A Project Report on

Library Automation System

Submitted by

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in partial fulfillment for the award of the degree

BACHELOR OF ENGINEERING

in

Electronics and Telecommunication Engineering

Under the Guidance of

Dr. Gautam Shah

St. Francis Institute of Technology, Mumbai

University of Mumbai

2022 - 2023

CERTIFICATE

This is to certify that **Sanika Anil Gawas, Yash Sanjay Kathe, Kaushik Sharad Khadilkar & Chirag Jagannath Kunder** are bonafide students of St. Francis Institute of Technology, Mumbai. They have successfully carried out the project titled **"Library Automation System"** in partial fulfilment of the award for the B.E. Degree in Electronics and Telecommunication Engineering of Mumbai University during the academic year 2022-2023. The work has not been presented elsewhere for the award of any other degree or diploma prior to this.

(Dr. Gautam Shah)

(Dr. Kevin Noronha)	**(Dr. Sincy George)**
EXTC HOD	**Principal**

Project Report Approval for B.E.

This project entitled ***'Library Automation System'*** by **Sanika Anil Gawas, Yash Sanjay Kathe, Kaushik Sharad Khadilkar, Chirag Jagannath Kunder** is approved for the degree of Bachelor of Engineering in Electronics and Telecommunication from the University of Mumbai.

Examiners

1. - - - - - - - - - - - - - - - - - -

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Date:

Place: Mumbai

ACKNOWLEDGEMENT

We are thankful to a number of individuals who have contributed towards our final year project and without their help, it would not have been possible. Firstly, we sincerely thank our project guide, Dr. Gautam Shah, for his constant and timely help and guidance throughout our preparation.

We are grateful to all project coordinators for their valuable input to our project. We are thankful to the College Library, Librarian and the Library staff for helping us. Additionally, we would like to express our appreciation to the college authorities and the entire faculty for their support in providing us with the facilities required throughout this semester.

We are also highly grateful to Dr. Kevin Noronha, Head of Department (EXTC), Principal, Dr. Sincy George, and Director Bro. Shantilal Kujur for providing the facilities, a conducive environment and encouragement.

(Sanika Anil Gawas)

(Yash Sanjay Kathe)

(Kaushik Sharad Khadilkar)

(Chirag Jagannath Kunder)

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included; we have adequately cited and referenced the original sources. We also declare that we have adhered to all academic honesty and integrity principles and have not misrepresented, fabricated, or falsified any idea/data/fact/source in this submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

(Sanika Anil Gawas)

(Yash Sanjay Kathe)

(Kaushik Sharad Khadilkar)

(Chirag Jagannath Kunder)

Abstract

Libraries play an essential role in our society. It is a gateway to provide resources and services that shape new opportunities for learning and gaining knowledge. The Library Automation System is a project aimed at developing a computerized system to automate all the daily tasks of the library with minimal human intervention. The central hardware involves a Raspberry Pi where the database is maintained, the web server is hosted and other necessary scripts are running. The system is based on admin-client interaction. On the admin side, all the information regarding books and library members is stored and updated; whereas on the client side, users can create a profile and keep track of the issue and return dates. The admin-client interaction is web-interface based. The project also provides security regarding unauthorized book borrowing using RFID technology.

Keywords: *Library Management System, Database, Barcode, QR-Code, RFID, Embedded systems, ISBN codes*

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List of Abbreviations

API	Application programming interface
CDA	Content Delivery Application
CMA	Content Management Application
CMS	Content Management Software
IR	Infrared radiation
ISBN	International Standard Book Number
LMS	Library Management System
MVC	Model-View-Controller
NPTEL	National Programme on Technology Enhanced Learning
OPAC	Online Public Access Catalogue
QR	Quick Response
RFID	Radio Frequency Identification

Chapter 1

Introduction

1.1 Motivation

A library is a place of endless knowledge, offering a variety of resources for people of all ages. From classic literature and new fiction to educational materials and reference books, libraries provide an incredible wealth of information. It is a gateway to providing resources and services that shape new opportunities for learning and gaining knowledge. As managing a big traditional library could be a daunting task, we believe that our project would be an excellent way to reduce the interaction between the Library staff and the users and manage the task efficiently.

Our project automates the task of issuing and returning books. It also helps to create a centralized system, portal and database for books, users and admins which assists the already existing system. A Raspberry Pi is used as the central hardware component where the database is maintained, the web server is hosted, as well as other necessary RFID scripts are running. The system is based on Admin-Client Interaction.

Library Automation System is a technique of maintaining and surveying books at the Library so that books are distributed and managed effectively. Digitizing libraries can help retrieve books quickly, store large amounts of data, have a long operating life, and have a low-cost advantage. It is the information and scientific trend of book management. It also eliminates the need for security personnel by employing Radio Frequency Identification (RFID) technology.

1.2 Problem Statement

The traditional library system is facing a number of challenges due to the rapid advancement of technology and the ever-changing global environment. The traditional library system is becoming increasingly outdated compared to the increased availability of digital resources. We were able to resolve some issues and increase the efficiency of the current system with our automation system.

In the traditional library management system every student has their own library card which has a certain fee. The librarian has to manually add the assigned book and manage the library card accordingly. They also have to keep track of the library cards until the student returns the book. Instead of this our system proposes the QR Code which the student gets after signing up with proper credentials. There is no proper database present for maintaining the book issuing system and student data in most traditional libraries. During busy hours it can be challenging for the librarian to assign books one by one to students. Also, it is very time-consuming. To solve this problem, we created a database on a cloud platform and also used Google Books API for getting the book's metadata. Also in our system, students can self-issue and return books. Another issue is Unauthorized borrowing. Most of the libraries lack an alert system for thefts. For this, we implemented RFID Technology. So our system provides security, manages data efficiently and saves time.

1.3 Methodology

The user needs to sign in first with his/her credentials and then get a uniquely generated Quick Response (QR) Code. There will be an Infrared radiation (IR) sensor placed which will detect the person and start the process. By scanning the QR code using a webcam, the user can log into their account at the library.

After logging into the student account, there are two options for the issuance and return of books. Based on the option selected the student has to place the book under a barcode scanner. The International Standard Book Number (ISBN) on the book is scanned and the details are fetched from the Google Books API which updates the database accordingly.

The admin login allows administrators to update books and add new ones. Here the admin scans the book's ISBN using a barcode scanner which fetches data from the Google Books API. The admin has to verify the data and enter the quantity. When similar books are already present, it shows that similar books already exist. Even after continuing, it stores the book data and updates the number of books that are already present. The whole system becomes more secure by having RFID tags attached to every book. These tags would raise an alarm if the book is taken out of the premises without being issued. The portal will allow students to check book availability.

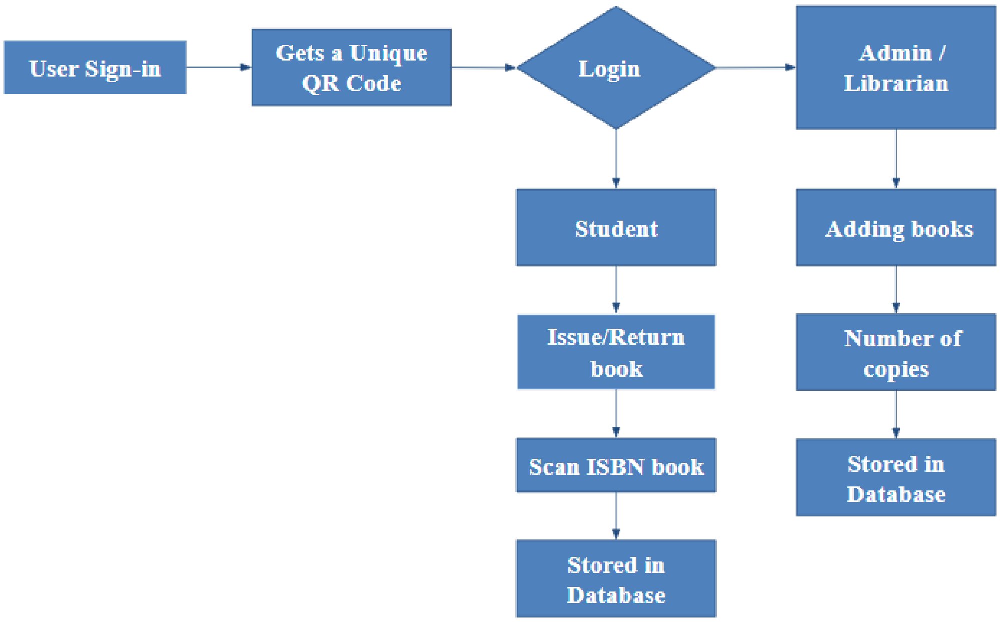


Figure 1.1: Automation Block Diagram

1.4 Organization of Project Report

This project report is organized as follows:

Chapter 2 presents the literature survey on the techniques used at present.

Chapter 3 provides a brief explanation of the Theoretical Background and Design Methodology which includes the architecture of the Automation model and the User Interface.

Chapter 4 is dedicated to the simulation and experimental results.

Chapter 5 presents the conclusions and future scope for this project.

Chapter 2

Literature Review

With Library Automation, librarians could focus more on acquiring and processing the collections, while dissemination may be left entirely to the automatic system. This automation covers for example self loan, self-return, and self-pickup systems. Such self-services can be delivered by incorporating RFID in both the collection and also the patron. The main purpose of implementing a library automation system is to provide a self-service system such that no librarians are needed for administration, while still maintaining security and minimizing fraudulent practices by incorporating crowd monitoring.

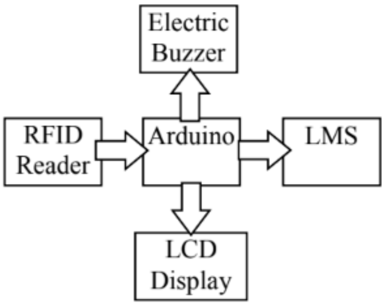
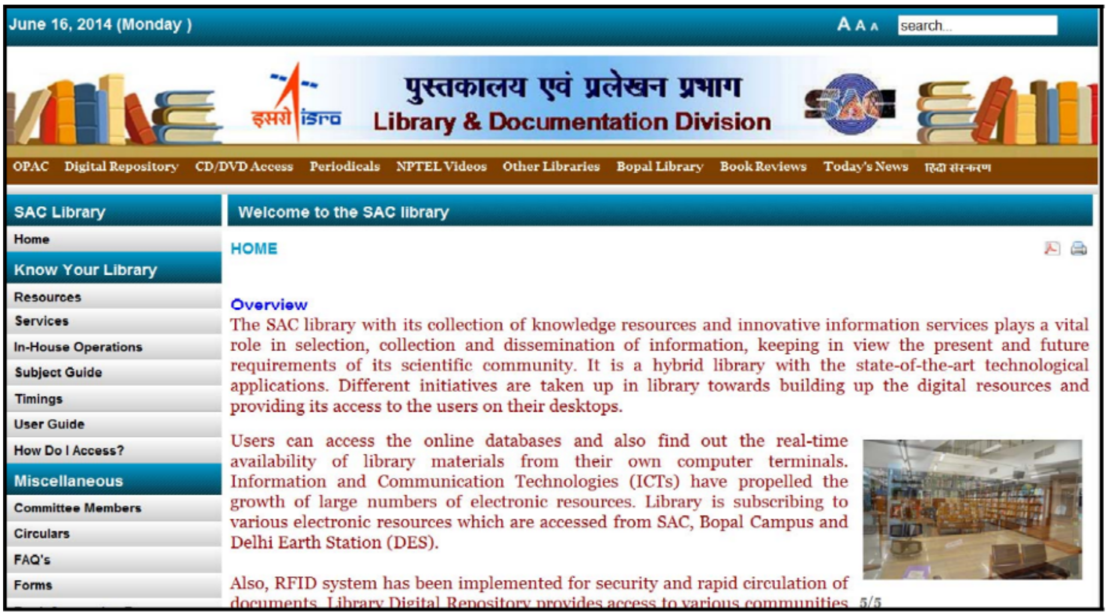


