PROJECT

SAVE

System for Effective Assessment of Driver State and Vehicle Control in Emergency Situations

Funding: European (4th RTD Framework Programme)

Duration: Jan 1996 - Dec 1998

Status: Complete with results

Background & policy context:

The SAVE system prevents accidents due to the drivers state through:
- non-intervening monitoring of driver status through multiple sensors
- in-time driver warning through audio and visual channels
- warnings surrounding traffic of the drivers problem
- taking automatic control of the car and safe parking it at the right side of the road
- automatic calling for help from an Emergency Centre and transmitting the vehicle position, possible cause of the emergency and personal medical data of the driver.

SAVE is based upon three principal subsystems: the Integrated Monitoring Unit (IMU), the SAVE Warning System (SWS) and the Automatic Control Device (ACD).

In 30% of road accidents, the main or secondary cause is related to the state of the driver: fatigue, drowsiness, use of alcohol or drugs, inattention or sudden illness. The purpose of SAVE project is to prevent such accidents, by monitoring the driver state through various subsystems which analyse driving behaviour (vehicle position on the road, speed, acceleration, etc.) and automatically measure basic physiological characteristics (eye-blink rate, steering grip force, head position, etc.) without physical contact with the driver.

It is statistically proven that a high percentage of road accidents are attributable to four main causes of driver impairment, namely:
-fatigue or sleep deprivation
-alcohol or drug abuse
-sudden illness
-prolonged periods of inattention.

Various systems have been offered to solve the problem. None of them has been widely accepted by the market, for the reasons that:
-they are based on one sensor only, therefore present low success rates
-they often require wiring of the driver, which is not acceptable by the majority.

Objectives:

The aim of SAVE project has been to develop a demonstration prototype of an integrated product (SAVE unit) that is able in real time to detect driver state and undertake emergency handling prior, during and after the emergency situation occurs. The system furthermore tries to identify driver impairment cause and classify it in one of the following categories: fatigue or sleep deprivation, alcohol or drug abuse, sudden illness of the driver and prolonged periods of inattention.

Parent Programmes:

FP4-TRANSPORT - Specific research, technological development and demonstration programme in the field of transport, 1994-1998

Institute type: Public institution

Institute name: European Commission; Directorate-General for Energy and Transport (DG TREN; formerly DG VII)

Funding type: Public (EU)

Other funding sources: Funded under the call: FP4-TELEMATICS 2C

Partners:

- Transport Research & Development International (GR)
- Centrale Organisatie TNO (NL)
- Centre National de la Recherche Scientifique - Laboratoire d'analyse et d'architecture des Systèmes, (FR)
- Centro Ricerche Fiat S.C.p.A. (IT)
- FIA (FR)
- GIE Renault Recherche Innovation (FR)
- Institut National de Recherche sur les Transports et leur Sécurité (INRETS) (FR)
- Laboratoire de Physiologie et de Psychologie Environmentales, (FR)
- Ministry of Transport, Rijkswaterstaat AVV (NL)
- Rijksuniversiteit Groningen (NL)
- Siemens Automotive S.A. (FR)
- Swedish National Road and Transport Research Institute (VTI) (SE)
- The Loughborough University of Technology (UK)
- Universität Stuttgart - Institut Arbeitswissenschaften und
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Key Results:

Integrated Monitoring Unit
The driver monitoring subsystem is based on measurements from various sensors, combined through a Neural Networks Algorithm.
The sensors can be considered in two categories: those that monitor the course taken by the vehicle on the road in correlation to drivers actions (acceleration, braking, steering, lane position of the car) , which are assembled into a drivers model, and those that monitor various physiological characteristics of the driver (i.e. eyelid, steering grip, head position sensors).
The system automatically creates a profile of the specific driver during the first day of use, by defining some parameters of the Hierarchical Manager (Neural Network) according to his personal driving style. In this way the chance of false alarms is minimised.

The Driver Warning System
There are four phases in the Driver Warning Sub-system:
- Green phase: Normal driving state
- Yellow phase: Slight problem, simple warning
- Orange phase: Driver state not sure, warning and request for driver confirmation
- Red phase: Bad driver state or not enough time for warning; hence activation of ACD.

The warning procedure is based on an audio signal, a voice message warning, visual lights flashing in the drivers mirror, and visual message on a screen .

Surrounding traffic warning and Emergency Centre calling subsystem
As the traffic around the SAVE vehicle needs to be informed adequately, the right direction lights and the brake light are activated, also a special triangle flashes at the back window of the car . After the vehicle is parked, an SMS message is sent to an Emergency Centre, transmitting the vehicle position (GPS co-ordinates), probable cause of incident, and drivers medical data from his smart card.

Automatic Control Device
The ACD system is based on various electronic sensors around the vehicle. Lane changing and braking are performed progressively, by separating the area around the vehicle into three manoeuvre zones :
-Vehicles in the outer green zone are informed that there is a problem
-When there is no other vehicle in the inner red zone, the vehicle decelerates gradually

-When there is no other vehicle in the middle yellow zone, the lane change procedure is initiated.
The zones naturally move with the moving vehicle.
ACD was proved to perform optimally under simple highway scenarios .

Conclusions and Plans for the Future
Although the ACD has been proved to be feasible, and developed for highway conditions, its introduction into the market requires awareness and a very high safety rate in all traffic conditions and full acceptance in the market. Therefore, its time to market is estimated to 15-20 years.
On the other hand, the IMU and the SWS subsystems are based on low-cost components and can be expected to enter the market successfully within 3-5 years.
The most important steps for the future would be the extension of IMU and ACD subsystems to cover all highway and, if possible, rural traffic scenarios, and adoption by Insurance companies as part of their long-term tariff structures.

STRIA Roadmaps: Cooperative, connected and automated transport

Transport mode: Road transport

Transport sectors: Passenger transport

Transport policies: Safety/Security

Geo-spatial type: Other