IntelliCIS COST ACTION IC0806

Intelligent Monitoring, Control and Security of Critical Infrastructure Systems

4th Action Workshop

13-14 June 2011,

Vilanova i la Geltrú, Spain

COST is supported by the EU RTD Framework Programme

IntelliCIS Action IC0806

4th Workshop, Vilanova i la Geltrú – Spain

13-14 June 2011

Program-at-a-glance

Monday, 13 June 2011	
09:00 – 10:00	**KEYNOTE LECTURE 1: Mladen Kezunovic**
10:00 – 10:30	COFFEE BREAK
10:30 – 11:45	**Session I : Wireless Sensor Networks and the Internet**
11:45 – 12:45	**Session II: Critical Infrastructures**
12:45 – 14:00	LUNCH
14:00 – 16:00	**Breakout sessions**
16:00 – 18:00	**IC0806 Management Committee Meeting**
21:00 – 23:00	DINNER

Tuesday, 14 June 2011	
09:00 – 10:00	**KEYNOTE LECTURE 2: Bo Wahlberg**
10:00 – 10:30	COFFEE BREAK
10:30 – 11:45	**Session III: Water and Waste**
11:45 – 12:45	**Session IV: Power Systems**
12:45 – 14:00	LUNCH
14:00 – 16:00	**Free time for research meetings/networking**

IntelliCIS Action IC0806 – Detailed Program

Monday, June 13

09:00 AM - 10:00 AM

KEYNOTE LECTURE 1

"Smart Grid: the Teaming Opportunities," Mladen Kezunovic
(Texas A&M University, United States of America)
Sala d'Actes
Chair: Elias Kyriakides (University of Cyprus, Cyprus)

10:00 AM -10:30 AM

COFFEE BREAK

10:30 AM - 11:45 AM

Session I: Wireless Sensor Networks and the Internet
Sala d'Actes
Chair: Mihaela Albu (University Politehnica Bucharest, Romania)

A Large Scale WSN-based Forest Fire Sensing and Management System
Evangelia D. Kolega (National Technical University of Athens, Greece)

WINSOME: WSN-based Secure Platform to Support Monitoring Applications for Critical Infrastructures
Fortunato Santucci (University of L'Aquila, Italy)

TARIFA: The Atomic Redesign of the Internet Future Architecture
Anny Martínez (Technical University of Catalonia, Spain)

11:45 AM – 12:45 PM

Session II: Critical Infrastructures

Sala d'Actes
Chair: George Ellinas (University of Cyprus, Cyprus)

MICIE: An Alerting System for Interdependent Critical Infrastructures
Paulo Simões (CISUC-DEI, University of Coimbra, Spain)

Adaptation of Level of Autonomy for Human-Machine-Interaction
Essam Badreddin (University of Heidelberg, Germany)

The DIESIS Approach to Semantically Interoperable Federated Critical Infrastructure Simulation
Erich Rome (Fraunhofer Institute for Intelligent Analysis and Information Systems, Germany)

12:45 PM – 2:00 PM

LUNCH

2:00 PM – 4:00 PM

Breakout sessions

Breakout session 1: Smart metering. Definitions, communication solutions, and impact on smart grids
Sala d'Actes
Chair: Mihaela Albu (University Politehnica Bucharest, Romania)

Breakout session 2: Energy Consumption and IT
Sala master
Chair: Erol Gelenbe (Imperial College, United Kingdom)

4:00 PM –6:00 PM

IC0806 Management Committee Meeting

Room AA201

9:00 PM – 11:00 PM

***DINNER** (at Xiringuito Miramar)*

Tuesday, June 14

9:00 AM - 10:00 AM

KEYNOTE LECTURE 2

"On Experiment Design for Identification of Structured Systems," Bo Wahlberg
(KTH Royal Institute of Technology, Stockholm, Sweden)
Sala d'Actes
Chair: Elias Kyriakides (University of Cyprus, Cyprus)

10:00 AM - 10:30 AM

COFFEE BREAK

10:30 AM – 11:45 PM

Session III: Water and Waste
Sala d'Actes
Chair: Jon Rostum (SINTEF, Norway)

Energy Efficient Control of a Water Boosting System with Multiple Variable-Speed Pumps in Parallel
Zhenyu Yang (Aalborg University, Denmark)

Real time faulty sensor and leaks detection method for complex water networks. Application to the Ter-Llobregat transport water network in Catalonia
Joseba Quevedo (Technical University of Catalonia, Spain)

Composting monitoring: a real world challenge for WSNs
Carlos Jumilla and Enric Solá (IRIS-Innovació i Reserca Industrial i Sostenible, Spain)

Multi-Objective WSN Deployment: Event Detection, Connectivity and Lifetime
Nadjib Achir (University Paris 13, France)

11:45 AM – 12:45 PM

Session IV: Power Systems

Sala d'Actes

Chair: Irineu Silva Dias (INESC Porto, Portugal)

Synchronous Measurements for Monitoring a Grid Section with Hydro Power Generators
Razvan Magureanu (University Politehnica Bucharest, Romania)

Diagnostics and prognostics of rotational machinery by means of nonlinear signal processing
Dani Juricic (Jozef Stefan Institute, Slovenia)

Reliability and Operational Performance of Generation and Transmission Power Systems with Increased Penetration of Renewable Energy Sources
Evangelos N. Dialynas (National Technical University of Athens, Greece)

12:45 PM – 2:00 PM

LUNCH

Smart grid: the teaming opportunities

Mladen Kezunovic
Texas A&M University
U.S.A.

