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User-Centric Online Library System Using PHP

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Abstract: The increasing dependence on technology in the field of education is reshaping traditional learning paradigms at an unprecedented rate. With the proliferation of digital tools and platforms, educational institutions are embracing technology to enhance teaching methodologies, facilitate personalized learning experiences, and bridge accessibility gaps. Furthermore, the integration of educational apps, online resources, and collaborative platforms is fostering a more dynamic and engaging learning environment, catering to diverse learning styles and preferences. Libraries are invaluable resources for students, offering a diverse array of books, journals, and digital materials essential for research and academic growth and the integration of technology in education cannot be considered complete without it also influencing how the libraries are used. This project aims to collect a huge amount of data on the books in the library and bring it together on a platform that would enable the smooth and efficient management of the library.

Keywords - Integrated Library Systems, Database Management, Online Public Access Catalogs.

I. INTRODUCTION

In response to the changing dynamics of education and the proliferation of digital resources within academic institutions, this project endeavors to develop an innovative library application tailored to the needs of students and researchers. With the abundance of e-books and digital materials available, navigating this vast repository has become increasingly challenging. The primary goal of this initiative is to provide a user-friendly solution for swift information retrieval, enhancing the overall user experience. A key feature of the proposed application is a sophisticated book recommendation system that offers personalized suggestions, based on student's choices. Additionally, the project aims to incorporate RFID technology and IoT integration to streamline resource tracking, automate processes, and optimize user management. Beyond these functionalities, the Smart Library System (SLS) will encompass centralized data storage, analytics capabilities, and robust security measures. Through collaboration with educational institutions, the SLS seeks to create a dynamic and engaging library environment, responsive to the evolving needs of its users. Ultimately, this project aims to address contemporary challenges in information access, ensuring that the library remains an essential tool for the modern learner.

II. LITERATURE SURVEY

Various researchers and students have published related work in national and international research papers, and theses to understand the objective, the types of algorithms they have used, and various techniques for pre-processing and data analysis.

V. A. Prakashe and B. V. Patle, proposed a paper that evaluates User-Oriented Library Services in NIT Libraries [1]. Five National Institutes of Technology (NITs) have successfully implemented services mentioned in the paper such as library applications, E-query services, CDROM-based searches, and daily E-newspaper access, significantly enhancing the library experience for students. This paper majorly helped us understand the main requirements of students concerned with an app that gives them better access to the library.

Making a working and efficient OPAC system is a very important part of the project and we took references from the paper written by M. Gupta and S. Jetty which explains the Library App used at Bundelkhand University [2], the focus of this app being on utilizing OPAC, E-books, and a dictionary in the library app.

Another paper that gave us an insight into an advanced OPAC system was the one written by K. Puritat and K. Intawong in which the OPAC module integrates an advanced recommendation system using title similarity, Dewey Decimal Classification (D.D.C), and comprehensive bibliographic data analysis for diverse and tailored book suggestions [3].

An efficient OPAC system demands good database management the reference for which was taken from a paper by M. M. Karim, A. Zavin, N. S. Khan, S. N. Tumpa, and M. N. Islam, which mentions a system of a digitized library system, with a cloud-hosted database, that fosters efficient resource management and collaboration [4]. The app showed us how good database management can cater to diverse user needs.

We also read a paper about vSQL to further explore about database management by Y. Zhang, D. Genkin, J. Katz, D. Papadopoulos, and C. Papamanthou, which introduces vSQL, a cryptographic protocol for verifying SQL queries on cloud databases, using extensions of the CMT protocol achieving efficient verification with significantly lower server overhead [5].

We studied about open-source systems like Koha and NewGenLib from the paper by Kumar, A., & Mandal, S [6] that state the methodology that integrates cloud-computing into library systems, optimizing processing power and enhancing resource management.

We thought of implementing a chatbot using which the users could easily access the app and hence referred to the platform implemented by T. Simud, S. Ruengittinun, N. Surasvadi, N. Sanglerdsinlapachai, and A. Plangprasopchok, called Thai People Map and Analytics Platform (TPMAP) that integrates a conversational agent using the Rasa conversational AI engine to support government officials in poverty alleviation strategies [7].

For a better understanding of a chatbot for students, we saw the Smart-Bot Assistant methodology put forward by N. Thalaya and K. Puritat which was implemented at five National Institutes of Technology [8].

We got an overall understanding of the impact of advancing technology on libraries, noting a shift towards web-based information searches over traditional library visits after reading the paper by A. J. A. Baetiong et al [9]

We also got an idea of integrating the new AR technology into the library system from the paper written by Hahn J [10].

III. SYSTEM ARCHITECTURE

In this paper, we thoroughly discuss and present the system architecture, focusing on two user types: students and librarians (admin). Fig. 1 depicts the proposed system architecture, detailing the processes of each function. Fig. 2 illustrates the functionalities of both user types, emphasizing student-centric usage and librarian roles for management purposes. Additionally, Fig. 3 outlines the software employed for each function. Through comprehensive analysis, we offer a structured approach to system design, catering to the specific needs of users while ensuring efficient management within the library environment.

