

Design and Implementation of a University Resource Booking and Management System in Nigeria.

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Abstract—This study addresses the inefficiencies in managing and booking university resources caused by manual or fragmented systems by developing a centralized web-based platform for real-time resource allocation and scheduling. Using a structured development approach, the system was built with React, Express.js, and PostgreSQL within a three-tier architecture to ensure scalability and performance. The resulting system allows students, lecturers, and administrators to easily view availability, make bookings, and receive immediate feedback, while also enabling administrators to oversee and control resource usage. Findings show that the system reduces scheduling conflicts, minimizes delays, and improves overall efficiency in resource management. Ultimately, it provides a reliable and user-friendly solution that enhances academic planning, with future improvements recommended to include mobile support, AI-driven scheduling, and integrated notification systems.

Index Terms—Resource allocation, Booking rights, Room type, Centralized calendar, Channel management, Event spaces, Course scheduling, Initiation phase, Planning phase, Work breakdown schedule, Data security, Analytics and reporting, User roles and permissions, Integration, Continuous improvement.

I. INTRODUCTION

A. Background to the Study

Resource management is a very crucial role that helps in the development of the university, the staff, and the students at the school. Coursera (2023) Resource management ensures the availability of resources needed to complete tasks [1]. It is also the ability to manage and organize resources so they are easy to access. University resource management problems include poor maintenance, understaffing, lack of student awareness, and inadequate security. Ivona Zakarija et al. (2025) Many universities still create timetables inefficiently, with repeated data entry

across multiple systems [2]. Anisulowoen et al. (2024) The Nigerian education system struggles with limited resources and poor maintenance [3]. CollegeNET (2024) Higher-ed scheduling problems include double bookings, resource misuse, and overlooked needs [4]. The inefficient management of university facilities may vary from university to university. Kehinde (2023) Facility management is an integrated corporate function in a culturally diverse and technological complex public corporation [5]. Causes of inefficient management of university facilities are poor planning, poor funding, and corruption. Azubuike et al. (2024), Corruption was identified as the leading cause of inefficient management of university facilities [6]. A poor resource management effect on universities is a decline in academic performance. Class scheduling affects student performance more in quantitative subjects than in qualitative subjects. The major importance of facility management in education is that it creates a conducive environment for children to learn. Manual resource booking systems are easy to set up and maintain, requiring minimal technical expertise or infrastructure, making them suitable for small institutions or those with limited budgets. Methods of scheduling lecture halls traditionally include; paper-based timetables, manual logbooks, spreadsheets (non-automated), and static bulletin boards. Resource booking systems that exist in universities include: Ecobook, YAROOMS, Resource booker touch, MRBS (Meeting Room Booking System). The limitations of manual resource booking systems are; Time consuming, High administrative workload, Error prone, Customer frustration, Limited availability, Inefficient communication, Lack of integration. Bookinglive (2021) Choosing the right online booking system is essential to ensure security, reliability, and scalability [7]. OM (2025) Excel is not ideal for resource planning due to its lack of real-time data, and

high risk of errors [8]. Using Excel for resource planning is a less effective and outdated method for modern, complex resource management compared to dedicated software. A web-based resource booking system is an online platform that allows users to reserve and manage resources, while a University Facility Management System centralizes the control of facilities, including booking, maintenance, scheduling, reporting, access control, notifications, and mobile access. O'Connor (2024) Automation in academic scheduling improves efficiency in admissions, advising, and student services [9]. A Database Management System manages data; this project builds a web system to prevent booking conflicts and optimize resource use.

B. Statement of the Problem

The major problem observed in universities is the difficulty in effectively managing and accessing limited academic resources such as lecture halls, laboratories, and equipment. These resources are often not enough for the large number of students and staff who need them, making proper allocation a challenge. In many cases, students and staff find it difficult to access these resources when needed due to poor coordination and lack of clear information about availability. Most universities still rely on manual methods such as paper records, logbooks, or spreadsheets, while some use basic systems that are not centralized or automated. These methods are time-consuming, prone to errors, and can lead to issues like double booking, loss of records, and delays in the booking process. They also lack real-time updates and proper communication across departments. As a result, there is a need for a centralized and automated system that can improve both the management and accessibility of these limited university resources. The aim of this study is to design and implement a university resource booking and management system that will be efficient in resource management, double booking, and good coordination between departments. It will help in time saving, automated reply, it will be open all day. It will have user privacy and security. It will be easy to know when issues arise. Additionally, the system aims to improve tracking, resource usage, support real-time updates and notifications, allow role-based access control, reduce administrative workload, and enhance user experience through a user-friendly interface. It will also be scalable to accommodate

future institutional growth and technological integration. The system will integrate with university platforms and provide reports to streamline operations and support administrative decisions.

C. Aim and Objectives

The aim of this study is to design and implement a university resource booking and management system. The specific objectives are to:

1. design a university resource booking and management system.
2. implement the proposed model.
3. evaluate the developed model

D. Methodology

The university resource booking system was designed and implemented using React for the frontend, Express.js for the backend, and PostgreSQL for database management. The system was developed within a structured development environment and tested to evaluate its effectiveness in preventing double bookings and improving overall booking efficiency.

