Preface

This book explores the concepts of big data, IoT and smart city along with recent research developments. It also includes various real time/offline applications and case studies in the field of engineering, computer science, IoT and smart cities with modern tools and technologies.

As a population grows, the resources become scarcer, therefore, the efficient usage of these limited goods becomes more important. Smart cities are a key factor in the consumption of materials and resources. Built on and integrating with big data, the cities of the future are becoming a realization today.

The integration of big data and interconnected technology along with the increasing population will lead to the necessary creation of smart cities. To continue providing people with safe, comfortable, and affordable places to live, cities must incorporate techniques and technologies to bring them into the future. We are looking forward to seeing the advances that will come to our cities in the near future.

OBJECTIVE OF THE BOOK

The main objective of this book is to cover development in urban areas about Internet of Things (IoT), Information and Communication Technology (ICT) and the technologies used to manage city's assets in a secure manner. IoT has developed into our daily lives from few days back. It represents a general concept for the ability of network devices to sense and collect data from the world around us, and then share that data across the internet where it can be processed and utilized for various interesting purposes. IoT can do following things for us:

- Build a system specific application using microcontroller,
- Receive alert messages on our smart electronic devices (mobile phones, smart watches etc.) in case of any danger detected at nearby places,
- Self-parking automobiles,

- Automatic ordering of groceries and other home supplies,
- Automatic tracking of exercise habits and other day-to-day personal activity including goal tracking and regular progress reports.

ICT is used to improve the quality, performance and interactivity in the services provided by cities. It also utilizes resources while using the services and improves interaction between a common man and government. City's assets may include various departments' information systems, physical infrastructure, institutes (schools/colleges, etc.), infirmaries, smart meters, smart water, power plants, public libraries, community services, etc.

Other objectives may include various real time/offline applications and case studies in the field of engineering, computer science, information security, interdisciplinary tools and cases of IoT, big data and smart city with modern tools and technologies used.

Smart cities are using information technologies to build the strong physical infrastructure, to open/process new innovative activities and to enable citizens to face new challenges to solve problems in an intelligent way. The reason for this growth is increase in communication through electronic devices, sensors, web logs, global positioning system (GPS) data, mobile data, IoT etc. The most challenging part in this is to discover new things in a city through technology. It requires to take new initiatives and government support. And this is possible through new technologies which involves cloud-based services, IoT, real-world user interfaces, use of smart phones, smart meters, networks of sensors and RFIDs, and more accurate communication based on the semantic web. We also need newer information management tools and technologies to deal with real time large volume and large variety of data.

This book is mainly focusing on IoT and technologies, big data and future horizon, smart city and future luxuries, the interdisciplinary tools, cases of IoT, big data and smart city.

ORGANIZATION OF THE BOOK

The book consists of 12 chapters that are organized in five sections as shown below. The first section consists of Chapters 1 to 5 which relates to information about next generation, a collaborative approach, a secure, distributed and reliable cloud-based reference architecture towards IoT, big data and smart city. It has also provided role of cloud, IoT and it's impacts in computing intelligence.

The second section elaborated on IoT and industry expectations. Chapter 6 from this section explained Industry 4.0: The New Industrial Revolution in detail. The third section of the book encloses two chapters that introduced the safety and security

Table 1. Organization of the book

Section 1: Next Generation: IoT, Big Data, and Smart City		
Chapter 1 Smart and Connected Cities	**Chapter 2** A Collaborative Approach: IoT, Big Data, and Smart City	
Chapter 3 Towards a Secure, Distributed, and Reliable Cloud-Based Reference Architecture for Big Data in Smart Cities	**Chapter 4** Cloud- and IoT-Powered Smart and Connected Cities	**Chapter 5** Internet of Things and Its Impacts in Computing Intelligence: A Comprehensive Review
Section 2: The IoT and Industry Expectations		
Chapter 6 Industry 4.0: The New Industrial Revolution		
Section 3: Safety and Security Systems		
Chapter 7 An Integrated Digital Authentication Mechanism for Intrusion Detection System		
Section 4: Applications in Electronic and Digital Technologies		
Chapter 8 Smart Traffic System Operations	**Chapter 9** Towards a Better and Smarter Healthcare and IoT	**Chapter 10** Smart Waste Management System
Section 5: The Case Studies: Urban Area in Context of Smart City Infrastructure		
Chapter 11 Big Data Analytics and Internet of Things for Urban Transportation: A Case of Pune City, Maharashtra, India	**Chapter 12** Songdo Smart City: An Aerotropolis and a Ubiquitous City	

system. Chapter 7 from this section has provided a sample real time application process of IDS which involves an access control for specified area forming a vital link in a security. It has also specified the digital authentication based secure system which can be adopted at home/organisations or any specified areas by the authorities.

The fourth section focuses on applications in electronics and digital technologies like smart traffic system operations, smarter healthcare and IoT and smart waste management system. The fifth section included case studies in urban areas in context of smart city infrastructure. Chapter 11 and 12 from this section provided case studies for big data analytics and IoT for urban transportation: a case of Pune city, Maharashtra, and Songdo smart city-urban analytics resp.

Section1: Next Generation – IoT, Big Data, and Smart City

The rapid growth in the urban population increases proper utilization of resources, services and infrastructure. These needs can be fulfilled by connecting and communicating various IoT devices with each other over the internet to establish smart systems.

