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Development of a Hostel Management System with Security for Off-Campus Student: A Case Study of the University of Ilorin

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Abstract

This study focuses on the design and implementation of an online off-campus hostel management system for students at the University of Ilorin, Nigeria. The system aims to address the challenges students face in securing off-campus accommodation due to the increasing student population and limited on-campus housing options. The traditional process of finding off-campus housing is often time-consuming, disorganized, and stressful, involving physical visits to multiple properties and reliance on informal networks. To address these issues, the study employed the Waterfall software development model, a linear and structured methodology that ensures systematic progression through distinct phases, including requirements analysis, system design, implementation, testing, deployment, and maintenance. The requirements analysis phase involved gathering detailed functional and non-functional requirements from stakeholders, including students, landlords, and administrative staff, to ensure the system met their needs. During the design phase, a comprehensive architectural blueprint was developed, including database schemas, user interface layouts, and system architecture diagrams. The implementation phase utilized modern web technologies such as HTML, CSS, JavaScript, and MySQL to create a responsive and user-friendly platform. Rigorous testing was conducted to validate the system's functionality, security, and reliability, ensuring it met all specified requirements. The system was then deployed to a production environment, and a maintenance plan was established to address future updates and improvements. The proposed system offers a centralized platform connecting students, landlords, and agents. Students can search for housing based on their preferences, including location and budget, and view property details such as descriptions and photos. Landlords and agents can advertise their properties to a wider audience. The study highlights the benefits of the online system, including reduced stress for students, increased efficiency for administrators, and improved access to off-campus housing options. It suggests that the system has the potential to enhance student's overall university experience by facilitating a smoother transition into off-campus living. Future development may include features like automated payments to further enhance the system's functionality. By employing the waterfall model, the study ensured a structured and disciplined approach to development, resulting in a robust and reliable platform that addresses the housing challenges faced by students at the University of Ilorin.
Keywords: Hostel management system, Off-campus, Online system, Students.

INTRODUCTION

In recent times, there has been an increase in the admission of students in Nigerian Higher Education Institutions. Over the past two decades, discussion on the subject of student accommodation has intensified, focusing on student satisfaction, the way it is built, its supply on the market and its management (Spire, 2018). This has resulted to a large number of students seeking accommodation.

Residential accommodation in tertiary institutions is provided to offer students the prospect for communal living, to promote social communication and enhance their level of comfort while on campus. In view of this, numerous scholars have described the provision

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of on-campus student housing facilities as central to the achievement of the goals of every tertiary institution. Yet, many universities are grappling with the challenge of providing conducive and suitable residential facilities for students on campus because of the continuous increase in student population in recent years (Osei-Poku et.al 2020). Inadequate on-campus student accommodation in Sub-Saharan higher educational institutions triggered the need for private sector intervention in the off-campus student private housing (SPH) delivery within university communities (Gbadegesin, 2021).

Hostel management is a tedious task that needs a lot of time and supervision (Pooja, Nishant, Shivam, & Himanshi, 2020). Due to this, it is necessary for every management to seek how to effectively manage the hostel. The quickest and most reliable way/method to resolve this is to seek digital intervention.

Student housing is not just one of the most important amenities on campus, but it also fosters an inclusive community that improves academic performance, comfort and social care (Appau, 2024)

The process of hostel management varies from school to school and are significantly different from one another. While some are online-based, some are manual-based which are referred to as offline based hostel management.

The offline hostel management is unfortunately what is practiced in most tertiary institutions in Nigeria and involves a lot of paper works. In this form of hostel management, hostel registration is manual and irrespective of the number of students that are to register, the process would be done manually and includes long queues of the students and stress on the part of officials or officers in charge of the hostel registration in Students' Affairs Unit (Matovu, 2019).

The clerk at the student's affairs unit/department keeps records of unoccupied or allocated rooms on a source document so as to know where to allocate a student.

After the enduring process of the hostel registration process, the officers get to review the files one after the other and file them. It is this process that is used to determine students that are eligible for the school hostel accommodation.