E. Scope of the Study

The system will focus on managing and booking university resources such as lecture halls, laboratories, and other facilities within the campus. The beneficiaries are students, lecturers, and administrative staff who need to reserve or manage university resources. The features include user registration and authentication, booking and cancellation of resources, approval and notification system, resource availability tracking, and the administrative dashboard. Geographically, the study is limited to universities within Nigeria. The work will cover the design, implementation, and testing phases of the system but will not extend to large scale deployment. It will also exclude integration with other university systems or payment platforms. The system will be a web-based application developed using specific technologies. It will not handle external institutions, it will not replace existing university enterprise resource planning systems but serve as a supportive module, it will not include advanced analytics.

F. Significance of the Study

It provides an efficient and reliable way to manage university resources; the system will eliminate manual methods of booking. For students and lecturers, it offers convenience by allowing them to check availability and make reservations online without physical paperwork or delays. For administrative staff, it reduces workload and improves coordination by providing an organized database for tracking and approving resource requests. The project will enhance productivity, save time, and promote accountability in resource management within universities in Nigeria. It will serve as a reference for future research and development of similar systems in Nigerian universities. The system promotes data accuracy and accountability, supports decision making by providing useful reports on how resources are utilized, helping management plan for future improvements or expansions, it helps protect user data and privacy by securing it from unauthorized access or hacking through proper authentication and data management techniques.

II. LITERATURE REVIEW

A. University Resource Management

Efficient management of physical and digital assets is a critical administrative function within universities, directly impacting the quality of teaching, research, and operational efficiency. The traditional approach to resource allocation, often reliant on paper-based forms, spreadsheets, or siloed departmental systems, has been widely documented as prone to inefficiencies, Adeyemi et al (2022) [10]. As noted, these manual methods frequently lead to double-bookings, underutilization of high-value assets, and a significant administrative burden on staff. The core challenge lies in the centralized coordination of a diverse portfolio of resources including lecture halls, laboratory equipment, and meeting rooms across multiple competing departments and user groups, Nakisozi et al. (2022) [11]. This often results in a sub-optimal experience for both staff and students, who may face difficulties in accessing necessary resources for their academic activities. The transition towards automated, centralized systems is therefore not merely a technological upgrade but a strategic imperative for modern educational institutions seeking to enhance resource visibility and operational fluidity.

B. Conceptual Framework

Concept of Resource Management Resource management refers to the process of effectively planning, allocating, and using an organization's resources physical, human, and infrastructural to meet ongoing objectives. In a university context, resources include classrooms, laboratories, equipment, staff availability, and other facilities, Ogundele, M. O., & Adebayo, A.S (2021) [12]. Good resource management ensures optimal utilizations, minimizes scheduling conflicts, and reduces idle time of resources. In many Nigerian universities, resource allocation is done manually, which often leads to overlapping bookings, underutilization, and difficulty in tracking usage overtime.

Concept of Booking Systems A booking or reservation system is one that allows users to reserve or schedule resources or services in advance. These systems may be manual or automated. Automated (or computerized / web-based) booking systems offer several benefits over manual ones, such as immediate feedback on availability, less administrative overhead, fewer errors, and better user satisfaction, Kusuma, W. H., Yulianingish, R., & Nurhidayati, I. (2021) [13]. In this project, the booking system will allow university staff and students to see availability of resources and make bookings online.

Concept of Database Management Systems (DBMS) A Database Management System is software that provides tools for defining, storing, updating, retrieving, and managing data in a database, Adebayo, & Lawal, F. H. (2022) [14]. Components include the database engine, schema, query processor, transactions management, users, resources, bookings, availability, and history. Using a robust DBMS helps ensure data integrity, avoid redundancy, and support scalability. Common DBMS platforms include MySQL, PostgreSQL, and Oracle.

Concept of System Design and Implementation System design involves translating requirements into architecture, components, interfaces, and data structures through tools like requirement specification, UML (use-case diagrams, class diagrams), data flow, diagrams, entity-relationship diagrams, and interface design, Martins, R., & Duarte, M. (2023) [15]. Implementation is the actual building, coding, testing, and deployment of the system. For your project, technology choices (programming language, framework, and database), user interface design,

security, performance, and maintainability are important, Pressman, & Maxim, B. R. (2020) [16].

Concept of Web-Based Systems A web-based system is an application that runs on a web server and is accessed through a web browser over a network such as the internet or an intranet. Unlike traditional desktop applications, web-based systems can be accessed from anywhere and do not require installation on individual devices. Such systems use a client server architecture, where the client (browser) sends a request to the server, which processes the request and returns the desired output. Technologies used in web-based systems include HTML, CSS, JavaScript, React for the frontend, Express.js and Node.js for the backend, and PostgreSQL for database management. In a university setting, a web-based booking system allows students and staff to access services remotely and efficiently, reducing administrative burden.

