Library Management System

CS262 - Final Project Requirement Document

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1 Project Description

In this era, we can find every information online very easily, libraries are also important. Libraries consists of all books that can be used online by the users. No matter who you are, you can find anything in a library. Libraries have all kinds of books, stories, and other things to learn, and they're free for everyone to use.

Previously, our library maintained records manually, where all transactions, including book borrowing and user information, were recorded in registers. Whenever a user borrowed a book, a handwritten receipt was issued to the user, detailing the book borrowed and the time of borrowing. However, this manual system had its limitations, including the risk of errors, time-consuming processes, and difficulty in accessing information.

To overcome the limitations, We develop an **advanced automated Library management system**. We are unable to keep all the record books manually. So, this system automates the library management. Initially we have three types of users. An admin, Staff and a Student. A student can register himself and then login into the system. Only students can register while staff cannot register and can only be added by an admin. Admin can also log in the system. An admin can add students, staff, and another admin. These three users have different roles based on their roles. When the admin logs in, they will see the admin menu. The admin can handle CRUD operations of Student and has the authority to add or delete staff.

An admin will add certain things such as categories which specify the type of book, publishers, and locations to indicate which locations is available in the library for the placement of the Book. By adding details about publishers to the library system, the admin provides students with valuable information about the origin of the books available in the library. An admin will add authors, and when adding books, they will add information such as the publisher, title, category of that book. Book are also managed efficiently in this advanced system. The students can easily search for their desired book.

When a student logs in with their credentials, they will be presented with the student menu. Students can request to borrow a book. When a student requests a book, if it is available, the system will record the request. If the book is not available at the moment, the system will inform the Student about its unavailability and provide nearest time for when the book will be available. Students can also provide reviews for books. If a user borrowed a book and not return it until the due date, they will pay fine due by the staff/librarian. Students cannot borrow other book until he will not pay the fine.

The librarian will be responsible for viewing student requests and issuing books to the students. If a student will not return a book before the due date, the librarian will impose a fine. Students cannot borrow other book until he will not pay the fine.

The Reports that were previously manually compiled will now be generated automatically by the

system. This will see the time.

To make this system more efficient we design a User-friendly User interface which is easily to handle and control. A user-friendly interface enhances the experience for librarians making it easier to navigate the system and find desired resources. This management system automates a lot of work which reduces the workload of librarians.

There are lots of benefits to using our new system. First, it stops mistakes because everything is done by the computer. Second, it saves time for the library staff because they don't have to do everything manually. Third, it makes it easier for students to find and borrow books. Finally, it makes sure everyone follows the rules by giving fines for late returns.

Overall, our new system makes the library run smoother and helps everyone find what they need faster and easier.

2 Project Features

2.1 Student Management

Students can register themselves into the system by providing their necessary details such as email with a password. Once registered, their profiles will created, and they will be able to log in to the system. This login system allows the students to interact with various features and functionalities of the library management system. The admin has the authority to add students directly into the system. This feature enables the admin to manage the registration process efficiently and ensure that all eligible students are included in the system.

2.2 Staff Management

In this library system, there is another functionality Which is staff management. The admin have authority to add, delete, and edit staff members in the library. This feature enables the admin to manage the staff in the library accurately.

2.3 Admin Management

Administrators have the authority to add other admins to the system, increasing admin capabilities. Admins can perform CRUD (Create, Read, Update, Delete) operations on users data, Books Data and admin records. It involves creating, deleting, and updating admin accounts.

2.4 Book Management

This feature is used for managing the library's collections. New books can be added, existing book details updated along with its details. When adding a book, information about the book's publisher and author is also recorded.

2.5 Author And Publisher Management

Admins can also add authors and publishers to the system. This means they can enter the details about who wrote the books and who published them. By doing this, admins make it easier to assign books to specific authors and publishers. It helps keep everything organized in the library system and makes it simpler for people to find the books.

2.6 Request Book

This feature will provide students with the ability to request books. When a student requests a book, if it is available, the system will record the request. If the book is not available at the moment, the system will inform the Student for not availability of the book and provide nearest time for when the the book will be available. This ensures that students are informed about the status of their requests and can plan accordingly for when they can access the book.

2.7 Book Issue

When a student requests to borrow a book, the request will forward to the staff and the staff will issue the book to the student. This process ensures a seamless and efficient workflow in the library management system.

2.8 Fine Management

If a student forgets to return the book before the due date, the system will automatically apply fines. Similarly, if a user forgets to returns the book till the due date, the system will mark the book as overdue and apply fines accordingly. When the fine applies, students will not be able to borrow any other books until the fines are paid. The system notify the students about the amount to be paid.

2.9 Student Reviews

Students can also give reviews about the books in the library. The review form will allow students to share their opinions, comments or concerns about individual books they have read. Reviews provided by students will be recorded and displayed for other student to reference and consider.

3 Technology Stack

Technology	Tools
Language	C#
Platform	Desktop
Frontend Technology	• Winforms in .Net Framework • ReaLTaiizor.3.7.7
IDEs	• Microsoft Visual Studio 2022

Table 1: Technology Stack

4 Project Actors

There are 3 actors in our Library Management System. They are as follows

4.1 Admin

Admin controls the whole system.The admin can handle tasks such as adding or removing books from the system, as well as managing students and staffs by adding new ones or removing previous.The admin has control over the entire system. The main role of admin is to manage books, keeps track of publishers and authors.

4.2 Staff/Librarian

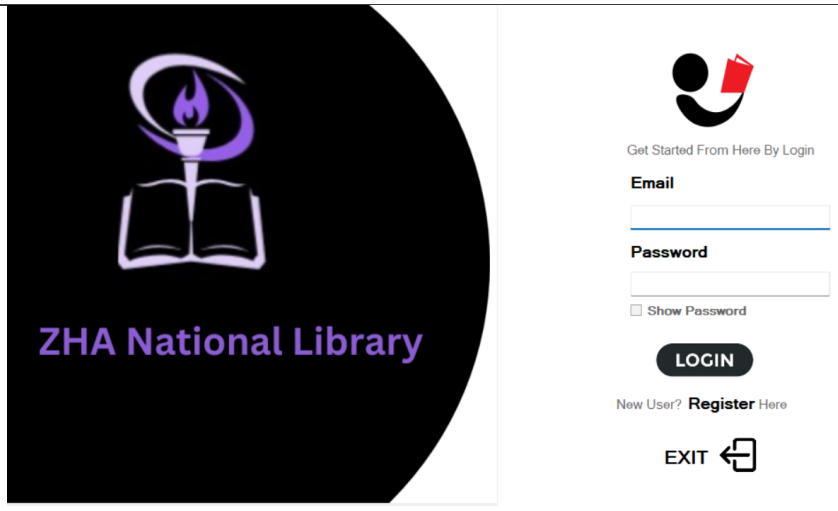
The librarian can review the student requests and issuing books accordingly. It also impose fines on students who fail to return the books by the due date. Librarian also manages the circulation of the books within the library. Moreover, they can view their salary and personal information.

4.3 Students

The role of the students in library is very important. They can request the Book. They can view the status of their requested Book. Students also contribute to library management by giving reviews for the book they borrowed. They interact with the system to access various features of library. Students play an important role in utilizing library resources effectively.

5 Use Cases

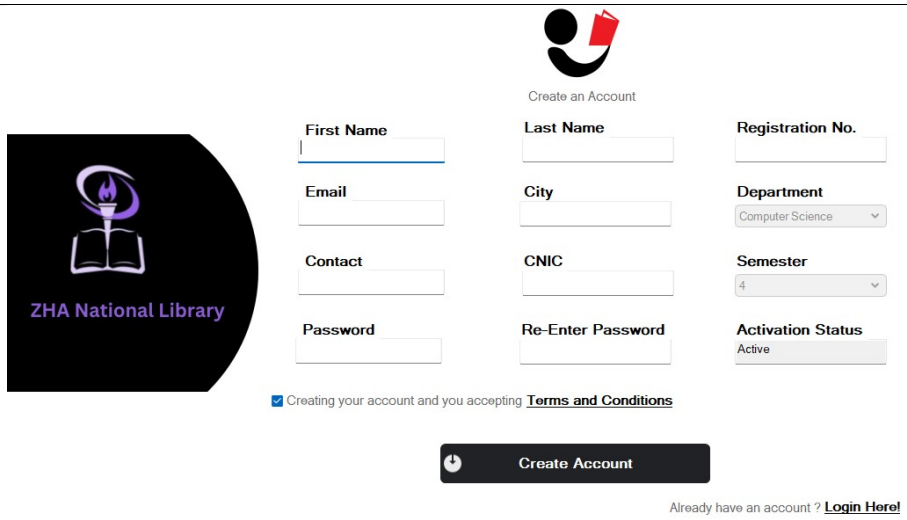
5.1 Login

UseCaseId	U01
Name	Login
Actor	Admin, Students, Staff
Description	**Main Flow:** • The user can traverse through the login page. • The user must enter the email and password in their respective text box and password box. • The user then clicks on login button. • System then checks the respective email and password. • If the given credentials provided by the user are correct then system recognizes them as one of the User like Admin or Student or Staff. **Alternative Flows:** a) Invalid Credentials • If any one of the credentials(email or password) is incorrect, the system displays an error. • User is then reuired to re-enter the password and email b) Account Error • If the user(student) does not contains any account, they have to first create their account by clicking on Register Here.
Layout In Pencil Tool	

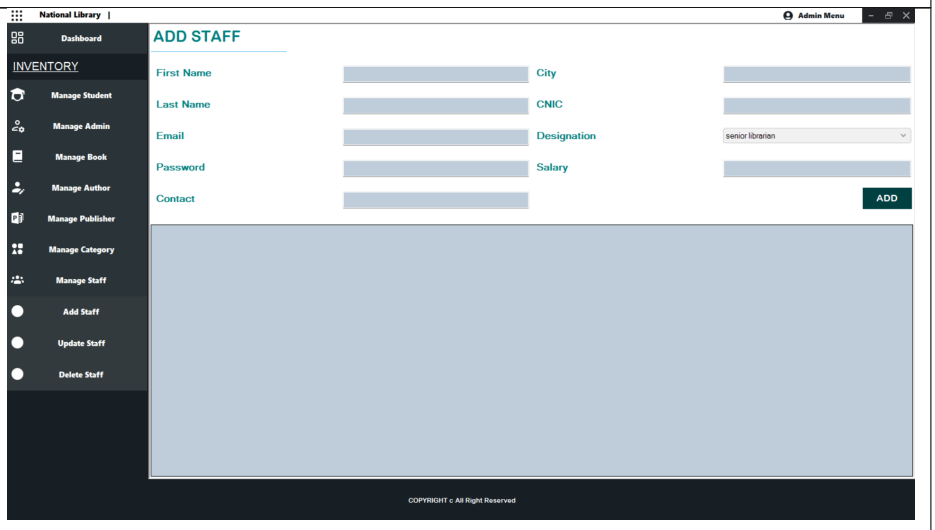
Validators	If the user enters wrong email or password or does not have account then an error message is occured which identifies the type of error.Password dont contains any negative number and must be atleast of length 8.Email must be of correct format(e.g xxx@gmail.com).

