

# 4th Innovation & Entrepreneurship Forum:

4th Industrial Revolution  
Technology and Society

19.04

IEF 2019



University  
of Cyprus





Centre for Entrepreneurship, University of Cyprus  
1 University Avenue  
2109, Nicosia  
Cyprus  
[www.c4e.org.cy](http://www.c4e.org.cy)

This book was prepared by the **Centre for Entrepreneurship of the University of Cyprus**.  
**Editorial Team:** Marios D. Dikaiiakos, Theodosios Trypiniotis, Pantelitsa Eteokleous,  
Ioanna Tsioutsioumi, Anastasia Constantinou

This work is produced by a collection of material from various participants at the 4th Innovation and Entrepreneurship Forum: 4th Industrial Revolution Technology and Society 2019. Any arguments, findings, conclusions expressed in this booklet do not necessarily reflect the views of the Centre for Entrepreneurship, nor do they guarantee the accuracy of data and information provided by the included work.

#### Copyright

This book may not be reproduced or published without the express prior permission of the Centre for Entrepreneurship, University of Cyprus. Authors of abstracts retain their own copyrights.

#### Attribution

Please cite the work as follows: Dikaiiakos, M.D., Trypiniotis, T., Eteokleous, P., Tsioutsioumi, I., Constantinou, A. Proceedings of the 4th Innovation and Entrepreneurship Forum, C4E Report Series, C4E-Rep-2019-01 (Published by the University of Cyprus, Nicosia, 2019).

#### Third-party Content

The Centre for Entrepreneurship does not necessarily own each component of the content of this work. The Center therefore does not warrant that the use of any third-party-owned component (e.g., tables, figures or images) or part contained in the work, will not infringe upon their rights. The re-use of a component within this booklet, is the sole responsibility of the person using it who has to decide on whether permission is needed from the copyright owner.

ISBN 978-9925-553-24-2 \* Copyright © 2019, University of Cyprus.

## TABLE OF CONTENTS

**04** FOREWORD

**05** UCY RECTOR'S MESSAGE

**07** ABOUT THE ORGANISER

**08** IEF 2019 ORGANISING COMMITTEE

**09** PARTNERS

**10** AGENDA

**11** SPEAKER

**12** THE INNOVATION TRACK ABSTRACTS

**32** AWARDS

**36** ACKNOWLEDGMENTS

## FOREWORD

It is with a great pleasure that we present this volume with the proceedings of the 4th Innovation and Entrepreneurship Forum, which took place at the University of Cyprus in Nicosia, on the 19th of April 2019.

The Forum coincided with the last day of classes for the academic year 2018 - 2019, with our students expecting with anticipation their graduation ceremony in June. Our young graduates are getting ready to embark on a challenging and exciting journey, pursuing advanced studies or seeking fulfilling careers in an environment that is increasingly uncertain, both globally and locally. There is an ongoing discussion in the media and politics this period, regarding the employability of young University graduates in Cyprus. "Can they find jobs that are 'relevant' to their education," they ask? One could add more perspective into this question, and ask as well: "to what extent jobs deemed relevant to today's education, will still exist tomorrow?" The answer is uncertain at best, if not negative, due to the impact of automation, of the rapid pace of scientific and technological progress, of globalization, and climate change.

The graduating class of 2019 will still be in the "job market" in 2050. So, how do we prepare, them and the classes that come after them, for jobs not yet invented? One approach, when you cannot predict the future, is to be prepared to face it and to shape it. To identify opportunities as they emerge and be ready to seize them. This is not easy! One thing is sure though: without solid knowledge, ingenuity, comfort in bold experimentation and risk-taking, an ability to establish collaboration and understand who to trust, without a deep understanding of human needs, you are doomed to fail.

The Innovation & Entrepreneurship Forum aspires to provide members of the University of Cyprus community - particularly young researchers and students - with a venue for presenting, competing, and discussing ideas and inventions that come out of their studies and their work, and that could possibly shape a future, in Cyprus and beyond. We wish to showcase

activities, celebrate achievements, give critical feedback, share ideas, nurture connections. Doing this in the confines of our community would not be enough. We need to establish and maintain bridges with economic and social stakeholders: the market and the society - they can help us better understand their needs, and we can help them translate our knowledge and ideas into impact with a tangible benefit for the local economy and society.

Therefore, we were delighted and indebted to receive the support in this effort from key stakeholders coming from the private sector and the government. We would like to thank, in particular, PwC Cyprus, who was our partner and sponsor in organizing the Forum for the fourth year, and a continuous supporter of various training and other activities of the Centre for Entrepreneurship. Thanks to the Enterprise Europe Network for sponsoring the Innovation Track; to the European Office of Cyprus, the Hellenic Bank, the IDEA Accelerator of the Bank of Cyprus for helping with the organization effort and the evaluation of teams. Thanks to Digital Tree and Aegean Airlines for providing student awards. We are also indebted to all the colleagues - academic, administrative and student volunteers - who made this event possible through their hard work and unwavering commitment.

Our sincere thanks go also to our panelists, judges, evaluators, presenters and participants to the Forum, and to our Distinguished Speaker, Dr Harry Anthony Patrinos of the World Bank, who came from Washington DC to deliver the PwC Distinguished Lecture today, on "The Future of Automation and its Implications for Educational Systems," a topic that is important and timely.

We hope that the Forum will bring a small but lasting impact in promoting the spirit of innovation and entrepreneurship in Cyprus.

**Professor Marios D. Dikaikiotis**  
General Chair of IEF2019

## UCY RECTOR'S MESSAGE

It is pleasure to welcome you at the **4th Innovation and Entrepreneurship Forum - IEF 2019; 4th Industrial Revolution: Technology and Society**, organized by the Centre for Entrepreneurship of the University of Cyprus (C4E) with the support of PwC Cyprus and in co-operations with the following research Centers and Organisations:

- KIOS Research and Innovation Center of Excellence
- RISE | Research centre on Interactive media, Smart systems and Emerging technologies
- FOSS Research Centre for Sustainable Energy
- Nireas International Water Research Center
- Oceanography Centre
- EMPHASIS Research Centre
- Enterprise Europe Network
- European Office of Cyprus

The 4th Forum will highlight research results with a potential for market exploitation and/or societal impact and celebrate entrepreneurial success, by honoring individuals or teams - members of the University of Cyprus extended community that demonstrate success in innovative entrepreneurship in Cyprus or abroad.

It is expected to bring together multidisciplinary knowledge from researchers, professionals, industry and business leaders and successful entrepreneurs seeking for potential research, economic and technological synergies.

The 4th Forum Innovation Track will point out recent research results and ideas with a strong market or societal potential impact that can be materialised through novel products, processes or services delivered by new or existing ventures, private or public organisations, governmental institutions or non-governmental initiatives. The Innovation Track exhibition is divided in the following sectors: **Smart Infrastructure, Health Sciences, Energy & Clean Tech and IT, Communications & Devices.**

Moreover in this year's Forum, we are turning the spotlight and to the student community by accommodating the **2nd Student Innovators** competition at the core of the program of the 4th Innovation and Entrepreneurship Forum. In the Student Innovators competition, teams and individuals present early stage innovative business ideas developed through various University courses in innovation, entrepreneurship. For the Student Innovators Competition (Sinn2019), 23 applications were submitted by teams and individuals of which 10 are invited to present their ideas to the final competition today after the **The PwC Distinguished Lecture - The Future of Automation and its Implications for Educational Systems**, by our prominent invited speaker Mr. Harry Antony Patrinos.

This year we are also hosting the **Business Pitch Session**, an experimental session aspiring to stimulate collaborations, effectively link the research community with the business world and encourage the resolution and study of real world problems by researchers, research teams and students of the University of Cyprus.

I would like to extend our gratitude to the major sponsor, contributor and strategic partner of the Centre for Entrepreneurship and University of Cyprus **PwC Cyprus**.

Innovation and entrepreneurship are key priorities of the University of Cyprus and at the same time prime movers of achieving economic growth. The development of innovative research and entrepreneurial activity based on technology and innovation will contribute significantly to the creation of new jobs and new ideas for economic growth, enhancing the competitiveness of the Cypriot economy.

Thank you for joining us at the 2019 Innovation & Entrepreneurship Forum. We hope you find this event beneficial, stimulating and productive.

**Professor Tasos Christofides**  
Rector, University of Cyprus



## ABOUT THE ORGANISER

### 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 marketplaces 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 makerspaces.

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.

# IEF 2019 ORGANISING COMMITTEE

# PARTNERS

## GENERAL CHAIR

- **Marios Dikaiakos**, C4E Director

## UCY ENTREPRENEUR AWARD CHAIR

- **Yiorgos Chrysanthou**, Entrepreneurship Council Chair

## INNOVATION TRACK CHAIRS

- **Theodosis Trypiniotis**, Entrepreneurship Council
- **Anastasia Constantinou**, Innovation Management Unit Head

## BUSINESS PITCH TRACK CHAIR

- **Elena Tanou**, Entrepreneurship Council

## FINANCE CHAIR

- **Pantelitsa Eteokleous**, C4E

## PUBLICITY CHAIR

- **Ioanna Tsioutsiumi**, C4E

## SINN COMPETITION CHAIR

- **Alexia Panayiotou**, Entrepreneurship Council

## MEMBERS

- **Anixi Antonakoudi**, KIOS Research and Innovation Center of Excellence
- **Charalambos Anastassiou**, FOSS Research Centre for Sustainable Energy
- **Symeon Christodoulou**, Entrepreneurship Council - NIREAS International Water Research Center
- **Elpida Christou**, European Office Cyprus
- **Daina Nicolaou**, Department of Business and Public Administration
- **Panos Markopoulos**, Entrepreneurship Council
- **Stavros Iezekiel**, EMPHASIS Research Centre
- **Yianna Samuel-Rhoads**, Oceanography Centre
- **Elena Zomeni**, European Office Cyprus
- **Ariana Polyviou**, C4E

