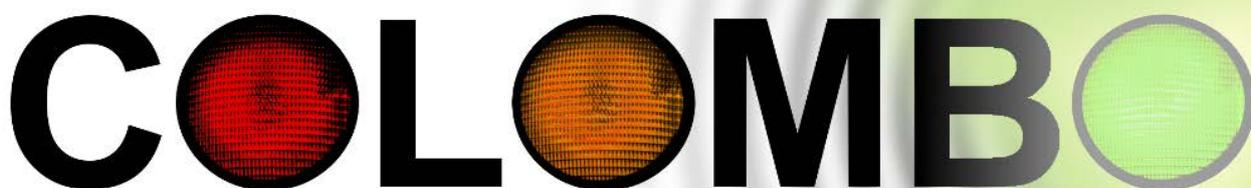Small or medium-scale focused research project (STREP)

ICT Call 8

FP7-ICT-2011-8

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

COLOMBO: Deliverable 6.7

Periodic report on User Community involvement and Dissemination

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1 Introduction

1.1 Project Context

The COLOMBO project will deliver a set of modern cooperative traffic surveillance and control applications that target at different transport related goals such as increasing mobility, resource efficiency, and environmental friendliness.

The surveillance applications use information gained via vehicular communication technology at low penetration rates (WP1). The self-organizing traffic light controls applications are of type using swarm intelligence methods (WP2). They are optimised based on simulations-in-the-loop (WP3). To allow the ex-ante appraisal of the applications' impacts, the evaluation framework must be defined. It has design interdependencies with the traffic simulation scenarios which trigger modification and extension requirements to existing simulation tools. Once realized they are implemented into a dedicated software suite which is mainly open source (WP5). Finally, the design and employment of emission models allows the development of environment-friendly solutions (WP4).
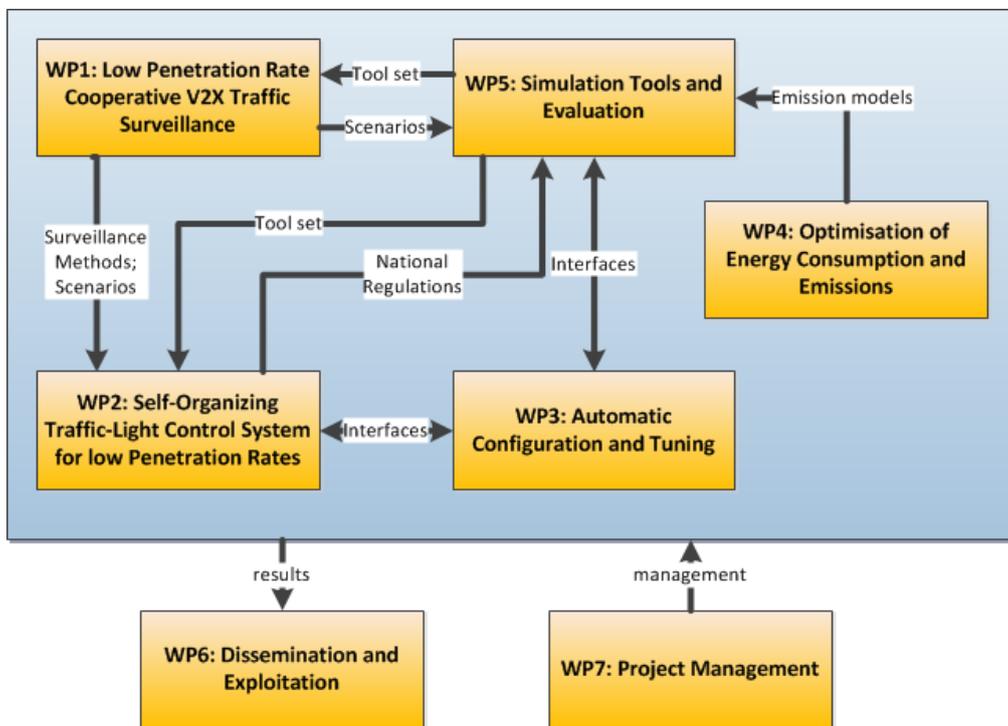
Figure 1.1: COLOMBO work packages

This deliverable is part of WP6 dealing with dissemination. WP6 involves the results of WP1-5. The objective of this work package is to disseminate the results of the project by involvement of the potential user community. Furthermore, increasing public knowledge about the project is also a way to prepare for exploitation.