Abstract:
The Smart Grid idea has captured imagination across the world lately due to its promise to answer many critical issues surrounding electric energy uses. This talk surveys many diverse areas of smart grid R&D: renewable energy resources and energy storage, smart meters, synchrophasors, smart appliances and electrical vehicles, cybersecurity, pervasive sensors and embedded systems, automation systems at all levels of power system enterprise, etc. As a result, teaming up for R&D projects has become rather involved due to multiple interdisciplinary and multidisciplinary skills needed to address various smart grid R&D issues. The talk will focus on the type of skills needed to deal with various smart grid applications ranging from engineering, economics, policy, agriculture and agriculture economics and various sciences. Examples of several solutions requiring the mix of skills will be discussed: microgrids, system-wide motoring, control, and protection, risk based maintenance, advanced planning tools and situational awareness, system integration, etc. Experiences from a few collaborative efforts that the author is participating in at this time will be discussed.

Biography:
Mladen Kezunovic received the Dipl. Ing. , M.S. and Ph.D. degrees in electrical engineering in 1974, 1977 and 1980, respectively. He is the Eugene E. Webb Professor and Site Director of Power Engineering Research Center (PSerc), an NSF I/UCRC at Texas A&M University. He is also a Deputy Director of another NSF I/UCRC "PHEV/BEV: Transportation and Electricity Convergence". He leads Smart Energy Campus Initiative and Smart Grid Center at Texas A&M University. His main research interests are fundamental concepts, technology and applications related to smart grid deployment. He has published over 400 papers, given over 100 seminars, invited lectures and short courses, and consulted for over 50 companies worldwide. Dr. Kezunovic is a Fellow of the IEEE, a member of CIGRE and Registered Professional Engineer in Texas. He is the Principal of Test Laboratories International, a consulting firm specializing in automated fault analysis, IED testing and smart grid deployment, and education. His current smart grid efforts are:

- *Distinguished Speaker*, IEEE Power & Energy Society
- *Member*, SGIP Governing Board, Smart Grid Interoperability Panel-SGIP
- *Chair*, SGIP Governing Board Communication, Marketing and Education working group
- *Member*, SGIP Testing and Certification Committee
- *Member*, EPRI NESCOR, cybersecurity team with DOE grant
- *Member*, many WGs in IEEE and North American Synchrophasor Initiative-NASPI,
- *Convener*, CIGRE WG on education for smart grid workforce in protection and substation automation areas
- *Technical Committee Chair*, The 2012 IEEE International Electrical Vehicle Conference
- *Member*, IEEE p2030.1, Working group on grid infrastructure for electric sourced transportation

COST is supported by the EU RTD Framework Programme

A Large Scale WSN-based Forest Fire Sensing and Management System

Evangelia D. Kolega
National Technical University of Athens, Greece

Abstract:
In this paper we suggest an application platform for developing a Fire Sensing Management System based on WSNs and further discuss decision support that can be based on such a platform and application software. The use of such a system can assist the appropriate authorities detect a forest fire incident in the very beginning and assess the relative severity of simultaneous forest fire incidents in order to decide how to best exploit available resources. Wireless Sensor Networks (WSNs) play a fundamental role in the implementation, being the in-situ detection mechanism. The Management and Decision Support System does the collection of network data, the depiction of temperature values on platforms such as Google maps, and the assessment of the relative severity of simultaneous fire fronts using forest fire simulation. It can also send real-time alarm messages, so that immediate action is undertaken by the crisis management authorities.

Biography:
Evangelia Kolega is a MSc - Phd candidate at the National Technical University of Athens (NTUA). Her main research issues are WSN applications, especially focused on environmental engineering, BAN and IP networks. She is currently a research fellow at National Hazards Centre of NTUA. Eva received the MSc degree in Networked Information Systems from the University of Piraeus and the Diploma in Electrical and Computer Engineering from the NTUA, Athens, Greece. She has worked for about 15 years as a network engineer and researcher for network companies, academic and research institutions. Some of them are the Greek Research and Technology Network (GRnet), the Computer Technology Institute of Patreus, the Network Operations Centre (N.O.C.) of the University of Piraeus and the N.O.C. of Technological Educational Institute (T.E.I.) of Athens. Eva has participated in a number of well known national network projects and in EU ones such as RESMA and EMEA. She has written five papers for conferences published in their proceedings (i.e. IEEE ICNSC 2011 - Delft, iEMSs 2010- Canada).

COST is supported by
the EU RTD Framework Programme

WINSOME: WSN-based Secure Platform to Support Monitoring Applications for Critical Infrastructures

M. Pugliese, L. Pomante, F. Santucci
University of L'Aquila, Italy

Abstract:
Reliability, robustness and flexibility are key requirements in designing monitoring systems for critical infrastructures that rely on pervasive and dense deployment of wireless sensor nodes. In our research work, improvement of reliability is addressed by efficient anomaly detection algorithm, robustness to faults, threats and attacks is supported by the adoption of a distributed computing architecture for data processing (in-network processing), flexibility is enhanced by the adoption of an underlying wireless sensor network (WSN) infrastructure to benefit from topology rearrangement and dynamic routing. By resorting to a platform-based design methodology, we define, develop and validate a platform (WINSOME, acronym for Wireless Sensor Network Secure System for Structural Integrity Monitoring and Alerting), that is aimed to satisfy the above requirements. In this frame, WINSOME exploits WSNs as the underlying ad-hoc infrastructure, mobile agent-based middleware as the application execution environment, and embeds novel anomaly detection rules and advanced state estimation techniques. The core function of WINSOME is the anomaly detection logic. From an architectural functional perspective, this logic is decomposed and shared across network nodes by means of mobile agents, which trigger their position and reaction according to events captured and processed through state transition mechanisms in the behaviour model of the critical infrastructure. In WINSOME, this model is based on Weak Process Models (WPM), a non-parametric version of Hidden Markov Models (HMM). The triggering mechanism is offered by a non-parametric detection technique that we denote as MVET. Reliability requirements in monitoring security in critical infrastructures typically enforce severe requirements to the detection process, such as zero false negatives (ZFN) and a manageable false positives rate: we can see that MVET can meet those requirements.

