LAUNCH OF THE KIOS RESEARCH CENTER

Read more about the image on the cover in "Cover Story" on p.2.

Also in this edition of the Intelligent Times

The KIOS Research Center for Intelligent Systems and Networks has been launched! In addition to official approval of its status as a "Research Unit" by the University of Cyprus Senate, the Center has been the recipient of a prestigious Cyprus Research Promotion Foundation "Research Center Grant."

The Center is already embarking in a flurry of activities. Academic and industrial partnerships have already been established with key players in the areas of intelligent systems and networks. In addition, its members have already attracted large scale research projects from the European Union and Cyprus. KIOS is also the coordinating institution of a new European Union COST action. And the Center's activities do not end here. KIOS is hosting an international conference on artificial neural networks and is organizing a program to offer research opportunities to undergraduate students.

Kios, the forgotten Titan

In ancient Greek mythology, Kios, (pronounced kee-os, in Greek "Κοῖος") the son of Uranos (Sky) and Gaia (Earth), was the Titan of "questioning intelligence" and the brother and husband of Phoebe, the goddess of "answering intelligence." The two completed one another and acted as the center of all knowledge. He also fathered Leto and thus was the grandfather of Apollo and Artemis. He was also the father of Asteria. The Titans, also known as the elder gods, ruled the earth before the Olympians overthrew them. At the end of the Titan-War Koios was cast into Tartaros with the rest of his brothers.

Director's Message

KIOS Research Center – off to a bright start

Welcome to the first issue of Intelligent Times, the official newsletter of the KIOS Research Center for Intelligent Systems and Networks. 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 Cypriot educational system, the high-tech industry and the society at large.

One of the key developments in information and communication technologies is the design of embedded platforms where sensing, information processing, actuation and intelligence are tightly integrated with the physical process, and possibly interconnected with other physical processes or systems. Such intelligent networked embedded systems are starting to appear everywhere, into our homes and offices, into mobile phones and other communication devices, into cars and airplanes, into medical instruments and high accuracy surgical robots. They are becoming integrated into critical infrastructure systems such as the power grid and water distribution networks, and even in the construction of roads, bridges and airports.

The KIOS Research Center aims at contributing to the advancement of knowledge in the monitoring, management and control of critical infrastructure systems and in the design of intelligent networked embedded systems. The goal of the Center is to develop advanced engineering and management tools for critical infrastructure systems such as telecommunication networks, electric power systems, healthcare delivery systems and environmental resources. Furthermore, the Center aims to instigate interdisciplinary interaction and promote collaboration between industry, academia and research organizations in high-tech areas of importance to Cyprus.

The KIOS team is also supported by several world renowned researchers who serve on the Academic Advisory Board. These include J. Sifakis (2008 Turing Award), C.G. Cassandras (Head, Division of Systems Engineering at Boston University and Editor-in-Chief of the IEEE Transactions on Automatic Control), C.L.M. Nikias (Executive Vice President and Provost, University of Southern California, Los Angeles), A. G. Constantinides (Head, Communications and Signal Processing Group, Imperial College, UK), P.A. Ioannou (Director, Center of Advanced Transportation Technologies, University of Southern California, Los Angeles), K. Athanasiou (Karl F. Hasselmann Professor of Bioengineering, Rice University, Houston, TX, USA), V. Vittal, (Ira A. Fulton Chair Professor in Electrical Engineering, Arizona State University, Editor-in-Chief of the IEEE Transactions on Power Systems).

The KIOS Research Center is off to a promising start. As you will read in this Newsletter, the KIOS Research Center was awarded a Strategic Infrastructure Project by the Research Promotion Foundation of Cyprus, it led the initiation of a new COST Action, entitled "Intelligent Monitoring, Control and Security of Critical Infrastructure Systems (IntelliCIS)" – the first ever COST Action to be initiated and coordinated by Cyprus, and was successful in attracting several EU research projects. Furthermore, the KIOS Center established a collaborative and mutually beneficial relationship with local industry, which facilitates technology transfer between academia and industry. And there is a lot more to come.

