



3rd Innovation

& Entrepreneurship Forum

“Research Commercialization
and Innovative Start-ups”

Nicosia, Cyprus, 28 November 2017



University
of Cyprus



THE
HELLENIC
INITIATIVE



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*This book was prepared by the **Centre for Entrepreneurship of the University of Cyprus.**
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WELCOME MESSAGE

It is a pleasure to welcome you at the 2017 Innovation and Entrepreneurship Forum (IEF2017), organized by the Centre for Entrepreneurship of the University of Cyprus (C4E) and The Hellenic Initiative (THI), in collaboration with PwC Cyprus and the MIT Enterprise Forum Greece (MITEF Greece).

The FORUM aims to exhibit cutting-edge university research with commercialization potential as well as to connect university researchers and Cypriot startups with innovation leaders and successful entrepreneurs from Cyprus, the USA, Europe and Asia. Attendees include business angels, investors, industry leaders, entrepreneurs, academic researchers, Cypriot start-ups, representatives of non-for profit organizations who support the Cypriot start-up community, government representatives, academic faculty and students.

This year's FORUM showcases innovative research emerging from the universities and research institutions in Cyprus, in four sectors; Smart Infrastructure, Health Sciences, Energy & Clean Tech and IT, Communications & Devices. It, therefore, gives you the opportunity to get a glimpse of the future generation of innovators in Cyprus!

We extend our gratitude to the IEF2017 Organizing Committee, the FORUM's keynote speakers and judges, corporate partners, special contributors, University colleagues, volunteers and the staff of the Centre for Entrepreneurship for their efforts in making this a successful day. A special thank you to the evaluators, from Cyprus and abroad, who contributed their knowledge, experience and enthusiasm in making this event a success. Special thanks to the major sponsors of the IEF2017, The Hellenic Initiative, PwC Cyprus and the USA Embassy in Cyprus.

We hope you find this event beneficial, stimulating and productive as it is the beginning of an initiative which aims to support the commercialization of innovative research in Cyprus.

Thank you for joining us at the 2017 Innovation & Entrepreneurship FORUM (IEF2017).



Constantinos Christofides
Rector, University of Cyprus

FOREWORD FROM THE FORUM'S GENERAL CHAIRS

This year's Forum is a small step towards establishing the foundation of a long-term sustainable research commercialization activity that will empower the research and innovation community of Cyprus to exploit ideas, inventions, and research results for the benefit of the Cypriot economy and society. An empowerment that is necessary for reorienting Cyprus to a path of sustainable economic growth based on knowledge and innovation, and for addressing the 21st century challenges raised by climate change, globalization and exponential technological progress.

To promote research commercialization, the Forum brings together the Cypriot academic, research and start-up communities with world experts, leading minds in innovation, successful entrepreneurs and investors from the USA, Europe, and Asia. To achieve this ambitious goal, the Centre for Entrepreneurship of the University of Cyprus (C4E) teamed up with "The Hellenic Initiative" (THI), a global movement of the Greek Diaspora comprising an impressive network of entrepreneurs and business leaders from around the world. We also received valuable support and advice from the MIT Enterprise Forum Greece (MITEF Greece), the Greek chapter of the global MIT Enterprise Forum and organizer to Greece's most successful tech start-up competition. These efforts would not have materialized without the strong and continuous support of our strategic partner, PwC Cyprus.

The program of the Forum aims at: i) Showcasing Cypriot cutting-edge university research with a commercialization potential; ii) Conducting a pitching competition with mature technology startups and offer to the best startup team a place to attend MITEF Greece acceleration program; iii) Connecting university researchers with expatriate innovation leaders and successful entrepreneurs; iv) Stimulating partnerships between researchers and respected investors from the USA and Europe, and v) presenting world-class examples and best practices in research commercialization from the USA and China. A series of training workshops on design thinking, product market fit, pitching and basic business principles were offered by C4E to help prepare teams participating to the Forum.

We are excited and humbled by the response of the Cyprus research and Innovation community to our call for applications. We received a total of 65 applications, which provide a representative sample of the Cyprus research and Innovation potential, and of the most vibrant areas of innovation activity in Cyprus. These applications underwent a rigorous evaluation process by external, volunteer evaluators from Cyprus and abroad. In this booklet, you will find the abstracts of the projects selected and invited for presentation at the Forum. On behalf of the Organizing Committee and the organizing institutions, we would like to extend our deep appreciation and gratitude to our sponsors (THI, PwC, the American Embassy in Cyprus), our supporters (MITEF Greece, Top Kinisis, the European Office of Cyprus and COOP Bank), and our keynote speakers, judges and evaluators who contributed their knowledge, expertise and enthusiasm in making this event a success!

Marios D. Dikaiakos University of Cyprus | **Michael Printzos** The Hellenic Initiative
George Saveriades Olitech Ltd



A MESSAGE FROM THE FORUM'S HONORARY CHAIRS

Over the last few years, there has been a growing awareness around the world of the impact of start-ups on the economy and the great opportunity it provides for ambitious youth. However, without access to adequate mentoring and other support, many prospective entrepreneurs look no further than copying the latest mobile app. Although this is not so hard and requires little capital, it does not generate great value. It's an approach that might make sense in a place with lackluster education or research; that is not the case in Cyprus.

For this reason, The Centre for Entrepreneurship (C4E) of the University of Cyprus and The Hellenic Initiative (THI) have organized the 2017 Innovation & Entrepreneurship Forum for the commercialization of innovative research and technology start-ups (IEF2017). Following the model of universities like MIT who have mastered technology commercialization, this effort will identify and support game-changing technological developments with the goal of creating new ventures.

Having reviewed several of these research projects, we can say that there is tremendous potential here in Cyprus to create a fertile start-up community. We look forward to seeing that take shape.

Marina Hatsopoulos Levitronix Technologies
Yiannis Monovoukas Helios Global Investments LLC



ABOUT THE ORGANISERS

1. THE CENTRE FOR ENTREPRENEURSHIP

The Centre for Entrepreneurship (C4E) of the University of Cyprus (UCY) aspires to: a) foster a culture of innovative entrepreneurship within the University and to develop relevant in-house expertise; b) provide the entire University community with high-quality services and the connections required to bring scientific innovations and novel ideas produced inside the University to global market-places, and c) contribute to the creation of a sustainable innovation ecosystem in Cyprus. C4E strives to provide the training, expertise, mentorship, support and connections that UCY's students and young scientists need to become effective entrepreneurs.

C4E considers Entrepreneurship in its broadest sense, namely as a mind-set in scientific and scholarly work that embraces creativity, critical thinking, imagination, risk-taking and the bold experimentation with new ideas and transformative scientific approaches. C4E aspires to turn new knowledge into real "value" that can serve the common good through novel products, processes and services, implemented by new or existing ventures, private or public organizations, governmental institutions or non-governmental initiatives.

C4E serves the entire University of Cyprus community, namely undergraduate, postgraduate and doctoral students, researchers and young scientists, faculty, and staff. Beyond the University, we contribute to the emergence of Cyprus' "start-up" ecosystem, participating in relevant initiatives and liaising with people and support structures, such as accelerators, incubators, and maker spaces. We promote the uptake of innovative results, the exploitation of scientific know-how and the use of advanced research infrastructures of UCY by existing private and public organizations, contributing to the competitiveness and growth of the Cypriot economy. We work with policy makers and the government to promote policies that support research, innovation, and entrepreneurship. We invite alumni to participate and contribute to our activities. We engage the Cypriot diaspora of entrepreneurs and innovators to become our ambassadors abroad.

Our Guiding Principles comprise the pursuit of excellence, an emphasis on collaboration, networking, and mentorship, a philosophy of experimentation, embracing diversity, and pursuing honesty and transparency.



2. THE HELLENIC INITIATIVE

The Hellenic Initiative (THI) is a global, non-profit, secular institution which mobilizes the Hellenic Diaspora and Philhellene community to support sustainable economic recovery and renewal for the people of Greece and Cyprus.

Our programs address crisis relief through strong non-profit organizations led by heroic Hellenes that are serving their country. They also build capacity in a new generation of heroes, business leaders and entrepreneurs with the skills and values to promote the long term growth of Hellenism.

- We invest in the future of Hellenism through direct philanthropy and economic revitalization.
- We empower people to provide crisis relief.
- We encourage and support entrepreneurs and create jobs.

We are The Hellenic Initiative – a global movement of the Hellenic Diaspora.