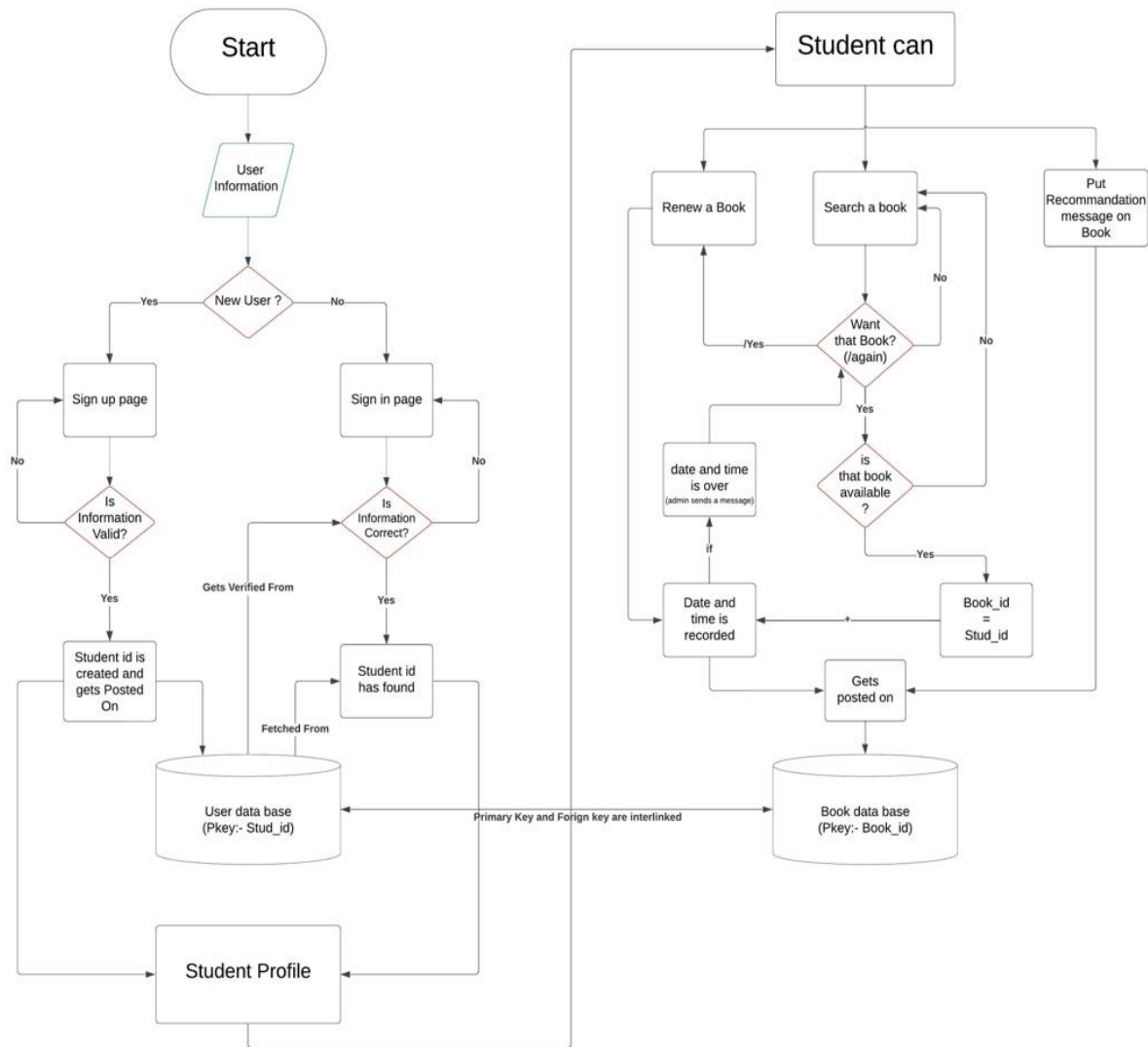


Fig 3.1 Proposed system architecture

Users begin by logging in or signing up on our website, verifying their identity through college databases. Upon successful login, students can access features like book renewal, search, and recommendations. Librarians manage these requests via the admin section. When a book is available, librarians permit issuance, recording the transaction in the database. Students can recommend books via messages, stored in the system. They can also view borrowing history and access previous year question papers. The system facilitates seamless interaction between students and librarians, enhancing library services.

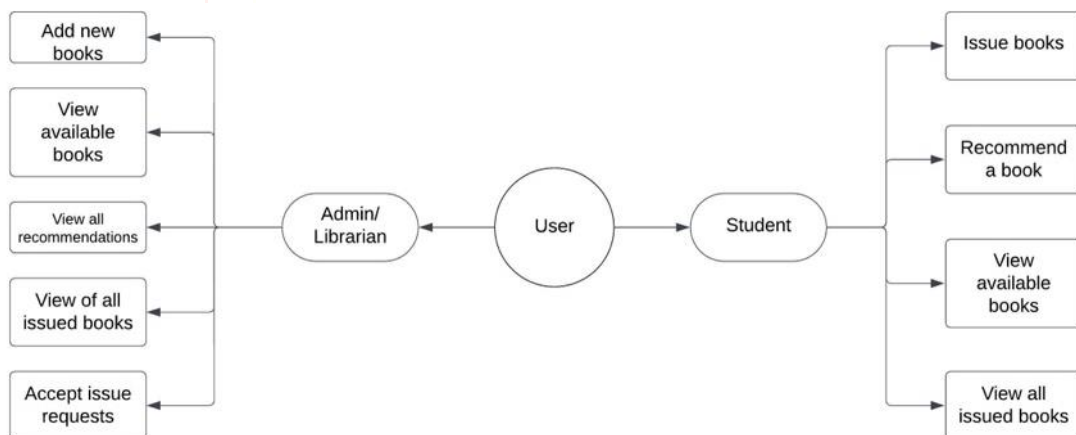


Fig 3.2 User types and their functions

The provided flowchart succinctly outlines the array of functions available to both the librarian and the student within the library system. For the librarian, these functions encompass adding new books to the library's inventory, overseeing the process of issuing books to users, managing requests for book issuance, and reviewing recommendations made by patrons. Additionally, the librarian can access comprehensive lists of both issued and available books, enabling efficient monitoring of the library's resources and user activity. On the other hand, students are empowered to interact with the system by issuing books for their personal use,

suggesting titles for acquisition, and accessing information regarding both issued and available books. This delineation of functions ensures a streamlined operation where librarians can effectively manage the library's collection and users can conveniently navigate and utilize the available resources. Through this system, librarians can maintain the integrity of the library's collection while facilitating students' access to the materials they need for academic and personal enrichment. Overall, the flowchart serves as a valuable reference for understanding the roles and capabilities of both librarians and students within the library ecosystem.

