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Smart City and IoT

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ABSTRACT

The new Internet of Things (IoT) applications are enabling Smart City initiatives worldwide. It provides the ability to remotely monitor, manage and control devices, and to create new insights and actionable information from massive streams of real-time data. The main features of a smart city include a high degree of information technology integration and a comprehensive application of information resources. The essential components of urban development for a smart city should include smart technology, smart industry, smart services, smart management and smart life. The Internet of Things is about installing sensors (RFID, IR, GPS, laser scanners, etc.) for everything, and connecting them to the internet through specific protocols for information exchange and communications, in order to achieve intelligent recognition, location, tracking, monitoring and management. With the technical support from IoT, smart city need to have three features of being instrumented, interconnected and intelligent. Only then a Smart City can be formed by integrating all these intelligent features at its advanced stage of IOT development. The explosive growth of Smart City and Internet of Things applications creates many scientific and engineering challenges that call for ingenious research efforts from both academia and industry, especially for the development of efficient, scalable, and reliable Smart City based on IoT. New protocols, architectures, and services are in dire needs to respond for these challenges. The goal of the special issue is to bring together scholars, professors, researchers, engineers and administrators resorting to the state-of-the-art technologies and ideas to significantly improve the field of Smart City based on IoT.

1. Introduction

We are very happy to publish this special issue of a Future Generation Computer Systems published by Elsevier. This issue contains 29 articles come from various countries, among which we mention Malaysia, Taiwan, Spain, France, Kingdom of Saudi Arabia, India, USA, United Kingdom, Korea and Austria. Achieving such a high quality of papers would have been impossible without the huge work that was undertaken by the Editorial Board members and External Reviewers. We take this opportunity to thank them for their great support and cooperation. Smart City and Internet of Things (IoT) special issue is focused on the various aspects of advances in Smart City and IoT. The IoT general architecture provide the media to be everywhere incorporating transparently and seamlessly a large number of different and heterogeneous end systems and sensors to provide services that employ very complex tasks. Thus it is has become one of the most widely applicable technology of the digital age, driving major changes across industries from smart grids to connected health. However, the market analysis[1] indicates clearly that Smart Cities and Smart Home stand out as the most prominent IoT applications. Obviously this driven by the decline of sensors cost and the cities management will to transition towards the real-time data-driven management across urban systems, including efficiently managing water, energy, waste, and transportation among other city-wide and home based services. There are many examples that we can spot on such applications that was the result of careful research (e.g. Padova, Italy Smart City system [1], City of Tokyo [2]). Cities continue to attract new people and by 2030 the UN estimates that than 60 percent of the global population is expected to live in large cities[2]. With nearly 38 million people, Tokyo tops UN's ranking of most populous cities followed by Delhi, Shanghai, Mexico City, São Paulo and Mumbai. The consequences and challenges for such vast increase in population on the city resources and services are more than obvious.

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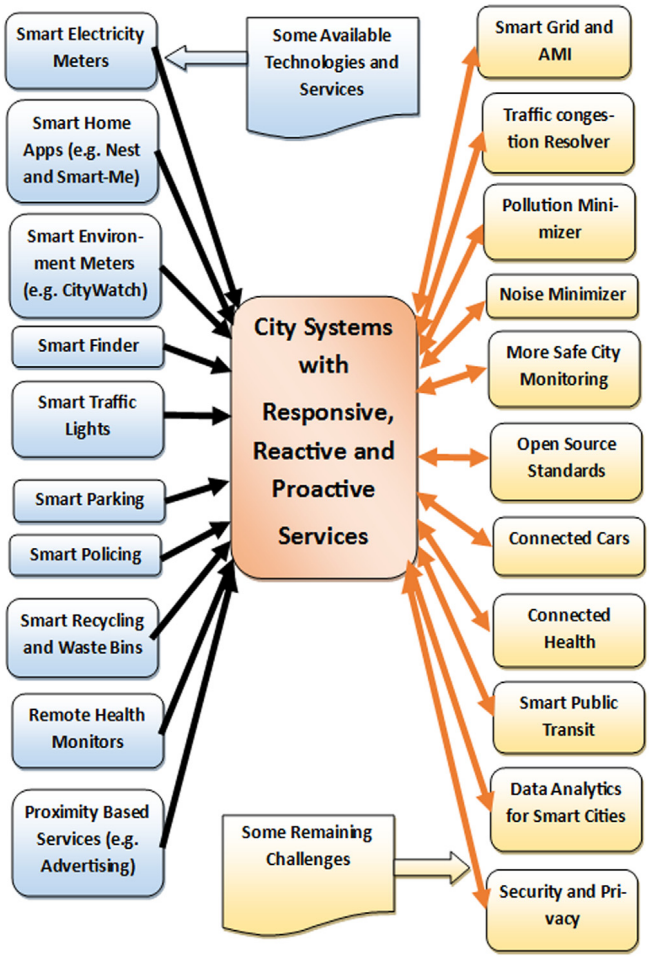

