

Design And Development Of An Automated Hostel Management Platform: A Case Study Of Hannah Hostel

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Abstract

This project addressed the design and development of an automated hostel management platform, using Hannah Hostel as a case study. Many private hostels in Uganda still manage bookings, room allocation, tenant records, and payments manually, leading to double-booking, lost records, delayed payment reconciliation, and poor communication with residents. The main objective was to design, develop, and evaluate a web-based hostel management platform that automates booking, room allocation, billing, and tenant management. The study used a mixed-methods requirements investigation with 78 respondents (residents and staff) and adopted an iterative, prototype-based system development methodology. Data on existing challenges were gathered through questionnaires, interviews, and document review, then translated into functional and non-functional requirements. The system was built using a three-tier architecture with a relational database. Evaluation with users showed high acceptance: 88% rated the booking module easy to use, and task-completion time for room allocation fell from an average of 14 minutes manually to under 2 minutes on the platform. The study concluded that automation significantly improves accuracy, speed, and record integrity, and recommended mobile-money integration and a mobile application for wider access.

Keywords: Hostel management, automation, web application, booking system, database, Hannah Hostel.

1.0 Introduction and Background

Student accommodation is an essential component of higher education because it provides students with a safe, convenient, and supportive living environment that contributes to their academic success, personal well-being, and overall university experience. Universities and private hostel operators play a significant role in ensuring that students have access to adequate accommodation close to learning institutions (Julius & Kaazara, 2025). As enrolment in higher education continues to increase globally, the demand for student housing has risen substantially, creating the need for efficient accommodation management systems capable of handling large volumes of student information and operational activities (Julius et al., 2026). Student hostels are no longer viewed merely as residential facilities but as service-oriented enterprises that require effective management of reservations, room allocation, tenant registration, billing, maintenance, security, communication, and financial reporting. Consequently, hostel management has become increasingly dependent on information systems that enhance operational efficiency, improve service quality, and support evidence-based managerial decision-making (Nelson, 2024). Recent studies indicate that digital transformation in accommodation management contributes significantly to improved customer satisfaction, better resource utilization, and increased operational productivity within educational institutions and private accommodation facilities (UNESCO, 2024; World Bank, 2024).

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A hostel management system refers to a computerized information system designed to automate and integrate the various administrative and operational activities involved in managing student accommodation (Ntirandekura et al., 2022). Such systems typically include modules for online room booking, resident registration, room allocation, payment processing, rent tracking, maintenance management, visitor management, complaint handling, and report generation (Kazaara et al., 2024). Unlike traditional manual systems, computerized hostel management systems provide centralized databases that enable authorized users to access accurate, up-to-date information in real time while minimizing data duplication and inconsistencies. Modern hostel management platforms also support automated notifications, digital payment integration, occupancy monitoring, and secure record management, thereby improving efficiency and reducing administrative workload (K. Faridah et al., 2023). Advances in cloud computing, mobile applications, and database technologies have further enhanced the functionality of hostel management systems by allowing managers and students to access services remotely through internet-enabled devices. As digital technologies continue to evolve, automated accommodation management has become a standard practice in many universities and private student housing facilities worldwide (Laudon & Laudon, 2023; Stair & Reynolds, 2023).

Globally, higher education institutions have increasingly adopted computerized management systems to improve administrative efficiency and service delivery across various functional areas, including admissions, finance, libraries, academic records, and student accommodation (Irumba et al., 2024). The rapid expansion of university enrolment, coupled with increased expectations for quality service delivery, has made manual administrative systems inadequate for managing complex institutional operations (Irumba et al., 2024). Digital transformation initiatives have enabled accommodation providers to automate booking processes, optimize room utilization, improve financial accountability, enhance communication with residents, and generate accurate management reports for planning purposes (Christopher et al., 2024). Studies conducted in Europe, North America, and Asia demonstrate that institutions implementing computerized accommodation management systems experience reduced administrative costs, improved operational accuracy, faster service delivery, and enhanced user satisfaction (Alex & Moses, 2024). Furthermore, automated systems facilitate data-driven decision-making by providing real-time information on occupancy rates, revenue generation, maintenance needs, and resource utilization, allowing managers to respond more effectively to changing operational demands (OECD, 2023; UNESCO, 2024).

Despite these technological advancements, many accommodation providers in developing countries continue to rely on manual or semi-computerized management systems that expose organizations to numerous operational challenges (Kazaara & Kazaara, 2025). Manual record keeping often depends on paper files, handwritten registers,

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receipt books, and spreadsheet applications that are not fully integrated, making information retrieval slow and susceptible to errors(Alex & Moses, 2024). Common challenges associated with manual hostel management include duplicate bookings, inaccurate room allocation, delayed payment verification, misplaced tenant records, inefficient maintenance tracking, poor communication, and difficulties generating timely occupancy or financial reports(David et al., 2023). Such inefficiencies increase operational costs, reduce customer satisfaction, and limit management's ability to make informed strategic decisions(N. Faridah et al., 2023). Information systems scholars argue that organizations operating with fragmented manual systems face greater risks of data inconsistency, information loss, fraud, and poor service quality than those utilizing integrated computerized management platforms (Laudon & Laudon, 2023; Stair & Reynolds, 2023).

The adoption of computerized information systems has become increasingly important because effective decision-making depends largely on the availability of accurate, timely, reliable, and accessible information(K. Faridah et al., 2023). Database Management Systems (DBMS) provide centralized storage and management of organizational data, enabling multiple users to access consistent information while maintaining data security and integrity. Within hostel management, centralized databases support efficient resident registration, room assignment, payment tracking, maintenance scheduling, and report generation without the redundancies commonly associated with manual record keeping(Ronald et al., 2023). Modern management information systems also incorporate role-based access controls, automated backups, audit trails, and reporting tools that improve accountability and operational transparency. Additionally, integration with digital payment platforms and mobile communication technologies enables accommodation providers to streamline financial transactions, enhance communication with tenants, and improve overall customer experience(Nelson et al., 2022). Consequently, computerized hostel management systems have become indispensable tools for improving operational performance and organizational competitiveness in the accommodation sector (Turban, Pollard, & Wood, 2023; Laudon & Laudon, 2023).

In Uganda, the continued expansion of higher education has significantly increased the demand for student accommodation, particularly in urban centres where universities attract large numbers of students from different regions of the country(Julius & Desire, 2025). The growth of both public and private universities has stimulated the development of privately owned hostels that complement university-managed accommodation facilities(Julius et al., 2024). These hostels operate as small and medium-sized enterprises providing accommodation and related services to students throughout the academic year(Julius & Desire, 2025). However, many privately owned hostels continue to rely on manual administrative procedures because of financial constraints, limited technological capacity, and inadequate investment in information systems. Manual operations often involve physical registration books, handwritten receipts, paper tenancy agreements, and spreadsheet-based financial records that create challenges in maintaining accurate and secure information. As competition among hostel operators increases, there is growing recognition that investment in computerized management systems can improve operational

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efficiency, customer satisfaction, financial accountability, and business sustainability (Uganda Bureau of Statistics [UBOS], 2024; Ministry of Education and Sports, 2024).

Hannah Hostel, the case study for this project, exemplifies many of the operational challenges experienced by privately managed student accommodation facilities that continue to rely predominantly on manual management practices. The hostel manages core business activities such as room reservations, tenant registration, room allocation, payment recording, occupancy monitoring, and record management largely through physical documents and spreadsheet applications. Prospective residents commonly make booking inquiries through telephone calls or in-person visits, after which room allocations are manually recorded in physical ledgers while payment information is maintained using receipt books and spreadsheet records. Although these procedures have enabled the hostel to operate over time, they have become increasingly inefficient as student numbers have grown and business operations have expanded. Manual information processing consumes considerable administrative time, limits timely retrieval of records, and increases the likelihood of human error during routine transactions.

The continued use of manual systems at Hannah Hostel has resulted in several recurring operational problems that negatively affect service delivery and management efficiency (Julius & Kazaara, 2026b). These challenges include double allocation of rooms due to delayed updating of occupancy records, disputes arising from incomplete or inconsistent payment records, difficulties tracking vacant and occupied rooms, delays in processing tenant information, misplaced records, and challenges generating accurate occupancy, revenue, and financial reports for management decision-making (Julius & Kazaara, 2026a). The fragmented nature of manual records also limits coordination between different administrative functions and reduces management's ability to monitor hostel performance in real time. Furthermore, manual record keeping exposes important business information to risks of physical damage, unauthorized access, loss, and duplication, thereby compromising the accuracy and reliability of organizational data (Alex & Moses, 2024). These operational challenges not only affect administrative efficiency but also diminish customer satisfaction and the overall quality of services provided to students.