ORGANISING COMMITTEE

HONORARY CHAIRS

Marina Hatsopoulos Levitronix Technologies

Yiannis Monovoukas Helios Global Investments LLC

GENERAL CO-CHAIRS

Marios D. Dikaiakos University of Cyprus

Michael Printzos The Hellenic Initiative

George Saveriades Olitech Ltd

MEMBERS

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Maria Markidou Georgiadou, University of Cyprus

Competition Track Chair:

Katerina Saridaki, MITEF Greece

Student Track Chair:

George Kassinis, University of Cyprus

Research Capacity Track Chair:

Theodosios Trypiniotis, University of Cyprus

Local Arrangements Chair:

Elena Tanou, Top Kinisis

Communications and Outreach Chair:

Ioanna Tsioutsoumi, University of Cyprus

Web Site:

Andreas Andreou, University of Cyprus

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SPECIAL CONTRIBUTORS



SUPPORTERS



AGENDA

BY INVITATION ONLY

9:00 AM – 10:30 AM	Research capacity exhibition*
10:00 AM	Registration
10:30 AM – 11:00 AM	Opening Remarks
11:00 AM – 11:20 AM	Keynote Speech by Mr. Leon Sandler - Executive Director, MIT Deshpande Centre for Technological Innovation "Commercializing research: Why it matters; What is its impact & the MIT experience?"
11:20 AM – 12:30 AM	Pitching Competition
12:30 PM – 1:00 PM	Networking Break
1:00 PM – 1:30 PM	5' Q & A for the best 5 start-ups
1:30 PM – 3:00 PM	Networking Session and Lunch

OPEN TO THE PUBLIC

3:00 PM – 3:15 PM	Announcement of Competition Track winners
3:15 PM – 3:45 PM	Speeches by: Mr. Herbert Chen - Vice Dean, TusPark, Tsinghua University "Why China needs a Science Park?" Ms Anna Protopapa - President and CEO of Mersana Therapeutics "Learnings from two decades in Biotech"
3:45 PM – 4:30 PM	PANEL DISCUSSION Topic: Key factors for succesful commercialization Panelists: Evgenios C Evgeniou - CEO PwC Cyprus (Moderator), Leon Sandler, Herbert Chen, Anna Protopapa, Marios Dikaiakos - Director C4E

* The research capacity exhibition will be open to the public from 10:30 AM - 5:00 PM

SPEAKERS



Leon Sandler

Executive Director, MIT Deshpande Center for Technological Innovation

Title: "Technological Innovation- commercializing university technologies for impact. The experience of the MIT Deshpande Center"



Herbert Hongbo Chen

COO, Tus Holdings (TusPark) Co., Ltd and Vice Dean, TusPark Research Institute for Innovation

Title: "Why China needs Science Park"



Anna Protopapas

President & CEO of Mersana Therapeutics

Title: "Learnings from two decades in Biotech"



**COMPETITION
TRACK**
ABSTRACTS

COMPETITION TRACK ABSTRACTS

1

11 PETS LTD

Kyriakos Stavrou, Demos Pavlou, Adonis Yiangou

Caring for pets is a central part of the life of their families. 11pets wants to help them provide the best possible care by taking advantage of modern technology. 11pets is a platform consisting of a complete set of interconnected, pet-centric software tools for pet owners and the key parties of the industry that promote collaboration and effectiveness.

The tools for owners help them to care for their pets, monitor their needs and their supplies and keep detailed medical records. As for pet welfare organizations, in addition to care, our tools cover the management of the shelters and promote adoptions. The tools for professionals cover everything they need for their day by day operation and the communication with the customers.

The whole system is interconnected and information can be shared on demand. The ability to collaborate has a synergistic effect improving significantly the level of pet care and at the same time creates a virtuous cycle that increases the population of users.

The owners and welfare organizations are the assets of the company and to them everything is offered for free. Tools to professionals are on an annual fee. Promotion is also offered as a paid service as well as the ability for 3rd parties to sell services/goods to our users. The most important asset is the data of user's pets. Data analytics for medical, behavioral and market studies, will be the major component with relevant enterprises being the customers.

We have already covered the owners and welfare organizations sectors with 4 tools and our apps already have more than 100K downloads worldwide. The wide adoption of our solutions makes it necessary to move faster. We are steadily moving closer to our vision, a unified, pet-centric ecosystem that does take the pet-care to a whole new level.

2

AJM Med-i-caps Ltd

Julius Georgiou, Anastasios Koulaouzidisian, Maya Thanouis

One in three people will get cancer during their lifetime; intestinal cancer is one of the top three most cancers, with nearly 1.4 million new cases diagnosed annually. If found at an early stage intestinal cancer survival rates go up dramatically. AJM Medicaps will replace colonoscopy, with a single electronic pill that works in conjunction with proprietary cancer markers, in order to accurately detect cancerous cells in the intestine at an early stage. Many national health organisations recommend colorectal cancer (CRC) screening in adults 50 to 75 years of age thus targeting an elderly population of 300 million that needs screening in Europe alone. AJM Medicaps will provide an easy, safe and precision screening solution for both the small and the large bowel, which is low-cost, comfortable and highly-efficient for early-stage cancer detection. Furthermore, AJM Medicaps solution has

COMPETITION TRACK ABSTRACTS

multiple other advantages such as easy test interpretation by non-specialist staff and use of totally safe, non-ionizing & non-radioactive substance(s) for the detection of the cancerous cells, thus allowing annual testing. Today's competition for large intestine screening includes colonoscopy (uncomfortable, even painful on occasions, certainly embarrassing for some that often requires sedation for successful outcome), computed tomography (costly, requires x-ray exposure) and the PET scan (costly and uses radioactive markers). Competition for small intestine screening includes double-balloon enteroscopy (extremely uncomfortable and limited scope), video capsule endoscopy (labour intensive analysis, easy to miss early stage cancers and requires external belt to collect data), CT scan and MRI (too expensive for a screening test). AJM Medicaps smart-pill solution screens both the small and large intestine for cancer in one go, without any discomfort, radiation, external belts or need for sedatives, at the price of a colonoscopy!

3

Advance Materials Design & Manufacturing LTD (AMDM LTD)

Katerina Sofocleous, Vasileios Drakonakis, Evelthon Iacovides, Maria Kalli

Market Growth

The Global Composites Market was about €73 Billion in 2016 and is expected to exceed €115 Billion in 2022.

Europe is expected to be the fastest growing regional market in Carbon Fiber Composites for the forecast period from 2015 to 2022 and is expected to exceed €9 Billion (<http://www.grandviewresearch.com/>).

Air traffic is expected to double by 2035: demanding nearly 33,070 new composite aircrafts (Mapping Demand, Global Market Forecast: 2016-2035, AIRBUS).

The major growth drivers for this market are greater penetration of carbon fabric materials in applications within aerospace, defense, automotive, sports, and wind energy industries, where the strength-weight ratio plays a quite significant role in structures.

These industries share a common supply chain when it comes to composites manufacturing. Carbon fabric manufacturers are a key link within this chain and this is the group of customers we are targeting.

Starting from central Europe and expanding within the EU, which has a great part of the market in the aforementioned fields.

NanoWeld could currently have a Potential EU Application of 246.5 Million m²/yr which translates in €740 Million/yr.

Product

Based on 30 years of experience in polymer composites research and industry, AMDM has developed NanoWeld® to offer a revolutionary solution to the field of carbon fiber composites.

- NanoWeld® is a material product in the form of textile with spectacular properties in terms of enhanced strength and weight savings compared to current carbon fiber textile solutions.
- NanoWeld® actually enhances existing carbon fabrics through nanotechnology implementation resulting in a final composite with 300% higher fracture toughness, 30% higher tensile strength, and up to 30% reduced weight.
- At an average cost of 1,1 €/m² for AMDM, NanoWeld® provides an added value to the final product of carbon fabric manufacturers for 4 €/m² projecting profit margin per year of more than €3 Million in 5 years from now.

4

COBRA

Panos Razis, Hans Rykaczewski, Viktor Minkin, Evangelia Dimovasili

Analysis of human intentions is very old problem. In our time, this analysis becomes more and more important due to the increasing number of terror attacks. There is need to protect against terror attacks and to provide scientific solutions for psycho-physiological testing of migrants for satisfying international values. Since standards are diverse in different countries and continents, we wish to focus in this proposal on the requirements and standards within the European Union. We propose to develop a simple, user-friendly and reliable solution for psycho-physiological testing for screening migrants coming to countries of the European Union.

5

Hypermedia Interactive Services Ltd

Daphne Demetriades-Colocassides, Vladimir Lelicanin, Philippos Droussiotis

"We aspire to ingrain the culture of sustainability to the millions of people who work in hospitality in a fun and engaging way."

"Sustainable practices in hospitality" is a training and engagement platform specializing in sustainability.

We aim to deliver a high-impact adult training solution that results in a valuable return of investment for hospitality accommodation enterprises committed to sustainability. We make learning more enjoyable and fun by making use of gamification elements to motivate and engage staff to work in a more "sustainable" environment. Staff learn how to engage in sustainable practices with "smart" "no or low-cost" practices that ultimately improve a hotel's triple-bottom-line and contribute to sustainable tourism development.

We target a €47 million market of hotel accommodation SMEs in Europe. Cyprus, our initial target market is worth €1 million. We primarily make our money by charging a per user license fee and we acquire customers through face-to-face presentations, networking and digital marketing.

Since our product launch in Q2 2017, we have received positive feedback from our customers, who are a diverse group of stakeholders in travel and tourism. We plan to enter the Greek market in 2018 and the European market by 2019.

