

NETCAR - Embedded Dynamic Car Situation Awareness System Based On Advanced Road Surveillance Employing Natural Driver's Communication Interface

Topic	Call "Mobility for Growth" MG3.4-2016 - Transport infrastructure innovation to increase the transport system safety at modal and intermodal level (including nodes and interchanges) MG6.2-2016 - Large-scale demonstration(s) of cooperative ITS
Duration of project	36 months
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1 Objectives

The main objective of the project is to create a distributed system based on wireless communication, combining data from video, audio, and other types of sensors installed in vehicles and traffic surveillance devices, in order to detect various application-defined and customized events related to traffic safety.

The project will include the modalities currently not used in ITS and V2x systems in order to provide a wide range of applications targeted at increased transportation safety. Combining data from video, audio, and radio-based sensors will allow various innovative types of information to be exchanged between vehicles in urban and non-urbanized areas, e.g. dense traffic regions, thus aiding in recognizing some predefined dangerous situations (such as wildlife presence, people walking in the road etc.), and providing warnings on traffic jams, dangerous situations on the road ahead (e.g. behind a sharp curve), difficult weather conditions and other unexpected events.

The focus of the project is also put on creation of novel, safe and efficient driver-friendly interfaces for human interaction with the system in a multimodal way, so that the driver will be able to control the system using voice commands and hand gestures. State-of-the art V2x mobile network solutions will be investigated and extended, whenever necessary, in order to provide an uninterrupted, reliable communication framework.

The expected results:

- distributed system based on V2x (Vehicle to other devices) wireless communication protocol, combining data from video, audio, and other types of sensors installed inside and outside of vehicles and traffic surveillance devices, in order to detect a variety of events related to traffic safety
- reliable communication technology, integrating vehicles with external sensors and city surveillance systems
- high (90% or more) rate of detection of crucial events related to traffic - verified employing testbed
- dedicated Human-Car-Interaction interface for effective and safe driver's communication with the system, ergonomic and intuitive driver's interface - verified during test exploitation.

The project will focus on the following topics:

- distributed sensors fusion,
- simultaneous environmental monitoring and exploitation of surveillance systems,
- intelligent interpretation of visual scene in surveillance systems with automatic threats detection,
- new methods for measuring distances between cars or between the car and route obstacles, car and pedestrians, etc.
- new methods for measuring traffic density by analysing acoustical noise,
- mesh networks protocols,
- multimedia data delivery in wireless channels,
- linking CAR-to-X protocols with video surveillance Open Network Video Interface (ONVIF)
- real-time dissemination of information integrated with GIS, distributing alarms and warning messages,
- driver-friendly data presentation and system interaction with a suited Human-Car-Interaction interface,
- employing speech recognition, gaze tracking, and gesture control,
- driver attention monitoring as an additional feature (gaze tracking, heart rate).

2 Relation to the Work Programme

The proposal will be dedicated to the creation of a new "intelligent mobility" solution, by means of equipping vehicles and city surveillance infrastructure with smart sensors, and a communication infrastructure, in order to increase safety in the traffic, quality of living, and to provide information meaningful to the driver, in an unobtrusive manner employing new generation of HCI interfaces. It is related primarily to **better mobility, less congestion, more safety and security**.

3. Ambition

The project will include the modalities currently not used in ITS and V2x systems in order to provide a wide range of applications targeted at increased transportation safety. Combining data from video, audio, and radio-based sensors will allow various, innovative types of information to be exchanged between vehicles, thus helping in recognizing some predefined dangerous situations (such as wildlife presence, people walking in the road etc.), warning on traffic jams, dangerous situations on the road ahead (e.g. behind a sharp curve), difficult weather conditions and other unexpected events. Thanks to an open programming standard, the list of possible applications would be extended with a repository of third-party software modules that may be easily integrated into an existing system in order to provide the desired functionality.

The focus of the project is also put on creation of novel, safe, and efficient driver-friendly interfaces for human interaction with the system in a multimodal way, so that the driver will be able to control the system using voice commands and hand gestures.

State-of-the art V2x mobile network solutions will be investigated and extended, if necessary, in order to provide an uninterrupted, reliable communication framework between cars and surrounding urban infrastructure.

4. Expected impacts

The project will provide several benefits compared to existing ITS (Intelligent Transportation Systems) and in-car systems. It will address the market of private cars, public transport vehicles, emergency vehicles, and vans & trucks. It will introduce new series of monitoring products employing an advanced software layer for audio & video analytics, and new methods and products for environment monitoring of city agglomerations.

The data communication among cars and between vehicles and surrounding urban structure will be prepared, implemented and tested. New paradigms of driver assistive information systems will be proposed and verified in practice. The project will have a wide business impact on sensors, cameras, car assistive systems, Car-to-X and ONVIF protocols development and on embedded processor circuits manufacturing, automotive industry development, so it will consequently create an opportunity to increase road safety and driving comfort and will have a positive economic impact on industrial sector.

5. Dissemination and communication activities

The communication system extending V2x could be promoted as a new pending standard. Automotive industry, especially major car makers will be informed about the project results by receiving a special memorandum. Road video surveillance-2-Car testbeds will be installed in some selected crossroads in European cities. APIs (Application Programming Interfaces) will be made available for third parties wishing to develop applications utilizing the elaborated systemic parts and protocols. A repository of software modules developed within the project for intelligent video & audio surveillance systems, for the communication layer, and for embedded processors will be made available to interested third parties.

Academic partners will take part in activities related to publishing of research results in journals and in conferences. The developed solutions will be presented on exhibitions. The project web page will promote the most significant results. A movie illustrating scenarios related to the usage of the developed system in various traffic situations will be produced and distributed over the Internet.

6. Exploitation

The project results will be commercialized starting 3 years after the end of the project. In order to get prepared to this important activity, during the project execution a preliminary (at month 18) and a final (at the end of the project) document precisely describing the future exploitation strategy will be developed. The project partners should have an agreed view on how they will recover the investment to be faced for the project execution. The project results will be used by the automotive industry for the integration of safety technologies in cars, an aspect that counts with a significant market potential. The development of a software API for the NETCAR technology will enable the possibility of establishing integration and functional enrichments competitive practices.