On completion of filing, hostel status computing and allocation of hostel accommodation spaces, students are then given their hostel materials such as pillows, mattress, identification card etc. to facilitate their settling into the hostel. This method usually requires many hands to put this in place. The detriment of this hostel management is the various form of risks that are involved one which is majorly operational risk. The operational risk involved can be inform of loss of documents, destruction of documents due to natural disaster, health challenges of administrators and portals as a result of heavy workload (Shoewu, Braimah, & Duduyemi, 2016).

Loss of receipts can be a major cause. Cheating can also be a factor since everything is manual and cannot be backed up. Lots of pages will be wasted for filling details of students, etc. The detriment of this hostel management is the various form of risks that are involved one which is majorly operational risk. The operational risk involved can be inform of loss of documents, destruction of documents due to natural disaster, health challenges of administrators and portals as a result of heavy workload (Shoewu, Braimah, & Duduyemi, 2016).

The importance of the online management system is used to address the lapses of the offline hostel management system such as easing the stress caused by offline hostel management on the part of the students, administrator, and the hostel portals. It also increases the turnaround time of the entire hostel registration and allocation process.

The online management system helps bring about efficiency, reducing time taken from the first step of application to allocation from days to seconds. All processes involved in-between the offline process including filing, reservation, documents verification are done electronically.

Elakkiya, Nirmala and Priyadarshini (2018) developed a web-based hostel management system for improving sustainable performance of educational institutions. They developed a software that is developed for managing various activities for the hostel. The system was developed because of human strain on individuals who are in-charge of the hostel management system offline. This and many more disadvantages of the existing system was the motivation for the development of the system.

The current hostel system in the University of Ilorin is a combination of on-campus and off-campus hostel system. The on-campus hostels are situated within the school premises, and they comprise of private and public hostel. The

public hostels are commonly referred to as 'school hostel'. There is currently one school hostel for male gender (Lagos Hostel) while there are three school hostels for female hostel (Lagos, Abuja and Zamfara Hostels). The capacity of each of the hostels is an average of about seven hundred (700) students. The total number of admitted students across all levels and faculties in the institution is about 50,000. Obviously, the available school hostels are insufficient to sufficiently accommodate the students.

It is worthy to note that the cost of acquiring school hostel is affordable being about thirty thousand naira (30,000) and it comes with an added advantage of proximity to academic facilities within the school. Securing school hostel is extremely competitive due to the total number of students that are being admitted to the school. The process of securing school hostel accommodation is an online balloting on the school hostel portal which can only be possible after school fees payment has been made.

On the other hand, the private hostel accommodation within the school premises are quite expensive and they range from an average of ninety thousand naira (90,000) to a hundred and fifty thousand naira (150,000) which is about three to five times the school hostel amount. At first, the private hostels were limited as compared to the number of registered students. When students are unable to secure on-campus school hostel accommodation and they cannot afford on-campus private hostel accommodation, they tend to resolve staying off-campus.

As a means to improve on future managerial operations, authorities of universities would need to sensitize students' housing owners and managers on the need to understand and appreciate the expectations and preferences of students. Among important managerial needs include noise insulation systems to be installed in all students' housing to provide conducive learning environments, first aid boxes to be made available in all premises at all times, managers to respond to repairs and provide regular facility checks, security to be improved by employing private security and repairing all weak lighting systems around buildings (Awotwe, et.al 2022).

Conclusively, it is fundamental for all tertiary institutions and stakeholders to consider and prioritise student housing to ensure adequate and good student houses are provided (Woru, et.al, 2024).

RELATED WORKS

The hostel system with the integration of Information Technology (IT) consists of three components i.e. human, task and application system (Ayaka, 2015). The human component refers to the input of the operator to complete the system. Irrespective of automation, an element of human ware is required to complete or begin the process of the system.

Several studies have been carried out on hostel system and this includes an online platform or hostel management system that enables registration of users, hostel payment and invoicing, allocation of hostel accommodation to students and hostel management system that manages integrations such as radio-Frequency identification (RFID) tags to go in and out of the hostel (Inamdar & Gupta, 2020).

