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User Navigation and Location Tracking System Indoor Localization for Smartphones : An Overview

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ABSTRACT: With the rapid development of smartphone industry, various positioning-enabled sensors such as GPS receivers, accelerometers, gyroscopes, digital compasses, cameras, Wi-Fi and Bluetooth have been built in smartphones for communication, entertainment and location-based services. Smartphone users can get their locations fixed according to the function of GPS receiver. This is the primary reason why the huge demand for real-time location information of mobile users has been unprecedented in recent years. However, the GPS receiver is often not effective in indoor environments due to the signal attenuation and multipath effects, although it as the major positioning devices have a powerful accuracy for outdoor positioning. This research investigates other built-in GPS and develops methods for improving the accuracy of indoor positioning. Combination with the wireless network, it can be a viable alternative solution for the indoor positioning purposes of the smartphone users. The main advantage of this solution is that it can be deployed with a minimal cost, as no specialized hardware is necessary for setting up the system. However, challenges remain for this solution due to complex indoor environment involved and extensive calibration data overhead.

KEYWORDS: Inertial Measurement Units (IMUs), WiFi, Received Signal Strength Indicator (RSSI), Particle Filter, Indoor Localization.

I. INTRODUCTION

1.1 Overview

Now a days most of the people using the smartphones for our daily purpose. Because the android smartphones have the memory capacities, good processing speed and higher data transfer rate. Android is Linux based operating system with java support and it comes with open source software.

Many map based android application is available in the Google play store. Map is used to transit the users from one place to another Google map, GPS is used for finding the specific location in outdoor environment. Using this application people can easily find the location such as roads, bridges, airport, shopping malls, etc. GPS (Global Positioning System) is one of the popular navigation system in the world. But it gives higher accuracy for outdoor environment not for indoor environment. Many university campus, shopping malls and organisation are very large, so the people are difficult to find the location inside the shopping malls, university campus and organization. There is no effective features for finding the location inside the buildings. In the application, using the indoor location based services is used to find the current location of the mobile clients. Indoor Location Based Services is the extension of location based services. It is used for tracking the location inside the buildings or campus. Indoor Atlas android SDK is used for indoor navigation. The SDK offers the features like the indoor positioning with higher accuracy and obtaining floor level. In Indoor Atlas to track the desired location then update the floor details for desired location and after fixing the route inside the buildings.

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1.2 Background

Whenever a user visits a new site (place) which has a large perimeter a proper guidance system is needed. When the user is outdoors technology like GPS can easily be utilized but when inside a premises like a hospital, college, mall etc., it doesn't work so it is very difficult for the user to navigate through the place and reach their destination. Various technologies have been used over time for the purpose of navigation like RFID, sensors, Bluetooth, WIFI etc.; while on one hand technologies like RFIDs and external sensors need to be carried around by the user all the time. There is also the issue of cost effectiveness in such devices and on the other hand devices like Bluetooth which is already available in smartphones cannot be used because of their short range. So the most efficient way for navigation is through a WIFI in such conditions. This system works on the same principle where WIFI technology is being utilized to help user to navigate in an indoor environment. Here already available WIFI in the user's smartphone and those inside the different outlets (in case of shopping malls) or departments (in case of college and hospital) are used for the purpose of navigation and tracking on site. Here already made available map (by administrator) are downloaded from the server to user's smartphone. Then this map is plotted with various locations of outlets and then this map is saved to the users' mobile unit. WIFI routers are used to localize (to find the exact position of the user) user through a concept called triangulation method (it requires signals from three or more Wi-Fi routers). Signal strength is an important factor for finding the exact and accurate location of smartphone user because if the strength is weak of even one of the routers then the position would be wrong by some meters. Though it is not a big issue in outdoor environment it is problematic in indoor environment as the user will be standing outside an outlet and the application will show another one. This is highly inefficient and the application won't be of much use. So we need three routers with good signal strength.

II. LITERATURE SURVEY

Alexey Kashevnik et. Al. proposed [1], Based on technology smartphone is used where all the features like its design, architecture and properties can be carried out. Technology like Wi-Fi, GSM and Bluetooth are inbuilt in the phone. Here comparative analysis of all the various techniques is done. The main concept is to provide user the functionality through which it can position as well as locate them. Here they provide solution for indoor positioning and navigation. By using algorithms like fingerprinting and triangulation they locate the user; maps are created for floor plans to position the user. As using Wi-Fi fingerprinting technology it will give accurate position of the users. It also provides information on special offers for outlets and contextual information to the user.

