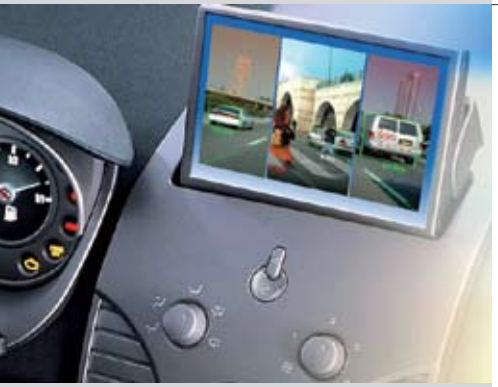
PROJECT RESULT

Automotive electronics

MEDEA+

2A401: Electronic technologies for day and night safe driving (Car Vision)



Optical sensor system development set to improve safety on Europe's roads

The rapid growth in advanced driver-assistance systems has generated a number of in-car devices aimed at cutting traffic accidents, either by providing information or through direct intervention in vehicle control. The MEDEA+ 2A401 Car Vision project has now developed the basic components required for integration of in-car visual data that can assist with the avoidance of collisions in any type of conditions. The result is a cost-effective CMOS-based vision system platform and associated software that can be integrated in low-/ medium-level vehicles to improve the safety of all road users.

Microelectronics are increasingly driving innovation in the automotive sector. Integration of products developed to improve safety has a key role in helping achieve European goals to halve road deaths. Advanced driver-assistance systems (ADAS) such as GPS navigation systems linked to traffic data from local radio stations, automated lights, adaptive cruise control, blind-spot detection and automatic parking contribute to improving road safety and could eventually lead to the 'driverless' car.

Current efforts focus on improving the 'intelligent car' in which sensing devices are making a substantial contribution to decision-making processes. Some merely provide information to the driver while others intervene directly in vehicle performance. Adaptive cruise control, for example, reduces the pre-set speed if it detects the presence of another vehicle ahead travelling more slowly.

Video technology has developed rapidly over recent years with a very wide range of applications in cars – from entertainment to monitoring the external environment. Higher levels of integration have provided ever greater computing power, making it possible to process the optical date to detect and react to obstacles whatever the conditions. However, although the market for automotive optical-recognition assistance and safety systems appears so promising, there have been no significant European manufacturing activities in this sector.

Lowering the costs

The MEDEA+ 2A401 Car Vision project therefore set out to develop a low cost CMOS-based optical detection device, an infra-red (IR) detection device, car-resistant packaging and the associated software to broaden the application area for on-board cameras in ADAS.

A key aim was to apply innovative optical solutions to reduce traffic accidents significantly under difficult driving conditions such as in fog or rain. The consortium focused on new image-recognition and safety systems, and developed a state-of-the-art platform to enhance day and night vision. This exploits a sensing system resistant to the extremes of the car environment.

A major innovation of Car Vision lay in the development of integrated vision technologies for the design of cost-effective recognition and assistance systems. The MEDEA+ project developed alternative solutions based on dedicated CMOS-based optical technology covering visible and both near- and far-infrared applications.

Evaluating the requirements

The main technological challenges facing the Car Vision partners were to:

- Build a low-cost CMOS process for a high-dynamic camera sensor;
- Encapsulate an infrared (IR) sensor based on microbolometer technology;

- Design a processor architecture to handle a high volume of data for ADAS;
- Design an advanced read-out circuit for the microbolometer in a 0.18 µm CMOS technology; and
- Design reliable software for vehicle lane departure warning and pedestrian detection.

Cost was important as automotive manufacturers are sensitive to component prices. Until now, applications have mainly been found in high-level cars as all previous solutions were too expensive for low- to mid-range vehicles.

The result of the collaborative efforts was the development of a programmable high dynamic range – 120 dB – CMOS sensor, and its automotive grade package. This new device has a sensitivity range better than any sensor already on the market. The second major development is the uncooled microbolometer package assembled in a collective way rather than individually.

These two achievements mean the availability of a low-cost day- and night-vision system which can be integrated in low-/medium-range cars as well as in luxury cars and could replace current Doppler radar systems.

A new architecture for pedestrian or vehicle lane detection has also been designed and emulated successfully but no processor has yet been built. Car Vision has, therefore, achieved its objectives of developing the necessary component parts and the software required to provide functionality. It will, however, still take some time before these new devices appear in series models.

Benefiting automotive market

As a result of participation in this MEDEA+ project, the partners have acquired considerable expertise that will be useful for further automotive developments. The commercial benefits of collaboration in such a programme include extension of the client portfolio and the opportunity to enter new markets.

At the completion of Car Vision, the CMOS sensor and software developments are complete and ready for integration with an ADAS package. The IR sensor will reach that stage by 2011 and commercial discussions are already under way.

The systems developed during the project will make a serious contribution to European road safety. As a result, they are expected to help reduce significantly the number of deaths and injuries caused by traffic accidents. They provide solutions for the protection of pedestrians and cyclists in conjunction with existing road infrastructure equipment.

Through the use of the intelligent multifunctional sensors developed during this project, in the near future European vehicle manufacturers will be able to offer state-of-the-art solutions that have functional interfaces to infotainment and multimedia systems.

Major benefits are expected in terms of research, competitiveness and employment for the automotive electronics industry. In terms of innovation, this is especially true for CMOS sensor optical technologies. The core achievement of Car Vision is a very innovative high dynamic CMOS sensor together with CMOS technology optimisation for automotive optical applications.

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KEY PROJECT DATES:

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