Book Republic: A Book Exchange System

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Book Republic: A Book Exchange System

by

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ABSTRACT

This study focuses on the development of a web application, *The Book Republic*, designed to facilitate book trading among enthusiasts through an online platform. The system enables users to borrow and swap books while fostering social interactions within the community. To evaluate its effectiveness, usability, and user experience, 24 participants—comprising students and professionals—assessed the platform. The results indicate that the system's innovative approach to book exchanging, compared to traditional manual methods, positively influenced usability ratings. *The Book Republic* obtained a System Usability Scale (SUS) score of 73.85, with students rating it at 73.41% and professionals at 74.23%. These findings highlight the platform's potential in enhancing accessibility and engagement within book-sharing communities.

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ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my adviser, **Prof. Danilo Mercado**, for his unwavering support, patience, and guidance throughout the course of this special project. His insightful advice and encouragement have been invaluable in shaping this work.

I am also profoundly grateful to my family for their love and support. To my husband, Bernard, whose constant motivation and belief in me pushed me to persevere even in the most challenging times—thank you for always standing by my side.

Lastly, I dedicate this work to my late grandmother, whose wisdom, love, and unwavering faith in me continue to inspire and guide me. This achievement is a tribute to her memory and the values she instilled in me.

With heartfelt appreciation, thank you all.

I. INTRODUCTION

A. *Background of the Study*

Book swapping has recently become digital in the form of book exchange websites. Before its proliferation in the internet, exchanging can only be made among friends and within members of book clubs. Today book enthusiasts can acquire books without spending a lot since participants only charge for the delivery fee of the books they mail. BooksMooch and PaperBackSwap.com are the two popular book trading sites with the biggest collections and number of members. They allow their users to ship books internationally. Since most of these sites are based in the US and other technologically advanced countries, it is unpractical and ironic for the overseas participants to pay for an expensive shipping fee when they can buy the equivalent new book locally for a cheaper price.

The idea of free trading of books is still a new and developing concept in the Philippines. Online bookstores that offer cheap deals are more common such as Aklatan and Avalon.ph that sell secondhand books and BookForLess.ph that sells new books at discounted prices. Nevertheless, non-government organizations host events and projects that promote open and free access to books.

One initiative is by WTA Architecture and Design Studio that runs the Book Stop Project.This project is about placing a pop out library in cities with high volume of pedestrian traffic to encourage passersby to read. The library is an open structure built from recycled materials that serves as a reading kiosk and also redistribution point for sharing of old books. The Book Stop mobile library as of this writing has been moved to Molito, Alabang from its previous location at San Sebastian Basilica in Quiapo, Manila. [1]

This paper proposes a project called Book Republic. It is a type of a Social Networking Service (SNS) in which book lovers from anywhere in the country can trade books for free. For each registered user, the system will provide a virtual bookshelf where he/she can manage and show his/her listing of books that he/she intends to lend and swap to other users. For users to take control of his/her books, he/she may accept or reject borrow and swap requests. The borrow feature will allow a book to circulate yet return to its owners bookshelf while the swap feature will exchange it with another book on other users bookshelf. Negotiations about shipping will be between users discretion via messaging. Book distribution and warehousing will not be covered by the system.

B. *Statement of the Problem*

A local-based book exchange website is not yet available in the Philippines. This project can serve as a prototype web application that will help design and determine the specifications and requirements of an efficient book exchange system fit for the needs and demands of the stakeholders. This study can provide a basic platform where Filipino readers can freely swap, borrow and discover books. For readers that are already members of foreign book exchange websites, this system can provide a cheaper cost for acquiring books over the network.

C. *Objectives of the Study*

The Book Republic aims to unify household bookshelves into one big e-library where users can freely share and exchange books to one another. This project also aims to provide users the following:

1. A user-friendly interface that will allow users to swap, borrow and discover book with eases;
2. An efficient and reliable book exchange system;
3. A social networking platform that fosters connections among book enthusiasts and promotes a culture of sharing.
4) An environment-friendly book swapping system;

D. *Significance of the Study*

One of the major beneficiaries of this study will be the students. Many universities abroad are adapting book swapping programs to help students save money on textbooks. Only few colleges are using automated systems and many are still implementing manual book barter.There are schools and cafes that organize informal and unsupervised book exchange programs in which people casually leave their books inside drop boxes for others to pick up later on [2]. Having an online portal, the giver and the taker of the books can trade with ease through the aid of the open information of the system. Overall this project will help the community through human resource development and through the preservation of the environment. With the aim of unifying household bookshelves into one big e-library, knowledge resources will be centralized and community book sharing will be optimized. Moreover, people will be motivated to read resulting to a collective increase in literacy. Also being a type of a social network, members can interact with one another to form a camaraderie through shared passion for books and reading. Lastly, this system can contribute in reducing the number of trees being cut down for paper production. Instead of increasing the demand for new books, old ones are reused and have the chance to be read by everybody in the community.

E. *Scope and Limitations*

The system does not cover logistics handling for book transfers or warehousing. Instead, it provides a messaging feature as the primary communication channel for users to negotiate trades. Since registration is open to all, users are responsible for deciding whom to trust when lending or swapping books. To facilitate secure exchanges, a trading request mechanism has been implemented, allowing users to monitor book transfers and select their preferred borrowers or swappers. This feature ensures greater control over transactions and enhances user confidence in book exchanges. With this selection feature, users also can handpick a preferred candidate borrower or swapper for their books.

I. REVIEW OF RELATED LITERATURE

The Republic Act No. 7743, otherwise known as An Act Providing for the Establishment of Congressional, City and Municipal Libraries and Barangay Reading Centers Throughout the Philippines Appropriating the Necessary Funds Therefore and for Other Purposes, recognizes the significance of having libraries in the community in promoting moral and intellectual well-being of people. In 2013, Sen. Loren Legarda filed the Senate Bill No. 355 that seeks to amend this two-decade old act legislated in 1994 [1]. The purpose of the amendment bill is to upgrade library facilities based on the latest computer and electronic library technology. However, the bill has not come to realization yet since its status remains pending up to now. According to Legarda, there is a need to equip public libraries with the latest computer and electronic library facilities to make sure that Filipino students have access to a wide variety of up-to-date learning materials.

