



September 29, 2004

Balocco, Italy

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**AWAKE Project Aim &
Objectives**
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CERTH/HIT

Road Safety
Workshop 2004





AWAKE Overview

- Co-funded by the European Commission under the IST programme of the FP5.
- Project Number: IST-2000-28062
- Start Date: September 2001.
- Duration: 36 months.
- Budget: over 6 M€.
- Project Coordinator: Dr. Evangelos Bekiaris, CERTH/HIT
- Project Officer: Mr. Fabrizio Minarini, European Commission

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AWAKE Consortium (1)

SIEMENS VDO
A u t o m o t i v e

ACTIA 

**AUTOMOTIVE SYSTEM
DEVELOPERS**

Autoliv

**NAVIGATION
TECHNOLOGIES**

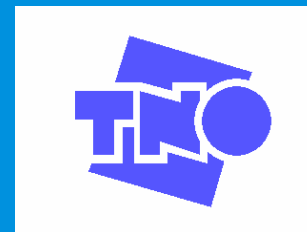
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AWAKE Consortium (2)



Hellenic Institute of Transport



**EUROPEAN RESEARCH
INSTITUTES**



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AWAKE Consortium (3)



EUROPEAN RESEARCH INSTITUTES



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AWAKE Consortium (4)

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UNIVERSITIES



I·A·T Institut
Arbeitswissenschaft und
Technologiemanagement
Universität Stuttgart

COAT-Basel
Center of Applied Technologies in Neuroscience



University of Basel, Department of Psychiatry



AWAKE Consortium (5)



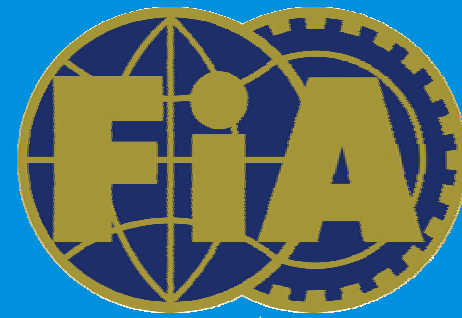
CAR MANUFACTURERS

DAIMLERCHRYSLER

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AWAKE Consortium (6)



END USERS



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AWAKE Concept

- To develop an unobtrusive, reliable system, which will monitor the driver and will detect hypovigilance in real time, based on multiple measuring parameters.
- Operating in all highway scenarios.
- Target goals:
 - Reliability level over 90%.
 - False alarm rate below 1%.
 - User acceptance over 70%.
 - HMI perception rate over 90%.

