Guest Editorial
Special Section on Internet-of-Things for Smart Cities and Urban Informatics

CITIES around the world are currently under quick transition toward a low-carbon environment, high quality of living, and resource-efficient economy. Smart systems are crucial components for building sustainable cities and aggregating comprehensive urban informatics. Internet-of-Things (IoT) is an emerging technology evolved from the convergence of wireless technologies, embedded systems, and the Internet. Extensive research on IoT is taking place on sensing and automatic control, network infrastructure and communication, and big data analytics. This facilitates a multidisciplinary approach for developing integrated solutions and creating novel applications to build a sustainable society. Combinations of IoT with autonomous systems, machine intelligence, sensor and actuator networks provide smart functions in wide application domains, including environmental monitoring, smart transportation, industrial production, and security surveillance.

This special section on Internet-of-Things for smart cities and urban informatics is focused on the development, adoption, and application of IoT technology to improve the efficiency of cities and enhance urban services in society. It covers topics including smart transportation, smart buildings, data transmission and analytics, system designs, and experiments of IoT for smart cities.

Vehicular network has been used to achieve highly efficient and flexible traffic scheduling at intersection roads for smart transportation systems. In modern transportation systems, traffic signals are widely used to schedule waiting vehicles at each lane. The paper entitled "Fuzzy Group-Based Intersection Control via Vehicular Networks for Smart Transportations," by Cheng *et al.*, proposes a novel approach, which divides vehicles in the same lane into smaller groups and schedules these vehicle groups using wireless communication instead of traffic lights. Such direct scheduling of vehicles can reduce waiting time and improve fairness, especially when the traffic volume in different lanes is imbalanced. The key challenge in such a design lies in determining the appropriate size of groups with respect to real-time traffic conditions. To cope with this issue, the paper proposed a neuro-fuzzy network-based grouping mechanism where the network is trained using the reinforcement learning technique. Also, vehicle groups are scheduled via a neuro-fuzzy network. Simulations using ns3 were conducted to evaluate the performance of the proposed algorithm. The results show that the proposed algorithm can reduce waiting time and at the same time improve fairness in various cases up to 40% compared with traffic light algorithms.

Participatory sensing is an emerging sensing paradigm for smart cities through leveraging the mobile devices of people as sensors. The paper "Participatory sensing for smart cities: A case study on transport trip quality measurement," by Xiao *et al.*, designed a prototype platform for efficient data collection and management of smartphone sensing. A transport Trip Quality Measurement System (TQMS) has been developed using this platform. TQMS organizes participatory sensing activities through a novel collaboration-driven incentive mechanism. The mobile participants collect the location, vibration, and other trip data, which can be used to detect bumpiness and jamming events on the routes. According to different criteria, the integrated platform supports the navigation of the most comfortable route, faster route, or healthier route. A comprehensive real-world case study has been conducted on TQMS, including platform promotion, participant recruitment, and activity organization.

Navigation services are widely used nowadays to recommend good quality routes for drivers. Nevertheless, the recommendation system often becomes ineffective once the drivers enter the last mile of their travels. Instead, local drivers have a better understanding of the surroundings of the destinations. With the deep penetration of 3G/4G mobile networks, drivers are well connected anytime and anywhere, so that they can readily access information from the Internet and share information in the driver's community. This motivates the design of CrowdNavi in the paper "CrowdNavi: Demystifying last mile navigation with crowdsourced driving information," by Fan *et al.* CrowdNavi is a complementary service to existing navigation systems, seeking to combat the last mile puzzle. CrowdNavi collects the crowdsourced driving information from users to identify their local driving patterns, and recommend the best local routes for users to reach their destinations. It offers a complete set of algorithms to identify the last segment from the drivers' trajectories, scoring the landmark, and locating best routes with user preferences. CrowdNavi has been implemented as an app on Android mobile OS to examine its performance under various circumstances. The experimental results demonstrate its superiority in navigating drivers in the last segment toward their final destination.

