolchain that suits their infrastructure best. This also allows the distribution of scenarios across multiple tools with little effort.

Just like each test method within the NATM, each virtual testing tool will have their own strengths and weakness based on the speed cost and cost of execution and the level of fidelity achieved. Typically lower fidelity tools are used to cover a vast number of scenarios to obtain a general understanding of the systems performance. Then it is possible to increase the level of fidelity within a subset of scenarios to validate the performance of the ADS in a statistically relevant number of realistic scenarios. A manufacturer's virtual testing toolchain may consist of the following tools:

6.18.1 Software in the Loop (SIL)

SIL can used to validate the control algorithms of the ADS software with basic sensor models, this can be done faster than real time so is an effective way to test the system over a vast number of scenarios.



Validation and documentation requirements Call for inputs

- RDW (10/02).
- AVL (17/02)
- WMG and PEARS (24/02)
- CITA and JRC (03/03)
- SAFE and general discussion (10-17/03)
- SG2 drafting and general discussions (24?-31/03)
- All presentations on UNECE-VMAD wiki page: https://wiki.unece.org/pages/viewpage.action?pageId=117508578

VMAD-SG2

Credibility assessment

- The framework identified goes beyond the toolchain validation and is based on the concept of “credibility”
  - ***“Credibility. The quality to elicit belief or trust in Models and Simulations results.” (NASA-STD-7009A.)***

NASA-HDBK-7009A

b. Development Related Credibility Factors

i. Data Pedigree.
ii. Verification.
iii. Validation.
iv. M&S (Revision) History.
v. M&S Process/Product Management.

Next steps

- Collection of written feedback and last round of inputs (31/03)
- Update of the Master Document and start discussion (14/04)
- To be more concrete it could be worth limiting the scope at the beginning
  - Start with motorway ADS applications

Thank you

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