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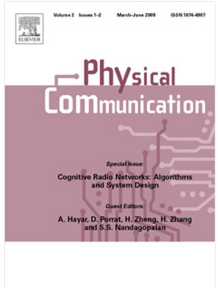


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Full length article

# ScOFi: Schematic Assisted Optimum Fingerprinting for Wi-Fi Indoor Localization using Peer Hand-shake

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**Abstract**

Received signal strength fingerprints based on Wi-Fi spectrum have been widely adopted in the recent years for indoor localization purposes due to cost-effectiveness and availability. However, until the peer hand-shake (PHS), existing work had not constrained the schematic dimension of the target area, which could dramatically reduce the localization error. As the demand for sensors everywhere schemes for 5G networks keeps on booming, effective signal propagation characterization with in indoors is very essential for Internet of things (IoT) indoor localization and navigation applications. We review, extend the validation of the PHS technique that leverages the schematic dimensions of the target area within the total indoor environment to construct, auto-dynamically transform and update fingerprint in complex indoor environments. Extensive experimental validation has been carried out in two scenarios; Scenario 1 categorizes lobby area while Scenario 2 categorizes corridor areas. We analyze the accuracy performance using Nearest Neighbor (NN) and the KNN algorithms. Experimental results show robustness of the PHS, achieving lower average localization error in diverse indoor dimensionalities than comparisons.

**Keywords**

Received Signal Strength Indicator; Wi-Fi Fingerprinting; Indoor Localization; Dimensions; Radio map; Databases; Sensors.

## 1. Introduction

Wireless area networking, deploying the Wi-Fi as a redundancy network to wired local area networks with in ever changing complex indoor environments, has dramatically driven the emergency of smart indoor environments that depend on location based services (LBS) [1]. Such services include localization of patients in hospital environment, falling infants at home, tracking of variable with in complex indoor environment, in-airport passenger navigation [2]. These IoT services have increased the demand for data, lower latency, and reduced energy consumption in mobile devices. In one case, high responsive human interaction such as remote surgeries in medical field could be realized in the next 5th generation of mobile communication, intelligent indoor robotics navigation at homes and in manufacturing, based on fast decisions by critical controls. The demand for such huge trucks of data has seen giant telecommunication service providers deploying micro cell within indoor environment, small cells outdoors with massive MIMOs. More micro cell equate to better RSSI reception by the mobile devices, and thus better localization accuracy for Received Signal Strength Indicators (RSSI) based techniques. Popular outdoors global navigation satellite systems such as the Global Positioning System (GPS) [3,4], the GLONASS [5] and the BeiDou-2 (BDS) [6] present outdoor precision of 5 m, 4.5-7.4 m, 10 m for civilian and 10 cm for military services respectively. However, they render little or no assistance indoors due to dependency on unobstructed Line-of-sight (LOS) to four or more satellites. In some instances, such systems should be fused with some indoor techniques. Indoor environments are complex and tedious to deploy successful outdoor localization techniques due to signal attenuation, multipath interference and variations in structural obstructions, such as the walls, furniture, and presence of human traffic. In recent years, we have seen fingerprinting emerging as a promising approach for indoor localization [7-10]