Amir Nakib [2] refers to indoor location which is static, as for outdoor system GPS is used which works accurately while designing mobile terminals for location tracking GPS is introduced but for obstructed area like inside the building where GPS signal are not found this system will not work and find the path. Now to overcome this different prediction method is used such as linear prediction, kalman prediction and particle prediction. It enhances the mobile phone user accuracy by predicting the trajectory using Digital fractional integration. To improve the performance we use the prediction methods like kalman filter and other existing linear filters. **According to Takamasa Higuchi [3]** for indoor positioning it is a big challenge for mobile user to provide exact position to the user. As in indoor, sometimes there is accuracy problem in positioning the user due to mobility errors. "Stop and go" behavior of the pedestrian is evaluated here using cooperative localization. The concept behind this is that to find the movement of the nodes i.e. static or moving. Now static nodes are used to reduce the battery power, the tracking should be done accurately and with energy efficiency. Cooperative localization is a method which is used to ensure the distance between the nodes for evaluating the location of the user. **Lyu-Han Chen [4]** concerns with indoor positioning system where the pedestrian dead reckoning PDR system is used which is based on mobile sensors. As mobile sensors are gyroscopes, magnetometer, digital compass and accelerometer. For indoor tracking these sensors are used to locate and estimate the user movement. In this WIFI system makes use of pedestrian dead reckoning system because the disadvantage of WIFI is overcome using PDR system. Using algorithms and methods like intelligent fusion algorithm the user location and its orientation should be determined. Nowadays Smartphones are equipped with a rich set of sensors i.e. inertial sensors. For indoor positioning system this sensors are important to recognize the real time user movement. For accuracy and stability of positing recognition the algorithm called fusion algorithm is used.

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Li Geng [5] addresses the indoor tracking using RFID i.e. radio frequency identification system as this system is previously used which is very cost effective here tag ID is used in premises and through the detection of tag ID, the location of user is recognized.

Nicholas D. Lane [6] focuses on Smartphones changes the life style of people, anywhere in location around us people become interactive with mobile device. Mobile phones and smartphones are the center of attraction and people used this phone as their part, Therefore in this paper we conclude the survey of smartphone sensing. Many applications using smartphone for e.g. in corporate world, hospitals, transportation, security etc. in today's world of technology people don't have time therefore the mobile device is used for interaction. Smartphones are highly equipped with sensors like GPS, accelerometer, digital compass, microphone, Wi-Fi etc. thus mobile phone sensing is rapidly increasing. Already we know that all people carry mobile phone through which they interact with applications, games, social networking sites and other resources they use to download files and data in mobile phone only. Through smartphones all these actions are possible.

We can view the map, also localization and navigation is done through GPS system. In this growing age of technology many features and applications are deployed which provide location based services. Many sensors like Wi-Fi, GPS accelerometer gyroscopes, orientation sensors and digital compass is used. For outdoor location tracking GPS geo positioning system is used and still it is very limited in some areas due to the signal strength. GPS is not used for indoors therefore for indoor tracking other application and methods are used i.e. Bluetooth, WI-FI, RFID and other proprietary systems.

Lei Zhang [7] Sens-Track it's a service for location tracking where sensors are used. GPS is used when user is outside the building and WIFI is used for indoor environment. Here android smartphone is used which is equipped with sensors to collect the data from the user. This reduces the use of GPS and increase accuracy. As smartphone faces the problem in battery consumption due to its low battery life processing and other features affect. Here solution for battery consumption is implemented. Using GPS user cannot be tracked under indoor environment therefore location sensing techniques is used to obtain the exact position. Using various sensors at a time makes the system accurate and it increases the energy efficiency cost.

III. PROPOSED SYSTEM DESIGN

3.1 Objectives

- To implement a system to measure the distance of user on each wifi point.
- System provides every specific time interval of location details to user. With the help of longitude and latitude.
- Deploy the system on real time environments.
- Improve the location accuracy of user with minimum time complexity.

3.2 Problem Statement

In the proposed work to design and implement a system that can be provide floor base user location tracking and recommending system under the WiFi as well GPS on own grid.