Figure 2.1: Block diagram for the self-return system

Figure 2.1 explains the block diagram of the self-return system. Since the self-return system is placed in any place where electrical power may not be available, power efficiency is the most crucial aspect of designing the system. For this reason, there are only 5 blocks in this system. They are an RFID reader that will help the system to read the book's RFID tag, and Arduino to process the RFID tags, set off an electric buzzer for notification, and send information to Library Management

System (LMS). The Arduino is used to read the RFID tag and send them to a micro PC for storage and processing purposes. A micro PC accepts the information from Arduino and Sends the tags to LMS for authentication, information fetch, and registration. It uses a camera to capture the picture of the borrower and show it on the display with all information. After issuing or returning a book, every time the librarian has to manually remove and attach the RFID tags.[1]

In order to provide information service delivery very effectively and efficiently, it is vital to store and retrieve information in the most convenient way. Content Management Software (CMS) is a software application used to create, customize, and manage information. CMS has become the favourite option among library professionals as it enables them to quickly build, deploy and maintain a content-rich website without the knowledge of programming languages. CMS supports the creation of content, its management, publishing, and presentation of information. It not only organizes the contents which include computer files, image media, audio files, video files, electronic documents, and Web content but also provides access to contents in digital form. CMS consists of two elements: the Content Management Application (CMA), which allows the developer to edit, modify and remove content from a website and the Content Delivery Application (CDA) which uses and compiles the information to update the website. Compared to traditional websites, CMS is better in terms of functionality, cost, and maintenance.[2]



Welcome to the SAC library

HOME

Overview

The SAC library with its collection of knowledge resources and innovative information services plays a vital role in selection, collection and dissemination of information, keeping in view the present and future requirements of its scientific community. It is a hybrid library with the state-of-the-art technological applications. Different initiatives are taken up in library towards building up the digital resources and providing its access to the users on their desktops.

Users can access the online databases and also find out the real-time availability of library materials from their own computer terminals. Information and Communication Technologies (ICTs) have propelled the growth of large numbers of electronic resources. Library is subscribing to various electronic resources which are accessed from SAC, Bopal Campus and Delhi Earth Station (DES).

Also, RFID system has been implemented for security and rapid circulation of documents. Library Digital Repository provides access to various communities

Figure 2.2: SAC Library portal

Figure 2.2 represents the SAC Library portal which provides various online, digital and personal services to its users on their desktops. The portal content is divided into two broad categories:

- Information about the library - Its resources, services, floor plan, working hours, general forms, user's guide, circulars, staff list, FAQs, etc.

- Digital services - Access to library content - Online Public Access Catalogue (OPAC), CD/DVD collection, digital repository, National Programme on Technology Enhanced Learning (NPTEL) videos, Current Awareness Service, e-resources, etc.[2]

The library management system is a web application. This will help the library staff to manage the activities in the library more efficiently. These activities will include issuing a book by a student or by a member of the faculty, returning the book within the stipulated time, etc. One can also reserve a book via this application if he/she needs the same urgently and will not be able to reach the library for some reason. A unique feature of this application is that a notification will be sent to the student or faculty by the administrator just before the return date. Also, the status of a book can be known i.e. a student who desires to issue a book that is unavailable can know who the holder of the book is and request him/her accordingly.[3]

Chapter 3

Theoretical Background & Design Methodology

3.1 Concepts

3.1.1 Model-View-Controller

Model-View-Controller (MVC) is a software architectural pattern for implementing user interfaces. It splits a software application into three interconnected parts that are the model, the view and the controller which separate the internal representations of information from how information is presented to the user. Figure 3.1 represents the design pattern of MVC.

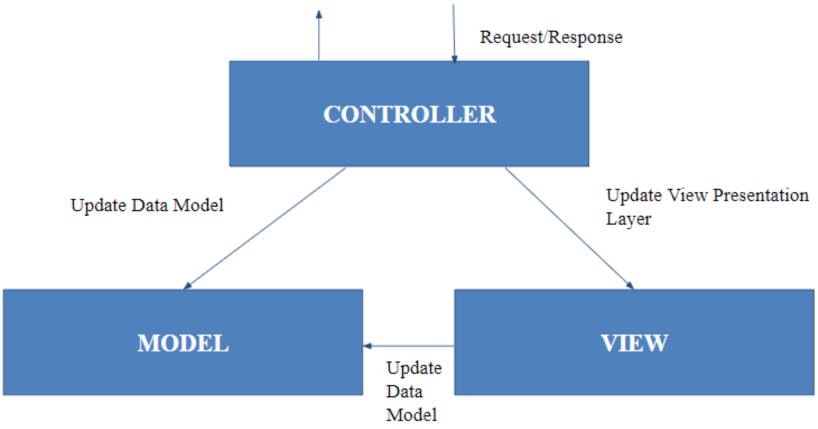


Figure 3.1: MVC Model

MVC Components:

1)The model
In the Model component, the user interacts with all the logic related to data. Typically, this refers to the data transferred between the View and Controller components, or to any other data related to business logic. For example, a Customer object will get information about the customer from the database and manipulate it, update it, and send the updated data back to the database or use it to render data in the database.

2)The view
The View component is used for all the UI logic of the application. For example, the Customer view will include all the UI components such as text boxes, dropdowns, etc. that the final user interacts with.

3)The controller
The Controller works as an interface between the Model and the View components in order to process all business logic and incoming requests. They manipulate data by using the Model component and then interact with the View component to render the final output. For example, the Customer controller will handle all the interactions and inputs from the Customer View and update the database according to the Customer Model. The same controller will be then used to view the customer data.
Each component is built to handle specific development aspects of an application. As one of the most widely used industry-standard web development frameworks, MVC is a popular option with developers looking to create scalable and extensible web applications.

3.1.2 Google Books API

The Google Books API allows clients to access the Google Books repository. It searches content, organizes and authenticates the user's personal library and allows them to modify the library as well. Using the Google Books API, the application can perform full-text searches and retrieve book information, viewability and eBook availability.

The Google Books API v1 gives programmatic access to many of the operations available on the Google Books website. Some of the main features that the API provides are:

1) Search and browse through the list of books that match a given query.
2) View information about a book, including metadata, availability and price, and links to the preview page.
3) Manage your own bookshelves.

3.1.3 MongoDB Atlas

MongoDB Atlas is an integrated suite of data services centred around a cloud database designed to accelerate and simplify data building. It is an easy-to-use cloud database service that helps developers and businesses quickly set up, maintain and scale their databases in the cloud. With MongoDB Atlas, users can easily provision, manage and monitor MongoDB clusters, no matter where the data is stored. MongoDB Atlas provides advanced features like built-in redundancy, automated backups, and high availability, allowing users to focus on building their applications and services instead of managing their databases. MongoDB Atlas also integrates easily with the other services in the MongoDB family, like MongoDB Compass, MongoDB Stitch, and MongoDB Charts. With MongoDB Atlas, users can quickly create, manage and scale their MongoDB clusters in a secure, reliable and cost-effective manner. The features of MongoDB Atlas are shown in Figure 3.2.

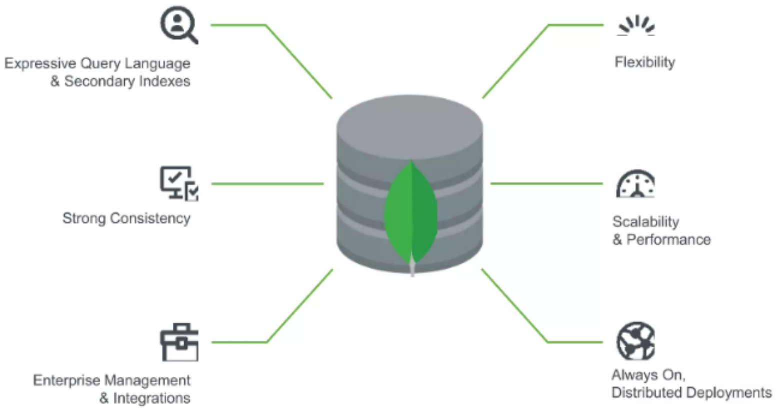


Figure 3.2: MongoDB Features

MongoDB Atlas provides several built-in security features to help you secure your data. These features include role-based access control, data encryption, audit logging, and more. Additionally, MongoDB Atlas integrates with other security solutions, such as identity providers, to provide an additional layer of security.

Data encryption is an important security measure. MongoDB Atlas provides encryption at rest, which ensures that all data stored in MongoDB Atlas is encrypted. This protects your data from malicious actors, as well as accidental data loss or theft.

Audit logging is also important when it comes to security. MongoDB Atlas provides audit logging to help you track who has accessed your data and which actions they took. This is especially useful when it comes to troubleshooting or investigating security incidents.

Finally, MongoDB Atlas integrates with other security solutions, such as identity providers. This helps ensure that only authorized users can access your data, and it further helps to protect your data from malicious actors. Figure 3.3 represents how MongoDB Atlas provide security. With these features, MongoDB Atlas ensures that your data is properly secured, both in transit and at rest.

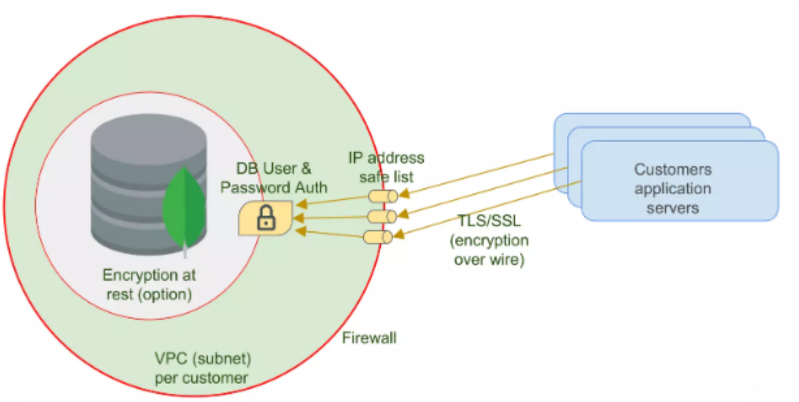


Figure 3.3: MongoDB Security

3.2 Architectural Design

The architectural design consists of the Client and the admin sides. It specifies the working process for both users and administrators.

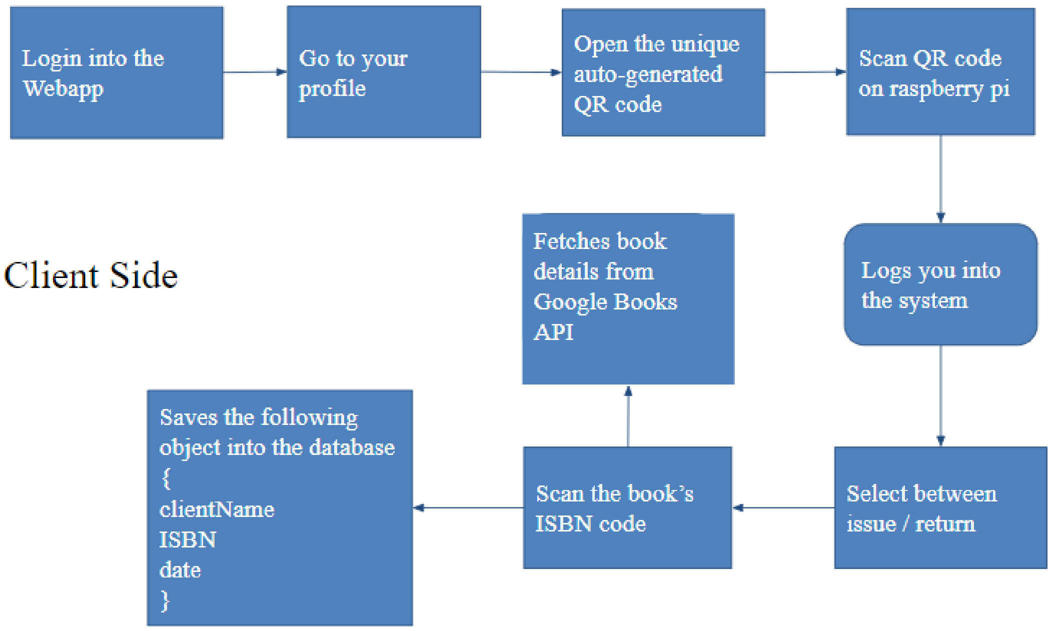

Login into the Webapp
Go to your profile
Open the unique auto-generated QR code
Scan QR code on raspberry pi
Client Side
Fetches book details from Google Books API
Logs you into the system
Saves the following object into the database { clientName ISBN date }
Scan the book's ISBN code
Select between issue / return

Figure 3.4: Activity Diagram for Client.

Figure 3.4 shows the Client's activity diagram. The process begins with the user signing into his account from his mobile device. Then the user gets a unique auto-generated QR code. This QR code acts as an identification which must be scanned. This QR code can be saved so the user does not have to log in again. The web camera interfaced with the Raspberry Pi scans the QR code and authenticates the user. The user has the option to decide whether to issue or return the book. Either of these processes includes scanning the ISBN on the book.

An ISBN is a unique number assigned to every published book. The ISBN number is encoded into an EAN-13 barcode as shown in Figure 3.5. Once the ISBN has been scanned successfully, the book details are fetched from the Google Books API by providing the decoded ISBN. The respective schema including the time stamp, user ID, and book details is then stored in the database.

0 123456 789012

Figure 3.5: ISBN

The admin needs to log in using their respective credentials. In order to add new books to the database, the admin has to scan the ISBN of the new book, check the data and enter the quantity of the books. If there is a book with the same title it shows a message of a similar title exists. If the admin still wants to add the data then gets stored in the database. This schema includes a timestamp and book details. The activity diagram for the Admin is shown in Figure 3.6.

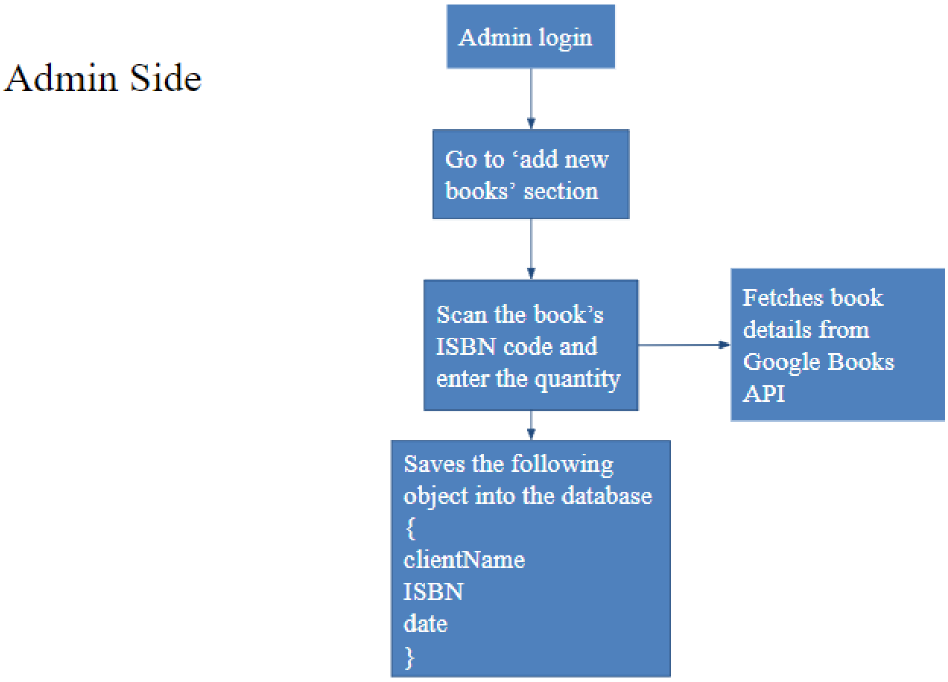
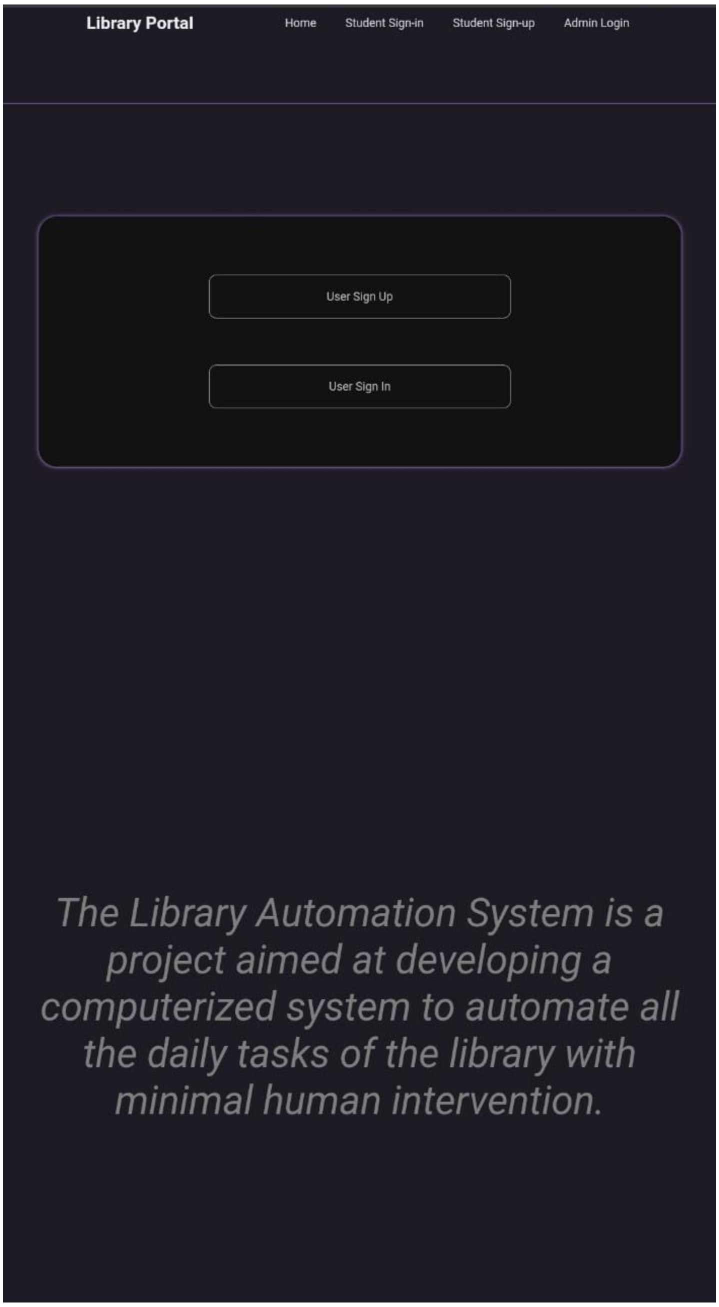

Admin Side
Admin login
Go to 'add new books' section
Scan the book's ISBN code and enter the quantity
Fetches book details from Google Books API
Saves the following object into the database
{
clientName
ISBN
date
}

Figure 3.6: Activity Diagram for Admin.

3.3 User Interface Design

It is necessary to have an easily understandable user interface for such an application to be usable by any user, regardless of age and experience. The front end is built using HTML, CSS, and JavaScript, with the goal of building a responsive interface.

Figure 3.7 represents the Homepage where users can sign Up and sign in. It has Student Sign-in, Student Sign-up and Admin Login.



The Library Automation System is a project aimed at developing a computerized system to automate all the daily tasks of the library with minimal human intervention.

Figure 3.7: Home page

If the user doesn't have an account he/she can sign up by entering the proper credentials of Email-Id, PID and Password. The SFIT -Virtual Library Sign-Up Page is shown in Figure 3.8.

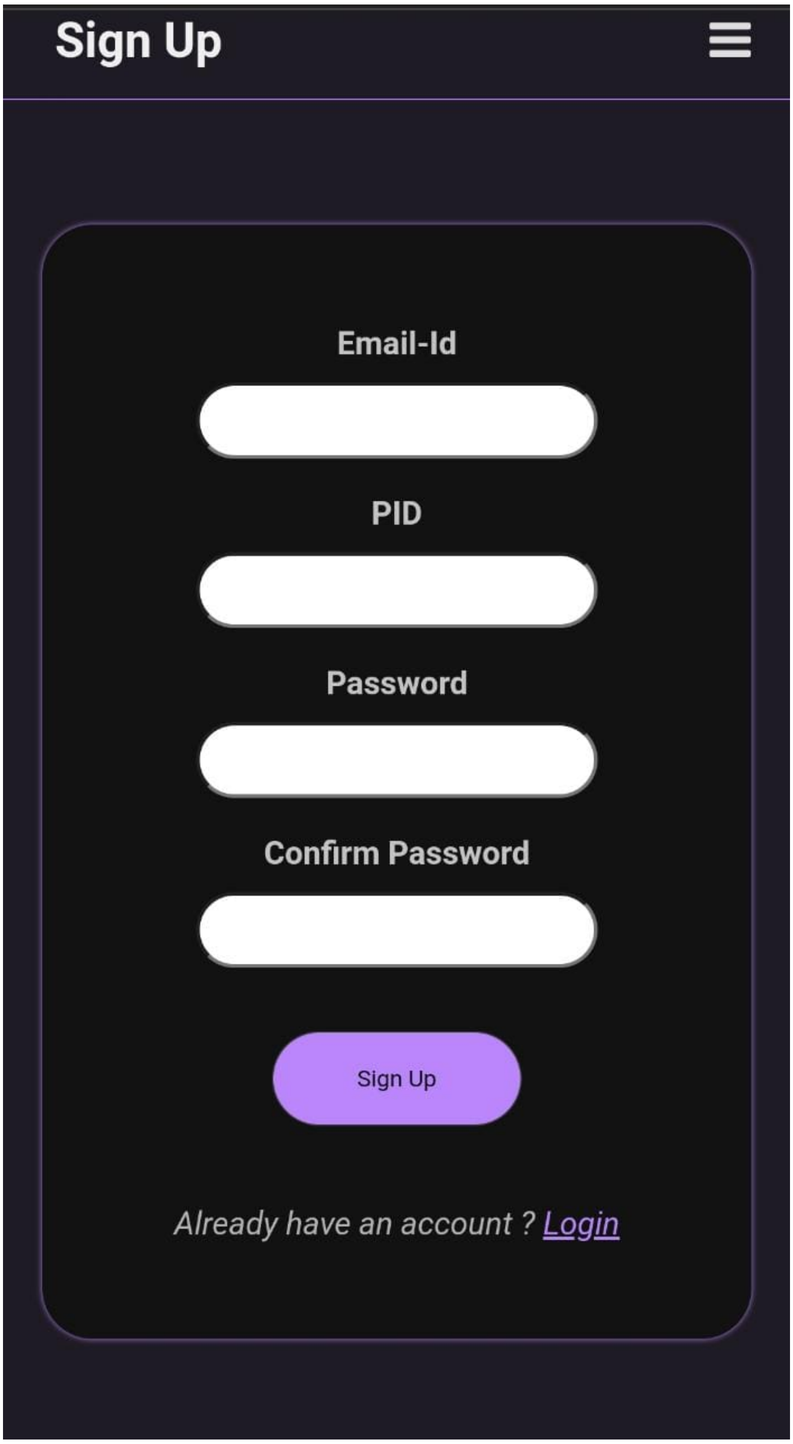


Figure 3.8: SFIT-Virtual library Sign-Up Page

Once the account is created successfully, the user can log in to their account. To log in the student needs email-id/pid and password. Figure 3.9 represents the Login page.

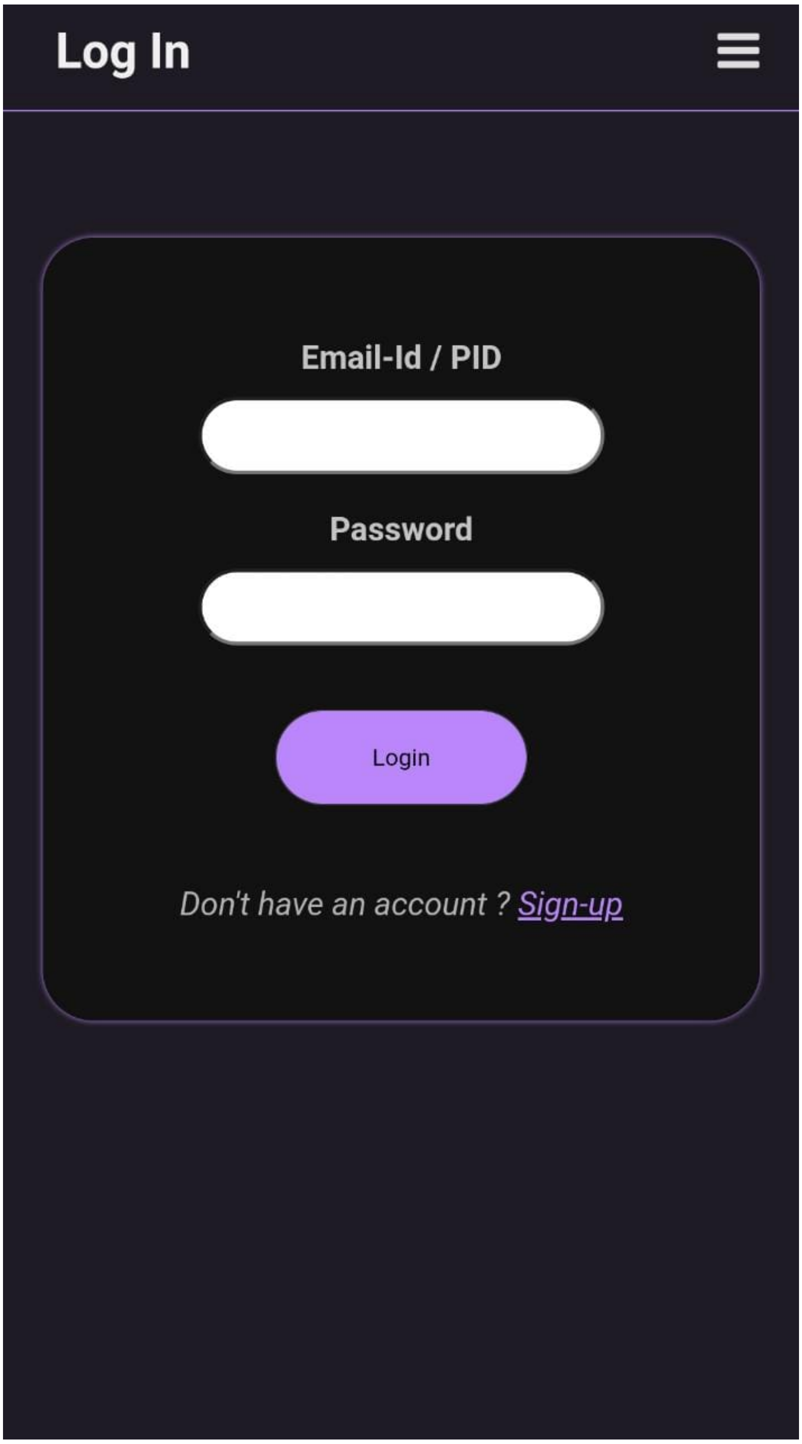


Figure 3.9: Student Login page

Figure 3.10 represents the page once the student logs in to his account. Here he gets three options one is for Issuing books, the next for returning the issued book and the last for searching for books in the library. Here the user can search for books and the details are provided by Google Books API.

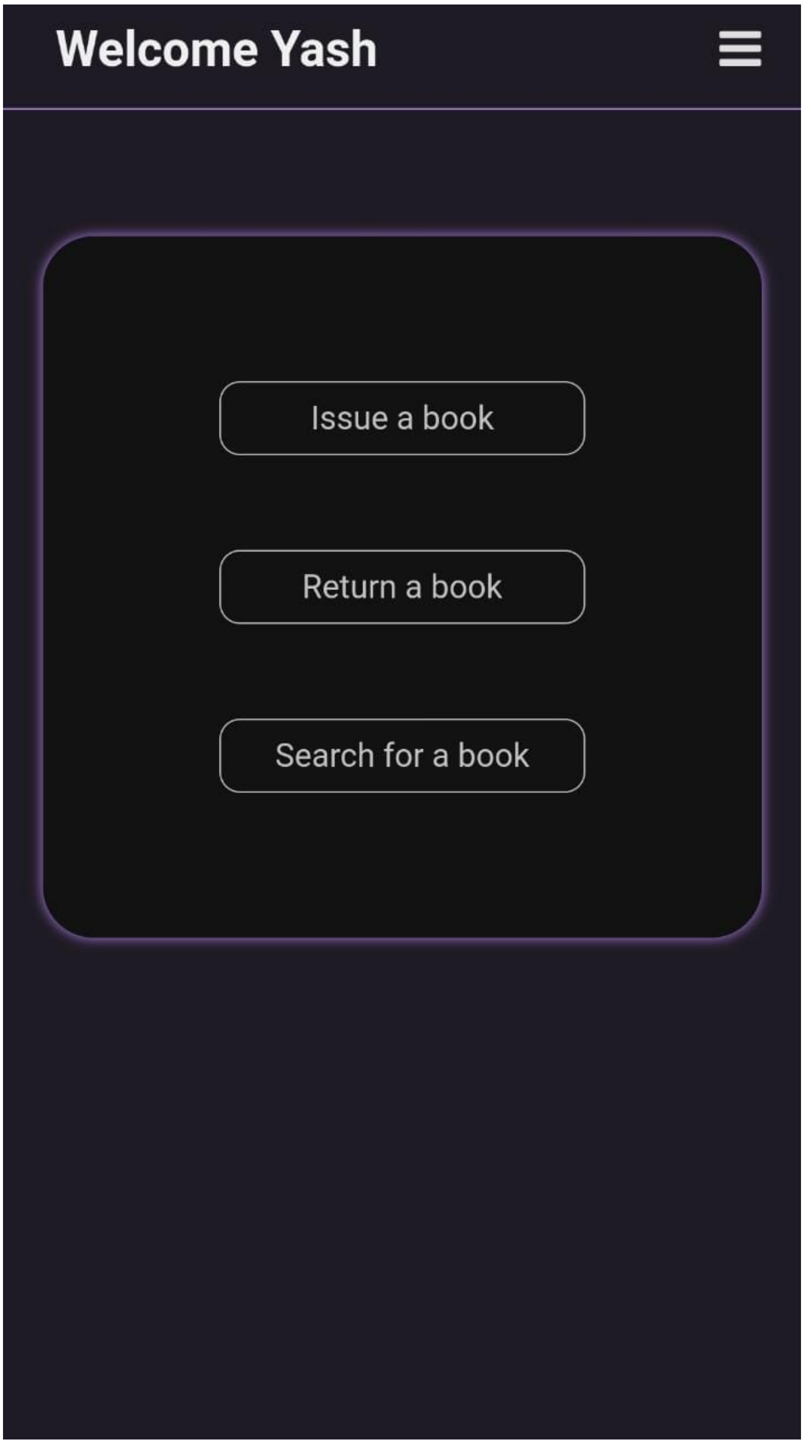
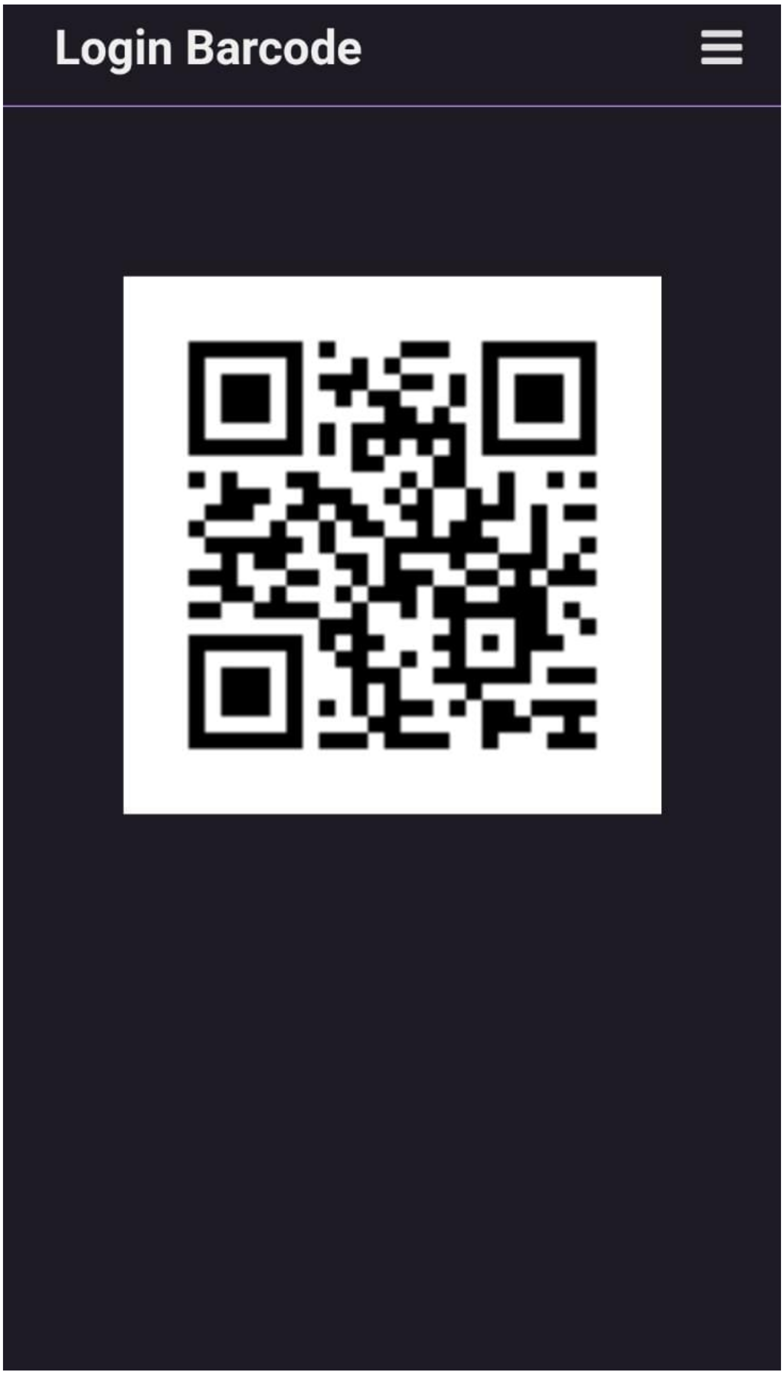


Figure 3.10: Student account page

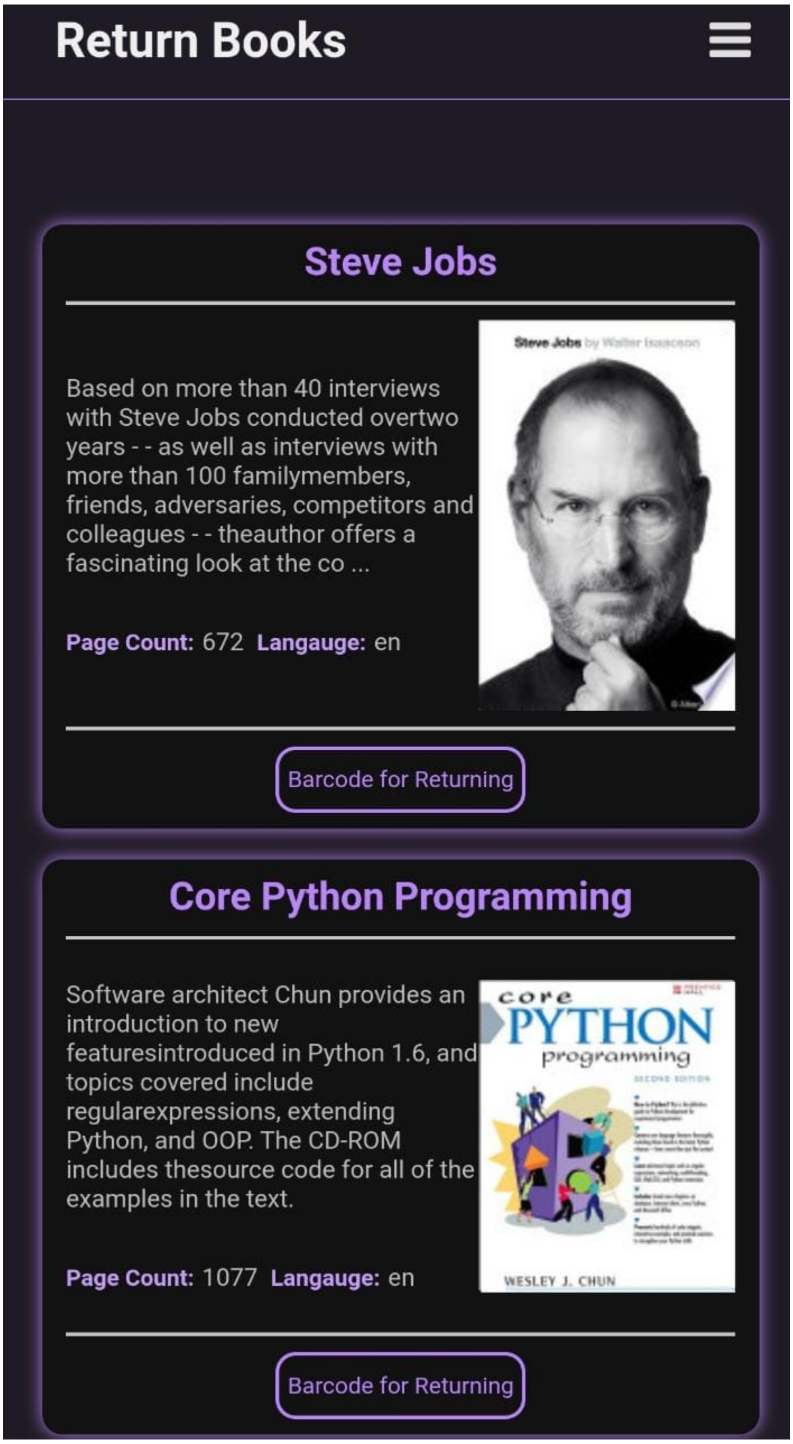
The student can issue the book from the library system and for that purpose, the login QR code must be scanned. After scanning the QR code the student gets logged in to the Library system portal. Figure 3.11 represents the QR code for the user. This QR code is unique to each individual student and works as an identification card or library card. Users require a QR code to log into the library system, which is created by encoding the ObjectId. The 'npm QR code' library creates the QR code.



Login Barcode

Figure 3.11: QR code for Login into library system

If the user has to return the books issued, he/she has to click return a book and then it gets directed to a page where all the books that are issued are displayed. The user has to select the book which he/she wants to return and click on Barcode for returning. The Return page is displayed in Figure 3.12.



Return Books

Steve Jobs

Based on more than 40 interviews with Steve Jobs conducted overtwo years - - as well as interviews with more than 100 familymembers, friends, adversaries, competitors and colleagues - - theauthor offers a fascinating look at the co ...

Page Count: 672 **Langauge:** en

Core Python Programming

Software architect Chun provides an introduction to new featuresintroduced in Python 1.6, and topics covered include regularexpressions, extending Python, and OOP. The CD-ROM includes thesource code for all of the examples in the text.

Page Count: 1077 **Langauge:** en

Figure 3.12: Return books page

The book return QR code is shown in Figure 3.13. Here the QR code value and the book ISBN should match for successfully returning the book.

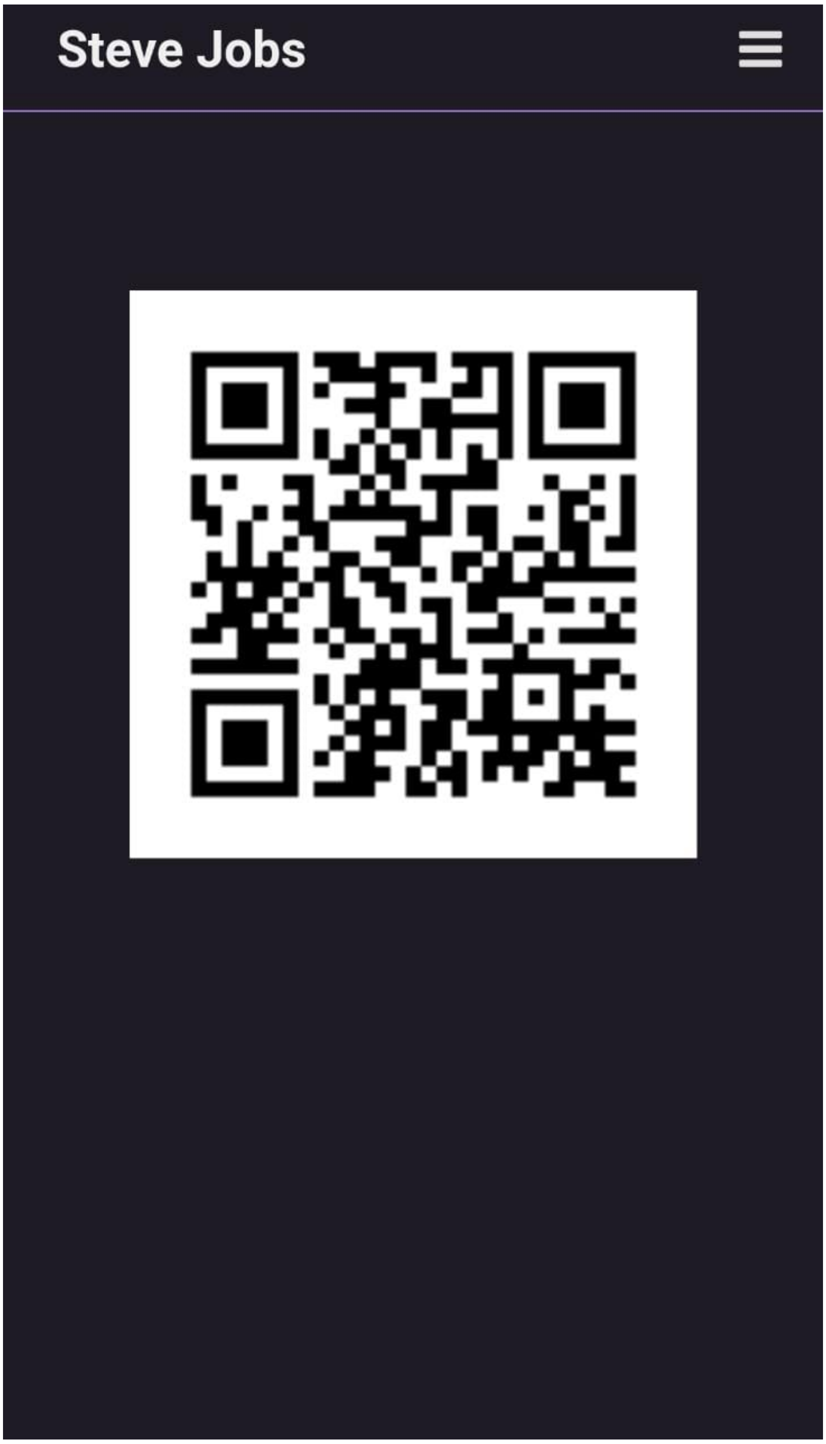
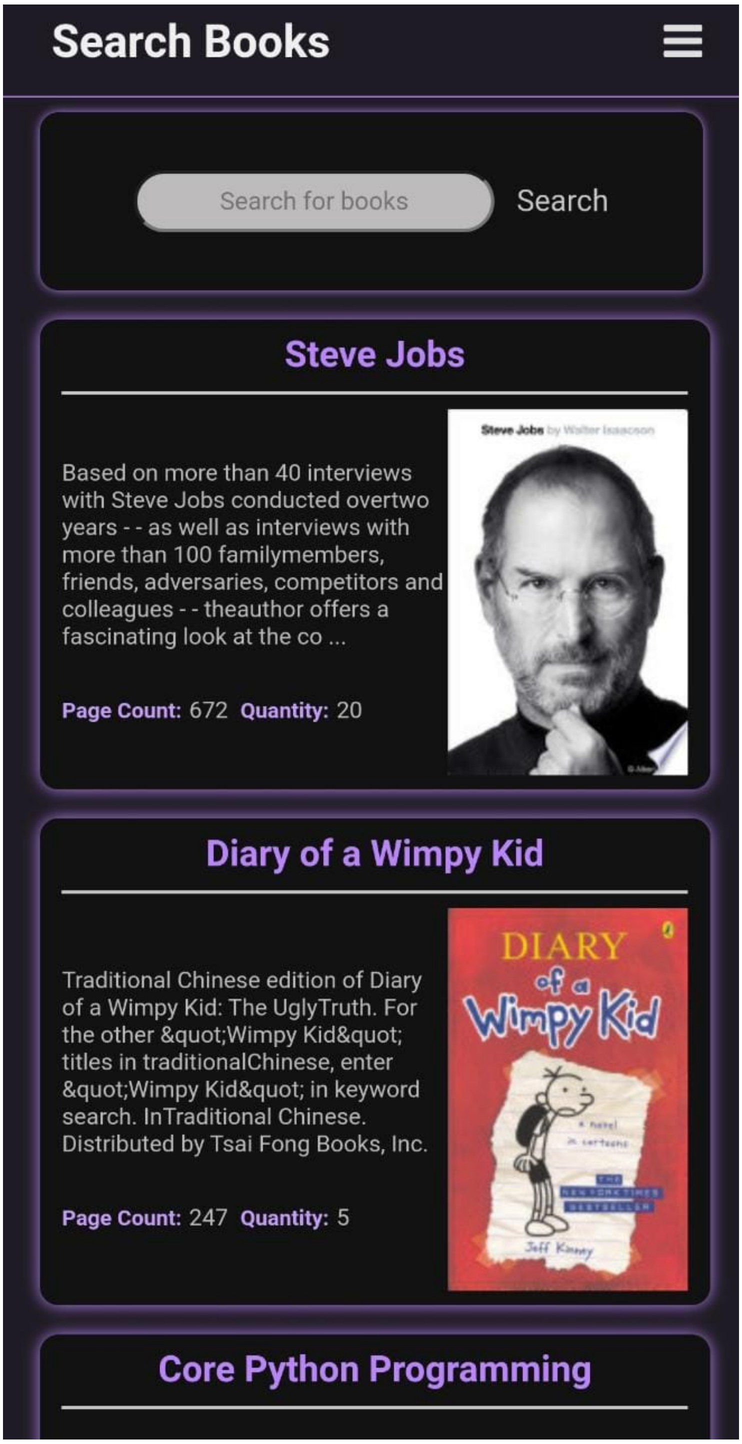


Figure 3.13: Barcode for returning books

The user can also search for various books that are available in the library. The student just has to type in the book name and hit enter. Figure 3.14 shows the search page.



Steve Jobs

Based on more than 40 interviews with Steve Jobs conducted overtwo years - - as well as interviews with more than 100 familymembers, friends, adversaries, competitors and colleagues - - theauthor offers a fascinating look at the co ...

Page Count: 672 **Quantity:** 20

Diary of a Wimpy Kid

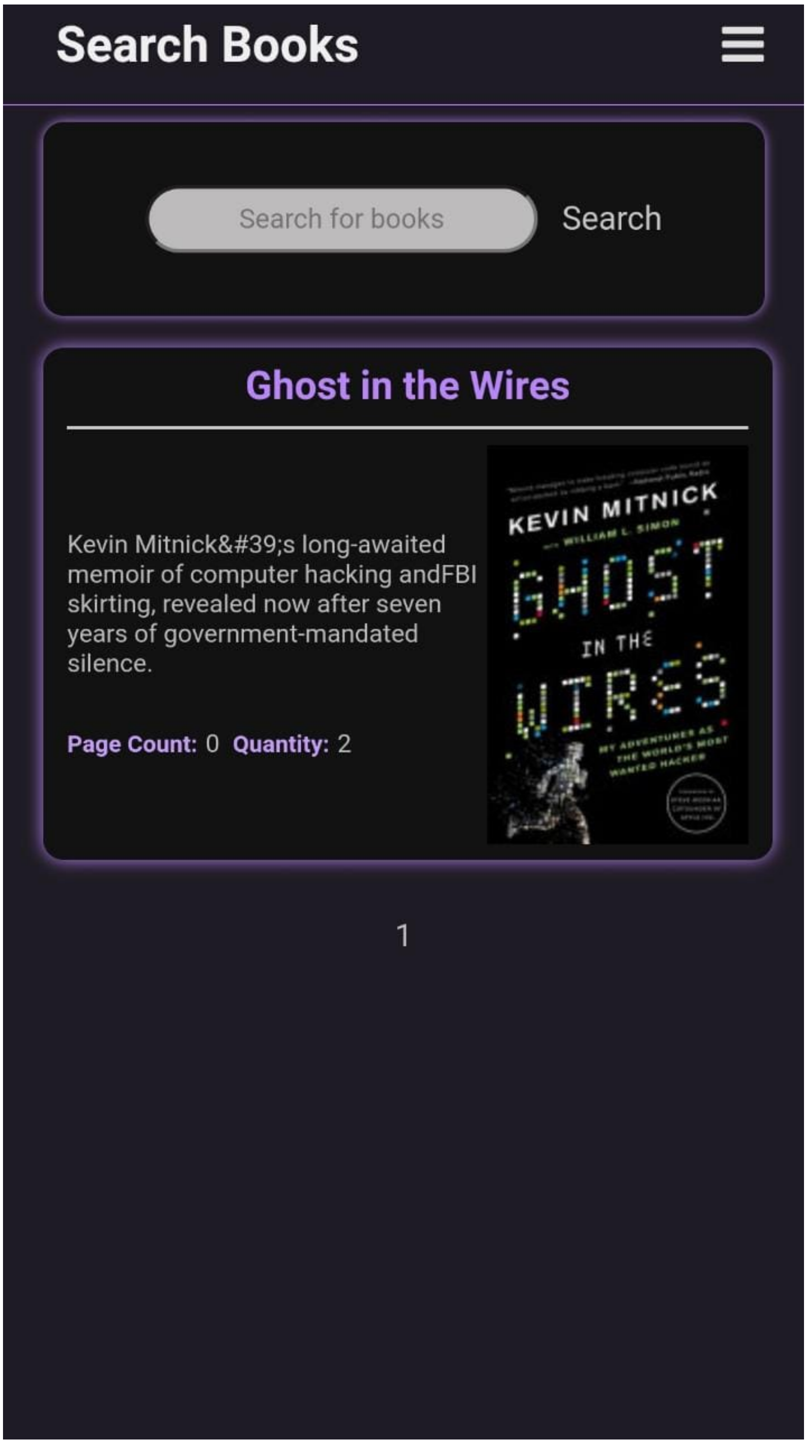
Traditional Chinese edition of Diary of a Wimpy Kid: The UglyTruth. For the other &quot;Wimpy Kid&quot; titles in traditionalChinese, enter &quot;Wimpy Kid&quot; in keyword search. InTraditional Chinese. Distributed by Tsai Fong Books, Inc.

Page Count: 247 **Quantity:** 5

Core Python Programming

Figure 3.14: Search Page

If the book that is searched is present in the library it displays it and all its information which is fetched from the Google Books API. Figure 3.15 shows the searched book.



Ghost in the Wires

Kevin Mitnick&#39;s long-awaited memoir of computer hacking andFBI skirting, revealed now after seven years of government-mandated silence.

Page Count: 0 **Quantity:** 2

Figure 3.15: Searched Book Page

For the admin side, the administrator has to login in first using Email-id and password. The login page for administrators is shown in Figure 3.15.

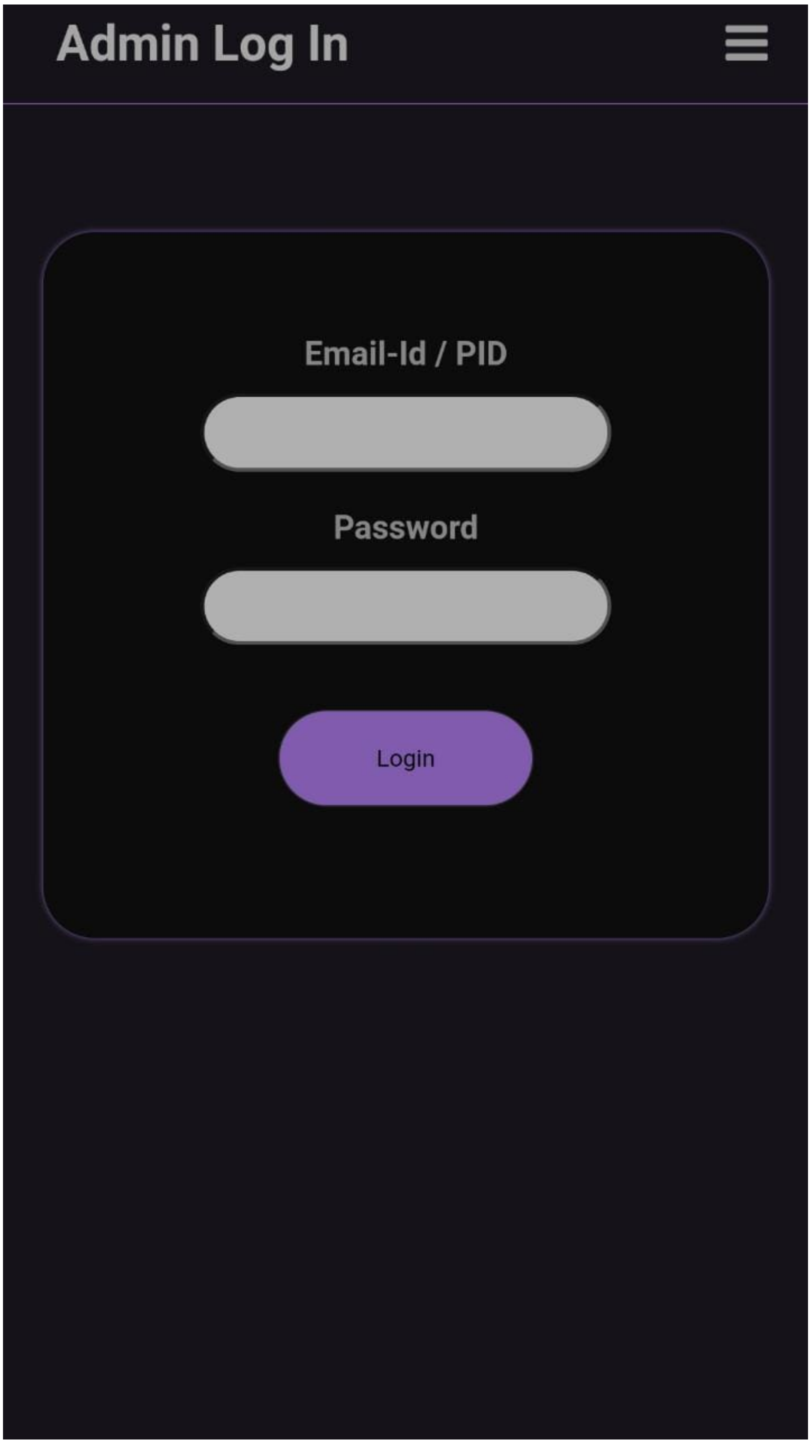
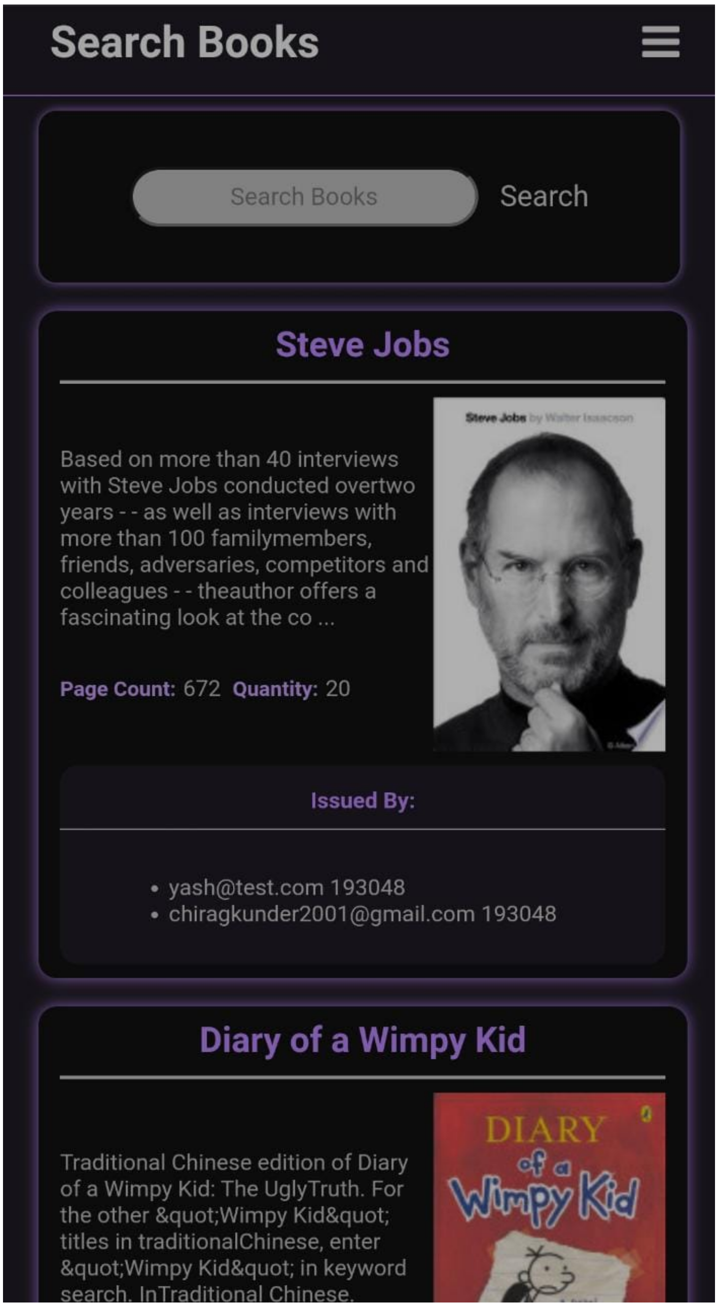


Figure 3.16: Login Page for Administrators

After logging in the Admin gets three options. The first is to get a login QR Code for login into the on-premise system. The second is to search books and the third is to search users.

The Admin can search for various books by entering the book name. After that, the book data is displayed with the student's name who has issued that book. Figure 3.16 shows the Book search page.



Search Books

Search Books | Search

Steve Jobs

Based on more than 40 interviews with Steve Jobs conducted overtwo years - - as well as interviews with more than 100 familymembers, friends, adversaries, competitors and colleagues - - theauthor offers a fascinating look at the co ...

