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Online Reservation Inventory Systems in Higher Education: A Gap Analysis and Enhancement Framework with SMS Notification Support

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Abstract
Resource reservation systems in educational institutions often face challenges related to scheduling conflicts, usability issues, and lack of integration with real-time communication tools. This study addresses these limitations by proposing an enhanced framework developed through a design science research approach. A gap matrix analysis of six published systems revealed consistent shortcomings in areas such as automated notifications, scheduling optimization, and real-time tracking. The proposed framework introduces key components—including a centralized booking interface, SMS notification layer, real-time inventory engine, and a feedback module—to bridge these gaps. Emphasizing user-centered design, interoperability, and evidence-based decision-making, this framework provides a strategic guide for the development of more effective and adaptable reservation systems within academic settings.

Keywords: *Resource Reservation System, Real-Time Inventory, Scheduling Optimization, SMS Notification, Framework Design, Design Science Research.*

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I. INTRODUCTION

Inventory and reservation management systems play a pivotal role in ensuring the seamless operation of administrative and academic functions within higher education institutions. Inventory is described as a core component of material management systems, playing a critical role in supply chain and logistics operations [17]. Organizations must recognize how inventory impacts financial outcomes, operational performance, and customer satisfaction to effectively align inventory practices with strategic goals [9]. In recent years, higher education institutions have increasingly adopted digital inventory systems to improve the tracking, allocation, and utilization of university resources such as equipment, facilities, and supplies. These systems are especially important in universities where resource sharing is frequent and proper documentation is critical for accountability and planning [18].

While many universities have implemented online inventory and reservation systems, the level of efficiency and functionality across these systems varies significantly. A growing body of academic literature has explored the components and effectiveness of such systems, particularly regarding their ability to address issues such as manual errors, untracked inventory, slow reservation processes, and lack of real-time updates [4]. Most of these studies emphasize common features such as item tracking, reservation logs, reporting functions, and user-level access control. However, despite these advancements, several limitations remain, including poor user notification, system accessibility gaps, and limited integration with communication technologies.

This research conducts a systematic literature review and design science approach of inventory and reservation systems used in higher education institutions, focusing on published studies, institutional reports, and case analyses. A key area of interest is the integration or lack of SMS-based notification features. Real-time alerts via SMS can improve communication between users and administrators, reduce missed reservations, and enhance system responsiveness. By analyzing common functionalities and recurring limitations in systems across Philippine state universities and similar higher education institutions, this study identifies operational gaps and evaluates the benefits of SMS integration. Insights from the literature will guide proposed improvements to support more efficient and user-friendly reservation and inventory processes.

II. LITERATURE REVIEW

The integration of digital technologies into administrative processes has become imperative for enhancing operational efficiency within state universities. Studies have demonstrated that adopting online systems tailored to the needs of university administrative staff can significantly alleviate workloads and

streamline tasks [10]. Online reservation and inventory management systems, particularly those augmented with SMS notification features, have been recognized for their potential to streamline resource allocation, minimize scheduling conflicts, and improve communication between administrators and users. For instance, the implementation of a queuing and service management system with SMS notifications has been shown to enhance administrative efficiency and facilitate timely service delivery [21]. This literature review examines existing systems, identifies prevailing gaps, and provides a rationale for the proposed development of an Online Reservation Inventory Management System with SMS Notification tailored for a state university setting.

2.1 Online Reservation Systems in Higher Education

2.1.1 iReserve: An Online Event Reservation for Lipa City Cultural with SMS Notification

This study was initiated to address the inefficiencies of manual event reservation processes at Lipa City Cultural, which often led to scheduling conflicts and administrative delays. The primary objective was to develop a web-based application that streamlines event bookings and integrates SMS notifications to promptly inform clients about their reservation statuses. Utilizing open-source technologies such as HTML, CSS, JavaScript, PHP, and MySQL, and adhering to the Software Development Life Cycle, the system was designed with comprehensive diagrams to ensure clarity in workflow and data management. Evaluation using the ISO 9126 software quality model indicated that the application met the desired standards in functionality, reliability, usability, efficiency, portability, and maintainability. However, the study did not explore the integration of real-time inventory tracking for equipment or facilities, nor did it assess the system's scalability for larger institutions, highlighting areas for potential enhancement in future developments [7].