5.2 Sign Up

UseCaseId	U02
Name	Sign Up
Actor	Student
Description	**Main Flow:** 1. Student navigates to the Sign Up page. 2. Student enters his credentials like first name, last name, email, password, contact number, city, CNIC, registration number, and department. 3. Student then clicks on the CREATE ACCOUNT button. 4. System checks the entered credentials. 5. The system creates a new account for the student if all field are correctly filled. 6. Student is then redirected to the Login page. **Alternative Flows:** a) Invalid Information 1. If any text filed is empty or the invalid data is entered, the system shows an error. b) Email Already Exists 1. If the entered email exists already in the database. 2. The student is directed to re-enter the email.

Layout In Pencil Tool	
Validators	It is mandatory to fill all the fields and if any one of them is not correctly filled then an error message indicating the type of error occurs.Contact number must be of eleven digits and Password must be of length 8.Similarly registration number must be valid.

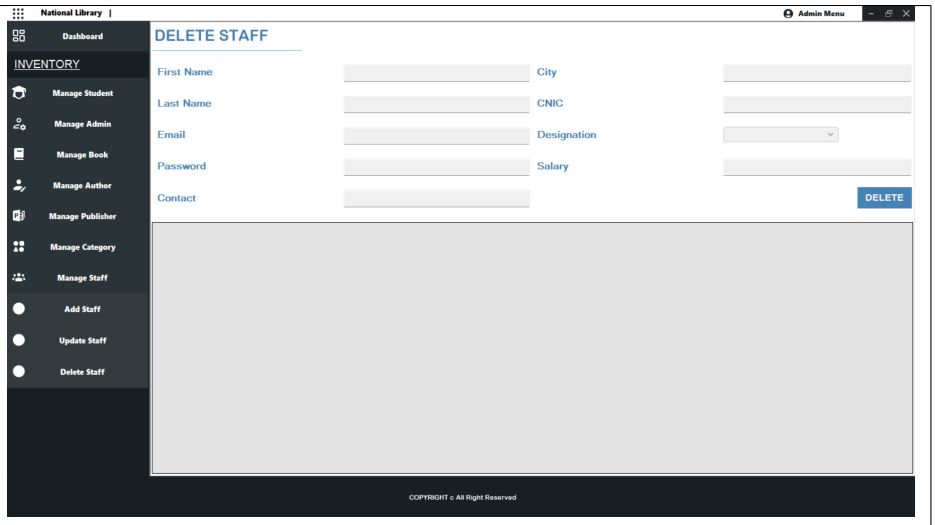
5.3 Add Staff

UseCaseId	U03
Name	Add Staff
Actor	Admin
Description	**Main Flow:** 1. The admin enters add staff form after clicking the add staff button. 2. Admin then add relevant information of the staff like First Name,Last Name,Email and Password. 3. Admin then clicks the Add Staff button. 4. System then checks the relevant information and Adds the staff. 5. System then displays a confirmation message to the Admin. **Alternative Flows:** 1. An error message will be displayed if Admin clicks on the Add Staff button without completing all the relevant fields. 2. If an email which already exists in the database then it displays an error message.
Layout In Pencil Tool	

Validators	If any field is not correctly filled or if any validations fails then it displays an error message.Contact number must be of eleven digits and Password must be of length 8.Email must be of correct format(e.g xxx@gmail.com).CNIC only contain 13 numbers.

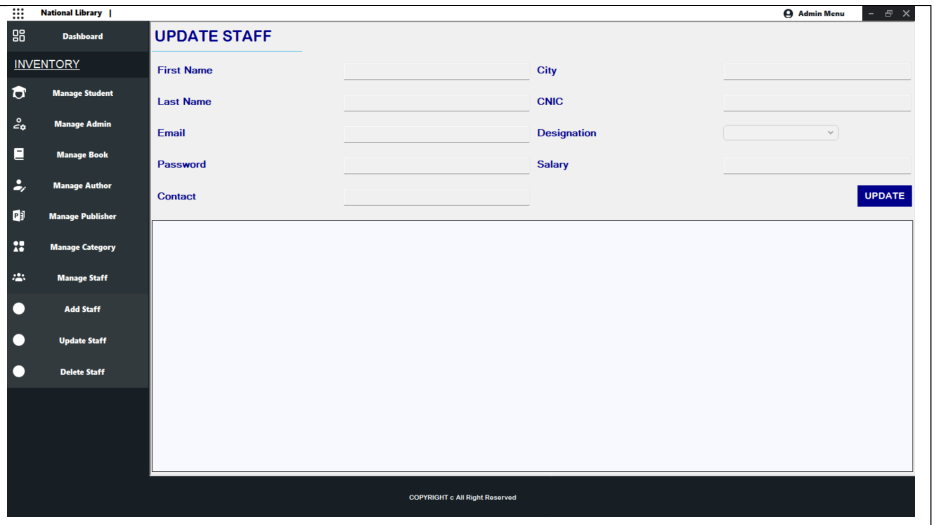
5.4 Delete Staff

UseCaseId	U04
Name	Delete Staff
Actor	Admin
Description	**Main Flow:** 1. The admins clicks on the Delete staff Button. 2. The system displays a list of existing staff members. 3. The admin select a staff member from the list. 4. The system displays the information of the staff in the text fields. 5. The admin clicks on the DELETE button. 6. The system Delete the staff account from the database. 7. The system displays a confirmation message to the Admin. **Alternative Flows:** 1. If admin clicks on the DELETE button Without filling any required field, the system displays an error.

Layout In Pencil Tool	
Validators	Deleting Staff form contain proper validation. In this form, their must be no empty field, all the fields are required with the proper format.Contact number must be of eleven digits and Password must be of length 8.Email must be of correct format(e.g xxx@gmail.com).CNIC only contain 13 numbers.

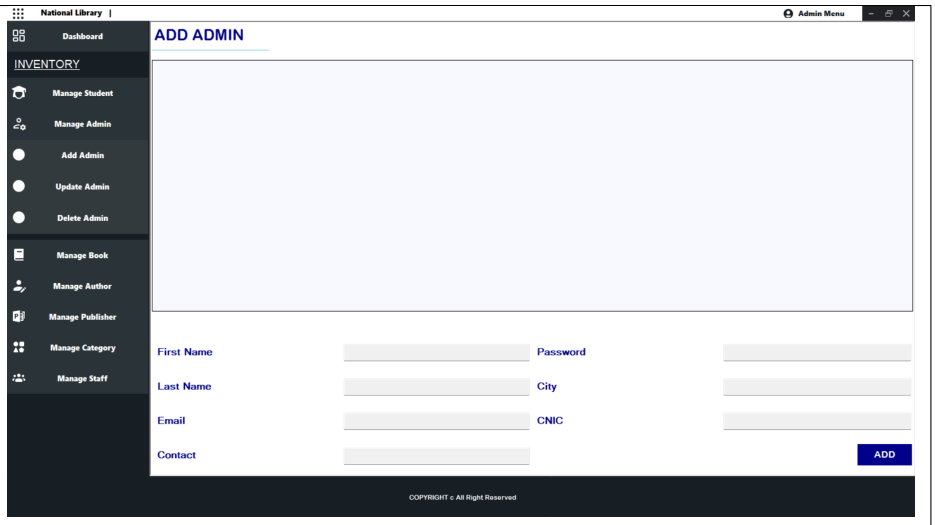
5.5 Update Staff

UseCaseId	U05
Name	Update Staff
Actor	Admin
Description	**Main Flow:** 1. The admins clicks on the Update staff Button. 2. The system displays a list of existing staff members. 3. The admin select a staff member from the list. 4. The system displays the information of the staff in the text fields. 5. The admin edits the staff information like name, contact, email etc. 6. The admin clicks on the UPDATE button. 7. The system Update the staff account from the database. 8. The system displays a confirmation message to the Admin. **Alternative Flows:** 1. Incomplete Information • If the admin update the staff without filling all required fields, the system displays an error. 2. Invalid Staff Information • If the admin enters invalid information an error message will appear.

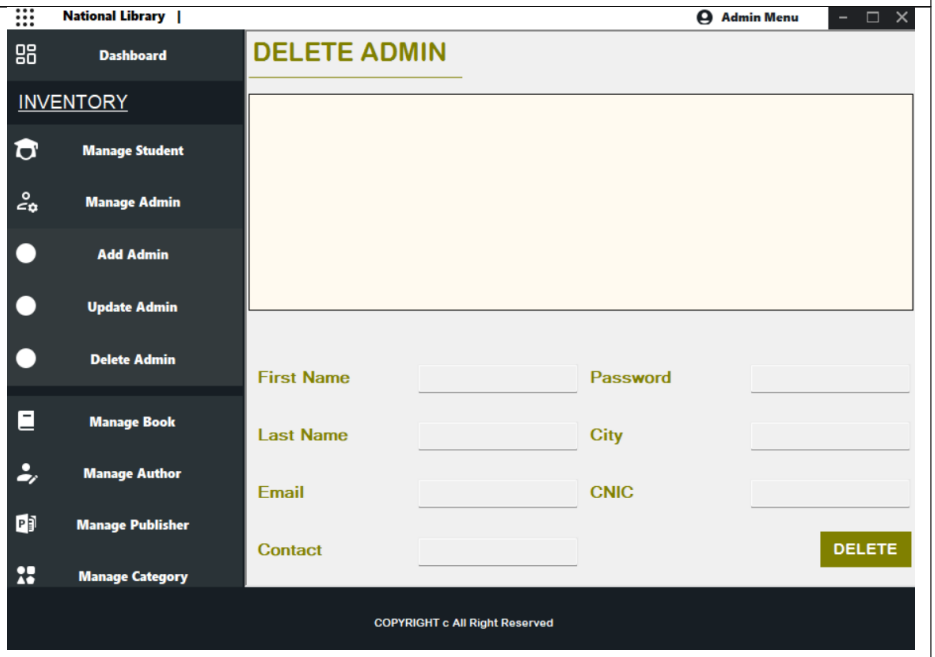
Layout In Pencil Tool	
Validators	Updating Staff form contain proper validation. In this form, their must be no empty field, all the fields are required with the proper format.Contact number must be of eleven digits and Password must be of length 8.Email must be of correct format(e.g xxx@gmail.com).CNIC only contain 13 numbers.

5.6 Add Admin

UseCaseId	U06
Name	Add Admin
Actor	Admin
Description	**Main Flow:** 1. Admin clicks on the Add Admin button. 2. Admin enters the new admin with their credentials like first name, last name, contact number, email, password, city, and CNIC into the respective fields. 3. Admin clicks the ADD button. 4. System Check the entered information. 5. If all fields are filled correctly, the system creates a new admin account. 6. Admin receives a confirmation message. **Alternative Flows:** a) Invalid Information 1. If any field is left empty or invalid data is entered, the system displays an error message indicates that information is incorrect and not validate. b) Email Already Exists 1. If the entered email already exists in the database, the system displays an error message indicates that the email is already exist.

Layout In Pencil Tool	
Validators	All the fields are Required. If any text box is empty, the system displays an error message. CNIC only contain 13 numbers.Contact number must be of eleven digits and Password must be of length 8.Email must be of correct format(e.g xxx@gmail.com).