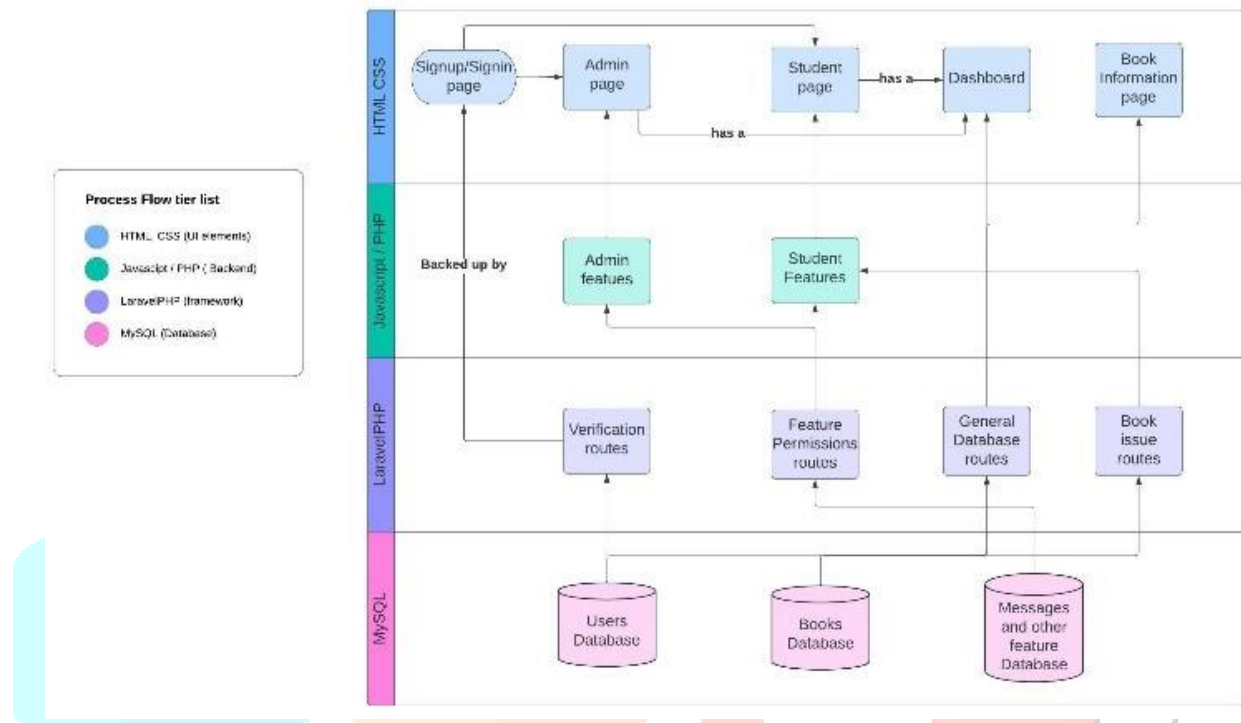


Fig 3.3 Process flow tier list

The system employs HTML/CSS for user interfaces like Signup/Signin, Admin, Student, Dashboard, and Book Information pages. Laravel/PHP handles verification routes for login and database operations like CRUD. Authentication routes integrate closely with database routes for user verification. Book issue routes manage borrowing and returning books, relying heavily on database routes for interactions. MySQL serves as the RDBMS, storing book and user data. The book database includes tables for books, authors, and genres, while the user database stores user details and roles. Together, these components create a comprehensive system for managing library resources and user interactions.

IV. IMPLEMENTATION AND RESULTS

Our library system website showcases an array of features designed to enhance the user experience, providing a seamless platform for efficient library management and user interaction.

