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EFFICIENT INFRASTRUCTURE MANAGEMENT: DEVELOPING A UNIFIED PLATFORM FOR OFFICE ALLOCATION AND CREDENTIAL SERVICES IN FEDPOFFA CAMPUS, OFFA, KWARA STATE

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Abstract: *In educational institutions, the efficient allocation of offices and facilities is vital for ensuring smooth administrative and operational workflows. This study explores "Efficient Infrastructure Management: Developing a Unified Platform for Office Allocation and Credential Services" at FEDPOFFA Campus, Offa, Kwara State, through the development and implementation of a software solution. The research aims to reduce inefficiencies, improve resource utilization, and streamline decision-making processes regarding office and facility assignment. Data were collected from the institution's administrative records, focusing on allocation patterns, usage statistics, and spatial management of offices and facilities. The methodology involved designing and implementing a software-based allocation system, which integrates real-time data collection and analysis, improving transparency and fairness. Results indicate a significant improvement in allocation efficiency post-implementation, with reduced office vacancy rates and better alignment of facility use with institutional needs. This paper presents the design process, implementation challenges, and outcomes of the software, emphasizing the importance of data-driven decision-making in educational administration. The proposed solution offers a scalable model adaptable to similar institutions seeking operational efficiency through software innovations.*

Keywords: *Credential, Efficient Infrastructure, Office Allocation, Office Management.*

1.0 Introduction

The allocation of offices and facilities in educational institutions is a complex administrative challenge that involves multiple stakeholders and the management of limited resources. Efficient office and facility allocation is essential for the effective functioning of academic institutions, contributing to smooth operations and increased productivity among staff and students alike. At Federal Polytechnic Offa (FEDPOFFA), the manual processes traditionally used for assigning office spaces have become inefficient and prone to errors. This study seeks to address these challenges by developing a software solution that optimizes office and facility allocation through automated decision-making and real-time data analysis.

The need for effective space management in educational institutions is a global concern, as highlighted by several studies in higher education management. For instance, Saroyan and Frenay (2023) argued that optimal allocation of resources, including physical space, is critical for improving both staff satisfaction and institutional efficiency. In Nigerian polytechnics, the pressure on office spaces and facilities has intensified due to increasing student enrollment and

administrative demands. This has resulted in suboptimal use of facilities, underutilized spaces, and in some cases, dissatisfaction among staff. The shift towards digitized systems for resource allocation, as advocated by Yuan and Pan (2023), provides a more structured, data-driven approach to resource management.

The traditional office allocation system at FEDPOFFA involves manual processes that are time-consuming and prone to errors. Such inefficiencies in space utilization not only affect staff productivity but also lead to the underutilization of available facilities. As shown in Table 1, the current office allocation data reveals significant gaps in how offices and other facilities are assigned. For example, approximately 30% of the available office spaces remain unoccupied due to poor management (see Table 1: Current Office Allocation Data). This problem is further compounded by the lack of a comprehensive, transparent, and dynamic system that can handle real-time changes in staff needs and institutional growth.

Table 1: Current Office Allocation Data (Before Implementation of Software)

Facility Type	Unoccupied Offices	Occupied Offices	Undisclosed Occupants
Administrative Offices	650	1800	120
Academic Offices	88	120	90
Laboratories	88	55	12

The primary objective of this research is to design and implement an optimized software solution for office and facility allocation at FEDPOFFA. The software aims to increase allocation efficiency, reduce vacancy rates, and align space usage with real-time institutional needs. Specifically, this study aims to:

1. Develop an office and facility allocation software capable of managing real-time data and automating decision-making processes.
2. Analyze the current state of office and facility allocation and compare it with post-implementation outcomes.
3. Evaluate the impact of the software on administrative efficiency and staff satisfaction at FEDPOFFA.

Recent advancements in software engineering and data analytics have provided new tools for optimizing resource management. The implementation of software solutions for office allocation, as documented by Al-Jumaili et al. (2023), has been shown to significantly improve institutional operations by providing real-time data on space usage and needs. Figure 1 illustrates the conceptual framework used for this study, which integrates data analysis, decision support systems, and facility management into one cohesive solution.