## WEBSITE

- **Andreas C. Andreou**, University of Cyprus

## ORGANISER



## MAJOR SPONSOR



## CO-ORGANISERS



## OTHER SPONSORS AND SUPPORTERS



## DIGITAL MEDIA SPONSOR



DIGITAL TREE

## AGENDA

LOCATION: UNIVERSITY OF CYPRUS

A. G. LEVENTIS COUNCIL  
& SENATE BUILDING

TIME	SESSION
	Registration
09:15-10:00	<b>The Innovation Track</b> The research exhibition will be open to the public until 3:00 PM
10:00-10:25	<b>Opening Remarks</b> Prof. Marios Dikaiakos - Director of C4E <b>Welcoming Address</b> by Prof. Tasos Christofides, Rector of the University of Cyprus
10:30-11:15	<b>PwC Annual Lecture in Innovation and Entrepreneurship, Introduction by Evgenios C. Evgeniou - CEO PwC Cyprus</b>  « <b>The Future of Automation and its Implications for Educational Systems</b> » <b>Speaker: Dr. Harry Patrinos - World Bank, Washington DC, USA</b>  Q&A Session
<b>PARALLEL SESSIONS</b>	
11:30-12:30	<b>The “Business Pitch” Session</b>
11:30-12:30	<b>SINN 2019</b> Student Innovators 2019 competition
13:00-14:30	<b>The Innovation Track</b> Networking Lunch
14:30-15:00	<b>Awards Ceremony</b> - UCY Entrepreneur Award - Best Poster/Demo Awards - SINN Competition Awards

## PWC DISTINGUISHED SPEAKER



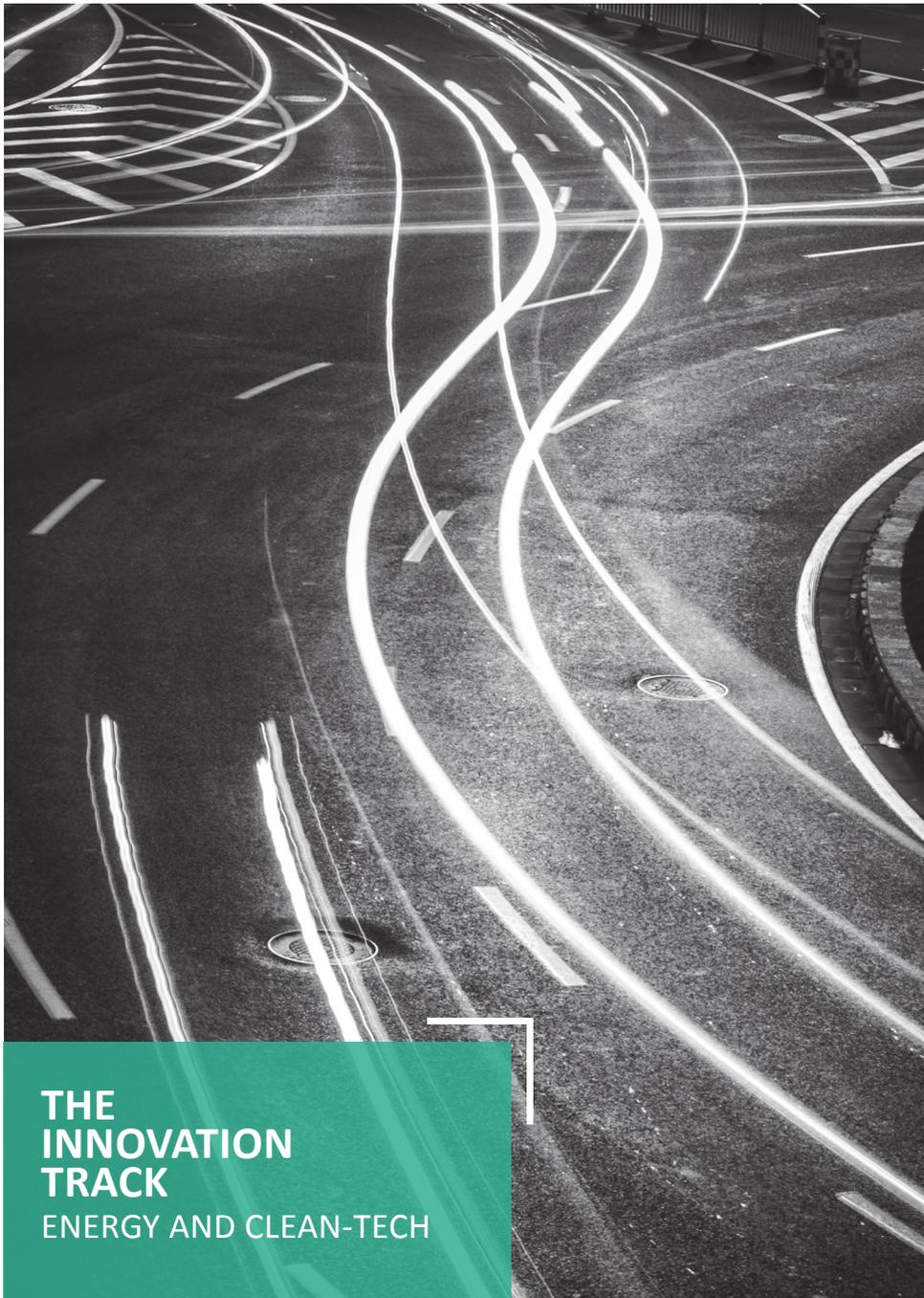
### The Future of Automation and its Implications for Educational Systems

The threat of automation implies a race between education and technology. In most countries, education systems are not providing workers with the skills necessary to compete in today's job markets. The growing mismatch between skills demand and supply holds back economic growth and undermines opportunities. At the same time, the returns to human capital are high in most countries, and a growing skills premium is evident in much of the world. Automation simultaneously results in deskilling and imposes a need for new skills, and is changing what education will need to look like in the future.

### Harry Anthony Patrinos - World Bank, Washington DC, USA

Harry Anthony Patrinos is the Practice Manager for the Europe and Central Asia

region of the World Bank's education global practice. He specializes in all areas of education, especially school-based management, demand-side financing and public-private partnerships. He managed education lending operations and analytical work programs in Argentina, Colombia and Mexico, as well as a regional research project on the socioeconomic status of Latin America's Indigenous Peoples, published as Indigenous Peoples, Poverty and Human Development in Latin America (Palgrave Macmillan, 2006). He is one of the main authors of the report, Lifelong Learning in the Global Knowledge Economy (World Bank, 2003). Mr. Patrinos has many publications in the academic and policy literature, with more than 40 journal articles. He is co-author of the books: Policy Analysis of Child Labor: A Comparative Study (St. Martin's, 1999), Decentralization of Education: Demand-Side Financing (World Bank, 1997), and Indigenous People and Poverty in Latin America: An Empirical Analysis with George Psacharopoulos (World Bank/ Ashgate, 1994). He has also worked in Africa, Asia, Europe, the Middle East and North America. He previously worked as an economist at the Economic Council of Canada. Mr. Patrinos received a doctorate from the University of Sussex.



## THE INNOVATION TRACK

### ENERGY AND CLEAN-TECH

## ENERGY AND CLEAN-TECH

### 1. **CONDITION MONITORING PLATFORM WITH DATA ANALYTIC FUNCTIONALITIES FOR ENHANCED PERFORMANCE OF PHOTOVOLTAIC (PV) SYSTEMS**

**George E. Georghiou, Andreas Livera**

*Photovoltaic Technology Laboratory, FOSS Research Centre for Sustainable Energy, Department of Electrical and Computer Engineering, University of Cyprus*

A key factor for the future of photovoltaic (PV) uptake and the PV value chain is the reduction of the Levelized Cost of Electricity (LCoE). This can be achieved by increasing the lifetime performance and reducing the operating costs through condition monitoring, safeguarding guarantees and cost-effective operation and maintenance (O&M).

Monitoring systems can improve the reliability and service performance of PV, provided that specific features based on data analytics are included. Those features are system health state monitors offering real-time operating state information, failure diagnosis for the detection and classification of faults, degradation rate (DR) estimation and other added value services such as capacity testing and forecasting. By integrating these functions into the monitoring system, optimal levels of PV performance are maintained and economic losses due to operational problems and downtime are reduced to a minimum. Indicatively, even a 1% global PV installation energy yield improvement (by reducing outages, soiling and acting fast when detecting failures) provides around 500 MEuros increased revenue per year.

### 2. **EARLY DETECTION OF POWER LOSS DUE TO POTENTIAL INDUCED DEGRADATION (PID) IN PHOTOVOLTAIC (PV) SYSTEM**

**George E. Georghiou, Michalis Florides**

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

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. As the name implies, this degradation mechanism is driven by voltage (potential) which develops under the normal operation of the PV system. There are no proven ways

to totally prevent PID although several manufacturers claim to produce PID-resistant PV modules, scientific studies on various modules demonstrated that more than 67% of them are prone to 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. In the field, PID can remain unnoticed for a long time and it is investigated only after significant power loss (typically 5%). Our work targets early PID detection in the field minimizing power and revenue loss. A low cost sensor, which will be installed on selected PV modules within a PV system, will be developed for the early detection of PID without the need to remove the modules for indoor testing.

## ENERGY AND CLEAN-TECH

### 3. REAL-TIME MONITORING OF RESERVOIRS DURING EOR OPERATIONS

**Theodosios Trypiniotis, Thanos Mitrelias, Constantinos Nicolaides, Angeliki Agorou**

*Dept. of Physics, EMPHASIS Research Centre, University of Cyprus, Cambridge Biomagnetics Ltd; Thin Film Magnetism, Cavendish Laboratory, University of Cambridge*

Enhanced Oil Recovery (EOR) techniques are embraced ever more frequently by the Oil & Gas industry because they can help increase the recovery factor of oil in a developed reservoir to an average 50-70% level. The more frequent deployment of EOR creates a need of ever more sophisticated tools to monitor and optimise such operations. This project involves the development of “smart tracers” for applications during EOR. In an EOR process, operators usually inject various fluids (gas, chemicals, seawater) in an effort to increase the amount of oil extracted from a reservoir. The overall process can be extremely

costly, especially in offshore operations, and 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 approach involves the use of nanomaterials that are injected into reservoirs. By precisely tuning their properties (e.g. magnetic, chemical etc.) they can act as markers of the expensive injected fluids enabling operators to visualise fluid flow pathways and monitor progression. Collecting such information about EOR operations in a dynamic manner, can potentially enable substantial enhancement of the incremental oil volumes produced. 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. For the latter applications, the properties of the “smart tracers” can be engineered so that they can be used as distinct tags that have unique codes to mark the goods.

