

IMPLEMENTATION OF PROXIMITY BASED SERVICES IN THE CENTRAL LIBRARY, NITC

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Abstract:

Beacons are discreet physical low energy bluetooth 4.0 signal transmitting devices that can notify nearby bluetooth-enabled devices of their presence. This project aims to implement proximity based services in the Central Library, NIT Calicut, with the aid of the 'Beacon technology'. This report aims to divulge the details about the project by briefing about the motivation, problem statement, earlier works/implementations related to this project, a high level design, the proof of concept and the work plan for the next semester for the project.

Keywords:

Beacons, Eddystone, iBeacon, bluetooth, OPAC search, NIT Calicut, Angular JS, jQuery, HTML, CSS, Arbor JS, Java, XML, Github, Google developer, Koha, Object oriented design.

Introduction:

Beacon device is a relatively new technology, first introduced by Apple in 2013. Since then, this technology has been put into tremendous use in the retail sales. Now Apple and Google have come up with their own beacon packet standards, "iBeacon" and "Eddystone".

In this project, the aim is to setup the beacon devices in the Central Library and guide the users to the book's/rack's precise location in the stack room with the aid of a supporting android application. It would also be used to notify users about the various updates of the library (new books, journals, etc.).

With the successful implementation of this project, the users intending to borrow a book in the library would be able to search for a book on their mobile devices and would be guided to the book's location in the stack room, instead of having to search for a book in the OPAC search systems and manually searching for the rack number in the library.

Motivation:

In the present scenario, a user who intends to borrow a book from the library, has to wait in a queue for his turn to search for a book in the systems present at the entrance of the stack room. Based on his search query/keywords, a number of related results would be displayed. He then has to make a note/remember each of the rack numbers for the books and then search around for the rack, which is annoying and laborious. One feasible solution to this problem would be a mobile application where he could search for books and be guided to the book's location instead of having to remember and search for the rack in the stack room. This project aims to solve the above problem with the help of beacon devices and an android application developed to track the beacon signals.

Problem statement:

To implement proximity based services powered by the beacon technology in the Central Library, NITC, to help the users find their required materials with ease and to keep them updated with the updates in the library.

Related works:

Recently, many libraries in the US and UK have been starting to adopt the beacon technology. Like the 'Boston Athenaeum', Boston, Massachusetts and the 'Orlando's Orange County' library system, Orlando. With this technology, these libraries are "able to inform patrons about services that matched their interests". Within the library, beacons are being used to connect patrons with relevant electronic resources as they browse in specific sections of the library's stacks or they could share instructions for technology in the library as patrons approach devices. This project is also along similar lines, helping users to find their required materials easily and keeping them updated with the latest publications and arrivals.

The technology stack being used for the implementation of the project are - 'Android Studio' (i.e. Java and XML) for the application

development, 'Angular JS 2', 'jQuery', 'HTML' and 'CSS' for the stack room rack layout implementation, 'Arbor JS' for the graph and path plotting on the layout, 'Github' as version control system, 'Estimote SDK' for tracking the beacon signals and 'Google Developer API' for managing the beacon devices.

Design:

The project is essentially a software development project. Hence the designs are 'Object oriented designs' with the help of a few OOD diagrams.

Some relevant Object Oriented Design diagrams are depicted in the section "Object Oriented Designs" towards the end of the report.

Proof of Concept:

The beacon devices have already been shipped from 'Estimote', the device manufacturer. The whole project is planned to be implemented in three stages. The first stage - integrating the application with the device SDK. Second stage - Mapping of the library stack room racks with the books and their rack numbers (details to be taken from the library database) and implementing a search functionality in the application. Third stage - Adding the navigation feature, integrating the application with the library database.

