Human-Centric Automation and Optimization For 
Smart Office

Manoj Goskonda, Nikhil Tawale, Vivek Ramteke, Akash Satardekar, Prof. S.A. Darade

U.G. student, Department of computer engineering, K.J. Trinity Academy of Engineering, Pune, India.

Abstract: Advanced positioning technology has led to the development of delivery services of automatic advertisements and notifications to the user based on his/her location. For indoor environments, Notification environments developed using beacons are preferred. A variety of applications from shopping malls and museums, prefer Indoor positioning systems using beacons to subject monitoring and tracking. The usability and reliability of these positioning systems are based on their accuracy, cost and the ease of deployment. In an indoor space, Beacons are installed by users, to construct the notification environment. To make setting of notification positions easier, the beacon installed is linked to the notification content. Using this system the customer as time is saved as customer gets notifications on his Smartphone when they pass through any malls, store etc. When the customer finds a notification they react to that and reach to that space. Customer enters into the space and gets more notifications about the space which may help the customer. Although, the Global Positioning System (GPS) is an accurate solution for outdoor space, it cannot be used in the indoor space.

Keyword- Beacon, Bluetooth low energy, location data, indoor positioning, diffusion, RFID.

INTRODUCTION

In a range of contexts including office buildings, museums, university campuses, airports and other public spaces, positioning as a method of augmenting and enhancing user experience is attracting increased interest from commercial organizations. None of the forms of marketing offers personalized marketing based on a user as current location in real time. Shopping is one regular activity that human beings spend significant amount of time. US Bureau of Labor carried out a survey, according to which, customers spend average of 1.4 hours every day on shopping. IPS has become the popular way to design navigation indoors. Instead of using satellites, IPS uses radio waves or magnetic fields to determine positions. A range of different technologies have been tested and implemented, such as using infrared, ultrasounds or more commonly Wi-Fi and Bluetooth. IPS are implemented in a couple of different ways. One approach is that a device, or listener, is used to register incoming signals from the beacons positioned around the person. Beacons are small, wireless transmitters that use low-energy Bluetooth technology to send signals to other smart devices nearby. They are one of the latest developments in location technology and proximity marketing. Put simply, they connect and transmit information to smart devices making location-based searching and interaction easier and more accurate.

LITERATURE SURVEY

In the paper [1], the objective was to add services and data that are location dependent, which includes navigation information, which the user configures depending on the requirements. About 136 beacons are deployed over a store area of around 6000m2 but the experimental data which was collected was done over a part of around 800m2, with about 25 beacons deployed over the area. The objective of the system is to determine the aisle in which the user is, and the user as position along the aisle. This provides with required information to check which products / categories of products are adjacent to the user. The system is primarily interested in determining the closest products to the user which is fully represented by the user as displacement along the occupied aisle as main axis, and the position across the width of the aisle is given less important. Hence it reduces the positioning problem faced to locate the user on an edge of a node graph, which represents the store aisle as map. Three positioning methods which were experimented were, Nearest Beacon: the baseline method of positioning is to estimate the position of the user to be that of the graph node which is adjacent to the beacon with the current highest recorded RSSI value. Weighted Beacon-Pair Range Estimates: to take different readings from multiple beacons at a time to improve spatial resolution of BLE readings is said to be unreliable. However, the node graph map constrains the position of the user, and the readings from neighboring beacons are used to improve the position estimate. Particle Filter: user positioning is considered as a non-linear Bayesian tracking problem. The state space is constrained to include only positions which lie along node edges of the graph map.

In the referred paper [2], the System based on BLE consists of 3 components: 1. Server Component 2. Smartphone Component 3. BLE (Beacons). The Smartphone component consists of an application where the location of the customer will be identified using BLE technology. The Notification or any advertisements can be viewed in the Smartphone provided based on the customers location inside any store or in any mall. Server Component transfers the data using Wi-Fi and the application in which server is connected sends any promotions or advertisements to the Smartphone. BLE makes the process of collecting any data related to the customer in an easier and in a faster way where it reduces cost and provide enhanced services to the customer according to their preferences. Beacon is a Bluetooth enabled device which is based on Bluetooth Low Energy Technology. Beacon is expertise in identifying proximity and can be used in public areas for various information. The data which beacons transmit will be in the form of packets and relevant Smartphone can take up the data which is transmitted. A data packet contains four components of information mainly, i. UUID ii major number iii minor number iv TX power. UUID is a 16-byte identifier that can be used to differentiate whenever there are large group of similar beacons. MAJOR NUMBER is used when smaller set of beacons present within the larger group can be differentiated. MINOR NUMBER can be used to identify individual set of beacons. TX POWER determines the nearest distance of beacons present around. Bluetooth Low Energy describes a new role for developing a geomarketing solution which makes the customer as shopping experience easier and efficient. BLE also helps in making decision
in-order to strengthen the relationship with the customer as personalized service and keep up the loyalty of the customers. Further the implementation using BLE technology can be done by sending customized messages such as advertisements or e-coupons to customers to their Smartphone as they enter the shop or if they are closer to the shop.

