Development of a Concept for Generating and Accessing Digital Maps containing Metadata for Automated Driving

Relevance to the Automotive Industry:	Automated and autonomous navigation is becoming increasingly important for all means of automotive vehicles. The automated driving functions not only require good environmental perception (e.g., other vehicles), but will also rely on metadata stored in a map. For instance, speed limits can be stored in a map, and then be made available using the vehicle's current location.
Research Location:	Technische Universität Darmstadt Institute for Automotive Engineering (FDZ)
Homepage (Engl.):	http://www.fzd.tu-darmstadt.de
Faculty Mentor:	Prof. Dr.rer.nat. Hermann Winner
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Project Description: Jun 03 - Aug 09, 2019 (10 weeks, 40 h/week)	The Technische Universität Darmstadt Institute of Automotive Engineering (FZD) is investigating high-automation and driver-assistance systems for trams. Modern automated driving functions depend on meta information, such as speed limits, to be stored in high-precision digital maps. This capability needs to be extended to automated and autonomous trams. The objective of this NSF REU project is to identify necessary and potentially desirable metadata to be stored in digital maps for automated and autonomous trams, and then design a storage concept that enables automated driving functions to recall the desired information in real time. **PHASE A** (1.5 weeks): Identify necessary and potentially desirable metadata (e.g., speed limits, stopping points) to be stored in digital maps for automated and autonomous tram operations. **PHASE B** (2.5 weeks): Perform state-of-the-art review on how maps and metadata are stored and recalled. Evaluate various solutions relative to the needs of automated and autonomous tram operations. **PHASE C** (2 weeks): Design a digital map system, including an abstract concept for storing data and for recalling data in real time (not at implementation level). **PHASE D** (3 weeks): Prototype an implementation of the design concept using a high-level programming language (e.g., MATLAB, Python), and then evaluate the concept. **PHASE E** (1 weeks): Finally, the NSF REU student will document the research performed, prepare a written report, and deliver an end-of-summer presentation on the research performed.
Target publications:	• WKM-Symposium 2020
Necessary Skills/ Knowledge:	• Experiences with MATLAB, Python, C or C++
Desirable Skills/ Knowledge:	• Experiences with digital maps, navigation techniques, GNSS • Experiences with Robot Operating System (ROS)
Additional Online Resource(s):	

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.