Preface

The Internet has restructured the global interrelations, the art of businesses, the cultural revolutions, and an unbelievable number of personal characteristics. Currently, machines are getting in to control innumerable autonomous gadgets via Internet and create Internet of Things (IoT). Thus, appliances are becoming the user of the Internet, just like humans with the Web browsers. Internet of Things is attracting the attention of recent researchers for its most promising opportunities and challenges. It has an imperative economic and societal impact for the future construction of information, network, and communication technology. The new regulation of future will be eventually, everything will be connected, and intelligently controlled. The concept of IoT is becoming more pertinent to the realistic world due to the development of mobile devices, embedded and ubiquitous communication technologies, cloud computing, and data analytics. Business procedures can be authorized; industries can be redesigned along IoT paradigm. In a broader sense, just like the Internet, Internet of Things enables the devices to exist in a myriad of places and facilitates applications ranging from trivial to the crucial. Conversely, it is still mystifying to understand IoT well, including definitions, content, and differences from other similar concepts.

The objective of this edited book was to provide the researchers of computer science and information technology the concepts, architectures, models, and key technologies which are required to achieve an in-depth knowledge in IoT. To achieve these objectives, we emphasized on essential concepts and its applications to real-life problems. This has been done to make the edited book more flexible and to stimulate further research interest in topics. We believe that our effort can make this collection interesting and highly attract the students pursuing pre-research, research, and even masters. This book is comprised of four parts: The first part is an attempt to provide an insight into theoretical foundation and fundamentals of on big data analysis that includes scalable architecture for big data processing, time series forecasting for big data, hybrid intelligent techniques, and applications to decision making by using neutrosophic sets. The second part discusses architecture for big data analysis and its applications, whereas the final parts discuss the issues pertaining to cloud computing.

Key deployment features in LTE-A systems for better support to IoT applications is explained in Chapter "Relay Technology for 5G Networks and IoT Applications." These features are likely to be improved further in 5G networks and future wireless mobile technologies. The exponential growth of wireless services driven by mobile Internet and smart devices has triggered the investigation of the 5G cellular network. For the better support of IoT applications, five key deployment features in LTE-A systems were discussed. Multi-hop relay provides coverage to mountainous and sparsely populated areas, heterogeneous relay saves bandwidth in the access link, mobile relay enhances the data rate of high-speed mobile users, and multiple backhauling provides higher peak data rates, and relay-assisted D2D enhances the average data rate. These features are likely to be enhanced further in 5G network for future wireless mobile technologies.

Two-way authentication security scheme for IoT based on existing Internet standards, specifically the datagram transport layer security protocol, is introduced and thoroughly discussed in Chapter "Two-Way Authentication for the Internet-of-Things." By relying on an established standard, existing implementations, engineering techniques, and security infrastructure can be reused, which enables an easy security uptake. The proposed security scheme uses two public key cryptography algorithms tailored for the resource heterogeneous nature of IoT devices. The extensive evaluation, based on real IoT systems, shows that the proposed architecture provides message integrity, confidentiality, and authenticity with affordable energy, end-to-end latency, and memory overhead.

Service-oriented architecture is essential for the use of wireless sensors networks in industrial applications such as the operation and maintenance of industrial installations. This architecture comprises the OCARI wireless sensor network and the OPC-UA/ROSA middleware, as well as the KASEM predictive maintenance system. This architecture targets various industrial applications such as process monitoring, pollutant detection, monitoring of fuel storage area, fire detection in temporary worksites, and health monitoring of people working in hazardous conditions. The solution proposed to support mobility in the OCARI network is simple and limits the overhead induced by mobile nodes. This mobility support is designed to be efficient in its use of resources. The properties of energy efficiency, determinism, latency, and robustness provided by OCARI to static wireless sensor nodes are ensured. In the absence of mobile nodes, the OCARI network behaves exactly as without mobility support and exhibits exactly the same performances. The design of such protocol extensions is also highlighted in Chapter "Mobility Support and Service Discovery for Industrial Process Monitoring."

