PROJECT PROFILE

2A401: Electronics technology for day and night safe driving (Car Vision)

AUTOMOTIVE ELECTRONICS

Partners:

CEA-LETI
CEA-LIST
CTAG
Ficosa
STMicroelectronics
ULIS

Project leader:

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Key project dates:

Start: January 2005
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Countries involved:

France
Spain

Road safety and the social impact of traffic accidents are major concerns for citizens. Consequently, car manufacturers are constantly seeking new ways of helping drivers avoid such occurrences. The Car Vision project involves innovative optical solutions for advanced driver-assistance applications. The consortium is using its extensive automotive expertise to focus on new image-recognition and safety systems, and to develop a state-of-the-art platform to enhance day and night vision. This will exploit a CMOS-based sensing system resistant to the extremes of the car environment. Major benefits are expected in European competitiveness and employment for the automotive and electronics industries.

Major efforts are being made in Europe to increase road safety and significantly reduce the number of deaths and injuries caused by traffic accidents, with an ambitious EU target of halving road deaths by 2010. A particular focus is placed on solutions to protect pedestrians and cyclists.

The MEDEA+ 2A401 Car Vision project will contribute to the European automotive industry's efforts in this area by developing highly integrated optical-recognition and image-processing technologies and safety systems to improve drivers' day and night vision. Through the use of the intelligent multifunctional CMOS-based sensors developed during this project, European vehicle manufacturers will be able to offer state-of-the-art active safety solutions that have functional interfaces to in-car infotainment and multimedia systems/displays.

Car Vision will generate highly-innovative solutions to reduce traffic accidents significantly under difficult driving conditions such as in fog and rain. It will be an opportunity for the European automotive electronics industry to strengthen its global leadership position and offer employment opportunities for the development and manufacture of the resultant recognition and assistance systems.

Through vertical and horizontal co-operation, this project will be supported by a team of automotive system and components experts including automotive equipment manufacturers, automotive hardware and software intellectual property (IP) providers, and semiconductor manufacturers. Developments will not only be in line with the stringent demands of the automotive environment but will also meet the design-to-cost-effectiveness specifications for high volume car applications.

New vision technologies

Although the market for automotive optical recognition assistance and safety systems is very promising, there have been no significant European manufacturing activities in this sector. Field trials are in progress on a mix of costly radar and charge-coupled device (CCD) sensor technologies, with applications from parking assistance to use of rear view, front view and side view cameras for collision avoidance. There are also tests for mirror/blind spot detection, seat monitoring and night vision.

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A major innovation of Car Vision lies in the development of new integrated vision technologies for the design of cost-effective recognition and assistance systems. Optical systems for these applications are currently dominated by Japanese companies offering mainly CCD technology. Car Vision will develop alternative solutions based on dedicated CMOS-based optical technology covering visible and both near and far infrared applications. Work will focus on a multiple pixel architecture solution to fulfil the stringent high dynamic range requirements for automotive safety applications.

CMOS imagers are gaining momentum against CCD as they offer higher levels of integration and cost-effectiveness. This is illustrated by the success of CMOS-based cameras in mobile phones. And there has been high market acceptance for the introduction of camera systems in cars despite current elevated prices. Moreover, thanks to the growing popularity of on-board navigation systems, liquid crystal display (LCD) screens are widely available to visualise camera images.

The Car Vision consortium will develop an innovative integrated CMOS camera that will perform a high degree of filtering to extract useful information from road scenes. The proposed architecture will greatly improve imager flexibility, preserve small pixel dimensions and make the imager suitable for medium to large resolutions.

Higher integration levels

Compared with other approaches, CMOS optical technology has the unique capability of integrating both the image-capture and image-processing features. CMOS sensors are ideal for automotive applications, offering a high level of integration and combining process, logic and memory features. CMOS technology also has the ability to integrate multiple functions on chip with very low power consumption compared with CCD. Furthermore, CMOS devices outperform CCD in the near infrared spectrum. They also deliver better quality images in high dynamic light conditions that are a major concern of the automotive industry.

The innovative platform proposed makes it possible to develop novel multifunctional optical sensors together with dedicated packaging for automotive use. Several optical sensing functions will be integrated on a single CMOS chip. The multifunctional sensor will be used to detect a number of critical environmental parameters – such as background luminance, visibility, rain and mist – while simultaneously providing information on the driving environment, including bends in the road, oncoming vehicles and the approach to tunnels.

Such sensors will also provide crucial input to a number of existing and emerging automotive driver-assistance (ADA) system functions – such as lane departure warning, adaptive headlamps, collision warning/avoidance and night vision.

For infrared applications, the project will address the idea of a complete 'camera on a chip'. The micro-packaging concept will be developed to provide vacuum packaging directly during front-end wafer fabrication operations. Specific algorithms and signal processing will be implemented on a dedicated chip to manage all vision sensors.

Innovative image-processing architecture will be developed in parallel with software to be compliant with automotive fault-tolerant system requirements. And dedicated firmware and software libraries will be available for applications such as pedestrian protection, lane departure warning and lane change decision aid systems, blind spot detection, and night vision enhancement.

Boost to Europe

Car manufacture is a major industry in Europe but the automotive optical sensor market is currently dominated by Japanese companies. Car Vision offers a unique opportunity to demonstrate more cost-effective solutions based on CMOS technology. It will support the development of R&D competences and ADA-system manufacturing capability close to European car makers' locations.

Successful results from the MEDEA+ project will not only improve road safety but will also boost employment in both R&D and device manufacture in Europe. The market for automotive safety systems is forecast to reach 15.9 million units a year by 2010. In addition, the current legislative focus in the European Union on mandatory active safety systems may well speed up their introduction.

The Car Vision platform should thus help to strengthen the competitiveness of the European automotive and electronics industries. And it will bring significant opportunities at all levels in the automotive value chain – from car manufacturers and their equipment suppliers to chipmakers and device manufacturers.

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