

Automatic Attendance System Using BLE Beacon

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Abstract: *The traditional systems does marking of attendance, handling lectures by paper signing pattern which disturbs the concentration of students but on research, proposed idea does task like automated marking attendance by use of BLE (Bluetooth Low Energy) beacons and the involves usage of automated tools like Selenium which will be reducing the paper work and error like proxy, missing attendance. The system also gives the idea about many events and programs by advertising their details and providing details of examinations in the college campus on reaching the place so system alerts the students if the lecture starts and they are outside the classroom. For making better decisions and keeping eye on everyone and to save students time and reduce their disturbance in lectures. It is using concept of proximity analysis solution using BLE 4.0 Technology which results to digitizing college activities and reduction of disturbance in concentration and also reduction in workload of staff for attendance manipulation and other activities, we can make use of this proposed technology using BLE 4.0 beacons. This system solves all the problem occurred in college indoor area. The previous system uses more hardware device for college activities like marking attendance, managing events and instructing for exam location which takes a long time for all the students to do that type of work.*

Keywords: BLE Beacon, Bluetooth Low Energy, attendance, multiple users

1. Introduction

Rapid technical progresses in mobile industry have elevated new challenges for researchers and scientists by allowing low-end devices in the last period. In this paper, improved methods are used for minimizing efforts of staff for handling information. The proposed system does the task like marking attendance more precisely and decreasing paper work and errors like proxy, missing attendance by use of BLE (Bluetooth Low Energy) beacon [1]. For making superior decisions and keeping eye on every person we can make use of this proposed technique. All attendance data of student and others will be stored in database. This project presents the efficient machine learning algorithm used in extracting current data related to College students and analysis on this data which can be used by principal to take further decision and lead to growth of the college more rapidly and accurately with less efforts. This project uses ML that can be used for forming the logic for accurate changes or decisions on certain conditions. Our research focus on the analysis of the data and this project can reduce the large workload of college.

2. About Ble Beacon

Using smart environments now a days in urban areas is mostly indoor [2], e.g., private homes, offices, and shopping centres. In the same manner, smart environment represents a heterogeneous field that combines different technologies [3]. Furthermore, the primary objective of smart environments and IoT is to make a connection between the virtual and the physical world. For this to be possible, different technologies have arisen and are actually combined to solve not only these but other problems in smart environments [4]. One of these technologies is Bluetooth Low Energy (BLE). It incorporated itself into almost every human wearable, such as smart phones and smart watches. [5]. Thanks to its low-power capability and minimum energy consumption [6,

7], BLE gives developers, researchers, and IT enthusiasts a perfect foundation to bring their IoT ideas to the real world.

However, one class of BLE, sometimes called a BT flavor, is the beacon technology, and lately, it found its place in many aspects of the IoT concept [8, 9]. Beacon devices are little hardware transmitters that are capable of broadcasting a specific preconfigured identifier to the nearby electronics. Bluetooth beacons operate using the Bluetooth 4.0 Low Energy standard so battery powered devices are possible. Battery life of devices varies depending on manufacturer. The Bluetooth LE protocol is significantly more power efficient than Bluetooth Classic. Such technology enables smartphones, tablets, and different wearables to perform a particular kind of action when near a beacon.

Although it applies to a various type of scenarios, it is mostly used for indoor positioning [10, 11]. What is more, identifying occupied indoor spaces within some particular building is fundamental for many reasons such as better building optimization and management of emergency situation evacuation plan. With the rise of global Bluetooth beacon devices market and predictions that forecast its growth [12], many companies offer a different kind of products with beacon possibilities, all based on BLE beacon broadcast capability [13, 14]. Basic beacon devices often do not provide advanced features, and managing them can also present a challenge. Excellent centralized systems that can control all the beacons at the same time exist, but they are either too expensive or part of some bigger commercial solution [15].

Therefore, in many circumstances, we need to manually approach each beacon to ensure that it still works and transmits the signal, or even to make some configuration changes. Furthermore, most of the commercial beacon devices associate their beacon to one advertisement, and that is their most significant disadvantage. It also means that if we want to advertise different information in the broadcasting

area, every beacon device needs to be associated with the specific beacon signal.

In this paper, we explain how to use above mentioned technology i.e. Bluetooth Low Energy Beacon in attendance system. Using the context-aware information to deliver personalized mobile services. Based on users location and by using the students or employees smart mobile devices the system can deliver different content. Ranging from informational updated, indoor maps, or any user relevant information this location data also increases the efficiency. However, besides being a powerful all-in-one mobile solution, its high cost is a clear disadvantage. Implementing this solution usually requires many Cisco proprietary devices and its engine, e.g., Cisco 3365 Mobility Services Engine.

