

Cooperative Self-Organizing System for low Carbon Mobility at low Penetration Rates



COLOMBO

COLOMBO will develop a self-organized, cooperative and automatically configurable traffic management system that smoothly merges traffic state monitoring and methods for intersection control based on self-organisation. It will prove the feasibility of using low penetration rates of vehicle-to-vehicle and vehicle-to-infrastructure communication (V2X) equipment for an efficient traffic management.

At a Glance

Project type:

Collaborative project (generic)

Programme:

7th EU Framework Programme

Project coordinator

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Project partners:

- Deutsches Zentrum für Luft- und Raumfahrt
- Alma Mater Studiorum – Università di Bologna
- Université Libre de Bruxelles
- PEEK TRAFFIC B.V.
- Technische Universität Graz
- EURECOM

Duration: 36 months

1/11/2012 to 31/10/2015

Total cost and EU funding:

€2,91 Million

(EU contribution: €2,1 Million)

Project website:

<http://www.colombo-fp7.eu/>

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Exploiting Vehicular Communications

Traffic control systems cope with road traffic by determining the situation on the roads and by controlling traffic flows. Emerging cooperative techniques like vehicle-to-infrastructure communication may increase the knowledge about the traffic situation and open new channels for delivering information. However, most cooperative systems require large penetration rates in order to assure their functionality, making the first steps towards their deployment unattractive.

COLOMBO works on overcoming this hurdle by delivering a set of modern, self-organizing traffic management algorithms designed for being applicable even at low penetration rates, ensuring their usability from the very first deployment days on. COLOMBO will focus on two traffic management topics: traffic surveillance and advanced traffic light control algorithms.

COLOMBO will deliver the following traffic management methodologies:

- A cooperative traffic state monitoring system, including
 - a local (intersection-based) incident monitoring and information system;
 - a local (intersection-based) emissions monitoring system;
- A cost-effective, self-organizing, fully distributed, and adaptive traffic light control system;
- A tool for automatic algorithm configuration and tuning.

COLOMBO will also:

- Extend available, well-established models for pollutant emission (PHEM), traffic simulation (SUMO) and vehicular communication (iTETRIS and ns-3).
- Develop and implement a simulation-based optimisation architecture, incorporating these tools.
- Develop a model for emission-optimal driver behaviour adapted to the new traffic light control system.
- Perform environmental assessment of the project results.
- Perform dissemination and exploitation activities. The project results will include
 - a fully functional educational kit and
 - a guideline on developing eco-friendly traffic light controls for traffic engineers.

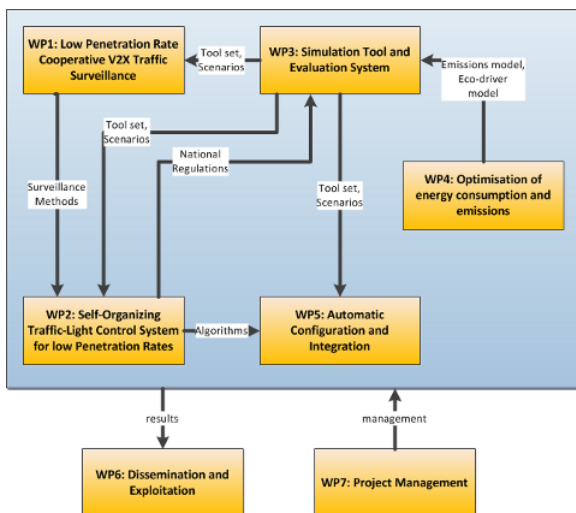
Project Structure

COLOMBO is divided into „work packages“ (WPs). The research and development is performed in the following work packages:

- WP1: Low Penetration Rate Cooperative V2X Traffic Surveillance
- WP2: Self-Organizing Traffic-Light Control System for low Penetration Rates
- WP3: Automatic Algorithm Configuration and Tuning
- WP4: Optimisation of Energy Consumption and Emissions
- WP5: Simulation Tools and Evaluation

Two further work packages are concerned with the dissemination of generated knowledge and with the management of the project, respectively:

- WP6: Dissemination and Exploitation
- WP7: Project Management



Open Source

The COLOMBO project will use and enhance several software packages. Most of them are available as open source.

- SUMO (Simulation of Urban MObility) - an open source (GPL) traffic simulation
- ns3 (network simulator 3) - an open source (GPL) communication simulation
- iTETRIS - an open source (GPL) V2X simulation middleware which joins SUMO, ns3, and applications into an executable system
- an open source optimization toolkit - to be developed
- PHEM (Passenger and Heavy Vehicles Emission Model) - a model of vehicular emissions

Expected Innovations

The first major advancement of COLOMBO is the design and evaluation of traffic surveillance methods that do not need the deployment of stationary, conventional detectors, but are mainly based on vehicular communication and on-board personal devices, such as PDAs. The main innovative outcomes are the following:

- a local (intersection-based) monitoring system for traffic state determination working with low penetration rates of equipped vehicles, additionally capable to determine travel times between the regarded and prior equipped intersections;
- a local (intersection-based) incident detection system enabling alert messages to incoming vehicles;
- a local (intersection-based) pollutant emissions monitoring system which works at low penetration rates of equipped vehicles.

The second major advancement is the development of a self-organizing traffic light system that has a number of features that represent a novelty with respect to existing state of the art control systems. It is

- fully autonomous as it does not require centralized supervision;
- distributed as it does not require any explicit communication nor synchronization between neighbouring intersections or by a traffic management centre;
- adaptive to traffic changes as it relies on information coming from sensors, and it is able to react rapidly to changing traffic conditions, with no need to model traffic nor forecasting traffic changes;
- sensor-aware but independent from the type of sensors installed;

Further Information

Please find further information and updates on the project on the projects web site:

<http://www.colombo-fp7.eu>



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