International Journal on Science and Technology (IJSAT)
E-ISSN: 2229-7677 ● Website: www.ijsat.org ● Email: editor@ijsat.org

An Innovative Approach to Integrate Library and Certification System

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Abstract
In this paper, we have introduced an auto-fine imposition system that calculates and applies fines for late book returns, reducing manual errors. The online book lending system allows users to check real-time book availability and locate books by rack and row before borrowing. An automated certification system generates digital certificates for hackathons, quizzes, and faculty-organized competitions, ensuring timely and error-free issuance. Further, to prevent account misuse, we are implementing OTP-based user authentication for secure registration and login. The system improves efficiency, minimizes administrative workload, and enhances accuracy in library operations and certification management. By integrating these advanced features, it offers a seamless and reliable experience for users. Also, we provide enhanced security, real-time accessibility, and automation, this all-in-one solution serves the college community effectively.

Keywords: Integrated Library System, Certification System, Event registration

1. Introduction

In the evolving landscape of education and resource management, integrating technology into traditional systems has become essential. The Integrated Library and Certification System addresses this need with a cloud-based platform that simplifies library management and academic certification processes. It enables users to efficiently search for books by title, author, or subject and track borrowing history, including lending and return dates. By integrating online resources, the system ensures seamless access to supplementary materials and allows users to manage book transactions from anywhere, enhancing the library experience. Additionally, the platform automates event registration, exam administration, and certification issuance, enabling users to register for events, complete multiple-choice assessments, and monitor progress toward certifications. By digitizing data, it reduces manual workloads, minimizes errors, and ensures data accuracy. This unified system enhances operational efficiency, accessibility, and accuracy, making it a vital tool for modern educational institutions to streamline processes and improve the overall user experience [1] [2].

The Integrated Library and Certification System plays a crucial role in modernizing library and academic certification processes by addressing the limitations of traditional methods. This cloud-based platform

allows users to efficiently search for books by title, author, or subject and track borrowing activities, providing a seamless and enhanced library experience. With the integration of online resources, it expands accessibility, enabling users to manage book transactions from anywhere and making library operations more efficient. Beyond library management, the system automates event registrations, exam management, and certification issuance, allowing students and faculty to register for events, complete assessments such as MCQs, and monitor their progress toward certifications without relying on manual processes. By digitizing data, it reduces administrative workload, minimizes errors, and ensures accuracy in tracking and issuing certifications. This dual-function platform bridges the gap between traditional academic processes and modern technological advancements, enhancing accessibility, efficiency, and accuracy. Its comprehensive approach meets the evolving needs of library management and certification systems, making it an indispensable tool for educational institutions[3] [4].

The Integrated Library and Certification System is a comprehensive, cloud-based platform designed to streamline library management and academic certification processes in educational institutions. It offers an efficient way to search for books by title, author, or subject, while also tracking borrowing history, including lending and return dates. The system integrates online resources, allowing users to access supplementary materials and manage book transactions remotely, enhancing the overall library experience. Additionally, the system automates the management of event registrations, exams, and certifications, simplifying administrative tasks. Users can register for events, complete exams and track their progress toward certification within the platform. By storing all relevant data electronically, the system reduces manual workloads and minimizes errors in event registration, exam tracking, and certification issuance. This integration improves the accuracy and efficiency of academic processes. With its all-in-one functionality, the platform enhances accessibility, operational efficiency, and data accuracy, making it a vital tool for modern educational institutions seeking to optimize library and certification management workflows The system serves as a modern solution to meet the increasing demands for seamless resource management and academic administration in educational settings[5][6].

The Integrated Library and Certification System offers numerous advantages by enhancing the efficiency and accuracy of library and academic certification management. By digitizing traditional library processes, the system enables users to easily search for books by title, author, or subject and track borrowing histories from anywhere, providing greater accessibility and convenience. The integration of online resources further enriches the library experience by offering seamless access to supplementary materials. Additionally, the system automates event registrations, exams, and certification management, streamlining these typically manual tasks. Users can register for events, complete exams, and track their certification progress, reducing administrative burdens and minimizing human error in tracking and issuing certificates. Storing data electronically ensures greater accuracy while improving process speed. The platform significantly improves operational efficiency and user satisfaction by providing a seamless, user-friendly experience for managing library resources and academic certifications. This all-in-one solution ultimately supports educational institutions by offering a cloud-based, automated approach to managing both library and certification workflows[7] [8].

