

CENTER'S INFRASTRUCTURE GRANT CONTRACT SIGNED WITH THE RESEARCH PROMOTION FOUNDATION

Moving Ahead! KIOS Into New Premises

The KIOS Research Center for Intelligent Systems and Networks now boasts new research premises. The tailor-made premises, successfully bring together, under one building, a significant part of the KIOS research activities. They are specifically designed to create an inspiring environment for conducting high-quality research and to provide the conditions from which to stimulate interdisciplinary interaction between researchers.

The new premises signify an important step towards the further development and growth of the KIOS Research Center and represent the strong level of commitment from all concerned (The University of Cyprus, faculty staff, and researchers) to develop a research center which can stimulate, dynamically, the implementation of high-quality research projects in modern cutting edge scientific and technological fields.

Strongly in line with the national and EU policy approaches, the new premises provide the physical infrastructure required for KIOS, and its partners, in their quest to contribute to the advancement of knowledge in the areas of computational intelligence and intelligent networked embedded system design, and applying these methodologies in monitoring, controlling, and optimizing the operation of large-scale complex systems.

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The KIOS Research Center for Intelligent Systems and Networks has received an Infrastructure Grant (through a competitive open call for proposals – DESMI 2008) from the Research Promotion Foundation of Cyprus, which supports the development of the Center's Infrastructure. The Grant is co-sponsored by the European Regional Development Fund and the Republic of Cyprus. This project is led by KIOS researchers and includes partners from leading international research organizations such as the Politecnico di Milano, ETH Zurich, SenSIP Research Center at Arizona State University, and the CISE Center at Boston University.

One of the key challenges in Information and Communication Technologies (ICT) is the integration of networked computing with physical systems and processes. In this framework, embedded computers add to physical systems significant new capabilities which are further extended when computers are networked and communicate with each other. Such integration will lead to a new generation of devices and intelligent systems that can adapt to malfunctions, cooperate and evolve during operation to become more efficient, fault tolerant, and trustworthy.

This exciting and challenging new research area will be the main focus of the KIOS infrastructure grant, both in terms of fundamental (basic) research as well as in the application of such systems in various contexts. On one hand, there is a wide spectrum of relevant applications, ranging from small devices for healthcare delivery, to large-scale critical infrastructure systems such as the electric power grid. On the other hand, the new system capabilities enable emerging new behaviors that necessitate rigorous investigation in order to be better understood and applied in practical settings. Successful solutions in the area of intelligent networked embedded systems require the harmonious integration of hardware and embedded software and/or algorithmic components. Therefore, the key objective of the KIOS infrastructure grant is to blend theory with applications and integrate algorithms, embedded software and hardware devices.

In addition to the management and infrastructure building activities, this project involves specific research objectives organized in nine general activities (4 more fundamental/theoretical and 5 more applied).

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DIRECTOR'S MESSAGE



Marios Polycarpou

Director of the KIOS Research Center
Professor of
Electrical and Computer Engineering
IEEE Fellow

KIOS Research Center – making Cyprus proud at a European research level

During the last year, the KIOS Research Center for Intelligent Systems and Networks has grown significantly. Currently, the KIOS Research Center employs more than 50 researchers, who are conducting high-quality research on various topics of interest to the Center. Their research is supported by more than 20 external research programs, funded by the European Union, the Research Promotion Foundation of Cyprus and by industry. The funded research programs are totaling more than 7 million euro, with the share for the KIOS Research Center being approximately 5 million euro.

The vision behind the KIOS Research Center is that of creating an inspiring environment for conducting high-quality interdisciplinary research for the promotion of a knowledge-based economy in Cyprus, which will ultimately benefit the Cyprus educational system, the high-tech industry and the society at large. Recently, the Center has moved to new premises on Kyrenias Avenue in Nicosia, approximately 2km from the new campus of the University of Cyprus. The new premises (450 m²) have helped tremendously in promoting interaction between researchers and further collaboration with industry.

The KIOS Research Center had many successes in the last year. One of the key successes has been the KIOS Infrastructure Grant, awarded through a

competitive open call by the Research Promotion Foundation of Cyprus. This infrastructure grant of 1.1 million euro over 4 years, was initiated on 1st September 2010, and it is co-sponsored by the European Regional Development Fund and the Republic of Cyprus. The KIOS Infrastructure Grant is coordinated by the University of Cyprus, in partnership with ETH Zurich, Politecnico di Milano, Arizona State University, and Boston University.

Another key success of the KIOS Research Center is the initiation of a new FP7 project, entitled iSense – Making Sense of Nonsense, which is funded by the European Commission under the Information and Communication Technologies (ICT), Cognitive Systems, Interactions and Robotics. The iSense project, which started on 1st January 2011, has an overall budget of approximately 4 million euro and it is coordinated by the KIOS Research Center. It is the first FP7 collaborative project of this size to be coordinated by the University of Cyprus. This indicates the impact that the KIOS Research Center has already had in promoting research at a European level and providing the opportunity for Cyprus to take a leading role in large-scale European program.

The KIOS Research Center has also initiated and is leading the IntelliCIS ESF-COST Action, which recently finished its second year of activities. The

IntelliCIS COST Action has participation of 32 countries, making it one of the largest COST Actions funded by the European Science Foundation (ESF). The ambitious aim of the IntelliCIS program is to form a European-wide scientific and technology knowledge platform and instigate interdisciplinary interaction in the development of innovative intelligent monitoring, control and safety methodologies for critical infrastructure systems, such as electric power systems, telecommunication networks, and water systems. Again, this is the first ESF COST program to be initiated and coordinated by the University of Cyprus.

A key priority of the KIOS Research Center is to promote technology transfer from academia to industry and other governmental organizations. The KIOS Research Center has fruitful collaborations with a large number of organizations (private, public, national, and international). It is important to strongly emphasize the support to the activities of the Research Center provided by the KIOS Industrial Members: the Electricity Authority of Cyprus (EAC) and PrimeTel PLC. These collaborations are crucial for the future success of the research center.