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AWAKE Components

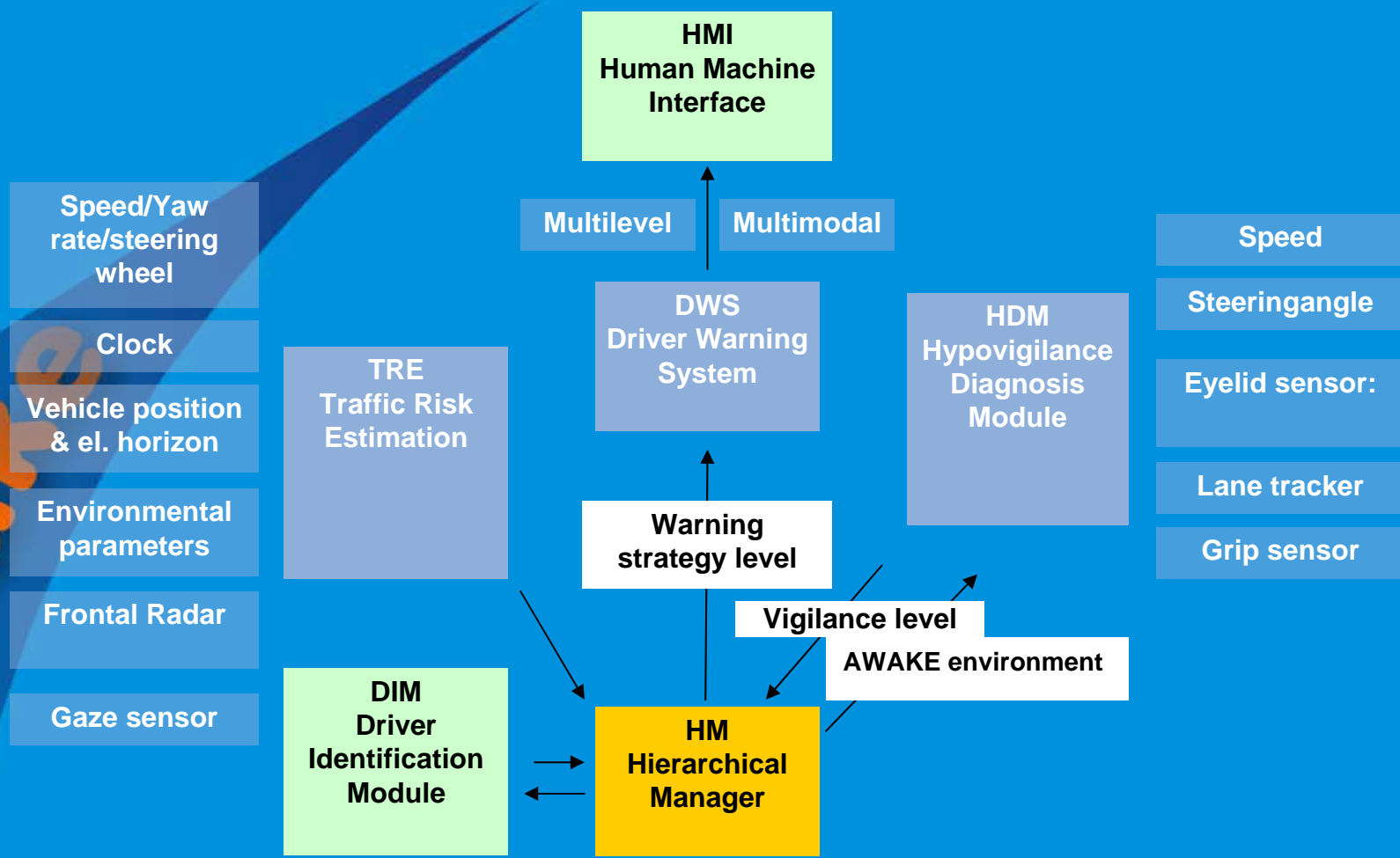
- Hypovigilance Diagnosis Module (HDM).
- Traffic Risk Estimation Module (TRE).
- Driver Warning System (DWS), using acoustic, visual and haptic means in various levels of warnings according to inputs from the monitoring module.
- Hierarchical Manager (HM), to perform self-diagnosis and co-ordinate the other system components.

