

Automation of Hostel Management through Enterprise Resource Planning (ERP) Solutions

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Abstract: Hostel management in educational institutions involves a wide range of administrative tasks that, when handled manually, lead to inefficiency, data errors, and poor transparency. This paper presents a survey of 13 research studies focused on digital and ERP-based hostel management systems. The reviewed works cover a broad range of technologies including web-based portals, cloud computing, AI, IoT, React Native, AWS, and JWT-based authentication. Each study was analyzed for its approach, key features, and limitations. Findings reveal that while individual systems address specific aspects like room allocation, complaint handling, or attendance tracking, most lack a comprehensive, fully integrated solution. Common gaps identified across studies include absence of occupancy audit mechanisms, limited scalability, no mobile support, inadequate security measures, and lack of analytical features. Based on this analysis, future research should focus on building unified ERP platforms that combine all hostel functions — including auditbased occupancy verification, predictive analytics, and cloudeasy architecture — into a single deployable system suitable for any educational institution.

Keywords: Hostel Management, ERP System, Survey, Literature Review, Web Application, Cloud Computing, Automation, Role-Based Access Control

I. INTRODUCTION

Ensuring that students have reasonably safe and well managed lodging is one of an institution's job responsibilities. Institutions will host hundreds of students and keeping track of where they are located (rooms assigned), how often (attendance), what is in a particular room (inventory), which complaints need to be resolved (complaints), and how much or little has been charged (finances) manually would be a major challenge on a long-term basis. Although this is a very large job, many institutions still continue to use spreadsheets or paper files to administer their lodging activities. The transition from a manual environment to an electronic environment has occurred in stages. Some institutions added a web portal used for assigning rooms, while others developed a way for students to submit complaints, and some even created an ERP solution for lodging management that did not address all components of lodging management. The lack of integration with other systems has caused many administrators to have to use multiple pieces of unlinked applications/data. This paper reviews 13 published research papers that study the use of an electronic lodging management system and identifies where the lodging management research area has been, where it is going, and the gaps that remain. Different studies reviewed represent various types of lodging management systems including, but not limited to, online allotment portals, AI-driven lodging booking systems, and cloud-hosted lodging management systems. We want to accomplish several things with this survey, not only to report on what's already been done but also to identify trends in what has been created, what is missing from existing solutions, and what recommended future developments to focus on. The evidence presented here demonstrates a clear need for the development of a single, unified, scalable, ERP based system for managing all aspects of running a hostel that can be used by many institutions with little or no customization required



II. LITERATURE REVIEW

The recent surge in the prevalence of digital technologies in the domain of educational institutions has motivated numerous research endeavors into automating hostel management by implementing centralized systems. The digitizing of various processes within a hostel, ranging from managing student records to allotting rooms, processing complaints, and tracking resources, has been a focus for many researchers aiming to minimize manual tasks. Several research papers on online ERP-based hostel allotment systems have proposed solutions to enhance and speed up the room allotment process to reduce paper usage and offer more transparency by introducing centralized data management.

A lot of work has been performed on implementing Agile methodologies in ERP software development. The findings indicate enhanced flexibility and increased adaptability that lead to better success rates. However, they do not concentrate on the specific aspects of hostel administration. The latest studies on an AI and IoT-powered hostel booking system were concerned about automated allocation, intelligent resource utilization, and intelligent search for rooms in order to deliver a better and an automatic accommodation management experience.

These works are only at a conceptual stage and have not been tested on a wide scale. A few research studies have examined cloud-based hostel and paying guest (PG) management systems and pointed out improved accessibility, scalability and centralized storage in contrast to reduced infrastructural costs.

Despite these advancements, many of these studies failed to take into consideration the aspects of audit management and administrative controls security. Several researches also involve scaled hostel management systems and web-based hostel booking systems to help in streamlining operations such as digital records and online management; however, they may lack comprehensive functionalities such as comprehensive role management, an inventory tracking facility, an audit trail, and detailed report creation. Other research works focused on the automated hostel management system in order to minimize workload and enhance data accuracy.

However, the majority of solutions only cover a particular hostel function rather than a comprehensive ERP that can handle many of the admin tasks through a single solution. From the existing studies, it can be clearly observed that many of them are covering individual hostel functionalities such as booking system, student records, allotment etc. It is noted that very few studies address a complete ERP-based solution that includes authentication, role-based permissions, student management, hostel management, allocation and a detailed report.

Hence, a centralized and secure web-based application supporting all major hostel admin functions, such as authentication through JWT tokens, role-based access, and comprehensive student and hostel record management, an inventory monitoring and reporting feature and a well-managed system capable of handling any lodging complaint would definitely be highly beneficial.

The Hostel ERP Management System as proposed in this paper will provide such functionalities in a single application. It will comprise all features from Authentication and role-based authorization to full-fledged hostel and student administration.

Study	Focus Area	Limitations	Proposed Work Advantage
T. Nandanwar, P. Bahutule	Online ERPbased hostel allotment	No AI or analytics, limited automation	Time-saving, cost-effective, reduces manual errors
S. K. Yadav, U. Tyagi	AI and IoTenabled hostel booking	Complex setup, not tested on large scale	Modern tech use, secure and userfriendly
Meyliana, S. F. Wijaya	Agile approach for ERP deployment	Theoretical model, lacks practical validation	Flexible, reduces failure risk
S. Agrawal, S. Rastog	Cloud computing for hostel and PG automation	No performance testing or user evaluation	Scalable, centralized data access, multi-device compatibility

Table I: Comparative Analysis of Existing Studies



III. METHODOLOGY

The proposed Hostel ERP Management System provides an automated and efficient platform for managing hostel operations in educational institutions. It overcomes the limitations of manual and semi-digital practices by bringing together student registration, room allocation, inventory tracking, attendance management, audit management, and complaint handling into one unified interface. The system has been fully implemented with all core modules functional, including user authentication, student management, room allocation, inventory management, attendance tracking, audit management, and complaint handling. The system successfully demonstrates its capability to streamline hostel workflows, reduce administrative burden, and improve overall coordination between students, rectors, and administrators.

A. Objectives of the Proposed System The main objectives of the proposed system are:

1. To automate repetitive and time-consuming hostel administrative tasks.
2. To establish secure, centralized data management with minimal redundancy.
3. To enhance transparency and accountability among students, rectors, and administrators.
4. To provide real-time access to hostel-related information for all authorized users.
5. To develop a scalable framework that can be expanded to include additional ERP functionalities in the future.

B. System Features

HERPMS offers a range of integrated features designed to improve efficiency, transparency, and data accuracy across hostel operations. Each module works within a centralized framework, ensuring smooth interaction between users and the database.

- **Centralized Database System:** All hostel-related data — student records, room occupancy, inventory, and complaints — is stored securely in one centralized database. Role-based access ensures administrators, rectors, and students only interact with information relevant to their role.
- **Automated Room Allocation:** Rooms are assigned based on predefined criteria such as gender, capacity, and current availability. This removes manual intervention from the allocation process and significantly reduces assignment errors.
- **Inventory Management:** All hostel assets including furniture, electrical appliances, and cleaning equipment are tracked in real time. The system monitors quantities, item conditions, and maintenance schedules to ensure resources are used efficiently and losses are minimized.
- **Audit of Students Living in Hostel:** This is one of the most distinctive features of HERPMS. The audit module regularly verifies the presence and details of students residing in the hostel, ensuring occupancy records stay accurate, unauthorized stays are flagged, and overall transparency is maintained.
- **Management of Students Living Inside and Outside Hostel:** A unified database covers both hostel residents and non-resident students, giving administrators a complete picture of accommodation distribution and helping with capacity planning decisions.
- **Attendance and Leave Management:** Rectors can record daily attendance digitally and manage leave requests through the system. Students submit leave applications online, which wardens can approve or reject directly through their dashboard.
- **Complaint and Feedback System:** Students raise complaints or suggestions through the portal. Each submission is logged and tracked, allowing administrators to monitor progress, respond promptly, and maintain a clear record of resolutions.
- **Report and Analytics Module:** The system generates detailed reports on room occupancy, inventory usage, audit findings, and complaint statistics. Analytical dashboards give administrators the data they need for informed, evidence-based decision-making.