COMPETITION TRACK ABSTRACTS

We have formed strategic alliances, and together with our experienced team with deep domain expertise of over 15 years offers us a significant first mover advantage. Our revenue is an amalgamation of new and repeat customers. The next three years will generate adequate profitability and sufficient cash providing a very satisfactory ROE of 35%. We are seeking €100k angel funds to finance Phase II earmarked to improve Phase I which will get us to our financial targets.

6

Lemon Labs Ltd

Konstantinos Barmounis, Anne Maisser

Nanoparticles suspended in the breathing air (i.e., aerosol particles) have potential adverse effects upon human health, while they also affect the dynamics of the Earth's climate. As a result, their routine monitoring, both in the indoor and outdoor environment, is crucial for understanding the mechanisms through which they can affect our health and climate. Monitoring airborne particles is also important for governmental authorities to identify cases of high concentration and take measures for protecting public health. Additionally, routine monitoring of airborne particles and particle exposure is also important for protecting workers at the industrial environment. For example, potential spills of airborne nanoparticles from the nanotechnology industry may significantly increase occupational exposure above the safety limits. Having the tools to assess human exposure to the airborne nanoparticles is therefore of primary importance. However, currently there is lack of portable instruments in the market, which can be used for measuring the concentration of nanoparticles in breathing air.

Lemon Labs Ltd has developed a patented technology which enables the manufacturing of portable and cost-effective instruments for nanoparticles monitoring. The founding team of Lemon Labs Ltd consists of a group of scientists with many years of experience in the development of aerosol instruments and measurement techniques. The main objective is to develop and commercialize instruments close to the needs of the scientific community, industry and public sector. As a result of our background, we are aware of the significant demand for such instruments in the industry and scientific community; a demand that, for the time being, cannot be satisfied by any existing manufacturers

7

Level 5

Marios Neophytou, Deanna Lacoste, Mindaugas Kirkus, Emre Yengel

Level 5 is a KAUST IP based start-up incorporated in Cyprus which provides a dust removal system for Close Circuit Television (CCTV) cameras using printed plasma actuators on protective glasses of the CCTV cameras without lowering the quality of the video image or disturbing the CCTV operation.

The Level 5 co-founders have developed KAUST Intellectual Property (IP) based technology (2 patents pending) into a business model, where their coating technology removes accumulated dust/sand from flat and parabolic surfaces. The technology involves the deposition of transparent electrodes on flexible substrates that when high voltage is applied, airflow is generated between printed electrodes repelling particles from the surface.

The technology developed by the Level5 team is established on more than 35 years of accumulated know-how. The idea in a nut shell is to print transparent electrodes on a flexible dielectric substrate that will cover the protective glass of CCTV cameras: both the conventional flat glass, as well as the new generation of dome. The specific arrangement of the transparent electrodes, once connected to a high-voltage low-current power supply, generates an ionic wind, which is extremely efficient in removing the dust particles as well as preventing pest problems. This technology is protected by two patents (pending).

Level 5 technology is a smart, efficient, and reliable solution for preserving perfect field-of-view CCTV and safety cameras with retrofit-ability, as it can be installed on already working cameras but also implemented during the assembly line. Additionally, the Level5 system does not require maintenance throughout the operating lifetime of the camera.

Level 5 technology has been assessed as having many market opportunities due to its retrofit-ability, cost effectiveness and flexibility. For example there are potential markets including solar panels, security cameras and building windows.

8

POLITICA.IO

Andrea Solomonidou, Valentinos Evripidou, Kyriakos Toubas

Politica is an innovative multi-segment platform for live reporting, analysis and data visualization. Inspired originally by the electoral procedures that attracted global interest in 2016 (Brexit, US), Politica aims to be the market leader in providing technological tools that can improve the current state of electoral reporting, data visualization, political analysis including better fact checking. We want to enable Media Outlets, Polling Companies, Research Organizations and Political Parties through the use of technology to report, visualize and analyse local elections in their respective countries and on a European level resulting in creating more informed and engaged citizens.

Politics is a multi-billion market and Politica is not only set to serve that, but the platform's tools find application in various other industries that are heavily involved in data analysis.

COMPETITION TRACK ABSTRACTS

9

PREDITI LIMITED

Konstantinos Soteriou, Panayiotis Panayiotou, Panikos Hadjipanayis

Prediti is a decision marketing tool which aims to disrupt consumer's in grocery store shopping experience.

Prediti knows what you want before you buy it, which is the beauty of our algorithm. This is done by our advanced analytics which segments the retailer's customers into homogeneous clusters based on their previous and current purchasing behavior. Prediti also knows your exact location in a retail store - that is the magic of our indoor positioning system. Prediti can thus push tailored, targeted, personalized and effective notifications on consumers' smartphones at their exact location in the retail store, taking customers experience to the next level.

Prediti enhances and offers value to all three stakeholders: Shoppers, Retailers and Brands.

So shoppers have the ability to have a personalized experience like the one they are used to have in Amazon, find their products location in the store, having their grocery list automated filled by recommendations based on their products life span, and share their grocery list with their family. On the other hand, brands for the first time have the ability to target their shoppers, at the most critical time; in particular, when they are in front of their products and are really thinking to purchase them.

10

RadiantFleet

Sofoklis Papasofokli, Marios Papasofokli, George Orphanides, George Papatthomas

The RadiantFleet pitch in a video format is available in the following link:

<https://www.facebook.com/radiantfleet/videos/1936118339965446/>

RadiantFleet is a crewing platform that is easy to use and can scale world-wide. According to Clarksons, the OPEX for the world's cargo fleet in 2016 excluding fuel was 101 billion USD. The 60% of that are costs directly related to crew. These 60bn USD are spent on crew wages, flights, taxis, insurance.

The crewing department is responsible to manage these costs.

Their main responsibilities are:

- a. To plan the crew rotation,
- b. Ensure the crew has the valid certificates and experience.
- c. Monitor and execute the crew changes efficiently

All these according to the owner requirements and industry regulations.

To achieve their task, they work with

- a. Manning agents in crew hot spots like Philippines, Russia, Ukraine.
- b. Flight agents to get the crew to the most convenient airport.
- c. Port agents to arrange transportation from the airport to the vessel.

All this communication is by emails and phone calls. This creates a lot of error prone double work and it is very inefficient. Their current toolset does not give them the opportunity to manage the costs proactively and optimize their planning. We created RadiantFleet with the vision to connect everybody on the same platform. To give them a single canvas where they can ALL work together as efficiently as possible.

With Radiantfleet you can:

- a. Optimize the workflows between your company and your partners
- b. Meet and exceed your client demands with 24/7 online access and add value to your existing services.
- c. Keep up with new regulations.
- d. Finally, with RadiantFleet you enable new business models based on transparency and collaboration.

RadiantFleet is unique because:

- a. it is a WEB platform and that gives us the ability to scale out to people everywhere in the world.
- b. It visualizes information so it's easy to understand and make optimization.
- c. It is intuitive and interactive.

With our graphical planner you can change your planning, check certificates and budget deviations with 1 single click.

RadiantFleet is recognized by the European union as an innovative project and we have been granted €172K Euro for further development.

Our business model is subscription based software as a service. We have plans for small, medium and large enterprises.

Our team shares more than 25 years of experience delivering software solutions for multinational companies around Europe. We have a solid understanding of crewing processes and the technical knowledge to deliver the best crewing platform.

A teal-tinted background image showing a person wearing glasses and a white t-shirt with text, working on a circuit board. The person is looking down at the board. The text on the t-shirt includes "ASSEMBLY & MAINTENANCE MANUAL" and "COV: SUB".

RESEARCH TRACK ABSTRACTS

SMART
INFRASTRUCTURES

1

Smartphone-Based Roadway Anomaly Detection and Classification

Charalambos Kyriakou, Symeon Christodoulou

Nireas International Water Research Center, Dept. of Civil and Environmental Engineering, University of Cyprus

This project proposes a data-driven framework on the use of supervised machine learning and smartphone sensor technologies for the detection, classification and geo-referencing of common roadway pavement surface anomalies. Further, the study proposes a low-cost and automated method to obtain up-to-date information about roadway pavement surface anomalies, with the use of smartphones mounted on vehicles. Robust regression analysis and bagged trees classification models are used to compliment smartphone-based data collection. The technology for the suggested system is readily available and accurate, and can be utilized in crowd-sourced applications for pavement management systems (PMS) and geographical information system (GIS) implementations. Further, the proposed methodology has been field-tested (detection and classification of five types of pavement surface anomalies, exhibiting accuracy levels higher than 90%) and at this time it is expanded to include larger datasets and a bigger number of common roadway pavement surface defect types. The proposed system is of practical importance since it provides continuous information about roadway pavement surface condition which can be valuable for pavement management systems and public safety.

2

Vision-Based Pavement Management System

Giorgos Hadjidemetriou, Symeon Christodoulou

Nireas International Water Research Center, Dept. of Civil and Environmental Engineering, University of Cyprus

The research project proposes an integrated decision support system for the management of flexible pavements, in the form of a decision tree; an entropy-based method for automatic detection of multiple pavement defects; an automated pavement patch classification and quantification system, using support vector machines; and a vision-based vehicle detection and classification algorithm.