C. Theoretical Framework

Two theories relevant to this research are:

Systems Theory: Views an institution (university) as a system made of interrelated subsystems (class scheduling, labs, equipment usage, etc.). Helps in understanding how changes in one part (e.g. resource booking) affect others, Adeyemi, J. K., & Adekunle, K. S. (2022) [17].

Information Systems Theory, including Technology Acceptance Model (TAM): These theories help in understanding how users accept and adopt new systems. For example, ease of use and perceived usefulness are likely to influence whether university staff and students will use your booking system, Davis, F. D. (2020) [18].

Review of Related Works A review of related works on the design and implementation of university resource booking and management systems reveals several existing approaches, key functionalities, and challenges. The literature highlights a shift from traditional, manual booking processes (paper-based logs, physical key management) to more efficient, automated web-based or online platforms.

Online Resource Booking Systems Several institutions and organizations have adopted online booking systems to improve efficiency and service delivery. For example, Baluu was founded in 2021 and is a comprehensive online booking system tailored for

small businesses. Despite being a newer platform, it offers a robust set of features, including:

1. A user-friendly, no-code website builder for businesses that do not have an existing online presence.
2. A customizable widget for seamless integration into existing websites.
3. Tools for managing event listings, schedules, finances, and client communications from a single dashboard.
4. Integration with various payment gateways for secure online transactions.

Similarly, Oladimeji and Musa (2020) designed a Classroom Allocation System for tertiary institutions [19]. Their system automated the allocation of classrooms based on course schedules. Although effective, the system was not web-based and required installation on local computers, making it less flexible for remote users.

Web-Based Resource Management systems Chukwu and Eze (2021) proposed a Web-Based Resource Management System that managed staff and equipment resources in an academic environment [20]. The system featured a centralized system that stored all resource information and provided an administrative dashboard for tracking resource usage. However, the interface was not user-friendly, and the system lacked a robust authentication mechanism for user access control. Nwosu et al. (2022) also developed a University Facility Booking Platform using PHP and MySQL [21]. The system allows users to check resource availability and make reservations online. Despite its success, the system did not include automated notifications or real-time updates, which are essential for improving communication between users and administrators.

International Studies on Resource Booking Systems Internationally, universities have implemented more advanced booking and management systems. For instance, the University of Cambridge (UK) developed an Internal Resource Booking Portal that integrates with their campus management software. This system supports automatic synchronization with academic timetables and includes calendar-based visualization. However, systems are complex and require high maintenance costs, making them difficult to replicate in most Nigerian universities. Similarly, Kumar and Sharma (2020) developed a Smart Resource

Scheduling System using cloud technology [22]. The system allowed multiple users to book and manage resources concurrently with real-time updates. While the system achieved scalability and performance, it required continuous internet connectivity and cloud service subscriptions, which can be challenging in developing environments with limited resources.

Review of Related Technologies Various technologies have been utilized in developing resource booking systems. Many existing solutions employ PHP, MySQL, and JavaScript for backend and frontend development, Nwosu, & Ibrahim,A. (2022) [23]. These technologies are open-source, platform-independent, and suitable for developing dynamic web applications. Other systems have integrated mobile technologies using frameworks such as Flutter or React Native to provide cross-platform accessibility, Adedapo, O.A., & Ogunrinde M. A. (2023) [24].

However, many of the reviewed systems suffer from common challenges such as:

1. Lack of user-friendly interfaces.
2. Limited reporting or analytics features.
3. No integration with existing institutional systems.
4. Limited scalability and poor data security measures.

These limitations highlight the need for a more comprehensive, secure, and flexible system.

Summary of Gaps Identified in Related Works From the reviewed Literature and systems, it can be observed that:

1. Many systems are limited to specific resources, such as laboratories or classrooms, and do not provide a unified platform for managing all university assets (Oluwole & Adekunle, 2021; Ibrahim et al., 2023) [25].
2. Some are not web-based, which reduces accessibility, scalability, and ease of use for staff and students (Chukwu & Eze, 2022) [26].
3. Security and authentication mechanisms in several systems are often weak, exposing data to unauthorized access (Ahmed & Musa, 2024) [27].
4. Most systems lack real-time updates and automated notifications for booking confirmations, cancellations, and scheduling conflicts (Okafor & Bello, 2020; Johnson et al., 2023) [28].
5. Some are not designed for Nigerian university context, where internet connectivity and power supply are inconsistent, making them unreliable for continuous operation (Nwachukwu et al., 2021; Ezeh & Olorunfemi, 2025) [29].

This project, therefore, seeks to design and implement a web-based university resource booking and management system that addresses these challenges by providing:

1. Centralized management of various university resources.
2. Real-time availability updates.
3. User authentication and role-based access control.
4. Accessibility via the web from any device.
5. A user-friendly and interactive interface.