This section elaborates the fundamental concepts of the smart and connected cities. The intention of Chapter 1 is to provide the information about: the needs of remembering the past (preservation and revitalization), the needs of living in the present (livability), the needs of planning for the future (attainability), the vision of smart and connected cities to improve livability, preservation, revitalization, and attainability of a community, how IoT is used to provide a ubiquitous network of connected devices and smart sensors for Smart and connected cities?, how IoT, machine to machine, big data and smart cities linkages can help in doing predictive analytics?, real potential of using big data analytics in smart cities, smart grid and traffic congestion management where big data analytics can be useful for decision makers and city planner.

The second chapter has provided a collaborative approach towards: IoT, big data and smart city. It has also focused on how big data helps decision-makers to plan for any expansion in either smart city services, resources, or areas along with the challenges involved in using big data and IoT in smart city. Chapter 3 outlined the development towards a secure, distributed, and reliable cloud-based reference architecture for the management of big data in a smart city. The focus of this chapter is on the conceptualization and implementation of an infrastructure to prove its feasibility.

In Chapter 4 smart communities through big data analytics and cloud-IoT are highlighted. This chapter covers the requirement of cloud computing, its elements, design issues and architecture model. In addition to this various design issues, overview of smart city communities through big data analytics are also described. Chapter 5 promotes the main concept of data growth for next generation IoT devices along with the discussion regarding how to handle the big data. The chapter has been concluded by providing various big data analytical tools that can be used effectively for faster processing and extraction of different significant information.

Section 2: The IoT and Industry Expectations

Use of IoT in industry with minimum investment is getting good results. This attracted various organizations to make use of IoT and gain insights of data to make important decisions. These decisions are benefited to improve productivity, work effectiveness, marketing capability etc. for growing their businesses.

Chapter 6 from this section provided the concept of industry 4.0 which can be considered as the 21st Century Industrial Revolution and will soon be the new form of manufacturing delight from the previous three industrial revolutions characterized by machines, electrical power, and information technology. The definitive customer would experience manufacturing requests determined by artificial intelligence, machine learning, and automated technologies linked with data science support for

gauging customer necessities. This new industrial revolution would possess systems with transformative technologies for managing interconnected systems between its physical assets and computational capabilities.

Section 3: Safety and Security Systems

As population grows, use of smart equipment's grows, which increases generation of data rapidly. In next 2-3 years it may increase at least 20 times as it is available right now. IoT is also contributing some percentage in expanding this data. Organizations are spending a massive amount of money on security; therefore, security is playing a most important role in big data these days.

Chapter 7 has demonstrated an application on human intrusion detection in secure space using wireless sensor networks. It is able to identify intrusion, send alerts and then track the object of interest. The system comprises of Infra-Red (IR) transceiver for continuous surveillance of the specified location. The main scope of this chapter is that the information technology world, organizations move their business to outsource through cloud. This can be used at specified locations of the defense, army and societal need locations such as hospitals, Houses, organizations etc. The military and environmental surveillance based on vibration sensing using an array of micro machined accelerometers or microphones has attracted the attention of several groups.

Section 4: Applications in Electronic and Digital Technologies

This section discusses various applications of IoT, big data and smart cities. Chapter 8 focuses on use of technology in Traffic management. It has discussed about the use of data coming from different sources in real-time and processing of this data to take immediate decisions. These decisions are the keys to control traffic management successfully in our cities. It is the need of the hour to leverage the enormous amount of data around us and create a more meaningful and smooth living for us.

With billions of smart devices already in use, the IoT has seen a rapid acceleration. IoT is also proving to play a pivotal role in health monitoring due to its low-cost infrastructure, internet connectivity, and by allowing the ease of access to health data from anywhere. Chapter 9 has sought to first highlight the complexity and challenges in healthcare systems. The chapter then proposed cloud-based solutions to build an enterprise data platform that integrates with IoT devices. Finally, big data solutions and smart applications are presented for both healthcare systems and patients. The chapter concludes by discussing great potentials of IoT. It also illustrates new research challenges faced by rapid growth of multitude of smart devices and the potentials for big data analytics with potential integration with healthcare data.

   Chapter 10 presented the design and development of Smart Waste Management System that is one of the primary components of a smart city. The Web Portal application that applies the MQTT and CoAP protocol for communicating data from the bins is presented. The usage of IoT Cloud, Data analytics and Visualization makes the decision making effective. This system avoids human intervention, saves human time and effort and provides a smart technology for waste management that leads to a healthy and pollution free environment. This system can be implemented in a smart city, where the public can be benefitted.

Section 5: The Case Studies – Urban Area in Context of Smart City Infrastructure

Chapter 11, primarily focused upon transportation sector in Pune and issues surrounding therein, wraps up with the finding that the city has a long way to go with respect to perking up mobility. Transportation is one of the few areas where the city lags behind compared to its urban counterparts in the country.

   Chapter 12 discusses and explores South Korea's Songdo smart city. This chapter gives a 360-degree view of Songdo smart city project, specifically with regards to planning, design, deployment of technologies, and especially, urban analytics. The chapter's major areas of focus are: looking into Songdo from the perspectives of its being an Aerotropolis and a ubiquitous city. Songdo international business district is a new ubiquitous city built from scratch on 600 hectares of reclaimed land along Incheon's waterfront. With all the modern amenities and LEED-certified buildings, Songdo will also survive in the future.

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