2.2.2 eReserba Cardinal: An Integrated Room Reservation System for Higher Education Institutions

This study addressed the inefficiencies of manual room booking processes common in universities, which often result in delays, scheduling conflicts, and administrative burden. Aimed at streamlining the reservation process, the system introduced an online platform that allowed students, faculty, and staff to reserve rooms more efficiently through a centralized interface. The implementation led to improved user satisfaction, reduced booking time, and fewer scheduling errors. However, the study lacked features such as real-time inventory tracking and SMS notifications, which are essential for enhancing communication and ensuring timely updates [5].

2.2.3 Online Reservation System for the Use of University Facilities for the OVPSA

Central Philippine University recognized the inefficiencies in the manual booking process for university facilities handled by the Office of the Vice President for Student Affairs (OVPSA). Traditional reservation methods often resulted in time-consuming workflows, scheduling overlaps, and difficulties in tracking reservation statuses. In response to these issues, a web-based reservation system was developed to streamline facility bookings and provide users with a more efficient means of submitting and monitoring their requests. The system included a calendar feature to help prevent double bookings and allowed OVPSA staff to manage, approve, or decline requests through an administrative dashboard. The development process followed the Iterative and Incremental Model, which enabled continuous refinement of system features. As a result, the platform significantly improved the overall organization and accessibility of the reservation process. However, it lacked additional capabilities such as SMS notification alerts and real-time inventory monitoring, revealing areas where future enhancements could further support timely communication and more responsive facility management [3].

2.2.4 Polytechnic University of the Philippines: Online Reservation System

The Polytechnic University of the Philippines – Taguig previously relied on a manual process for handling facility reservations, which often resulted in inefficiencies such as scheduling delays and clerical errors. These issues negatively impacted both the student body and administrative personnel by consuming time and causing inconsistencies in booking records. To resolve these challenges, a system was introduced by Dacanay et al. that digitized the reservation process. The proposed online platform enabled users to view available time slots and submit reservation requests electronically. This initiative aimed to streamline scheduling, reduce the burden on staff, and generate more reliable reports and summaries of reservation activities. While the system significantly improved operational efficiency, it lacked real-time communication

tools such as SMS alerts and did not feature inventory monitoring capabilities. These omissions suggest important opportunities for future improvements to increase user engagement and enhance overall system responsiveness [6].

2.2 Real-Time Inventory Tracking for Facilities and Equipment

2.2.1 Online Supply Inventory System

This study developed at Bukidnon State University – Alubijid External Studies Center sought to digitize the institution's manual inventory management process, which was previously reliant on spreadsheet-based tracking methods. Through the use of PHP, MySQL, HTML, CSS, and JavaScript, the system was designed to improve the accuracy of inventory records, reduce data redundancy, and automate the generation of reports. The implementation of the system led to enhanced operational efficiency and projected cost savings. However, several limitations were identified, particularly in the context of real-time inventory tracking for facilities and equipment within higher education institutions. The system was restricted to single-user access and lacked features for concurrent usage, role-based access control, and real-time updates—functionalities essential for managing shared institutional resources. More critically, the system did not support reservation-based inventory tracking or provide automated communication features such as SMS notifications. These gaps underscore the need for an enhanced inventory system tailored to the higher education context, incorporating real-time tracking, reservation functionality, user management, and SMS notification support [1].

2.2.2 Analysis of the Inventory Management System Towards Enhanced University Service Delivery

This study by Odasco and Saong (2023) examined the University of Baguio's Requisition, Procurement, and Inventory System (UBRPIS), focusing on its role in improving institutional service delivery. Employing a quantitative descriptive research design, the researchers surveyed 101 university employees to assess their familiarity with UBRPIS processes, identify system limitations, and propose enhancements. Findings indicated that while most users were acquainted with procedures such as non-consumable item requests, barcode utilization, and physical inventory, significant challenges persisted. Notably, 38.60% of respondents cited issues with barcode placement, and 46.50% reported difficulties due to the unavailability of non-consumable items. The study concluded that despite user familiarity, operational inefficiencies remained, recommending investments in advanced inventory management technologies and regular staff training. However, in relation to real-time inventory tracking for facilities and equipment, the study revealed gaps pertinent to the current research. UBRPIS lacked features such as real-time inventory updates, reservation functionalities for shared resources, and automated SMS notifications, which are crucial for efficient resource management in higher education settings. Addressing these deficiencies is essential for developing a more responsive and user-centric inventory system [18].