Nevertheless, there are efforts made by non-government organizations in promoting open and free access to books. One initiative is by WTA Architecture and Design Studio that runs the Book Stop Project, a mobile library that promotes reading on the pedestrian [2]. This project is about placing a pop out library in cities with high volume of pedestrian traffic to encourage the passersby to read. Being a company that also promotes sustainability, the library is an open structure built from recycled materials that serves as a reading kiosk and also redistribution point for sharing of old books.

There are schools and cafes that organize informal and unsupervised book exchange programs in which people casually leave their books inside drop boxes for others to pick up later on [3].

In this digital age where people can instantly get information with just a few clicks, searching directly in the internet provides a faster and more convenient way of querying than going to research in the library. Traditional book swapping going digital is motivational especially in this time of rapid technological advancement.

Book exchange sites encourage people to read books in a fun, trendy yet cost-effective way. In 2015, Ng and Pera developed EasyEx, a sophisticated book exchange system that can analyzes users' preference on books to give precise book recommendations [4]. The system can also accommodate multiple users to create an exchange cycle in oppose to the usual swapping between two users. These two features of EasyEX were implemented using the Recommendation Toolkit from the LensKit.org and OptaPlanner, a constraint satisfaction solver.

The Recommendation Toolkit examines every exchange transaction. This refers to all possible combination of a user and the books he/she is interested in. Each candidate exchange transaction is assigned an appeal score called the degree of interest. The degree of interest is computed using multiple linear regression model to get the average ratings obtained from both Personalized Mean and Matrix Factorization of the LenSkit framework. After getting all the degree of appeals, as part of the optimization process, the OptaPlanner will analyze each exchange transaction using sophisticated heuristics and metaheuristics to generate the optimal set of exchanges among users. The developer of EasyEx claimed that they were the first to employ OptaPlanner in a book exchange system in identifying an optimal book recommendation since this application of the algorithm is commonly used in vehicle routing and employee shift rostering.

In environmental perspective, Trupti (2010) conducted a study on how libraries can contribute to the conservation of the environment. He believes that libraries as a social organization must actively disseminate information on environmental sustainability. Accordingly, implementation of green technology and practicing green culture in the libraries can act as a key factor in the sustainability movement. He specified ways on how libraries can go green. Among the examples is going digital in every aspect like emailing newsletters and announcements instead of printing hardcopies to reduce paper usage. He also mentioned others way on his study such as the constructing green library building and greening existing facilities and services within the library [5]

Social networking features in digital platforms contribute to user retention and engagement. Studies by Kim & Park (2018) emphasize that interactive features, such as messaging and user reviews, enhance trust among users in online marketplaces. The ability to communicate and negotiate directly with other users has been shown to improve transaction success rates and user satisfaction (Harrison et al., 2022). By incorporating a messaging system, The Book Republic enables users to establish connections, negotiate trades, and create a sense of community among book enthusiasts.

One of the challenges in online trading platforms is trust among users. Research by Xu et al. (2019) suggests that implementing features like user ratings, transaction tracking, and controlled access to exchanges can mitigate risks and build confidence in peer-to-peer transactions. The Book Republic addresses this issue by allowing users to select preferred borrowers or swappers through a trade request system, ensuring a more secure and transparent book exchange process.

II. MATERIALS AND METHODS

A. System Requirements

The Book Republic is a web application that aims to create an online community where users can share and exchange books to one another. It covers basic features of an SNS such as profile, friend and message management with the addition of trading modules such as borrowing and swapping of books. Registered users called bookworms can have their own bookshelf interface where all the books they want to share with fellow bookworms can be managed. The administrator will be in charge of managing the information on all users, books, and transactions. Non-registered users called guests, who can only view the public book listing, has no privilege of trading.

The development of *The Book Republic* web application will utilize a structured technology stack to ensure efficient functionality, maintainability, and scalability. The backend of the system will be primarily implemented using PHP, leveraging its flexibility and compatibility with web applications. To enhance performance and streamline development, the CodeIgniter framework will be used, providing a lightweight yet powerful structure for organizing code, managing database interactions, and improving program compilation efficiency.

For the frontend development, the system will incorporate JavaScript and jQuery, ensuring dynamic and interactive user experiences. jQuery will be utilized to simplify scripting, enhance client-side functionalities, and provide seamless interactions between users and the platform. Additionally, a n open-source CSS theme, the Cryptic Color Admin 1.8 will be integrated to establish a visually appealing and user-friendly interface, ensuring intuitive navigation and accessibility.

In terms of database management, MySQL will be employed as the primary Database Management System (DBMS) to store and manage user information, book records, transaction details, and system logs. MySQL's reliability, scalability, and support for structured query language (SQL) make it a suitable choice for handling large volumes of data while ensuring data integrity and security.

The system will be designed to operate on standard web servers capable of running PHP and MySQL, making it deployable across various hosting environments. Additionally, security measures such as input validation, SQL injection prevention, and user authentication mechanisms will be implemented to safeguard user data and maintain system integrity.

B. User Types and Privileges

The Book Republic supports three distinct user groups: Bookworm, Administrator, and Guest. Each user group has specific roles and access privileges within the platform. Bookworms are registered users with the most interactive features, such as managing their personal bookshelves, sending and responding to borrow or swap requests, adding friends, and participating in messaging and activity tracking. Administrators, on the other hand, have full control over system-wide settings, user management, content moderation, and report handling to ensure the smooth operation of the platform. Certain functionalities are exclusive to Bookworms and Administrators and are not available to Guest users, ensuring that more advanced features are reserved for those who are actively engaged in the community.

