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Indoor Navigation System

[1]Tushar Gothivarekar, [2]Ajay Motwani, [3]Chaitanya Pathak, [4]Sunil Yadav,
[5]Ajay Perupalli, [6]Pramod Gauda

Abstract: **This paper details the development of an indoor navigation system on a Smartphone. Research of previous work in the field preceded the development of a new approach that uses data from the device's compass, adapter, and wireless accelerometer to determine user position. Finger printing technique is used to locate the current position. Indoor navigation systems can be used in college campuses, malls, hospitals and museums. A particular user can reach to its destination by using Indoor navigation system. Indoor navigation system is convenient to use and is very useful technology. There's a possible way to determine in indoor navigation that is by using signal strengths from WiFi routers. Thus by recording this signal strength at certain position, fingerprint can be created. They are very unique in the sense that it is possible to distinguish positions. By research we have discover that how to make use of fingerprints in smartphone based indoor navigation system, which uses fingerprints as a positioning technique. Improvements can be further suggested regarding the translation of the fingerprint location to absolute positions based on the coordinates using the extensions of the smart navigation system and by distinguishing some user properties like navigating through areas which are restricted, thus navigation for disabled users, or at the time of arrival estimations.**

Keywords: **Wireless Networks, Navigation, Mobile Computing, AutoCAD, Eclipse IDE and Blueprint.**

1. INTRODUCTION

In today's life style where everybody use navigation technology and are extensively addicted to its services, so we found that there is one more room for development in this area which is indoor navigation. Among all technologies most famous technology is GPS. But as we all know there are some limitations in GPS services which are as follows:

1. It cannot be used in multi storage building (signal problem).
2. GPS cannot detect floor number (height of building).

So we found that we cannot completely depend on GPS for navigation, and that's why we are working on purely WiFi based navigation system. We are all known to WiFi zone that is the area covered up with WiFi signals and it can trace user's real time position. In metro cities there are so many large structures, used for several purposes like hospitals, shopping complexes and mostly for malls, we can directly implement the blue print of that structure on WiFi zone. The remaining part can be achieved by developing an application for smart phones which must be user friendly for user interface**.** Let's take an example of shopping mall. Our navigation system can help user to locate his car parked inside the parking zone. On the other hand this system can even help user in emergency situations to find their way out for escape. Navigation is the process of accurately establishing the user's position and then displaying directions to guide them through feasible paths to their de-sired destination.

2. RELATED WORK

In a survey of several positioning technologies many approaches were applicable for indoor use. Since it is clear, indoor applications may have very different requirements. But the application should be user friendly for the user, so that the user will not find any difficulties while performing various operations on that application. In order to find the location of the user we will treat each floor as an independent WiFi zone. Separate data base for each floor will be maintained. Database will contain information about the floor like changing rooms, billing counter, emergency exit, parking zone etc.

2.1 ***Wireless Network:*** **-** Wireless network uses wireless data connections in order to connect with network nodes [1]. Wireless networks help people to guide at the building exit whenever there's an emergency situation. In wireless networks sensors detect emergency event and quickly separate hazardous areas from safe areas. Appropriate implementation thus results into appropriate as well as safety navigation. Simulation helps to navigate safely. User can navigate properly due to the used of wireless network. Wireless network also support multipath routing from a source to a specific destination. Wireless network plays a vital role in communication as well as in navigation. Wireless network is very essential for navigation.

2.2 ***Navigation:-***In this navigation system, users can view their real time position on blue print of building [2]. But in actual it shows real time position as per WiFi zone. It means that we have two layered of map. We will place blue print at the front end and WiFi zone at the back end. User interface have to deal with blueprint and will not deal with signals. Whole floor is divided by the WiFi zone in matrix form it means the zone is divided as rows and column. The position can be track from block to block basis. Consider that WiFi router is receiving signals from first block of the WiFi zone so that we can say that the position of the user is at first row and first column. WiFi routers are supposing to work and only for the floor where it is mounted.

