A Privacy-Preserving Mobile LBS System for Small Businesses

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Abstract

Small-to-medium businesses are always seeking affordable ways to advertise their products and services securely. With the emergence of mobile technology, it is possible than ever to implement innovative Location-based Advertising (LBS) systems using smartphones that preserve the privacy of mobile users. In this paper, we present a prototype implementation of such systems by developing a distributed privacy-preserving system, which has parts executing on smartphones as a mobile app, as well as a web-based application hosted on the cloud. The mobile app leverages Google Maps libraries to enhance the user experience in using the app. Mobile users can use the app to commute to their daily destinations while viewing relevant ads such as job openings in their neighborhood, discounts on favorite meals, etc. We developed a client-server privacy architecture that anonymizes the mobile user trajectories using a bounded perturbation strategy. A multi-modal sensing approach is proposed for modeling the context switching of the developed LBS system, which we represent as a Finite State Machine (FSM) model. The multi-modal sensing approach can reduce the power consumed by mobile devices by automatically detecting sensing mode changes to avoid unnecessary sensing. The developed LBS system is organized into two parts: the business side and the user side. First, the business side allows business owners to create new ads by providing the ad details, Geo-location, photos, and any other instructions. Second, the user side allows mobile users to navigate through the map to see ads while walking, driving, bicycling, or quietly sitting in their offices. Experimental results are presented to demonstrate the scalability and performance of the mobile side. Our experimental evaluation demonstrates that the mobile app incurs low processing overhead and consequently has a small energy footprint.

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