Existing library and certification systems often face significant drawbacks, primarily due to their reliance on manual processes. Traditional library management involves time-consuming tasks like cataloguing and tracking borrowed books, which increases the risk of errors and inefficiencies. Users may struggle with accessing resources remotely, and real-time updates on book availability can be inconsistent, leading to delays. The lack of integration with online resources further complicates access to supplementary materials. In academic certification management, manual event registrations, exam tracking, and certificate issuance create bottlenecks, prone to human error and delays. Data storage is often fragmented,

making it difficult to track user progress or retrieve records efficiently. The absence of automation results in high administrative workload, reducing productivity and accuracy. Limited user interaction with these systems can also diminish the overall student experience. Ultimately, these systems lack the scalability, accuracy, and accessibility needed to meet the demands of modern educational institutions [9][10].

To overcome the limitations of existing systems, the Integrated Library and Certification System leverages cloud-based technology, automation, and seamless integration. By digitizing library management, users can search for books, track borrowing histories, and access online resources remotely, ensuring greater accessibility and real-time updates on book availability. Automation streamlines processes such as cataloguing, book transactions, and event registrations, reducing human errors and administrative workload. Additionally, the system uses centralized data storage, enabling easy retrieval of user progress and historical records. The integration of event registration, exams, and certification management allows for smoother, error-free processing and faster certificate issuance. Automation also improves efficiency, reducing delays in certification tracking and management. This method improves the user experience while increasing operational productivity, providing a more accurate, scalable, and accessible solution for both library and academic certification management [11] [12].

Literature Survey

Wilson[13]presented profiles of five next-generation library management systems, highlighting their key features and emerging trends. Using a survey, they collected information on the development history, standards, interoperability, and functionality of systems such as Alma, Sierra, OLE, WorldShare Management Services, and Intota. A descriptive approach was employed to compile detailed system profiles and analyse the survey results. The study emphasized that next-generation systems prioritize advanced functionality, seamless interoperability, and compliance with evolving standards. It concluded that the trends in library management systems reflect a growing emphasis on adaptability, innovation, and enhanced resource management capabilities.
Xie et al.[14]studied architectural models, design requirements, and evaluation criteria for digital library management systems (DLMS). They analyzed key aspects such as functionality, interoperability, and the ongoing debate between open-source and proprietary systems, while also reviewing DLMS currently in use. Using a combined theoretical and practical approach, they assessed and evaluated various DLMS models and systems. Their findings highlighted the importance of balancing functionality, interoperability, and system openness to effectively address the diverse needs of libraries. They concluded that well-defined evaluation criteria are crucial for selecting the most suitable open-source DLMS for effective digital library management.

Stuart and Hebels [15] discussed the core functions of computerized library information systems, focusing on acquisition, cataloguing, circulation, and management reporting. They analyzed how these functions are integrated within library management systems and their role in the broader electronic library environment. Using a descriptive approach, they examined the evolution of library management systems in modern libraries. Their findings highlight that these systems are increasingly evolving to support both physical and electronic resources, with a stronger emphasis on integration and adherence to standards. They concluded that automated library systems must adapt to the broader electronic library environment and conform to standards that facilitate effective digital resource management.

Jam [16]surveyed government school libraries in Benue State to assess their administration, resources, and operational challenges. They conducted a survey using 100 questionnaires, with 70 responses providing

data for analysis, focusing on library cooperation and central administration. Using a surveybased approach, they gathered data on library operations and administration. The study revealed that government school libraries face challenges due to poor infrastructure, limited funds, and centralized administration, which impact their operations. Based on the findings, suggestions for improvement in administration, acquisition policies, staffing, and operational standards were provided, along with areas for future research.

Araya and Adhana [17] developed a computerized library management system for the Asmara Community College of Education to replace the manual system and provide better access to library services. They implemented a web-based Digital Library Management System (DLMS) using technologies such as Java, PHP, HTML, and MYSQL to manage and distribute digital resources. Adopting a design and development approach, they created a system that efficiently handles library activities, ensuring easy access for users and improved management for librarians. They identified that the manual system had limitations, such as physical damage to documents, high costs, and missing files, which the new digital system aims to address. The implementation of a web-based DLMS promotes digital reading habits, enhances users' knowledge, and provides unlimited access to digital resources for users in remote areas.

This study aims to improve the library user experience through a Full Stack Web Application that simplifies book searches by title, author, or subject. Users can check availability and request books effortlessly, reducing manual inefficiencies. With cloud-based features and secure electronic data storage, the system provides seamless, remote access to library resources.