Biography:
Fortunato Santucci (S\'93-M\'95-SM\'00) received the laurea degree and the Ph.D. degree in Electronic Engineering in 1989 and 1994, respectively. In 1989 he was with Selenia Spazio S.p.a., Rome. In 1991-1992 he was at the Solid State Electronics Institute (I.E.S.S.) of the National Research Council (C.N.R.), Rome. Since 1994 he has been with the Department of Electrical and Information Engineering, University of L'Aquila, Italy, where he currently holds the position of Associate Professor and holds the chair of the Telecommunications Engineering program. He was a visiting researcher at the Department of Electrical and Computer Engineering of the University of Victoria, BC in 1996. His current research activity is focused on communication theory, access control and radio resource management in future mobile radio systems, technologies and architectures for wireless embedded networks. He has participated in major national and european research programs in wireless mobile communications and embedded systems, and coordinates research programs funded by industrial partners. Since 2000 he has served as an Editor for the IEEE Transactions on Communications and, more recently, also for Kluwer Telecommunications Systems and Hindawi. He is in the TPC of major international conferences and has been author and speaker of invited/plenary talks in several conferences. He is in the Board of Directors of the Centre of Excellence DEWS at the University of L'Aquila, of the Radiolabs consortium, and also in the Technical Committee of CNIT, Italy. He is a co-founder and a member of the board of governors of the spin-off company WEST Aquila srl. He is an author of about 180 papers published in international journals, conference proceedings and book chapters.

COST is supported by the EU RTD Framework Programme

TARIFA: The Atomic Redesign of the Internet Future Architecture

Anny Martínez, Xavi Masip, René Serral
Universitat Politécnica de Catalunya, Spain

Abstract:
The Internet is facing an architectural crisis as the load and stress on the Network increases with new users and applications. Current Internet architecture is becoming more and more ossified and complex; with lots of patches aimed to amend different issues that have arisen during its almost 40 years of existence. Furthermore, new services and computing paradigms require new modes of interaction, new features (identification, context-awareness, seamless service discovery and composition, etc.) and clean solutions to known issues (mobility, security, flexibility, etc.); but it is not clear how the current Internet architecture will be able to cope with all these new requirements. We believe that most of the known issues could be potentially solved by the design of a new network architecture that encompasses all the requirements to achieve. TARIFA aims at defining a novel approach to a Future Internet architectural redesign, based on a role-based paradigm consisting of non-divisible atomic functions.

Biography:
Anny Martínez is a Ph.D. student of the Computer Architecture Programme at the *Technical University of Catalonia*, Spain since November 2010. Her current research is in the area of design of new control, management and addressing strategies for the future Internet. She received her degree in Electronic Engineering from *Universidad Simon Bolívar*, Venezuela in 2008. In the past she worked as Software Engineer for *Smartmatic Labs*, a technological solution enterprise.

COST is supported by the EU RTD Framework Programme

MICIE: An Alerting System for Interdependent Critical Infrastructures

Paulo Simões
CISUC-DEI, University of Coimbra

Abstract:
MICIE is a European research project that addresses the development of risk management tools for interdependent Critical Infrastructures (CIs). In this presentation we will provide an overview of the project vision and outcomes, focusing in three of the MICIE keystones:

- a risk prediction tool which provides CI operators with real-time risk assessment, based on the status of their own CI and interdependent CIs.
- a platform for secure, real-time mediation of risk data between interdependent CIs.
- and the validation of this framework in Reference Scenarios that feature mutually interdependent CIs such as power distribution networks and telecommunications networks.

Biography:
Paulo Simões is a Professor at the Department of Informatics Engineering of University of Coimbra and a senior researcher at the Laboratory for Communications and Telematics since 2002. His main research interests are Security, Network Management and Critical Infrastructure Protection. He has more than 70 journal and conference publications in these areas. He has been involved in several European research projects (FP6 EuQos, FP6 WEIRD, FP6 OpenNet, FP7 MICIE, FP6 Content NoE), both with technical and management activities. He has also participated in various industry-funded research projects. More information is available at: http://eden.dei.uc.pt/~psimoes/

COST is supported by the EU RTD Framework Programme

Adaptation of Level of Autonomy for Human-Machine-Interaction

Essam Badreddin
University of Heidelberg, Germany

Abstract:
A generic system model and a control scheme for the real-time adaptation of autonomy level for Human-Machine-Interaction are proposed. The topology of the system is based on a recursive nested behaviour-based control structure, which is an abstraction of multiple cascaded control loops. The technical system and its operator are modelled symmetrically as dynamical system components, which are decomposed into behavioural levels with different reaction times. Comparing the human behaviour with the behaviour realization of the technical system on the higher levels, a human reference model can be identified. Due to the simple structure of the reference model, the user characteristics can be observed in real-time. According to the system structure, a scheme is developed for the adaptation of the autonomy level in real-time based on the individual characteristics. As a result, guide-lines are provided for the dependable design of interfaces between the human operator and the technical system.