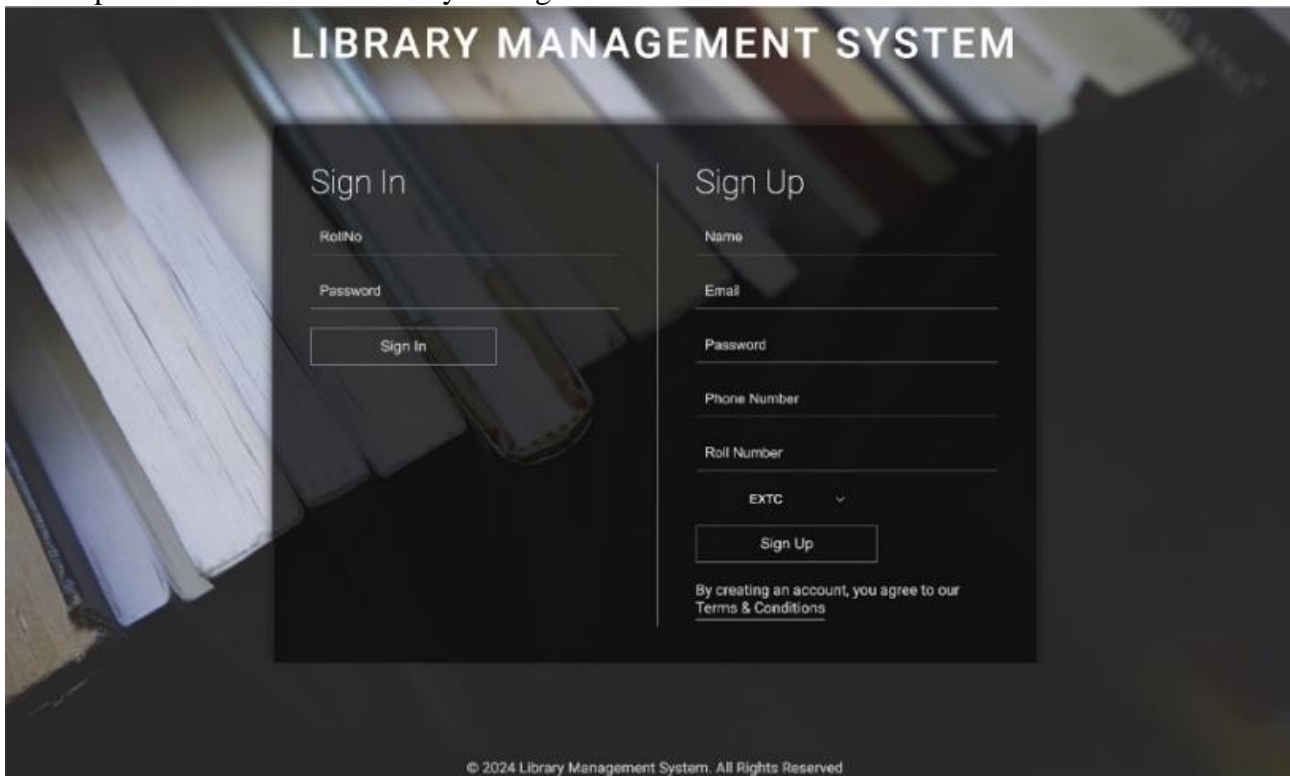
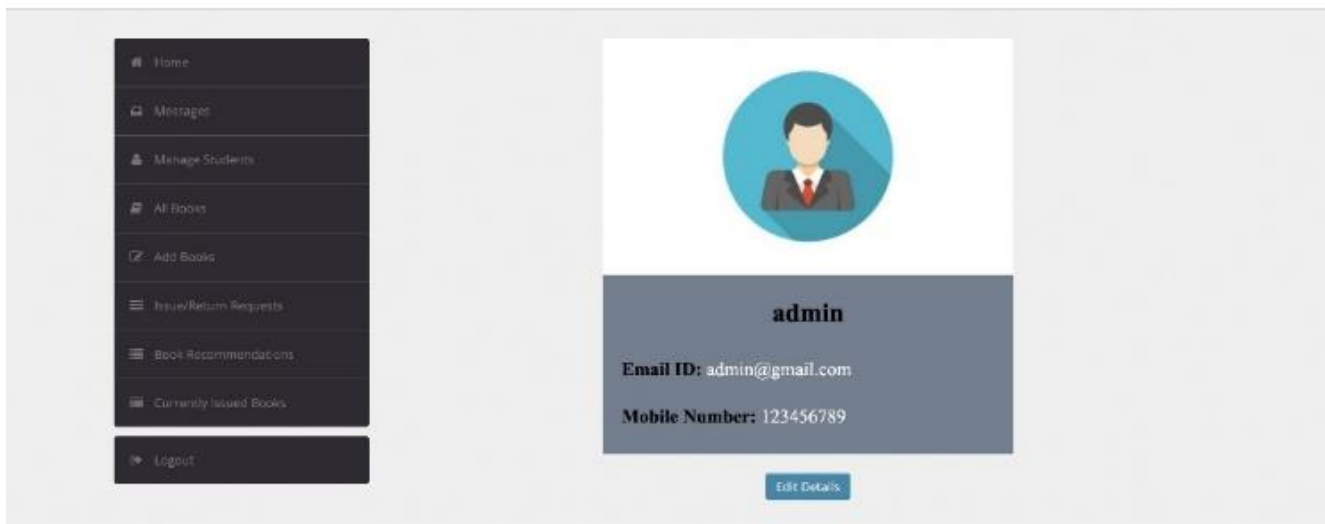


Fig 4.1 Sign up/Login Page

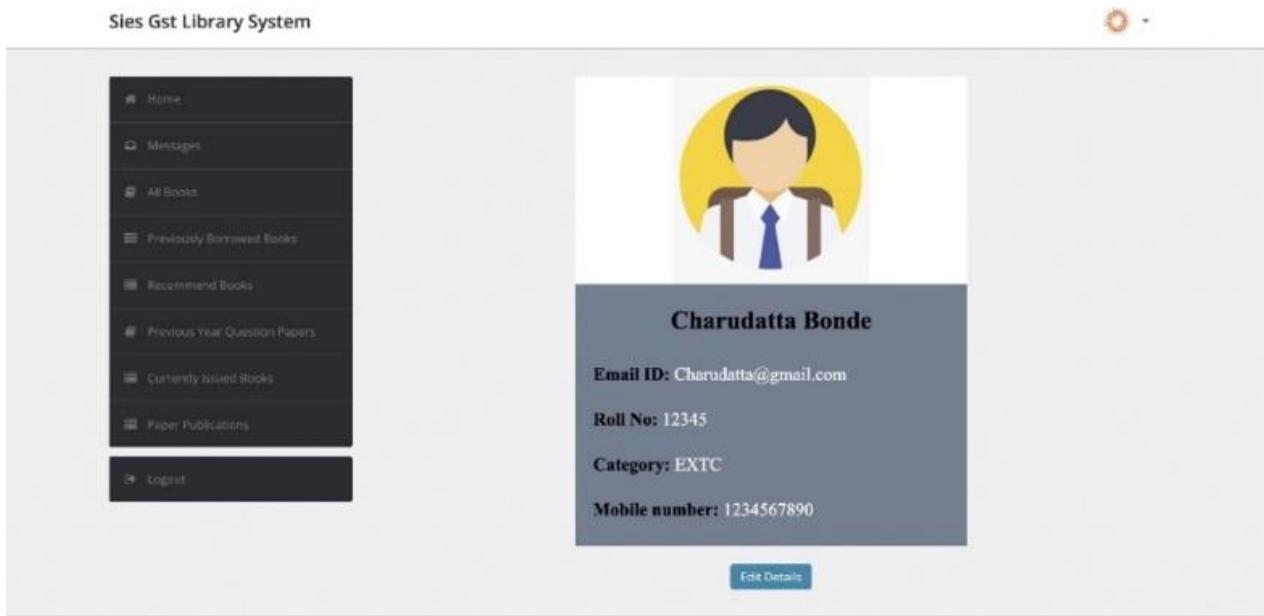
The Sign-up/Login Page seeks email and password information for secure access, along with additional specifics such as college name, PRN (Permanent Registration Number), branch, and department to tailor the user experience. The inclusion of these details aims to create a personalized profile for seamless library interactions.