1.2 Document Objectives

The objectives of this document are to give an overview on the dissemination activities and user community involvement that has taken place during the third year.

1.3 Document structure

The document distinguishes between dissemination in chapter 2 and user community involvement in chapter 3. Within dissemination sections have been made for the website, presentations, publications and dissemination activities that have been started up, but have not yet finished. Within user community involvement there are sections for the SUMO community, the ns-3 community and the traffic engineering community.

2 Dissemination

2.1 Colombo project website

The web page located at <u>http://www.colombo-fp7.eu/</u> is the first source of information about the project. The web page's basic layout was already discussed in D6.5 and has not changed. It is shown in Figure 2. Additionally a separate deliverable on the website D6.8 is also submitted.

Figure 2: The COLOMBO web site as shown in Internet Explorer version 9

The changes performed on the web pages after the last user and community involvement deliverable (D6.5) are described in a high detail in the deliverable D6.8#5. They can be summarized as follows:

- a web page with presentations that currently includes the slides presented at the webinars and at the workshops on the ITS congresses, see section 2.5, has been added,
- the results pages were updated, including updates of the pages that list the publications and the deliverables, as well as a rework of the software development,
- the software pages have been extended to also include the virtual machine with a working COLOMBO overall simulation system (COSS) installed and the evaluation toolkit. Both are part of the educational toolkit.

The level of monthly web site visitors in the third year as shown in Figure 3 exceeds the one of the previous year.
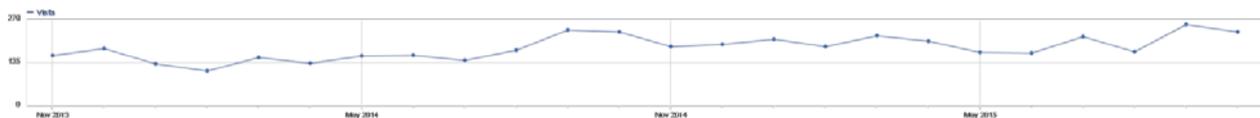

Figure 3: Visitors per month since tracking the visitors.

Again, as reported in D6.6 after the second period, most of the visitors come from the United States of America, as shown in Figure 5. Almost all European countries, the BRIC states, most of Central and South American countries, as well as Australia had page visitors, too.
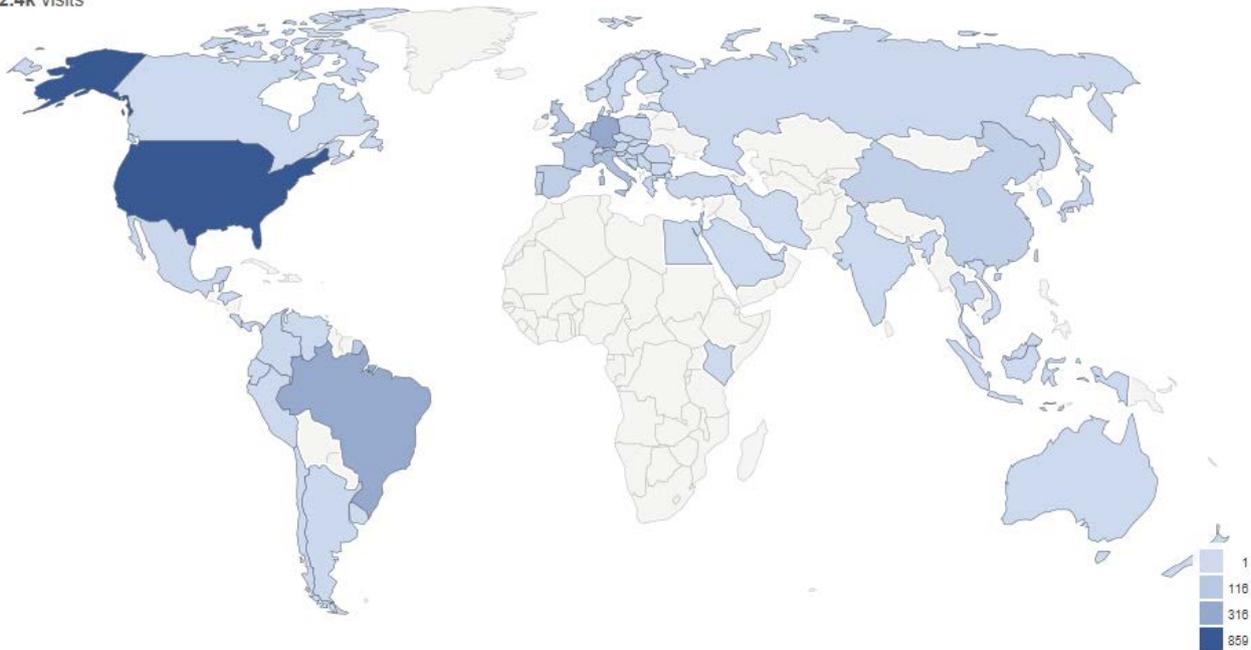
Figure 4: COLOMBO web pages visitors by country (1st of November 2014 to 30st of October 2015)