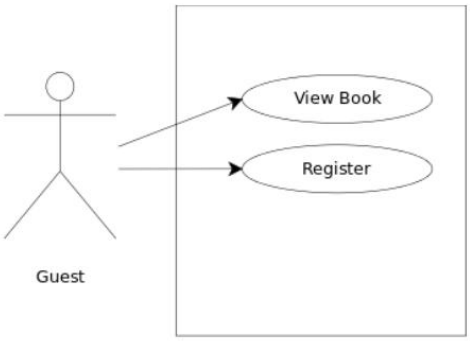

Figure 1: Use Case Diagram of Guest

Figure 1 shows the system features of the guest, which is the least privileged user of the system as they are only allowed to view public listing of books unless they register as bookworm. Guests are unregistered users with limited access; they can browse public areas of the site, such as the main library, but are restricted from using interactive features like messaging, book management, or friend requests.

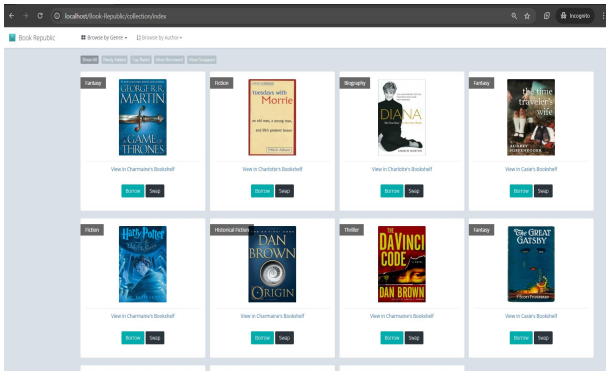

Figure 2. Browse Collection feature for Guest

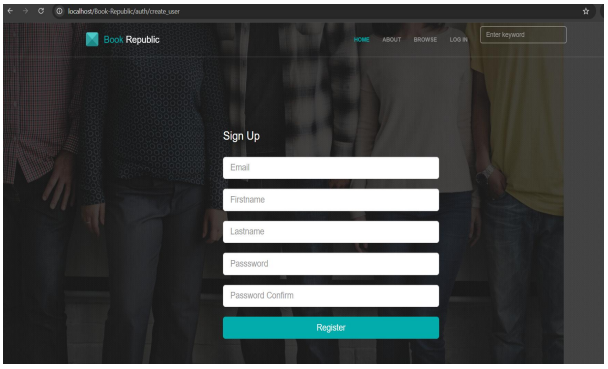

Figure 3. Signup feature for full access of the website

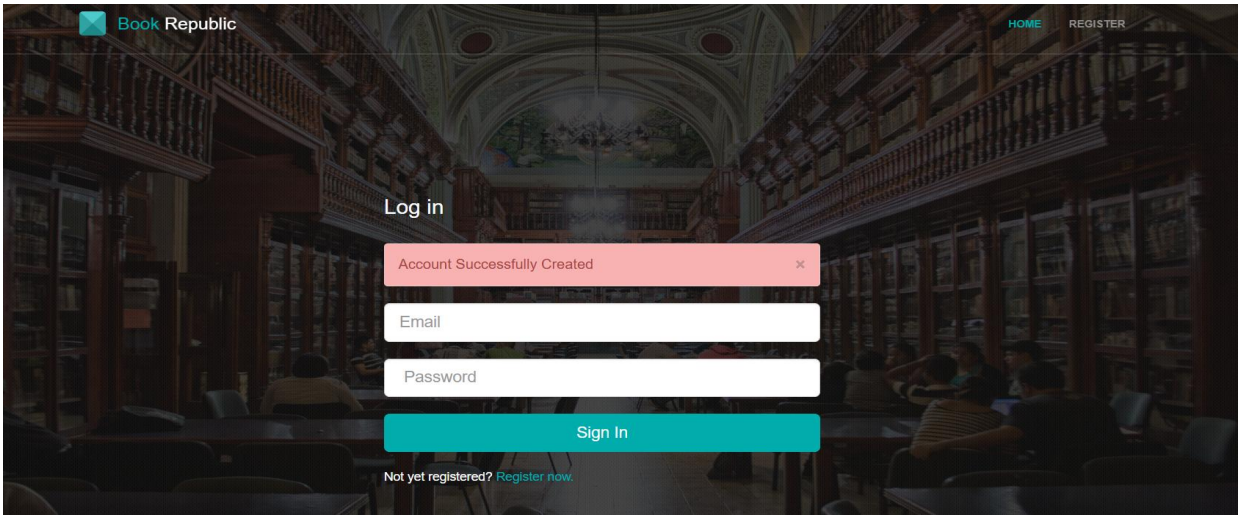

Figure 4. After successful registration, guest now called bookworm can login.

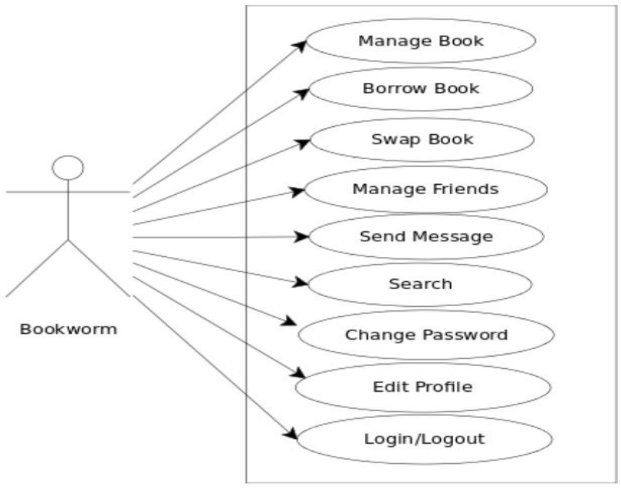

Figure 5. Features that can be accessed by the Bookworm user

As shown in Figure 5, the Bookworm user holds elevated privileges as the primary user of the system. This user is responsible for managing their bookshelf by adding, deleting, and updating book entries. They can browse other users' bookshelves via search, although adding Bookworm friends enhances and simplifies this process. The user can confirm or reject friend requests, as well as borrow and swap requests. They can update their profile information and display photo, view their activity history through logs, and communicate with fellow Bookworms through messages. Additionally, they can send reports to the administrator and change their account password.

