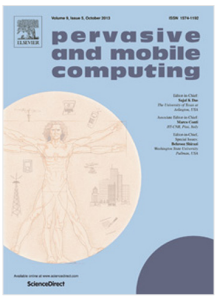
# Accepted Manuscript




A fine-grained indoor fingerprinting localization based on magnetic field strength and channel state information

Xudong Huang, Songtao Guo, Yan Wu, Yuanyuan Yang

PII: S1574-1192(17)30288-2
DOI: http://dx.doi.org/10.1016/j.pmcj.2017.08.003
Reference: PMCJ 883

To appear in: *Pervasive and Mobile Computing*

Received date : 30 May 2017
Revised date : 30 July 2017
Accepted date : 15 August 2017

Please cite this article as: X. Huang, S. Guo, Y. Wu, Y. Yang, A fine-grained indoor fingerprinting localization based on magnetic field strength and channel state information, *Pervasive and Mobile Computing* (2017), http://dx.doi.org/10.1016/j.pmcj.2017.08.003

# A Fine-Grained Indoor Fingerprinting Localization Based on Magnetic Field Strength and Channel State Information

Xudong Huang[a], Songtao Guo[a,*], Yan Wu[a], Yuanyuan Yang[a,b]

[a]*College of Electronic and Information Engineering, Southwest University, Chongqing, 400715, China*
[b]*Department of Electrical and Computer Engineering, Stony Brook University, Stony Brook, NY 11794, USA*

**Abstract**

With the popularity of wireless networks and smart devices, indoor localization gets developed rapidly. The location-based information services have attracted more and more attentions and the accurate location information has played an important role in the practical application. However, a large position measurement error in the unique indoor environment brings some challenges for accurate indoor localization. In this paper, we propose a hybrid fingerprint localization algorithm by synthetically utilizing Channel State Information (CSI) and magnetic field strength. Firstly, we give an improved Line of Sight (LOS) identification algorithm to narrow down the matching area that localization requires. Then, we combine CSI with magnetic field information to construct a fusion fingerprint database and provide a Multi-Dimensional Scaling $k$-Nearest Neighbor (MDS-KNN) method to achieve the fingerprint matching. Experiment result reveals that our proposed localization algorithm has better robustness and higher positioning accuracy than the traditional fingerprint location methods.

*Keywords:* Indoor localization, Magnetic field, Fingerprinting system, Channel state information.

## 1. Introduction

Nowadays, the development of portable devices (e.g., smartphones and panel computers) plays an important role in the growth of emerging fields, such as Location-Based Services (LBS) [1], [2] and Internet of Things Applications (IOTA) [3], [4]. To meet the demands for LBS and IOTA, many localization techniques are proposed to estimate and provide user position information. The Global Positioning System (GPS) [5] has been generally used for positioning in outdoor environment, which is one of the most famous localization technique. However, in indoor environment GPS performs poorly and is unsuitable for indoor positioning: the satellite signal is blocked and attenuated by the buildings. This flaw will lead to a poor positioning accuracy and make GPS nearly impossible to meet the demand of indoor positioning. On the other hand, the indoor signal disturbed by furniture, pedestrians and walls is complex and volatile, which makes the location algorithm difficult to achieve high accuracy and robustness. Thus, some indoor positioning systems have been developed for indoor applications, such as ultrasound [6], Radio Frequency Identification (RFID) [7], Bluetooth [8], Infrared [9] and inertial sensors [10].

*Corresponding author: Tel.: +86-23-68250947; Fax: +86-23-68250069.
*Email address:* songtao_guo@163.com (Songtao Guo)