

A Research on Indoor Emplacement Guider

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Abstract— This paper is dedicated to explaining the implementation of indoor positioning system with most optimum characteristics. This is because Global Positioning system is not suitable for Indoor positioning, due to lost signals within the building walls. The indoor positioning system is based on the application of Wi-Fi access points found abundantly in smart phones, malls and buildings. The main goal of this project is to maintain budget and power consumption to the lowest value possible while completing the project within time boundary. The system provides the localization and navigation services.

Keywords: Indoor Positioning, BLE Beacon, Received Signal Strength, Google API

I. INTRODUCTION

This system is implemented for the purpose of Indoor Positioning system. It often happens that in bigger organization like Hospitals, malls we get lost, find difficult to reach to the specific locations. Which leads in lots of time wastage. GPS works outside the buildings, but its signal gets lost inside the building walls. To overcome this problem beacons are placed at different places in the organization. It continuously transmits the signal that other device can see. It broadcasts the radio signal 1/10th of seconds. The Beacons are placed at convenient places so that users can receive good quality of signal at most places

II. SYSTEM COMPONENTS

The whole systems consist of three components: Server, Smartphones and BLE beacons.

A. Smart Phone

Smart phone is used to collect Received Signal Strength (RSS) data for the system and depending on the signal provide the positioning and navigation. Smart phone must be equipped with the Bluetooth 4.0 adaptor so that it will be compatible with the protocol.

B. Beacon

Beacon are low-cost, low powered transmitter equipped with Bluetooth Low Energy, also called Bluetooth 4.0 that can be used to deliver location-aware, context aware messages.

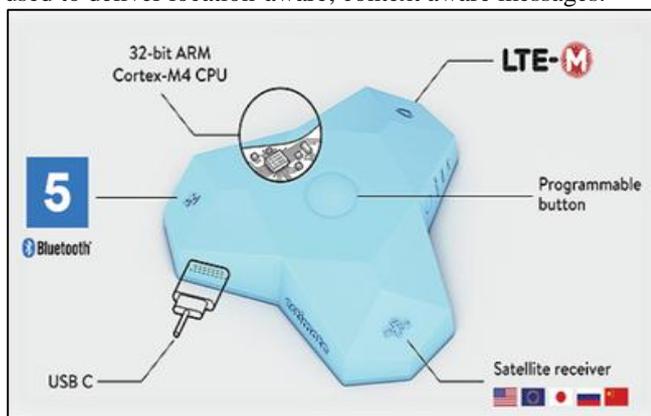


Fig. 1: BLE Beacon

C. Google Map API

Google map is a web mapping service developed by google. It offers satellite imagery, aerial photography, 360-degree panoramic view of streets. Using this API we can trace our beacons and provide their actual location into the system depending upon the longitude and latitude.

D. Directions API

Directions API provides the service by calculating the distance between the locations and providing the shortest path. Using Direction API one can:

- 1) Search the directions for different mode like walking, bike, etc.
- 2) Returns multi part directions using series of way-points.

III. RELATED WORK

- 1) The author in this paper demonstrated the Wi-Fi estimation technique that was using data for calculation. There is brief information about the application of Gaussian Mixture Model (GMM) to represent the large Wi-Fi database and reduce it to lower number. Also, they applied the Practical Filter for calculation of location estimation technique. The system was composition of web and mobile terminal. The author named the system as indoor locky which was adopting the crowdsourcing to reduce the labor cost.
- 2) The author proposed Wi-Fi indoor positioning system that improved the localization performance from bottle neck in TOA or AOA. The system needed the wide signal bandwidth and number of antennas for transmitting large number of messages. Also the author demonstrated the system performance where it can support localization by single Wi-Fi AP. He also stated that the performance of system can be improved by AOA joint positioning where there are more than two Wi-Fi APs.
- 3) The author demonstrated in this paper the improved indoor positioning algorithm based on RSSI-Trilateration technique for internet of things. Trilateration is the technique to determine the location of object. The system also contained a reference point which needed to be chosen carefully for localization for the user. The system also contributed towards the reference point and distance from access point by using trilateration algorithm.
- 4) The author proposed a system which used beacons for indoor positioning in small areas. The beacons are scan and information is stored on database. The Euclidean distance correction (ECKP) which was developed from KNN that K-Nearest nodes algorithm.

Sr.no	Name of paper	Advantage	Disadvantage
1	Design and Implementation of Wi-Fi Indoor Localization based on Gaussian Mixture Model and Particle Filter. [1]	Using Gaussian Mixture Model (GMM) and Particle Filter data volume got reduce with more accuracy.	Enter building information from web browser can be inaccurate.
2	Wi-Fi based Indoor Positioning. [2]	Approach to overcome bandwidth limits and multipath. Reduces need of multiple antennas.	The time shift property which refers to the time difference to time messages is not precise and performance is degraded.
3	Improved Indoor positioning algorithm based on RSSI-Trilateration technique for IOT. [3]	Improved positioning model. Error rates are reduced by using some reference points as proposed in the model.	Surrounding signals and obstacles can cause a little big difference in positioning results. The result also depends on no. of obstacles, which degrade the performance.
4	IPS using Euclidean Distance correction algorithm with beacon. [4]	Improved Algorithm for position calculation.	During offline data collection it was found that same smart phones when they start scanning some beacons failed to scan.

