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DEVELOPMENT OF AN ONLINE SCHOOL LIBRARY MANAGEMENT SYSTEM

CASE STUDY: OMEGA HIGH SCHOOL JOS

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DECLARATION

I, **ELLA Caleb Adah** hereby declare that this work titled **''Development of an Online School Library Management System, case study: Omega High School Jos''** is my original work and has never been presented elsewhere for any academic qualifications in any other university or for any other award, except where stated by reference or acknowledgement.

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APPROVAL

I, RUTARINDWA Jean-Pierre hereby certify that the dissertation titled **"Development of an Online School Library Management System case study: Omega High School Jos"** was done and submitted by ELLA Caleb Adah under my supervision.

RUTARINDWA JEAN-PIERRE

Date: ……. / …… / ……..

Signature: ………………..

DEDICATION

This research is dedicated firstly to God almighty for giving me life and everything I have, then to my beloved parents who have selflessly supported me financially, spiritually and emotionally on my academic journey from day one up to this point, to my incredible sisters who have supported and encouraged me constantly, to my aunt for taking me in, and providing the opportunity for me to study in this prestigious institution, to my friends who have been there for me through thick and thin.

Finally, I dedicate this research to my supervisor and the head of my department for his tireless efforts and help during the duration of this project.

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ELLA Caleb Adah

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ABBREVIATIONS AND ACRONYMS

AI   : Artificial Intelligence

CSS   : Cascading Style Sheets

DFD   : Data Flow Diagram

ERD   : Entity Relationship Diagram

GUI   : Graphical User Interface

HTML   : Hypertext Markup Language

ILMS   : Integrated Library Management Systems

JS   : JavaScript

LMS   : Library Management System

MARC   : Machine Readable Cataloging

MySQL   : My Structured Query Language

NLP   : Natural Language Processing

OSLMS   : Online School Library Management System

PHP   : Hypertext Processor

RBAC   : Role Based Access Control

RDA   : Resource Description Access

SSADM   : Structure System Analysis and Design Methodology

SQL   : Structured Query Language

ABSTRACT

The "Development of an Online School Library Management System" for the Omega High School library aims to address the challenges of manual library management by providing a web-based application tailored to streamline library operations. This system offers a comprehensive solution for organizing, cataloging, and accessing library resources, benefiting both students and administrators. By leveraging technologies such as PHP, HTML, CSS, and MySQL, the system enhances efficiency, accuracy, and accessibility, enriching the educational experience for all its users. Key features of the system include a user-friendly interface, book search functionalities, and book management modules allowing librarians to focus more on educational initiatives rather than routine administrative tasks. The integration of a robust database improves data handling, ensuring a well-organized and efficient library environment.

Keywords: Online, Library, Database, Library Management System, User-friendly, Interface.

CHAPTER 1: GENERAL INTRODUCTION

1.0. Introduction

A library can be defined as the heart of a community, a place where people come together for learning, sharing, and growth.

According to Lorcan Dempsey (2020), "A library is a collection of resources in a variety of formats that is organized by information professionals or other experts who provide convenient physical, digital, bibliographic, or intellectual access and offer targeted services and programs with the mission of educating, informing, or entertaining a variety of audiences and the goal of stimulating individual learning and advancing society as a whole." In the educational sector, libraries play a vital role in ensuring that students learn new things by providing them access to a wide range of learning resources. In today's digital age, the role of libraries in educational institutions transcends mere repositories of books and resources; they serve as dynamic hubs of learning and discovery. However, the manual management and coordination of library activities often pose significant challenges, which may result in consuming valuable time and resources that could be otherwise directed towards enhancing educational experiences. Recognizing this need for efficiency and innovation, the "Development of an Online School Library Management System" endeavors to revolutionize the way libraries are managed within some educational settings.

This research project proposes the development of a web-based software application tailored specifically for schools and institutions to help streamline library operations.

By automating the manual tasks involved in library management, the system aims to reduce the burden of manual effort on librarians and administrators. Moreover, the system will offer

features such as a user-friendly interface for both users and administrators, efficient book search functionality and other features to ensure the smooth running of the library.

Through the implementation of this Online School Library Management System, educational institutions can expect to witness significant improvements in efficiency, accuracy, and accessibility of library resources.

1.1. Background of the study

Historically, libraries have played a crucial role in academia, dating back to ancient civilizations, such as Mesopotamia, Egypt, and Greece. However, the modern concept of libraries as integral components of educational institutions began to take shape in the 19th century with the establishment of public education systems. During this period, the proliferation of schools and the expansion of formal education led to the recognition of the need for organized collections of educational materials to support teaching and learning. School libraries emerged as repositories of knowledge, providing students with access to textbooks, reference materials, and literature to supplement their studies (Wayne Graham, 2017).

In the early 20th century, the advent of library science as a distinct field further influenced library management practices. Pioneers such as Melvil Dewey and S.R. Ranganathan introduced classification systems of organization that revolutionized the way libraries were structured and managed. The mid to late 20th century witnessed significant advancements in information technology, which began to impact library management practices. The introduction of automated systems streamlined library operations and improved accessibility to resources (Jodi Reeves Eyre & Christa Williford, 2017).

With the widespread adoption of computers and the internet in the late 20th and early 21st centuries, there was a paradigm shift in library management systems towards digital solutions. Integrated library management systems (ILMS) and library management software emerged as essential tools for automating various library functions.

Against this historical backdrop, the "Development of an Online School Library Management System" project represents the latest iteration of efforts to leverage technology by optimizing library operations within educational institutions. Building upon decades of advancements in library science and technology, this research project aims to design a web-based application which will use HTML, Bootstrap, PHP, and MYSQL to specifically handle the needs of school libraries,offering a comprehensive solution for efficient and effective management of library resources.

1.2. Problem Statement

Over the years, the activities within the Omega High School library have been manually operated and managed. This brought about difficulties in integrating various formats, including multimedia and e-resources, because of the outdated management systems that are present. The librarians in the school work long shifts manually keeping records of the books borrowed, registered students, and other activities that take place in the library. Due to the large number of students in the school, this manual task poses to be very stressful thereby leading to inefficient cataloging, resource tracking constraints, and misplacement of records. To bridge the gap, the school library requires a modern and digitized "Online School Library Management System" with an intuitive user-friendly interface, which has effective cataloging, and analytics capabilities to help reduce the stress and strain faced by librarians when manually handling and coordinating the library activities. It will also help to bring the school library back to life, thereby making it a

dynamic center of knowledge. Based on the fact that the library will be digitized, it will encourage students to find reading and acquiring knowledge interesting and enjoyable.

1.3. Objective of the Project:
1.3.1. General Objective

The objective of the Online School Library Management System (OSLMS) project is to design and implement an efficient and user-friendly system that automates the various tasks associated with managing a library.

1.3.2. Specific Objectives

The specific objectives of the project include:

I.   To develop an intuitive and user-friendly interface for librarians and students to facilitate easy navigation, quick retrieval of information, and seamless interaction with the system.

II.   To implement a database to store users' records and data.

III. To provide features for students and librarians to create accounts, and manage personal information, thereby fostering a personalized and user-centric library experience.

IV.   To implement an advanced search mechanism to allow users to quickly locate books, and other resources, promoting a more efficient and enjoyable library experience.

By achieving these objectives, the Online School Library Management System aims to enhance the overall efficiency, accessibility, and user satisfaction of the library services, ultimately contributing to an enriched learning and research environment within the institution.

1.3.3. Research Questions

- How are users able to carry out library operations such as borrowing and returning of books?

- How are users' records and data handled within the system?

- How are students and librarians able to manage their respective activities on the system?

- How are the books and other resources located within the system?

1.4. Scope of the study
1.4.1. Content Scope

The content scope of the library management system refers to the features and functionalities that the system will include to meet the requirements of managing the library effectively.

The content scope of the Online School Library Management System (OSLMS) includes key functionalities such as book management, user data management, circulation management, search and retrieval, and security and access control. Book management covers the acquisition, cataloging, and organization of books and library materials. User data management involves creating databases to handle user records, manage accounts, and provide authentication. Circulation management automates processes like book check-ins, check-outs, and reservations to improve efficiency. The system also implements a robust search and retrieval mechanism, enabling users to easily find books,and other resources. Finally, security and access control ensure the protection of sensitive data with secure passwords and user privilege management.

1.4.2. Geographical Scope

The physical area where this study is being carried out is in Jos city, Plateau State, Nigeria, where Omega High School is located.

1.4.3. Time Scope

The time scope of this study encompasses an examination of the library management system at Omega High School in Jos, Plateau State, Nigeria, from the year 2014 to 2024. The study involves reviewing the school's historical data to understand its previous library management practices, analyzing trends and technologies and making recommendations for future improvements.

1.5. Project Methodology

During the process of conducting this research, the methods which were used to gather information were crucial in the decision making process.In the course of this research, the following data collection techniques were used: Documentation and Observation

1.5.1. Data Collection Tools:

- **Documentation:**

  The documentation method aimed to analyze the existing library management system by reviewing all relevant records, manuals, logs, and reports. This helped to understand the current processes, identify inefficiencies, and determine areas for improvement.

- **Observation:**

  The observation method involved the process of directly monitoring the library operations to gain insights into the day-to-day challenges and user interactions with the existing system. This helped to see beyond what was documented and understand the practical implications of the existing system.

1.5.2. Software Development Model

The software development model to be used is the Agile Model.

The Agile model is a methodology in software development that promotes iterative progress, collaboration, and adaptability. It focuses on delivering small, functional segments of the project in time-boxed iterations known as sprints.By adopting the Agile model, the library management system can be developed in a structured yet flexible manner, ensuring that the final product is robust, user-friendly, and meets the stakeholders' expectations.

1.5.3. System Analysis And Design Approach

The System Analysis And Design Approach to be used for the project is the Structured approach.

The structured approach is a systematic, step by step method used to develop information systems. This approach emphasizes breaking down a system into manageable parts and uses specific techniques to ensure a clear and detailed design. This approach helps in managing complexity, reducing errors and ensuring that the final system meets the requirements of the users.

By using the Structured approach, we can ensure a comprehensive, organized and detailed process for developing the Online School Library Management System.

1.6. Significance of the study

The development of the school library management system brings significant improvements to the school's library operations, benefiting both students and librarians in the following ways:

- **Enhanced Student Experience:**

  Students gain easy and efficient access to a wide range of learning resources.

  - The system facilitates better resource discovery, promoting academic growth and learning.

- **Improved Efficiency for Librarians:**

Librarians experience a reduction in manual effort required to perform tasks, allowing them to focus on more strategic activities.

The system ensures accurate and streamlined management of library operations, improving overall efficiency and effectiveness.

1.6.1. Personal Interest

The project reflects a personal passion for technology-driven solutions in education, aiming to create a user-friendly system that aligns with modern digital literacy trends. By developing this system, the project contributes to personal growth in technical skills and understanding of library management systems, while also addressing the challenge of making library resources more accessible and engaging for users.

1.6.2. Institutional Interest

For the institution, the OSLMS serves as a strategic asset that enhances the overall quality of education by integrating library services with academic programs. It supports the institution's mission of providing a comprehensive educational experience by ensuring that students and staff have seamless access to information resources. Moreover, the system contributes to the

institution's reputation by showcasing its commitment to leveraging technology to improve educational services and operational efficiency.

1.6.3. Public Interest

From a public interest perspective, the LMS supports the broader educational community by setting a standard for library services in the digital age. It demonstrates the importance of integrating technology into educational infrastructure, potentially serving as a model for other schools and public libraries. The system promotes lifelong learning and equal access to information, reflecting the public interest in creating more informed and knowledgeable communities. Additionally, by improving access to educational resources, the system contributes to societal goals such as increased literacy rates and reduced information inequality.