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Functional Architecture

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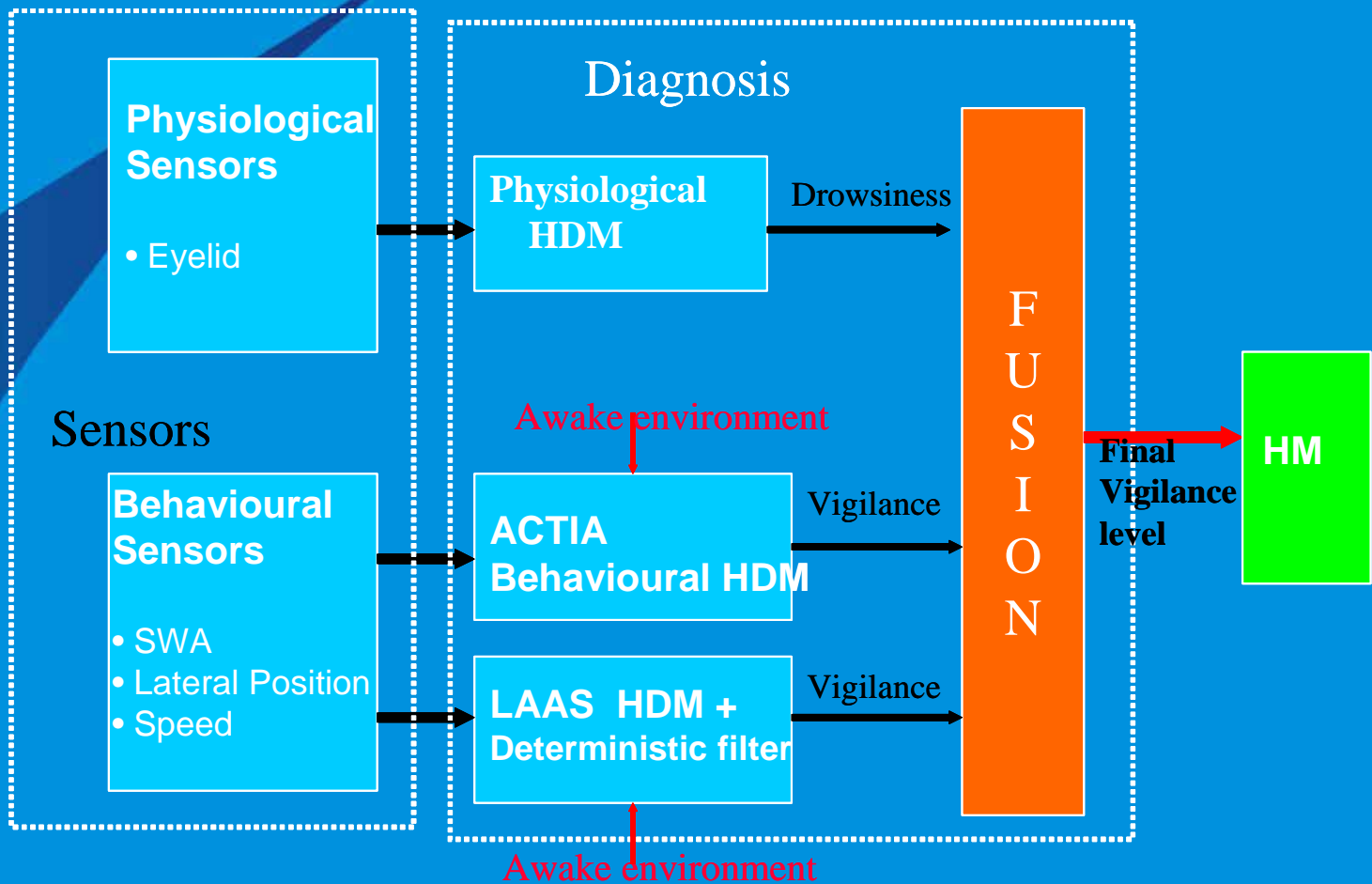


Hypovigilance Diagnosis Module

- Aim: detect & diagnose in real time driver's hypovigilance.
- Behavioural diagnosis detecting hypovigilance based on:
 - driving behaviour (LP, SWA, speed)
 - physiological diagnosis (driver's eyelid activity, grip pressure on the steering wheel) .
- Fusion in 3 level hypovigilance diagnosis each minute :
 - Driver is vigilant meaning her/his driving behaviour is normal and she/he is in an **awake** physiological state.
 - Driver is slightly hypovigilant meaning there is a degradation of his/her driving behaviour or she/he shows **first signs of drowsiness**.
 - Driver is hypovigilant meaning he is driving in an unsafe way or she/he is **drowsy/sleepy**.



