Guest Editorial
RFID Technologies & Internet of Things

The next-generation of the Internet aims to integrate heterogeneous wireless technologies and low-cost embedded devices in order to contribute to assert the concept of Internet of Things (IoT). The main idea behind the IoT concept is to have worldwide interconnected objects, each one individually discovered and addressed as a resource in the network. In this new scenario, the Human-to-Machine paradigm (H2M) is increasingly moving toward the new Machine-to-Machine (M2M) paradigm, so leading to an improvement of several aspects in everyday life. Certainly, Wireless Sensor Network (WSN) and Radio Frequency Identification (RFID) are playing a fundamental role as IoT enabling technologies. A very intersting research topic is focused on the integration between RFID and WSN in order to spread smart environments able to capture, in a pervasive way, all useful information from the real world.

This special issue on RFID Technology and Internet of Things of the JOURNAL OF COMMUNICATIONS SOFTWARE AND SYSTEMS aims to report on the recent advancement and developments in various aspects of the IoT such as RFID, NFC, tracing and tracking systems, supply chain, security in IoT, WSN, integration between RFID and WSN, and so on.

Fifteen papers were submitted and ten of them have been recommended for publication based on the standard reviewing process. Papers published in this special issue of JCOMSS cover most research topics previuosly reported.

In the work "Performance Evaluation of a Novel Animals Tracking System based on UHF RFID Technology" [1], the authors Luca Catarinucci, Riccardo Colella, Luca Mainetti, Vincenzo Mighali, Luigi Patrono, Ilaria Sergi, and Luciano Tarricone, demonstrate that passive RFID technology in UHF band can be efficiently used to create an innovative tracking system for laboratory animals, in order to support the researcher in the behavioral analysis of this animals. They deeply investigated all aspects of RFID technology in the UHF band and designed a complete system, both hardware and software, able to precisely track mice that move in a cage. The experimental results, reported in this work, demonstrate the appropriateness of the proposed approach.

In the work "An information-centric and REST-based approach for EPC Information Services" [2], the authors Federica Paganelli, Stefano Turchi, Lorenzo Bianchi, Lucia Ciofi, Maria Chiara Pettenati, Franco Pirri, and Dino Giuli propose an implementation of the EPCIS specifications based on the adoption of Linked Data and REST principles. They argue that the adoption of such principles in the EPCIS domain will improve information sharing across organizational boundaries and ease the development of web-based applications, exploiting data and events made available through the EPC Network. The InterDataNet (IDN) Framework puts into practice these principles since it is capable of handling EPC data and events as a graph of globally-addressable resources. Such resources can be navigated, queried, and aggregated through a uniform interface and seamlessly across organization domains.

In the work "Secure Document and Asset Tracking" [3], the authors Heinz Lugo, Diana Segura, Vasilis Michopoulos, Paul Conway, and Andy West present the development of an RFID based management system to keep traceability records and real time tracking for documents and assets with security constraints on their access and use/storage locations. A comparison between AS IS and TO BE models ir reported. The authors show that the use of such system can lead to a reduction of up to 60% in the time involved in the document/asset management activities.

In the work "Influence of Managing the Number of Tag Bits Transmitted on the Query Tree RFID Collision Resolution Protocol" [4], the authors Hugo Landaluce, Asier Perallos, and Ignacio Angulo present a new methodology, called 'window', to manage the number of bits transmitted by a tag. The aim is show how the query tree (QT) protocol is influenced by this feature, and how the performance of the novel protocol, query window tree (QwT), improves when the tag ID distribution is correlated. A comparison between the Query Tree and the new proposed QwT protocol for various tag ID distributions is reported. Simulations show that the QwT positively decreases the total number of bits that are transmitted by tags.

In the work "RFID Mutual Authentication Protocols based on Gene Mutation and Transfer" [5], the authors Raghav V. Sampangi and Srinivas Sampalli demonstrate two mutual authentication protocols for RFID systems that are based on the concept of gene mutation and transfer. They present two protocols to generate encryption keys independently at the RFID tag and the server. The protocols offer mutual authentication of the communicating entities due to the nature of the key updates (independent, dynamic, continuous and based on the concept of gene mutation and transfer). The protocols demonstrate that the use of the concept of gene mutation and transfer for key generation and management offers increased security and facilitates mutual authentication. Their work is validated by simulation studies and security analysis.