2. Material and Methods

Its construction strategy as implemented in the Library Management System development is organized into four steps: Database design, architectural design, interface design, and component structuring. As the system's database design progresses, its structure is formulated in three stages: the first stage is the conceptual design stage, which defines entities such as books, users, and transactions; second is the schema design phase which focuses on relationships and constraints. The third is the physical design phase, focusing on the structure of the database towards optimization of queries. Different styles deal with information in different ways. In particular, focus on the preparation of a design that allows for a scalable and secure system infrastructure to enable the functioning of a library. The design allows a focused approach and a friendly environment as far as searching for books, borrowing, and account management is concerned. The last, the component structuring outlines the system into functional components like book management, user login, and log of books borrowed to achieve modularity and ease of maintenance. This methodology guarantees an organized and automated library management system that is efficient and most accessible.

2.1 *Database Design*

Database design plays a crucial role in preventing data duplication and involves developing a detailed data model for a database. This model includes conceptual, logical, and physical storage elements needed to structure a database using Data Definition Language (DDL). DDL facilitates database creation. A fully detailed data model defines attributes for each entity, ensuring a well-organized structure. The database design process typically comprises multiple stages, overseen by database designers. The key steps in this process include:

2.1.1*Conceptual Design*

In order to get closer to the finished structure, the conceptual design phase concentrates on creating an initial framework based on needs that have been defined. The ER (Entity-Relationship) representation is one popular method. One popular structured information visualization tool is the ER Diagram (ERD). It provides a structured approach to database structuring by visually representing entities, their relationships, and properties. ERDs help describe the interactions, flow, and changes that occur inside a system. An ERD of the Library Management System (LMS) is shown in Fig. 1, emphasizing the relationships and traits of different entities.

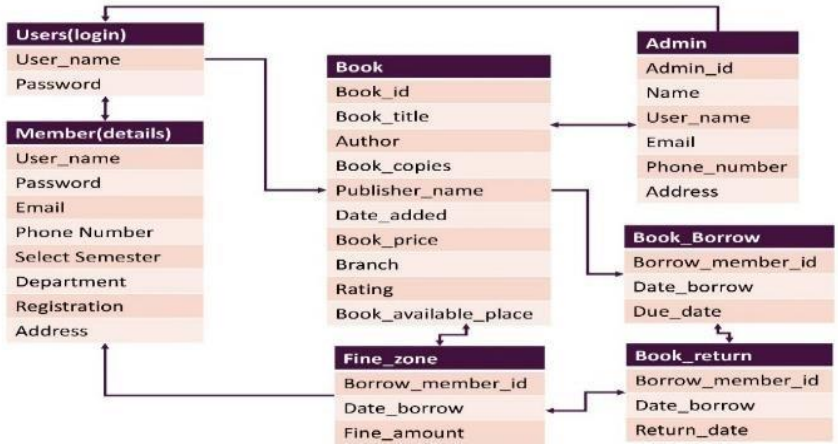


Figure 1: *Entity Relationship Diagram*

2.1.1*Schema Design*

The main goal of schema design is to organize data into clearly defined relationships that are represented by entities and attributes. In a relational database, an entity is a unique data component that is frequently mapped to a table. Usually shown as table columns, attributes specify the particular characteristics of an item. In order to facilitate effective data administration and retrieval, this step creates a clear database schema.

2.1.1Physical Design

The physical design phase involves outlining the specific implementation details, such as table structures, data types, field sizes, and indexing strategies. This step ensures that the database is built with adequate specifications for efficient performance. Primary focus remains on relational modelling and database management using MySQL, prioritizing essential structural aspects.

2.2Interface Design

The construction of interface layout places a strong emphasis on foreseeing user needs and guaranteeing smooth interaction with easily navigable, accessible, and organized content. In order to create an intuitive and captivating experience, this phase integrates ideas from graphic design, user interaction tactics, and content arrangement.

2.3Architecture Design

Architecture design refers to the high-level structuring of both computer and software architecture. Selecting an appropriate model requires an understanding of key modules, their functions, interconnections, dependencies, database structures, and technology specifications. System integration testing is conducted during this phase to validate the design. Once system requirements are determined, essential hardware, software, and data resources are identified to meet functional specifications.

