Bachelorabschlussarbeit

Thomas King, Stephan Kopf

July 2006

1 Bachelorabschlussarbeit

1.1 Working Title

Determining a Reasonable Grid Dimension of Reference Points for Fingerprinting-Based Positioning Systems

1.2 Summary

Recently, various indoor positoning systems based on Fingerprinting have been proposed (e.g., [1], [3]). Basically, these indoor positioning systems work as follows: Wireless-LAN access points periodically transmit beacons and every mobile device that receives beacons from at least one access point is able to estimate its position.

Fingerprinting approaches work in two stages: in the training phase a database that stores the physical coordinates and radio fingerprints of the reference points is created. A radio fingerprint comprises the signal strength values of all Wireless-LAN access points in communication range at a particular position. The database is then used in the online phase to compute the position of mobile devices. If a mobile device wants to know its position, it collects the signal strength values of the Wireless-LAN access points in its communication range and matches these sample with the data stored in the database. If no direct match is found the nearest fingerprint is selected and based on the selected fingerprint the position is derived.

As shown in [3], the aforementioned Wireless LAN-based indoor location systems work well in various indoor conditions and provide location accuracy up to a few meters.

1.3 The Thesis

Subject of this thesis is to evaluate the impact of different grid dimensions of reference points on the average positioning error. In a first step, the student should enhance the already existing grid of reference points at the A5,6 building on our campus, so that an investigation can be carried out. In a next step, the student should analyze the impact of the grid dimension of reference points on the positioning accuracy. Furthermore, the student should study how fingerprints for reference points surrounded by other reference points can be interpolated. Building characteristics, such as walls and doors, should also be

considered to infer rules for interpolation. For these interpolation tasks, the already existing *Loceva* framework should be used. *Loceva* (A Location Evaluation Framework) has been developed at Praktische Informatik IV [2] to evaluate various positioning algorithms. Based on the results, formulas to calculate the complexity of collecting offline data and to compute a positioning estimate should be derived. Finally, a optimal grid dimension with respect of positioning accuracy should be determined.

References

[1] P. Bahl and V. N. Padmanabhan. RADAR: An In-Building RF-Based User Location and Tracking System. In *Proceedings of the 19th International Conference on Computer Communications (Infocom)*, volume 2, pages 775–784, Tel Aviv, March 2000. IEEE.

[2] T. King and S. Kopf. Loclib - A Location Library. Website: http://www.informatik.uni-mannheim.de/pi4/lib/projects/loclib/, November 2005.

[3] M. Youssef and A. Agrawala. The Horus WLAN Location Determination System. In *Proceedings of the 3rd International Conference on Mobile Systems, Applications, and Services (Mobisys)*, pages 205–218, 2005.