Smart InNavigation: A Smart Solution for Indoor Navigation

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ABSTRACT

Over the past two decades, the Global Positioning System (GPS) has become a leading technology for outdoor navigation by locating the user's current position. However, signals attenuation inside buildings makes indoor navigation difficult and therefore GPS does not work in indoor environments. There are many systems that provide indoor navigation but require special and expensive tools and are able to operate in a limited environment. This paper proposed a system called Smart InNavigation that will definitely benefit users who are unfamiliar with an area. This is a smart solution to find your way inside the buildings using Augmented Reality and 2D maps. Using this system, users will be able to track their current location and move from one place to another in the indoor environment. In addition, the system will provide a feature of procedural navigation, which will guide the user to perform any task in an environment they are unfamiliar with, by providing detailed information on how to perform the task.

Keywords: Global Positioning System, Indoor Navigation, Procedural Navigation, Augmented Reality.

INTRODUCTION

The Global Positioning System (GPS) has made outdoor navigation easier, but the lack of signals inside indoor areas has made navigation extremely difficult (Jamil et al.; Sattarian et al.). Navigating in an unknown environment is exhausting for most of the people. In places such as educational institutions, hospitals, shopping malls and airports etc. where indoor navigation is essential, there is a need for a system that can guide the users properly within the area (Ayyalasomayajula et al.; Diakité and Zlatanova; Sato, Oh, Guerreiro, et al.). Although many personal navigation tools have been suggested to enable indoor navigation, they do not provide meaningful features about the surroundings, and may require special tools to operate. Furthermore, many of the deployed systems are often working in limited circumstances, which may not accurately operate in all the real environment (Yin et al.; Cui et al.). Considering the problems in the indoor, after reviewing the existing apps, it has been concluded that these apps need to be improved as follows: (1) Using common tools that are affordable for everyone. (2) Demonstrating additional information with localization to help within an environment and (3) Developing a system that works in all the real environment (Sato, Oh, Naito, et al.).

To address the above issues, this research proposed the indoor navigation system called Smart InNavigation to guide the users accurately to their destination in indoor areas. Smart InNavigation entails the continual tracking of the user's position and displaying a guided route to the user's intended destination.

METHODOLOGY

The proposed system is based on Augmented Reality (AR) and a straightforward 2D view map that helps and guides the user from one location to another or to locate an individual in a real-time environment. Users can view their PIN location and find their destination on app. AR navigation guides the users through pointing arrows that help them find their way. A 2D map that looks like a GPS map shows the whole area. Using 2D

maps or AR, users can easily find the desired destination location in the indoor environment. Moreover, the user can also switch from 2D view to AR or vice versa through the navigation mode.

Smart InNavigation is using an existing environment and adding some imaginary components to the system that people will interact with in the same way they interact with the real environment. Thus, they feel that these objects are real and that they are part of that environment. To track an individual, mobile Bluetooth or beacons are using that will be easily embedded on a person's ID card, for accurate positioning.

The system has another feature called procedural navigation. To the best of our knowledge, this is completely new concept in navigation that has not yet been applied to existing apps. This feature guides users through their work in a specific area and helps users see their work from one place to another through the app's navigation feature. Users also have detailed information about their work that is stored in the database and assists them perform their tasks.

The proposed system will be tested on a number of user-related activities that they can perform at the university, such as gathering information about university departments or admissions procedures or paying fees. To do this, a list of activities will be embedded in the system that users need to perform at university. Once users will interact with these tasks, they will be instructed to perform their tasks through AR navigation or 2D map and to process any information to reach their desired destination.

There are basically 4 modules in the proposed system for educational institutions: for students, faculty, administration and visitors. When students are using Smart InNavigation app, they need access to specific classrooms, labs and other locations on campus, where they can find their lecturers if needed. With this app, they can easily get to where they want to go. In addition, the system has a notification feature that will notify students before class according to their timetable, which will serve as a reminder. Faculty members can find their desired destination such as classrooms, labs, etc. using this smart app. In addition, the lecturer will be notified of their next scheduled class. Administration will have full access to navigate across campus and will be able to easily see the location of specific individuals through the positioning feature. While, visitors will have limited access in the system as they should not have approach to lecture rooms or labs etc. They can find the places they need, such as the admission section, canteen, photo state shop, etc. In the visitor module, there will be two options for navigation. Simple navigation that will go from one place to another and the procedural navigation where the visitor will choose the task to be performed such as paying admission fee or taking admission etc. Then, according to the task, the system will guide the whole process using AR navigation or a 2D map until the whole process is completed.

CONCLUSION

The need for navigation in the indoor environment is becoming one of the basic needs. In infrastructures such as campuses, hospitals, large organizations or buildings, and complex malls, people try to find their destination. This paper proposed a system, Smart InNavigation, which seeks to address the problem of indoor navigation. Users can find their desired destination inside the building through AR navigation and 2D maps. Using procedural navigation, the system makes it easy for users to complete the task with a step-by-step guide they want to accomplish. Furthermore, with Beacons technology, the system can track the user's current position in the internal environment.

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