Methods Test Bench for Safety in AD

Relevance to the Automotive and Autonomous Systems Industries:	Safety validation is one of the biggest challenges for the introduction of highly automated vehicles. Many existing and novel methods are hard to apply and test. There is therefore a need for a methods test-bench to evaluate, validate, and compare these various methods for safety in automated driving (AD).
Research Location:	Technische Universität Darmstadt Institute for Automotive Engineering (FZD)
Homepage (Engl.):	http://www.fzd.tu-darmstadt.de
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Project Description: May 22 - Jul 28, 2023 (10 weeks, 40 h/week)	The Technische Universität Darmstadt Institute for Automotive Engineering (FZD) is participating in the AUTOtech.*agil* project that includes investigating a modular safety approach for highly automated vehicles (HAVs). The literature provides several approaches to reduce the amount of testing required. These approaches must be tested extensively for evaluation and validation, which can quickly become an overwhelming task. FZD has therefore developed the concept of a methods test bench in the form of an automated slot car track that offers a capsulated system with automated vehicles, and that allows for the application of novel methods and the evaluation of their effectiveness and completeness. This NSF REU project will be concerned with developing the first prototype of this methods test bench. The objective for the NSF REU student will be to implement a first set of driving functions for the automated vehicles. This will comprise of object tracking, map matching, and a simple driving function. The successful outcome will be to demonstrate a functional prototype of the test bench. **PHASE A** (2 weeks): During this introduction phase, the NSF REU student will review relevant research in the field of automated driving (AD); investigate existing architectures for object tracking and driving functions; derive requirements for the prototype; and detail and distribute project responsibilities. **PHASE B** (3 weeks): Next, the student will develop a detailed concept for a first prototype, including object detection, map matching, and a simple driving function to operate the vehicle and react to traffic. **PHASE C** (3 weeks): Then the student will implement this concept with actual vehicles on a track. The prototype will then be evaluated with regards to the derived requirements and its applicability as a methods test-bench. **PHASE D** (2 weeks): Finally, the NSF REU students will document the research performed, the implementation, and the tests prepare a written report; and deliver an end-of-summer presentation on the research performed.
Target publications:	• **11. Tagung Automatisiertes Fahren**, *Eine Fachtagung der TU München und des TÜV SÜD*, Munich, Germany, December 7-8, 2023. Short papers (German) due June 16, 2023. Full papers (English) due later.
Necessary Skills/ Knowledge:	• Interest in automotive safety and automated driving
Desirable Skills/ Knowledge:	• Experience with Python, and object detection
Additional Online Resource(s):	https://www.fzd.tu-darmstadt.de/forschung/research_projects_fzd/rp_autotechagil/index.en.jsp

NSF REU Students must have completed at least two semesters of engineering studies prior to the proposed summer research, and they must have at least one semester remaining before they can earn their BS in Engineering.