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# Guest Editorial

## Guest Editorial Special Issue on Communications Technologies and Infrastructures for Smart e-Health Systems

**Sana Ullah***

**Witold Pedrycz**

**George K. Karagiannidis**

**Han-Chieh Chao**

**Adam Gacek**

**Christos Verikoukis**

*CISTER Research Centre

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Sana Ullah*, Witold Pedrycz, George K. Karagiannidis, Han-Chieh Chao, Adam Gacek, Christos Verikoukis

*CISTER Research Centre

Polytechnic Institute of Porto (ISEP-IPP)

Rua Dr. António Bernardino de Almeida, 431

4200-072 Porto

Portugal

Tel.: +351.22.8340509, Fax: +351.22.8321159

E-mail: sauah@isep.ipp.pt

http://www.cister.isep.ipp.pt

## Abstract

The papers in included in this special issue examines new and novel communication methods for smart e-health systems. Recent developments in the healthcare domain have facilitated the integration of several technologies for smart, cost-effective, reliable, and pervasive health monitoring of chronic diseases. Current research efforts focus on developing real-time communication methods, mostly for body area networks (BANs) that are used to deliver patients´ information effectively. These efforts are limited to communication within a BAN; however, less attention has been paid to connect multiple BANs to remote servers in real time. In addition, there is a limited study on the integration of BANs with different technologies including mobile cloud computing 14a technology that may assist in storing and processing the huge amount of BAN data at competitive costs. Machine to machine is also considered to be a valuable paradigm in delivering BAN data to a remote server/cloud for further analysis. This may assist in reducing risks and cost of remote health monitoring. Unlike conventional research in BANs where researchers focused on individual networks, there is a need to develop innovative communication methods with a focus on complete and smart e-health systems. This smart e-health system must integrate the aforementioned technologies with multiple BANs, and provide rich healthcare services to end users. It calls for research on versatile topics ranging from physical and medium access control protocols to BANs coexistence, traffic characterization, cloud resource allocation, and cloud monitoring and maintenance.

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RECENT development in the healthcare domain have facilitated the integration of several technologies for smart, cost-effective, reliable, and pervasive health monitoring of chronic diseases. Current research efforts focus on developing real-time communication methods, mostly for body area networks (BANs) that are used to deliver patients′ information effectively. These efforts are limited to communication within a BAN; however, less attention has been paid to connect multiple BANs to remote servers in real time. In addition, there is a limited study on the integration of BANs with different technologies including mobile cloud computing—a technology that may assist in storing and processing the huge amount of BAN data at competitive costs. Machine to machine is also considered to be a valuable paradigm in delivering BAN data to a remote server/cloud for further analysis. This may assist in reducing risks and cost of remote health monitoring. Unlike conventional research in BANs where researchers focused on individual networks, there is a need to develop innovative communication methods with a focus on complete and smart e-health systems. This smart e-health system must integrate the aforementioned technologies with multiple BANs, and provide rich healthcare services to end users. It calls for research on versatile topics ranging from physical and medium access control protocols to BANs coexistence, traffic characterization, cloud resource allocation, and cloud monitoring and maintenance.

The objective of this Special Issue is to disseminate high-quality work on novel communication methods for smart e-health systems. We have received approximately 18 papers in different domains. All papers were rigorously reviewed and eight papers were finally selected for publication. The first paper, "SmartHear: A Smartphone-Based Remote Microphone Hearing Assistive System Using Wireless Technologies," by Lin *et al.*, proposes a novel hearing assistive system for individuals with mild-to-moderate hearing loss and shows an average improvement across four typical audiograms for mild-to-moderate hearing loss in different conditions. The second paper, "SADHealth: A Personal Mobile Sensing System for Seasonal Health Monitoring," by McNamara and Ngai, presents SADHealth, an unobtrusive and lightweight personal mobile sensing system that exploits technologies on smartphones to collect data on light exposure, mood, and activity levels of individuals without using any external sensing devices. The proposed work allows healthcare professionals and individuals to diagnose and rectify problems such as mood disorder or winter blues caused by seasonal affective disorder. The third paper, "Joint Layer-Based Formation and Self-Routing Algorithm for Bluetooth Multihop Networks," by C.-M. Yu and Y.-B. Yu, proposed a layer-based topology formation called the Bluelayer in order to mitigate formation complexity of the mesh-shaped topology in Bluetooth multihop networks. The Bluelayer considers a distributed self-routing scatternet to achieve less route discovery overhead. The fourth paper, "The Critical Patients Localization Algorithm Using Sparse Representation for Mixed Signals in Emergency Healthcare System," by Wan *et al.*, proposes a new patient localization algorithm for the emergency healthcare system based on future generation mobile cloud computation. The system uses a novel direction-of-arrival algorithm in the presence of mutual coupling to locate multiple patients' locations simultaneously. The fifth paper, "Certificateless Public Auditing Scheme for Cloud-Assisted Wireless Body Area Networks," by He *et al.*, proposes an efficient certificateless public auditing scheme for ensuring integrity of the stored data in cloud-assisted BANs. The proposed scheme is provably secure in a random oracle model and outperforms previously proposed auditing schemes. The sixth paper, "Link-Quality-Aware Resource Allocation With Load Balance in Wireless Body Area Networks," by Samanta *et al.*, proposes a link-quality-aware resource allocation system for BANs. The proposed system consisting of two phases (temporal link quality measurement and subchannel allocation phases) significantly increases link quality between BANs and available access points. The seventh paper, "On the Correlation of Sensor Location and Human Activity Recognition in Body Area Networks (BANs)," by Khan *et al.*, investigates the effects of on-body sensor location on the accuracy of activity recognition. The proposed work uses wearable action recognition dataset for experiments. The results conclude that different combinations of sensors may be observed in order to accurately recognize various activities. The last paper, "Policy-Controlled Authenticated Access to LLN-Connected Healthcare Resources," by Rantos *et al.*, proposes an architecture that provides a cross platform and robust access control mechanism, allowing authorized entities to consume services provided by e-health nodes. The feasibility of the proposed architecture is analyzed through experiments comprising heterogeneous testbed featuring desktop systems and typical embedded devices.