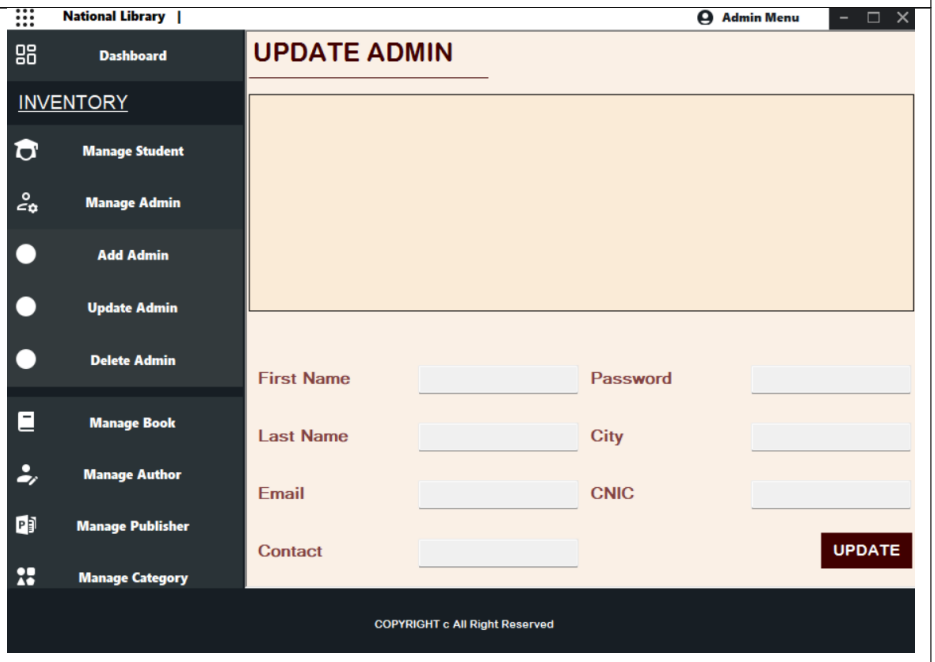
5.7 Delete Admin

UseCaseId	U07
Name	Delete Admin
Actor	Admin
Description	**Main Flow:** 1. Admin clicks on the Delete Admin button. 2. Admin selects the admin they want to delete. 3. Admin clicks on the DELETE button. 4. System removes the selected admin account. 5. Admin receives a confirmation message. **Alternative Flows:** a) Admin Cancels Deletion 1. If admin cancels the deletion action, then no deletion occurs. b) Invalid Selection 1. If no admin is selected for deletion, the system prompts the admin to select an admin to delete.
Layout In Pencil Tool	

Validators	All the fields are Required. Nothing of the Text box is accepted as an empty. CNIC only contain 13 numbers.Contact number must be of eleven digits and Password must be of length 8.Email must be of correct format(e.g xxx@gmail.com).

5.8 Update Admin

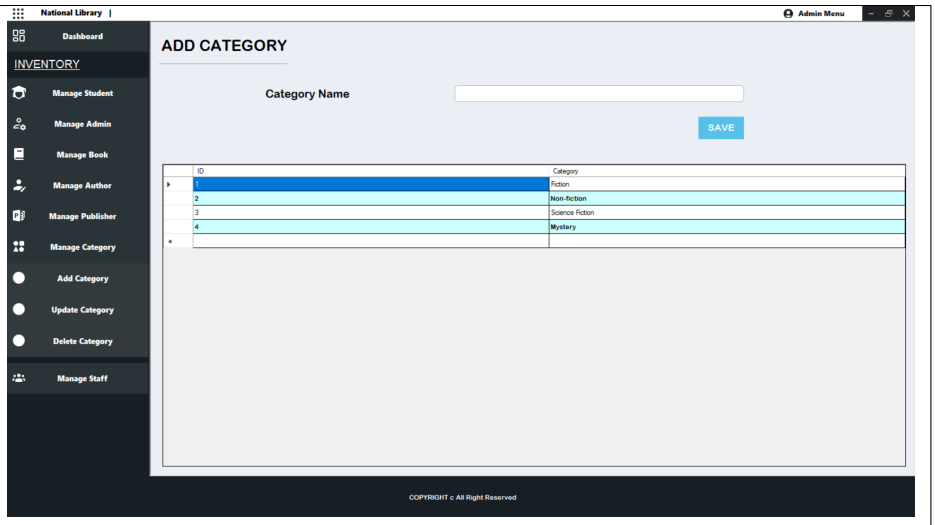
UseCaseId	U08
Name	Update Admin
Actor	Admin

Description	**Main Flow:** 1. The admins clicks on the Update admin Button. 2. The system displays a list of existing admin. 3. The admin select a admin from the list. 4. The system displays the information of the admin in the text fields. 5. The admin edits the admin information like name, contact, email, CNIC etc. 6. The admin clicks on the UPDATE button. 7. The system Update the admin account from the database. 8. The system displays a confirmation message to the Admin. **Alternative Flows:** a) Admin Cancels Update 1. If admin cancels the update then no updation occurs b) Invalid Selection 1. If no admin is selected for updating, the system prompts the admin to select an admin to update.
Layout In Pencil Tool	

Validators	All the fields are Required. Nothing of the Text box is accepted as an empty. CNIC only contain 13 numbers.Contact number must be of eleven digits and Password must be of length 8.Email must be of correct format(e.g xxx@gmail.com).

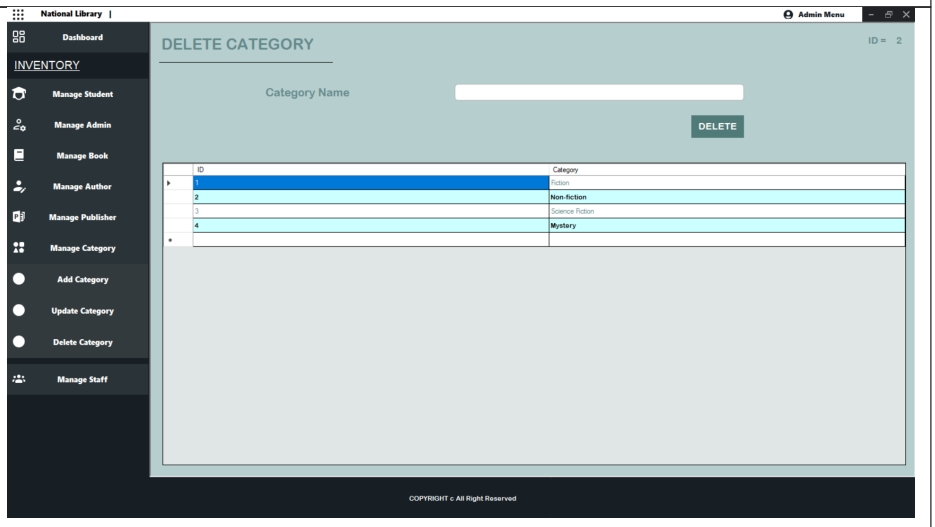
5.9 Add Category

UseCaseId	U09
Name	Add Category
Actor	Admin
Description	**Main Flow:** 1. Admin clicks on Add Category button. 2. Admin enters the name of the new category into the text field. 3. Admin clicks the ADD button. 4. System validates the entered information. 5. If the category name is unique and not empty, the system adds the new category. 6. Admin receives a confirmation message. **Alternative Flows:** a) Invalid Category Name 1. If the category name field is left empty or contains invalid characters, the system displays an error. b) Category Name Exist: 1. If the category name already exists in the database, the system displays an error message. 2. Admin is prompted to add the different category name.

Layout In Pencil Tool	
Validators	All the fields are Required. Nothing of the Text box is accepted as an empty.

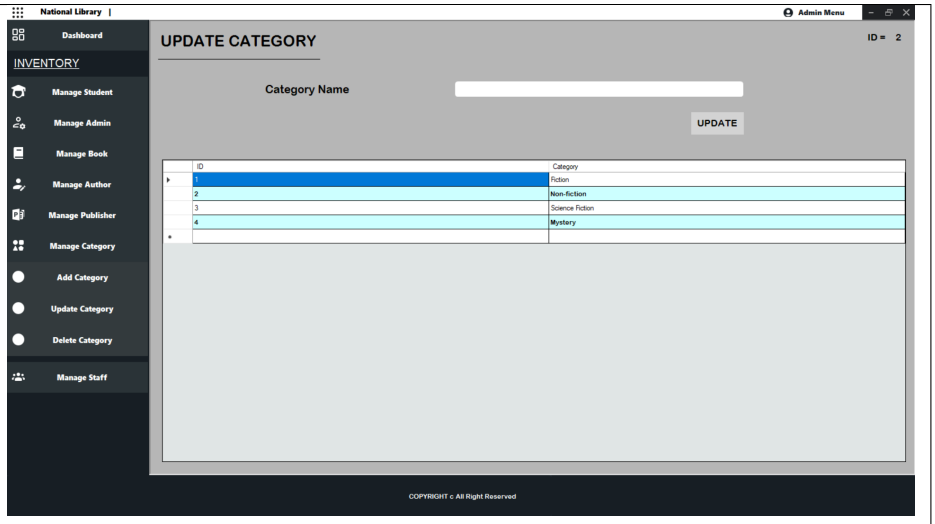
5.10 Delete Category

UseCaseId	U10
Name	Delete Category
Actor	Admin

Description	**Main Flow:** 1. The admin clicks the Delete Category button. 2. The system displays a list of existing Category. 3. The admin select a category from the list. 4. The system displays the information of the category in the text fields. 5. The admin clicks on the DELETE button. 6. The system DELETE the Category from the database. 7. The system displays a confirmation message to the Admin. **Alternative Flows:** a) Invalid Selection 1. If no catogory is selected for deletion, the admin is prompted to select category first.
Layout In Pencil Tool	
Validators	All the fields are Required. Nothing of the Text box is accepted as an empty.

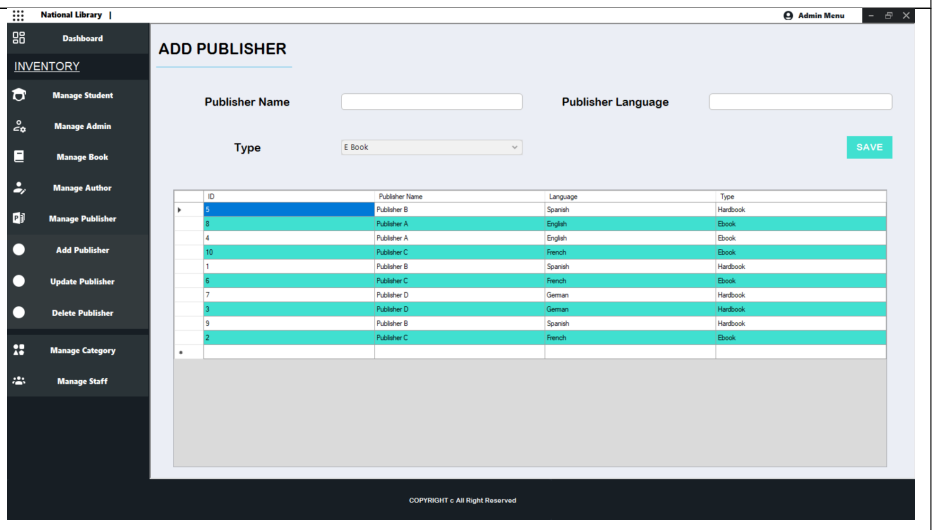
5.11 Update Category

UseCaseId	U11
Name	Update Category
Actor	Admin
Description	**Main Flow:** 1. The admin clicks on Update Category button 2. The admin selects the category they want to update from the list of categories. 3. The admin edits the category name. 4. The admin clicks on UPDATE button. 5. The system validates the information. 6. If the category name is already not exist and not empty, the system updates the category. 7. The admin receives a confirmation message. **Alternative Flows:** a) Invalid Selection 1. If no catogory is selected for deletion, the admin is prompted to select category first. b) Category Exist 1. If the entered category name already exists in the database, the system displays an error message.