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

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Cover Story

(continued from p.1)

The cover is inspired by the Nazca lines in the Peruvian desert. The lines are attributed, by some, to beings of higher intelligence. More information at the Unesco World Heritage site:

http://whc.unesco.org/en/list/700

Publication Information

Research News

KIOS: A Strategic Infrastructure Project

In 2008, the Research Promotion Foundation (RPF) of Cyprus announced the "New Infrastructure" program. The general objective of this program is the creation of new research units and laboratories, which are expected to play an important role in the development of critical mass of researchers and the enhancement of the research potential of organizations in Cyprus, and contribute in social and financial progress. The establishment of new, modern and efficient research infrastructures is expected to enhance the competitiveness of the knowledge economy of Cyprus and provide it with the necessary scientific and technological impetus. Part of this program are the "Strategic Infrastructure Projects" which will finance the development and operation at the first "embryonic" stage of new research units involved in the implementation of high-quality research projects in modern cutting-edge scientific and technological fields. The RPF's long-term objective is the creation of the necessary conditions for the future evolution of the most successful of the funded units to larger institutes or research centers by making use of national and/or international funding sources.

The KIOS Research Center was successful in securing one of the "Strategic Infrastructure Projects" in the area of Information and Computer Technology (ICT.) The Center will focus on research in the area of intelligent networked embedded systems and its application to safety-critical and trustworthy systems, an area that ranks very high in the research priorities of funding agencies and industry in Europe and North America. The awarded project provides the "seed" funding required for establishing the infrastructure and it will enable the Center to progress towards its long-term goal which is to become a self-sustained Research Center that conducts world-class research, with particular benefits to the Cypriot society, economy, and industry. It is envisioned that the activities of the proposed KIOS Research Center not only will be sustainable but they will also grow with time as the Center attains worldwide visibility. Based on this long-term vision, the following specific objectives have been set:
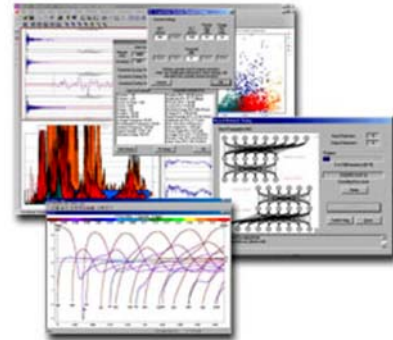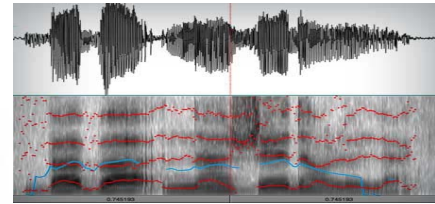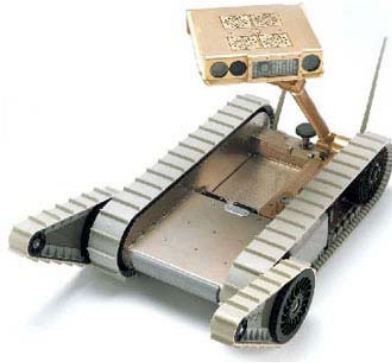
- Create an inspiring environment for conducting high quality research which will be an attractive place for qualified and motivated researchers to pursue their careers.

- Create the necessary critical mass of researchers that will work in the multidisciplinary area of intelligent networked embedded systems. A main objective of the Center is to aid in the reversal of the brain-drain of qualified researchers by creating viable career options.

- Create the necessary infrastructure for conducting multidisciplinary research in the area of intelligent embedded systems and networks. This project will facilitate synergies between several laboratories (each in a different area) in order to enable the aggregate to successfully enter this new field. Investigate the design and analysis of new methods for intelligent networked embedded systems (massively distributed networked systems with focus on key fundamental issues such as cooperation, coordination, fault-tolerance, planning, adaptation, reconfiguration, self-organization, and evolution.)