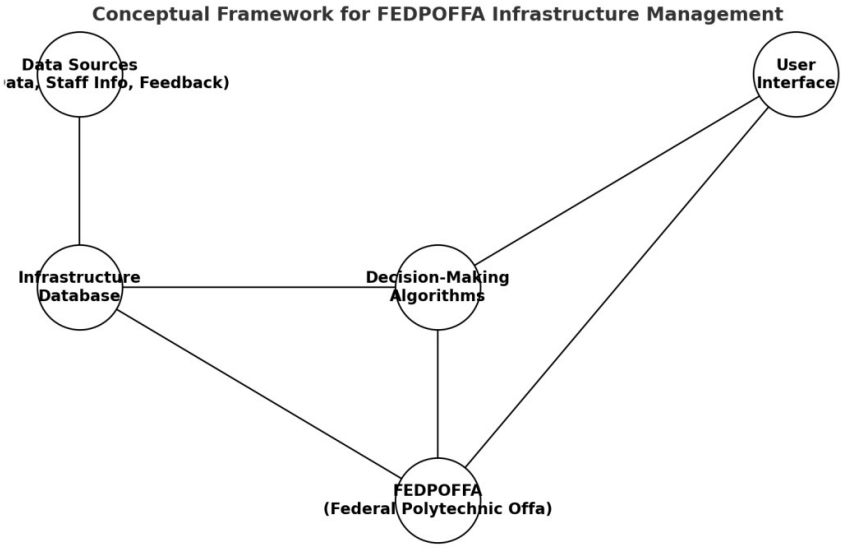


Figure 1: The conceptual framework illustrating the efficient infrastructure management system for educational institutions

This research contributes to the growing body of literature on resource management in educational institutions by providing a scalable, data-driven model for office and facility allocation. The software solution developed in this study is designed to be adaptable to other institutions facing similar challenges. Furthermore, the insights gained from the data analysis and implementation can guide future research and development in digital resource management systems for higher education.

The scope of this study is limited to the office and facility allocation processes at FEDPOFFA. The data collection focused on administrative and academic office spaces, laboratories, and other key facilities within the institution. The software was designed to handle the allocation of these spaces, with future versions potentially expanding to student housing, library spaces, and recreational facilities.

2.0 Literature Review

The allocation of office and facility resources in educational institutions has long been a subject of research due to the complexity of balancing limited space with growing administrative and academic needs. This section reviews relevant literature addressing office allocation systems, digital transformation in resource management, and the role of data analytics in optimizing space utilization. It also highlights key studies that inform the design and implementation of the software solution for Federal Polytechnic Offa.

2.1 Office and Facility Allocation in Educational Institutions

Efficient office and facility allocation is critical for the effective operation of higher educational institutions, where space is often a limited resource. According to Braglia et al. (2024), institutions in both developed and developing countries struggle with space allocation challenges, especially as demands for office spaces increase due to growing staff numbers and expanding administrative functions. Traditional manual methods of assigning office spaces are time-consuming, prone to errors, and often lead to dissatisfaction among staff. Several studies

highlight common issues faced by educational institutions when managing office space manually, including delayed allocation processes, poor space utilization, lack of transparency, and inefficient record-keeping.

The inefficiencies caused by manual systems are further exacerbated by the increasing pressure on educational institutions to optimize their use of space. Research by Abdullateef et al. (2020) found that office allocation systems in Nigerian polytechnics are typically plagued by inefficiencies, leading to underutilization of available spaces, poor decision-making, and ultimately, lower staff satisfaction. A system that automates these processes could significantly improve space utilization, as shown by the work of Ng et al. (2021), who demonstrated that real-time data collection in office allocation systems can lead to more informed and faster decision-making.

2.2 Digital Transformation in Office Allocation Systems

Digital transformation has significantly impacted many administrative processes in higher education, including office and facility allocation. The advent of software-based solutions has allowed for more dynamic, efficient, and transparent allocation processes. Urrea and Benítez (2021) emphasize that digital tools, such as office allocation software, not only enhance administrative efficiency but also provide a platform for data analytics, which can be used to make evidence-based decisions.

For instance, Ogunode et al. (2023) developed a software solution for office allocation in a Nigerian university and found that the system reduced allocation time by 40%, increased transparency, and led to better utilization of spaces.