In the referred paper [3], we see that In the current days the technology is being developing to be in its best version. Online transaction and shopping has gained a lot of scope nowadays, but some customer feels the website used for shopping is not feasible. To overcome this problem we can use the Bluetooth Low Energy concept by implementing the triangulation algorithm to calculate the current location of the user through beacons. In the proposed system the customer will receive the notifications and services provided by the vendor when he passes near the store/mall, thus providing the customized advertisement service to the user. BLE beacons are a low-cost, low-power consuming devices that can provide the short-range wireless communication. The beacons will be sending the small identification frames that are received by the mobile, thus helping in calculating the distance between the mobile user and the beacon through received strength signal. The beacons protocol is using the 40 channels of 2MHz each which are used for the transfer of advertisements. This proposed system will help the customer by providing the customized services and saves customers time. Most of the indoor positioning techniques are using Wi-Fi and Bluetooth technology, to optimize this system an extended Kalman filter can be used. This is explained below: A) Pre-Process of RSSI values: The RSSI values are unstable even in the well-defines, well-designed indoor scenario/area due to the multipath fading. In order get optimal result the unstable values has to be removed via preprocessing of the received RSSI values. B) Kalman Filtering: The distance between the mobile and the beacon devices are calculated using the Kalman equation, which will be using the prepressed RSSI values for the calculation. C) Triangulation: Once the mobile device gets the distance between the beacon the triangulation technique is used to find out the coordinates, which contain the three circles with beacons are centered at each beacon with the equal radius. Proposed System: The proposed system contain three parts namely 1) Mobile application 2) Shopping mall 3) Server The system will provide the user with mobile application to access the services provided. Once the user installs and initiate the app and turn on the Bluetooth on his/her device, the mobile will get connected with the beacon devices sending the Bluetooth signals. The mobile will get the unique ID of the beacon device and transfer the details required into the server and the services and advertisements will be delivered to the customer. The server contains the services, advertisements loaded to it by the vendor. The server also stores the customer information. All the transfer of the data from mobile to server and from server to mobile will takes place by using Wi-Fi. Thus the customized service Is provided. Hence, The proposed system will help the customer to get information about the special offers and services provided by the retailers when he/she is nearer the hop and information about particular product when nearer to the product.

In the referred paper [4], it says that Proximity marketing is a technology where it delivers advertisements to users depending upon the location in which they are present. Customer while shopping find difficulties to take full advantage of different offers provided by many stores because it may be irrelevant when advertisements sent through SMS messages. Advertisements can be directly sent using many technologies like GPS, RFID, NFC and Wi-Fi. System using beacon technology can be used in delivering advertisements to the customer as Smartphone enters the store or who happens to be nearby the store. Technology usually used for location based advertisements is GPS (Global Positioning System). Normal Android Smartphone which uses GPS enabled application like Google Maps drains out phones battery. Location based services which is the beacon Technology is provided by apple which uses IOS platform is a new technology in mobiles. It delivers the relevant content to customers based on their present location and also in public transportation in nearby stations. iBeacon technology is preferable in using GPS since using BLE with this technology consumes less power. Every business aims at obtaining the new customers and also maintaining the current customer in an efficient way. There are traditional methods which are been already in use when it comes to advertising that is through newspapers, radio, television etc. The modern way of technology in advertising is known as Proximity Marketing which delivers advertisements based on the location of the customer which also consist of mobile advertisements. Proximity Marketing can also be known as Location based advertising(LBA).Proximity Marketing can be effective when it is personalized that is personalizing according to the customers interests and delivers it based on the customer as location. It should also be timely effective that targets people at specific domain in the whole advertising. The main goal is to provide advertisements to the customers Smartphone based on their location using beacon Technology. It can also deliver advertisements to passengers who are in transportation or any users who are nearby to the station. It also serves as an advantage to the store owners to advertise their products in the store which leads to profit.