Biography:
Prof. Dr.sc.techn. Essam Badreddin is currently the head of the Automation laboratory at the University of Heidelberg, Germany. He earned his Swiss Diploma (Dipl.Ing. ETH) in Electrical Engineering, the Doctor of technical sciences (Dr.sc.techn.) in Control Theory and Habilitation (Habil.) in Mechanical Engineering from the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland. He then served in the industry at Contraves-Zurich as an R&D System Engineer in the air-defence sector, where he also holds several international patents (Silver Dollar awarded). He returned to the ETH-Zurich to found and lead the first robotics research group and build, one of if not, the first autonomous mobile robot of an industrial scale in Europe and introduce one of the first courses on the design of autonomous mobile robots worldwide. As Deputy Chair for Risk&Safety Technology, he lead the research group for risk and safety modeling & assessment at the ETH-Zurich. In Japan, he served as a Monbushu associate Prof. at Toyohashi University of Technology before he moved to Germany to establish and lead the Automation Laboratory at the Institute of Computer Engineering at the University of Mannheim; currently at the University of Heidelberg. Prof. Badreddin's research interests span process control, robotics, cognitive engineering and dependable hybrid systems. Among other national and international boards, he is the coordinator of the European project OpenGain and the State project ECOMODIS, a member of the management committee and financial raporteur of the European project IntelliCIS, peer-reviewer for the United Nation and reviewer of the German Research Foundation (DFG).

COST is supported by the EU RTD Framework Programme

The DIESIS Approach to Semantically Interoperable Federated Critical Infrastructure Simulation

Erich Rome
Fraunhofer Institute for Intelligent Analysis and Information Systems (Fraunhofer IAIS)

Abstract:
Critical infrastructures (CI) such as telecommunication or the power grids and their dependencies are getting increasingly complex. Understanding these – often indirect –dependencies is a vital precondition for the prevention of cross-sector cascading failures of CI. Simulation is an important tool for CI dependency analysis, for the test of risk reduction methods, and as well for the evaluation of past failures. Moreover, interaction of such simulations with external threat models, e.g., a river flood model and economic models, may assist in what-if decision-making processes. The simulation of complex scenarios involving several different CI sectors requires the usage of heterogeneous federated simulations of CI. However, common standards for modelling and interoperability of such federated CI simulations are missing. We present a novel approach for coupling CI simulations, developed and realised in the EU project DIESIS. The DIESIS core technologies for coupling CI simulations include a middleware that enables semantic interoperability of the federate simulators, a systematic, service-oriented approach to set up and run such federations, a communication middleware for distributed simulation, and, most importantly, a scenario-based architecture concept for modelling and federated simulation of CI. The architecture foresees a flexible pair-wise (lateral) coupling of simulators. DIESIS has implemented a demonstrator as a proof of concept for its approach and technologies, by coupling four different simulation systems (three interacting CIs and an external, common threat). In this presentation, the focus is on the architectural concept and the interoperability middleware that realises this concept, allowing the coupling of heterogeneous simulation systems using heterogeneous time and data models. We will discuss the basic technical concepts and will describe the particular setup of the technical demonstrator that employs all these concepts. The proposed architecture is open for further extensions.

Biography:
ERICH ROME is a Senior Researcher and Project Manager at the Fraunhofer Institute for Intelligent Analysis and Information Systems (IAIS) in Sankt Augustin, Germany. From his educational background, he is a computer scientist with a minor in physics and he holds a PhD in engineering sciences from the University of Bremen. The areas of his research interests comprise federated simulation techniques, preventive security and critical infrastructure protection, as well as machine perception, robotics and sensory systems. He has coordinated and managed several multi-disciplinary European research projects in FP6 and FP7: the STRePs DIESIS and MACS, and the IP IRRIIS as an interim coordinator.

COST is supported by the EU RTD Framework Programme

On Experiment Design for Identification of Structured Systems

Bo Wahlberg
KTH Royal Institute of Technology, Sweden

Abstract:
Modeling of dynamical systems is fundamental in almost all disciplines of science, ranging from life science to critical infrastructure systems. Models are used for design and analysis of complex technical systems. A most important issue in modeling is the understanding of the accuracy and limitations of a model in terms of complexity and functionality. That is, is it of sufficiently good quality with respect to the intended application? In particular, this is an issue if the model is used for monitoring and control. System identification concerns the construction and validation of mathematical models of dynamical systems from experimental data. Identification of complex dynamical systems, such as large scale networked systems, is still a most challenging task. A main issue is validation and performance analysis of the model estimates, i.e. to assess the quality of the estimated model. To obtain useful results it is most important to make use of a priori given structural information to specify relevant model structures. Models of physical systems are often based on combining and connecting simple block behaviors, such as cascade or parallel structures. We will present model reduction and system identification methods that take the structure into account.
The quality of an estimated model should be related to the specifications of the intended application. A classical approach is to study the "size" of the asymptotic covariance matrix (the inverse of the Fisher information matrix) of the corresponding parameter vector estimate. In many cases it is possible to design and implement external excitation signals, e.g. pilot signals in communications systems or input signals in control applications. The objective of this presentation is to present some recent advances in optimal experiment design for system identification with a certain application in mind. The idea is to minimize experimental costs (e.g. the power of the excitation signal), while guarantying that the estimated model with a given probability satisfies the specifications of the application. This will result in a convex optimization problem, where the optimal solution should reveal system properties important for the application while hiding irrelevant dynamics. This presentation is based on joint work with Mariette Annergren, Håkan Hjalmarsson and Cristian Rojas, KTH.