2.3 ***Mobile Computing:*** **-** The process of computation on a mobile device [3]. In mobile computing, a set of different distributed computing system or service provider servers connect, and synchronize through mobile communication protocols. Offers mobility with computing power and allows running many applications on single device Wireless devices, such as mobile phones, smartcards, laptop computers, personal digital assistants, and the like, are gaining wide popularity. They are becoming smaller and smaller, and more and more part of everyday life, while their computing capabilities are growing quickly. This technology on personal devices enables people to access their personal information as well as public resources anytime and anywhere. Wireless networks of increasing bandwidth and software development kits can be connected to these devices and are also available incase to be used by third parties to develop applications.

2.4 AutoCAD: **-** (CAD) Computer Aided Drafting is done on a software called AutoCAD this software is Developed and marketed by Autodesk Company AutoCAD is used by wide range of engineers, industries, by architects, project managers and other professionals [4]. AutoCAD was derived from a program begun in 1977 and released in 1979 .The native file format of AutoCAD is .dwg.

2.5 Eclipse IDE:-Eclipse is an IDE (Integrated Development Environment)[7]. It contains a base workspace. It also contains an extensible plug-in system for customizing the environment. Eclipse is used to develop application mostly written in Java. By using different plug-ins, Eclipse can develop application in different programming languages also like C, Ada, C++, Java Script, PHP, Perl, ABAP, Python, Ruby, Groovy, Etc.

Eclipse IDE can be combined with ADT (Android Development Tool) using ADT plug-in provided by Google so that it provides an integrated environment in which we can build applications base on android. The capabilities of Eclipse is extended by ADT to let developers set up new Android projects, add packages based on the Android Framework API, create an application UI, debug their applications using the Android SDK tools, and export .apk files in order to distribute their applications.

2.6 Blueprint: - A blueprint is a reproduction of an engineering design technical drawing, documenting an architecture using a contact print process on light-sensitive sheets [11]. Traditional blueprints have been replaced by more modern, less expensive printing methods As display technologies have advanced, the use of mobile devices, like the Android and iPad powered tablets, for viewing plans has increased among modern construction firms. The traditional term "blueprint" has continued to be used informally (usually by non-expert commentators) to refer to each type of image. Practicing engineers, architects and drafters just call them "drawings" or "prints".

3. PROPOSED SYSTEM

To understand the functionality of the system considers the following block diagram [1].

In the diagram user is roaming around the building. WiFi routers are mounted as shown in the figure such that the connectivity can be provided throughout the whole floor. Now user is passing within the router range then as per our row and column structure, router will detect the block from which it is receiving the signals and send the appropriate position information to the user's device. The row and column info is calculated at the server end and then it again sends the

appropriate information back to the router. Again the router will send the appropriate signals to the user's device. As shown in the figure user can then notice its real time position. As per the communication between the users device, router and server users position gets refresh and user can locate its real time motion within the map.

The additional features such as:

1. Emergency Exit.

2. Flexibility.

3. Bookmark Facility available within the map.

Emergency Exit: In case there is an emergency in the building, server will broadcast the emergency exit details to all the routers and routers will send details to the navigation system.

Flexibility: Flexibility is provided such that mall authority can modify their floor time to time. Relative changes in our blue print can be made in maintenance procedure. Hence we can say that flexibility can be provided within the system and easy to maintain.

Book Mark: User is free to save the co ordinates he want from the blue print such that he can arrive on the saved locations. It can help user to roam within necessary locations.

