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Smart Advertising Using BLE Beacons

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SMART ADVERTISING USING BLE BEACONS

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Abstract: with the addition of Bluetooth Low Energy in the world of IoT, the way of sending and receiving data in a crowded area to specific audience has step up. It has been drastically easy to work with BLE with the help of Beacons. This paper addresses the usage of BLE Beacons for Smart Advertising-wirelessly-of any content with the help of an android app. In addition, it proposes how BLE Beacons can be used for in-door navigation and indoor safety and surveillance.

Keywords—Advertising, Beacons, Bluetooth Low Energy, Indoor Navigation, Indoor Surveillance, IoT

1. Introduction:

The world of IoT is revolutionizing as we speak, newer methods to integrate data from various sensors with the user cloud are coming to the picture. Still it is quite sophomoric bringing in the concern on creating a secure network to exchange data. Where public Wi-Fi are used, there comes a threat to privacy and can ultimately ruin the user experience. This is where Bluetooth Shows its advantage, which allows to work in a narrow-sighted region for specific application. With the advancements in Bluetooth Low Energy (BLE), it has been relatively easy to get interacted with sensors where there are privations to the power supply. BLE is found now-a-days in almost every Smartphone since the introduction to Bluetooth 4.0. This is necessary as, when devices would not have internet connectivity, they still can communicate with each other in a welter.

The general focus of this paper in particular is on, how BLE technology can be used with Beacons as bridge to advertise or promote contents to targeted people in a cluster. This can be achieved by programming an android app which interacts with the Bluetooth signals transmitted from Beacons. The app can be integrated with multiple intents which supports regularity with each other. Moreover, a mesh of Beacons can be utilized construct indoor map which can be further used Indoor Navigation. This proposed system can result in a system which can be helpful in cases like fire disasters in a large institution.

A. Bluetooth Low Energy:

Bluetooth Low Energy (BLE) which widely marketed as Bluetooth Smart has an origin from the year 2004 and was publicly used by the people from the year of 2010 with introduction and integration to Bluetooth 4.0. The most important aspect of BLE is its low power consumption. A Button-Cell is enough to power for at least 2 years, which again is beneficiary to make the BLE devices in a small-compact factor. BLE has found its ways in wide areas of day-to-day life activities; whether it is in beacons, sports, fitness, security and indoor mapping & tracking.

B. Beacons:

A beacon is meant to send signals within a bounded region, which are being caught by devices for a designed purpose. There are a few Beacon providers in market offering various modifications, from Estimote [1] to ibeacons [2]. Manufacturers allow users to alter the BLE signals as they want from increasing or decreasing the broadcasting power, time delay between two consecutive signals and area covered. Each beacon is identified mainly by three components [3]; UUID which follows “8-4-4-4-12” characters format, minor and major which is assigned to android app. Users can assign any website, or they can link it with their android or iOS apps to advertise a specific website when in action. Few beacons like ones from “Estimote” [4] have built in GPIO pins, which generally are low count but allows to manage external data to send and receive them. Now a days beacons are advancing with smaller form factors, integration with LTE [5] and Video Beacons. With such wide area of facilities and development, it can be said that beacons have bright future and will help modify the Smart City Industries.

2. Workflow

A. Connectivity between Beacon and Android device

It is not a rarity of Bluetooth to be in every android device. The BLE signals transmitted from beacons are received by the device and embedded actions can be performed. When a device receives the BLE signal it interacts with device’s behavior with help of

android app such as Notifications, getting locations etc. which are ultimately is interactable as decided by the app designer. As shown in Fig 1. workflow is easily understandable.

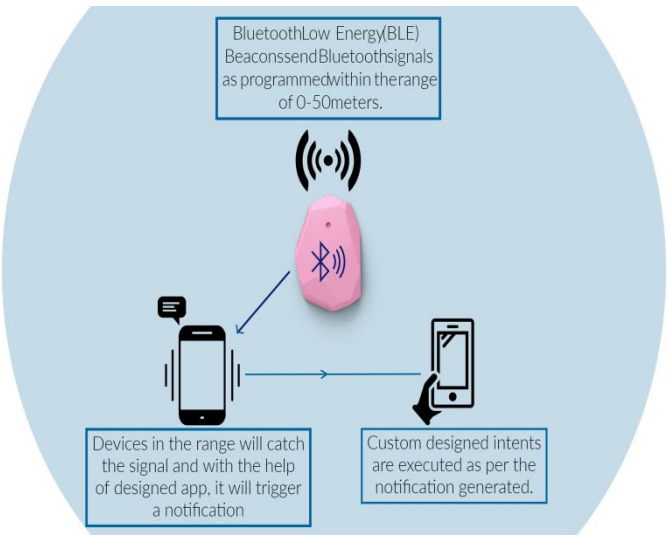

Figure 1 Overall Workflow

B. Android App:

The android is designed in Android studio, thanks to Estimote SDK [6] that the programming process becomes less tedious. The app can communicate with stock Android functionalities like notification, on-screen alerts which is intended to catch people's mind around haze. Having Proximity functionality enabled in beacons, whenever someone with the app installed comes in the pre-set range of transmitting area, user gets notification alert in his/her smartphone. This notification act as a bridge to drive user to an intent programmed for that beacon.

