



Introduction to Special Issue on Smart Systems Facts, Challenges and Technologies

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Preamble: The University of Bahrain Smart Cities event has been organized in collaboration with the IET-EMEA (IET Europe, Middle East and Africa Regional), IET, (The Institution of Engineering and Technology), UK. Smart Cities relate to the employment of smart technologies and data as the means to solving cities' sustainability challenges and prospering in the future world. We are on the edge of an explosion in cities transforming themselves to be smarter. This can be achieved while relying on and using data and technology to improve a number of sectors.

The main purpose of the event was creating awareness about the future prospects of Smart Cities. The event served as a platform to exchange ideas, prototypes and systems in an international setting. The event's objectives were also to emphasize the role of the University of Bahrain in promoting a smarter kingdom via its consultancy, intellectual forums, publications and innovative solutions. In addition, the event also focused on networking opportunities for research and development related to smart cities. The symposium offered an excellent opportunity for scientists, innovators, and engineers to interact, share experiences and present their latest research with peers in a multidisciplinary engineering background. The symposium venue was at University of Bahrain, and was run for two days, (22- 23 April 2018). The symposium involved both invited speakers (talking about the need for and benefits of smart cities), in addition to academic peer-reviewed papers published by the IET digital library, IEEE Xplore digital library, and indexed by SCOPUS.

This special issue of the International Journal of Computing and Digital Systems (IJCDs), focuses on smart systems research and technologies, and publishes selected papers from the Smart Cities Symposium, whose main theme was "Solutions for a Smarter Economy" (22- 23 April 2018, Manama, Bahrain). The symposium had eight different tracks that cover important aspects related to electrical, computer and electronics engineering. Three members of the technical program review committee reviewed each paper, and the accepted papers were presented during the symposium, only four papers were accepted as extended versions in this special issue. The papers included here offer in-depth discussion and informal exchange of ideas, concepts, and experiences in a wide range of topics related to smart cities, Engineering, IT, AI and other related solutions for future smart cities.

Keywords: Smart Systems, Technologies, Performance Evaluation, Assessment

INTRODUCTION



The accelerated integration and convergence of communications, computing, and control over the last decade has commanded researchers from different disciplines to become involved in the emerging field of distributed networked control systems (DNCS), where the operations of sensors, actuators, and controllers are distributed at different geographical locations and coordinated through information exchanged over communication networks. Some typical characteristics of those systems are reflected in their asynchronous operations, diversified functions, and complicated organizational structures.

The widespread applications of cyber-physical and/or IOT technologies have been one of the major driving forces for research and development of DNCS. More recently, the emergence of pervasive communication and computing has significantly intensified the effort of building such systems for control and management of various network-centric complex systems that have become more and more popular in micro grids, aerospace systems, tele-operation, and intelligent systems, process automation, computer integrated manufacturing, business operations, as well as public administration.

This special issue, which publishes selected papers from Smart Cities 2018 (SCS2018), includes ten papers that cover different areas related to the theme of the Smart Systems Facts, Challenges, and Technologies. The main contributions of the accepted papers in the SI of SCS2018 are highlighted in the remaining part of this introduction.

Authors of paper [1] provide a concise security evaluation on IoT networks. The paper performs a security evaluation in IoT using a practical approach and provides some recommendations to mitigate some security threats. The paper presents an analysis about the cyber-security in the IoT context of smart homes and smart cities. The focus is on the ZigBee protocol. The main attacks towards the security of an IoT system are described. A real testbed is used to simulate such attacks within the ZigBee protocol. Hence, the authors derived possible countermeasures.

In [2] authors describe the design and implementation of a remote Smart Oil Pipeline Surveillance System (SOPSS), the paper reflects empirical work by describing the development phases of proposed SOPSS, the system could be considered as an IoT application. SOPSS is a monitoring system with visual feature that allows the users to monitor the target objects remotely in a secure and efficient way reducing the effort and resources consumption.

In [3], authors developed an efficient model to determine the Panel Generator Factor (PGF), their model was compared with other models and it was found to be more efficient. The proposed model tested on the IEEE123 bus system. The PV panels added to the IEEE123 bus system.

An implementation of smart medicine dispenser with associated system and GUI development is discussed in [4], the paper is an extension of a previously reported work Smart Medicine Dispenser (SMD) presented at 2018 IEEE 4th Middle East Conference on Biomedical Engineering (MECBME). Authors have comprehensively discussed the design and novelty of smart medication dispenser.

Authors of [5] proposed automated system that provide different services offered in a restaurant and connects the various equipment of this restaurant, in order to simplify and facilitate the work of employees using this system. A content-based recommendation module based on the use of a similarity measure was used to keep track of the client order history in order to suggest or recommend to him similar dishes for his next orders.

Paper [6] provides an overview of a smart energy controller system that proposes a residential air conditioner (RAC) to save the electricity costs using a new algorithm based on DR. The proposed DR algorithm is applied under three strategies. The first strategy considers operation during one day of the week from 12 pm to 12 am, the second strategy considers controlling of thermostat by sensing inside room temperature during 12 pm to 12 am of the day, and the third strategy considers operation of RAC by real time price (RTP) with several cases. The Experimental result of



the proposed SEC is compared with each other strategy of EMS. The third strategy provides better results in terms of energy consumption and electricity cost.

Authors of [7] proposed distributed strategy for UAVs formation control and obstacles avoidance using a consensus-based switching topology. This novel approach allows UAVs to keep the desired topology and switch it in the event of avoiding obstacles. A double loop control structure was designed using a back stepping controller for tracking of the reference path, while a Sliding Mode Controller (SMC) was adopted for formation control.