The first stage of the project, i.e., integrating the Estimote SDK with the android application is complete, after a thorough study of the beacon technology and the SDK. Then, a map of the stack room layout was created as webpage using web technologies and it was integrated into the application with the help of an activity (an android user interface) that acts as an offline web browser serving the web page. Then, a search feature was implemented where the user searches for a rack number and the corresponding rack would be searched in the layout and would be shown to the user. Currently, the implementation of the graph and navigation path from the entrance of the stack room to the rack is in progress.

Screenshots of the existing application added in the section - "Screenshots of the present prototype" for reference.

Work plan for next semester:

The library search system is developed in 'KOHA', an ILS (Integrated library system). The next stage would involve a study of KOHA and development of its API's to communicate with the android application. Once this is implemented, the integration of the application with the library database would be complete. The user would then be able to search for a book on the application, the results for which would be fetched from the server. The details would include the related book's title, author and other details, the rack number of the book and status of the books (availability, damage, etc.). Then, the next step would be to fetch the user's precise location dynamically as he moves around in the library with the help of the beacon devices placed around the stack room and then show the navigation path from the user's location to the rack where the book is present. Once this is done, then the other features like showing the user the latest news about the new journals, publications, etc would be implemented in the application. There would also be a feature in the application where the user can store information about the books he has borrowed their due date and he would be alerted when the due date is near.

Conclusion:

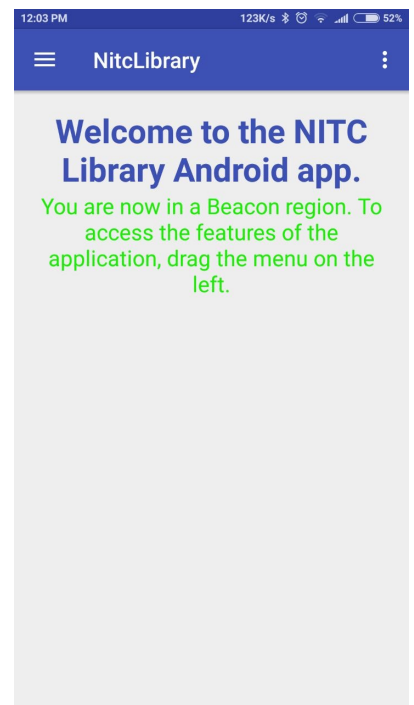
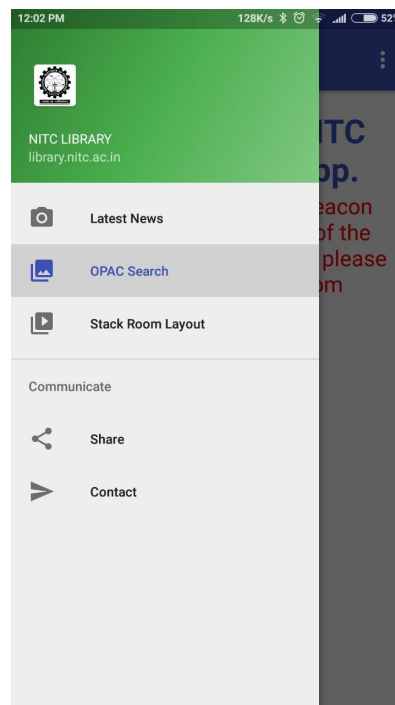
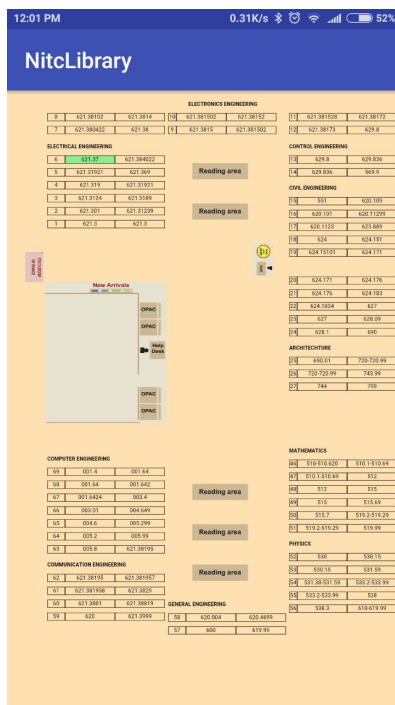
The technology being used - "Beacon Technology" is a relatively new one and this project is one of the very first implementations of this technology in India. And with the help of this project, we aim to solve a critical problem with a very simple solution and help the NIT Calicut community by making their task of borrowing books from the library effortless and facile.

