Special Issue on “Wireless Robotics: Research and Standardisation”

(Selected Topics from the Strategic Workshop, May 6–8, 2012, Aalborg, Denmark)

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The 14th Edition of the closed-door Strategic Workshop was held in Aalborg, Denmark from the 6th to the 8th of May, 2012. The focus during the active two-day discussions of the participating major stakeholders, was on wireless robotics—research and standardisation.

Wireless robotics is an area of active research with enormous, untapped potential for the future—for household use, for applications in industry and production, for elderly care, in hospitals as well as in a host of other fields.

This Special Issue features ten selected papers on the above topic that focus on various innovative proposals and concepts that can enable wireless robotics towards the standardisation.

The first paper, “*Wireless Robotics: Opportunities and Challenges*”, by Sivabalan Arumugam, Ritesh Kumar Kalle and Anand R Prasad states that rapid standardisation and proliferation of wireless robotics will increase productivity, profitability and guarantee sustainability in all application areas of robotics including industrial, defense, scientific, medical and civilian sectors.

The second paper, “*QoS Challenges in Wireless Sensor Networked Robotics*”, by Evy Troubleyn, Ingrid Moerman and Piet Demeester shows that combining mobile robotics and sensor networks opens a new area of possible applications and that these applications often have stringent and diverse requirements on the delivered Quality of Service level. Since QoS support is already challenging in wireless sensor networks, adding mobile robotics increases this challenge.

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The third paper, “*Collaborative Relaying Strategies in Autonomic Management of Mobile Robotics*”, by João Paulo Barraca, Rasool Sadeghi and Rui L. Aguiar presents a system for complex mobile robot environments, able to consider both fully mobile, semi-mobile, and fixed robots. The reference case assumes a set of low cost information nodes that are potentially repositioned by robots, in order to optimize communication (both in terms of performance and energy) by exploring cooperative communications.

The fourth paper, “*In-Network Computations of Machine-to-Machine Communications for Wireless Robotics*”, by Kwang-Cheng Chen, Fan-Min Tseng and Chi-Heng Lin explains that the entire information system for wireless robotics involves computation for robot operation and M2M communications for two-fold purpose, control of robots and information exchange with environment (primarily information collection from sensors).

The fifth paper, “*An Exposition of Performance-Security Trade-offs in RANETs Based on Quantitative Network Models*”, by G. Miskeen, D. D. Kouvatso and E. Habib Zadeh focuses with the design and development of advanced performance and security mechanisms and associated extended numerical case studies for establishing optimal performance and security trade-offs in RANETs. The approach is based on the decomposition of RANETs into individual hybrid G-GSPN_QN models of robotic nodes, based on the departing, splitting and merging traffic flow streams and novel combined performance and security metrics.

The sixth paper, “*Underwater Localisation and Environment Mapping using Wireless Robotics*”, by Sen Wang, Ling Chen, Huosheng Hu, Zhibin Xue and Wei Pang presents a novel underwater localisation and mapping strategy for a school of wireless networked URFs, which consists of two algorithms: CLPF for three-dimensional localisation and OGMA for three-dimensional mapping.

The seventh paper, “*A Framework for Testing of Wireless Underwater*”, by J. Poncela and M.C. Aguayo-Torres states that the underwater realm is one yet poorly grasped but with high prospects. However, its characteristics make it a harsh environment where most of the operations must be performed by remote equipment. Such scenarios call for different heterogeneous devices operating in a cooperative/coordinated way.

The eighth paper, “*Wireless Robotics: Generalization of an Efficient Approach with Multi-h CPM signalling and L²-orthogonal Space-Time coding*”, by Miguel Angel Hisojo, Jérôme Lebrun and Luc Deneire provides a generalized version of the physical layer satisfying the need of high energy efficiency by means of the L²-orthogonal STC-CPM as well as the high spectral efficiency by means of STC.

The ninth paper, “*Performance Analysis of Combined mMCSK-mMFSK Modulation in AWGN and Rayleigh Fading Channel*”, by Ari Pouttu presents the results for mMCSK-mMFSK modulation in AWGN and flat Rayleigh fading channels for both coherent and non-coherent receivers. The performance has been also assessed with orthogonal and non-orthogonal code constructs for coherent receiver.

The tenth paper, “*Out of the shadow: long term cost development of intelligent sensor networks*”, by Erik Fledderus, Leon Kester and Karin Kranenburg-Bruinsma shows how individual ISN component prices decline at an almost predictable speed. This is mainly a result of generic developments in technology. These developments sustain because an economy of scale is reached at the level of individual components. This makes the integration of these components the most important barrier to acquire large scale implementation of ISNs, both with respect to cost and needed R&D breakthroughs. Integration includes the need for standardisation and interoperability between different standards.