In the work "SafeRFID-MW: a RFID Middleware with runtime fault diagnosis" [6], the authors Rafik Kheddam, Oum-El-Kheir Akatouf, and Ioannis Parissis propose a novel fault-tolerant RFID middleware providing two fault-tolerant

mechanisms. The first mechanism is an online diagnosis algorithm based on a statistical analysis of the generated RFID data to identify faulty components of the system such as faulty readers or tags. The second mechanism is a verification process based on an extended finite state machine of the Low Level Reader Protocol (LLRP), the communication standard between RFID readers and RFID middleware.

In the work "Indoor localization by using particle filtering approach with wireless sensor nodes" [7], the authors Hakan Koyuncu, and Ahmet Çevik propose an indoor localization technique by using particle filtering approach with Jennic type wireless sensor nodes. Unknown object positions are mapped by using Received signal strengths across the sensing area. These received signal strengths are converted into distances between the trasnmitters and the receiver on the unknown object by using ITU propagation loss model. Particles are randomly generated in circular boundaries instead of randomly generated across the total test area.

In the work "Performance Evaluation of an Energy-Efficient MAC Scheduler by using a Test Bed Approach" [8], the authors Daniele Alessandrelli, Luca Mainetti, Luigi Patrono, Giovanni Pellerano, Matteo Petracca, and Maria Laura Stefanizzi propose and validate an energy efficient communication protocol for WSNs based on an asynchronous scheduler that significantly reduces the power consumption of WSN nodes through an approach based on duty-cycle. The authors thoroughly evaluated the performances and the portability of the proposed solution by means of both simulations, carried out using the Contiki simulation tools, and test beds based on two different platforms. The presented results demonstrate the effectiveness of the proposed scheduler, as well as its benefits in saving nodes energy and extending network lifetime with respect to the standard IEEE 802.15.4 protocol.

In the work "Performance of Multiple-Antennas in ISO 18000-7 Standard with Using Limited Feedback Schemes" [9], the author Ali Eksim realizes that a tag consumes too much energy to perform a satisfactory communication in Rayleigh fading channel. Motivated by this need, he aims to ameliorate a RFID system performance from the perspective of better communication and energy efficiency. Detailed and extensively simulations show that limited feedback schemes yields more than 30 dB better performance with respect to the single antenna case. In addition, the Multiple-Input Multiple-Output RFID system by using limited feedback schemes are simulated and evaluated.

Finally, in the the work "WSN and RFID Integration in the IoT scenario: an Advanced Safety System for Industrial Plants" [10] **,** the authors Matteo Petracca, Stefano Bocchino, Andrea Azzara' , Riccardo Pelliccia, Marco Ghibaudi and Paolo Pagano propose and discuss the integration of WSN and RFID technologies in the IoT scenario. The proposed approach is based on the REST paradigm, thanks to which the two technologies can be seamless integrated by representing sensors, actuators and RFID related data as network resources globally addressable through state-of-the-art IoT protocols. The authors detail the integration approach for the Smart Factory use case by proposing and developing an advanced IoT-based WSN and RFID integrated solution aiming at improving safety in industrial plants.

REFERENCES

[1] L. Catarinucci, R. Colella, L. Mainetti, V. Mighali, L. Patrono, I. Sergi, and L. Tarricone: *Performance Evaluation of a Novel Animals Tracking System based on UHF RFID Technology,* JCOMSS, vol. 9, no. 1, pp. 4-13, 2013.

[2] F. Paganelli, S. Turchi, L. Bianchi, L. Ciofi, M. C. Pettenati, F Pirri, and D. Giuli: *An information-centric and REST-based approach for EPC Information Services*, JCOMSS, vol. 9, no. 1, pp. 14-23, 2013.