- Investigate the application of the methodologies of intelligent networked embedded systems in key application domains such as (a) electric power systems; (b) telecommunication networks; (c) water distribution systems; (d) transportation networks and (e) personalized healthcare systems. It is envisioned that as the size of the KIOS Research Center grows, it can possibly expand into more application domains, within the common unifying theme of monitoring and control of safety-critical and trustworthy systems. A key objective is to be able to integrate strong theoretical research in practical settings and maintain a good balance between basic and applied research.

- Achieve long-term sustainability by attracting significant research funding from the European Commission and the industry.

- Establish a large network of collaboration that will include several internationally recognized research institutions. This will be beneficial in providing access to knowledge and infrastructure that may not be available locally. These collaboration efforts have already started. Furthermore, KIOS has led the effort to initiate a new 4-year COST Action that deals with intelligent networked embedded systems and its application to critical infrastructure systems. This is the first ever approved COST Action to be initiated from Cyprus. (See detailed description on p. 5.)

- Establish a long-term collaborative and mutually beneficial relationship with the industry in Cyprus. Such collaboration will lead to joint research projects and facilitate technology transfer between academia and industry.

- Increase the visibility of the Center at an international level by promoting a number of dissemination activities including publications of the produced knowledge and results in leading journals and conferences.

- Take actions to secure the long-term sustainability of the Center by protecting the Intellectual Property Rights of the produced knowledge.

- Contribute to the promotion of a knowledge-based economy in Cyprus via the creation of new jobs in high tech areas and the design of new products or services, in collaboration with the industry.

- Promote the knowledge-based economy in Cyprus by the meticulous training of new researchers at the KIOS Research Center. The Center will also offer targeted training seminars.

- Facilitate the initiation of new start-up and spin-off companies in Cyprus.

- Contribute in raising the public awareness on high-tech issues and encourage young students to pursue careers in this area.

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

Research News

Acoustic Scene Analysis for Detecting Living Entities

Fundamental to natural cognitive systems is the ability to detect and differentiate other living creatures in the world and to characterize their behavior. Sound is the primary medium for long distance passive and active interaction between animals, and between animals and their environment; ranging from human speech communication to the active acoustic scene analysis of bats and dolphins using biosonar. The ultimate aim of this project is to prototype a real-time distributed system that is capable of forming composite representations of animate entities in the world exclusively through the use of information derived from sounds.

The project will be conducted by the KIOS Research team of Dr. Julio Georgiou and will be funded by the European Union Framework Program 7 with an amount of €649,760 for a period of 36 months.

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

A Zero CO2 Emissions Electricity Generation Prototype (ZeroCO2)

The European Union has set targets for energy generation using renewable energy sources (RES) as well as targets for CO_2 emissions. Thus, research for the optimization of large scale generation from renewable energy sources is vital for the reduction of our dependency on fossil fuels and the reduction of CO_2 emissions. This project aims at developing and testing an electricity generation system having zero CO_2 emissions. The proposed prototype system will generate electricity from renewable sources (the main focus is wind energy), avoiding at the same time all the problems associated with electricity generation from wind energy such as the variability of the wind, harmonics in the power system, and system stability problems. Due to the novel configuration proposed in this project, the electric energy out of this system will be clean, green, and regulated.

The prototype system will be connected directly to the grid of the Electricity Authority of Cyprus. The system will be extensively tested under different operating conditions to examine its response based on input or load variations, as well as its interaction in a grid-connected operation.

The project is funded by the Financial Mechanism of the European Economic Area, through the Planning Bureau of the Republic of Cyprus. The funding level is of the order of €750.000. The KIOS research team in this project is led by Dr. Elias Kyriakides. Stay tuned for further information and important results in the next few months!

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

Research News

IntelliCIS: New ESF-COST Action led by KIOS!