1.7. Limitations of the study

The School Library Management System can offer many benefits, it may also have certain limitations. The constraints that were faced during the development of the system include:

- **Data Collection Constraints:** The process involved in the collection of data for the research using questionnaires was posed with problems such as inaccuracies and biases.
- **Offline Accessibility:** Based on the fact that the Library Management System is web-based, the system faced limitations in providing offline access to some resources as it requires internet connectivity to function effectively.
- **Limited User-Interface Customization:** The styling capabilities provided by HTML and CSS led to a reduced level of dynamism in designing the User

Interface as compared to frameworks with extensive User Interface libraries that provide advanced customization features.

In order to mitigate these limitations, it is essential to continuously monitor and update the system, follow best practices in coding and security, and consider adopting additional technologies or frameworks based on evolving project requirements. Regular testing and user feedback can also help identify and address these potential constraints.

1.8. Organization of the Project
Chapter 1: General Introduction

This chapter contains the introduction and background of the project. It includes the purpose for which the study was carried out, the problem statement, objectives of the study, research questions, scope and limitations of the study.

Chapter 2: Literature Review

The second chapter encompasses the definitions of the terms used in this study, and a review of existing works of literature that relate to this study, and an overview of existing related systems.

Chapter 3: System Analysis and Design

This chapter presents the system analysis and design methods and techniques used to design the new system. It also includes the analysis of the current system.

Chapter 4: System Implementation

This chapter will show the implementation of the system. It also includes the attached images that will show the functionality of the new system.

Conclusion and Recommendation

This is the last chapter of the project which shows the conclusion of the project, future work and recommendations that can be included to enhance the project.

CHAPTER 2: LITERATURE REVIEW

2.0. Introduction

There have been many library management systems which have been developed in the past. All these systems were created with the sole purpose of streamlining library activities, and making sure that all the library functions, procedures, and protocols are effectively carried out. These systems were also created to reduce the manual involvement of librarians in managing library activities. This helps to provide user satisfaction for the students, the librarians, and all other users that come in contact with the system.

This chapter contains the literature review of the proposed system, and will also consider the previous and existing systems which relate to the proposed system at hand.

2.1. Definition of key terms

This project is titled 'Development of an Online School Library Management System', the following terms and concepts relating to the project are defined as follows:

2.1.1. Online

The term "online" is defined as the state of being connected to the internet, allowing for communication, data exchange, or access to digital resources in real-time (Singh and Thurman 2019).

2.1.2. School

Henry Giroux(2019) defines a school as more than just a place for formal education; he views it as a critical site of cultural and ideological production.

2.1.3. Library

A library is defined as an evolving entity that includes both physical and digital resources. Modern libraries serve as dynamic spaces offering access to a variety of digital resources, while also providing educational, research, and community services, moving beyond traditional roles as mere repositories of books (Keller, M. A., & Reich, V. A. 2017).

2.1.4. Management

Management is defined as the process of coordinating and overseeing the work activities of others so that their activities are completed efficiently and effectively. This involves planning, organizing, leading, and controlling resources, including human, financial, and informational resources, to achieve organizational goals (Robbins & Coulter, 2018).

2.1.5. System

A system is defined as a collection of interrelated and interdependent components that function together within a defined boundary to achieve a common purpose. Each component of the system interacts according to specific rules or processes, contributing to the overall function of the system as a unified whole. In systems theory, this concept is applied across various disciplines, emphasizing the structure, purpose, and behavior of systems within their environments (Bertalanffy & Rapoport, 2020).

2.1.6. Management System

A management system is described as a coherent set of policies, processes, and procedures that organizations implement to meet their objectives and continually improve their performance. These systems create a structured framework that helps manage and coordinate business activities, ensuring consistency, effectiveness, and alignment with strategic goals. The management system integrates various organizational processes, enhancing overall operational

efficiency and guiding the organization towards its desired outcomes (Hoyle & Thompson, 2019).

2.1.7. Library Management System

A Library Management System (LMS) is described as software designed to manage the core operations of a library, including cataloging, circulation, and inventory management. An LMS typically consists of a relational database, software to facilitate interactions with the database, and graphical user interfaces for both staff and patrons. It supports the efficient handling of library resources and services by automating key processes and aiding in administrative decision-making (Kochtanek & Matthews, 2020).

2.1.8. User-Friendly

This is the ability of a product, gadget or system to prioritize the needs of users and have a mental model or underlying metaphor that makes them easily navigable. Such devices should be able to mirror human values in the way they interact with us. (Kuang & Fabricant, 2019).

2.1.9. Interface

This is defined as a tool, device, or program that allows users to interact with a computer system, software, or another device. An interface facilitates communication between the user and the system by translating user inputs into actions that the system can understand, and vice versa. This interaction can be achieved through various means, such as graphical user interfaces (GUIs), command-line interfaces, or other forms of user-device communication. Interfaces are crucial in making technology accessible and usable by translating complex system operations into user-friendly actions (Johnson & Shneiderman, 2021).

2.1.10. Database:

A database is described as a systematically organized collection of data that is stored and managed by a Database Management System (DBMS). The primary purpose of a database is to ensure that data is structured in a way that allows for efficient retrieval, management, and updating of information. Databases are essential for various applications, including business operations, data analytics, and research, providing a backbone for data storage and manipulation in a structured format (Silberschatz, Korth, & Sudarshan, 2020).

2.2. Review of Related Literatures

Due to the advancement in technology, the process of managing and coordinating the activities of a library have been made easier and more efficient. The constant development of the internet has brought about a dynamic shift that has inspired the effective management of school library activities. Below are some relevant works of literature that correlate with this study:

2.2.1. Efficient Book Management.

Efficient book management refers to the systematic organization, control, and administration of a library's collection to maximize accessibility, accuracy, and usability for patrons and staff. It involves the optimization of library activities such as cataloging, classification, circulation, and inventory management through the use of technology. Efficient book management involves the following processes; cataloging, classification, circulation and inventory management. These processes are explained by some authors in the literature below. Effective **cataloging** helps in the precise identification and retrieval of books, which improves user access and library efficiency. T. G. Turner (2018).

- **Classification systems**, like the Dewey Decimal System or the Library of Congress Classification, are essential for organizing books in a way that makes them easy to find. C. B. Harris (2020). C. B. Harris emphasized that proper classification enhances the user experience by ensuring books are placed in logically structured categories.
- **Circulation Management:** Circulation systems handle the check-out and return processes. An efficient circulation system reduces the time and effort required for book transactions, improves accuracy in tracking items, and enhances overall patron satisfaction P. J. Johnson (2017).

- **Inventory Management:** Inventory control involves tracking book stock, managing book acquisitions, and handling lost or damaged items. Effective inventory management helps maintain optimal book stock levels, minimizes losses, and ensures the availability of popular titles M. E. Wilson (2021).

2.2.2. User-friendly Interface.

A user-friendly interface in a Library Management System (LMS) is designed to be intuitive, accessible, and easy to navigate, allowing all users of all skill levels to effectively interact with the system. It prioritizes usability, ensuring that tasks like searching for books, checking availability, and managing user accounts can be performed with minimal effort and confusion.

A user-friendly interface includes features such as **clear navigation, search functionality, consistent design, and accessibility.** The following features from the perspectives of some authors are explained in the literature below.

- **Clear Navigation:** ''Clear navigation paths and consistent design elements are essential in reducing user frustration, making it easier for users to locate resources and complete tasks efficiently'' S. A. Johnson (2019). According to Johnson, a well-designed navigation system allows users to ''predict their next steps based on their previous interactions with the system,'' thereby increasing overall usability.

- **Search Functionality:** ''An effective search function should not only allow for basic keyword searches but also support advanced filtering options and search suggestions to guide users in finding the exact materials they need'' D. R. Matthews (2020). Matthews further asserted that ''search suggestions and auto-complete features can significantly

enhance the user experience by reducing the time and effort required to locate specific resources.''

- **Consistent Design: ''**A responsive design ensures that users have a consistent and efficient experience whether they are accessing the LMS from a desktop, tablet, or smartphone'' E. K. Williams (2021).

- **Accessibility:** According to L. M. Carter (2020), ''ensuring LMS interfaces are accessible is not just about compliance with standards; it is about providing equal access to information for all users, regardless of their abilities.''

2.2.3. Database.

A database is an organized collection of structured information or data, typically stored electronically in a computer system.

In a Library Management System (LMS), a database serves as the backbone for storing , managing, and retrieving large volumes of data, including information about books, users, transactions, and other library resources. The database enables efficient management of data, supports complex queries, and ensures data integrity and security (Elmasri & Navathe, 2023).

In order for a database to function effectively, numerous processes are involved, some of the processes are discussed below from the perspectives of different authors in their works of literature.

- **Data Storage and Organization:** ''Relational databases are particularly well-suited for Library Management Systems (LMS) because they allow for the complex relationships between different data entities to be represented clearly and managed efficiently'' R.G. Thomas (2018). Thomas further explained that ''by organizing data into related tables, an

LMS can provide more accurate and meaningful connections between different pieces of information''.

- **Data Retrieval and Querying:** ''The ability to perform complex queries quickly and accurately is essential for an effective LMS, as it directly impacts the user experience'' J. A. Campbell (2019). Campbell emphasized the use of ''SQL (Structured Query Language) as a powerful tool for interacting with the database, allowing librarians and users to retrieve, update, and manage data with precision.''

- **Data Integrity and Security:** M. S. Carter (2020) notes that ''maintaining data integrity ensures that the information within the LMS stays accurate and reliable, which is crucial for both librarians and users.'' Carter argued further that ''robust security measures, including access control and encryption, are essential to protect sensitive data from unauthorized access and breaches.''

- **Scalability and Performance:** ''As the library's collection and user base expand, the database must scale efficiently to maintain performance and avoid bottlenecks'' L. D. Martinez (2021). Martinez also discussed the trade-offs between normalization and denormalization, noting that ''while normalization reduces redundancy and enhances data integrity, denormalization can improve performance by simplifying query execution.''

2.2.4. Enhanced Search and Retrieval.

Enhanced search and retrieval refer to advanced methods and technologies used to improve the efficiency and accuracy of finding information within a Library Management System (LMS). These techniques go beyond basic search functionalities, incorporating features such as natural language processing, faceted search, filtering, relevancy ranking, and predictive search. The goal

is to provide users with more relevant results faster, thereby improving the overall user experience and making library resources more accessible.

Enhanced search and retrieval involves the following:

- **Natural Language Processing (NLP):** J. K. Adams (2020) highlighted the transformative impact of NLP on search capabilities in LMS, noting that "Natural Language Processing allows library systems to interpret and respond to user queries more naturally, reducing the need for precise keyword input and enhancing the user experience" Adams argued that NLP "bridges the gap between how users think and how search algorithms traditionally function, leading to more accurate and user-friendly search results."

- **Faceted Search and Filtering:** L. B. Fisher discussed the importance of faceted search in managing large collections within an LMS. Fisher explains that "faceted search empowers users to refine their searches across multiple dimensions, such as author, genre, or publication date, making it easier to navigate vast amounts of data and pinpoint specific resources" (Fisher, 2019). Fisher emphasizes that "this method not only enhances the search process but also helps users discover related materials they might otherwise overlook."

- **Relevancy Ranking:** M. H. Lee (2020) emphasized the role of relevancy ranking and improving the accuracy of search results within an LMS. Lee stated that ''relevancy ranking algorithms are crucial for ensuring that the most pertinent search results appear at the top of the list, based on factors such as keyword usage and user behavior.''Lee further noted that ''effective relevancy ranking can significantly reduce the time users send searching for information , leading to a more efficient library experience.''

- **Predictive Search:** T. R. Johnson (2022) discussed the benefits of predictive search in enhancing user engagement with LMS. Johnson observes that "predictive search, by offering real-time suggestions as users type, not only accelerates the search process but also introduces users to additional resources that align with their query." Johnson argued that "this feature helps users refine their search queries on the fly, leading to more accurate and comprehensive search outcomes."

2.2.5. Account Management

Account management in a Library Management System (LMS) encompasses the processes and features required for administrators to create, manage, and maintain user accounts. It includes functionalities that allow users, such as students and librarians, to access and manage their personal and professional information. Key aspects of account management involve authentication, authorization, role-based access control, and account monitoring, which are critical for ensuring secure access to resources and protecting sensitive data (Sadalage & Fowler, 2022).

Effective account management involves the following functionalities as discussed in the paragraphs below.

- **User Authentication and Authorization:** E. L. Robinson (2018) highlighted the significance of robust authentication and authorization mechanisms in LMS. Robinson states that "effective authentication is the first line of defense in protecting library resources and user data, ensuring that only authorized individuals can access specific functions within the system". Robinson also emphasized that "multi-factor authentication can add an extra layer of security, significantly reducing the risk of unauthorized access."

- **Role-Based Access Control (RBAC):** T. M. Douglas (2021) discussed the importance of RBAC in maintaining the security and integrity of an LMS. Douglas argued that "role-based access control helps libraries ensure that users only have access to the data and functions necessary for their roles, thereby minimizing the risk of data breaches and unauthorized activities."Douglas also noted that "RBAC simplifies account management by categorizing users into predefined roles, making it easier to manage permissions across the system."

- **Account Creation and Management:** S. R. Johnson (2020) explored the intricacies of account creation and management in an LMS. Johnson explained that "admin-controlled account management is crucial for maintaining the operational efficiency and security of the library system, ensuring that user accounts are properly created, maintained, and deactivated as needed". Johnson further noted that "monitoring account activity through detailed logs can help detect and prevent potential security breaches."

- **Profile Management and Personalization:** L. K. Spencer (2021) emphasized the role of profile management in enhancing user experience within an LMS. Spencer stated that "allowing users to manage their profiles and personalize their experience leads to higher engagement and satisfaction, as users can tailor the system to their needs." Spencer also pointed out that "personalization features, such as borrowing history and notification settings, make it easier for users to manage their library interactions effectively" L.K. Spencer (2021).

2.2.6. Other Related Literature

This contains a brief overview of other systems that are related to this project, including their operations and functionalities.

2.2.7. Other Perspectives of Technology in Library Management

The following insights emphasize on the crucial role of technology in managing library operations.

1. **Automated Library Management Systems (LMS):** LMS systems are crucial for managing library operations such as cataloging, circulation, acquisitions, and serials management. These systems help in maintaining accurate records, streamlining processes, and improving overall efficiency (Wong. M, 2022).

2. **Digital Cataloging:** Effective cataloging requires adherence to standards such as MARC (Machine-Readable Cataloging), Dublin Core and RDA (Resource Description and Access). These standards ensure consistency and interoperability between different library systems (Lee & Reitz, 2023).

3. **Digital Libraries and Repositories:** Creating and maintaining digital libraries and institutional repositories involves digitizing physical collections, managing digital assets and providing long term preservation solutions (McKinnon, 2022).

The examination of various automated library systems, highlights the significant advancements and benefits these systems offer to modern library management. These software solutions have revolutionized the way libraries operate, providing efficient cataloging, circulation, and user management functionalities.

The adoption of automated library systems not only streamlines administrative tasks but also enhances the user experience by providing seamless access to library resources. The ability to integrate with various digital platforms and support for multiple formats ensures that libraries can cater to the diverse needs of their patrons. Furthermore, the ongoing development and

community support for these open-source systems ensure that they continue to evolve, incorporating the latest technological advancements and user feedback.

In conclusion, the transition to automated library systems represents a significant leap forward for library management. The systems discussed, exemplify the potential for improved efficiency, accessibility, and user satisfaction in library operations. As libraries continue to adapt to the digital age, the role of automated systems will undoubtedly become increasingly pivotal, ensuring that libraries remain relevant and vital resources for their communities.

CHAPTER 3: SYSTEM ANALYSIS AND DESIGN

3.0. Introduction

In this chapter, we delve into the crucial phase of system development: **System Analysis and Design**. This phase serves as the bedrock for creating an effective and efficient Library Management System (LMS). The goal of system analysis and design is to thoroughly understand the current system, identify the requirements of the new system, and then conceptualize a blueprint that meets these requirements.

System Analysis is the process of studying and understanding a system in detail to identify its objectives, functions, and problems. It involves gathering and analyzing data, understanding user needs, and defining system requirements. The outcome of system analysis is a clear understanding of what the system should accomplish.

System Design refers to the process of planning and structuring the new system. It involves creating detailed specifications, diagrams, and models that will guide the development of the new system. The design phase translates the system requirements identified during analysis into a model that will be used to build up the new system.

This chapter contains a breakdown of the system analysis and design processes involved in the development of the School Library Management System for Omega High School.

3.1. Analysis of the Current System

3.1.1. Mode of Operation of the Current System

The sequence of operations that take place within the Omega High School library are as follows:

1. **Library Card-Based Identification**:

   Students use a physical library card containing their personal information in order to gain access to library services.

2. **Book Acquisition:**

   When a student wants to borrow a book, that student makes his or her way to the library building with a library card. When the student has chosen their desired book, the librarian manually logs the book details, including the borrowing date and return date, both on the student's library card and in a physical record book.

3. **Record Keeping:**

   The librarian manually records all the data concerning the library in a physical log book. The data the librarian records includes the records of students that have accessed the library, the books borrowed, the books returned and the curriculum related books that have been assigned to the students.

4. **Library Notifications**:

   In order for students to get informed about library activities, the librarian has to either verbally inform the students, or give them the notice on their library cards. For example, the librarian can verbally inform a student to acquire books relevant to the student's curriculum.

5. **Book Search:** When a book is to be acquired from the school's library, the librarian manually probes the bookshelves until that particular book has been located. This is a very strenuous process for the librarians.

3.1.2. Problems associated with the Current System

Currently, the processes involved in managing and maintaining the Omega High School library are primarily manual. Librarians face diverse challenges and bottlenecks in maintaining all the activities that take place in the school library. The existing system is posed with the following problems:

3.1.2.1. Manual Operation: Time-Consuming for Librarians

The current library system relies heavily on manual operations, which significantly increases the time and effort required to manage resources and coordinate library activities. Librarians must manually enter, update, and retrieve records, often leading to delays and inefficiencies. Tasks such as cataloging new books, updating borrower records, and processing returns involve repetitive, time-consuming steps. This not only slows down daily operations but also increases the likelihood of human error, which can further complicate resource management.

3.1.2.2. Time-Consuming Processes

Due to the manual nature of the current system, many processes that could be automated are instead carried out by hand. For example, issuing a book to a student requires checking the physical records for availability, manually updating the records, and ensuring that all entries are accurate. Similarly, returning books involves cross-checking records and updating them manually. These processes consume a considerable amount of time, leading to long queues and

delays for students and staff alike. This inefficiency affects the overall user experience, making it frustrating for both librarians and users.

3.1.2.3. Inadequate Record Keeping

The current system struggles with maintaining accurate and up-to-date records. Since all the library records are kept manually, there is a high chance of errors such as incorrect entries, duplicate records, or incomplete information. Over time, these inaccuracies accumulate, thereby making it difficult to maintain a reliable documentation of library records.

3.1.2.4. Misplacement of Records

With the existing manual system, the misplacement of records is a common issue. Physical records, such as library cards or logbooks, can easily be misplaced or lost, leading to significant challenges in tracking library resources. When records are lost, it becomes nearly impossible to determine the status of books or other library materials, resulting in confusion and potential loss of resources. This not only hinders the day-to-day functioning of the library but also impacts long-term resource management and accountability.

3.1.2.5. Difficulty in Locating Library Resources

Locating specific books or resources within the library is another major challenge faced by the current system. Without a digital catalog, students and staff must rely on manual searches, which are often time-consuming and inefficient. The lack of an organized, searchable database means that finding a particular book or resource can take a significant amount of time, especially in larger libraries with extensive collections. This difficulty in locating resources not only frustrates users but also diminishes the library's effectiveness in providing timely access to information.

In general, the manual operational processes involved in managing the Omega High School Library are unsatisfactory, and unable to cater for the increasing needs of the students and librarians.The issues that have been pinpointed necessitate the development of an Online School Library Management System in order to optimize the library operations of the school and improve its overall productivity.

3.2. Analysis of the New System
3.2.1. Introduction

The Online School Library Management System is designed in order to rectify the problems faced by the existing system. The new system aims to modernize the processes involved in managing the school library activities, thereby making it more efficient and reliable.The following sections discuss the system requirements, functional diagrams, and software development methodologies used in implementing the new system.

3.2.2. System Requirements
3.2.2.1. Functional System Requirements

Functional system requirements refer to the behaviors, functions or features that a system must have to meet the needs of its users and achieve its intended purpose. The functional system requirements of the Online School Library Management System include the following:

- **User Authentication:** The system must allow users to create accounts, login with a username and password, and log out securely.

- **Book Search Functionality:** The system must provide users with the ability to search for books and locate other library resources.

- **Database:** The system must provide a reliable database in order to store user's data and keep records.

- **User-friendly Interface:** The system must provide a user-friendly interface which enables users to interact with the system effectively.

- **User Notifications:** The system must inform users about library updates, such as return dates for books borrowed.

- **Book Acquisition:** The system should enable administrators to add new books to the library's inventory, and also allow for updating or removing book records as needed.

- **Book Return:** The system should facilitate the return process by allowing users to return borrowed books. It should automatically update the library's inventory and ensure that the book is marked as returned.

- **Report Generation:** The system should provide functionalities to generate reports that help in tracking and analyzing the library's operations.

3.2.2.2. Non-Functional System Requirements

Non-functional system requirements define the criteria that evaluate the performance and operational capabilities of a system, rather than specific behaviors or functions. These requirements focus on how the system performs certain functions rather than on the functions themselves. These requirements are crucial for ensuring the system is usable, reliable, and efficient. The non-functional system requirements of the Online School Library Management System include the following:

- **Operability:** The system should be intuitive, user-friendly and easy to navigate by all users, including those with limited technological skills.

- **Security:** The system must implement robust authentication mechanisms in order to ensure that only authorized users can have access to it.

- **Error Handling:** The system should be able to handle expected and unexpected errors in ways that prevent loss of information.

- **Efficiency:** The system should utilize resources such as memory and processing power effectively in order to ensure optimal performance.

- **Capacity:** The system should be capable of supporting a growing number of users and data without compromising its performance.

3.2.3. Functional Diagram

A functional diagram refers to a visual representation of the functions or processes within a system and their relationships. It provides a high-level view of how different components of the system interact and work together to achieve the desired outcome. The primary purpose of a functional diagram is to illustrate the system's behavior and the flow of data or tasks between different functions. The figure below represents the functional diagram for the Online School Library Management System.
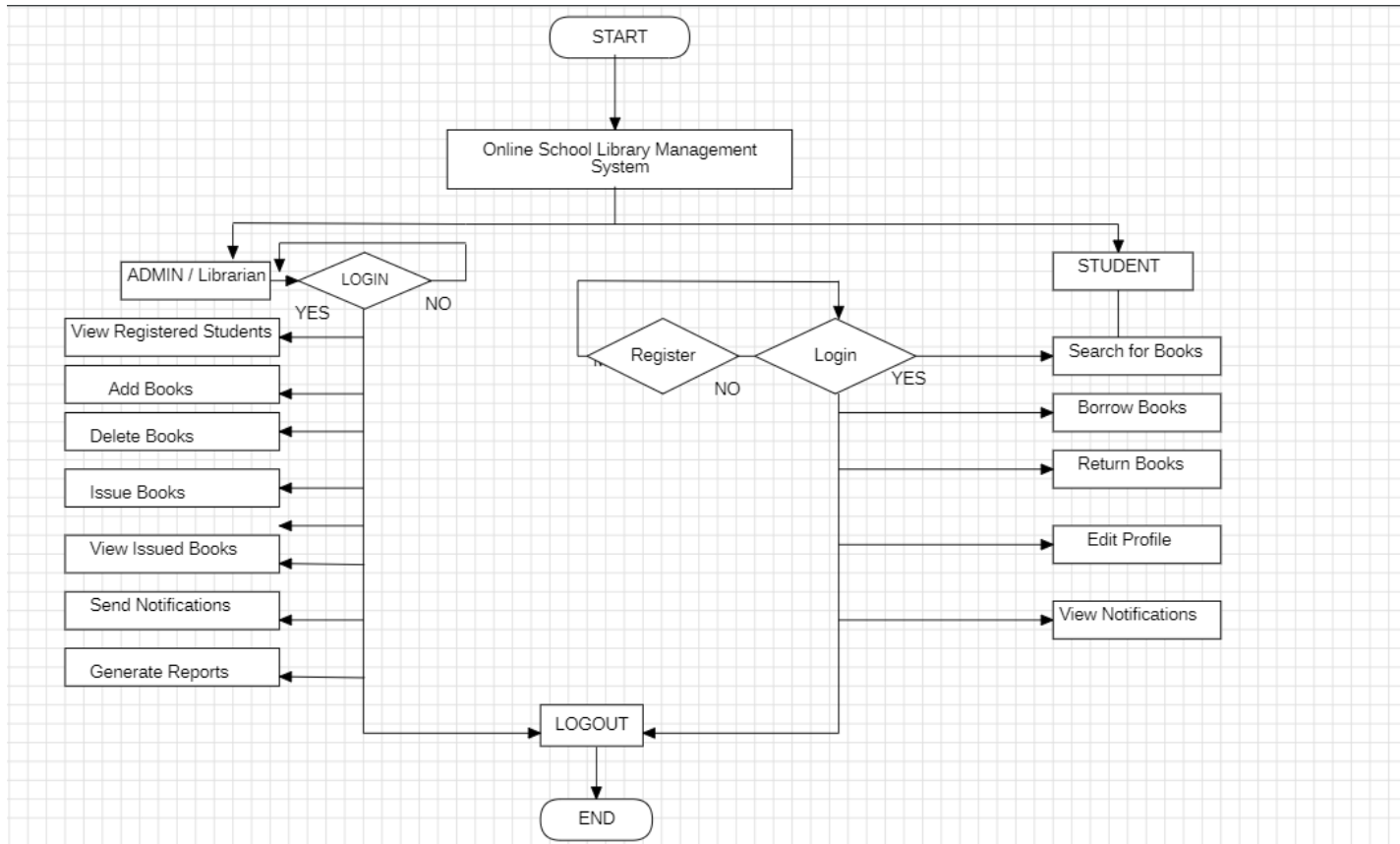
Figure 1. Functional Diagram

3.2.3.1. Components of a Functional Diagram

The components of a functional diagram include the following:

- **Processes/Functions:** These are represented as triangles or circles. They depict the key
  tasks or operations that the system must perform.

- **Inputs/Outputs:** Shown as arrows, they indicate the flow of data or triggers between
  functions. Inputs are the information or actions required for a function to operate, while
  outputs are the results produced by the function.

- **Actors:** Actors refer to the users or external entities that interact with the system. They
  are represented as labeled blocks.

- **Data Stores:** Represented as parallel lines or cylinders, these depict where data is stored within the system.

- **Flow Arrows:** These arrows indicate the direction of data or control the flow between functions, data stores, and actors.

3.2.4. Methodological Approach
3.2.4.1. Data Collection Techniques

While conducting my research, I made use of efficient data collection methods in order to effectively gather all the required data and resources that were needed. The following data collection techniques were utilized:

- **Documentation:**

  I applied the documentation method to analyze the existing library management system of the Omega High School by reviewing its important records, manuals, logs, and reports. This helped me to understand the current processes, identify its shortcomings, and determine areas for improvement.

- **Observation:**

  The observation method was implemented by directly monitoring the library operations to gain insights into the day-to-day challenges and user interactions with the existing system. This helped me to see beyond what was documented and understand the practical implications of the existing system.

3.2.4.2. Software Development Methodology

The software development methodology I used for this project is the Agile model. The Agile model is a software development methodology that emphasizes flexibility, collaboration and customer-focused iterative progress. It is particularly effective in projects where requirements are expected to evolve, or when there is need for continuous user feedback (Schwaber & Sutherland, 2020).
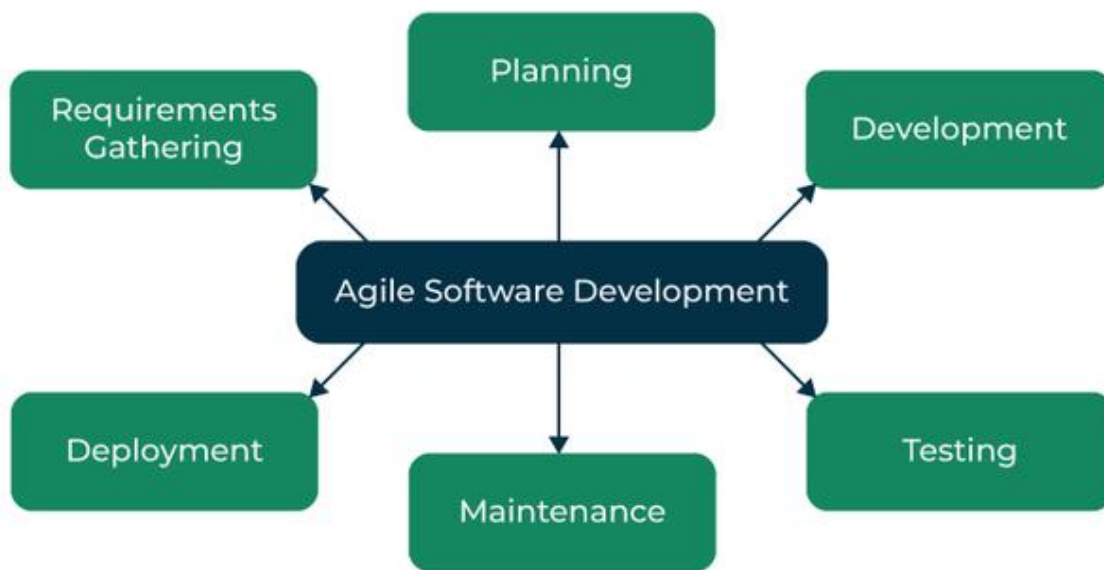
Figure 2. Agile Model

This model was chosen because it provides flexibility and adaptability in managing and changing requirements. This creates room for changes to be made to the system with ease and efficiency. The agile model involves the following procedures:

- **Project Initiation and Planning:** This stage involves defining the project's scope, objectives, and identifying key stakeholders. It also includes creating a product backlog—a prioritized list of features and requirements that will serve as the roadmap for the development process.

- **Sprint Planning:** This stage involves selecting specific tasks from the product backlog to focus on during the upcoming sprint. These tasks are broken down into smaller, manageable units that can be completed within the sprint's timeframe.

- **Development:** This stage involves the actual coding and building of the selected features. Collaboration is crucial to ensure that everything meets the required standards.

- **Daily Stand-Ups:** This stage involves participating in brief, daily meetings to discuss progress, challenges, and plans for the day. These meetings help keep everyone aligned and allow for prompt resolution of issues.

- **Testing:** This stage involves continuously testing the features being developed throughout the sprint. It includes running unit tests, integration tests, and sometimes user acceptance tests to ensure that everything functions correctly.

- **Review and Retrospective:** This stage involves reviewing the completed work at the end of the sprint and gathering feedback from stakeholders. It also includes reflecting on what went well, what didn't, and identifying areas for improvement in the next sprint.

- **Iteration and Adaptation:** This stage involves making adjustments based on the feedback and reflections from the review and retrospective. It focuses on adapting the project to incorporate any changes or new requirements before starting the next sprint.

3.2.4.3. System Analysis and Design Methodology

The system analysis and design methodology that was used is the Structured System Analysis and Design Methodology (SSADM). The structured approach is a systematic, step by step method used to develop information systems. This approach emphasizes breaking down a system into manageable parts and using specific techniques to ensure a clear and detailed design. This

approach helps in managing complexity, reducing errors and ensuring that the final system meets the requirements of the users.

By using the Structured approach, I was able to ensure a comprehensive, organized and detailed process for developing the Online School Library Management System.

3.2.4.3.1. Overview of Structured System Analysis and Design Methodology (SSADM)

Structured analysis and design is a systematic methodology used in software engineering and systems development. This approach is primarily focused on dividing complex systems into smaller, more manageable components to facilitate better understanding, analysis, and design. According to various authors, structured analysis emphasizes the logical function of a system, while structured design focuses on translating these functions into a coherent and efficient system structure.

Structured methods are particularly effective in handling complex data-centric systems, where a clear understanding of data flows and processes is essential."Structured agility integrates the discipline of structured analysis with the flexibility of agile methodologies." (Jalote, P. 2017).

3.2.4.3.2. Processes Involved in SSADM

- **Problem Definition:** This initial step involves identifying and understanding the problem that the new system is meant to solve. This includes analyzing the current system, identifying deficiencies, and establishing clear objectives for the new system.
- **Feasibility Study:** The feasibility study assesses the viability of the project from technical, economic, and operational perspectives. It helps determine whether the project should proceed and identifies potential risks.

- **Requirements Gathering and Analysis:** This phase involves collecting and analyzing the functional and non-functional requirements of the system from stakeholders. Techniques like interviews, surveys, and document analysis are commonly used.

- **Data Modeling:** Data modeling creates a conceptual representation of the system's data, focusing on the data structures and relationships. This ensures that the system's data architecture supports its functional requirements.

- **Process Modeling:** This step involves creating models that describe how data flows through the system and how processes transform this data. Tools like Data Flow Diagrams (DFDs) are used to depict these processes and their interactions.

- **Design Specification:** The design specification translates the logical models from the analysis phase into detailed design documents. These documents specify the system architecture, data structures, user interfaces, and algorithms necessary for implementation.

- **System Implementation:** In this phase, the system is coded, tested, and deployed based on the design specifications. The goal is to create a working system that meets the documented requirements.

- **System Testing:** System testing involves validating that the system meets all requirements and performs as expected. This includes unit testing, integration testing, system testing, and user acceptance testing.

- **Maintenance:** After deployment, the system enters the maintenance phase, where it is updated, improved, and corrected as necessary. This phase ensures the system continues to meet user needs and adapt to changes.

3.2.4.3.3. System Design

Definition: System design is defined as the process of translating the requirements and architecture into a detailed blueprint for constructing the system. This includes specifying the system's data structures, algorithms, user interface, and overall system architecture (Roger S. Pressman, 2019).

System design is classified into the following subdivisions:

- **Architectural Design:** Involves defining the overall structure of the system, including its high-level components and their interactions (Roger S. Pressman, 2019).

- **Interface Design:** Focuses on the development of user and system interfaces, ensuring that they meet usability and functional requirements (Roger S. Pressman, 2019).

- **Data Design:** Involves creating detailed data models, including databases, data warehouses, and data flows (Roger S. Pressman, 2019).

- **Component-Level Design:** Specifies the detailed design of individual software components, including the algorithms and data structures they use (Roger S. Pressman, 2019).