The proposed system, which is currently being field tested, is vision-based and aims to automatically detect multiple pavement distress forms by use of low-cost technology. The presented method uses roadway surface videos collected by a low-cost dashboard camera positioned on the rear of a passenger vehicle, moving in a real-life urban network, under normal traffic conditions. A novel algorithm calculates the entropy of each gray-scale frame, extracted from the videos, and isolates those that include pavement anomalies, using entropy threshold values. It is able to effectively detect simultaneously the pavement defects of potholes, patching, shoving,

SMART INFRASTRUCTURES

raveling and all types of cracking, with an overall image-based classification accuracy, precision, recall and F1 score of 85.57%, 73.13%, 76.58% and 74.82%, respectively. The proposed system provides transportation agencies with an alternative to manual inspections and/or to the use of high-cost specialized vehicles, that can save significant time and cost.

3

PRODROMOS: GIS-Based Integrated Platform for the Safe Transport of Dangerous Cargo through Seaports and Roadways

Anastasis Gagatsis, Sofia Kraniofi, Symeon Christodoulou

Nireas International Water Research Center, Dept. of Civil and Environmental Engineering, University of Cyprus

The platform described herein addresses European mandates for the safety and security in multimodal transport, focusing on the transfer of dangerous cargo through seaports, and in national efforts to adhere to both the aforementioned guidelines and the International Carriage of Dangerous Goods by Road (ADR) guidelines. The described system, which implements an integrated methodology to complement a "single window" platform, for the security, information and operation of intelligent marine transport, has successfully been field-tested in Cyprus and Greece. The system integrates custom hardware (GPS devices, SMS Server) and software (GIS tracking, route optimization, fleet management, alarms) with existing communication technologies (GSM/GPRS, SMS). Information on the transfer of goods (including dangerous goods) is entered into the system by the various stakeholders through the Single Window platform which, upon integration, is distributed to the Ports Authority and its various stakeholders. A subset of that information, pertaining to dangerous cargo, is then transferred to a 'mini Single Window' platform, processed to identify the associated ADR class and its severity, prior to being transferred to the port's yard planning module and an MS-SQL server for deciding how the cargo should be handled within the port. The information is also passed to the port's gate security for informing when a cargo is need of a GPS tracker for monitoring its delivery through the roadway network. Should a cargo needs to be tracked, a GPS tracker is assigned to the container, secured and activated through a track-n'-trace platform, which is web-enabled and in constant communication with the Single Window platform (links 8 and 9). The track-n'-trace platform also provides geocoded tracking while the cargo is transported through roadways, providing geospatial fencing and enforcement through several SQL/GIS triggers and GPRS alerts to the cargo handler, the command center and to first responders. Cargo departure is authorized through ANPR cameras at the seaport's gate, while transnational cooperation is secured through data transfers from port to port.

4

Intelligent Monitoring and Control Technologies for Road Transportation Systems

Stelios Timotheou, Christos Panagiotou, Marios Polycarpou

KIOS Research and Innovation Center of Excellence, Dept. of Electrical and Computer Engineering, University of Cyprus

The KIOS Center of Excellence has produced a number of innovations related to the monitoring and control of intelligent transportation systems.

These include:

Innovation 1. Mobile software application for bus fleet monitoring

Innovation 2. Methods for distributed traffic signal control

Innovation 3. Methods for the detection, identification and localization of sensor faults in road transportation systems

Innovation 4. Methods for robust traffic state estimation

Innovation 5. Architecture and methods for route reservation, as well as dynamic routing and balancing in road networks.

The proposed innovations add substantial value for the real-time monitoring and control of transportation systems by improving the information available on the road conditions and alleviating congestion which has enormous environmental, economic and social implications.



SMART INFRASTRUCTURES

5

Holistic Vulnerability Assessment Of Water Distribution Networks (Safest)

Agathoklis Agathokleous , Symeon Christodoulou

Nireas International Water Research Center, Dept. of Civil and Environmental Engineering, University of Cyprus

The research project refers to an integrated decision support system for the management of water distribution networks.

The proposed platform's scientific and technological objectives can be summarised as follows:

- Develop a platform for holistic vulnerability assessment of WDNs, based on open-source software (OSS), locally-developed hardware, and in-house scientific knowledge. The platform is modular and scalable so that it can be adopted by other WDN operators.
- With respect to quantitative analysis, the platform will amalgamate years-long knowledge from Nireas-IWRC and WBN on pipe vulnerability, waterloss, pressure management, automatic meter reading, and intermittent water supply operations, to assess network-wide vulnerabilities and produce city-wide risk maps.
- With respect to qualitative analysis, the platform will amalgamate years-long knowledge from Nireas-IWRC, CUT and CING on both physicochemical contaminants and microbiological agents and their dispersion in WDN, chemical interactions between pipe materials and water, to assess network-wide external and internal vulnerabilities to various contaminants (S01-S08) and to produce city-wide risk maps.
- Increase a WDN's security against malicious external attacks on the WDN's water quality and quantity, through real-time monitoring and decision support systems.
- Develop sensor placement optimisation models for various scenarios, for the early and most efficient detection of vulnerabilities (e.g. water loss, chlorination levels, pollution).
- Address specific local problems (such as the high levels of non-revenue water in WDNs, currently estimated at 30% nationwide, and the high vulnerability stemming from intermittent water supply operations) that are of particular interest at international level, and of local problems (such as the water-mix attributes and their effects on network vulnerability) which will be looked into for the first time on an international level.

6

Event diagnosis method for water distribution systems

Demetrios Eliades, Christos Panagiotou, Marios Polycarpou

KIOS Research and Innovation Center of Excellence, Dept. of Electrical and Computer Engineering, University of Cyprus

The KIOS CoE has produced a number of innovations related to the monitoring and control of water distribution systems; these include:

- Methods for selecting the best locations to install sensors within a network to minimize contamination risk
- Methods for detecting quality events using standard sensor measurements
- Methods for isolating the source of contamination events
- Methods for detecting leakage events
- Methods for real time monitoring of water distribution systems

Currently leakage and contamination events correspond to large financial losses for utilities. On average 20% of the drinking water which enters a water distribution network is lost due to leakages and other causes. Currently monitoring is conducted using consumer reports and with expert operators monitoring an increasing number of sensors. The value proposition is to reduce significantly the workload of the operators and to reduce the costs due to leakages and contamination events, by incorporating smart algorithms which are able to detect events as soon as possible.

7

Tools/Methodologies with Application to Power Systems

Markos Asprou and Lenos Hadjidemetriou, Elias Kyriakides

KIOS Research and Innovation Center of Excellence, Dept. of Electrical and Computer Engineering, University of Cyprus

The power system group of the KIOS Center of Excellence (CoE) performs quality research that results in innovative tools and methodologies applicable to power system. The developed tools and methodologies can be separated in two categories: 1) tools/methodologies that are applicable to Supervisory Control and Data Acquisition system (SCADA) of power systems and 2) tools/methodologies related to the integration of the renewable energy sources into the grid. In the first category, the power system group demonstrates innovative work on the monitoring and control of power systems with the development of a hybrid state estimator that utilizes measurements from a cutting-edge measurement technology, the Synchronized Measurement Technology. The developed hybrid state estimator provides very accurate information to the power system operators about the operating condition of the system. With respect to the control of the power system, a controlled islanding methodology that can prevent a power system blackout after a severe disturbance was developed. The developed methodology splits the system into smaller systems (islands) to maintain the operation of the power system with the minimum disconnection of consumers. Further, as the penetration of renewables in the power systems increases, there are several

SMART INFRASTRUCTURES

challenges in integrating the renewable energy sources without affecting the grid operation. In this sense, KIOS power system group concentrates on developing methodologies and tools that enables the smooth integration of renewable energy sources to the grid. More specifically, a novel PV system architecture was designed for exploiting the smart inverter capabilities and kinetic storage device. This architecture also comprises advanced control methods for smart inverters applicable to the embedded micro-controller of the inverter for improving the power quality of the PV systems and providing new ancillary services to the grid. In addition, a low-cost distribution network monitoring tool was developed exploiting information and communication technology and already available measurements from installed PV inverters. The monitoring tool estimates the power production of all the residential PVs and can enhance the monitoring of the voltage of the distribution grid. It is worth mentioning that the tool is developed through the collaboration of the KIOS CoE and the Eletoyia company within the ENHANCE project.

8

Smart Camera Networks

Christos Kyrkou, Christos Laoudias, Savvas Papaioannou, Christos Panagiotou, Marios Polycarpou, Theocharis Theocharides

KIOS Research and Innovation Center of Excellence, Dept. of Electrical and Computer Engineering, University of Cyprus

Smart Camera Networks (SCNs) consist of networked cameras that collaboratively perform various computer vision tasks (e.g., activity monitoring, object identification, target tracking, etc.), while monitoring an area. SCNs can effectively support the decision-making process, thus they are becoming an integral component towards smart cities. Recently, emerging platforms for SCNs, offer advanced sensing, processing, and networking capabilities that trigger the development of a wide range of applications from security and surveillance, autonomous vehicles, traffic monitoring, personalized healthcare, industrial monitoring, and augmented reality. Such SCN platforms are envisioned to dynamically adjust their control parameters, i.e., pan-tilt-zoom for fixed cameras, and also 2D location and/or height for mobile cameras (e.g., mounted on robots, drones, moving vehicles) for performing the assigned task, while optimizing the, sometimes conflicting, underlying objectives (e.g., maximizing the number of tracked targets or the size of the monitoring area, minimizing power consumption, etc.). The optimization of the multi-objective function, that gives the optimal control parameters at each time step based on the latest camera readings and previous state of the SCN, can be performed by a coordinating entity (i.e. all related measurements and camera-specific state vectors are transmitted to a central processing unit that runs the computations) or by each camera individually in a distributed fashion (using measurements from neighboring cameras) paving the way to fully autonomous SCN platforms.

