ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

Indoor Positioning System (IPS) Using Android

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ABSTRACT: In recent years there has been increase in the development of wireless technologies and location services there are several new projects have arisen in this field. This project approaches the design and development of the system that combines the technologies of wireless, location and android which results in the implementation of Indoor Positioning System. An android application has been developed which helps in detecting the user's location in simple and useful way. This application is based on the Wi-Fi manager API of android. It compares the data stored in the SQL database with the Wi-Fi data received at any given time, and the values applied to a series of algorithm and the position of the user is found. This application is able to obtain the position of any person who is within the Wi-Fi coverage and it displays on the screen of any android device (upto lollipop) with the android operating system. Besides the estimation of position this system displays a map that helps to see in which area of the building you were present in real time.

KEYWORDS: Android operating system, Access point, Fingerprinting, Sparsity, Wi-Fi manager API.

I. INTRODUCTION

As the mobile telecommunication and information technology improved nowadays several services have appeared based on user location in indoor environments. Similarly several systems that depend on user positioning are being developed. Wireless location based services are having a growing impact in the recent years. One of the most useful and known is the "fingerprinting" technique. The main issue that has to be taken into account is that indoor location depends on various factors that do not apply in outdoor location such as refraction, reflection and multipath. Moreover an important economic factor exists caused by the need of a major infrastructure in indoor location networks, access points, sensors, etc. The fingerprinting technique is based on the signal strength received by the mobile phone for each of the access points in the wireless network. One of the main problems in this technique is the fluctuations in the received signal strength. This is due to various factors that depend on the environment, such as the dampness, people presence, objects, etc. Particularly, regarding the people's presence in the environments where a user has to be located.

II. RELATED WORK

There are several approaches used for indoor positioning such as Triangulation power, Power vector, Heuristic, Finger printing etc., for locating the position of the Wi-Fi signal. For wireless network Fingerprinting approach is more suitable. In Finger printing approach the RSS of the Wi-Fi signal is identified from various positions. The Fingerprinting location model is designed based on the power of the received signal of the different access points on a certain position. Using these values the user's position is calculated. It is called Fingerprinting, because the main part of the method is to create a knowledge base with the signal strength data taken in different environments. A matrix is created with the received power of each access point in a series of known locations.In order to do this, it is necessary to examine the network infrastructure of the building, and accumulating the power of the received signal of each access point. The accuracy of the system can be increased when using a high density of training points. The precision of this algorithm depends on the distance between the points that have been measured in the training process.
The training process needs to be done once and the data can then be used by all clients. It would be necessary to repeat it, in case of structural changes in the building, or when there are major modifications in the wireless network

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infrastructure, suppose, if the access point locations change. With the Fingerprinting database base created, the client starts the system for the first time by downloading the training database created. Next, the client would scan the network, getting the signal power from the access points in that particular location. After this processing, using the "k-nearest neighbours algorithm", access points compare the data obtained by the client with the knowledge base obtained in the Fingerprinting process to estimate the position where the client is located.

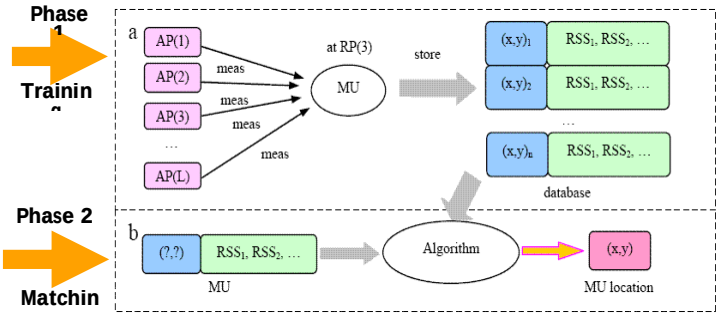

Fig1. System Based on Fingerprinting Approach

III. PROPOSED SYSTEM

Since the demand for indoor Location-Based Services (LBSs) increases; the development of an accurate indoor positioning and tracking system on mobile devices increases. The core location detection problem can be considered as a sparse natured problem which can be solved by applying the Compressive Sensing (CS) theory. This theory proposes compact received signal strength (RSS) based real-time indoor positioning and tracking systems using CS theory. This can be implemented on smart phones, which are both limited in processing power and memory compared to laptops. The proposed system is implemented on Android Mobile-operated smart devices and their performances in different experimental sites are evaluated. Experimental results show that the proposed system is a light weight real-time algorithm that performs better than other traditional methods in terms of accuracy under constraints of limited processing and memory resources. With the wide deployment of the mobile wireless systems and networks, the location-based services (LBSs) are made possible on mobile devices such as smart phones.