Biography:
Bo Wahlberg received the M.Sc. degree in Electrical Engineering 1983 and the Ph.D. degree in 1987 from Linköping University, Sweden. In December 1991, he became Professor of the Chair of Automatic Control at the KTH Royal Institute of Technology, Stockholm, Sweden. He was a Fulbright visiting professor at the Information Systems Lab, Stanford University, USA, August 1997 - July 1998 and July 2009 - June 2010, and vice president at KTH 1999 - 2001. He is a past chairman of the IFAC Technical Committee on Modeling, Identification and Signal processing and a Fellow of the IEEE. He is co-founder of the VR Linnaeus Center ACCESS and the Centre of Autonomous Systems at KTH. His research interests include system identification, modeling and control of industrial processes, and signal processing with applications in communication and autonomous systems.

COST is supported by the EU RTD Framework Programme

Energy Efficient Control of a Water Boosting System with Multiple Variable-Speed Pumps in Parallel

Zhenyu Yang
Aalborg University, Denmark

Abstract:
The objective for controlling a water boosting system equipped with multiple variable-speed pumps in parallel is to minimize the pump system energy consumption by control the number of running pumps and their corresponding speeds in a real-time manner, subject to potential changes of set-points and operating conditions. An optimal pump scheduling and control strategy is proposed in this talk. After a number of static models for different pump combinations are derived, a number of optimal scheduling algorithms are proposed from a formulated Mixed Integer Non-Linear Program (MINLP) problem. In order to cope with potential modeling errors, a feedback control mechanism is also introduced into the proposed framework. In case of unknown operating conditions, an identification algorithm is proposed to estimate unknown system coefficients at an online manner. The experimental results on a physical setup show a huge potential to improve the energy efficiency of multi-pump systems using the proposed method and algorithms.

Biography:
Dr. Zhenyu Yang is an Associate Professor at Department of Energy Technology, Aalborg University, Denmark. He got his B.Sc. and M.Sc degrees from Shandong University (China) in 1991 and 1994, respectively. He got his PhD degree in Automatic Control from Beijing University of Aero. & Astro. in 1998. After one-year postdoctor at TU Delft (Netherlands), he joined Aalborg University in 1999. His research interests include: fault detection and diagnosis, fault tolerant control, hybrid control systems, reliability modeling, analysis and design, and industrial applications of advanced control techniques. Dr. Zhenyu Yang is IEEE Member.

COST is supported by
the EU RTD Framework Programme

"Real time faulty sensor and leaks detection method for complex water networks. Application to the Ter-Llobregat transport water network in Catalonia"

Joseba Quevedo

Universitat Politécnica de Catalunya, Spain

Abstract:

In a complex water distribution network, a telecontrol system must acquire, store and validate data from many flowmeters and other sensors every few minutes to achieve accurate monitoring of the whole network in real time. Frequent operation problems in the communication system between the set of the sensors and the data logger, or in the telecontrol itself, generate missing data during a certain periods of time. The stored data are sometimes uncorrelated and of no use for historic records. Missing data must, therefore, be replaced by a set of estimated data. A second common problem is the lack of reliability of the flowmeters (offset, drift, break-downs), producing false flow data readings. These false data must also be detected and replaced by estimated data, since flow data are used for several network water management tasks, namely: operational control, leak detection maintenance, efficiency computation and billing/ consumer services. The same type of problem can be found in gas or electricity networks. To address these problem specifications, this work proposes a model based methodology for data validation (detection) and replacement of faulty/missing flowmeter measurements in a water distribution network based on temporal redundancy of the flowmeters and spatial redundancy of the water network. The validated or estimated data of the sensors using this methodology will be applied further to detect possible leaks in the different sectors of the transport water network of Ter-Llobregat in Catalunya.

Biography:

I received the Master degree in Electrical, Electronic and Control Engineering in 1973 and the PhD in Control Engineering from the University Paul Sabatier of Toulouse (France) in 1976, and the PhD in Computer Engineering from the Technical University of Catalonia in 1982. Since 1979 I am working at the Technical University of Catalonia, as a full professor since 1990. I have published more than 150 journal and conference papers in the areas of advanced control, identification and parameter estimation, fault detection and diagnosis and fault tolerant control and their applications to large scale systems (water distribution systems and sewer networks) and to industrial processes. I have taken part in several Spanish and European research projects in the field of advanced control and supervision and its application to complex systems. I have also coordinated projects with national and international companies in the water and energy domains related to the improvement of optimal control of drinking water and sewer networks. At present, I am a member of the scientific committee of CETAQUA (AGBAR-UPC-CSIC), a water applications research center in Barcelona. I was the conference chairman of the XV International Federation of Automatic Control (IFAC) World Congress in Barcelona (2002) with more than 2000 delegates. Also, last year I was the National Organizing Committee Chairman of the SAFEPROCESS Symposium in Barcelona with more than 300 specialists in fault diagnosis and fault tolerant control. I will organize the IEEE Mediterranean Control and Automation to be held in Barcelona 2012.