HDM Functional Architecture





Traffic Risk Estimation Module

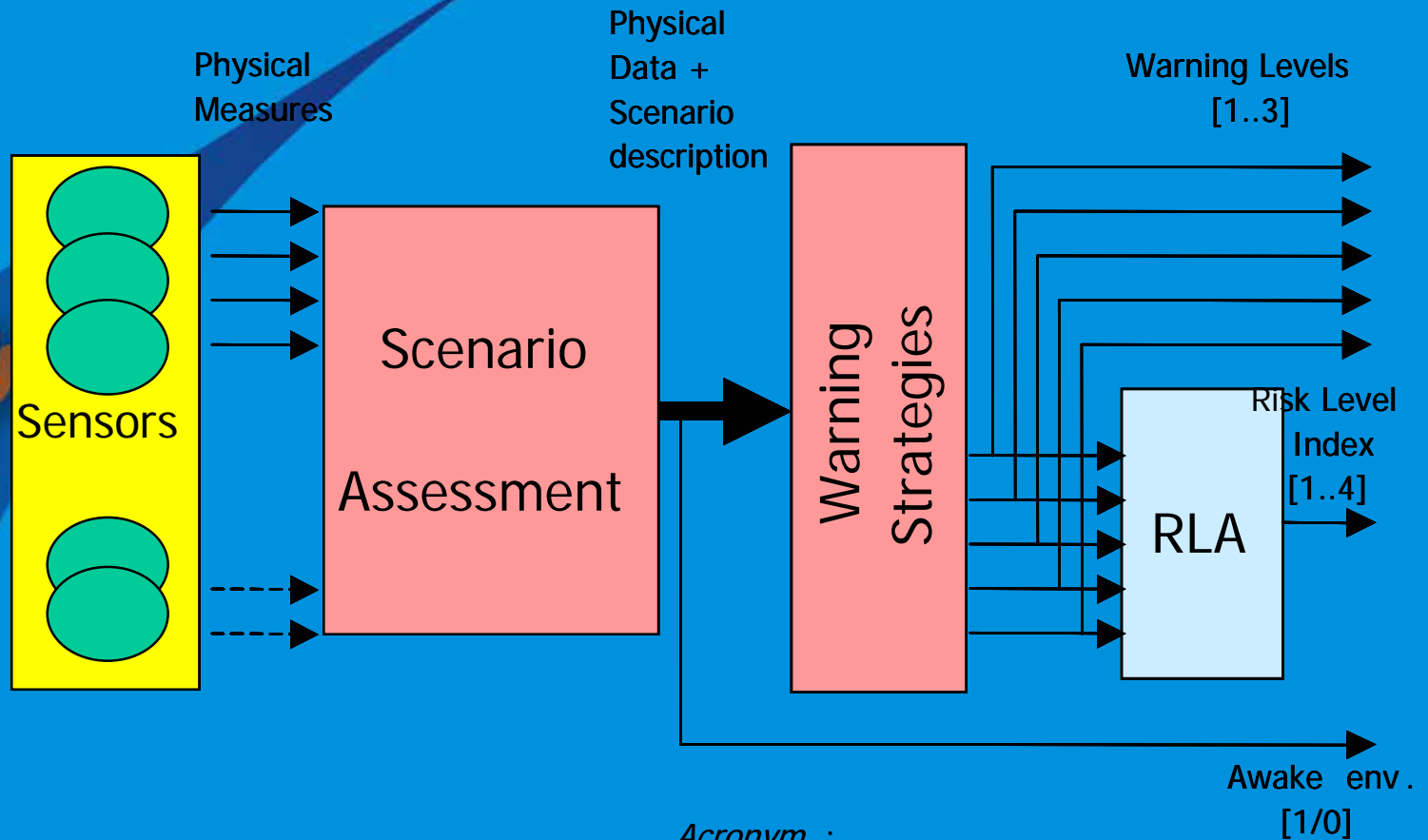
- Aim: To assess the traffic situation around the vehicle and thus the involved risks for the driver and the passengers.
- TRE aim is reached through 3 main steps:
 - integrate all information coming from sensors to describe the scenario (vehicle sensors, radar, GPS, cameras)
 - identify discrete risks and generate, for each risk event a warning level (Frontal Collision Warning, Lane Warning, Curve Warning, Environment Condition Warning, Weak Warning)
 - integrates discrete risks into an overall Risk Level

