Smart Indoor Navigation Using Wifi Triangulation

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Abstract — **Every field has developed significantly over the past few decades and it is visible in the field of Information Technology. It is clearly seen from the recent figures that World Wide Web namely internet and other communication systems have developed and spread sharply in many countries around the globe and also even in poor societies. Nowadays internet plays a major role in everyone's life. In this GPS (Global Positioning System) is one of the equipment's that helps to find the way to reach the destination from source. In general GPS cannot help to navigate in indoor boundaries (Shopping Malls, Hotels, and Colleges) in such cases, the navigation can be done with the help of detecting the WIFI spot in and around the particular place. This can be done by WIFI triangulation method. This helps the person to find the exact way to reach the destination. The WIFI spot is detected in the following way, Suppose we have four WIFI spot inside the campus through a WIFI detector or through smart phone we can create connection between the WIFI which show the range and strength of the WIFI signal through that we need to create an map for the campus or commercial place that can show the path for the people and makes an easy way to find the place inside. This is the concept that can be used to find the way inside any big commercial place without the help of human.**

Index Terms— GPS, WIFI Triangulation, Smart Phone, WIFI Detector.

I. INTRODUCTION

NOW days internet is boom today everywhere, without internet nothing is possible to achieve in this technical world. The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to link several billion devices worldwide. Through that it possible to connect to end to end of the world. Most of the internet is connected in TCP (*Transmission Control Program)* connection because it is the best transmission state for forwarding up off information.

Common access method for internet connection is used upon by dial-up connection with computer using a device called modem via telephone cable. These cable are made up off optical fiber cable so that the transmission rate of the information will be fast. These are the common method for creating up of internet connection. In same way now days things have change due to the developing off technology so trend became in wireless connection that is shorty called as Wi-Fi.Which is easy to access by using up off IP address. And the next most important thing in the internet is GPS *(Global Positioning System)* which is mainly used for detecting up off location and also help to navigation places in around the world. The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. It is the job of GPS to locate the place in around the world. The design of GPS is based partly on similar ground-based radio-navigation systems, such as LORAN and the Navigator. The GPS system concept is based on *time*, it has the atomic clock of satellite in outer of world orbit which is to calculate time by means off revolving of earth. The communication of GPS are indicated by navigation of signal transmitted by GPS satellites. In same way GPS does not work under inside of home, colleges, commercial place because it's quite developed to identify places, route, and time in around the outer world i.e. *(It is able to find the path for the place that we need to go.)*

To identity the navigation inside any commercial places has developed by using off RSS and Non-Line-of-Sight bias. This result can be achieved by developing localization techniques having proper map-aware model to measure the process. Through navigation can be done inside a place. But this process does not able to work under in all the condition, due to strength of the signal.

Based on this preliminary we developing a navigation system that can be pretended to improve the localization for the indoor places, which helps the human who are new to the places can able identify the places easily where we need to actually with the help of this navigation.

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Our proposed system which major help to detect the navigation for indoor places so that there is no need of any manual or human help to guide the place. This system is mainly work under the WIFI Signals, these WIFI are been setup in inside of building or commercials place, because now days all big commercial place and college having the WIFI access point for accessing up of internet so this way can help to make the navigation for the indoor place. The theme of the process is to find the any place inside a building and colleges. This can done by a concept of Wi-Fi triangulation method, the method is to set-up the Wi-Fi inside the place where we need to navigate the any place, so the Wi-Fi is fixed inside the all over the building either each end of the building, so the signal is able to transmitted from the Wi-Fi access point that can be detected by smart phone or any other instrument which will help to navigate. The map is created for the place that we need to navigate. Through that map a spot is mention by identifying up of the Wi-Fi spot in that place that are mention by dot or some other point which can be easily understood. Through that way we can access the navigation for the place, but the most important things is to create the exact map for that place.

This method will help to find and guide the people to go where ever they need to go in that place. Which saves the time, confusion for people.
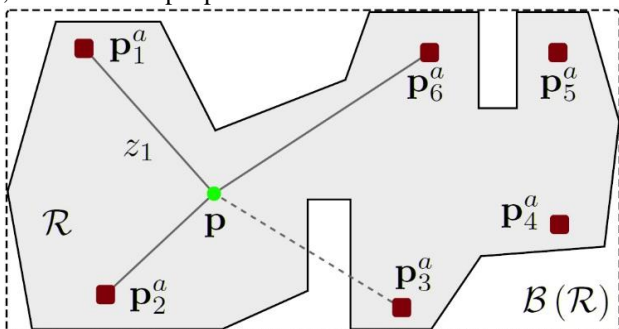

Fig 1 Location Detection by Wi-Fi

Example of a localization system RoomPa = 6 anchors (red squares) to localize a single Person (green circle) and operating over a boundedMap (whose support R is identified by the grey area). The presence of a link between the person and a given room is evidenced by acontinuous (dashed) line (that is place that person need to go).