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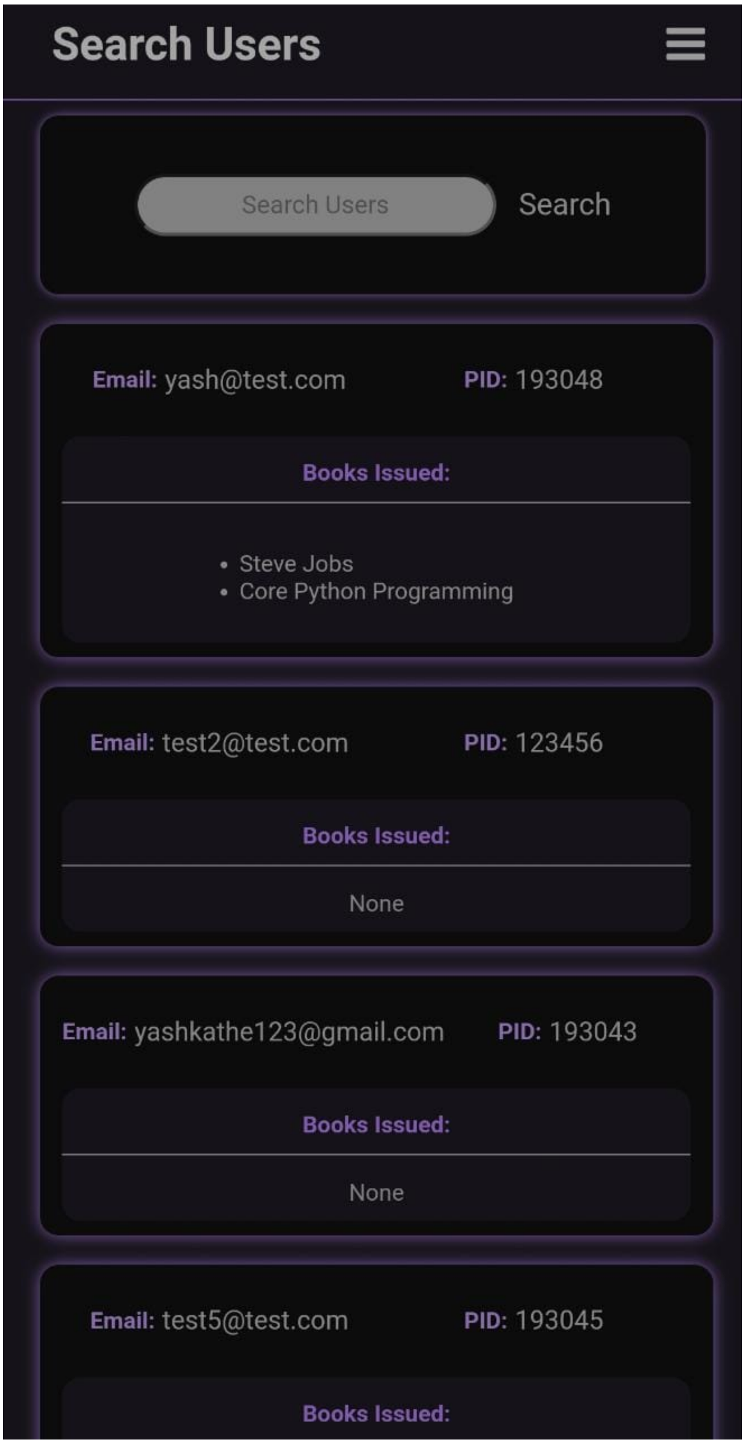
Diary of a Wimpy Kid

Traditional Chinese edition of Diary of a Wimpy Kid: The UglyTruth. For the other &quot;Wimpy Kid&quot; titles in traditionalChinese, enter &quot;Wimpy Kid&quot; in keyword search. InTraditional Chinese.

Figure 3.17: Search books for Admin Login

The Admin can also search various users by searching the user's name. The Admin gets the student details and list of books issued by the user. Figure 3.18 shows the User search page.



Email: yash@test.com PID: 193048

Books Issued:

- Steve Jobs
- Core Python Programming

Email: test2@test.com PID: 123456

Books Issued:

None

Email: yashkathe123@gmail.com PID: 193043

Books Issued:

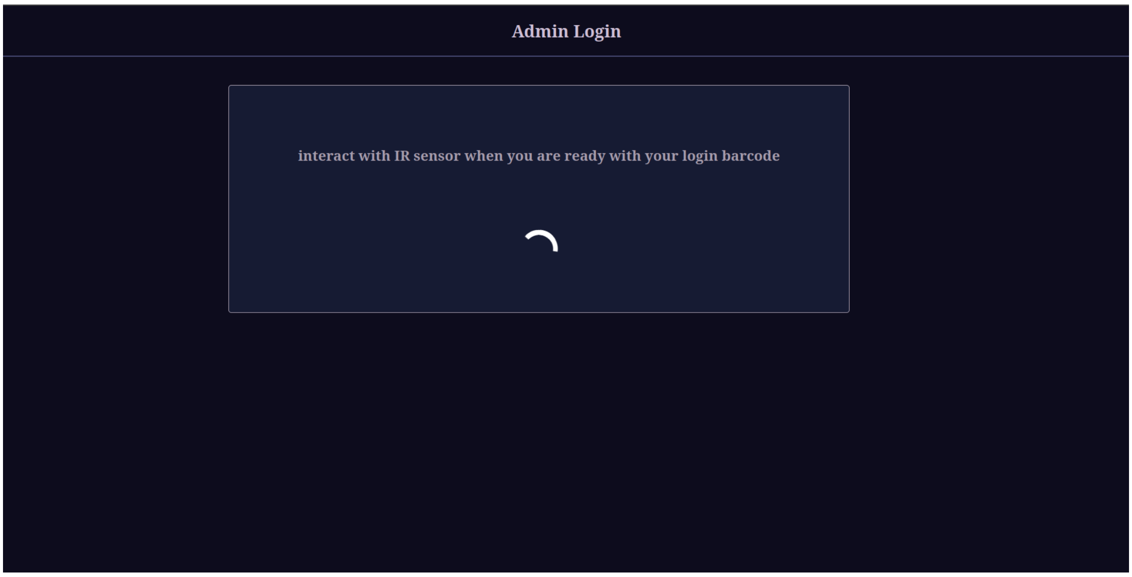
None

Email: test5@test.com PID: 193045

Books Issued:

Figure 3.18: Search Users by Admin

This is the User Interface for on-premise System. Figure 3.19 shows the start of the process. The Process starts when the User interacts with the IR Sensor. IR transmitter continuously emits the IR light and the IR receiver checks for reflected light. When light hits an object in front of it, it is reflected back and received by the IR receiver. This way the object is detected.

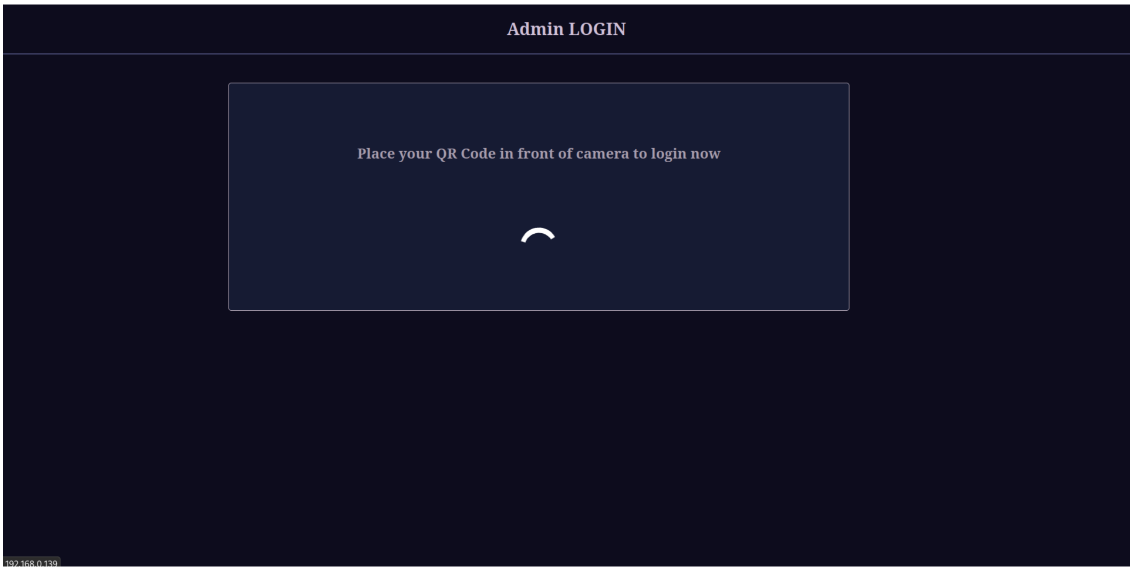


Admin Login

interact with IR sensor when you are ready with your login barcode

Figure 3.19: Interacting with IR sensor

Figure 3.20 represents that the IR sensor has detected the user and started the process. It lets the user know that he/she has to place QR Code in order to log in.



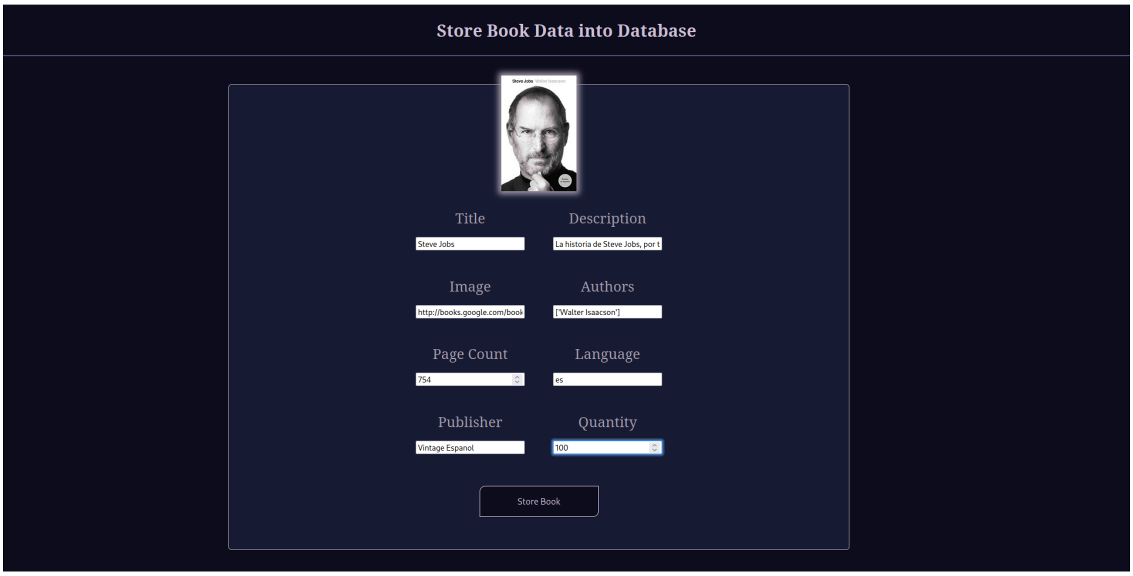
Admin LOGIN

Place your QR Code in front of camera to login now

192.168.0.139

Figure 3.20: Scanning QR code to login

For the Librarian login, the admin has the feature of storing books in the book database. Figure 3.21 represents the web page where the book data is fetched after scanning ISBN and the Librarian can add the book quantity.



