HAVEit

Highly automated vehicles for intelligent transport

7th Framework programme
ICT-2007.6.1
ICT for intelligent vehicles and mobility services
Grant agreement no.: 212154

The future of driving

Deliverable D51.2 Automated Assistance in Roadworks and Congestion: Components installed, working and tested

Version number	Version 1.0
Dissemination level	CO / public version
Lead contractor	Continental Automotive GmbH
Due date	31.01.2010
Date of preparation	31.01.2010

Authors

Waldemar Schrinner	Continental Teves
Matthias Strauß	Continental Teves
Stefan Lüke	Continental Teves
Matthias Komar	Continental ADC

With contributions from:

Heike Lepke	University of Amberg-Weiden
Anna Schieben	German Aerospace Center
Gerald Temme	German Aerospace Center
Alain Giralt	Continental Automotive France
Robert Baier	Continental Teves
Jürgen Pfeiffer	Continental Teves
Christian Thur	Continental Teves
Dirk Waldbauer	Continental Teves

Project Manager

Alfred Hoess

Holger Zeng

Project Co-ordinator

Reiner Hoeger

Continental Automotive GmbH, STA EG

Siemensstrasse 12

93055 Regensburg

Germany

Phone +49 941 790 3673

Fax +49 941 790 13 3673

E-mail reiner.hoeger@continental-corporation.com

Executive summary

The overall objective of the HAVEit project is to develop technical systems and solutions that improve automotive safety and efficiency. Continental Teves contributes to the overall objective by developing the safety and comfort focused application: Automated Assistance in Roadworks and Congestion (ARC).

The Automated Roadwork Assistance (WP5100 in the HAVEit project structure) is fundamentally intended to support the driver in overload situations like driving in narrow lanes of roadwork areas with lot of vehicles driving closely beside.

The ARC is a passenger car application which will support the driver on motorways and motorway similar roads and particularly in roadworks with different levels of automation in longitudinal and lateral control of the vehicle. In roadworks the automation will work at speeds between 0 and 80 km/h. The automation spectrum is as follows:

- Highly-Automated: automated longitudinal and lateral control
- Semi-Automated: automated longitudinal control (ACC)
- Assisted driving: assisted lateral control (Heading Control)
- Intervening safety functions: automated emergency braking

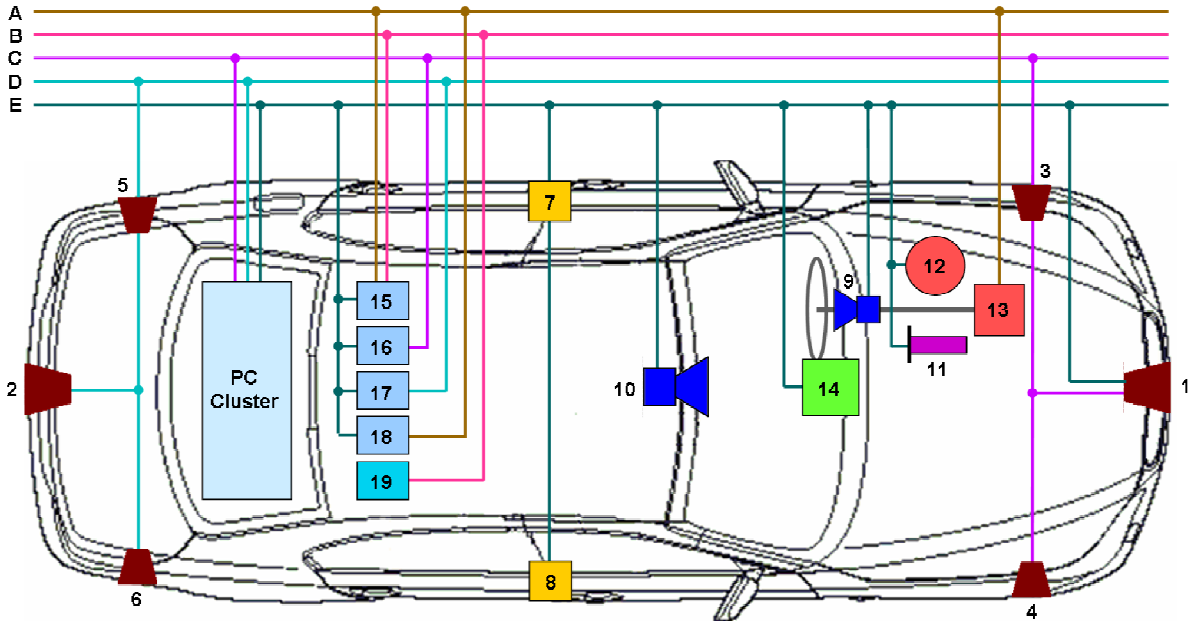
This guarantees that the driver gets the best possible support available, in particular with respect to lateral vehicle control. ARC thus will contribute to traffic safety.