DLR's electronic archive elib has been linked to the download section and since become the primary source of deliverables and other offered documents. 300 unique document requests were counted, with D4.2 "Extended Simulation Tool PHEM coupled to SUMO with User Guide" at the forefront (n=40).

Besides, a LinkedIn group has been established which mirrors the news posted on the blog. It is as well used successfully as a channel for communicating with scientists and practitioners. Further information was given in the web site updates (D6.8#5) and is as well included in the Periodic Report (D7.3).

2.2 Presentations

The project has been presented at the Bologna smart city exhibition in November 2014. The attendance was high (around 60 people) and the project has established many contacts with mobility managers in provinces and municipalities that are interested in the COLOMBO solution. In particular, the municipality Monza, a smaller city close to Milano, is interested in using the system for a couple of intersections that are very congested and they do not want to make structural changes to the road network. This contact was followed up further to create a real-world scenario for testing the COLOMBO traffic control systems. The results are reported in D5.4 and will be discussed with Monza after the end of the project.

Wolfgang Niebel became member of the newly founded working group 1.4.5 "Wirtschaftliche Bewertung von Telematikanwendungen im Verkehr" (Economic appraisal of ITS) within the German FGSV (Forschungsgesellschaft für Straßen- und Verkehrswesen). The topic comprises C-ITS. During the constituting meeting on Thursday 29th January 2015 and at the 2nd meeting on 24th September 2015 in Cologne COLOMBO project results such as its methodology of synthetic scenarios and simulation outcomes were suggested to include in the knowledge document.

In February 2015 the COLOMBO project was invited for a guest presentation for the traffic engineering group of the state government of North-Holland in the Netherlands, they were enthusiastic to hear about the innovative activities Colombo is doing. Even though the penetration of cooperative vehicles on the road is still low, they saw the potential of the system for the future. Therefore, the state will start an initiative to update required software standards for traffic light

controllers to be better prepared for cooperative data. Imtech will be involved in this as well, but as the activity is not only for the benefit of Colombo, no WP6 hours were booked for this.

Wolfgang Niebel attended the workshop on socio-economic impacts of road vehicle automation organised by the FP7 project CityMobil 2. About 100 experts from Europe, the USA and Asia discussed on 30th and 31st March 2015 in La Rochelle (FR), with results being published in May 2015. Beside placing COLOMBO results in the discussion and personal talks where suitable, the POLIS network manager's pointing to the "Position Paper on Cooperative Systems in Urban Mobility" dating from 2010 will give additional input to the project.

2.3 Publications

Multiple conferences have been visited in which the following list of papers were published and presented:

ITS World, October 2015:

- Daniel Krajzewicz, Robbin Blokpoel, Riccardo Belletti, Jérôme Härri, Stefan Hausberger, Jérémie Dubois-Lacoste: Traffic management based on vehicular communication at low equipment rates, ITS World Congress, Bordeaux, October 2015.
- Daniel Krajzewicz, Peter Wagner, Marko Wölki, Martin Dippold: Driving patterns reducing pollutant emission at traffic lights, ITS World Congress, Bordeaux, October 2015
- Robbin Blokpoel, Stefan Hausberger, Daniel Krajzewicz, Jaap Vreeswijk: Emission optimized control for isolated intersections, ITS World Congress, Bordeaux, October 2015.
- Robbin Blokpoel, Carlo Kielstra, Jaap Vreeswijk: Data fusion of cooperative data with adaptive traffic control, ITS World Congress, Bordeaux, October 2015.