2.3 Integration of SMS Notification Systems in University Management Platforms

The integration of SMS (Short Messaging Service) notification systems into university management platforms has proven to be a strategic enhancement in higher education institutions, particularly in the Philippines. These systems offer a variety of benefits, from improved communication to efficient administrative operations. The following sections explore these benefits in detail, supported by published research.

2.3.1 Enhanced Communication and Real-Time Notifications

SMS notification systems significantly enhance the speed and reliability of communication between universities and students. The study "Web-Based Information System Portal with SMS Support for Aklan State University-Kalibo Campus" developed a system to streamline academic processes by allowing students to access grades and account information via SMS and web, while enabling faculty to submit grades online. Aimed at improving efficiency and accessibility, the system was evaluated using ISO 9126 standards and received high ratings for functionality, reliability, and usability from students, faculty, and IT experts. Results showed that the system was error-free, met its objectives, and significantly enhanced the convenience of academic transactions for both students and teachers [8]. Correspondingly, in the study "Queuing and Service Management System with SMS Notification in Southern Leyte State University - College of Agriculture, Food and Environmental Sciences" where a system was developed in response to the persistent queuing inefficiencies experienced by students and staff to streamline client accommodation and expedite service transactions. Aimed at fostering

organized, systematic, and timely service delivery, the system was designed with features such as automated queuing, SMS alerts, networked multi-user access, report generation, and secure user roles. Utilizing data analysis and process evaluation, the research revealed that the existing manual system lacked competence in issuing priority numbers and maintaining transaction records, leading to overtaking and delayed services, with a weighted mean of 2.48 indicating significant room for improvement. Following its development, the QSMS demonstrated clear improvements in administrative efficiency and user satisfaction, significantly reducing wait times and ensuring smoother, more transparent service flows. The study concludes that technology-driven queuing systems, supported by SMS notifications, can greatly enhance operational productivity and customer experience in public institutions, especially when coupled with strategic planning and proper implementation [19].

2.3.2 Improved Student Engagement and Academic Performance

Academic success and engagement is tailored to effective communication. The study "Campus Activities Management System with SMS Reminders" was developed to streamline the coordination of campus events while ensuring timely and effective communication with students. Designed for Aemilianum College Inc., the system integrates essential features like user registration, event creation, student data management, and automated SMS notifications to remind participants of upcoming activities. By implementing modules aligned with ISO 25010 standards—functionality, reliability, usability, efficiency, maintainability, and portability—the platform delivered a highly usable and reliable experience, significantly improving attendance and user satisfaction. The inclusion of SMS reminders proved especially effective, helping students manage their time better, stay informed about academic and extracurricular opportunities, and participate more actively. Ultimately, the system not only addressed logistical challenges in event organization but also contributed to fostering a more engaged and informed student body, supporting their academic success through consistent communication and involvement [2].

2.3.3 Increased Administrative Efficiency and Operational Streamlining

Integrating SMS with university platforms reduces manual administrative tasks. The "Scholarship Grant Management Information System with SMS Notification" was developed to address inefficiencies in scholarship processing and communication, especially heightened during the COVID-19 pandemic. The system aimed to simplify the management of scholarship data and enhance communication through SMS alerts, ensuring timely updates for student applicants. Evaluated for usability, functionality, and performance, it demonstrated efficiency in application processing, secure data handling, and effective information delivery. With positive feedback from users, the system was found to significantly improve scholarship operations, making it a reliable tool for educational institutions [12]. Similarly, the study "A Web-Based Student Support Services System Integrating Short Message Service Application Programming Interface", integrated with a Short Message Service (SMS) API to streamline communication between students, faculty, and staff at a university. Aimed at improving information delivery, the system features auto-reply SMS responses, bulk messaging, and real-time academic updates, offering a more accessible and timely alternative to traditional communication methods. Through features like profile management, grade monitoring, and report generation, it also reduced paperwork and standardized academic processes. Survey feedback showed high acceptance among users, highlighting the system's efficiency, speed, and convenience. As a result, the researchers recommended its adoption as a complementary communication tool, supporting the university's shift to more responsive, mobile-accessible services—emphasizing the need for awareness campaigns, stakeholder training, and future enhancements like SMS-based enrollment solutions [21].

2.4 Optimized Scheduling and Centralized Booking

Efficient scheduling and centralized booking are crucial for managing shared resources in higher education institutions, where overlapping reservations, manual coordination, and communication delays often disrupt academic and administrative operations. The reviewed systems demonstrated the positive impact of digitized booking platforms in reducing scheduling conflicts, streamlining approval workflows, and improving user experience. These systems commonly featured centralized dashboards, calendar-based reservation views, and structured approval processes, allowing departments to monitor and manage bookings more systematically. However, limitations persist, including the absence of real-time availability indicators and integrated inventory awareness during the scheduling process. Without these features, the risk of double bookings or underutilization of institutional resources remains. Therefore, optimizing scheduling through a centralized booking system must

not only consolidate requests but also integrate dynamic inventory data and real-time feedback mechanisms—enhanced further with SMS notification support to ensure timely confirmations, cancellations, and reminders for all stakeholders involved.

2.5 Summary of Gaps and Opportunities

A thorough analysis of existing online reservation and inventory systems in higher education reveals several recurring limitations and unexplored opportunities. While current systems have made strides in digitizing manual processes and improving administrative workflows, most fall short in areas critical to comprehensive service delivery—namely, real-time inventory tracking, role-based system access, and automated communication features like SMS notifications. Systems such as iReserve and eReserba Cardinal succeeded in streamlining bookings but lacked integration with facility and equipment inventories, limiting their scope in resource coordination. Inventory systems like those at Bukidnon State University and University of Baguio, meanwhile, improved supply tracking but were disconnected from reservation functionalities and failed to support timely user communication. These gaps present clear opportunities for enhancement. The proposed framework envisions an integrated Online Reservation Inventory System with SMS Notification Support—designed to unify reservation, scheduling, inventory management, and real-time alerts into one cohesive platform. This convergence aims to boost operational efficiency, ensure transparency in resource usage, and deliver a more user-centric experience across departments in higher education institutions.

III. RESEARCH METHODOLOGY

3. 1 Research Design

This study employs a hybrid research design that combines a Systematic Literature Review (SLR**)** with a Design Science Research (DSR) methodology. The SLR is used to comprehensively gather and analyze existing literature, systems, and institutional practices related to online reservation and inventory systems in higher education. It enables the identification of common system features, gaps, and limitations—particularly with respect to real-time inventory tracking and SMS notification integration.

Following the review, the Design Science Research approach guides the formulation of an enhancement framework that addresses the identified deficiencies. This includes outlining improved system architecture, functionality, and integration strategies, specifically focusing on optimized reservation, inventory, scheduling, centralized booking, and real-time user communication via SMS.

3. 2 Data Sources and Collection Procedures

Data were gathered through a systematic search of relevant studies, institutional reports, and system documentation published within the last ten years. The following sources were used: Google Scholar, IEEE Xplore, ResearchGate, and ScienceDirect for academic databases. In addition, university archives and system manuals (from Philippine State Universities, where accessible) and project documentation and theses related to inventory and reservation systems in HEIs were also utilized. Search terms included: online reservation system higher education, university inventory management system, SMS notification in campus systems, room and equipment booking systems and real-time inventory tracking in education. The search was restricted to articles published between 2013 and 2024.

The following criteria were used to determine the inclusion of an article: (1) it should be focused on higher education settings; (2) it must provide technical or functional descriptions of reservation or inventory systems; and (3) it may mention or include communication features, such as SMS-based. The search exclusion criteria includes: (1) commercial booking systems not tailored for academic institutions; and (2) studies not providing technical system details.

3.3 Data Analysis

3.3.1 Qualitative Content Analysis (SLR Phase)

Documents were subjected to open and axial coding using qualitative content analysis. Segments describing system functionality, user experiences, limitations, and communication mechanisms were extracted and categorized into thematic codes. Emerging themes included: (1) Lack of real-time updates; (2) Limited user

notification capabilities; (3) Booking conflicts; (4) Fragmented inventory tracking; and (5) Absence of mobile communication (e.g., SMS)

3.3.2 Gap Matrix Mapping

Each system described in the literature was analyzed against a custom-designed gap matrix. The frequency and severity of gaps informed the prioritization of features in the framework. The matrix evaluated systems on the presence and quality of key features:

Table 1: Gap Matrix Mapping based on Features Evaluated.

Feature Number	Feature Evaluated	Scoring Criteria
1	Real-time Inventory Tracking	0 = Absent, 1 = Partially, 2 = Fully
2	SMS Notification	0 = None, 1 = Manual only, 2 = Automated
3	Reservation Conflict Management	0 = None, 1 = Reactive, 2 = Preventive
4	Scheduling Optimization	0 = Manual, 1 = Rule-based, 2 = Smart
5	User Roles and Access Control	0 = None, 1 = Basic, 2 = Granular
6	System Usability	0 = Poor, 1 = Moderate, 2 = High

3.4 Development of the Enhancement Framework (DSR Phase)

3.4.1 Guiding Principles for Framework Design

The development of the enhancement framework is grounded in established principles from Design Science Research (DSR), Information Systems (IS) design, and Human-Centered Design. These principles ensure that the proposed system addresses identified gaps effectively and aligns with best practices in system development.

1. **User-Centered Design**

   At the heart of the proposed framework is the commitment to meet the actual needs of its primary users—students, faculty, and administrative staff. A user-centered design approach ensures that the system is not only functional but also intuitive, accessible, and easy to navigate. By focusing on how people interact with the system in real-world scenarios, the design can better support daily academic and administrative tasks. This principle is consistent with the ISO 9241-210 standard, which stresses the importance of understanding users, their goals, and the environments in which they operate [14].

2. **Interoperability and Integration**

   To function effectively within a university setting, the system must be able to connect and work seamlessly with existing platforms, such as SMS services, academic calendars, and student portals. Integrating these elements helps reduce duplication of effort, streamline workflows, and create a more unified experience for users. This aligns with the TOGAF framework, which promotes the development of systems that can collaborate and share data across different domains [20].

3. **Real-Time Communication and Feedback**

   Timely and relevant communication is essential in ensuring that reservation processes are smooth and well-managed. By integrating SMS notifications for confirmations, updates, and reminders, users are kept informed and engaged. This level of communication not only enhances transparency but also minimizes missed reservations or misunderstandings. The ITIL 4 principles emphasize the role of prompt feedback and effective communication in maintaining high-quality service management [16].

4. **Centralization and Optimization**

A centralized reservation system can significantly simplify the process of managing shared resources. By bringing all booking functions into one cohesive platform, institutions can avoid scheduling conflicts, eliminate redundancies, and maintain better oversight of equipment and facility usage. COBIT 5 supports this idea by highlighting the value of central governance structures that help align IT operations with broader institutional goals [15].

5. **Configurability and Scalability**

Each higher education institution has its own set of needs, so the system should be flexible enough to allow for customization. At the same time, it should be designed to scale, accommodating growing user bases and expanding functionalities over time. This principle reflects best practices in information architecture, where systems are built to evolve in response to changing requirements and environments [11].

6. **Evidence-Based Decision-Making**

Finally, the framework is anchored in the use of evidence and research findings to inform its design choices. Rather than relying solely on assumptions, it incorporates insights from the literature and system evaluations to determine what works and what needs improvement. This is a core tenet of Design Science Research, which calls for the development and refinement of systems based on systematic analysis and empirical validation [13].