The KIOS Research Center coordinates a new European research cooperation program in the framework of the European Science Foundation COST Actions (European Cooperation in the field of Scientific and Technical Research). KIOS researchers have taken the initiative to propose the new COST Action, supported by more than 50 researchers in 20 countries, including local companies and organizations such as the Electricity Authority of Cyprus, PrimeTel, the Transmission System Operator and SignalGenerix. The Action, entitled "Intelligent Monitoring, Control and Security of Critical Infrastructure Systems" (IntelliCIS), is a four year program and has officially started on May 11, 2009. During the kick-off meeting in Brussels, Elias Kyriakides has been elected Action Chair of IntelliCIS. Marios Polycarpou and Christos Panayiotou have been appointed as members of the Management Committee of the Action.

IntelliCIS is envisioned to be 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 interests of the Center's researchers, demonstrating the relevance and timeliness of the research topics of the KIOS Research Center within the European Research Area.

The design, monitoring, control and security of electric power systems, telecommunication networks, and water distribution networks are becoming increasingly more challenging as their size, complexity and interactions are steadily growing. Moreover, these critical infrastructures are susceptible to natural disasters, frequent failures, as well as malicious attacks. There is an urgent need to develop a common system-theoretic framework for modeling the behavior of critical infrastructure systems and for designing algorithms for intelligent monitoring, control and security of such systems. This COST Action will contribute to the advancement of knowledge in the areas of computational intelligence and autonomous agents, with specific emphasis on the application of these methodologies in monitoring and controlling large-scale distributed complex systems. This will be achieved by the development of innovative techniques and algorithms for fault tolerant operation of critical infrastructures and their evaluation by theoretical analysis and simulation.

In Europe and in the USA, there is a tremendous investment in research activities on critical infrastructure systems. Coordinating such a large network is definitely a success for KIOS and the University of Cyprus. It should be noted that this is the first COST Action initiated or coordinated by a Cypriot research organization. It is expected that this activity will result in tools and algorithms that will be applied directly to the many industries and organizations involved in this field. A number of research positions will be created both in the KIOS Research Center as well as in the participant organizations, enabling new researchers to remain active in cutting edge research and contribute in the well-being of society through research in the fields of monitoring, control, and security of critical infrastructure systems.

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

Industrial Partnerships

Members and Friends

The KIOS Research Center aims to the establishment of a long-term collaborative and mutually beneficial relationship with the local industry and other related organizations. Such collaboration will lead to joint research projects and facilitate technology transfer between academia and industry. In this regard, the Center has already secured two important local industrial members with annual funding contributions to the Center's research activities.

The first industrial member is the Electricity Authority of Cyprus (EAC), a semi-governmental organization which is the leading player in the local energy sector and the largest employer in Cyprus. The other current KIOS industrial member is PrimeTel Plc., a large private telecommunication and information technology company incorporated in Cyprus, and one of the few telecommunications operators in the region that can provide a full spectrum of connectivity and services. Furthermore, several other companies, non-profit, and government organizations are very enthusiastic in joining forces with the Center in different research projects. These include the energy and telecommunications regulatory authorities, water management services, health providers, etc. Specifically, the Center has already received the expressed interest for collaboration of the following companies and organizations: SignalGeneriX, a primarily R&D company specializing in DSP algorithms, communication networks, and wireless and generic applications; HellasSAT, the owner and operator of HELLAS SAT 2 (a high power and advanced satellite), which offers a broad range of high-quality services such as video broadcasting (DTH) transmissions, video contribution, program distribution/contribution, and IP and broadband services; Hyperion Systems Engineering, the leading independent supplier of process systems engineering services and turnkey solutions in Cyprus; Epos-Iasis, a recent R&D start-up specializing in optical molecu-lar imaging for early cancer diagnosis; Appolonion Private Hospital, an modern hospital which offers high quality care to its patients; the Cyprus Ministry of Communications and Works, with main areas of responsibility in communications, public transport, merchant shipping, civil aviation, public works and the antiquities; the Cyprus Water Development Department, responsible for implementing the water policy of the Ministry of Agriculture, Natural Resources and Environment; the Cyprus Transmission System Operator of Electrical Energy, responsible, among others, for securing the operation of the electricity transmission system.

