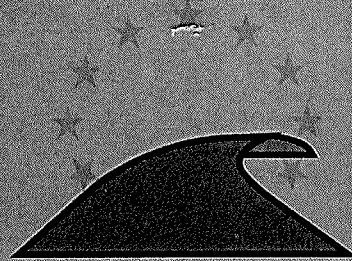


CROATIAN SCIENTIFIC SOCIETY
FOR TRANSPORT



COLLECTION OF PAPERS
Volume 2

SYMPOSIUM
HZDP 2009

XVI International Scientific Symposium

Transport Systems
2009

23 - 24 April, 2009
OPATIJA • CROATIA

SUVREMENI PROMET

**DVOMJESEČNI ČASOPIS
ZA PITANJA TEORIJE I PRAKSE PROMETA**
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Najbolji radovi iz Suvremenog prometa tiskaju se na engleskom jeziku u godišnjem broju časopisa pod nazivom "MODERN TRAFFIC". Članci u tom časopisu imaju po tri međunarodne recenzije.

**Izdavanje znanstvenog časopisa SUVREMENI PROMET - ZAGREB
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SUVREMENI PROMET

ČASOPIS
ZA PITANJA TEORIJE I PRAKSE PROMETA

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ZA PROMET, ZAGREB

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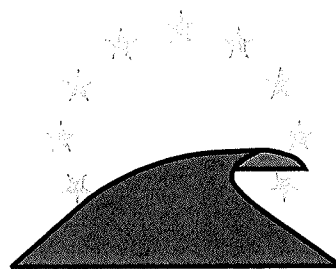
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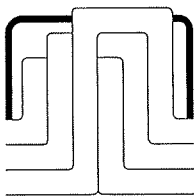
Transport Systems 2009

SYMPOSIUM
HZDP 2009

Under the auspices of
European Platform of Transport Sciences



23 - 24 April, 2009
OPATIJA • CROATIA



PROMETNI SUSTAVI 2009.

Šesnaesti međunarodni simpozij pod nazivom "PROMETNI SUSTAVI" održava se u Opatiji 23.-24. travnja 2009., u Kongresnoj dvorani *HOTELE ADRIATIC*. Organizator simpozija je Hrvatsko znanstveno društvo za promet,

u suradnji s

Ministarstvom mora, prometa i infrastrukture * Ministarstvom znanosti, obrazovanja i športa * Akademijom tehničkih znanosti Hrvatske i Hrvatskom gospodarskom komorom.

Pokrovitelj Simpozija je:

Europska platforma prometnih znanosti

Zbornik radova I i Zbornik radova II sadržavat će svaki po tridesetak radova i više priloga. Radovi koji nisu tiskani u zbornicima radova I i II bit će objavljeni u Zborniku radova III ili *Suvremenom prometu* zajedno sa zaključcima Simpozija i drugim popratnim aktivnostima.

Provedbeno programsko i znanstveno vijeće činili su znanstvenici:

prof. dr. sc. Marija Bogataj (Slovenija), prof. dr. sc. Šimun Bogdan (Federacija BiH), prof. dr. sc. Kristi M. Bombol (Makedonija), prof. dr. sc. Hubert Bronk (Poljska), prof. dr. sc. Vesna Cerovac (Hrvatska), prof. dr. sc. Božo Ćorić (Federacija BiH), prof. dr. sc. Nenad Dujmović – zamjenik predsjednika (Hrvatska), dr. sc. Petar Đukan (Hrvatska), o.prof. dr. sc. Peter Faller (Austrija), prof. dr. sc. Miljenko Ferić (Hrvatska), em. prof. ddr. e.h. Gerhard Heimerl (Njemačka), prof. dr. sc. Heiner Hautau (Njemačka), dr. habil. Peter Hanspach (Njemačka), prof. dr. sc. Pavao Komadina (Hrvatska), prof. dr. sc. Martin Lipičnik (Slovenija), prof. dr. sc. Ante Mišković (Federacija BiH), prof. dr. sc. František Palik (Češka), prof. dr. sc. Želimir Pašalić (Hrvatska), prof. dr. sc. Mario Plenković (Hrvatska), prof. dr. sc. Juraj Plenković (Hrvatska), prof. dr. sc. Silvestar Perše (Hrvatska), prof. ddr. sc. Franko Rotim - predsjednik (Hrvatska), prof. dr. sc. Mate Sršen (Hrvatska), prof. dr. sc. Damir Šimulčik (Hrvatska), prof. dr. sc. Vojo Višekruna (Federacija BiH), prof. ddr. sc. Elżbieta Załoga (Poljska), prof. dr. sc. Ratko Zelenika (Hrvatska).