The proposed map-aware model has the following relevant Features: a) it relates the NLOS bias affecting measurements to map geometrical features; b) it can be employed in localization systems based on ranging techniques; c) it contains few parameters to be estimated from measurements; d) Even it can work at offline reader also (without internet connection the map can be read)

II. MODELLING AND REFERENCE

In this project, we introduce an indoor navigation system using Multiple Wi-Fi Access points. We use Wi-Fi APS at either corners of the building. Each Wi-Fi APS has unique MAC address, by using MAC and Signal Strength we can map the location without using GPS. It is possible to use these parameters to convert this exponential to a linear model. Also we can estimate the Speed using how fast the signal get weak or strong.

As early we discuss the localization system of Room that has the map of 2D localization system operating in an indoor scenario and room Padevices, called anchors and whose position are known to estimate the place of P of single person.
In a Room by formulating the position from the map-aware these can be done by modelling the system by means of architecture diagram(*fig 2*).
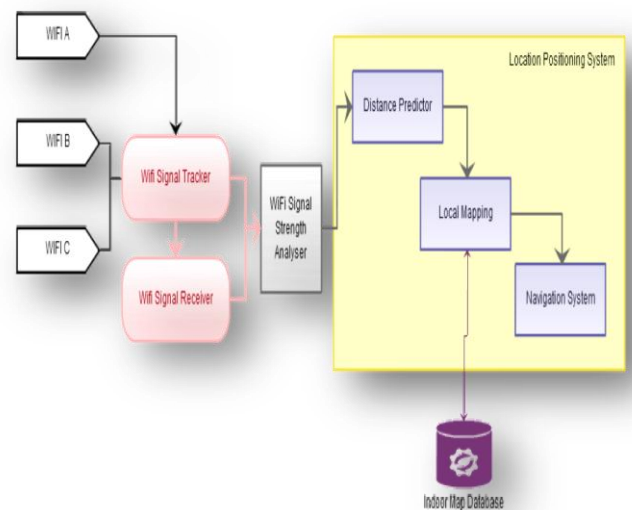

Fig 2 Architecture Diagram of Navigation Setup

The architecture diagram shows : a) it consists of three Wi-Fi access point namely Wi-Fi A, Wi-Fi B, Wi-Fi C; b) These three are interconnected with Wi-Fi signal tracker and this Signal tracker is connected to Wi-Fi signal receiver; c) This whole setup are connected to Wi-Fi signal analyzer; d) This analyzer are connected to Location Position System the Location Positing System consists major sector they are distance predictor, local Mapping, navigation system which help to detect and navigate the places; e) the local mapping is connected to indoor database from that we can access the map of the indoor places.

A. WIFI

Wi-Fi is a wireless technology that are useful to connect all over the world. It's a local area wireless technology that allows an electronic device to participate in computer networking using 2.4 GHz UHF and 5 GHz SHFISM radio bands. Wi-Fi technology may be used to provide Internet access to devices that are within the range of a wireless network that is connected to the Internet. The coverage of one or more interconnected access points (*hotspots*) can extend from an area as small as a few rooms to as large as many square kilometers. Wi-Fi provides service in private homes, businesses, as well as in public spaces such as Organizations and businesses, such as airports, hotels, and restaurants. The main advantages of Wi-Fi is cheaper deployment of local area networks (LANs). Also spaces where cables cannot be run, such as outdoor areas and historical buildings, can host wireless LANs.Here for our system we using a Wi-Fi 802.11And range will be as need for the place where we need the navigation point or setup. As we going to implement this process in our college so the Wi-Fi range will be as implemented as per our college area. The access point will be setup in all over the place of college for good range of signal.

B. Wi-Fi Signal Tracker and Receiver

Wi-Fi Tracker is a Wi-Fi scanner that can help you see the state of wireless networks in your area. This Wi-Fi scanner uses your GPS and Wi-Fi in combination to scan for Wi-Fi hotspots, but in our project this tracker will be used for scanning of Wi-Fi hotspot through which we can able to identify places in our college. Wi-Fi Receiver is component which is used to receive the Wi-Fi signal from the access point, through that data has been accessed and it use for navigating in inside the college.