3.3 Project Overview

Indoor Atlas is used in proposed system. Indoor plan infrastructure to identify the campus indoor structure. The application server is responsible for identifying the policy corresponding to a particular location and performing the necessary action . Indoor Location based services is used to specify the current location tracking indoor position helps to navigate the users. Conference, seminars, symposium information are described by college event information. Apart from this, it notifies the user if he comes near the library or the seminar hall. IndoorAtlas MapCreator for Android is used to create maps to test the indoor navigation and also to record the sensor data. Indoor plan infrastructure is 2D plan for constructing the indoor structure of the college. Indoor plan infrastructure is main requirement for indoor location tracking system. Based on the infrastructure to develop the indoor application on the android platform. It is used to find the indoor location.

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3.4 Development Methodology

The software packages used for implementing the system use Android SD and languages used in the proposed system are php in server side, java in client side. Android is an operating system based on Linux with a Java programming interface. The Android Software Development Kit (Android SDK) provides all necessary tools to develop Android applications. This includes a compiler, debugger and a device emulator, as well as its own virtual machine to run Android programs. Android Software Development Kit (Android SDK) with Eclipse ADT is used for client side or for main application implementation. SDK 19 is used to develop the application.

Initially, home page will be displayed in the application. When the user inside the campus, can view their current location. The user request the desired location in the map application. It shows the current and desired location with floor details. Using this application, user can know staff and event details. The user can request the staff or event details to the server.

3.5 System Architecture

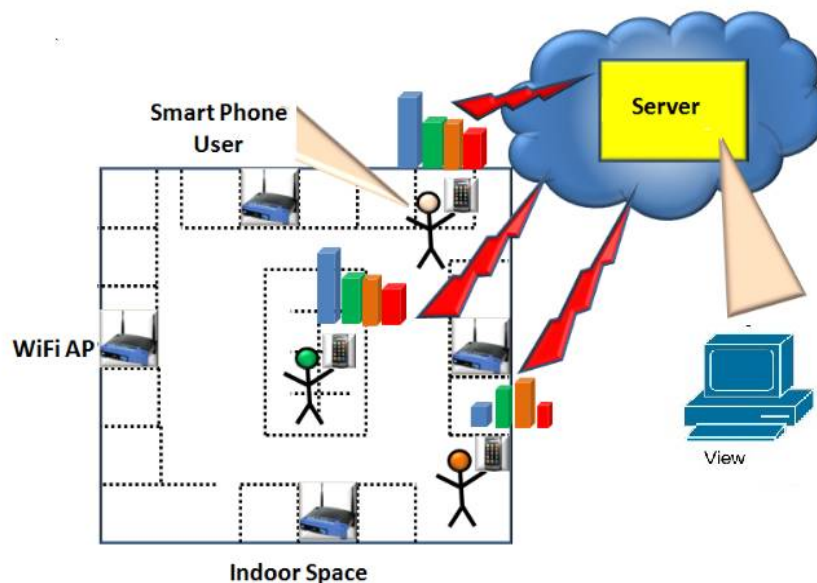


Figure 1 : Proposed System Architecture

IV. RESULTS AND DISCUSSION

In recent years with the help of Google maps, location searching becomes a new trend, when people are not aware of their location. Google maps provide lots of functionalities like showing any location, alternative path from any location to other location and estimates time to reach the location. But it is not well developed for indoor navigation. It is very difficult to find and get shortest path from current location to any location inside university like entrance gates, departments, canteen, library, playground and parking lots etc. for the new admitted students and visitors. To reduce this pain inside the campus, implement the campus indoor location tracking system on android platform has been designed, implemented and tested successfully in this work. This application provides shortest route guide for users from his/her own location to desired location and event updates with its proper place. API is the navigation module to conclude the location of user. Indoor location tracking system is implemented in Indoor Atlas Android SDK where the floor structures are placed on the outdoor map of the institution. Each single floor details are placed in it, to prepare the

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Indoor plan infrastructure map. Now the user can view their source position in the indoor plan. During the time, API key will generate at server side. With the help of API key, can implement the coding part in client side. Indoor location-based search (LBS) is growing as a natural extension of location-based search and marketing. Location-based services (LBS) provide personalized services to the mobile clients according to their current location. People can track own location and also navigate from one location to another location very easily.

