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Editorial

The Green Internet of Things (G-IoT)

Fadi Al-Turjman,[1] **Ahmed Kamal**,[2] **Mubashir Husain Rehmani**,[3] **Ayman Radwan**,[4] **and Al-Sakib Khan Pathan**[5]

[1]*Antalya Bilim University, Antalya, Turkey*
[2]*Iowa State University, Ames, USA*
[3]*Cork Institute of Technology, Ireland*
[4]*Instituto de Telecomunicações Aveiro, Aveiro, Portugal*
[5]*Southeast University, Dhaka, Bangladesh*

Correspondence should be addressed to Fadi Al-Turjman; fadi@metu.edu.tr

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The Internet of Things (IoT) has been envisaged to describe a number of technologies and research disciplines that enable global connectivity over the worldwide physical objects. Enabling technologies like Radio-Frequency Identification (RFID), sensor networks, biometrics, and nanotechnologies are now becoming very common, bringing the IoT into real implementations addressing varying applications, including smart grid, e-health, and intelligent transportation. They foreshadow an exciting future that closely interconnects our physical world via green networks. Green networks in IoT will contribute to reducing emissions and pollutions, exploiting environmental conservation and surveillance, and minimizing operational costs and power consumption.

The Green Internet of Things (G-IoT) is predicted to introduce significant changes in our daily life and would help realize the vision of "green ambient intelligence". Within few years, we will be surrounded by a massive amount of sensors, devices, and "things," which will be able to communicate via 5G, act "intelligently," and provide green support for users in managing their tasks. These new smart objects will also be context-aware and able to perform certain functions autonomously, calling for new forms of green communication between people and things and between things themselves, where power consumption is optimized and bandwidth utilization is maximized. This development would be relevant not only to researchers, but also to corporations and individuals alike. Considering these facts, the aim of this special issue (SI) was to focus on both theoretical and implementation aspects in green next generation networks or networks that can be utilized in providing green systems through IoT enabling technologies.

We are glad to reach this stage after processing all the submitted papers to this SI. Finally, we could include total four (4) high-quality papers that provide beneficial data points within the spectrum of this ongoing research and development efforts. These four papers were selected from 16 outstanding submissions; all accepted papers have undergone multiple reviews. We have been also very selective in choosing the reviewers. In the following, we summarize the common themes within these papers.

In the paper "An IoT Architecture for Assessing Road Safety in Smart Cities", the author introduces a novel, cost-effective Internet of Things (IoT) architecture that facilitates the realization of a robust and dynamic computational core in assessing the safety of a road network and its elements. In doing so, the author introduces a new, meaningful, and scalable metric for assessing road safety. He also showcases the use of machine learning in the design of the metric computation core through a novel application of Hidden Markov Models (HMMs). Finally, the impact of the proposed architecture is demonstrated through an application to safety-based route planning.

Meanwhile, the paper "Power Profiling of Context Aware Systems: A Contemporary Analysis and Framework for Power Conservation", addresses the need for smart service discovery, delivery, and adaptation through a context aware

system, which adapts to the users' context. Given that the devices are mobile and battery operated, the main challenge in a context awareness approach is power conservation. The devices are composed of small sensors that consume power in the order of a few mW. However, their consumptions increase manifold during data processing. And thus, there is a need to conserve power while delivering the requisite functionality of the context aware system. Therefore, this feature is termed as 'power awareness.' In this paper, authors describe different power awareness techniques and compare them in terms of their conservation effectiveness. In addition, based on the investigations and comparison of the results, a power aware framework is proposed for a context aware system.

In the paper "Congestion Control and Prediction Schemes Using Fuzzy Logic System with Adaptive Membership Function in Wireless Sensor Networks", the network congestion challenge has been considered. This challenge is crucial in wireless sensor networks (WSNs) with restrictions and constraints, including limited computing power, memory, and transmission due to self-contained batteries, which limit sensor node lifetime. Determining a path to avoid congested routes can prolong the network. Thus, the authors present a path determination architecture for WSNs that takes congestion into account. The architecture is divided into 3 stages, excluding the final criteria for path determination: (1) initial path construction in a top-down hierarchical structure, (2) path derivation with energy-aware assisted routing, and (3) congestion prediction using exponential smoothing. With several factors, such as hop count, remaining energy, buffer occupancy, and forwarding rate, we apply fuzzy logic systems to determine proper weights among those factors in addition to optimizing the weight over the membership functions using a bat algorithm. The simulation results indicate the superior performance of the proposed method in terms of high throughput, low packet loss, balancing the overall energy consumption, and prolonging the network lifetime compared to state-of-the-art protocols.

Since the digital revolution led by the Internet of Things (IoT) is already reshaping several traditional business sectors. Moreover, because of its very nature, the promise of the IoT is also to reduce energy consumption and pollutant emissions in several environmental scenarios. At the same time, it is desirable to keep the development of IoT as sustainable as possible, hence truly realizing the vision of the green IoT. In the paper "An Open IoT Platform to Promote Eco-Sustainable Innovation in Western Africa: Real Urban and Rural Testbeds", authors show how a full-stack IoT framework can alleviate some real environmental problems afflicting countries in Western Africa. In this paper authors present three real IoT-based deployments currently hosted in two rural areas of Senegal and Ghana and one metropolitan area of Togo. These testbeds are connected to a Cloud-based software platform, purposely designed, and engineered to address some very specific environmental, economic, and social requirements of the region.

We hope that this collection of papers contributes to the active discussion among industry, academia, and governmental regulators. Ultimately, it will be the technical interchange among the IoT systems, and the wireless sensor networks that will support the emerging systems in the near future.

Conflicts of Interest

The editors declare that they have no conflicts of interest regarding the publication of this special issue.

Fadi Al-Turjman
Ahmed Kamal
Mubashir Husain Rehmani
Ayman Radwan
Al-Sakib Khan Pathan