Guest Editorial

“Things” as Intelligent Sensors and Actuators in the Users’ Context: Processing and Communications Issues

The technological evolution of the Internet of Things (IoT) and of the related devices, and their increasing diffusion, give mobile network providers the opportunity to come up with more advanced and innovative services. Among these are the so-called context-aware services: highly customizable services tailored to the user’s preferences and needs, which rely on real-time knowledge of the user’s surroundings, without requiring complex configuration on the user’s part. Examples of context-aware services are user profile changes that result from context changes, user proximity-based advertising, or media content tagging, etc. Applications based on the information acquired, processed and distributed by the IoT can answer the following questions about the objects’ surroundings: what, who, where, when, why, and how.

Consequently, a description of the environment in which the IoT is deployed must be obtained by acquiring and combining signals and data from different sources of the devices, both external and internal, which brings forward unprecedented challenges as well as opportunities. Toward this end, this Special Issue is devoted to recent advances in addressing challenges on processing, computing, communications issues and also energy saving in the users’ context. The Calls for Papers was issued in the middle of 2015, with the submission deadline set as December 1, 2015. We have received 48 submissions and ultimately 17 high-quality papers have been selected, which are categorized into the following five groups.

I. DETECTION, TRACKING, AND LOCALIZATION

The paper “An Android-Based Mechanism for Energy Efficient Localization Depending on Indoor/Outdoor Context” by Capurso et al., presented an energy consumption analysis of the localization methods available on modern Android smartphones and proposed the addition of an indoor localization mechanism that can be triggered depending on whether a user is detected to be indoors or outdoors. The next paper “IGMM-Based Co-Localization of Mobile Users With Ambient Radio Signals” by Varela et al., proposed a real-time infinite Gaussian mixture model based co-localization system, in a centralized manner, which leverages co-located users with high accuracy, by exploiting the similarity of radio frequency measurements from users’ mobile terminal and without requiring any further information about them.

The paper “On Demand Color Calibration for Pedestrian Tracking in Nonoverlapping Fields of View” by Waizumi et al., presented a framework of on demand color calibration system to track pedestrians across nonoverlapping fields of fixed camera view, based on the machine-to-machine (M2M) approach exchanging color information of multiple fixed cameras autonomously. The next paper, “Leveraging Crowdsourcing for Efficient Malicious Users Detection in Large-Scale Social Networks” by Yang et al., proposed a novel approach that leverages the power of users to perform the detection task, and designed incentive mechanisms to encourage the participation of users for both scenarios of full information and partial information.

The paper “Detecting Driver’s Smartphone Usage via Nonintrusively Sensing Driving Dynamics” by Bo et al., addressed a critical task of dynamically detecting the simultaneous behavior of driving and texting using smartphone as the sensor, proposed, designed, and implemented TEXIVE which achieves the goal of detecting texting operations during driving utilizing irregularities and rich micromovements of users. The next paper, “Device-Free RF Human Body Fall Detection and Localization in Industrial Workplaces” by Kianoush et al., proposed a framework for human body motion sensing with special focus on joint body localization and fall detection, which continuously monitors and processes the RF signals emitted by industry-compliant radio devices operating in the 2.4 GHz ISM band and supporting M2M communication functions.

The last paper in this group, “Radios as Sensors” by Cianca et al., focused on how the identification of the human body presence and movement can be carried out by analyzing the RF signals transmitted by sources of opportunity, using radio receiver, intrinsically an electronic sensor, for device-free human activity recognition.

II. ENERGY MANAGEMENT

The paper “Optimized Day-Ahead Pricing With Renewable Energy Demand-Side Management for Smart Grids” by Chiu et al., considered renewable energy buyback schemes
with dynamic pricing to achieve the goal of energy efficiency for smart grids, and proposed a day-ahead time-dependent pricing scheme in a distributed manner seeking to achieve maximum benefits for both users and electric companies. The next paper, “Robust Relay Selection for Large-Scale Energy Harvesting IoT Networks” by Kawabata et al., studied energy-harvesting (EH) relay selection in large-scale networks, proposed a new EH relay selection based on residual batteries of relays and channel distribution information between relays and a common destination so that the resulting outage probability is minimized while minimizing the feedback cost.

III. CLOUD SYSTEM

The paper “Design and Implementation of Cloud Enabled Random Neural Network-Based Decentralized Smart Controller With Intelligent Sensor Nodes for HVAC” by Javed et al., presented a random neural network (RNN) based smart controller on a IoT platform, which is modular and not limited to but has several sensors for measuring temp, humidity, inlet air coming from the HVAC duct and PIR, and is integrated with cloud processing for training the RNN. The next paper, “Multi-Objective Optimization in Cloud Brokering System for Connected IoT” by Kumrai et al., considered a cloud broker as an intermediary in the infrastructure to manage the large number of connected things in cloud computing, and studied an optimization problem to maximize the profit of the broker while minimizing the response time of request and the energy consumption.

IV. INFORMATION DIFFUSION AND RETRIEVAL

The paper “RaWPG: A Data Retrieval Protocol in Micro-Sensor Networks Based on Random Walk and Pull Gossip for Communicating Materials” by Mekki et al., considered integration of thousands of microsensor nodes, each storing different information on material properties in its memory, and designed a specific wireless sensor network protocol to extract this information. The next paper, “Context-Aware Information Diffusion for Alerting Messages in 5G Mobile Social Networks” by Araniti et al., built upon social-awareness and device-to-device communications for information diffusion solutions in emergency scenarios, where context-aware information is collected from a set of devices deployed in the environment, and the data is integrated and elaborated at the base station.

V. MISCELLANEOUS

The last group of papers address various issues spanning eHealth, MAC, semantic reasoning, and IoT architecture resilience. The paper “Robot Assistant in Management of Diabetes in Children Based on the Internet of Things” by Al-Taee et al., presented a new eHealth platform incorporating humanoid robots to support an emerging multidimensional care approach for the treatment of diabetes, which extends the IoT to a Web-centric IoT through utilizing existing Web standards to access and control objects of the physical layer. The next paper, “Distributed and Adaptive Medium Access Control for Internet-of-Things-Enabled Mobile Networks” by Ye and Zhuang, proposed a distributed and adaptive hybrid medium access control scheme for a single-hop IoT-enabled mobile ad hoc network supporting voice and data services, and designed a hybrid super-frame structure to accommodate packet transmissions from a varying number of mobile nodes.

The paper “Semantic Reasoning for Context-Aware Internet of Things Applications” by Maarala et al., developed a semantic reasoning system operating in a realistic IoT environment, and studied how to utilize semantic IoT data for reasoning of actionable knowledge by applying state-of-the-art semantic technologies. The next paper, “Resilient IoT Architectures Over Dynamic Sensor Networks With Adaptive Components” by Oteafy and Hassanein, addressed the core issue of IoT component interaction and operation, and abstracted IoT things as wirelessly interfaced components, which introduce functionality physically decoupled from their devices boosting resilience, dynamicity, and resource utilization.

In conclusion, the papers presented in this Special Issue demonstrate the latest advances about processing and communications issues on “things” as intelligent sensors and actuators in the users’ context. We would like to deliver our appreciations to both the authors and the reviewers for their hard work in helping us manage this Special Issue. Also, we would like to express our sincere gratitude to the former Editor-in-Chief, Dr. C. Wang, for providing this opportunity and lots of guidance throughout the process.