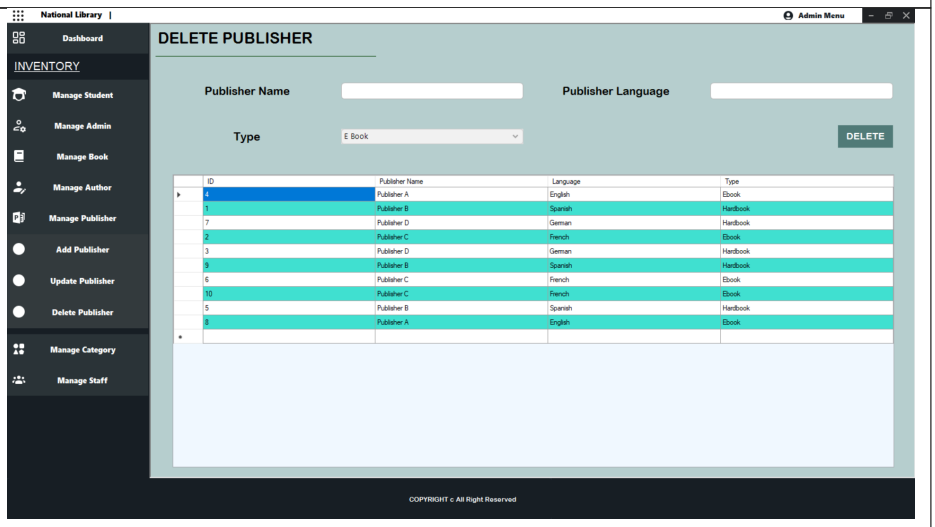
Layout In Pencil Tool	
Validators	All the fields are Required. Nothing of the Text box is accepted as an empty.

5.12 Add Publisher

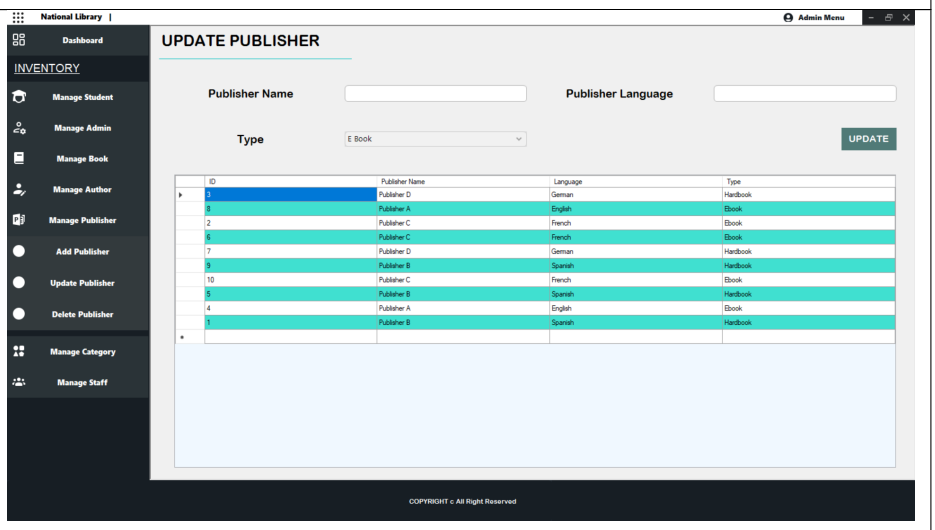
UseCaseId	U12
Name	Add Publisher
Actor	Admin

Description	**Main Flow:** 1. The admin clicks the Add Publisher button. 2. The admin enters the information of the new publisher in the text fields. 3. The admin clicks the ADD button. 4. The system validates the entered information. 5. If the publisher name is unique and not empty, the system adds the new publisher. 6. The admin receives a confirmation message. **Alternative Flows:** a) Invalid Publisher 1. If any field is left empty , the system displays an error. b) Publisher Exist 1. If the publisher name is already exists in the database, the system displays an error message.
Layout In Pencil Tool	
Validators	All the fields are Required. If any text box is empty then system displays an error to fill all the fields.

5.13 Delete Publisher

UseCaseId	U13
Name	Delete Publisher
Actor	Admin
Description	**Main Flow:** 1. Admin clicks on the Delete Publisher button. 2. Admin selects the Publisher they want to delete. 3. Admin clicks on the DELETE button. 4. System removes the selected Publisher. 5. Admin receives a confirmation message. **Alternative Flows:** a) Invalid Selection 1. If no publisher is selected for deletion, the admin is prompted to select the publisher first.
Layout In Pencil Tool	
Validators	All the fields are Required. If any text box is empty then system displays an error to fill all the fields.

5.14 Update Publisher

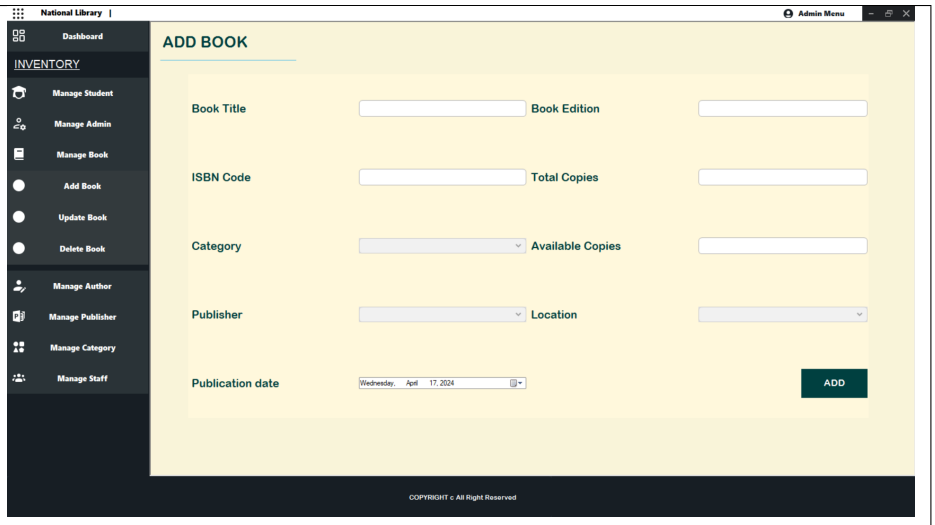
UseCaseId	U14
Name	Update Publisher
Actor	Admin
Description	**Main Flow:** 1. The admins clicks on the Update Publisher Button. 2. The system displays a list of existing Publisher. 3. The admin select a Publisher from the list. 4. The admin edits the Publisher information. 5. The admin clicks on the UPDATE button. 6. The system Update the Publisher from the database. 7. The system displays a confirmation message to the Admin. **Alternative Flows:** a) Invalid Publisher 1. If any field is left empty, then admin is prompted to fill all the fields. b) Publisher Exist: 1. If the publisher is already exist in the database, system displays an error.
Layout In Pencil Tool	

Validators	All the fields are Required. If any text box is empty then system displays an error to fill all the fields.

5.15 Add Book

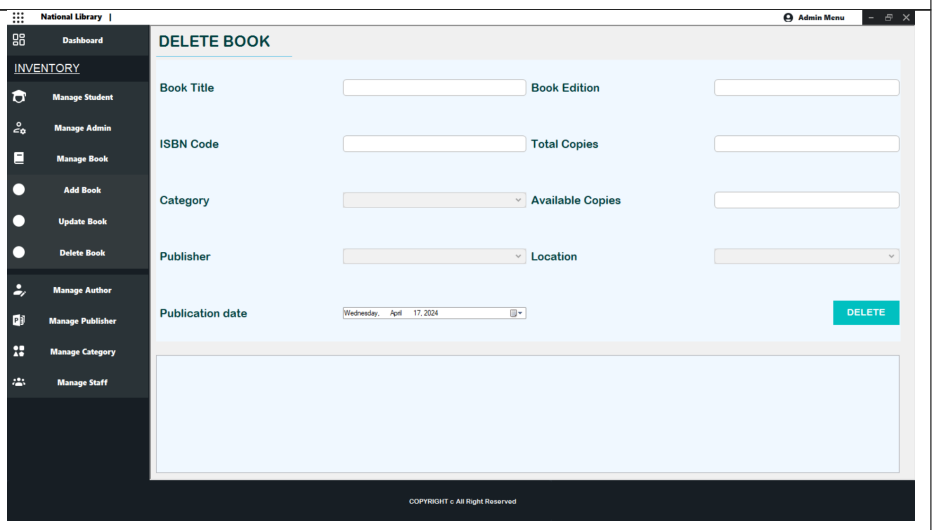
UseCaseId	U15
Name	Add Book
Actor	Admin

Description	**Main Flow:** 1. Admin navigates to the ”Add Book” page. 2. Admin enters the title, ISBN, category, publisher name, total copies, available copies, edition, and other relevant details of the book into the respective text boxes. 3. Admin press the ”Add” Button. 4. System validates the information that are entered by the Admin. 5. The Book is adding in the database if all the field are filled properly. 6. Admin received the message for successfully adding new book in Database **Alternative Flows:** a) Invalid Information: 1. If any required field is left empty or invalid data is entered, the system displays an error message indicating the missing or incorrect information. 2. Admin is prompted to fill in the required information correctly. b) ISBN Already Exists: 1. If the entered ISBN already exists in the database, the system displays an error message indicating that the book with the same ISBN already exists.

Layout In Pencil Tool	
Validators	All the fields are required. Empty fields are not accepted. The system validates each field to ensure correct information is entered.

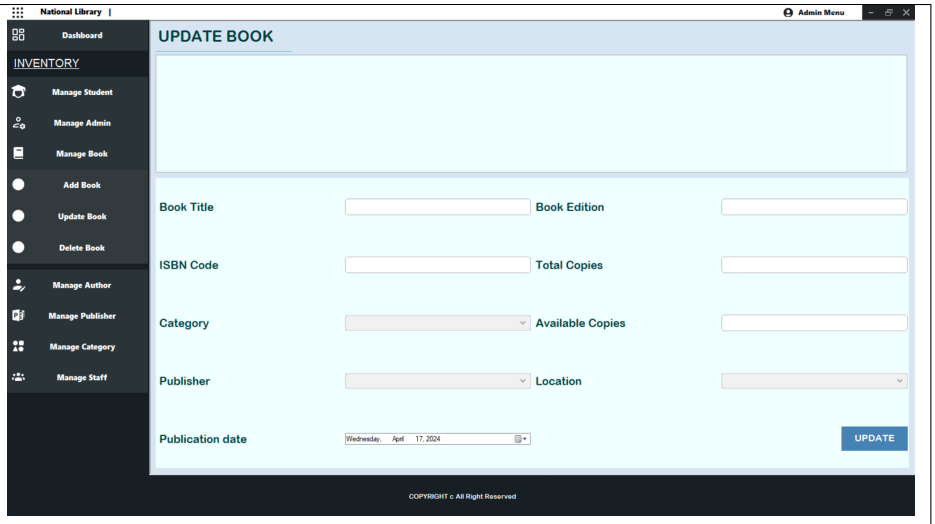
5.16 Delete Book

UseCaseId	U16
Name	Delete Book
Actor	Admin

Description	**Main Flow:** 1. Admin navigates to the ”Delete Book” page. 2. System displays a list of books available in the library. 3. Admin selects the book to delete from the list. 4. Admin clicks the ”Delete” button. 5. System confirms the deletion of the selected book. 6. Book is removed from the library database. **Alternative Flows:** a) No Books Selected: 1. If Admin tries to delete without selecting any book, the system displays an error message indicating that at least one book must be selected for deletion. 2. Admin is prompted to select book for deletion. b) Deletion Failure: 1. If there is an issue with deleting the book from the database (e.g., database error), the system displays an error message indicating that the book could not be deleted.
Layout In Pencil Tool	
Validators	All the fields are Required. Nothing of the Text box is accepted as an empty.

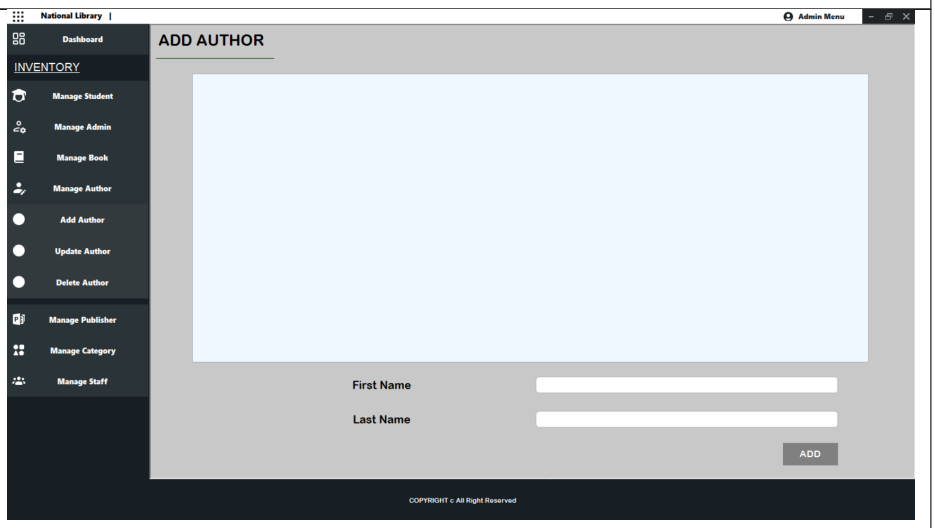
5.17 Update Book

UseCaseId	U17
Name	Update Book
Actor	Admin
Description	**Main Flow:** 1. Admin navigates to the ”Update Book” page. 2. System displays a list of books available in the library. 3. Admin selects the book to update from the list. 4. Admin makes changes to the book details (e.g., title, category, publisher). 5. Admin clicks the ”Update” button. 6. System validates the updated information. 7. If all required fields are filled correctly, the system updates the book details in the library database. **Alternative Flows:** a) No Book Selected: 1. If Admin tries to update without selecting any book, the system displays an error message indicating that a book must be selected for updating. 2. Admin is prompted to select a book for updating.

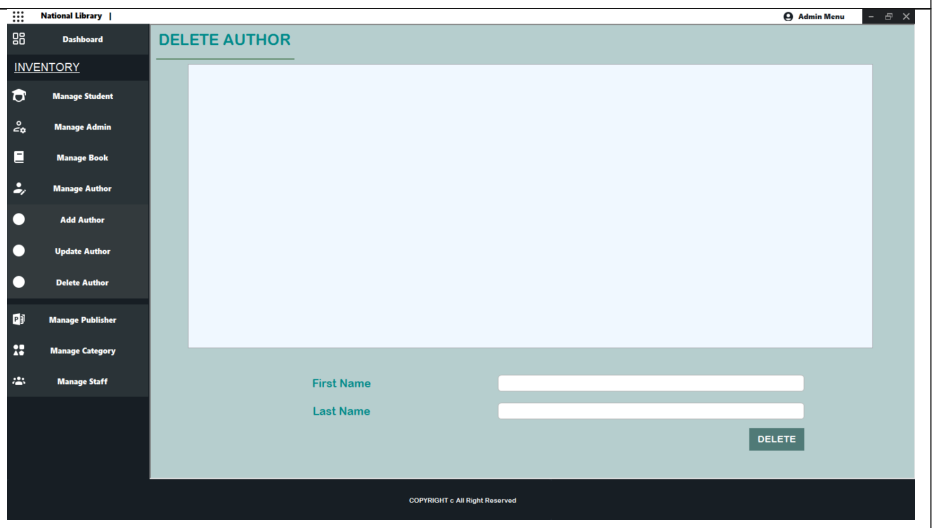
Layout In Pencil Tool	
Validators	All the fields are Required. Nothing of the Text box is accepted as an empty.

5.18 Add Author

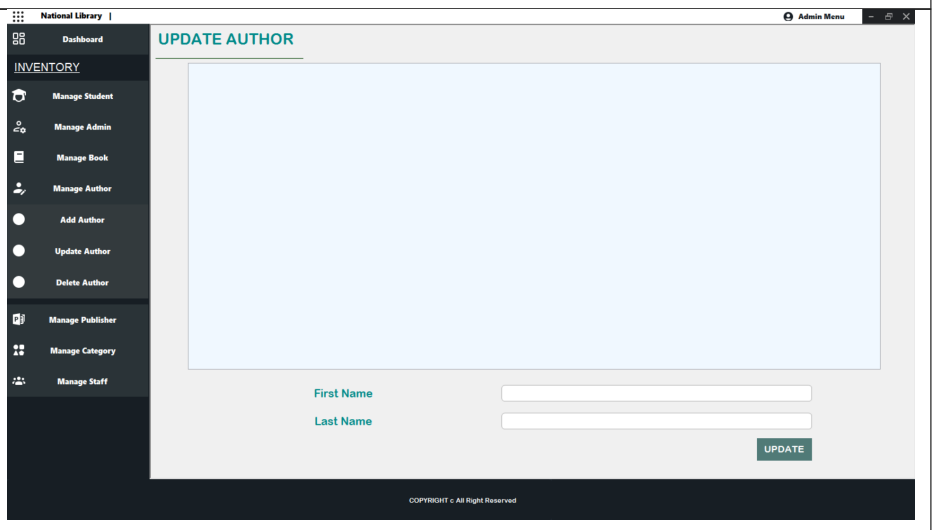
UseCaseId	U18
Name	Add Author
Actor	Admin

Description	**Main Flow:** 1. The admin clicks the Add Author button. 2. The admin enter the information of Author like First Name and Last Name. 3. The admin clicks the ADD button. 4. If the name of author is unique then author is add in the database. 5. Admin receives the confirmation message. **Alternative Flows:** a) Invalid Information: 1. if any of the field is empty while adding then system displays an error. 2. Admin is required to fill all the fields.
Layout In Pencil Tool	
Validators	All the fields are Required. Nothing of the Text box is accepted as an empty.

5.19 Delete Author

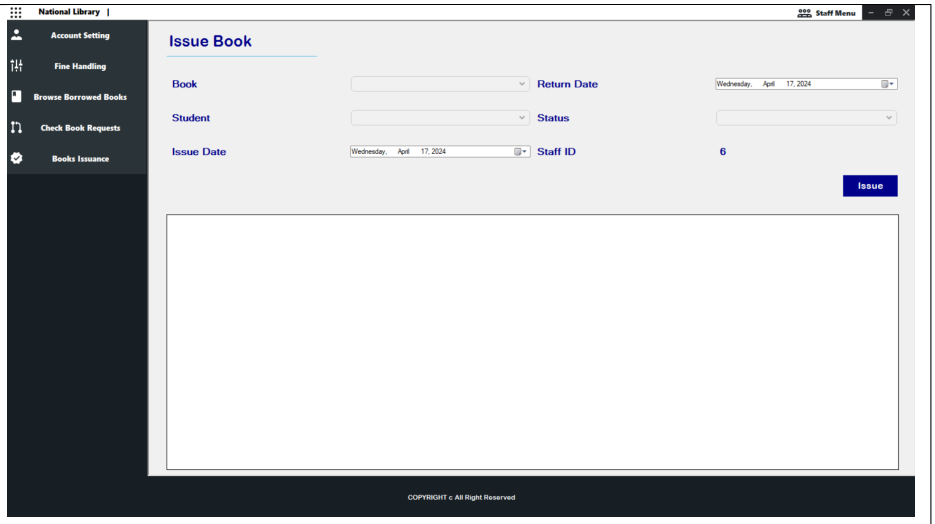
UseCaseId	U19
Name	Delete Author
Actor	Admin
Description	**Main Flow:** 1. Admin clicks the Delete Author button. 2. Admin selects the Author they want to delete. 3. Admin clicks on the delete button. 4. The system removes the selected Author. 5. Admin receives the confirmation message. **Alternative Flows:** a) Invalid Selection 1. If no author is selected for the deletion then system displays an error. 2. Admin is prompted to select author for deletion.
Layout In Pencil Tool	
Validators	All the fields are Required. Nothing of the Text box is accepted as an empty.

5.20 Update Author

UseCaseId	U20
Name	Update Author
Actor	Admin
Description	**Main Flow:** 1. Admin clicks on the Update Author button. 2. The system displays list of Author. 3. The admin select the author. 4. The admin edits the author information. 5. The admin clicks on the UPDATE button. 6. The system update the author in the database. 7. The system displays a confirmation message. **Alternative Flows:** a) No Author Selected 1. If no author is selected for the updation, then system displays an error. b) Author Exist 1. If any field is left empty, then admin is prompted to fill all the fields.
Layout In Pencil Tool	
Validators	All the fields are Required. Nothing of the Text box is accepted as an empty.

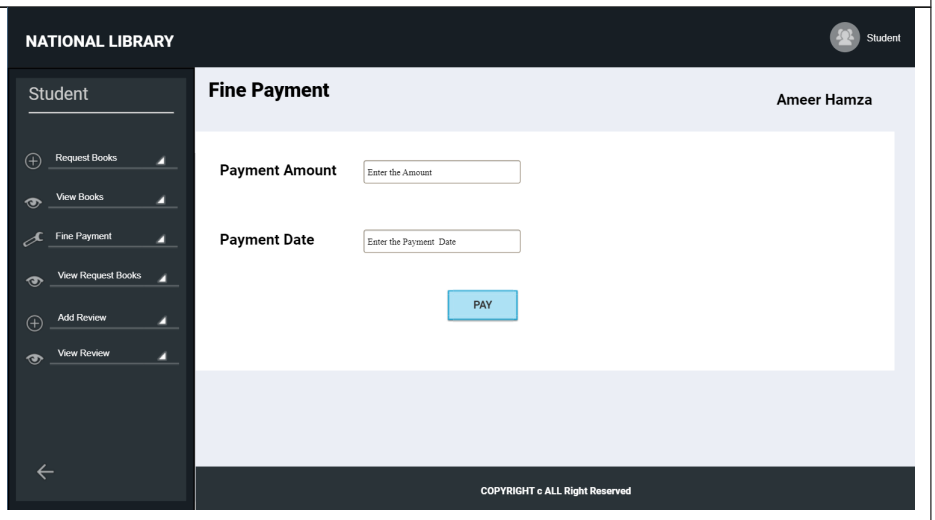
5.21 Book Issue

UseCaseId	U21
Name	Book Issue
Actor	Staff
Description	**Main Flow:** 1. Staff navigates to the ”Issue Book” section in menu. 2. System then displays the form of issuing a book. 3. Staff selects the student to issue the book from the dropdown menu. 4. Staff selects the book to be issued. 5. Staff confirms the issue date of book. 6. Staff then clicks on the ”Issue” button. 7. Then system checks the entered information. 8. If all the fields are filled correctly and selected book is available then the system update the status of the book as ”Issued” and records the issue details in the database. **Alternative Flows:** a) No Book or Student Selected: 1. If a staff is trying to issue a book without selecting the student or book then it displays an error message indicating the type of error. 2. Staff is required to select the book and a student for issuing.

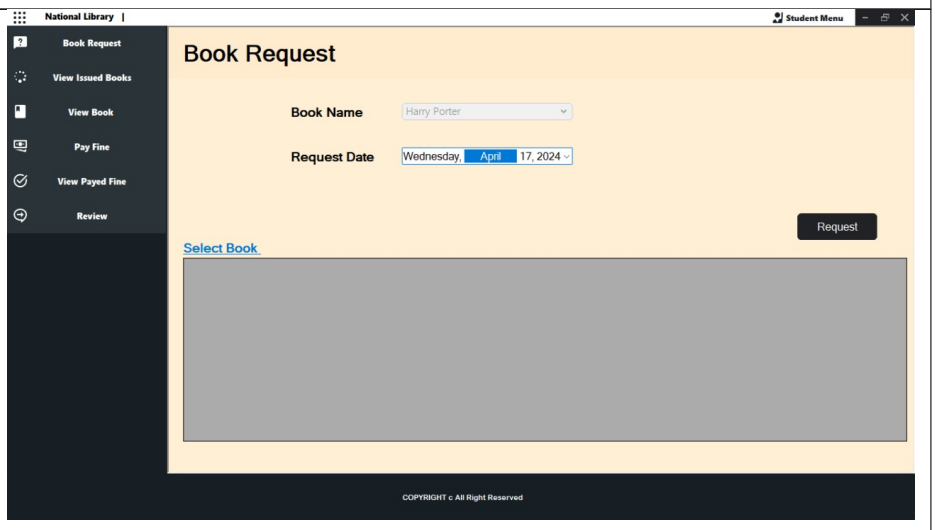
Layout In Pencil Tool	
Validators	All the fields of form are required to issue a book and all the relevant information must be correct to issue a book.

5.22 Pay Fine

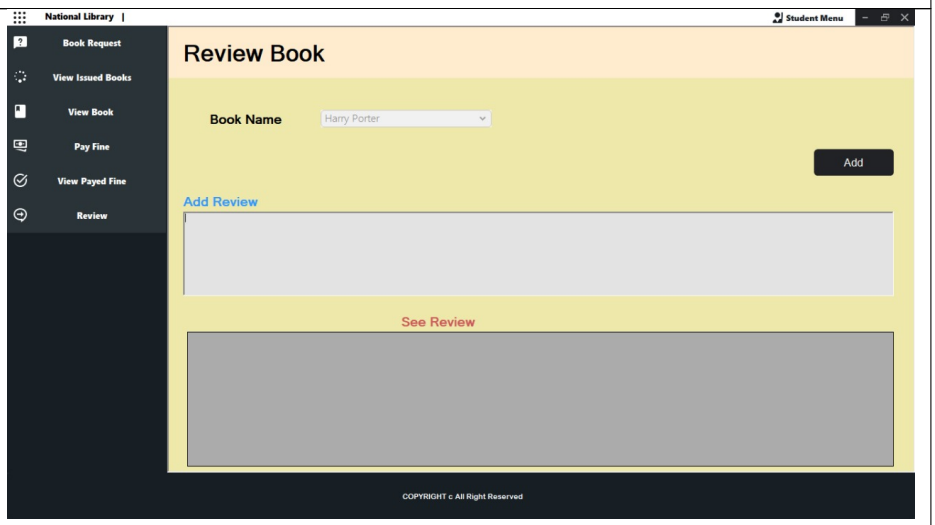
UseCaseId	U22
Name	Pay Fine
Actor	Student

Description	**Main Flow:** 1. Student logs in to account. 2. Student selects the ”Pay Fine” operation. 3. A form for fine payment is shown by the error. 4. Student then enters the amount of payment and payment date into their respective fields. 5. System then clicks on ”Pay” button. 6. System then validates the required fields. 7. When all the fields are entered correctly then the system records the payment details (amount, payment date) in the library database. **Alternative Flows:** a) Invalid Information: 1. If any field is left by the student or any invalid data is entered then the error message is displayed that shows the type of error. 2. Student is required to fill all the essential information correctly.
Layout In Pencil Tool	
Validators	For issue a book to the student all fields must be completed and staff must add proper details for all fields.

5.23 Request Book

UseCaseId	U23
Name	Request Book
Actor	Student
Description	**Main Flow:** 1. Student navigates through the Book Request form. 2. Student enters the book name and selects the date of request. 3. Student then clicks on the Request button. 4. System then checks the name and request date. 5. If all requirements are correctly filled then it generates a request for a book. **Alternative Flows:** a) Invalid Information: 1. If any field is left by the student or any invalid data is entered then the error message is displayed that shows the type of error. 2. Student is required to fill all the essential elements.
Layout In Pencil Tool	
Validators	To complete the book request the name of book and the request date must be correct.

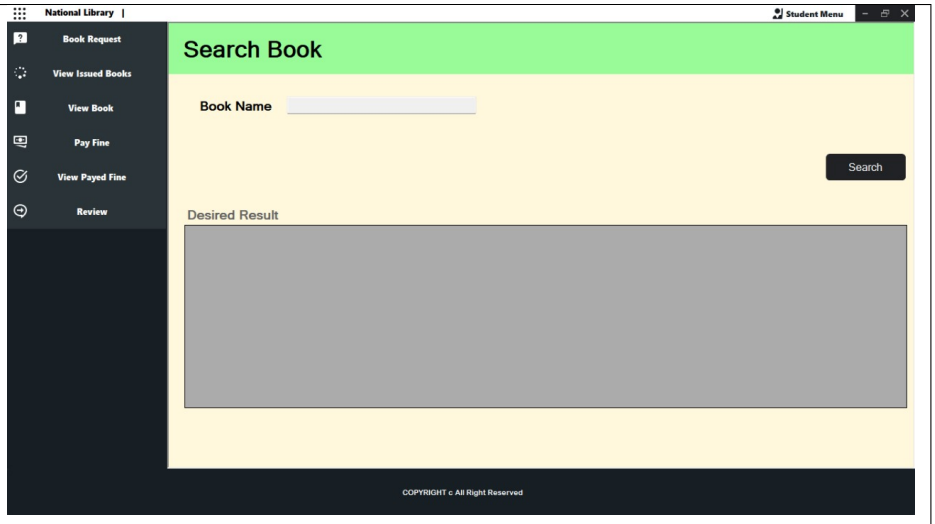
5.24 Add Review

UseCaseId	U24
Name	Add Review
Actor	Student
Description	**Main Flow:** 1. Student navigates through the Review Book form. 2. Student enters the book name and then writes the review in the add review section. 3. Student then clicks on the Add Button. 4. System then checks the name as it exists in the database or not. 5. If a book exist in the database then the review about the book is added. 6. Student can view his reviews in given table below. **Alternative Flows:** a) Invalid Information: 1. If student tries to review a book without writing the book name or adding any review then an error message is shown that displays the all fields must be filled. 2. Student is required to write book name and review of the book.
Layout In Pencil Tool	

Validators	To add a review of the book all validations must be met. Book name must be valid and must exists in the database and to add review add review section must not be null.

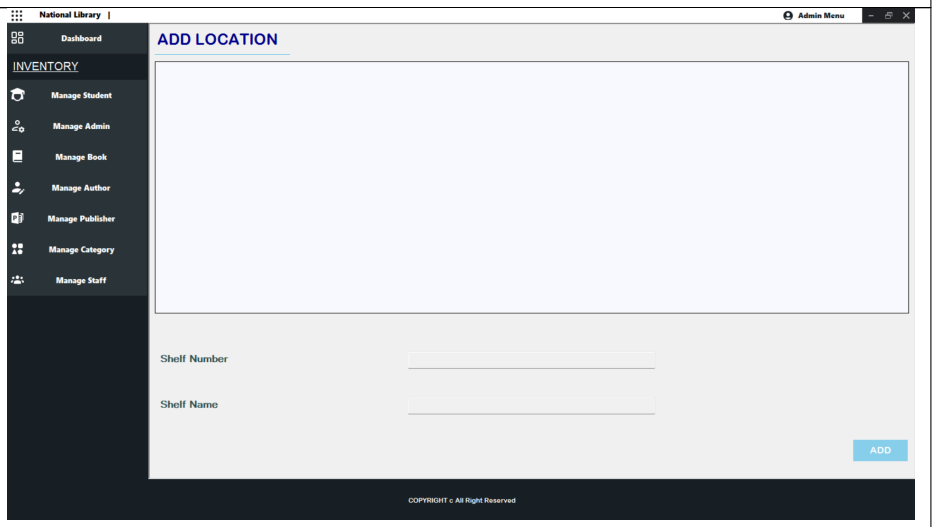
5.25 Search a Book

UseCaseId	U25
Name	Search a Book
Actor	Student
Description	**Main Flow:** 1. Student navigates through the search Book form. 2. Student enters the book name. 3. Student then clicks on the Search Button. 4. System then checks the name as it exists in the database or not. 5. If a book exists in the database then the book is shown in the table with full details. **Alternative Flows:** a) Invalid Information: 1. If student tries to search a book without writing the book name then an error message is shown.. 2. Student is required to write book name.

Layout In Pencil Tool	
Validators	Validation not exist in this form.