C. Wi-Fi Signal Strength Analyzer

Wireless signal strength is traditionally measured in either percentile or dBm. The level of 100% is equivalent to the signal level of -35 dBm and higher, e.g. both -25 dBm and -15 dBm will be shown as 100%, because this level of signal is very high. The level of 1% is equivalent to the signal level of -95 dBm. Between -95 dBm and -35 dBm, the percentage scale is linear, i.e. 50% is equivalent to -65 dBm. This Wi-Fi analyzer which are detecting and analysis of signal strength of the Wi-Fi which is presented in College. The percentage are mention above for signal strength.

D. Location Positioning System

Location Positioning System is term which for tracking or finding off place inside the navigation system. This system is basically worked under the way of major three distance predictor, Local Mapping and Navigation System. This device will help to locate the particular place inside the college.

1) Distance Predictor

The distance predictor is a method to find out the distance traveled knows distance predictor. This method is used for calculating the distance and time travel by person to reach the place and to find what is distance for that place inside college.

2) Local Mapping

The local mapping is segment for creating Map for the local area which is help to find out the spot for the place in any local area. Here this local mapping is used for maintaining the map for the college which stored in the database that is create for storing the map.

3) Navigation System

Navigation System main process of locating of place where the human are searching or for finding out the places in around the world by means of GPS, but in this project that are been used to find the spot of the Wi-Fi for navigation to locate places inside the college.

These are technique which we going to implement in our system for finding out location of the place where and all places are located. Once these system are been implemented in our system then these are constructed into a single application which can be able to loaded or installed in the smart phone. So that we can able to connect to Wi-Fi through that we can detect the place that we need to go. The application that are developed by using up off the Android ADK *(android developing kit)*.

Fig 3 Example for Indoor Map of college

III. WORKING AND RELATED TECHNIQUE

The Working model is based on the process related to the architecture diagram which we are discuss before the process are undergone by the different ways off step to reach the location of the place in the indoor navigation. The first step in the navigation process is to set the Wi-Fi access point in around the college or corners of the college so that the signals can able to transmit all around the place, these signals are detected by smart phone and are pointed out for the forming off navigation system, these are received by signal tracker and receiver which is already in build in the smart phone and a separate map has been created and are stored in the local map database, once it has been loaded in local map then the smart phone can able to show the map and access point are shown as dot like represented, it say about the place that are inside the college. Through this technique we can able to create the map for all the kind of commercials places which is useful for the human to go through.
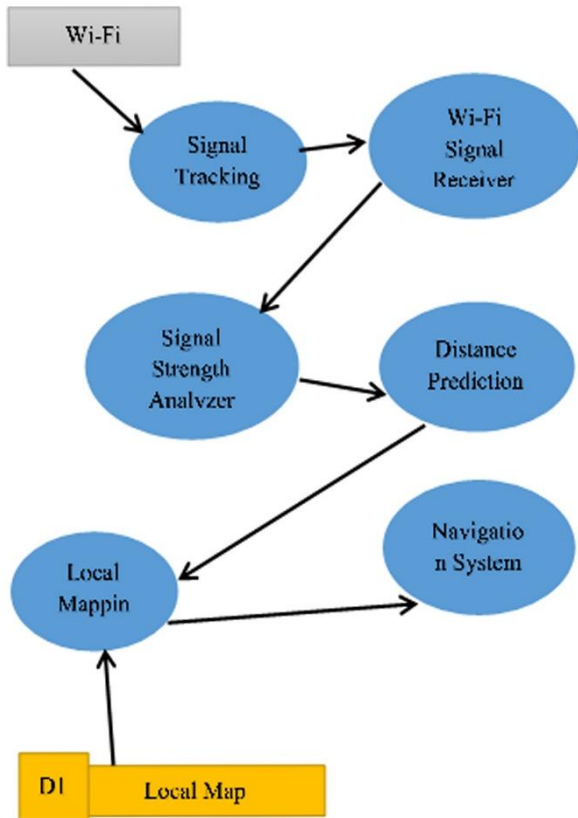
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Fig 4 Data Flow Diagram for Indoor Navigation

