PERPETUAL HELP COLLEGE OF MANILA
1240 V. Concepcion Street., Sampaloc, Manila 1008
COLLEGE DEPARTMENT – JONELTA
Tel. Nos.: 7318199/7311550/7412681

PerpetualEASE: A library Resource Borrowing System for Perpetual Help College of Manila using MySQL

Magaan, Zoren Christian C.
Ramos, Joylyn E.
Trani, Chrizea Jhane P.

SUBMITTED TO THE
PERPETUAL HELP COLLEGE OF MANILA
COLLEGE - JONELTA

IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE SUBJECT
SORFTWARE ENGINEERING II

COLLEGE OF COMPUTER STUDIES
DEPARTMENT

DECEMBER 2024

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Acknowledgments

The researchers would like to acknowledge and express gratitude to all those who contributed and supported the accomplishment and completion of this project.

The researchers would like to thank their College of Computer Studies adviser, Ms. Anna Liza O. Villanueva, for giving them the skills to perform the study and guiding them throughout the process of this project. Also, the researchers would like to express their appreciation to their families and friends for their motivation and support. With their support, input, and participation, this study was successful

Introduction

In the rapidly evolving landscape of library services, the Perpetual Enhanced Access System for Education (PerpetualEASE) stands as a testament to the transformative power of digital technologies. Over the past few decades, libraries have undergone a remarkable shift from traditional repositories of physical books to dynamic hubs of information, embracing digital tools to meet the changing needs of society. This shift has given rise to terms like "library software" and "digital library management systems," reflecting the pivotal role of technology in modern library operations (Halder, 2021). However, alongside these advancements come challenges, including management dilemmas, cybersecurity threats, and the need for continuous adaptation to evolving user preferences.

As society places an increasing emphasis on access to information, library system solutions like PerpetualEASE play a crucial role in facilitating seamless access to extensive collections of digital resources. Drawing from the DELOS Manifesto's definition of a Digital Library Management System (DLMS), PerpetualEASE embodies “a versatile software system designed to create and manage digital library systems with essential features for digital libraries” (Candela et al., 2007). This includes functionalities for cataloging, organizing, and retrieving digital resources, as well as robust security measures to protect against cyber threats and ensure data integrity.

Despite the challenges posed by the digital transition, the concept of hybrid libraries emerges as a promising solution, blending traditional and digital elements to cater to diverse user's needs. By integrating the best of both worlds, hybrid libraries leverage technology to

enhance user experiences while preserving the value of physical collections and personalized services. As libraries continue to evolve in response to technological advancements and changing user expectations, solutions like PerpetualEASE remain at the forefront, empowering libraries to adapt, innovate, and thrive in the digital age.

Background of the Study

The PerpetualEASE library system aims to revolutionize library management systems by offering advanced features and user-friendly interfaces tailored to the needs of educational institutions like Harvard University. Drawing inspiration from Harvard's successful implementation of digital library solutions (Harvard Library, n.d.), the PerpetualEASE system seeks to enhance library services and streamline operations for students, faculty members, library staff, and other users. By leveraging modern technologies and innovative approaches, PerpetualEASE aims to address traditional challenges in digitizing library materials and offer transformative solutions that improve efficiency and the user experience.

Similar to Harvard's BorrowDirect and Interlibrary Loan services, PerpetualEASE offers a comprehensive range of services designed to meet diverse needs. From borrowing books to accessing digital resources, PerpetualEASE aims to provide a seamless experience for users. The system's user-friendly interface and robust data management capabilities, akin to MySQL, enable automation, improved accuracy, and centralized data storage.

Key features of the PerpetualEASE library system include:

Automation

With the PerpetualEASE library system, library users can easily request materials and services through an intuitive online platform, expediting the processing and distribution of resources. This streamlined automation process ensures that users receive prompt access to the materials they need, enhancing their overall library experience and satisfaction.

Improved Accuracy

By digitizing data entry and management processes, the PerpetualEASE system minimizes errors and discrepancies, guaranteeing the accuracy and reliability of library information. This enhanced precision not only streamlines workflows but also instills confidence in users that they are accessing the most up-to-date and accurate resources available.

Centralized Data Storage

The PerpetualEASE platform centralizes library data storage, ensuring that information is securely stored and easily accessible to authorized personnel. This centralized approach simplifies data management processes, facilitates seamless information retrieval, and enhances the overall organization and accessibility of library resources.

The implementation of the PerpetualEASE library system is expected to have a significant impact on various aspects of library services at the Perpetual Help College of Manila, including supporting research data management and fostering a conducive learning environment. By providing tools to store, share, and manage data effectively, PerpetualEASE aims to ensure the

long-term accessibility and accuracy of research results, ultimately benefiting the users at the Perpetual Help College of Manila.

Statement of the Problem

Through the implementation of the Perpetual Enhanced Access System for Education (PerpetualEASE), the following are the crucial challenges faced by the researchers:

1. What is the current library system at the Perpetual Help College of Manila?
2. What features and databases are needed in the PerpetualEASE library system?
3. What resources are necessary to develop the PerpetualEASE library system?
4. What is the level of effectiveness of PerpetualEASE in terms of ISO 25010?
5. What is the level of acceptance of the users?
6. How can the PerpetualEASE digitized library resource borrowing system yield tangible benefits to the librarians and the administrators, optimizing their workflow efficiency and enhancing overall library management?

Objectives of the Study

General Objective

To develop the PerpetualEASE Digitized Library Resources Borrowing System for the Perpetual Help College of Manila Library using MySQL.

Specific Objectives

The specific objectives of the project encompass several key areas:

Current Library System Analysis

Assess the existing library system at the Perpetual Help College of Manila to identify its strengths, weaknesses, and areas for improvement. Conduct a comprehensive review of the current library management practices, software tools, and technologies utilized.

Requirements Gathering and Database Design

Determine the essential features, functionalities, and databases needed in the PerpetualEASE library system through stakeholder consultations and requirements-gathering sessions. Design a robust and scalable database architecture tailored to meet the specific needs and objectives of the PerpetualEASE project.

Resource Identification and Allocation

Identify the necessary resources, including human resources, software tools, and budgetary allocations required for the development and implementation of the PerpetualEASE library system. Develop a resource allocation plan to ensure efficient utilization of available resources and timely completion of project milestones.

Effectiveness Evaluation using ISO 25010

Evaluate the effectiveness of the PerpetualEASE library system following the ISO 25010 standard, focusing on key quality attributes such as functionality, reliability, usability, efficiency, and maintainability. Conduct rigorous testing and validation procedures to assess the system's compliance with ISO 25010 requirements and standards.

User Acceptance Assessment

Measure the level of acceptance of the PerpetualEASE library system among end-users, including administrators, librarians, faculty, and students. Gather feedback through surveys, interviews, and usability testing sessions to identify user perceptions, satisfaction levels, and areas for improvement.

Workflow Optimization and Management Enhancement

Investigate how the digitized library resource borrowing system implemented by PerpetualEASE can optimize workflow efficiency and enhance overall library management for librarians and administrators. Identify specific benefits, such as time savings, reduced administrative burden, and improved access to library resources, resulting from the implementation of the PerpetualEASE system.

Significance of the Study

The result of this project will benefit the following:

For Students and Faculty. The PerpetualEASE library system aims to streamline the borrowing process, making it easier for both students and faculty members to access essential learning resources. By facilitating efficient resource utilization, the system seeks to enhance academic performance and support users' learning needs.

For Library Staff. PerpetualEASE empowers library staff to work more productively and efficiently by providing tools for managing library resources and transactions. The system's features enable staff members to handle tasks effectively, improving overall library operations.

For the Institution. The implementation of PerpetualEASE positions the Perpetual Help College of Manila as an innovative educational institution capable of adapting to the evolving demands of its faculty and students. By enhancing academic assistance systems and library services, the institution demonstrates its commitment to providing quality educational support, ultimately contributing to the overall academic experience of its users.

For Future Researchers. This project serves as a valuable reference for future researchers interested in library systems and their impact on learning institutions. By documenting the development and implementation process of PerpetualEASE, the study adds to the body of knowledge in information management and library studies, providing insights and best practices for similar projects in the future.

Scope and Limitation

The PerpetualEASE library system offers a user-friendly interface for users to seamlessly access and interact with the library's extensive collection of materials. Key functionalities include the ability to borrow books, reserve books for future use, search for specific titles or categories, and check the availability of desired books in real-time. Through these features, users can conveniently navigate the library's resources, ensuring efficient access to the information they need for their academic pursuits.

To maintain focus on core functionalities, the system excludes financial transactions such as fines or charges and functions unrelated to library operations like acquisitions and administrative tasks. As well, proponents excluded books that are considered to or included in the category of being an “E-book.” Additionally, integration with external systems beyond MySQL and detailed analytics beyond resource utilization and overdue items are outside the project's scope. Modifications to the MySQL database are also excluded, emphasizing the system's primary focus on managing library resources effectively and efficiently.

Overall, the PerpetualEASE library system provides a comprehensive solution for managing library materials and facilitating user interactions, enhancing the overall library experience for students, faculty, staff, and other users at Perpetual Help College of Manila.

Methodology of the Study

Technology Used

To effectively address the issues the researchers, face in establishing PerpetualEASE, they have adopted a combination of technologies and approaches. The project is mostly using Python and PyCharm for the front end, with MySQL, and Xampp powering the back end. These components together provide an organized framework for the work.

Research Approach

The approach the researchers took is based on Rapid Application Development (RAD), a methodology selected for its capacity to accelerate development and optimize the design process. The initial step, requirements planning, is building an adequate foundation by defining the project's

parameters, locating major stakeholders, and setting specific goals. By doing this, team members' awareness of project expectations is shared, and coherence is ensured.

Then, during the requirements collection stage, the Entity-Relationship Diagram (ERD) helped with database architecture by providing a visual depiction of entities and their relationships.

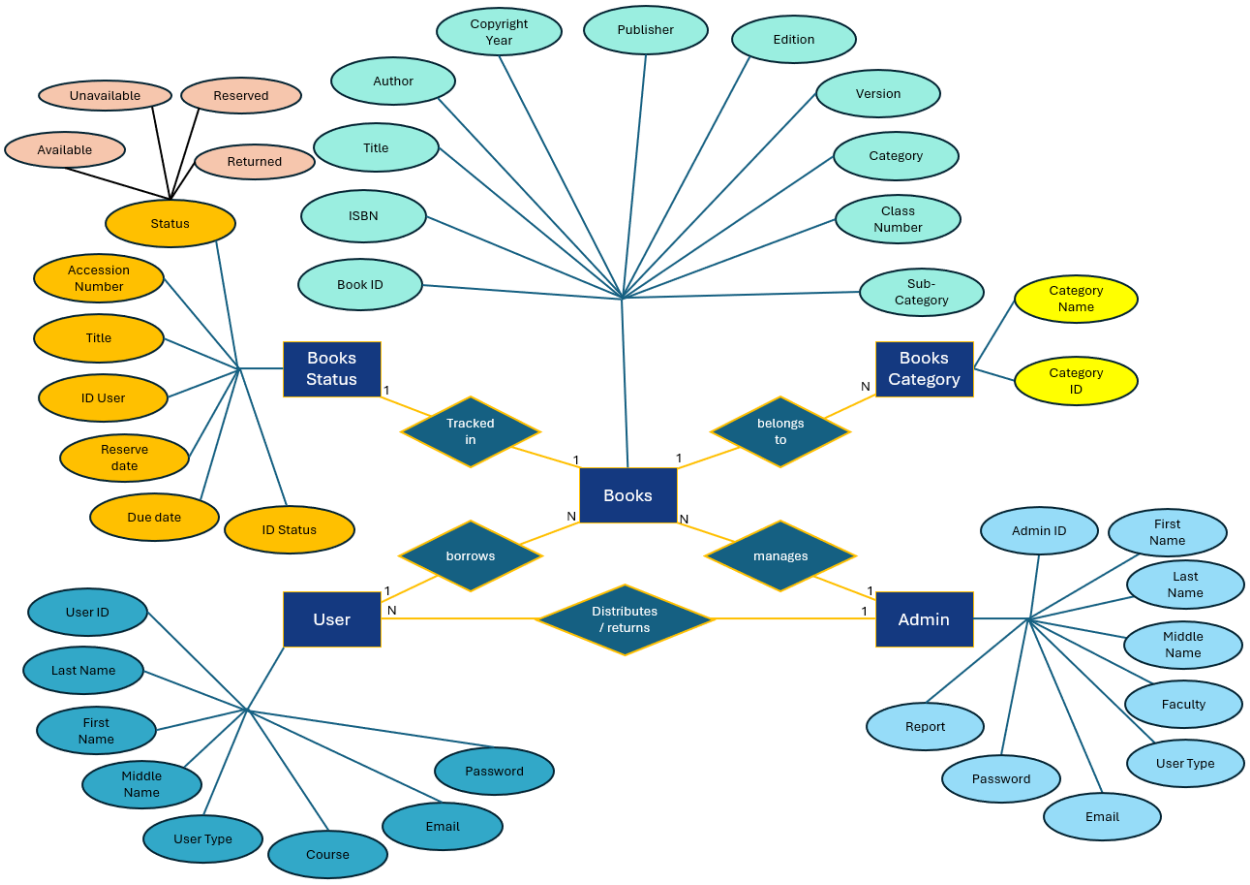


Figure 1: Entity Relationship Diagram of the PerpetualEASE library system.