9

SwiftTag

George Heracleous, Panayiotis Kolios

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In search and rescue missions, first responders find trouble accessing hard-to-reach areas (eg steep slopes, dense vegetation). In many cases the mission gets challenging due to bad weather (eg. floods) which are prevailing in the area. It is for that reason that unmanned aerial vehicles (UAVs) have become much wanted tools to ease response and improve response times under varying degrees of difficulty. In a nutshell, UAVs can navigate and cover big search areas while capturing valuable data to pinpoint and assess the situation on the ground. However, to enable effective search and rescue functionality, both the drone search paths and the processing of captured footage should be properly coupled and optimized. For that reason a customized drone app has been implemented to intelligently automate the search and detection functionalities offered by UAVs and the camera payloads. This app and the underlying algorithms greatly improve search and rescue missions as shown through real exercises where the proposed solution has been tested. Through the app users only need to choose the area and type of mission which the UAV is going to search. Thereafter the UAV executes the mission while the user can monitor the whole process and focus on situation assessment.

With regards to the market value, the overall public safety and security market is estimated to be worth more than 450 Billion Euros by 2021, according to "Critical Communication Network, Biometric and Authentication System, Surveillance System, Emergency and Disaster Management, Cyber Security", Service, Vertical, and Region - Global Forecast to 2021", published by Markets and Markets. Drones are already taking up a large share of that market and the proposed solution is envisioned to become bundled with that share.



**RESEARCH
TRACK
ABSTRACTS**
HEALTH SCIENCES

1

Atomic Force Microscopy identification of Nano-Mechanical

Fingerprints for Cancer Diagnosis

Andreas Stylianou, Triantafyllos Stylianopoulos

Department of Mechanical and Manufacturing Engineering, University of Cyprus

Cancer development and progression is closely associated with changes in cytoarchitecture, extracellular matrix (ECM) composition and structure, as well as changes in mechano-cellular phenotype and mechanical properties of the tumor. The project aims to develop the appropriate methodology for the Atomic Force Microscopy (AFM) identification of the nano-mechanical FingerPrints of solid tumors, which will be used as a diagnostic tool and nano-mechanical biomarker for more accurate, objective and early cancer diagnosis.

AFM studies have been conducted on different cancer cell lines and it has been demonstrated that cancer cells present reduced stiffness compared to normal cells. Furthermore, AFM in tissue level can address both the mechano-cellular softening and the microenvironmental stiffening during cancer progression. It has been demonstrated that malignant tissues have a broad distribution of elastic modulus (i.e., stiffness) with a distinct lower elasticity peak (LEP) (corresponding to the "softer" cancer cells) and a second peak, the higher elasticity peak (HEP) (indicating the ECM stiffening). Overall these results highlights that AFM can provide novel quantitative mechano-biomarkers that may have translational significance for the clinical diagnosis of cancer. The proposed research will provide new insights into cancer diagnosis and will contribute to the development of a mechanically-driven diagnostic approach that could be employed in parallel to standard biopsy procedures, offering a novel quantitative biomarker with blind assay properties, allowing unbiased evaluation of tumor biopsies. The developed method will be further expanded and be commercially exploited by "AFroMite RDT" an enterprise under establishment by the authors, which has already requested funding as a start-up company.

2

Multifunctional nanoparticle delivery systems for the treatment of breast cancer

Triantafyllos Stylianopoulos

Department of Mechanical and Manufacturing Engineering, University of Cyprus

Advances in cancer nanomedicine have led to the development of several new systemically administered nanoparticles to treat cancer. Their effectiveness, however, is limited owing to physiological barriers posed by the abnormal tumor microenvironment. For example, pegylated liposomal doxorubicin (DOXIL®), approved worldwide for treating breast cancer, and other liposomal formulations, clinically approved or currently in multiple clinical trials, represent nanotherapeutics whose large size (~100 nm) hinders their intratumoral distribution, reducing therapeutic effectiveness. Physiological barriers to nanomedicine delivery impact therapy, particularly for patients with very dense tumors, such as those of pancreatic and breast cancer that are rich in extracellular fibers and stromal cells, particularly cancer associated fibroblasts (CAFs). The dense composition of these tumors generates forces that compress intratumoral blood vessels, reducing tumor blood vessel functionality and thus, the systemic administration of the drug to the tumor site. Inefficient drug delivery in these tumor types explains, in large part, the low survival rates observed. Here, we propose the development of a multifunctional nanoparticle drug delivery system, which will co-deliver an anti-CAF drug aiming to disrupt the structure of the tumor by depleting CAFs and fibers and a chemotherapeutic agent aiming to eradicate cancer cells. This multifunctional drug delivery system will allow targeted administration of both drugs to the tumor site: the anti-CAF drug will improve tumor blood vessel functionality and nanoparticle delivery, while the cytotoxic drug will eradicate cancer cells. This novel nanoparticle formulation is expected to introduce new design considerations for cancer nanomedicines and bring important economic and societal benefits.

3

Development of a novel therapeutic approach for breast cancer based on the nano-formulation of a small molecular inhibitor (SMI) of an anti-apoptotic protein

Christiana Neophytou, Andreas Constantinou

Department of Biological Sciences, University of Cyprus

Synthetic derivatives of Vitamin E have shown promising anti-cancer properties against many types of cancer, including breast and prostate. D-alpha-tocopheryl polyethylene glycol succinate (TPGS) is a vitamin E derivative frequently used as a vehicle for drug delivery systems to enhance drug solubility and increase the oral bioavailability of anti-cancer drugs. We have previously shown that TPGS kills through apoptosis (a form of cellular death) specifically breast cancer cells characterized by very high levels of the protein Survivin, without

harming normal/physiological cells. Specifically, in these experiments, we used SKBR3 (characterized as PR-, ER-, Her2Neu+) and we determined cellular viability (with the MTT assay), cell cycle progression (with flow cytometry analysis) and gene expression (with qPCR and Western Blot). Among many combinations that had been tested, we found that the TPGS-SMI (Small Molecule Inhibitor) combination was the most effective in killing cultured cancer cells (through apoptosis) and decreasing the levels of Survivin-the protein that enables them to multiply and proliferate uncontrollably. Since SKBR3 cells overexpress the Her2neu protein, we propose to synthesize a TPGS-based nanoparticle, perhaps micelle, loaded with the SMI and conjugated with the antibody Herceptin for targeted delivery to the cancer site. Once the nanoparticle is produced by expert subcontractors (or collaborators) we will test its ability to block the development of tumors in mice that had been implanted with Her2neu-overexpressing breast cancer cells. Thus, our outmost goal is to develop a TPGS-based-SMI-loaded nanoparticle carrier for enhanced, targeted, therapeutic effect against an aggressive, but quite common, type of breast cancer.

4

NAT inhibition as a therapeutic strategy in colorectal cancer

Antonis Kirmizis

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Colorectal cancer (CRC) is the third most common cancer and one of the leading causes of death worldwide affecting almost equally women and men. Despite considerable progress in CRC care, the 5-year survival rate is still relatively low especially for patients with metastatic disease (10%). A great challenge to CRC management is the lack of effective anti-cancer agents that target and block specific molecular mechanisms which transform normal colorectal cells to adenocarcinomas. It is therefore urgent to develop more effective targeted treatments against this common disease. Epigenetic alterations are increasingly recognised as a causal mechanism in CRC and because they are reversible, targeting epigenetic regulators is considered a highly promising therapeutic approach. Through our recent work, the epigenetic NAT (Nacetyltransferase) enzyme Naa40 has emerged as a potential therapeutic target since it is frequently upregulated in CRC and its inactivation induces robust cancer cell death as well as prevents tumor growth in animal models. Therefore, in a proof-of-concept project we aim to exploit the therapeutic potential of Naa40 inhibition by developing a lead small molecule compound that blocks Naa40 activity and move this inhibitor towards a commercialisation path. Currently, no such Naa40 blocker exists underscoring the importance of this proof-of-concept project. To achieve the above objective we have joined forces with pharmaceutical chemists to discover the best inhibitor for this NAT enzyme. Accordingly, during this project we plan to evaluate the developed inhibitor through preclinical validation studies, clarify the IP position and consider patenting the discoveries. Overall,

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successful accomplishment of this project will comprise the initial steps for bringing the developed Naa40 inhibitor to a stage where it can be exploited as a marketable product that would eventually benefit CRC patients