For more information regarding the activities of the KIOS Research Center, please visit the KIOS webpage: www.kios.ucy.ac.cy

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KIOS Research Center
University of Cyprus
75 Kallipoleos St,
1678 Nicosia Cyprus
Email: kios@ucy.ac.cy

Tel: +357 22-893450/51
Fax: +357 22-893455
Web: <http://www.kios.ucy.ac.cy>

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CENTER NEWS

Center's Infrastructure Grant - Contract Signed with the Research Promotion Foundation

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The fundamental activities include (a) Optimal Sensor and Actuator Placement for Intelligent Monitoring, Control and Security, (b) Real-Time Data Processing and Cooperative Control in Distributed Systems, (c) Fault Diagnosis and Security of Distributed Safety-Critical Systems and (d) System Design and Implementation using Hardware/Software Co-Design. The applications include intelligent monitoring and control of large infrastructure systems such as power systems, telecommunication networks, water distribution networks, transportation systems, and accident and emergency systems.

Moving Ahead! KIOS In- to New Premises

(From p.1)



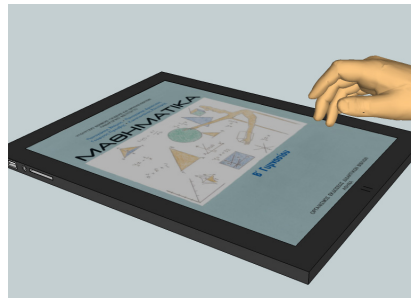
State of the Art – Functionality for Research

The premises, which are close to the main University of Cyprus campus, house dedicated laboratories for research, offer facilities for seminars and training and provide functional and dedicated office space for over 40 researchers and administrative staff. The facilities were specifically designed by expert members of the KIOS Core Group who are also faculty of the De-

partment of Electrical and Computer Engineering at the University of Cyprus and have extensive experience in designing and setting up laboratories and research facilities.

Kalina Georgiades is Project Manager at KIOS (georgiades.kalina@ucy.ac.cy)

Award to KIOS Researchers



The proposal submitted by KIOS researchers Christos Laoudias, Demetris Eliades, and Demetris Stavrou was ranked first in the competition "Design of a digital eBook reader and content management platform". The competition was launched by the University of Patras and the Greek Free/Open-Source Software Society (GFOSS), under the auspices of the Special Secretariat for Digital Planning in Greece.

The objective of the competition was to describe new ideas for the introduction of eBook readers in education. The proposal is based on a lightweight portable device, such as the increasingly popular Tablets (e.g., iPad), which could eventually replace the printed school books and notepads in the near future, thus enhancing the learning process for pupils and students. In addition, such digital eBook readers can be more interactive than regular books and teachers will be able to organize their courses and classrooms, and provide material to the students via the Internet.

The next milestone is the implementation of a functional prototype system to demonstrate the new opportunities offered in education. The ultimate goal is to develop an end-to-end solution that integrates the eBook readers with the content management platform in order to serve the upcoming needs and the new trends in education.

The researchers will receive a €4.000 award during a ceremony that will be organized by the University of Patras. More information on the competition and the proposal are available at <http://b.ook.gr/>.

Networking Session at ICT 2010

The KIOS Research Center of the University of Cyprus was selected to lead a networking session at the EU ICT 2010 Conference, following a highly competitive application process. This session, coordinated by KIOS faculty and researchers, was entitled "Trustworthy Critical Infrastructure Systems" and was designed to facilitate an open discussion on intelligent control and security of Critical Infrastructure Systems with key players from academia and industry. This emphasizes a positive recognition at European level of research undertakings in Cyprus and reflects the significant contribution Cyprus can make towards research in the field of Trustworthy Critical Infrastructure Systems. The networking session entitled Trustworthy Critical Infrastructure Systems took place on the third day of the ICT 2010 Conference (29th September 2010). The session was organized by the KIOS Research Center (Univ. of Cyprus), with the support of the European Organization for Security (EOS).



The EU ICT Conference, which is organized biennially by the European Commission and in 2010 was hosted by the Belgian Presidency of the European Union, attracted over 6,000 participants worldwide. This biennial event was a unique gathering point for researchers, business people, investors, and high level policy makers in the field of digital innovation. Through a program of speeches, workshops, and networking sessions the Conference provided a valuable forum from which the latest research trends in information and communication technologies could be explored including policy priorities such as Europe's Digital Agenda and the 2011-2012 financial program (€2.8 billion) of the European Union for funding research and innovation in ICT. There was a 10.000 m² exhibition of Europe's latest cutting edge ICT research and a carefully selected program of networking sessions on topics of key relevance for ICT.

RESEARCH RESULTS

Smart Irrigation

KIOS Researchers conducted research for WATER-BEE (<http://www.water-bee.eu/>), a 2-year R&D project, funded by the EC's FP7 under "Research for SMEs". The KIOS team led the design and implementation of the intelligent agents that enable smart irrigation which provide effective irrigation treatment to the crops. Effective irrigation means that crop yield is maximized while water consumption is minimized. More specifically, the following intelligent agents have been developed: 1. Crop agents that include the unique characteristics and needs for each specific crop and can be customized based on the user's previous experience with the crop. 2. Irrigation agents that are responsible for deciding when to irrigate and how much water to apply based on the model recommendations, the soil moisture sensor readings, the current weather conditions, and crop specific parameters. 3. Fault detection agents that can identify faulty sensors and possible problems with the water distribution system. For fusing all the information together, the KIOS team has developed a Fuzzy Inference System. Furthermore, the team explored Machine Learning methods that enable WATER-BEE to adapt to its environment over time by utilizing the data received from the sensors. The WATER-BEE irrigation system has been successfully implemented at a number of field trials across Europe and demonstrated considerable savings in water (up to 50%) and in some cases a trend for increased yield.



Optical Networks

Tania Panayiotou, a Ph.D. student at the KIOS Research Center, published a paper and presented her work at the IEEE/OSA Optical Fiber Communications (OFC) conference that took place in San Diego, CA, on March 21-25 2010. Tania's research paper entitled "Designing and Engineering Metropolitan Area Transparent Optical Networks for the Provisioning of Multicast

Sessions" and the work dealt with the problem of provisioning multicast connections in metropolitan area networks while taking into account physical layer impairments. Research results show that different node designs and engineering approaches as well as different system physical parameters produce different multicast group blocking results, a strong indicator that a better interaction between the physical and logical layers is needed for multicast connection provisioning in optical networks to be more effective.