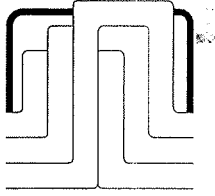
Najbolji radovi iz zbornika I, II, III (oko 20 radova) objavit će se u godišnjem specijalnom broju časopisa pod nazivom *MODERN TRAFFIC*, koji se tiska na engleskom i njemačkom jeziku. Radovi iz ovog časopisa imaju po tri recenzije i referiraju se u odgovarajućim bazama podataka.

Cilj Simpozija jest okupljanje europskih prometnih i drugih stručnjaka, koji će predstaviti radove s temama odnosa europskog prometa te razmijeniti iskustva koja bi mogla biti korisna u profiliranju budućeg razvitka europskoga prometnog sustava.

Preporuke i zaključci Simpozija osobito bi trebali poslužiti oblikovanju djelotvornije hrvatske prometne politike, posebice u situaciji uključivanja Hrvatske u Europsku uniju.

Glavni i odgovorni urednik
Prof. ddr. sc. **Franko ROTIM**

Opatija, travanj 2009.



TRANSPORT SYSTEMS 2009

XVI International Scientific Symposium on the subject of "TRANSPORT SYSTEMS" is held in Opatija on April 23 and 24, 2009, in the Symposium Hall of the HOTEL ADRIATIC. The Symposium organizer is the Croatian Scientific Society for Transport.,

in cooperation with

*Ministry for the Sea, Transport and Infrastructure * Ministry for Science, Education and Sport * Croatian Academy of Engineering * Croatian Chamber of Economy.*

Sponsor of the Symposium is:

European Platform for Transport Sciences

Paper Collection I and Paper Collection II will comprise approximately thirty papers each, together with several supplements. Papers which are not printed in Paper Collections I and II will be published in Papers Collection III together with conclusions of the Symposium and other accompanying activities.

The Executive Programme and Scientific Committee was composed of scientist:

Prof. Dr. Sc. Marija Bogataj (Slovenia), Prof. Dr. Sc. Šimun Bogdan (Bosnia and Herzegovina Federation), Prof. Dr. Sc. Kristi M. Bombol (FYROM), Prof. DDr. Sc. Hubert Bronk (Poland), Prof. Dr. Sc. Vesna Cerovac (Croatia), Prof. Dr. Sc. Božo Čorić (Bosnia and Herzegovina Federation), Prof. Dr. Sc. Nenad Dujmović (Croatia), Dr. Sc. Petar Đukan (Croatia), o.Prof. Dr. Sc. Peter Faller (Austria), Prof. Dr. Sc. Miljenko Ferić (Croatia), em. Prof. DDr. e.h. Gerhard Heimerl (Germany), Prof. Dr. Sc. Heiner Hautau (Germany), Dr. habil. Peter Hanspach (Germany), Prof. Dr. Sc. Pavao Komadina (Croatia), Prof. Dr. Sc. Martin Lipičnik (Slovenia), Prof. Dr. Sc. Ante Mišković (Bosnia and Herzegovina Federation), Prof. Dr. Sc. František Palik (Szech Republica), Prof. Dr. Sc. Želimir Pašalić (Croatia), Prof. Dr. Sc. Mario Plenković (Croatia), Prof. Dr. Sc. Juraj Plenković (Croatia), Prof. Dr. Sc. Silvestar Perše (Croatia), Prof. DDr. sc. Franko Rotim - president (Croatia), Prof. Dr. Sc. Mate Sršen (Croatia), Prof. Dr. Sc. Damir Šimulčik (Croatia), Prof. Dr. Sc. Vojo Višekruna (Bosnia and Herzegovina Federation), Prof. DDr. Sc. Elżbieta Załoga (Poland), Prof. Dr. Sc. Ratko Zelenika (Croatia).

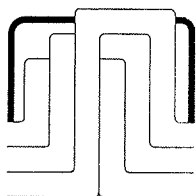
The best articles from Paper Collections I, II and III (approximately 20 articles) will be published in the yearly special issue of a magazine entitled MODERN TRAFFIC, which is printed in English and German Language. Articles from this magazine have three reviews each, and are quoted in the primary and secondary publications and data bases.

The goal of the Symposium is to gather European transport and other experts, which will present papers on the subject of relations in the European transport, and exchange experience that could be useful in the profiling of future European transport system development.

Recommendations and conclusions of the Symposium should especially contribute to the forming of a more efficient Croatian transport policy, what is very important in the process of Croatian accessing to the European Union.