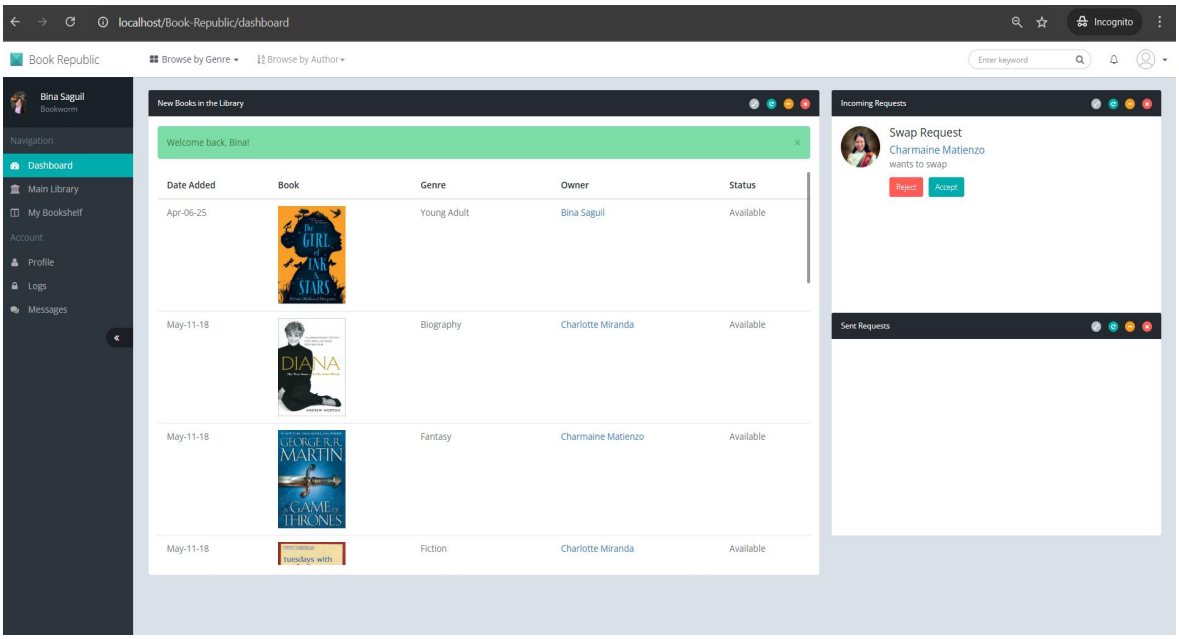

Figure 6. Dashboard of the Bookworm User

Upon successful login, the Bookworm user is redirected to their dashboard, where they can immediately view all books available in the main library. A side panel provides easy navigation to the user's personal Bookshelf, where they can manage their book collection by adding, updating, or deleting entries. On the right-side panel, the user can access and respond to incoming swap, borrow, and friendship requests from fellow Bookworm

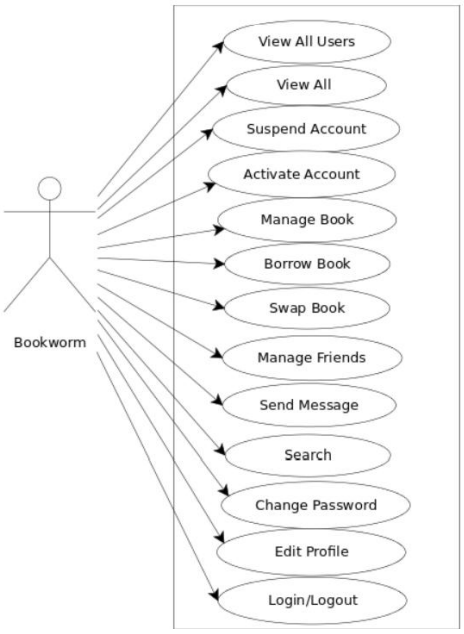

Figure 7. Use Case for Admin

The administrator class extends the functionality of the bookworm class, but with additional responsibilities that center around the overall management and maintenance of the system to ensure database integrity and smooth operation. While the administrator shares the core features of the bookworm, such as the ability to borrow and swap books, their role is more expansive and integral to the system's upkeep. The administrator is responsible for managing not only user information but also detailed records of books and transactions, ensuring that all data is accurately recorded and securely maintained.

In addition to these basic tasks, the administrator has the authority to monitor user activities through detailed logs, providing a way to track interactions, transactions, and any potential issues that may arise within the system. This allows the administrator to promptly identify and address any suspicious or problematic behavior. Furthermore, the administrator has the ability to receive and review reports from bookworms about any irregularities or concerns, such as misuse of the system or violations of the community guidelines.

Based on the information in these reports, the administrator is empowered to take appropriate actions to maintain the integrity and health of the system, including suspending or even permanently disabling user accounts if necessary. In addition to managing user accounts, the administrator also holds the crucial ability to promote a bookworm to an administrator role, ensuring that the system has qualified individuals to assist in overseeing its functions and continued growth. This added responsibility ensures that the system remains well-managed and that the user community can continue to engage in a fair and organized manner.

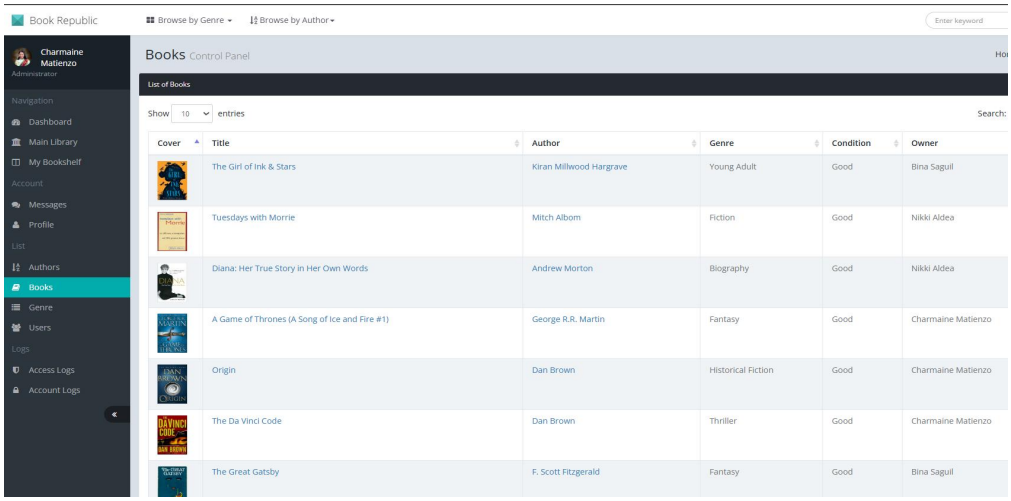

Figure 8. The Administrator Dashboard

C. Systems Features and Flow

The Book Republic covers the most basic features of a social networking site combined with necessary functionalities of a book exchange system. The features ensure that there will be interaction among the users to accomplish the goal of book trading. There are unique features for each user group, but some features can be performed by more than one user group.

