Design of a Camera Mounting and Calibration for Test Vehicle

Relevance to the Automotive Industry:	Autonomous vehicles represent one of the most important future segments of the automotive industry. To realize such vehicles, it will be necessary to develop new functions and capabilities to facilitate various aspects of automated driving. The project ***A**utomated **D**riving **Da**rmstadt for Students* ("aDDa4students") aims to develop a test vehicle platform to facilitate the design, implementation, and testing of such new automated driving functions and capabilities.	
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 05 - Aug 10, 2018 (10 weeks, 40 h/week)	The Technische Universität Darmstadt Institute for Automotive Engineering (FZD) is participating in the interdisciplinary project *aDDa4students* and the design of its test vehicle platform. This NSF REU project will be concerned with the vehicle's environmental perception system, and in particular with its six cameras that will deliver a 360-degree view of the vehicle's surrounding environment. The objective for these three (3) NSF REU students is to design a mounting system and an associated calibration system for these cameras in the test vehicle. This includes identifying customer needs; developing specifications; and generating, screening, and selecting concepts for both systems. The successful outcome will be for the cameras to be mounted, calibrated, and for their six image streams to be fused to provide a 360-degree image for the test vehicle. **PHASE A** (2 weeks): During this introduction phase, the NSF REU students will review relevant research; investigate existing software and hardware; identify customer needs and develop specifications for camera mounting, calibration, and image fusion; and detail and distribute project responsibilities. **PHASE B** (3 weeks): Next, the students will generate, screen, and select compatible concepts for the camera mounting, calibration, and image fusion; develop CAD models and manufacturing documents for the camera mountings; and document this work. **PHASE C** (3 weeks): Then, the students will install the cameras, and implement the calibration and image fusion, using ROS, MATLAB, Python, etc.; and test and validate first the individual components and then the integrated system. **PHASE D** (2 weeks): Finally, the NSF REU students will document the research performed, prepare a written report, and deliver an end-of-summer presentation on the research performed.	
Target publications:	• Darmstädter Kolloquium "mensch + fahrzeug" • Uni-DAS e.V. Workshop Fahrerassistenz und automatisiertes Fahren	
Necessary Skills/ Knowledge:	• Experience with MATLAB • Experience with CAD	
Desirable Skills/ Knowledge:	• Experience with Robotic Operating System (ROS) • Experience with Python and/or C++ programming	
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.