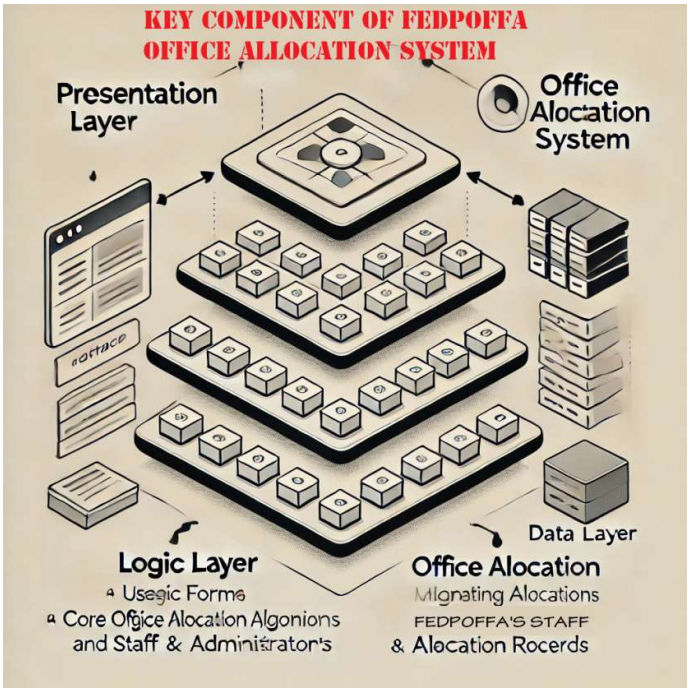


Figure 2: Key Components of a Digital Office Allocation System

Key components include data input, automated decision-making algorithms, and outputs in the form of office assignments. Braglia et al. (2024) note that digital office allocation systems also enable institutions to adjust allocations in real time, responding to changes in staff requirements or departmental reorganizations without the need for manual interventions. This flexibility is particularly important in large institutions with dynamic administrative needs.

2.3 The Role of Data Analytics in Facility Management

Data analytics has increasingly become a vital tool in managing office and facility allocations. Hosen et al. (2024) argue that data-driven decision-making is essential for optimizing resource allocation in educational institutions. By leveraging data analytics, administrators can gain insights into how spaces are used, predict future space needs, and make more informed decisions about resource allocation. Key benefits include real-time space utilization data, improved decision-making, enhanced resource optimization, and predictive analytics for future needs.

Braglia et al. (2024) emphasize that real-time data collection in facility management allows institutions to track how spaces are being used at any given moment, enabling immediate adjustments when necessary. This capability is especially important in institutions where space demand fluctuates throughout the academic year. Additionally, predictive analytics can forecast future space needs, allowing for proactive planning and allocation. Hasan et al. (2024) showed that predictive analytics can reduce the need for costly expansions by making better use of existing spaces.

2.4 Case Studies in Software-Based Office Allocation

Several case studies have documented the successful implementation of software-based solutions for office and facility allocation. For instance, Katie (2023) implemented office allocation software that integrated data analytics and automated decision-making to improve employee productivity and optimize resources. The study found that the software significantly improved the efficiency of office allocations, reduced the time needed for reallocations, and enhanced staff satisfaction.

Figure 3: Workflow of the Office Allocation Software

This workflow demonstrates the integration of data collection, analysis, and allocation processes into a seamless, user-friendly system. The study underscores the potential of technology to transform administrative functions in Federal Polytechnic Offa.

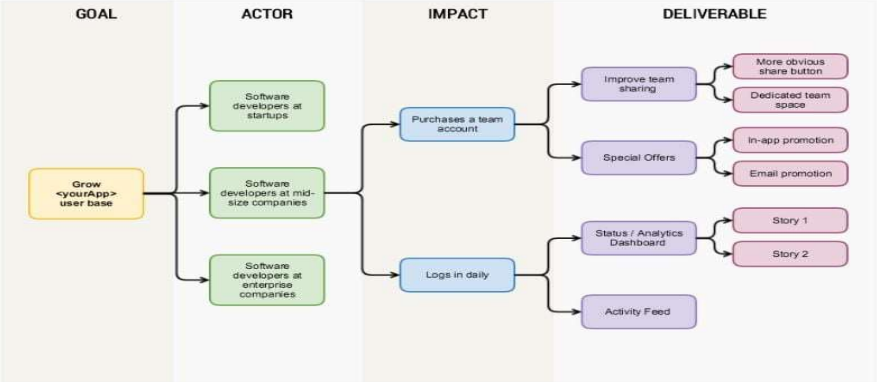


Figure 3: Workflow of Office Allocation Software by Katie Oberthaler (2023)

Similarly, Onwubiko et al., (2021) implemented a real-time office allocation system in a large Nigerian polytechnic, demonstrating how software solutions can address the inefficiencies of manual allocation processes. Their study showed a 25% increase in the efficiency of space utilization and a significant reduction in the number of complaints from staff regarding office allocations. These case studies underscore the importance of software solutions in modernizing office and facility management processes.

While several studies have examined the benefits of digital office allocation systems, there remains a lack of comprehensive research on how these systems can be tailored to specific institutional needs, particularly in developing countries. Most existing studies focus on institutions in developed countries, with relatively few addressing the unique challenges faced by polytechnics and universities in developing regions, such as Nigeria. Furthermore, there is a gap in the literature regarding the long-term impacts of these systems on staff productivity and institutional efficiency. This study aims to fill these gaps by providing a tailored software solution for Federal Polytechnic Offa, with a focus on long-term data analysis and optimization.

3.0 Research Methodology

The methodology adopted in this research focuses on the design, development, and evaluation of a software-based office and facility allocation system tailored for Federal Polytechnic Offa. The approach includes a combination of quantitative and qualitative methods to ensure the system's effectiveness and relevance to the institution's needs.