Chaudhri and Kevat (2021) created an Android application that makes use of the Random Forest Classifier machine learning method. By analyzing students' study habits, routines, and other factors, this software can better match them with housemates. Quick and precise allocation decisions are made while reducing noisy data thanks to the Random Forest Classifier's capacity to adapt to a variety of input attributes and competency with huge datasets. Additionally, it indicates the value of a feature, assisting hostel management in comprehending the aspects that affect allocation. This new idea intends to enhance the dorm experience by boosting roommate compatibility and encouraging inclusivity, thereby enhancing students' well-being and academic success.

The study of Elakkiya and Priyadarshini (2018) on web-based hostel management system for improving sustainable performance of educational institutions developed modules such as student information, room allocation, attendance entry, mass payment calculation, stock availability and gate pass as modules of the of the developed system. The software designed is synonymous to an Enterprise Resource Planning (ERP) System for hostel management purpose.

METHODOLOGY

Review of Existing System

It is the duty of the school to provide a suitable accommodation system in form of hostels for their admitted students. These hostel accommodations are usually situated within the school premises, catered for and managed by the school management. Due to increasing number of admitted students in higher education institutions, available hostel accommodations in school can no longer hold the number of admitted students. In lieu of this, private bodies are also allowed to build hostel accommodations in schools under a Build-Operate-Transfer (BOT) contract between the school management and the private investor(s)/establishment(s). These private hostels built within the school premises in a specified geographical region within the school are well equipped and they come at a cost and usually more expensive than the school hostel. The intervention of private investors in providing hostel accommodations within the school premises is yet to meet the demand of the number of students that are being admitted into these institutions. This way, other students settle to live outside the school and convey themselves to the school premises daily for lectures, tests and examination. Living outside of the school could be living with a family member or a guardian that reside close to or around the geographical location of the school. Other students who do not have whom they can stay around the school resolve to getting vacant off-campus hostel accommodations in communities that are around the school

Software Development Model

The Waterfall approach was employed for the software development process in this project. The waterfall model illustrates the software development process in a linear sequential flow as shown in Figure 1. It indicates that each step of the development process begins only after the previous phases are accomplished. In this waterfall paradigm, the phases do not overlap.

Because it offered a precise and organized framework for methodically handling every stage of the development process, the Waterfall model was especially well-suited for this project. The first phase involved a comprehensive analysis of the system's functional and non-functional requirements. This included gathering detailed input from stakeholders, such as students, landlords, and administrative staff, to understand their needs and expectations. The requirements were documented in a Software Requirements Specification (SRS) document, which served as the foundation for all subsequent phases. The online off-campus hostel administration system's functional and non-functional demands were carefully defined starting with the requirements analysis phase, guaranteeing a firm grasp of the system's objectives and expectations. During the design phase, the system's architectural blueprint was meticulously crafted. This included: Database Design: A relational database schema was developed using MySQL, with tables normalized to ensure data integrity and efficiency. Entity-Relationship (ER) diagrams were created to visualize the relationships between entities such as users, hostels, bookings, and payments. User Interface Design: Wireframes and mock-ups were developed for key user interfaces, such as the student dashboard, landlord portal, and administrative panel. The design prioritized usability, accessibility, and responsiveness across devices.

Following design completion, the implementation phase was carried out, utilizing technologies like HTML, CSS, JavaScript, and MySQL to translate the design specifications into working code. After development, rigorous testing was conducted to verify that the system met all specified requirements and was free from critical defects. The deployment phase marked the system's rollout to its intended users, and a final maintenance phase was planned to address any future updates or bug fixes. This linear progression ensured that each phase was completed thoroughly before moving on, minimizing risks and maintaining control throughout the project lifecycle.