The Center has also established an Industrial Advisory Board, comprised of industry leaders, which will provide the research perspective of the industrial partners, promote the collaboration of the Center with industry, and oversee the technology transfer between academia and industry. The Industrial Advisory Board will play a significant role in strengthening the influence that the Center will have in the local economy and will aid to the long-term sustainability of the Center.

Electrifying Collaboration

The Electricity Authority of Cyprus (EAC) is a significant partner for the KIOS Research Center. The EAC has supported KIOS from its first steps, and the support of the EAC is valuable for the long term vision of KIOS. One of the main tracks of KIOS is the area of electric power systems and renewable energy sources. These are topics that are of immediate interest to the EAC. As such, the collaboration between KIOS and EAC has been enhanced and solidified through the participation of both entities in national and European research proposals and research projects.

The KIOS Research Center greatly appreciates the support by the EAC, as it achieves the bilateral knowledge transfer between industry and academia, and allows the Center researchers to have a realistic view of the practical problems facing the electricity industry. The KIOS researchers are working, in collaboration with the Research Department of the EAC, on research projects related to the optimization of the transmission network, the optimization of the 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.

Prime Communications

The collaboration between PrimeTel PLC and the KIOS Research Center has already been a fruitful one, recently winning their first two joint competitive research proposals by the Cyprus Research Promotion Foundation. This research will focus mainly on optical access networks and systems and specifically on wavelength-division multiplexed passive optical networks. The final goal is to construct cost-efficient, high-bandwidth fiber-to-the-home networks that will enhance the capabilities of telecommunications companies and service providers offering triple-play services. PrimeTel's collaboration with the Center is greatly valued, as it allows for the transfer of knowledge between industry and academia and creates a platform for addressing practical challenges faced by the service provider's industry today.

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Industrial Partnerships

KIOS – PrimeTel Workshop

As a part of the collaboration between the KIOS Research Center and PrimeTel, a joint technical workshop was organized on 11/2/2009, focusing on telecommunications technology and applications that are of interest to the triple-play provider's industry. The joint workshop brought together researchers and practitioners working on the optimization of telecommunications networks (wired and wireless) from different perspectives, such as performance analysis and component design, and researchers working more on providing intelligent and useful applications to the users.

Several topics were presented from PrimeTel researchers and researchers that collaborate with PrimeTel in European projects, as well as from KIOS researchers working in the telecommunication networks area. Dr. Ralf Eickhoff from Dresden University of Technology presented results from the MIMAX project funded by the European Commission (FP7 program) on WLANs with MIMO features, on the analog front-end design, as well as on the digital baseband processing for short-range RF-MIMO communication. Miguel Alborg from IDI Eikon and Haris Neophytou from PrimeTel presented the T-Seniority project funded by the European Commission (FP7 program) that focuses on expanding the benefits of information society to older people through digital TV channels.

KIOS researchers Dr. Georgios Ellinas and Dr. Christos Panayiotou presented their research work on fiber-optic network design and ubiquitous intelligent sensing environments, respectively. Specifically, Dr. Ellinas presented the problems of routing, grooming, and survivability for transparent optical networks that support unicast and multicast applications when the physical layer impairments are taken into consideration during the provisioning of each application. He also presented a software simulation tool for metropolitan optical networks that can be utilized by network designers and researchers to design and evaluate the performance of metropolitan optical networks when such applications are present. Dr. Panayiotou presented an overview of wireless sensor networks and analyzed some novel algorithms on event detection and localization. These techniques can be utilized for a wide range of applications including environmental monitoring, traffic monitoring and control, area surveillance, etc.

The joint workshop was very successful, and was well attended by scientists interested in the latest advances in telecommunication technology, as well as faculty and postgraduate and undergraduate students of the University of Cyprus.

