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Editorial

Innovative Technologies and Services for Smart Cities

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1. Introduction

Smart cities represent a multidiscipline field continuously evolved by the advancement of sensor-based information technology and communication technology. Less budget, resource constraints, and continuous software upgradesare some of the few problems affecting the implementation of smart cities. However, it is to note that smart city is not only a technical issue but also smart governance as a complex process of institutional change and acknowledgement of the geopolitical nature of appealing visions of socio-technical governance [1,2]. The only solution to these problems is to develop smarter technologies and more efficient usage of available infrastructures in order to meet the needs of smart cities [3]. A combination of smart sensors, universal platform, information and communication technologies (ICT), Internet of Things (IoT), energy harvesting, cloud computing, and open source technologies, compatible with next generation networks (NGN), will help towards the actual achievement of a smart city [4,5]. It is now possible to develop significant technology platforms and IoT solutions for smart cities without a massive investment. However, IoT interoperability is still at a very early stage, and standardization is difficult to achieve as it is usually led by companies with strong market positions. There is a need for stand-alone development, where large companies will not dictate terms and conditions.

The aim of this special issue is to report on the design and development of smart sensors, a universal interfacing platform, along with the IoT framework, extending it to next-generation networks (4G, 5G, and future networks) for monitoring parameters of interest with the goal of achieving smart cities. Examples of this work include developing novel sensors for monitoring of environmental pollution and other parameters and making the data available to a wider community through remote access to cloud computing. The proposed universal interfacing platform with the IoT framework will solve many challenging issues, and it will significantly boost the growth of IoT-related applications, not just in the environmental monitoring domain, but in the other key areas, such as smart home, wearables, smart city with smart waste management, smart E-metering, smart water supply, intelligent traffic control, smart grid and remote health care applications, in any country [6]. The need is to develop a low-cost solution so that any country, without investing a massive amount of resources, can exploit the research outcomes.

2. The Present Issue

This special issue consists of twelve papers covering important topics in the field of innovative technologies and services for smart cities. The contents of these papers are introduced here.

In reference [7], a thin film metal oxide sensor to measure trace moisture from 3 to 100 ppm has been fabricated and its response characteristics are studied. Moisture measurement in ppm level is a challenging and costly affair. A simple method has been proposed to improve the sensitivity in ppm

range and to prevent wastage of nanostructured materials. The response parameters of the sensor are compared with the commercial DEW point meter. The dew point is the temperature at which the water vapor present in air/gas condenses to liquid form. This sensor is useful for the condition monitoring of gas insulated substations (GISs), transformers, and circuit breakers in order to achieve an uninterrupted power supply in smart cities.

In [8], a smart prayer mat has been designed and tested for detecting human postures and counting posture cycles. This smart praying mat may be helpfulto help old and forgetful Muslims to perform their obligatory five times a day religious praying at regular prescribed times. Authors employ resistive force sensors placed at the prescribed locations in the mat, where forces are significant and consistent. Unique force patterns are observed according to the position of postures. This technology was successfully tested with 30 participants in the age group of 30 to 60 years.Recent trends are to develop a building-integrated photovoltaic system (BIPS) to generate low-cost environmentally friendly electrical energy. But the low-output efficiency and high costs are the challenges for the implementation of BIPS system. A low-cost solution with improved solar efficiency by using aluminum reflector has been proposed in [9]. A bi-reflector solar PV system (BRPVS) with thin film Al-foil reflector and an LLC converter for a BIPV system is proposed and experimented with a 400-W prototype. A cadmium–sulfide (CdS) photo-resistor sensor and an Arduino-based algorithm is developed to control the working of the reflectors. Experimental results show that there is an enhancement of 28% power efficiency with respect to the solar PV module.

A multiwalled carbon nanotube-based strain sensor is fabricated for structural health monitoring application [10]. The sensor is fabricated by mixing different amounts of MWCNT and epoxy resin (EpoThin®). The sensor works on resistive principle and is mounted on a metal specimen (beam). The impedance variation of the sensor is studied with the variation of tensile strength on the spavin with a controlled known force. The response of the sensor shows a significant change in impedance with a variation of tensile strength. An Internet of Things (IoT)-compatible smart trap detector for crawling insects and other arthropods in an urban environment has been developed in [11]. A box-shaped device attracts targeted insect pests, senses the presence of insects, and takes a picture of the internal space of the boxautomatically, and after a fixed time interval the picture is sent to an authorized person/stakeholder through a WiFi device. The device has detection efficiency in the range of 96% to 99%. Asemantic-based decision support system (DSS), depending on ontological models, to assist architects and interior designers in domestic environments' reconfiguration for independent living is discussed in [12]. The development process of the ontology is presented in detail together with the results deriving from reasoning processes. To ease the reconfiguration of domestic environments, a prototypical application taking advantage of the DSS is presented. A zero-power microwave sensor having two pairs of open-ended coaxial probes is used as a liquid sensor.One is inside a known pure reference water sample, and the other one is inside the water under test. The basestation propagates a single tone signal at the frequency of f0/2. At the sensing node, an antenna absorbs that signal and a passive frequency doubler makes its frequency twice, i.e., f0, which will be used as the carrier signal. At base station, the sensed signal is demodulated. The proposed system is tested for humic acid water at 2.5 GHz frequency [13].A wireless sensor network having four metal oxide gas sensors powered by a solar panel to discriminate four volatile compounds, such as benzene, toluene, ethylbenzene, and xylene (BTEX) has been proposed in [14]. Pattern recognition of data is carried out by a radial basis neural network and principal component analysis. ZigBee protocol is used to transmit data wirelessly to a self-developed data cloud. RoomFort, a smart comfort management system is developed to enhance the comfort of hotel room guests. It provides a set of domain ontologies to formalize comfort-related metrics and to exploit the automatic reasoning capabilities provided by Semantic Web technologies while gathering data through a network of sensors to ensure guests are provided with tailored comfort profiles during their stays in the hotel [15]. Automatic detection of unusual crowd dynamics using geotagged posts on location-based social networks (LBSNs) is proposed in [16]. Authors use Instagram API media/search endpoint to collect the location of the

pictures posted by Instagram users in a given area periodically. Locations are summarized by their centroid. The entropy algorithm succeeds in finding abnormal events without the need for a training phase, being able to dynamically adapt to changes in crowd behavior. Cost-effective delivery of substantialdata content information is a big challenge facing modern mobile communication networks. In reference [17], authors propose an integrated, proactive content delivery scheme that jointly exploits the availability of multiple service tiers and multi-user behavior prediction. Three optimal algorithms and one heuristic algorithm are introduced to solve the cost-minimization problems of multi-user proactive content delivery under different modeling assumptions. In the traditional wireless sensor network (WSN), loading balancing technology is difficult to meet the requirements of adaptability and flexibility. In reference [18], the load balancing issue is addressed by software-defined WSN. This mechanism utilizes the advantages of a centralized control SDN (software-defined network) and flexible traffic scheduling. The simulation results show that the improved SDSNLB (software-defined sensor network load balancing) routing algorithm has better performance than LEACH (low-energy adaptive clustering hierarchy) protocol.

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