Attendance system using Beacon Technology

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Abstract-Beacons act as a backbone of Internet of Things. Beacons are simple devices, which determine the proximity. The beacons send simple Radio Frequency signals to determine the nearness. The attendance plays a major role in an organization. Being in a fast moving world, the traditional method is time consuming. The beacons play a major role in determining the proximity. The member ID card in the organization can embed with Beacons. These beacons can send the radio frequency signals, which can be received by the Beacon receiver. The existing system has the beacon embedded in the mobile phones. If the user doesn't carry their mobile phones, it would serve as a major problem. But all the members carry the ID card, which is mandatory in most of the organization. When the receiver identifies the beacon, the attendance would be marked automatically. The track of the beacons can be done and the attendance can be maintained throughout. This activity can be recorded and used for further reference.

Keywords-Beacons, Internet of Things, Beacon Receiver, Radio-Frequency Signals.

I INTRODUCTION

Internet of Things is simply nothing but the devices or the physical object that exchange data to communicate with each other and perform the assigned work. In such an atmosphere, beacons are playing a major role in Internet of Things as they send the radio frequency signals saying, "Here I am". These beacons act as transmitter only. They do not send any sort of data to the other devices. This way it is more efficient and secure. The Universal Unique Identification (UUID) identifies the beacons. The UUID can further be identified with major ID and minor ID.

The underlying technology of Beacons is nothing but the Bluetooth Low Energy. Bluetooth provides the complete platform for the beacon technology. The Bluetooth incorporated in the device can easily identify the group of the beacons. The beacon sends out its UUID about ten times every second (sometimes more, sometimes less, depending on the settings). A nearby Bluetooth-enabled device, like your phone, picks up that signal. When a dedicated app or software recognizes it, it links it to an action or piece of content stored in the cloud and displays it to the user.

(A) Features of Beacons:

- Efficient battery life
- Platform Independent
- Precise tracking of the objects
- User-friendly navigation
- Unique Identification
- No data exchange and more Security
- Efficient interaction between the objects

(B) Applications:

- In retail stores and Offline payment
- Street lights on and off
- Attendance system
- Notification on arrival
- Activating devices based on proximity
- Data analysis
- Geohopper to call a web hook
- Activity tracking

II LITERATURE REVIEW

Attendance system using beacons has been implemented in numerous industries and organizations. The attendance is taken efficiently using beacons in the mobile phone. The radio signals sent from the mobile are identified and the attendance is marked as present. This paper proposes a system to replace ID cards embedded with beacons instead of mobile phones with beacons. The proximity of the beacons in the mobile phone with beacons is tracked as it comes close to another Beacon. The beacon receiver marks the member of the organization as present. Further, as the member enters the campus he also can view the updates of his day in his mobile phone.

The presence of the member of the organization will be registered when they arrive near the beacon. In this, the app has to constantly send data whenever it synchronizes and get a chance to connect to the mobile data or Wi-Fi. Depending on the type of beacon either, Eddystone or iBeacon, configuration has to be changed constantly. This serves as a major problem when the OS of the mobile varies.

The beacon distance can be calculate with four proximity zones, namely,

- Immediate (very close to the beacon receiver)
- Near (about 1-3 m from the beacon receiver)
- Far (if there is too much signal fluctuation or far away)
- Unknown

The software such as MacBeacon from Radius Networks, Evothings Workbench is generally used in the backend for tracking the beacons. The browsers like Calamari, All hour as well engage in various attendance tracking systems.

The existing system of the attendance management include, the traditional method marking attendance manually which was later improvised with biometric attendance management system. Then it was upgraded by RFID tracking followed by Bluetooth Low Energy with Beacons. This system consists of beacons, which is in the mobile phones and is tracked accordingly. Based on this, the application updates the data to the server and is efficiently elaborated for further updating and manipulation of data.

The main drawback of existing attendance management using mobile system is that it requires a constant Internet connection in the mobile. The student should always carry the mobile or the gadgets always for the purpose of attendance.

III PROPOSED WORK

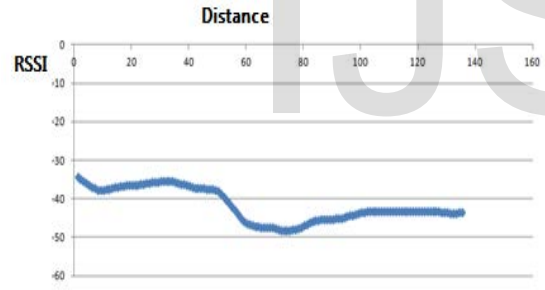
The work proposed is embedding the Beacons in the ID card of the member of the organization. The beacon receiver can identify the beacon and automatically mark the attendance for the respective student based on the unique ID, automatically.

The beacon broadcast its signal with power known as, broadcasting power or the transmit power. The value ranges between -40 dBm and +4 dBm. The broadcasting power has a direct impact on the signal range. That is, more the power, more stable the signal would be. But it has negative effect on the life of the battery. The range of beacon is up to 70m (+ 4 dBm). But in real world it can be expected to range up to 50m. The long range Beacons' can broadcast the signal up to 200 m. The beacons generally broadcast its signal between a range of 100ms and 2000ms. Shorter the distance more stable is the signal would be.

Generally, RX and RSSI are used to measure the radio signal strength. Both RX

and RSSI (Received Signal Strength Indication) indicate the power level received by an antenna. The difference between RX and RSSI is that RX is measured in milliWatts (mW) or decibel-milliwatts (dBm) whereas RSSI is a signal strength percentage. The higher the RSSI number, the stronger the signal would be. Unlike RX, RSSI is a relative measurement that is mostly defined by each chip manufacturer. There is no standardized relationship of any particular physical parameter to the RSSI reading. For example, Manufacturer A could have an RSSI max value of 100 while Manufacturer B will return RSSI values anywhere from 0 to 127. However, on one specific chip, we could have a mapping of an RSSI value to a particular physical RX value. For some platforms, only RSSI data is available from the high level API.

Below is the example of the RSSI variation with respect to distance.



The beacon receiver generally consists of RSSI (Received Signal Strength Indication), for measuring the radio signal strength. The RSSI can give an accurate result based on the fluctuation of the radio signal. Based on the strength of the signal the proximity can be determined. The beacon's transmit power is in packet structure, and the receiver have an RSSI. Using the RSSI and TX power, the receiver can estimate the distance.

The RSSI value may change on fixed location or distance. A factor for variation could be the hardware or the radio platform. For example, in an iOS device there aren't many different chipsets, the RSSI value could accurately reflect the relationship to the distance. The RSSI value from iPhone A probably means the same strength value on an iPhone B. However, on Android devices where we have a large variation of devices and chipsets, the absolute value of RSSI won't help you easily map to a location. The same RSSI value on two different Android phones with two different chipsets may mean two different signal strengths. However, the RSSI value could still be very helpful in the proximity applications if you use it to get the trend of the RSSI value change. That trend could give you meaningful data.

In future, the Bluetooth is likely to incorporate Angle-of-Arrival (AoA) and Angle-of-Departure (AoD) features, which allow determining the spatial location of Bluetooth devices. AoA and AoD will provide high-accuracy location detection, potentially giving position accuracy to within tens of centimeters.Until AoA and AoD are standardized, the RSSI + TX power calculation is the best proximity measurement, and changes unpredictably with the real world of walls, weather, people, and propagation.

The below table represent the TX power, RSSI at one meter and Range (in meter) relationship.

TX Power	**RSSI at 1meter**	**Range (meter)**
0	-115 dBm	2
1	-84 dBm	4
2	-81 dBm	10
3	-77 dBm	20
4	-72 dBm	30
5	-69 dBm	40
6	-65 dBm	60
7	-59 dBm	70

In this, the scenario turns out completely; when the member of the organization enters, the beacon receiver detects the radio

signals send out from the beacon. The beacon receiver, in turn marks the person identified with the particular beacon (UUID) as present. The data of the beacon entering and leaving the campus could be easily monitored with the movement. Thus, in this methodology, use of mobile phones for the attendance can be replaced with ID cards, which serves as a mandatory entry pass for every organization.

(A) *Application:*

- Can be applied in colleges for attendance monitoring.
- Can be used in industries to track the employees.

(B) *Advantage:*

- The manpower required for maintaining the data is less
- Dependency of mobile phone can be reduced through this method.
- Maintenance is easy

IV CONCLUSION

By implementing Beacon technology with the help of Internet of things (IoT) every simple work can be minimized. Internet of things being the new emerging technology and Beacons being a backbone, it would create a great change in various organizations. IoT will reduce every work of the human through the communication between the devices. This attendance management using Beacon technology will greatly benefit various organizations efficiently. This system is specifically efficient for the organization to use the ID card preferable to mobile phones for tracking the person.

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