Power Systems with High Wind Power Share

Wind energy has drawn much attention recently due to its competitiveness compared to other renewable sources of energy, as well as its high benefits to the reduction of emissions and to the reduction of the dependency on fossil fuels. Ph.D. student Irina Ciornei is working on the optimal integration of wind energy in power systems, with an emphasis to the Cyprus power system. In one part of this work, a stochastic economic dispatch formulation is proposed to incorporate the impact of the variability of wind generation. The purpose of this formulation is to limit the probability of available capacity not meeting the load due to the aggregated variability of the wind generation and the load demand. The problem is non-convex and complex; therefore, a hybrid heuristic solution method is used. Some results and an analysis of the proposed methodology have been reported in international conferences (for example, I. Ciornei and E. Kyriakides, "Heuristic solution for the nonconvex dispatch of generation in power systems with high wind power share," IEEE Power Engineering Society General Meeting, Calgary, Canada, July 2009).

Best Paper Award for KIOS Researchers

KIOS researchers Christos Ttofis and Christos Kyrkou, as well as Dr. Theodoros Theodoridis and Dr. Maria Michael received the "Best Paper Award" at the IEEE International Conference on Microelectronic Systems Education (MSE2009), for their work "FPGA-Based NoC-Driven Sequence of Lab Assignments for Manycore Systems". The conference took place on 26th of July 2010, in San Francisco, California. Christos Ttofis gave a presentation about the work that involved the development of a sequence of laboratory assignments for manycore systems that interconnected via Net-

works-on-Chip (NoC). This sequence of lab assignments introduced a practical FPGA-based teaching framework to emulate manycore systems, and can be utilized by instructors to teach students the fundamental design concepts of NoC-based manycore systems and their integration. Furthermore, it allows students to be exposed to the programming and scalability challenges involved in the development of future manycore designs. The framework utilizes FPGA-based emulation as part of the lab assignments, particularly targeting design parameter exploration associated with the interconnection network supporting the manycore system. The sequence of lab assignments consists of a NoC IP development flow, a processor core integration stage and the system integration via the I/O ports and the targeted applications. The hardware modules derived from the lab assignments can be easily and quickly reconfigured and modified for use in other educational labs. Students have the opportunity to both explore and evaluate many aspects of manycore architectures via the evaluation and benchmarking platform, which consists of C++ code for generating the data packets and a VGA controller used for visualizing the system status during execution.

SVM's in Raman Spectroscopy

The presentation "Classification of Raman Spectra using Support Vector Machines," by Alexandros Kyriakides at the IEEE 9th International Conference on Information Technology and Applications in Biomedicine, November 5-7, 2009, Larnaca, Cyprus, won second prize for student presentation. The classification of Raman spectra can be very useful in a wide range of diagnostic applications including bacterial identification. Before the classification, some form of pre-processing is commonly applied to the spectra. This pre-processing greatly affects the accuracy of the results and introduces user bias and over-fitting effects. In this work, we propose a novel approach of using Support Vector Machines with the correlation kernel. The correlation kernel is "self-normalizing" and produces superior classification performance with minimal pre-processing, even on highly-noisy data obtained using inexpensive equipment. Such effective classification approaches can lead to clinically valuable diagnostic applications of Raman Spectroscopy. This work has also been accepted for publication in the Journal of Raman Spectroscopy.

RESEARCH RESULTS

Energy-Efficient Embedded and Mobile Multiprocessor System-on-Chip Architectures

The Energy-Efficient Embedded and Mobile Multiprocessor System-on-Chip Architectures (EMPSoC) project was funded by the Research Promotion Foundation of Cyprus during the period December 2008 – November 2010. The project aimed to apply system-level optimization algorithms in the design of energy-efficient mobile and embedded Multi-Processor System-on-Chip (MPSoC) architectures. These architectures encapsulate several processing elements and cores interconnected via a packet-based on-chip network, and have been adopted as the dominant architectural trend in embedded and mobile processors utilized by a wide range of devices and applications. Embedded and mobile devices, however, depend on battery for operation, and are thus constrained by several issues and present complicated design and integration. The ultimate goal of the EMPSoC project was to address one of the most important issues faced during the design of such devices, being the reduction of energy consumption. Specifically, the main objective of the project was to reduce the overall energy of MPSoCs by applying intelligent system-level optimization algorithms and exporting them in hardware, and also by designing a re-configurable on-chip network, which exploit heterogeneity in MPSoCs by dynamically altering the routing algorithm and adjusting the task assignment on the processing elements, for energy savings of at least 10%, while maintaining present reliability and performance levels of MPSoCs.

The project involved several steps in achieving the aforementioned goals. The first step involved deriving communication and computation application models suitable for embedded and mobile environments, based on feedback from industry. The derived application models include Quadrature Amplitude Modulation (QAM), 3D reconstruction in stereo images and well-known object detection algorithms such as Neural Networks, Haar-Features with AdaBoost and Support Vector Machines (SVM). After deriving the application models, the next step was to identify intelligent algorithms suitable for exploring energy reduction, and to verify and evaluate the functionality of each algorithm by integrating it in the application models under investigation. On-chip network

and MPSoC components were also implemented in Hardware Description Language (HDL) and used to integrate the application models with the algorithms into MPSoC architectures. In addition, a state-of-the-art testbed environment for evaluation of the performance and energy consumption of embedded and mobile devices has been established, and hardware prototype implementations for each of the application models have been created on cutting-edge FPGA technology. The results obtained in the different classes of application models mentioned previously indicated that the project goals were successfully met, as the reduction in energy consumption for the applications investigated was more than the reduction initially targeted.

