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Personal Assistant For Visually Impaired People In Malls

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Abstract - *This paper proposes an indoor navigation technique for a smartphone using WiFi. Every day we use location-dependant services, but there is still a lack of information about a popular indoor location system. Considering the vast population of visually impaired people and the problems they are facing while indoor navigation, this paper proposes a system that will make their navigation better with the help of mobile application and WiFi. This system proposes indoor localization using WIFI received signal strength indicator(RSSI) measurement from the existing access points(APs).*

Key Words: **WIFI Router, Fingerprinting, Indoor Navigation, RSSI, Access Points(APs), Reference Points(RPs).**

1. INTRODUCTION

In a world out there, more than 39M population is visually impaired facing major problems in navigating through the complex and huddled areas like malls, airports, universities, and many more populous areas.

Indoor positioning is a very complex matter as common outdoor technologies don't work inside buildings. The signals sent from these satellites do not penetrate all kinds of barriers with ease. When you use a GPS inside a building, a variety of physical barriers and potential interference sources make it difficult for the device to pinpoint your location accurately.

In today's era, location-based services (LBS) have attracted many researchers due to their huge advantages and easy implementation on smartphones and laptops. Indoor navigation is one among the many applications that rely on the location information on these mobile devices.

The wireless indoor positioning system is a system to locate objects or people inside a building using radio waves, magnetic fields, acoustic signals, or other sensory information collected by mobile devices.

For indoor positioning navigation purpose, we present this paper which provides the use of WIFI access points for calculating the relative position of the user by using fingerprinting algorithms.

Each Wi-Fi access point, whether customer hotspot, the router transmits specific data. Using an RSSI (Received Signal Strength Indication) an app can calculate the current location of the end user device. This requires a database with information about the locations with which this data can be compared. This method is called fingerprinting.

The rest of the paper is organized as follows. Section 2 discusses about Indoor Positioning System. Section 3 discusses about the Proposed System. Section 4 discusses about the Future Scope. Section 5 discusses about the Conclusion.

1.1 INDOOR POSITIONING SYSTEM

The easiest way to describe Indoor Positioning Systems (IPS) is that its like a GPS for indoor environments.

The wireless indoor positioning system is a system to locate objects or people inside a building using radio waves, magnetic fields, acoustic signals, or other sensory information collected by mobile devices. There are many application that uses an indoor positioning system like military applications, surveillance, monitoring, locate people or objects inside buildings, mining, traveling and development of location-based services.

GPS the most popular technology in location determination is not suitable for indoor location estimation. The devices are unable to catch radio waves from satellites if the user is indoor of some building.

1.1.1. RELATED WORK

Here we are referring some earlier technologies and techniques used in Indoor Positioning:-

1) Active Badge technique is based on infrared signals. In this system, the Active badge is used which emits infrared signals after fixed time intervals and sends a unique identifier to the receivers. These receivers then send the data to the central server. The drawback of this technique is the short range of infrared signals. In addition to that, it also requires direct line-of-sight between receivers and the badge.

2) Another well-known indoor positioning system is using mTag which uses RFID technology. It is used to define certain RFID receivers which are placed at different locations in an area under investigation. Also, the mobile device is pinned with a passive RFID tag which is used to determine its location information. But the main drawback of using RFID is high deployment cost.

1.1.2. WHY TO USE WIFI

1) WiFi-powered location-based services use the existing WiFi infrastructure to detect the devices whose WiFi is turned on. For example, if a person enters an organization or a retail establishment, the owner can send push notifications with relevant information.
2) To identify the customers, WiFi-based methods use MAC addresses and SSID. Its widely accessible as most mobile devices and establishments already have WiFi to use WiFi LBSs for engagement.
3) On the other hand, beacons are basically Bluetooth Low Energy (BLE)-based indoor transmitters that sense the nearness of a user and send information to the smartphones. They are known to provide very accurate information of the user location, and its recommended for micro-location activities. When the signal reaches the users smartphone, location-based information is shown.
4) However, due to the low power and short range, one would need many overlapping beacons to cover an area. Beacons are easy-to-deploy but they do need to be installed, which could bring up a substantial hardware/installation cost.

1.2. PROPOSED SYSTEM

This paper presents the indoor navigation system using WIFI routers with the help of a well-known technique called as a fingerprinting method used for determining the position of unknown location.

The system explains the working of both the client side and the server side and the basic motive of the fingerprinting system.

The flow of the proposed system is shown in the below diagram:

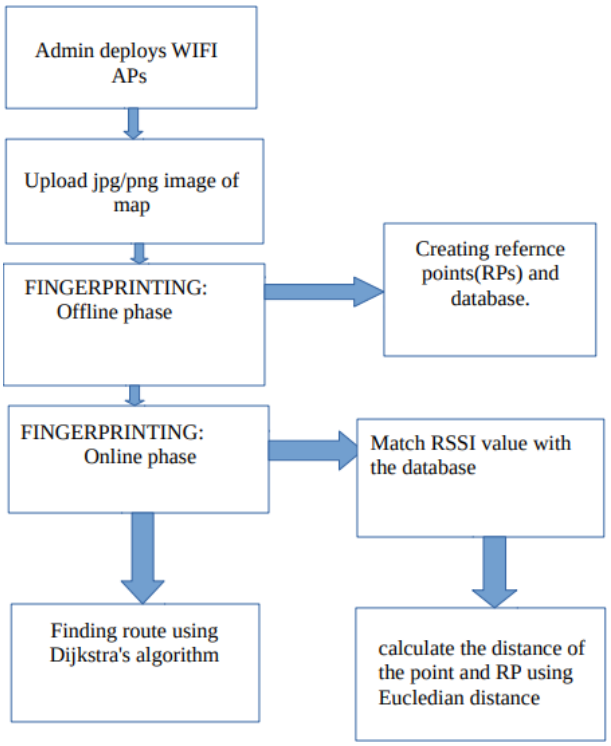

Fig.1. Proposed system

1.2.1. CUSTOMIZING MAP

The very first step that needs to be done by admin is to upload the image of the floor map on the server side application. The image can be of type png/jpg. Secondly, the admin will deploy the WIFI router in the room which will act as the Access Points (APs).