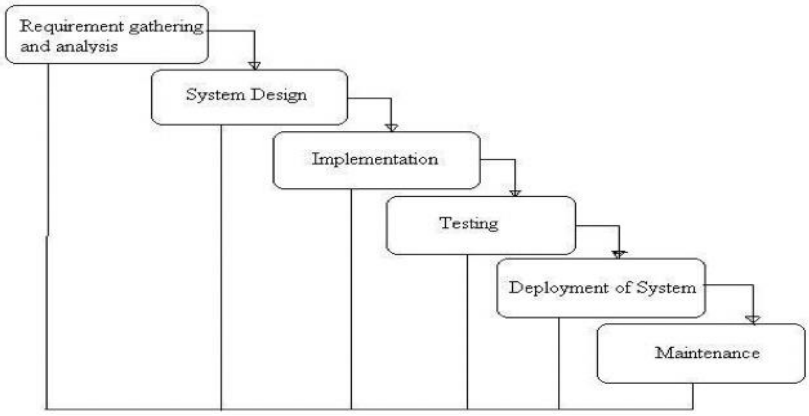

Figure 1. Waterfall development model.

The implementation stage of the development model involved the use of web technologies, including Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), and JavaScript, while MySQL was the chosen solution for database management and storage. This approach adhered to global best practices, ensuring ease of maintenance and enabling a faster development cycle while focusing on the application's core features. Additionally, it provided a solid foundation for future improvements, making it easier to introduce new functionalities.

To ensure the system's reliability, security, and trustworthiness, a comprehensive set of security measures was implemented throughout the development process. These measures were designed to address potential vulnerabilities at multiple levels, ensuring robust protection against both common and sophisticated threats.

Input validation and sanitization were prioritized to mitigate risks associated with user-generated data. All forms handling user input, such as account creation, login, and property listings, were rigorously validated to prevent malicious data from entering the system. This approach effectively safeguarded against vulnerabilities like SQL injection and cross-site scripting (XSS), which are among the most prevalent threats to web applications. For instance, SQL injection attacks were prevented by using parameterized queries and prepared statements, while XSS vulnerabilities were mitigated by escaping user input and implementing Content Security Policy (CSP) headers. These measures ensured that user inputs were thoroughly scrutinized and sanitized before being processed or stored.

Strong authentication protocols were implemented to enhance user account security. Password complexity requirements were enforced, mandating a combination of uppercase and lowercase letters, numbers, and special characters to create robust passwords. Additionally, mechanisms such as account lockouts after multiple failed login attempts and CAPTCHA challenges were introduced to deter brute-force attacks. Multi-factor authentication (MFA) was also integrated, adding an extra layer of security by requiring users to verify their identity through a secondary method, such as a one-time password (OTP) sent to their registered email or mobile device. These measures significantly reduced the risk of unauthorized access to user accounts.

Role-based access control (RBAC) was implemented to ensure that users could only access functionalities and data appropriate to their roles. For example, students were granted access to features like booking management and payment processing, while landlords were provided with tools to manage property listings and view booking requests. Administrative users, on the other hand, were given access to system-wide controls and reporting tools. This granular access control not only minimized the risk of data breaches but also ensured compliance with the principle of least privilege, a cornerstone of secure system design.

To protect sensitive data, encryption was employed both during transmission and while at rest. Data transmitted between the client and server was secured using HTTPS with TLS (Transport Layer Security) encryption, ensuring that sensitive information such as login credentials and payment details could not be intercepted by malicious actors. Within the database, sensitive data like passwords and personal identification information were encrypted using industry-standard algorithms. This ensured that even in the event of

unauthorized access to the database, the encrypted data would remain unreadable and unusable.

A robust backup and disaster recovery system was established to safeguard critical data and ensure business continuity. Regular automated backups were scheduled to create copies of the database and application files, which were stored in secure, off-site locations. In the event of hardware failures, data corruption, or other disruptions, these backups could be used to restore the system to its previous state with minimal downtime. Additionally, a disaster recovery plan was developed, outlining step-by-step procedures for responding to various types of incidents, from server crashes to cyberattacks. This proactive approach ensured that the system could quickly recover from disruptions, maintaining its reliability and availability for users.

