## Embedded WiSeNts

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### Embedded WiSeNts

 Coordinating European Research on Wireless Sensor Networks and Cooperating Objects

#### **Cooperating Objects**

- Autonomous devices endowed with computing, communication, sensing and/or actuating capabilities
- Cooperating Objects collaborate each other to achieve a global common goal
- Typical applications: building automation, monitoring of dangerous goods, patient surveillance
- > Problem: many isolated research efforts across Europe

#### **Project Information**

#### Embedded WiSeNts

- Cooperating Embedded Systems for Exploration and Control featuring Wireless Sensor Networks
- Coordination Action, 6th FP
- From September 2004 to August 2006

#### Partners

- A Consortium of 12 Partners from 10 European countries
- Cooperating Industrials: ABB, SAP, Microsoft, Infineon, Siemens, DoCoMo, T-Systems, STMicroelectronics

CINI, TUB, Un. of Twente, Un. of Padova, Cambridge, ETH, SICS, INRIA, Un. Of Copenaghen, Un. of Stuttgart, Yedipe Un, AICIA.



### **Education & Training**

#### Development of joint education activities

**1.Summer School.** International Summer School on Wireless Sensor Networks and Smart Objects.

- 60 partecipants (180 applicants)
- Lectures and practical labs
- Application competition

#### 2. Teach-ware improvement and dissemination.

Provide teachers and students with teaching material:

- Web site as exchange platform
- Development of adequate teach-ware modules

 Student Mobility. Financial support for master and PhD students to visit other institutions and labs.



### **Research Integration**

Integration and Harmonization of European research

- Research Facilitation: Platform and Tools. Improve communication and cooperation and minimize unnecessary duplication of effort.
  - Platform survey
  - Discussion forums
- Distinguished Visitors Program. Encourage visits of distinguished researchers to partner institutions.

3. Workshop Organization. Establish the European Workshop on Wireless Sensor Networks (EWSN) as a scientific exchange forum.



#### **Road Mapping & Technology Adoption**

Survey of the state of the art and development of a critical research agenda

1. Studies. A survey of today's state of the art and open research issues by the mean of the following studies:

- Applications and Application Scenarios
- Paradigms for Algorithms and Interactions
- Vertical System Functions
- System Architectures and Programming Models
- 2. Visions for innovative applications. An attempt to envision potential disrupting future applications of Cooperating Objects.
  - Whitepaper on visionary applications
  - Sentient Future Competition
- 3. Research Roadmap preparation. The studies and the visionary applications whitepaper serve as a starting point for the *Research Roadmap* document. The roadmap will:
  - Estimate time and effort for on-going and additional research
  - Identify research areas requiring special attention in the near future
  - Suggest organizational and funding measures for future research
  - Provide guidelines for the analysis and solution of specific problems for the realization of applications





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- August 29 September 3, 2005, Schloss Dagstuhl, Germany http://www.vs.inf.ethz.ch/events/dag2005/
- <u>Activities:</u>
- Lectures. Usually, each day will feature lectures and discussions around a broad theme. Three to four lectures will be presented per day (morning and late afternoon).
- **TinyOS hands-on tutorial**. Participants can learn to program sensor nodes using <u>TinyOS</u>. This tutorial will be given by experienced <u>TinyOS experts</u>..
- **Participants workshop**. Some time will be reserved for a workshop where participants can present their own work and involvement in the field.
- **Application competition**. Participants can submit their ideas about application scenarios involving sensor networks and smart objects. The best contributions will be awarded with Apple iPods. Further information is available
- Lecturers: Jan Beutel, Kay Romer, Friedemannn Mattern, <u>Marc Langheinrich</u> ETH; Holger Karl, Un. of Paderborn; Pedro Marron, Un. of Stuttgart; Koen Langendoen, TU Delft; Marcelo Pias, Cambridge Un.; <u>Albrecht Schmidt</u>, LMU Munich; <u>Joe Polastre</u>, <u>Rob Szewczyk</u> Moteiv.





#### EMBEDDED-WISENTS TEACHWARE

home courses teaching material contribution testbed user registration

- WiSenTs website contains references to classes and teaching material relevant for students, teachers and professionals that want to focus on the aspects of pervasive computing related to sensor networks, lowpower design, and cooperative objects.
- Provides also remote access to DIKU Testbed. DIKU Testbed is an experimental wireless sensor network deployed in the building of the <u>Department of Computer</u> <u>Science</u> at <u>University of Copenhagen</u>. The testbed has about 40 <u>Freescale DIG-528 boards</u>. A full scale deployment with about 120 boards is planned for 2006



## **Student Mobility**

- Mobility of master and PhD students among the different WiSeNts partners
  - value added experience for students
  - knowhow transfer
  - encouraged collaboration and cooperation among the different groups



### **Research Integration**

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## **Research Facilitation**



European Platforms

Other Platforms







#### Survey Document





# **Distinguished Visitors**

WiSeNt will support mobility of researchers working in the area of cooperating objects by means of a Distinguished Visitor Program. "The visits shall take on the form of a distinguished researcher, who is not necessarily part of the project (external visitors are actually encouraged), visiting a project partner institution. There, the visitor is asked to deliver a talk, which will be made available via electronic means to the public, as well as to be available for discussion with project partners. To maximize the benefits of such a visit, project partners are encouraged to also send researchers (i.e., preferably senior researchers, postdocs, advanced PhD students if required and appropriate) to such an event



# Militsa Stojanovic



- Researcher, MIT
- Recognized expert on acoustic communications
- Current topics of interest, selected for the collaborating with the WiSeNts partners: underwater acoustic sensor networks.
- Selected Location: Un. of Padova
- Seminars will be given, open to other partners/students, recorded.
- Duration of the visit: april 2006



## Tom La Porta

- Professor, Penn State Un.
- Recognized expert on wireless and mobile communications
- Current topics of interest, selected for the collaborating with the WiSeNts partners: mobile sensor networks.
- Selected Location: CINI lab@Rome University "La Sapienza"
- Seminars will be given, open to other partners/students, recorded.
- Duration of the visit: may-june 2006







## **Robin Kravets**

- Associate Professor at UIUC
- Recognized expert on energy-efficient protocols, ad hoc networks, QoS support in such networks
- Current topics of interest, selected for the collaborating with the WiSeNts partners: integration of heterogeneous networks, including networks of cooperating objects and traditional networks.
- Selected Location: CINI lab@Rome University "La Sapienza"
- Seminars will be given, open to other partners/students, recorded.
- Duration of the visit: end of august-end of december.