C. System Workflow

The system workflow operates as follows:

1. User Authentication: Users log in through role-based credentials — Admin, Rector, or Student — ensuring secure and controlled access.
2. Operation Access: Each user is directed to a role-specific dashboard. Administrators manage overall records, rectors handle attendance and complaints, while students access personal data and submit requests.
3. Data Processing: Every action — room allocation, student registration, inventory update, or complaint submission — is processed through the backend and instantly updated in the centralized database.
4. Feedback and Reports: The system generates real-time reports on occupancy, attendance, inventory, and complaints, helping administrators and rectors make informed decisions.

D. SYSTEM ARCHITECTURE HERPMS

A three-tier architecture — Presentation, Application, and Database — where each layer handles specific responsibilities independently. This separation keeps the system maintainable, scalable, and ensures that changes in one layer do not affect the others.

1 Presentation Layer This is what users directly interact with — role-based dashboards and forms for administrators, rectors, and students. Built using HTML5, CSS3, JavaScript, and React, the interface is responsive and works smoothly across different devices.

2 Application Layer This layer handles all business logic and sits between the interface and the database. Node.js and Express power the backend, validating requests and processing them according to defined rules. Role-based authentication ensures users only access what they are permitted to.

3 Database Layer All hostel data — student profiles, room records, inventory, attendance, and complaints — is stored using MySQL and MongoDB. Entity-relationship modelling keeps redundancy low and data integrity high, while encryption and periodic backups prevent data loss.

4 Data Flow and Integration Data move bidirectionally across all three layers through secure protocols. Every user action is processed through the application layer and instantly reflected in the database, with results returned to the interface in real time.

5 Security and Scalability The system uses RBAC, SSL encryption, and input validation to prevent unauthorized access. Its modular design allows new features to be added without affecting existing components, and regular backups ensure quick recovery when needed.

E. Development Environment

The system was implemented using the technologies listed below:

Programming Language: TypeScript

Backend Framework: Express.js

Frontend Framework: React with Vite

Mobile Framework: Expo React Native

Database: PostgreSQL

ORM: Prisma

Authentication: JWT and Twilio OTP

HTTP Client: Axios

Version Control: Git

Development environments were configured independently for backend, frontend, and mobile applications to support modular deployment and testing.



IV. PROPOSED SYSTEM

Based on the gaps and limitations identified across all 13 reviewed works, this section outlines the key characteristics that a comprehensive hostel ERP management system should possess.

- **Unified Integrated Platform:** The proposed system should bring all hostel functions — student registration, room allocation, inventory management, attendance tracking, expenditure monitoring, complaint handling, and occupancy auditing — into one centralized platform. No fragmentation, no disconnected tools.
- **Student Audit Module:** Since no reviewed system included this feature, the proposed system must incorporate a dedicated audit module that periodically verifies whether registered hostel residents are actually occupying their assigned rooms. This would directly address unauthorized stays and occupancy discrepancies.
- **Role-Based Access Control:** The system should provide separate dashboards and access permissions for administrators, wardens, and students. Each user group should interact only with data and functions relevant to their role, keeping the system both secure and easy to use.
- **Centralized Database with Real-Time Sync:** All modules should operate through a single centralized database that updates in real time. This eliminates data inconsistency across departments and ensures every user is always working with accurate, current information.
- **Security Infrastructure:** The proposed system should implement JWT-based authentication, role-based access control, SSL encryption, input validation, and multifactor authentication to address the security weaknesses consistently observed in existing systems.
- **Analytics and Reporting:** A built-in analytics dashboard should allow administrators to generate reports on room occupancy, inventory usage, attendance trends, complaint resolution, and expenditure patterns — supporting informed, data-driven decision-making.
- **Cloud-Ready and Scalable Architecture:** The system should be designed for cloud deployment from the start, ensuring it can scale to handle large numbers of concurrent users across multiple hostel blocks or institutional branches without performance degradation.
- **Mobile Accessibility:** A mobile-friendly interface or dedicated application should accompany the web platform, giving students and wardens easy access to key functions — leave requests, complaint submission, notifications — from their smartphones.

