Guest Editorial
RFID Technologies & Internet of Things

The Internet of Things (IoT) is envisioned as a network of billions or trillions of smart "objects" connected to the Internet and characterized by sensing, actuating, and data processing capabilities. Main goal of the IoT is to create a better world for human beings, where objects around us knows what we like, what we want, and what we need and act accordigly without explicit instructions. The opportunity to implement pervasive environments that are able to detect environmental parameters in a smart mode is becoming more attractive for both the academic and the industrial world in many scenarios such as environmental monitoring, building automation, healthcare, smart cities, smart grid, logistics, etc.. A very interesting research challange aims to implement smart environments able to minimize costs and to maximize the satisfation level of end-users.

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 correlated to emerging hardware and software technologies enabling the IoT, such as RFID, WSN, system software architecture, integrated solutions, embedded systems, and so on.

Only eight of the submitted papers 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. They are split in three main groups focused mainly on hardware solutions ([1], [2]), services and software architectures ([3],[4],[5],[6]), and network protocols ([7],[8]) validated by analytics and simulation approaches.

In the work "Wireless Monitoring System of Household Electrical Consumption with Daly-Based Control Unit of Lighting Facilities Remotely Controlled by Internet" [1], the authors P. Visconti, P. Primiceri, and G. Cavalera propose a wireless monitoring smart system for the reduction of household energy waste. It consists of a hardware apparatus and PIC-based software for managing and remote control of home's electrical facilities based on both ZigBee and Wi-Fi wireless technologies. The proposed apparatus is able to detect absorbed current from electrical loads, to calculate dissipated power and energy with the aim to show, in real-time, calculated consumption values on web page properly realized for user's remote control. Moreover, it can switch on/off the monitored electrical loads for obtaining energy saving and user satisfaction. By sending DALI-standard commands to slave loads (e.g., lighting facilities based on LEDs), the user can monitor, remotely by using a tablet/smartphone connected to internet, the operation's state and adjust the light intensity of each light point for achieving different scenarios, as well as the energy efficiency and home comfort. All functional tests, carried out on realized PCB prototype, have provided positive results allowing the use for the monitoring/driving of a real house's electrical facilities.

In the work "Using Battery-Less RFID Tags with Augmented Capabilities in the Internet of Things" [2], the authors R. Colella, L. Catarinucci, A. Esposito and L. Tarricone envisioned the potentialities in the framework of the Internet of Things of new kinds of RFID tags aggregating storage and processing capability, communication, sensing, actuation, pro-active two-way reader-tag communication, and reliable long-term memory. Leveraging on their own solution, they investigate more in detail two applicative scenarios to illustrate how augmented RFID devices may support advanced IoT systems.

In the work "An ECA-based Semantic Architecture for IoT Building Automation Systems" [3], the authors P. Lillo, L. Mainetti, V. Mighali, L. Patrono, and P. Rametta propose a novel rule-based semantic architecture for the easy implementation of building automation applications in an IoT context. Currently, existing solutions are strictly intended for specific applications and their customization is often limited to what developers have considered at the design and implementation time. So, the integration of new functionalities requires significant changes by developers, while common users cannot make personalizations by themselves. The proposed system is able to overcame these limitations by providing the end-user with the capability to build his own applications without any knowledge on programming languages and hardware technologies. In more detail, applications are structured as a set of Event-Condition-Action (ECA) rules and the layered architecture separates high-level semantic reasoning aspects from low-level execution details. The proposed architecture is also compared with main state-of-the-art solutions and a standard-based implementation framework is suggested. The last aspect is treated by referring to standardized guidelines and widely-accepted platforms, in order to make the proposal more attractive and robust.

In the work "A Combined Batteryless Radio and WiFi Indoor Positioning System for Hospital Nursing" [4], the authors R. Kanan and O. Elhassan aims to design an efficient hospital nurse calling system which combines two types of indoor localization systems to locate patients and nurses equipped with their smartphones respectively. The main goal of developing such system is to decrease the time taking for nurses to provide healthcare for patients. Patients' positioning system is RF based. Indeed, each patient is equipped with a wireless and battery-free call button. A dedicated program has been developed to calculate the position of the call button and post it on an online database. On the other hand, the nurses' localization system is WiFi-based.