In the referred paper [5], Handling the operations of the administration of the education institutions involving the interaction between the students and the faculties is a tedious job. One of the solutions that can be suggested is using the Bluetooth beacons that provide the analysis based on the proximity. These beacons can provide the surveillance of the institution area in real-time, helping in automating the administrative operations. It also helps to communicate with the students and other staffs. Today we are very much depended on the location based applications for our various operations. The GPS serves as an excellent location-based application, but it cannot operate in the indoor areas. We can overcome by this problem by using the proximity sensing using the Bluetooth. Initially the Bluetooth in the smart phones used the WIFI signals for the sensing purpose, which was then replaced by the concept of Bluetooth low energy developed by the Nokia. In the proposed system attempt to automate the institutions operations using the beacons are done. Every student will be tracked inside the campus and the relative location details are used to automate the management tasks. Web page links can be used to communicate with the student. Indoor navigation is being done by using the various technologies like NFC, Wi-Fi, Bluetooth, RFID etc. As the availability of Bluetooth and Wi-Fi is easier they are widely used in indoor positioning .The criteria to be considered is the energy consumption which is less in case of using the Bluetooth low energy.

- PROBLEM STATEMENT

In a range of contexts including office buildings, museums, university campuses, airports and other public spaces, Indoor positioning as a method of augmenting and enhancing user experience is attracting increased interest from commercial organizations. None of the forms of marketing offers personalized marketing based on a user as current location in real time.
Shopping is one regular activity that human beings spend significant amount of time. US Bureau of Labor carried out a survey, according to which, customers spends average of 1.4 hours every day on shopping. Moreover, CISCO Internet Business Solution Group conducted a study, according to which, the four top reasons for users to use new technology are to Find best price (63%), Save time (47%), Find best assortment (26%) and get best quality (25%). SWIRL carried out a survey according to which, shopper behavior are influenced by Beacon marketing campaigns: 73% of surveyed shoppers said that their likelihood to purchase during their store visit increased with beacon triggered content and offers, 61% said they would do more holiday shopping delivered mobile content and offers at stores while they shop, 61% said they would visit a store more often with beacon advertising campaigns, and 60% said they would buy more product as a result of receiving beacon-triggered advertising messages. The main aim of this project is to evaluate if lost assets can be tracked in indoor environments by using a couple of smartphones and beacons. In more detail, to implement a smartphone application able to locate the beacons accurately enough at a low cost and being energy efficient as well as user-friendly.

**PROPOSED SYSTEM**

Bluetooth Low Energy, (BLE or Bluetooth Smart) is a new technology that allows Bluetooth signals to be transmitted with lower power consumption while maintaining a similar communication range. Proximity beacon device that based on BLE technology can provide indoor and outdoor positioning service to BLE ready mobile devices that supports Bluetooth 4.0. Inside a building, Bluetooth indoor positioning would be more practical than using the Global Positioning System (GPS) because the latter requires a view to the clear sky for consistent satellite communication. Bluetooth micro-location technology therefore opened up possibilities for context and location awareness feature to be integrated into mobile applications. A BLE proximity beacon is a low-powered transmitter device that will broadcast a signal at a certain interval to indicate their presence. Without the need of pairing, a Bluetooth Smart ready device will be able to receive the signal when in range. The signal strength (RSSI) received by the mobile device will be used to estimate the distance between the user device and the beacon. Mobile applications can be designed to dynamically perform action or display information paired to the nearest beacon. The terminology for such intelligence is called location awareness. The BLE beacon technology is featured by Apple in iOS7 and Apple trademarked it as iBeacon.

![Fig. 1 Proposed System](image)

Radio Frequency (RF) transmitter is kept in pocket of user which user has to carry everywhere. RF receiver recognize particular user after detecting frequency of RF transmitter. Whenever any person enters into any room RF receiver detects him/her presence. LCD will display any important information sent by higher authority (in case of School/College, Principal will sent any important notification to a teacher which will display on LCD of particular room where teacher is present). Buzzer will alert about notification. If anyone enters in restricted room then LCD displays restricted area and buzzer will not stop until that person doesn’t come out from that room.

**V. CONCLUSION**

The aim of this project is to investigate and develop a new approach of an IPS which tracks down a lost object and relies on the users of the application. Was it possible to use only cheap BLE beacons and then let the more expensive parts of the system be the users smartphones? To make this possible, we needed to combine an earlier approach of an IPS, where a user can be positioned relative to the room, and combine it with the crowd-sourced localization technique. In addition to this, we needed to evaluate how many users were required to run the application in order to get a fast and reliable result. The accuracy to get a users position relative to the room is very good thanks to existing technology. The hard part has been to get a good accuracy of a lost asset relative to the user. As stated earlier, the beacons attached to the assets are not meant to return an exact distance, they instead work with proximity. This is the main cause of the unreliability of the accuracy in our tests. Besides this proximity beacon, Estimote also provides location beacons. This leads to the first possible extension of this thesis, replacing the current bea-cons with these location beacons. Since they are developed to track real-time positions, it would most certainly give us a more accurate position of our lost assets. Our conclusion is that we know that the application works and fulfills our preconditions, if enough people use it.
REFERENCES


