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# 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


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**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 vý´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

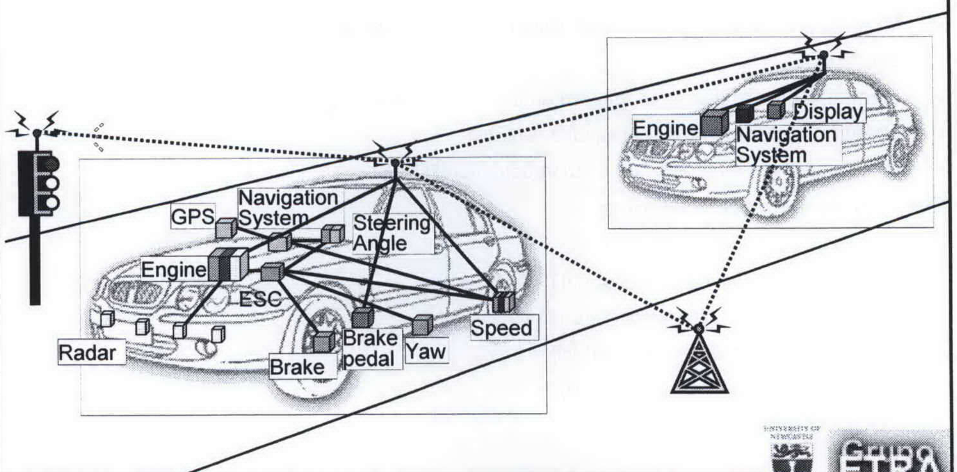
- Current sensor technology uses wired communication in a car (CAN, LIN, FlexRay, MOST) but
  - Bus technologies have different interfaces
- Cars react to other cars (e.g. Adaptive Cruise Control), but do not cooperate between them and
  - Communication technology is also different from wired technology
- 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

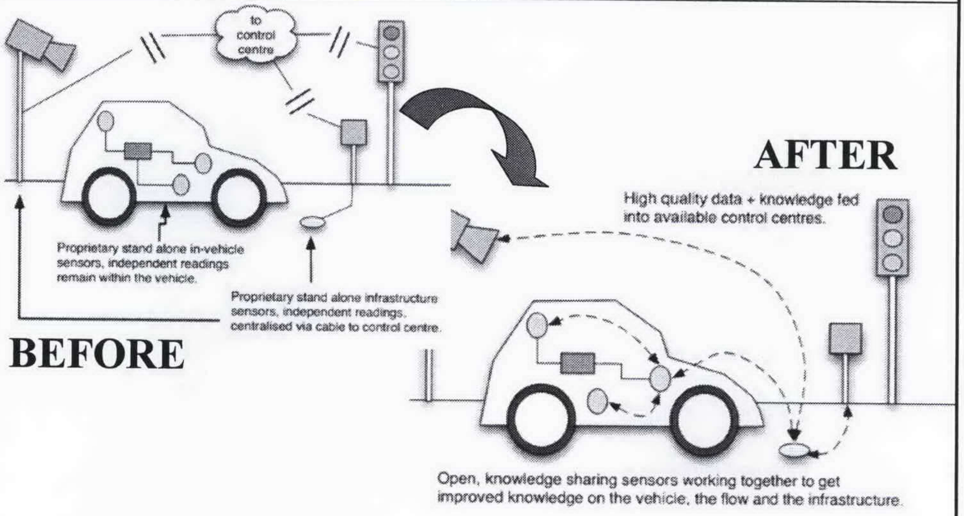
- Within automotive system:
  - Several sensors within one system
    such as elements of the engine
- At a car level:
  - Different sub-systems
    such as radar and video sensor
- At outside-the-car level
  with cars and infrastructure



## Visionary scenario for EMMA



## Visionary scenario for TRACKSS






## 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];

# TRACKSS main objectives (2/2)

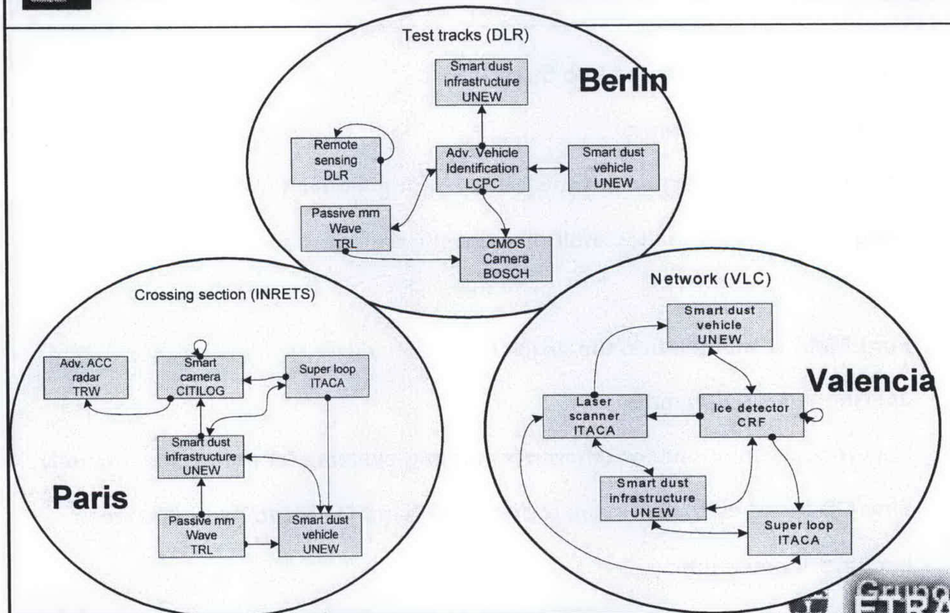
2) **To embed knowledge sharing capabilities into the above sensing technologies**

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)



# 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

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## 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"

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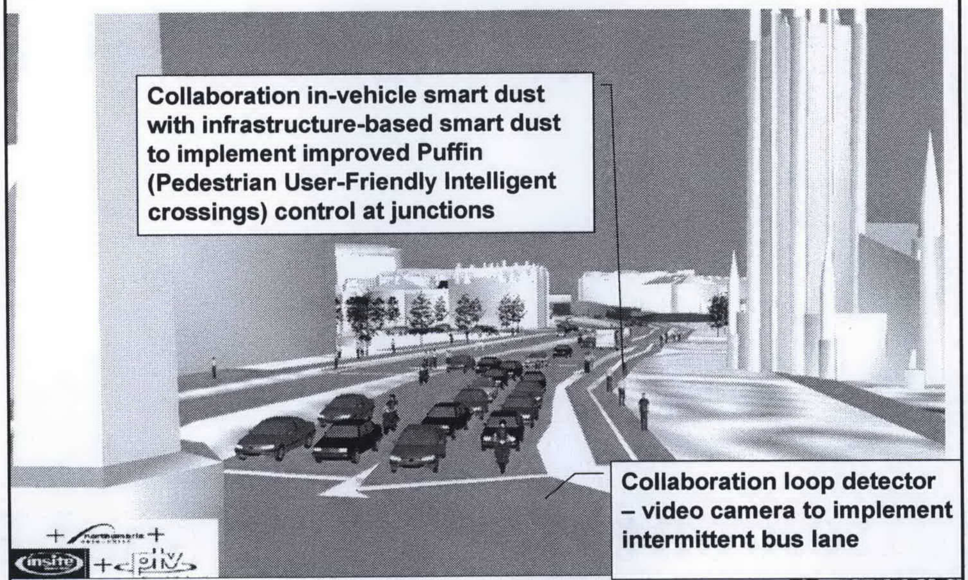
## Examples for Haymarket (Newcastle)



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