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

Undergraduate Research Opportunities Program

The KIOS Research Center launched UROP, an acronym for Undergraduate Research Opportunities Program. UROP cultivates and supports research partnerships between undergraduate students and KIOS faculty. The purpose of UROP is to involve undergraduate students in cutting-edge research within the KIOS Research Center. The level of involvement can range from being an assistant in experimental research to doing tasks such as development of software or investigating a specific topic. As UROPers, undergraduates are also encouraged to participate in each phase of standard research activity: developing research plans, writing proposals, conducting research, analyzing data and presenting research results in oral and written form. UROP projects take place during the summer, and research can be done in collaboration with any faculty of the Center.

UROP benefits students by:
- allowing them to participate in exciting research and investigate areas of interest
- enhancing their knowledge of the latest technology
- providing the opportunity to acquire the skills of the intellectual process of inquiry
- gaining practical skills and knowledge they eventually apply to careers after graduation or as graduate students
- allowing students and faculty members to interact so as to foster closer ties
- giving them the opportunity to mature professionally

For further information, you may contact the UROP coordinator or the KIOS Center Secretariat.

International Conference on Artificial Neural Networks (ICANN)

The KIOS Research Center is hosting the 19th International Conference on Artificial Neural Networks (ICANN 2009) which will be held in Cyprus from the 14th to the 17th of September. ICANN is an annual conference organized since 1991 by the European Neural Network Society (ENNS) in co-operation with the International Neural Network Society and the Japanese Neural Network Society, and is a premier event in all topics related to neural networks. ICANN 2009 will provide a high-level international forum for the academic and industrial community to address new challenges, share solutions and discuss future research directions in neural networks, learning systems, computational intelligence, and real-world applications.

The scope of the conference will cover, but is not limited to, the following areas:
- Computational neuroscience
- Connectionist cognitive science
- Data analysis and pattern recognition
- Graphical networks models, Bayesian networks
- Hardware implementations and embedded systems
- Intelligent multimedia and the semantic web
- Neural and hybrid architectures and learning algorithms
- Neural control, planning and robotics applications
- Intelligent control and adaptive systems
- Neural dynamics and complex systems
- Neuroinformatics and bioinformatics
- Real world applications
- Self-organization
- Sequential and structured information processing
- Brain-computer interface and cognitive architectures
- Signal and time series processing, blind source separation
- Vision and image processing
- Computational intelligence applications to biomedical systems
- Critical infrastructure systems
- Manufacturing systems
- Intelligent environmental systems

KIOS Lunch Seminars

The Center has established a series of monthly seminars to allow its members to become familiar with each other's research areas; it also facilitates a lively discussion of possible research venues and collaborations. The following topics were covered so far:
- Seminar 1 - September, 26, 2008
  M. Polycarpou, "KIOS Research Center for Intelligent Systems & Networks"
  E. Kyriakides, "Research in Electric Power Systems"
- Seminar 2 - October 31, 2008
  C. Pitris, "Optical Diagnostics"
  M. Neophytou, "Modelling the wind flow and air pollution dispersion in complex urban geometries: Computational-Fluid-Dynamics case simulation"
- Seminar 3 - March 6, 2009
  F. Constantinidou, "Effects of Systematic Neurocognitive Rehabilitation after Moderate to Severe Traumatic Brain Injury"
  G. Ellinas, "Optical Networking Activities"
- Seminar 4 - March 27, 2009
  G. Hadjicrhistofi , "Network Security Research Activities"
- Seminar 5 - April 24, 2009
  S. Christodoulou, "BIM, FIAPP, ACO, ANN/FL, RCSP, WSN, Entropy ... and Other Acronyms for Infrastructure Management"
- Seminar 6 - June 26, 2009
  T. Theocharides , "Embedded and Applicaiton-Specific Systems-on-Chip"

For more information please visit
http://www.kios.org.cy/Conferences/LunchSeminars/