3. Applications/ Uses

- 1) Advertising: Bluetooth beacons can be used to send a packet of information that contains a Universally Unique Identifier (UUID). This UUID is used to trigger events specific to that beacon. In the case of Apple's iBeacon the UUID will be recognized by an app on the user device that will trigger an event. This event is fully customizable by the app developer but in the case of advertising the event might be a push notification with an ad. However, with a UID based system the users device must connect to an online server which is capable of understanding the beacons UUID. Once the UUID is sent to the server the appropriate message action is sent to a users device.
- 2) Indoor navigation: Indoor positioning with beacons falls into three categories. Implementations with many beacons per room, implementations with one beacon per room, and implementations with a few beacons per building. Indoor navigation with Bluetooth is still in its infancy but attempts have been made to find a working solution.
- 3) Notification and interaction: Beacons can be associated with the artpieces in a museum to encourage further interaction. For example, a notification can be sent to user's mobile device when user is in the proximity to a particular artpiece. By sending user the notification, user is alerted with the artpiece in his proximity, and if user indicates their further interest, a specific app can be installed to interact with the encountered artpiece. In general, a native app is needed for a mobile device to interact with the beacon if the beacon uses iBeacon protocol; whereas if Eddystone is employed, user can interact with the artpiece through a physical web URL broadcast by the Eddy stone.
- 4) Healthcare: Using the device tracking capabilities of Bluetooth beacons, in-home patient monitoring is possible. Using bluetooth beacons a person's movements and activities can be tracked in their home. Bluetooth beacons are a good alternative to in house cameras due to their increased level of privacy. Additionally bluetooth beacons can be used in hospitals or other workplaces to ensure workers meet certain standards. For example, a beacon may be placed at a hand sanitizer dispenser in a hospital, the beacons can help ensure employees are using the station regularly [16].

4. Related Work

Lately, beacons found its use in many research areas [17] [18] [19]. Researchers mostly orientate their work on using beacons for indoor localization and message dissemination. Researchers in [20] suggested the idea of a Smart Campus for the educational purposes where a specific individual information is delivered to users, depending on their profile. In this solution, users receive corresponding data through the application installed on their smart devices. Although the method seems interesting, the authors have not described how they create a user profile and in what way they distribute the information to them.

1) Message Dissemination: The Bluetooth Content Distribution Stations on Public Transport project [21] done by Department of Electrical and Computer Engineering at the University of California, called Bluespot, is an example of such system. The goal of this mentioned system is to provide users an easy way of accessing interest-based information while using public transport (bus). The central part of the Bluespot system is a station placed on a bus vehicle in the public transit system. The station synchronizes data when in Wi-Fi range (central location, for example) and uses Bluetooth Low Energy Beacon technology to distribute all the content to currently boarded users. Even though the Bluespot system represents an order system, where users before accessing their interest data have to place the order and wait for their data, it is an excellent example of an interest based message dissemination system where authors combine two different technologies (Wi-Fi and BLE beacons). In [17] researchers made a proposal of interaction system between visitors and collection in museum hall by using BLE Beacon technology. The system is designed for users to interact with museum items while taking a museum tour and uses a user proximity and retention time. That way a specific user can receive more personalized information regarding the subject in which he is interested. Another example of message dissemination system by using BLE beacon technology is a project done by VTT Technical Research Centre of Finland, Oulu [22]. In this work, researchers are linking physical objects with their semantic description and later broadcasting unique identifiers over BLE beacon technology. This way a specific user, while using a specially made application, is aware of its surrounding without a need for any previous interaction. The most significant motivator of the message dissemination part is a commercial Virtual BLE Beacon solution. It delivers a high-accuracy location using Cisco Beacon Point hardware and CMX Cloud Beacon Center management [23]. This product represents both BLE and Wi-Fi solution for supporting indoor customer experience and insight. Connected Mobile Experiences (CMX) is a mobility solution that uses location intelligence gathered from the Wi-Fi network to help organizations of all different industries monetize their network by engaging with their customers and optimizing business operations.

5. Proposed System

1) System Overview: This system provides all function of teacher and student in one single android application. The students and teacher are supposed to have installed the

application in their android devices. The teacher and student use this application functionality. Likewise, any user can use the application and do any type of activity such as tap for attendance, choose valid beacon id, mark attendance.

2) Stepwise procedure-working:

- i) Authorized user arranges a set of ID and name of the user.
- ii) The authorized user turns on BLE (Bluetooth Low Energy) beacon to spread a message to the Android devices.
- iii) Next, the students run the application and scan the beacon device, this device provides message to the application.
- iv) The Android devices within the range receive the message transmitted from the BLE beacon.
- v) Finally, the Android devices send the scanned received message and input data together to the database.
- vi) Then database processes data and send proper information to corresponding android devices.
- vii) For this, the RESTful web services are used to communicate with the server and client(android device) and accessing the information stored on server which helps in validation of user as well as connecting android devices with the appropriate nearby blebeacons of interest.

6. Conclusion

In this paper, we defined automatic attendance system which gives the students the ability to mark their attendance automatically through their Android devices.

Implementation of indoor positioning using BLE beacon signals gives major results and enhancement in location estimation using error minimization which further improves the correctness. The application offers reliability, time savings and easy control. It can be used as a base for creating similar applications for tracking attendance, event, and location in colleges and in offices or any workplace.

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