5

Prototype Systems of Theranostic Biomarkers for In Vivo Molecular

Management of Cancer

Andreani Odysseos, Costas Pitris

KIOS Research and Innovation Center of Excellence, Dept. of Electrical and Computer Engineering, University of Cyprus / EPOS Iasis Research & Development Ltd

The proposed commercializable product is a set of theranostic (therapeutic+diagnostic) compounds for the diagnosis and therapy of tyrosine kinase related malignancies which include several types of cancer. In the post-genetics personalized medicine era, major issues challenging the successful application of targeted and personalized therapies, in this case related to the tyrosine kinase cellular pathway, include: (i) early detection and intervention at the molecular level and (ii) management of resistance and reconstitution of responsiveness. The presented invention consists of a new method to combine (i) molecules that can be detected via endoscopic, MRI or other imaging techniques (diagnostic beacon) which allow diagnosis and localization of the tumor and (ii) a quinazoline-based tyrosine kinase inhibitor and/or a natural product (therapeutic). These compounds inhibit the cancer progression and promote cell death thus leading to effective therapy. A possible first application could be in the management of Glioblastoma Multiforme (GBM), the most malignant primary brain tumor which, despite being a rare disease, has a grim prognosis with a median survival of 14 months. The GBM market, as a niche, was estimated at \$659 M in 2014, expected to reach \$3.3 B in 2024 with a compound annual growth rate of 17.4%. Even with modest market penetration the application of the proposed product to this rare (orphan) disease can have both a significant impact and a substantial return on investment. In addition, the proposed theranostic system can be applied to other types of cancer, such as colorectal, lung, etc., further expanding its applications and market.

6

AtheroRisk – An Ultrasound Imaging Intelligent System for Stroke Risk

Stratification in Asymptomatic and Low-Risk Symptomatic Patients with

Moderate to Severe Carotid Bifurcation Atherosclerosis

Andrew Nicolaides, Efthymoulos Kyriakou, Christos P. Loizou, Marios S. Pattichis, Constantinos S. Pattichis

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Cyprus Cardiovascular Disease Education and Research Centre, Frederick University

The overall objective of the AtheroRisk product is to develop an integrated intelligent system for the stratification of stroke risk patients combining different clinical and imaging risk factors but based on the morphology and motion characteristics of the ultrasound video images of carotid bifurcation plaques producing moderate to severe stenosis. To achieve this objective we will: (1) Develop an adaptive multi-scale texture analysis system to predict strokes. (2) Develop a video analysis system to differentiate between concordant and discordant plaque motion. (3) Develop multivariate regression analysis and neural-network models that combine predictor variables and texture features for the stratification of stroke risk. (4) Collect data and carry out blind validation and models risk derived from tasks (1)-(3). We expect that our system will be able to identify high risk groups of (a) asymptomatic patients that will contain 90% of strokes that will occur during follow-up and (b) of symptomatic patients that will need urgent operation within 24-48 hours. Identifying symptomatic patients at high risk should spare 75% of patients from unnecessary operations with a saving of 1.5 billion Euro per year in Europe.

7

Real time portable emergency telemedicine system

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Department of Computer Science, University of Cyprus

The provision of effective healthcare support through emergency telemedicine is the major field of interest of this work. Remote health locations such as ships navigating in wide seas, ambulances, rural health centers (RHC) or other remote health locations are common examples of possible emergency sites. In order to support the above different growing application fields we created a combined real-time and store and forward facility that consists of a network of mobile telemedicine units, a coordination central server and doctors' units. This system can be used when handling emergency cases in ambulances, ships, RHC by using a mobile telemedicine unit at the emergency site and a doctor's unit at the hospital-expert's site. The system allows the real time transmission of vital biosignals (3-12 lead ECG, non-invasive blood pressure,

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oxygen saturation (SpO₂), and temperature), scenery video and images of the patient. The transmission is performed over any communication link that supports TCP/IP network protocol such as 4G/3G mobile communications, satellite communications, and cable lines. The availability of prompt and expert medical care can meaningfully improve health care services at understaffed rural or remote areas. In emergency cases where immediate medical treatment is the issue, early and specialized pre-hospital patient management contributes to the survival as well as future well-being of the patients. Additionally transportation of patients from a navigating ship or from a remote location can cost a lot of money, put human lives into danger and sometimes is unnecessary. When using a real time telemedicine system like this, evaluation of the patient and decision for transportation will be more accurate. When using a real time telemedicine system like this, evaluation of the patient and decision for transportation will be more accurate.



“AEROSTATA” Parent Training Program: Parenting Strong Willed Children More Effectively

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Social mission: Strengthening community resilience by increasing protective factors within the family system for the benefit of society as a whole.

The Social Initiative: Empowering parents of younger children with disruptive behaviors to become more effective in their parenting role. Disruptive behaviors are very common among young children and are a risk factor for academic failure, substance abuse, and delinquency. Systematic parent training in the early years is the most effective way to disrupt this negative developmental pathway. Basic Social Product/Service AEROSTATA is a significantly improved product developed at the University of Cyprus (2012) for Greek speaking parents of young children (ages 2-8 years old) with strong willed behaviors. The product is available as a face-to-face service delivered with robust methods over 1+6 weekly, 2-hour sessions by trained professionals to groups of 10-13 parents. It teaches five parenting skills that, when applied systematically, promote a happier family environment and increase resilience against academic failure, substance abuse, and delinquency. The prototype was pilot tested and the improved version (2014) was found empirically validated through randomized clinical trials. It has been market-tested in Cyprus with about 250 parents and is well accepted by consumers, community partners, and sponsors.

Value Proposition: High utility in the daily life of parents and families of young children. High social value Fills a more general gap in Cyprus for systematic and empirically validated parent training programs.

Crisis support. Strengthens protective and resilience factors in the family system that aim to counterbalance the effects of risk factors that have

increased as a result of the financial crisis.

Boosts the local economy by creating new positions for unemployed, young, early-career psychologists and psychology researchers

Twofold purpose / Target Groups: Parents/Children/Families,

Universal/community-wide AND targeted application

Students, new researchers, and early career psychologists Training, mentorship, and supervised vocational experience to develop new skills and become more competitive in the job market.





**RESEARCH
TRACK
ABSTRACTS**
ENERGY &
CLEAN TECH

1

Early Potential Induced Degradation (PID) of Photovoltaic (PV)

Systems in the Field

Michalis Florides, George E. Georghiou

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Photovoltaic (PV) systems are susceptible to different degradation mechanisms which degrade their performance (i.e. power output) over the years. Potential Induced Degradation (PID) is becoming more pronounced in the last few years due to the increased system voltages used in the field. As the name implies, this degradation mechanism is driven by voltage (potential) which develops under the normal operation of the PV system. Since the aluminium frame of PV modules is grounded for safety reasons, half of the modules are under positive voltage bias and the other half are under negative voltage bias. The modules under negative bias are susceptible to PID. One solution is to ground the negative side of the PV string but this is not possible due to the transformer-less inverters used today. Other solutions reported are based on adjusting the material properties of the PV modules. However those are costly and are at the research stage at this point. No method used or at the experimental level has been proven to totally prevent PID. Furthermore, the PV systems voltage is expected to further increase more in order to improve the overall efficiency. This will make PID even worse affecting the reliability of the system. PID can progress fast decreasing the output power production of a PV system. If it goes unnoticed, energy and hence revenue will be lost. Our work targets early PID detection in the field minimizing power and revenue loss.

2

Advanced Failure Detection Algorithms and Performance Decision

Classification for Grid-Connected PV Systems

Andreas Livera, Alexander Phinikarides, George Makrides, George E. Georghiou

FOSS Research Center for Sustainable Energy, Dept. of Electrical and Computer Engineering, University of Cyprus

A major part of current research activities in the photovoltaics (PV) field focuses on the reliability of the installations and the guaranteed lifetime output. In this domain, the accurate identification of failures in grid-connected PV systems is crucial for their further penetration in the energy mix. Failures can occur during the operational lifetime of a PV system due to different factors (such as inverter shutdown, partial shading, string defect and bypass diode fault) and such failures decrease the output power of the PV system.

In this perspective, the implementation of fault analysis tools is essential to ensure the reliability and optimal performance of PV systems by quickly

identifying and accurately quantifying the factors behind the various failure mechanisms. The ability to detect and diagnose potential failures at an early stage or before occurrence is also crucial to reduce costs associated with operation and maintenance (O&M) and system downtime.

The scope of this work is to propose a methodology for the development of failure detection routines (FDRs) that will operate on acquired data sets of grid-connected PV systems and determine accurately the exhibited failures. Currently, FDRs have been developed and benchmarked on a test PV system installed at the University of Cyprus (UCY). The developed routines have shown high accuracy of fault detection upon their occurrence and high classification accuracy.

It is anticipated that this tool will be integrated into PV monitoring systems and become a standard for the automated surveillance of grid-connected PV systems. With its integration, operators can take corrective actions, minimize the power losses caused by these failures and improve the performance and reliability of their system.