I. Entities

- **Students:**

  Attributes: User ID (Primary Key), Last Name, First Name, Middle Name, Couse, Email, and Password

- **Admin:**

  Attributes: Admin ID(Primary Key), Last Name, First Name, Middle Name, Faculty, Email, and Password.

- **Book Category:**

  Attributes: Category ID, Category Name.

- **Books:**

  Attributes: Book ID (Primary Key), ISBN, Title, Author, Publisher, Copyright year, Volume, Class Number.

- **Book Status**

  Attributes: ID Status (Primary Key), Accession Number, Title, ID User, Reserve Date, Due date, Status.

II. Relationships

Manages (Association between Admin and Books): The admin is responsible for the overall management of the books in the library. This includes tasks like adding new books, updating book information, and overseeing the entire book collection.

Belongs to (Association between Books and Book Category): Each book is classified into one or more categories (e.g., Generalities, technologies, etc.). This allows for better organization and searching of the book collection.

Tracked in (Association between Books and Book Status): The status of a book is tracked throughout its lifecycle. Possible statuses include:

- Available: The book is currently available for borrowing.
- Unavailable: The book is currently borrowed by a student.
- Reserved: The book has been reserved by a student and is not available for borrowing until the reservation is fulfilled.
- Returned: The book has been returned by the student and is ready to be checked back in.

Borrows Book(s) (Association between Students and Books): Students can borrow books from the library. This action updates the book's status to "Unavailable" and records the borrowing information (e.g., borrower, due date).

Distributes (Association between Admin and Students): The admin is responsible for issuing borrowed books to the students. This typically involves checking out the book to the student and updating the book's status and related records.

Returns the book(s) (Association between Students and Admin): Students return borrowed books to the admin. This action updates the book's status to "Available" or "Returned" and records the return information.

Rapid Application Development Model

The feedback from stakeholders is carefully gathered via documentation and interviews, which form the foundation of the system's operation. Prototypes can be created using RAD's iterative approach, which allows for rapid feedback loops from users. Iterative revision guarantees ongoing improvement in functionality and design. Database configuration, coding, integration, and thorough testing to guarantee requirement compliance are the main priorities of the implementation phase.

Researchers adhere to ethical principles throughout the project by ensuring that every phase of the research and development process aligns with established ethical guidelines. This includes obtaining informed consent from participants, protecting their privacy, and minimizing any potential risks or harm. Ethical considerations are integrated into the design, implementation, and evaluation of the system, with protocols in place for data collection, handling, and analysis. Additionally, ongoing ethical review and oversight mechanisms are implemented to ensure that

the project maintains the highest standards of research integrity and respects the rights and well-being of all involved parties.

The last stage, which will be implemented in the following semester, comprises a thorough assessment of the system's functionality, user satisfaction, and conformity to project objectives. The methodology is continuous and evaluative, and additional development efforts will be informed by user input, project progress reviews, and continuous monitoring. This phase delay is a testament to the researcher's dedication to creating a system that continuously refines and evaluates itself to meet the needs of its stakeholders and users.

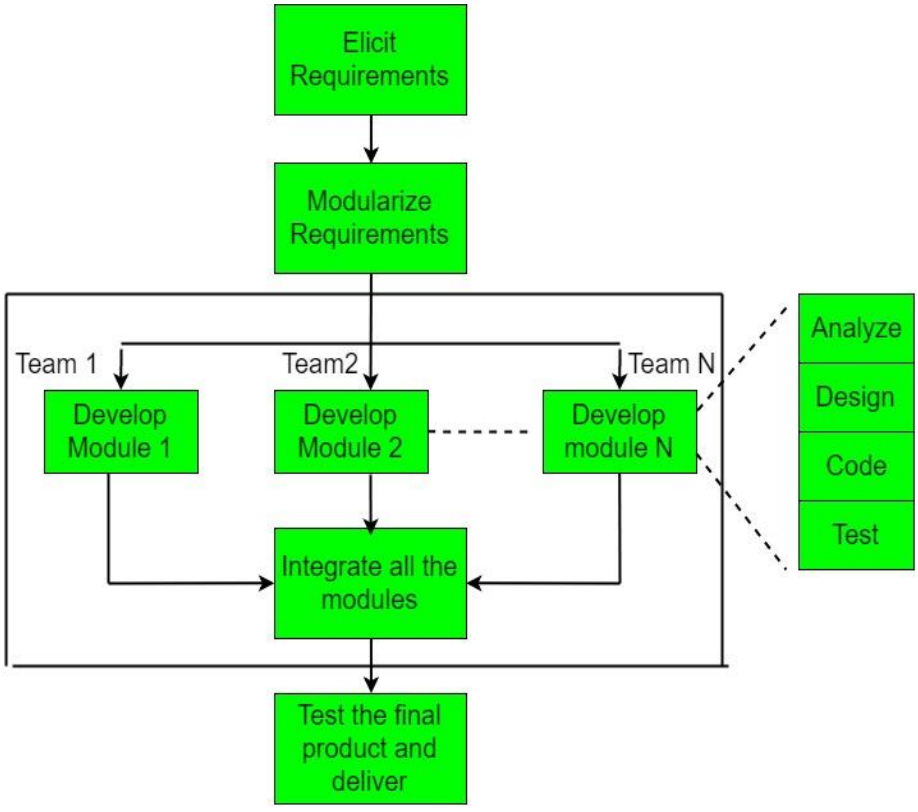


Figure 2. Rapid Application Development Model.

Data Gathering Procedures and Outputs

The researchers conducted multiple interviews with the library staff on March 13, 2024, in Perpetual Help College of Manila's library. The first interview was video recorded, while the second was only voice recorded.

The first interview is described as a structured interview. In a structured interview, the interviewer asks a predetermined set of questions in a fixed order. The first staff was asked about the following questions:

What is the number of books in the library?

"Around 8,000 to 10,000 books are currently in the library."

How many students borrow books in a week?

"Estimated 10 to 20 students borrow books in a week."

How much time does the borrowing procedure take?

"The borrowing procedure takes less than 5 minutes."

How much is the library's WIFI and electricity budget for a year?

"We do not know the library's WIFI and electricity budget."

How much is your estimated salary, together with that of your colleagues?

"Our estimated salary is ₱15,000 to ₱18,000."

Does the library have a digital library borrowing system?

"Yes, the Perpetual Help College of Manila library has a digital library borrowing system."

What are your dilemmas in terms of the borrowing system you have right now?

"So far, there are no existing dilemmas in terms of the borrowing system."

The second interview is a semi-structured interview, a type of interview where the interviewer asks a set of predetermined questions but also allows for flexibility in the conversation. The second staff member was asked about the following:

What are the electrical appliances currently in the library, and how many are there?

"Television: 1, water dispenser: 1, printer: 2, air conditioner: 5, outlet: 6, personal computer: 14, fluorescent light: 34, data cabinet: 1, router: 1, switch hub: 2"

In conclusion, the interviews conducted with the library staff provided valuable insights into various aspects of the library's operations and resources. Through structured and semi-structured interviews, we gained information about the quantity of books in the library, borrowing procedures, budget considerations, staff salaries, and the presence of a digital library borrowing system. Additionally, we learned about the electrical appliances present in the library. These interviews serve as foundational data for further analysis and improvement of library services at Perpetual Help College of Manila.

Documentation of the Current System

Narrative Model

The existing system at the Library of Perpetual Help College of Manila employs a hierarchical user interface, as depicted in Figure 3. Upon successful login, users are presented with a menu panel on the left side of the screen, offering navigation options such as Library, OPAC, Recommend Collection, and My Home.

Figure 4 illustrates the login process within the library management system. Users input their credentials to access the system's functionalities. Upon entering the Library section, users encounter various options, including Library in Brief, The Staff, Policies & Procedures, Book

Numbering System, and Locator, as depicted in Figure 5. Navigating to the OPAC section, users can perform specific book searches based on title, author, or subject, as demonstrated in Figure 6. The Recommend Collection section allows users to suggest books to the staff for consideration, as shown in Figure 7. Finally, the My Home page provides users with a dashboard displaying analytics such as Summary, Circulation, Fine information, messages, etc. Info, My Booklist, Chng Pwd, and Lib. Attendance, as depicted in Figure 8.

Existing System

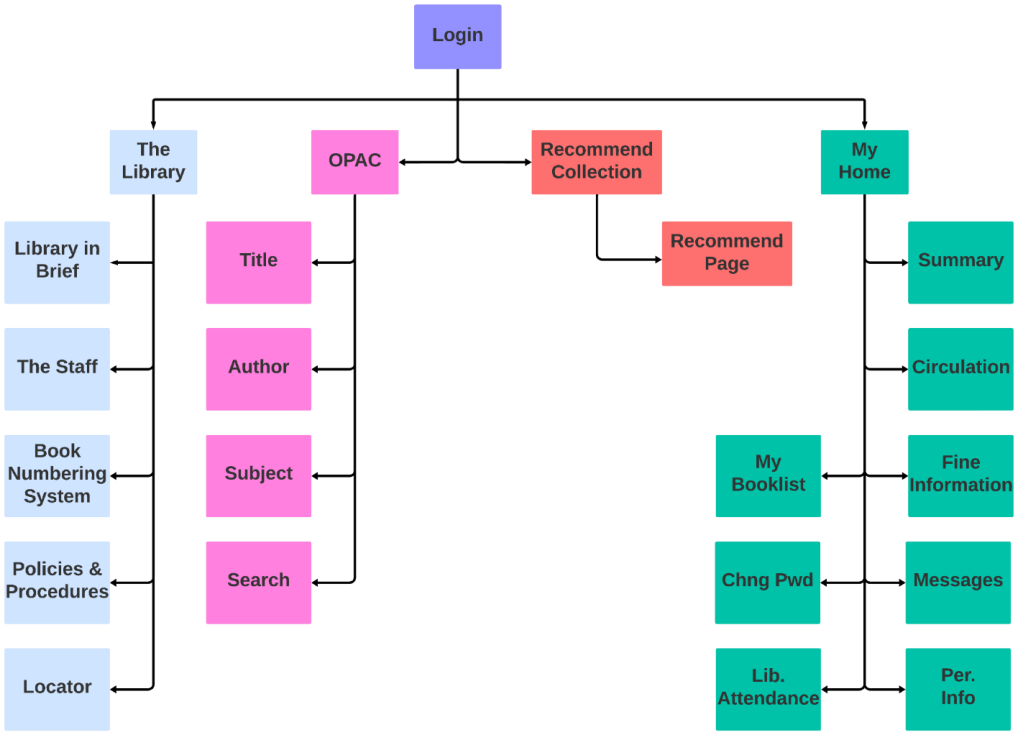


Figure 3.1 Existing System Hierarchical Chart

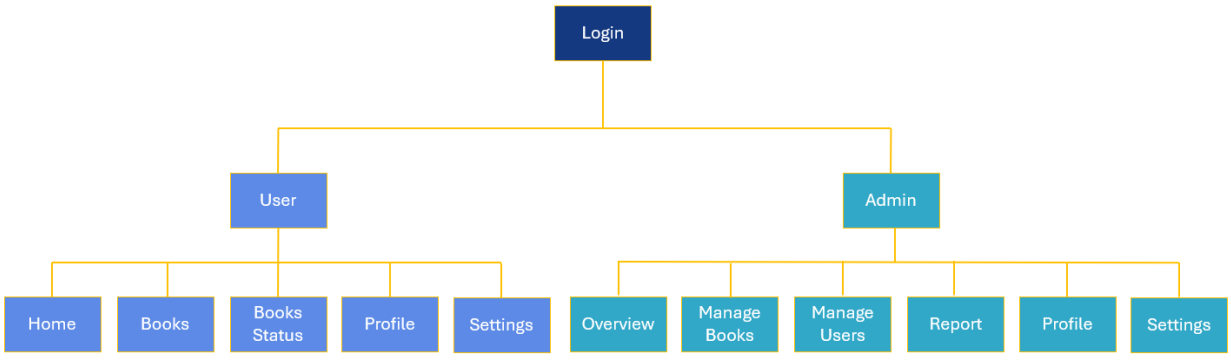


Figure 3.2 Proposed System Hierarchical Chart

Figure 3.1 illustrates the flow of the user interface of the existing system. After the user has successfully logged in, a menu panel will appear on the left side of the screen, where you can choose where to navigate. The Library, OPAC, Recommend Collection, and My Home buttons are visible for access. Figure 3.2 shows the proponents' proposed system wherein programmers have improved the current library system's interface in borrowing, reserving, and returning books.

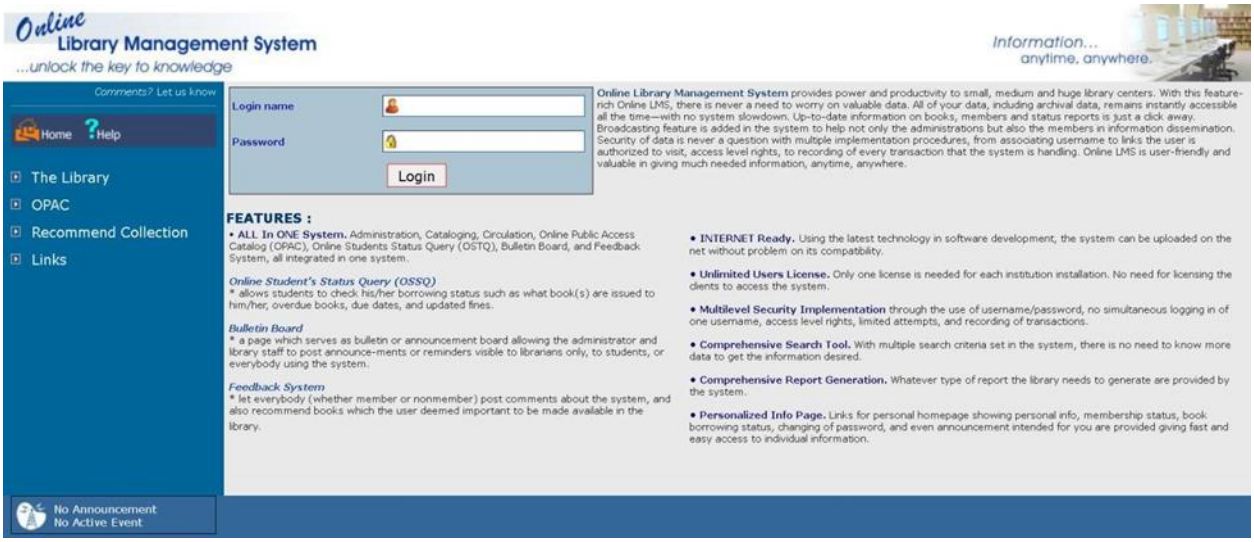


Figure 4. Existing System Login

Figure 4 shows the existing system login for the library management system of the Perpetual Help College of Manila.

Figure 5. Existing System The Library

Figure 5 shows the inside of the existing system, the library, which shows many options, including Library in Brief, The Staff, Policies & Procedures, Book Numbering System, and Locator.

Figure 6. Existing System OPAC

Figure 6 shows the inside of the OPAC button; this is where you can search specifically for the books. It has Title, Author, and Subject.

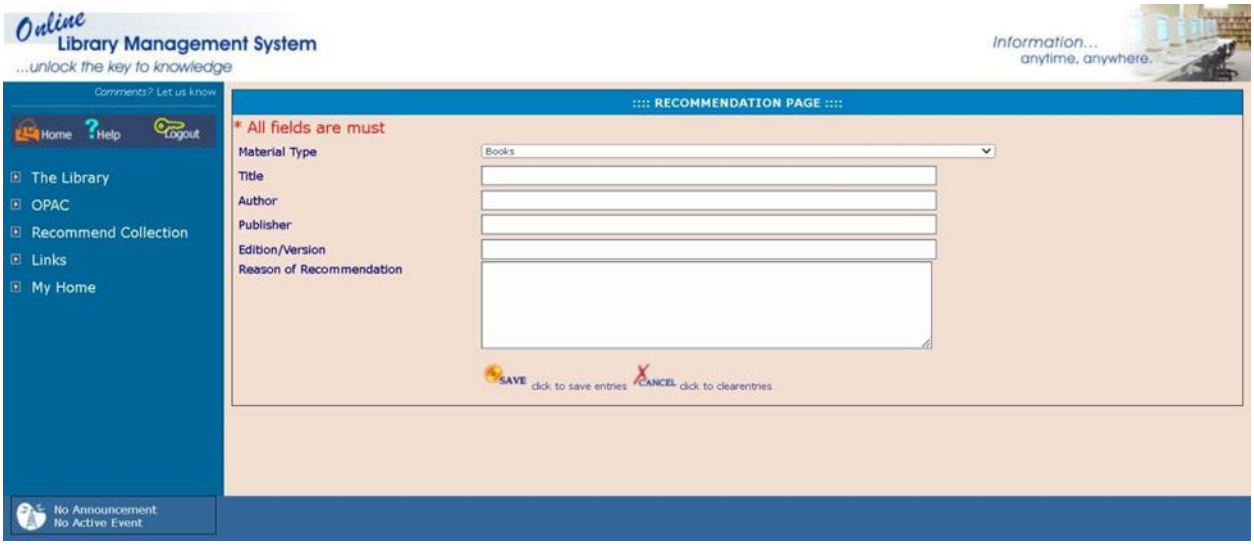


Figure 7. Existing System Recommend Collection

Figure 7 shows the inside of the recommend collection; this is where the user can recommend books to the staff.

Figure 8. Existing System My Home

Figure 8 shows the inside of the home page; this is where your analytics are shown, which are: Summary, Circulation, Fine Information, Messages, Per. Info, My Booklist, Chng Pwd, Lib. Attendance.

Software/Project Estimation

1.1.1 Schedule of Activities

Task Name	Duration	Start Date	Finish Date
PROJECT I	**293 days**		
Kick-off meeting with the team	3 days	February 29, 2024	March 2, 2024
Meeting with the team	1 day	March 5, 2024	March 5, 2024
Meeting with the team	1 day	March 7, 2024	March 7, 2024
Planning with the team	1 day	March 12, 2024	March 12, 2024
Interviewing the staff of the library	1 day	March 13, 2024	March 13, 2024
Creating the manuscript of the interview	1 day	March 16, 2024	March 16, 2024
Constructing the risk management of the project	2 days	March 18, 2024	March 19, 2024
Calculating the initial budget and financial analysis	2 days	March 19, 2024	March 20, 2024
Consulting the risk management and budget planning	1 day	March 21, 2024	March 21, 2024
Revising the risk management and budget planning	2 days	October 18, 2024	October 20, 2024
Finding the necessary tools for the project	2 days	October 20, 2024	October22, 2024
Downloading the necessary tools for the project	1 day	October 22, 2024	October 23, 2024
System Analysis and Design			
Database Setup and Configuration	3 days	October 25, 2024	October 28, 2024

Database Design	1 day	October 28, 2024	October 29, 2024
Development Stage			
Developing the GUI of the Login	1 day	November 4, 2024	November 5, 2024
Developing the GUI of the Home Page	2 days	November 6, 2024	November 8, 2024
Developing the GUI of the Books	2 days	November 8, 2024	November 10, 2024
Developing the GUI of the Categories	2 days	November 10, 2024	November 12, 2024
Designing the GUI of the Software	2 days	November 12, 2024	November 14, 2024
Programming the Code for the System	5 days	November 14, 2024	November 19, 2024
Integrating the GUI with Backend Functionality	9 days	November 20, 2024	November 29, 2024
Verifying the GUI and System Interaction	8 day	December 1, 2024	December 9, 2024
Initial Testing	8 days	December 10, 2024	December 18, 2024
Defending the Project to the Panels	1 day	December 18, 2024	December 18, 2024

Table 1. Schedule of Activities

Table 1 shows the schedule of activities that the project had through its completion. The table includes the phases, which are: the System Analysis and Design phase, Development Stage phase, Testing phase, and Deployment phase.

Project Milestones

PROJECT PHASE	Days	Start Date	End date
Inception Phase	**3 days**	February 29, 2024	March 2, 2024
Planning Phase	**8 days**	March 5, 2024	March 12, 2024
Construction Phase	**52 days**	October 18, 2024	December 9, 2024
Initial Testing Phase	**8 days**	December 10, 2024	December 18, 2024

Table 2. Project Milestones

Table 2 shows the project milestones, which show the Project Phases, Days, Start Date, and End Date.

Cost Estimation

Initial Budget Estimate and Financial Analysis

Total Budget Allocation ……...**₱35,391.80**

Cost Components

1. Library Borrowing System
2. Staff Training Cost
3. Network and Communications
4. Prototyping and Testing
5. Documentation

PROJECT SCOPE ESTIMATE

Hardware / Software Acquisition …….42.38%

Training Cost ……...…….5.09%

Effort Cost ……....32.62%

Network and Communications ……12.85%

Contingency Fund …….7.07%

Project Scope Estimate		Percentage Allocation	Total Cost
1	Hardware / Software Acquisition	42.38%	₱15,000.00
2	Training Cost	5.09%	₱1,800.00
3	Effort Cost	32.62%	₱11,544.00

4	Network and Communications	12.85%	₱4,547.80
5	Contingency Fund	7.06%	₱2,500.00
Total		**100%**	**₱35,391.80**

Table 3. Cost Estimation

Table 3 outlines the cost estimation and allocation for various components of the project, including hardware/software acquisition, training, effort, network, and contingency funds. Each component is assigned a percentage allocation based on the total budget, with corresponding total costs provided for clarity.

Product / Good / Service for Acquisition with Projected Budget

Product / Good / Service	Unit Price	Quantity	Total Price
CAPITAL EXPENDITURES (HARDWARE)			
Hard Copy Bond Paper	₱200.00	3	₱600.00/Yearly
Full Set Ink Cartridge	₱500.00	2	₱1,000.00/Yearly
		TOTAL	**₱1,600.00/Yearly**
CAPITAL EXPENDITURES (SOFTWARE)			
Microsoft 365 Family Account	₱5,773.02	2	₱5,773.02/Yearly
Veeam Backup & Replication	₱5,189.40	1	₱5,189.40/Yearly
Bitdefender Antivirus	₱899.00	1	₱899.00/Yearly
		TOTAL	**₱11,861.42/Yearly**
		GRAND TOTAL	**₱13,461.42/Yearly**

OPERATIONAL EXPENDITURES			
Staff Labor	₱610/Daily	2	₱24,400/Monthly
Electricity	₱8.89/Hourly	1	₱1796.36/Monthly
Contract Type			
Fixed-Priced Contract: The purchase of the above-mentioned capital and operational expenditures will be accomplished through fixed fixed-priced contract.			

Table 4. Expenditures Cost

Table 4 outlines the anticipated expenses for acquiring essential hardware, software, and operational resources vital for the project's execution. From capital expenditures for hardware and software licenses to operational costs like staff labor and electricity, the projected budget totals ₱13,461.42 yearly, managed through a fixed-priced contract procurement approach.

Requirements Analysis specification (model system requirements)

Process Specification/Modeling

Below is the Data Flow Diagram (DFD) that the researchers used to illustrate the process flows within the system:

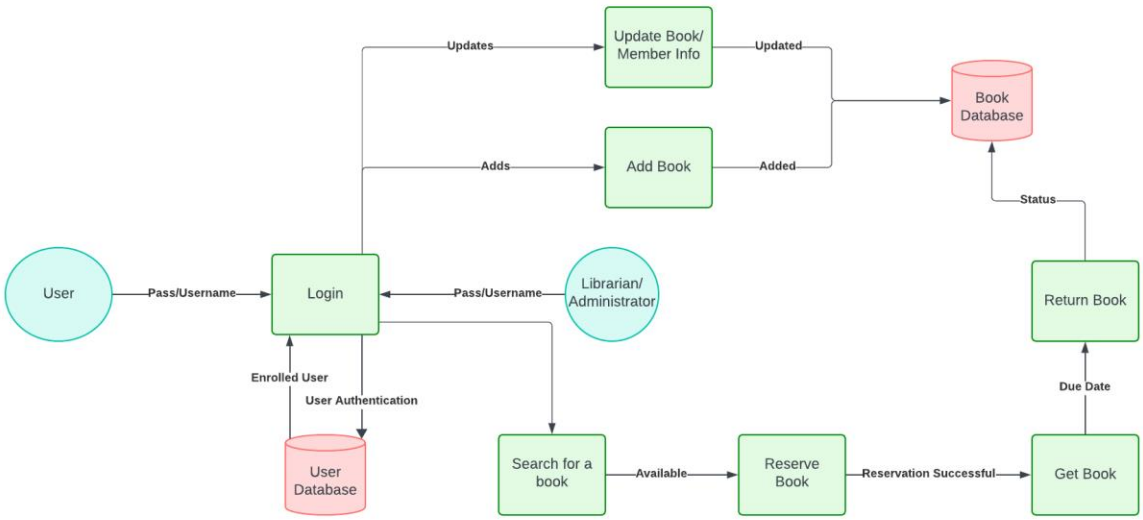


Figure 9: Data Flow Diagram of PerpetualEASE

Entities

a) **Users** - Individuals who would interact with the PerpetualEASE Library System. Users can include students, faculty, staff, or any other individuals registered with the school's library.

b) **Librarians/Administrators** - Personnel responsible for managing the library's operations, including cataloging books, managing memberships, and overseeing the overall functioning of the library.

Key Processes

a) **Login** - The process through which users authenticate themselves to access the system by providing valid credentials such as a username and password.

b) **Search for Book** - The process of finding specific books within the library's collection based on various search criteria such as title, author, category, or keywords.

c) **Reserve Book** - The process of requesting to reserve a book that is currently unavailable but will be made available for borrowing once returned by another user.

d) **Get Book** - The process of borrowing a book from the library after it has been successfully located and reserved.

e) **Return Book** - The process of returning a borrowed book to the library's collection after the loan period has ended.

f) **Add Book** - The process of adding new books to the library's collection includes cataloging relevant information such as title, author, ISBN, and genre. In this process, only librarians and administrators can access it.

g) **Update Member/Book Information** - The process of modifying existing member or book records within the system, such as updating contact information for users or

updating book availability status. Like the latter, librarians and administrators are the ones who can only access this.

Data Stores

a) **User Database** - A repository that stores information about users registered with the library, including their details, login credentials, borrowing history, and membership status.

b) **Book Database** - A database that houses information about the library's collection of books, including details such as title, author, ISBN, availability status, and location within the library.

Data Flow

a) **User Login Data -** The flow of information containing user login details, including personal information and login credentials from the database.

b) **User Authentication** - The flow of login credentials (username and password) for user authentication during the login process.

c) **Book Information Provision -** The flow of book details from the book database to users searching for specific titles or information.

d) **Book Requests** - The flow of requests from users to borrow specific books from the library's collection.

e) **Book/User Information Updates -** The flow of information for updating member or book records within the system, including modifications to user profiles or book availability status.

f) **Book Addition** - The flow of information for adding new books to the library's collection, including cataloging relevant details into the book database.

1.1.2 Data Specification/Modeling

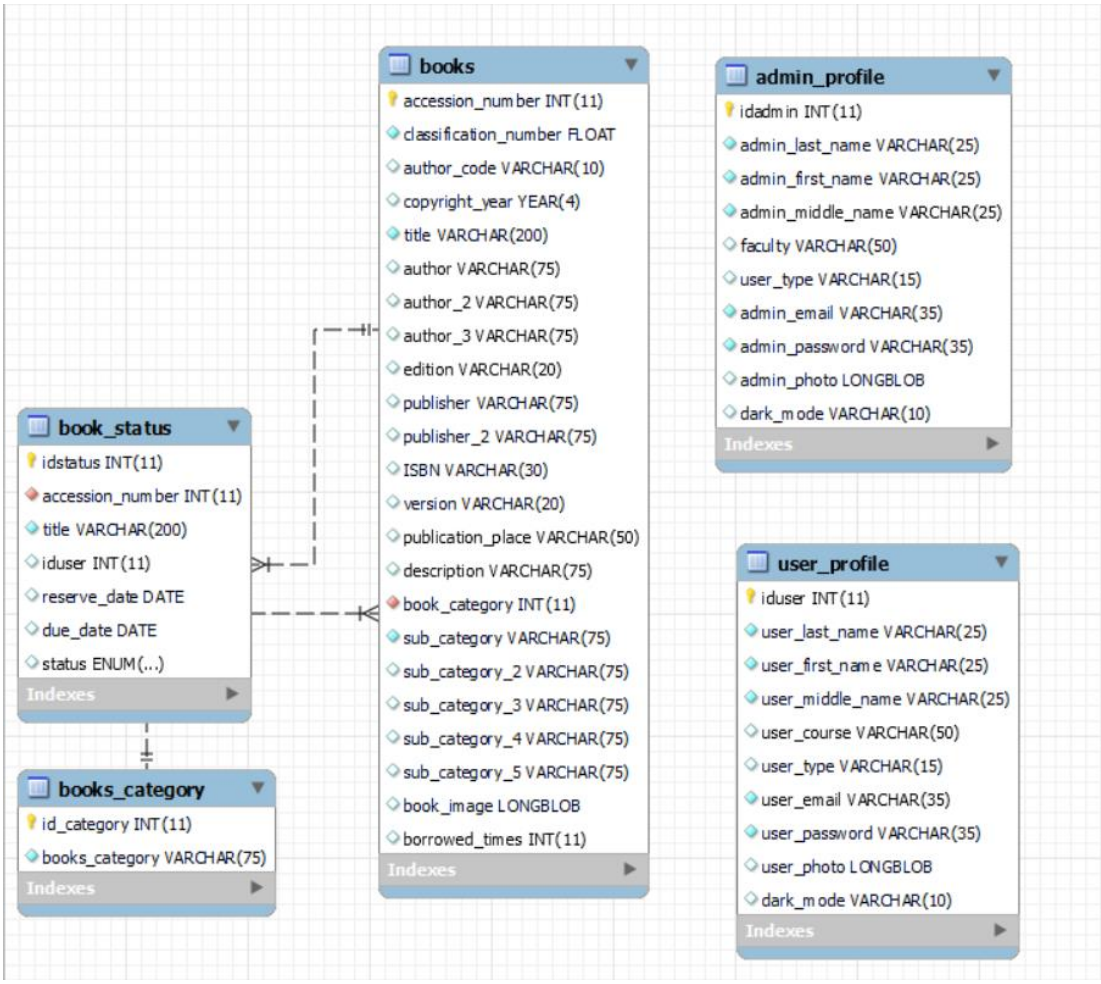


Figure 10. Database Reverse Engineering

Figure 10 provides an in-depth view of the database reverse engineering for the system, highlighting its core components and their respective functionalities. The database is structured to efficiently manage and store information crucial to the system's operations. The key elements of the database are as follows:

a) user_profile: This table is designed to store the credentials and personal information of students. It includes data such as usernames, passwords, and other identifying details required for

logging into the system. In addition to authentication, the information is also displayed in the profile section, allowing users to view and manage their personal details.

b) admin_profile: Similar in structure to the user profile, this table stores data specific to system administrators. It includes credentials and additional information that allows administrators to access and manage the system effectively. By separating student and administrator profiles, the system ensures proper role-based access control and maintains security.

c) books: This table is a repository of book-related information, including titles, authors, publication dates, and other bibliographic details. It serves as the central catalog, enabling users to search for and retrieve detailed information about the books available within the system.

d) book_status: The book status table plays a crucial role in tracking the availability of books. It stores data indicating whether a particular book is available, borrowed, reserved, or under maintenance. This ensures that users and administrators have real-time access to the current status of each book, facilitating smooth borrowing and reservation processes.

e) book_category: This table organizes books into predefined categories, making it easier for users to browse and locate specific types of books. By grouping books under relevant genres or subjects, this table enhances the system's usability and search functionality.

In summary, the database is designed to provide a robust and organized structure for managing user credentials, book information, and system operations. Each component works together seamlessly to ensure efficient handling of data and a user-friendly experience.

Normalization

1. **User Table (user):**
    - iduser (Primary Key)

- user_last_name
- user_first_name
- user_middle_name
- user_course
- user_type
- user_email
- user_password
- user_photo
- dark_mode

2. Admin Table (admin):

- idadmin (Primary Key)
- admin_last_name
- admin_first_name
- admin_middle_name
- faculty
- user_type
- admin_email
- admin_password
- admin_photo
- dark_mode

3. Book Categories Table:

- id_category (Primary Key)
- books_category

4. Book Table:

- accession_number (Primary Key)
- classification_number
- author_code
- copyright_year
- title
- author
- author_2
- author_3
- edition
- publisher
- publisher_2
- ISBN
- version
- publication_place
- description
- book_category (Foreign Key)
- sub_category
- sub_category_2
- sub_category_3
- sub_category_4
- sub_category_5
- book_image

Database Schema

Column Name	Datatype	PK	NN	UQ	B	UN	ZF	AI	G	Default/Expression
iduser	INT	☑	☑	☐	☐	☐	☐	☐	☐	'0'
user_last_name	VARCHAR(25)	☐	☑	☐	☐	☐	☐	☐	☐	
user_first_name	VARCHAR(25)	☐	☑	☐	☐	☐	☐	☐	☐	
user_middle_name	VARCHAR(25)	☐	☑	☐	☐	☐	☐	☐	☐	
user_course	VARCHAR(50)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
user_type	VARCHAR(15)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
user_email	VARCHAR(35)	☐	☑	☐	☐	☐	☐	☐	☐	
user_password	VARCHAR(35)	☐	☑	☐	☐	☐	☐	☐	☐	
user_photo	LONGBLOB	☐	☐	☐	☐	☐	☐	☐	☐	NULL
dark_mode	VARCHAR(10)	☐	☐	☐	☐	☐	☐	☐	☐	'Off'

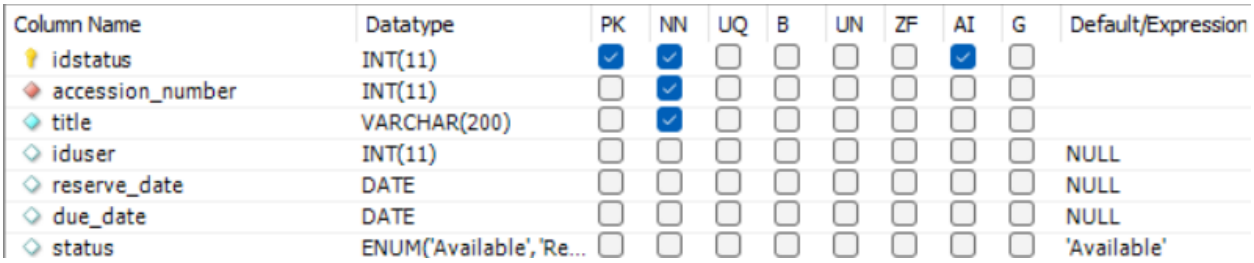
Figure 11 . Data Schema of Users

Column Name	Datatype	PK	NN	UQ	B	UN	ZF	AI	G	Default/Expression
idadmin	INT	☑	☑	☐	☐	☐	☐	☐	☐	'0'
admin_last_name	VARCHAR(25)	☐	☑	☐	☐	☐	☐	☐	☐	
admin_first_name	VARCHAR(25)	☐	☑	☐	☐	☐	☐	☐	☐	
admin_middle_name	VARCHAR(25)	☐	☑	☐	☐	☐	☐	☐	☐	
faculty	VARCHAR(50)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
user_type	VARCHAR(15)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
admin_email	VARCHAR(35)	☐	☑	☐	☐	☐	☐	☐	☐	
admin_password	VARCHAR(35)	☐	☑	☐	☐	☐	☐	☐	☐	
admin_photo	LONGBLOB	☐	☐	☐	☐	☐	☐	☐	☐	NULL
dark_mode	VARCHAR(10)	☐	☐	☐	☐	☐	☐	☐	☐	'Off'

Figure 12. Data Schema of Admin

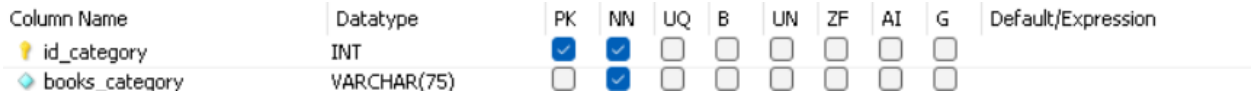
Column Name	Datatype	PK	NN	UQ	B	UN	ZF	AI	G	Default/Expression
accession_number	INT	☑	☑	☐	☐	☐	☐	☐	☐	
classification_number	FLOAT	☐	☑	☐	☐	☐	☐	☐	☐	'0'
author_code	VARCHAR(10)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
copyright_year	YEAR	☐	☐	☐	☐	☐	☐	☐	☐	'2024'
title	VARCHAR(200)	☐	☑	☐	☐	☐	☐	☐	☐	
author	VARCHAR(75)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
author_2	VARCHAR(75)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
author_3	VARCHAR(75)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
edition	VARCHAR(20)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
publisher	VARCHAR(75)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
publisher_2	VARCHAR(75)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
ISBN	VARCHAR(30)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
version	VARCHAR(20)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
publication_place	VARCHAR(50)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
description	VARCHAR(75)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
book_category	INT	☐	☑	☐	☐	☐	☐	☐	☐	
sub_category	VARCHAR(75)	☐	☑	☐	☐	☐	☐	☐	☐	'New'
sub_category_2	VARCHAR(75)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
sub_category_3	VARCHAR(75)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
sub_category_4	VARCHAR(75)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
sub_category_5	VARCHAR(75)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
book_image	LONGBLOB	☐	☐	☐	☐	☐	☐	☐	☐	NULL

Figure 13 . Data Schema of Books



Column Name	Datatype	PK	NN	UQ	B	UN	ZF	AI	G	Default/Expression
idstatus	INT(11)	☑	☑	☐	☐	☐	☐	☑	☐	
accession_number	INT(11)	☐	☑	☐	☐	☐	☐	☐	☐	
title	VARCHAR(200)	☐	☑	☐	☐	☐	☐	☐	☐	
iduser	INT(11)	☐	☐	☐	☐	☐	☐	☐	☐	NULL
reserve_date	DATE	☐	☐	☐	☐	☐	☐	☐	☐	NULL
due_date	DATE	☐	☐	☐	☐	☐	☐	☐	☐	NULL
status	ENUM('Available','Re...	☐	☐	☐	☐	☐	☐	☐	☐	'Available'

Figure 14 . Data Schema of Books Status



Column Name	Datatype	PK	NN	UQ	B	UN	ZF	AI	G	Default/Expression
id_category	INT	☑	☑	☐	☐	☐	☐	☐	☐	
books_category	VARCHAR(75)	☐	☑	☐	☐	☐	☐	☐	☐	

Figure 15 . Data Schema of Books Category

Software Design Specification

Process Specification

The initial interface of the PerpetualEASE software is encapsulated in a hierarchical chart, as shown in Figure 3.1. This figure delineates the structured flow of the user interface, specifically designed for students. After logging into the system, students are greeted with a menu bar positioned at the top of the screen, featuring options such as Home, Books, Profile, and Logout. This intuitive design ensures that students can easily navigate through the different sections of the platform, enhancing the overall user experience.

As for the database that the system will use, the school will provide datasets containing the relevant information of each student, book, book categories, and faculty/staff to be inputted into the parameters of the system's database. In this way, security and exclusivity is ensured while using the program as this builds upon already existing and long-running systems and data.

Upon successful login, students are taken to the homepage user interface featured in Figure 25. This homepage showcases featured books and categorizes them for easy browsing. The bookpage user interface, as highlighted in Figure 26, plays a crucial role in the system by allowing students to search for specific books, explore various categories, and select genres to view related titles. This interface streamlines the borrowing process, enabling students to reserve books with a single click. Once a reservation is made, a confirmation pop-up panel appears as demonstrated in Figure 27, detailing the reservation information and reminding users to collect their books from the library. Additionally, the student's profile interface provides comprehensive details such as their name, ID number, course, year level, address, and history of borrowed and returned books, further enhancing the personalized user experience.

1.1.3 Data Specification

idstatus	accession_number	title	iduser	reserve_date	due_date	status
1	36	Introduction to systems analysis and design	230773286	NULL	2024-12-22	Borrowed
2	4390	Rise of russia	230773286	NULL	2024-12-22	Borrowed
3	396	Legal and ethical aspects of health information ...	230773286	NULL	2024-12-19	Borrowed
4	26	Computer accounting essentials using EPeachtree	230773286	NULL	2024-12-22	Borrowed
5	38	Information technology literacy	230773286	NULL	2024-12-22	Borrowed
6	253	On sense and direct reference	230773286	2024-12-15	2024-12-22	Borrowed
7	418	Science and health: with key to the scriptures	230773286	2024-12-27	2025-01-03	Borrowed
8	4391	Renaissance	230773286	2024-12-15	2024-12-22	Borrowed
11	397	Classic cases in medical ethics: accounts of case...	230773286	2024-12-16	2024-12-23	Borrowed
13	4258	The informed writer: using sources in the discipline	230773286	2024-12-18	2024-12-25	Reserved

Figure 16. PerpetualEASE Books Status Database

id_category	books_category
0	Generalities
1	Philosophy, Parapsychology and Occultism, Psychology
2	Religion
3	Social Sciences
4	Language
5	Natural Sciences and Mathematics
6	Technology
7	The Arts
8	Literature
9	Geography, History and Auxiliary Disciplines

Figure 17. PerpetualEASE Category Database

accession_number	classification_number	author_code	copyright_year	title	author	author_2	author_3	edition
1060	362.17	H714	2009	Nursing leadership & management	Mary Ann Hogan	Donna M. Nicklitas	NULL	NULL
1298	428.2	H118	2009	A writer's reference	Diana Hacker	NULL	NULL	6th Edit
1299	428.2	L963	2010	The St. Martins Handbook	Andrea A. Lunsford	NULL	NULL	6th Edit
1307	428.64	W411	2002	Mosaic 2 reading	Brenda Wegmann	Miki Knezevic	NULL	4th Edit
1362	512.5	B223	2008	Intermediate algebra	Stefan Baratto	Kelly Kaiser Kohl...	Barry Be...	NULL
1363	512.5	B223	2008	Intermediate algebra	Stefan Baratto	Kelly Kaiser Kohl...	Barry Be...	NULL
1365	512.9	M647	2007	Intermediate algebra	Julie Miller	Molly O'Neil	Nancy H...	NULL
1366	512.9	D867	2004	Algebra for college students	Mark Dugopolski	NULL	NULL	3rd Edit
1369	512.9	L533	2001	College algebra and trigonometry	Louis Leithold	NULL	NULL	NULL
1370	512.9	L533	2001	College algebra and trigonometry	Louis Leithold	NULL	NULL	NULL

publisher	publisher_2	ISBN	version	publication_place	description	book_category	sub_category
Pearson Education, Inc.	NULL	978-0-13-119601-8	NULL	New Jersey	XII, 246. ; 25cm ; + CD-ROM	3	Nursing Services
Bedford	St. Martin's	978-0-312-66476-3	NULL	New York	XXXV, 509p. ; 21.5cm	4	Writing & Rheto
Bedford	St. Martin's	978-0-312-0-6648...	NULL	New York	XXXIX, 931p. : color ill, ; 21.5c...	4	Writing & Rheto
McGraw Hill	NULL	978-0-07-232964-3	NULL	New York	XI, 258p. : color ill. ; 25.5cm	4	Language and L
McGraw Hill	NULL	978--0-07-327347-1	NULL	Boston	XXV, 1060p. col. ill. ; 27.5cm i...	5	Mathematics-Alg
McGraw Hill	NULL	978--0-07-327347-1	NULL	Boston	XXV, 1060p. col. ill. ; 27.5cm i...	5	Mathematics-Alg
McGraw Hill	NULL	978-0-07-302326-7	NULL	Boston	XXVI, 860p. col. ill. ; 27.5cm	5	Mathematics-Alg
McGraw Hill	NULL	0-07-244392-8	NULL	Boston	XXV, 780p. ill. ; 21.5cm	5	Mathematics-Alg
Pearson Education Asia Pte Ltd	NULL	981-4035-83-1	NULL	Singapore	XVIII, 702p. ill. ; 19.5cm	5	Mathematics-Alg
Pearson Education Asia Pte Ltd	NULL	981-4035-83-1	NULL	Singapore	XVIII, 702p. ill. ; 19.5cm	5	Mathematics-Alg

sub_category	sub_category_2	sub_category_3	sub_category_4	sub_c
Nursing Services-Administration-Examination...	Leadership-Examinations, Questions	NULL	NULL	NULL
Writing & Rhetoric	Reference	NULL	NULL	NULL
Writing & Rhetoric	Reference	NULL	NULL	NULL
Language and Linguistics	NULL	NULL	NULL	NULL
Mathematics-Algebra	NULL	NULL	NULL	NULL
Mathematics-Algebra	NULL	NULL	NULL	NULL
Mathematics-Algebra	NULL	NULL	NULL	NULL
Mathematics-Algebra	NULL	NULL	NULL	NULL
Mathematics-Algebra and Trigonometry	NULL	NULL	NULL	NULL
Mathematics-Algebra and Trigonometry	NULL	NULL	NULL	NULL

Figure 18. PerpetualEASE Books Database

iduser	user_last_name	user_first_name	user_middle_name	user_course	user_type	user_email	user_password	user_photo	dark_mode
220201137	Magaan	Zoren Christian	Chavez	BS Computer Science	Student	m22-0201-137@manila.uphsl.edu.ph	123123	BLOB	Off
220773286	Ramos	Joylyn	Eudela	BS Computer Science	Student	joylyn.deleon.ramos@gmail.com	Perps#1234	BLOB	Off
232661856	Trani	Chrizea Jhane	Prochina	BS Computer Science	Student	m23-2661-856@manila.uphsl.edu.ph	Phcm#1234	BLOB	On

Figure 19. PerpetualEASE User Database

idadmin	admin_last_name	admin_first_name	admin_middle_name	faculty	user_type	admin_email	admin_password	admin_photo	dark_mode
19067	Villanueva	Anna Liza	Ognita	College of Computer Studies	Admin	villanueva.anna@manila.uphsl.edu.ph	1	BLOB	Off
19068	Tungol	Rodel	M	College of Computer Studies	Admin	rodeltungol@uphsl.edu.ph	Uphs#1234	BLOB	Off
19069	De Luna	Jeusuel Nonnatus	Noblezala	College of Computer Studies	Admin	deluna.jeusuel@manila.uphsl.edu.ph	Phcm#1234	BLOB	Off

Figure 20. PerpetualEASE Admin Database

Screen/Interface Specifications

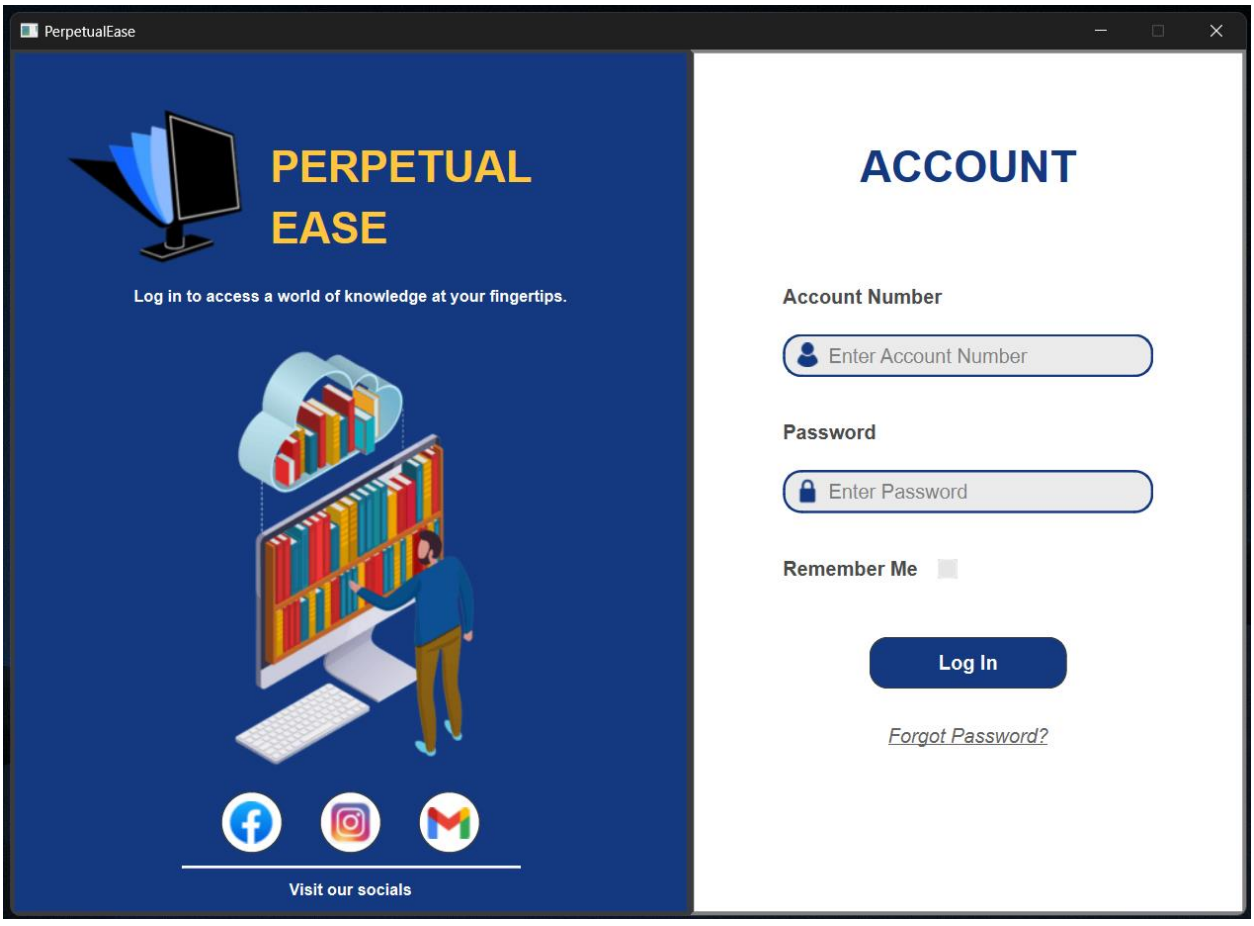


Figure 21. PerpetualEASE Student's Login User Interface

Figure 21. shows the login that requires the users to input their username and password for a user authentication.

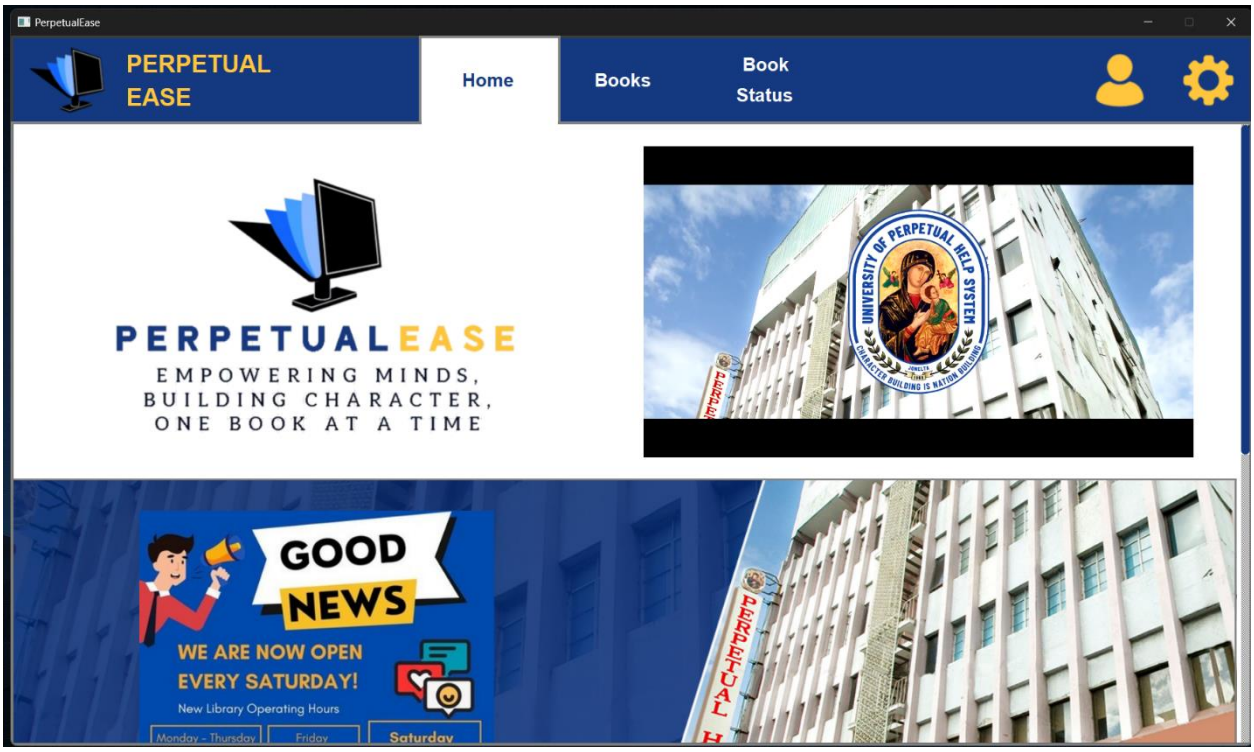


Figure 22. PerpetualEASE Student's Homepage User Interface

When the user successfully logs in, the homepage user interface shown in Figure 23 will show up. This figure contains the featured books and categories of books

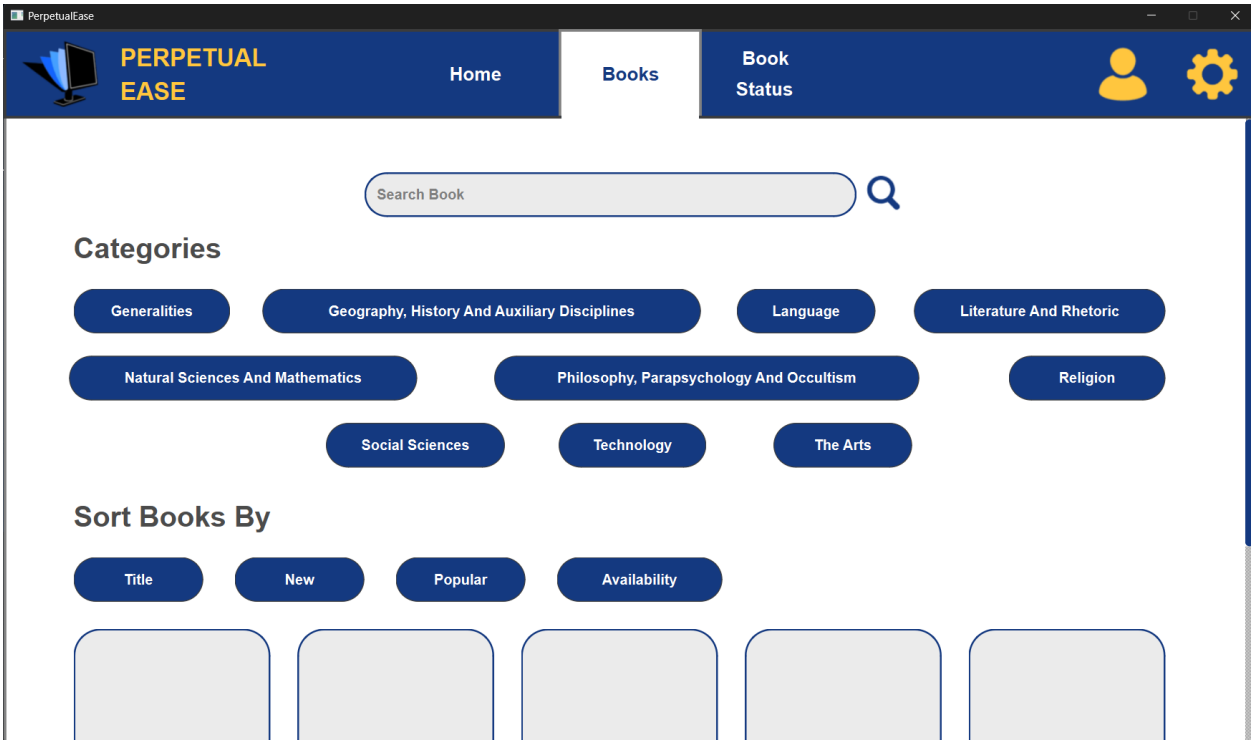


Figure 23. PerpetualEASE Student's Books User Interface

The bookpage user interface, which is an important feature of the system, is shown in Figure 23. Students can easily search for particular books, browse through different categories at random, and choose a genre to immediately access a panel just for that particular genre. In addition to giving students the option to study a variety of literary genres, the bookpage interface makes borrowing books easier by allowing them to check out books with just one click, improving accessibility and the user experience.

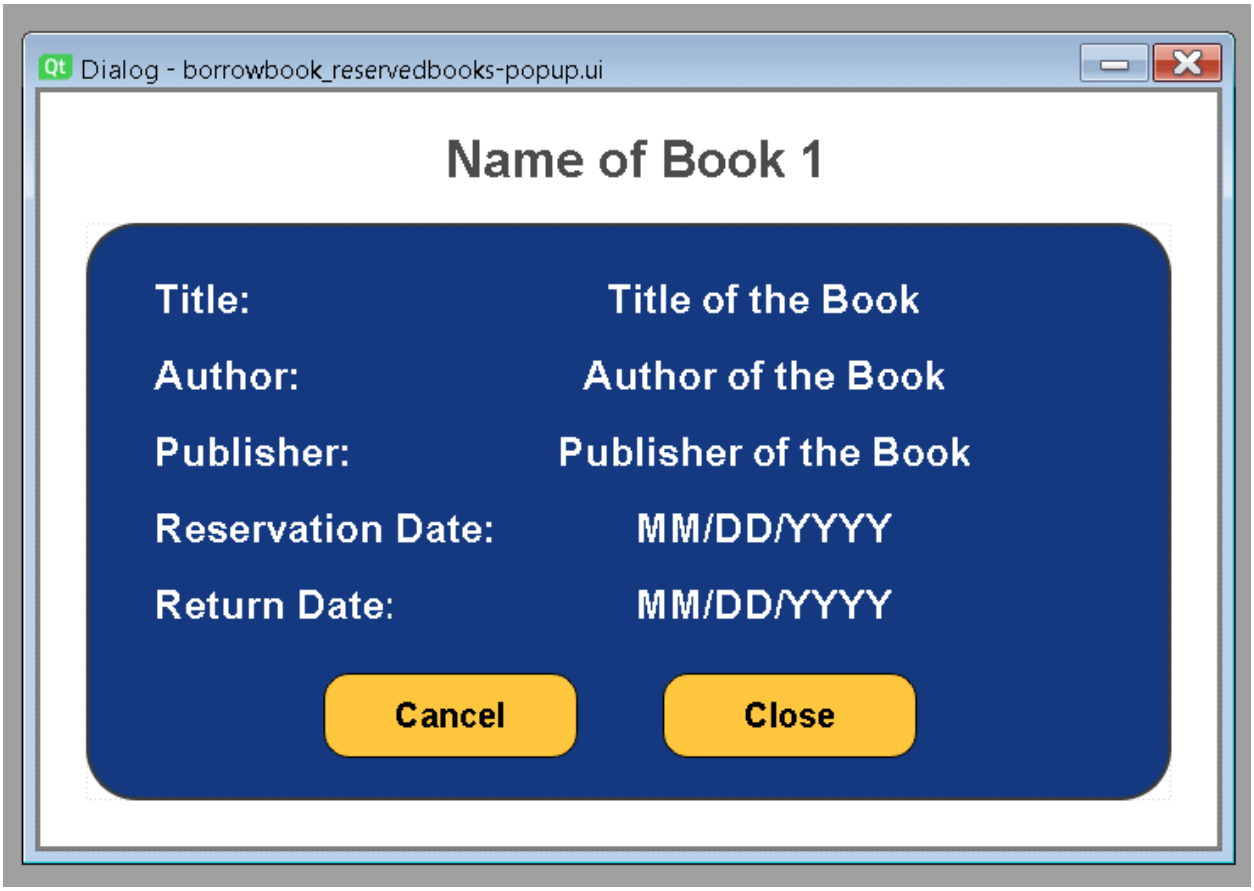


Figure 24. PerpetualEASE Student's Reservation Completed User Interface

Once the user selects to borrow a book(s), the reservation completed pop-up panel will show. It contains the reservation confirmation, users' names, the title of the reserved book, its author and publisher, the date it was reserved, and the date it should be returned. In this panel, a reminder would also be seen, notifying the user to get the book from the school's library within a specific timeframe.

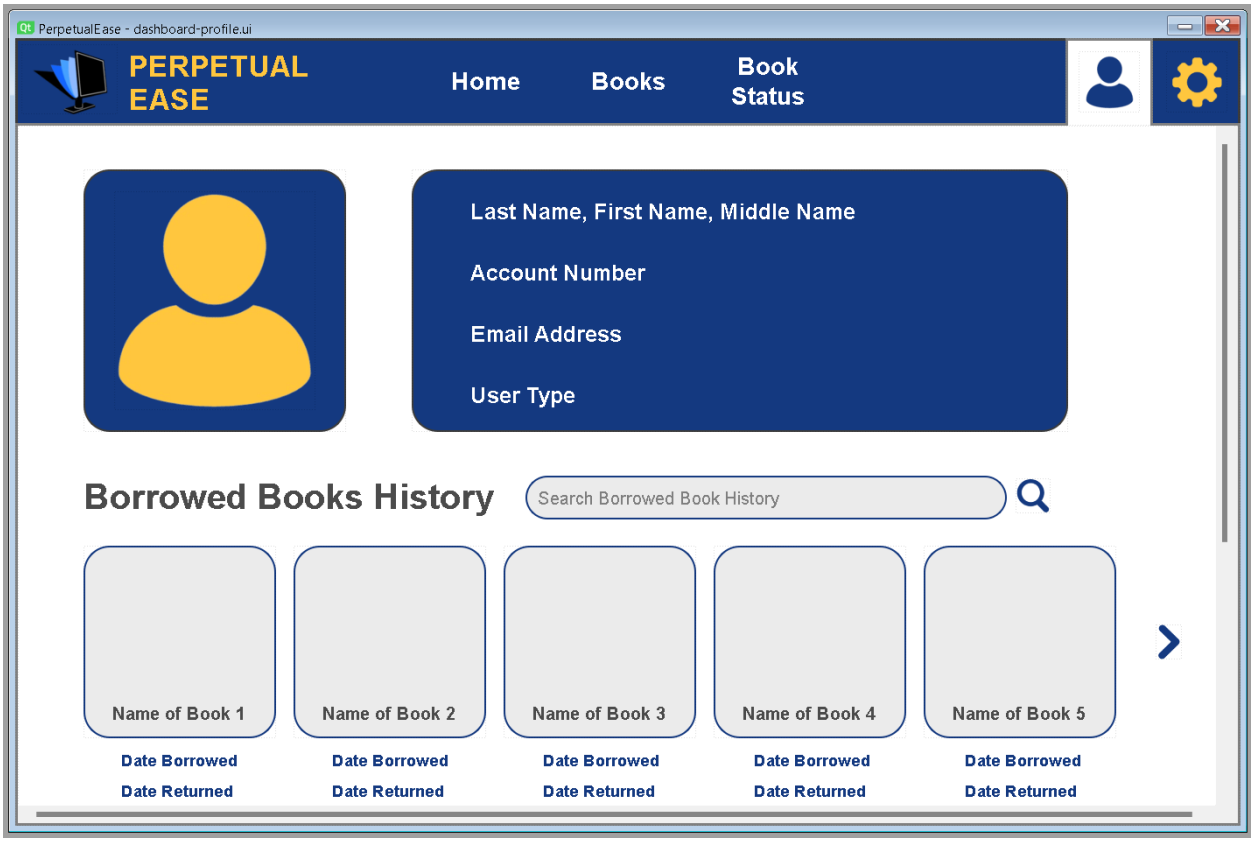


Figure 25. PerpetualEASE Student's Profile User Interface

Figure 26 shows the student's profile and its information. This includes the student's name, ID number, course, year level, address, books borrowed, and books returned.

Program/Module Specification

The program code reached to thousands of lines per file, the reason why proponents' decided to compile it to a Google drive that can be accessed by the link:

https://drive.google.com/drive/folders/1hNj0d2REmhw9KvRxo_vr8F1HzOdiQ80p?usp=sharing

Software Implementation

The software implementation of the PerpetualEASE Library System began with a thorough requirement analysis phase. The project team, stakeholders, students, faculty, librarians, and administrators were actively engaged to gather their input and understand their needs. Through interviews and meetings, functional and non-functional requirements for the system were meticulously elicited and documented using tools like use cases and user stories. Use cases are detailed descriptions of how users interact with the system to achieve specific goals or tasks. User stories are concise, informal descriptions of system features or functionalities from the perspective of an end user. And requirement specifications. This phase provided a clear roadmap for the subsequent stages of development.

Following the requirement analysis, the system design phase commenced. Collaborating closely with UX/UI designers, prototypes and mockups were created to visualize the layout and user interface of the software. ERD diagrams and system flowcharts were developed to illustrate the relationships between different components of the software. Additionally, data models and entity-relationship diagrams were defined to establish the structure of the database and ensure efficient data management.

With the design in place, the database design phase ensued. The database schema was meticulously designed using MySQL, considering factors such as data normalization, indexing, and relational integrity. Entities such as books, users, staff, and administrative roles were identified, and their attributes and relationships were defined. The database design aimed to optimize performance by implementing appropriate indexing strategies and normalization techniques.

Subsequently, the development phase began, where tasks were assigned to the project team based on the defined requirements and design specifications. Utilizing programming languages and frameworks such as Python, the software's backend logic and frontend user interface were implemented. Features such as book borrowing, reservation, search functionality, user authentication, and administrative controls were integrated according to the agreed-upon requirements.

Following development, rigorous testing was conducted to validate the correctness and functionality of the software. Various types of testing, including unit tests, integration tests, system tests, and user acceptance tests, were performed to verify different aspects of the software, including functional requirements, usability, performance, and security. Any identified bugs, errors, or issues were addressed through iterative testing and debugging cycles.

Upon successful testing, the deployment phase began, focusing on preparing the software for deployment by configuring the necessary server infrastructure. This involved setting up and configuring the physical server, installing the operating system, and deploying XAMPP—a solution that includes the Apache web server, MySQL database, and PHP interpreter. Configuration tasks included setting up virtual hosts, adjusting PHP settings, and ensuring server security.

Compatibility with the target deployment environment, in this case, XAMPP, was carefully verified to guarantee smooth operation. Additionally, optimizations for performance and scalability were implemented to ensure the software runs efficiently and can handle increased

usage over time. To facilitate the deployment process, detailed deployment procedures and protocols were established. These procedures outlined the steps for safely deploying the software to production servers and XAMPP environments, ensuring a seamless transition from testing to live operation.

Training and documentation played a crucial role in ensuring the successful adoption of the software. Training sessions and workshops were conducted for library staff and users to familiarize them with the software's features and functionality. Additionally, user manuals and guides were created to provide step-by-step instructions for using the software. Ongoing support and assistance were offered to address user questions, concerns, and feedback.

Finally, maintenance and support protocols were implemented to ensure the software's continued functionality and performance. Ongoing monitoring of system performance, security vulnerabilities, and user feedback was conducted to identify areas for improvement and implement necessary updates or enhancements. Communication channels were established for users to report issues and receive timely support from the project team. Through meticulous attention to detail and collaboration across the project team, stakeholders, administrator, staff, and users, the PerpetualEASE Library System was successfully implemented to meet the needs of the Perpetual Help College of Manila library and its users.

Programming Considerations, Issues, and Tools

The researchers constructed thorough coding guidelines and best practices specifically for Python, the programming language of choice for creating the software for the library borrowing

system. They assured modular architecture and flexibility to support future additions and alterations by utilizing Python's object-oriented nature. Their expertise in Python provided familiarity and flexibility, allowing the team to easily create complicated capabilities.