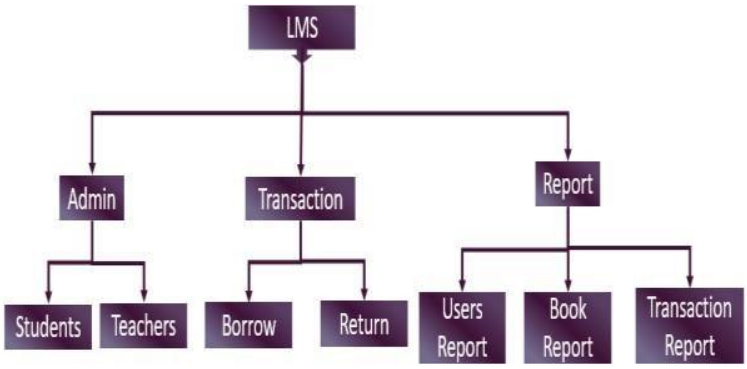


Figure2: *Architecture Design Diagram*

2.4 Component Structuring

The process of breaking down the entire system into more manageable, smaller components is known as component structuring, or thorough system planning. Because each unit is clearly described, developers may successfully implement the functionality. The system's framework is represented by a process diagram in Fig. 3, which uses pseudo-code to define logical workflows and operational needs.

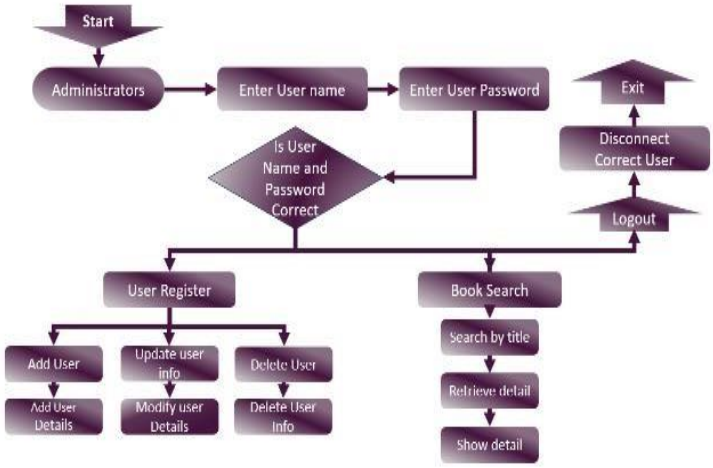


Figure 3: *Component Structuring Workflow*

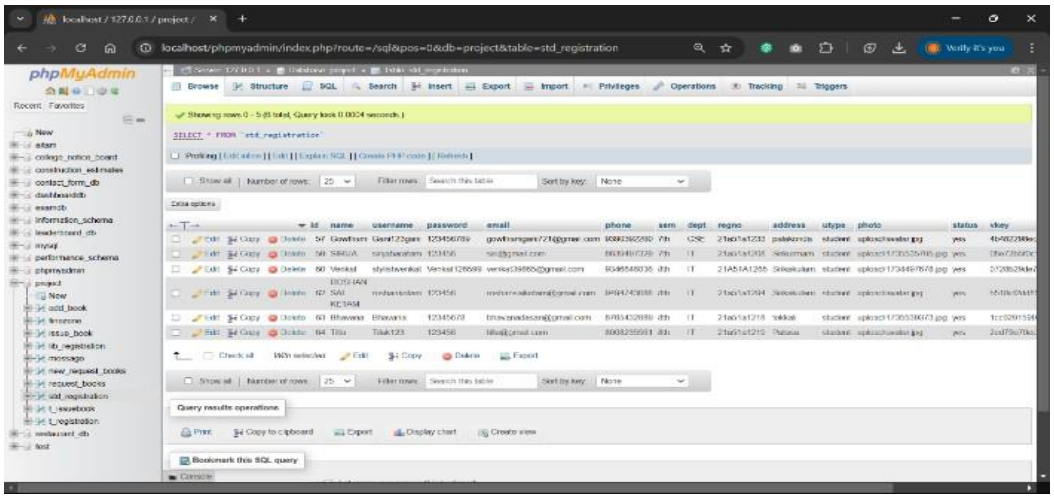
3.Results and Discussions

This part analyses the outcomes generated by the developed system. The observations highlight how the system optimizes usability and streamlines operations. Table 1 presents an overview of test scenarios, goals, prerequisites, anticipated outputs, and obtained results, enabling an evaluation of the system's effectiveness in meeting its intended purpose. Shifting from traditional manual processes to an automated framework greatly enhances precision and productivity.