5.26 Add Location

UseCaseId	U26
Name	Add location
Actor	Admin

Description	**Main Flow:** 1. Admin navigates through the Add location 2. The admin enters the information of the new location in the text fields. 3. The admin clicks the ADD button. 4. The system validates the entered information. 5. The Admin receives a confirmation message. **Alternative Flows:** a) Invalid location: 1. If any field is left empty , the system displays an error. 2. If location already exist then system displays an error message.
Layout In Pencil Tool	
Validators	Shelf number only contains integers. All fiels must be filled.

User Interface Details :

Use Case ID	Text Box	Drop Down	Password Box	Table	Data Field	But tons	AC	RB	CB	M	Text Area	Progress Bar
U01	1	0	1	0	0	1	0	1	0	0	0	0
U02	8	2	2	0	0	1	0	0	1	0	0	0
U03	8	1	0	1	0	1	0	0	0	0	0	0
U04	8	1	0	1	0	1	0	0	0	0	0	0
U05	8	1	0	1	0	1	0	0	0	0	0	0
U06	7	0	0	1	0	1	0	0	0	0	0	0
U07	7	0	0	1	0	1	0	0	0	0	0	0
U08	7	0	0	1	0	1	0	0	0	0	0	0
U09	1	0	0	1	0	1	0	0	0	0	0	0
U10	1	0	0	1	0	1	0	0	0	0	0	0
U11	1	0	0	1	0	1	0	0	0	0	0	0
U12	2	1	0	1	0	1	0	0	0	0	0	0
U13	2	1	0	1	0	1	0	0	0	0	0	0
U14	2	1	0	1	0	1	0	0	0	0	0	0
U15	5	4	0	0	0	1	0	0	0	0	0	0
U16	5	4	0	1	0	1	0	0	0	0	0	0
U17	5	4	0	1	0	1	0	0	0	0	0	0
U18	2	0	0	1	0	1	0	0	0	0	0	0
U19	2	0	0	1	0	1	0	0	0	0	0	0
U20	2	0	0	1	0	1	0	0	0	0	0	0
U21	2	3	0	1	0	1	0	0	0	0	0	0
U22	2	0	0	1	0	1	0	0	0	0	0	0
U23	1	1	0	1	0	1	0	0	0	0	0	0
U24	0	1	0	1	1	1	0	0	0	0	0	0
U25	1	0	0	1	0	1	0	0	0	0	0	0
U26	2	0	0	1	0	1	0	0	0	0	0	0

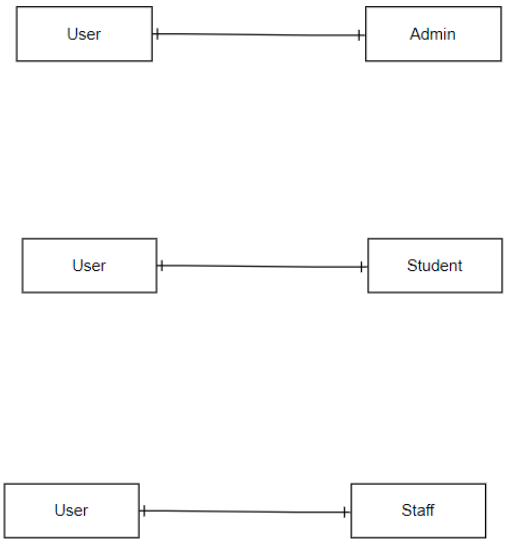
6 Classes

There must be a change can be applied during the implementation. This is not the final view of the classes.

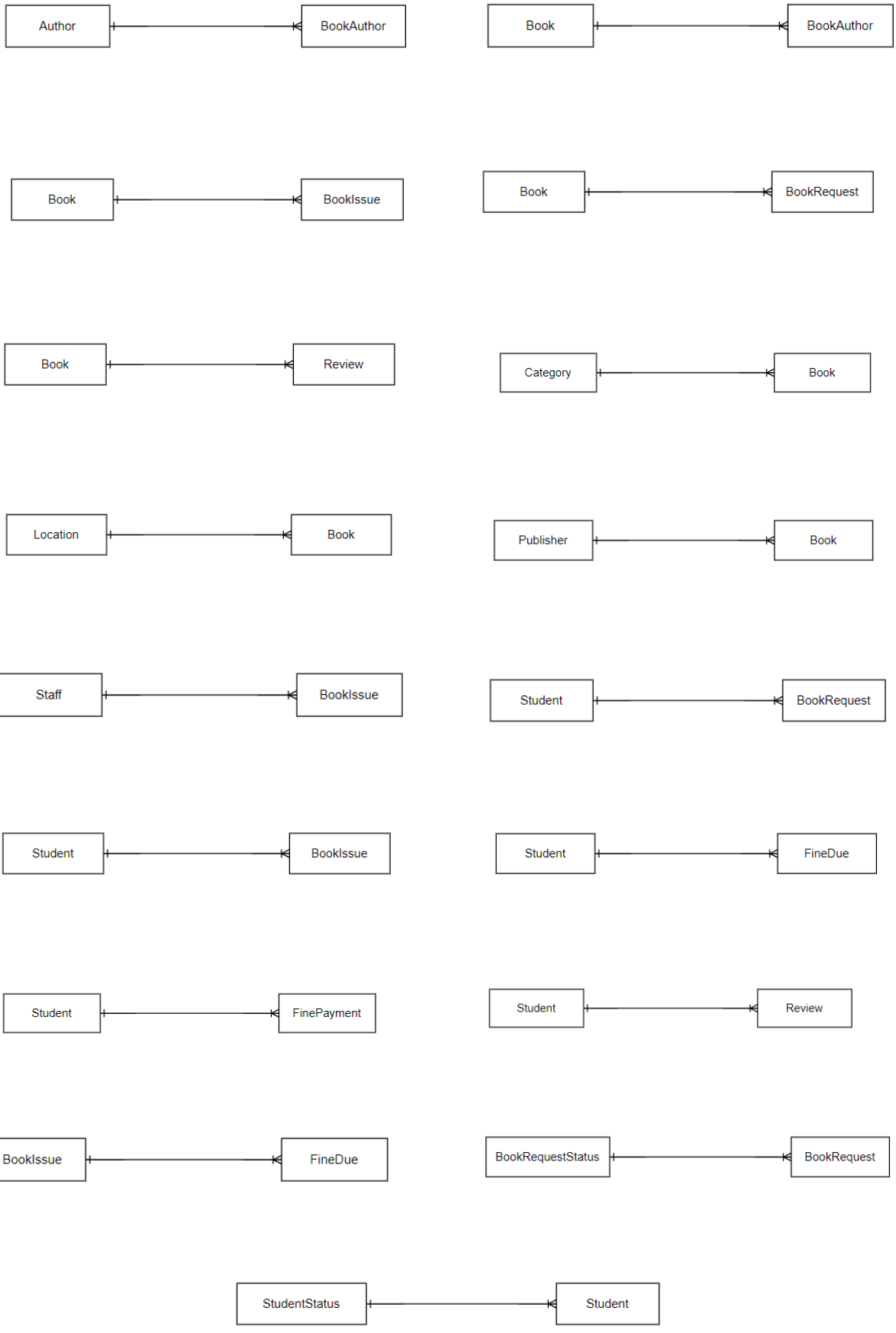
Class Name	Software/Domain	Is Abstract	Is Singleton	Has Parameterized Constructor
Book	Domain	No	No	Yes
User	Domain	yes	No	Yes
Student	Domain	No	No	Yes
Category	Domain	No	No	Yes
Publisher	Domain	No	No	Yes
Admin	Domain	No	No	Yes
Staff	Domain	No	No	Yes
Author	Domain	No	No	Yes
Location	Domain	No	No	Yes
Book Author	Domain	No	No	Yes
Book Issue	Domain	No	No	Yes
Book Request	Domain	No	No	Yes
Fine calculator	Software	No	yes	Yes
Report Generator	Software	No	yes	Yes
Fine Payment	Domain	No	No	Yes
Due Fine	Domain	No	No	Yes

7 ER Design

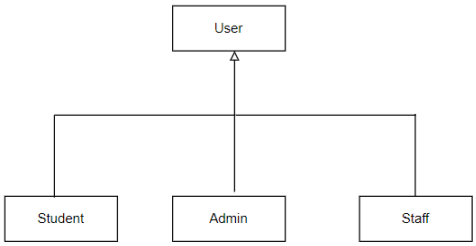
7.1 One to One Relationship



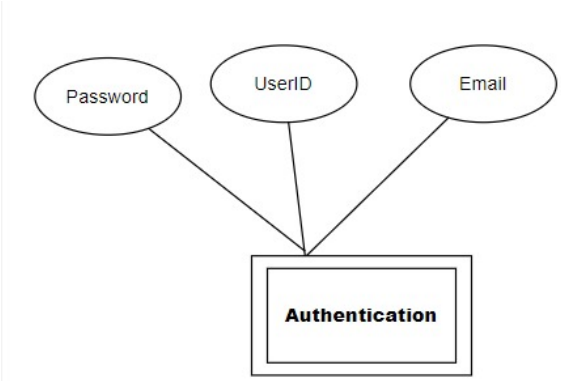
7.2 One to Many Relationship

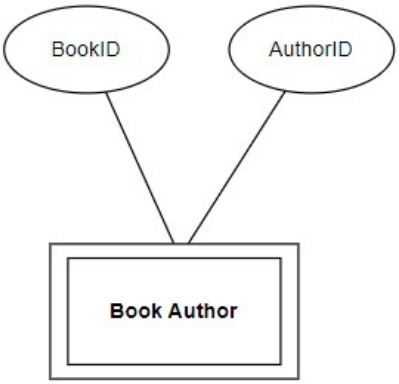

Author
BookAuthor
Book
BookAuthor
Book
BookIssue
Book
BookRequest
Book
Review
Category
Book
Location
Book
Publisher
Book
Staff
BookIssue
Student
BookRequest
Student
BookIssue
Student
FineDue
Student
FinePayment
Student
Review
BookIssue
FineDue
BookRequestStatus
BookRequest
StudentStatus
Student

7.3 Multi-Level Inheritance

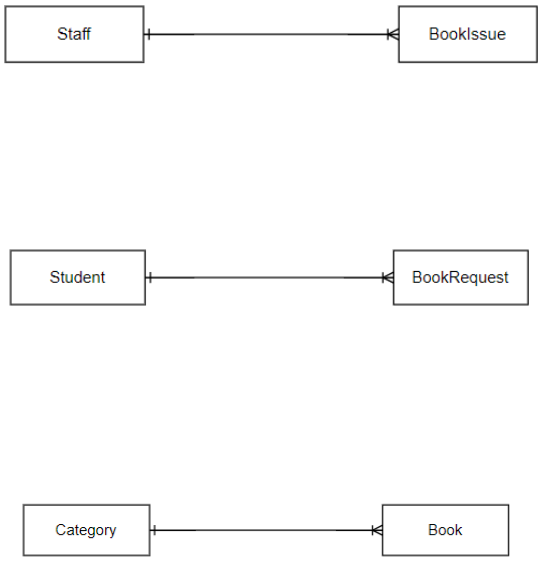


7.4 Weak Entities

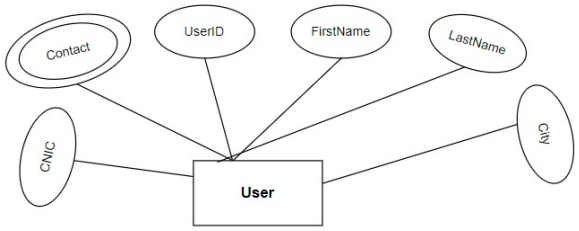




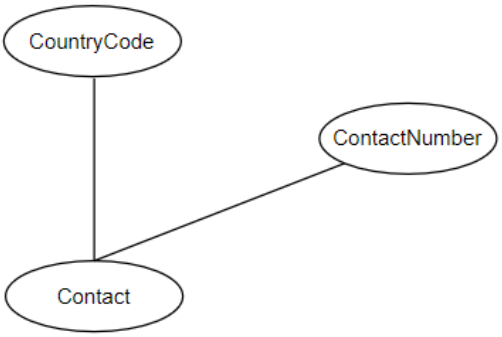
7.5 Strong Relationship



7.6 Multivalued Attributes



7.7 Complex Attributes



8 Transaction

A database transaction is a set of one or more database operations that are executed as a single unit of work.Our system contains following transactions:

8.1 Fine Payment

when a student pays fine for not returning the book before the due date, the payment process should be transactional. This makes sure the fine is deducted from student account only if transaction completed successfully. If any issue occurs during payment process then transaction can be rolled back to avoid deduction from the fine incorrectly.

