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Internet of Things for Smart Cities

Technologies, Big Data and Security

Springer

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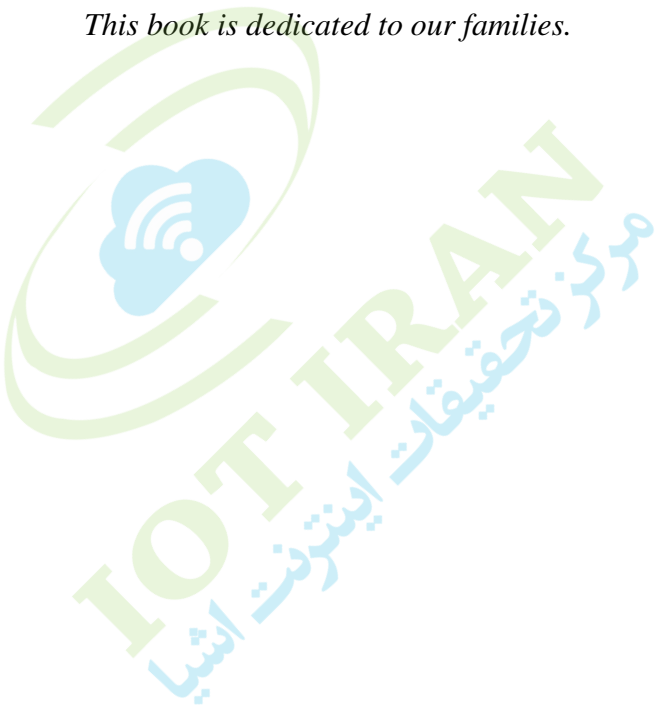
This book is dedicated to our families.



Foreword

Internet of Things (IoT) has now become a key enabling technology that spans multiple technology domains from data sensing and processing to networking and data analytics. IoT is used in many applications ranging from home security and factory automation to healthcare delivery to autonomous driving. In this book, the authors provide an essential overview of IoT for smart cities and key challenges associated with it, then cover communication technologies and protocols for IoT in smart cities. The coverage includes big data impacts on IoT operations, in terms of processing, storage, and analytics; security and privacy issues; and challenges of IoT for smart cities. IoT-based charging solution for electric vehicles is demonstrated as a practical application in smart cities. As such, it will be a good reference resource for graduate students, researchers, and industry practitioners working in IoT applications for smart city.

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September 2018

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Preface

The concept of the smart city was introduced as the potential solution to the challenges created by urbanization with complex and costly operations. The envisioned goal of smart city is to be cost effective, intelligent, and autonomous with ease-of-use providing better quality of life. Most definitions for smart city involve the use of information and communication technologies (ICTs) to enhance the quality of urban life with reduced cost and resource consumption. Recently, ICT convergence with the Internet of Things (IoT) has been effectively exploited to provide many novel features with minimum human intervention in smart cities. This book describes different components of IoT for smart cities including sensor technologies, communication technologies, big data analytics, and security. The book is organized into five chapters that are described below.

IoT offers smart solutions for cities in terms of governance, economic growth, environmental sustainability, quality of life, transportation, power, and water usage. In Chap. 1, the authors provide an insight into different aspects of smart cities, challenges, and common IoT solutions for future cities.

In Chap. 2, the authors provide an overview of the general classification of communication protocols for IoT networks followed by the analysis of the technical details and specific advantages and limitations of different protocol. Recent protocols for IoT networks are discussed with the comparative analysis of two use cases of IoT and the communication technologies.

Chapter 3, titled Dimension Reduction for Big Data Analytics in Internet of Things, presents an overview of dimension reduction in IoT systems. A discussion on solutions for dimension reduction with focus on principal component analysis is also presented to reduce consumption of energy and computation resources.

The Internet of Vehicles paradigm can play a significant role by providing holistic data exchange between charging infrastructure and electric vehicles (EVs) in emerging smart cities. Large-scale implementation of EVs can impose extra burdens on electric grids making the scheduling essential to optimize the charging process. The authors of Chap. 4 present a profit maximization approach for EV charge scheduling in smart distribution systems by considering the cost and speed of charging at the charging stations.

Recently, blockchain technology is investigated extensively for security and privacy in IoT. Chapter 5 provides an overview of the use of blockchain technology for IoT. First, the authors review the literature for a better understanding of research direction in blockchain for IoT systems. The challenges associated with the deployment of IoT and blockchain for the IoT systems are discussed followed by two case studies on smart homes and food supply chain traceability to show the effectiveness of blockchain technology for IoT.

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Contents

Acronyms

3GPP	Third generation partnership project
3G	Third generation of cellular networks
4G	Fourth generation of cellular networks
5G	Fifth generation of cellular networks
AMQP	Advanced message queuing protocol
BEV	Battery electric vehicle
BLE	Bluetooth low energy
CALM	Continuous air interference long and medium range
CAM	Cooperative awareness message
CoAP	Constrained application protocol
DDS	Data distribution service
DENM	Decentralized environmental notification message
DSRC	Dedicated short range communication
ETSI	European Telecommunications Standards Institute
EV	Electric vehicle
G2V	Grid-to-vehicle
GHG	Greenhouse gas
GNSS	Global navigation satellite system
GPRS	General packet radio service
GPS	Global positioning system
GSM	Global system for mobile communication
H2V	Home-to-vehicle
HACCP	Hazard analysis and critical control points
HEV	Hybrid electric vehicle
ICE	Internal combustion engine
ICTs	Information and communication technologies
IETF	Internet engineering task force
IoST	Internet of Smart Things
IoT	Internet of Things
IoV	Internet of vehicles
ITS	Intelligent transportation system

ITU	International Telecommunication Union
LAN	Local area network
LPWA	Low power wide area
LR-WPAN	Low-rate wireless personal area network
LTE	Long-Term Evolution
MQTT	Message queuing telemetry transport
PCA	Principal component analysis
PET	Plug-in electric train
PEV	Plug-in electric vehicle
PHEV	Plug-in hybrid electric vehicle
PLC	Power line communication
RFID	Radio frequency identification
RPL	Routing protocol for low-power and lossy networks
SIG	Special interest group
SV	Sensor vehicle
UDP	User datagram protocol
V2G	Vehicle-to-grid
V2H	Vehicle-to-home
V2I	Vehicle-to-infrastructure
V2V	Vehicle-to-vehicle