Table 1 Summary of Reviewed Literature

Author(s) & Year	Title of Publication	Aim/Objectives	Methodology	Findings	Recommendations	Research Gap(s)
University of Cambridge (2021)	Resource Booking Portal	To integrate booking with university timetable	Web portal integration	Real-time Findings	Simplify maintenance	High-cost complex for replication
Oladimeji & Musa (2020)	Classroom Allocation System	To automate classroom allocation	Local software development	Automated classroom scheduling	Convert to web-based platform	Not accessible remotely
Chukwu & Eze (2021)	Web-Based Resource Management System	To manage academic staff and equipment	Centralized database, web interface	Centralized tracking of resources	Improve user interface	Weak authentication, poor usability
Nwosu et al. (2022)	University Facility Booking Platform	To facilitate facility booking and availability checks	PHP/MYSQL	Simplified booking process	Add real-time updates	No automated notifications
Kumar & Sharma (2020)	Smart Resource	To allow concurrent	Cloud-based system	Scalable and efficient	Reduce dependence on cloud	Requires constant internet

	Scheduling System	resource booking using cloud				
Rahman & Uddin (2020)	Modern Web-Based Systems	To evaluate backend frameworks for resource systems	Review methodology	PHP/MYSQL proven effective	Include mobile integration	Limited focus on academic environments

III. METHODOLOGY

The methodology adopted in the design and implementation of the University Resource Booking and Management System. It explains the tools, techniques, and design considerations used to ensure that the developed system is reliable, scalable, and user-friendly. The design process includes the system architecture, database design, flowchart, and use case modeling. Each diagram is discussed before presentation as required by the departmental template. System analysis involves understanding and specifying the functional requirements of the proposed system. The current manual approach to booking university resources such as classrooms, laboratories, and halls is time-consuming and error-prone. The proposed system automates this process, thereby improving efficiency and reducing scheduling conflicts. System design defines the overall structure and behavior of the system. It includes logical and physical components that work together to achieve the desired functionality. Proper system design ensures maintainability and scalability.

System Architecture; The system is based on a three-tier architecture consisting of the presentation layer, application layer, and database layer. This approach promotes modularity and scalability (Tojiev, 2025) [30].

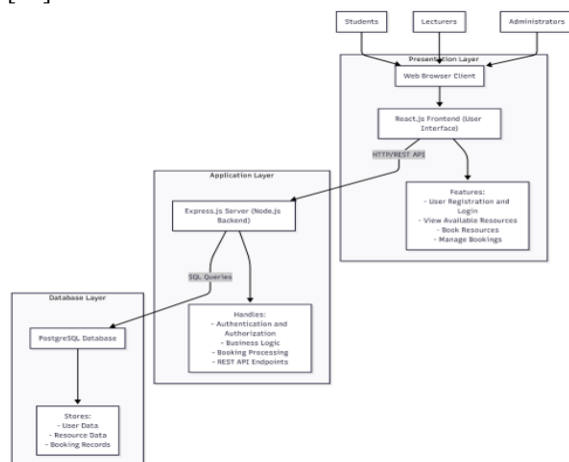


Figure 1 shows the system architecture of the developed application.

The database design ensures efficient storage, retrieval, and management of data. It uses an Entity-Relationship Diagram (ERD) to represent entities such as Users, Resources, Bookings, and their relationships. The use case diagram is an interaction between users (students, lecturers, administrators) and the system. It captures functionalities such as booking resources, approving requests, and viewing schedules (Kusuma et al., 2021) [31].

The system flowchart explains the logical flow of activities in the booking process, from user login to confirmation of resource booking. It helps identify dependencies and potential errors (Pressman & Maxim, 2020) [32].

System implementation involves translating the design into a working application. The system was developed using React for the frontend and Express.js for backend development, with PostgreSQL as the database management system. Visual Studio Code was used as the development environment, and a local development server was configured for testing and deployment. The incremental model was adopted to allow for iterative development and continuous testing. Development Stack:

1. Front-end: React
2. Back-end: Express.js
3. Database: PostgreSQL
4. Server Environment: Visual Studio Code
5. Development Approach: Incremental model
6. Architecture: Three-tier architecture (Presentation, Application, Database layers)

System Testing Testing was performed at various levels to ensure that all modules functioned correctly. Unit testing verified each component, integration testing ensured that modules worked together, and user acceptance testing validated the system against user needs.

1. Unit Testing: Individual component verification
2. Integration Testing: Module interaction testing
3. User Acceptance Testing: Validation with university stakeholders

4. Performance Metrics: Booking accuracy, response time, conflict resolution

Feedback will be collected through testing phases and used to improve system functionality and user experience.

System Evaluation This system demonstrates clear superiority over existing solutions by combining a robust, scalable three-tier architecture with a context-aware design made for Nigerian universities. It eliminates the critical flaws of manual and basic digital systems, such as double-booking, and poor security through automated conflict detection, role-based access, and real-time notifications. Furthermore, its incremental development approach and use of a proven, cost-effective technology stack (Express.js, PostgreSQL) ensure a reliable, maintainable, and user-friendly platform that directly addresses the unique infrastructural challenges like unstable internet, setting it apart from both outdated local methods and ill-fitting international software.