System Testing Outcomes

Module	Purpose	Functionality	Outcome
Login Module	Secure authentication	Allows access only to users with valid credentials; incorrect attempts show error messages	Prevents unauthorized access
User Management	Adding new users	New members can be registered; duplicate emails trigger an error message	Avoids redundant entries
Book Management	Managing books	New books are added; if a book already exists, the system updates the number of copies	Ensures accurate book records
Transaction Module	Borrowing and returning books	Users can borrow available books; if unavailable, they must wait until return	Maintains proper book circulation
Archive Module	Storing e- and books digital records	Checks for duplicate files before adding new ones	Prevents redundant storage of digital content
Database Structure	Managing system records	Stores, adds, deletes, and updates data; tables record LMS entries and user details	Maintains a well-organized database for efficient operations

To effectively store and handle different file kinds within the system, a structured database has been put into place. Users can add, remove, and edit documents in this database as needed. An overview of the records kept in the Library Management System (LMS) throughout various interactions is shown in



Tables 2 through 5. These tables are essential for monitoring system activity. Important user information, such as the user ID, username, password, first name, and last name, is also intended to be stored in the

Table 2: End-Users Availability Table

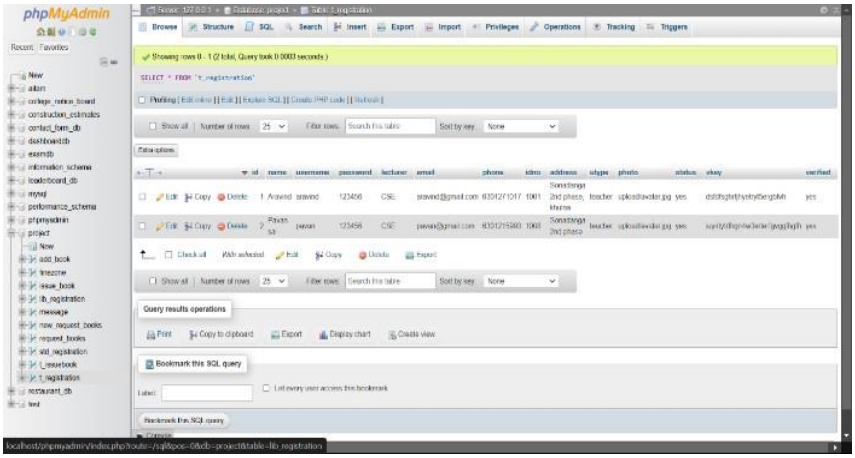
user table. This methodical approach preserves data security and integrity while improving user management.

End Users' Availability

Comprehensive information about users engaging with the system is stored in the End Users Availability Table, which captures crucial system-related and personal characteristics. When examining user involvement, authentication procedures, and general accessibility, this is essential.There are several attributes in the table, such as:

User Identification: Each user is uniquely identified by their ID and registration number. Name, email, phone number, and address are examples of personal information that aids in user administration and communication.

The following fields are necessary for safe login and verification: username, password, vkey, and verified.



Academic Information: dept (department) and sem (semester): Important for classifying users according to their academic affiliation.

User Role and Status: utype (user type), status: determines the user's level of access and the state of their account activity.

Profile Information: photo: keeps user identity photos in storage.