COST is supported by the EU RTD Framework Programme

Composting monitoring: a real world challenge for WSNs

Carlos Jumilla and Enric Solà

IRIS (Innovació i Reserca Industrial i Sostenible), Spain

Abstract:
Waste disposal and treatment are two major issues to address in modern cities infrastructures as well as in rural areas with high intensive farming. As society awareness of environmental issues grows, the necessity for efficient organic waste treatment system is becoming more and more critical. Composting is nature's way of recycling organic waste into valuable fertilizer. It is a natural biological process in which microorganisms such as bacteria and fungi break down organic matter. Since approximately 45-55% of the waste stream is organic matter, composting plays a significant role in today's waste treatment. But composting needs to be well controlled to optimize the compost quality and to avoid undesirable odors or germs.
We will present the COMPO-BALL system, a project funded by the FP7, which is developing a new system for monitoring the temperature and humidity during composting processes using a wireless sensor network. The high density and humidity of the medium hinder the communications inside the compost severely and force the transmission among the sensors to use a frequency band as low as possible. This special nature of the medium prevents the use of extended and readily available communication standards and technologies such as Zigbee or 6LoWPAN. In addition, composting is a long process which requires the autonomous operation of the sensor nodes for several months. Therefore, new communication protocols have to be programmed and adapted for this particular application, which might also be applicable in other Critical Infrastructure Systems where low frequency bands are preferred or in fact the only available option due to high attenuation of the medium or to increase the transmission range over the air at a very low power consumption.

Biography:
Carlos Jumilla Pedreño holds a Masters Degree (2008) in Telecommunications Engineering from the Telecommunications Engineering Technical School of the Technical University of Cartagena (UPCT). He carried out his Master Thesis at Loughborough University (Leicestershire, UK). He also has worked at ESTEC (ESA complex in The Netherlands) in satellite communications a company supported by and participated in the European Space Agency (ESA) Business Incubator of the Technology Transfer Program (TTP) initiative. In this company he gained experience in communication protocols used for security and remote data acquisition (SCADA). Currently, he is working at IRIS as a developer for several private and European projects and whose areas of expertise include electronic design, protocols design, wireless sensor networks, Printed Circuit Board layout design and assembly, RF data transmission links and microcontroller Software development.

Enric Solà Garcia holds a Masters Degree (2007) in Telecommunications Engineering from the Telecommunication Engineering School of Barcelona, Polytechnic University of Catalunya (UPC). He started to work in the field of wireless data transmission and network design in Philips Research Aachen, where he carried out his Master Thesis. He has also worked in Trend Communications, where he has been involved in Software, Firmware and Hardware design projects in several technologies, such as Ethernet and SDH. From October 2008, he has been involved in the management and technical development of FP7 EU funded projects such as “Water-Bee” and “Compo-Ball”, both of them based on wireless sensor networks and system framework integration. He has proven expertise, experience and skills in electronic design, ZigBee wireless sensor networks, Printed Circuit Board layout design and assembly, RF data transmission links and Software development (C++, C#, Java, LabView, etc.). He has also experience in control systems, sensors and data acquisition and signal conditioning.

COST is supported by the EU RTD Framework Programme

Multi-Objective WSN Deployment: Event Detection, Connectivity and Lifetime

Nadjib Achir
University Paris 13, France

Abstract:
In this work, we address a static wireless sensor network deployment problem. The objectives are to consideration the cost of deployment (number of sensors), the quality of monitoring, the network connectivity, and the network lifetime. We formalized the problem as multi-objectives combinatorial optimization problem. To resolve this problem, we propose a deployment algorithm called Multi-Objectives Deployment Algorithm (MODA). Our approach is based on Multi-Objectives Tabu Search (MOTS) metaheuristic and virtual forces. The results obtained outperform the related deployment strategies. In addition, in MODA we have to know the installed protocol stack in the nodes. In this work we assumes ZigBee nodes, where the routing protocol is based on Ad hoc On Demand Distance Vector routing algorithm (AODV) and the MAC/Phy layers are specified in IEEE 802.15.4 standard.

Biography:
Nadjib ACHIR received in 1999 the M.S. degree from the University of Versailles Saint Quentin en Yvelines, France. In 2003 he obtained the Ph.D. degree in computer networks from the University of the Pierre et Marie Curie, Paris 6. From 2002 to 2004, he was an associate lecturer at the University of Paris 11 and École Nationale Supérieure d'Informatique pour l'Industrie et l'Entreprise (ENSIIE), France. From December 2004, he is assistant professor at University of Paris 13, France. He is involved in many research project dealing with sensor network, multimedia communications, mesh networks and gaming. Nadjib Achir current research interests include Ad hoc and Sensor Networks, Gaming support over wireless and wired network, Wireless and Mesh Networks, Performance evaluation. He published his work in major IEEE conferences (ICC, Globecom, PIMRC, WCNC, VTC, CCNC) and renowned journals. He was the track Chair in IFIP Wireless Days 2008/2010 and the general co-chair of IFIP Wireless Days 2009. He also acted or still acts as TPC member of the following IFIP, ACM or IEEE conferences and workshops (ICC, GLOBECOM, PIMRC, GIIS, VTC, Wireless Days, etc).

COST is supported by
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Synchronous Measurements for Monitoring a Grid Section with Hydro Power Generators