Apart from driving, cycling is becoming an increasingly popular traffic mode in sustainable society. Yet, limited cyclist behavior models shed light on cases at signalized intersections with heterogeneous traffic, where bicycle behavior is characterized

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by frequent confrontations with other road users (vehicles, bicycles, and pedestrians). The paper "Cyclist social force model at unsignalized intersections with heterogeneous traffic," by Huang *et al.*, develops a microscopic simulation model for cyclist behavior analysis at signalized intersection, with heterogeneous traffic. The cyclist crossing model applied fuzzy logic and social force theory for this purpose. The parameters are either estimated directly based on empirical data or derived indirectly through maximum-likelihood estimation. Simulation results indicated that the model can represent cyclist crossing behavior at unsignalized intersections with heterogeneous traffic as in the real world.

IoT systems in smart cities are often comprised of massive volumes of data. Through exchanges of information, smart objects are capable of reasoning and generate a higher level of intelligence. The effectiveness of data collection processes is a key factor to the success of IoT systems. Smart devices in IoT systems are often shared by different parties, so the design of efficient data collection processes is very important. The paper "Concurrent data collection trees for IoT applications," by Cheng *et al.*, proposes concurrent data collection trees specifically designed for IoT applications. It is shown that, compared with an existing single-user data collection structure, systems with the proposed tree structures can significantly shorten their concurrent data collection processes.

Data collection and data analytics are crucial for smart cities, which involve complex and massive amount of data. The paper "Applicability of big data techniques to smart cities deployments," by Moreno *et al.*, presents the application of big data techniques to smart cities. A general IoT-based architecture is proposed, which can be applied to different smart cities applications. The paper discusses two scenarios of big data analysis in smart cities. The first scenario illustrates services implemented in the smart campus of the University of Murcia, Spain. The second one is focused on a tram service scenario, where thousands of transit-card transactions have to be processed. Results obtained from both scenarios show the potential of the applicability of big data techniques to provide profitable services of smart cities, such as the management of the energy consumption and comfort in smart buildings, and the detection of travel profiles in smart transportation.

Stable and reliable wireless communication is one of the critical demands for smart cities to connect people and devices. Although intelligent terminals can be leveraged to deliver and exchange data through Internet, poor network coverage and expensive network access challenge the deployment of the network infrastructure. Efficient transmission schemes are necessary for data communications, in particular, considering the opportunistic nature of mobile smart devices such as smartphones. The paper "Social-oriented adaptive transmission in opportunistic internet of smartphones," by Ning *et al.* proposes a social-oriented smartphone-based adaptive transmission mechanism to improve the network connectivity and throughput in IoT for smart cities. A social-oriented double-auction-based relay selection scheme is investigated to stimulate the relay smartphones to forward packets for others, so that the network connectivity can be strengthened. Furthermore, relay method selection is proposed by integrating various kinds of transmission schemes in an optimal fashion for achieving high network throughput.

Many modern IoT applications are supported by wireless communications and require modification of existing infrastructures. The paper "Asynchronous and selective transmission for dewiring of building management systems," by Luo *et al.*, investigates how to convert existing wired Building Management System (BMS) to a (partial) wireless system without modification of the existing building protocols. It proposes an asynchronous-response framework that maintains the control plane of the upper layer protocols intact, and uses a modular design to prioritize and schedule data flow to handle link quality and throughput variations. The proposed design has been implemented in a real BMS system and proven by experiments as very efficient in deployment.

The last paper, "IoT software infrastructure for energy management and simulation in smart cities," by Brundu *et al.*, presents an IoT software infrastructure that enables energy management and simulation of new control policies in smart cities. The proposed platform enables the interoperability and the correlation of (near-) real-time building energy profiles with environmental data from sensors as well as building and grid models. In a smart city context, this platform fulfills;

1) the integration of heterogeneous data sources at the building and district level;
2) the simulation of novel energy policies at the district level aimed at the optimization of the energy usage, accounting also for its impact on building comfort.

The platform has been deployed in city and successfully tested with a novel control policy for the heating distribution network.

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Edith Ngai, *Guest Editor*
Uppsala University
Uppsala 752 37, Sweden
edith.ngai@it.uu.se

Falko Dressler, *Guest Editor*
University of Paderborn
Paderborn 33102, Germany
dressler@ccs-labs.org

Victor Leung, *Guest Editor*
University of British Columbia
Vancouver, BC V6T 1Z4, Canada
vleung@ece.ubc.ca

Mo Li, *Guest Editor*
Nanyang Technological University
Singapore 639798
limo@ntu.edu.sg

Edith C.-H. Ngai (M'07–SM'15) received the Ph.D. degree from The Chinese University of Hong Kong, Pok Fu Lam, Hong Kong, in 2007.