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We would like to thank the Editor-in-Chief, Prof. V. Piuri, for giving us the opportunity to edit this Special Issue. We would like to express our gratitude to the Reviewers who have carefully reviewed all the papers within a limited amount of time.

SANA ULLAH, *Guest Editor*
Department of Computer and Software Technology
University of Swat
Mingora, Pakistan
Polytechnic Institute of Porto
Porto 4200-465, Portugal

WITOLD PEDRYCZ, *Guest Editor*
Department of Electrical and Computer Engineering
University of Alberta
Edmonton, AB T6G 2R3, Canada

GEORGE K. KARAGIANNIDIS, *Guest Editor*
Department of Electrical and Computer Engineering
Aristotle University of Thessaloniki
Thessaloniki 541 24, Greece

HAN-CHIEH CHAO, *Guest Editor*
National Dong Hwa University
Hualien County 974, Taiwan

ADAM GACEK, *Guest Editor*
Institute of Medical Technology and Equipment
Zabrze 41-800, Poland

CHRISTOS VERIKOUKIS, *Guest Editor*
Centre Tecnològic de Telecomunicacions de Catalunya
Barcelona 08860, Spain

**Sana Ullah** received the Ph.D. degree in information and communication engineering from Inha University, Incheon, South Korea, in 2011.

From December 2011 to March 2014, he was an Assistant Professor with the College of Computer and Information Science, King Saud University, Riyadh, Saudi Arabia. He is currently an Assistant Professor with the Department of Computer and Software Technology, University of Swat, Mingora, Pakistan.

Dr. Ullah is currently an Editor for the Springer *Journal of Medical Systems* (JOMS), *KSII Transaction of Internet and Information Systems*, Wiley *Security and Communication Network*, *Journal of Internet Technology*, and *International Journal of Autonomous and Adaptive Communications Systems*. He was a Guest Editor for many top journals including Elsevier's *Journal of Information Science*, Springer's *Journal of Medical Systems*, and *Springer Journal of Telecommunication Systems*. He was also the Co-Chair/TPC member for a number of international conferences including BodyNets, IEEE PIMRC, IEEE Healthcom, IEEE Globecom, and IEEE WCNC.

**Witold Pedrycz** (F'98) is a Professor and Canada Research Chair in computational intelligence with the Department of Electrical and Computer Engineering, University of Alberta, Edmonton, AB, Canada. He is also with the Systems Research Institute, Polish Academy of Sciences, Warsaw, Poland. He is the author of 16 research monographs and edited volumes covering various aspects of computational intelligence, data mining, and software engineering. His main research interests include computational intelligence, fuzzy modeling and granular computing, knowledge discovery and data science, fuzzy control, pattern recognition, knowledge-based neural networks, relational computing, and software engineering. He has authored or coauthored numerous papers in these areas.

Dr. Pedrycz, in 2009, was elected a foreign member of the Polish Academy of Sciences. In 2012, he was elected a Fellow of the Royal Society of Canada. He has been a member of numerous Program Committees of the IEEE conferences in the area of fuzzy sets and neurocomputing. In 2007, he was the recipient of the prestigious Norbert Wiener Award from the IEEE Systems, Man, and Cybernetics Society. He was the recipient of the IEEE Canada Computer Engineering Medal, the Cajastur Prize for Soft Computing from the European Centre for Soft Computing, the Killam Prize, and the Fuzzy Pioneer Award from the IEEE Computational Intelligence Society. He is vigorously involved in editorial activities. He is the Editor-in-Chief for *Information Sciences*, *WIREs Data Mining and Knowledge Discovery* (Wiley), and the *International Journal of Granular Computing* (Springer). He is on the Advisory Board of the IEEE TRANSACTIONS ON FUZZY SYSTEMS and is a member of a number of Editorial Boards of international journals.

**George K. Karagiannidis** (M'96–SM'03–F'14) was born in Pythagoreio, Greece. He received the University Diploma (five years) and Ph.D. degree in electrical and computer engineering from the University of Patras, Patra, Greece, in 1987 and 1999, respectively.