### 4. VIRIDOM-INTELLIGENT ENERGY

**Vasos Vassiliou, Zinon Zinonos**

*Dept. of Computer Science, University of Cyprus & RISE Research Center on Interactive Multimedia, Smart Systems and Emerging Technologies Dept. of Computer Science, Neapolis University of Paphos*

The work submitted for consideration is in the area of CleanTech. The Internet of Things evolution makes homes smarter with the support of connected devices. At the same time, renewable energy sources, electric vehicles, and energy storage are technologies that are already present in the home and they are growing exponentially. All these changes put

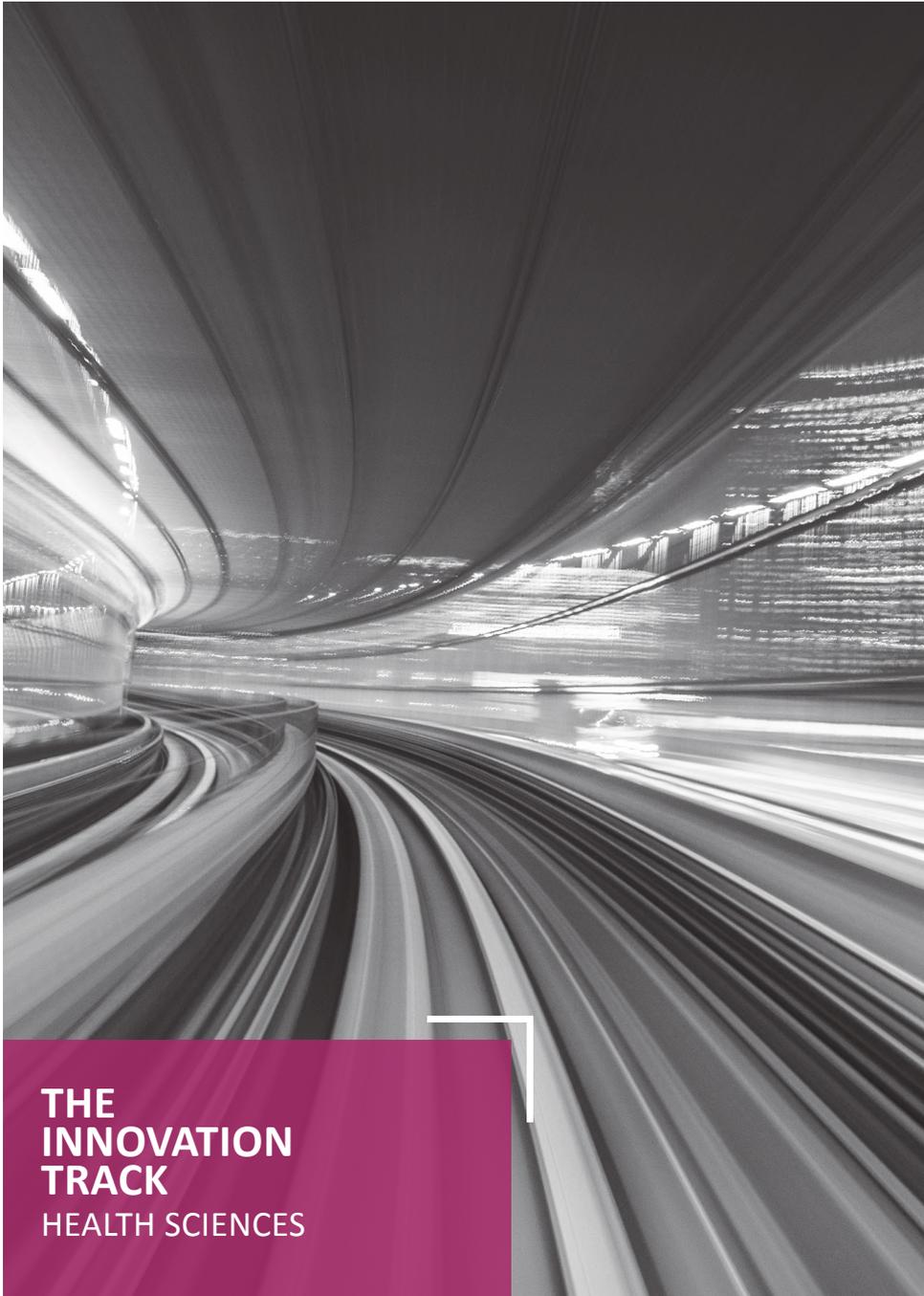
significant pressure on energy utilities, home/building energy management companies, and energy service companies to offer better services. Their competition is huge and many are not agile enough, or do not have the expertise, to adapt to these complex conditions, something that affects their revenues. We address the issue of energy-data analytics and decision support services for energy companies. At the same time, there is an increasing demand from homeowners for simple solutions that exploit all these technological advancements in order to reduce their costs and increase their comfort. We also address the lack of solutions that would enable residents to participate easily in the process of

## ENERGY AND CLEAN-TECH

saving energy. VIRIDOM is a B2B SaaS for energy management and energy efficiency for residential and small commercial buildings. VIRIDOM provides its intelligent software solutions to companies which offer energy efficiency and energy management products and integrated solutions. Such companies may be manufacturers of energy-related equipment (thermostats, controllers, and charging stations), home service providers, energy service companies and energy utility companies. VIRIDOM integrates

algorithmic intelligence into smart energy products and enables buildings to become intelligent in the way they use energy. The developed algorithms automate the balancing between the required level of comfort and cost, and control the usage, or storage of intermittent renewable energies in the most efficient way. This solution removes the complexity of modern green homes and facilitates the energy transition for the end-users.





## THE INNOVATION TRACK

HEALTH SCIENCES

## HEALTH SCIENCES

### 1. CUREX: SECURE AND PRIVATE HEALTH DATA EXCHANGE

**Christos Laoudias, Nicolas Nicolaou, Christos Panayiotou, Ioannis Giannoulakis, Emmanouil Kafetzakis, Sotiris Koussouris, Evmorfia Biliri**

*KIOS Research and Innovation Center of Excellence, University of Cyprus; Eight Bells Ltd; Suite5 Data Intelligence Solutions Ltd*

The Health sector's increasing dependence on digital information and communication infrastructures renders it vulnerable to threats to privacy and cybersecurity, especially as the theft of health data has become particularly lucrative for cyber criminals. At the same time, a breach of integrity of health data can have dramatic consequences for the patients affected. CUREX is a 3-year Research and Innovation Action project funded by H2020 and the consortium includes 16 academic, industrial, and SME partners from 9 EU member states. CUREX addresses comprehensively the protection of the confidentiality and integrity of health data by producing a novel, flexible and scalable situational awareness-oriented platform. It allows a healthcare provider to assess the realistic cybersecurity and

privacy risks they are exposed to and suggest mathematically optimal strategies for addressing these risks with safeguards tailored specifically for each business case and application. CUREX is fully GDPR compliant by design. At its core, a decentralised architecture enhanced with a private blockchain infrastructure ensures the integrity of the risk assessment process and of all data transactions that occur between the diverse range of stakeholders involved. Crucially, CUREX expands beyond technical measures and places emphasis also on improving cyber hygiene through training and raising awareness activities for a healthcare institution's personnel. Its validation focuses on the highly challenging condition of (cross-border) health data exchange, spanning patient cross-border mobility, remote healthcare, and data exchange for research. CUREX consortium will also utilise the outcomes of the well-known MyHealthMyData project in a dedicated demonstration that will use their blockchain-enabled platform, which will control the actual data exchange. We envisage that CUREX will impact the European market developing one of the first blockchain platform for risk assessment management under the GDPR.

### 2. INTEGRATING TEMPORAL ABSTRACTION WITH BAYESIAN NETWORKS: A VALIDATION IN THE FIELD OF CORONARY HEART DISEASE

**Elpida Keravnou, Athena Stassopoulou, Kalia Orphanou**

*LinC Laboratory, Dept. of Computer Science, University of Cyprus and Dept. of Computer Science, University of Nicosia*

The project explores the integration of two Artificial Intelligence approaches: Temporal abstraction (TA) and Bayesian networks (BN) in order to improve medical problem solving. BN and TA demonstrated their effectiveness as standalone engines, predominantly for medical problem solving, but not in conjunction. The key research hypothesis that this project set out to investigate was whether the

