

Automated Real Time In-Store Retail Marketing Using Beacon

Jigar Kothari^{1*}, Trupti Shah², Bhavin Nagaria³, Apurv Choubey⁴ and SaiDeepthi Pabba⁵

^{1*, 2, 3, 4, 5}Department of Computer Engineering, K J Somaiya College of Engineering, India

www.ijcseonline.org

Received: Jan /24/2016

Revised: Feb/07/2016

Accepted: Feb/19/2016

Accepted: Feb/29/2016

Abstract— Bluetooth Special Interest group designed the version 4.0+ of the Bluetooth device termed as Bluetooth Low Energy (BLE). It is a wireless personal area network technology. Bluetooth Low Energy (BLE) is a newly emerged technology targeting low-power, low-cost wireless communications within medium or short range. BLE has extended the already wide acceptance of Bluetooth and is an ideal choice for a variety of sensor-based products, as well as ubiquitous mobile devices [1]. This group aimed at novel applications in fitness, security, healthcare and home entertainment industries. Bluetooth Low Energy (BLE) is also called as Bluetooth Smart device. This device is application friendly. It is built for the Internet of Things (IoT). BLE is the version 4.0+ of the Bluetooth specification.

Keywords— Bluetooth Low Energy(BLE), Android, Bluetooth, Proximity.

I. INTRODUCTION

Beacon is small Bluetooth Enabled Low Energy (BLE) [2] Device. BLE is a device which continuously broadcasts the signals and allows Bluetooth devices receive small information within short distances.

It consists of two parts-

1. Broadcaster (Beacon Device)
2. Receiver (Smartphone App)

It consists of two Parts-Broadcaster and Receiver. In our system, **Broadcaster is a Beacon device** which radiates BLE signals and **Receiver is a Smartphone Application** which will be installed in customer's smartphone having Android version of 4.4 and above. With the help of the Bluetooth Low Energy it is possible for the beacon device to broadcast the signals. [1]

With these changes, the standby power consumption of BLE devices is ultra-low and the operating power consumption is significantly reduced. BLE is ideal for applications requiring infrequent or periodic transfers of small amounts of data and can be used in a wide range of medical, industrial, and consumer applications. Compared with other similar technologies, like Zigbee [1], BLE is more suitable for low-complexity devices with small data throughput, expected to operate for years on a coin-sized battery. Therefore, it is a leading candidate for the newly emerged market of "accessories", i.e. small and simple devices that can serve as peripherals for smartphones and other mobile devices.

II. SYSTEM DESCRIPTION

We have proposed the system of Beacon in Android having version 4.4 and above. In our system, we are using Beacon in retail marketing for advertisement and attracting customers towards this market. In this system the beacon is having a range of -85db up to maximum proximity range

when the 3V battery is connected and the signals would be captured by the mobile phone. According to the range of proximity the near, far, unknown and immediate is defined and due to which is used for the range the application would sense the signals and provide the popup offers which would be in the database of android (SQLite) [6] and this would be used accordingly for the purpose of users to notify about any of the offers which are available for any item.

A. SCOPE

We will be using Beacon device as an input to this project. The proposed approach provides the details of all the merchandise offers, research & sales information. It provides information on a Bluetooth enabled device via Beacon and accordingly the notifications are displayed on smartphone.

It can also be used in colleges for the alert to students about the theft of any item and it can be also used to notify students of different years about the Labs and Lecture scheduled at the particular Labs and rooms.

III. REQUIREMENTS

A. Hardware

- 15 connectors which would be used to connect pins of the beacon device as per the defined description of the pins on beacon device.
- 2 colored sleeves (red + green) to distinguish between the ground and power source pin (Vcc)
- 2 colored wires (red + green)
- 2-coin cell + connectors/stand (1 meter)
- 3 switch (push pull) for the beacon power purpose.

B. Software

- Android Studio (SDK 4.4 and above)
- SQLite Database for the Storage and retrieval of records.

IV. IMPLEMENTATION

- In this beacon has various pins which is connected through male-female connectors and the beacon would accordingly have programmed through embedded C language.
- The circuit is designed in such that there is a coin cell battery and the battery and the push pull switch is connected through the coin cell and whenever the push pull switch is pressed the beacon would start and transmit the signals accordingly.
- There is a 3V battery which is being connected to the beacon device according to the battery power the RSSI (Received Signal Strength Indicator) [1] the signal strength the reception of the application would be possible.
- If the battery is of 15V battery and is connected to the beacon the range would be more and it would cover large area for the transmission and the mobile would receive the offers accordingly.