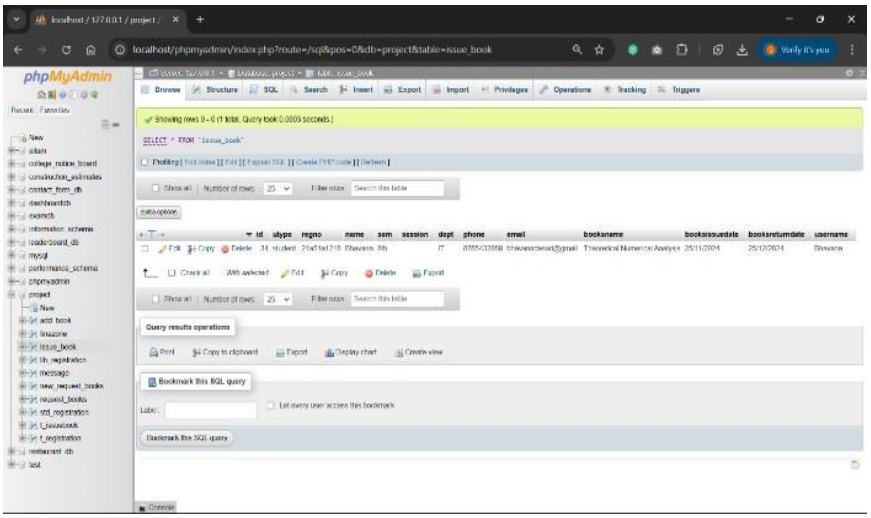


Table 3: Borrowed Books Details

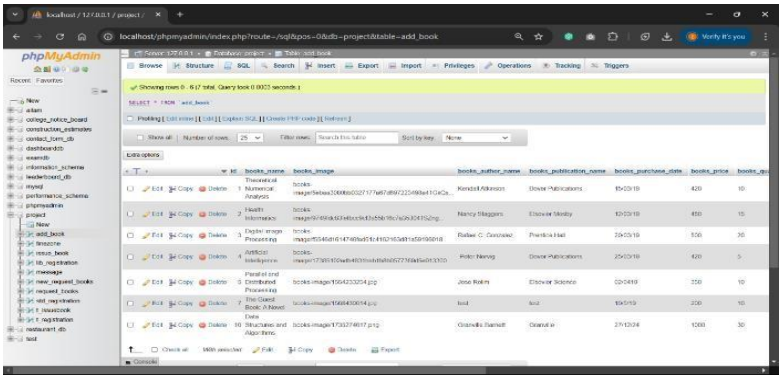


Table 4: Book availability in the Library

One essential part of the Library Management System is the Books Availability in the Library table, which provides an exhaustive list of all the books kept in the library. In order to ensure effective cataloguing, tracking, and management of library resources, this table offers crucial metadata about every book.

The id field serves as the table's main key and is used to uniquely identify each book. The book's title is stored in the books_name attribute, while the names of the author and publisher are recorded in the books_author_name and books_publication_name attributes, respectively. A books_image field, which contains the book's cover image for simple identification, is added to improve accessibility.

The books_purchase_date and books_price characteristics keep track of each book's buy date and price in order to preserve financial and inventory records. By displaying the total number of copies bought and their current loan availability, the books_quantity and books_availability fields aid in stock level monitoring.

To ensure accountability in the system, the librarian_username field registers the staff member in charge of managing the book entry. Any related digital versions or supplemental papers are stored in the

books_file attribute to enable digital access. Especially in multi-branch organizations, the branch field facilitates the management of books across several library locations.

Last but not least, the rating field keeps track of user-assigned book ratings in order to include user feedback and assist readers and libraries in identifying well-liked and popular works.

By offering a systematic and structured approach to book management, this table significantly improves accessibility and efficiency in the use of library resources, hence maximizing the library's operations.

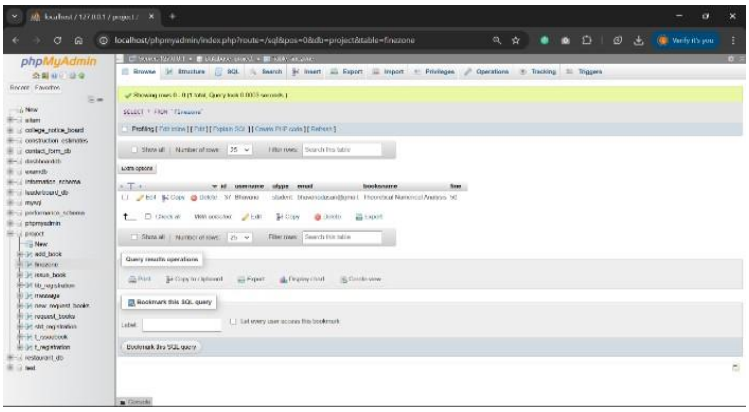


Table.5 Fine Imposed section

Figures 4 to 8 showcase the graphical user interface of the Library Management System (LMS), highlighting the main page that both users and administrators can navigate to access the system. Figure 4 presents the admin login page, where administrators can sign in using their assigned credentials. For general users, registration is mandatory before gaining access to the system.

Figures 5 and 6 depict the registration process for new members and books, which is managed by the library admin and librarians. Both administrators and librarians have full control over adding, modifying, or removing books from the system's digital archive. Additionally, the library admin, like the librarian, can frequently update the system with new books to meet user demands and encourage reading habits.

Figure 7 illustrates the borrowing functionality in the LMS, where registered users can check out books seamlessly. Lastly, Figure 8 represents the electronic archive, which maintains a comprehensive record of all books and magazines available for digital access and downloads.

