Editorial

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Biographical notes: Lorenzo Mucchi received his DrIng in Telecommunications Engineering from the University of Florence (Italy) in 1998 and his PhD in Telecommunications and Information Society in 2001. Since 2001, he has been with the Department of Electronics and Telecommunications of the University of Florence as a Research Scientist. His main research areas are spread spectrum techniques (UWB, CDMA), cooperative communication systems, cognitive radio, wireless security, diversity techniques and satellite communications. Currently, he has published five book chapters, 18 international journals papers and several conference papers (~55). Since 2004, he has been TPC of about 18 international conferences.

Matti Hämäläinen received his MSc and DrSc in Electrical Engineering and Telecommunications Engineering, respectively, from the University of Oulu, Finland in 1994 and 2006. He has been a Researcher and a Project Manager in the Telecommunication Laboratory at the University of Oulu between 1993–1999. Since 1999, he has been with Centre for Wireless Communications (CWC) at the same university holding the same positions. Since 2007, he has been a Research Director in short range communications at CWC. His research interests include wireless sensor and body area networks, medical ICT, ultra wideband transceivers and channel modelling.

Kamya Yekeh Yazdandoost is an Expert Researcher at the National Institute of Information and Communications Technology, Japan. He is an Adjunct Professor at the University of Oulu, Finland and the recipient of Finland Distinguished Professor Program Fellow. He is the Chair of the channel modelling committee and the co-editor of the channel modelling document of the IEEE.802.15.6 on Body Area Network Standardization. He is a senior member of IEEE. He is the co-Chair of PIMRC2011 Track on Wireless Networks and Health Care. He is a co-author of the book *Wireless Body Area Network* and recipient of the IEEE PIMRC 2009 Best Paper Award.

Kamran Sayrafian-Pour is a Programme Manager at the Information Technology Laboratory of the National Institute of Standards and Technology located in Maryland, USA. He received his PhD, MS and BS in Electrical and Computer Engineering from the University of Maryland, Villanova University and Sharif University of Technology, respectively. Since 2004, he has also been an Adjunct Faculty of the University of Maryland where he received the Outstanding Teaching Award in 2010. He has served as the co-chair, organiser, and technical advisory board member of several international conferences and workshops. His research interests include mobile sensor networks, RF-based indoor positioning and body area networks.

In the near future, the demographics change the age pyramid of human population upside down. There will be more elderly people than young and middle-aged people. This will create problems for the healthcare sector, and definitely, new technological solutions are needed to support all people requiring assistance and care. This challenge should be addressed by advances in the medical sector as well as in the ICT domain in general.

The fields of applications for ultra wide band (UWB) technologies demonstrate that devices using this technology can be used in practice in all cases where we need highly precise remote observation or medical monitoring of objects or persons at short distances. For example, detection of motion of subject's chest requires high sensitivity and specificity of medical imaging radars. UWB radars are useful in hospitals and at homes where they can provide remote measurement of heart and respiratory rates as well as other parameters of the patient's vital activity. Medical imaging using UWB impulses can detect particulars which were not identified before.

By offering practical solutions that is promised to be commercially viable, UWB application domain is rapidly growing in the healthcare sector. As a result of this growing interest, the IEEE standardisation committee has been working on a networking standard for wearable and implantable sensors/actuators referred to as body area networks (BANs). Worldwide availability and the opportunity to have small sized antennas make UWB an attractive candidate for wireless BAN applications. As such, UWB is one of the technologies considered for wearable applications in the upcoming IEEE802.15.6 standard. UWB-enabled medical sensors can be worn on the body surface or embedded in clothing in order to communicate a wide range of information such as ECG, EEG, temperature, breath rate, etc.

A deep understanding of the interactions between UWB electromagnetic fields, human body and environments must be achieved in order to optimally exploit the vast potential of this technology. Wearable, and possible in the future also implantable wireless sensors based on UWB technology can be successfully used to build a human body area network. This will extend the reach of healthcare services from hospitals to people's home; and therefore, increase the quality of life and safety for many individuals in a cost effective way.

The objective of this special issue is to highlight current and emerging applications of UWB technology in biomedicine and healthcare applications. In this special issue, we are presenting six outstanding papers covering various aspects of the applications of UWB systems in biomedicine by several leading research groups.

The first article titled 'UWB systems for body area networks' is a very good overview of the UWB physical layer for body area networks. This paper offers some good commentary on the design and detail of the IEEE standards. This review could be valuable to any researchers requiring a concise synopsis of the recent developments by the IEEE standardisation 802.15.6 Task Group.

The second article titled as 'IEEE 802.15.4a UWB receivers in medical applications' is investigating different UWB receivers based on IEEE802.15.4a by means of simulations. The impact of the burst length and channel decoding methods on the receiver performance were studied.

The third article titled as 'On the UWB medical radars working principles' is addressing the use of UWB radar in wireless monitoring of vital signs. The antenna, antenna design, boundary around antenna, human body tissue effect, and near field of antenna for purpose of medical radar have been discussed.

The fourth article titled as 'Physics-based propagation characterisations of UWB signals for the urine detection in human bladder' is presenting an IR-UWB radar for the detection of water accumulation in the human bladder. The objective is to monitor the level of urine in patients who suffer from urinary incontinence. Using a model of human bladder with different tissue layers, the authors show the potential of UWB technology as new non-invasive sensors to detect urine in the human bladder.

The fifth article titled 'Application of IEEE 802.15.6 IR-UWB physical layer for medical BAN' investigates several aspects of IEEE 802.15.6 DPSK IR-UWB physical layer for usage in the medical BAN such as the types of the waveforms used in the standard and the packet structure. The paper also provides mathematical analysis of two receiver structures: the duty-cycled sampling receiver and the chirp receiver. The paper continues with developing a method of synchronisation for preamble structure described in the standard.

The sixth article titled as 'Experimental study in breath detection and human target ranging in the presence of obstacles using ultra-wideband signals' is explaining the measurement-based analysis of breath activity detection. The results showed that it is possible to reliable detect breath, and hence, humans existence through walls using UWB radar type apparatus.

The editors believe that these interesting papers will inspire further progress and innovation in the area of UWB systems in biomedicine and healthcare applications.

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