2012 International Conference on Indoor Positioning and Indoor Navigation, 13-15th November 2012

WiFi Fingerprinting Signal Strength Error Modeling for Short Distances

Vahideh Moghtadaiee
School of Surveying and Spatial Information Systems
University of New south Wales
Sydney, Australia
v.moghtadaiee@student.unsw.edu.au

Andrew G. Dempster
School of Surveying and Spatial Information Systems
University of New south Wales
Sydney, Australia
a.dempster@unsw.edu.au

ABSTRACT

With increasing user demands on Location-based Services (LBS) and Social Networking Services (SNS), indoor positioning has become more crucial. Because of the general failure of GPS indoors, non-GNSS navigation technologies are essential for such areas. Wireless Local Area Networks (WLAN) have widely been employed for indoor localisation based on the Received Signal Strength (RSS)-based location fingerprinting technique. The fingerprinting technique stores the location-dependent characteristics of a signal collected at known locations ahead of the system's use for localisation in a database. When positioning, the user's device records its own vector(s) of signal strength and matches it against the pre-recorded database of vectors by applying pattern matching algorithms. Location is then calculated based on the best matches between the new and stored vectors. We examined the relationship between the measured Manhattan and Euclidean Distance and the geometric distance between RPs in a fingerprint database. The correlation between geometric and vector distance was poor. However, because "nearest neighbour" algorithms are used, only short vector distances are important. Furthermore, the measured RSSIs varied much more as a function of distance (due to fast fading) than it did as a function of time at a single test point. Hence, the difference between variances measured at two test points was not a good indicator of the measured difference in signal strength. This led to the current investigation of very short geometric distances. In this paper, a new algorithm is applied to examine data from locations at very short ranges from each other and to investigate the relationship between vector distance and the geometric distance in closer areas in order to observe the nature of the relationship between short-range fingerprints. The experimental test bed was carried out in a large furnished office. Two west-east and south-north lines in a cross shape with 4m length are considered. We find that even at short distances, variation due to fading dominates and averaging fingerprints over a range near the point of interest is helpful.

KEYWORDS: Indoor positioning, Fingerprinting, Error modeling.