IV. PROPOSED SYSTEM

A. Architecture

The basic architecture of the system contains mobile Application, BLE beacons and Database (here Google API). Three of the components interact with each other to fetch the proper data and get the proper indoor locations.

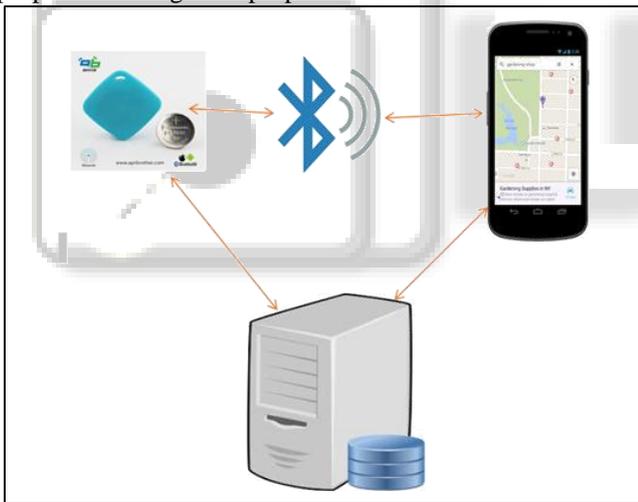


Fig. 2: Architecture of Proposed System

B. Working of Application

While implementing this system the main motive was to overcome the disadvantages of Global Positioning System (GPS) which hinders performance for indoor positioning. In this system we have used beacon which in turn makes use of Bluetooth low energy technology. Beacon works as a Light House. It keeps transferring the signal with in the specified range max up to 60mtrs to notify its presence. Beacon do not transfer any data other than it's ID (i.e. Beacon Id). The system scans for the beacon present in the environment. System contains the file which has information of longitude and latitude of each beacon set. With the help of this Longitude and Latitude Google API can place the beacon in real environment on to the user screen. Direction API is used

for calculating the distance between the beacons and providing the shortest possible path to the user.

The System also consists of Admin portal where admin can add new beacon into the environment and set its longitude and latitude. The addition of newer beacons and deploying them in to the environment becomes easy.

C. Applications of IEG

1) Indoor Navigation

The Proposed System make it easy to navigate the indoor location and save time.

2) Autonomous Robot Navigation

Automatic robots can be implemented where the proposed system can be embedded which in turn will reduce the manual work.

3) Rescue Operation

This system can also be implemented in Rescue system, which will help to reach to the unknown place earlier and save many lives.

4) Proximity Marketing

Proximity marketing is one of the good application of IEG. Using IEG wireless marketing can be done, when the user comes in contact with the beacon near the shop, user will get all the latest offers available in the shop.

5) Warehouse/Workforce Monitoring

This system can also be used in warehouse to keep the track of goods stored.

6) Indoor Positioning Games

Indoor Positioning Games can also be implemented using this system.

V. COMPARATIVE STUDY

A. Problem with GPS

- Geometric dilution of precision
- Visibility
- GPS movement
- High Temperature
- Unmarked roads
- It is two dimensional

- Signals cannot pass through walls, roof and other objects.

B. Disadvantages Associated with Existing System

- GPS requires continue internet connection for obtaining locations.
- Error in accuracy of locations of higher altitude and mountain.
- Technology is expensive with infrastructure.
- High false alarm rate.
- Easy to be disabled.
- Complexity of hardware components.

C. Advantages of Proposed System

1) Easy for user

Indoor wayfinding becomes even easier with an indoor positioning system as user don't have to type in their position while navigating from point A to point B. Likewise, they don't have to worry about counting door, turns, or the like as they can see their real time position on the map as they move through the building.

2) Improved UX

Other advantages of IEG is the improved user experience. Besides making it easier for users to navigate, indoor positioning system ensures a user experience as google maps, which users already know and love.

3) Insights

With an indoor positioning system you also have the possibility of heat mapping, so you can see how people move around your venue. This allows you to gain important insights on what's good about your layout and what could be improved to increase sales at merchandise stalls, minimize wait times at food and drink vendors, or differentiate stand pricing at conventions.

4) Location-based marketing

The Combination of indoor navigation and indoor positioning also gives you the benefits of location-based marketing. Not only does this allow you to create a more personalized experience.

D. Disadvantages

1) An Investment

Speaking of ROI, there's no doubt that indoor positioning is an investment. First off all. It's a subscription and not one-off payment, and second, it's time consuming to set up. Setting up an indoor positioning system usually means deploying Bluetooth beacons, but it also means fingerprinting your venue, which is a time-consuming task. Just to give you an idea of the task, buildings need at least 1 beacon per 200m² in average depending on the physics of building as well as the accuracy needed.

2) Maintenance

Another disadvantage of IPS is the maintenance. The beacons themselves don't require other maintenance than a new battery occasionally, and the best BLE beacons run five to eight years before their batteries need to be changed.

VI. CONCLUSION

On the basis of comparative study of systems used for Indoor positioning system, our system is efficient in terms of accuracy, feasibility and cost.

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