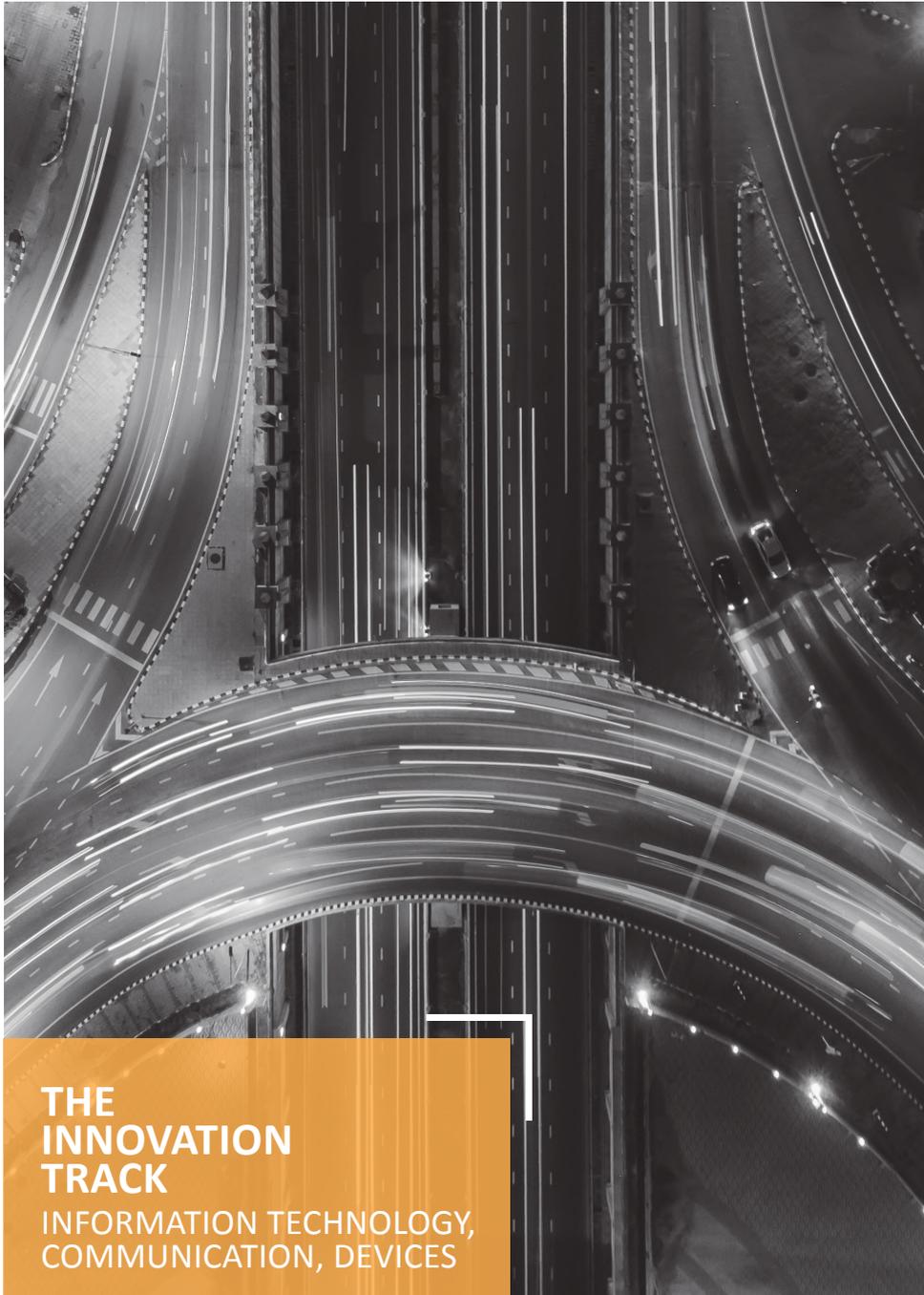
## HEALTH SCIENCES

integration of TA with BN could yield notable performance improvements in medical problem solving. Towards this end, the field of Coronary Heart Disease (CHD) was selected as a testbed and demonstrator of the attempted integration. Overall, in this project two models were developed:

- a) a temporal extension of a BN, namely a Dynamic Bayesian network, whose nodes represent basic TAs applied for diagnosis and prognosis (primary and secondary prevention) of CHD,
- b) a Naïve Bayes classifier whose features represent frequent temporal association

rules (TARs), a type of complex TAs, applied for the diagnosis of CHD. Both integration systems successfully handled the class imbalance problem, in training and evaluation stages using various resampling techniques. The comparative results of the performance of the proposed two models, against more standard approaches demonstrate the viability of our hypothesis that the integration of BNs with TAs can yield performance improvements in medical problem solving. Moreover, a notable strength of our approach is that it can be applied both to regular and irregular time-series data that evolve in time, with single or multiple granularities.





## THE INNOVATION TRACK

INFORMATION TECHNOLOGY,  
COMMUNICATION, DEVICES

## INFORMATION TECHNOLOGY, COMMUNICATION, DEVICES

### 1. A LIGHTWEIGHT INTRUSION DETECTION SYSTEM FOR WIRELESS SENSOR NETWORKS AND THE INTERNET OF THINGS

**Vasos Vassiliou, Christiana Ioannou**

*Dept. of Computer Science, University of Cyprus & RISE Research Center on Interactive Multimedia, Smart Systems and Emerging Technologies*

The work submitted for consideration deals with the Security of the Internet of Things (IoT). 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 anomalydetection mechanism based on statistical analysis. The mIDS solution fits perfectly into the new IoT security product category that Gartner recently created and calls: “Real-Time Discovery, Visibility, and Threat Detection” .

### 2. SIMPLEX: AN INTEGRATED RECORDING SYSTEM FOR THE DOCUMENTATION OF ARCHAEOLOGICAL CERAMICS

**Athanasios Vionis, Charalambos Paraskeva**

*Archaeological Research Unit, University of Cyprus*

The discipline of archaeology in Cyprus has expanded rapidly from the 1990s onwards, a fact mirrored by the increasing number of excavations, surveys and laboratory projects on the island. As a result, raw digital archaeological data, particularly regarding ceramics, are being produced at an exponential rate. However, due to the lack of central policies regarding digital cultural data management, the non-application of international recording protocols, and the use of divergent closed-source recording software packages,

the datasets produced by the numerous archaeological projects are incompatible and non-transferable, thus they eventually become unreadable and inaccessible to research. The SimpleX system is designed to ameliorate these issues by introducing an exemplary integrated, open-source data recording system to document archaeological ceramics, which is currently being field-tested by the Settled and Sacred Landscapes of Cyprus (SeSaLaC) project for the documentation of its ceramic assemblage. From a technical/scientific point of view, the system reduces the complexities of recording pottery data, standardises the recording methodology, allows the rapid, easy, semi-automated and en masse recording of quantitative and qualitative archaeological information, effortlessly connects to third-party software that enable further analyses,

## INFORMATION TECHNOLOGY, COMMUNICATION, DEVICES

and also provides a mechanism to export data in the RDF/XML format, which prevents data rot and ensures data remain open and comparable. Business-wise, SimpleX is the first open-source software of this kind in Cyprus, and although

currently used locally, it can be easily transformed to an online service for use by the archaeological and cultural heritage communities of Cyprus.

### 3. CHECK-IT - VISUALIZING FAKE NEWS ON SOCIAL MEDIA

**Demetris Paschalides, Pallis George, Dikaiakos Marios**

*Lab for Internet Computing, Dept. of Computer Science, University of Cyprus*

Check-it empowers users with the tools they need in order to check whether the stories they read online are fake or not. In this way, **i)** users will be able to see if what they read is fake and **ii)** users may be reluctant to forward news, which is known to be fake. The main problem that Check-It tries to address is that when users view news on social media they usually have little, if any,

means to decide whether the information they see is real or fake. Although it is true that some social media allow users to report any fake news they see, most of the social media out there do not provide such functionality. Therefore, they place all the burden of deciding whether a story is fake or real on the end user. Check-It proposes a way for people to consume digital news with an automated ability to “check” whether a story is fake or not. Towards this end, Check-It extends the web browser capabilities with a “check it” button (a browser plug-in) that enables users to check whether a story is true or fake.

### 4. ENEDI - ENERGY SAVING IN PUBLIC ACADEMIC BUILDINGS WITH DATA CENTERS

**Nicholas Loulloudes, Thanasis Tryfonos, Andreas Andreou, Marios Dikaiakos, George Pallis**

*Lab for Internet Computing, Dept. of Computer Science, University of Cyprus*

IoT is an exciting technological revolution since the internet. There are various applications that IoT can implement in areas including transport, governance, medical, education, farming among others. According to Gartner, IoT has rapidly

become the most hyped expression across business and technology and it is expected to reach 20 billion internet-connected devices by 2020. These devices range from sensors vending machines, jet engines, connected cars and myriad of other examples producing gigantic amounts of data. The intimidating amount of data dictates the need for a process for storing, analyzing and distilling IoT data into actionable information that becomes intelligence. To this end, we propose ENEDI, an IoT middleware for the collection, storage, analysis and visualization of data originating from

## INFORMATION TECHNOLOGY, COMMUNICATION, DEVICES

IoT. ENEDI consists of the following components:

**a)** A ubiquitous monitoring system that facilitates the collection and storage of IoT produced data. The monitoring system provides an extensible abstraction of the IoT layer, allowing literally any device that emits data through a network protocol to pair with the ENEDI monitoring system facilitating the collection of sensed data at regular time intervals and their storage into time series databases for future analysis.

**b)** An interchangeable and programmable processing engine that implements the business logic that transforms raw data into useful intelligence. ENEDI offers a Bring-Your-Own-Logic development model that enables developers to implement their own algorithms to distill useful intelligence based on monitoring data according to their respective use-case

**c)** An intuitive Dashboard that visualizes raw and processed data from the IoT Layer.

### 5. HARDWARE FOR ADAPTIVE FUNCTIONAL METASURFACES

**Julius Georgiou**

*Holistic Electronics Research Laboratory, Dept. of Electrical and Computer Engineering, University of Cyprus*

Man-made electromagnetic waves are a key part of modern life, given their extensive use in telecommunication systems, e.g. wireless telephony and internet access, and in medical devices e.g. MRI for imaging. Within the EU FET VISORSURF project, UCY team’s objective is to develop the hardware for dynamic manipulation of electromagnetic behavior, through a patterned metallic array of meta-atoms, whose connectivity and load impedance is dynamically adjusted by underlying customized active circuits, thus creating the world’s first Hypersurface. There are many problems that can be solved through the invention of such a Hypersurface, e.g. mobile phone base-stations sometimes need to transmit EM power levels which are higher than those permitted for an acceptable quality of

service, however they can’t do so, since there might be people residing in an adjacent building. A Hypersurface could be used on demand, to absorb part of the electromagnetic radiation headed for that building or even dynamically reflect part of the electromagnetic energy to a location where extra power is needed to get the required signal strength for reception. Given the generic nature of electromagnetic wave manipulation the business case for this invention is extensive, however the most obvious commercialization routes would include the telecom industry, space applications, as well as security. As there are currently no electronic chips on the market that have been designed to act as a dynamic RF load within a Metasurface/Hypersurface array, in this project the Holistic Electronics Research Laboratory in collaboration with the Microwaves and Antennas Lab has developed integrated circuits to fill in this gap in the market, thus enabling very dense Hypersurface metallic arrays to manipulate EM waves, both for directional reflection and absorption.