3.2.4.4. Tools Used in SSADM.

In the development of the Online School Library Management System for Omega High School, the following SSADM tools were applied:

- **Data Flow Diagrams (DFDs):** Data Flow Diagrams were one of the primary tools used to represent the flow of information within the system. They graphically depict data processes, data stores, data flows, and external entities, offering a high-level view of the system's functional structure.
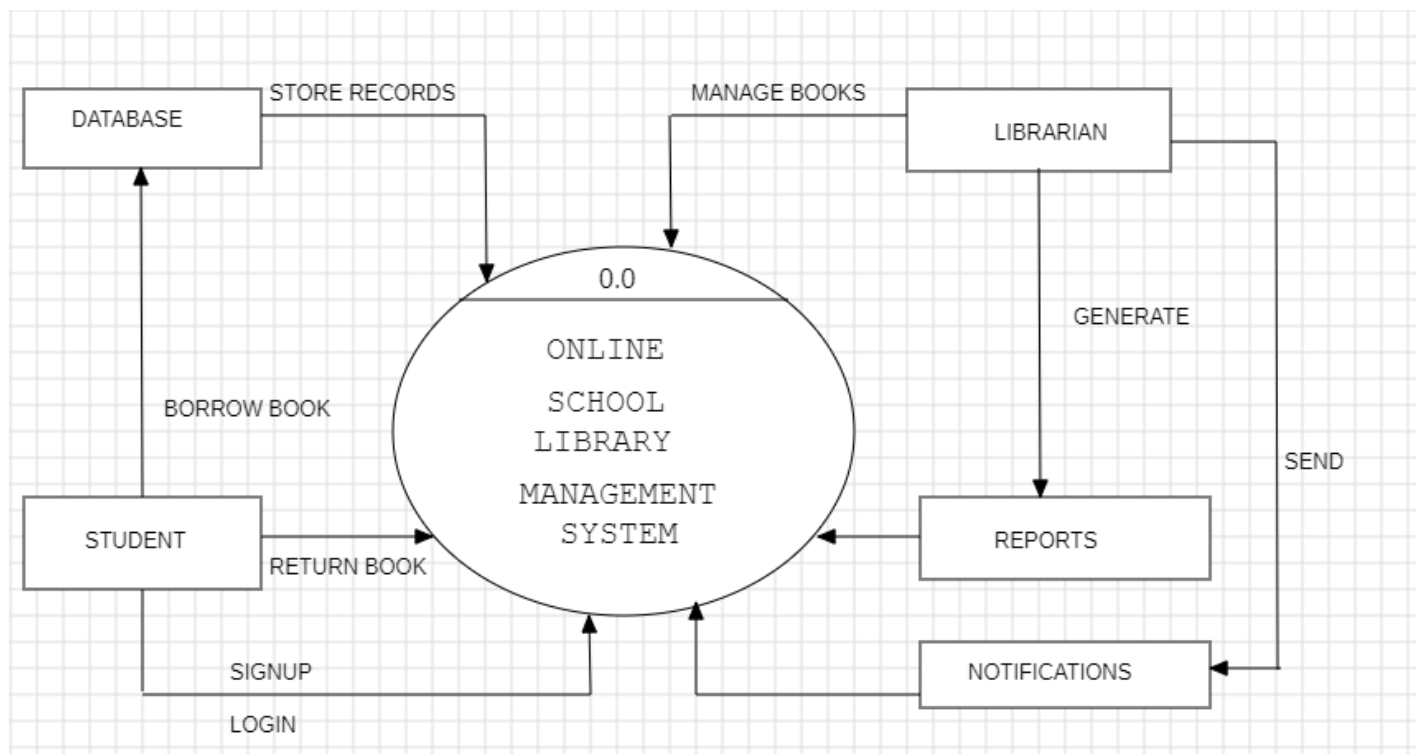
Figure 3. Level 0 Data Flow Diagram (Context Diagram)
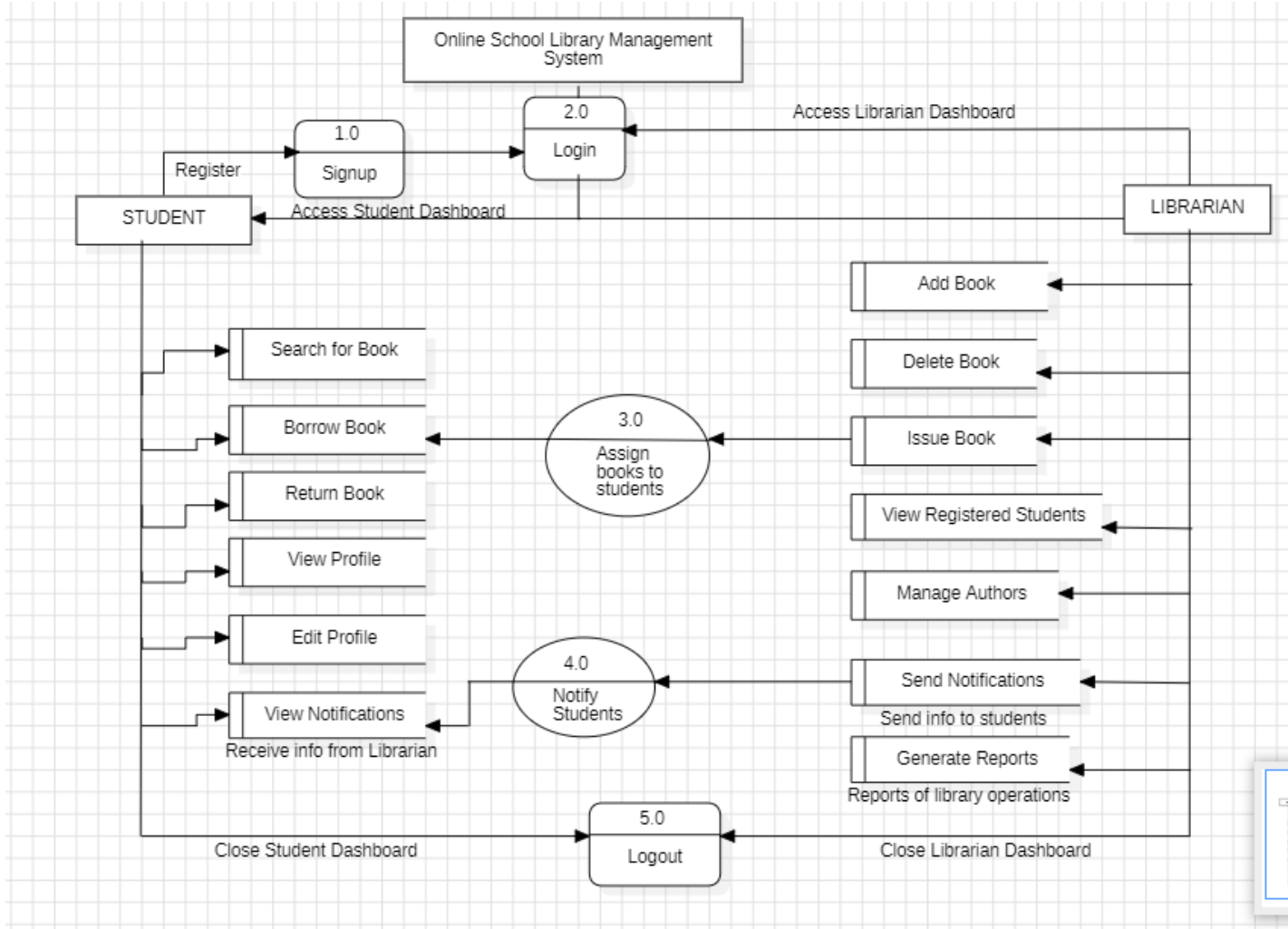
Figure 4. Level 1 Data Flow Diagram

- **Entity Relationship Diagrams (ERDs):** ERDs were used to model the data structures required by the system, focusing on the entities involved, the relationships between them, and the attributes that define these entities. ERDs helped in designing the system's database by ensuring data integrity and consistency.
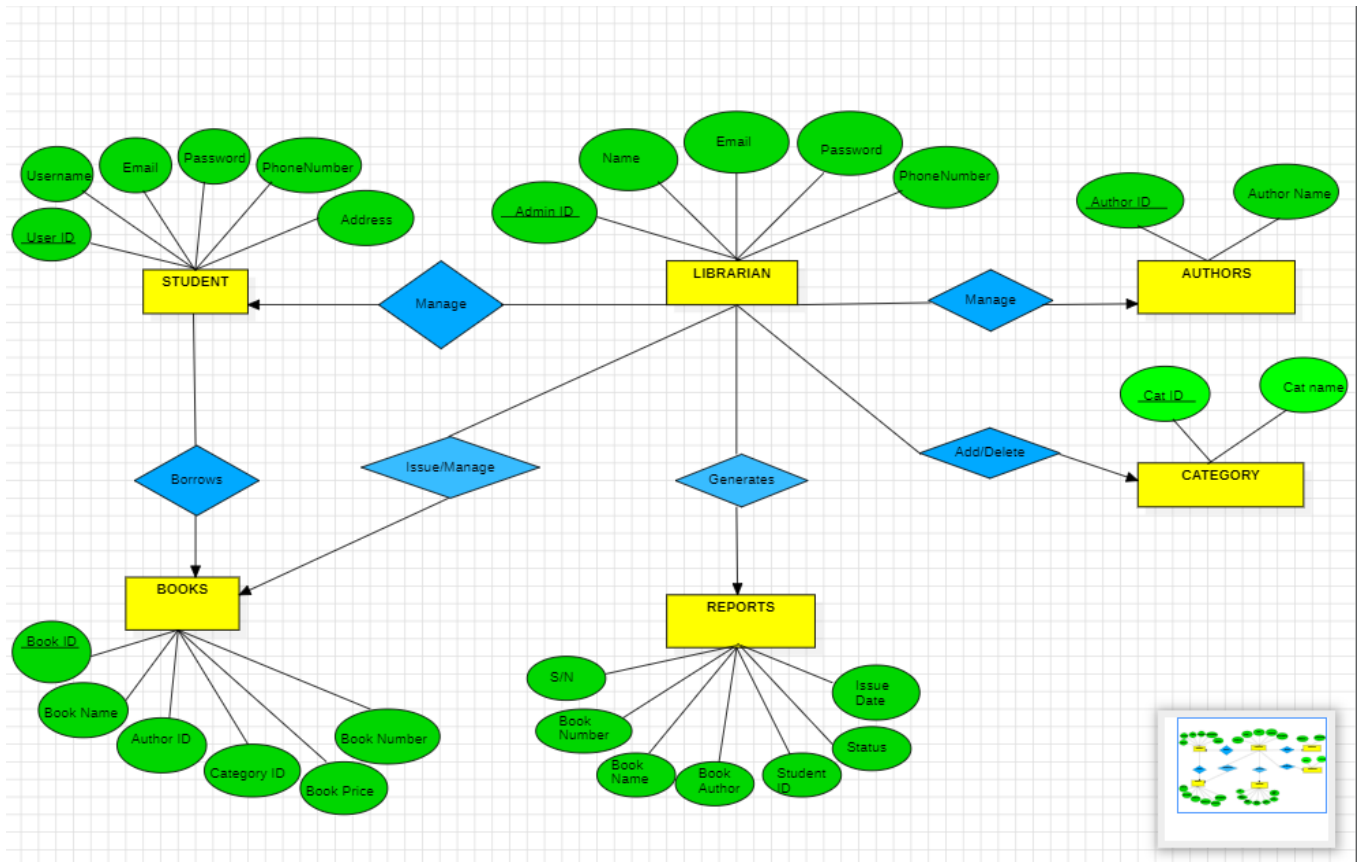
Figure 5. Entity Relationship Diagram

- **Data Dictionary:** A data dictionary is a centralized repository of information about the data elements within a system, including definitions, types, allowable values, and relationships. It was a crucial tool used for maintaining consistency and clarity in system documentation of the online school library management system.

  The data dictionary for the online school library management system contains the following:

Table 1. Admins Table

Attribute Name	Data Type	Constraints	Description
ID	INT	Primary Key, Auto Increment	Unique identifier for each admin.
Name	VARCHAR (15)	NOT NULL	Admin's name.
Email	VARCHAR (20)	NOT NULL	Admin's email address.
Password	VARCHAR (15)	NOT NULL	Admin's password.
Phone_number	VARCHAR (11)	NOT NULL	Admin's phone number.

Table 2. Users Table

Attribute Name	Data Type	Constraints	Descriptions
ID	INT	Primary Key, Auto Increment.	Unique identifier for each student.
Name	VARCHAR (15)	NOT NULL	Name of the student.
Email	VARCHAR (20)	NOT NULL	Student's email.
Password	VARCHAR (15)	NOT NULL	Student's password.
Phone_number	INT (12)	NOT NULL	Student's phone number.
Address	VARCHAR (25)	NOT NULL	Student's address.

Table 3. Books Table

Attribute Name	Data Type	Constraints	Description
Book_id	INT	Primary Key, Auto Increment.	Unique identifier for each book.
Book_name	VARCHAR (30)	NOT NULL	Name of the book.
Author_id	INT (11)	NOT NULL	Identifier for the author.
Cat_id	INT (11)	NOT NULL	Category identifier.
Book_number	INT (11)	NOT NULL	ISBN number of the book.
Book_price	INT (11)	NOT NULL	Price of the book.

Table 4. Authors Table

Attribute Name	Data Type	Constraints	Description
Author_id	INT	Primary Key, Auto Increment.	Unique identifier for each author.
Author_name	VARCHAR (30)	NOT NULL	Author's name.

Table 5. Book Category Table

Attribute Name	Data Type	Constraints	Description
Cat_id	INT	Primary Key, Auto Increment.	Unique identifier for each book category.
Cat_name	VARCHAR (20)	NOT NULL	Book category name.

Table 6. Issued Books Table

Attribute Name	Data Type	Constraints	Description
Serial_number	INT	Primary Key, Auto Increment.	Serial number.
Book_number	VARCHAR (11)	NOT NULL	ISBN number of the book.
Book_name	VARCHAR (30)	NOT NULL	Name of the book.
Book_author	VARCHAR (30)	NOT NULL	Name of the author.
Student_id	INT (11)	NOT NULL	Student identification number.
Status	VARCHAR (11)	NOT NULL	Book status.
Issue_date	DATETIME	NOT NULL	Issue date of the book.

Table 7. Notifications Table

Attribute Name	Data Type	Constraints	Description
id	int(11)	Primary Key, Auto Increment.	Notification id.
Student_id	int(11)	NOT NULL	Student identification number.
Message	TEXT	NOT NULL	Message details.
Date_sent	DATETIME	Current_timestamp()	Date the message was sent.

By implementing the Structured System Analysis and Design Methodology and its tools, I was able to ensure that the Online School Library Management System was well designed, analyzed and documented to meet the user requirements.

CHAPTER 4: SYSTEM IMPLEMENTATION
4.0. Implementation and Coding
4.1. Introduction

The implementation and coding phase is where the system design is transformed into a working application through programming. It involves writing codes based on the design specifications using selected programming languages, tools and frameworks. This phase is vital as it brings the system to life, making sure that all planned features work as intended and meet the requirements of the system.

This chapter deals with the implementation and testing of the online school library management system, and discusses the tools and technologies that were put into use during the process of creating the system.

4.1.1. Description of Implementation Tools and Technology

The tools utilized during the system implementation are listed below:

- Visual Studio Code 2022 (v1.70.2) as the Integrated Development Environment (IDE).
- XAMPP: XAMPP is an open-source, cross-platform web server solution stack package that is widely used for web development. It provides a local server environment to run and test web applications on a computer before deploying them to a live server.

The following technologies were used in the coding and implementation phase of the online school library management system:

- **PHP (Hypertext Preprocessor)**

  PHP is a popular server-side scripting language designed for web development. It is embedded within HTML and is used to create dynamic content, manage sessions, and interact with databases.PHP was used as the backbone of the system's server-side logic. It handled the core functionalities like processing user requests, managing sessions, interacting with the MySQL database, and generating dynamic content on the web pages (Khandelwal. A. 2023).

- **Bootstrap**

Bootstrap is a powerful front-end framework that includes CSS and JavaScript components for creating responsive and mobile-friendly websites. It simplifies the design process with pre-built components like navigation bars, forms, buttons, and grid layouts. Bootstrap was used to design a responsive and visually appealing interface for the Online School Library Management System. It helped to quickly build a clean and consistent User Interface without having to write extensive CSS from scratch (Sharma. M. 2023).

- **CSS (Cascading Style Sheets)**

  is used to style and layout web pages, enhancing the appearance of HTML elements with colors, fonts, spacing, and overall aesthetics. CSS was used to customize the styles of the webpages of the system, thereby making it more engaging and user-friendly (Keith. J. 2023).

- **JavaScript**

JavaScript, often abbreviated JS, is a programming language which is used to create interactive and dynamic elements on webpages (Simpson, 2023).

JavaScript was implemented to add interactivity to the online library's interface. It was essential for validating user inputs and managing form submissions (Simpson, 2023).

- **MySQL (My Structured Query Language)**

MySQL is a widely used open-source relational database management system that stores and manages data. It allows the execution of queries to retrieve, insert, update, and delete data efficiently. MySQL was used as the database system for the Online School Library Management System to store all the data related to books, users, and other relevant information (Stokes, 2023).

- **HTML (Hypertext Markup Language)**

    HTML is the standard language for creating the structure and layout of web pages. It defines the elements like headings, paragraphs, links, and forms that make up the content of a website. HTML was used in the system to create layouts of various sections such as the user dashboard, and to create forms such as the user registration form (Robbins, 2023).

4.1.2. Screenshots of the System
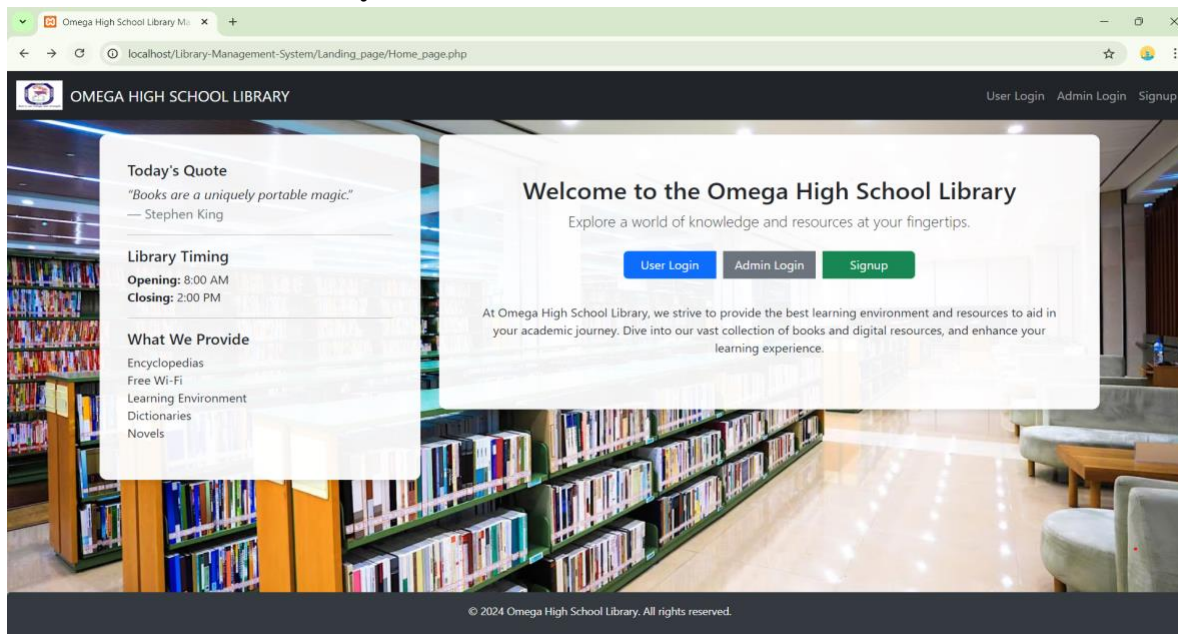
Figure 6. Web Application Homepage

The figure above represents the homepage or landing page of the online school library management system.

Figure 7. Administrator Dashboard Page
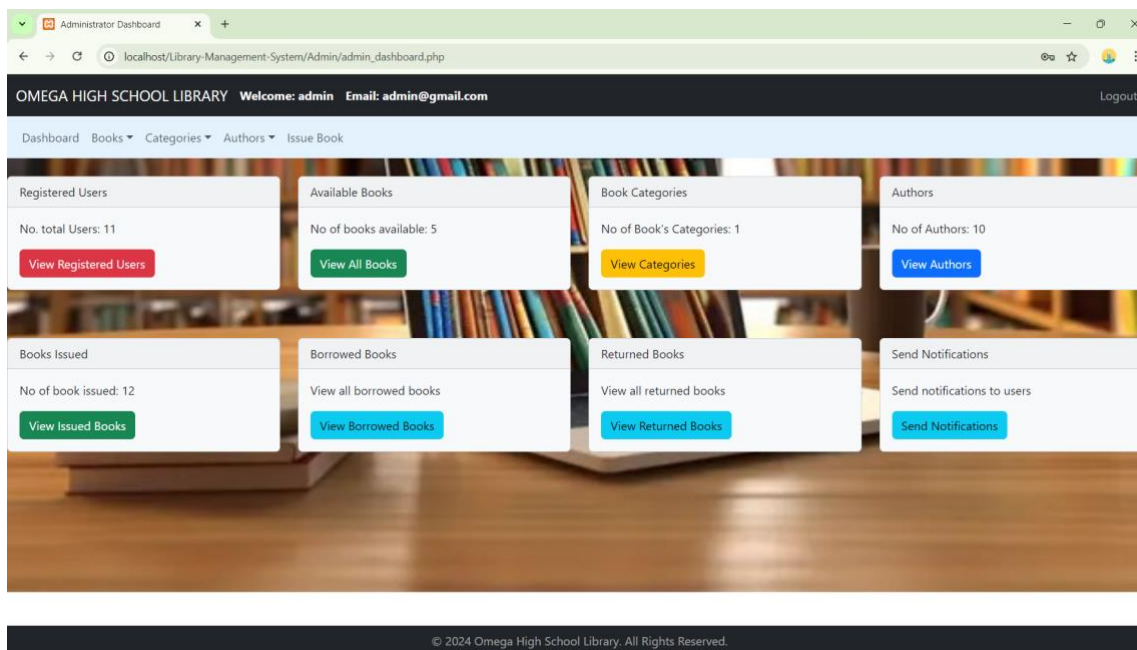
This is the page through which the librarian manages the overall library operations of the system.
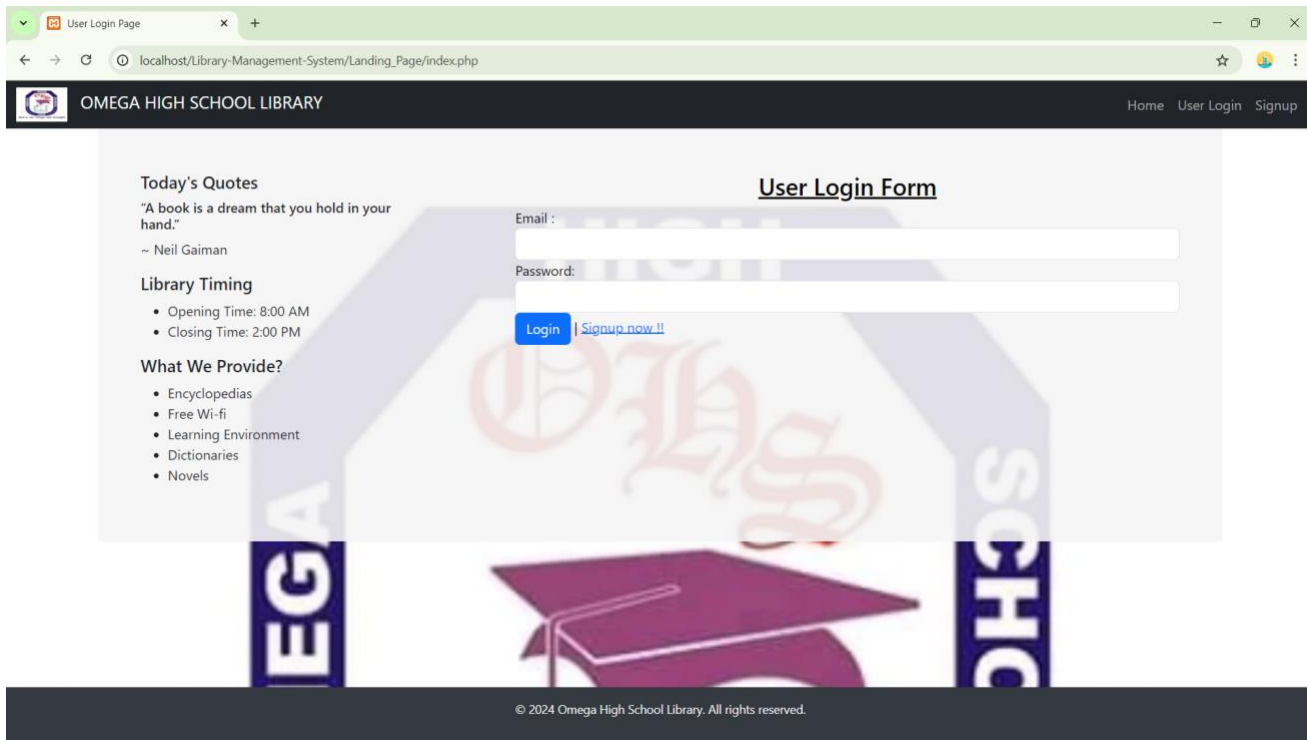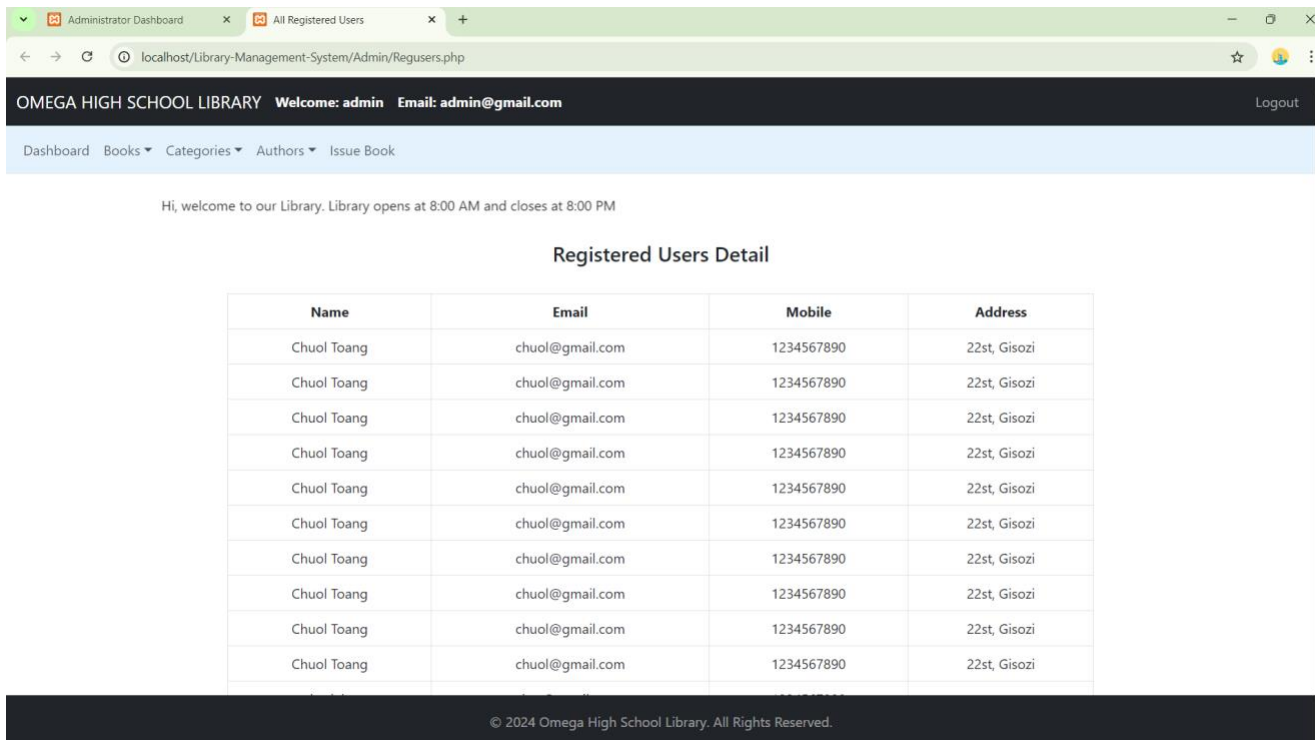
Figure 8. User Login Page