Fig 5 Data Flow Diagram for Wi-Fi Receiver

The Technique used in the method for indoor navigation is Wi-Fi triangulation method and Triangulation distance calculation algorithm, these both technique is main purpose for mention the distance and how to get the signals without getting loss of Wi-Fi signal to achieve this requirements we are following this technique
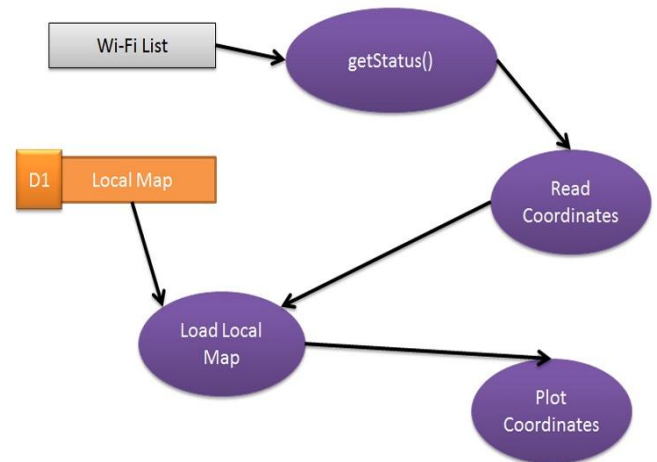
Fig 6 Data Flow Diagram for Local Mapping

IV. PROBLEM STATEMENT

In this statement we discuss some of the problem that already existing in the system.

- Some navigation which will be using of fingerprint through which it can deliver the accuracy of the navigation but in same way indoor localization to be implemented in current state of the art smart phones, leveraging their sensing capabilities in order to deliver up to 1.5 meters accuracy
- Research of previous work in the field preceded the development of a new approach that uses data from the device's wireless adapter, accelerometer, and compass to determine user position. A routing algorithm calculates the optimal path from user position to destination. Testing verified that twometer accuracy, sufficient for navigation, was achieved, compare to above method it possible to achieve 5 meters more than previous but it's not possible to always carry the compass and accelerometer for long.
- Rollators i.e. (trolley) for the detection of the trolley where it moving, we need to set-up a camera and some sensors to it. Fitting up off camera and sensors to all the trolley is bit difficult.
- Robotic navigation that are been done by using od sound waves and Wi-Fi navigation signals but the sound waves doesn't possible to hear up to all floors of the building and some building the sound waves are able to transmit, so it difficult to achieve it.
- RFID (Radio frequency signals) it does not much transmit all over for navigation process though, if you are using RFID then collision may occur, if more people are using the same frequency.

V. RELATED WORKS

The work based on the navigation system that is already presented in the world, that they are followed some based

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technique for achieving the navigation in indoor places. The developing of an indoor navigation system on a web-enabled smartphone, the research of the existing project have develop a new approach of user data from the devices of wireless adapter, accelerometer, and compass to determine the user position. This method is based on routing algorithm which is help to detect the short the path for the place through which we can able to get through the place easily.

The main drawback of this method and algorithm is that the routing algorithm which helps to determine up to the certain of the distance and durability will be slow, so the transaction of the data will be slow and we need more time to wait for loading of the page. Another method that based on the navigation system based on smart phone that are work under the principle of computer vision technique such as Hough transform and candy edge detection, and dead reckoning to calculate and track the user's movement, the algorithm is based on step robust detection algorithm, which process the inertial measurements obtain from the smart phone motion and sensors that are presents to identify the rotation, finally all the components are combined together to compute and display navigation to achieving the destination of average of 2.1m.The RFID technique is another existing method for navigating for the indoor system, here RFID using the radio frequency which is shot wave format and easily received by all the device which is better for transmitting of the signal but these rays are cannot be used in smart phone because need to in-build the sensing device for the further implements for accepting this signals and also the range will be used in small range (like inside of living room).In order to overcome from all the disadvantages we are going to Wi-Fi triangulation method this will be continuously supplying of signals for transmitted the data through Wi-Fi and also all new developed technology having this facilities and also all upcoming technology and devices also having this Wi-Fi technology so it's easy for navigating the places.

VI. CONCLUSION

Our Proposed system which talks the about the technology of Wi-Fi and Wi-Fi triangulation method, the deals with forming up of Wi-Fi setup in the place where we need to access the navigation system through this a map is created and navigation is formed through the spotting up of place. This is the technique will be very useful for finding up off the place inside any commercial buildings, colleges, school and house which will help the new people who are coming to the place can easily identify the places where they wants to go but one thing we need Wi-Fi point, in same way the people who are accessing the Wi-Fi some will use that Wi-Fi access for downloading or some illegal action will occur for that a secure system is arranged that we are presenting a firewall in the Wi-Fi accessing which helps to prevent from the illegal access of the Wi-Fi data transaction. There won't be any damage, data loss and other technical issues that will not occur i.e. loss of range, deviation of signals. These are the extension and other facilities are providing for the navigation in indoor.

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