After logging in, the Bookworm is directed to their personalized homepage, which serves as the central hub for user activity. The **My Bookshelf** section displays all books the user has added; new entries can be added by clicking the plus icon located at the lower right corner, while existing books can be viewed, edited, or deleted by selecting their thumbnail images. The **Notifications** panel presents all incoming requests related to borrowing, swapping, and friend connections. The **Inbox** contains a list of all the user's messages and ongoing conversations. The **Friends** section displays the user's list of connections, allowing easy access to their bookshelves. Lastly, the **Activity Log** records and displays all actions performed by the user that result in changes to their account information in the system's database.

1. Create, View and Manage Users Account

This module includes essential features for managing user accounts. In order to fully utilize the system, guests are required to register and create an account, thereby gaining access as Bookworm users. Both Bookworms and Administrators are provided with a Profile feature, which allows them to upload a profile picture, share their reading list, and view their list of friends for easier access of their bookshelves (Fig. 9).

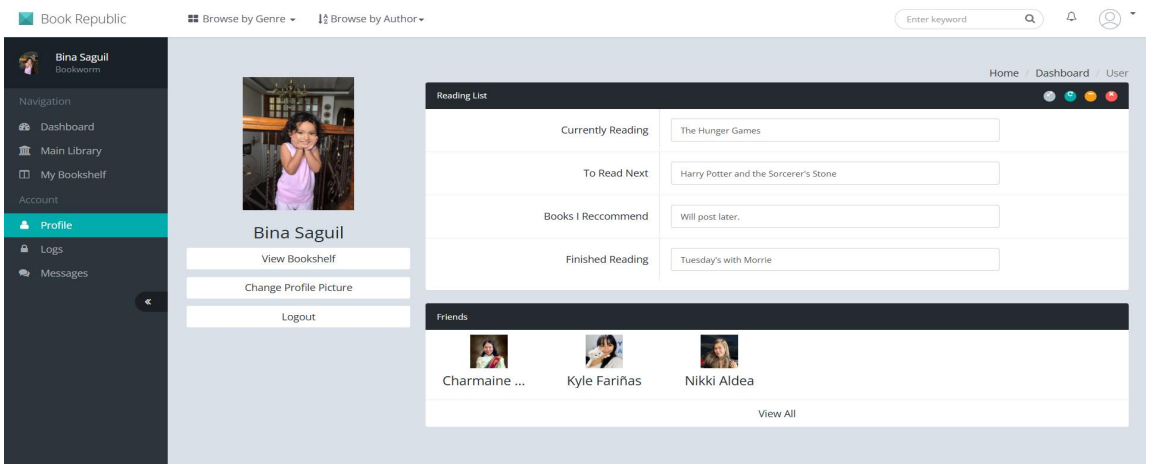

Figure 9: Profile Management Feature accessible by Bookworm and Administrator

The **Administrator** holds the highest level of access and control within the system, serving as the primary authority responsible for the overall management and maintenance of the platform. As the designated site moderator, the Administrator plays a crucial role in ensuring that the system operates smoothly, securely, and in accordance with its intended policies and guidelines.

Key responsibilities of the Administrator include monitoring and overseeing user activity across the platform. This involves reviewing access logs, tracking login histories, and identifying any unusual or suspicious behavior that may pose a risk to system integrity or user safety. The Administrator also has the ability to view detailed account logs to assist in audits, troubleshooting, or compliance-related tasks.

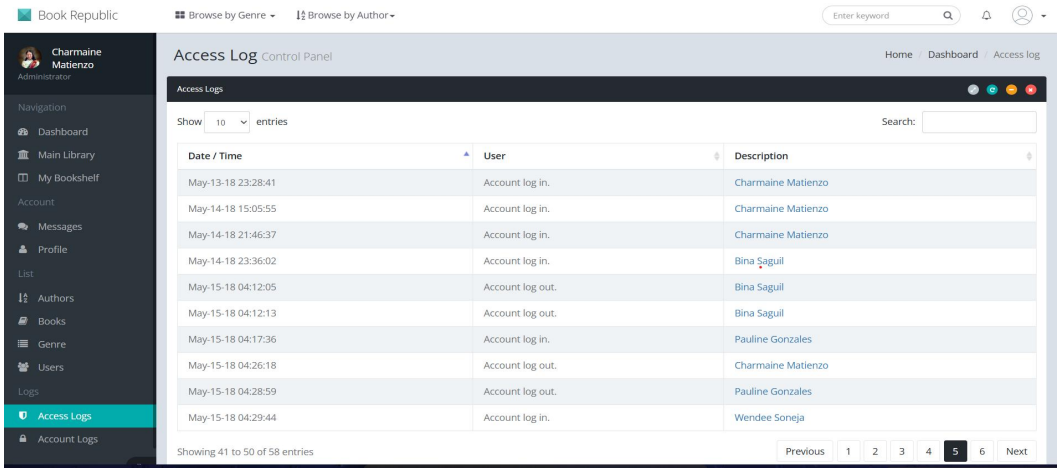

Figure 10. Access Log Module for the Administrator

In addition to monitoring, the Administrator is tasked with managing all user accounts. This includes creating and updating user profiles, modifying access permissions, and handling requests related to user roles or privileges. When necessary, the Administrator can activate newly registered accounts or deactivate existing ones, either temporarily or permanently, based on account status, user behavior, or policy violations.

