Bluetooth Low Energy: Need of the Hour

Ankita Singh

Dept of Electronics and Telecommunications,
Indira College of Engineering and Management, Pune.
singhankita119@gmail.com

Abstract: It appears fantabulous to be a part of fast apprehending complete big tech internet world, which is capable of connecting millions and billions of devices to internet. But it seems a little bizarre that to interact with each smart device, user would have to download a separate mobile or tablet application. We are here to deal with the same problem using beacons in this paper.

Keywords: Beacons, Physical web ,IoT, Ecosystem, Eddy stone.

I.   INTRODUCTION

Now-a-days world is becoming opportunistic for the mass to communicate digitally with their surroundings on the fly. When it is quote example, the first which strikes the mind is many electric meters are helping users to clear your electricity bills sitting in any corner of the world; user can rent a car using their mobile phones etc. but for the innovators, it seems difficult to prelude contextual experiences that people can easily access. Users aren't ready to install app for every purpose though there is a prevalence of smart devices and at the same place and to get rid of this problem seed of physical web is sown.

- It's an open source approach nurtured by Google
- Build contextual interactions that people can innovate and use with ease.

The core power of web is to interact on demand, which itself defines the physical web. Through this; people will be able to interact to any smart device – a poster, a vending machine, a bus stop, a rental cab and the time has finally ended when you used to download a separate app for each of them.

II.   WHY IS SUCH AN ECOSYSTEM REQUIRED?

In the upcoming days, the number of smart devices is going to deluge assuming that for each smart device, we would need to install its own mobile app, it doesn't seem pragmatic. So in such scenario, we would need a system which would allow universal interaction for all kinds of smart device and the physical web stands for this. If we move according to the physical web, we would have a common application for interaction with all smart devices.

III.   HOW DOES THE PHYSICAL WEB FUNCTION?

It is beacons which make physical web a reality. In the upcoming days, our approach on accessing information would change forever. Tiny beacons would be placed beneath our feet, on streetlights, underneath the product in the stores, on the movie posters in the malls, those would broadcast Bluetooth signals. A new network of beacons is formed in which some of the beacons would get online, others would talk to each other, and most of them will communicate with our phones.

IV.   WHAT DOES A BEACON REALLY SIGNIFY?

Tiny Bluetooth radios which have a very short range signal are called beacons. Nearby beacons are scanned by the app present on phone. It's our mobile phone which carries on simple and complex actions after scanning the nearby beacons and one of the simplest actions for your phone will be to receive alerts. Example can be listed as to unlock a door using your mobile, switching on/off the electrical appliances as you move from one room to another. On the other side these beacons can also perform certain complex tasks such as monitoring, mapping and transactions which can be acquired using the web connections present on your phone. Example you

- According to the time you spent in the gym.

- As soon as you enter the any multiplex and start watching a movie

V. ESTABLISHMENT OF PHYSICAL WEB

The essential tools required to get started with the physical web are:
- A beacon [or two] that advertises packets.
- Software available on your mobile phones which recognizes these packets and takes suitable action.

VI. BUILDING STONES HELPFUL IN CONSTRUCTION OF BLE ENABLED BEACON

Any of the microcontrollers which have Bluetooth stack [BLE] can be used for building the beacon. Microcontroller board which has an on-board BLE chip would do the same such as Linkit one mediate whereas we can also go for BLE chip which wouldn't contain an on-board BLE chip in them. Example: Ardvino Uno with a redbear lab BLE shield.

When a beacon is sending out signals it uses an advertising mode, which is supported by BLE and using this mode, the beacon would repeatedly advertise its name. The code which is to be uploaded into the microcontroller should definitely include the advertising name and the relative positions of these beacons can be detected using mobile application with the help of signal strength [RSSI – Received signal strength indicator]. The two beacons should be named differently so as to distinguish them easily on the application side.

Which summarizes as the microcontroller needs to transmit the frames in such a method that it can be detected and decoded using mobile phones. We can get an idea for the packing of data from Google's Eddy stone project. Eddy stone is a protocol specification that depicts a Bluetooth low energy message format for vicinity beacon messages. The different types of frames which can be used depending upon their applications are now available in the project.

At present, the project gifts us three types of frames which are URL frame, UID frame and TLM frame. The specific uses of these frames are given below:

- URL Frame: transmit web URL's
- UID Frame: transmit the unique identity of beacon and using this unique ID's beacons is distinguished.
- TLM Frame: transmit the telemetry information about the beacon such as battery voltage, beacon temperature etc.