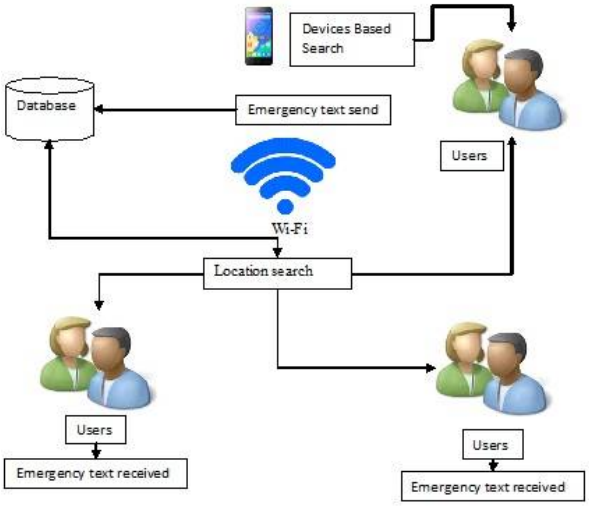

Fig 2.System Architecture

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IV. IMPLEMENTATION IN ANDROID

THE INDOOR POSITIONING SYSTEM IS IMPLEMENTED IN ANDROID AS FOLLOWS.

- First the Wi-Fi must be turned on in the mobile phone.
- The user must login to the system. The login process is important because, the system should allow only the authenticated user to use the application as some unauthorized person can alter the grid position.
- The user has to load the blueprint of the building from the local storage.
- The blueprint must be in the form of image format and the image has to be scaled properly.
- The image which is scaled is then applied on a grid.
- By storing the access points (Wi-Fi signal) in the corresponding grid position (Finger printing) the access points along with the grid position is stored in the local storage.
- After storing the entire grid position in the database, the user position can be tracked.
- In case if we have to share the image along with the grid points to our neighbors the image can be shared easily.

By gathering more grid positions the accuracy in the user position can be improved effectively.

V. SIMULATION RESULTS

The simulation studies involves the functionality of entire system. Fig.3. shows the login of the application, in case if the system is used by unauthorized user. Fig.4. shows the Location information (fingerprinting process) that has to be saved by the user (manually) by loading the blueprint image of the building from the local storage of the mobile. Fig.5. shows already stored fingerprinted image from the local storage. This fingerprinted image can be shared to any other users such that the user need not want to follow the fingerprinting process again. Fig.6. shows the tracking of remote user in the map image, the location of the remote user is indicated by the pin like pointer in the image.

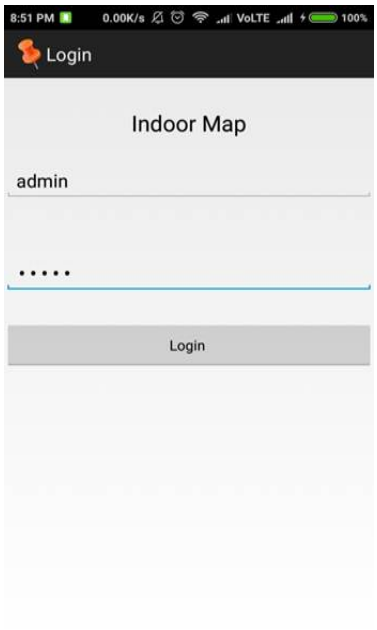

Fig. 3. Login of the application

Fig. 4. Fingerprinting process

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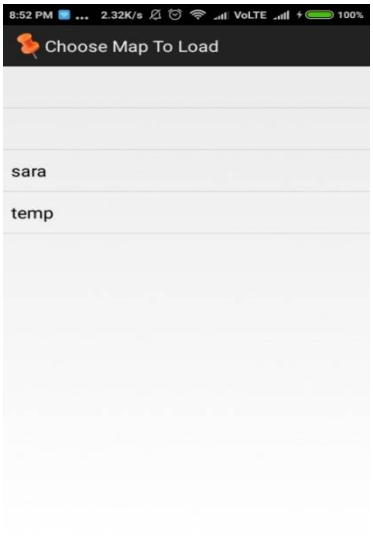

Fig. 5. Already fingerprinted map

Fig. 6. Tracking remote person

VI. CONCLUSIONAND FUTURE WORK

Indoor positioning system is more useful in locating, navigating and tracking in an indoor environment. The main purpose of building this system in an android environment is that, the users can easily understand and visualize the system and it is handy to use in any physical environment. The application can be enhanced by applying more complex techniques. Suppose if we make a lot of measurements in one spot, more data would be available to have higher accuracy. As a result of this, it would be possible to achieve a more accurate location. Thus this system can be applicable to security, hospitals and so on. In future, the system can also be further implemented by tracing the route of the user by the order of the movement of the user (i.e.) if the remote user first goes to patient's room then goes to emergency ward and so on, in the case of hospital environment. Thus the user can effectively monitor the remote users activity form the static position itself.

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