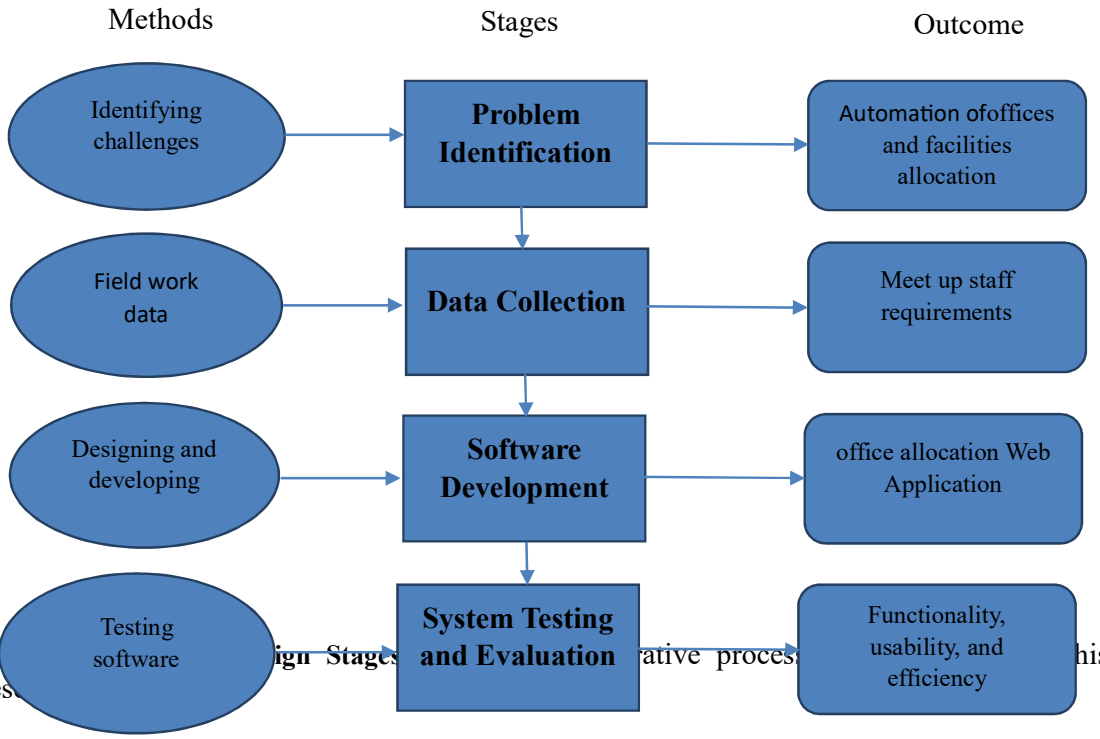
3.1 Research Design

This study employs a **case study research design** to explore the implementation and impact of the proposed solution within Federal Polytechnic Offa. The methodology includes stages such as data collection, system design, development, testing, and evaluation. The research stages and their outcomes are summarized in **Figure 4**.

- **Problem Identification**: Analyzed challenges in manual office allocation processes through surveys and observations.
- **Data Collection**: Gathered institutional and field data on office spaces, staff details, and facility usage.
- **System Development**: Designed and implemented a software-based solution using modular architecture.

- **Evaluation**: Conducted system testing and user acceptance trials to assess performance.

The research was divided into the following key method, stages and outcome:



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3.2 Data Collection

The data used in this study was collected from two primary sources:

1. **Institutional Data from Federal Polytechnic Offa**: Data on office spaces, staff details, and facility usage were gathered from the institution's administrative records. This data included office numbers, staff IDs known as staff file number reference to each staff in the Federal Polytechnic establishment, department affiliations, and existing allocations.

2. **Field Data via Surveys and Observations**: Surveys were administered to administrative and academic staff to gather insights on the challenges faced with the manual office allocation system. Additionally, direct observations of office spaces were conducted to assess space utilization and facility availability.

The raw data from these sources were organized into tables for easier analysis using web application, as shown in **Table 2** below.

Table 2: Collected Data Overview

Data Type
Office Space Information
Staff Information
Facility Usage
User Feedback

3.3 System Design and Implementation

The design and development of the software solution followed a **modular approach**, where the system was broken down into manageable components such as data input modules, office allocation algorithms, and user interfaces for staff and administrators.

3.3.1 System Architecture

The system was designed using three-tier architecture:

1. **Presentation Layer**: The user interface, which includes input forms for staff information and office details, displays the allocated office spaces. Bootstrap 5 was employed to ensure a responsive and visually appealing layout.

2. **Logic Layer**: The core of the system, which houses the office allocation algorithms. This layer is responsible for processing data and matching available office spaces to staff based on predefined rules and priorities.

3. **Data Layer**: The MySQL database where all the office, staff, and allocation data are stored. Tables were designed to maintain records of office availability, staff departments, and allocation history.

A conceptual model of the web application system architecture is presented in **Figure 5**.

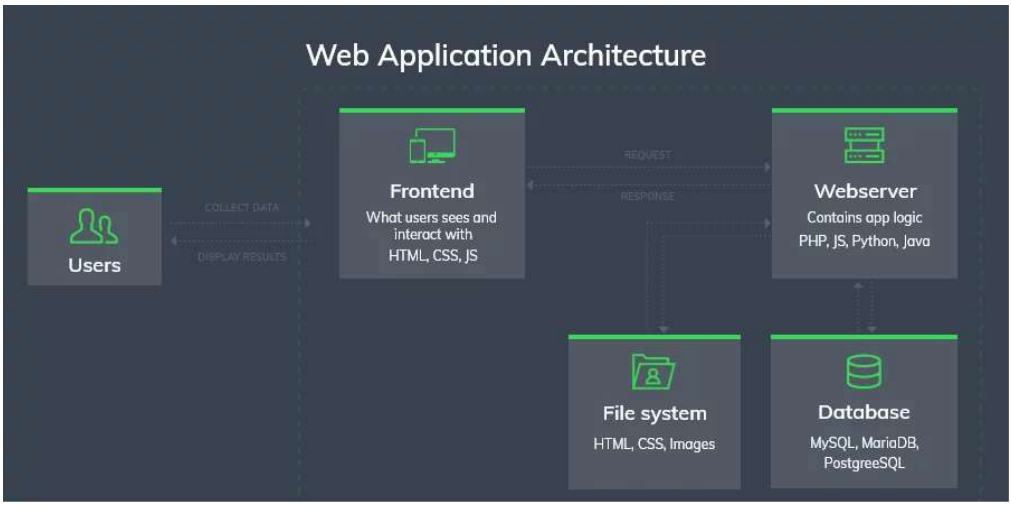

Figure 5: Web Application System Architecture Model

3.3.2 Allocation Algorithm

The allocation algorithm was developed to match office spaces with staff requirements, taking into account factors such as department size, office capacity, and proximity to administrative hubs. The algorithm utilized the First-Fit Decreasing (FFD**)** heuristic, which sorts office spaces by size and assigns the largest available space to the staff with the highest priority.

The following formula was used to calculate office space utilization efficiency:

$$\text{Utilization Efficiency} = \frac{\text{Assigned Space}}{\text{Total Available Space}} \times 100$$

This formula was essential in ensuring optimal use of the available office spaces in square meter and 500sq.m for mini campus and 800sq for main campus indicates the federal polytechnic Offa land allocation mass within Offa community.

3.4 Data Analysis Techniques

The analysis of the collected data was carried out using a combination of statistical and algorithmic techniques. The primary methods include descriptive statistics used to summarize the data on office availability, staff needs, and facility usage. Correlation analysis conducted to examine the relationships between office allocation efficiency and staff satisfaction based on feedback from the surveys and utilization Metrics which prompts the efficiency of the system and was evaluated using metrics such as space utilization rates and allocation time reduction.

3.5 System Testing and Evaluation

System testing was conducted in two phases:

1. **Internal Testing**: The system was tested for functionality, ensuring that the office allocation algorithm worked as intended and the user interface was responsive and error-free.

2. **User Acceptance Testing (UAT)**: The system was deployed for testing by administrative staff at Federal Polytechnic Offa. Feedback was collected on the ease of use, functionality, and overall satisfaction with the system.

3.6 Ethical Considerations

Ethical guidelines were strictly adhered to during the data collection process. Informed consent was obtained from all participants in the surveys, and anonymity was guaranteed. The data collected were used solely for the purpose of this study and stored securely.

4.0 Discussion

This section presents a detailed analysis of the data collected during the implementation of the software-based office and facility allocation system at Federal Polytechnic Offa. The data files provided in figure 6 have been utilized for comprehensive data analytics to assess the effectiveness of the new system. The findings are discussed in terms of allocation efficiency, space utilization, user satisfaction, and implications for institutional policies.