Localization for Next Generation Wireless Communication Networks

Over the last decade there has been an increasing interest of the research community in alternative Position Estimation Methods (PEM) that do not rely on satellite-based systems, such as the GPS. The main reasons driving this research are the high power consumption of GPS receivers, as well as the severe attenuation or blockage of satellite signals in dense urban areas and especially in indoor environments. According to recent statistics, people tend to spend 80-90% of their time inside buildings, such as shopping malls, museums etc, where GPS geolocation is infeasible. This fact combined with the massive availability of mobile devices has motivated the development of PEMs that rely on the existing Wireless Communication Systems (WCS) infrastructure, such as cellular networks (GSM/3G) or WLAN. Following the availability of location information, new location aware services have emerged, including in-building guidance, asset tracking in warehouses or hospitals and indoor navigation.

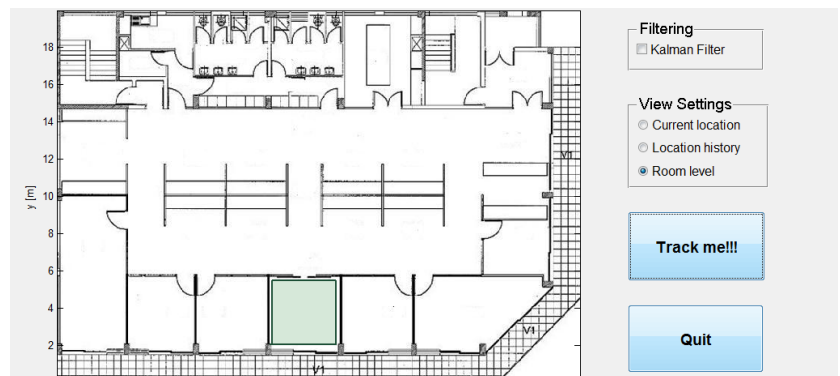
During this project we analyzed the

PEMs presented in the literature, addressed some general problems that lead to significant accuracy degradation and proposed several techniques to improve the performance of some PEMs. Finally, we developed novel methods that are applicable in both indoor and outdoor places and exploit the Beyond 3rd Generation (B3G) communication systems, where multiple WCS coexist and overlap, providing numerous measurements that may be used to improve the accuracy. Our focus was on the development of indoor PEMs that rely on the existing WLAN infrastructure, i.e., Access Points (APs), already deployed in many buildings. These PEMs utilize Received Signal Strength (RSS) measurements from neighboring WLAN APs collected by a mobile device.

Finally, we designed and implemented an indoor positioning application that was successfully tested and demonstrated in the premises of the KIOS Research Center. The unknown user location is determined by fingerprint-based PEMs using a Tablet PC equipped with a WLAN card. We developed the software required to collect the RSS fingerprints and analyze the training data. We also developed the software and GUI to perform positioning and visualize the estimated user location on the floor-plan map. The visualization options include indicating the current estimated location, plotting the successive estimates to reflect the traveled path or highlighting the room where the user resides.

The project was funded by the Research Promotion Foundation of Cyprus in the framework of the "Young Researchers" program (ΠΙENEK/ENIEX/0506/59). The Young Researcher, Christos Laoudias is a Ph.D. candidate at the ECE Dept. and a researcher at KIOS. The related publications, research conclusions and technical reports are available on the project's website:

<http://www2.ucy.ac.cy/~laoudias/pa ges/ira.html>.



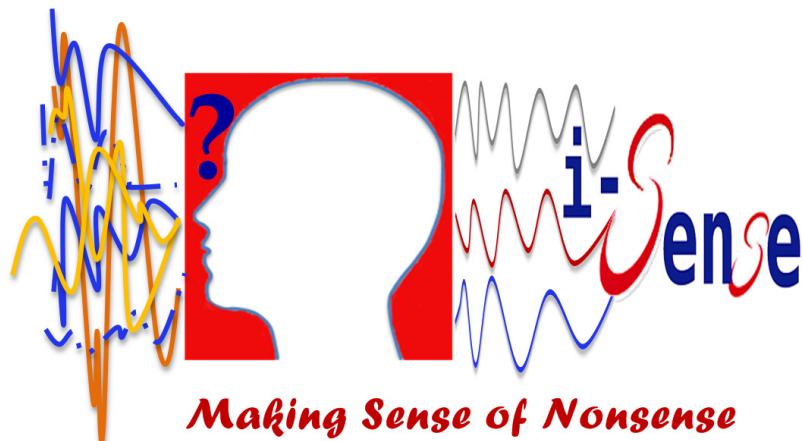
RESEARCH NEWS

iSense: Making Sense of Nonsense

The KIOS Research Center for Intelligent Systems and Networks has led an effort to prepare an innovative research proposal that has been submitted for funding to the Framework Program Seven (FP7) of the European Commission under Information and Communication Technologies (ICT), Cognitive Systems, Interactions and Robotics. The proposal (iSense: Making Sense of Nonsenses) has received excellent reviews and was selected for funding. iSense's overall budget is approximately 4 million Euros for three years. iSense involves a multidisciplinary team of researchers from the Politecnico di Milano, Italy, University of Birmingham, UK, ST Microelectronics, Italy and Universidad Politécnica de Catalunya, Spain. The project coordinator is the KIOS Director Prof. Marios Polycarpou while the KIOS team also includes Associate Professors Christos Panayiotou and George Ellinas and Assistant Professor Elias Kyriakides.

The main motivation behind this project is to develop the tools and design methodology that will prevent situations where a fault event of one or more components (sensor, actuator, communication link) may cause an overall critical system failure. Imagine a building which can autonomously lead its occupants to safety in case of an emergency (e.g., in case of a fire). This building will be able to detect and locate the presence of the danger, automatically compute the optimal evacuation routes, avoiding dangerous areas and limiting people congestion at the emergency exits, and provide the necessary visual and auditory signals for the people to follow. In addition, this building can also take remedial actions such as close the appropriate ventilation ducts or cut electricity in dangerous areas. Such buildings are currently being designed and are expected to become reality in the near future. Now imagine the same building but at the time of the emergency, one of its sensors, e.g., the sensor that detects the presence of people at a major emergency exit, failed and remained "stuck" at the "overcrowded" state. In this case, the building would not be able to compute the optimal evacuation paths, directing the occupants to more dangerous routes, thus endangering people's lives. Thus, the project's objective is to prevent such catastrophic failures.

