Collaborations Among In-Vehicle and Infrastructure-Based Sensing Technology for Automotive Applications: The EMMA and TRACKSS EU Projects

Sergio Grosso, Dr Alan Tully, and Dr Budi Arief
University of Newcastle upon Tyne, UK

Antonio Marques and Manuel Serrano Matoses
ETRA, Spain

Abstract

- New synergetic approach to sensing data for automotive applications;
- Software development to build networks of non-homogeneous technologies
- Approach dealing with parts of the engine, detectors within the car and the car itself in connection to the outside world

About the Speaker

Sergio Grosso is Researcher at the University of Newcastle upon Tyne and Senior Transport Consultant for PTV. He has started traffic modelling in 1993 and since then he has worked on a wide range of applications related to consultancy, training, auditing, student supervision, project work, demonstrations, and software development. Models dealt with are either at a macro or micro scale, urban and motorways, mostly private transport. Currently involved with the TRACKSS EU project, he has previously worked on the CLEOPATRA, COSMOS and SENSOR EU projects. He has developed programs for macroscopic assessment of traffic and pollution/noise estimation from microsimulation.

Collaborations Among In-Vehicle and Infrastructure-Based Sensing Technology for Automotive Applications: The EMMA and TRACKSS EU Projects

Sergio Grosso, Dr Alan Tully, and Dr. Budi Arief
University of Newcastle upon Tyne (UK)
Contact: Sergio.Grosso@ncl.ac.uk

Antonio Marques and Manuel Serrano Matoses
ETRA (Spain)

Summary

Description of EMMA and TRACKSS projects

Objectives and common goal

Validation activities

A test scenario for collaborative sensing at Haymarket, Newcastle

References and acknowledgments

Background information

Name	TRACKSS		EMMA	
Acronym	Technologies for Road Advanced Cooperative Knowledge Sharing Sensors		Embedded Middleware in Mobility Applications	
WWW	www.trackss.net		www.emmaproject.eu	
Duration	from January 2006 to July 2008		from May 2006 to October 2008	
Value	2.5 M Eur		1.6 M Eur	

Partners				
	ETRA Research and Development, S. A (ETRA)	Spain	ETRA Research and Development, S. A (ETRA)	Spain
	Robert Bosch GmbH (BOSCH)	Germany	Centro Ricerche Fiat (CRF)	Italy
	Centrum dopravního vy´zkumu (CDV)	Czech Republic	ETRI (ETRI)	Korea
	Citilog (CTL)	France	ITTI (ITTI)	Poland
	Centro Ricerche Fiat (CRF)	Italy	TRW Conekt (TRW)	UK
	DLR (DLR)	Germany	Universität Stuttgart (IPVS)	Germany
	INRETS (INRETS)	France	University of Newcastle (UNEW)	UK
	ITACA (ITACA)	Spain		
	LCPC (LCPC)	France		
	Institute for transport Sciences (KTI)	Hungary		
	Moviquity (MOV)	Spain		
	TRL (TRL)	UK		
	TRW Conekt (TRW)	UK		
	University of Newcastle (UNEW)	UK		

State of the Art - Problems

- Current sensor technology uses wired communication in a car
  (CAN, LIN, FlexRay, MOST) but
  - Bus technologies have different interfaces
- Cars react to other cars (e.g. Adaptive Cruise Control), but
  do not cooperate between them and
  - Communication technology is also different from wired technology
- Communication between cars and infrastructure
  (e.g. Floating Car Data in Germany) can be improved
  - Infrastructure devices are usually more powerful than car's
- Interactions altogether form an highly complex system!
  - Many interfaces required
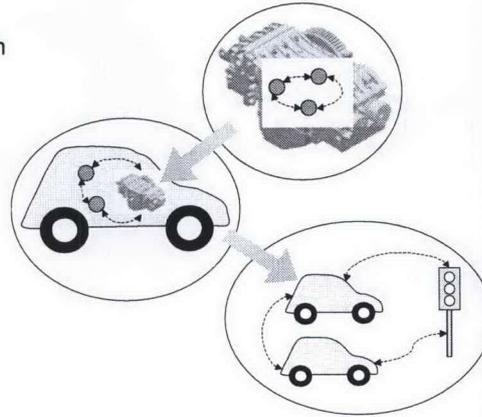 - Many dependencies to be taken into account