Ethical Consideration This study was carried out in line with institutional research ethics guidelines. User data involved in the University Resource Booking and Management System was treated with strict confidentiality and used solely for research purposes. Only necessary information required for booking was collected, and no personal data was shared with any unauthorized third party. Participation during testing was voluntary and posed no risk or harm to any individual. All external sources used in this research were properly referenced to maintain academic integrity.

IV. SYSTEM IMPLEMENTATION AND EVALUATION

The implementation of the University Resource Booking and Management System involved the integration of several web development technologies to produce a functional and efficient application for managing university resources. The system was developed using Express.js for backend operations, PostgreSQL for database management, and React for the frontend interface, while a local Node.js development environment was used for testing and deployment. Express.js was selected for its effectiveness in handling server-side logic, processing user requests such as registration, login, and resource booking, and enabling seamless interaction between

the user interface and the database. Its compatibility with PostgreSQL and support for dynamic content generation made it suitable for implementing the core functionalities of the system. PostgreSQL was used to manage and store data related to users, available resources such as lecture halls and laboratories, and booking records. The use of structured query language (SQL) ensured efficient data storage, retrieval, and manipulation, while security measures such as password hashing were implemented to protect user credentials from unauthorized access. In addition, React was utilized to design a responsive and user-friendly interface that allows users to easily navigate the system, check resource availability, and submit booking requests. A local Node.js development environment was used for testing and deployment of the system, supporting Express.js execution and PostgreSQL database integration. The system was developed using the incremental model, which enabled the project to be built in stages with continuous testing and refinement of each module before integration. Furthermore, the system adopted a three-tier architecture consisting of the presentation layer, application layer, and database layer, ensuring proper separation of concerns, improved maintainability, and scalability. Through the effective integration of these technologies and design approaches, the system achieved efficient data processing, secure authentication, and reliable booking management, thereby providing a practical solution for minimizing scheduling conflicts and improving the utilization of university resources.

Testing of the Application the University Resource Booking and Management System underwent thorough testing to ensure it functions as intended, meets all requirements, and provides a seamless experience for users. Two main types of testing were carried out: alpha testing and beta testing. Alpha testing focused on evaluating the internal functionality of the system, identifying and fixing any errors, and ensuring that the booking and management features met the expectations of stakeholders, including students, lecturers, and administrators. During this phase, usability tests were conducted by asking a selected group of users to perform specific tasks, such as registering accounts, viewing available resources, submitting booking requests, and managing bookings. Feedback from these users helped improve navigation, interface responsiveness, and overall ease of use.

Performance testing was also conducted to simulate multiple simultaneous users, verifying that the system could handle numerous booking requests efficiently without slowing down or crashing. After alpha testing, beta testing was conducted with external users who were not involved in the development phase. This group included students and administrators who interacted with the system in real-world scenarios, submitting bookings, checking resource availability, and reviewing administrative controls. Their feedback was carefully collected and analyzed to make final improvements to the system, ensuring that any remaining bugs or usability issues were addressed. The combination of alpha and beta testing ensured that the system is reliable, secure, and user-friendly, with efficient booking management and resource allocation. Overall, this testing process validated the system's functionality, performance, and readiness for deployment, providing a practical and dependable solution for managing university resources effectively.

Hardware Requirements

1. Computer with Core i3 processor or higher
2. Minimum 8 GB RAM
3. Minimum 256 GB storage (hard disk or SSD)
4. Internet connection
5. Windows, MacOS, or Linux operating system
6. External hard drive or cloud storage for backups
7. Web browser (latest version of Chrome, Firefox, or Edge)

Software Requirements The system relies on a specific set of software requirements to ensure its proper functioning and optimal performance. It supports multiple web browsers such as Chrome, Firefox, and Edge. The development was primarily implemented using:

1. **Development Tools & IDEs:** VS Code for coding, Node.js (Express.js) for backend development, and PostgreSQL for database management.
2. **Backend & Database:** Express.js for backend development and PostgreSQL for relational database storage.
3. **Frontend Technologies:** React for creating a responsive and interactive user interface.
4. **Version Control & Collaboration:** Git and GitHub for version control and team collaboration.
5. **Testing Environment:** XAMPP server and modern web browsers for system testing and debugging.

System Security/Protection Ensuring the security and protection of the University Resource Booking and Management System is of paramount importance, as it stores sensitive user information and booking data. To safeguard this data and prevent unauthorized access, the system implements secure authentication mechanisms using Express.js. Users are verified through a combination of email and password, and all passwords are stored in the database using password hashing to prevent credential theft. Access to system features is restricted based on user roles, ensuring that students, lecturers, and administrators can only perform actions appropriate to their permissions. Beyond authentication, data transmission and storage are secured through encryption and secure server practices. All interactions with the database are carried out using prepared statements and secure queries, reducing the risk of PostgreSQL injection attacks. Additionally, sensitive booking information and user details are protected from unauthorized access through role-based access control, which prevents users from manipulating or viewing data outside their privileges. By integrating these security measures, the system maintains a high level of resilience against cyber threats while providing a reliable and secure platform for managing university resources.