The URL frames are transmitted using a compressed encoding advertisement packet. Once you receive the packet, it is decoded by an app on the mobile phone / tablet.

VII. SETTING UP THE MOBILE APPLICATIONS

Following characteristics should be included while building this application:

- The app should be capable enough to listen to the nearby present beacons
- A notification should always be shown, whenever a beacon is detected
- The list of available beacons present nearby should open as the user taps the notification.
- The webpage of the URL associated with that beacon should open as soon as a particular beacon from the list is tapped. The physical web isn't just limited to the advertising of packets but using these packets we can also detect the vicinity of beacons.

VIII. GOING DEEP INTO THE PHYSICAL WEB

One of the crucial issues to be dealt is SECURITY & PRIVACY, before turning the prototype into product which can be implemented in N no. of ways. Some of them are listed: we can be clandestine the URL i.e. by using a non – branded domain or else we can also keep a long session for the webpage, else we can only allow local network to access the webpage.

We can't assume the communication to be limited between beacon and mobile phones / tablets to be limited only to Bluetooth as Wi-Fi can also be used to implement this protocol. Since it is popularly that power is most prominent issue with all IOT devices and in such cases Bluetooth proves more efficient when compared to Wi-Fi.

The present method used for user tracking is based on Bluetooth broadcast. In the same approach, the beacon advertises the packets which gathered by user's mobile phone without connecting to the beacon which suggests that user's identity is not revealed i.e. it acts like a deep throat.

But if the user once clicks on the received URL message, they are then known to the webpage. This user can serve as a boon in future to enrich users browsing experience.

With so many useful applications of this project, we can move ahead with it keeping in mind the four basic pillars succouring the physical web:

a) OPEN SOURCE: The entire project serves an open initiative so that more and more innovators can come together and enrich their experience.
b) BLUETOOTH [BLE]: It is most appropriate for IOT device with the advantage that BLE is energy efficient.
c) URL's: Users are offered URLs not applications for each separate device.
d) SEARCH ENGINE: ranked list of results based on previous history, signal strength, user preferences should be made available with the user.

Basic elements to be present in the mind while establishing the environment:

- The profile needs to be same for mobile in order to communicate with Bluetooth enabled device .e.g. the mobile/ tablet should have support for GATT profile, if the device is using the GATT profile.
- By the way if using Eddystone protocol specification, then Eddystone's PDU frame must follow Bluetooth CSSv5 and should contain Eddystone UUID, for allowing background scanning of beacons.
- As versions above Android Lollipop 5.0 are preferred by
- Eddystone and in such case avoid using older android versions if you want to be benefited with the same.
- Avoid using older Bluetooth stack on the microcontroller side.

CONCLUSION

Last but not yet the least the physical web has come up with a feature of interaction on demand i.e.it is an approach of internet of things .it can interact with the objects present around us such as vending machine, parking meters, shopping stores, we need not download a separate app for each of them.

ACKNOWLEDGEMENT

REFERENCES

[1] Dr. Subhadra Rajpoot physical web using BLE international Conferenceon innovation and challenges in cyber securty 2016.
[2] Moook Choi, Wan-Ki Park, Ilwoo Lee, "Smart Office Energy Management System Using Bluetooth Low Energy Based Beacons and a Mobile App", International Conference on Consumer Electronics (ICCE),IEEE,2015,pp. 501-502.
[3] Ramsey Faragher, Robert Harle," Location Fingerprinting With Bluetooth Low Energy Beacons", Selected Areas in Communication,Journal,IEEE,volume-33,issue-11, pp.2418-2428,2015
[4]DarrelEtherington,"http://techcrunch.com/2014/10/02/google-thephysical-web/",Online,Internet,Posted October 2, 2014
[5] Teodor sumalan Eugen lupu "low cost wireless system for patient monitoring" IEEE 2015 pp 4673-7545.
[6] M. Radhakrishnan, A. Misra, R. K. Balan and Y. Lee, "Smartphones and BLE Services: Empirical Insights," *Mobile Ad Hoc and Sensor Systems (MASS), 2015 IEEE 12th International Conference on*, Dallas, TX, 2015, pp. 226-234.
[7] Jeong Gil Chenyang Lu, "Wireless sensor for health care" vol 98 2010 pp 1947-1960.