8.2 Book Addition and Removal

Transaction can also accurs in addition and deletion of the book. It means that these changes happen all at once. If you edit or remove a book, a transaction sure that these actions are completed correctly. If something goes wrong during the process, the transaction roll back the process.

8.3 Book Issuance and Return

When a student returns a book, using serialization transaction sure that these actions happen in a fair order. For example, two students trying to borrow the same book at same time, make sure each student transaction is handles in such a way its the only one happening.

8.4 Book Request Handling

When the student request a book, the request first check the availability of the book and update the status of the book request. This involves the interaction between book request and book request status table. Transaction ensure that books availability status is accurate during request process.

9 Views

A view is a virtual table in a database that is based on the result of a query.In this system these following views are created:

9.1 Book Catalog View

A view is a virtual table that allows you to combine data from multiple tables into a single table-like structure. By creating a view that includes information from the Book, Category, Publisher, and Author tables, you can easily display a comprehensive catalog of all the books in your library.This view can display details like book title, ISBN code, category name, publisher name, publication type, publication language, and author names.

9.2 Student Borrowing History View

Create a view that joins the BookIssue, Book, and Student tables to provide a history of book borrowings by students. This view can include details such as student ID, book title, issue date, return date, and issue status.Through this view we easily check all the borrowing details of students.

9.3 Fine Collection View

Generate a view that combines data from the fine Due and the Fine payment table to provide a Summary of fines collected from students.This view can include these attributes such as student ID, Fine amount, Fine Date and Payment Date.By using this we easily check the detail of the student who has fined.

9.4 Available Books View

Create a view that calculates the number of available copies for each book by subtracting the total number of copies from the number of copies currently issued.

9.5 Popular Books View

Generate a view that calculates reviews from the Reviews table to identify popular books based on user reviews. This view can include details such as book title, and total number of reviews about that book.

9.6 Student Details View

Generate a view that combines data from the Student, User, and StudentStatus tables to provide detailed information about each student. This view can include student ID, first name, last name, email, registration number, department, semester, and account status.

10 Stored Procedure

Some other procedures can also be add in this system during the implementation.

10.1 Add Book

This stored procedure us used to insert a new book in database. It takes the parameters of the book like title, ISBN, Edition, Publisher, Category, Edition etc.

10.2 Update Book

This stored procedure allows updating the detail of an existing book in the database. It accepts parameters for Bookid ad update the information such as title, ISBN, category etc.

10.3 Search Book

This stored procedure is used for searching the book from the database on various attributes like title, category, ISBN. It takes such parameter and return a book data.

10.4 Issue Book

This is used to Issue a book to the student. It update the book issue table with information such as bookid, studentid, issuedate,returndate.

10.5 Return Book

This procedure marks a book as returned book. It updates the status of the book.

10.6 Request Book

This procedure is used to request a book. It insert request into book request table with detail such as studetid, bookid, requestdate.

10.7 PayFine

This procedure allows student to pay fines in payfine table.

10.8 GetStudentBook

This procedure retrieves a list of book borrowed by a particular student. It accepts studentid as a parameter and return a list of borrow books.

10.9 Generate reports

This procedure generates various reports such as popular books based on their criteria.

11 Triggers

Their must be changing can be applied during the implementation.

11.1 Book Issuing and Returning

we also create a trigger that automatically update the number of available copies of books when a book is issued or returned. This makes the count of the available books remains accurate. For Example, When student borrowed a book then trigger setup the decrement of available copies and when student return a book then trigger setup to increment in available book copies.

11.2 Fine payment

Trigger is also used to calculate overdue fine for books. We can also create a trigger that calculates the fine amount based on the difference between the return date and due date, and updates the records when a book is returned.

12 Exception

Type of Exception	Why this exception will occur	How you will handle the exception
SQLException	Database connection failure, SQL syntax error, or deadlock	Implement try-catch blocks around database operations using SQL queries involving tables like `Book`, `Student`, `Admin`, etc. Handle SQLExceptions by logging errors and notifying the user with appropriate messages.
FormatException	Invalid input format entered by the user in forms or text fields	Implement try-catch blocks around user input validation code. Catch FormatExceptions and provide user feedback indicating the correct input format.
NullPointerException	Null input provided by the user or null reference encountered during input processing	Use try-catch blocks to catch NullPointerExceptions when handling user input. Provide appropriate error messages or handle null cases gracefully to prevent application crashes.

13 Project Plan

Use Case Id	Use Case Name	Member Name	Estimated Completion Date
U01	Login In	Abdullah Fassi	21-04-2024
U02	SignUp	Muhammad Zubair	21-04-2024
U03	Add Staff	Ameer Hamza	21-04-2024
U04	Delete Staff	Ameer Hamza	22-04-2024
U05	Update Staff	Ameer Hamza	22-04-2024
U06	Add Admin	Muhammad Zubair	23-04-2024
U07	Delete Admin	Muhammad Zubair	23-04-2024
U08	Update Admin	Muhammad Zubair	24-04-2024
U09	Add Category	Abdullah Fassi	24-04-2024
U10	Delete Category	Abdullah Fassi	24-04-2024
U11	Update Category	Abdullah Fassi	25-04-2024
U12	Add Publisher	Ameer Hamza	25-04-2024
U13	Delete Publisher	Muhammad Zubair	25-04-2024
U14	Update Publisher	Ameer Hamza	26-04-2024
U15	Add Book	Ameer Hamza	26-04-2024
U16	Delete Book	Abdullah Fassi	27-04-2024
U17	Update Book	Muhammad Zubair	27-04-2024
U18	Add Author	Ameer Hamza	28-04-2024
U19	Delete Author	Ameer Hamza	28-04-2024
U20	Update Author	Muhammad Zubair	28-04-2024
U21	Book Issue	Abdullah Fassi	29-04-2024
U22	Pay Fine	Abdullah Fassi	29-04-2024
U23	Request Book	Muhammad Zubair	30-04-2024
U24	Add Review	Ameer Hamza	30-04-2024
U25	Search a book	Muhammad Zubair	30-04-2024
U26	Add Location	Ameer Hamza	01-04-2024

14 ERD

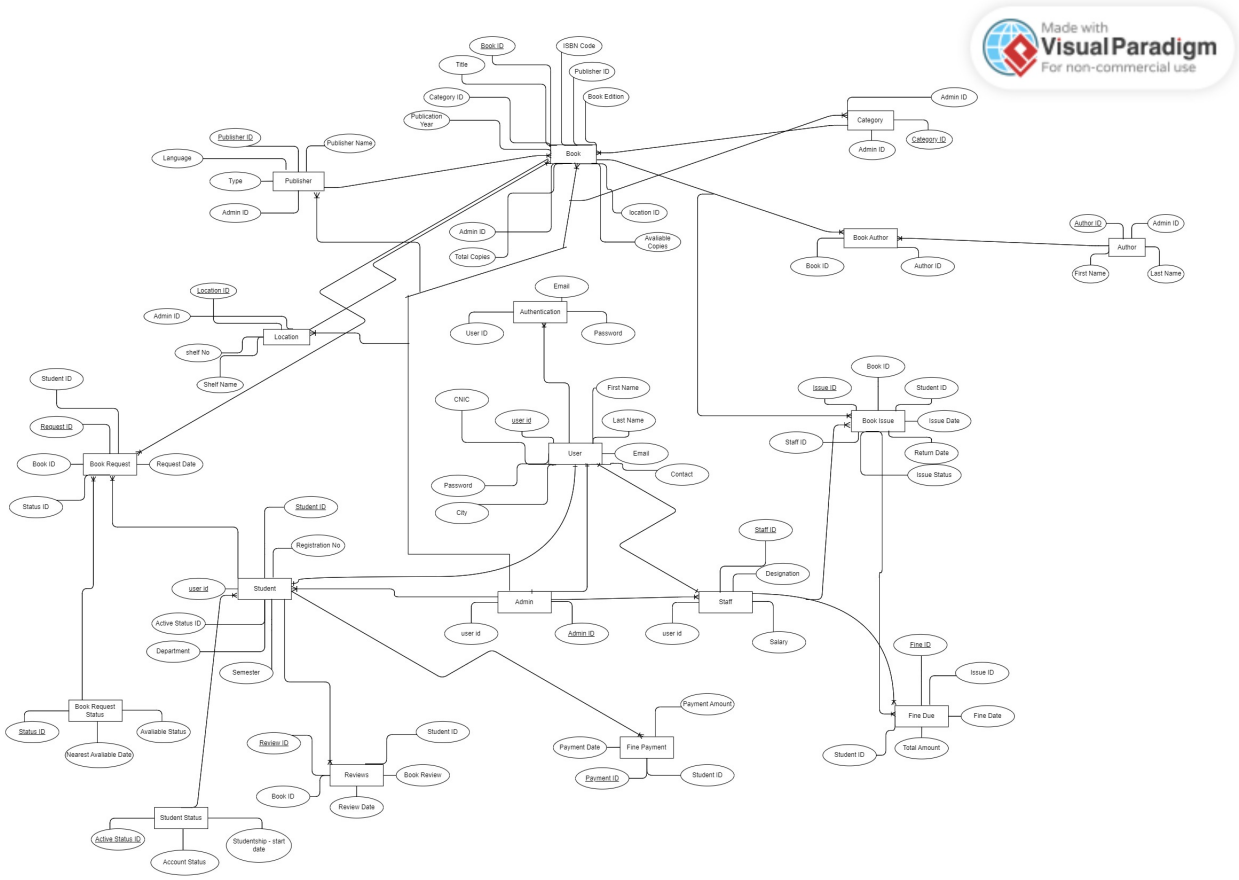


Figure 1: ER Diagram