Collectively, these security measures not only enhanced the system's resilience against threats but also fostered trust among its users. By prioritizing data protection, access control, and system integrity, the platform provided a secure and reliable environment for students and landlords to interact and conduct transactions. This focus on security aligns with best practices in software development and underscores the importance of building systems that are not only functional but also trustworthy and resilient in the face of evolving threats.

RESULTS AND DISCUSSION

Results

The development of an online off-campus hostel management system is a novel approach to addressing the challenges students face when seeking housing near the University of Ilorin. This system provides a centralized platform for students, landlords, and agents to connect, streamlining the traditionally cumbersome and inefficient process of finding off-campus accommodation.

The customer authentication flow shows the different authentication screens of customer account creation and customer login.

Account creation: when a user creates an account, as either a landlord or student, they need to create one with a unique email address, a unique username, and a password.

User login: When a user wants to begin a new session on the website, the authentication checks require them to enter their username and password to help identify them. The system then checks the values they input on the database and grants access accordingly.

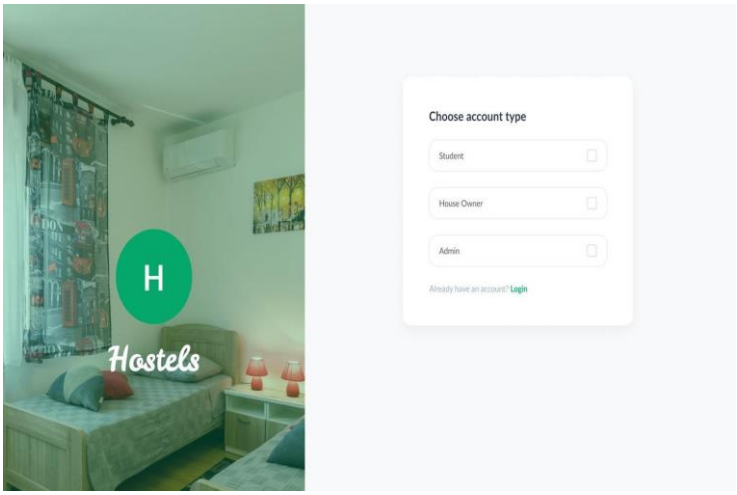

Figure 2. Account type page.

Hostel Information: This section shows the customer more details about the hostel which they selected to view as shown in Figure 3. It displays multiple images of the hostel and its rooms. The landing page is sectioned properly, with a sidebar by the left, entailing various activities like saving hostels as favourites, minimal notification system setup. In addition, the main app section shows a chosen hostel, highlighting features the hostel provides, images from the hostel, previous hostel previews and a map section to easily locate the physical structure of the hostel.

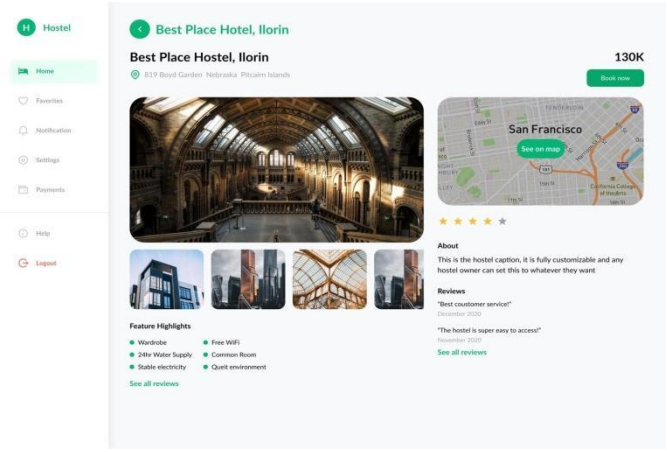

Figure 3. Hostel information page.

Landlord Page: The landlord section of the application is an encompassing section for listing new properties by a property owner popularly referred to as landlord in Nigeria. Figure 4 shows the initial step of the process to listing a new property by a landlord.

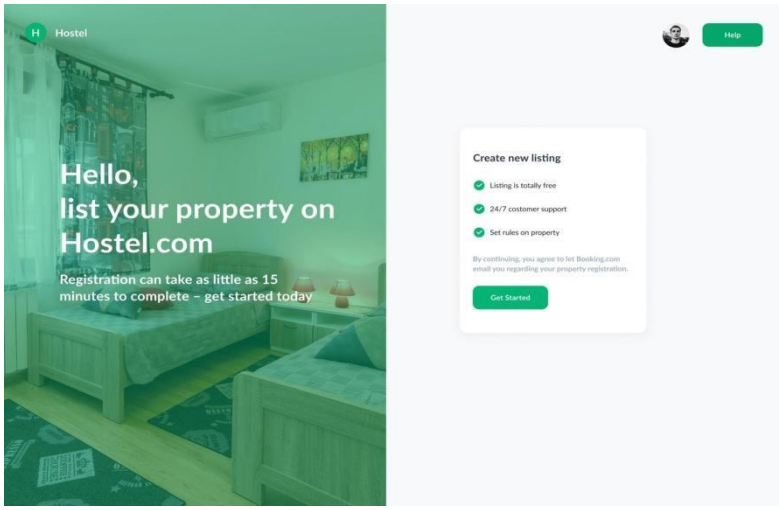

Figure 4. New listing page.

Home Page: The Home Page allows students to access various hostels that are available. It also shows the "view available hostel and prices; search for hostels; and view location.

The system's ability to filter accommodations based on location and budget is particularly beneficial for students. This allows for more targeted searches, saving time and effort that would otherwise be spent on physically visiting multiple properties. The inclusion of property images and descriptions provides students with a visual understanding of the accommodations, further aiding their decision-making process.

For landlords and agents, the system offers a free platform to advertise their properties to a wider audience of potential tenants. This is especially beneficial for landlords whose properties are not located in high-traffic areas or are managed by agents with limited reach. By reducing the reliance on traditional methods of advertising, such as word-of-mouth or physical signage, the system increases the visibility of these properties and potentially leads to faster occupancy rates.

By addressing the inefficiencies of the existing off-campus housing system, this project provides a practical solution with the potential to significantly improve students' overall university experience. The streamlined process, improved communication, and efficient data management facilitated by the online platform are expected to contribute to a more organized and less stressful housing search, ultimately allowing students to focus on their academic pursuits.

CONCLUSION

This study aimed to create an online hostel management system for students living off-campus at the University of Ilorin in Nigeria. Due to an increase in student admissions in recent times, on-campus accommodations are not enough to house all students. Consequently, many students have to find off-campus housing, which has traditionally been a time-consuming, disorganized, and stressful process.

This paper proposed an online system that simplifies the process of finding off-campus housing by connecting students with landlords and agents. The system allows students to search for housing based on their preferred location and budget, as well as view descriptions and photos of available accommodations. The system also provides a platform for landlords and agents to upload information about available properties. This system is expected to provide several advantages, including a more efficient, organized, and less stressful process for finding off-campus housing, potentially contributing to students' academic performance and overall well-being.

This system's emphasis on automation is a significant departure from the manual processes prevalent in most Nigerian tertiary institutions. The online platform minimizes paperwork, streamlines communication, and promotes efficient data management, offering benefits for both students and administrators. By reducing the time and effort required to manage hostel-related tasks, the system allows administrators to focus on other important aspects of student affairs.

The system was designed using HTML, CSS, JavaScript, PHP, and MySQL Database, chosen for their compatibility, security, ease of use, and object-oriented nature. Testing and evaluation of the system showed positive results, with all specified requirements met. However, there are some limitations to this system, including the requirement of internet access for use, the need for user registration, and the fact that it cannot be used to secure on-campus accommodations. Additionally, the system currently does not have a feature for automated payments to landlords.

The system has the potential to significantly improve the process of finding off-campus housing for students at the University of Ilorin. Further development of the system, including the addition of features such as automated payments, could make the system even more beneficial for both students and landlords.

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