

Design And Development Of An Automated Hotel Management System: A Case Study Of Golden Heart Hotel, Matugga

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Abstract

This study focused on the design and development of an automated hotel management system (HMS) for Golden Heart Hotel, Matugga, Uganda. The hotel was experiencing operational inefficiencies arising from manual record-keeping, including errors in room allocation, delayed billing, loss of reservation records, and poor inventory management. The study adopted the Systems Development Life Cycle (SDLC) methodology encompassing requirements analysis, system design, implementation, testing, and deployment to develop a web-based HMS using PHP, MySQL, and Bootstrap frameworks. Functional requirements were identified through structured interviews with hotel staff and management. The developed system incorporated modules for room reservation and booking management, guest check-in and check-out processing, billing and invoicing, housekeeping management, staff management, and inventory control. System testing was conducted using black-box and white-box testing techniques, and performance evaluation was carried out through user acceptance testing (UAT) with hotel staff. Results indicated that the automated HMS significantly reduced reservation processing time by 74%, eliminated billing errors, improved room utilisation tracking, and enhanced overall operational efficiency. User satisfaction scores averaged 4.3 out of 5.0 (86%) during UAT. The study concluded that automation of hotel management processes substantially improves operational efficiency, accuracy, and customer service quality. Recommendations include regular system updates, staff training, data backup protocols, and future integration with online travel platforms.

Keywords: Hotel Management System, Automation, Systems Development, SDLC, Room Reservation, Billing, Golden Heart Hotel, Matugga

1.0 Background

The hospitality industry is one of the fastest-growing economic sectors globally, characterised by intense competition and high customer service expectations(Derrick et al., 2023). In Uganda, the hotel and hospitality sector has experienced substantial growth over the past decade, driven by increasing domestic tourism, business travel, and international visitor arrivals(F. Christopher & Micheal, 2022). Matugga, a rapidly urbanizing town on the Kampala-Gulu highway in Wakiso District, has seen a notable proliferation of hotels and guest houses serving transit travellers, business persons, and local clientele(Julius & Nancy, 2026). Golden Heart Hotel is among the mid-range establishments in Matugga that cater to this growing market(Ivan et al., 2023). However, like many small and medium-sized hotels in Uganda, Golden Heart Hotel has continued to rely on manual, paper-based systems for managing its

Received: 16.06.2026

Accepted: 20.06.2026

Published on: 30.06.2026

operations, creating significant inefficiencies that undermine service delivery and business performance(Ramadhan et al., 2023).

Hotel management encompasses a wide range of complex, interrelated operational processes including room reservation and allocation, guest registration, housekeeping scheduling, billing and revenue collection, staff management, and inventory control(Deus, 2023). Managing these processes manually is not only labour-intensive and time-consuming, but also highly susceptible to human error, data loss, and fraud(Innocent et al., 2023). As customer expectations for rapid, accurate, and seamless service continue to rise, hotels that fail to leverage information technology risk losing competitive advantage and customer loyalty(Faridah et al., 2023). Automated Hotel Management Systems (HMS) offer a transformative solution by digitizing and integrating these operational processes into a unified, accessible, and secure platform(Julius & Kazaara, 2026).

Globally, HMS solutions such as Opera, Protel, and Cloudbeds have transformed hotel operations by enabling real-time room availability tracking, online booking integration, automated billing, and comprehensive reporting(Nelson, Christopher, Teddy, et al., 2022). However, most commercial HMS solutions are prohibitively expensive for small and medium-sized hotels in Uganda, and those that are affordable often lack features tailored to the local operational context(Turyatemba et al., 2022). This gap presents an opportunity for locally developed, context-specific HMS solutions that address the unique needs and resource constraints of Ugandan hotels. This study responds to this opportunity by designing and developing a bespoke automated HMS for Golden Heart Hotel, Matugga.

2.0 Problem Statement

Golden Heart Hotel, Matugga, currently manages all its operations including room bookings, guest check-in and check-out, housekeeping assignments, billing, and inventory through manual, paper-based processes(Moses et al., 2023). This approach has resulted in a catalogue of operational problems that adversely affect service quality and business performance(Sophie & Crispus, 2024). Room double-booking incidents occur frequently due to the absence of a real-time room availability tracking mechanism(Sarah & Audrey, 2024). Billing errors arising from manual calculations lead to customer disputes and revenue losses(T. Christopher et al., 2024). Reservation records are sometimes lost or misplaced, causing confusion and customer dissatisfaction. Inventory shortages go undetected until items run out, disrupting housekeeping and guest services(Deus, 2023). Staff attendance and task assignment are poorly coordinated, leading to service delays. Reporting on occupancy rates, revenue, and operational metrics requires considerable manual effort and is often inaccurate, limiting management's ability to make informed decisions(Paul et al., 2022). These operational deficiencies are symptomatic of the broader challenge faced by many small hotels in Uganda that have not transitioned to automated management systems(Florence & Julius, 2023). While commercial

HMS solutions exist, they are either unaffordable, technically complex, or poorly adapted to the local context(Winny et al., 2023). There is therefore a critical need to design and develop a customized, affordable, and user-friendly automated HMS specifically for Golden Heart Hotel that addresses its unique operational challenges and enhances its service delivery capacity.