Fig. 1. Smart Cities and IoT: Available Technologies vs Challenges.

The only viable solution is to confront this problem by developing techniques to reduce resource consumption of the city in smart and intelligent way. Fig. 1 illustrates the most important techniques currently available for solving parts of the problem along with the future challenges that remain to be solved.

2. Content of this issue

This special issue will provide a chance for academic and industry professionals to discuss recent progress, problems and solutions in the area of smart city technologies and IoT, including development, implementation, strategies and policies.

In "Studying Real Traffic and Mobility Scenarios for a Smart City Using a New Monitoring and Tracking System" [3], the paper presents a novel mobility monitoring system and some of its applications to address problems that would be solved in a Smart City, such as the optimization of traffic flows in terms of trip-time and security (Smart Traffic), and the improvement of security or energetic issues inside buildings.

The "Semantic Service Provisioning for Smart Objects: Integrating IoT Applications into the Web" [4], proposes the service provisioning architecture for smart objects with semantic annotation to enables the integration of IoT applications into the Web. This aims to bring smart object services to the Web and make them accessible by plenty of existing Web APIs in consideration of its constraints such as limited resources (ROM, RAM, and CPU), low-power microcontrollers, and low-bitrate communication links.

In "Business model analysis of public services operating in the smart city ecosystem: The case of SmartSantander" [5], the main objective of this research is to gain a deeper knowledge about practical business models matching into a real-life smart city ecosystem. The main results of the study highlight that those public services properly managed embedding IoT technology convey cost reductions in the long term.

The paper "Smart vending machines in the era of internet of things" [6], propose a real-world deployment in building an Internet of Things (IoT) system for vending machines. This paper also introduces a new approach for mobile proximity payment for unattended point of sales. This approach guarantees that when the transaction occurs and the products are dispensed the consumer is physically close to the vending machine. The ultimate goal is to minimize the Total Cost of Ownership (TCO) for vending operators while enhancing the consumer purchasing experience, driving up the demand for mass adoption of the "Internet of vending machines".

The paper "Deployment of an open sensorized platform in a smart city context" [7], presents how to embed an open sensorized platform for both hardware and software in the context of a smart city, more specifically in a university campus. For this integration, GIScience comes into play, where it offers different open standards that allow full control over "smart things" as an agile and interoperable way to achieve this. To test the system, the authors deployed a network of different sensorized platforms inside the university campus, in order to monitor environmental phenomena.

The paper "Citizen-Centric Data Services for Smarter Cities" [8], proposes that smarter cities can be achieved by combining already available infrastructure, i.e., Open Government Data and sensor networks deployed in cities, with the citizens' active contributions towards city knowledge by means of their smartphones and the apps executed in them. In addition, this work introduces the main characteristics of the IES Cities platform, whose goal is to ease the generation of citizen-centric apps that exploit urban data in different domains.

