NATIONAL UNIVERSITY OF SINGAPORE

School of Computing

PH.D DEFENCE - PUBLIC SEMINAR

Title: **Self-Calibrating Participatory Wireless Indoor Localization**

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Abstract:

For many mobile applications, it is often critically important to know the accurate indoor location of the mobile device. However, despite significant research progress in the past two decades, an indoor localization system that can be easily deployed on a large scale remains a challenge. The first challenge that hinders the large-scale deployment of indoor localization systems is the labor-intensive and time-consuming site survey. Many of existing indoor localization systems requires a dedicated offline calibration to build a wireless fingerprint database (i.e., radio map) for localization. In addition, the radio maps need to be periodically updated to reflect the environmental dynamics. The other challenge is the lack of efficient approach that accurately estimates the localization accuracy of the deployed systems.

The focus of the work in this thesis is to effectively tackle these challenges by designing accuracy-aware self-calibrating indoor localization systems. In particular, we focus on the wireless fingerprint based indoor localization. In summary, three major contributions are made in this thesis:

(1) We first design and implement PiLoc, a self-calibrating active indoor localization system, which infers the indoor floor plans and builds radio maps for localization automatically. Different from the state-of-the-art, PiLoc leverages participatory sensing to automatically bootstrap the localization system while requiring no prior knowledge about the indoor environment, which greatly reduces the system calibration cost for active indoor localization.

(2) To enable indoor localization without explicit cooperation of mobile devices, we then design and implement SpiLoc, a self-calibrating passive indoor localization system for mobile devices. The key novelty of SpiLoc is that it automatically bootstraps the radio maps needed for passive localization through opportunistic RSS trace mapping. Evaluation shows that while SpiLoc requires no dedicated calibration, it achieves fine-grained localization performance to locate mobile devices even without their explicit cooperation.

(3) Finally, we propose A2Loc, which achieves accuracy awareness for generic wireless fingerprint based indoor localization systems. A2Loc takes the constructed radio maps as input, and estimates the localization performance of the system based on the property of the fingerprints in the radio map. In addition, other useful information such as localization landmarks that can be used to further improve the localization performance is also extracted by A2Loc.

To sum up, the three works proposed in this thesis exploit participatory sensing to achieve accuracy-aware self-calibrating indoor localization, which significantly reduces the calibration and evaluation cost when deploying indoor localization systems in practice. In the end, limitations and future works are discussed.