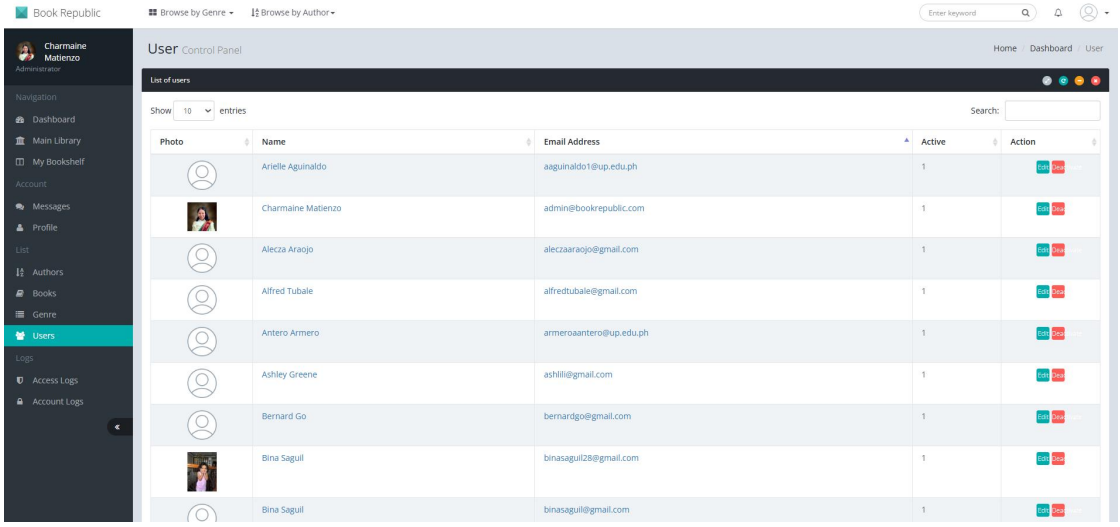

Figure 11: The User Accounts Management Module for the Administrator

2. Viewing, Adding and Managing Books

This module includes view, edit, delete, and add new book in the bookshelf that are accessible to both bookworms and administrators (Fig. 11). The guest can only view the books while the administrator has the overall management of all the books in the admin panel and can perform features such as delete, update, and view book.

Each registered bookworm user is given the “My Bookshelf” platform (Fig. 11) where he/she can add books for sharing over the site. Adding a book requires input of title, author, genre, synopsis and uploading of the book cover.

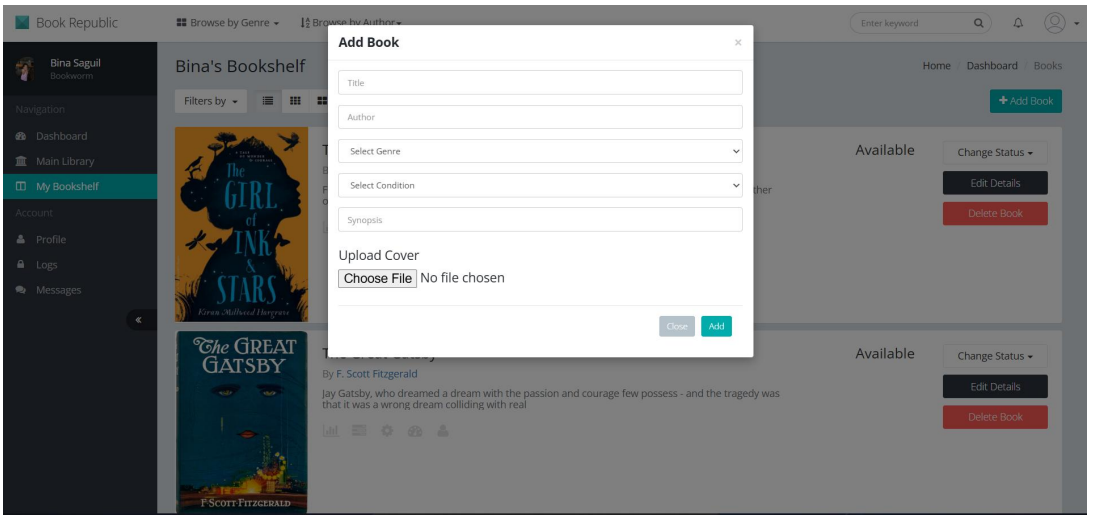

Figure 11. The Bookshelf feature, a virtual library to manage user’s book listing.

Similarly, the system provides users with the ability to browse their friends’ bookshelves. By navigating to the “Profile” section through the sidebar and clicking on their friend’s thumbnail and “View Bookshelf”. users can view a complete list of books that their friends have made available.

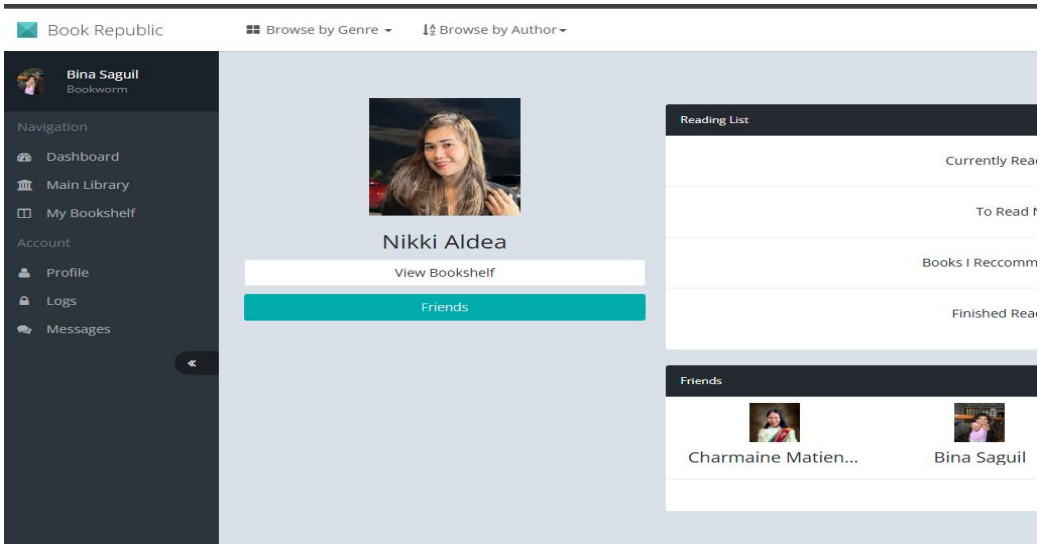

Figure 12. Viewing Friend’s Profile and navigating friend’ bookshelf

Each bookshelf displays all the books owned or shared by a specific friend, making it easy to discover new titles or find something of interest. From this list, users have the option to initiate a **Borrow** or **Swap** request directly on any available book, depending on their preference

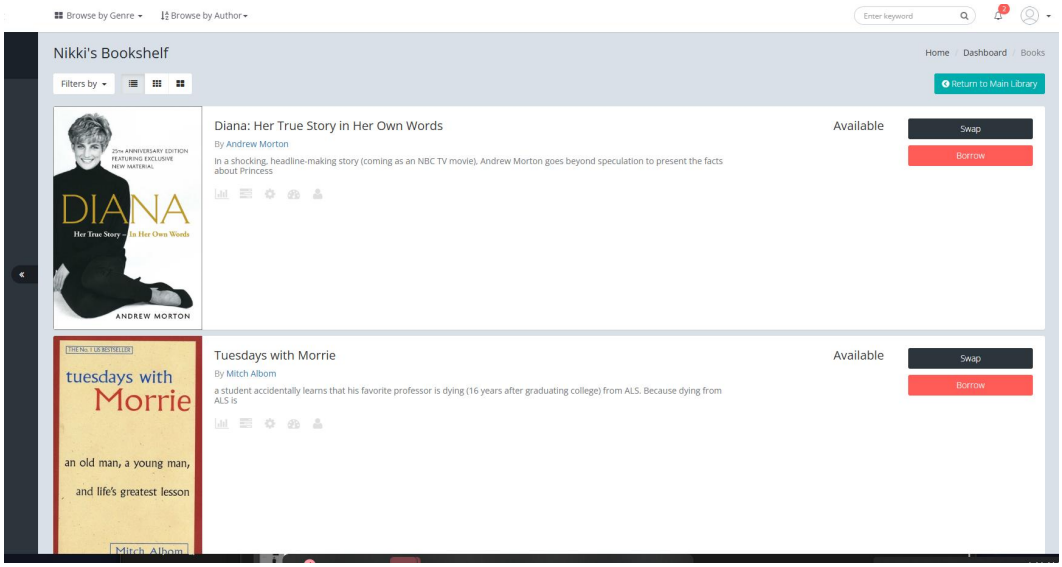

Figure 12. Browsing through Friend's bookshelf

3. Borrowing and Swapping of a Book

To access this feature, the user must first select a book. There are two primary methods for locating a book within the system. The first method is browsing through the Main Library that can be immediately found at the Bookworm's dashboard and navigation sidebar. The second method allows the user to browse friends' bookshelves by selecting the "Friends" option in the sidebar menu. (Fig.12)

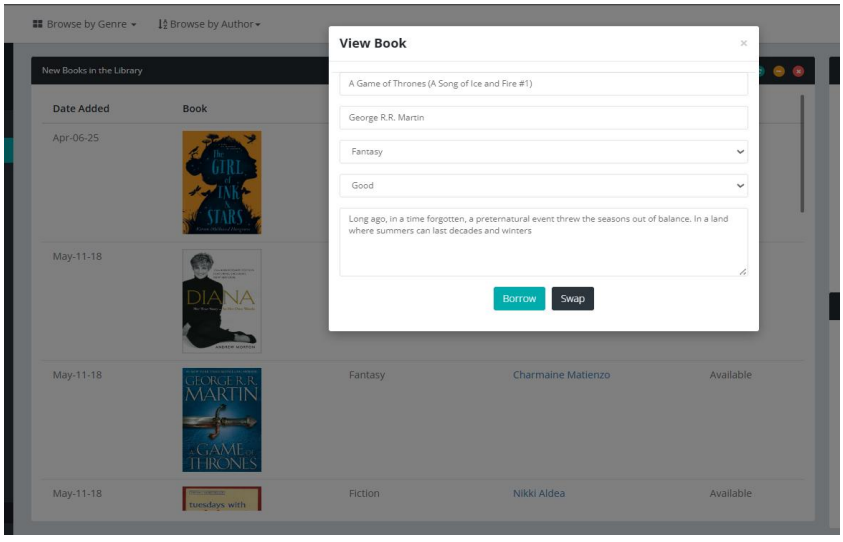

Figure 13. Selecting book to borrow

Once a book has been selected, a modal window is triggered when the user clicks on the book they intend to borrow or swap (Fig.13). This modal displays relevant metadata about the selected book, including the title, author, genre, description, and physical condition. At the bottom of the modal, actionable buttons labeled **Borrow** and **Swap** are provided to allow the user to initiate the desired transaction

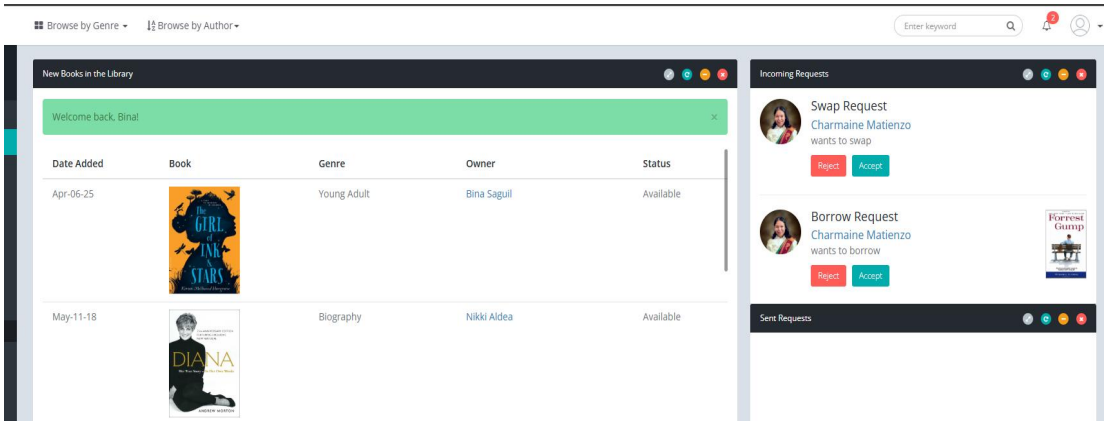

Figure 14. Accepting/Rejecting borrow/swap request

Once a request is sent, the owner of the book will receive a notification indicating that a borrow or swap request has been made for their book (Fig 14). The owner can then review the request directly from their dashboard and choose to either accept or decline it based on their preference.