She is currently an Associate Professor at the Department of Information Technology, Uppsala University, Uppsala, Sweden, and also a Guest Researcher at Ericsson Research, Kista, Sweden. She was a Postdoctoral Researcher with Imperial College London, London, U.K., in 2007–2008. Her research interests include Internet-of-Things, mobile cloud computing, smart cities and urban computing, network security, and privacy.

Dr. Ngai received the VINNMER Fellow award by VINNMER, Sweden, in 2009. She is a Project Leader of the Green IoT Project for Sustainable City Development, Sweden. She is a Program Chair of ACM womENcourage 2015, TPC Co-Chair of the IEEE SmartCity 2015, and Track-Chair of the IEEE Intelligent Sensors, Sensor Networks and Information Processing, 2015. She was a Guest Editor of special issues of the IEEE INTERNET OF THINGS Journal, the IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS, *MONET*, and *EURASIP Journal on Wireless Communications and Networking*. She is an Associate Editor of EAI endorsed *Transactions on Collaborative Computing* and is on the technical committee of *Elsevier Computer Communications*.

Falko Dressler (F'17) received the M.Sc. and Ph.D. degrees from the Department of Computer Science, University of Erlangen, Bavaria, Germany, in 1998 and 2003, respectively.

He is currently a Full Professor of computer science and the Chair of Distributed Embedded Systems at the Heinz Nixdorf Institute, Paderborn, Germany, and the Department of Computer Science, University of Paderborn, Paderborn, Germany, where he is also a member of the University Senate. His research interests include adaptive wireless networking, self-organization techniques, and embedded system design with applications in ad hoc and sensor networks, vehicular networks, industrial wireless networks, and nano-networking.

Dr. Dressler is an Associate Editor-in-Chief for *Elsevier Computer Communications*, as well as an Editor for journals such as the IEEE TRANSACTIONS ON MOBILE COMPUTING, *Elsevier Ad Hoc Networks*, and *Elsevier Nano Communication Networks*. He has been a Chair of conferences such as IEEE INFOCOM, ACM MobiSys, ACM MobiHoc, IEEE Vehicular Networking Conference, IEEE Global Telecommunications, and many others.

Victor Leung (S'75–M'89–SM'97–F'03) received the B.A.Sc. (Honors) and Ph.D. degrees in electrical engineering from the University of British Columbia, Vancouver, BC, Canada, in 1977 and 1982, respectively.

He is a Professor of electrical and computer engineering and also the TELUS Mobility Research Chair at the University of British Columbia. His research interests include areas of wireless networks and mobile systems. He has coauthored more than 950 technical papers in archival journals and refereed conference proceedings, several of which have won best-paper awards.

Dr. Leung is on the editorial boards of the IEEE TRANSACTIONS ON GREEN COMMUNICATIONS AND NETWORKING, IEEE WIRELESS COMMUNICATIONS LETTERS, IEEE ACCESS, and several other journals. He has provided leadership to the technical program committees and organizing committees of numerous international conferences. He received the APEBC Gold Medal award in 1977, NSERC Postgraduate Scholarships from 1977–1981, the UBC Killam Research Prize in 2012, and the IEEE Vancouver Section Centennial Award. He is a Fellow of the Royal Society of Canada, the Canadian Academy of Engineering, and the Engineering Institute of Canada.

Mo Li received the B.S. degree in computer science and technology from Tsinghua University, Beijing, China, in 2004, and the Ph.D. degree in computer science and engineering from The Hong Kong University of Science and Technology, Hong Kong, in 2009.

He is currently an Associate Professor at the School of Computer Science and Engineering, Nanyang Technological University, Singapore. His research interests include networked and distributed sensing, wireless and mobile, cyber-physical systems, smart city, and urban computing.

Dr. Li is an Editor of the IEEE/ACM TRANSACTIONS ON NETWORKING, the IEEE TRANSACTIONS ON MOBILE COMPUTING, and the IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS.