PROXIMITY BASED OBJECT DESCRIPTION SYSTEM FOR MUSEUM USING BLE BEACONS

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Abstract: The Museum Assistant application for Museums, Art Galleries and similar places will display the Audio/Video description and other textual information about the art pieces or monuments. It also includes smart light system for museum which helps to save electrical energy. These application features makes touring and sightseeing more interesting and digitized. Switching from tedious paper guides to mobile application guides will allow the tourist to get a new experience to explore and understand the history better. The user can reserve tickets, get basic information about the museum and also provide valuable feedback**.**

Key words - Museum Assistant, Bluetooth low energy, BLE Beacon, Firebase

1. INTRODUCTION

Currently, museums rely on the traditional methods to display information to the visitors which makes it tedious and an uninteractive experience for the visitors. Our system is designed to minimize the hassle and make it a user-friendly and interactive experience for the visitors. Also, the system will help the museum authorities to track and analyse the visitors. The proposed system will first scan the Eddystone UID provided in the ticket. On scanning this UID, the app will provide the museum guide from the entry to the exit of the museum. When the tourist is in an artefact range, the application will automatically provide the information of that particular artefact. At the end of the museum tour, the visitors provide their valuable feedback.

The traditional method that most of the museum follow is an age old method. A label is displayed in front of every monument/artwork on display in the museum. This traditional way provides very limited information and does not interact with the visitor whatsoever. This makes the museum visiting boring for some visitors. Few museums have taken an extra step to digitize this process by developing a system that makes use of a QR Code that is attached near every monument/artwork present on display in the museum. The visitor uses an android application that scans the QR code and displays the information about the monument/artwork. This systems makes the user perform extra steps in order to obtain the information, which few visitors are not comfortable with. Thus, this method is not the ideal one.

The Basic Museum Information is now ready for the users to view. The user can access basic information regarding the Museum like Timings, Directions, Current Exhibits, Ticketing Information, etc. Detection of Art piece using BLE Beacon is successful. Reservation of tickets along with the feedback form module of the application has also been completed.

2. RELATED WORK

Taking reference from paper presented by K. Sornalatha and V. R. Kavitha the authors system relies on a Raspberry Pi as a wearable device that will capture the user's movement, does the background subtraction algorithm to perform Image processing and it gets the localization information from a Bluetooth Low Energy (BLE) which is fixed in the museum. Hence, this wearable device will increase the performance of the whole system by sending only matched frame to cloud processing center. All the artwork and related multimedia contents need to be uploaded to cloud. By doing so, everyone can easily access the monument/artwork profile and history through smart phone by using the mobile application. [1]

Taking reference from paper presented by Amruta Mane, et. al. the authors application makes use of an android application that scans a QR Code present at each monument/artwork to display information about the same. The system also provided a ticketing system within the same application itself. Online approach for ticket booking for museum reduces paperwork and creates transparent system. According to the authors, this method of implementation is fairly simple and many museums were ready to test

this system with a very positive outlook. The author believes that this system will support to eliminate and reduce the problems faced by the current systems. Also, this system is designed particularly for the needs of a Museum so that it could carry out its operations in a smooth and efficient way. [2]

Taking references from Mighali, Vincenzo, et. al. which uses the Bluetooth low energy technology for processing the images. They produced the system to improve the culture of the user as the tourism plays important role in modern society. Mainly they produce the system for indoor location based using the Bluetooth low energy, the wearable which can used by the users which provides the function of capturing the images processing the images related to user point of view and the user accessible mobile device which used to display the information.[3]

Taking reference from paper presented by Stefano Alletto, Rita Cucchiara, Giuseppe Del Fiore the authors relies on Bluetooth low energy for images recognition. They have proposed the wearable device to display the information about the museum specifically. In this case the proposed system interacts to the cloud to fetch the data and share among the user wearable devises. The main difference is the device is interacted with the middleware hardware. [4]

Taking the reference from the journal by Basalamah, Anas the author relies on Bluetooth Low Energy (BLE) instead of Radio Frequency Identification (RFID) for identifying the person from the cloud, as the RFID is more expensive than the BLE. Each user has its own Bluetooth Low Energy tags. They proposed the user application which runs on mobile smartphone which used the Bluetooth Low Energy tags for detection. This application is used to find the multiple persons which are in range of the mobile application. As the user clicks on the start collecting button mobile application starts collecting the tokens within its ranges and displays the number of tokens detected by the application. This technology helps to find the solders if the any one of the solders is missed or get injured. Then this system will easy to find the tokens, since the Bluetooth Low Energy has long battery life. So the main moto of this paper is to use Bluetooth Low Energy is the working of proximity detection of the Bluetooth Low Energy. Hence this technology is easy to detect and send the information to users. [5]

3. METHODOLOGY

The user has to download an application on to his/her smartphone. The user can find all the details about the museum like contact information, timings, directions, current exhibits, etc. The user can also purchase tickets for the application itself. The application contains all the information of a given artwork/monument in the form of audio/video/images. The user will be provided with a Unique ID along with the ticket he/she purchases. The Unique ID will be used by the visitor to login in the app. After login, the user has to enter his/her personal details and can now enjoy the experience. Each monument/artwork will be equipped with a BLE Beacon. When the visitor enters the range of the monument/artwork, an action will be triggered within the app. The user can now see the information of the artwork/monument in the form of audio/video/images. When the users exits the range of the monument/artwork, the information will disappear from the app. The same process will be repeated for each of the monument/artwork the visitor visits. Along with the triggering of information, the application will also trigger the on/off switch of the lights upon visitor/entering or leaving the monument/artwork. The visitor can track his/her progress throughout the visit. During exit, the user will be prompted to provide a feedback on the visit. The administrator will be provided with web portal from where he/she can access purchased ticket details, add/remove monument/artwork information, access and analyse the feedback provided by the visitors.

To implement the above, we will be using an android application which will be used by the visitor and a web portal for the museum authorities. The application will be detecting the range of the BLE Beacon which will be attached to each monument/artwork. For implementing the smart lights, the lights will be connected to a Relay, which will be connected to NodeMCU. The NodeMCU will be connected to a cloud based realtime database i.e. Firebase, which will toggle the switch based on user entering or leaving the monument/artwork.

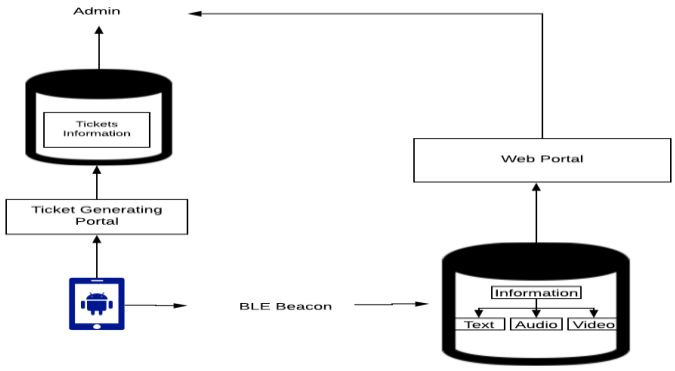

Fig 1: System Architecture

The Bluetooth Low Energy is wireless sensors personal area network technology. The Bluetooth Low Energy has two types one is Proximity Tag and another is Proximity Beacon. The BLE Beacon is used to detect the information. The recent version of BLE Beacon is Bluetooth 5.0. The BLE Beacon has default battery life minimum 3 years and maximum upto 5 years. The maximum range of BLE Beacon Bluetooth is 100 meter you can change the range from 1 meter to 100 meter as per user requirements. The SDK used by the BLE Beacon are Proximity SDK and the Estimote SDK. This BLE Beacon work as accelerometer, temperature measure, ambient light. The NFC and the RGB LED are the additional technologies that can support to the BLE Beacon.

