Chapter 6
NB-IoT for Healthcare

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ABSTRACT

The quality of the healthcare system is a significant contributor to a nation's economy. Technological developments in the internet of things (IoT), cloud computing, and wireless body area networks (WBAN) and their interaction have given a boost to healthcare as an application domain which seems to be very promising to improve the quality of health care. Long-range and ubiquitous deployment needs of healthcare can be very well handled by narrow band IoT (NB-IoT). NB-IoT has the potential to reduce power and bandwidth requirements. NB-IoT is a low power wide area (LPWA) version of IoT which has the potential to cater to remote healthcare needs. NB-IoT is preferred over other networks due to cost efficiency, longevity, security, and mature, wide-reaching networks. However, security is an unavoidable threat in any IoT network, so as in NB-IoT. In this chapter, the authors discuss the performance of NB-IoT for healthcare applications, the issues and challenges faced, and some of the solutions to countermeasure these problems.

INTRODUCTION

Before the Internet of Things (IoT), health care was limited to patients' direct visit to physician and in some cases, tele or text communications. Continuous remote monitoring was not possible. The advent of IoT has made remote health monitoring, programs for remote fitness, cure of persistent diseases, and remote care of the elderly possible. IoT enables the physicians to provide better care and increases the satisfaction level of patients as waiting time, hospital stay, and frequency of readmission to hospital is greatly reduced. In turn, IoT has improved the health care sector by reducing the costs and improving the overall outcome as well as the experience.

Deployment of IoT using the existing mobile communication networks fails to be efficient, as they are not optimized for applications that send or receive small amounts of data less frequently. This is a typi-

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cal characteristic of mostly all IoT devices and mainly the devices used in healthcare applications. Also, other technologies offer great outdoor coverage but fail to provide deep coverage within the building/ infrastructure. Further to this, communication modules that connect to GSM, 3G, or LTE support many services that may not be required for application such as health care. These complex modules add to the hardware cost and complexity and remain underutilized. The battery life if such modules are used comes down. To summarize the challenges faced during IoT deployment are High power-consuming devices that lead to the maintenance of these battery-operated devices costly and recurring, compromised coverage in the building premises, and sensors that are incapable of low power wide area coverage need setting up local gateways and their maintenance. To cater to these challenges in its release 13, 3GPP suggested technologies that are mainly focused and are optimized keeping IoT applications in mind. These are called LPWAN (Low power wide area network) technologies. It is a type of wireless communication network designed to cover a larger area and enable long-distance communication. This technology uses a narrow band for communication and hence offers a low bit rate for communicating among things/ sensors operated on a battery. In 2013, LPWA technologies surfaced as a class of wireless technologies that are the best fit for the kind of needs specific to machine-to-machine (M2M) communication and battery-operated IoT devices. GSMA wireless industry made an association with 3GPP and defined the standards in 2015 for coverage, cost, and power consumption for IoT applications. Since then LPWA technology became the most preferred choice for IoT applications. LPWAN technologies reinforce the business case for IoT solutions, as it offers a low-cost power saving solution. It supports data transfer in small sporadic data packets ranging from 10 to 1000 bytes in size. LPWAN operates with greater power and bandwidth efficiency and over a larger area with a simple infrastructure and hardware which translates into greater cost efficiency.

The Top LPWAN technologies are listed below. LoRa, Sigfox, LTE-M, and NB-IoT. Among these LTE-M, and NB-IoT is preferred over other technologies as it has the potential to make massive IoT economically viable. The advantages offered by NB-IoT like lower costs reduced power consumption, and deep coverage indoor can benefit the healthcare applications.

In this chapter, we discussed various aspects of Narrow Band IoT, comparison of LPWAN technologies for healthcare, the architecture used for NB-IoT healthcare, issues and challenges involved, and how NB-IoT can benefit the health care sector.

The rest of the chapter is organized as follows. In Section 2, the literature review of NB-IoT and its use in healthcare applications is discussed. In Section 3, the need and utility of NB-IoT in healthcare are presented, other LPWAN options for healthcare are discussed and compared. In section 4, NB-IoT architecture for healthcare application is discussed. Deployment methods are discussed in brief. In Section 5, Challenges and issues in NB-IoT healthcare systems are presented. Security issues and their solutions are presented here. In section 6 few case studies are discussed. Section 7 talks about future research directions in NB-IoT and healthcare. Finally, Section 8 summarizes all the important points involved in NB-IoT for the healthcare sector.

LITERATURE REVIEW

Due to the rapid improvement in modern technology and special attention to healthcare, ample research is being conducted in this area. New research in this field helps to solve a few challenges as well as provides insight into new exciting problems. Almost many aspects have been introduced to make our life