PROJECT RESULT

Automotive electronics

MEDEA+

2A403: Caring Cars

Monitoring human health for safer driving

Accidents create a serious toll of deaths and injuries on European roads each year. They also add to the indirect costs of transport – a major drain on the European economy. The MEDEA+ Caring Cars project sought to drive down such statistics by developing an innovative range of in-vehicle sensors capable of monitoring the physical health of drivers and passengers. In addition, an in-vehicle wireless infrastructure capable of communicating with the outside world laid the foundations for future intelligent vehicles that will look after the health of their passengers as well as transporting them.

Each year over 40,000 people are killed and around 1.7 million injured on the roads in Europe. Research shows that over 90% of all road accidents are caused by human error, and many could be prevented if drivers were aware of their physical condition and encouraged to concentrate on their actions or take a break from driving.

Apart from the social costs of accident and injury, road accidents are considered part of the indirect cost of transport, and the European Environment Agency estimates that these indirect costs amount to some 8% of gross domestic product (GDP). The objective of the MEDEA+ 2A403 Caring Cars project was to increase motoring safety by applying physical-health monitoring systems to the automotive environment, thereby helping reduce the high social and economic cost such accidents cause. The key focus of the project was the development of a number of innovative sensors and sensor applications that monitor, in real time, the vital signs of physical health for vehicle drivers and passengers. This development was backed by the creation of an open-standards control-and-communications infrastructure for connecting the sensors within the vehicle, and communicating the data gathered to the outside world.

Driver-health monitoring

A wide range of sensors was deployed within the project. One novel approach was applied to the monitoring of driver health. Sensors integrated within specially developed conductive textiles were located on the car steering wheel and, through contact or near-contact with the driver's hands, were able to monitor his/her heart rate and other vital signs, and communicate this data to the vehicle communications gateway.

Another example was a low-power temperature sensor with radio-frequency identification (RFID) connectivity, which was built into a smart infant seat and enabled the health of the child in its seat to be communicated to the in-car network. Once standardisation is improved in areas such as in-vehicle power management and video rendering for video monitoring of the child in his/her seat, sensor applications like this could find mass market take-up developing rapidly.

Deploying wearable sensors, in addition to those mounted within the vehicle, provided the in-vehicle communications network with a range of additional data on the vehicle driver and passengers, such as vital signs, alertness and emotional state.

Managing in-car services

An important part of Caring Car was to ensure that data from the monitoring of such human-health vital signs was communicated to the

outside world, as well as within the vehicle. The project therefore developed a controller platform to manage the various services and applications within vehicles. These services included:

- An advanced emergency call system, integrated with the sensors and devices in the car and the Caring Cars communications gateway. The system supports four eCall European automated emergency call scenarios – basic and enhanced eCall, automatic and manual call – and includes a 'blackbox' functionality;
- Redundant hardware to take over if the onboard controller unit fails;
- Integration with first responders and public safety answering points (PSAPs);
- Galileo global positioning system ready;
- Bidirectional video eCalls and fast alarm processing;
- In-car navigation; and
- Access for Internet communications.

The advanced emergency call system for example linked the data from the various in-vehicle sensors to remote emergency-services providers such as police, fire and ambulance services as part of the emergency call system, providing video data as well as normal audio calls.

An additional component was development of speech-recognition technology resources for the vehicle infrastructure. The objectives here were to make possible speech-based actuation of vehicle controls, and to underpin the development of voice-dialogue approaches for interacting with the driver and analysing his/her physical and psychological condition. By the end of the MEDEA+ project, a patent had been filed covering this area of work.

In addition a services-execution platform was developed to provide general functions such as the in-car communications gateway and management of the various applications and shared resources – such as the graphic user interface and voice system. The platform consisted of service middleware and a set of basic functions and application programming interfaces to enable the development of advanced embedded services for the automotive environment.

High market potential

The Caring Cars team successfully demonstrated all the sensors and applications developed in a specially fitted-out car. The market potential for such applications is high, as they have possibilities for a wide range of commercial-driving applications such as taxicabs, commercial vehicle fleets and hire cars.

All the services developed rely on the use of an on-board control unit and gateway capable of linking to a range of wireless networks. The project partners have assumed that this on-board unit would be built into the car as standard by the vehicle manufacturers, enabling its facilities to be marketed as a range of additional vehicle options either by the manufacturer or subsequently by third-party service suppliers.

The partners estimate that by 2018 all new cars could be fitted with such on-board units, offering the same facilities as those demonstrated in Caring Cars. If the EU develops a European standard on in-car wireless networks and interfaces, then demand could potentially rise to a need of over 40 million units within the coming decade.

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