Driver in the loop: manoeuvre based driving as an automation approach

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Abstract

The aim of this study was to overcome the trade-off between the drivers' involvement in the driving process on one side and a high degree of automation on the other side. Therefore the study extended the adaptable automation approach of the Playbook-Metaphor by Miller & Parasuraman (2007) to a concept for highly automated driving by applying a manoeuvre-based approach. It was implemented for the context of driving on motorways and enables the driver to choose the manoeuvre for specific driving situations via a touch interface. Since the system did not explicitly ask for a drivers' choice of the manoeuvre they had to be aware of the dynamic situation with a simultaneously high degree of support in the driving task. It was expected that the potential downsides of a high automation level could be antagonized by the manoeuvre-based approach. To prove this hypothesis an assistance system based on the manoeuvre-based approach was compared to a highly automated mode with very low driver involvement in a driving simulator study. It was shown that the manoeuvre-based system yields, compared to highly automation, to a significant decrease in loss of control in case of a system failure.

Introduction

There are more and more advanced driving assistant systems (ADAS) which actively support drivers in fulfilling the driving task. Examples of such active supporting systems are Adaptive Cruise Control and Heading Control, which control the longitudinal and lateral stabilisation of the vehicle on the road. In case of a combination of these two systems drivers solely need to monitor the system. They can potentially take their hands off the steering wheel and their feet off the gas and braking pedal. Fully automated driving seems to be a fairly plausible future prospective.

These assistant driving systems are intended to provide a higher comfort, safety and traffic efficiency. However, as known from various man-machine contexts they can also cause "out-of-the-loop (ootl) performance problems" (Endsley & Kiris, 1995), e.g. loss of situation awareness (Endsley & Kiris, 1995), decrease of system acceptance (Miller, 1999), loss of mode awareness (Sarter et al., 1994), deskilling

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