Razvan Magureanu, Mihaela Albu

University Politehnica Bucharest, Romania

Abstract:
In order to perform a better exploitation of the renewable resources in Romania, there are several projects to operate in an optimal way the existing small and large hydro power plants installed on the same river, on a large geographical area. One of these grid sections includes 18 hydro plants 33 small hydro generation units, with individual rated power between 4.8 MW and 7.7 MW, spread along 220 km. The total power (also including a large power plant up the same river, 220 MW) is 432 MW. The elevation difference on this section is 750 meters. In the attempt to operate them as a Virtual Power Plant, allowing a better water and electrical energy management, a monitoring campaign began in 2010, as part of a R&D partnership between universities, DSO, TSO and the company owning the power plants. The aim is to provide better services to the stakeholders involved, including system services to the TSO. Among the necessary equipment, phasor measurement units and devices able to deliver synchronized data are of particular interest. Two PMUs (proprietary systems) have been installed in the grid section and are already online as part of in an Academic Network operational since 2010; however, although they perform several functions specific to WAMS, one cannot extend their functionalities as to include for example protection features or test other algorithms. Therefore, a new device, able to emulate PMU functionalities has been developed based on a Programmable FPGA Controller with variable hardware geometry synchronized acquisition modules, up to 50 kHz sampling rates and GPS clock signal. This unit, performing data acquisition, has been installed on a small hydro power plant at Mihailesti with two Kaplan and one Francis Turbine-Generator groups, grid-connected by three independent power transformers. On the Francis group an Energy Management Modular Smart Power Quality Transducer is installed. On the SHP output a PMU acquires the voltages and the generated line currents. All the information, along with other partners' sites, are stored on a server, providing online monitoring and real time control functions.

Biography:
Professor, Dept. of Electrical Engineering. He was a postdoctoral fellow with UMIST in UK (1970-1971). He has an established position in the European Power Electronics community, with recognized expertise in power electronic systems and motion control. He is a member of the Romanian Academy for Technical Sciences and he is the author of over 120 papers and 8 patents. He was a coordinator or partner in four European Research projects on topics related to energy efficiency, power quality and optimal use of renewable energy sources.

COST is supported by the EU RTD Framework Programme

Diagnostics and prognostics of rotational machinery by means of nonlinear signal processing

Dani Juricic
Jozef Stefan Institute, Slovenia

Abstract:
Rotational machines and drives are the most ubiquitous item of equipment in almost all industrial branches. Wear, excessive operational loads or errors in assembly might cause premature unexpected failures resulting in partial or total production downtime and damaged equipment. In order to keep high availability of the asset the EU industrial sector is estimated to spend on maintenance 4%- 8% of the total sales turnover, which is prohibitively high. Moreover, 30-50% of the expenditure is wasted through ineffective maintenance. The problem is that currently prevailing reactive (react-to-failure) and preventive (periodic) maintenance paradigms are outdated and need to be replaced with more cost-effective predictive maintenance based on advanced diagnostic and prognostic solutions. The underlying contribution presents a comprehensive approach to the problem based on new algorithms for feature extraction based on Wavelet Packet Transform, Spectral Kurtosis and Information Entropy Measures. The prognostic part relies on data-driven algorithms that employ nonlinear dynamic models of wear phenomena. The models are updated on-line by means of a maximum likelihood method while the distribution of the expected failure times is calculated by Monte Carlo simulations. The approach is demonstrated on experimental test rigs.

Biography:
Dani Juricic has completed the undergraduate studies at the Faculty of Electrical Engineering, the University of Ljubljana, in 1980 and received his MSc and PhD degree in the area of automatic control in 1984 and in 1990 respectively. Since 1981 he been appointed with the Department of Systems and Control at the Jozef Stefan Institute now at the position of research fellow. He has served as project leader or responsible person in a number of national and international projects and projects for industry. Since 2009 he has lead the programme group Systems and Control involved in a long-term research programme. Since October 2008 he has had part time assignement at the Faculty of Engineering and Management, the University of Nova Gorica. In 2001 and 2007 was elected Assistant Professor at the University of Ljubljana and Associate Professor at the University of Nova Gorica respectively (both in the area of electrical engineering). Since 2004 he has been involved in teaching assignements related to various topics: Environmental modelling at the Faculty of Environmental Sciences (University of Nova Gorica), Modern control technologies and Modelling of complex processes at the Jozef Stefan Postgraduate School and Control of logistic systems and Stochastic processes in logistics at the University of Maribor. In attempt to promote dissemination of most recent achievements in control systems technologies he has acted as one of the co-founders of a novel continuing education scheme for engineers in industry. The scheme has been running for 15 years as a suite of intensive one-week courses organised on the regular basis. He has been co-operating with a number of European research groups, e.g. Universite Libre de Bruxelles, Academy of Sciences of the Czech Republic, Hungarian Acedemy of Sciences and Technical University Darmstadt. During the academic year 1984/1985 he has been with the Institute of Automation, Technical University Darmstadt, where he completed part of his PhD Dissertation. In 2001 he was awarded DAAD Fellowship for research assignement at the same university. In 2006 he visited Department of Physics, Lancaster University (UK) as EPSRC Visiting Research Fellow.

COST is supported by the EU RTD Framework Programme

Reliability and Operational Performance of Generation and Transmission Power Systems With Increased Penetration of Renewable Energy Sources

Prof. E. N. Dialynas
National Technical University of Athens, Greece

Abstract:
The operational procedures that are being applied in the electric power systems have shown significant changes during the last years due to the increased penetration of Renewable Energy Sources (RES), such as wind parks and photovoltaic systems. The main achievement of these facilities is the low emission performance of power systems being obtained but certain concerns exist about the impact on their reliability and operational performance. This fact together with certain generation issues that concern the commissioning of new and the decommissioning of old power plants, have resulted in certain aspects that need to be considered thoroughly for assuring the reliable supply of electric energy to the customers and the ability of the systems to respond to any disturbances that may occur.

The purpose of this presentation is to describe computational probabilistic techniques that have been developed for assessing the reliability and operational performance of power systems that incorporate increased penetration levels of RES generation. These techniques are based on the Monte – Carlo sequential simulation approach and simulate realistically the stochastic nature of the RES facilities. An appropriate set of indices is calculated for quantifying the system performance. A number of alternative case studies are described representing various operational schemes of a typical power system based on the Greek interconnected power system. These schemes include different planning features and operating conditions, such as different criteria for spinning reserve requirements and various wind penetration levels. The obtained results of the indices are presented and compared in order to examine their impact on the system operation.