## INFORMATION TECHNOLOGY, COMMUNICATION, DEVICES

### 6. HYBRID MEMS MICROFLUIDIC GYROSCOPE

**Julius Georgiou**

*Holistic Electronics Research Laboratory,  
Dept. of Electrical and Computer  
Engineering University of Cyprus*

The project idea was a result of not being able to find an ultra-low-power gyroscope on the market, for use in a project for vestibular implants. As such, a new novel gyroscope was designed and fabricated, which was not based on vibrating masses,

but on a principle similar to that used by the natural vestibular system for determining self-motion. The resulting gyroscope could be applied to other larger markets, with similar requirements as a vestibular implant; e.g. the gaming industry, where virtual reality goggles require a sensor for self-motion in order to move the “viewing direction” accordingly. As these are portable devices, low-power components are essential.

### 7. ICARUS: AVIATION-DRIVEN DATA VALUE CHAIN FOR DIVERSIFIED GLOBAL AND LOCAL OPERATIONS

**Dimosthenis Stefanidis, Loukas Pouis,  
Marios Dikaiakos, George Pallis**

*Lab for Internet Computing, Dept. of  
Computer Science, University of Cyprus*

ICARUS aims to build a novel data value chain in the aviation-related sectors towards data-driven innovation and collaboration across currently diversified and fragmented industry players, acting as multiplier of the “combined” data value that can be accrued, shared and traded, and rejuvenating the existing, increasingly non-linear models/processes in aviation. Using methods such as big data analytics, deep learning, semantic data enrichment, and blockchain powered data sharing, ICARUS will address critical barriers for the adoption of Big Data in the aviation industry (e.g. data fragmentation, data provenance, data licensing and ownership,

data veracity), and will enable aviation-related big data scenarios for EU-based companies, organizations and scientists, through a multi-sided platform that will allow exploration, curation, integration and deep analysis of original, synthesized and derivative data characterized by different velocity, variety and volume in a trusted and fair manner. ICARUS will bring together the Aerospace, Tourism, Health, Security, Transport, Retail, Weather, and Public sectors and accelerate their data-driven collaboration under the prism of a novel aviation-driven data value chain. Representative use cases of the overall domain’s value chain include: (I) Sophisticated passenger handling mechanisms and personalized services on ground facilities, (II) Enhanced routes analysis of aircrafts for improved fuel consumption optimization and pollution awareness, (III) More accurate and realistic prediction model of epidemics, (IV) Novel Passenger experiences pre-in and post-flight.

## INFORMATION TECHNOLOGY, COMMUNICATION, DEVICES

### 8. MIPHOSAT

**Stavros Iezekiel**

*EMPHASIS Research Centre, University  
of Cyprus*

The aim of the MIPHOSAT project (which is funded under the PECS programme of the European Space Agency) is to develop next generation satellite payloads. Increased end-user demands on capacity and bandwidth are motivating development of high-throughput satellites, in order to provide cost-effective and flexible broadband connections to a large number of user terminals. This is driven by a need to bring high-speed internet to developing regions and for those applications where fibre coverage is not cost effective or even not possible (e.g. aircraft), high throughput satellites are a viable solution. Therefore, there is a requirement for new satellite

payload architectures, offering in-orbit reconfigurability and signal processing that are capable of supporting tens of antenna beams for multi-spot coverage. These new demands are very challenging in a space environment, where size, weight and power requirements are all critical. In such a situation, the use of photonics technology (based on both fibre-optics, but also recently on integrated photonic chips) is seen as the way forward, since it offers large bandwidth, low loss, inherent flexibility and is intrinsically lightweight (as compared to conventional microwave circuits). MIPHOSAT will examine the use of photonics for the development of new photonically-enabled satellites offering high-throughput broadband services, by developing new methods of frequency downconversion.



## INFORMATION TECHNOLOGY, COMMUNICATION, DEVICES

### 9. **PARKAPP**

**Riana Alexandrou, George Livadiotis,  
Giannis Giagkou**

ParkApp is an app available on the android and apple app market. This free app will allow users to look up available parking and see specifically how many parking spots are available near their destination. ParkApp, unlike competitor's apps does not tie down the customer to reservation-based parking, or pre-scheduled parking,

but simply look at real time data to know. The live data collected will depend on the technologically-enabled parking counters that majority of parking lots already have. Furthermore, this double-sided business platform will not only depend on the lot owners, but other businesses wanting to advertise, or people wanting to use the services.

### 10. **ARTIFICIALLY INTELLIGENT AUTONOMOUS DRONES TO SUPPORT SECURITY SERVICE PROVIDERS**

**Panayiotis Kolios**

*KIOS Research and Innovation Center of  
Excellence, University of Cyprus*

Unmanned Aerial Vehicles (UAVs) are considered as a promising technology with broad applicability to a plethora of applications as identified in "Commission Staff Working Document (SWD(2012)259)". One such highly-relevant application domain is that of monitoring sensitive facilities for the purpose of prevention and rapid response to security threads. In this domain, traditional surveillance infrastructure and reconnaissance personnel entail a high capital and operational expenditure, and as a result

their availability is very limited. On the other hand, and similar to the smartphone market, the UAS industry relies on electronic components that follow a Moore's-law-style pace and for that reason, the technology is rapidly advancing while purchasing costs exponentially decrease. The caveat is of course the increasing complexity of the UAV and its underlying subsystems that can alienate non-technical experts, including Security Service providers, from using them in practice. The proprietary artificially-intelligent technology own by KIOS CoE overcomes this barrier by automating the complete cycle of patrolling, sensing, detecting and tracking intruders by UAVs and allow non-technical staff to viably operate UAVs in practice. This will in turn enable enhanced security services and improve safety and security.

## INFORMATION TECHNOLOGY, COMMUNICATION, DEVICES

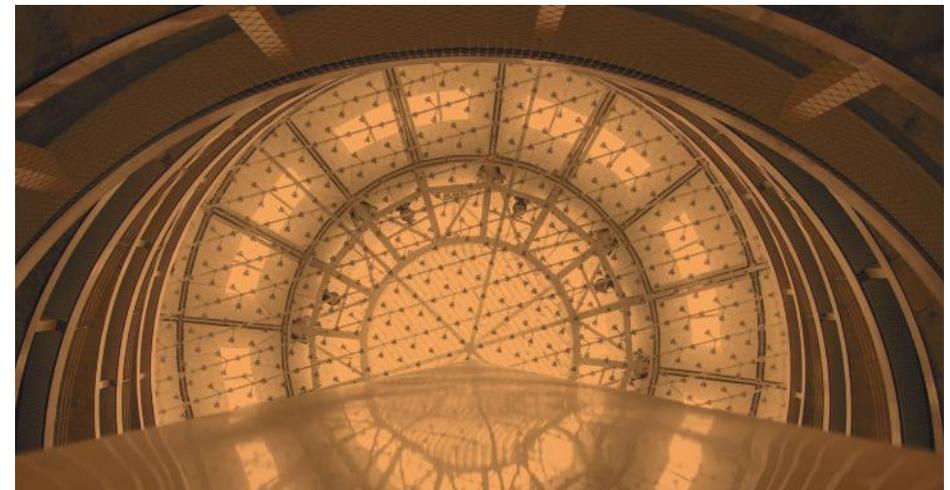
### 11. **STREAMSIGHT: A QUERY-DRIVEN FRAMEWORK FOR STREAMING ANALYTICS IN EDGE COMPUTING**

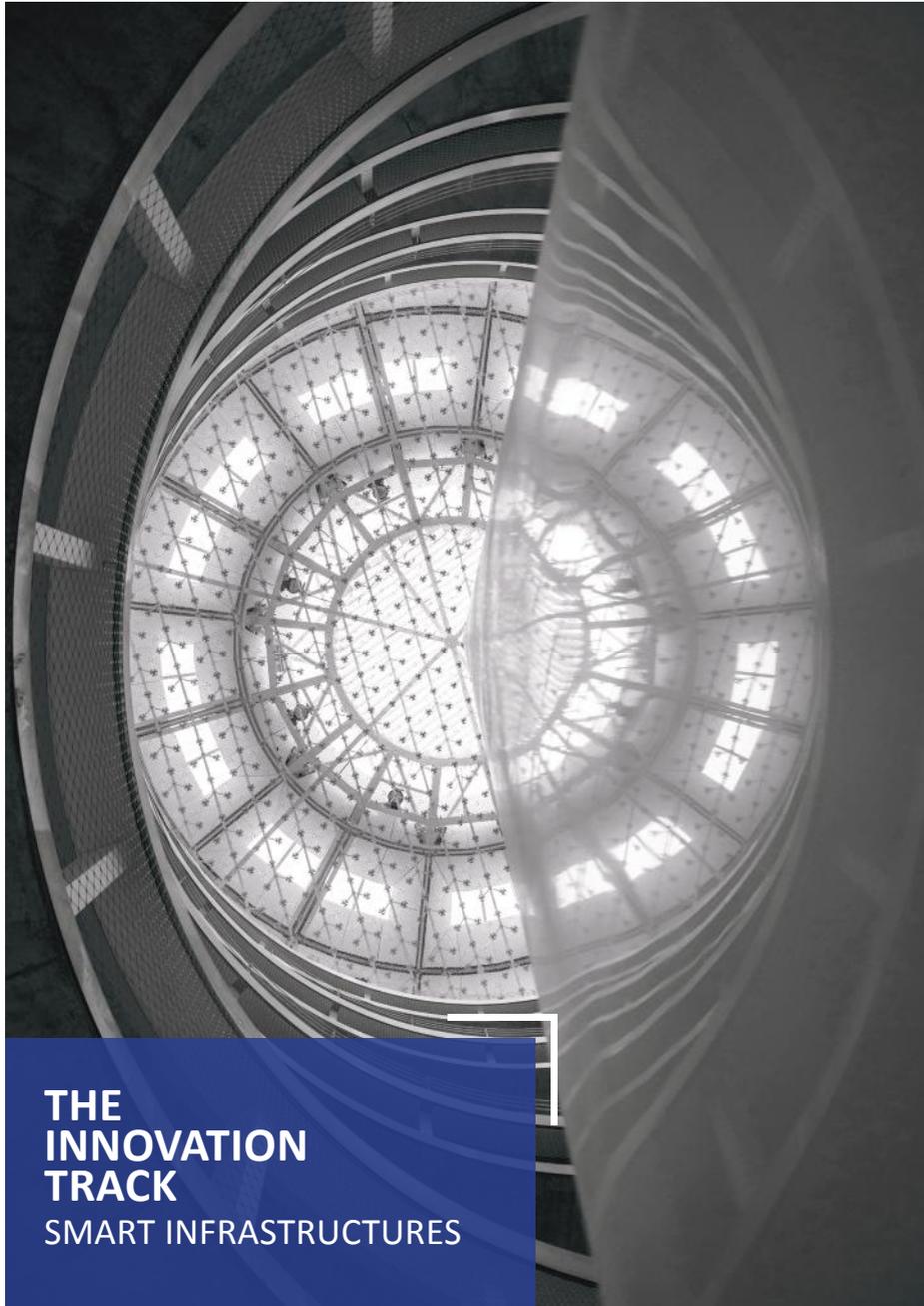
**Zacharias Georgiou, Moysis Symeonides,  
Demetris Trihinas, Marios Dikaiakos,  
George Pallis**