Body area networks (BAN) represents the natural union between connectivity and miniaturization. Formally, it is defined as a system of devices in close proximity to a human body that cooperate for the benefit of the user. These networks are appealing to the researchers due to their wide range of applications. However, typical properties of body area network bring the necessity to achieve an efficient medium access protocol in terms of power consumption and delay. The strength of a BAN signal is affected by the physical location (in or on body) and orientation

of the nodes, in relation to each other as well as the human body. A complete survey is presented in Chapter "MAC Protocols in Body Area Network-A Survey."

Current developments are observed in Internet of Nano-Things (IoNT) and Industrial Internet of Things (IIoT). Advanced development in nanotechnology led to nanomachines and nanoscale devices. The number of connected devices will increase at a hasty pace in future. This may drive added intensification in the network size and complexity for real-time traffic handling, since these devices are smart with manifold features. Adoption of IoNT will facilitate communication over Internet to facilitate interaction among these real-world physical elements. IIOT is heralded habitually as a way to improve operational efficiency. Chapter "Internet of Nano Things and Industrial Internet of Things" focuses on the concepts, architecture, applications, and future research directions in the both IoNT and IIoT.

Security issues in the deployment of wireless sensor networks in IoT are discussed in Chapter "Secure Distributed Group Rekeying Scheme for Cluster Based Wireless Sensor Networks Using Multilevel Encryption." A model that deals with a variety of passive attacks including node capturing and eavesdropping followed by a novel scheme using dynamic key management and encrypted data security is elucidated. With the evolution of diverse tiny devices, unrealistic connection among themselves and other devices has become practical. Most significant aspect in the IoT paradigm is WSN. Connecting WSN and other IoT elements go beyond remote access and create a heterogeneous information system. Embedding the computational competence in all objects present in the system provide a qualitative and quantitative leap in primary sectors such as health care and logistics. Enhanced usage of wireless sensor networks in fields such as military obligates the building up of secure environment. To this end, Chapter "Secure Distributed Group Rekeying Scheme for Cluster Based Wireless Sensor Networks using Multilevel Encryption" presents a novel scheme using dynamic key management and encrypted data protection to ensure environmental security with reduced and limited sensor usage.

Presently, wireless sensor networks are becoming more spreading and dominating. Both industry and academia are targeting their research works for the sake of advancing their functions. The safety of a wireless sensor network is negotiated due to the random distribution of sensor nodes in exposed environment, memory restraints, power restraints, and unattended nature. Furthermore, providing confidence between every couple of communicating nodes is a demanding issue in this kind of networks. Under these conditions, Chapter "Recognizing Attacks in Wireless Sensor Network in View of Internet of Things" spotlights on recognizing a variety of attacks and their symptoms on wireless sensor networks.

Association of wireless sensor network in IoT automation to enable green computing is of recent research. It combines sensing, computation, and communication into a single miniature device, thus necessitating IoT on wrathful utilization of WSN. Simultaneously, it does not assume a specific communication technology. But wireless communication technology plays a major role and in particular propagates many applications in many industries. The tiny, craggy, economical, and low-powered wireless sensor networks sensors bring the IoT to

even the smallest objects installed in any environment at reasonable costs. Chapter "Wireless Sensor Network in Automation and Inter of Things" provides a survey on wireless sensor network in automaton.

Chapter "Challenges of Distributed Storage Systems in Internet of Things" describes the issues related to fusion, privacy, security, and trust in distributed storage systems to gain more benefits from IoT. Important information from the network devices in various places has to be sensed, accessed, and processed for various purposes. Additionally, the heterogeneous information acquired from diverse devices cannot be handled by traditional storage system. It makes distributed data storage more popular for proficient data management and leads to technologies such as cloud computing. The augmentation of these storage devices entails several challenges such as data consistency, error handling, data fusion, security, and privacy.