The emergence of networked embedded systems and sensor/actuator net-



works has made possible the development of several sophisticated monitoring and control applications where a large amount of real-time data about the monitored environment is collected and processed to activate the appropriate actuators and achieve the desired control objectives. Depending on the application, such data may have different characteristics: multidimensional, multi-scale, and spatially distributed. Moreover, the data values may be influenced by controlled variables, as well as by external environmental factors. However, in many cases the collected data may not make much sense! For example, the temperature sensor may be recording rapidly increasing temperatures, possibly indicating a fire, while the smoke detector sees nothing. What does the system do? For humans, the decision is easy because they have redundant sensory information which they are able to process in real-time and correctly assess the situation. Furthermore, they have very good confidence in the state of their sensory organs. For machines, however, the decision is not as easy. Information redundancy is limited due to cost and in addition the state of the sensors and actuators is not always known and several things can go wrong. For example, some measurements may be missing, sensor performance may be deteriorating due to aging or environmental conditions, sensors may be drifting, etc. In some cases, data received from different sensors (or actuators), on the same unit (e.g., with different resolution) or residing in a cluster, may become inconsistent. At the same time, the environment can be subject to nonstationarity phenomena and the electronics, e.g., the signal conditioning stage, is prone to drifts and soft/hard faults. Such problems, which will generate "nonsense data," are generally the result of some faults in the sensor/actuator system itself or an ab-

normality in the monitored environment, which may be either permanent or temporary, developing abruptly or incipiently. These problems become more pronounced as sensing/actuation systems get older.

The main objective of this project is to "make sense of nonsense" by developing intelligent data processing methods for analyzing and interpreting the data such that faults are detected (and where possible anticipated), isolated, and identified as soon as possible, and accommodated for in future decisions or actuator actions. The problem becomes more challenging when these sensing/actuation systems are used in a wide range of environments which are not known a priori and, as a result, it is unrealistic to assume the existence of an accurate model for the behavior of various components in the monitored environment. Therefore, this project will focus on innovative cognitive fault diagnosis approaches that can learn characteristics or system dynamics of the monitored environment and adapt their behavior and predict missing or inconsistent data to achieve fault tolerant monitoring and control.

More info about the project can be found at: <http://www.i-sense.org>



RESEARCH NEWS

Development of an Advanced Electric Generator Design Tool for the Power Engineering Industry



The aim of the project is to develop an “Electric Generator Toolbox” which will complement and enhance an established, industry-leading Finite Element Analysis (FEA) program for Electromagnetic Analysis. Electromagnetic Finite Element Analysis programs are used for the design of electromagnetic devices, including electrical machines and actuators. The program often relies on the user to command electro-

magnetics at such a level so as to correctly define the machine as a ‘mathematical / physical model’ and ‘translate’ FEA results into machine-specific quantities. In recent years, with growing concerns over the lack of ‘specialists’, the need for “Applications Oriented Software” (AOS) is becoming more and more significant. It is envisioned that the advantages of the final software tool to be developed in this project will be the enhancement of the analytical competencies of the FEA program, as well as the capability of providing users with results that directly feed into the machine design sheet. In addition, it is imperative for the designer to model the machine alongside its associated drive, and as part of a wider electromechanical system. Through an efficient parameter identification process, the proposed “Electric Generator Toolbox” must therefore provide equivalent circuit

parameters fully characterizing the machine through a collection of equations that are appropriate for feeding a system design simulator. The results of this research project will mainly be applied to synchronous generators used in conventional generating stations and synchronous and asynchronous generators used in wind farms.

This project is funded by the Research Promotion Foundation of Cyprus with a grant of 156,000 euro. KIOS is working closely with Electromagnetic Valley Ltd, a Cyprus SME specializing in software development for electric machines. The KIOS research team in this project is led by Dr. Elias Kyriakides.

Elias Kyriakides is an Assistant Professor of Electrical and Computer Engineering at the University of Cyprus (elias@ucy.ac.cy)

From Virtual Worlds to Virtual Engineering Classrooms: Emerging Virtual Learning Experiences in Engineering and English as a Second Language

Research in Computer-Mediated Communications (CMC) and Multi-user Virtual Environments (MUVES) is becoming one of the most prominent and fertile areas of research in Applied Linguistics, English as a Second Language, and Education. Multi-user Virtual Environments, such as Second Life (SL), offer interactive forums embedded in three-dimensional realities where students and educators can explore, experience, and construct simulated, interactive virtual environments through their avatars or online personas. Constructive, task-oriented activities can be carefully designed to engage students in “knowledge-building” ex-

changes, allowing them to experience firsthand what they read in textbooks or in other assigned material. The aim of this project is to develop and implement task-oriented activities which will offer ample opportunities to undergraduate Electrical Engineering students to expand their knowledge in the subject-matter and at the same time to interact in the target language, English. Unlike conventional classroom settings where students are usually exposed to the instructional material through Power-Point presentations, textbooks, and other activities, the affordances of this virtually-constructed environment, specifically

designed for the needs of Electrical Engineering students, will allow students to experience and interact with these three-dimensional objects and view how they can be implemented in real contexts. For instance, students will have the opportunity to view wind turbines and engage in constructive discussions about their critical role in energy conservation. Such discussions can guide students in developing a conceptual understanding of key concepts in Electrical Engineering, and at the same time to use the target language to explore such critical constructs in Engineering. The project has brought together a pool of researchers, with diverse research interests and educational backgrounds, who will tackle challenging theoretical and practical constructs in Applied Linguistics and identify effective pedagogical approaches for the implementation of such virtually-constructed forums in engineering courses.

This project is funded by the Research Promotion Foundation of Cyprus, with a grant of 100,000 euro. The KIOS research team in this project is led by Dr. Elias Kyriakides and Dr. Stella K. Hadjistassou.

