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Device-free Localization Technique for Indoor Detection and Tracking of Human Body: A Survey

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Abstract

The extensive usages of WLANs and mobile devices have increased the interest in Indoor localization systems for wireless environments. In the context of wireless-based localization system, researchers have always focused on device-based localization system, in which tracked entities must have a device attached. This practice for many years developed localization systems like Global Positioning System; Radio Frequency based system, Ultrasonic bases system and Infrared base systems. These all location based systems need a device to be attached with tracked entity, in order to run part of localization algorithm. Thus, all these systems are called as active device-based location systems. Recently a new concept device-free localization system is introduced; this system can detect and track any entity without carrying any radio device or participating actively in the localization process. A human body is detected in the device-free localization system by observing the changes in the received signal strength of WLAN environment. This paper presents a comprehensive survey of various techniques of the device-free localization system.

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1. Introduction

The widespread growths of localization systems and fast advancements in the networks of communication have motivated the extensive research interest in the location determination area. At present estimating the possible location of any entity has become the crucial component of WLAN environment. Approximating the location is useful for various applications like monitoring patients in hospital, estimating the location of assets, tour guides, conference guides, shopping guides and information, games, network access based on the user's location and security (Vorst, Sommer, Hoene, & Carle 2008). The Global Positioning System (GPS) is famous outdoor location estimation used worldwide. GPS was first time used for military application (Youssef & Mah, 2007). Due to low cost for implementing the number of devices using GPS technology is increasing every year. Although GPS has become the popular technology for tracking and navigation purposes, it has some limitations as well. For example, no functionality in indoor environments and requirement of attached device with user at all times, in cities with tallest buildings, or between mountains because of the requirement of Line-of-Sight (LoS) to communicate satellites. Therefore, there is a dire need for an accurate indoor location-based system. For these reasons, device-free localization (DfL) system has recently attracted the attention of the research community (Patwari & Wilson, 2010).

The WLAN Device-free localization concept was first time introduced in (Seifeldim & Youssef, 2010), and it takes advantage of extensive deployment of Wi-Fi network everywhere. The DfL can detect human body in indoor environment by analyzing how a human body changes the pattern of received signal strength without wearing any device. This concept is applied both for detection and tracking of human body. In comparison to wired security and surveillance systems, WSN reduce both cost and installation time, and can be easily reinstalled at any other area of interest if required. On the other hand, low cost of unit leads to deploy many nodes to cover a larger area.

Figure 1 depicts the different components of DfL system. A dfL system consists of access points (APs) as the signal transmitter, monitoring points (MPs) such as personal computer or a laptop and an application server (AS) to initiate actions as required and process the data.

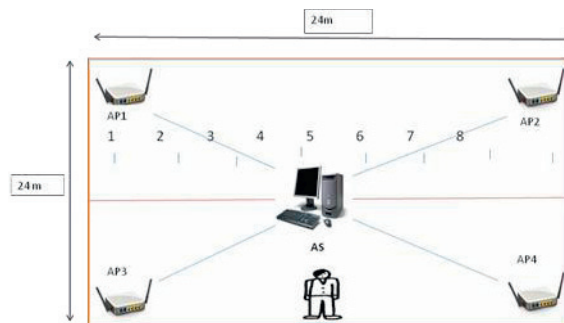


Figure 1. System components of DfL

This paper focuses on the survey of various device free localization techniques and systems. This work provides the key features of recent developments in the device-free location based system. The paper also highlights the challenges of this area of research.

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