System Maintenance To ensure the reliability and performance of the University Resource Booking and Management System (URBMS), a comprehensive maintenance strategy is implemented, encompassing regular backups, system updates, and proactive monitoring procedures. Periodic backups of system data, including user information, booking records, and configurations, are carried out to prevent data loss and ensure quick recovery in case of system failure or unexpected incidents. Additionally, regular updates and patches are applied to address security vulnerabilities, fix bugs, and enhance system performance. These updates are carefully scheduled to minimize disruption to users while keeping the system secure and up to date. Continuous monitoring is also performed to detect and resolve issues promptly, ensuring that the system operates efficiently and consistently over time.

System Evaluation The evaluation process for the University Resource Booking and Management System (URBMS) encompasses several key metrics and methods to assess its effectiveness and performance. The system's success is measured by its

ability to efficiently manage and facilitate the booking of university resources, ensuring that users can seamlessly reserve and access available facilities. Additionally, system adoption and user engagement are monitored through metrics such as user registrations, login frequency, and booking activities. User feedback is also regularly collected to evaluate satisfaction levels and identify areas for improvement. Continuous monitoring of system reliability and performance ensures smooth operation and minimal downtime, while analysis of usage data provides insights for informed decision-making. Furthermore, benchmarking against similar systems is conducted to identify strengths and areas requiring enhancement, ensuring continuous improvement in the system's usability and efficiency.

Snapshots of Implementation

1. Landing Page: This snapshot illustrates the main entry interface where users access the system. It provides navigation options, including signup and login, and introduces the different user roles within the university's resource booking system.

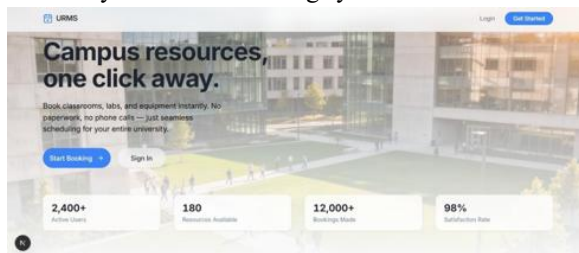


Figure 2. Landing page

2. Signup as Student Page: Displays the registration form specifically designed for students, allowing them to create an account by entering relevant details such as matric number, department, and level.

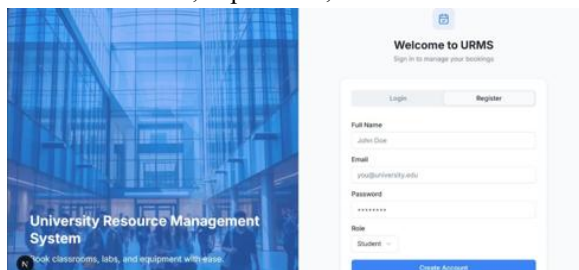


Figure 3. Signup as Student page

3. Login Page: Demonstrates the login interface that enables users (students and administrators) to securely access their accounts using their credentials.

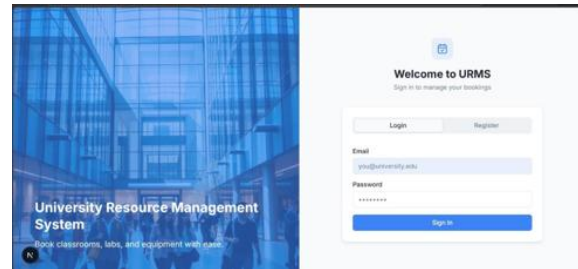


Figure 4. Login page

4. User Dashboard (Home Page): Displays the main dashboard users see upon logging in. Students can view available resources and booking options, while administrators can manage resources and monitor booking.

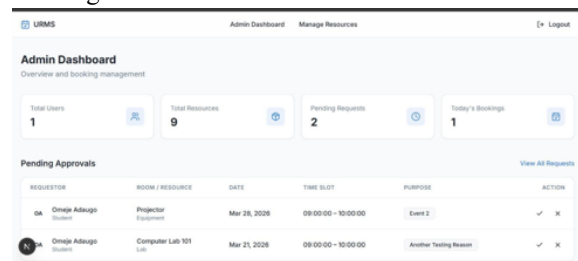


Figure 5. Home page

5. Resource Selection Page: Enables users to view and select available university resources such as lecture halls, laboratories, or equipment for booking.

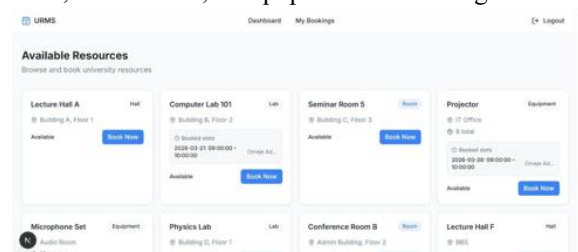


Figure 6. Resource selection page

6. Booking Page: Provides an interface where users can select dates and time slots to reserve a chosen resource based on availability.