Editor-in Chief
Prof. DDr. Sc. **Franko ROTIM**

Opatija, April 23-24. 2009



Mr. Sc. Gordana Nikolić
Dario Zorić, mag. oec.
Business academy Rijeka
(P.A.R. d.o.o.)
Rijeka

Traffic Business Administration
*Review**

NEW TECHNOLOGY (WSN) IN DISTRIBUTION

U.D.C. 656.022.88

1 Introduction

The Seventh Framework Programme (FP7) for research and technological development (FP7) is the European Union's chief instrument for funding research over the period 2007 to 2013.[1]

Business academy Rijeka is working on the FP7 - ProSense project (EU FP7 – IPSI WSN project – Croatia Rijeka ProSense Team). The overall objective of the project is to improve the research potential and capability of FEEIT and ETF research centres and to develop them into wireless sensor networking centres of excellence capable of driving the research agenda and serving as a seed for development of other similar centres in the region.

This will be achieved on one side through an active and organized exchange of researchers and on the other side through exchange of scientific know-how and RTD results at a series of workshops and seminars. Main partner on this PROSENSE project is Ericsson Ireland Research Centre - EIRC.

In particular, ProSense focuses on the following goals:

- Objective 1: Improve the wireless sensor networking research capacity and capability of selected WBC (Western Balkan Country) centres of excellence in terms of scientific and technical human resources and S&T infrastructure to enable them to drive and actively contribute to this research field.
- Objective 2: Promote and reinforce researchers and research institutions from the EU's convergence regions.
- Objective 3: Build a sustainable cooperation framework to support continuous collaboration in the wireless sensor networking research field between research institutions based in the WBC, the EU's convergence regions and Member States, particularly under the FP7 framework.
- Objective 4: Establish means for closer collaborations of the WBC research centres and researchers from the WBC region that have left the region to prevent brain drain and support brain gain.
- Objective 5: Disseminate economic and social benefits of potential key applications for the region and identify newly

accessible market niches within the EU and WB countries to generate interest and opportunities for the local industry and particularly SMEs. [2]

2 Croatia Rijeka ProSense Team

Business academy Rijeka is lifelong learning academy. Because of the constant, dynamic evaluations in economy nowadays lifelong learning is useful premise.

Our partner in this project is 4LOOK. The company 4LOOK is representing international companies, importing and selling professional equipment and tools of the highest quality for hair stylists and beauty salons, encompassing by its width all requirements of our buyers. 4LOOK products are widely recognizable with superior quality and design and application at the top of the world technology.

The main goal of logistics and distribution is to provide a time and space optimal, and cost effective, flow of materials, goods and information in the company.

We propose creating an infrastructure whose plugins could easily be implemented. Application will be designed to plan and measure the optimal route between locations.

2.1 Infrastructure and Application

Interconnection of sensor networks via an overlay network - the goal of this task is to interconnect deployed sensor networks in the WBC centres with the existing sensor networks in the labs of other partners. This will create a unique deployment of collaborative sensor networks spreading across the EU and WBC that will open up new research challenges. Furthermore, the overlay network will be enhanced with a web based remote access that will allow access and query of the WBC WSN's (wireless sensor networks) from one single place.

Demonstration activities - deployed sensor network premises in WBC centres will be used not only for research and education activities, but for knowledge dissemination as well. Demos/proofs of the concept of the use cases selected for each WBC centre will be presented to the local research and industrial community and general public at one-day presentations of the sensor facilities in both WBC centres.

The communication between networked embedded systems has become a major research domain in the communication networks area.

Wireless sensor networks (WSN) build of huge amounts of interacting nodes build the basis for this research. Issues such as mobility, network size, deployment density, and energy are the key factors for the development of new communication methodologies.

2.1.1 Our infrastructure

Daily route planning is made with application for tactical planning of transport with help of complex algorithm with which the customer orders are allocated on the vehicles for delivery. Besides defining relations between order-delivery, result of the daily delivery planning is calculation of optimal route of delivery based on higher criteria like:

- (A) the path length
- (B) total delivery time
- (C) total cost of delivery.

The basic infrastructure includes:

- (a) a sunspot equipped with appropriate monitoring sensors and related equipment attached to each measuring point, at busy crossroads etc...
- (b) a network of sunspots deployed along the roads towards the central station
- (c) interface to the central station for easy tracking and monitoring...

2.1.2 Our Application

Efficient operations require precise and timely decision-making. Knowledge about the location of vehicles, loading or delivery at any time are powerful tool for optimal performance and cost savings. Sunspot system can provide the key information. Application will be designed to plan the route between locations using this application for time planning, etc...