Author Biographies

R. Prasad is currently the Director of Center for Teleinfrastruktur (CTIF), and holds the chair of wireless information and multimedia communications. He has published over 700 technical papers, contributed to several books, and has authored, coauthored, and edited over twenty books. His latest book is *"Introduction to Ultra Wideband for Wireless Communications"*. Prof. Prasad has served as a member of the advisory and program committees of several IEEE international conferences. He has also presented keynote speeches, and delivered papers and tutorials on WPMC at various universities, technical institutions, and IEEE conferences. He was the founder and chairman of the IEEE Vehicular Technology/Communications Society Joint Chapter, Benelux Section, and is now the honorary chairman. In addition, Prof. Prasad is the founder of the IEEE Symposium on Communications and Vehicular Technology (SCVT) in the Benelux, and he was the symposium chairman of SCVT'93. Presently, he is the Chairman of IEEE Vehicular Technology/Communications/Information Theory/Aerospace and

Electronics Systems/Society Joint Chapter, Denmark Section. In addition, Prof. Prasad is the coordinating editor and editor-in-chief of the *Springer International Journal on Wireless Personal Communications*. He was the technical program chairman of the PIMRC'94 International Symposium held in The Hague, The Netherlands, from September 19–23, 1994 and also of the Third Communication Theory Mini-Conference in Conjunction with GLOBECOM'94, held in San Francisco, California, from November 27–30, 1994. He was the conference chairman of the fiftieth IEEE Vehicular Technology Conference and the steering committee chairman of the second International Symposium WPMC, both held in Amsterdam, The Netherlands, from September 19–23, 1999. He was the general chairman of WPMC'01 which was held in Aalborg, Denmark, from September 9–12, 2001, and of the first International Wireless Summit (IWS 2005) held also in Aalborg, Denmark on September 17–22, 2005. He was the General Chair of the First International Conference on Wireless Communication, Vehicular Technology, Information Theory and Aerospace & Electronic Systems Technology (Wireless VITAE) held on May 17–20, 2009 in Aalborg. Prof. Prasad was also the founding chairman of the European Center of Excellence in Telecommunications, known as HERMES and now he is the honorary chairman. He is a fellow of IEEE, a fellow of IETE, a fellow of IET, a member of The Netherlands Electronics and Radio Society (NERG), and a member of IDA (Engineering Society in Denmark). Prof. Prasad is advisor to several multinational companies. He has received several international academic, industrial and governmental awards of which the most recent is the Ridder in the Order of Dannebrog (2010), a distinction awarded by the Queen of Denmark.

M. Ruggieri was with FACE-ITT and GTC-ITT (Roanoke, VA) in the High Frequency Division (1985–1986); Research and Teaching Assistant at the University of Roma Tor Vergata (1986–1991); Associate Professor in Telecommunications at Univ. of L'Aquila (1991–1994) and at Tor Vergata (1994–2000). Since November 2000 she is Full Professor in Telecommunications at Tor Vergata. Since 2003 she directs a Master in "Advanced Satellite Communications and Navigation Systems" at Tor Vergata. Her research focuses on space communications and navigation systems, integrated systems, mobile and multimedia networks, ICT for biotechnology, energy and disaster ahead management. In 2004–2006 she was in the Technical-Scientific Committee of the Italian Space Agency (ASI). In 2007–2008 she has been Vice-President of the ASI Technical-Scientific Committee. Since December 2007 she belongs to the Italian *Superior Council of Telecommunications* as Expert. Since March 2010 she is member of the Committee of Experts for the Research Policy (CEPR) of the Ministry of University and Research (MIUR). She was President of the IEEE Aerospace and Electronic Systems (AES) Society (2010–2011). She is Chair of the AESS Nominations and Appointments Committee (2012–2013) and Member of the IEEE TAB (Technical Activity Board) Strategic Planning Committee (2011–2013). She has been elected IEEE Division IX Director-Elect (2013) and will be IEEE Division IX Director in 2014–2015. Since December 2006 she is Vice President of the *AFCEA Rome Chapter*. She is Director of *CTIF_Italy*, the Ital-

ian branch of the *Center for Teleinfrastruktur* (CTIF) in Aalborg (Danimarca), opened at the University of Roma Tor Vergata. She is Editor of the *IEEE Transactions on AES for Space Systems*. She was awarded the 1990 *Piero Fanti International Prize* and she had a nomination for the *Harry M. Mimmo Award* in 1996 and the *Cristoforo Colombo Award* in 2002. She received the 2009 *Pisa Donna Award*. She received the 2012 *Roma Capitale Donna* for research achievements. She is author of about 320 papers, on international journals/transactions and proceedings of international conferences, book chapters and books (9).