In the work "A Cloud Architecture for Managing IoT-aware Applications According to Knowledge Processing Rules" [5], the authors L. Mainetti, L. Manco, L. Patrono, and R. Vergallo propose a software architecture for IoT systems able to manage the behaviour of involved IoT entities basing on knowledge processing tools. The main goal is informing the user of the occurrence of events of interest semantically determined starting from actual state of the environment. The architecture exploits the potentialities of the Web of Topics (WoX) approach, a conceptual model that simplifies the designing of IoT applications. Leveraging the WoX approach, the architecture introduces an innovative way to mine knowledge from IoT devices aside from any technological background, so that facing the intrinsic heterogeneity affecting IoT entities. The discussed architecture is composed by different modules integrated into an Enterprise Service Bus (ESB), strongly decoupled and provided with RESTful-compliant web interfaces to communicate each other and with the external environment, according to a SOA structure. The paper shows how the system is able to receive data coming from sensors and to semantically interpret them by means of a series of business rules that act as knowledge processor.

In the work "A pervasive computing system for the remote management of hospital waste" [6], the authors E. Katsiri and K. Moschou propose Greenactions, a novel Pervasive Computing system for the remote end-to-end management of hazardous medical waste. Currently, a very small percentage of medical waste is actually disposed of properly in final reception units while the rest is unaccounted for potentially exposing the community at large to infection, toxic effects and injuries, and risking polluting the environment. Greenactions provides real-time traceability for 100% of medical waste, by continually monitoring the full life cycle of each waste container, from their delivery to the hospitals, through to their collection and disposal, and providing remedial action in real-time, whenever an incident occurs. This is achieved by employing both fixed and handheld RFID and sensor technology, supported by a state-machine model that knows at any time the current and next state of each waste container. Deployed together with a small fleet of appropriately modified vehicles for waste collection, Greenactions provides an integrated solution can be applied in any waste collection and tracking scenario, without requiring any costly, proprietary infrastructure thus alleviating the burden of medical waste management from health-care units.

In the work "Border surveillance monitoring using Quadcopter UAV-Aided Wireless Sensor Networks" [6], the authors S. Berrahal, J.-H. Kimu, S. Rekhis, N. Boudriga, D. Wilkinsu, and J. Acevedo propose a novel cooperative border surveillance solution. It is composed of a Wireless Sensor Network (WSN) deployed terrestrially to detect and track trespassers, and a set of lightweight unmanned aircraft vehicles (UAVs) in the form of quadcopters that interact with the deployed WSN to improve the border surveillance, the detection and investigation of network failures, the maintenance of the sensor network, the tracking of trespasser, the capture and transmission of real time video of the intrusion scene, and the response to hostage situations. A heuristic-based scheduling algorithm is described to optimize the tracking mission by increasing the rate of detected trespassers spotted by the quadcopters. Together with the design of the electrical, mechanical and software architecture of the proposed VTail quadcopter, we develop in this paper powerless techniques to accurately localize terrestrial sensors using RFID technology, compute the optimal positions of the new sensors to drop, relay data between isolated islands of nodes, and wake up sensors to track intruders. The developed VTail prototype is tested to provide valid and accurate parameters' values to the simulation. The latter is conducted to evaluate the performance of the proposed WSN-based surveillance solution.

Finally, in the work "Asymptotic Analysis of Backlog Estimates for Dynamic Frame Aloha" [7] , the authors L. Barletta, F. Borgonovo, and I. Filippini, deals with the asymptotic efficiency of the tag identification procedure in the Radio Frequency Identification standard, when using Dynamic Frame Aloha. Since the efficiency of the identification procedure depends on the step-by-step estimate of the number of tags to be identified, the paper investigates how the convergence of some estimates affects, with respect to the ideal case, the efficiency of the entire identification duration. It is shown that a popular estimate, long known because of its simplicity, is indeed inefficient. A proposal is formulated for a simple variation of this estimate that, making use of the Frame Restart property of the standard, reaches optimal efficiency.

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