The figure above represents the user login page. This is the page through which users can gain access to the online library services.
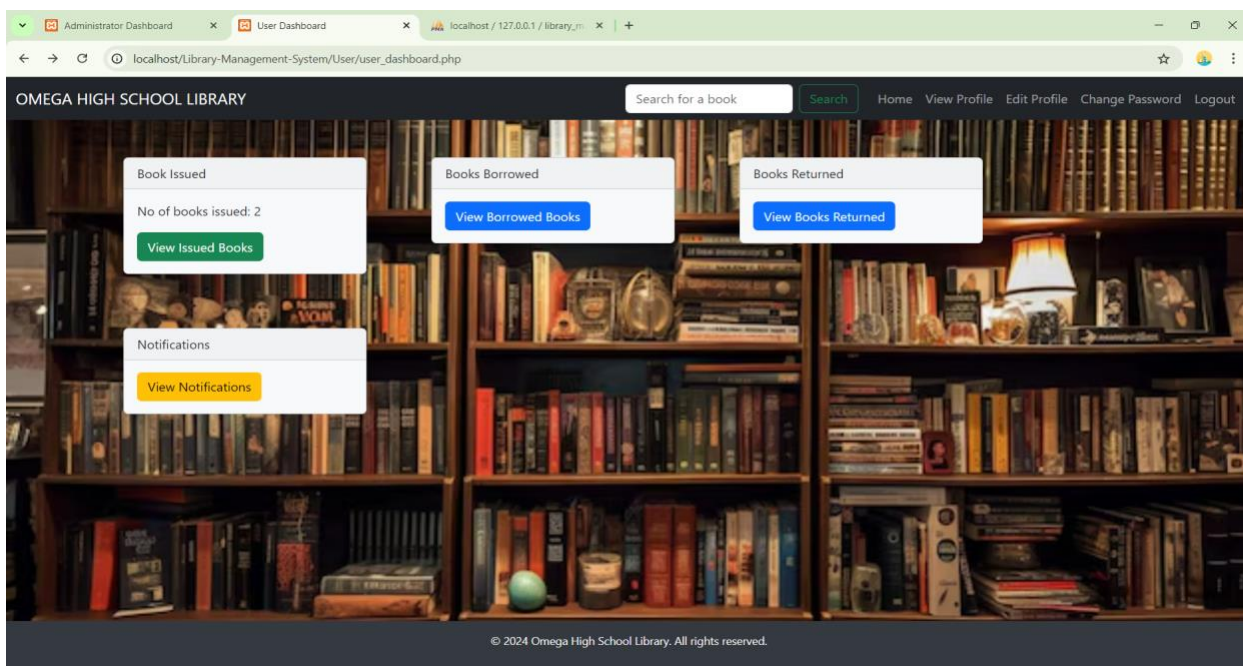
Figure 9. User Dashboard Page

The image above represents the user dashboard page. This is where the users perform their library functions such as searching for books, and borrowing books.

Figure 10. Registered Users Page

The image above represents a module on the administrator's dashboard which displays the details of all users that are currently registered on the system.

4.2. Testing

Testing involves the process of evaluating an application or a system in order to identify and resolve any defects or errors within the system. System testing is a critical phase in the software development lifecycle where the entire system is tested as a whole to ensure that it meets the specified requirements and functions correctly. This phase involves evaluating the complete and

integrated software to validate that it performs as expected in various scenarios, including normal, edge, and error conditions.

4.2.1. Introduction

In the field of software engineering, system testing is a pivotal phase where the entire integrated system is evaluated to ensure that it meets the defined requirements and performs as expected. It is one of the final testing stages in the development process and plays a crucial role in verifying the overall behavior and quality of the software product before it is released to users. During the process of system testing, various types of tests are conducted, such as functional testing, performance testing, usability testing, and security testing. The goal is to identify any defects or issues before the software is deployed to the end users. This phase verifies that all components and modules of the system work together seamlessly and that the system meets the quality standards for reliability, usability, and efficiency.Spencer, L. K. (2021). Enhancing User Experience in Learning Management Systems: The Role of Profile Management and Personalization. Routledge.

Ultimately, system testing helps ensure that the software not only meets the functional requirements but also performs well under load, handles data correctly, provides a good user experience, and is secure from vulnerabilities. By thoroughly testing the system, developers can locate and fix issues early, reducing the risk of problems in the production environment.

4.2.2. Unit Testing Outputs

Unit testing involves the process of testing the individual components of the online school library management system in order to ensure that they function correctly.

Test Case: Verify User Registration

This test case verifies the functionality of the user registration module of the Online School Library Management System by checking if a new user can register with valid input data.

Table 8. Test Output:

User Details	Input Data	Description	Test Result
Name	Caleb Ella	Input username	PASS
Email	caleb@gmail.com	Input valid email	PASS
Password	caleb1234	Input password	PASS
Phone_number	0781223457	Input phone number	PASS
Address	KK 77 Street	Input address	PASS

Table 8. Unit testing Output

4.2.3. Validation Testing Outputs

Validation testing is a type of software testing that ensures that the online school library management system meets the required needs of the end users.

Test Case: Validate Error Messages for Empty Fields

This test case ensures that the Online School Library Management System displays error messages when required fields are left empty during the registration and login processes.

Figure 11. Error Message Validation

Test Result: Pass

4.2.4. Integration Testing Outputs

Integration testing of the online school library management system involves the process of testing how the individual components of the system function when combined together as a group.

4.2.4.1. Integration Test Case: Integration of Admin Notification System with User Dashboard

This test case ensures that the notifications sent by the admin are correctly displayed in the user's profile on the User Dashboard page.

Test Steps:

1. Admin sends a notification to a user.

2. User receives the notification on the user dashboard.

Expected Result:

The notification appears in the user's dashboard under the "View Notifications" block.

Actual Result:

The notification appears on the user dashboard and the user successfully receives the notification sent by the admin without any issues.
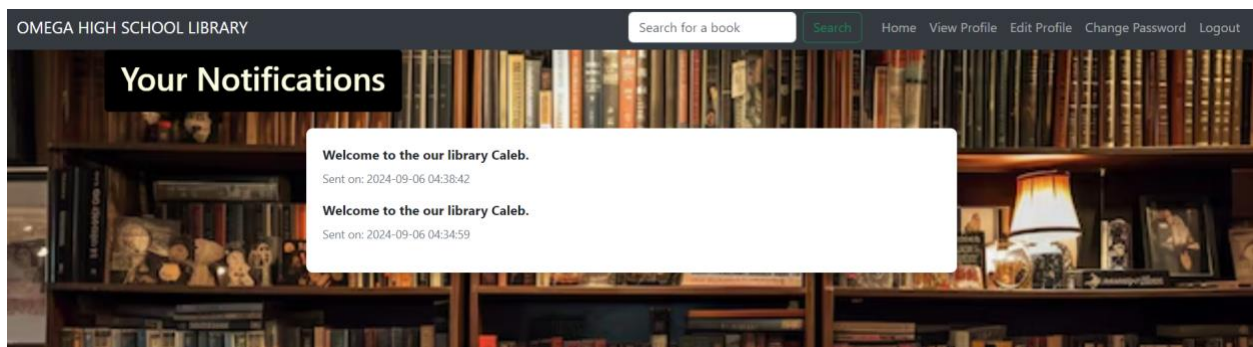
Figure 12. Notification Integration Test

Test Result: Pass

4.2.5. Functional and System Testing
4.2.5.1. Test Case: User Login with Correct Credentials
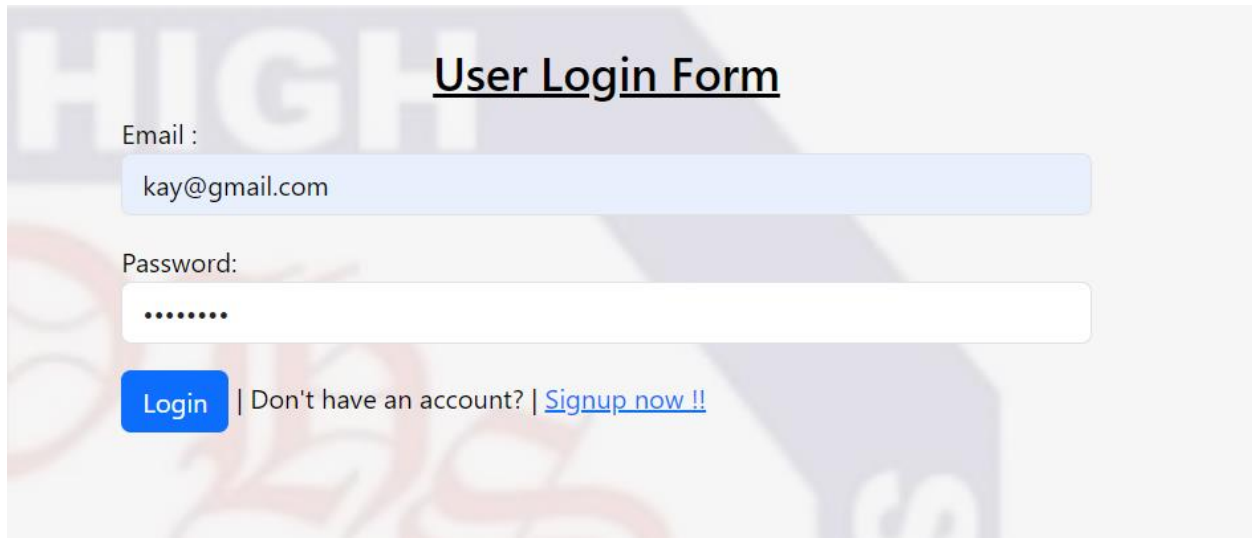
This test ensures that users can login with a valid email and password.