Elias Kyriakides is an Assistant Professor of Electrical and Computer Engineering at the University of Cyprus (elias@ucy.ac.cy)



There is a growing perception that copper-based access networks will soon no longer be able to meet the ever-growing consumer demand for bandwidth. This, along with a combination of regulatory and competitive forces, as well as recent rapid advances and standardization of Passive Optical Network (PON) technology, have prompted carriers around the world to consider PON-based fiber-to-the-curb/home systems as a possible successor to current copper-based access solutions. Concurrent with the upsurge of PON-based wireline broadband access solutions, the growing demand for advanced data-centric mobile multimedia services including multimedia messaging, mobile video, mobile music, mobile TV, and IPTV, has accelerated the development and deployment of new wireless broadband access technologies. These emerging technologies, including High-Speed Packet Access, fourth-generation (4G) mobile WiMAX, and cellular Long-Term Evolution (LTE) are capable of delivering speeds comparable to or better than current fixed-line broadband access systems – up to 15-200 Mb/s peak air throughput per user.

[illegible]

A new research project that is funded by the Research Promotion Foundation of Cyprus was recently secured by Prof. G. Ellinas and his team, in collaboration with the University of Nico-

sia, the University of Patras, and PrimeTel Plc., that proposes the implementation of a high-capacity, high-performance, cost-effective, converged fixed-mobile access networking solution that holistically addresses many of the key outstanding issues with both of today's wired/wireless broadband access technologies. This novel architecture can then efficiently backhaul and support a mix of advanced wired and wireless multimedia traffic and services along with the diverse quality of service (QoS), capacity/rate, and reliability requirements set by these services.

George Ellinas is an Associate Professor of Electrical and Computer Engineering at the University of Cyprus (gellinas@ucy.ac.cy)

Over the last few decades, the Internet has grown exponentially, bringing about hard questions about its future sustainability. At the same time, the proliferation of wireless and mobile devices with Internet connectivity has created a new landscape for a wireless future Internet. It is evident that in the emerging “Future Internet”, wireless networking will remain significantly important, but at the same time increasingly complicated. Complexity already affects network operators and service providers, who face a growth versus cost dilemma. In this context, the KIOS Research Center has successfully attracted a grant of 124500 Euros from the Research Promotion Foundation of Cyprus with a proposal titled “Autonomic Wireless Networking for the Future Internet through Distributed Policy-Based Management” (AUTOWINFI). The proposal was ranked first among over 70 competing ones and will finance the

postdoctoral research of Dr. Hadjiantonis at KIOS Research Center in collaboration with Prof. George Ellinas. The grant is in the context of the DIDAKTOR programme of RPF, cofinanced by the Structural Funds of the EU and particularly the European Regional Development Fund (ERDF).

The main objective of AUTOWINFI is to influence the ongoing design of the Future Internet (FI) to fully integrate mobile and wireless networks in a simplified, automated, and scalable manner. Through this project, it is proposed that seamless wireless networking in the FI will be achieved by applying “autonomic concepts”. By using distributed policy-based management (DPBM) and introducing three architectural entities, the lack of critical functionality from today’s Internet will be addressed, i.e., management decentralization, seamless



mobility, and spontaneous communications. The implementation of the project will result in transparent management functionality on the end-devices of the FI, leading into more robust and scalable operation. To facilitate real life experimentation and prototype development, a mobile and wireless networking testbed has been created, based on open source software and supporting multiple wireless technologies.

Antonis M. Hadjiantonis is a Research Fellow at KIOS (hadjiantonis.antonis@ucy.ac.cy)

Activities of the IntelliCIS ESF-COST Action

The IntelliCIS ESF-COST Action ("Intelligent Monitoring, Control and Security of Critical Infrastructure Systems", <http://www.intellicis.eu>), led by the KIOS Research Center, continues to grow at a steady pace! More than 130 participants from 32 countries and 60 institutions have so far joined IntelliCIS and participate in its activities. Researchers from non-COST countries (such as the USA, South Africa, Lebanon, Moldova, and Australia) have also joined the network.

So far, four IntelliCIS Workshops have been held. The First IntelliCIS Workshop took place in Limassol, Cyprus, on September 16-17, 2009. The Second Workshop was held in Budapest, Hun-

gary, on May 17-18, 2010, and the Third in Novi Sad, Serbia, on September 23-24, 2010. The Fourth IntelliCIS Workshop took place in Villanova I la Geltru, Spain, on June 13-14, 2011. The IntelliCIS participants will meet again on September 26-27, 2011, in Milan, Italy.

More than ten short term scientific missions (STSMs), i.e., research exchanges between institutions, have already been performed, enabling IntelliCIS participants to visit their peers and enhance research collaborations or explore new research opportunities. A significant percentage of STSMs were devoted to Ph.D. students who benefited significantly by joining for a short



period another research institution.

IntelliCIS continues steadily in achieving its goal of being a catalyst for instigating interdisciplinary interaction and promoting collaboration between industry, academia, and research organizations on the subject of security, quality, reliability, and efficiency of critical infrastructure systems. At the epicenter of these critical infrastructure systems lie the electric power systems, telecommunication networks, and water distribution networks. These systems coincide with the research activities currently undertaken by the KIOS Research Center.

Elias Kyriakides is an Assistant Professor of Electrical and Computer Engineering at the University of Cyprus (elias@ucy.ac.cy)



3rd IntelliCIS Workshop and Management Committee Meeting, 2010

Members of the KIOS Research Center of the University of Cyprus organized and participated in the 3rd IntelliCIS Workshop and Management Committee Meeting that took place in the University of Novi Sad, Novi Sad, Serbia in September 2010. The networking session was coordinated by Prof. Elias Kyriakides, the IntelliCIS COST Action Chair and a KIOS founding member, in

conjunction with Prof. Veljko Malbasa from the University of Novi Sad, who was the local organizer. The IntelliCIS COST Action workshops aim at fostering dissemination and increasing the share of knowledge across the Action domains and within the European scientific community. IntelliCIS Workshops are organized either independently or in parallel to relevant conferences that are related to the Action topics.

Three tutorials were presented during the COST workshop on Telecommunication networks, Electric Power Systems, and Water Systems and two Breakout Sessions were organized that dealt with (i) Real-time Water Quality Management in Water Distribution Networks and (ii) Wide Area Measurement and Control in Power Systems. During the breakout sessions, fruitful discussion was initiated in identifying research topics and possible collaborations and synergies amongst the COST members. Furthermore, a number of invited talks were presented on issues related to critical infrastructures that brought the participants up-to-date on current research challenges and possible solutions.