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TRE Functional Architecture

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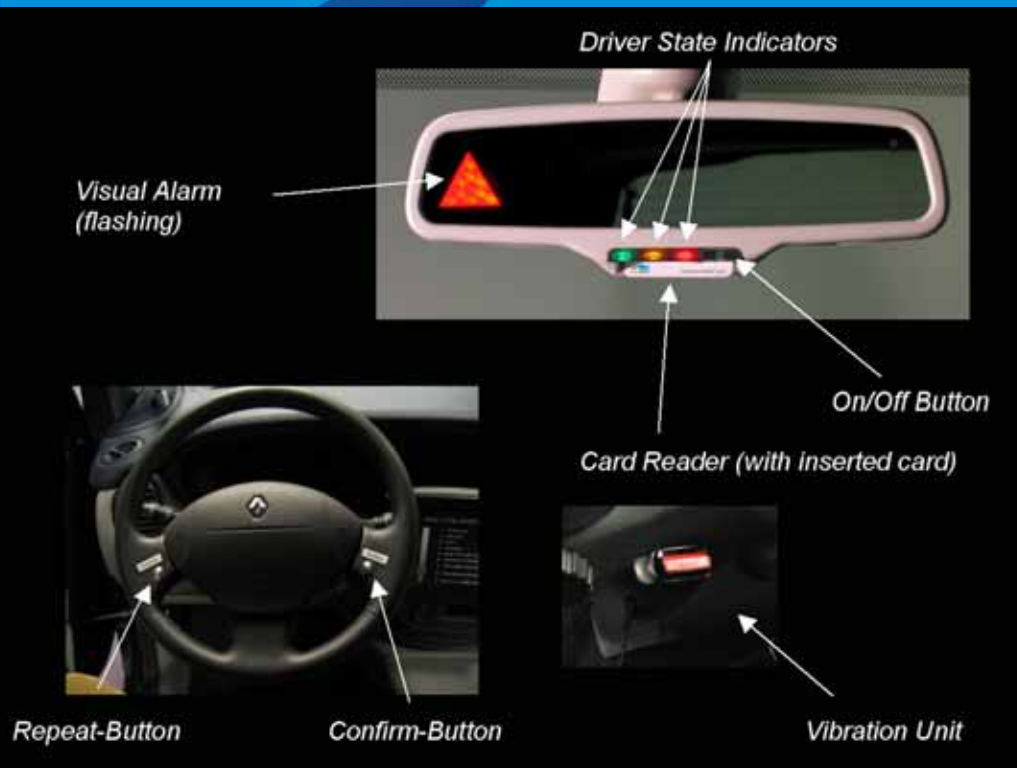
Acronym :

RLA: Risk Level Assessment



Driver Warning System

- Aim: Warn safely and on time the driver about his/her reduced vigilance according to the traffic situation, and consult him/her on the appropriate course of action.
- DWS consists of:



- (i) Acoustic module for alerting sounds and driver information using stereo speakers.
 - (ii) Vibration device for haptic warnings.
 - (iii) Visual warning and state indication device.
 - (iv) Buttons mounted at the steering wheel for repeat and confirm actions.
 - (v) Card reader for personalisation of the AWAKE system.
- September 29 2004, Balocco, Italy



DWS Structure

Driver Status

- Driver awake
- Driver slightly drowsy
- Driver drowsy
- Confirmation of warning by driver

Traffic Risk

- Risk level index
- Lane departure warning (left/right)
- Collision warning (cautionary/imminent)
- Curve warning (cautionary/imminent)

Driver characteristics

- Driver ID
- Language
- Preferred warning components
- Intensity of warning stimuli

Hierarchical Manager





Hierarchical Manager

- Aim: coordinate in real time the activities of the AWAKE subsystems. Functionalities of HM include:
 - Processing of HDM input (vigilance level)
 - Processing of TRE input (traffic risk index)
 - Processing of smart card information (driver profile)
 - Control of driver warnings and feedback,
 - Priority management of DWS output
 - Demo mode
 - Data logging
 - Exchange of data between AWAKE CAN bus and TCP/IP network
 - Conversion of data formats according to subsystem's requirements
 - Error management
 - Shut-down procedure

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AWAKE Achievements

- Development of 4 main modules (HDM, TRE, HM & DWS).
- Implementation of modules in the integrated AWAKE system.
- Validation in 17+1 pilots in 7 countries.
 - 3 prototype vehicles for measurements.
 - 5 driving simulators, including a heavy vehicle one and a VR one.
 - Tests also with specific user groups (novice drivers, shift workers, elderly drivers, SAS patients, professional drivers).
- 3 demonstrators (city car, luxury car, heavy vehicle).
- System Performance: Sensitivity : 66-83%, Specificity : 75-89% (excluding extreme cases)
- Users Ratings: Acceptance: over 70% - up to 87%
- Usefulness: over 90% - up to 100%