Biography:
Evangelos N. Dialynas received the Diploma in electrical engineering from the National Technical University of Athens (NTUA), Athens, Greece, in 1975 and the M.Sc. and Ph.D. degrees from the University of Manchester Institute of Science and Technology, Manchester, U.K., in 1977 and 1979 respectively. He is presently a Professor in electric power systems at the School of Electrical and Computer Engineering at NTUA and the Director of Electric Energy Systems Laboratory. His research interests are reliability modelling and evaluation, power system probabilistic assessment, power system operation under the competitive electric energy market, impact of high penetration on the reliability and operational performance of interconnected and isolated power systems, power quality indices and computer applications of power systems. As a result of his research activities, he has written more than 70 papers published in international technical journals after review and more than 100 papers presented in various international conferences and published in their proceedings. He is a member of the Technical Chamber of Greece, a senior member of IEEE and a member of IET. He is also a distinguished member of CIGRE and a member of the Administrative Council of CIGRE.

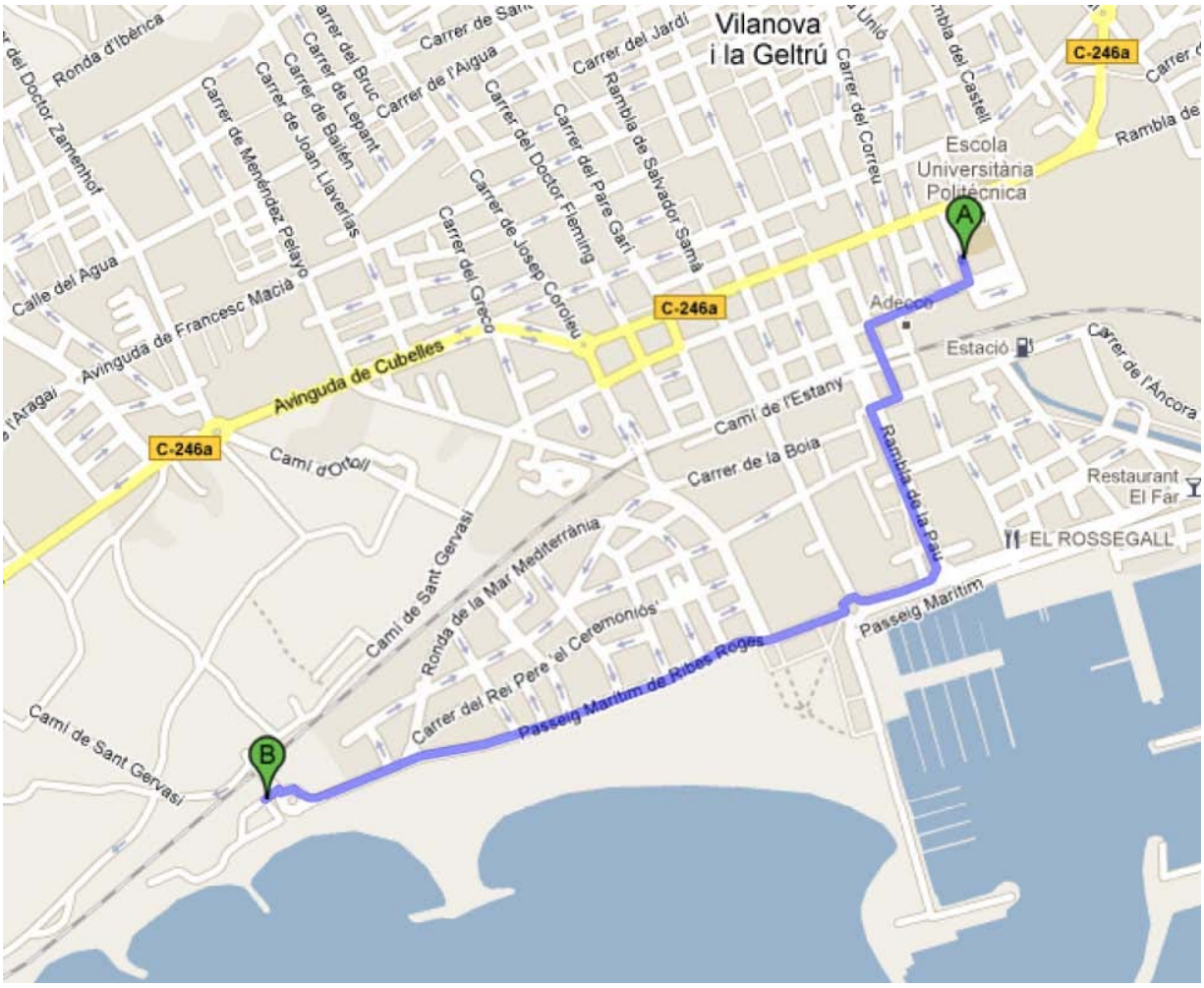
COST is supported by the EU RTD Framework Programme

CAMPUS DE VILANOVA I LA GELTRÚ

Technical University of Catalonia and Hotels Location, Vilanova i la Geltrú

Directions on how to reach “Xiringuito Miramar Restaurant” from the Technical University of Catalonia

Dinner: 13 June 2011, 9:00 pm



A. UPC

B. Xiringuito Miramar Restaurant

Address: *Platja de Sant Gervasi, Vilanova i la Geltrú*