

GUEST EDITORIAL PREFACE

Special Issue on Sensor Networks, Internet of Things and Smart Devices

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It is estimated that by 2020 more than 50 billion devices will be connected to the Internet (<http://share.cisco.com/internet-of-things.html>). The amount of data generation and communication is also increasing. Everyday around 20 quintillion bytes of data are generated (<http://www-01.ibm.com/software/data/bigdata/>). This data includes video and audio content, social media, documents, news and many other sources of online information. There is also a growing trend to integrate physical world information into the Internet. Real world data observation and collection is supported by sensory devices, smart phones and GPS. This is complemented by an even larger number of fixed sensors recording observations of a wide variety of modalities. Geographically distributed sensor nodes are capable of forming ad hoc networking topologies, with nodes expected to be dynamically inserted and removed from a network. The sensors are increasingly being connected to the Internet and Web infrastructure. In order to support interoperability, information processing, and efficient integration and fusion of data from heterogeneous sources, solutions such the Sensor Web Enablement (SWE) standards developed by the Open Geospatial Consortium are widely being

adopted by industry, government and academia alike. While such frameworks provide some interoperability, semantics is increasingly seen as a key enabler for the integration of sensor data and broader Web information systems. Analytical and reasoning capabilities afforded by and the semantic technologies are considered important for developing advanced applications that go from capturing observations to detecting events and ultimately creating higher-level abstractions and situational awareness. Healthcare, transportation, retail, and environmental monitoring, energy sector applications are leading the rapid emergence of commercial, public sector, and scientific research activities that involve integration of the cyber, physical and social data and semantics.

This special issue focuses on semantic technologies for sensor networks and Internet of Things, and showcases some of the new theory and technical innovations in the ways semantic web technologies can contribute to the growth, application and deployment of (wireless) sensor and actuator networks, and internet-connected smart things. For this special issue we received 18 submissions. After the first round of review 5 papers were invited to submit a revised version. During the second round of reviews we

accepted 3 papers, which are included in this special issue (acceptance rate 16.6%).

At the invitation of Professor Amit Sheth, Editor-in-Chief of the *International Journal on Semantic Web and Information Systems*, the co-editors of this special issue, together with Wei Wang (University of Surrey) and Cory Henson (Wright State University), have written a survey paper on the primary progress in applying semantic technologies for the Internet of Things. The paper reviews the recent developments in information modelling, ontology design, and processing of semantic data in the Internet of Things and discusses the main challenges and research issues in different areas related to this domain.

In the paper, “A Core Ontological Model for Semantic Sensor Web Infrastructures,” Raúl García-Castro, Oscar Corcho, and Chris Hill present the development of an ontological model and describe a set of guidelines that can be used in Semantic Sensor Web infrastructures. They propose using upper ontologies to facilitate interoperability between such infrastructures. By separating the infrastructure and the domain ontologies the ontological model is created in a modular form and is extensible. The paper also includes the evaluation results obtained when considering different aspects such as vocabulary, syntax, structure, semantics, representation, and context.

In the paper, “Enabling Query Technologies for the Semantic Sensor Web,” Jean-Paul Calbimonte, Hoyoung Jeung, Oscar Corcho, and Karl Aberer describe the theoretical foundations and technologies that enable semantically enriched sensor metadata to be exposed, and support querying sensor observations through SPARQL extensions. The authors describe using query rewriting and data translation techniques according to mapping languages and managing pull and push delivery modes. The proposed solution has been implemented using different stream and sensor management systems. The authors have shown that the proposed principles can be applied to a wide range of situations. The presented work also provides experimental evidence of the feasibility of the solution by using

it for sensors with medium-low rates, which are common in real environmental deployments.

In the paper, “An Architecture for Managing Knowledge and System Dynamism in the Worldwide Sensor Web,” Deshendra Moodley, Ingo Simonis, and Jules Raymond Tapamo present an ontology driven agent based Sensor Web architecture for managing knowledge and system dynamism. The authors describe their architecture by means of a case study on wild-fire detection and demonstrate the operation of the proposed architecture. The authors discuss how their architecture proposes a modular and flexible conceptual knowledge representation and reasoning framework for the Sensor Web. They state that the framework can be used to capture, share and apply complex causal theories between sensor observations and natural processes.

The Internet of Things will influence emerging technologies, data processing and data analytics and applications on the Web. Semantic technologies play a key role in enabling automated processing and interpretation of large scale Internet of Things data. The *International Journal on Semantic Web and Information Systems* is a unique venue to source and discuss recent developments and to provide timely investigation and demonstration of the current research advancements within this area.

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