IV. RESULT AND DISCUSSION

4.1 Results of the Literature Review

The systematic literature review included six peer-reviewed journal articles and institutional case studies focusing on inventory and reservation systems within higher education. These sources revealed that while institutions have increasingly adopted online systems, many implementations still suffer from limitations in terms of real-time communication, integration, and user accessibility. Most systems focused on core functionalities such as item availability tracking, booking logs, approval workflows, and limited reporting tools. However, integration with SMS notification systems was either absent or inconsistently applied, particularly in public institutions. Furthermore, user feedback mechanisms and centralized dashboards were often underdeveloped or lacking entirely.

4.2 Gap Matrix Results

Table 2 below reveals the results of gap matrix analysis based on the scoring criteria established from Table 1 above.

Table 2: Gap Matrix Results based on Established Scoring Criteria.

Literature	Real-time Inventory Tracking	SMS Notification	Reservation Conflict Management	Scheduling Optimization	User Roles and Access Control	System Usability
iReserve: An Online Event Reservation for Lipa City Cultural with SMS Notification	0	2	1	0	1	1
eReserba Cardinal: An Integrated Room Reservation System for Higher Education Institutions	1	0	1	1	1	1
Online Reservation System for the Use of University Facilities for the OVPSA	1	0	1	1	1	1
Polytechnic University of the Philippines: Online Reservation System	1	1	1	0	1	1
Online Supply Inventory System	1	0	0	0	1	1
Analysis of the Inventory Management System Towards Enhanced University Service Delivery	1	0	1	1	1	1

Legend for Coding Scheme:

- **Real-time Inventory Tracking:**
  0 = Absent, 1 = Partially, 2 = Fully
- **SMS Notification:**
  0 = None, 1 = Manual only, 2 = Automated
- **Reservation Conflict Management:**
  0 = None, 1 = Reactive, 2 = Preventive
- **Scheduling Optimization:**
  0 = Manual, 1 = Rule-based, 2 = Smart
- **User Roles and Access Control:**
  0 = None, 1 = Basic, 2 = Granular
- **System Usability:**
  0 = Poor, 1 = Moderate, 2 = High

4.3 The Enhanced Framework

4.3.1 Overview of the Proposed Framework

Based on insights from the SLR and gap matrix analysis, the DSR methodology guided the development of an enhancement framework. This framework aims to offer a modular, scalable solution for online reservation and inventory systems tailored to the context of higher education institutions. Table 3 presents the following key components designed to address recurring limitations:

Table 3: Proposed Enhanced Framework Key Components.

Component	Purpose	Reason for Inclusion
Core Reservation & Inventory Module	Enables real-time asset management and booking	Found in nearly all systems reviewed; baseline features like booking, item listings, etc.
SMS Notification Layer	Provides real-time updates to users or admins to reduce missed reservations	Frequently absent; emphasized in the study as a critical area for improvement
Optimized Scheduling Subsystem	Resolves booking conflicts and manages time slots	Most systems focus on booking alone without scheduling system integration
Centralized Booking Interface	Unified platform for different departments/facilities	Needed to address conflicts and double-bookings; from literature and gap matrix
Real-Time Inventory Tracking Engine	Updates availability and logs usage instantly	Systems lacked live tracking; appeared often in gap matrix and in your literature section
Access Control & User Roles Module	Ensures secure, role-based access	Scalability and user-level access gaps noted across cases
Admin Dashboard and Analytics	Monitors trends, reports usage, and detects inefficiencies	Found in mature systems, but lacking in simpler ones; aids planning and reporting
Feedback and Reporting Module	Allows users to provide post-reservation feedback and admins can generate reports on usage patterns, missed reservations, and system performance.	To enable continuous system improvement through user input and data-driven insights, enhancing usability and operational decision-making.
Usability Layer (UX/UI Guidelines)	Enhances user experience through intuitive design	Usability complaints were common in the content analysis and review reports