4th European conference on Wireless Sensor Networks (EWSN 2007)

January 29-31, 2007, Delft, The Netherlands

- Embedded WiSeNts organizes and supports EWSN
- EWSN 2007, the European conference on Wireless Sensor Networks, is the fourth of a series of annual meetings focusing on the latest research in the rapidly growing area of wireless sensor networks. EWSN 2007 will be held at Delft University of Technology, Delft, The Netherlands, on January 29-31, 2007. http://www.dritte.org/ewsn (deadline Sept 3 2006)
- Previous events were held in Berlin, Germany (2004), in Istanbul, Turkey (2005), and in
- <u>Zurich, Switzerland (2006)</u>. http://www.ewsn.org/2006/?index



4th European conference on Wireless Sensor Networks (EWSN 2007)

January 29-31, 2007, Delft, The Netherlands

- Focus on all topics of WSN ranging from lower layers, to upper layers, applications and services
- Demos, competition on visionary applications have been a key point of past edition
- In all the past three editions a whole session has been devoted to <u>European WSN Research</u> <u>Initiatives</u>.
  - presentations by representatives of the major projects in the area of WSN and cooperating objects
  - Presentations by EU commission representatives



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## **Studies**

#### Embedded WiSeNts - Research Roadmap - Studies

http://www.embedded-wisents.org/studies/studies\_wp3.html



The main objectives of the studies carried out in the Embedded WiSeNts Coordination Action are:

- In-depth analysis of the current state-of-the-art in Cooperating Embedded Systems and Wireless Sensor Networks.
- Identify open issues and trends in the field.

In the scope of the project, a Cooperating Object (CO) is defined as a collection of sensors, actuators, controllers or other COs that communicate with each other and are able to achieve, more or less autonomously, a common goal. The inclusion of other cooperating objects, as part of CO itself indicates that these objects can combine their sensors, controllers and actuators in a hierarchical way and are, therefore, able to create arbitrarily complex structures.



## **Studies**

#### Study 1: Applications and applications scenarios

Overview of cooperating object (CO) applications and application scenarios that can be readily understood today and identify relevant state of the art, projects and activities in the CO domain.

Some application scenarios that enable us to better understand the area of CO in the wide sense of the term from two different perspectives: *socio-economic* and *application domains*.

#### Study 2: Paradigms for algorithms and interactions

Provide an up-to-date overview of the fundamental design *paradigms, algorithms and interaction patterns* that enable the realization of systems based on Cooperating Objects (COs).

Thematic Areas: Wireless Sensor Networks for Environmental Monitoring, Wireless Sensor Networks with Mobile Nodes, Autonomous Robotic Teams and Inter Vehicular Networks.

#### Study 3: Vertical Systems Functions

The main goal of this study is to discuss the roles and effects of Vertical System Functions which are defined as the functionality that addresses the needs of applications in specific domains. Vertical Functions also offer minimal essential functionality that is missing from available real-time operating systems.

#### Study 4: System Architectures and Programming Models

Survey the current state of the art of programming models and system architecture for Cooperating Objects. The document points out some of the limitations of current approaches, and proposes some research perspectives.



### The Sentient Future Competition\*

click here for Rules und Regulations



▶ imagine the future 10 years from now

envision a scenario for wireless sensor networks and cooperating objects

#### win cash! ► win up to 6,000 € in cash

\* created by the Embedded WiSeNts coordination action and sponsored by the Deutsche Telekom Laboratories competition opening October 1<sup>st</sup>, 2005, apply until November 30<sup>th</sup>, 2005





- To stimulate identification of long term applications
- 79 entries were received and reviewed by a panel of 24 <u>experts</u>. A shortlist of entries was selected based on these reviews. The shortlisted entries were then carefully reviewed by all members of the distinguished judging panel who identified three winners



### Sentient Future Competition

## And the Winners are....

- <u>First prize</u>: Large Scale Body Sensing for Infectious Disease Control (*Markus Endler, Rio de Janeiro*)
- WSN to contineously monitor large scale animal population, to perform automatic diagnosis and warn about possible dangers
- Correlation of different datas (on the history data of an infected animal, the places it was close to, the other animals it was in contact with) are used to identify and control illness spreading













## And the Winners are....

- <u>Second prize</u>: The intelligent waste management system (*D. Schoch, M. Sala ETH*)
- RFID system to track pieces of waste and encourages correct disposal by financial incentives
- The person who disposes the waste is in possession of a collection card. Whenever he/she throws a piece of card in a bin or diposes recyclable material a certain deposit is credited on the card





## And the Winners are....

- <u>Third prize</u>: Vision of congestion-free road traffic and cooperating objects (*R. Morla, Lancaster University*)
- Automatic traffic control system based on communication from the vehicles to the environment and on communication between vehicles



For more information http://www.embedded-wisents.org/competition/competition\_ann.htm



# Roadmap

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# Thank you!