Sensing cooperation for EMMA and TRACKSS

- Within automotive system:
  - Several sensors within one system
  such as elements of the engine
- At a car level:
  - Different sub-systems
  such as radar and video sensor
- At outside-the-car level
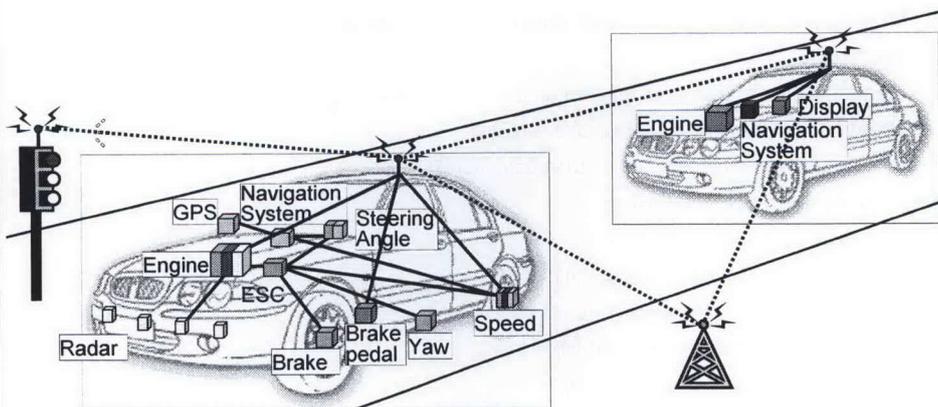 with cars and infrastructure

Visionary scenario for EMMA

Visionary scenario for TRACKSS
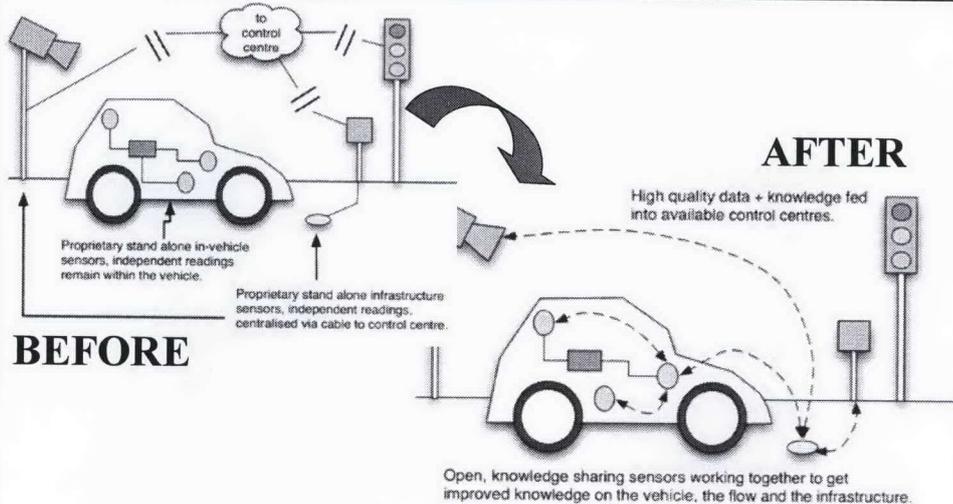
BEFORE / AFTER

More in detail: TRACKSS main objectives (1/2)

1) To develop and /or improve a number of sensing technologies:

On-board vehicle sensors:

- Ice-detection [CRF];
- Video-camera with enhanced night vision, lane/road side recognition, detection vulnerable users [BOSCH];
- Infrared sensor to detect an infrared emitter with vehicle ID [LCPC];
- Smart dust for in-vehicle applications [UNEW];
- Electromagnetic sensor for pedestrian detection [TRL];

External sensing technologies:

- In-road inductive loops [ITACA];
- Laser scanners (for infrastructure) [ITACA];
- Video cameras for infrastructure [CTL];
- Smart dust for infrastructure [UNEW];
- Spaceborne/airborne sensors [DLR];
- Advanced radar sensor [TRW];

2) **To embed knowledge sharing capabilities into the above sensing technologies**

3) **To develop a Data Integration Module (DIM), a Decision Support System (DSS), and a Knowledge Management Administrator (KMA) to firstly reorganize, correct and optimize the data collected and then assess and predict the ambient conditions affecting the safety and efficiency of transport**

4) **To validate the project results in three scenarios:**

    i.   A controlled environment – test track (Berlin)

    ii. An intersection (Paris)

    iii. A section of network (Valencia)

