Simulation-based safeguarding and operational domain approval of automated vehicles – Two examples from logistics and combined goods/passenger transport

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Automated driving is becoming increasingly present not only in America, but also in Germany. Numerous projects are working on demonstrations of possible solutions, particularly in public transport. However, test rides in Germany have so far only been carried out as part of test approvals, i.e. with a safety driver on board. As a result, there is a lack of experience to date concerning the approval of operational domain (OD), which is required by the German legislation (AFGBV, §7 and §8) in addition to type approval. This poses major challenges for state authorities, which are responsible for issuing this authorization, as well as for local authorities and cities. A model procedure for issuing an OD approval on the basis of the AFGBV is currently being described by a working group lead by KBA and TÜV Association. The current need to focus on manual activities, e.g. through extensive real-world driving, is an obstacle for scaling individual dedicated routes to entire city districts or rural areas. Simulation tools offer the opportunity to simplify the verification process and also to consider the complexity of different boundary conditions (e.g. weather, traffic).

The proposed approach for the simulation-based OD verification is utilizing a virtual replication of both the topology and the environmental conditions as well as typical traffic conditions. Existing data such as Open Street Map maps, satellite images, weather data from the German Weather Service or statistical traffic data can serve as a basis. For more precise data, targeted traffic measurements can also be carried out at central junctions in the targeted area. For example, to take into account the volume of non-motorized road users. The proposal of this article is to use these parameterized simulation environments to evaluate the vehicle perception in relation to the specific sensor set-up and thus identify possible critical route sections for the automated vehicle. These results can serve as a basis for OD approval or for the formulation of necessary measures, e.g. through infrastructure support.

The first results of this approach, using the open source simulation tools GEMSTAR and SUMO, will be shown at the examples of use cases from the AUTOGVZ and IMoGer projects. Both projects aim for obtaining an OD approval. The AUTOGVZ use case is dealing with automated logistics transport at the Bremen Freight Village (GVZ) and the IMoGer use case focuses on combined freight and passenger transport in a small district in the city of Braunschweig (see Figure 1).
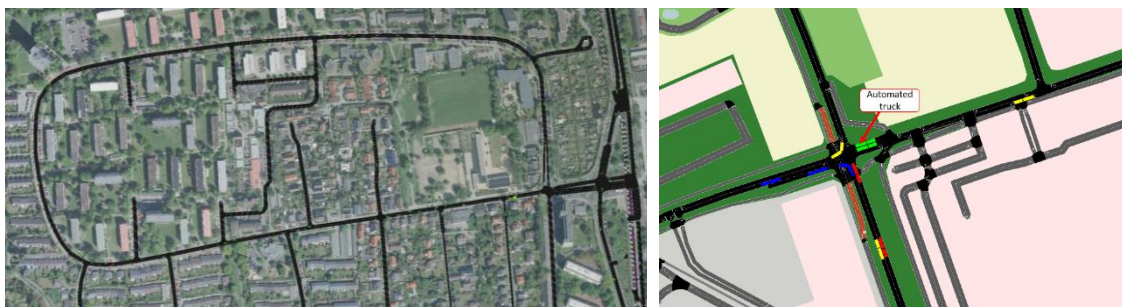

Figure 1: Simulation of the areas "Schwarzer Berg" in Braunschweig (left) and parts of the Bremen Freight Village (right)

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