ECE 5734

Embedded Systems Verification & Validation

Project on

VERIFICATION OF SAFETY AND SECURITY REQUIREMENTS IN AUTONOMOUS VEHICLE

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Winter 2022

Abstract

An autonomous vehicle system is a very complex system, involving the interaction of onboard intelligent computing systems, a range of sensors, radars, and electromechanical parts. Society of Automotive Engineers (SAE) has defined various standards to define the automation level of vehicles. Based on the standards and levels defined, an autonomous vehicle can perform an entire or part of the Dynamic Driving Task (DDT). The self-driving transportation system should be designed to operate without human interference, in coordination with perception, decision & control, and vehicle platform manipulation functions based on both the internal system and external environment. Modeling an autonomous vehicle must include safety and security as two inter-dependent properties to protect the vehicle and environment from accidental failures and intentional attacks.

The objective of the project is to develop a model and verify the functional requirements of the autonomous vehicle systems using the LabVIEW simulation tool. The autonomous vehicle model is designed based on physics and mimics the sensors that a real vehicle would see on the road. It will include such sensors as wheel velocity sensors to measure the vehicle's current velocity, distance measurement sensors to measure the distance to cars in front of and behind the vehicle, and lane centering sensors to measure how far from the center of the lane the vehicle is. Using the sensors from the model, the automated driving program will drive actuators in the model which will change inherent properties, such as acceleration, velocity, and center-lane position, and verify these properties are within acceptable parameters for the test. The requirements for the system centered towards safety measures such as automatic braking system, accidental failure, and hazard analysis are to be identified and added to the developed vehicle model. The selection of safety and security requirement metrics are defined reliant on the automation level defined by the international SAE standards. The project aims at verification and validation of requirements of the safety process based on hazard analysis

and risk assessment, and requirements for threat analysis and risk assessment in the security process of a fully autonomous vehicle. The model targets incorporating safety and security countermeasures to ensure consistency of the autonomous transportation system.