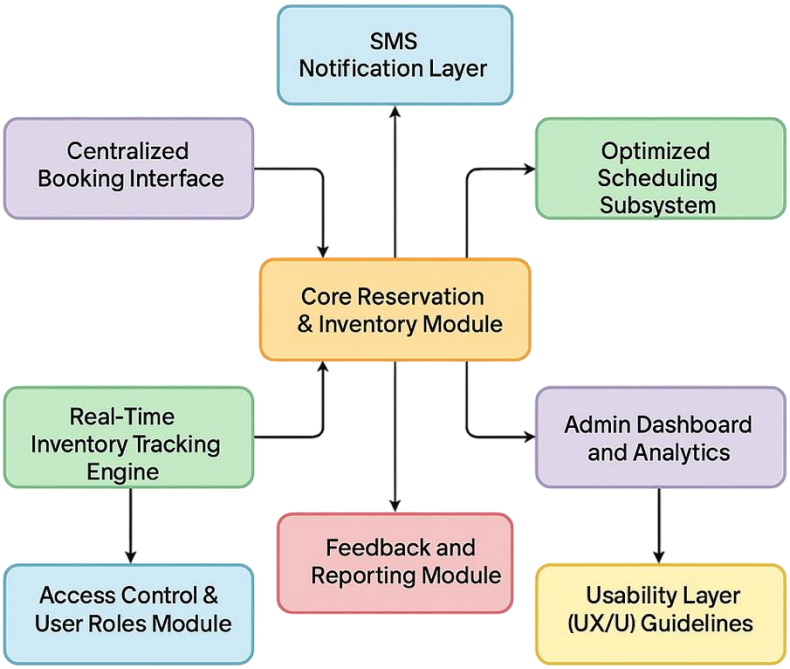

Figure 1: Proposed Enhanced Framework for Online Reservation Inventory System in Higher Education Flow Diagram

4.3.2 Sample Scenarios or Use Cases

Scenario 1: Student Booking a Projector for Classroom Use

A student preparing for a classroom presentation needs to reserve a projector. By accessing the Centralized Booking Interface, they can quickly view and select from the available equipment based on their preferred date and time. The system automatically checks for scheduling conflicts through the Optimized Scheduling Subsystem and confirms the availability. Once the booking is finalized, the student receives an automated SMS confirmation, and the inventory is updated in real time to reflect the reservation. This streamlined process ensures both convenience and clarity for the user.

Scenario 2: Administrator Monitoring Weekly Usage

An administrator overseeing equipment and room reservations wants to understand how resources are being used across the campus. Through the Admin Dashboard and Analytics module, they generate a weekly usage report that highlights peak booking periods, underutilized facilities, and usage trends. These insights enable the administrator to make informed decisions—such as reallocating resources, adjusting room availability, or planning for future investments—thereby improving operational efficiency and user satisfaction.

Scenario 3: Faculty Reserving a Conference Room with a Scheduling Conflict

A faculty member attempts to book a conference room for a department meeting. The system detects a conflict due to an overlapping reservation. Instead of simply denying the request, the Optimized Scheduling Subsystem suggests alternative available time slots. The faculty member selects a new time, receives a prompt SMS confirmation, and the reservation is successfully recorded. Access permissions managed through the User Roles Module ensure that the faculty member is given priority access, supporting structured and equitable use of institutional resources.

Scenario 4: Gathering Feedback for Continuous Improvement

After using a reserved laptop, a student is prompted by the system to share feedback on their experience. The Feedback and Reporting Module collects this input, which is then made available to administrators for review. Over time, patterns such as frequent complaints about a specific item or recurring technical issues can be identified and addressed proactively. This mechanism fosters a responsive and user-centered system that evolves based on actual user experiences and needs.

V. CONCLUSION

This study has successfully identified the key limitations of existing resource reservation systems in academic institutions and proposed a comprehensive enhancement framework tailored to address these gaps. Through a rigorous literature review, gap analysis, and application of design science research principles, the proposed framework integrates core functionalities such as real-time inventory tracking, optimized scheduling, automated SMS notifications, and user role-based access controls. By prioritizing usability, integration, and data-driven insights, the system aims to deliver a more responsive, efficient, and user-friendly experience for students, faculty, and administrators alike. Ultimately, the framework sets the foundation for future system development that is scalable, configurable, and aligned with institutional needs.

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