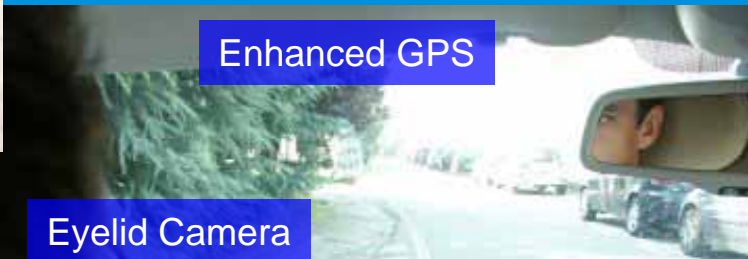
AWAKE City-Car Demonstrator



AWAKE mirror device



Frontal Radar



Enhanced GPS



Lane Tracker



Eyelid Sensor

Eyelid Camera

Infrared Illumination

Steering grip force sensor

DWS buttons

Steering wheel angle sensor



Eyegaze Detection



Seatbelt Vibration Device



AWAKE Luxury-Car Demonstrator



Frontal radar



Steering grip force sensor



Visual warnings and card reader



Lane tracking camera



Eyelid sensor



DWS buttons

Infrared illumination



Eyegaze detection



Seatbelt vibration device

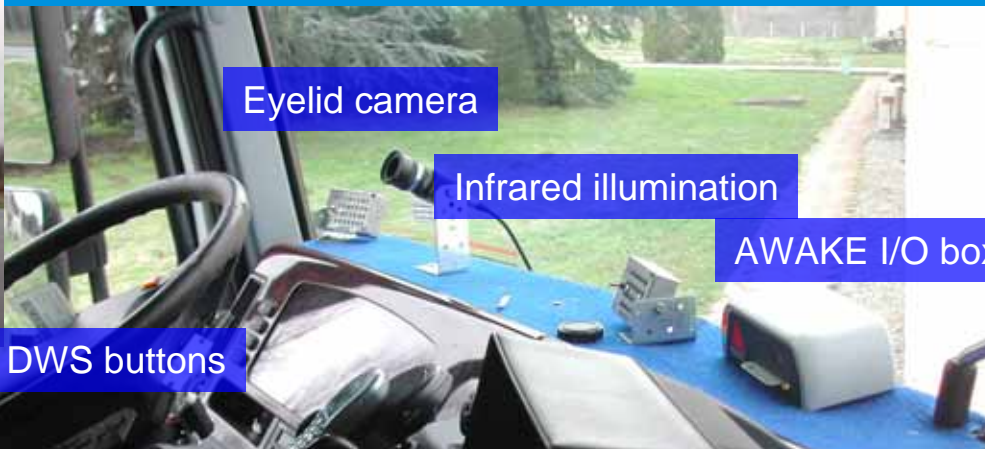
Steering wheel angle sensor



Additional stereo speakers



AWAKE Heavy-Vehicle Demonstrator



Eyelid camera

Infrared illumination

AWAKE I/O box

Lane tracker

DWS buttons

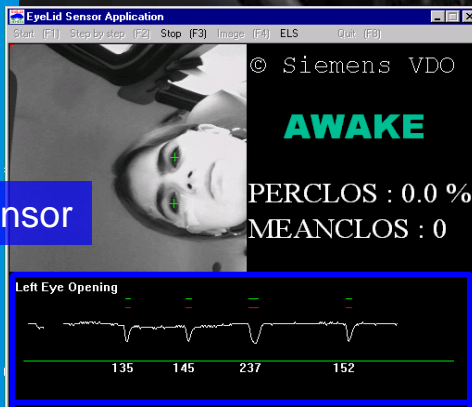


Steering grip force sensor

Steering wheel angle sensor



Frontal radar



Eyelid Sensor



Enhanced GPS navigation