

## A Review on WPS Techniques in Indoor Position System

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### ABSTRACT

Satellite-based Global Positioning Systems (GPS) have enabled a variety of location based services such as navigation systems, and become increasingly popular and important in our everyday life. So, there is need of finding system for indoor locations. The indoor positioning technology applied inside building attracts a significant research works. Indoor Positioning System can be used for different purposes and for different services, so a lot of research is going on to find a more accurate position with low Location Based Services (LBS) drive. The development of indoor positioning techniques is mainly due to the need to provide service continuity inside buildings. The impacts of human behaviour on RSSI distribution are explored and analysed. The main goal is to develop an application for mobile tracking which helps in detecting position of human inside building which explore different services like it will be used in malls for employee tracking and management or in colleges for tracking staff and manage the system etc.

**Keywords :** GPS (global positioning system), LBS (location base service), Positioning Techniques, Wi-Fi, RSSI (residue signal strength indication)

### I. INTRODUCTION

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 Smartphone's for communication, entertainment this is the primary reason why the huge demand for real-time location information of mobile users has been extraordinary in recent years. 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 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. To make solution to the challenges, Fingerprinting method is studied to give more accuracy and Solve the problem of noise. This method is more efficient than the other techniques

The popularity and increasing demand of Smartphone's bring different kind of services in which one most popular is location based services. We know that, LBS is depends on users location and we can get user location using GPS technology. In the past few years, GPS has been widely used in outdoor positioning and tracking in our daily life [2].

GPS has been widely used for navigation and positioning, and various types of GPS receivers for different positioning accuracies have been available.

□ GPS provides 7.8 m accuracy outdoor in best condition.

□ GPS is not work at indoor location because attenuation of signals to floors and walls.

As we know that GPS signal are not able to penetrate walls. So, there is the solution for indoor locations. The different technologies are present for positioning purpose like Bluetooth, Cellular, Conventional radio signals, LED lights, Wi-Fi etc. In which Wi-Fi is one of the efficient technology as compare to deployment and cost concern.

□ Wi-Fi is now a widely acknowledged and used technology for positioning. Positions can be determined with a good accuracy in an indoor environment when Wi-Fi infrastructure is available.

□ Most positioning approaches using a Wi-Fi system are similar to the Cell ID approach. Signal strength fingerprinting methods are used for most advanced Wi-Fi positioning systems.

□ Wi-Fi has more significances over other technology. Using RSSI we can find location of end device. The Wi-Fi device is easily available in laptops, Mobile phones that make easier to make Wi-Fi as a better device for indoor localization.

There are four different techniques can used for positioning purpose using Wi-Fi. They have different characteristics and they differ by accuracies, hardware required. These are [3],

1. RSSI and Tri-Literation
2. RSSI and fingerprinting
3. Angle of Arrival
4. Time of flight
5. Time difference of arrival

Tri-literation and fingerprinting are two main estimation methods often used for estimating the

location of indoor mobile objects with Wi-Fi networks. In proposed system, fingerprinting method is used for location estimation because It gives more accuracy s compared to other methods. It need to store location fingerprinting database in calibration phase. In positioning phase the RSSI signal from three different APs are taken as input and by using location estimation algorithms it will find out location. Tri-literation and fingerprinting are two main estimation methods often used for estimating the location of indoor mobile objects with Wi-Fi networks. In proposed system, fingerprinting method is used for location estimation because it gives more accuracy s compared to other methods. It need to store location fingerprinting database in calibration phase. In positioning phase the RSSI signal from three different APs are taken as input and by using location estimation algorithms it will find out location.

## II. LITERATURE REVIEW

The paper Hybrid positioning system combining angle-based localization, pedestrian dead reckoning and map filtering written by P. Ranki says The angle-based localization system provides absolute location estimates. PDR movement and angle-based location estimates are fused together with a building vector map in a fusion filter The paper Indoor Localization Method Based on Wi-Fi Trilateration Technique written by says Approaches based on signal propagation model and received signal strength measurement collection are considered.

For Chenshu Wu, Zheng Yang, Yunhao Liu, and Wei Xi, closed localization approaches rely heavily on job site research at each site. The fingerprints are divided into different virtual rooms, and a logical plan is constructed accordingly. Localization is achieved by finding the correspondence between a logical and a true plan. They are implemented in a typical office building and reach 86% of average room level accuracy, which is competitive for existing projects.

From Garas Samara [3] Tarek Almedyat designed and implemented a segmentation process to track the area into small areas well in an open environment and cannot be used in complex conditions.

