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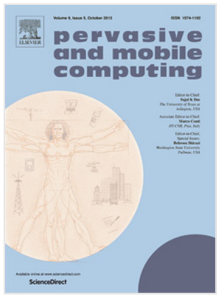

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Energy-Efficient WiFi Scanning for Localization

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Abstract

WiFi radio signals are commonly used for the localization of mobile devices. However, frequent scanning of WiFi reduces user experiences because it consumes significant energy on mobile devices. In this paper, we propose an energy-efficient WiFi scan system for localization. The proposed system preserves the quality of service of each application and minimizes the energy consumption of WiFi scanning. The main idea is that the system adaptively controls the dwell time of beacon-listening in given locations. We predict the number of scanned access points (APs) according to locations and optimize the dwell time of beacon-listening to obtain the minimum number of scanned APs. The evaluation shows that the proposed system saves the energy consumption of WiFi scans by 33.6% and 45.7%, according to the number of scanned APs, while not decreasing the accuracy of localization in indoor and outdoor scenarios.

Keywords: Indoor Localization; Wi-Fi Fingerprinting; Energy Saving; WPS

1. Introduction

A location-based service (LBS) is commonly used in mobile devices, such as smartphones and tablets. The LBS applications use GPS, cell towers, and WiFi signals for localization. Specifically, WiFi signals are widely used in LBS applications because WiFi networks are available almost everywhere in both indoor and outdoor environments. Especially, in indoor and urban area, the location from WiFi signal is more accurate than GPS and cell tower positioning. In WiFi-based localization, LBS applications perform a WiFi scan using 802.11 WLAN technologies to obtain information about surrounding WiFi access points (APs). Our observation is that the required accuracy of applications is diverse; thus, some applications use redundant energy for scanning all APs. For example, the navigation application [1] requires pinpoint accuracy, while weather reporting [2] requires less accuracy. However, both applications perform the same operations for the same duration to scan all WiFi APs.

A WiFi scan consumes significant energy on mobile devices. The scan operation repeatedly broadcasts beacons and waits for a reply for a specific duration (e.g., 200 ms) in all channels of WiFi networks (e.g., 32 channels on Samsung Galaxy S4) [3], [4]. LBS applications consume more energy since they commonly perform multiple scans at each localization. Additionally, the mobile platform induces frequent WiFi scanning in applications. For example, the Android system provides the “always allow scanning” function in the 4.3 version, which enables WiFi scanning even though WiFi is turned off [5]. We claim that the current scan operation is not optimized for localization. In

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