

Automatic vehicle guidance – Does the vehicle need a driver?

Adrian Zlocki, Jian Chen, Ahmed Benmimoun

Institut für Kraftfahrwesen Aachen, RWTH Aachen University
Steinbachstr. 7, 52074 Aachen, Germany
Phone: +49 241 80 25616
Fax: +49 241 80 22147
E-mail: zlocki@ika.rwth-aachen.de

Today assistance systems support the driver in the driving task. In the future these systems will evolve and increase the safety of a vehicle. At the Institut für Kraftfahrwesen, RWTH Aachen University, assistance systems of the next generation for longitudinal and lateral control as well as for special driving situations such as intersections and parking are developed. This paper describes those systems, provides test results and shows possibilities how to automate vehicle guidance.

Driver Assistance Systems, Sensors & Actuators, Vehicle Control

1. INTRODUCTION

Within the last 20 years the traffic density has increased constantly, as the significance of mobility became a growing factor in everyday life. For the future a further increase of traffic on the available infrastructure is forecasted. Stress situations resulting of stop&go-traffic and the necessity to continuously monitor complex traffic situations require full attention of the driver. One solution for this problem is to improve automated transport such as metros by taking it out of the protected environment. The European research project CityMobil deals with this approach, see [7]. Another approach is to improve modern vehicles by means of advanced driver assistance systems (ADAS).

ADAS are developed in order to support the driver in complex environments, relieve him of monotonous driving tasks and compensate inattention in dangerous situations. Due to the progress in sensor technology the possible degree of driver assistance is increasing. Fig. 1 shows the market introduction of ADAS and the expected introduction of future systems [5].

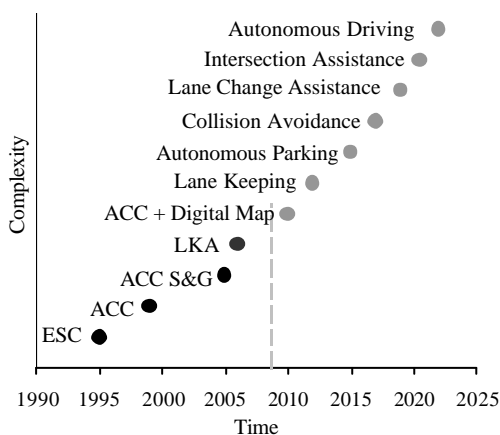


Fig. 1: Expected market introduction of ADAS

Today assistance systems for longitudinal guidance (e.g. ACC) are successfully introduced into the market in most upper-class vehicles. Innovative manufacturer have already introduced the second generation of longitudinal assistance (e.g. ACC stop&go). Those systems operate in low driving velocities below 30 km/h down to complete standstill.

Systems for lateral guidance on the other hand support the driver in the steering of the vehicle. Today they do not take over full lateral control (e.g. Lane Keeping Assistance, LKA) yet. LKA add additional torque into the steering column and therefore help the driver to remain in the center of the driving lane.

Functions such as parking aids, parking assistance and adaptive front-lighting systems increase the driving safety and comfort and are possibilities to raise the awareness of technological advantages of a vehicle.

Next to the technical feasibility of the assistance functions, the human ability to acquire and process information (tiredness, distraction, evaluation of driving situations) as well as the reactions towards the information flow (stabilisation of the vehicle, proportioning of desired values) are limited. Therefore the vision of the accident free vehicle can only be realised by taking the driver out of the control loop.

In order to provide automatic vehicle guidance and to develop the necessary control algorithms a test vehicle has been build up at the Institut für Kraftfahrwesen Aachen (ika) at the RWTH Aachen University. By means of this vehicle the automated longitudinal and lateral vehicle control are realized. Furthermore different comfort functions can be demonstrated.