SIES GST Library System



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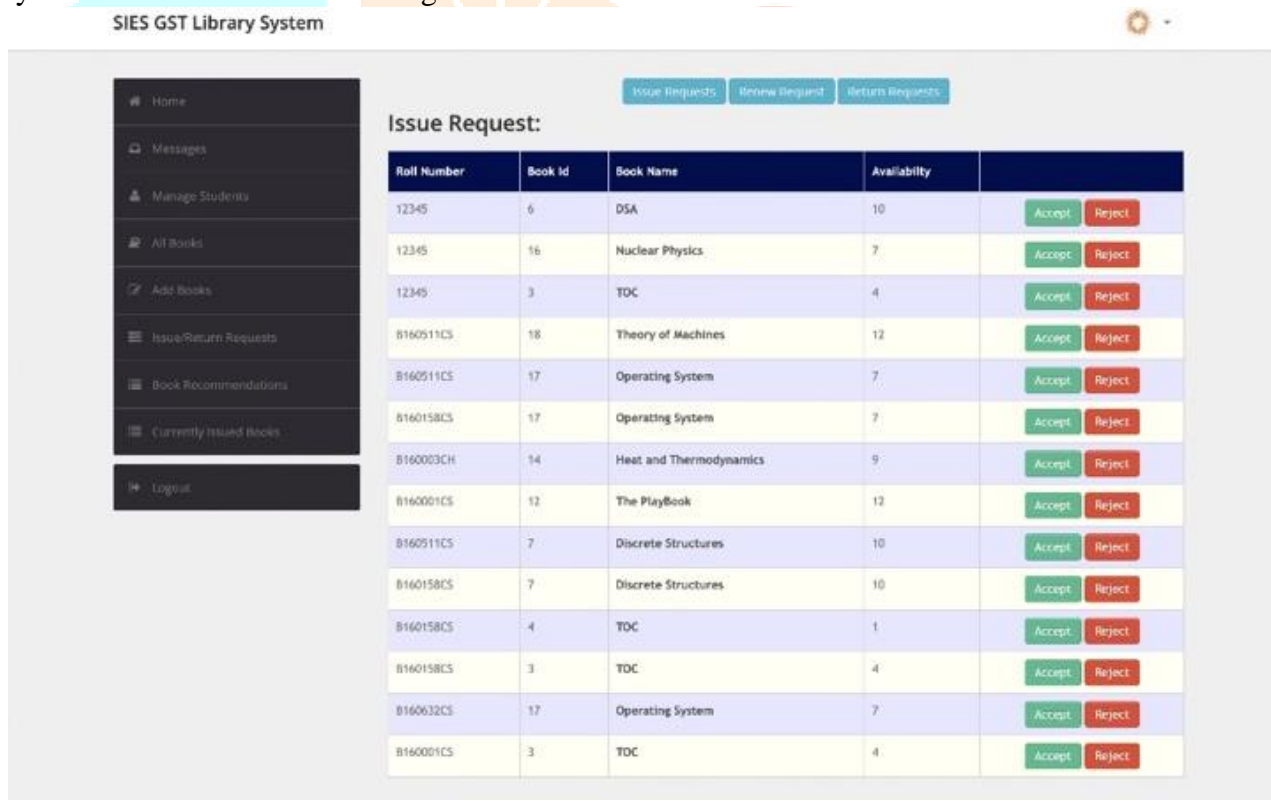
Fig 4.2 User as an Admin/Librarian