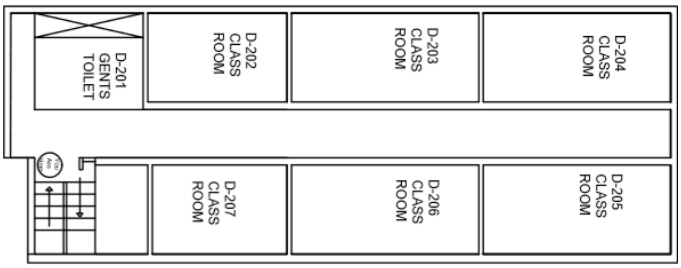

Fig.2. Customize the map

1.2.2. FINGERPRINTING METHOD

Fingerprinting method in indoor navigation works just like the fingerprints in biology works. As the fingerprints of every human are unique similarly the location of every reference point (or simply a point) is also unique. This method uses this criterion of the unique location of every point and calculates the unknown location.

Fingerprinting works in two phases:1) Offline phase and 2) Online phase.

1) OFFLINE PHASE: In the offline phase, the RSSI signals emitted by the WIFI access points(APs) are captured by the admins device at a known location (location whose coordinates are already known). These locations are called as reference points (RPs). Because of the fluctuation in RSSI values, the RSSI values for every RP is calculated by taking the mean of the RSSI values for a particular time interval (say 20 values in a minute).

Now after taking the RSSI values for every RP, these values along with their respective locations are stored in the database for further matching in Online phase.

2) ONLINE PHASE: In an online phase, the user comes into the picture. As soon as the user (or device) comes in contact with any of the APs it receives the RSSI signals. The value of these RSSI signal (say the unknown location is 'A' - an entrance point) is matched with the values in the database. The RP with the nearest value of RSSI signal is taken to be the nearest RP of point A. This is calculated using k nearest neighbor algorithm. Now the location of point A is calculated by calculating the Euclidean distance between the RSSI value of the chosen RP and the RSSI value of the point A.

1.2.3. FINDING THE ROUTE

After finding the unknown location with the help of the fingerprinting method, this system proposes the Djisktras Algorithm for finding the shortest route between the source and the destination. Here the RPs could act as the node of the graph used for applying the Djisktras Algorithm. Hence, The shortest path between the entrance and the room number D- 204 will be calculated and the user will get navigated through that path.

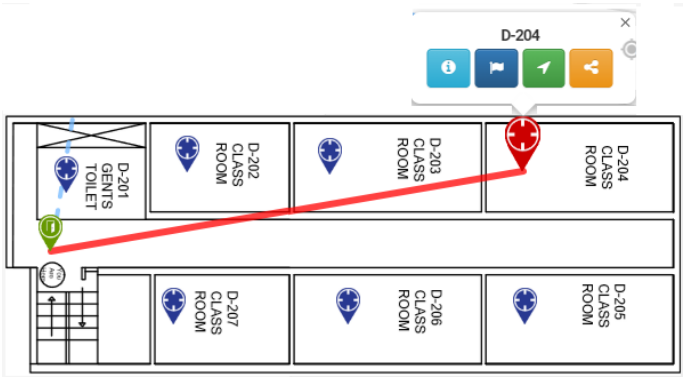

Fig.4. Shortest path to destination

It is an algorithm for finding the shortest path between the nodes of a graph. It computes the least cost path from one node to other nodes.

2. FUTURE SCOPE

1) Further for the navigation purpose, dynamic obstacle detection can be added to the system making it more dynamic and real time.
2) Further to this indoor navigation system, product identification feature could be added with the use of QR codes making this system a fully equipped mall assistant.
3) With the help of QR codes, the product information could be retrieved and the information is transferred in the form of speech for the visually impaired person.

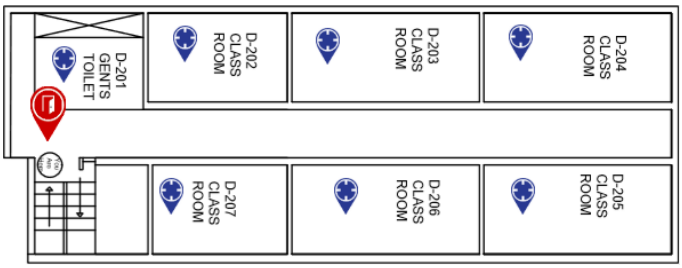

Fig.3. Plotting of the RPs

3. CONCLUSIONS

This paper proposes the indoor navigation system with the help of WIFI.

1) We are developing an Indoor navigation system using Finger-printing method to determine the location of the user.
2) We are providing the shortest path to the user in order to reach the destination point from the source point.

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