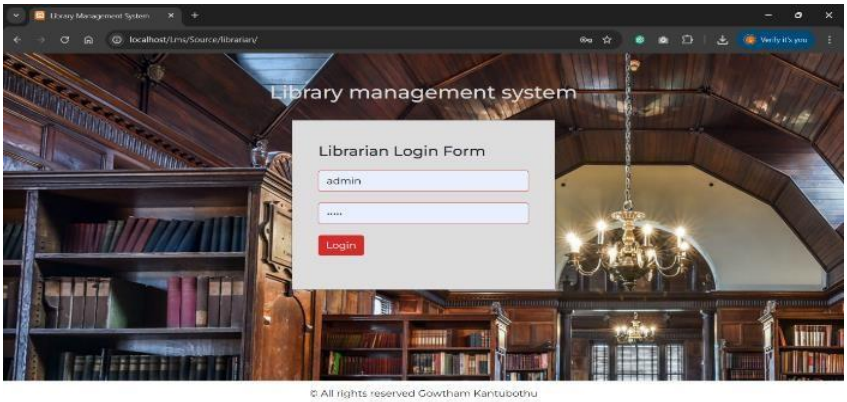


Figure 4: Librarian Login Section

Authorized library employees can access the Library Management System through the Librarian Login Section, a secure authentication module. To preserve data integrity and stop unwanted changes, this part makes sure that only registered librarians are able to manage book records, keep track of inventory. Librarian credentials, such as a distinct username and a strong password, are needed for the login system. After successfully authenticating, librarians can access administration features like managing digital resources, adding, editing, or deleting book listings, and keeping track of book availability.

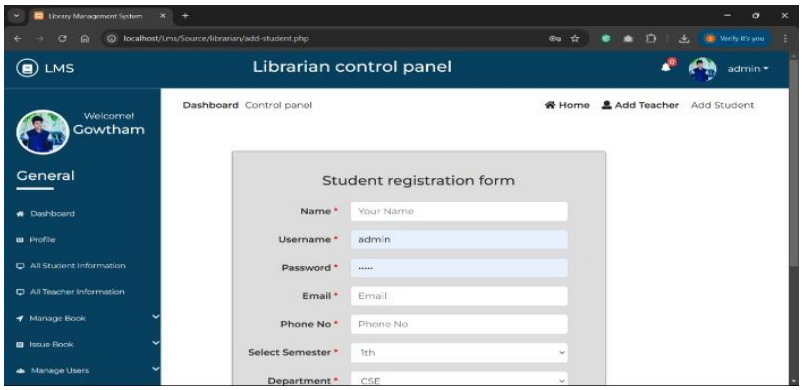


Figure 5: Inserting the New users

An essential part of the Library Management System is the New User Insertion procedure, which enables users to register and access library resources. In order to provide effective user management and authentication, this procedure entails gathering and storing crucial user data in an organized database table.

The primary key, the id field, is used to individually identify each user. While the username is used for login, the entire name of the user is stored in the name column. To guarantee data security and stop unwanted access, a strong password is kept, frequently in encrypted form. Contact information is provided in the phone and email fields, which helps the library and its patrons communicate.

Along with a distinct regno (registration number) for student identification, the sem (semester) and dept (department) fields are included to classify users according to their academic details. Residential information is stored in the address column and could be helpful for correspondence or record-keeping. By differentiating between students, faculty, and other library users, the utype field establishes the user role. A photo field that stores profile photographs is included to improve user identification. The user's account status—whether it is active, pending, or deactivated—is tracked in the status column.

A vkey, or verification key, is created at registration for safe account activation, guaranteeing that only verified users may access the system. If the user has successfully finished the email verification process, it is confirmed in the validity field to validate the user is to be allowed or not to access the services. The system guarantees safe authentication, role-based access control, and simplified library services by effectively organizing user data, improving both the user experience and operational effectiveness.

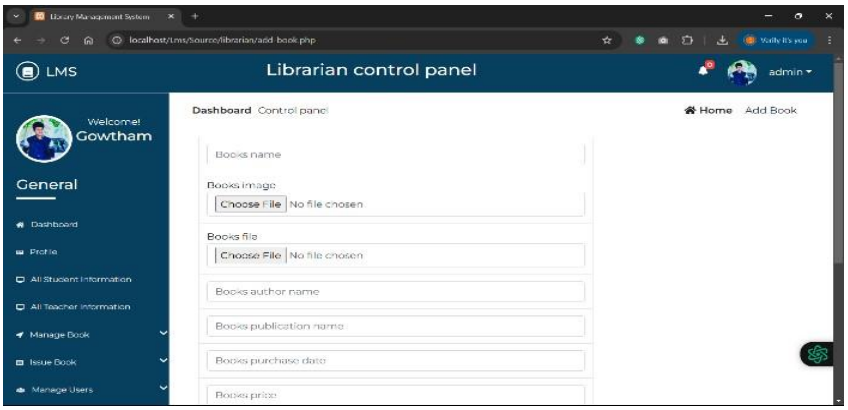


Figure 6: Attaching New Books

To guarantee correct categorization and administration, the librarian is in charge of entering each book's details into the system. This entails giving pertinent details including the book's title, author, publishing information, date of purchase, cost, quantity, and availability. The librarian must also attach a digital file for internet access, submit a picture of the book, and indicate where it should be stored. The system also requires the librarian's username for accountability and records the branch where the book is available. Following entry of the necessary information, the data is sent to the backend database, guaranteeing correct documentation and smooth library operations.