Test Steps:

- Navigate to the user login page.

- Enter valid email and password.

- Click on the login button.

Actual Result: User has successfully logged in and is redirected to the user dashboard page.

Figure 13. User Login Test

Test Result: Pass

4.2.5.2. Test Case: Book Search Functionality

This test verifies that the book search feature returns correct results based on the search criteria and the availability of the book in the database.

Test Steps:

Enter the name of a book in the search bar.

Actual Result:

The name of the book is displayed in the search results.

Figure 14. Book Search Test

Test Result: Pass

4.2.5.3. Test Case: Editing User Profile Information

This test ensures that users can edit their profile information once they have logged into their accounts.

Test Steps:

Change profile information such as address or phone number.

Actual Result:

User profile is successfully updated with the newly entered information.

Test Result: Pass

4.2.5.4. System Testing Outputs
4.2.5.4.1. User Interface Consistency

This test ensures consistency across different pages and components of the online school library management system.

Actual Result:

The user interface is consistent across all pages and components of the system.

Test Result: Pass

4.2.5.4.2. Test Case: Form Layout and Usability

This test ensures that all forms within the online school library management system are easy to use and visually appealing.

Actual Result:

All forms within the system are well-aligned, easy to use, and visually consistent with the interface design.

Test Result: Pass

4.2.6. Acceptance Testing Report:

Date: 19th August, 2024

Project Name: Online School Library Management System

Tester: Ella Caleb Adah

The acceptance testing phase aimed to confirm that the Online School Library Management System has met the specified requirements of the system and is now set for deployment.

4.2.6.1. User Login Test:

This test verified that users can login successfully with a valid email and password.

Outcome:

Pass

Comments:

The user login process functions seamlessly allowing users to access their dashboards without any issues.

4.2.6.2. Book Search Test:

Description: Verifies that users can search for books available in the library's database.

Outcome:

 Pass

Comments:

Users are able to successfully search for books available in the database by typing the name of the book in the search bar.

4.2.6.3. Overall Assessment:

The acceptance testing phase has certified that the Online School Library Management System has met the specified requirements of the system and is suitable for deployment.

4.2.6.4. Recommendations:

Sign-off: I, Ella Caleb Adah, hereby sign off on the acceptance testing of the Online School Library Management System.

Signature:

…………………………………………………………………………………..

4.3. CONCLUSION AND RECOMMENDATIONS
4.3.1. CONCLUSION

The major goal that this research project aims to achieve is to streamline the processes involved in managing school libraries. With this system in place, library processes such as book acquisition and return will be made easier. It will also help to reduce the manual effort put in by library administrators in maintaining and coordinating the activities of the school library.

During the course of this research, the researcher has brought up viable solutions to rectify the problems associated with the existing system, and was also able to achieve the set objectives. In the course of implementing the new system, a well-functional database was developed in order to improve the management of user data. In addition to that, the school library of the case study now has a user-friendly interface which enables students to perform library operations with ease.

Finally, the administrators are now able to generate accurate reports concerning the library, ensuring that records are kept efficiently. The development of the Online School Library has played a vital role in enhancing the current library of Omega High School Jos, increasing its efficiency and overall productivity.

4.3.2. RECOMMENDATIONS

Based on the findings and conclusions of this study, the following recommendations are proposed in order to enhance the functionality and effectiveness of the Online School Library Management system:

● **System Enhancement and Expansion**

It is recommended to continuously improve and expand the system by incorporating advanced features such as machine learning algorithms for predictive analysis, personalized book recommendations, and automated content categorization. These enhancements would further optimize the user experience and ensure the system remains relevant to evolving user needs.

● **Regular Maintenance and Updates**

Regular maintenance and structured updating are highly recommended to fix bugs, reduce security risks, and introduce new features when needed. A scheduled maintenance plan needs to be developed which will ensure that the online school library management system remains secure, and up-to-date.

● **User Feedback Mechanism**

Setting up a continuous feedback mechanism from the end-users is crucial for the improvement of the library's system. A feedback feature should be developed on the system which will enable users to provide feedback on the problems they faced while interacting with the system, suggest features, and provide general input. This approach will foster a user-centered design and facilitate iterative enhancement of the system.

● **Enhanced Data Security Measures**

As the online school library management system deals with the sensitivity of user data, it is recommended to implement enhanced security measures, including encrypted data storage, two-

factor authentication, and regular security checks. This will protect the system by preventing unauthorized access and ensure compliance with data protection regulations.

- **Promotion of Digital Literacy**

The successful implementation of the online school library management system also relies on promoting digital literacy among its users. Initiatives to enhance digital literacy, particularly among students and staff with limited technological skills, should be prioritized to ensure equitable access and use of the system.

4.3.3. FUTURE WORK

The development of the online school library management system marks a significant step toward improving library services and user experience within the educational institution. However, there are several areas where further research and development could enhance the system's capabilities and overall impact. The following are some improvements and modifications that can be added to the system in the long run:

- **Incorporation of Artificial Intelligence for Personalized User Experience**

Incorporating artificial intelligence (AI) could further personalize the user experience of the online school library by providing tailored book recommendations based on user behavior, preferences, and borrowing history. AI-driven chatbots could also be added to assist users with queries and guide them through some functionalities of the system

- **Incorporation with External Library Networks**

Another future improvement that can be made is the integration of the system with external library networks. This will help to enable resource sharing and inter-library loans. This would also broaden the range of available library resources and foster collaborative academic opportunities.

- **Expansion of Digital Content Management**

In the long run, the digital resources available in the online school library can be expanded. Improved library resources such as e-books, audio books, and multimedia features can be added to the system. This would provide users with diverse learning options, thereby enhancing the overall value of the online school library management system.

4.3.4. SUMMARY

This project was centered on the development of an online school library management system for the case study: Omega High School, Jos. The system was implemented in order to improve the way the school library is managed, by streamlining its activities, and reducing the amount of manual effort required by administrators of the school to maintain the library.

The system allows students to digitally create accounts which enable them to perform their library operations digitally. The students interact with the web based application through a user-friendly interface. This allows them to search for books and resources, borrow books, return books, and get important updates concerning the library activities. The system also provides functionalities for the library administrators to manage the school library with ease. The system was developed using technologies such as PHP, CSS, MYSQL, and HTML. These technologies

helped in the coding and implementation of the system development process. The system was tested thoroughly in aspects such as usability, user friendliness, security, and functionality.

Recommendations for the enhancement of the system included features such as the expansion of digital content management, incorporation of artificial intelligence features, and collaboration with other external library entities.

In general, the overall development of the online school library was successfully implemented, enhancing and streamlining library operations and reducing the stress involved in managing the library. The system has made the Omega High School library an improved center of knowledge.

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APPENDICES
Source Codes

Figure 15. Part source code for the homepage

The figure above shows a segment of the source code that was used to create the homepage.

Figure 16. Part source code for Administrator Dashboard Page

The image above shows a segment of the source code that was used to create the administrator dashboard page.

Figure 17. Part source code for User Login Page

The figure above represents a part of the source code that was used to create the user login page.

Figure 18. Part source code for User Dashboard Page

The figure above shows part of the source code that was used to create the user dashboard page.
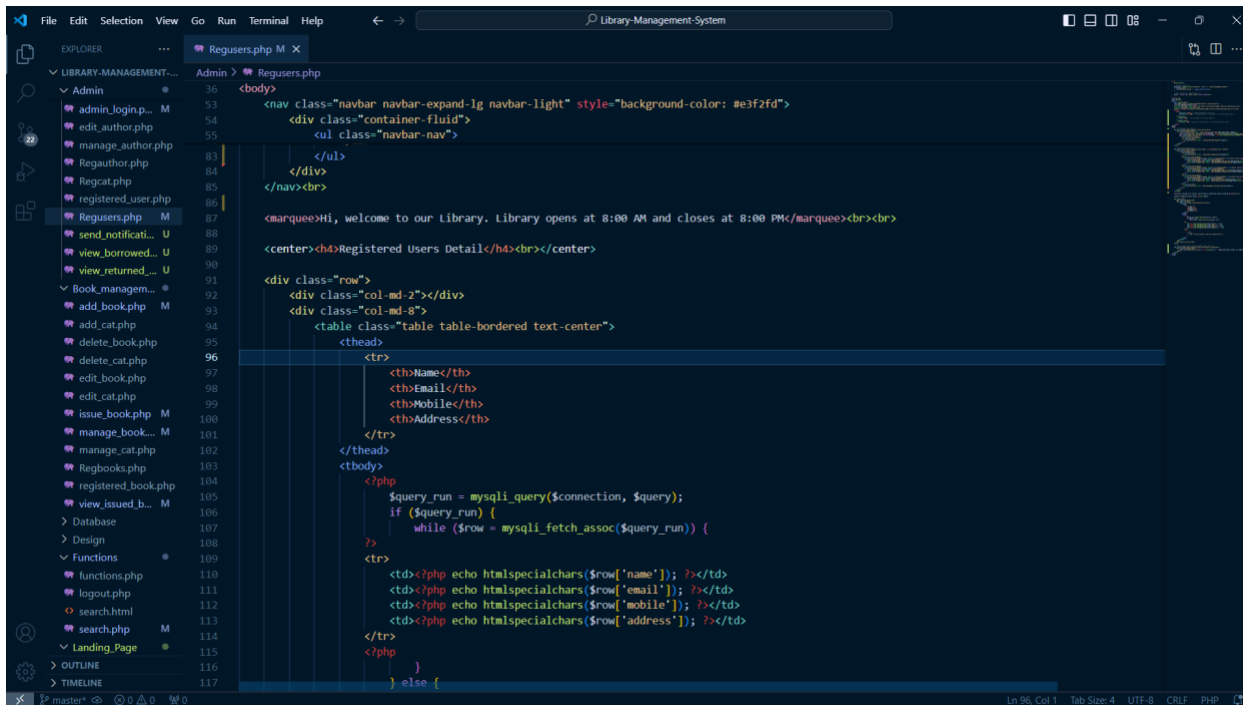
Figure 19. Part source code for Registered Users Page

The figure above shows a part of the source code that was used to design the registered users page.

TIME FRAME

Table 9. Time Frame

Task	Start Date	End Date	Day Complete
Data Collection	10-May	25-May	15
Analysis	25-May	5-June	10
Design	5-June	15-June	10
Coding	15-June	20-Aug	66
Testing	21-Aug	2-Sept	12
Maintenance	2-Sept	15-Sept	13

Questions

- How are users able to carry out library operations such as borrowing and returning of books?

- How are users' records and data handled within the system?

- How are students and librarians able to manage their respective activities on the system?

- How are the books and other resources located within the system?