3

Dynamic imaging of reservoirs during Enhanced Oil Recovery operations

Theodossis Trypiniotis

Department of Physics, University of Cyprus

In a world where oil majors struggle to secure new oil reserves, they readily turn to their existing fields in which the oil recovery factor is between 20-40%. Using Enhanced Oil Recovery (EOR) techniques can increase recovery to 50-70% level and the industry is embracing such techniques at a very fast pace in the last few years creating a need of ever more sophisticated tools to monitor and optimise such operations.

The project involves the development of magnetic nano-agents for applications during EOR. In an EOR process, operators usually inject various fluids (gas, chemicals, seawater) at high pressure in an effort to increase the amount of oil extracted from a reservoir. Monitoring the various fluid streams in the reservoir is crucial for optimising the process and quickly identifying and reacting to possible complications during production.

Our novel approach involves the use of magnetic nano-agents that are injected into reservoirs with other fluids. By precisely tuning the magnetic properties of the nano-agent so that it has a specific response to electromagnetic (EM) waves, it can act as a contrast enhancer for EM surveys. Surveys can be repeated as necessary providing a means to monitor the progression of injected fluids over time. The nano-agent consists of nanometer sized particles of one or more magnetic materials allowing wide tunability to their EM response. The technology provides a platform for other applications. We envisage variations of the technique to work during fracking operations and as an anti-counterfeiting measure for oil or other valuable goods.

4

"A Novel, Clean and Green Catalytic Technology to Eliminate NOx Emissions Emissions under Strongly Oxidizing Conditions Using Hydrogen (H2-SCR)"

Angelos M. Efstathiou

Department of Chemistry, University of Cyprus

The University of Cyprus (UOC) is highly interested to explore the capabilities of applying the newly developed novel NOx control green catalytic technology for the selective reduction of NOx present in stationary and mobile NOx polluting sources into N2 and H2O using hydrogen as reducing agent and at low temperatures (T<200oC). NOx Polluting Sources where H2-SCR can be implemented:

Industrial Units (e.g., Furnaces, Boilers, Nitric Acid Production Units, Incinerators, Power Plants)

Boilers for Central Heating

Diesel engines, H2 Internal Combustion Engines, High-T Fuel Cells

Patent: A.M. Efstathiou, P.G. Savva, C.N. Costa, "Catalyst Containing Platinum and Palladium for the Selective Reduction of NOx with Hydrogen (H2-SCR)", US 8,114,369 B2 (2012).

Expected Sales Volume of H2-SCR Technology

• Industrial Units where H2 is available on site:

Example: Olefin and Hydrogen Production Plants

This case is very attractive, where NH3-SCR is the current technology but which presents several problems and disadvantages compared to low-temperature H2-SCR.

It is estimated that over 800 furnaces are used in olefin plants worldwide. On the average, a de-NOx unit in these furnaces installed will require 4-6 m3 of catalyst with an expected life-time of 2 years (after that, the catalyst must be replaced). The sales price from the de-NOx catalyst is expected to be 0.1-0.15 MEuros per m3. Thus, it is expected that between 300 and 700 MEuros would be the sales volume of such de-NOx catalysts for just the olefin production industry worldwide.

A person is shown from a top-down perspective, wearing a white shirt. They are holding a tablet in their right hand and have a laptop open in front of them. The entire scene is overlaid with a semi-transparent blue filter. A white rectangular frame is centered over the person's torso, containing the text.

**RESEARCH
TRACK
ABSTRACTS**
IT, COMMUNICATIONS
& DEVICES

IT, COMMUNICATIONS AND DEVICES

1

Mids: a lightweight intrusion detection system for wireless sensor networks and the internet of things

Christiana Ioannou, Vasos Vassiliou

Department of Computer Science, University of Cyprus

Internet of Things is the term that is being used to identify "smart" devices (examples: home appliances and medical equipment) that are connecting to the Internet to provide consumers and businesses with more control, convenience, speed, accuracy, and savings.

As a key component in information technology security, Intrusion Detection Systems (IDS) monitor networks for suspicious activity or violations of policies. IDS has been a mainstay in cybersecurity for years. Now, however, with the arrival of the Internet of Things (IoT) revolution and the need to protect all these diverse "connected" devices, IDS with its signature-based approach is not sufficient for addressing the new and growing security issues that come with the proliferation of "smart stuff."

We have created a novel framework for Intrusion Detection Systems (IDSs) for wireless sensor networks and the Internet of Things and developed a tool for easy integration of such system in commonly-used IoT/WSN platforms and related operating systems.

The current research proposes an IDS that can detect unknown attacks using a lightweight anomaly detection mechanism based on statistical analysis. The proposed mIDS solution fits precisely into the new IoT security product category that Gartner recently created and calls: "Real-Time Discovery, Visibility, and Threat Detection".

2

AdaM: an Adaptive Monitoring Framework for the Internet of Things

Demetris Trihinas, George Pallis, Marios D. Dikaiakos

Department of Computer Science, University of Cyprus

Recent advancements in microelectronics and data mining have made the Internet of Things (IoT) a reality opening up new and disruptive opportunities for innovators to develop offerings capable of producing vast and analytic insights. However, to produce such an unprecedented wealth of insights intense processing and constant data dissemination over the network is still required. This results in increased energy consumption for IoT devices while cloud services consuming IoT data are constantly overwhelmed and are struggling to be effective.

AdaM is a lightweight framework embeddable in the software core of IoT devices (e.g., raspberry pi's, android devices), and monitoring tools in general, that addresses these challenges by dynamically adjusting the monitoring intensity and the amount of data disseminated through the network. This significantly reduces energy consumption on IoT devices while

IT, COMMUNICATIONS AND DEVICES

also reducing the amount of data flooding IoT services in the cloud. To achieve this, AdaM incorporates low-cost approximate and probabilistic learning algorithms for metric sampling and filtering that capture runtime knowledge from the monitoring metric stream evolution, trend and variability, adjusting the metric collection and dissemination rate of the IoT device based on the confidence of each algorithmic model to correctly estimate what will happen next in the monitoring metric stream. After testing AdaM with real-world data from cloud applications, wearables and intelligent transportation services, results show that AdaM is able to reduce energy consumption by at least 83%, data volume by 71%, shift detection delays by 61% while maintaining accuracy above 91% in comparison to other IoT frameworks.

3

Motus Sense

Haris Zacharatos, Yiorgos Chrysanthou

Department of Computer Science, University of Cyprus

Affective Computing is the branch of Artificial Intelligence which focuses on the development of systems and devices to recognize, interpret and manage human emotions like anger, contempt, disgust, fear, joy, sadness and surprise. Motus Sense is a human data analytics platform that uses artificial intelligence (AI), mobile, wearables and the Internet of Things (IoT) to reveal deep insights about people -how they feel, think, behave-and engage brands. Understanding people is the key to marketing, sales and customer service but today's tools are limited in their insights. Our human-driven data and emotion analytics help you understand and anticipate people's needs, which will enable the delivery of highly targeted content. We use a SaaS model for emotion identification, so businesses as well as researchers can use emotion recognition with ease. We provide a multi-modal emotion recognition system covering recognition from face, body, voice, heart rate and text, which is powered by our scientific research results. We are constantly developing the Artificial intelligence models that are the backbone of Motus sense in order to increase the emotion recognition rates.

4

Hybrid MEMS microfluidic gyroscope

Charalambos Andreou, Marios Sophocleous, Julius Georgiou

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The invention is a novel, hybrid MEMS microfluidic gyroscope (US patent approved, EU patent pending). The gyroscope mimics the operation of the natural vestibular semicircular canal. It has been fabricated in a commercially available MEMS process, which allows for microfluidic channels to be implemented in etched glass layers, which sandwich a bulk-micro machined silicon substrate, containing the sensing structures. Two similar versions (membrane-based & cantilever-based) of the gyroscope were designed in

the laboratory using a MEMS specialized software (CoventorWare). Both versions were tested using a Tes-3T Motion Dynamic rate table in the laboratory. The rotational acceleration applied is directly proportional to the deflection of the membrane/cantilevers, which is sensed by piezoresistors. The specifications of this gyroscope enable its use in low-power applications with continuous operation such as smartphones, virtual reality goggles and vestibular implants. Although the gyroscope is ideal for these applications, its use can be expanded to all other applications. The general gyroscope market is expected to reach \$3.50 Billion by 2022 (marketsandmarkets) whilst virtual reality goggles revenues will go up to \$7.17 billion by the end of 2017 and \$75 billion by 2021 according to Greenlight Insights. Smartphones Market is projected to be 2.2 billion units by 2020 (Global Industry Analysts, Inc.). Therefore, entering such a vast market with a radically new device at low cost, has the potential to provide substantial amount of profit in a short period of time.

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Operational Intelligence of Machine-to-Machine Simultaneous

Control and Communication

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The invention generally relates to coding of information signals in existing commercial controllers that are currently applied to control dynamical systems.