V. SUMMARY AND CONCLUSION

In this work we introduced the primary technologies used in indoor localization systems. Both commercialized products and research prototypes are discussed. System for pedestrians is proposed in this system. The system integrates a traditional PDR system with SRP adaptive drift calibration at access control points and a particle filter map matching algorithm. The information derived from SRP subsystem enables PDR to offer drift-free tracking and by taking advantage of existing access control systems, it offers a natural way to integrate user interactions at no additional cost. The map constraints, introduced by a simplified particle filter with LTR mechanism, further enhance the accuracy and keep the computation complexity acceptable for real-time processing on mobile devices with limited resources. The long-term experiment verified the robust and reliable tracking of the proposed system with 0.13% final position error with respect to a total travelled distance of over one kilometer. Moreover, the accurate tracking performance is independent of travelled distance and the system covers both corridor and rooms of indoor environments, offering a more practical way for pedestrian navigation.

Future work will focus on extending the system to support different ways of carrying the smartphone during walking. Also, a more comprehensive system will be studied combining both outdoor and indoor environments to provide seamless tracking of the pedestrians.

REFERENCES

1. Alexey Kashevnik, Maxim Shchekotov, Comparative Analysis of Indoor Positioning Systems Based on Communications Supported by Smartphones. Saint-Petersburg Institute for Informatics and Automation of Russian Academy Science Saint-Petersburg, Russia. _PROCEEDING OF THE 12TH CONFERENCE OF FRUCT ASSOCIATION.
2. Amir Nakib, Boubaker Daachi, Mustapha Dakkak, and Patrick Siarry, Mobile Tracking Based on Fractional Integration, IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 13, NO. 10, OCTOBER 2014.
3. Takama Higuchi, Sae Fujii, Hirozumi Yamaguchi, Member, IEEE, and Teruo Higashino, Mobile Node Localization Focusing on Stop-and-Go Behavior of Indoor Pedestrians, IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 13, NO. 7, JULY 2014.
4. Lyu-Han Chen, Eric Hsiao-Kuang Wu, Ming-Hui Jin, and Gen-Huey Chen, Intelligent Fusion of Wi-Fi and Inertial Sensor-Based Positioning Systems for Indoor Pedestrian Navigation, 1530-437X (c) 2013 IEEE.
5. Li Geng, Mónica F. Bugallo, Akshay Athalye, and Petar M. Djurić, Indoor Tracking With RFID Systems, IEEE JOURNAL OF SELECTED TOPICS IN SIGNAL PROCESSING, VOL. 8, NO. 1, FEBRUARY 2014
6. Nicholas D. Lane, Emiliano Miluzzo, Hong Lu, Daniel Peebles, Tanzeem Choudhury, and Andrew T. Campbell, Dartmouth College, A Survey of Mobile Phone Sensing, IEEE Communications Magazine • September 2010.
7. Lei Zhang, Student Member, IEEE, Jiangchuan Liu, Senior Member, IEEE, Hongbo Jiang, Member, IEEE, and Yong Guan, Member, IEEE SensTrack: Energy-Efficient Location Tracking With Smartphone Sensors, IEEE SENSORS JOURNAL, VOL. 13, NO. 10, OCTOBER 2013.
8. Alessio Colombo, Student Member, IEEE, Daniele Fontanelli, Member, IEEE, David Macii, Member, IEEE, and Luigi Palopoli, Flexible Indoor Localization and Tracking Based on a Wearable Platform and Sensor Data Fusion, IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, VOL. 63, NO. 4, APRIL 2014.
9. Alejandro Correa, Marc Barcelo, Antoni Morell, and Jose Lopez Vicario, Enhanced Inertial-Aided Indoor Tracking System for Wireless Sensor Networks: A Review, IEEE SENSORS JOURNAL, VOL. 14, NO. 9, SEPTEMBER 2014.
10. Anthea WainSy Au, Chen Feng, Shahrokh Valaee, Senior Member, IEEE, Sophia Reyes, Sameh Sorour, Member, IEEE, Samuel N. Markowitz, Deborah Gold, Keith Gordon, and Moshe Eizenman, Indoor Tracking and Navigation Using Received Signal Strength and Compressive Sensing on a Mobile Device, IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 12, NO. 10, OCTOBER 2013.