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Fig. 5 User as a Student

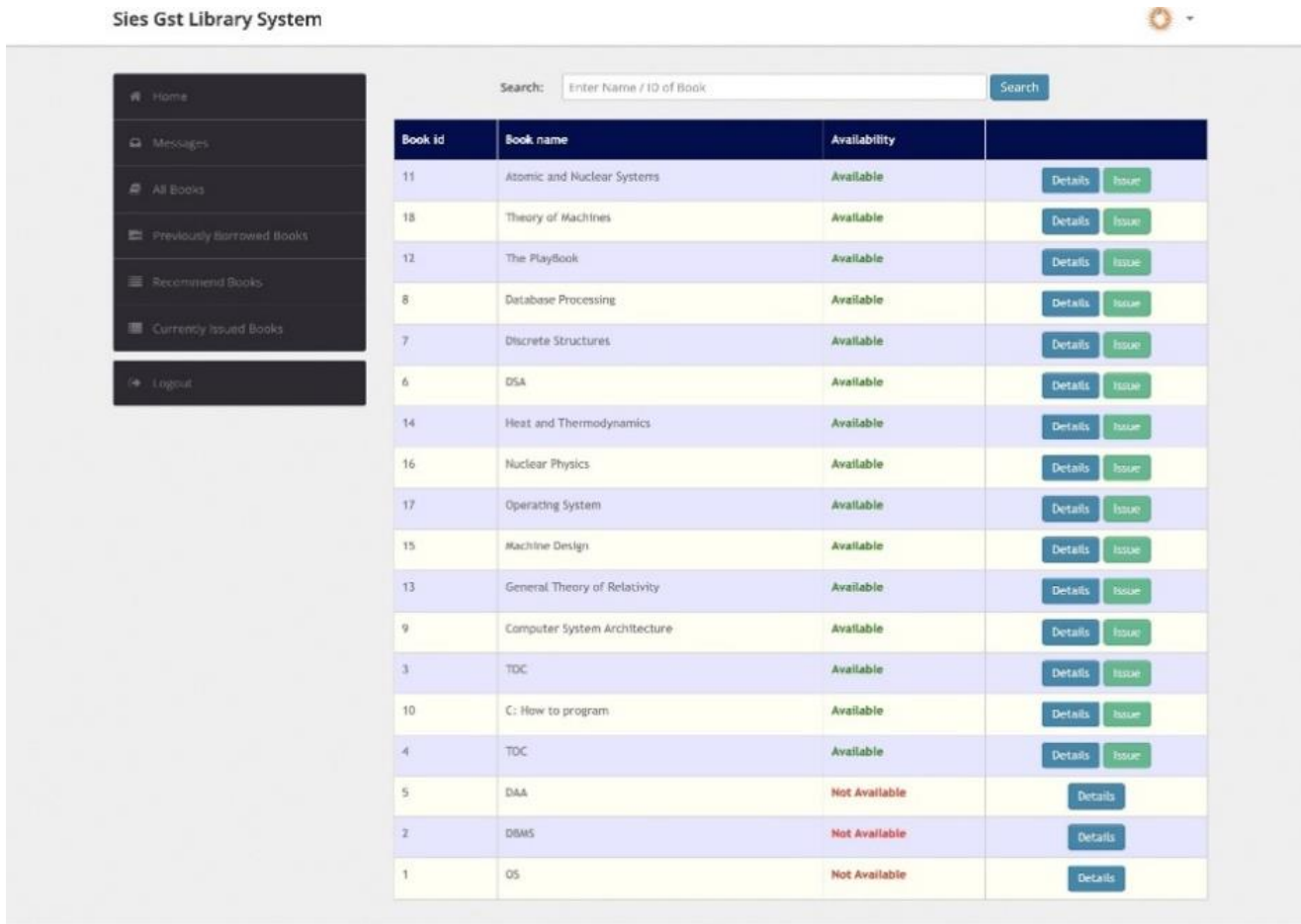
For Admin/librarian page, it allows the librarian to efficiently manage book issues, recommendations, add new books, and oversee databases with a streamlined interface. Whereas for User (Student) page, it allows the students to seamlessly issue books, receive recommendations, and view borrowing history and available library books with a user-centric design.



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Fig 4.3 Book Issue Requests to Librarian

The picture shows how many students want to borrow books from the library. It helps the librarian understand the demand for books, making it easier to manage and allocate resources efficiently.

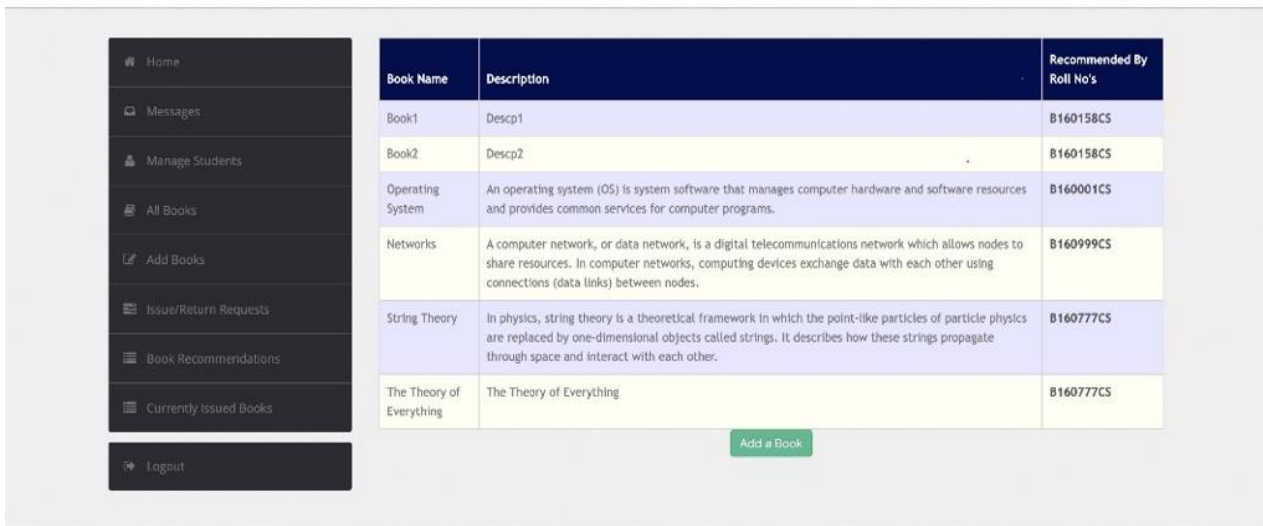


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Fig 4.4 View of Available/non-available books

The image visually presents each book's availability, quantity, ISBN, and title, simplifying tracking for users by indicating accessibility and availability status.