This document summarizes the components installed into the ARC demonstrator vehicle and presents basic tests to ensure that the components are properly working. The demonstrator vehicle is a Volkswagen Passat CC passenger car. The VW Passat has been equipped with:

- Perception layer components
  - Environment sensors (which were described in deliverable D51.1)
  - Vehicle sensors
  - Data fusion
- Command layer components
  - Co-pilot module (see also deliverables D31.1 and D31.2)
  - Driver state assessment including Chassis Safety Controller and direct driver monitoring system (see also deliverables D21.1, D21.2, D32.1 and D32.2)
  - Mode selection and arbitration unit (see also deliverables D33.2, D33.3 and D33.4)
  - Command generation and validation
- Execution layer components
  - Drivetrain control
  - Brake system
  - Steering system (see also deliverable D23.2)
- Driver interface components
  - Primary driver interface (steering wheel, acceleration and brake pedal)
  - Display components (primary and secondary information display)

- Switching components (mode switching buttons and ACC lever)
- Haptic and additional optic components (MSB, AFFP, LEDs)
- Driver interface audio device

The ARC demonstrator is built on the common HAVEit architecture which has been described in deliverable D12.1. In chapter 2.3.1 of D12.1 the logical components listed above are assigned to their respective physical components in the ARC demonstrator. Figure 1 gives an overview over the main physical components installed in the vehicle.



A	Vehicle PT CAN	1+2	Long & Mid Range Radar	11	Force Feedback Pedal	15	Gateway VPU
B	Joint System CAN	3-6	Short Range Radar	12	Active Brake Booster	16	Radar Front VPU
C	Radar Front CAN	7+8	Motorized Seat Belt (MSB)	13	Active Servo Steering	17	Rear Fusion VPU
D	Radar Rear CAN	9	Driver Monitoring System	14	Touch Screen Monitor	18	Control VPU
E	Private CAN	10	Front Camera			19	DSA CSC

Figure 1: Main hardware components of ARC demonstrator

The main objective of project milestone M3 in WP5100 related with this deliverable was to install all components in the ARC demonstrator vehicle and to prove their functionality. This objective has been reached for all hardware components and for most of the software components. All initial tests of the installed components have been successfully passed.

The next steps will focus on the development, implementation and integration of functionalities of the ARC application, in particular the different automation levels and the HAVEit HMI including mode switching and transitions. Another main point will be the adaptation of the lateral control algorithms to the steering system, which may reveal that an additional steering angle control has to be developed for the steering system.

References

[1] S. Lüke, M. Wintermantel, T. Raste und P. Rieth: *Ein neuartiges Fernbereichsradar und dessen Anwendung zur Lenkunterstützung in Ausweichsituationen,* Automatisierungs-, Assistenzsysteme und eingebettete Systeme für Transportmittel AAET, Braunschweig, 2009

[2] Bruce Morey: *Continental integrates driver assistance*, Automotive Engineering International (AEI) Online, Magazine, September 2007

[3] Richard Hartley, Andrew Zisserman. *Multiple view geometry in computer vision*. Cambridge University Press, Cambridge, 2000

[4] A. Hohm, C. Wojek, B. Schiele und H. Winner: „*Multi-Level Sensorfusion and Computer-Vision Algorithms within a Driver Assistance System for Avoiding Overtaking Accidents*" FISITA World Automotive Congress, München, September 2008

[5] S. Heinrich: "*Sensor-Fusion von Radar und Kamera mittels Kalmanfilter*", CTI-conference, Stuttgart, Germany, November 2005

[6] S. Lüke, M. Komar und M. Strauss: *Reduced Stopping Distance by Radar-Vision Fusion*, contribution to congress Advanced Microsystems for Automotive Applications, Springer Berlin Heidelberg, Berlin, Mai 2007

[7] S. Thrun, W. Burgard, und D. Fox: "*Probabilistic robotics*", Intelligent robotics and autonomous agents, MIT Press, Cambridge, Mass. [u.a.], 2005

[8] M. Darms, M. Komar und M. Lueke: *Gridbasierte Straßenrandschätzung für ein Spurhaltesystem,* 6. ADAS Workshop, Löwenstein/Hößlinsülz, Sept. 2009

[9] S.Lüke, M.Darms, M.Komar, D.Waldbauer: *Ein Assistenzsystem zur Unterstützung des Fahrers in Baustellen*. 11. Braunschweiger Symposium AAET 2010.