

MaWi: A Hybrid Magnetic and Wi-Fi System for Scalable Indoor Localization

Chi Zhang
Nanyang Technological
University
Singapore
czhang8@ntu.edu.sg

Jun Luo
Nanyang Technological
University
Singapore
junluo@ntu.edu.sg

Jianxin Wu
Nanjing University
Nanjing, China
wujx2001@nju.edu.cn

ABSTRACT

We present MaWi - a smart phone based scalable indoor localization system. Central to MaWi is a novel framework combining two self-contained but complementary localization techniques: Wi-Fi and Ambient Magnetic Field. Combining the two techniques, MaWi not only achieves a high localization accuracy, but also effectively reduces human labor in building fingerprint databases: to avoid war-driving, MaWi is designed to work with low quality fingerprint databases that can be efficiently built by only one person. Our experiments demonstrate that MaWi, with a fingerprint database as scarce as one data sample at each spot, outperforms the state-of-the-art proposals working on a richer fingerprint database.

MaWi does not depend on any dedicated infrastructure, except for detectable Wi-Fi access points, which are almost always available in indoor area. A fingerprint database should be fetched by a human surveyor before MaWi can locate users. In our experiment, we employ only one surveyor holding smart phone to walk around the deployment area, while recording the fingerprints of both Wi-Fi and magnetic field at passed location. The results in Table 1 show that, even for a large area of 22500 m², we only need no more than 1 hour to get a usable database for localization.

MaWi requires user to horizontally hold a smart phone, and point it ahead. We show a real localization process on our MaWi client for five seconds in Figure 1. User stands still during the whole procedure at the lower side of the floor plan(indicated by the particle at the 5-th second). We compare MaWi with Horus with rich fingerprint database and show the result in Figure 2.

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Table 1: Test Sites and Survey Times

Area	Size	Wi-Fi APs	Time (min)
Office	800 m ²	18 ± 5	6
Library	3100 m ²	43 ± 9	28
Shopping Mall	22500 m ²	27 ± 7	55

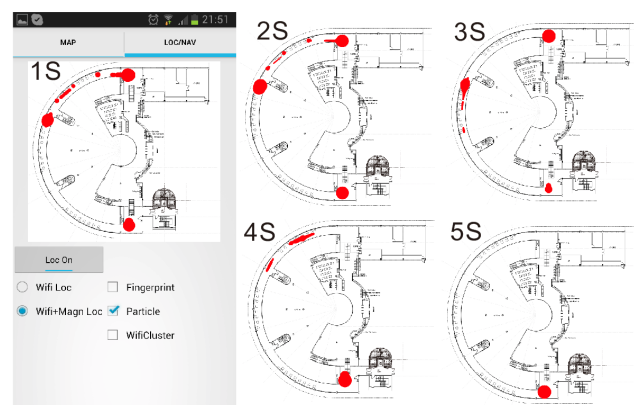


Figure 1: MaWi localization on a client. Sizes of red dots denote particles' weights, and time sequence is indicated at the upper-left corner of each figure.

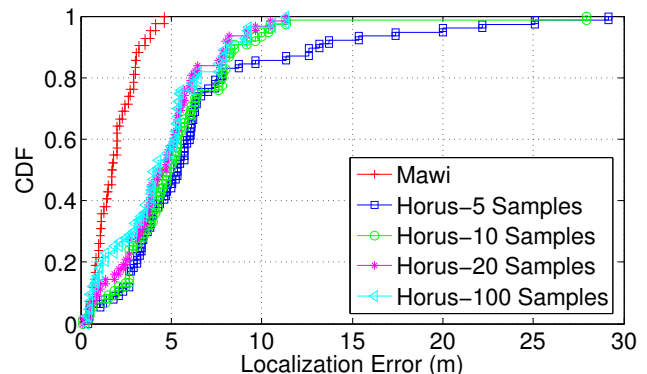


Figure 2: Localization accuracy comparison between MaWi, and Horus (with rich fingerprint database)