Other conferences:

- Jakob Erdmann, Daniel Krajzewicz: Modelling Pedestrian Dynamics in SUMO, in proc. of SUMO 2015 – Intermodal Simulation for Intermodal Transport, 7-8 May 2015, Berlin.
- Sosina Gashaw, Jérôme Härri: V2X Data Dissemination Delay for Vehicular Traffic Density Estimations, in proc. of the IEEE Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM'15), 14-17 June 2015, Boston, USA.
- Jérôme Härri: Communication Technologies in ITS, ITS EduNET in conjunction with Mobile TUM, 29th June 2015, TU Munich, Munich Germany.
- Daniel Krajzewicz, Andreas Leich, Robbin Blokpoel, Michela Milano, Thomas Stützle: COLOMBO: Exploiting Vehicular Communications at Low Equipment Rates for Traffic Management Purposes, Advanced Microsystems for Automotive Applications (AMAA), 7-8 July 2015, Berlin
- Thomas Stützle, Manuel López-Ibáñez: Automatic (Offline) Configuration of Algorithms. Advanced Tutorial given at the GECCO 2015 conference, 11-15 July 2015, Madrid, Spain.
- Thomas Stützle: Automated Algorithm Configuration: Advances and Perspectives. Invited tutorial given at the EURO'2015 conference, 12-15 July 2015, Glasgow, UK.
- Robbin Blokpoel, Jaap Vreeswijk, Guus Sluijsmans: New traffic light control strategy based on probe vehicle data, 18th Euro Working Group on Transportation, EWGT 2015, 14-16 July 2015, Delft, The Netherlands.

Accepted for publication:

- Marko Wölki, Daniel Krajzewicz, Andreas Leich: OPTIMAL DRIVING OF CONNECTED VEHICLES AT TRAFFIC LIGHTS, TRB Annual Meeting, 10-14 January 2016, Washington D.C., USA.

2.4 Activities in progress

Currently the following papers are under review:

- Marek Junghans, Andreas Leich, Jerome Härri: Traffic state estimation from V2X data using a Bayesian net approach, TRISTAN SYMPOSIUM 2016

More publications on final project results will also follow. The consortium is planning to attend at least the SUMO conference and ITS Europe congress in 2016, but more conferences that focus on communications can also be attended as Eurecom is investigating the possibility for a small grant for post-project dissemination. The University of Bologna will also be in touch with the regional government of Bologna and the municipality of Monza to discuss what the project results can mean to them.

2.5 Workshop and webinar

During the Webinar at the 22nd of July 2015, the advisory board was informed about results of WP1 (data fusion), WP2 (SWARM based traffic light control), WP4 (emission modelling) and WP5 (Evaluation plan).

With four advisory board members attending, the attendance can be considered good. Some interesting comments and questions were raised, which were later posted on the LinkedIn site, too. For WP1 a suggestion was made to compare with real-world scenarios to see if malfunctioning loop detectors can be detected. WP2 was received well and it was hinted at trying lognormal distribution functions for the pheromone functions used to select a macro policy. The work in WP4 on emission modelling was complimented by the audience. The work in COLOMBO was compared with the FP7 project *Peacox* and the TNO software VERSIT+ and seen as progress with respect to them thanks to the reduced computational time of the newly developed PHEMLight. The webinar was meant to bridge the gap between the first and the second workshop that took place in June 2014 and October 2015 during the ITS Europe and World congresses. Also, this was a good opportunity to get some final feedback before the end of the project.

The final project workshop was part of the official program of the ITS World congress as session SIS 2604 'Traffic management with cooperative detection'. The session started with the cooperative detection and data fusion techniques developed in COLOMBO by Jérôme Härri. Afterwards, Federico Caselli presented about COLOMBO's results from the SWARM traffic light control. To give and outlook to future applications of COLOMBO to network-wide traffic management, the following two speakers, Francesco Viti and Jaume Barcelo, talked about OD matrix estimation. A very interesting link these external speakers made was the fact that a high penetration system (like a loop detector) with low geographic coverage can be combined with a low penetration system with high geographic coverage to create a very complete overview. The session closed with a summary on the state of the art of traffic management for urban and highway areas and the expected C-ITS penetration rates in the next 30 years by Robbin Blokpoel. The final presentation was shorter and also meant to lead in a discussion. The final statement was that with the SWARM system deployed, a C-ITS equipped vehicle can have a small advantage over a non-equipped road user. This advantage can even be configured to be larger when desired, so the main question for the audience was whether this would be an ethical method to boost C-ITS penetration. Most response on this came from the external (advisory board) speakers who agreed this would be a good strategy. The session was attended by approximately 70 people of which only around 6 were connected to the organizers. This is more than double the attendance of the previous session at ITS Europe (30) and can be seen as a sign that people show growing interest for the subject.