From 2000 to 2004, he was a Senior Researcher with the Institute for Space Applications and Remote Sensing, National Observatory of Athens, Athens, Greece. In June 2004, he joined the faculty of Aristotle University of Thessaloniki, Thessaloniki, Greece, where he is currently a Professor with the Department of Electrical and Computer Engineering and the Director with Digital Telecommunications Systems and Networks Laboratory. He is also an Honorary Professor with Southwest Jiaotong University, Chengdu, China. He has authored or co-authored more than 450 technical papers published in scientific journals and presented at international conferences. He is also the author of the Greek edition of *Telecommunications Systems* and a coauthor of *Advanced Optical Wireless Communications Systems* (Cambridge Publications, 2012). His research interests include digital communications systems and signal processing with an emphasis on wireless communications, optical wireless communications, wireless power transfer and applications, molecular and nanoscale communications, stochastic processes in biology, and wireless security.

Dr. Karagiannidis has been the General Chair, Technical Program Chair, and a member of Technical Program Committees for several IEEE and non-IEEE conferences. He was an Editor for the IEEE TRANSACTIONS ON COMMUNICATIONS, a Senior Editor for IEEE COMMUNICATIONS LETTERS, an Editor for the *EURASIP Journal of Wireless Communications and Networks,* and several times a Guest Editor for the IEEE TRANSACTIONS ON SELECTED AREAS IN COMMUNICATIONS. From 2012 to 2015, he was the Editor-in Chief for IEEE COMMUNICATIONS LETTERS. He is one of the highly cited authors across all areas of electrical engineering, recognized as the 2015, 2016, and 2017 Web-of-Science Highly Cited Researcher.

**Han-Chieh Chao** received the M.S. and Ph.D. degrees in electrical engineering from Purdue University, West Lafayette, IN, USA, in 1989 and 1993, respectively.

Since February 2016, he has been the President with the National Dong Hwa University, Hualien, Taiwan. He was the President with National Ilan University from 2010 to 2016, and the Director with the Computer Center for Taiwanese Ministry of Education, from September 2008 to July 2010. He is currently with National Dong Hwa University, Hualien County, Taiwan. He has authored or coauthored 4 books and about 300 refereed professional research papers. He supervised more than 100 M.S.E.E. thesis students and 4 Ph.D. students. His research interests include high-speed networks, wireless networks, IPv6-based networks, digital creative arts, e-Government, and digital divide.

Dr. Chao is the ISI ESI top one percent scholar and was the recipient of the 2014 and 2016 IET Premium Awards. He is the Editor-in-Chief (EiC) for *IET Networks* and the *Journal of Internet Technology*. He is the Founding EiC for the *International Journal of Internet Protocol Technology* and the *International Journal of Ad Hoc and Ubiquitous Computing*. He was a Guest Editor for *Mobile Networking and Applications* (ACM MONET), IEEE JOUNRAL ON SELECTED AREAS IN COMMUNCATIONS, *IEEE Communications Magazine*, IEEE SYSTEMS JOURNAL, *Computer Communications*, *IEE Proceedings Communications*, *the Computer Journal*, *Telecommunication Systems*, *Wireless Personal Communications*, and *Wireless Communications and Mobile Computing*. Dr. Chao is a Fellow of the IET.

**Adam Gacek** (M'02–SM'14) received the M.Sc. degree in electronic engineering and Ph.D. degree in technical sciences from the Silesian University of Technology, Gliwice, Poland, in 1970 and 1986, respectively, and the D.Sc. degree from the Institute of Biocybernetics and Biomedical Engineering, Polish Academy of Sciences, Warsaw, Poland, in 2009.

He was the long-standing Managing Director for the Institute of Medical Technology and Equipment, Zabrze, Poland, and is currently a Professor. His research interests include biomedical instrumentation and signal processing, especially detection and analysis of ECG signals based on the technology of fuzzy sets and information granulation.

Dr. Gacek is a member of the Polish Society of Biomedical Engineering, the Committee of Biocybernetics and Biomedical Engineering of the Polish Academy of Science, and the Polish Society of Theoretical and Applied Electronics.

**Christos Verikoukis** received the Ph.D. degree from the Universitat Politècnica de Catalunya, Barcelona, Spain, in 2000.

He is a Fellow Researcher with the Centre Tecnològic de Telecomunicacions de Catalunya (CTTC/CERCA), Barcelona, and an Adjunct Associate Professor with the University of Barcelona, Barcelona. He is a coauthor of 4 books, 18 chapters, 2 patents, 117 journal papers, and more than 180 conference papers. He has participated in more than 30 competitive projects and was the Principal Investigator of national projects. He has supervised 15 Ph.D. students and 5 postdoctoral researchers.

Dr. Verikoukis is currently the Chair of the IEEE ComSoc CSIM TC. He was the recipient of the Best Paper Awards of IEEE ICC 2011, IEEE GLOBECOM 2014 and 2015, and EUCNC/EURACON 2016 and the EURASIP 2013 Best Paper Award for the *Journal on Advances in Signal Processing*.