PyCharm was chosen as the Integrated Development Environment (IDE) in conjunction with Python because of its strong features, which include code debugging, version control integration, and user-friendly UI design tools. The researchers found PyCharm to be user-friendly and compatible with Python, which made it easier for team members to collaborate effectively and create quickly. The IDE's ability to adapt to various screen sizes and resolutions ensured that developers could work comfortably across different devices.

A local development server environment was established for the backend infrastructure using XAMPP, which stands for cross-platform Apache, MySQL, and Perl. This stack made it possible to integrate the Apache web server with the MySQL database management system. The database management system used by the library to store and administer its collection, user data, and transactional data utilizes MySQL. While InnoDB is the storage engine utilized by the group.

Throughout the development process, the team addressed various challenges and considerations, such as database schema design, data validation, and concurrency control. They utilized industry best practices and design patterns to ensure the scalability, performance, and security of the database.

System Requirements Specification

Hardware Requirements

The researchers for the PerpetualEASE project intend to create a productive library resource borrowing system that considers both software and hardware needs. Compatibility with several operating systems is crucial for hardware, with suggestions made specifically for Windows, Mac, and Linux.

A minimum 2GHz processor, 4GB of RAM (ideally 8GB), and a minimum 1024 x 600-pixel screen resolution are required for a computer. It is advised to have high-speed internet connectivity to easily access digital information. Proponents also suggest utilizing Windows 8 or up to the previous versions for a swift interface.

Additionally, researchers suggest that, for compatibility and performance, equipment no older than three years be used. For data storage and user privacy protection, adequate storage space and secure connections are also essential. Physical space requirements include electrical requirements and equipment specifications, with a focus on grounding and dedicated power lines. To guarantee that there are enough access points for users, terminal requirements are based on circulation, patron visits, acquisitions, and subscriptions.

The college community will have a great user experience and the PerpetualEASE system will function effectively and securely if these standards are met.

Software Requirements

A thorough set of software requirements is included in PerpetualEASE, an innovative library resources borrowing system, to accommodate the various needs of both users and staff.

In terms of functionality, it encourages administrator and user-friendly interfaces; this includes a simple and interactive user interface that prompts users and administrators to log in for proper input criteria, incorporates an efficient database system for effective data administration, and provides a strong search tool to locate resources quickly. Non-functionally, it prioritizes usability through error handling and intuitive design, guarantees data integrity through strict security measures, ensures continuous user availability, allows for scalability to handle growing demands, and keeps optimal performance even during peak usage. It also highlights error management procedures and produces informative reports to improve operational effectiveness.

Together, these exacting software specifications guarantee PerpetualEASE's effectiveness, user experience, and flexibility to accommodate contemporary library operations.

Human Resource Requirements

The PerpetualEASE library borrowing system completely transforms how users utilize library resources. This Human Resource (HR) requirement outlines the fundamental roles, responsibilities, abilities, and credentials required for efficiently administering and expanding the system to guarantee its success.

1. **Project Manager:** Oversees the development process, coordinating teams and stakeholders. Strong leadership, communication, and organizational skills are necessary.
2. **System Analyst:** Responsible for soliciting clear requirements from the client and project stakeholders. Performs requirements analysis and data gathering.
3. **Technical Lead:** Ensures system quality through rigorous testing. Proficiency in testing methodologies and bug-tracking tools is essential.

4. **System Administrator:** Manages the system environment, including installation, configuration, and maintenance. Requires expertise in operating systems, network administration, and database management.
5. **Software Developer:** Responsible for coding, testing, and debugging the software. Proficiency in programming languages, software development methodologies, and version control systems is crucial.
6. **Documentation:** Responsible for compiling all project documentation and reporting into organizational formats. Responsible for assisting the project manager in configuration management and revision control for all project documentation. Responsible for scribing duties during all project meetings and maintaining all project communication distribution lists.
7. **Librarian:** serves as the primary liaison between the software system and its end-users, ensuring smooth navigation and access to library resources. Responsibilities include cataloging materials, managing user accounts, handling inquiries, and facilitating the borrowing and return process.

Acknowledging the specified HR requirements guarantees PerpetualEASE's smooth functioning and development. This document is the foundation for selecting, developing, and overseeing a knowledgeable staff that is dedicated to providing an exceptional library borrowing experience.

Software Maintenance Plan

The software maintenance plan for PerpetualEASE Library System ensures functionality, performance, and security. It includes regular updates, backups, and disaster recovery procedures. Real-time monitoring identifies performance issues, while security measures protect against cyber threats. User support and training promote software adoption, and comprehensive documentation ensures shared information. Through these efforts, the plan aims to sustain reliability, security, and longevity, enhancing value for the library and its users.

Regular Updates and Patches

This involves establishing a schedule for regular updates and patches to address vulnerabilities and ensure compatibility with evolving technologies. Updates will be conducted monthly, with patches applied as needed based on security advisories and software enhancements. A dedicated team will oversee the update process, testing patches in a staging environment before deploying them to the live system.

Scheduled Backups and Disaster Recovery

Scheduled backups will be performed daily to ensure the integrity of data and configurations. Backup procedures will include full and incremental backups, with data stored securely both on-site and off-site to mitigate the risk of data loss in the event of a disaster. Disaster recovery plans will be documented and regularly tested to ensure rapid and efficient restoration of services in the event of an incident.

Real-Time Monitoring

Real-time monitoring tools will be deployed to track the software's performance and resource utilization continuously. Key metrics such as CPU usage, memory consumption, and network traffic will be monitored, with alerts configured to notify administrators of any anomalies or performance issues. This proactive approach will enable swift identification and resolution of performance bottlenecks and capacity issues.

Security Measures

Robust security measures will be implemented to safeguard the software from cyber threats and unauthorized access. Encryption protocols will be applied to protect data both in transit and at rest. Access controls will be enforced through role-based permissions, restricting access to sensitive features and data based on user roles. Regular security audits will be conducted to identify and address any vulnerabilities proactively.

User Support and Training

A dedicated support team will provide ongoing assistance to library staff and patrons, addressing any software-related queries or issues promptly. User training sessions will be conducted regularly to ensure that all users are proficient in using the software effectively. Training materials, including user manuals and video tutorials, will be made available online for easy access.

Documentation and Knowledge Management

Comprehensive documentation will be maintained to capture all aspects of the software, including installation procedures, configuration settings, and troubleshooting guides. A centralized knowledge base will be established to store and organize software-related information, making it easily accessible to project stakeholders. Regular reviews and updates will be conducted to ensure that the documentation remains accurate and up-to-date.

Appendices

Appendix A: Glossary of Terms

- **Application Programming Interface (API)** - is a set of protocols and tools for building software and applications, allowing different systems to communicate with each other.
- **Availability** - refers to the status indicating whether a book is available for borrowing or not.
- **Backend** - is part of the software that handles business logic, database interactions, and server-side operations.
- **BorrowDirect** – is a service allowing users to borrow books from a consortium of libraries.

- **Data Flow Diagram (DFD)** – is a way of representing a flow of data through a process or a system. The DFD also provides information about the outputs and inputs of each entity

and the process itself. A data-flow diagram has no control flow—there are no decision rules and no loops.

- **Database Schema** – is the structure of a database described in a formal language supported, typically, by a relational database management system. The term "schema" refers to the organization of data as a blueprint for how the database is constructed.
- **Digital Library Management System (DLMS)** – is a computer-based system where all the functions of the library are controlled digitally and in a systematic way. It helps in keeping a record of books, journals, catalogs, newspapers, CDs, etc. in the library.
- **Entity-Relationship Diagram (ERD)** – is a diagram used in database design to illustrate the relationships between entities like people, things, or concepts in a database. An ERD will also often visualize the attributes of these entities.
- **Functional Requirements** – is a specific behaviors or functions expected from the system, such as the ability to search for books or check out books.
- **Hierarchical Chart** – is a system in which people or things are put at various levels or ranks according to their importance. When you work in a company, you will find that your company structure can be illustrated as a hierarchical organizational chart.
- **Integration Testing** – is testing in which individual software modules are combined and tested as a group to ensure they work together correctly.
- **ISO 25010** – is the quality model is the cornerstone of a product quality evaluation system. The quality model determines which quality characteristics will be considered when evaluating the properties of a software product.

- **Library Management System (LMS)** – is a software that is designed to manage all the functions of a library. It helps the librarian maintain a database of new books and the books that are borrowed by members, along with their due dates. This system completely automates all your library's activities.
- **MySQL** – is an open-source relational database management system used to store and manage the library's data. Its name is a combination of "My," the name of co-founder Michael Widenius's daughter My, and "SQL," the acronym for Structured Query Language.
- **Non-Functional Requirements** – are attributes that define the quality of the system, such as performance, usability, and security.
- **Online Public Access Catalog (OPAC)** – is an online database of materials held by a library or group of libraries. Online catalogs have largely replaced the analog card catalogs previously used in libraries.
- **phpMyAdmin (PHP)** – is a free software tool written in PHP that is intended to handle the administration of a MySQL or MariaDB database server. phpMyAdmin can be used to perform most administration tasks, including creating a database, running queries, and adding user accounts.
- **PyCharm -** is an integrated development environment (IDE) used for programming in Python. It provides code analysis, a graphical debugger, an integrated unit tester, integration with version control systems, and supports web development with Django.
- **Python** is a programming language that lets you work quickly and integrate systems more effectively.

- **Rapid Application Development (RAD)** – is an agile software development approach that focuses more on ongoing software projects and user feedback and less on following a strict plan. As such, it emphasizes rapid prototyping over costly planning.
- **SQL (Structured Query Language)** – is a standardized language used to communicate with and manipulate databases.
- **Unit Testing** – is the testing of individual components of the software to ensure they work as expected.
- **User Acceptance Testing (UAT)** – is the final phase of testing where the intended users test the software to ensure it meets their needs and requirements.
- **User Stories** – is a short, simple descriptions of a feature told from the perspective of the user who desires the new capability, often used in Agile development.
- **Use Cases** – is descriptions of how users will interact with the system to achieve a specific goal.
- **XAMPP** – is a free and open-source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, MariaDB database, and interpreters for scripts written in the PHP and Perl programming languages.

Appendix B: Interview Transcripts

Interview Date: March 13, 2024

Location: Perpetual Help College of Manila's library

Interview 1: Video recorded

Interviewee: Library Staff 1

Questions and Responses:

- **Quantity of books in the library:** "Around 8,000 to 10,000 books are currently in the library."
- **Students borrowing books in a week:** "Estimated 10 to 20 students borrow books in a week."
- **Borrowing procedure time:** "The borrowing procedure takes less than 5 mins."
- **Library's WIFI and electricity budget:** "We do not know the library's WIFI and electricity budget."
- **Staff salary:** "Our estimated salary is ₱15,000 to ₱18,000"
- **Digital library borrowing system:** "Yes, the Perpetual Help College of Manila library has a digital library borrowing system."
- **Dilemmas in the borrowing system:** "So far, there is no existing dilemmas in terms of the borrowing system."

Interview 2: Voice recorded

Interviewee: Library Staff 2

Questions and Responses:

Electrical appliances in the library:

- Television: 1
- Water dispenser: 1
- Printer: 2
- Air conditioner: 5
- Outlet: 6
- Personal computer: 14
- Fluorescent light: 34
- Data cabinet: 1
- Router: 1
- Switch hub: 2

Appendix C: Database Schema

User Table:

- userId (Primary Key)
- lastname
- firstname

- email
- password

Book Categories Table:

- categoryId (Primary Key)
- category_name

Book Table:

- bookId (Primary Key)
- categoryId (Foreign Key referencing Book Categories Table)
- title
- author
- publisher
- year_published
- edition
- availability
- date_returned
- image

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Resource Persons

Anna Liza O. Villanueva

Dean of the College of Computer Studies

Perpetual Help College of Manila

Rodel M. Tungol

Professor of the College of Computer Studies

Perpetual Help College of Manila