3 User community involvement

3.1 SUMO community

COLOMBO itself has not yet been announced on main SUMO's communication channels, but changes are reflected in the documentation and according documentation pages were extended by a reference to the project, showing the feature's or sub-module's origin. Both, the project logo as well as the log of the European Commission are included. Figure 6 shows a screenshot of used footer.
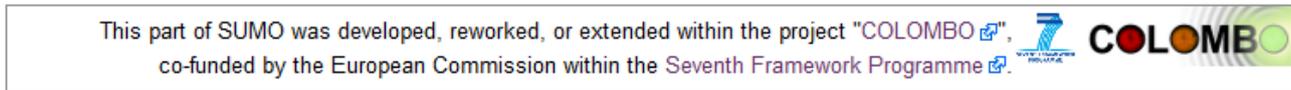

Figure 5: Footer used on SUMO documentation pages.

Extensions to SUMO implemented within the COLOMBO project are at first added to a working copy that is dedicated to the project. After being finalised, they are moved into SUMO's "main trunk" that contains the release version.

Up to now, the following extensions have been released:

• traceExporter
• PHEMlight
• Pedestrian dynamics and bicycle support
• Open Street Map (OSM) import for features related to road users in different modes of transport (Bus and Bicycle)

These extensions are well accepted by the SUMO users. The traceExporter script was already released within the first Reporting Period and initial interactions with SUMO-users regarding this tool were already given in D6.5.

The pedestrian dynamics extension was accepted very fast by third-party users and several discussions on the sumo-user mailing list have been observed. But (half a year after the release), no third-party publication that refers to it is known, yet.

PHEMlight is known to be under investigation by third-party users as well. SUMO is directly implemented within SUMO, but uses additional data files, each describing a single emission class. Within the standard SUMO-release, PHEMlight includes the definitions for two emission types only. Both describe passenger EURO 4 vehicles, the first one powered by Diesel, the second by Gasoline. Up to now, one commercial user has ordered a copy of the full data set. The project partner DLR who will use it in an internal project.

3.2 Traffic engineering community

The traffic engineering community has been directly involved in this period through the workshop at the ITS World congress. New is also the attendance of the EWGT conference which targets the traffic engineering community directly. Also the follow-up activity from the researchers night in Bologna was a direct involvement of the traffic engineering community as the contact is with the traffic departments of Monza and the state government of Bologna (see section 2.2).

As outlined in section 2.1 and described in D6.8#5 in detail, the LinkedIn group has been used for discussions with traffic community. Albeit no directly usable information could be obtained, the channel is assumed to be a very valuable dissemination channel.

Similarly, COLOMBO results were already included in new proposals for H2020 projects, like DETECT, MAVEN, and IMPACT which will use the additions to SUMO for accurate traffic modelling.

Important results for the traffic engineering community are also included in the educational toolkit. Both the SWARM algorithm and the evaluation toolkit used in the project are released as open source with extensive documentation for users to set up their own simulations and extend the source code further to suit their specific needs. The SWARM algorithm can serve as an algorithm to evaluate the impact of cooperative systems on traffic light control or to simply compare and study the difference with existing control strategies. The evaluation toolkit speeds up the evaluation of traffic simulations and gives deeper insight in the specific results by including many extra measurements. For example the standard deviation and maximum value can give a good insight in the stability of the performance of a strategy.

3.3 Communication engineering community

The communication engineering community is following the COLOMBO project with interest, also through the dissemination of some important obtained result at various conferences. The COLOMBO educational toolkit has a virtual machine that includes a full installation of the communication simulator ns-3 and a lot of cooperation with the ns-3 project has taken place, including sharing source code. The educational toolkit can even be seen as a good example on how to use the ns-3 software.

Additionally, the iTetris platform has been extended, which has also been shared with the community through the same virtual machine in the educational toolkit. Extensions were done to the platform and source code has been published so users can extend this further.