4. Creating, Sending and Managing Messages

This module provides a built-in messaging feature that allows users to communicate directly with one another within the system. It is designed to facilitate smooth interaction, especially when coordinating book borrowing or swapping, or simply engaging in casual conversation. Users can create and compose new messages by selecting a recipient and entering the subject and message content. Once composed, messages can be sent instantly, and recipients will be notified accordingly. All received messages can be viewed in the user's inbox, where each message displays relevant details such as the sender's name, the time and date it was sent, and the full message body.

5. Viewing and Managing Activity Logs

This module allows users to manage their activity logs. Users can access a detailed list of their past activities, including the time, date, and nature of each action performed within the system. This functionality allows for easy monitoring and reviewing of user interactions, helping to track progress, identify patterns, and ensure accountability.

E. Testing & Assessment of Book Republic

The System testing was conducted to evaluate the usability and functionality of the Book Republic web application. A total of **24 participants** were invited to take part in the testing phase by accessing the system through its host server at bookrepublic.charmainematienzo.com. The participant pool was intentionally diversified, consisting of **12 students** and **12 professionals**, in order to gain insights from users with varying backgrounds and levels of technical familiarity.

During the testing session, participants were given a series of guided tasks designed to assess the platform's core features and user interface efficiency. Specifically, they were instructed to perform the following key functions: **add a book** to their personal bookshelf, **borrow a book** from another user, **initiate a book swap**, **add a friend** to their network, and **send a message** to another user. These tasks were selected as they represent the main user interactions within the Book Republic system and are critical to the overall user experience.

Following the hands-on experience, participants were asked to complete the **System Usability Scale (SUS)** questionnaire. The SUS is a standardized tool used to measure users' subjective assessments of system usability and user-friendliness. The results obtained from this evaluation provided valuable quantitative data, offering insight into how users perceived the ease of use, efficiency, and satisfaction associated with the system. This feedback was instrumental in identifying both strengths and areas for improvement in the design and functionality of the platform.

III. RESULTS AND DISCUSSION

The Book Republic obtained a score of 73.85 in the System Usability Scale. According to SUS standard, scores that falls above 90 were exceptional, between 80 and the latter were good, between 70 and the former were acceptable and anything below 70 had usability issues already [6]. The web application falls under acceptable using Bangor's descriptive scale. The SUS rating is 73.41% for just students and on the other hand the score obtained from the professionals is 74.23%. Comparing the ratings obtained by separating the two demographic profiles, it can be inferred that the slight difference suggests that profiles do not have significant effect on how users rated the system.

TABLE I. Frequency distribution of the responses on the System Usability Scale.

STATEMENTS	SD	D	N	A	SA	T
1. I think that I would like to use this system frequently	0	1	2	5	9	7
2. I found this system unnecessarily complex	1	4	6	5	6	2
3. I thought this system was easy to use	0	1	3	6	8	6
4. I think that I would need the support of a technical person to be able to use this system	1	3	5	7	6	2
5. I found the various functions in this system were well integrated	0	2	4	6	7	5
6. I thought there was too much inconsistency in this system	1	4	7	6	4	2
7. I would imagine that most people would learn to use this system very quickly	0	1	4	5	9	5
8. I found this system very cumbersome to use	1	3	6	6	5	3
9. I felt very confident using this system	0	1	3	7	8	5
10. I needed to learn a lot of things before I could get going with this system	1	3	5	7	5	3

IV. CONCLUSION

This study successfully explores the potential of upscaling book exchange systems into an online community platform, leveraging a goal-specific interface and crowdsourcing approach to enhance trading experiences. By providing a basic platform for users to freely swap, borrow, and discover books, this project lays the groundwork for the development of a more advanced web application. This application could serve as a prototype for a more sophisticated book exchange system, with the ultimate goal of consolidating household bookshelves into one vast e-library.

Such a platform would centralize knowledge resources, foster community book-sharing, and inspire individuals to read more, leading to an overall increase in literacy rates. To further improve the system, the study recommends integrating additional features, such as a smart recommendation tool based on users' preferred genres. Moreover, future studies should assess the environmental impact of the platform, particularly by evaluating how much paper and fuel are conserved through each book swap.

In conclusion, with SUS Rating of 73.85%, this study provides a solid foundation for building a scalable and impactful book-sharing ecosystem that not only promotes literacy but also contributes positively to environmental sustainability.

V. RECOMMENDATIONS

While this study has successfully introduced a functional platform for book swapping, borrowing, and discovery, there is significant potential for further development, especially when upscaling the system into a full-fledged online community. Incorporating a goal-specific interface, paired with a crowdsourcing approach, can enhance user engagement and make the trading experience more dynamic and efficient.

The current platform lays the groundwork for a more advanced system, serving as a prototype that demonstrates the feasibility of a community-driven book exchange. By encouraging users to freely share and access reference materials, this system supports the vision of unifying individual household bookshelves into a centralized digital library. In doing so, knowledge resources become more accessible, community-based book sharing is promoted, and a collective drive toward improved literacy is fostered.

To further improve the system, it is recommended that future versions integrate AI-driven features, such as a smart book recommendation tool tailored to each user's preferred genres and reading history. This enhancement can significantly personalize the user experience and increase user engagement. Additionally, a future study is recommended to evaluate the **environmental impact** of the system—particularly in terms of resource savings. An investigation into the amount of paper, fuel, and other materials conserved through each successful book swap could highlight the ecological benefits of digital book sharing platforms and reinforce their value in promoting sustainable practices.

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