[3] H. Lugo, D. Segura, V. Michopoulos, P. Conway, and A. West: *Secure Document and Asset Tracking*, JCOMSS, vol. 9, no. 1, pp. 24-34, 2013.

[4] H. Landaluce, A. Perallos, and I. Angulo: *Influence of Managing the Number of Tag Bits Transmittedon the Query Tree RFID Collision Resolution Protocol,* JCOMSS, vol. 9, no. 1, pp. 35-43, 2013.

[5] R. V. Sampangi, and S. Sampalli: *RFID Mutual Authentication Protocols based on Gene Mutation and Transfer*, JCOMSS, vol. 9, no. 1, pp. 44-56, 2013.

[6] R. Kheddam, O. El K. Aktouf, and I. Parissis: *SafeRFID-MW: a RFID Middleware with runtime fault diagnosis*: JCOMSS, vol. 9, no. 1, pp. 57-73, 2013.

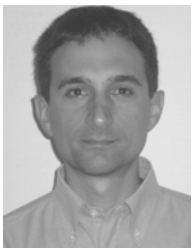
[7] H. Koyuncu, and A. Çevik: *Indoor Localization by using Particle Filtering Approach with Wireless Sensor Nodes*, JCOMSS, vol. 9, no. 1, pp. 74-83, 2013.

[8] D. Alessandrelli, L. Mainetti, L. Patrono, G. Pellerano, M. Petracca, and M. L. Stefanizzi: *Performance Evaluationof anEnergy-Efficient MAC Scheduler by using a Test Bed Approach*, JCOMSS, vol. 9, no. 1, pp. 84-96, 2013.

[9] A. Ekşim: *Performance of Multiple-Antennas in ISO 18000-7 Standard with Using Limited Feedback Schemes*, JCOMSS, vol. 9, no. 1, pp. 97-103, 2013.

[10] M. Petracca, S. Bocchino, A. Azzarà, R. Pelliccia, M. Ghibaudi, and P. Pagano: *WSN and RFID Integration in the IoT scenario: an Advanced Safety System for Industrial Plants*, JCOMSS, vol. 9, no. 1, pp. 104-113 , 2013.

EDITORS



Luigi Patrono (luigi.patrono@unisalento.it) received his MS in Computer Engineering from University of Lecce, Lecce, Italy, in 1999 and PhD in Innovative Materials and Technologies for Satellite Networks from ISUFI-University of Lecce, Lecce, Italy, in 2003. He is an Assistant Professor of Network Design at the University of Salento, Lecce, Italy. His research interests include RFID, EPCglobal, Internet of Things, Wireless Sensor

Networks, and design and performance evaluation of protocols. He is Organizer Chair of the international Symposium on RFID Technologies and Internet of Things within the IEEE SoftCOM conference. He is Guest Editor of the Special Issue on RFID Technologies & Internet of Things. He is author of about 60 scientific papers published on international journals and conferences and four chapters of books with international diffusion.

Joško Radić received his M.S. and Ph.D. degrees both in communication engineering from the University of Split in 2005 and 2009, respectively. Hi is currently Post Doctoral Researcher at the Department of Electronics, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split. His research interests include wireless communications, signal processing, multicarrier systems, and coding theory. Dr. Radic is a member of IEEE Communications Society, Broadcast Technology, Consumer Electronics and Oceanic Engineering Societies. He is also a member of the Croatian Communications and Information Society (CCIS).

Matteo Petracca received the M.S. degree in Telecommunication Engineering in 2003 and the Ph.D. degree in Information and System Engineering in 2007, both from the Politecnico di Torino, Turin, Italy. From March 2007 to November 2009 he was a post-doc researcher at the Politecnico di Torino working on multimedia processing and transmission over wired and wireless packet networks. In 2009 he joined the ScuolaSuperioreSant'Anna in Pisa, Italy and in the 2010 the CNIT (National Inter-University Consortium for Telecommunications) as research fellow. Dr. Petracca has been actively involved in many Italian and European research projects. He is co-author of more than 30 scientific papers published in international journals, peer-reviewed conference proceedings and book chapters.