BLIND ASSISTED INDOOR NAVIGATION SERVICES

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Abstract-*The increasing growth of smartphone technology and human interaction inside buildings for business, entertainment, educational and official purpose has led to the importance for Indoor Navigation services. This service could be further expanded for blinds, whose travelling ability is completely diminished by vision. The proposed system provides enhanced tactile audio feedback and vibration for positioning and navigating indoors. Since GPS services are not available indoors, the system uses signals from existing WiFi access points to calculate user position and navigate them. The service rely on geolocation databases that store indoor models comprising of floor-maps and points-of interest along with wireless signals used to localize users. The system is very beneficial for the common man to locate and navigate any outdoors and indoors because it minimizes the need of external help to blind. The main advantage of the proposed system is that it doesn't require any new hardware, and use the existing smartphones, the user need not have to bear any additional cost and the platform is free and completely feasible for anyone.*

1. INTRODUCTION

People with visual disabilities, i.e., partially or totally blind, are often challenged by places that are not designed for their special condition. Examples of these places are bus and train terminals, public offices, hospitals, educational buildings, and shopping malls. Several everyday objects that are present in most built environments become real obstacles for blind people, even putting at risk their physical integrity. Simple objects such as chairs, tables and stairs, hinder their movements and can often cause serious accidents. Since vision is the most important organ to sense the surroundings, its loss can significantly reduce the visually impaired's individual orientation and mobility, especially in unfamiliar and complex indoor environments. Even with the help of a guide dog or cane, it is still a challenge for the visually impaired to independently navigate in such environments without help from sighted individuals. Currently, blind and visually impaired users mainly rely on training from Orientation and Mobility (O&M) instructors to acquire orientation and mobility skills. O&M instructors will guide their clients to the destination while taking into consideration the environment and client's mobility. While such instruction is very effective, navigating to unfamiliar environments requires the help of an O&M instructor or a sighted person limiting the independence of blind and visually impaired users. It is commonly accepted that the incapability of moving freely and independently can hinder the full integration of an individual into society.

Several proposals have tried to address this challenge in indoor and outdoor environments [1]. However most of them have limitations, since this challenge involves many issues (e.g., accuracy, coverage, usability and interoperability) that are not easy to address with the current technology. Therefore, this can still be considered an open problem.

2. TAXONOMY

The localization dimension is related to the requirement for dedicated equipment or not, which may heavily affect both deployment cost and accuracy. A large number of state-of-the-art geolocation systems rely on crowdsourcing rather than cost-prohibitive data collection by professionals to address deployment cost, system scalability and maintenance bringing up, however, new research challenges. Privacy and confidentiality are critical for the wide adoption of indoor geolocation services because users have always been concerned about sharing their location data. While localization and privacy are key design factors, proper modeling of indoor spaces is equally important for the development of efficient IIN services and this dimension is not considered in existing classifications.

3. LOCALIZATION

The combined Navigator and Logger is a designated tool for Android users, which can benefit from Wi-Fi fingerprinting [2], [3] available under this platform. The Navigator allows users to hear their current location on top of the floorplan map and navigate between POIs inside the building using voice commands, similarly to the Viewer (iOS, Android, Windows). The main difference, is that the Navigator offers superb accuracy. The Navigator also uses the onboard smartphone sensors (i.e., accelerometer, gyroscope and digital compass), which are seamlessly integrated in our tracking module to smooth the WiFi locations and enhance the navigation experience to give enhances tactile feedback. The Logger application enables users to record RSS readings from nearby Wi-Fi APs and upload them to our Server through a Web 2.0 API (in JSON). It is used by volunteers for contributing RSS data and for crowdsourcing signal maps.

4. CROWDSOURCING

The module features several modules to support crowdsourcing of location-dependent sensor readings collected on smartphones. Firstly, given that mobile devices are outfitted with diverse hardware sensors provided by a wide variety of vendors means that Wi-Fi measurements can greatly vary. It handles this by means of a differential fingerprinting module that outputs signal strength differences, instead of absolute values. Secondly, the outlier filtering module detects and rejects invalid user contributions to avoid the contamination of the Wi-Fi radiomap with erroneous signal strength data. This may occur accidentally, in case well-intentioned contributors click on the wrong part of the building to mark their true location while collecting data, or deliberately in case a malicious user aims to compromise the accuracy of the system.

5. PRIVACY

Anyplace offers a flexible privacy scheme, where a user has the option to localize by caching complete indoor models on the smartphone (thus obtaining absolute location privacy), or by intelligently downloading subsets of buildings through the IIN service without disclosing location-context metadata of users. The system camouflages a user trajectory among k other users offering energy-efficiency, high performance in terms of retrieval time and network resource conservation, without hindering the provision of fine-grained location updates.

6. MODELLING

The Architect Web app offers a feature-rich, user-friendly and account-based interface for managing indoor models. Particularly, after logging in a user can place the blueprint of a building. Using the floor editor, the user can upload, scale and rotate the desired blueprints to fit them properly. The user can later add, annotate and geo-tag POIs inside the building and connect them to indicate feasible paths for enabling the delivery of navigation directions.

All the communications are made my voice commands and tactile feedback. Each turnings are intimated my vibration and voice commands. The positions are internally processed in maps of the building. The Destination is inputted by voice commands in the starting, once a valid destination is inputted navigation is automatically started. After reaching the destination the navigation module can be given with new destination.

7. CONCLUSION

The system summarizes the growing space of blind assisted indoor navigation services that aim to transform digital services in indoor and urban spaces. It provides a rigorous taxonomy that classifies many recent academic and industrial technologies and services, based on a rigorous multidimensional taxonomy. The system presents the dimensions of taxonomy through the lens of an open, modular, extensible and scalable blind assisted indoor navigation services architecture, concluding with open technical challenges in the field. The limits of this proposal need to be established in order to identify the scenarios where the system can be a contribution for the visually impaired. That study will also help determine improvement areas of this solution.

REFERENCES

[1] Bradley, N.A.; Dunlop, M.D. An experimental investigation into wayfinding directions for visually impaired people. Pers. Ubiquitous Comput. 2005, 9, 395–403.

[2] Aislelabs, “The Hitchhikers Guide to iBeacon Hardware: A Comprehensive Report by Aislelabs” Available at: http://goo.gl/eCsUp9, May 4, 2015.

[3] D. Lymberopoulos, et. al., “A realistic evaluation and comparison of indoor location technologies: Experiences and lessons learned”, In ACM/IEEE IPSN 2015.