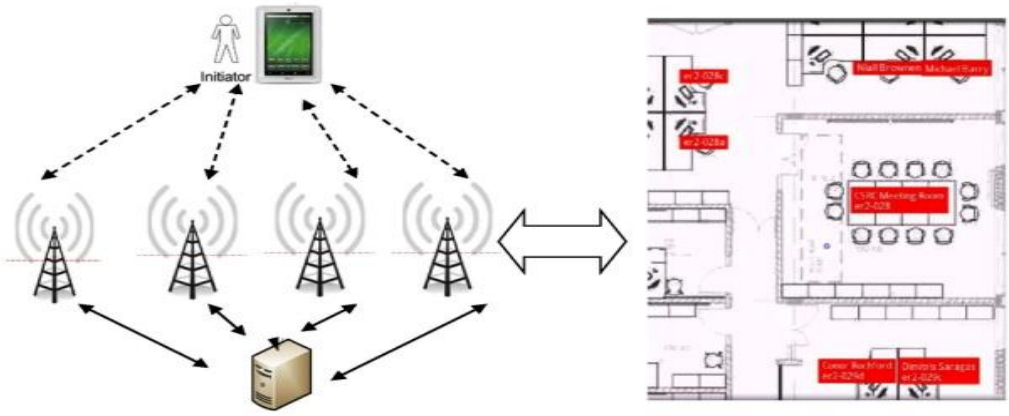

Figure 1: System Architecture

As from the above diagram, blueprint of a particular location like a building structure will be implemented on the routers. Then MATLAB will perform different operations like calculating signal strength and locating the position of the user, MATLAB will also calculate the user distance and this information will be send to the navigation system and navigation system will give directions to the user, so that the user can reach at his particular destination. MATLAB also helps in customization of the navigation process. MATLAB is also used for implementation of algorithms in order to develop any application. MATLAB also plays a vital role in plotting of data and functions. Symbolic computing is also done with the help of MATLAB. The MATLAB application can be implemented by using MATLAB language.

MATLAB application plays an important role while building the navigation system. Fingerprinting algorithm is applied on indoor navigation system. The fingerprinting process works according to the movements of the objects.

Thus in order to create the fingerprinting we must be able to used the signal strengths within the entire building with the help of services like data logging.

Use of GPS suffers from radio wave propagation. Thus signals are not able to penetrate buildings, and even if they do, there signal strength is very week. In order to overcome this problem one can use the WiFi which belongs in same category of frequency. But WiFi is can deliver the services more effectively as it has long range of frequencies.

Fingerprinting concept has been developing to find the position of a particular user in the indoor space [17]. Due to the lack of geometry, direct map matching Algorithm was difficult to implement. Thus to aim at the exact location of an entire space is difficult to implement in order to overcome this problem locations of the entire space have been brought

together with similar fingerprints. Thus locations have been chosen and recorded in fingerprints which the can be clearly distinguished from each other.

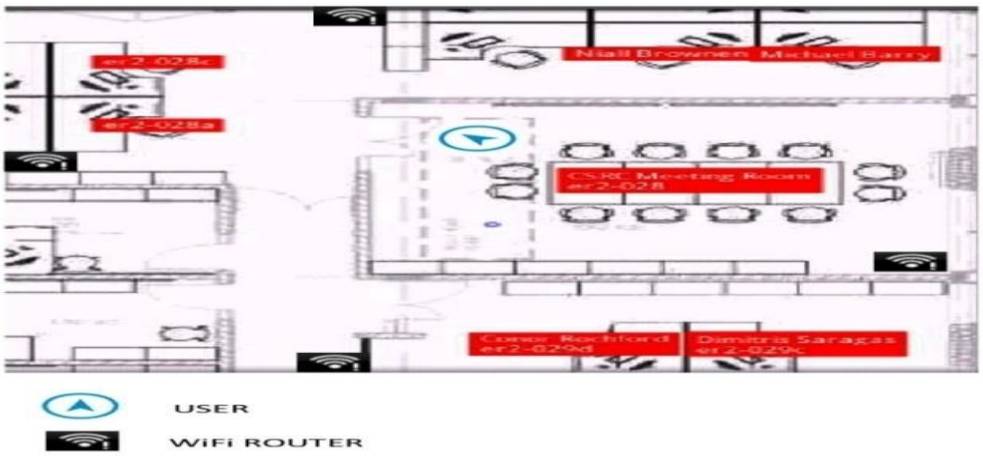

Figure 2: Internal System Implementation

Potential Technologies and their pros and cons:

1. GPS

Pros

- Moderate to high outdoor accuracy.
- High availability.

Cons

- Low to minimal indoor accuracy.

2. WiFi

Pros

- Easily available throughout.
- Minimal costs for implementation

Cons

- Multipath propagation can change network strength.

4. CONCLUSION

From the above report we can say that indoor navigation system is an effective application for navigation. Users can navigate without any inconvenience by the use of Indoor navigation system. Thus our solutions combine internal measurements to estimate user's position, thus it also detects the obstacles around them. Thus from the above topics we have summarized all the possible outcomes that will make indoor navigation system a better application in the future.

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