Store Book Data into Database

Title: Steve Jobs

Description: La historia de Steve Jobs, por t

Image: http://books.google.com/book

Authors: ['Walter Isaacson']

Page Count: 754

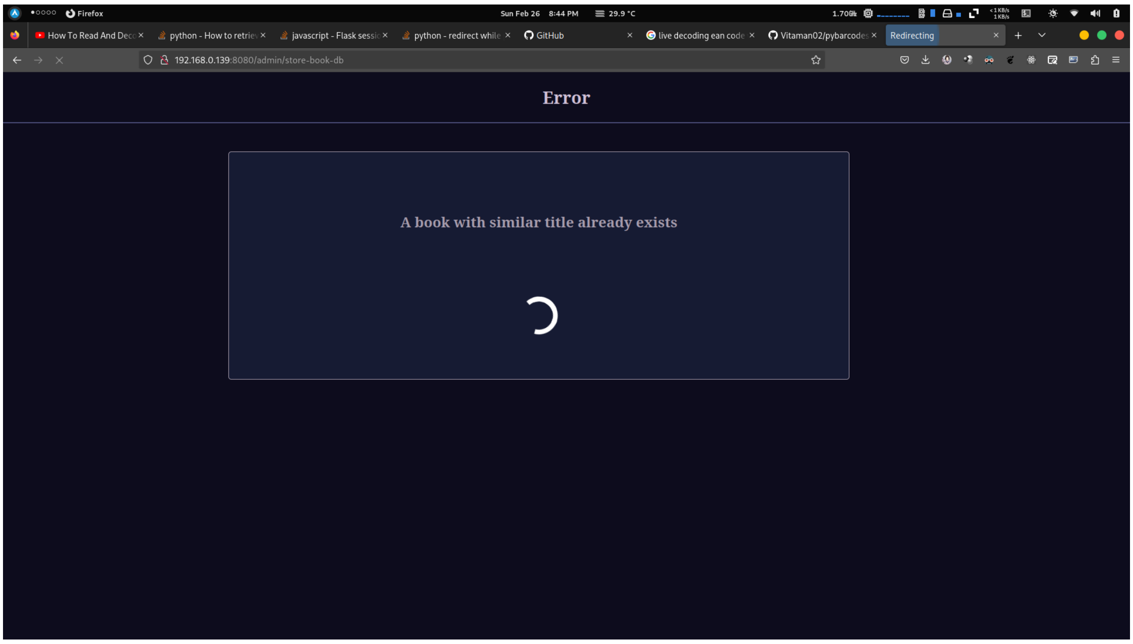
Language: es

Publisher: Vintage Espanol

Quantity: 100

Figure 3.21: Storing Books in Database

If the Book already exists it shows the error message. The error message is shown in Figure 3.22.



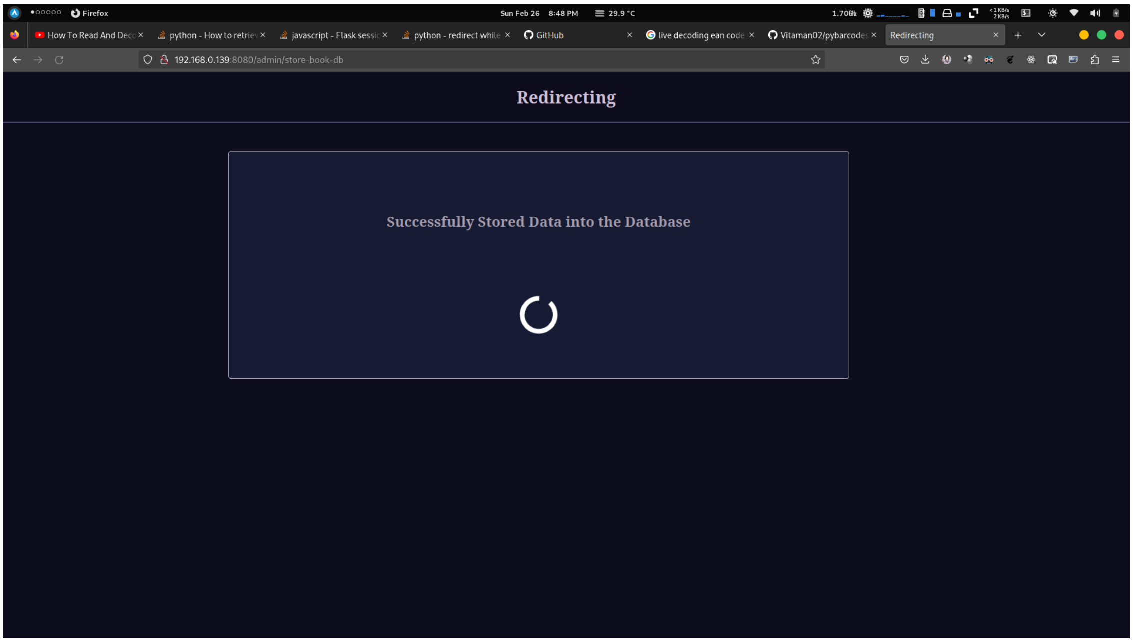
192.168.0.139:8080/admin/store-book-db

Error

A book with similar title already exists

Figure 3.22: Error page

The Admin can then successfully add the book quantity if a similar book exists the admin can check and correct it or else continue it. The successful addition of the book is shown in Figure 3.23.



Redirecting

Successfully Stored Data into the Database

Figure 3.23: Successfully storing Books in Database

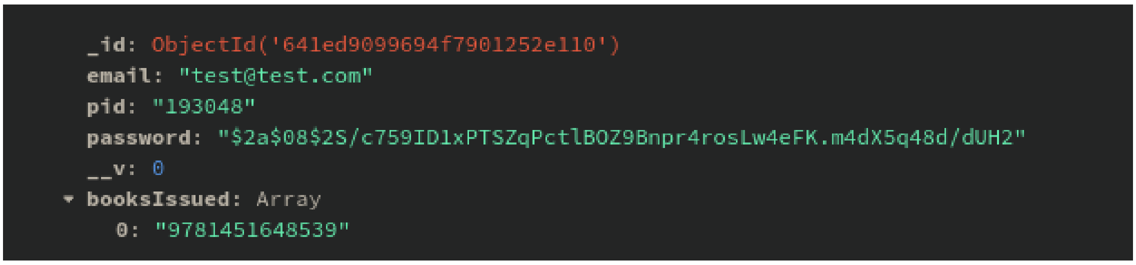
Chapter 4

Simulation and Experimental Results

The database is designed and developed using Mongo-DB Atlas where Students and Books exhibit an N-N relationship. Here a student can issue N books and books with the same ISBN can be issued by N students. The database is stored on the cloud using Mongo-DB Atlas which is scalable and secure.

In order to authorize and save student data into the student database, the user is required to sign up on the website, and a unique ID in the form of a QR Code is provided to him as part of the registration process. This QR Code which is created by encoding the ObjectId of Student from the database can be later used to login into the Library premises. The user will have to scan the QR code with the help of the Camera module present in our system. The given QR code is scanned using the camera module and the value of the QR code is printed. Once the QR code is detected, the user is through the authentication process and can continue with his issuing or returning process.

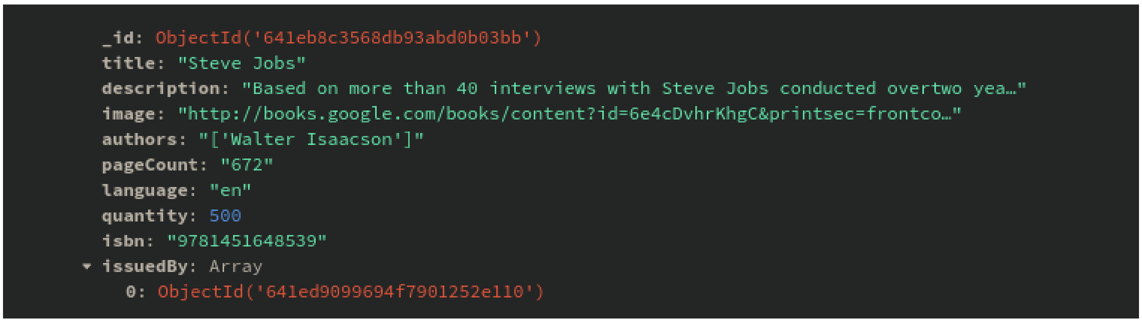
All the user data is stored in the Student Database. The schema of the database is shown in Figure 4.1. It has the email-id and pid of the student stored and the password is also saved but in an encrypted format. The user account credentials are stored in the form of key-value pairs. Also, each account is given a unique id by the database itself. Whenever the student issues the book, the ISBN of that book gets saved in the issued books column.



```
  _id: ObjectId('641ed9099694f7901252e110')
  email: "test@test.com"
  pid: "193048"
  password: "$2a$08$2S/c759ID1xPTSZqPctlBOZ9Bnpr4rosLw4eFK.m4dX5q48d/dUH2"
  __v: 0
▾ booksIssued: Array
    0: "9781451648539"
```

Figure 4.1: Student Database

In order to add new books to the library, the librarian must first log in with the correct credentials, and after that, he or she must scan the ISBN of the new book. Once the librarian has confirmed the details of the book, he or she has to enter the number of books. The schema of the book database is shown in Figure 4.2. It has the book title, description, image, authors, page count and language of the book stored. It stores the quantity of the book and it gets updated every time the book is issued or returned. Furthermore, if the same ISBN book is added to the list, the quantity for that book will be added as well. The book credentials are stored in the form of key-value pairs. Each book is given a unique ID by the database itself. Whenever the book is issued by a student the objID of the student is stored in the book database.



```
  _id: ObjectId('641eb8c3568db93abd0b03bb')
  title: "Steve Jobs"
  description: "Based on more than 40 interviews with Steve Jobs conducted overtwo yea…"
  image: "http://books.google.com/books/content?id=6e4cDvhrKhgC&printsec=frontco…"
  authors: "['Walter Isaacson']"
  pageCount: "672"
  language: "en"
  quantity: 500
  isbn: "9781451648539"
▾ issuedBy: Array
    0: ObjectId('641ed9099694f7901252e110')
```

Figure 4.2: Book Database

Chapter 5

Conclusion and Future Scope

5.1 Conclusion

Many libraries today find it difficult to manage all the workloads and a large number of customers. To mitigate such problems we have developed a user interface which makes it easier for clients to log into their account. With the help of this interface, it is easier to keep track of books that have been issued or returned to the library. The QR code and ISBN scanner work very efficiently and reduce the librarian's work. With the help of the Google Books API, users and administrators can view details about the books. By providing these features, our main aim is to make a completely self-service automated system for the clients as well as the staff so that they can work through the process faster and more efficiently.

5.2 Future Scope

Given the current pace of technological advancements and market evolutions, there are a lot of new features that could be included in this system in the upcoming future. Some of them are:

1) Book recommendation:

The library can also be enhanced by adding a book recommendation system, where the user will be able to get suggestions of the book they should issue if the book they are looking for is not present at the moment in the library. If, for example, a user desired to obtain a book on kinematics by a particular author but the book was not present in the library, he would be provided with the recommendation of the book he required.

2) Shelf Management:

An automated library shelf management system to assist the librarians with more efficient shelf management to find any misplaced books on the library shelf. The purpose of this is to check whether the book was at the right location or not.

3) Online Payment:

When users join public libraries they need to pay a certain amount which is refundable. When membership ends they can make payment online using a credit card or debit card. When a user does not return the book on the assigned deadline he needs to pay the fine to the library which can be done online.

4) Authentication:

In the current system, we use a QR code for student authentication. However, any user with the QR code of a different person can be assigned a book in their name, therefore, we can add a fingerprint scanner.

5) Alert System:

The student will get a notification before the deadline for returning the book. This will enable them to return the book on time without paying the late fine.

References

[1] N. Karna, D. Pratama and M. Ramzani, â€œ Self Service System for Library Automation: Case Study at Telkom University Open Library â€ 2019 International Conference on Information and Communications Technology (ICOIACT). Indonesia, 2019, pp. 689-693, doi: 10.1109/ICOIACT46704.2019.8938439.

[2] R. Patnaik and M. K. Mishra, â€œRole of Content Management Software (CMS) in libraries for information dissemination,â€ 2015 4th International Symposium on Emerging Trends and Technologies in Libraries and Information Services, 2015, pp. 117-121, doi: 10.1109/ETTLIS.2015.7048183.

[3] Hardik Poojary, Riddesh Ravindranath, Ankit Saigal and Jeffie Joseph, â€œLibrary management applicationâ€ 2013-14, Department of Information Technology, SFIT.