In the paper, "Using Augmented Reality and Internet of Things to Improve Accessibility of People with Motor Disabilities in the Context of Smart Cities" [9], the authors have developed a system that enables wheelchair users to interact with items placed beyond their arm's length, with the help of Augmented Reality (AR) and Radio Frequency Identification (RFID) technologies. The proposed system is an interactive AR application that runs on different interfaces, allowing the user to digitally interact with the physical items on the shelf, thanks to an updated inventory provided by an RFID system.

The paper, "Adaptive and Context-Aware Service Composition for IoT-based Smart Cities" [10] present an adaptive service composition framework that supports such dynamic reasoning. The framework is based on wEASEL, an abstract service model representing services and user tasks in terms of their signature, specification (i.e., context-aware pre-conditions, post-conditions and effects) and conversation (i.e., behaviour with related data-flow and context-flow constraints). The evaluation shows that the wEASEL-based system performs more accurate composition and allows end-users to discover and investigate more composition opportunities than other approaches.

The paper, "IoFClime: The fuzzy logic and the Internet of Things to control indoor temperature regarding the outdoor ambient conditions" [11] propose a new approach to control the temperature using the Internet of Things together its platforms and fuzzy logic regarding not only the indoor temperature but also the outdoor temperature and humidity in order to save energy and to set a more comfortable environment for their users. It concluded that the fuzzy approach allows us to achieve an energy saving around 40% and thus, save money.

The paper, "Efficient certificateless access control for industrial Internet of Things" [12] proposed a modified certificateless signcryption scheme that satisfies public verifiability, ciphertext authenticity and insider security. Compared with existing two access control schemes using traditional signcryption, the proposed scheme achieves public verifiability, ciphertext authenticity and insider security.

In "Pareto optimization for the two-agent scheduling problems with linear non-increasing deterioration based on Internet of Things" [13], the authors investigate the Pareto optimization scheduling on a single machine with two competing agents and linear non-increasing deterioration, which is Multi-agent scheduling problems often occurred in the Internet of Things. Experimentation results show that the algorithms presented in this paper are efficient.

The paper "Midgar: Detection of people through computer vision in the Internet of Things scenarios to improve the security in Smart Cities, Smart Towns, and Smart Homes" [14], analyzes the pictures through Computer Vision to detect people in the analysed pictures. With this analysis, the authors are able to obtain if these pictures contain people and handle the pictures as if they were sensors with two possible states.

In the paper, "A Novel Communication System Approach for a Smart City based on the Human Nervous System" [15], this work proposes a novel communication architecture, ubiquitous and resilient, inspired in the human nervous system by the definition of Smart Gateways, able to satisfy the needs of a real SC and adaptable to the growing and specific requirements of every single city.

In the paper "Contributing to Appliances' Energy Efficiency with Internet of Things, Smart Data and User Engagement" [16], the authors describes the OpenFridge platform and approach, its evaluation results with the real life users, and discusses the lessons learned and open issues. The system demonstrates the feasibility of the approach of the users interacting with the semantic energy data and eventually opening it up for the data economy.

In the paper, "A Message Efficient Intersection Control Algorithm for Intelligent Transportation in Smart Cities" [17] the authors design a new algorithm to realize intersection control via vehicular ad hoc networking. Compared similar works, this new algorithm can conduct intersection control with much less message cost, and its advantage is validated by simulations using ns3.

The "Design and Implementation of the Secure Compiler and Virtual Machine for Developing Secure IoT Services" [18], proposes a compiler and a virtual machine with secure software concepts for developing secure and trustworthy services for IoT environments. This approach does not only enable the development of applications that are robust against external attacks, it also reduces the huge cost associated with preventing problems anticipated at the service operational stage.

The paper "Major Requirements for Building Smart Homes in Smart Cities based on Internet of Things Technologies" [19], defines the major requirements for building SH. Seven unique requirement recommendations are defined and classified according to the specific quality of the SH building blocks.

In this study, "Distributed Proxy Cache Technology based on Autonomic Computing in Smart Cities" [20], a distributed proxy cache management platform based on autonomous decision is proposed. The platform realizes highly efficient automatic cache management by taking the advantages of autonomous perception and decision.

In "Tag Localization in a Two-Dimensional RFID Tag Matrix" [21], the authors propose a RFID based localization scheme that estimates the row and column indexes of tags that are spread in a two-dimensional matrix using the movement of an RFID reader. Proposed estimation scheme is applicable for applications that need relative positions among tagged objects.

The paper "Knowledge-infused and Consistent Complex Event Processing over Real-time and Persistent Streams" [22], introduce a Knowledge-infused CEP (χ-CEP) framework that provides domain-aware knowledge query constructs along with temporal operators that allow end-to-end queries to span across real-time and persistent streams. They translate this query model to efficient query execution over online and online data streams, proposing several optimizations to mitigate the overheads introduced by evaluating semantic predicates and in accessing high-volume historic data streams.

In this study, "Case of ARM Emulation Optimization for Offloading Mechanisms in Mobile Cloud Computing" [23], the authors evaluate the overhead of the system and application virtualization techniques and emulation frameworks that enable MCC offloading mechanisms. They concluded that the overhead of virtualization and emulation techniques need to be reduced for efficient MCC offloading frameworks.

In this study, "A PRNU-Based Counter-Forensic Method to Manipulate Smartphone Image Source Identification Techniques" [24], the algorithms are proposed based on sensor noise and wavelet transforms which can alter the information which is usually employed to find the source of an image, and forge it so that it could point to a different, unrelated device. The algorithms proposed will help to strengthen existing techniques and develop new forensic approaches for mobile image source identification that will be more robust against attacks.

The paper, "Network-Aware Virtual Machine Migration in an Overcommitted Cloud" [25], aims to minimize network traffic costs by considering the inherent dependencies among VMs that comprise a multi-tier application and the underlying topology of physical machines and to ensure a good trade-off between network communication and VM migration costs. The mechanism that the swarm intelligence algorithm aims to find is an approximate optimal solution through repeated iterations to make it a good solution for the VM migration problem.

In the paper, "Indoor Mobile Object Tracking using RFID" [26] the authors propose a promising approach using RFID for indoor mobile object tracking. A moving object equipped with an RFID tag can be tracked by the pre-deployed RFID reader network. The results validate the effectiveness of our indoor tracking solution using RFID.

In the paper, "Particle Swarm Optimization based Clustering Algorithm with Mobile Sink for WSNs" [27], the authors present a particle swarm optimization based clustering algorithm with mobile sink support for WSNs. The authors describe the principle of our EPMS algorithm in detail, where the virtual clustering technique combined with PSO algorithm is utilized to improve the network performance. Through extensive simulation, it was concluded that better performance is achieved by EPMS than other three traditional routing algorithms for WSNs.

In the paper "A semi-supervised social relationships inferred model based on mobile phone data" [28], the authors present a semi-supervised social relationships inferred model. This model can infer the relationships based on a large amount of unlabeled data or a small amount of labeled data. The model is a co-training style semi-supervised model which is combined with the support vector machine and naive Bayes. The proposed model is evaluated by a real mobile communication network dataset and the experiment results show that the model is effective in relationship mining, especially when the relationship network is in a stable state.

In the paper, "Simulation Framework of Ubiquitous Network Environments for Designing Diverse Network Robots" [29], the authors propose a framework that allows the design and simulation of network robot avatars and a variety of smart homes in a virtual environment to address the above problems. This framework activates a network robot avatar based on information obtained from

various sensors mounted in the smart home; these sensors identify the daily routine of the human avatar residing in the smart home.

In this study, "Advanced Payload Analyzer Preprocessor" [30], a novel network-based intrusion detection system for recognition of unknown threats (zero-day attacks) has been proposed. This is done through a detailed statistical analysis of the binary contents of payloads. The information processing involves the use of n-gram and Bloom filter structures. This approach offers various improvements compared with similar proposals.

Finally the paper on "An Adaptive Meta-Heuristic Search for the Internet of Thing" [31], the authors proposed an effective context-aware method inspired by Ant clustering algorithm to cluster sensors in the form of Sensor Semantic Overlay Networks (SSONs) in which sensors with similar context information are gathered into one cluster.

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