CO3302 Computer Engineering Project

LIB SYS - An Android Library Book Management System using Cloud services

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Abstract — This paper describes an android application for library management. It is called LIB SYS. Typical libraries face many problems due to their inefficient management methods. Many users face difficulties while getting their desired book. Using LIB SYS users can view all the details of the books in the libraries. They can borrow books directly or by post. Librarians can issue and add returned books without any writing work. It reduces the time of users and librarians and makes library management easier.

1 Introduction

1.1 Background

Books are a very important source of knowledge. Nowadays books are also in digital form (PDF, E-PUB, etc.). Libraries have a huge collection of various books. People can get books from library. But due to the lack of knowledge about the books available in the library and inefficient management of library, peoples face many difficulties while getting their needed books. Human errors and time-consuming methods in data entry, and Duplication of data make management inefficient. Travel restriction due to the pandemic also increases the difficulty of getting books. Because people need to go to the library to borrow books. So An application with features for Viewing and updating Books details, Borrowing books and can solve problems. LIB SYS is developed to solve these problems.

1.2 Description

LIB SYS is an Android Application. It efficiently manages the library using the cloud service. It has two interfaces. One for Admins (Librarians) and one for library users. Admins and Library users need to log in to enter the application. Admin and users can

create their accounts by providing their details. librarian need to provide their Library ID to prove he is a librarian.

Users can view the books, download the e-books, and borrow books. Books are displayed with the book cover, book details (Author, edition), book description, rating, Availability of book and Borrowable time. Borrowable time is based on user rating. System recommends books to the user by using past borrowed or downloaded books. Users can borrow books from the library directly or by post. Books that have borrowable time greater than two days are allowed to borrow via post. User is allowed to borrow books within the borrowable period. When a book is available to borrow, user can send a borrow request to admin. When a user sent a borrow request, the number of available books will be reduced and a book is reserved for user. Admin will get a notification for the borrow request. If admin does not response the request within three hours, request is considered as time out. Users can view the status of their borrow request and the remaining time to return the book. Users will be notified on returning day of book and a day before returning day. If user hold book for more than the allowed period, user must pay the penalty and users will be notified until user returns the book.

Admins can add books, View users, and lend books. All Copies of books have a unique QR code. It is generated when librarian adds copies of book. One copy of Book is always reserved for library use. Admins scan the QR code of the book and issue book. When user borrow books directly, admin handover the books. When user borrows book via post, Admin sent the book through registered post and User needs to pay the cost of the registered post along with the borrow request. When user returns the book, Admin will scan the QR code in the book and update the available book list and borrowers list.

2 Related Work

Glibrary [6], Which is a library management App in google play store, has the most library management features. they are student/member management, staff management, Book issue, return management, Bar-code management, Rack Management and SMS feature. but LIB SYS does not have staff, Rack Management and SMS feature. Instead of SMS feature LIB SYS have push notifications feature. In amazon kindle, [3] Users can Borrow books, download books, and listen to audio-books. but LIB SYS does not have an audio-books feature. In Cloud Library [4], Users can download free E-books and audio books, receive due date reminders, and view upcoming library events. Librarians can set book selves based on genres, add books, and view issue return history of books. LIB SIS also have all these features. but LIB SYS shows all library books to users not a specific or selected library.

Geng,Lihua [1] proposed a Library Information Storage System Architecture including DAS (Direct Attached Storage), NAS (Network Attached Storage), SAN (Storage Area Network) and cloud storage. it uses on-premises storage devices. but LIB SYS only use cloud storage, because of the following reasons. Cloud storage can be accessed anytime, anywhere. It has backups. it is prone to power shortages. Cloud storage can be increased at any time. That project also includes library staff management. but LIB SYS is only

for library books management.

3 Methodology

Project is developed under waterfall methodology.[5]

3.1 Requirement definition

In this stage, Requirement specification was done and documented. Reasons for inefficiency of the current library management system are analyzed and methods to improve that system, Method to increase the knowledge about the libraries and their books among the people are planned. Human errors and time-consuming methods in data entry, and Duplication of data are reasons for the inefficiency of library management system. So, Developing an application with features for Viewing and updating Books details, Borrowing books and can solve problems.

Feasibility Analysis also happened in this stage to find out which Current technologies can be used to develop solution. Nowadays Most people use internet. So, developing application based on internet as a solution is not an issue. Most peoples using the android operating system.[7] So android application will cover most of the people. Books have a unique ISBN number. So Bar code scanners can be used to identify the book. In this application, there is a need for Authentication, Cloud Database and Automated Notification. Firebase provides these cloud services.[2] So, It can be used to develop the application.

3.2 System and software design

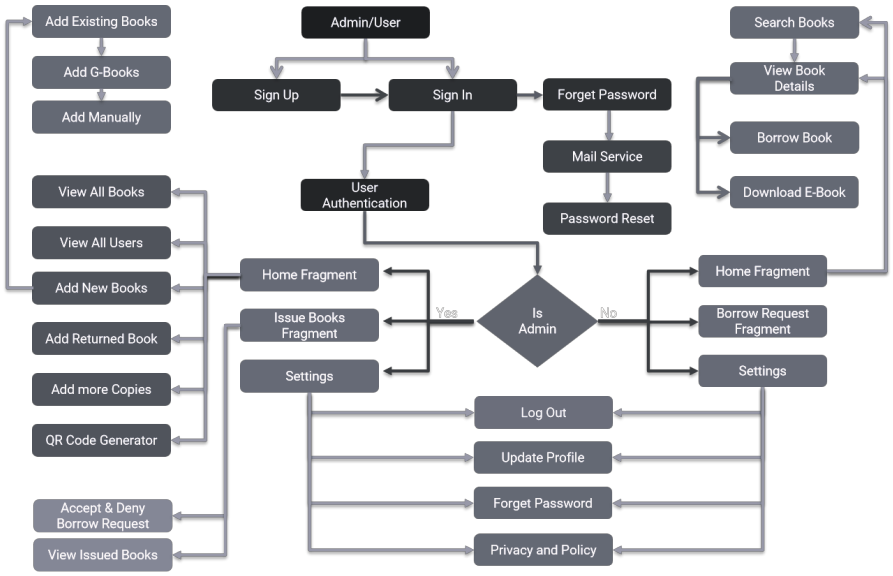


Figure 1: Flow Diagram of Application

In this stage, A representation of how the application works is created in this phase. Database design is created. Figma and XML are used to design UI/UX of the application in the android studio. Figure 1 shows the user flow of the application. Figure 2 shows how notifications are passed to librarian and borrower.

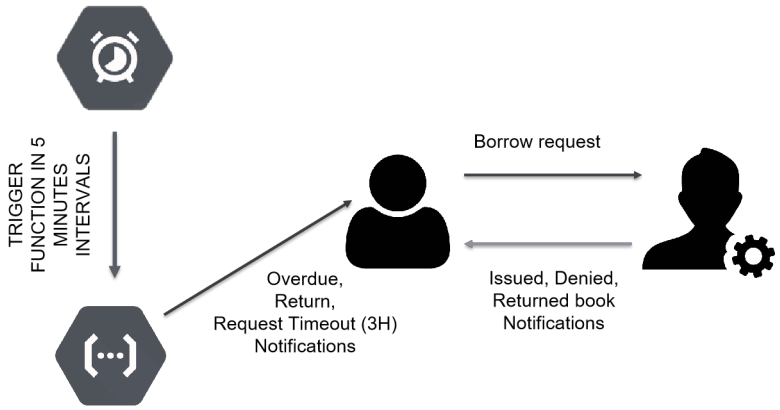


Figure 2: Notification Diagram of Application

3.3 Implementation and Unit testing

In this Stage, System is developed as units. Java is used for front-End development, and Firebase is used for back-End development. Firestore is used for storing data. Firebase Auth is used to authenticate users. Firebase Cloud Messaging is used to send push notifications between librarian and borrower when borrower send a borrow request or librarian accepts or denies the request. Android studio is used for app development.

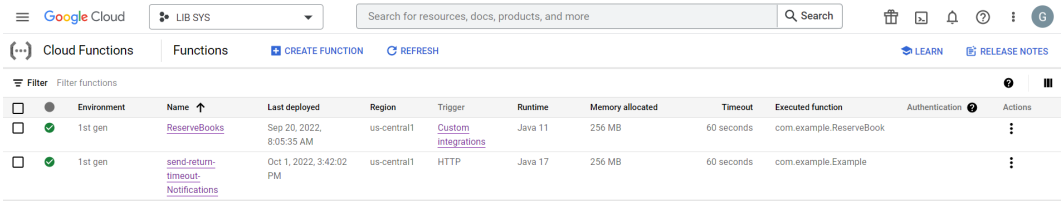


Figure 3: Cloud Functions

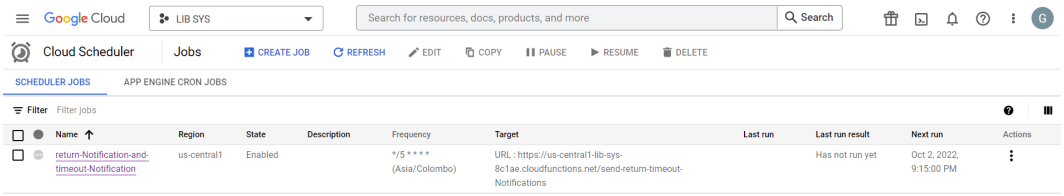


Figure 4: Cloud Scheduler

Here are the APIs used in the application and their usages.

1. Google Books API - Getting book details.
2. Google Maps API - Getting borrower and librarian address.
3. Google Cloud Function API - Reserving books when borrower send a borrow request.
4. Google Cloud Scheduler API - Trigger cloud function to run every 5 minutes to send Overdue, Timeout, and Return Book notifications.

Each unit is tested to ensure its correct functionality. Which is called as unit testing.

3.4 Integration and System Testing

In this Stage, Units which were developed during implementation and unit testing stage are integrated into a system. After the integration, alpha testing was done by using some dummy librarians and borrowers. Beta testing is done by using some real librarians and borrowers.

3.5 Deployment

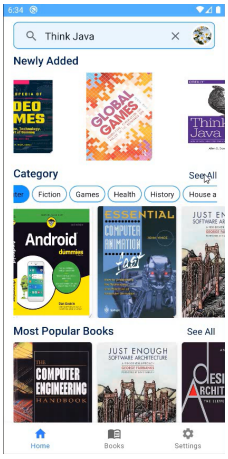
In this stage, Application will be published into the Google Play Store. Users can download app through play store.

3.6 Maintenance

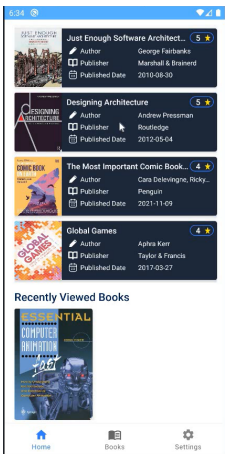
In this stage, errors that were not identified in the early stage are identified and corrected. Updated version of app is released to users.

4 Experiments and Results

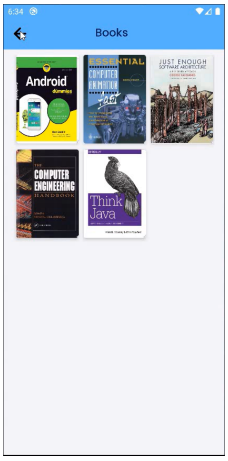
Users can view all the details of the books in the libraries. They can filter books according to category. They can know where the book is available and how long it can be borrowed without visiting the library. They can borrow books directly or by post. So, People can borrow books through post even during pandemic. They do not need to stand in a queue for a long period. If they do not want the printed book or the Book is not available in any library, They can download E-Book. Users will not forget the return date of borrowed book. Because they will receive an automated notification at returning day of the book and a day before returning day.



(a) Home page Top

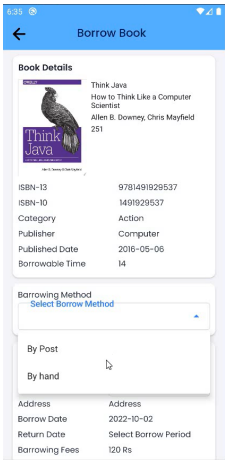


(b) Home page Bottom

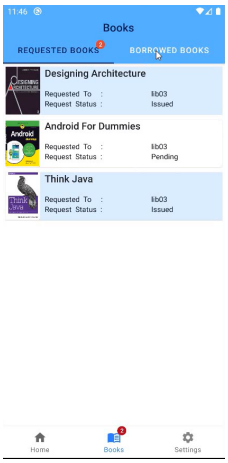


(c) View Books

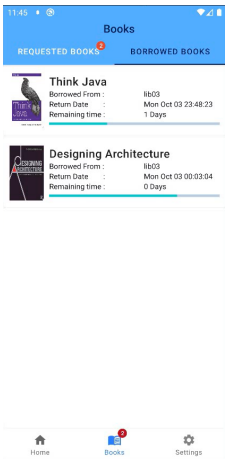
(d) Book Details



(e) Borrow Page



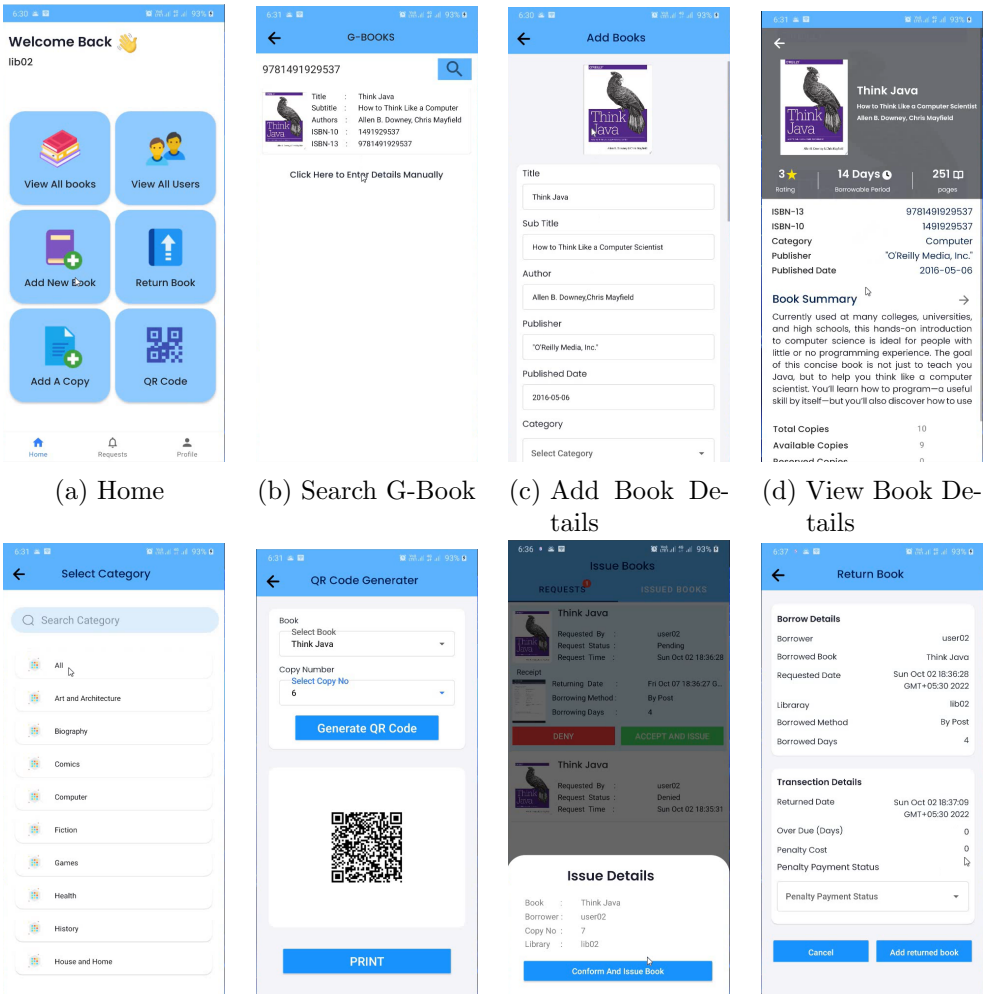
(f) Borrow Request



(g) Borrowed

Figure 5: User Interfaces of LIB SYS

Librarian can add books easily by scanning the ISBN number of the book. They can easily issue books and add returned books by scanning QR code on the book without any writing work.They can track which copy of the book is issued to whom and when.



(a) Home (b) Search G-Book (c) Add Book Details (d) View Book Details

(e) View Books (f) QR Code Generator (g) Issue Book (h) Return Book

Figure 6: Librarian Interfaces of LIB SYS

5 Conclusions

This paper presents LIB SYS - An Android Application. Through this application anyone can get the details of all the books in the library. Makes anyone from anywhere can borrow book from any library. It increases the number of book readers by reducing the difficulties while getting a book. It saves users time by making borrowing procedures online. It reduces the workload of librarians and reduces the cost of maintenance. It reduces human errors in library management.

In future, it can be developed to return Return multiple books at one time By using RFID instead of QR code. Because many RFID can be scanned at a time.[8] Payment Gateways can be added to do transactions. So, Librarian does not need to check the

payment receipt. Voice assistants and chat-bots can be added to give easy access. Audio Books Feature can be added.

References

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