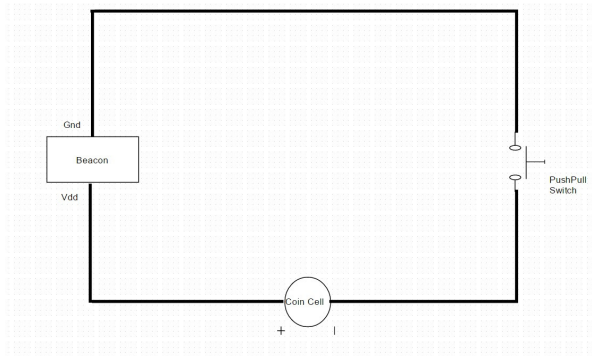


Fig.1. Beacon Layout Diagram

- In the above circuit there is a coin cell which can be 3V battery for power source to beacon device through Push Pull switch
- Whenever the Push Pull Switch is pressed the coin cell activates the Beacon device and beacon starts transmitting signals.
- The signals RSSI is programmed in android studio which is used to determine the proximity range and accordingly sense the range for the particular beacon device and display offers.

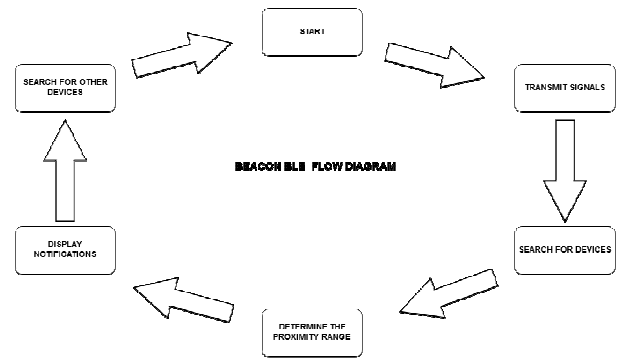


Fig.2. Flowchart of Beacon Device

The above figure shows the mechanism and working of the beacon device and its flow diagram which indicates the process by which the following working is performed

V. ALGORITHM

1. Bluetooth low energy device emitting advertisement following a strict format, followed by a variable UUID, and a major, minor pair.
2. Iterate through Minor IDs of Beacon and accordingly compare the proximity range which is defined in the system.
3. According to Proximity Range, determine which beacon device is within the range of the Smartphone, the ranges can vary from
 - Far
 - Near
 - Immediate
 - Unknown
4. Determine the closest range through some Location interface function with Received Signal Strength Indicator.
5. Accordingly connect or fetch the information for that particular beacon ID.
6. Search the Minor ID of the Beacon with the Minor ID stored in the Database.
7. showNotification () is invoked and will display the information.

8.

A. Algorithm Flow

```
let uuidString = "B9407F30-F5F8-466E-AFF9-25556B57FE6D"
```

```
let majorID = 1
```

```
let minorID = arrayOfString
```

```
let count = no. of beacons
```

if (count>=0)

For each minor ID

```

{
switch proximity
Case proximity.near:
msg = "You are near the beacon"
Case proximity.Immediate:
msg = "You are in the immediate proximity of the beacon"
Case proximity.far:
msg = "You are far away from the beacon"
Case proximity.Unknown:
msg = "No beacons are nearby"
}
distanceId:Determine_Location(proximity)
Compare distanceId with stored minorId in database
through connectivity and
Trigger showNotification()[4]
    
```

Unique Identifiers



Fig.3. Unique Identifiers

The figure above shows the format of unique identifiers Beacons are Low Proximity Transmitters.

A Proximity UUID (universally unique identifier) [3]:128-bit value that uniquely identifies one or more Beacons as being of a certain type or from a certain organization. This identifier is mandatory.

- A major value: 16-bit unsigned integer used to differentiate Beacons that have the same proximity UUID.
- A minor value: 16-bit unsigned integer used to differentiate Beacons that have the same proximity UUID and major value.

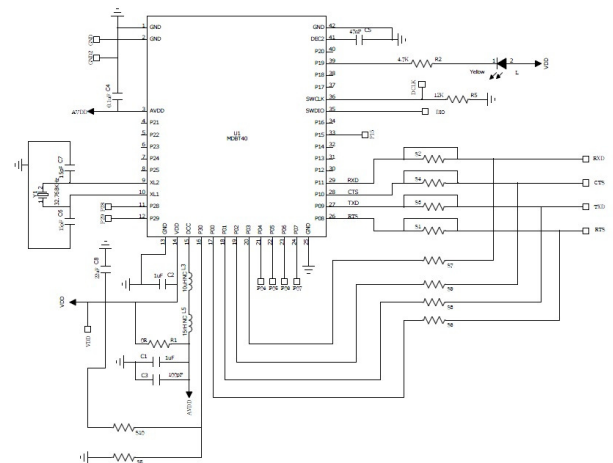


Fig.4. Pin Diagram of Beacon Device [7]

Pin configurations includes: [7]

1. Reset: The reset button is connected to the interface. Switch can be on and off by pressing the reset button.
2. Power Supply: There are several power options
 - a. USB
 - b. External power supply through P1 (1.8V to 3.3 V)
 - c. Coin cell battery.
 GPIO interface: Pins through which buttons and LED's can be connected.
3. UART configuration: Below table shows an overview of the UART connections and the interface. TXD means data to be transmitted. RXD means Data to be received.

nRF51822		Interface MCU
Default GPIO	UART	UART
P0.09	TXD	RXD
P0.11	RXD	TXD

VI. WORKING PRINCIPLE

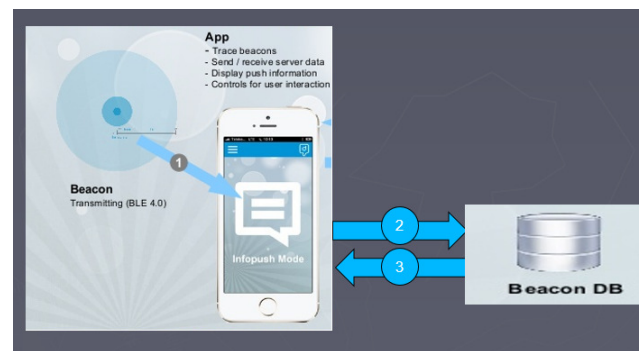


Fig.5. Working Principle

Figure gives the full description about the working of beacon device with the software application in real-time. The Beacon device continuously transmits signals within its proximity range.

This figure shows the 3 step process.

- Step1: The Bluetooth device when comes within the proximity range it detects the beacon device.
- Step2: After tracing beacon device the application installed in the smartphone sends the beacon's UUID, MajorID and MinorID to the Beacon Database.
- Step3: The smartphone application receives the information related to that particular beacon and application notifies that information to the user. After this the user controls the application depending upon its level of interest.

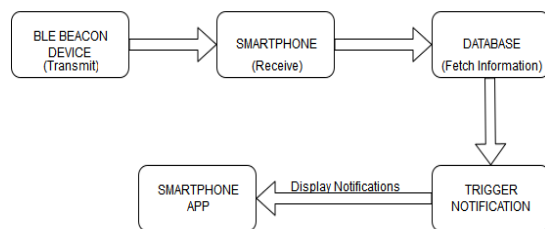


Fig.6. Flow of Proposed System

To implement this working we have proposed the flow of the system. Figure shows the flow of our proposed system. BLE Beacon device continuously transmits the signal. The smartphone device will receive the signal and fetch the information about detected beacon from the database. The database used in this system will be SQLite database. The database will trigger the notifications that will be displayed in the smartphone application.

A. MERITS

1. The device is scalable it can be used for any type of application.
2. Easy to maintain.
3. Ease of Understanding in order to use the device because there is only a small device which would transmit signals and application would receive notifications.
4. Less Expensive.

B. LIMITATIONS

1. The beacons transmit low energy signal when the battery is low.
2. There is an interference in signals whenever two signals meet.
3. There can be delay in reporting and therefore once the signal is detected by the mobile device the other mobile devices speed may vary for detection of signals.

4. The signals can be duplicated and it would be easy to spoof signals.

VII. ACKNOWLEDGMENT

Through this acknowledgement, we express our sincere gratitude to all those people who have been associated with this project and helped us with it and made it a worthwhile experience. Firstly, we extend our thanks to the various people who have shared their Signatures. Our deepest thanks to Ms.Sai Deepthi Pabba, the guide of our project for guiding us with attention and care. Also, we would like to express our gratitude to Prof. Uday Joshi for helping us. We would also thank our institution and our faculty members. We would like to again extend our sincerest gratitude to our esteemed mentor for this project, Prof. Sai Deepthi Pabba.

VIII. CONCLUSION & FUTUREWORK

Our proposed system is to create a new technology out of the existing technology of iBeacon [5] and to extend it to the today's technology like Android devices. We have also developed an Android App to monitor all the aspects of Beacon device and to store all the data within the App using SQLite Database. Beacon device would be deployed to the retail marketers that would make more profit in India for any of the sales purpose in the mall. Our Future Scope is to extend this project for the iOS devices.

REFERENCES

- [1] Maria Varsamou & Theodore Antonakopoulos, "A bluetooth smart analyzer in iBeacon networks", International Conference on Consumer Electronics - Berlin (ICCE-Berlin), INSPEC Accession Number: 14917193, Page No (288 - 292), 7-10 Sept. 2014.
- [2] Louay Bassbouss , Gökem Güçlü & Stephan Steglich, "Towards a remote launch mechanism of TV companion applications using iBeacon ", IEEE 3rd Global Conference on Consumer Electronics (GCCE), NSPEC Accession Number: 14904692, Page No (538 - 539), 7-10 Oct. 2014.
- [3] Cheolhoon Kim & Sungwon Lee , "A research on Beacon code architecture extension using category and code Beacon structure" , International Conference on Information and Communication Technology Convergence (ICTC), INSPEC Accession Number: 14833413 , Page No (187 - 188), 22-24 Oct. 2014.

WEB REFERENCES

- [4] <http://ibeaconmodules.us/blogs/news/14702963-tutorial-swift-based-ibeacon-app-development-with-corelocation-on-apple-ios-7-8>
- [5] <http://www.beaconsandwich.com/what-is-ibeacon.html>
- [6] <http://developer.android.com/reference/android/database/sqlite/SQLiteDatabase.html>
- [7] <http://redbearlab.com/blenano/>
- [8] <https://mobstac.quora.com/What-are-the-limitations-of-beacons-And-what%E2%80%99s-the-way-around>