

Master Thesis Proposal (Diplomarbeitsbeschreibung)

Thomas King, Stephan Kopf

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1 Master Thesis

1.1 Working Title

Distribution of Fingerprints for 802.11-based Positioning Systems

1.2 Introduction

In recent years we have seen a lot of research in the area of indoor positioning systems mainly because the well-known *Global Positioning System (GPS)* is not properly functional in indoor environments. One of the most promising technologies that could be an equivalent to GPS but indoors are *802.11-based positioning systems* [1, 2]. Nowadays, 802.11 hardware is cheaply available and installed nearly everywhere where people live and work. Another important fact is that 802.11 is a wireless local area network technology that is usually used to provide Internet access to mobile users, however, it can be used for positioning purposes at the same time. Even better, almost all modern PDAs, cellphones and laptops are capable to communicate with 802.11 infrastructure because they are shipped with built-in 802.11 hardware.

The best positioning results can be achieved with 802.11 positioning systems that utilize the so-called *Fingerprint* approach [1]. This technique comprises two stages: an offline training phase and online position determination phase. During the offline phase, the signal strength distributions (also called *fingerprints*) collected from access points at predefined reference points in the operation area are stored in a database together with their physical coordinate. During the position determination phase, mobile devices sample the signal strength of access points in their communication range and search for similar patterns in the database. The closest match is selected and its physical coordinate returned as a position estimate.

A lot of research has focused on algorithms that compute the closest match (e.g., [6, 7, 5]). The authors of these papers assume that the overall fingerprint database is stored on the mobile device. If we think of large deployments of these positioning systems (e.g. covering all buildings on a campus), keeping the complete database on the mobile device is not feasible for many reasons: fingerprint databases change due to structural alterations, are updated because of new deployments or relocation of access points, or they are just too big to

be stored on a mobile device. Furthermore, computing position estimates on a central server is not practical for many scalability reasons.

In the literature there is only one reference considering the distribution of the fingerprint database [3]. However, this paper only suggests two distribution algorithms and provides no evaluation.

1.3 The Thesis

Subject of this thesis is an implementation and evaluation of fingerprint data distribution algorithms as described in [3]. Furthermore, new ideas for algorithms should be developed, implemented and evaluated.

To evaluate the algorithms, a simulation study should be carried out. The following questions should be answered by this study:

- What is the update frequency?
- How large are the updates?
- How large is the fingerprint database on a mobile device?
- Does a fingerprint database distribution algorithm interfere with the positioning accuracy?

Additionally, a real world test should be performed to examine problems that have been missed in the simulation study. For this, the Loclib framework should be used. Loclib is a framework that provides positioning related features and has been developed at Praktische Informatik IV [4].

Literatur

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