Chapter 7
Narrowband IoT for Emergency Medicine

Subrata Kumar Routray
https://orcid.org/0000-0002-3155-276X
Medical University, Pleven, Bulgaria

ABSTRACT

The arrival of internet of things (IoT) is a new revolution in the information and communication technologies. It added several new dimensions to the new and existing platforms of ICTs. It has improved the quality of our modern living by several new and smart technologies and their value-added applications. Applying the new emerging technologies in emergency medical services could offer better services to human lives during the emergency conditions. This chapter provides an overview of utilizing the IoT in the field of emergency medicine. IoT has tremendous potential to transform how the healthcare providers interact with patients. In order to achieve this, the healthcare sectors need widespread adoption and implementation of IoT. Healthcare sector is huge when compared with other IoT-enabled sectors. Therefore, the widespread deployment of IoT needs an effective version of IoT which is economical and does not pose any risk to the patients. Both these criteria can be met by the lighter and simpler version of IoT known as narrowband IoT (NBIoT). It is suitable due to its low power wide area (LPWA) coverage capabilities. In this chapter, the authors review the network architectures, applications, and trends of NBIoT in the modern healthcare. They further discuss how different wearable devices with coordinated smart sensors can improve emergency monitoring of patients for improved services in out-hospital and in-hospital scenarios. Finally, they give an account of advantages and disadvantages NBIoT in the emergency medical applications.

INTRODUCTION

The Internet has become an integral part of modern lives. The introduction of the Internet of Things (IoT) is a technological shift in wireless connectivity. IoT connects the world of objects and things to the Internet through sensors and actuators by collecting and sharing information at all time and all the locations of their deployment. IoT (also known as Internet of Everything when fully deployed in a locality)

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aims to make daily human activities smarter and safer with minimum human intervention. IoT connects different devices to organize human needs in both normal and emergency situations.

The role of IoT in modern medicine is very new and found to be rewarding. These days people use IoT based online health applications to monitor health parameters, locations, human activities, health related activities and many other things. IoT in Health sector is a value addition for patient care and decision making especially in the field of emergency medical-care. IoT is going to play important role in per-hospital remote monitoring of patients and suitable treatment by constant feedback from sensors and wearable devices. These devices will exchange patient's vital parameters continuously to medical emergency center to monitor and evaluate the patient health. Emergency care services need this technology to provide high quality and affordable health services with minimum errors. To provide high quality services to every case we need resources, organization for efficient and widespread services which is not reliable with present day infrastructure. A lighter and wider IoT network is needed for large scale healthcare deployment. Narrowband IoT (NBIoT) is one such forms of IoT which can play important roles in healthcare. It seems that NBIoT will fill this void in healthcare and several other sectors in the coming years.

NBIoT is a low power wide area (LPWA) technology. Meaning NBIoT works economically with low energy consumption covering a large area which is suitable for widespread emergency medical services. It uses a narrow band frequency for its operation with cellular and non-cellular platforms. It can operate smoothly with existing LTE and GSM networks. The battery lives of NBIoT sensors are expected to last more than 10 years which makes it energy efficient and a green choice. It can be deployed in and around the hospitals for smart patient monitoring. The applications of sensors and smart wireless devices can provide continuous physiological information of patients outside hospital for making perfect decisions on health conditions.

In this chapter, the roles of IoT and especially NBIoT in emergency healthcare are discussed. It provides the basic framework of NBIoT based healthcare for the general public. A special focus is given to the framework for emergency medicine in the modern context using NBIoT. In order to improve emergency service with patient centered real time information system the support of NBIoT is essential. In this chapter we present the recent advances in these aspects of healthcare using the existing literature and the recent findings.

The remaining parts of this chapter are arranged as follows. In Section 2, we provide the main state of the art of NBIoT with respect to its deployment and applications for emergency medicine. In Section3, we provide the main features of IoT and NBIoT and how they are suitably matching the needs of emergency medicine. In Section 4, we provide the main applications of NBIoT for emergency medical. In section 5, the main advantages and disadvantages of NBIoT application in emergency medicine are shown. In Section 6, we provide the future research directions of NBIoT in healthcare. In the last section we conclude with the main concluding remarks of this chapter.

SECTION 2 - LITERATURE REVIEW

Medical emergency in an important area of research and several works have been done since long past. There are several technologies being applied to the emergency conditions in healthcare. Thus it is a well researched area in medicine and a lot of literatures are available on it. However, the IoT is not very old and the applications of IoTs have started only since 2010. Narrowband IoT is even newer when compared