Demo: Unsupervised Indoor Localization

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ABSTRACT

We propose UnLoc [1], an unsupervised indoor localization scheme that bypasses the need for war-driving. Our key observation is that certain locations in an indoor environment present an identifiable signature on one or more sensing dimensions. An elevator, for instance, imposes a distinct pattern on a smartphone's accelerometer; a specific spot may experience an unusual magnetic fluctuation (refer to Figure 1). This form of urban sensing and activity recognition has already been demonstrated in literature [2, 3], but not yet applied in pure localization applications. We hypothesize that these kind of signatures naturally exist in the environment and can be envisioned as internal *landmarks* of a building. Mobile devices that "sense" these landmarks can recalibrate their locations, while dead-reckoning schemes can track them between landmarks. Neither war-driving nor floorplans are necessary - the system simultaneously computes the locations of users and landmarks, in a manner so that they converge reasonably quickly. We believe this is an unconventional approach to indoor localization, holding promise for real-world deployment.

Categories and Subject Descriptors

H.3.4 [**Information Storage and Retrieval**]: Systems and Software; C.2.4 [**Computer-Communication Networks**]: Distributed Systems

General Terms

Design, Experimentation, Performance

Keywords

Location, Mobile phones, Sensing, Landmarks, Recursion

1. DEMONSTRATION

We conducted real-life experiments in 3 different university buildings - Computer Science, Engineering, and North Gate shopping mall [1]. We covered approximately 1750m^2, 3000m^2, and 4000m^2, respectively, in these buildings. Users walked around arbitrarily in the building for 1.5 hours, covering multiple floors; they carried 2 Android NexusS phones with UnLoc, one in the pocket and another in the hand with the screen facing up. The results of those experiments are shown in Figure 2.

We propose a live demonstration of the UnLoc system to show its localization capabilities. Prior to the day of the demonstration, we will bootstrap the system for the demonstration area; this entails having multiple people walk around various parts of the hotel carrying phones with UnLoc in order to generate a database of landmarks. On the day of the demonstration, we will invite participants to walk around the vicinity while holding Android NexusS phones installed with our system. They will be able to track their location on the screen of their phone through a floor map display. Meanwhile, other participants on site will be able to view a more detailed graphical display, showing the locations of both users and landmarks.

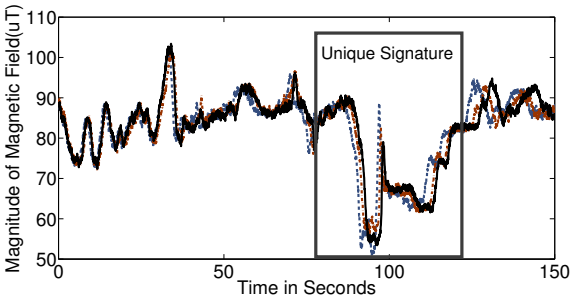

Figure 1: Magnetic signature near a networking lab.

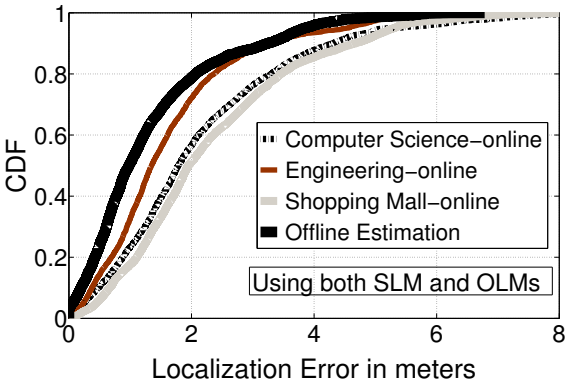

Figure 2: CDF of localization error using SLMs and OLMs

2. REFERENCES

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[2] J. Chung et al. Indoor location sensing using geo-magnetism. In *MobiSys*. ACM, 2011.

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