IET More on TRACKSS validation: Envisaged cooperation
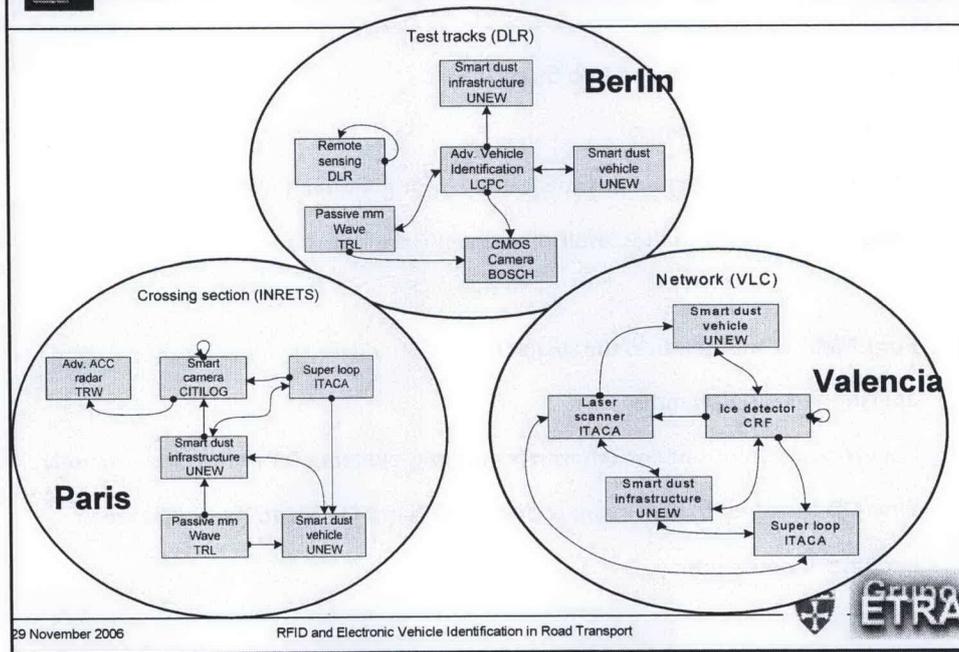
EMMA's main objectives and validation

To build a middleware platform for WIreless COoperative sensing objects (wicos).

3 levels of wicos are to be tested (and validated):

    1a) Engine sensors prototyped by CRF such as:

        exhaust gas sensors;

        oil conditions sensors;

        pressure sensors;

        position sensors for VVA – variable valve actuator;

    1b) Car-level sensors with:

        the engine (1a) as a single wico plus

        radar sensor

        video sensor

        EPAS (Electronic Power-Assisted Steering)

    1c) Supra-car level sensors, using the car (1b) as a wico itself. Smart dust
        would be used for the communication

State of the work

1)   For TRACKSS (11 months into the project):

    1a) Defined requirements

    1b) Currently working on a Knowledge Sharing Model (KSM) capable of
    integrating at least the technologies specified by the 3 test cases

2)   For EMMA (7 months into the project)

    2a) Defined requirements

    2b) Work on solutions for different operating systems for smart dust, namely

    Tiny-OS (used by UNEW's smart dust) and Nano-Q+ (used by ETRI's) to
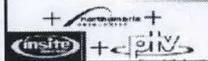
    become "compatible"

Examples for Haymarket (Newcastle)

Collaboration in-vehicle smart dust with infrastructure-based smart dust to implement improved Puffin (Pedestrian User-Friendly Intelligent crossings) control at junctions

Collaboration loop detector – video camera to implement intermittent bus lane

29 November 2006   RFID and Electronic Vehicle Identification in Road Transport

---

References

Tully A. and Blythe P. T. (2005) Investigating the next generation mobile wireless technology to deliver a mobile pervasive computing environment for road user charging and other ITS services. In *Proceedings of the First IEE Automotive Electronics Conference*, London, 15-16 March pp. 233-243.

Grosso, S., Bell, M.G.H., Ehlert, A. (2006) Avenues for Detectors Exploitation in Traffic Modelling. E-Challenges Conference, Barcelona, October.

The authors wish also to thank the colleagues of the University of Stuttgart (Daniel Minder) for their collaboration in the preparation of this presentation

29 November 2006   RFID and Electronic Vehicle Identification in Road Transport