### III. ARCHITECTURE

#### Trilateration

Trilateration uses the distances of an object from three known points, which are usually fixed points with known coordinates to determine the position of an object [7]. This method has been widely used in conventional surveying and GPS positioning. GPS receivers use the trilateration method to determine the user's position, speed and elevation etc.

During active measurements for a mobile device, the average signal strengths for all visible APs are measured and trilateration can be used to estimate the location of the device. It is very difficult to estimate accurate distances based on RSS measurements due to signal attenuation. walls, floors, microwave ovens, cordless phones and Bluetooth devices all cause signal attenuation since the same frequency (2.4 GHz band) is used in the 802.11b protocol and its related devices. The orientation of the antenna and the movement of people inside the building are all other factors affecting the signal strength. For example, the position errors from pure Wi-Fi signals excess 6–8 meters.

#### Fingerprinting

The fingerprinting technique has been used for indoor positioning for several years. In the positioning phase, the signal strengths from the APs are measured at

Fig 1: Offline Phase (Calibration)

The mobile side and compared with all the records in the database to identify the most probable location of

the mobile object using either the deterministic or probabilistic algorithms.

When used with Wi-Fi systems, the fingerprinting method can be typically divided into two phases, calibration phase and positioning phase. The calibration phase is for establishing a database storing locations of reference points (RPs) in the area of interest. In this phase, signal strengths from all the RPs are measured first, then the mean values of the RSS at each of the RPs are calculated, along with other information including the coordinates, the orientation and MAC address etc.). Apart from this, it is relatively simple to be deployed. at the mobile device, any existing WLAN infrastructure can be used for positioning.

Fig 2: Online Phase (Positioning Phase)

#### Location Fingerprinting Technique:

##### Development and Implementation of system

- ✓ To develop propose system, the work is divided in two phase as whole system has two different phase.
- ✓ Two applications needed, one is for generating location training data. The proposed system make the user's work easy to take fingerprint data. The second application is for online phase (positioning phase) where we can see location of the user.
- ✓ The application will be implemented in android.
- ✓ In fingerprinting technique, following are some definitions to be considered,
- ✓ APs are usually fixed transmitter such as Wi-Fi routers.
- ✓ A reference position is the position in the indoor environment that needs to be tracked and the signal fingerprint at each reference Point are updated or inserted in the survey database.
- ✓ The received signal strength (RSS) can be defined as the measure of signal power from an

AP to a receiver which can be sample without any additional requirement in WLAN environment.

Fingerprinting based positioning systems usually work in two phases,

i) Offline Phase:

Fingerprint database is established.

RSS values that are obtained from APs on a specific time period at the predetermined reference points are stored in database i.e. called fingerprint database.

Each fingerprint in this database contains basically location information and RSS values obtained from surrounding access points at that location.

Single samples of RSSI recorded from the nearby access point are not sufficient to characterize a fingerprint. Due to presence of noise in the environment it is necessary to obtain an average of the readings to successfully identify a fingerprint.

ii) Online Phase:

- ✓ Positioning is performed.
- ✓ A mobile device measures the RSS values in an unknown location in shorter time.
- ✓ Then these RSS values compared with the values in database.
- ✓ The mobile client applies a location estimation algorithm to estimate its current location using the previously created radio map.
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Fig 3: Location Fingerprinting Technique

## IV. IV. ADVANTAGES AND LIMITATIONS

Advantages:

- ✓ Wi-Fi Routers are easily found in several areas.
- ✓ It is cheap equipment as compared to other devices required for indoor positioning.
- ✓ Now a day's maximum people carry Smartphone's.

Limitations:

- ✓ Human efforts required in fingerprinting technique of Wi-Fi positioning and it is also time consuming.
- ✓ Maintenance required for technologies like Bluetooth and Wi-Fi in indoor positioning system.
- ✓ If position of single Wi-Fi router (AP) changed then system will provide inaccurate results and again offline phase need to take place.

## V. APPLICATIONS

1. Application for mobile tracking which helps in detecting position of human inside building which explore different services like it will be used in malls for employee tracking.
2. Application attendance system in colleges/organization for tracking staff and manage the system etc.

## VI. CONCLUSION

The proposed system is for Android smart phones. There are three or more APs are need to install at specific locations for improving accuracy. Positioning using Wi-Fi signals is easy to implement and requires lower cost than other localization systems. The K-nearest neighbour algorithm is used for location estimation. The proposed system is a new technology to time and attendance system.

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