

Title: Framework for the safety assessment of an autonomous vehicle using real-world scenarios.

Topic: Vehicle Electronics and Software

Abstract (min 300 words, max 500 words):

% Introduce AVs and importance of scenario-based testing

The development of Autonomous Vehicles (AVs) has made significant progress and it is expected that AVs will be introduced soon. An important aspect in the development of AVs is the safety assessment. As traditional methods for safety assessment of vehicles are not feasible to be performed AVs within reasonable time and cost, other approaches have been proposed. Among these, real-world scenario-based assessment is widely supported by many players in the automotive field. Scenario-based assessment allows for using virtual simulation tools in addition to physical tests, such as on a test track or proving ground.

% Explain problem of road authorities/independent assessors

In this paper, we describe a framework for a real-world scenario-based road-approval assessment considering three stakeholders: the applicant, the (road or vehicle) authority, and an assessor. In this framework, the applicant is applying for an AV approval, the assessor assesses the AV and advises the authority, and the authority sets the requirements for the AV and decides whether an AV is approved or not. The challenges are as follows. Firstly, due to the complex operational design domain (ODD) and dynamic driving task (DDT), many test scenarios are required in order to obtain enough confidence in the assessment of the AV. Consequently, it is assumed that due to the assessor's limited resources, it is infeasible to conduct all tests by the assessor. Secondly, the tests need to be tailored to the ODD and DDT description of the corresponding AV. Thirdly, it is assumed that the applicant does not want to disclose all detailed test results because of proprietary or confidential information contained in these results.

% Proposed solution

In the described framework, tests need to be proposed by the applicant. Next to the framework, we will describe how these tests may be derived based on the ODD and DDT description. The assessor assesses whether the set of tests sufficiently covers the operational design domain and whether a successful outcome of the tests provides enough confidence that the requirements of the authority are met. As a result, the assessor does not need to perform all tests for each applicant. The assessor will decide according to which selection procedure tests are selected for the actual assessment.

Each of the selected tests has a strict minimum outcome that is used as a pass/fail criterion and possibly a desired outcome. A slight deviation of the AV's behavior compared to the desired outcome should not directly compromise safety; pass/fail criteria are selected such that an AV that fails a criterion is believed to show serious safety issues when deployed on the public road. Since the assessor is unable to conduct all tests, the applicant needs to declare for each test if the AV adheres to the minimum and/or desired outcome. Thus, the applicant does not need to disclose the details of the test results. The applicant might use virtual simulations to derive the test results. The assessor will conduct a selection of the tests to verify the fidelity of the results provided by the applicant. Therefore, the assessor does not need to conduct all tests.

% Conclusions

In conclusion, we propose a framework that can be adopted by authorities to assess the safety – and therefore the road-worthiness – of AVs. An independent assessor conducts a limited number of tests of the applicant's AV and because only the system level is considered, the applicant does not need to disclose any details regarding the sub-system-level design of the AV.