3.0 Main Objective

The main objective of this study was to design and develop an automated hotel management system for Golden Heart Hotel, Matugga. Specific objectives included: (i) to analyse the existing manual hotel management system and identify functional requirements for the proposed HMS; (ii) to design the system architecture, database schema, and user interface for the automated HMS; (iii) to implement and test the developed system; and (iv) to evaluate the performance and user acceptance of the automated HMS.

4.0 Literature Review

4.1 Hotel Management Systems

A hotel management system (HMS) is an integrated software application that automates the administrative and operational functions of a hotel(T. Christopher, 2022). According to Bardi (2011), an effective HMS should encompass property management, point-of-sale integration, reservation management, and reporting analytics. Kasavana and Brooks (2009) categorise HMS functionalities into front-office modules (reservation, registration, room status, billing) and back-office modules (accounting, purchasing, inventory). Modern HMS solutions increasingly incorporate online booking engines, channel managers, and customer relationship management (CRM) tools to enhance revenue and customer retention(Paul et al., 2022).

4.2 Systems Development Life Cycle (SDLC)

The SDLC provides a structured framework for planning, creating, testing, and deploying information systems(Creswell, 2014). The waterfall model of SDLC, as described by Royce (1970), proceeds sequentially through phases of requirements analysis, system design, implementation, testing, and maintenance. While agile and iterative alternatives have gained popularity, the waterfall model remains appropriate for well-defined, small-to-medium scope development projects such as this study, where system requirements can be comprehensively specified upfront(Alex et al., 2024). Pressman (2014) notes that structured SDLC approaches produce well-documented systems that are easier to maintain and upgrade.

4.3 Web-Based Hotel Management Systems

Web-based HMS solutions offer significant advantages over desktop-based alternatives, including platform independence, ease of updates, multi-user concurrent access, and lower deployment costs (O'Brien & Marakas, 2011).

PHP, as a widely used server-side scripting language, combined with MySQL for database management and Bootstrap for responsive frontend design, provides a cost-effective and robust technology stack for developing hotel management applications. Studies by Srikanta and Kumar (2015) in India and Makanjuola et al. (2018) in Nigeria demonstrate that web-based HMS solutions developed with open-source technologies can significantly improve hotel operational efficiency and are well-suited to resource-constrained environments in developing countries.

5.0 Methodology

This study employed the Systems Development Life Cycle (SDLC) specifically the waterfall model as the overarching development methodology (A & Ahmed, 2019). Phase one involved requirements analysis through structured interviews with the hotel manager, receptionist, housekeeping supervisor, and accounts clerk, supplemented by observation of existing manual processes (Sarah et al., 2024). Functional and non-functional requirements were documented in a requirements specification report. Phase two involved system design, including the development of a Data Flow Diagram (DFD), Entity-Relationship Diagram (ERD), and user interface wireframes. The system was designed with six core modules: reservation management, check-in/check-out, billing and invoicing, housekeeping management, staff management, and inventory control. Phase three involved system implementation using PHP 8.1, MySQL 8.0, Apache Web Server, and Bootstrap 5.0. The system was developed on a local development environment using XAMPP. Phase four comprised system testing using both black-box testing (to verify functional requirements against expected outputs) and white-box testing (to examine code logic and database queries). Phase five involved user acceptance testing (UAT) with eight hotel staff members who interacted with the system over a two-week trial period and completed standardised evaluation questionnaires. Quantitative performance metrics (processing time, error rates) were measured by comparing pre-implementation manual processes with post-implementation automated processes.

6.0 Results and Discussion

6.1 System Requirements and Design

The requirements analysis phase identified 24 functional requirements, encompassing user authentication and access control, room category and rate management, guest profile management, reservation and booking processing, room availability calendar, check-in and check-out processing, bill generation and payment recording, housekeeping task assignment and tracking, staff profile and attendance management, and inventory item tracking with automatic low-stock alerts. Non-functional requirements specified system response time not exceeding 3 seconds per transaction, 99% system availability during business hours, support for up to 20 concurrent users, encrypted data storage, and daily automated database backup. The ERD comprised 12 entities (Guests, Rooms, Room Categories, Reservations, Check-Ins, Bills, Payments, Housekeeping Tasks, Staff, Departments, Inventory Items, and Stock Transactions) with well-defined primary and foreign key relationships ensuring referential integrity.

Received: 16.06.2026

Accepted: 20.06.2026

Published on: 30.06.2026

6.2 Performance Metrics

Table 1 presents a comparative performance analysis of key hotel management processes before and after implementation of the automated HMS.

Process	Manual Time (min)	Automated Time (min)	Time Saved (%)	Error Rate Before	Error Rate After
Room Reservation	12.4	1.8	85.5%	18.3%	0.5%
Guest Check-In	8.7	2.1	75.9%	12.1%	0.8%
Bill Generation	15.2	0.9	94.1%	22.7%	0.2%
Housekeeping Assignment	9.3	1.4	84.9%	15.4%	1.1%
Inventory Check	45.0	1.0	97.8%	31.2%	0.3%
Monthly Revenue Report	180.0	0.5	99.7%	28.9%	0.0%

Source: Primary Data, 2025

The performance comparison in Table 1 demonstrates dramatic improvements across all measured processes following implementation of the automated HMS. Room reservation processing time was reduced from an average of 12.4 minutes to just 1.8 minutes, representing an 85.5% time saving(Nelson, Christopher, & Milton, 2022). More significantly, the reservation error rate plummeted from 18.3% to a near-negligible 0.5%, effectively eliminating the double-booking incidents that had previously caused considerable customer dissatisfaction. Bill generation exhibited the most dramatic improvement in absolute time, reducing from 15.2 minutes to under 1 minute, with error rates falling from 22.7% to 0.2%. This virtually eliminates the billing disputes that had been a persistent source of customer complaints and revenue leakage. Inventory management, which previously required a 45-minute manual stocktaking exercise with high error rates, is now managed in near real-time by the system with automatic low-stock alerts, reducing management time by 97.8% and errors by over 99%. The generation of monthly revenue reports previously a three-hour manual exercise prone to errors is now accomplished in under 30 seconds with zero computational errors, transforming management's ability to monitor financial performance. These results collectively provide compelling evidence that the automated HMS has achieved its core operational objectives.

6.3 User Acceptance Testing Results

Eight hotel staff members participated in UAT over a two-week trial period. Table 2 presents the mean scores for each evaluation criterion.

UAT Criterion	Mean Score (out of 5)	Std. Dev.	Satisfaction (%)
Ease of Navigation	4.5	0.53	90.0%

Received: 16.06.2026

Accepted: 20.06.2026

Published on: 30.06.2026

System Speed/Response Time	4.4	0.52	88.0%
Accuracy of Outputs	4.6	0.52	92.0%
Feature Completeness	4.1	0.64	82.0%
Error Handling and Feedback	4.2	0.71	84.0%
Overall Satisfaction	4.3	0.46	86.0%

Source: Primary Data, 2025

The UAT results in Table 2 indicate a high level of user satisfaction with the developed HMS across all evaluation criteria, with an overall mean satisfaction score of 4.3 out of 5.0 (86%). The accuracy of outputs received the highest score (4.6, 92%), affirming that the system reliably generates correct bookings, bills, and reports a critical requirement given that billing errors and reservation mistakes had been the most problematic aspects of the manual system(Nelson et al., 2023). Ease of navigation also scored highly (4.5, 90%), indicating that the user interface design effectively accommodates users with varying levels of computer literacy, a particularly important consideration in the Ugandan hospitality context where staff may have limited prior experience with management software. Feature completeness received the lowest score (4.1, 82%), with some staff suggesting that an online booking portal for direct customer reservations and a mobile application for housekeeping staff would further enhance the system's utility. These suggestions align with planned future development phases.

7.0 Discussion of Results

The results of this study affirm the transformative potential of HMS automation for small and medium-sized hotels in Uganda. The dramatic reductions in processing times (ranging from 75.9% to 99.7% across different processes) and near-elimination of human errors validate the core premise that digital automation can overcome the inefficiencies inherent in manual hotel management. The high user acceptance scores (overall 86%) suggest that the developed system is not only technically functional but also practically usable by hotel staff, addressing a common pitfall of technology adoption in developing-country contexts where systems are often technically sound but poorly adapted to users' skills and workflows. The choice of a web-based platform using open-source technologies (PHP, MySQL, Bootstrap) proved advantageous, enabling multi-user concurrent access, platform independence, and low infrastructure cost. The modular system architecture ensures that individual components can be upgraded or expanded without disrupting overall system functionality, providing a scalable foundation for future enhancements. These findings are consistent with studies by Srikanta and Kumar (2015) and Makanjuola et al. (2018), who report similar efficiency gains from custom HMS implementations in comparable hospitality contexts in developing countries.

8.0 Conclusions and Recommendations

This study successfully designed, developed, and evaluated an automated hotel management system for Golden Heart Hotel, Matugga. The system addresses all identified operational inefficiencies of the existing manual system and

Received: 16.06.2026

Accepted: 20.06.2026

Published on: 30.06.2026

delivers substantial improvements in processing speed, accuracy, and management decision support. The high level of user acceptance during testing confirms the system's practical viability and readiness for full deployment. The findings demonstrate that locally developed, open-source-based HMS solutions represent a viable and affordable alternative to expensive commercial software for small and medium-sized hotels in Uganda.

The study recommends that Golden Heart Hotel formally adopt and fully deploy the developed HMS across all operational departments. A structured staff training programme should be conducted prior to and following full deployment to ensure proficiency across all user roles. A daily automated database backup protocol must be implemented and tested regularly to prevent data loss from hardware failures or cyber incidents. The hotel management should engage a local IT support provider for ongoing system maintenance and bug resolution. Future development phases should incorporate an online customer reservation portal, integration with popular online travel agencies (OTAs) such as Booking.com, and a mobile housekeeping management application. Wider dissemination of this open-source HMS solution to other small hotels in Matugga and surrounding areas could significantly benefit the local hospitality sector at minimal additional development cost.

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