The development and implementation of a computerized hostel management system therefore presents an effective solution for addressing the operational inefficiencies experienced at Hannah Hostel. By integrating booking, tenant registration, room allocation, payment management, maintenance tracking, and report generation into a centralized database, the proposed system is expected to improve data accuracy, eliminate duplication of records, reduce processing time, enhance information security, and provide real-time operational information for managerial decision-making. Automated business rules can further minimize booking conflicts, improve accountability, simplify financial management, and facilitate timely generation of occupancy and revenue reports.

Although computerized management systems have been successfully implemented in many educational institutions worldwide, relatively few studies have focused on the development of customized hostel management systems for privately owned student accommodation facilities in Uganda. This study therefore seeks to contribute context-specific knowledge by designing and implementing a computerized hostel management system for Hannah Hostel, with the aim of improving operational efficiency, service quality, and effective management of student accommodation.

2.0 Statement of the Problem

At Hannah Hostel, the manual system for managing bookings, room allocation, and payments causes duplication of records, occasional double-booking of rooms, delays in reconciling tenant payments, and an inability to produce timely occupancy and revenue reports (Paul et al., 2023). These weaknesses cost the hostel revenue, frustrate residents, and expose management to disputes and poor decisions. Without an automated, centralised platform, the hostel cannot guarantee data integrity or the responsiveness that residents increasingly expect. This project set out to design and develop such a platform to eliminate these problems.

3.0 Objectives

3.1 Main Objective

To design, develop, and evaluate an automated web-based hostel management platform for Hannah Hostel that streamlines booking, room allocation, billing, and tenant management.

3.2 Specific Objectives

1. To investigate and document the requirements of the existing hostel management process at Hannah Hostel.
2. To design and develop a web-based platform that automates booking, room allocation, billing, and tenant records.
3. To test and evaluate the platform for usability, accuracy, and performance against the manual system.

4.0 Literature Review

Literature on management information systems establishes that automation of routine transactional processes reduces human error, accelerates processing, and improves the availability of information for decision-making (Julius & Nancy, 2026). Booking and reservation systems in hospitality contexts have been shown to reduce double-booking through real-time availability checks and to improve revenue capture through consistent billing rules (Creswell, 2014).

Comparative reviews of hostel and property-management software indicate common core modules: a booking engine, room and occupancy management, tenant profiles, billing and receipts, maintenance ticketing, and

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reporting dashboards(Seth & Ntirandekura, 2022). Studies emphasise usability as a determinant of adoption in small enterprises, favouring simple, role-based interfaces over feature-heavy systems(Julius & Kaazara, 2025). The literature also highlights the value of mobile-money and online payment integration in African contexts, where card penetration is low but mobile-money usage is high(Ramadhan et al., 2023). Iterative and prototype-driven development methodologies are recommended for small systems because they allow requirements to be refined with users as working versions are demonstrated. This project applied those lessons to Hannah Hostel.

5.0 Methodology

The project used a prototype-based, iterative system development methodology combined with a mixed-methods requirements investigation. In the requirements phase, questionnaires and interviews were administered to 78 respondents—residents, front-desk staff, and management—and existing paper records were reviewed to understand current workflows and pain points(Sarah et al., 2024).

Requirements were translated into functional specifications (booking, allocation, billing, tenant management, reporting) and non-functional specifications (usability, security, performance, reliability)(Ntirandekura et al., 2022). The system was designed using a three-tier architecture: a presentation layer (responsive web interface), an application layer (business logic and role-based access control), and a data layer (a normalised relational database)(Sarah & Audrey, 2024). Development proceeded in iterations, each ending with a demonstrable prototype that users reviewed. Testing included unit testing, integration testing, and user-acceptance testing, in which residents and staff performed representative tasks while completion time and error rates were recorded and usability was rated on a five-point scale(Alex & Moses, 2024).

6.0 Results and Interpretation

6.1 Documented Requirements

The requirements investigation identified the priority problems and the modules needed to solve them, summarized below.

Table 1: Identified problems and corresponding system modules

Problem in manual system	% citing it	Module designed
Double-booking of rooms	71%	Real-time booking engine
Lost or duplicated tenant records	64%	Central tenant database
Delayed payment reconciliation	68%	Billing & receipts module
No occupancy/revenue reports	59%	Reporting dashboard
Slow maintenance response	46%	Maintenance ticketing

Source: Primary Data, 2025

The findings presented in Table 1 identified the major challenges associated with the existing manual hostel management system and the corresponding automated modules that were developed to address each challenge. The most frequently cited problem was double-booking of rooms, reported by 71% of the respondents. This finding suggested that room reservation conflicts were the most critical operational challenge experienced under the manual system. The occurrence of double bookings indicated that manual reservation procedures were inefficient, prone to human error, and incapable of providing real-time updates on room availability. To address this challenge, a real-time booking engine was designed to automatically update room availability and prevent multiple reservations for the same room, thereby improving the accuracy and efficiency of the booking process.

The findings further revealed that delayed payment reconciliation was identified by 68% of the respondents as another major operational challenge. This suggested that manually verifying payments and matching receipts with tenant accounts consumed considerable time and often delayed financial reporting and decision-making. Such delays could result in inaccuracies in financial records and increase the risk of accounting errors. Consequently, a billing and receipts module was developed to automate invoice generation, payment recording, and receipt issuance, thereby improving the efficiency and accuracy of financial management within the hostel management system.

Similarly, lost or duplicated tenant records were reported by 64% of the respondents. This finding indicated that the manual storage and retrieval of tenant information exposed the institution to frequent data inconsistencies, missing records, and duplication of tenant information. These weaknesses negatively affected administrative efficiency and made it difficult to track tenant histories accurately. To overcome this limitation, the system incorporated a central tenant database, which was designed to securely store tenant information in a centralized digital repository while minimizing duplication and facilitating faster retrieval of records.

The findings also showed that 59% of the respondents identified the absence of occupancy and revenue reports as a significant weakness of the manual system. This suggested that management experienced difficulties in monitoring hostel occupancy levels, revenue performance, and operational trends because reports had to be prepared manually. To address this challenge, a reporting dashboard was developed to generate real-time occupancy statistics, revenue summaries, and other management reports automatically. This functionality was expected to improve decision-making by providing timely and accurate information to administrators.

Finally, slow maintenance response was cited by 46% of the respondents, making it the least frequently reported challenge among those assessed. Although fewer respondents identified this problem, the findings suggested that

delays in reporting and responding to maintenance issues still affected the quality of hostel services and resident satisfaction. To improve maintenance management, a maintenance ticketing module was developed to allow maintenance requests to be submitted, tracked, and resolved systematically.

6.2 System Modules Delivered

The completed platform delivered the following working modules, each tested against its requirement.

Table 2: Delivered modules and test outcome

Module	Key function	Test result
Booking engine	Real-time availability & reservation	Passed
Room allocation	Assign/transfer rooms, prevent conflicts	Passed
Billing & receipts	Invoice, record payment, generate receipt	Passed
Tenant management	Profiles, check-in/out history	Passed
Reporting dashboard	Occupancy & revenue reports	Passed
User & access control	Role-based login (admin, staff, resident)	Passed

Source: Primary Data, 2025

The findings presented in Table 2 indicated that all the major modules developed for the automated hostel management system successfully passed functional testing. This demonstrated that the developed system was capable of performing the intended operations effectively and reliably.

The booking engine, whose primary function was to provide real-time room availability and reservation management, successfully passed all functional tests. This finding suggested that the module accurately updated room availability, processed reservations efficiently, and effectively prevented booking conflicts. The successful testing indicated that the booking engine was capable of eliminating many of the reservation challenges associated with the previous manual system.

Similarly, the room allocation module, which was designed to assign rooms, facilitate room transfers, and prevent allocation conflicts, also passed the testing process successfully. This finding demonstrated that the module accurately allocated available rooms to tenants while ensuring that duplicate assignments and allocation errors were minimized. The successful implementation of this functionality was expected to improve room management efficiency and optimize occupancy management.

The billing and receipts module likewise passed all functional tests. The module was designed to automate invoice generation, record tenant payments, and generate official payment receipts. The successful test results suggested

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that the module accurately handled financial transactions while reducing manual computation errors and improving accountability within hostel financial management.

Furthermore, the tenant management module, which maintained tenant profiles together with check-in and check-out histories, successfully passed system testing. This finding indicated that the module effectively stored, updated, and retrieved tenant information while maintaining comprehensive occupancy records. The successful implementation of this component demonstrated its ability to improve record management and facilitate easier retrieval of tenant information. Similarly, the reporting dashboard passed all testing requirements, confirming its ability to generate occupancy reports, revenue summaries, and other management reports accurately and efficiently. The automated reporting functionality was expected to significantly improve managerial decision-making by providing real-time operational information. Finally, the user and access control module, which supported role-based login for administrators, staff, and residents, also passed system testing successfully. This finding demonstrated that the system effectively restricted user access according to assigned roles, thereby enhancing system security and protecting sensitive information.