For example, two beacons 'A' and 'B' are placed at a distance quite far from each other. An android app is designed to interact with the incoming BLE signals from them. So, when a user arrives in the proximity of beacon 'A' he will be alerted by a notification in his device by which he can interact with a specific window of the app. When he moves out of bounded area, he can be greeted by yet another notification. Similarly moving towards beacon 'B' specific set of action can be performed.

3. WORKING:

Present paper highlights how to advertise/feed the campus events, important annoucement throught the beacons. The education campus used is BVM Engineering College.

A. Advertising of college events:

For demonstration purpose we designed an android app which advertises our college's stall at a project expo. The beacons here we used were from Estimote. The best thing about Estimote is its wide set of accessibility to configure how the beacon behaves [7] from altering the area bounded to transmitting power. Every delegate had our app installed in their android phones. So, whenever any delegate reached near our college's stall they were notified as shown in Fig 2.

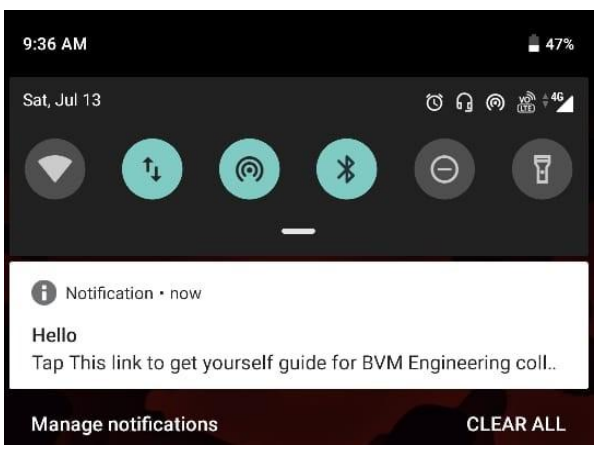

Figure 2. In-Range Notification

The notification was linked with intent where they can interact to browse the college's website and had a registration link for an upcoming event as in Fig 3. One can dynamically change the contents to be advertise, that will allow the user to advertise multiple links through the same BLE beacons. One can timely feeds the contents and provide multiple options for campus events.

Figure 3 Designed App

When they moved out of the boundary set for the beacon, they were again notified having a greeting message as shown in Fig 4.

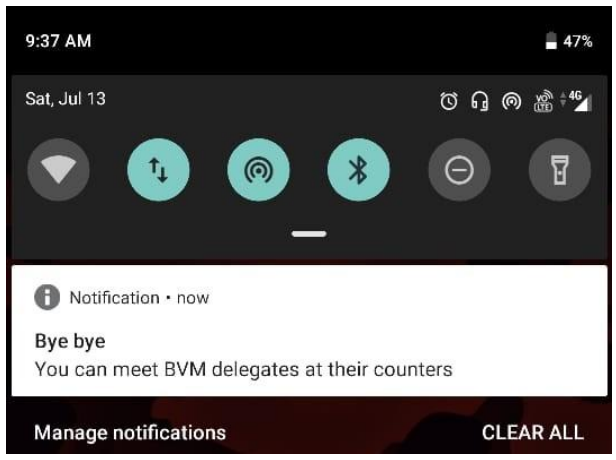

Figure 4 out of range notification

B. Indoor Mapping and Tracking:

Creating a mesh network of beacons indoor can help us to achieve complete indoor map. By arranging the beacons at appropriate distances from one other and modifying the signal interval and transmitting power an interactive map which can be further used for Indoor Tracking and Navigation[8]. This is most useful in government offices where it's hard to contact at the right person's desk. An overall android app with all the data necessary to achieve the task can be built which consists real time positioning system where users can have an idea around its environment. More proficient use of such a system is during the cases of indoor fire. A local host can have a track of the movements of individuals and exact location of a person trapped in fire can be known.

4. LIMITATION AND SOLUTION:

Since Beacons operate on Bluetooth frequency there comes be little-ness of covering large area. For that number of beacons are required gets increased which can be troublesome as each beacon needs to be configured individually in the app designed. This problem can be overcome by using a device which has both BLE functionality and Internet connectivity, smartphones to be precise. This opens the door to solve the problems of getting things lost. It can be better illustrated as; if on a thing which we don't want to

get lost a BLE beacon is placed, it will continuously send BLE signals which can be received by surrounding smartphones which updates the device's location via internet connectivity. The system can be improved, and precise location of lost items can be found.

5. CONCLUSION AND FURTHER STUDIES:

With this paper we showcased the use of Bluetooth Low Energy and Beacons for the purpose of smart advertising. The mechanism of the smart advertising can be easily adopted in any premises with a set of events to be broadcast to the nearby BLE devices. As a result, we now know how each of small technology can help achieve our goals towards Internet of Things, Internet of Everything and Smart-City. For smart city as a target usage of other communication factors like LWAN using technologies like LoRa and Zigbee and having them integrated with low power devices like beacons can be achieved. To provide more effective and correct guidance to the citizen this model can be optimized for the "Nagar Seva Sadan" and other public places particularly for the navigation. Highlighting which window is for what task, further it can be customize to provide the feed/advertisement in local language for easy to understand. Our final goal to achieve using Bluetooth Low Energy and Beacons is to create a smart advertising and a tracking system. For Advertising, user specific content can be displayed on screen placed in shopping malls, easy buying and checking out process.

6. References:

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