*Dept. of Computer Science, University of  
Nicosia and Lab for Internet Computing  
Dept. of Computer Science, University  
of Cyprus*

With the prevalence of the Internet of Things (IoT) as the dominating technology to monitor and understand the physical world, inevitably both the number of internet-enabled "things" and the amount of IoT data are exploding. These data can provide valuable insights to companies for enabling near real-time decision-making to improve business processes. However, IoT services are spread into wide areas of coverage, and therefore a naive deployment can be inefficient and error-prone. Furthermore, queries are not envisioned beforehand, but are rather exploratory and submitted ad-hoc by platform operators. This implies specific knowledge of the programming model

of the underlying processing engine and requires multiple lines of code. Therefore, the implementation of abstractions, which are able to model knowledge extraction from data streams supporting a wide range of exploratory queries, is still an open research challenge. To overcome these challenges we introduce StreamSight, a framework for edge-enabled IoT services which provides a rich and declarative query model abstraction for expressing complex analytics on monitoring data streams and then dynamically compiling these queries into stream processing jobs for continuous execution on distributed processing engines. StreamSight supports users in composing analytic queries that are automatically translated and mapped to streaming operations suitable for running on distributed processing engines deployed in wide areas of coverage. This aids both advanced and inexperienced users to abstract and rigorously express complex analytics operations over streaming data, along with query constraints such as sample size and upper error-bounds for query execution to output approximate and in time answers.





## THE INNOVATION TRACK

### SMART INFRASTRUCTURES

## SMART INFRASTRUCTURES

### 1. ADVANCED INTEGRATION OF RENEWABLE ENERGY SOURCES WITHIN SMART DISTRIBUTION GRIDS

**Elias Kyriakides, Lenos Hadjidemetriou**

*KIOS Research and Innovation Center of Excellence, Power Systems Group, University of Cyprus*

Low-voltage distribution grids face several challenges due to the high penetration of renewable energy sources, the increasing demand (electrification of thermal and transportation sector), and the limited observability (absence of smart metering infrastructure). These challenges impose problems regarding the integrity, stability, power quality and efficiency of distribution grids. Therefore, intelligent solutions are required in order to overcome these problems. This project presents a complete solution of a multi-functional grid tied inverter for advancing the integration of renewable energy sources within

smart distribution grids. Advanced local control techniques have been developed for enabling new ancillary services for the inverter in order to provide fault ride through support, reactive power compensation and phase balancing services and harmonic elimination schemes under any grid conditions. Furthermore, flexible functionalities and Internet of Thing (IoT) capabilities of inverters can be exploited to develop centralized control schemes (in distribution feeder level) to reduce energy losses, enhance stability and power quality and maximize the utilization of existing grid capacity. The effectiveness of the proposed inverter has already been validated using a grid-connected prototype setup. Moreover, the advanced testbed and laboratory facilities of the KIOS CoE has been used in order to experimentally validate the proposed solution using Hardware In the Loop (HIL) framework.

### 2. INTELLIGENT BUILDING AUTOMATION DIAGNOSTICS

**Marios Polycarpou, Demetrios Eliades**

*KIOS Research and Innovation Center of Excellence, University of Cyprus*

Buildings are large consumers of energy. According to EU statistics regarding energy and buildings, it is estimated that buildings are responsible for 40% of the total energy consumption and 36% of the total greenhouse gas emissions in the EU-28. It is also estimated that 5-20% of the energy consumed in commercial buildings for heating, ventilation, air conditioning, lighting and water heating can be attributed to various faults and inefficiencies of the building management

systems. A study from the US Department of Energy shows that a combination of controls and diagnostics could reduce commercial building energy consumption by approximately 40%. The issues of fault detection, diagnosis and automatic recovery in buildings will become even more crucial in the future as Internet-of-Things (IoT) devices will be widely deployed in smart buildings and homes. Therefore, there is a market need for an intelligent building automation diagnostic system, which will integrate with existing BMS to facilitate continuous and effective monitoring of the buildings, to detect and isolate component faults or unexpected events as early as possible. The Domognostics platform consists of a semantically-enhanced IoT platform

## SMART INFRASTRUCTURES

which integrates with commercial and experimental devices monitoring environmental conditions in buildings, as well as with state-of-the-art algorithms which are utilizing model-based anomaly diagnosis for detecting faults in the heating/cooling system as well as in

the air quality. Domognostics has the potential of integrating with existing Building Management Systems (BMS) and thus extending their overall monitoring and anomaly detection capabilities using physical and analytical redundancy.

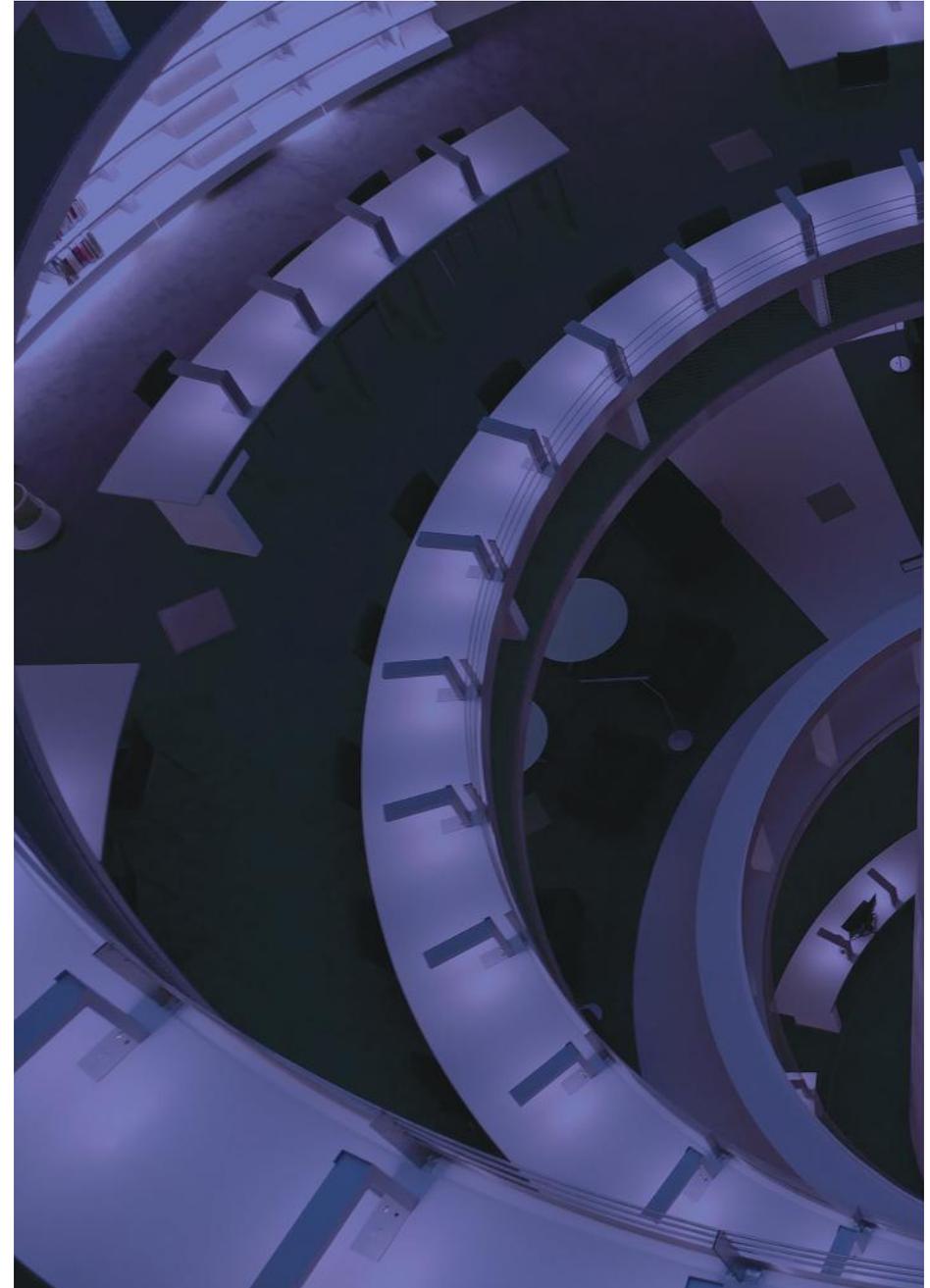
### 3. SMARTPHONE-BASED ROADWAY ANOMALY DETECTION AND CLASSIFICATION