George Ellinas is an Associate Professor of Electrical and Computer Engineering at the University of Cyprus (gellinas@ucy.ac.cy)



CONFERENCES AND MEETINGS

19th International Conference on Artificial Neural Networks (ICANN 2009)



The KIOS Research Center, together with the Department of Electrical and Computer Engineering of the University of Cyprus, have successfully organized the 19th International Conference on Artificial Neural Networks (ICANN 2009). This is an annual meeting sponsored by the European Neural Network Society (ENNS), in cooperation with the International Neural Network Society (INNS) and the Japanese Neural Network Society (JNNS). ICANN 2009 was also technically sponsored by the IEEE Computational Intelligence Society. This series

of conferences has been held annually since 1991 in various European countries and covers the field of neurocomputing, learning systems and related areas.

The conference was held on September 14-17, 2009, in Limassol and featured a four day technical program with six keynote plenary lectures from worldwide renowned scholars who are leaders in their fields. ICANN2009 exhibited a truly international character as reflected in the composition of both the technical program committee

members, coming from 25 different countries and representing all five continents, and of the approximately 300 conference participants representing 37 countries. Out of ~ 300 paper submissions, the Technical Program Committee selected ~ 200 papers, which were published in a two-volume proceedings in Springer's prestigious series of Lecture Notes in Computer Science. In addition to the regular papers and the keynote plenary lectures, the technical program also included two tutorials on exciting new topics, two competitions, and two workshops. The Conference held its banquet at the Center of the Lefkara Village following an excursion to Xirokiti.

The conference was cosponsored by the Department of Electrical and Computer Engineering of the University of Cyprus, the Cyprus Tourism Organization, and PrimeTel PLC. One of the workshops was supported by the EU-sponsored COST Action "Intelligent Monitoring, Control and Security of Critical Infrastructure Systems" (IntellicIS).

Christos Panayiotou is the Deputy Director of the KIOS Research Center and an Associate Professor of Electrical and Computer Engineering at the University of Cyprus (christosp@ucy.ac.cy)

IEEE Biomedical Circuits and Systems Conference (BIOCAS 2010)



The IEEE Biomedical Circuits and Systems Conference (BIOCAS 2010) was organized at Paphos, 3-5 of November 2010. The recent years have witnessed an explosion of research activities in the areas of life sciences, physical sciences, and engineering with application to medical problems. Such activities require inter-disciplinary collaborations among scientists, engineers, medical researchers, and practitioners to solve complex real world problems. The BIOCAS conferences are the pre-

mier forum where researchers can present results and innovative solutions for today's health problems at the frontiers of Biomedical Engineering. "Smart Hybrid Biosystems" was chosen as the theme for the 2010 conference. The conference was multidisciplinary in nature comprising an eclectic mix of insightful tutorials, and technical sessions. Keynote Talks included "Biomedical Hybrids – Some Experiments" by Kevin Warwick, University of Reading, UK, "Restoring the "Sixth

Sense" with a Multichannel Vestibular Prosthesis" by Charley Della Santina, Johns Hopkins, USA, and "Building Brains" by Steve Furber, University of Manchester, UK.

The organization of the conference enabled participants to broaden their knowledge in emerging areas of research at the interface of the life sciences and the circuits and systems engineering discipline. Topics covered in papers and tutorials included bioinformatics, bioinspired systems, biomedical imaging technologies and image processing, BioMEMS, biomedical instrumentation, biosensor devices and interface, biosignal processing, body area networks/body sensor network, electronics for brain science, implantable electronics, innovative circuits for medical applications, lab-on-chip, medical information systems, telecare systems, and wireless technology for medicine biology and the life sciences.

Julio Georgiou is an Assistant Professor of Electrical and Computer Engineering at the University of Cyprus (julio@ucy.ac.cy)

INDUSTRIAL PARTNERSHIPS

Getting Results with the EAC



The KIOS Research Center concentrates on topics that are of immediate interest to the Electricity Authority of Cyprus (EAC), such as the optimization of the transmission network, the optimization of electricity generation, the implementation of smart grids in electricity distribution networks, the forecasting of electric load demand, and the optimal integration of wind

energy into the electricity network. The EAC has contributed significantly to the establishment of the KIOS Research Center by becoming the first industrial partner of the Center. The collaboration between the KIOS Center and EAC has been enhanced and solidified through the collaboration in research projects.

One of the critically important functions in a power system is its monitoring through measurements obtained from various locations of the system. Effective monitoring allows the operator to have a clear view of the system and prepare for possible contingencies or operations that will improve the reliability, security, or performance of the system. The supervisory control and data acquisition (SCADA) system based on conventional measurements such as the power flow, power injection, voltage, and current measurements is inherently slow in nature, and fails to provide a real-time picture of the state of the power system. The synchronized measurement technology (SMT), which is increasingly being used in state-of-the-art power systems, helps in getting real-time information regarding the states of a power system.



The SMT is facilitated through the installation of devices called phasor measurement units (PMUs). The KIOS research team has obtained two such PMU devices from a leading manufacturer of protection equipment and has installed them in the Cyprus power system both for demonstration purposes and for verifying the algorithms and methodologies developed by KIOS researchers. These algorithms and methodologies have been successfully tested on standard test systems, and the research findings are published in international journals and conferences. Applications in the Cyprus power system are the next step of this research work.

Elias Kyriakides is an Assistant Professor of Electrical and Computer Engineering at the University of Cyprus (elias@ucy.ac.cy)

Prime Research with Primetel



The collaboration between PrimeTel PLC and the KIOS Research Center has resulted in winning the research project entitled "Converged Fixed-Mobile Networking Transport Infrastructure for Next-Generation Broadband Access" and is funded by the Research Promotion Foundation of Cyprus under the ICT Thematic Area.

