# Wi-Fi Indoor Positioning System

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*Abstract*

*Location tracking services are more attractive technologies in today's world. These services make the use of wireless networks and broadband multimedia wireless networks to provide the location tracking services inside the buildings and campus areas. In this services determining the user's current location or position accurately is the most important phenomena. Wi-Fi enabled indoor positioning technique is widely used in the outdoor environment to locate the persons moving inside the building and this technique is gaining popularity as all the android smart phones have this application. This technique is efficient in improving the positioning techniques. The aim of this project is to create an application to locate the position of the user inside thebuilding with more accuracy of the position of the user.*

*Keywords:* *Wireless, networks, Wi-Fi, indoor, android*

## INTRODUCTION

One of the attainable ways that to work out the position of the employment within the indoor atmosphere is to form the use of the signal strengths from the Wi-Fi router which is additionally called a multipath strength. IPS systems use different technologies, together with distance mensuration to nearby anchor nodes with legendary positions, e.g., Wi-Fi access points, magnetic positioning, dead reckoning [1, 2]. They either actively find mobile devices and tags or give ambient location or environmental context for devices to get sensed. These systems are with success used in many applications like plus following. The increasing demand for location based services within buildings has made indoor positioning a big project topic. Thanks to the signal attenuation caused by construction materials, the satellite primarily based world Positioning System (GPS) loses significant power inside touching the

desired coverage for receivers by a minimum of four satellites. Additionally, the multiple reflections at surfaces cause multi-path propagation serving for uncontrollable errors. These very same effects square measure degrading all acknowledged solutions for indoor locating that uses magnetic force waves from indoor transmitters to indoor receivers. A bundle of physical and mathematical methods is applied to compensate for these problems. Promising direction radio frequency positioning error correction opened by the use of alternative sources of navigational information, such as inertial measurement unit (IMU), monocular camera Simultaneous localizationand mapping (SLAM) and Wi-Fi SLAM. The indoor environment has man disruptive factors like walls, windows, doors and so on. A positioning system must beable to handle these problems to deliver good results. Ahigher accuracy is also required for the indoors because it is important to locate a user at least in the right room. Because few meters can make a big difference. As there is no other positioning service is running a Wi-Fi is especially interesting for indoors [3–5].

**WI-FI SLAM**
Allow your smart phone to pinpoint its location (and the placement of your

friends) in period of time to a pair of .5 m accuracy using solely close Wi-Fi signals that are already present in buildings. We have a tendency to be building subsequent generation of location-based mobile apps that, for the primary time, engage with users at the size that private interaction actually takes place. Applications vary from stepwise indoor navigation, to product-level retail client engagement, to proximity-based social networking. The software Wi-Fislam provides the easy means to find out the exactlocation of the user within any particular building. This software has developed for the indoor positioning of thepeople inside the buildings, e.g., Universities, hospital, malls etc.

**HOW DOES WI-FI SLAM WORKS?**
Apple recently acquired Wi-Fi Slam. How does their technology work? Allow your smart phone to pinpoint its location and the location of your friends in real-time to 2.5 m accuracy using only ambient Wi-Fi signals that are already presentin buildings. We are building the next generation of location-based mobile apps that, for the first time, engagewith users at the scale that personal interaction actually takes place. Applications range from step-by-step indoornavigation, to product-level retail customer engagement, to proximity-

based social networking. Indoor location has been the most difficult task to setupand execute the method successfully. As the globalpositioning system (GPS) is the best technology for the positioning of the persons or an object outdoor. But GPSdoes not work for the purpose of indoor positioning. Obviously, Wi-Fi and cell tower trilateration does not work indoors. Enough scans in one place and you will have an accurate profile of a building that can be used to make a map. The goal of Wi-Fi SLAM and its SDK is "to try to make indoor location as accessible as possible to anyone whowants to try it.

## MAP VIEW

### Search and Navigation

This provides easy way togenerate the map which allows to t find any object ornavigate inside any building in real time.

### Indoor Location for user's Venue

This gives own customized, fully featured indoor location app in few minutes to user.

### Give the Mobile Presence

This gives the user a brand exposure to the user to create the map of a building with the own device and also helps in tracking the person entering or leaving the region.

### Easy to Use

It is user friendly application and it takes very few minutes to get started.