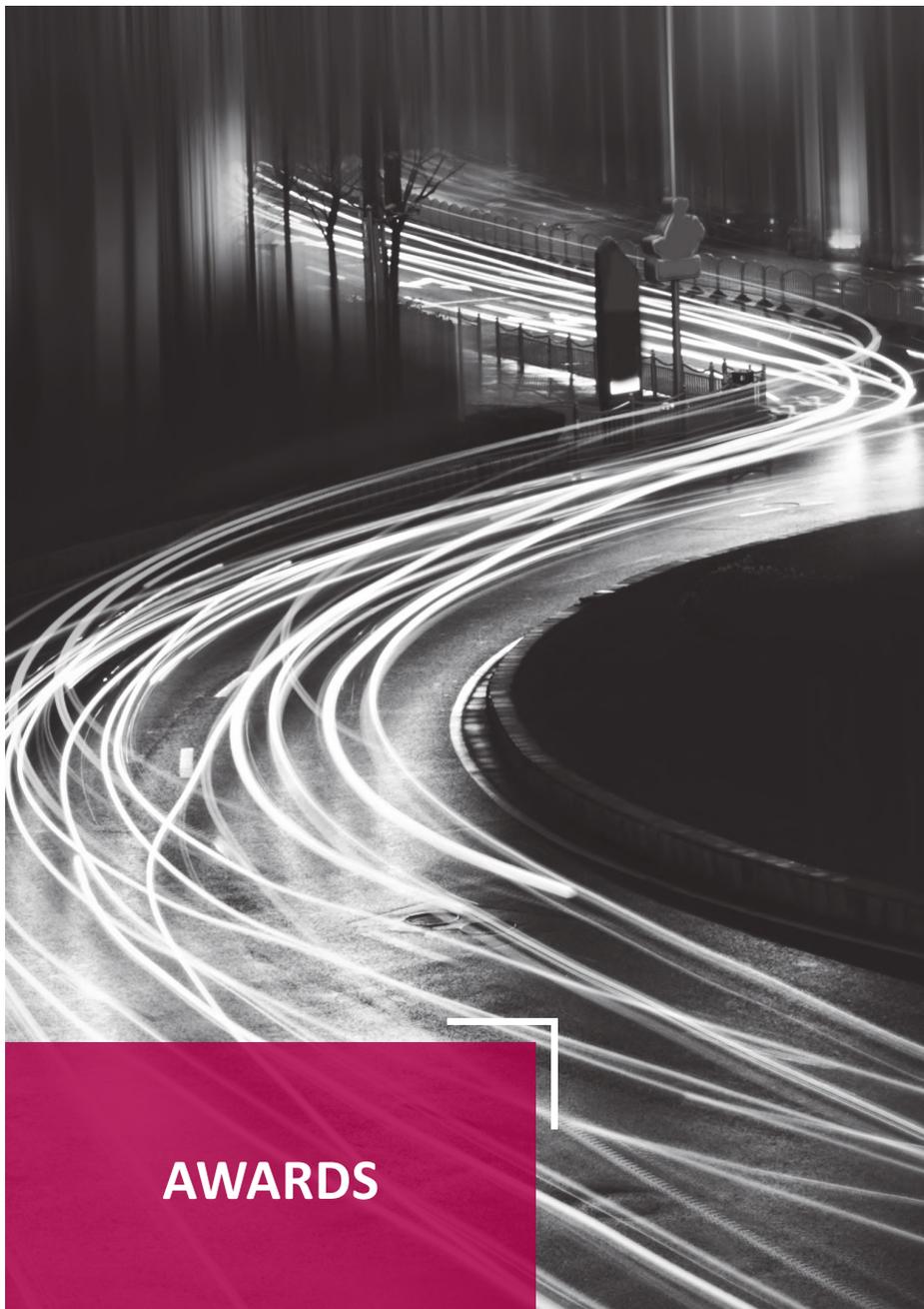
**Charalambos Kyriakou,  
Symeon Christodoulou**

*EUPALINOS Lab, Dept. of Civil and Environmental Engineering,  
University of Cyprus*

The systematic management of pavements has become increasingly essential to both agencies and the travelling public, as pavements continue to age and deteriorate, budgeting levels decrease due to reduced finance capitals or increased competition for funds and the quality of ridership and the drivers' safety are heavily affected by the condition of roadway pavements. The described research investigates the development of an innovative low-cost Geographic Information System (GIS)-based pavement monitoring system for the evaluation of roadway pavement surface condition. The research project suggests a pavement monitoring system that gives the pavement agencies the opportunity to timely assess and manage their pavements at low cost

and to avoid unnecessarily constructing new ones. The proposed system explores the use of data, collected by sensors from smartphones and from automobiles' (OBD-II) devices while vehicles are in movement, for the detection and classification of pavement surface anomalies. The smartphone-based data collection is complimented with robust regression analysis, ANN techniques, various algorithms and bagged trees classification models for classifying detected roadway anomalies. The proposed method and system architecture have already been in development, utilized four metrics in the analysis, and have been checked, until now, against five types of roadway anomalies, and validated against hundreds of roadways runs (resulting in a training dataset of more than 45000 roadway points/profiles) with above 90% accuracy rate. Research project sensors distress data of cracks, rutting, ravelling, patching and potholes were validated and corresponded against the images of the official surveys that agencies are currently using.





## AWARDS

**UCY ENTREPRENEUR AWARD**

*A distinction honoring members of the University of Cyprus community who demonstrate success in innovative entrepreneurship.*

Through this Award, C4E aspires to present and celebrate the achievements of recent or present affiliates of the University (alumni, researchers, students, faculty, employees), who created value for the economy and society through entrepreneurial activities characterized by traits like novelty, risk-taking, scientific or technical excellence, social responsibility, and an international outlook.

**AWARD RECIPIENTS:**

**Giorgos Larkou, Giorgos Matthaiou and Giorgos Nicolaidis**  
*Founders of Impact Tech Ltd*

**Dimitris Eliadis**  
*Founder of Phoebe Research and Innovation Ltd*

**THE INNOVATION TRACK BEST POSTER / DEMO AWARDS AND THE PEOPLE'S AWARD****FIRST PRIZES:**

*"Real-time monitoring of reservoirs during EOR operations"*

*Department of Physics of the University of Cyprus, EMPHASIS Research Center, Cavendish Laboratory, Cambridge University and Cambridge Biomagnetics Ltd*

**Team:** Assistant Professor Theodosios Trypieniots, Angeliki Agorou, Konstantinos Nikolaidis from the University of Cyprus and Thanos Mitrellas from Cambridge University

*"Lightweight Intrusion Detection System for Wireless Sensor Networks and the Internet of Things"*

*Department of Computer Science of the University of Cyprus*

**Team:** Assistant Professor Vassos Vassiliou and Dr. Christiana Ioannou.

**SECOND PRIZE:**

*'CUREX: SeCure and pRivate hEalth data eXchange' KIOS Research and Innovation Center of Excellence*

**Team:** Dr. Christos Laoudias, Dr. Nikos Nikolaou and Professor Christos Panayiotou.

**THE PEOPLE'S AWARD:**

*"StreamSight: A Query-Driven Framework for Streaming Analytics in Edge Computing"*

*Department of Computer Science of the University of Cyprus*

**Team:** Postgraduate Students Zacharia Georgiou, Moses Symeonidis, Research Associate Dr. Dimitris Trichinas, Professor Marios Dikaiakos, Assistant Professor Giorgos Pallis.

**THE SINN 2019 COMPETITION WINNERS:****FIRST PRIZE**

*"Anonymous Social Network for Students"*

**Team:** Rafail Andreou, Giorgos Longinos and Chrysovalantis Christodoulou from the Computer Science Department

Anonymous is a social network that enables anonymous communication between students. Users will be able to talk, encouraged to discuss their concerns or problems and express their opinions anonymously through the network's posts and in private chat and meet new people within the university community. The users will have the opportunity to search for other people by their username, their age, their gender, their interests etc. Thus, the users will be able to discuss anonymously to other people for something that bothers them and ask for help and advice, without any consideration for revealing their real identity.

## AWARDS

### SECOND PRIZE "Shelvino"

**Team:** Katia Kyriakoudes from the French and European Studies Department, Irene Appiou and Loizos Prodromou from the Business Administration Department, Styliana Baghdhadie from the Department of Architecture and Yiannis Mavros from the Department of Electrical and Computer Engineering.