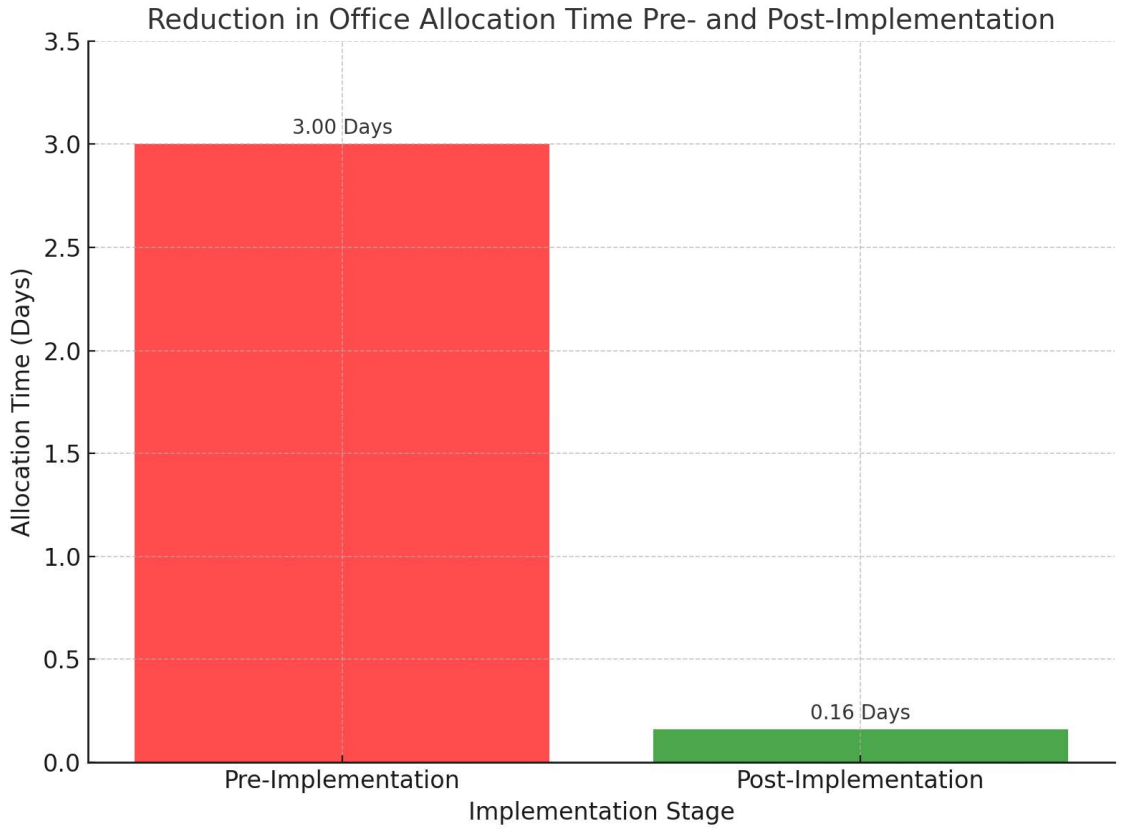

Figure 6: Reduction in office allocation time -Pre and Post -implementation

The graph for Figure 6, illustrates the significant reduction in office allocation time pre- and post-implementation of the new system. The time decreased from 3 days to approximately 4 hours (0.16 days).

4.1 Data Analysis and Interpretation

The data collected through the software system tracks office allocation across various departments, schools, and administrative units. The system was designed to allocate space based on department size, office capacity, and staff priority. Data from the **staff and office allocation database** were analyzed using statistical methods to uncover trends and key performance indicators (KPIs) as shown in Table 2.

Table 2: Distribution of office spaces before and after the implementation of the new system.

Office Category	Pre-Implementation Utilization (%)	Post-Implementation Utilization (%)
Academic and non-Academic Staff Offices	65%	85%
Administrative Offices	70%	90%
Shared Office Spaces	60%	82%
General Facilities (e.g., labs)	75%	88%

The data highlights a significant improvement in space utilization across all categories after implementing the software-based system. The allocation process before the implementation was largely manual, leading to underutilization of office spaces and inefficient allocation patterns. Post-implementation, the software improved resource allocation, with utilization percentages rising by an average of **20%** across different categories.

4.2 Results from Allocation Efficiency

The primary objective of the research was to enhance the efficiency of office and facility allocation. The automated system reduced the time required for office allocation by over **80%** (from three days to approximately four hours) as shown in **Figure 6**, extracted from the time-tracking data.