An application would be developed using the above defined infrastructure as follows:

- (a) when passers by enter the monitored area, information is delivered about the current status
- (b) alarm is generated if warning condition is present, via cell phone
- (c) measuring the stall positions of the vehicles
- (d) measuring the deviation of delivery between two target destinations
- (e) measuring the deviation of delivery between multiple target destinations
- (f) present the expenditure for the traveled miles and compare it with the plan of optimal route
- (g) present the realized time delivery and compare it with the optimal time delivery
- (h) information about check point destinations that are frequently passed by
- (i) all above mentioned functionalities can be enhance

2.2 Itinerary

The final demo will be completed before October 31 2009 with intermediate results as follows:

- January 31 2009 detailed project requirements,
- Hardware infrastructure before February 28 2009,

- Software infrastructure before April 30 2009,
- Application before June 30 2009,
- Testing completed before August 31 2009,
- Lessons learned incorporated before October 31 2009.

3 Other Sensors Networks Deployment

3.1 Sensor Network Implementation in the WBC Centre in Skopje

The WBC centre in Skopje targets an emergency/disaster recovery use case of wireless sensor network nodes. It will focus on an actual implementation of a sensor network test bed aimed at monitoring potentially emergent situations and responding accordingly. Relevant sensor equipment for this purpose will be ordered and commissioned. Two experts from INRIA and UB will assist the equipment procurement and installation. In addition, the test bed will be enhanced with a web interface providing remote access and management of emergency situations. The novel equipment will be used for research and educational activities (undergraduate and postgraduate).

3.2 Sensor Network Implementation in the WBC Centre in Belgrade

The research centre in Belgrade will focus on personal health monitoring and elderly care applications of wireless sensor networks. A smart environment capable of monitoring activities and health of its inhabitants will be built including a web interface for remote caregivers to monitor the status of the inhabitants. Relevant solutions from the JSI (ECG monitoring and processing) will be integrated into the environment. During the commission of the equipment and setting up of the research test bed, two experienced researchers from the partner organizations (CTI, LMI) will visit Belgrade to support ETF in these activities. New equipment will be used for research, educational (undergraduate and postgraduate studies) and dissemination activities. [3]

LITERATURE

- [1] http://cordis.europa.eu/home_en.html
- [2] http://www.prosense-project.eu/index.php?option=com_content&task=view&id=13&Itemid=31
- [3] http://www.prosense-project.eu/index.php?option=com_content&task=view&id=19&Itemid=37

SUMMARY

SAŽETAK

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New Technology (WSN) in Distribution

It can be said that many approaches for WSN have been studied and we can already see the first impressive solutions and applications. Basically, the following application has been adapted to solve the open issues in distribution. The application will be designed to plan and measure the optimal route between locations. The application will be developed using the above defined infrastructure as follows: when passers-by enter the monitored area, information is delivered about the current status; alarm is generated if warning condition is present (via cell phone), measuring the stall positions of the vehicles; measuring the deviation of delivery between two target destinations; measuring the deviation of delivery between multiple target destinations; presenting the expenditure for the traveled miles and comparing it with the plan of optimal route; presenting the realized time delivery and comparing it with the optimal time delivery; providing information about the check point destinations that are frequently passed by and others. Finally, the multi-objective optimization is presented.

Key words: economics, new technologies, research, distribution, logistics, WSN, FP7, PROSENSE

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Nove tehnologije (WSN) u distribuciji

Može se reći da su mnogi pristupi WSN tehnologije bili istraživani i sada se mogu vidjeti prvi impresivni rezultati i aplikacije. U osnovi, ova aplikacija je prilagođena za rješavanje problema distribucije, a bit će dizajnirana da planira i mjeri optimalnu rutu između odredišta. Aplikacija će biti razvijena korištenjem definirane infrastrukture: kad prolaznici uđu u nadzirano područje, šalje se informacija o trenutnom stanju; u slučaju detektiranja uvjeta opasnosti, alarm se aktivira putem mobilnog telefona, mjeri stanje vozila u stajanju; mjeri odstupanje u vremenu isporuke između dvaju odredišta, mjeri odstupanje u vremenu isporuke između više odredišta, utvrđuje troškove prijedjenih kilometara i uspoređuje ih s planom optimalnog puta isporuke; utvrđuje realizirano vrijeme isporuke i uspoređuje s optimalnim vremenom isporuke; daje informacije o stacionarnom odredištu pokraj kojeg objekt često prolazi i dr. Naposljetku, predstavljena je multiobjektivna (realna) optimizacija.

Ključne riječi: gospodarstvo, nove tehnologije, istraživanje, distribucija, logistika, WSN, FP7, PROSENSE