Traditionally, commercial controllers are not designed to code information and signal or communicate information to other processors attached to the control system. In this invention, the mathematical models of control systems are used as channels to secretly communicate or signal encoded information to other processes connected to control systems, such as field devices, outputs, other controllers or processors, etc. The invention further relates to:

- (i) controller design in control systems, with a dual role, to simultaneously control and encode information,
- (ii) achieve optimal performance with respect to control objectives,
- (iii) encode information and transfer, communicate or signal the information through the control system, and
- (iv) decode the information at outputs of control systems, with arbitrary small error probability.

The invention facilitates signaling of information from one processor of a control system to another processor, through the control system (which is the medium of communication), without any need to introduce external infrastructure, such as wireless and wired technologies, to communicate such information. A dynamical control system is any system with control inputs and controlled outputs, such as, biological system models, surveillance systems, financial instruments (i.e., portfolio selection), robotic systems, compute

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based control models, military machines, communication channels (i.e., wired or wireless), and in general, any system in which control is applied to achieve a desired performance. The invention is directly applicable to existing commercial controllers, such as, programmable logic controllers, PID controllers, etc., by modifying their operation to include another signal, the encoded signal that carries information messages, to be communicated through the control system to another processor attached to it.

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3D Motion Search Engine

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We have devised algorithms for analyzing the similarity of digitized 3D motions (i.e. walking, dancing, etc.) based on their style. These algorithms are the foundation for developing a commercial 3D Motion Search Engine (3DMSE), which does not currently exist.

A 3DMSE cannot be build based purely on the concept of using keywords, as the data are too complex to describe verbally. The idea is to provide a specialized 3D motion search-by-example, similar to how Google Images enables searching using an image as the input query. The 3DMSE can be provided as an online service over the web, but more importantly it can be built into or as an add-on to existing software. A 3DMSE would be transformational for the entertainment industries, since they heavily rely on motions to animate 3D characters in feature films and video games.

The search engine can also play a key role for other content developers of 3D multimedia applications aimed at education, patient rehabilitation and sports. Moreover, 3D motion search can be instrumental for advancing humanoid robotics, since it can be used to rapidly assess perceived human motions and react accordingly, or use search results to synthesize human motions. These targeted customer segments are consistently record-breaking in their spending on 3D technologies and thus such a product could yield a significant return on investment. Thus the most obvious approach for commercializing the 3DMSE would be to directly market it to high value business customers.

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ProximAid

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ProximAid is a mobile phone application which allows nearby devices to interconnect without the use of an existing telecommunication or Internet network. ProximAid aims to provide help to people who need help during a mass emergency incident, for example during an earthquake, telecommunication towers of an area it might get out of service. In this scenario, affected peoples will not be able to communicate with first responders in order to have the necessary help. ProximAid will allow life-saving synergies to communicate with affected peoples in order to locate and provide help to them. In addition, ProximAid can be used for entertainment reasons as well, for example gives the opportunity to a team of walkers to communicate even in a forest or a mountain where the telecommunication network is not very stable in some cases. The application is taking advantage of existing features of mobile devices, such as Wi-Fi Direct, and builds a local network using the involved nearby mobile devices and allows them to exchange data such as text and multimedia. ProximAid makes use of smart techniques in order to save battery consumption during the use of the application. ProximAid can be extended in order to be used for encrypted data exchange between nearby phones and to provide security in a building by recording sound and capturing images under certain circumstances.

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MANDOLA - Monitoring and Detecting OnLine Hate Speech

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The massive adoption of mobile devices that offer Internet connectivity, geo-location capabilities, and continuous access to online social networking services (OSNs) has enabled users to contribute content to OSNs on a continuous basis, from different locations and at different times of the day. In this context, a challenge is to develop tools that would allow individual users, academics, social scientists and policy makers to actively observe, report, collect, analyze sentiments and emotions. New platforms should be developed that will aggregate and analyze social data streams across multiple facets, such as time, location, people, content, network, and sentiment. MANDOLA is a real-time scalable, big-data platform for sentiment analysis of social data streams. MANDOLA takes advantage of data streams from social media like Twitter and other sources (e.g. comment section of news sites), and uses natural language processing, text analysis and machine learning to identify,

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extract, quantify, and study affective states and subjective information. MANDOLA has been configured and used to monitor the spread and penetration of online hate-related speech using a big-data approach, and present this information through the MANDOLA visualization dashboard. In addition to the big-data platform, MANDOLA comprises a novel mobile application running on major mobile platforms, which allows end-users to report anonymously and with a few clicks, any hate-related speech encountered on different mobile sites or mobile apps, via a unified, simple, user-friendly interface.

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UNICORN: A Novel Framework for Multi-cloud Services Development, Orchestration, Deployment and Continuous Management Fostering Cloud Technologies Uptake from Digital SMEs and Startups

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Over the past years, the worldwide cloud market has evolved, with growth projections exceeding \$247 billion. Additionally, DevOps, became the leading software engineering trend among SMEs, shifting from traditional, large-scale delivery models to an agile mindset, enabled by better integrating development and operations teams and employing more automated processes. Moreover, SMEs & start-ups are adopting the Microservice architectural paradigm allowing them to break 'monolithic' applications into smaller services. Albeit DevOps and Microservice adoption is spreading, there are still many challenges that need to be overcome such as vendor lock-in, orchestration and management of multi-cloud application deployments, effective management and projection of cost budgets of deployed services and tackling security issues and data privacy constraints and restrictions. Towards this end, the Unicorn Project will develop the novel DevOps-as-a-Service Unicorn framework. Unicorn aims to simplify the development, deployment and management of secure and elastic by design, multi-cloud services by developing a three-layered platform consisting of the Unicorn IDE built on top of the popular cloud IDE, Eclipse Che, that will allow members of the DevOps team to provide security and privacy enforcement mechanisms and restrictions, monitoring metric collection and resource management across multiple cloud sites, by using source code annotations provided by a set of design libraries. At the second layer, Unicorn Smart Orchestrator, is responsible to perform validation and enforce policies during the application's lifetime. Finally, the Multi-Cloud Execution Environment is comprised of the processing, storage and communication offerings allocated for the smooth execution of, deployed through the Unicorn platform, applications.

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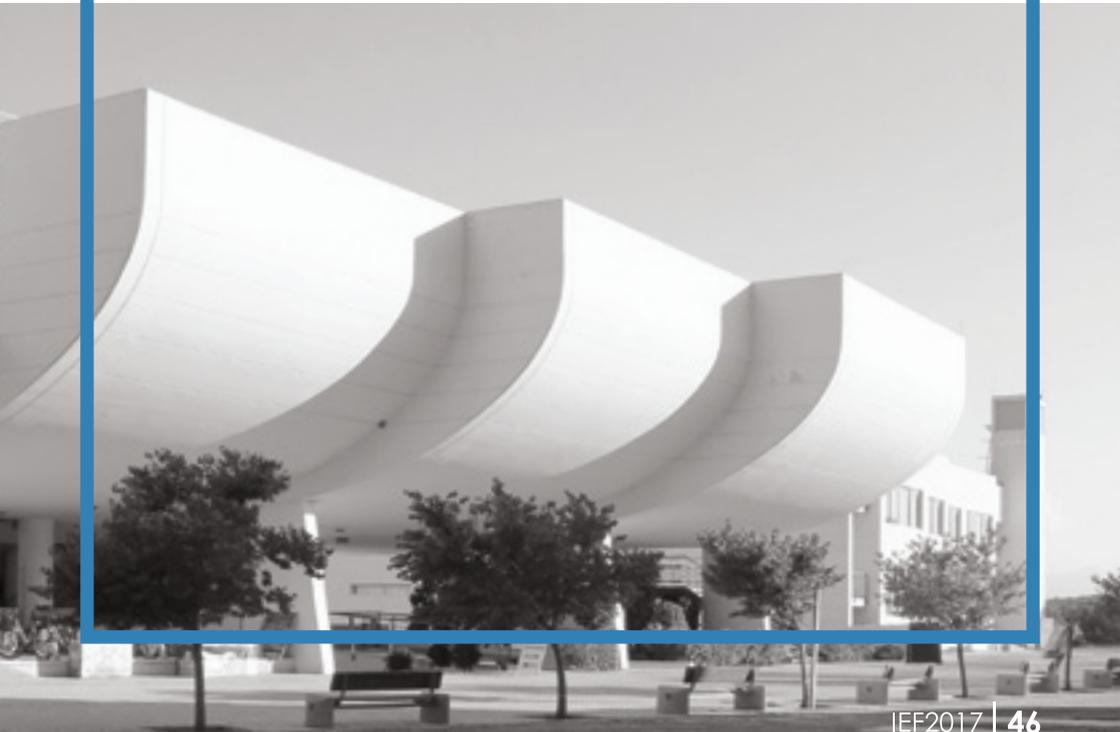
Algorithms/ software for simulations and data science

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Development of scalable algorithms and data analytics for various applications that include Climate modeling, turbulence, health analytics, design of chemical processes. The group has also contributed to the development to scalable algorithms for linear solvers including contributing to the open NVIDIA source QUDA. Multigrid and asynchronous solvers are being investigated.

These activities take place at the Physics Department of the University of Cyprus and CaSToRC of the Cyprus Institute with Assist. Profs G. Koutsou, T. Christoudias and Yuri Suleymanov.



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