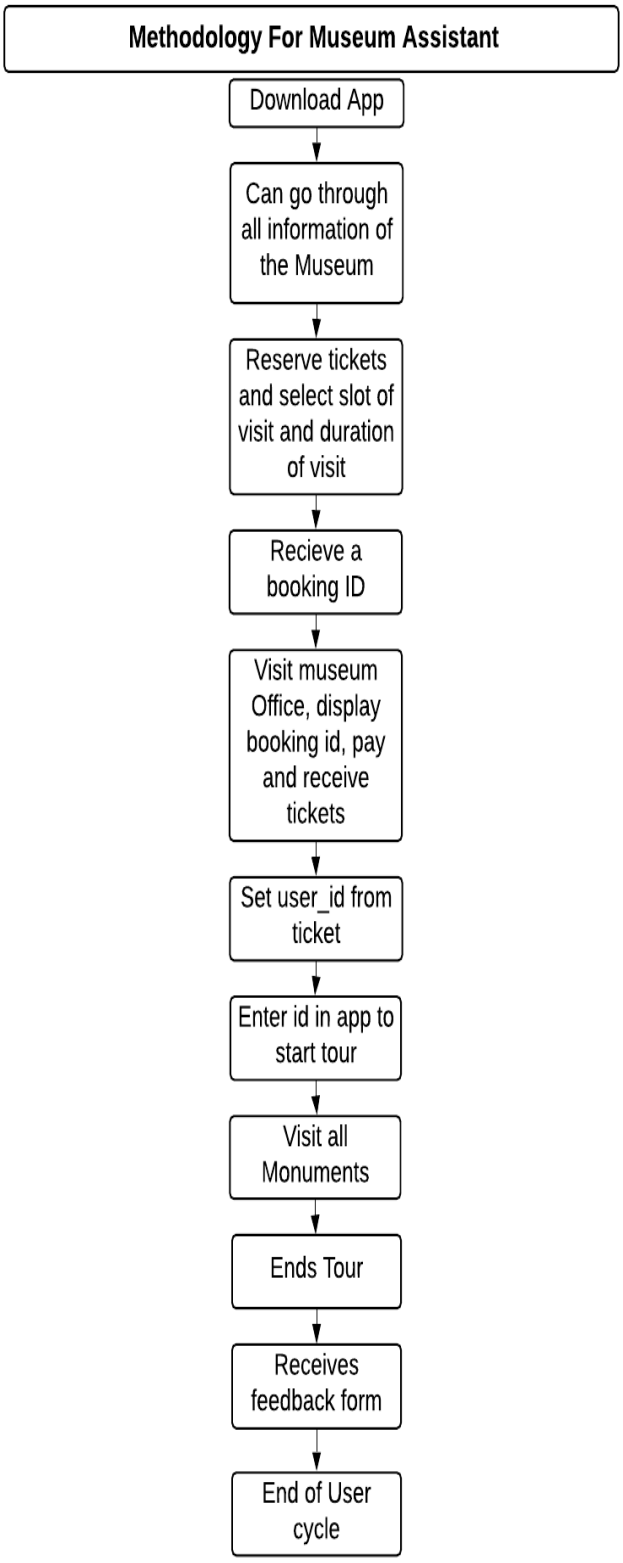

Fig 2: Methodology for Museum Assistant

The following features will be available for the user in the android application:

***i.*Basic Museum Assistant**

The user can view basic information about the Museum like Timings, Directions to the museum, Ticketing information, Current Exhibitions, etc.

ii. Proximity Based Object Description

As soon as a user enters the range of the monument/artwork, the description will be shown in the form audio/video/text.

iii. Ticketing Portal

The users can purchase their tickets to visit the museum from the application itself. The Unique Ticket ID will be further used to enable the Object Description System.

iv. Feedback Form

Upon completing the visit, the user can submit the feedback and share their experience with the Museum authorities so that they can improve the experience.

4. WORKPLACE DEPLOYMENT

The Museum visitor has to download the Android Application to access all the features. The user (also visitor) can view all the information of the museum like current exhibits on floor and other details about the museum. The user can reserve tickets for visiting the museum. The payment of the same can be done in person at the museum. Apart from this, the major feature of the application is the proximity based object description system.

The user can visit the 'Ticketing' tab in the application to reserve their tickets. The user has to select the No. of tickets, Date, Time Slot and Duration of visit during the Ticket Reservation action. The user will be provided with a Reservation ID which he/she has to present to the Ticketing Counter at the museum. The museum employee will verify the Reservation ID. Upon confirmation, the user would be asked to pay for the ticket. After the payment is done successfully, the User will obtain a ticket with a unique UserID. The UserID will further be used to enable further features in the application.

After entering the museum, the user has to enter his UserID when prompted. The museum will be equipped with Bluetooth Low Energy based Beacons that will be placed in front of each exhibit. Each Beacon will be having a UniqueID that will recognize each Beacon and the exhibit it is assigned to. When the user enters the proximity of the museum, while keeping his application open, the Beacon will detect the presence of the user and his/her device. The app then identifies the UniqueID of the beacon and identifies which exhibit he/she is visiting. The app then triggers a URL based on the beacon. The URL is a webpage of all the details of the current exhibit that the user is currently in proximity of. The user can then interact with the web page and access all the information about the exhibit in terms of Audio, Video, Text and Images. If the user exits the proximity of the Exhibit Beacon, the webpage will disappear from the user's application.

When the user has visited all the exhibits and wants to exit the museum, he/she can press the 'Exit' button. After clicking the 'Exit' button, the user will be redirected to the Feedback page. The user can fill the feedback form and proceed towards exit. The admin can later on view all the feedback entered by the visitors and use that data to further improve the experience for the users.

5. CONCLUSION

The proposed system has been designed for indoor locations. In near future, the system can be upgraded to use in outdoor locations while serving to more number of users at any given time. The system can be made more interactive by adding a trivia quiz and some other small games to keep the users interacting and more involved.

The proposed system focuses to solve a major issue faced by the museums and help them attract more visitors and make the whole experience more involving and interactive for the visitors. Furthermore, it also helps the museum authorities to analyze the data and improve the services provided to the visitor. This in turn, will increase the number of people visiting the museum and enjoying their experience.

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