

# Drive-by-Wire Control

## Executive Summary

As part of the worldwide push for highly-automated and autonomous driving, with their unassailable benefits, Eindhoven University of Technology (TUE) is stepping up its research efforts in these areas. This development project, which is part of these research efforts, was undertaken by the ASD trainees in cooperation with the Mobile Perception Systems lab and partners from industry.

Implementing a Drive-by-Wire (DbW) system in a vehicle is the first step towards implementing highly automated driving functionalities and, eventually, autonomous driving. The aim of this project, hence, was to develop and implement a software based DbW system for a Toyota Prius 2018 using off the shelf hardware. First goal was getting the vehicle steering and acceleration to be controlled using a joystick, in addition to conducting the functional safety analysis of this system according the ISO standard 26262. The task at hand for the team was to use only open-source code and commercial off-the-shelf components. By so doing, TUE would be able to significantly cut its cost and time for highly-automated and autonomous driving research.

The project team approached the task by dividing themselves into two sub-teams: one addressing the functional safety analysis part while the other focusing on design and implementation. On the functional safety analysis part, the team produced the Hazard Analysis and Risk Assessment study for the system, following the ISO 26262 guidelines, followed by the Failure Mode and Effects Analysis study and eventually obtaining the functional safety requirements of the system which were integrated in its architecture. The design and implementation team, on the other hand, focused in parallel on the design objective: the system was to be as affordable as possible and to use only open-source code. The utilised hardware, consequently, consisted of only a mid-range laptop, a joystick, and communication adapters to tap into the vehicle's CAN bus.

The team managed to successfully complete the functional safety analysis for the system and to control the steering through the joystick, with acceleration control poised to be the next step. A supervisory controller was subsequently developed for the system to ensure its transition to a safe state in case of emergencies or failures. Furthermore, low-level functional safety requirements are set to be derived from high-level ones as future work.