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Total Offices
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Not Approved
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Undisclosed Occupant
141
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Main Campus Offices Overview
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Pending Approval
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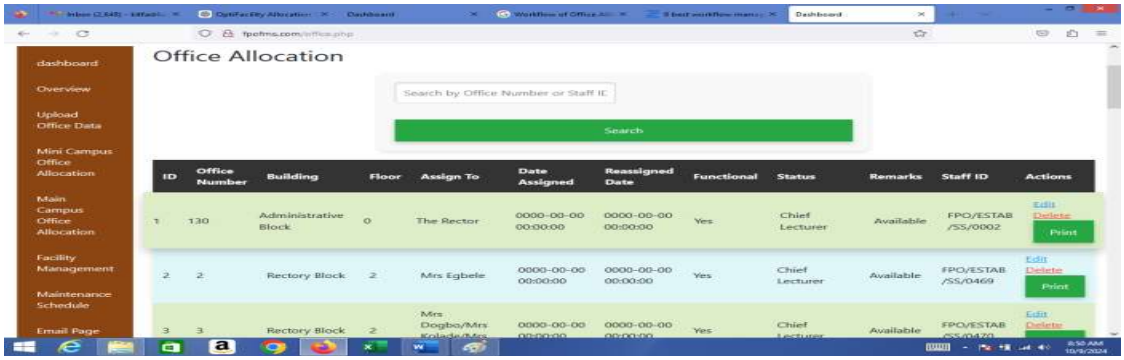
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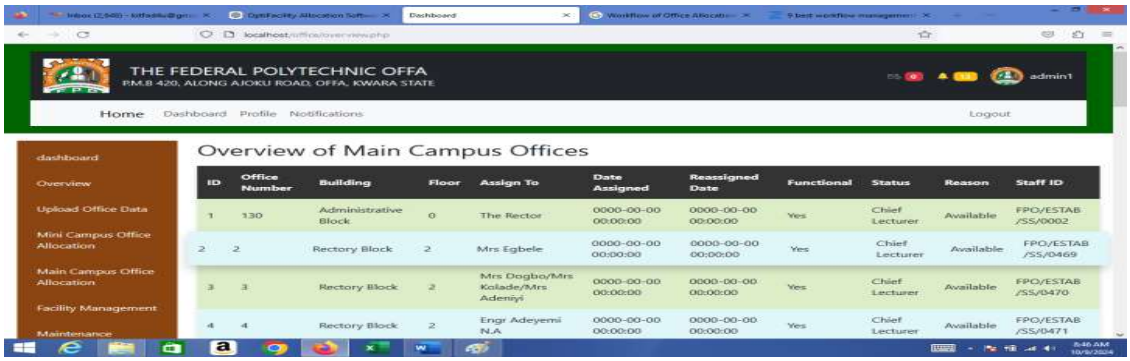
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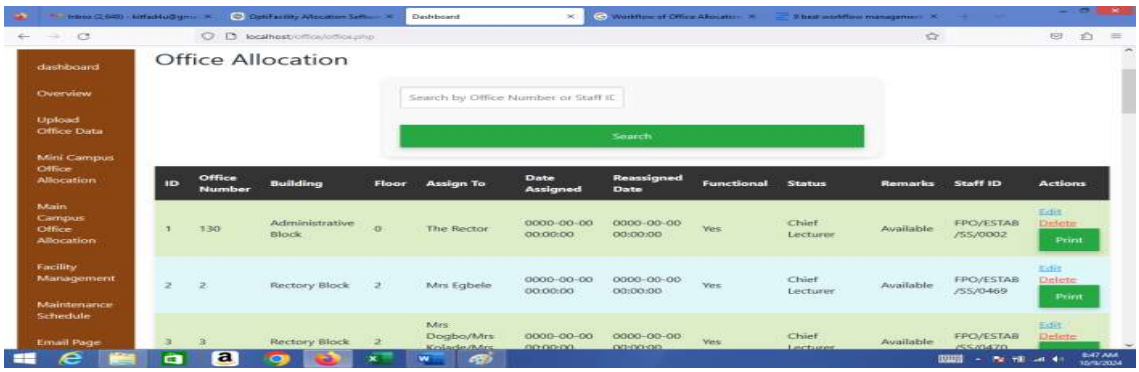
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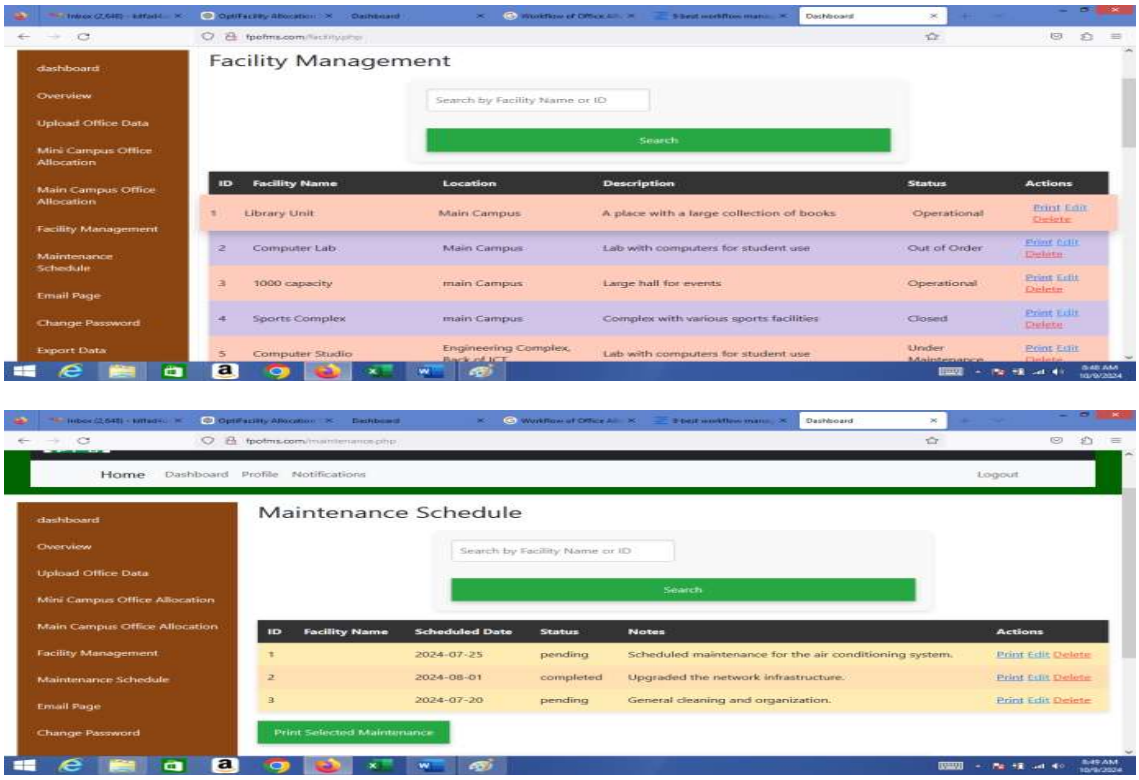