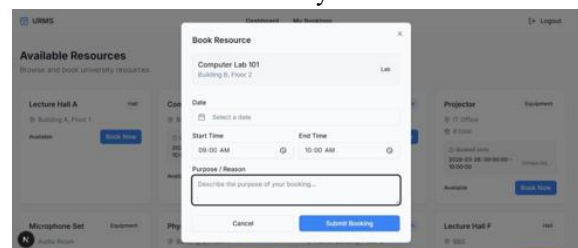


Figure 7. Booking page

7. Booking Confirmation Page: Displays confirmation details after a successful booking, including resource name, date, and time.

Resource	Category	Date	Time	Qty	Status	Actions
Lecture Hall A	Hall	2026-03-28	09:00:00 - 10:00:00	1	Reported	
Projector	Equipment	2026-03-28	09:00:00 - 10:00:00	1	Pending	Cancel
Computer Lab 101	Lab	2026-03-21	09:00:00 - 10:00:00	1	Pending	Cancel

Figure 8. Booking confirmation page

8. Admin Resource Management Page: Allows administrators to add, update, or delete resources and manage booking requests within the system.

Name	Category	Location	Quantity	Actions
Lecture Hall A	Hall	Building A, Floor 1	1	
Computer Lab 101	Lab	Building B, Floor 2	1	
Seminar Room 5	Room	Building C, Floor 3	1	
Projector	Equipment	IT Office	5	
Microphone Set	Equipment	Audio Room	10	
Portable Lab	Lab	Building D, Floor 1	1	

Figure 9. Resource management page

9. Booking History Page: Enables users to view their past and upcoming bookings, providing transparency and easy tracking of reserved resources.

Resource	Category	Date	Time	Qty	Status	Actions
Lecture Hall A	Hall	2026-03-28	09:00:00 - 10:00:00	1	Reported	
Projector	Equipment	2026-03-28	09:00:00 - 10:00:00	1	Pending	Cancel
Computer Lab 101	Lab	2026-03-21	09:00:00 - 10:00:00	1	Pending	Cancel

Figure 10. Booking history page

V. SUMMARY, CONCLUSION AND RECOMMENDATIONS

This section examines the outcomes and implications of implementing the University Resource Booking and Management System (URBMS), based on insights gathered during the design and development process. The system has demonstrated effectiveness in streamlining the process of booking and managing university resources, enabling users to easily reserve facilities within the university environment. Feedback from users indicates a generally positive experience with the system, particularly in terms of ease of use

and accessibility, although some users experienced minor challenges with features such as booking confirmation and availability updates. The system overall shows satisfactory performance in terms of speed, reliability, and functionality, although occasional delays in updating resource availability highlight the need for continuous monitoring and improvement. Resource management was efficiently handled through proper scheduling, tracking, and database organization, although consistent efforts are required to maintain data accuracy and prevent booking conflicts.

The implementation of the system significantly improves the management and utilization of university resources, while future enhancements could further optimize performance and user experience through features such as real-time notifications, mobile integration, advanced scheduling options, and improved reporting mechanisms. This evaluation of system performance, user satisfaction, and potential areas for improvement provides valuable insights for stakeholders and supports future development aimed at enhancing the overall effectiveness of the system.

Summary This study focused on the design and implementation of a University Resource Booking and Management System (URBMS) aimed at improving the management and utilization of resources within a university environment. The system serves as a centralized platform for scheduling and managing resources such as lecture halls, laboratories, and other facilities, enabling users to efficiently make reservations and access available resources. The backend was developed using appropriate server-side technologies and a structured database system to ensure efficient data storage, retrieval, and management, while the frontend was designed using web technologies to provide a responsive and user-friendly interface. Key features of the system include secure user authentication, role-based access control, real-time resource availability tracking, and an efficient booking and approval process. The system eliminates the inefficiencies associated with manual booking methods and uncoordinated communication channels. An iterative development approach was adopted to allow continuous improvement throughout the development process, which included requirement analysis, system design using Unified Modeling Language (UML) diagrams, implementation, testing, and deployment. The system was evaluated based on

usability, performance, and reliability, ensuring that it meets the needs of users while maintaining security and scalability. Overall, the system enhances resource management, improves operational efficiency, and provides a reliable platform for managing university resources.