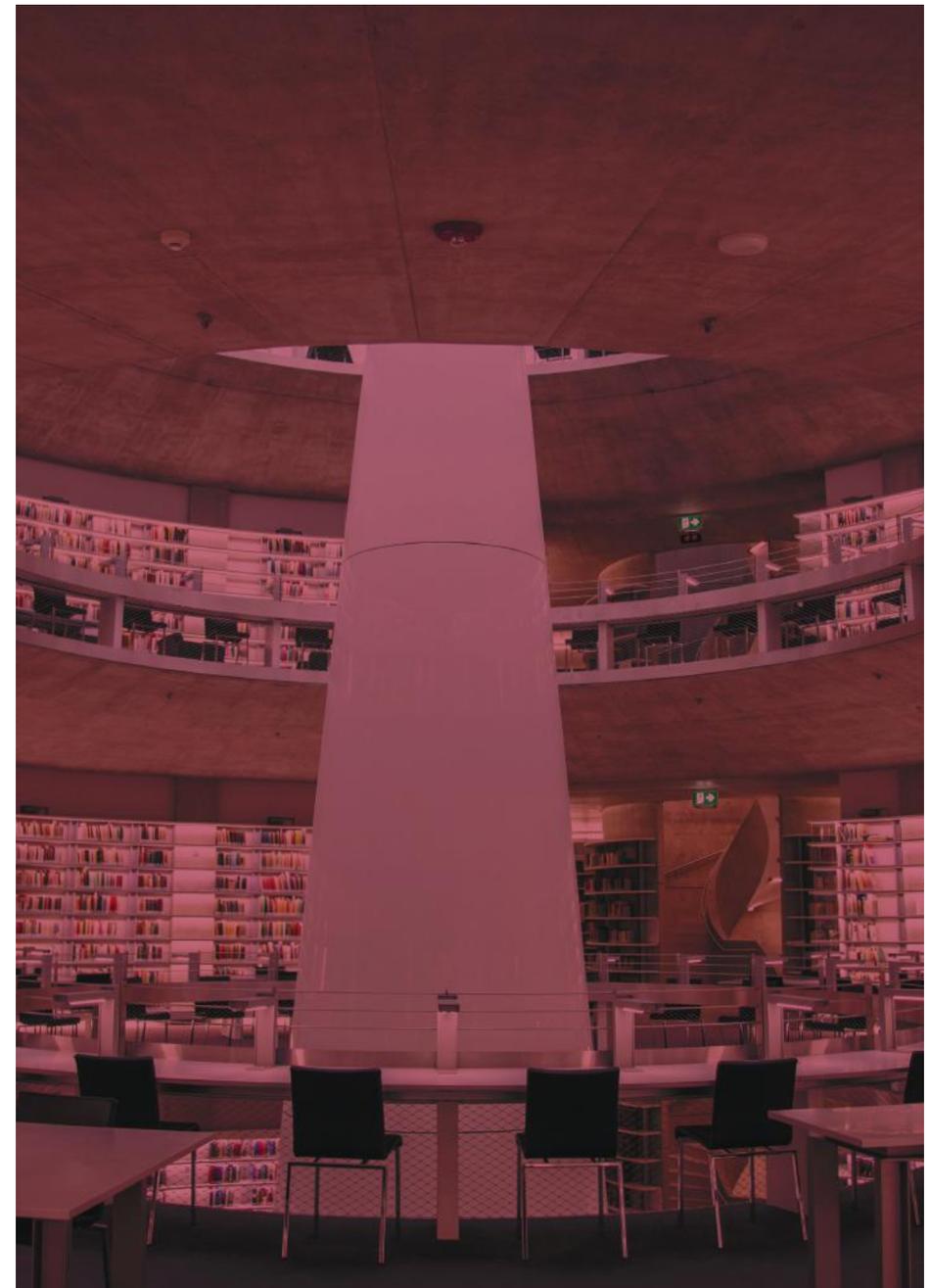
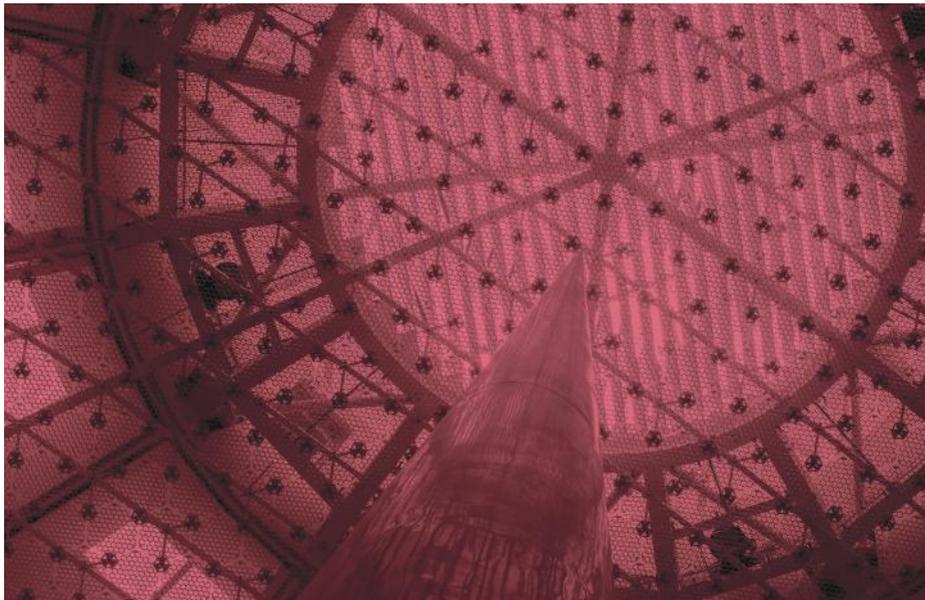
Shelvino is about a system based on RFID usb reader that will fix the book shelving problem in big libraries in an easy and time efficient way. The Shelvino system will not only help the librarians in saving time, but also in keeping a track on all books wrongly placed. The system will also show whether a book is borrowed or is still in the library,

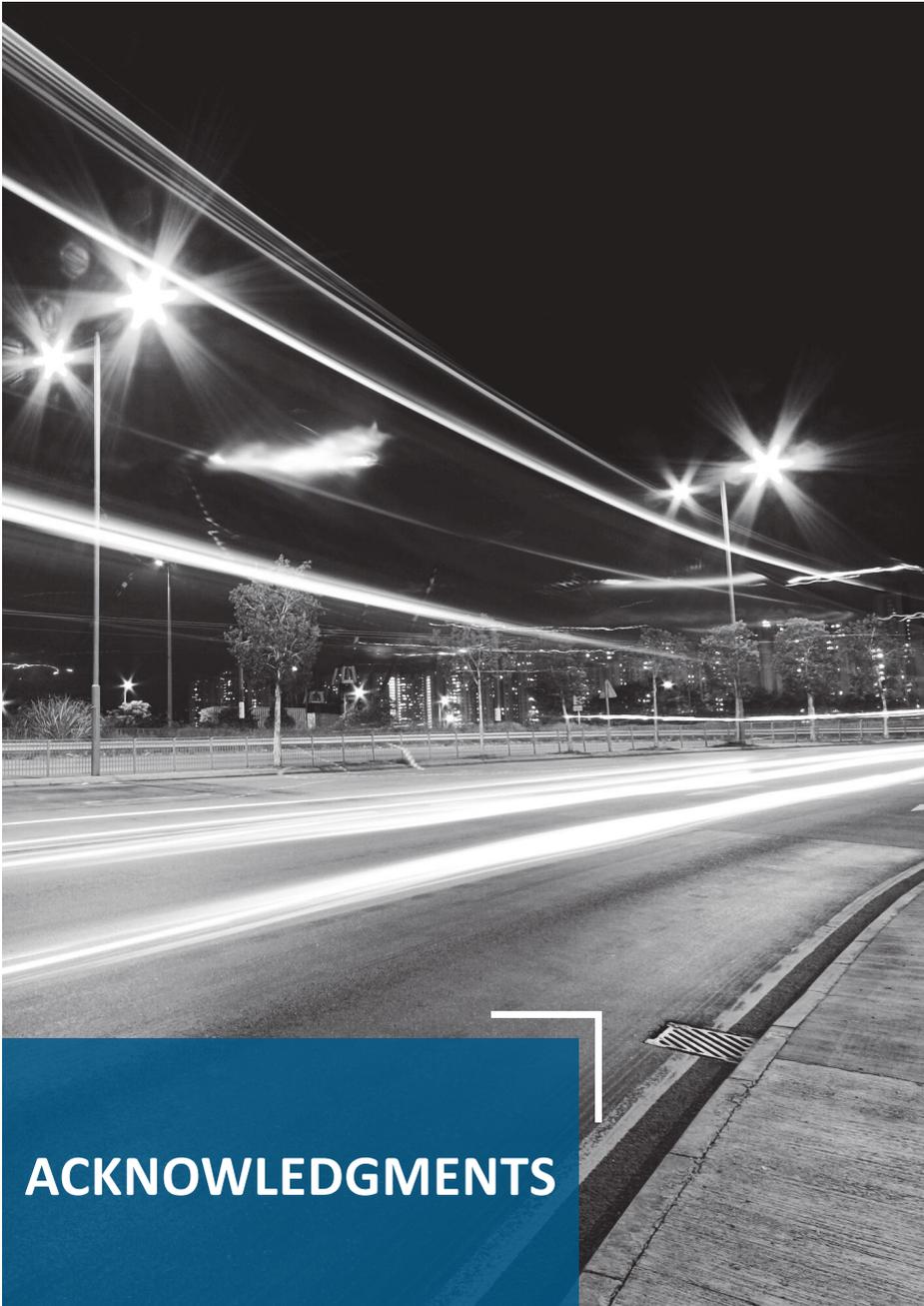
low dimmed lights will indicate the book's activity and status.

### THIRD PRIZE "HealthGum"

**Team:** Andreas Georgiou, Maria Kazamia, Elina Panteli, Andreas Kapetanos and Pantelis Hadjihambis from the Department of Electrical and Computer Engineering.

HealthGum aims to be a gum able to detect lung cancer through specific proteins on saliva. Based on recent researches, people with lung cancer have increased rates of nine proteins and VOCs substances in any stage of cancer. The gum will be able to identify them and change its color as a result.





## ACKNOWLEDGMENTS

### **INNOVATION TRACK EVALUATION COMMITTEE:**

**Alexandros Michaelides**  
CEO, RTD Talos

**Michael Stavrides**  
Director at Tax, Reporting and Strategy Services of PwC Cyprus

**Chrysanthos Chrysanthou**  
Partner at Kindred Capital VC

### **SINN 2019 PANEL OF JUDGES:**

**Andreas Papadopoulos**  
Strategic Development Director  
of the Hellenic Bank

**Angela Panayiotou**  
Manager IDEA Cy

**Xenia Papandreou**  
Youth Mentor

**Phanos Demetriou**  
CMO & Director of Services Digital Tree

**Odysseas Economides**  
Founder of Robo & Teemby and 2018 SINN winner

### **BUSINESS PITCH PRESENTERS:**

**Marianna Papadopoulou**  
Assistant to the Director - Blue Island PIC

**Elias Nikolaou**  
Head of Quality, Food Safety and Hygiene - Blue Island PIC

**Theodoros Kringou**  
Managing Director - The Infocredit Group Ltd

**Antonis Kountouris**  
Head of Research and Development Department - Nicolaidis & Kountouris Metal Company Ltd

**Marinos Markides**  
Systems Manager - OCL Oceanic Catering

**Panayiotis Kyprianou**  
Director of Business Development - Thanos Hotels & Resorts

## ACKNOWLEDGMENTS