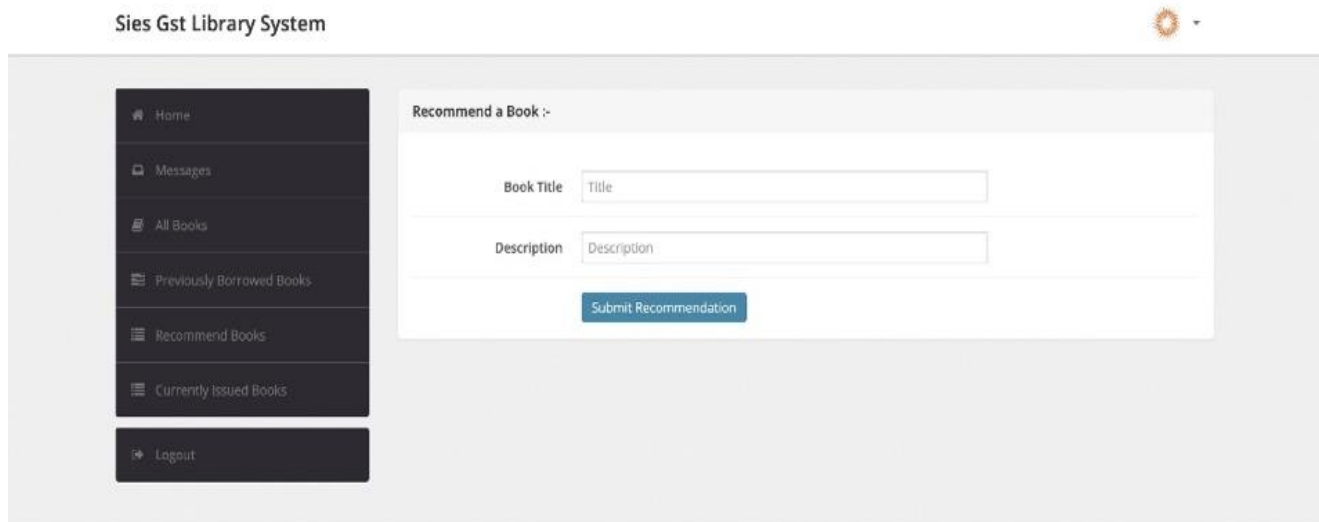
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Fig 4.5 Book Recommendations to the admin

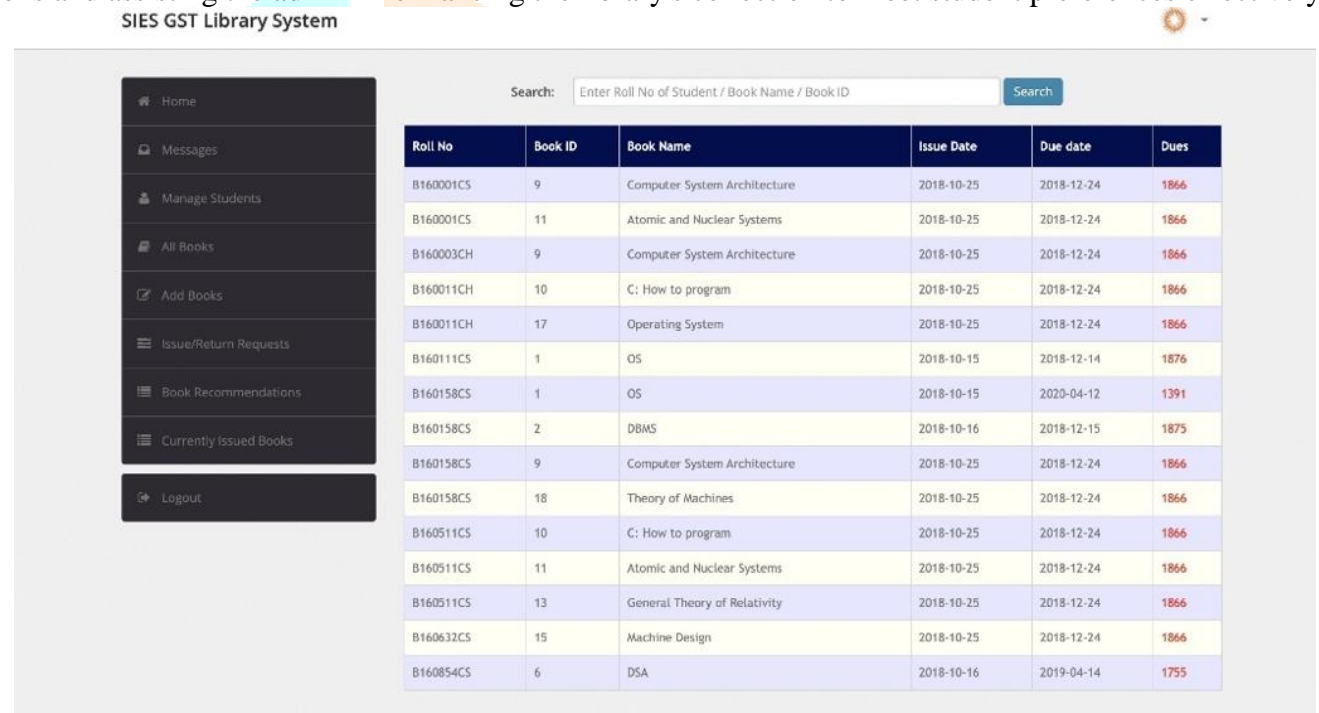
The image illustrates a Book Recommendations feature, streamlining user feedback for students to suggest books, aiding administrators in enhancing the library collection for an enriched reading experience.