Limitations of Research While this study aimed to design and implement a functional University Resource Booking and Management System for Babcock University, several limitations must be acknowledged:

1. **Integration with existing university systems:** The main objective of this project was to develop a standalone resource booking system. Its full integration with pre-existing institutional systems, such as email services, Google Calendar, or the university's Learning Management System (LMS), was not extensively explored. Future studies should examine how effectively the system can operate alongside these platforms for smoother adoption and interoperability.
2. **Long-term reliability and scalability:** Due to the limited timeframe of the research, the long-term performance, security, and scalability of the system were not fully evaluated. Continuous monitoring, updates, and potential system optimizations will be necessary to ensure sustained reliability as the number of users and resources grows.
3. **Technical proficiency of users:** This study assumes that both students and staff have a basic level of digital literacy to effectively use the system. Variations in technical competence may affect usability, potentially limiting adoption. Broader user testing with a more diverse group could provide insights to make the system more user-friendly.
4. **Time constraints on testing and evaluation:** The system was developed and tested within a limited academic period. Extended testing with a larger number of participants would provide a more comprehensive understanding of system performance, user experience, and potential challenges in real-world deployment.

Conclusion The University Resource Booking and Management System has been fully developed and evaluated, demonstrating that it meets the original

project objectives. The system provides an efficient platform for booking and managing university resources, such as lecture halls, laboratories, and equipment, improving both administrative efficiency and the student experience. Features including resource booking, scheduling notifications, and administrative controls were refined based on user feedback to ensure the system aligns with the needs of students and staff. Usability testing confirmed that the interface is intuitive and user-friendly, while performance testing demonstrated that the system can handle multiple concurrent operations reliably. Overall, the deployment of this system represents a significant advancement in resource management at Babcock University, offering a practical model for streamlining administrative processes and enhancing operational efficiency.

Contribution to Knowledge The design and implementation of the University Resource Booking and Management System have led to several notable contributions to the existing body of knowledge:

1. **Practical application of web-based management systems in the university:** This project moves beyond theoretical discussions by providing a functional, web-based platform specifically for booking and managing university resources. It demonstrates how digital systems can be leveraged to improve accessibility, organization, and utilization of resources such as lecture halls, laboratories, and equipment.
2. **Integration of software engineering principles in university resource management:** The study applies systematic software development methodologies, including Agile development and Unified Modeling Language (UML), to design and implement a scalable resource booking system. It highlights the effectiveness of structured software engineering approaches in addressing administrative challenges in the university.
3. **Security and data integrity in university resource management:** The research addresses important security concerns associated with managing university resources emphasizing best practices in user authentication, access control, and data protection. It contributes to knowledge on safeguarding sensitive institutional information in web-based management systems.

4. Scalability and sustainability of digital resource platforms: By utilizing modern web technologies and structured database management, the system provides a scalable model for future university resource management systems. It offers insights into cost-effective and sustainable strategies for automating resource booking and administrative processes.
5. Enhanced efficiency and accessibility in university resource utilization: The system optimizes the way students and staff book and access university resources, reducing reliance on manual or paper-based scheduling methods. This study contributes to the understanding of how technology can streamline resource allocation, improve operational efficiency, and enhance overall user experience in the university.

Recommendations To optimize the usage and ensure the longevity of the University Resource Booking and Management System, the following recommendations are proposed:

1. Regular maintenance and updates: The system should undergo routine maintenance to ensure smooth operation. This includes timely updates to address any emerging software bugs, security vulnerabilities, or compatibility issues with new technologies. Establishing a schedule for regular maintenance will help maintain system reliability and user confidence.
2. Promotion of digital literacy among users: Encourage students and staff to develop and enhance their digital skills. Effective use of the resource booking system relies on users' ability to navigate and interact with the platform efficiently, making digital proficiency a key factor in adoption and satisfaction.
3. Collaboration with technological partners: Engage with IT experts or technology partners to continually improve the system. Collaboration can provide new insights, innovative features, and technical expertise that enhance system functionality and keep it up to date with modern resource management practices.
4. Scalability considerations: As the number of users and resources grows, the system should be scalable to handle increased bookings and operations without performance issues. Planning for scalability from the beginning will help avoid

potential challenges associated with future expansion of the university's resource management needs.

Suggestion for Further Studies To further advance the field of university resource management systems, future research could explore several directions to enhance the efficiency and effectiveness of such platforms:

1. Integration with existing university systems: Future studies could examine how the resource booking system can be fully integrated with existing university platforms, such as Google Calendar, email services, or Learning Management Systems (LMS), to improve interoperability and provide a seamless experience for students and staff.
2. Enhanced security and data protection measures: Research could explore advanced security frameworks, such as multi-factor authentication, AI-driven threat detection, and improved access control mechanisms, to further safeguard sensitive booking data and ensure the integrity of university resources.
3. AI-driven resource optimization: The system could be enhanced by incorporating artificial intelligence to predict peak resource usage, suggest optimal booking times, and provide analytics for better management of university facilities.
4. Offline access and mobile optimization: Considering connectivity challenges within the university, research could focus on developing offline access capabilities and optimizing the system for mobile devices and low-bandwidth environments to ensure consistent usability.
5. Data-driven analysis of resource utilization: Future studies could analyze how the use of a centralized digital booking system impacts resource efficiency, staff workload, and overall operational performance compared to manual scheduling methods, providing insights for continuous improvement.

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