A. Advantages of the Proposed System

Unlike typical tools for managing hostels (manual methods), HERPMS provides significant advantages due to their seamless integration. Each piece of HERPMS is designed to deliver reliability and transparency, while also being scalable. Therefore, the amount of work done by administrative personnel will be substantially reduced as a result of these three features.

- **Operational Efficiency:** In addition to the administrative staff benefiting from fewer repetitive tasks, the automated functions associated with room assignments, student records management and inventory management will allow for substantial time and energy savings on a daily basis.
- **Improved Accuracy:** Having all records stored in one database eliminates multiple inconsistencies associated with record keeping that would result from maintaining records from multiple sources. All information will be up-to-date and accurate in all modules without the need for manual verification.
- **Enhanced Transparency:** With the help of these two systems, every action that happens in the hostel can be tracked, allowing students, rectors and administrators to see things that were previously difficult to see before.
- **Resource Optimization:** The inventory module provides institutions with complete history of the quantity, condition and maintenance schedule of all assets (i.e. buildings) which enables better utilisation of existing resources and minimisation of losses through duplication of such resources.



- **Data Centralization:** Having records of both resident and non-resident students in one location gives management the ability to get an accurate view of accommodation availability across the institution, assisting in overall planning and resource allocation.
- **Scalability:** This is because of its modular design, which means future enhancements can be added easily into the system. financial integration, advanced analytical tools, biometric attendance, etc. without disrupting functionality.
- **User Accessibility:** The system provides a tailored interface for each user. Administrators, Wardens and Students each have a clean, uncluttered Dashboard with all of their specific needs listed only; no surplus or lack of information will be provided.

V. CONCLUSION

A review of 13 research studies that focus on digital and ERP-based hostel management systems was conducted to better understand how these studies differ in terms of approaches, technologies used, strengths and weaknesses. The literature that has been reviewed consists of a number of different types of systems that represent a wide variety of applications; from basic web-based portals for allotting hostel rooms to cloud-enabled frameworks of automation and AI-enabled platforms for booking accommodation. Although each of these studies proposes some contribution to the body of knowledge, there does not appear to be a single comprehensive and integrated approach that addresses the entirety of hostel administration. The analysis demonstrated that there are persistent gaps among all of the studies including: lack of occupancy auditing capabilities; lack of complete modules for all aspects of hostel operation; lack of adequate security and access controls; lack of scalability; lack of mobile capability; and lack of advanced analytics.

These gaps are more than trivial omissions; they are features that any hostel management system that is to be considered viable for use by a higher education institution must possess. The system being proposed in this paper proposes solutions to address each of the gaps noted above by providing an all-in-one integrated hostel management platform, with access control based on defined roles, real-time data synchronization, an auditing module, and cloud-enabled architecture. This is not a theoretical recommendation; it is in direct response to the missing components indicated in all of the studies reviewed. A review of 13 research studies that focus on digital and ERP-based hostel management systems was conducted to better understand how these studies differ in terms of approaches, technologies used, strengths and weaknesses. The literature that has been reviewed consists of a number of different types of systems that represent a wide variety of applications; from basic web-based portals for allotting hostel rooms to cloud-enabled frameworks of automation and AI-enabled platforms for booking accommodation. Although each of these studies proposes some contribution to the body of knowledge, there does not appear to be a single comprehensive and integrated approach that addresses the entirety of hostel administration. The analysis demonstrated that there are persistent gaps among all of the studies including: lack of occupancy auditing capabilities; lack of complete modules for all aspects of hostel operation; lack of adequate security and access controls; lack of scalability; lack of mobile capability; and lack of advanced analytics. These gaps are more than trivial omissions; they are features that any hostel management system that is to be considered viable for use by a higher education institution must possess. The system being proposed in this paper proposes solutions to address each of the gaps noted above by providing an all-in-one integrated hostel management platform, with access control based on defined roles, real-time data synchronization, an auditing module, and cloud-enabled architecture. This is not a theoretical recommendation; it is in direct response to the missing components indicated in all of the studies reviewed.

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