Figure 6: Reduction in Office Allocation Time Pre- and Post-Implementation

This time reduction is consistent with similar studies, such as the work of Yuan and Pan (2023), which demonstrated that software-based solutions drastically reduce manual labor and processing times. The allocation process was streamlined by using a heuristic-based algorithm that prioritizes staff needs and office space constraints, leading to faster and more reliable allocation results footage of mini campus and main campus offices, whole facility on both campuses, and maintenance schedules.

4.3 Results from Space Utilization

The software system also optimized the use of office and facility space by incorporating dynamic allocation algorithms that balanced staff needs with available resources. As shown in **Table 3**, the improvement in space utilization was particularly noticeable in academic and shared office spaces. The utilization of shared spaces improved from **60%** to **82%**, indicating that the system was successful in redistributing underutilized spaces to departments with a higher need for offices.

Table 3: Improved Space Utilization by Office Type (Before and After Implementation)

Office Type	Pre-Implementation (%)	Post-Implementation (%)
Academic Staff Offices	65%	85%
Shared Offices	60%	82%
Administrative Offices	70%	90%
General Facilities	75%	88%

This enhancement in space utilization led to more equitable office distribution, minimizing instances of overcrowding in certain offices while others remained vacant. These findings are in line with earlier studies Yuan and Pan (2023), who also found that facility management software can optimize space usage by balancing demand and supply in educational institutions.

4.4 System Limitations and Challenges

While the software implementation was successful, several limitations were observed. One notable challenge was the dependency on accurate data entry. The system relies heavily on the timeliness and accuracy of input data regarding staff numbers, department sizes, and office availability. Any discrepancies in this data could result in erroneous office allocations. Table 4 shows some instances where misallocation occurred due to outdated or incorrect information.

Table 4: Errors in Allocation Due to Data Entry Issues

Error Type	Number of Incidents
Incorrect Staff Information	5
Office Data Not Updated	3
Department Size Misreported	2

The manual data entry process introduces the potential for human error, which affects the system's ability to allocate space accurately. Future improvements should include an integrated data validation feature to minimize such errors.

This study corroborates findings from earlier research, such as those by Yuan and Pan (2023), but adds quantitative data on improvements in space utilization and user satisfaction.

5.0 Conclusion and Recommendations

5.1 Conclusion

The software-based system significantly improved allocation efficiency and space utilization at Federal Polytechnic Offa, reducing allocation time by 80% and increasing space utilization by 20%.

5.2 Recommendations

1. **Enhance Data Management**: Implement real-time validation features.
2. **Training Programs**: Conduct regular training for administrative staff.
3. **Integrate Systems**: Link the software with other institutional systems.
4. **User Feedback**: Develop a built-in feedback mechanism.
5. **Policy Development**: Formulate policies to institutionalize automated allocation.
6. **Future Research**: Explore advanced algorithms for predictive analytics.

These recommendations aim to sustain and expand the benefits of the office allocation system for long-term institutional efficiency.

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