The proposed architecture enables, for the first time, efficient strategies for developing collaborative, distributed

Quality-of-Service (QoS)-aware dynamic network resource allocation and packet scheduling schemes that are specifically tailored to the converged optical-wireless architecture, while at the same time conforming to the signaling and control standards of each access technology separately. These integrated algorithms will improve the network's resource management, thus improving the overall system performance including throughput, delay, and better support of both fixed and mobile QoS guarantees.

Next-generation access networks will require telecom, broadcasting, and Internet access infrastructure and service providers to offer a wide variety of services, including high-speed Internet access, high-definition television (HDTV) distribution, and interactive multimedia gaming and conferencing, in addition to symmetric bandwidth-on-demand services. To meet the demand of next-generation access networks, many broad areas of convergence in communications are currently taking place, and at the core of the

convergence is the trend toward seamless integration of broadband wired and wireless access networks. QoS is especially important for the new generation of Internet applications such as VoIP, video-on-demand and other consumer services. Some core networking technologies like Ethernet were not designed to support prioritized traffic or guaranteed performance levels, making it much more difficult to implement QoS solutions across the Internet.

With the inclusion of PrimeTel PLC in the consortium, a large telecom service provider that owns and operates its own nationwide fiber-optic network, the research partners will have access to extensive fiber-optic facilities and equipment that will be leveraged for the successful testing of a proof-of-concept architecture and algorithms.

George Ellinas is an Associate Professor of Electrical and Computer Engineering at the University of Cyprus (gellinas@ucy.ac.cy)

M. Polycarpou Elected President of the IEEE Computational Intelligence Society



The KIOS Research Center Director, Professor Marios Polycarpou, has been elected the new President of the IEEE Computational Intelligence Society.

The IEEE Computational Intelligence Society (CIS), with more than 7000 members worldwide, focuses on computational and theoretical aspects of mimicking nature for problem solving. CIS core technologies include neural, fuzzy, and evolutionary computation, as well as hybrid intelligent systems that contain these and other related paradigms. The Society has its own history of transformation from the Neural Network Council to the Neural Network Society to the current CIS. While many of the core technologies that define the CIS were developed early in the history of computing, their application has expanded tremendously over the last two decades to include intelligent computer games, biomedical applications, data-mining, etc, and represents its own exciting and growing field of engineering.

Professor Marios Polycarpou, will serve as the President-Elect in 2011, the President of the Society in 2012-2013 and the Past-President in 2014. This is a great honor and recognition both for him and our Center.

1st KIOS Workshop

On Monday 18 April 2011, the KIOS Research Center organized the First KIOS Workshop aiming to facilitate better collaboration between the researchers within the Center as well as its collaborators. The Workshop was co-organized with SignalGeneriX, Ltd, and was funded through the research programs from the Research Promotion Foundation of Cyprus and EUREKA.

Talks included an overview of the KIOS Research Center by Marios Polycarpou, as well as presentations from Center collaborators Andreas Spanias, Arizona State University, (SenSIP Cen-

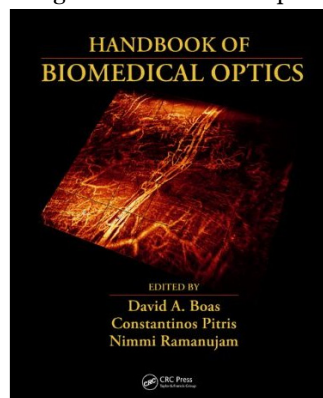
ter and NSF Consortium Research) Cesare Alippi, Politecnico di Milano, (Distributed Embedded Systems) and Kostas Margellos, ETH Zurich (Security in Power Systems: Impact Identification of a Cyber Attack in the Automatic Generation Control). Various talks from KIOS researchers spanned the entire range of research fields covered by the Center. They included subjects in the broad areas of "Infrastructure Monitoring and Applications," "Embedded Systems," and "Communication Systems and Classification."



This workshop was an excellent opportunity to exchange ideas and foster further collaborations both between KIOS researchers as well as the external collaborators.

Book Publication

The CRC Press, Taylor and Francis Group, has officially announced the publication of the Handbook of Biomedical Optics (ISBN 978-1-4200-9036-9) a project originated by one of the KIOS faculty members, Dr. Constantinos Pitris with colleagues in the USA. Biomedical optics holds tremendous promise to deliver effective, safe, non- or minimally invasive diagnostics and targeted, customizable therapeutics. The Handbook of Biomedical Optics provides an in-depth treatment of the field, including coverage of applications for biomedical research, diagnosis, and therapy. It introduces the theory and fundamentals of each subject, ensuring accessibility to a wide multidisciplinary readership. It also offers a view of the state of the art and discusses advantages and disadvantages of various techniques.



C.L. Max Nikias, Elected 11th President of the University of Southern California.



KIOS Advisory Board Member, C. L. Max Nikias, University of Southern California (USC) executive vice president and provost, was elected the 11th president of USC. Nikias was selected by a special search committee after extensive search from a list of very distinguished and accomplished candidates. Over the course of his career as a researcher, educator, and university administrator, Nikias has earned accolades for his leadership, innovation and fundraising, as well as his ability to build partnerships among varied constituencies.

As a vice president, Nikias was credited with accelerating the university's academic momentum, recruiting new leadership, strengthening the academic medical enterprise, helping attract a series of major donations to the institution, creating innovative cross-disciplinary programs, enhancing the university's globalization efforts and increasing support for students at the undergraduate, graduate, and doctoral levels. After being named provost in 2005, Nikias worked with faculty and deans to develop a number of new programs to create a distinct academic environment at USC.

Nikias is a member of the National Academy of Engineering and a Fellow of the Institute of Electrical and Electronics Engineers, the California Council on Science and Technology, and the American Association for the Advancement of Science. He is the recipient of the 2008 IEEE Simon Ramo Medal. He has been a high-level technical consultant to the Department of Defense, holding a security clearance for 15 years. He has authored more than 95 peer-reviewed journal articles, 180 refereed conference papers, three textbooks, and eight patents. Three of his publications received best paper awards. He lives on the Palos Verdes Peninsula with his wife, Niki, and their two daughters, Georgiana and Maria, both of whom attend USC.