Chapter 2
An Overview of IoT Infrastructure Architecture, Enabling Technologies, Issues, Integration of Cloud, and Simulation Tools

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ABSTRACT

Many critical studies and research were carried out to improve the technologies of IoT. Nevertheless, several challenges need to be solved to determine the maximum value of IoT. These problems and concerns will be approached from specific IoT perspectives, such as applications, enabling technologies, issues, and so on. The key purpose of this work is to explore IoT technology in terms of technical and social aspects. The work discusses various challenges and major issues of IoT including detailed architecture and applications. The research further summarizes the recent literature of various areas of IoT and explains their importance. Moreover, the importance of integration of cloud in IoT infrastructure has been discussed. The research also mentioned and described various simulation tools through which the characteristics of the IoT environment can be analyzed empirically. This work lets the readers and the researchers grasp the IoT and its real-life applicability.

INTRODUCTION

Internet of Things (IoT) is one of the emerging topics in recent times in terms of technical, social, and financial consequences. From the past decades, there is a significant development in the fields of wireless communication technology, information and communication systems, industrial designs, and electromechanical systems encouragements progress new technology named as the Internet of Things. The most

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important intention of the IoT is to connect all or any devices to the internet or other connected devices (Sinche, 2020). IoT is the collection network of home appliances, physical devices, vehicular networks, and added devices fixed with sensors, electronics, and actuators along with network connectivity which make-possibility for mentioned objects to gather/accumulate and exchange information/data. IoT works as a massive network of organized things and people allocate those gathered resources in relation to the way they are utilized and also know regarding the surrounding atmosphere. Here each and everything typically identified with its corresponding computing system however it proficient to interoperate inside the existing internet infrastructure.

IoT is a paradigm where the real world is connected to the virtual world through the internet. IoT has wide scope in each trade of the world starting from engineering, medical, finance, food, energy, and agriculture. New devices, OS, architectures, platforms, security, and communication protocol are emerging in terms of IoT. As research is done in IoT, many new challenges are coming like massive connectivity, coverage, security, scalability. To achieve these goals that create problems a few years back now seems easy due to the interconnection of things. Both advancement and challenges are growing hand in hand. IoT adds a new taxonomy every day to its definition. It will take time to make IoT's boundary stable. IoT applications can be broadly categorized as consumer-based, industrial-based, and infrastructure-based applications. Some of the consumer-based applications are home automation, self-driven vehicles, smart wearable, automated healthcare, smart homes, etc. Major industrial application is smart manufacturing process and control system, smart retail and supply chain, internet industry, industrial automation etc. Infrastructure based applications are the smart city, habitat monitoring, smart environment, smart grid, etc. (Ngu, 2017).

IoT ecosystem is a system that brings together all the heterogeneous components of IoT in a managed way to build an efficient system. It is the integration of devices, operating system, controllers, gateways, middleware, and platform. All these elements are connected through communication protocol and interfaces like Zigbee, low power Wi-Fi, Message Queuing Telemetry Transport (MQTT), Low Power Personal Area Network for IPv6 (6LoWPAN), Near Field Communication (NFC), Bluetooth low energy (BLE), etc. IoT ecosystem connects a large number of physical devices in a single system. These connected devices have been increasing exponentially. In 2020 the count will increase to 50–100 billion according to various Information and Communication Technology (ICT) reports (Stoyanova, 2020). From the latest updates in the IoT field, there will be more than 30 billion things/devices continuously online and higher than 200 B. Chander and G. Kumaravelan billion things/devices infrequently online by the year 2020. In the early hours of 2000, Kevin Ashton one of the pioneer researchers of MIT institute AutoID Lab who made ground base work that comes out nowadays as the Internet of Things (IoT).

By the year 2022, up to 45 percent of all internet traffic will be projected by IoT. In addition to these predictions, the McKinsey Institute has stated that, over the last five years, the number of linked devices has risen 300 percent. IoT-based services can provide substantial economic development in the industry. It is estimated that the total annual economic impact of IoT will be $2.7 to $6.2 trillion by the year 2025.

This work will provide a study on pieces of literature that includes the core concepts of IoT such as IoT architecture, frameworks, enablers, issues, cloud-based IoT, etc. The increasing number of architecture proposed has yet to converge on a reference model. In the meantime, several initiatives such as IoT-A seek to develop specific architecture focused on the study of researchers and industry's needs. A three-layer design composed of the sensing, the network, and application layers are the primary architecture extracted from the set of proposals. However, several models that add further abstraction to the IoT architecture were proposed in the recent literature. The work will then provide a detailed overview of the