## TECHINQUES FOR INDOOR POSITIONING

### Real Time Location system (RTLS)

The Real Time Location Systems are used to track the position of theobjects or people automatically inside any building. These systems are not referring to the RFID, GPS or mobile CE902 Project Proposal 6 phone tracking. The positioning with theses technique dosed not includes speed directionand spatial orientation of the person or an object. In this technique the wireless RTL tags are connected to the objects or within the devices the user has. Using these stags the wireless signals are received by the system togenerate the location of that object or a person. Somehow the RTLS are similar to the RFID techniques but the differences between these two techniques are:

1. The tags in RFID are read as they pass the fixed points.
2. RTLS tags are read automatically and continuously.
3. Also some RTLS technologies make the use of GPS to locate the tags and to generate the results.

## RFID Technique

Location based Services are the most popular services used in many organizations for locating the users of the system. These systems are used on themobile phones. Existing systems makes the use of single technologies like Bluetooth and RFID. RFID technique offers the more accuracy in positioning the user than anylocation tracking system. The RFID technique needs the expensive equipment to perform the location tracking andto provide the accuracy.

## Location and Tracking

One of the methods to thrive forsufficient operational suitability is "tracking". Whether, a sequence of locations determined form a trajectory fromthe first to the most actual location. Statistical methodsthen serve for smoothing the locations determined in atrack resembling the physical capabilities of the object tomove. This smoothing must be applied, when a targetmoves and also for a resident target, to compensate erraticmeasures. Otherwise the single resident location or eventhe followed trajectory would compose of an itinerant sequence of jumps.

## Positioning Techniques

There are five techniques used for the positioning and that are as follows:

### The Cell Identification

In this methods the transmitters divides the regions into the number of tiles or the cells andthe location of the signal receiver is identified within thesecells only. This technique is not as useful as it is hard tofind the location of the receiver within the cell.

### The Angle of Arrival

In this method position of the user is determined by the angle from the transmittertowards the receiver with the help of directional antennabut this method is also unreliable as it is not suitable formultipath as well as it needs line of sight while detecting the receiver.

### Time of Arrival (TOA)

It can calculate the correct andexact distance of the transmitter to receiver by using the travel time of the signals between transmitter and receiverat constant speed. In case of more signals synchronization is required.

**Time difference of the Arrival (TDOA)**

This method is quite similar to the Time of Arrival (TOA) but the only difference is the in TDOA synchronization is required

atthe receiver side only. CE 902 Project Proposal 8.

*Received Signal Strength (RSS)*

In this method the radio map is created and this method is also called as fingerprinting. There are two phases in this method andthat are: Online phase and offline phase.

## GOALS

Goals of the project: Location tracking services are more attractive technologies in today's world. These services make the use of wireless networks and broadband multimedia wireless networks to provide the locationtracking services inside the buildings and campus areas. In this services determining the user's current location orposition accurately is the most important phenomena. The primary goal of this project is to examine the level ofaccuracy achieved in the positioning system by making the android environment. Also, this system can determine which floor the user maybe on. Current positioning systems are basically target the outdoor settings and in thisproject we intended to perform the indoor positioningusing Wi-Fi based applications.

During the implementation of this project many of the things must have been clear such as:

a)  The questions regarding the use of the Wi-Fi service

b)  The infrastructural requirements are also need to be considered while building the software.

c)  After completion of the software the user must getsatisfied with service the software will provide and alsothe determination of the goals which need to be met (whatare the user requirement are the goals should be.

## EVALUATION

Evaluation is the testing of the steps and application which is built and to check its performance. Testing is performedat the end of the project. Evaluation includes: Design, Develop, Implement and Analyze. Design includes thestructure of the project. Whereas implementation andanalyze will be the final steps involved in the project. This process will be the successful process if theapplication will get success in calculating the exactlocation of the user inside the building. This factor includes that the location of a person inside any room will be the fixed location and it will be the accurate position of the user within that room.

**Testing Plan**

This factor includes the testing of thecomplete structure of the project which means to check that the program which is implemented works on the android and the application of android performed all the functions included in the Wi-Fi scanning and location calculating. In this method the locations need to be added on the program to find accurate position of the device. The accuracy of the system will be calculated when there are more number of Wi-Fi devices is available. One of the ways to calculate the accuracy of the system is to obtain the final results by checking it on the various access points. The above procedure is efficient for the larger area covered by the Wi-Fi network such as the academic building. The mapping of the area is necessary for this method. Once all the requirements will get satisfied the application will give the accurate location of the user inside the building.

**CONCLUSION**

Indoor positioning is a huge area, with many applications various indoor positioning techniques. Many improvements can be carried for different systemsfixed indoor positioning systems have a better accuracycompared to the pedestrian positioning systems.

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