Chapter 4
Bluetooth Low-Energy-Based Applications: The State of Art

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ABSTRACT

This chapter focuses on the comprehensive contents of various applications and principles related to Bluetooth low energy (BLE). The internet of things (IoT) applications like indoor localization, proximity detection problem by using Bluetooth low energy, and enhancing the sales in the commercial market by using BLE have the same database requirement and common implementation idea. The real-world applications are complex and require intensive computation. These computations should take less time, cost, and battery power. The chapter mainly focuses on the usage of BLE beacons for indoor localization. The motive behind the study of BLE devices is that it is supported by mobile smart devices that augment its application exponentially.

INTRODUCTION

Localization is locating any object or person in a space which may be open (outdoor) or limited (indoor/closed). Localization has become an intense research area for the past decade because of its real life application in various domains. During this
tenure of intensive research in the area of localization, earlier the focus was limited to outdoor localization but during the past few years. Recently indoor localization has also acquired focus of many researchers from industry and academia and thus intensifying research in the area of indoor localization (Liu, Darabi, Banerjee, and Liu, 2007).

There exist various technologies that have been used for outdoor localization. Global Positioning System (GPS) has been recognized to be the most efficient technology for outdoor localization, but it has some drawbacks that limit its application impossible for indoor localization and proximity detection. The major limitations of GPS are required of specialized hardware and demand for line-of-sight between sender and receiver. An additional limitation of GPS is that the accuracy of the result is also affected by the interference and noise in the environment (Zahid F., Rosdiadee N., & Mahamod I, 2013).

The proximity detection and location detection is furthermore tedious with the existing satellite system when object or person moves into the closed loop architecture like inside the building or in the area where the line of sight is not available. The situation is also complicated in high-density urban areas with rare line-of-sight to the satellites. The solution to the above problem, which can solve the indoor localization and proximity detection, is the use of radio network like Wi-Fi, IEEE 802.11 etc. But during the literature survey, it is learned that few technologies were developed in order to be used for indoor localization. However, these technologies are not in usage due to cost and performance. Thus, it concurs that wireless systems can be implemented for indoor localization considering that many buildings have existing WLAN infrastructure. This wireless system for indoor localization can be coalesced with GPS to escalate and broaden its application. As already stated, despite rigorous research in indoor positioning, it is deprived of its extensive application. The major reasons that deject its widespread application are expensive, cost, excess battery power consumption and inadequate accuracy.

Research must thank the IoT (García, Espada, Valdez, García-Díaz, Midgar, 2014) which comes up with the advanced technology like Bluetooth Low Energy (BLE) which can be used effectively for solving the above problem. Bluetooth Low Energy (BLE) technology is a very good alternative for indoor location detection, which augments Wi-Fi access points for indoor localization. Bluetooth low energy is a promising technology developed by SIG group the leverage of BLE is through its properties which dominate the existing Wi-Fi techniques, i.e. low power consumption, small size, connectivity to mobile phones, low cost, robust, efficient, multi-vendor interoperability, global availability, license free. One of the leading advantages of BLE it is cost effective and it consumes very less power as compared to Wi-Fi. One of the prominent motives behind the beacon popularity is, it is possible to place the beacons in the spots where Wi-Fi access points would be difficult to power. As the
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