An improved Secure Router Discovery prevention mechanism is proposed in [8]. It is lightweight, integrated and self-regulated to overcome the issues with existing prevention techniques. The primary focus of this research are the assumptions, threat model and design goals of the proposed mechanism. It also outlines the proposed architecture, components of the building blocks of the architecture and the operation of this lightweight mechanism.

Authors of paper [9] presented a model for large-scale automated greenhouse system for more efficient greenhouses. The model is simulated by the GNS simulator. The automated greenhouse system is based on IoT for sensing soil moisture, light, temperature and humidity. They provide a solution for fault tolerant node placement using Menger's Theorem. Simulation of the proposed model carried out and the results suggest the better model of sensor node placement in a greenhouse system.

A Smart Toll Collection System (STCS) is presented in [10]. The STCS technology is specially designed for Bangladesh. Two types of toll collection system which are manual and computerized exist in Bangladesh. Both systems require human operator for toll collection. This however is time-consuming process. With this respect, a smart (fully automated) toll collection system is proposed in this paper.

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Magdi Sadek Mahmoud obtained B. Sc. (Honors) in communication engineering, M. Sc. in electronic engineering and Ph. D. in systems engineering, all from Cairo University in 1968, 1972 and 1974, respectively. He has been a professor of engineering since 1984. He is now a Distinguished Professor at KFUPM, Saudi Arabia. He was on the faculty at different universities worldwide including Egypt (CU, AUC), Kuwait (KU), UAE (UAEU), UK (UMIST), USA (Pitt, Case Western), Singapore (Nanyang) and Australia (Adelaide). He lectured in Venezuela (Caracas), Germany (Hanover), UK ((Kent), USA (UoSA), Canada (Montreal) and China (BIT, Yanshan, USTB). He is the principal author of fifty-two (52) books, inclusive book-chapters and the author/co-author of more than 600 peer-reviewed papers. He is the recipient of two national,

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Eltoweissy received several awards and recognition for research, education, service and entrepreneurship, including best paper awards, top placements at Cyber Security competitions, and nomination for the Virginia SCHEV Outstanding Faculty Awards, the highest honor for faculty in Virginia. Eltoweissy is a senior member of IEEE and ACM..



Kevin Curran obtained is a Professor of Cyber Security, Executive Co-Director of the Legal innovation Centre and group leader of the Ambient Intelligence & Virtual Worlds Research Group at Ulster University. He is also a senior member of the IEEE. Prof Curran is perhaps most well-known for his work on cyber security, blockchain and location positioning within indoor environments evidenced by over 800 peer review papers. He is one of the most interviewed technology experts in the UK with over 1000+ interviews in recent years.

<https://kevincurran.org/interviews/>



Wael Elmedany is currently an associate professor of Computer Engineering at University of Bahrain, Kingdom of Bahrain, and senior member of IEEE society. Elmedany holds a PhD degree in Electrical Engineering, Manchester University, UK, 1999; MSc degree in computer communications, Menoufia University, Egypt, 1991; BSc degree in Electronic Engineering, Menoufia University, Egypt 1987. Elmedany was assistant professor of computer communications, department of Electrical Engineering, Cairo University, Fayoum branch, 2000-2005, and assistant professor of electronics and computer communications, in Faculty of Electronic Engineering, Menoufia University, Egypt, 1999-2000. Elmedany was the research and development director of Evara R&D, Egypt, 2001-2003, and general director of Varia IC, Egypt, 2003-2005. He is the founder and managing editor of International Journal of Computing and Digital Systems (IJCDs). He is the founder and organizer of MobiApps, DPNoC, and WoTBD workshops and symposium series. He is also an editor of many journals special issues, member of editorial boards for many international journals, and member of technical program committees of many conferences. He is also reviewer in many international journals and conferences, and acts as chairperson in many conferences. El-Medany has over forty publications in a well-known international conferences and journals, and attended several national and international conferences and workshops. His research interests in ASIC design, FPGA, embedded systems, network on chip, remote monitoring systems, and reconfigurable computing.



Chitra Balakrishna, Ph.D. MBCS, FHEA , CEH is an academic, author, futuristic technology and open source enthusiast with over 19 years of experience spanning across academia and industry in the areas of Cyber Security, Data Networking, Mobile Communications, Technologies and Applications. She has been instrumental in acquiring research income of over £2 million as a co-investigator or principal investigator from funding sources such as ERDF, Innovate UK, HEA, EPSRC and British Council. She has over 40 academic publications to her credit in international journals and conference proceedings. In addition, she has authored a highly cited book on 'IP Multimedia Subsystem ' by John Wiley publications. She is currently the Program Leader for Cyber Security at Open University. She has previously held position of program leader for Networking, Security and Forensics at Edge Hill University and Head of Networks and Services with Centre of Excellence for Mobile Applications and Services. During her tenure as an academic member of staff at the University of South Wales, she set up an open source next-generation networking (NGN) lab in collaboration with industrial partners such as Orange and France Telecom. She is a founding member of a very successful IEEE conference on Next-Generation Applications, Technologies and services which is in its 11th edition and a chair for an IEEE sponsored workshop on Smart Cities for 5 years. In 2017, she secured a £80K grant from HEA for a project on gamification of cyber security education. The outcomes are maintained at a public website - <http://www.cyberedge.uk>. She currently holds a £40K GSIKE UK-Gulf partnership fund with University of Bahrain.



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