6.3 Performance and Usability Evaluation

User-acceptance testing compared the platform with the manual process on task-completion time, error rate, and usability rating.

Table 3: Comparison of manual system versus automated platform

Metric	Manual	Automated	Change
Room allocation time (avg)	14.0 min	1.8 min	–87%
Booking errors per 50 bookings	9	1	–89%
Payment reconciliation time (avg)	22 min	3 min	–86%
Report generation time	≈ 2 hrs	< 1 min	–99%
Usability rating (booking module)		88% easy	

Source: Primary Data, 2025

The findings presented in Table 3 demonstrated substantial improvements in operational efficiency following the implementation of the automated hostel management platform when compared with the previous manual system. The average room allocation time decreased dramatically from 14.0 minutes under the manual system to only 1.8 minutes under the automated platform, representing an 87% reduction. This finding suggested that the automated room allocation process significantly improved administrative efficiency by enabling staff to allocate rooms much faster while reducing delays experienced by prospective tenants. The reduction also reflected the effectiveness of automated room availability tracking and conflict prevention mechanisms.

The findings further revealed a remarkable reduction in booking errors, which decreased from 9 errors per 50 bookings under the manual system to only 1 error per 50 bookings after automation, representing an 89% improvement. This suggested that the automated booking engine substantially minimized human errors associated with manual reservation processes. The significant decline in booking errors demonstrated the effectiveness of real-time reservation updates and automated conflict detection in improving the reliability and accuracy of room bookings.

Similarly, the average payment reconciliation time was reduced from 22 minutes under the manual system to only 3 minutes with the automated platform, representing an 86% reduction. This finding suggested that the automated billing and receipts module significantly streamlined financial management processes by enabling faster verification of payments, automatic updating of financial records, and immediate generation of payment receipts. Consequently, financial transactions became more efficient and less susceptible to manual errors.

The findings also demonstrated the most substantial improvement in report generation time. Under the manual system, management reports required approximately two hours to prepare, whereas the automated platform generated similar reports in less than one minute, representing a remarkable 99% reduction in reporting time. This dramatic improvement suggested that automated reporting significantly enhanced managerial efficiency by providing immediate access to occupancy statistics, revenue summaries, and other operational reports needed for timely decision-making. Finally, the evaluation of system usability revealed that 88% of users rated the booking module as easy to use. This finding suggested a high level of user acceptance and satisfaction with the system's interface and functionality. The positive usability rating indicated that users were able to navigate the booking module with minimal difficulty, thereby increasing the likelihood of successful adoption and long-term utilization of the automated platform.

7. Discussion of Results

The results confirm the central premise from the literature that automating transactional processes improves accuracy, speed, and information availability. The elimination of double-booking through a real-time availability check directly resolved the most-cited problem, validating the choice to prioritise the booking engine. The steep reductions in reconciliation time and reporting effort show that centralising data removes the redundant manual work that previously delayed management decisions.

High usability ratings reflect the value of the role-based, simple interface designed with users through iterative prototyping, consistent with adoption findings in small-enterprise systems. The residual booking error (1 in 50) traced to data-entry mistakes rather than system logic, indicating that input validation and, ultimately, self-service

booking by residents could reduce errors further. Overall, the platform met its objectives and outperformed the manual system on every measured dimension.

8. Conclusions

The project successfully designed, developed, and evaluated an automated hostel management platform for Hannah Hostel. The system automates booking, room allocation, billing, tenant management, and reporting, and it substantially outperforms the manual process in speed, accuracy, and record integrity. User evaluation confirmed high acceptance and usability. It is concluded that automation is an effective and practical solution to the operational problems Hannah Hostel faced under manual management.

9. Recommendations

4. Integrate mobile-money and online payment gateways so residents can pay directly, further reducing reconciliation effort and delays.
5. Develop a companion mobile application to widen resident access to booking, payment, and maintenance requests.
6. Add resident self-service booking with strong input validation to reduce residual data-entry errors.
7. Implement automated data backup and role-based security policies to protect tenant records.
8. Provide short training and a user manual for staff to sustain correct use and ease future onboarding.

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