Chapter "Internet of Things Based Intelligent Elderly Care System" illustrates an approach for intelligent elderly care system on vision-based IoT. It explains a method for fall detection of elderly people which could prevent fatality and could provide immediate attention to other health-related injuries of vulnerable. A foremost challenge for society in near future will be meeting the needs of an aging people. Energy efficiency programs such as green deal miss many elderly in fuel poverty. Such people and those with health-related issues may be benefited by simply installing such an intelligent vision-based system in their homes. Moreover, the disadvantage of carrying a sensor by the sick and elderly is also prevented by identifying and sending alerts to other family members on acute emergencies.

The characteristics and applications of domain-specific IoTs, including smart cities, smart medical and health care, retail, logistics, supply chain management, manufacturing, aerospace and aviation, automotive and telecommunication, smart energy, smart transportation, smart pharmaceutical industry, and smart environment, are elucidated in Chapter "Challenges, Issues and Applications of Internet of Things." Also, IoT devices congregate and distribute information directly with each other and the cloud, making it achievable to gather, record, and analyze new data streams faster and more precisely. This chapter explores in greater depth the role of IoT in various applications with a quicker look at the technological characteristics that formulate it a reality and examine the opportunities, challenges, and issues at present.

The omnipresent exploitation of mobile and sensor devices is creating IoT a broad collection of potential Internet applications. It is apparent that the current hype around the IoT is enormous. The various information and communication perspective challenges associated with IoT for the expansion of the future society is stressed in Chapter "Application of Technologies in Internet of Things." Additionally, it also discusses how this technology can help in medical applications to offer cost-effective quality health care with enhanced manpower competence. With the maturity of the technology for collecting, analyzing, and transmitting data in the IoT, exciting novel IoT-driven healthcare applications and systems emerge progressively.

Current state of the Internet of Things from people's association point of view is much important. In IoT, objects become smart and autonomously communicate with

one another and human beings, through networks supported by interfaces. The IoT systems are enhanced by surveying diverse interactions between the humans and the IoT to mine the implanted intelligence about individual, environment, and society. In the upcoming years, the IoT is expected to bridge various technologies to enable new applications by connecting physical objects together in support of intelligent decision making. With this perception, Chapter "An Appraisal on Human-Centered Internet of Things" spotlights and surveys the support of intelligent human–computer interaction for the IoT and to deal with human-centered concerns.

The Internet of Things represents the upcoming huge step in the Internet with its ability to gather, distribute, analyze, and interpret data. Millions of devices are expected to be connected or networked into the IoT structure that require massive dissemination of networks as well as the method of converting raw data into meaningful interpretations. The form of communication that is experienced now is either human–human or human–device. More influential smart phones, appliances, tablets, and the applications that are similarly rich and powerful available for each will enable buyers and business customers to interact seamlessly with companies altering the business processes. The technologies that enable the implementation of IoT, the objectives, future vision, and case studies are presented in Chapter "A Survey on Internet of Things: Case Studies, Applications, and Future Directions."

Internet of things and cloud computing are dissimilar technologies, but they are already part of our life. The espousal is considered to be more and more persistent and consequently making them as significant components of the future Internet. A novel paradigm of merging cloud computing and IoT is foreseen as disruptive which may enable a huge application scenario. Cloud computing is considered as a dynamic infrastructure which will be the only choice to maintain enormous and volatile information and can supply an illusion of unlimited computing resources to the users. Cloud will empower IoT by presenting resilient computing power, storage, and networking. With this perception, Chapter "Internet of Things in Cloud Computing" discusses cloud computing in IoT.

Much of researchers in different industries and organizations across the globe have started research in Internet of Things. Simultaneously, a lot of techniques pertaining to computational intelligence, data analysis, and cloud computing are progressing at the other end. Fusing the IoT and these latest techniques, technologies will acquire it to a newer dimension. To keep abreast with this development in a cohesive manner, we strove to keep the book reader friendly. The main objective is to bring most of the major developments in the above-mentioned area in a precise manner, so that it can serve as a handbook for many researchers. We trust and hope that this edited book will help the researchers, who have interest in IoT, cloud computing, and its applications to keep insight into recent advances and their importance in real-life applications.

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