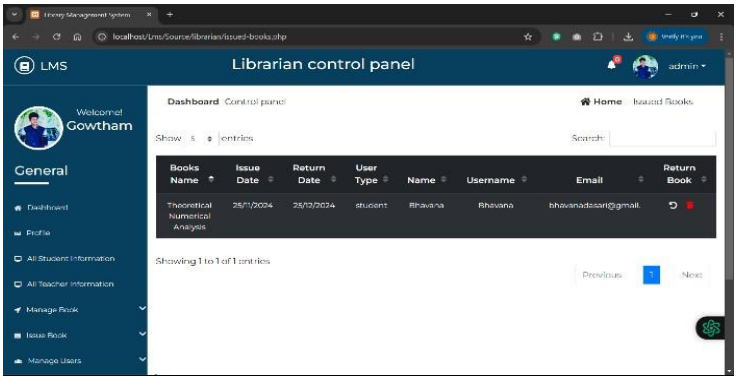


Figure 7: Borrowed Book Details

The **Borrowed Book Details Page** provides a comprehensive view of all books borrowed by students, allowing the library to efficiently track book circulation. This page displays essential borrower details, including student registration number, name, semester, session, department, and contact information. It also records book-specific details such as the book title, issue date, and return date, ensuring that due dates are monitored effectively.

Librarians can use this page to manage book returns, send reminders for overdue books, and maintain accountability. Additionally, the page includes the librarian's username who issued the book, ensuring proper record-keeping and tracking of transactions. This system helps streamline library operations, minimize lost books, and improve overall efficiency in managing borrowed books.

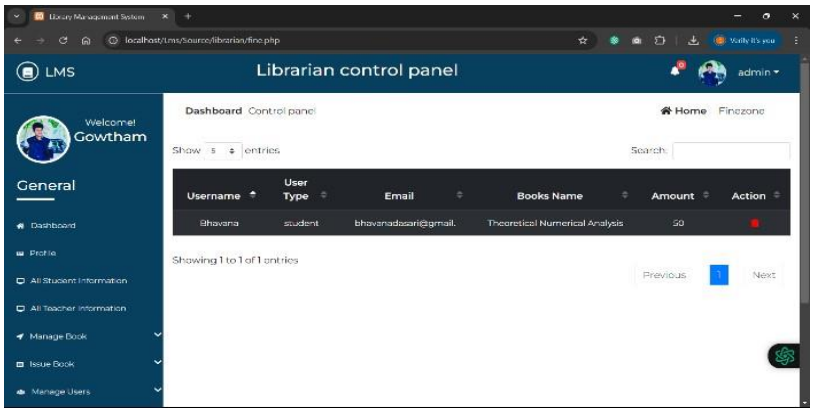


Figure 8: Penalty Area

Librarians can monitor and oversee student loan books using the Borrowed Book Details Page, which guarantees efficient library operations. Each borrowed book is described in full on this page, along with the student's name, department, semester, registration number, and contact information. In order to efficiently track due dates, it also logs the book title, issue date, and anticipated return date.

The technology allows librarians to enforce late submission penalties in order to keep book returns disciplined. The librarian may compute and impose a fine in accordance with the library's late return policy if a book is not returned by the deadline. Accountability is guaranteed, prompt book returns are encouraged, and availability for other users is preserved thanks to this function. Students can also receive notices and reminders from the librarian about books that are past due.

4.Conclusion

The Integrated Library and Certification System represents a significant step toward the modernization of library and academic certification processes. By leveraging cloud-based technology, the system enhances accessibility, efficiency, and accuracy in managing book transactions, borrowing history, and certification issuance. Its automated features reduce manual workload and errors, providing users with seamless access to library resources and certification tracking. This system not only improves library management by digitizing records and streamlining book searches but also enhances academic certification by automating event registrations and exam evaluations. By integrating these functionalities, it offers a comprehensive platform that supports educational institutions in fostering a more efficient, reliable, and user-friendly environment. Ultimately, the implementation of this system contributes to a more structured, accessible, and technologically advanced approach to library and certification management.

5.Acknowledgement

This research was successfully accomplished by supporting from Aditya Institute of Technology and Management. In addition, the case study was tested with different college Libraries. We would like to thank all.

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