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Fig 4.6 Book recommendations page for students

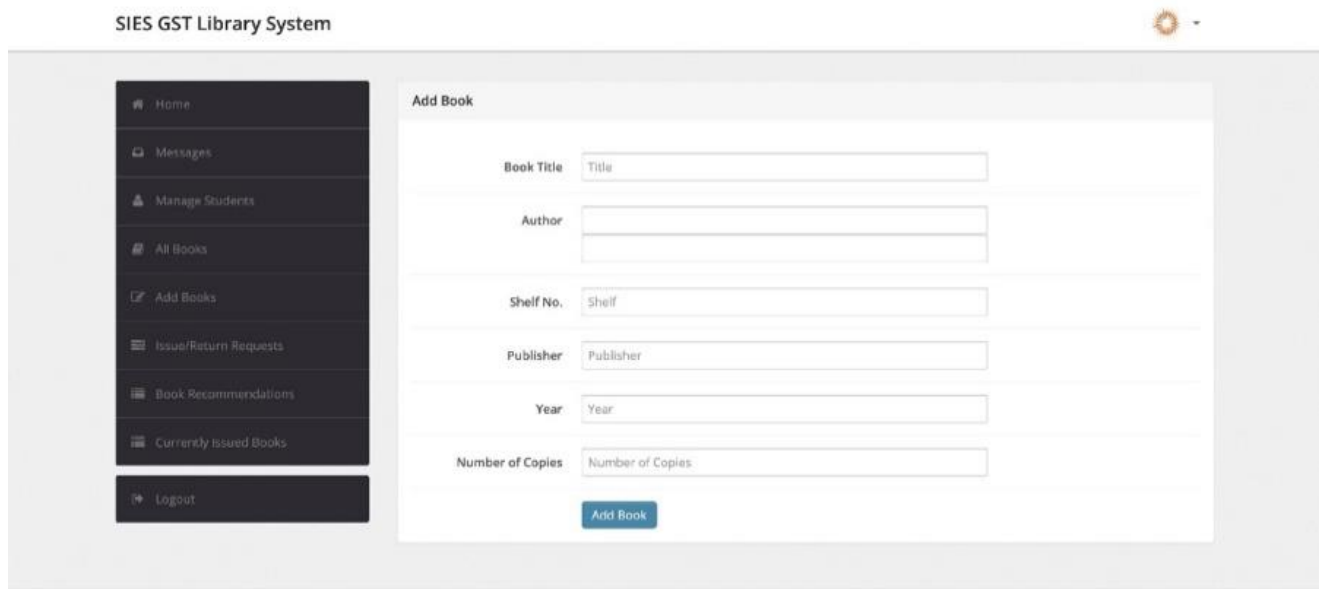
The image reveals a Book Recommendations page where students can inform the admin about books lacking in the college library. This feature enables seamless communication, empowering students to suggest desired books and assisting the admin in enhancing the library's collection to meet student preferences effectively.



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Fig 4.7 View of all the issued books

The picture presents an overview of all issued books to the admin, displaying details such as ISBN and names. This visual simplifies book tracking, providing the admin with a concise and comprehensive snapshot of the current book-lending activities within the college library.



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Fig 4.8 Addition of more books page for admin

The image exhibits the 'Addition of More Books' page for admin, showcasing the seamless process of incorporating new books into the library. With fields for essential details, these visual aids the admin in efficiently updating and expanding the library collection, ensuring a user-friendly and streamlined addition process.

V. FUTURE SCOPES

5.1 Expansion of Database with NoSQL Solutions: Integrating NoSQL databases like MongoDB or MySQL offers scalability and flexibility in managing large volumes of data. By utilizing these solutions, the system can accommodate multiple college databases, facilitating seamless sharing of resources and information across institutions.

5.2 Intercollege Access to Books: The project's future scope includes enabling students to access a diverse range of books from multiple colleges. Through collaboration with other institutions, students gain permission to borrow books via the librarian or admin, enhancing their access to a wider variety of academic resources.

5.3 Enhanced User Experience with Detailed Book Information: Implementing detailed book summaries and author insights enriches the user interface experience for students. By providing comprehensive information about each book, including summaries and author perspectives, the system enhances user engagement and facilitates informed book selections.

5.4 Online Book Issuing Services for Non-Available Books: Offering online book issuing services for non-available books expands accessibility and convenience for students. Through this feature, students can request and borrow books that are currently unavailable in the library's physical collection, enhancing their access to desired resources.

5.5 OCR Integration for Book Cover Scanning: Integrating Optical Character Recognition (OCR) technology enables students to scan book cover pages and perform text-based searches. By scanning book covers, students can quickly access information about the book's content, author, and availability, enhancing search efficiency and user experience.

VI. DISCUSSION AND ANALYSIS

We successfully executed the project but identified some areas for improvement. To establish a reliable connection between the database and the front end, we must use react.js and next.js. In addition, we need to use PostgreSQL to ensure adequate storage capacity. The primary challenges we faced were the limitations on the maximum number of book entries in the MySQL database and the allocation of the last book reservation. This problem often arises when the library has only one book and multiple people request it at the same time. The issue stems from the session-based nature of PHP and Laravel, making it nearly impossible to determine who requested the book first. React.js solves this by providing real-time data updates, enabling us to allocate the book to the user who requested it first. We have implemented these solutions in our next prototype, ensuring that we have a reliable and scalable system in place.

VII. CONCLUSION

In conclusion, our project represents a significant step towards modernizing and improving the library experience for students. The efficient management of data and bringing all the users and the librarian on the same platform has the potential to revolutionize how students access and explore library resources. We wish to harness technology and data-driven insights that would lead to the creation of a user-friendly app that streamlines book discovery and promotes a culture of continuous learning. This project not only addresses the practical needs of library users but also underscores the power of technology to create a more engaging and efficient educational environment. As we move forward, we remain committed to further refining our app and expanding its capabilities, continually adapting to the evolving preferences and requirements of students. This project can underscore the importance of technology in shaping the future of libraries, ensuring that they remain vital hubs of knowledge and learning in the digital age. In an era where digital solutions and personalized experiences are becoming increasingly prevalent, our app positions the library as a forward-thinking and adaptable institution. It empowers students to make the most of the library's resources while facilitating their journey to discover new books and knowledge. With this project, we not only envision a more user-centric library system but also reinforce the idea that technology, when leveraged thoughtfully, can elevate traditional institutions to new heights.

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