References:

There are no relevant IEEE papers to this project. However, a few relevant links to the SDK and API's being used for this project are listed below:

- Google developers guide for beacons - <https://developers.google.com/beacons/>
- Beacons developer guide by Estimote - <http://developer.estimote.com>

Screenshots of the prototype developed:

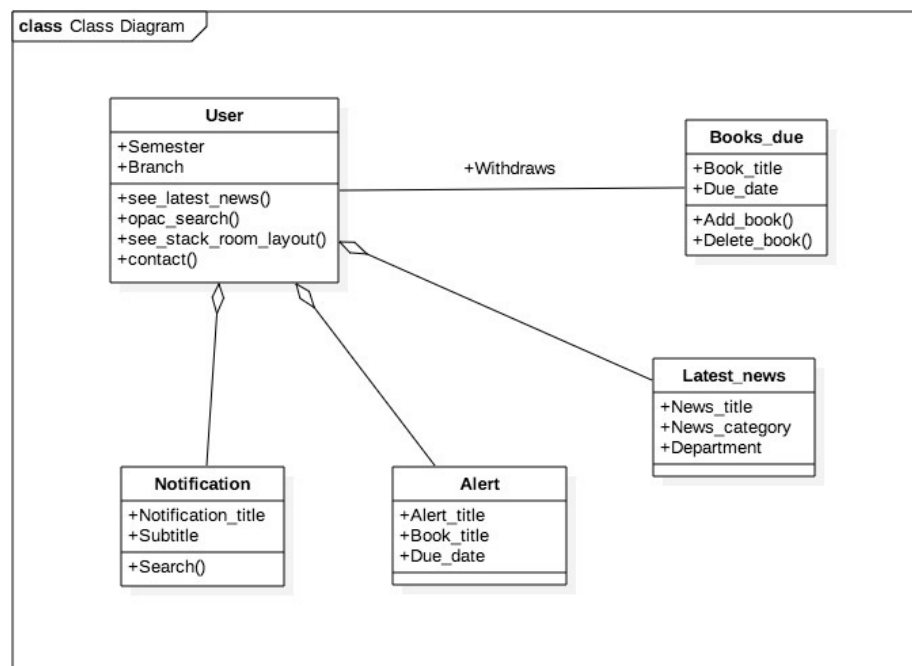


Object Oriented Designs:

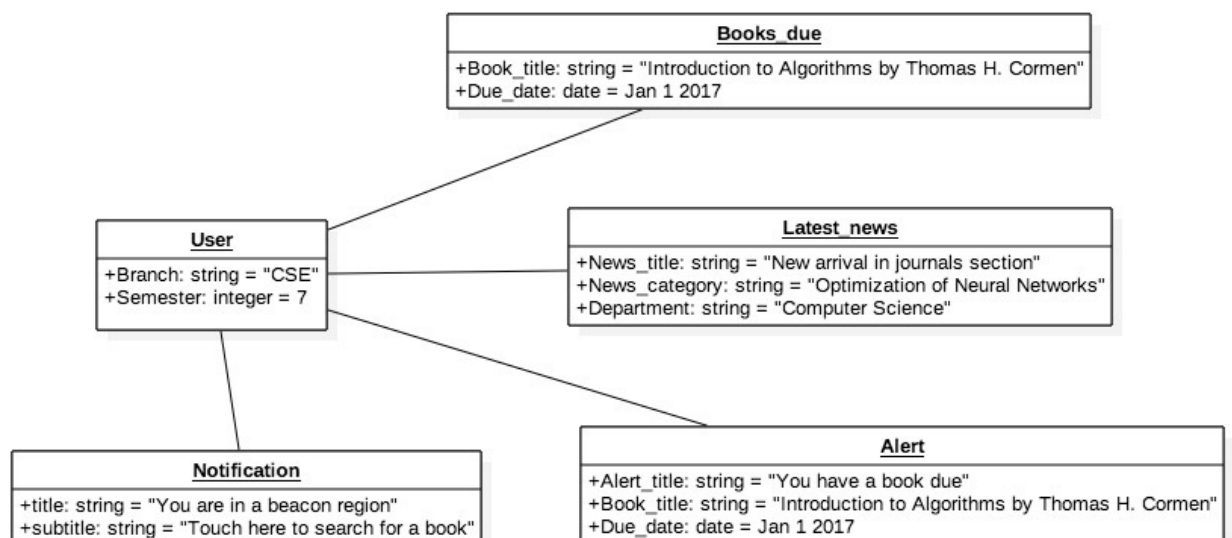
1. **ER Diagram:**



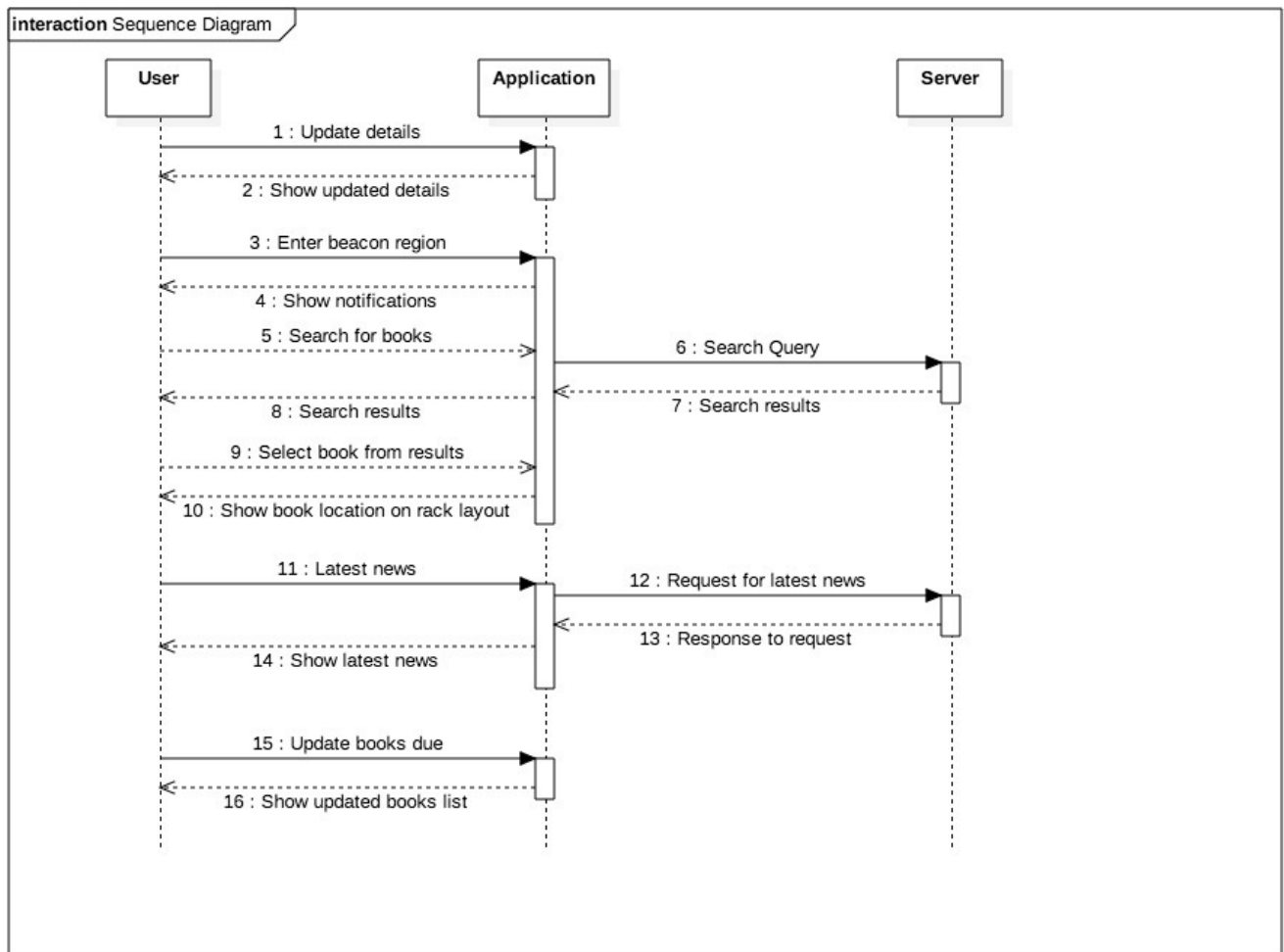
2. Class Diagram:



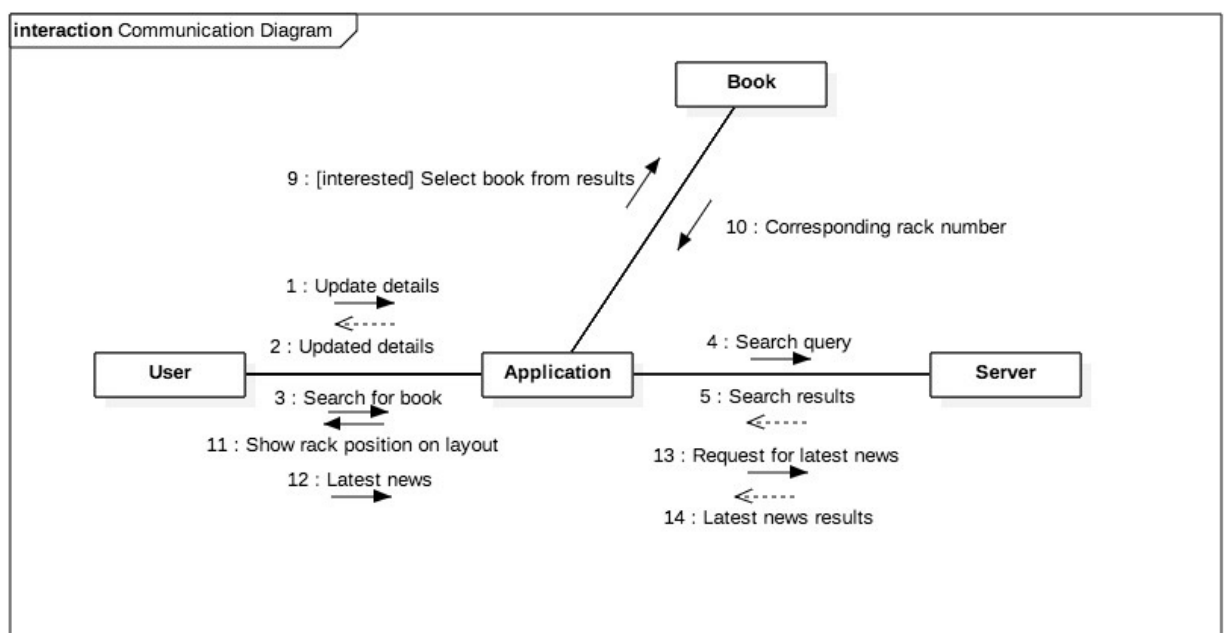
3. Object Diagram:



4. Sequence Diagram:



5. Communication Diagram:



6. Use Case Diagram:

