

Research Article

An Integrated Operations Management System for Enhancing Administrative Efficiency in Ghana's District Assemblies

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Abstract

The COVID-19 pandemic, driven by the SARS-CoV-2 virus, necessitated an unprecedented shift to remote work, revealing critical gaps in digital infrastructures capable of maintaining organizational operations. This challenge was particularly pronounced in district assemblies in Ghana, where traditional, paper-based workflows impeded the transition to remote environments, heightening operational vulnerabilities. Despite the World Health Organization (WHO) downgrading COVID-19 as a Public Health Emergency of International Concern (PHEIC), the global ramifications of the virus and potential for future pandemics underscore the need for resilient, adaptable digital solutions. This paper presents an online integrated business operation management system tailored for district assemblies in Ghana. The system was developed using the Rapid Application Development (RAD) methodology, facilitating rapid, iterative deployment and user-centric design. Technologies such as HTML, CSS, and PHP were utilized for the front-end, while MySQL ensured secure and efficient back-end data management. The approach helped to digitize core administrative processes and transition from paper-based operations to streamlined electronic workflows. The implemented system successfully digitalized essential administrative workflows, improving operational continuity and efficiency. By replacing conventional procedures with robust electronic processes, the system provides a sustainable framework for enhanced functionality in public sector management. Furthermore, it strengthens organizational preparedness for future disruptions, ensuring resilience in remote and hybrid work contexts. The scope of this research is limited to district assemblies in Ghana, which may constrain the generalizability of the findings to other administrative contexts or geographical regions. Further studies could explore customization for broader governmental structures and assess long-term impacts on service delivery and user satisfaction. This paper presents a novel application of digital transformation principles within the public sector, addressing a critical gap in e-governance solutions for district assemblies in Ghana. By integrating user-focused design and scalable technology, the proposed system not only meets current administrative demands but also positions district assemblies for enhanced functionality and resilience in the face of future challenges.

Keywords: Software Development, Office Automation, System Architecture, Remote Working

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1. Introduction

In 2019, the emergence of a novel respiratory disease, later named COVID-19, caused a significant global health crisis, resulting in millions of deaths worldwide (Jha et al., 2022). On January 12, 2020, the World Health Organization (WHO) confirmed that COVID-19 was caused by the SARS-CoV-2 virus, first identified in Wuhan City, Hubei Province, China (World Health Organization, 2020a). By January 30, 2020, the WHO designated COVID-19 as a Public Health Emergency of International Concern (PHEIC), officially declaring it a pandemic on March 11, 2020, due to its rapid and widespread transmission (World Health Organization, 2020b). In response to the pandemic, institutions worldwide—including schools, financial organizations, recreational centers, and government agencies—were compelled to close, and bans on social and religious gatherings were imposed, prompting a shift to technology-driven remote operations (Brodeur et al., 2020). For district assembly staff in Ghana, this abrupt shift to remote work presented numerous challenges, particularly in communication, collaboration, and access to resources, which affected operational efficiency and decision-making. Consequently, project implementation timelines experienced delays as lockdowns were enforced to control the spread of the virus (Upoalkpajor & Upoalkpajor, 2020). Although the WHO announced on March 5, 2023, that COVID-19 no longer qualifies as a PHEIC, the virus remains a global threat, with the potential for future pandemics looming (Geddes, 2023). Researchers have suggested that future pandemics are likely to arise from natural processes such as climate change, biodiversity loss, anthropogenic factors (e.g., corporate interests, culture, globalization), and population growth (Thoradeniya & Jayasinghe, 2021). In light of these risks, it is imperative for Ghana's Metropolitan, Municipal, and District Assemblies (MMDAs) to develop remote operational capabilities that enable continuity in community service delivery during health crises. Currently, however, Ghana's MMDAs lack a system for efficient remote operations in the event of future pandemics. To address this gap, this paper presents a web-based integrated operations management software specifically designed for district assemblies. This system digitalizes key administrative functions, reducing reliance on manual processes and enhancing operational resilience. Stakeholders were interviewed to understand the workflows within their units and the information flow between departments. The requirements gathered were carefully reviewed, prioritized, and validated to ensure they were actionable, relevant, and aligned with the system's objectives, providing a strong foundation for the successful implementation of the software.

Pretest findings underscored the critical importance of developing a tailored Management Information System (MIS) application. This system is designed to address the specific needs of users, validate the growing demand for digitized administrative processes, and ensure seamless functionality and usability in modern organizational settings. By leveraging available resources and technical expertise, this project addresses essential operational gaps in MMDAs, enhancing their capacity to streamline and improve administrative efficiency. The need to develop a robust, integrated management information system (MIS) for district assemblies is critical to addressing the operational and administrative challenges highlighted by the COVID-19 pandemic. The pandemic exposed significant gaps in the ability of Metropolitan, Municipal, and District Assemblies (MMDAs) to maintain effective service delivery and administrative continuity during emergencies that disrupt in-person operations. Limited adoption of digital solutions within these assemblies has led to inefficiencies, delayed decision-making, and an inability to fulfill mandates under restrictive conditions. In this paper, not only is the problem addressed but also to future-proof MMDAs by building a foundation for sustainable digital transformation. The system will facilitate efficient record-keeping, secure document management, workflow automation, and role-based access, improving overall governance within district assemblies. By conducting a thorough requirements analysis and engaging key stakeholders, this study ensures that the developed solution is user-centered, meeting specific operational needs while leveraging available technical resources. This paper provides a strategic response to the operational gaps observed during the pandemic, empowering district assemblies to function optimally, enhance service delivery, and remain resilient in the face of future challenges.

2. Literature Review

In modern organizations, the integration of Information and Communication Technology (ICT) has redefined workflows, enhanced productivity, and automated routine tasks, making office automation essential (Foss, 2018). The COVID-19 pandemic underscored ICT's critical role in maintaining

organizational continuity, particularly in Ghana, where universities and businesses transitioned online to sustain operations. However, the long-term adoption of these tools remains uncertain (GIZ, 2020). Historically, ICT advancements, such as email (Pagliaro, 2020) and cloud computing (Nimrod et al., 2020), have transformed office environments by enabling scalable and collaborative solutions. Recent innovations like Robotic Process Automation (RPA) further enhance operational efficiency but present integration challenges (Davenport, 2018). Several studies continue to highlight the importance of ICT in knowledge sharing, interdisciplinary collaboration, and redefined workforce roles (Mohiuddin et al., 2022; Foss et al., 2018). Despite these advancements, Ghana's Metropolitan, Municipal, and District Assemblies (MMDAs) still rely on standalone software and traditional paper-based methods, limiting efficiency and policy compliance. The adoption of a unified Management Information System (MIS) could address these gaps, modernize processes, and align governance with ICT advancements (Local Government Service, 2023).

3. Methods

3.1. System Architecture

The system architecture provides an overarching view of the system's structure, clarifying its operational behavior and interactions. Figure 1 demonstrates the proposed system's architecture, detailing how users engage with different system modules. It also highlights the transaction processes, user interactions, and report generation functionalities. For the system development, the Rapid Application Development (RAD) methodology was chosen. RAD is a software development approach that emphasizes quick prototyping and iterative refinement, prioritizing collaboration, active user engagement, and continuous feedback to deliver robust software solutions efficiently (Sommerville, 2016). Figure. 2 depicts the stages of RAD methodology that was applied.

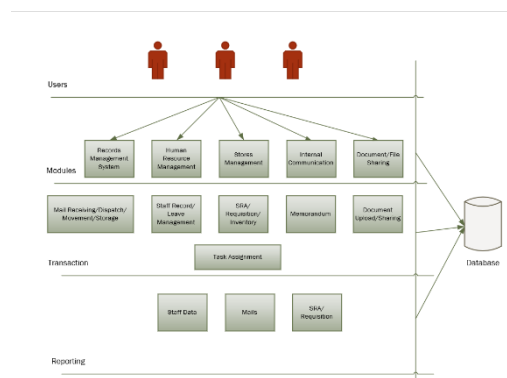


Figure 1. Architecture of the proposed system

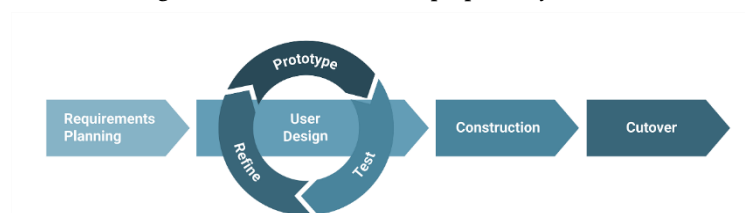


Figure 2. Stages in Rapid Application Development Methodology

The RAD Methodology consists of four main stages:

1. Requirements Planning: Stakeholders collaborate to define business needs and project scope, ensuring alignment on goals.
2. User Design: Developers and users work interactively to create prototypes, ensuring the design meets user needs.
3. Construction: Prototypes evolve into fully functional systems with rapid iterations.
4. Cutover: The system is finalized, tested, and deployed, with minimal disruptions.

4. Results

The proposed system digitalizes key operational processes within Metropolitan, Municipal, and District Assemblies (MMDAs) in Ghana. By reducing physical interactions within office environments, it leverages on Information and Communication Technology (ICT) to streamline administrative workflows, enhance efficiency, and ensure operational continuity. This approach prepares MMDAs to maintain effective functionality during future pandemics or similar disruptions, fostering resilience and adaptability in service delivery.

4.1. User Login and Registration Activity Diagram

Figure 3 presents the UML activity diagram for the user registration and login process. Existing users interact with a login interface where they provide their username and password. These credentials are authenticated against records in the database's user table. Upon successful validation, the system grants access by redirecting the user to the dashboard to proceed with transactions. For new users, the system displays a registration page where they can create an account. Once the registration process is successfully completed, the user is redirected to the login page to authenticate their credentials before gaining access to the system.

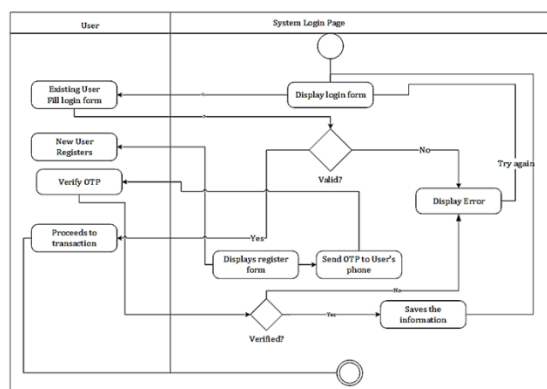


Figure 3. Login and Registration UML Activity Diagram

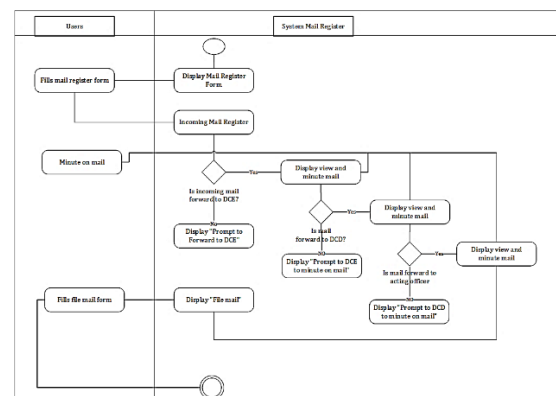


Figure 4. Mail Receiving and Movement Activity Diagram

4.2. Mail Receiving and Movement Activity Diagram

The activity diagram in Figure. 4 illustrates the process of receiving and managing mail or letters. It details how incoming correspondence is received, forwarded to key stakeholders such as the Chief Executive, Coordinating Director, and relevant action officers, and subsequently returned to the records unit for filing and archival.

4.3. Internal Communication Use Case Diagram

Figure. 5 depicts the use case diagram for internal communication within the organization, specifically through memorandums. As shown in the diagram, the primary actor (staff) has the ability, upon successful login, to create (write), view, or delete a memo. The secondary actors, which may include the Coordinating Director, Finance Officer, or Budget Officer, are able to view, comment on, or approve the memo for further action. This system facilitates streamlined communication and decision-making within the organization.

4.4. Implementation

4.4.1. Programming Language

The user interface, content structure, and overall appearance were designed using HTML, CSS, and JavaScript, leveraging the Bootstrap framework for responsiveness. PHP was employed as the server-side scripting language to handle requests and deliver results to users. The database, consisting of 58 tables, was designed and implemented using MySQL.

4.4.2. Coding Standards and guidelines

This paper adhered to several coding standards, including the use of comments to clarify non-obvious sections of code. Consistent naming conventions were applied both in the code and the database schema. Variables in the code were named systematically, and tables in the database were named using specific

prefixes to avoid conflicts with tables that may share identical names across different schemas or databases.

4.4.3. Implementation and Integration

To ensure that only authorized users can access the system, the login and registration component was developed as the initial gateway. This component establishes user sessions and redirects users based on their roles and permissions, determining the actions they are authorized to perform. Subsequent components, including records and documentation management, stores management, human resources, and internal communications, were individually implemented and tested in conjunction with the login functionality to ensure that users are correctly directed to the appropriate modules according to their access levels. Once individual testing was completed, all components were integrated and tested together. A significant challenge encountered during this process was a lack of clarity regarding the requirements from district assembly officers. This led to delays in the implementation phase, as the software had to be repeatedly modified to align with evolving requirements.

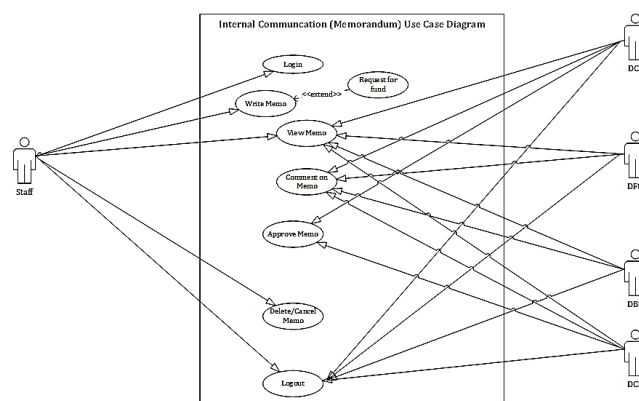


Figure. 5. Internal Communication Use Case Diagram

4.4.4. Testing

The software underwent testing utilizing the Waterfall testing methodology, a structured and sequential approach that follows a top-down progression. This methodology facilitated the testing of individual software modules in isolation, ensuring that each component functioned correctly and met its intended specifications. By testing each module independently, the methodology allowed for the identification and resolution of issues within specific parts of the system before integrating them into the larger framework. Following the successful verification of individual modules, the complete system was tested as a whole to ensure that it fully met the specified requirements and performed as expected under real-world conditions.

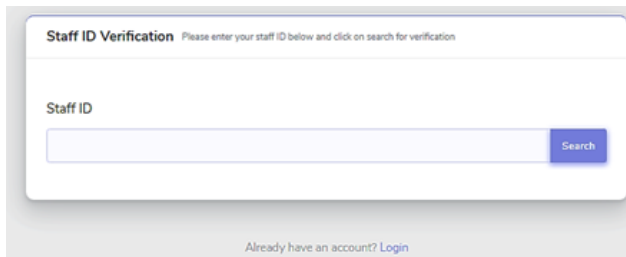
4.5. User Interface Design

The User Interface (UI) design of the software follows a user-centred approach, focusing on delivering an intuitive, visually appealing, and functional experience. During the requirement analysis phase, comprehensive user research was conducted to understand user preferences and behaviours, ensuring the interface aligns with their needs and expectations. The design emphasizes clarity, consistency, and an organized visual hierarchy to guide users logically through the system. Key features such as intuitive navigation, responsive design across various devices, and real-time feedback enhance usability, making the interface both aesthetically pleasing and accessible. Iterative usability testing was performed to refine the UI, ensuring a seamless and efficient user experience. This process underscores the critical role of a well-designed interface in the overall success of the software application.

4.6. Registration Form

Only authorized staff, whose details have been inputted or migrated into the database by the system administrator or human resource manager, are eligible to register as users of the system. On the login page (Figure. 6), new staff members or users can initiate the registration process by clicking the registration link. Upon selecting this link, new users are directed to Figure. 6 (Staff Verification Page) to

confirm their affiliation with the MMDA. If the staff ID is successfully verified, the user is redirected to Figure. 7, where they are prompted to confirm their details by selecting a password and providing their phone number and email address. A One-Time Password (OTP) is then generated and sent via SMS to the phone number provided. Once received, the user is redirected to Figure. 8 (Verify OTP) to complete the registration process. If the entered OTP is valid, the user's information is saved into the user table in the database. If the user does not receive the OTP, the "Resend OTP" button can be used to generate and send a new OTP.

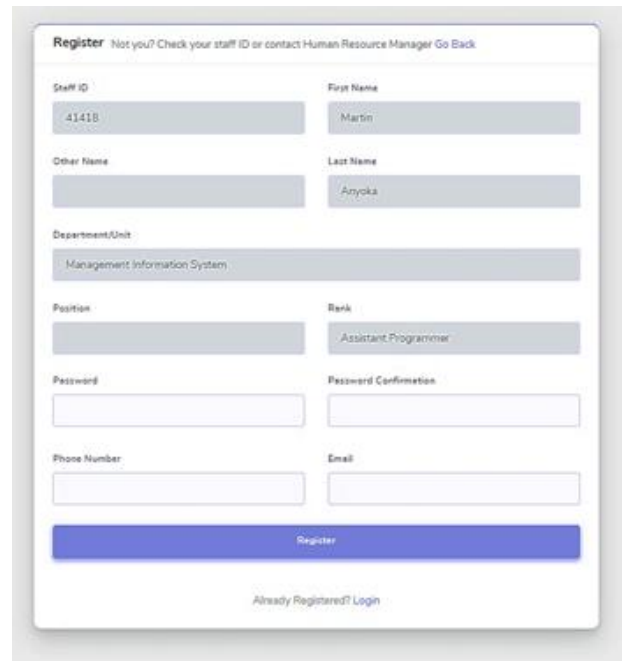


Staff ID Verification Please enter your staff ID below and click on search for verification

Staff ID

[Already have an account? Login](#)

Figure. 6 Staff ID verification page



Register Not you? Check your staff ID or contact Human Resource Manager Go Back

Staff ID: 41418

First Name: Martin

Other Name:

Last Name: Anyoka

Department/Unit: Management Information System

Position:

Rank: Assistant Programmer

Password:

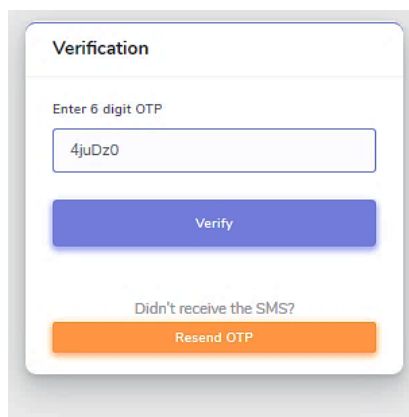
Password Confirmation:

Phone Number:

Email:

[Already Registered? Login](#)

Figure. 7 User registration page



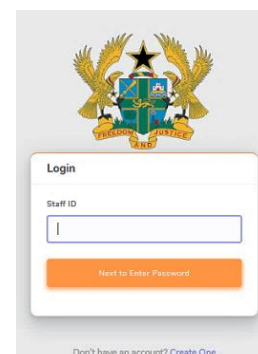
Verification

Enter 6 digit OTP

4juDz0

Didn't receive the SMS?

Figure. 8 OTP Verification form

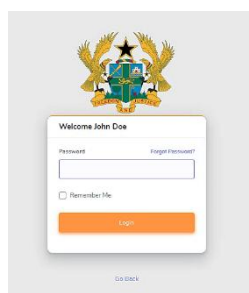


Login

Staff ID

[Don't have an account? Create One](#)

Figure. 9 (a) Login Screen



Welcome John Doe

Password:

[Forgot Password?](#)

☐ Remember Me

[Go Back](#)

Figure. 9 (b) Login Screen

4.7. User Login

Existing users can log in by entering their username (staff ID) and password to access the system. Incorrect usernames or passwords will be rejected by the system. The login process is conducted in two phases: first, the user enters their username (Figure. 9a) and clicks "Next." The system then verifies whether the username exists, retrieves the corresponding password, and compares it with the password entered by the user in Figure. 9b. If the entered password matches the stored one, the user is granted access and redirected to the system's dashboard.

4.8. Dashboard

The dashboard offers users a concise overview of key information and data relevant to the system's functionality. It provides access to various modules based on the user's role or department. Additionally, the dashboard displays notifications and alerts to keep users informed. An example of the dashboard layout is shown in Figure. 10.

4.9. Records Management Module

The records management module of the system facilitates functions such as the creation of administrative and personal files, recording of received and dispatched mails/letters, circulation of documents, and filing and archiving of records. Figure. 11 illustrates the interface for adding or receiving new mail. Users can enter the relevant details of the mail, upload a scanned copy (in PDF format) of the received mail, and save it within the system. Figure. 12 presents the interface for the incoming mail register, displaying all registered received mails. Once the entries are successfully made and saved, the "Forward" button is used to send the received mail to the Chief Executive. As shown in Figure. 13, the forwarded mail is received by the Chief Executive, who can then add comments, as illustrated in Figure 14, before passing it on to the Coordinating Director. Figure. 14 displays the content of the mail forwarded from the records unit. The "Comment" and "Forward" buttons are used to add comments and forward the mail to the next responsible party, which in this case is the Coordinating Director's desk. The Coordinating Director follows a similar process to either forward the mail or assign tasks to the action officer, after which it is returned to the records unit for filing. Figure. 15 shows the comments made by the officers. These comments are printed directly onto the saved PDF file.

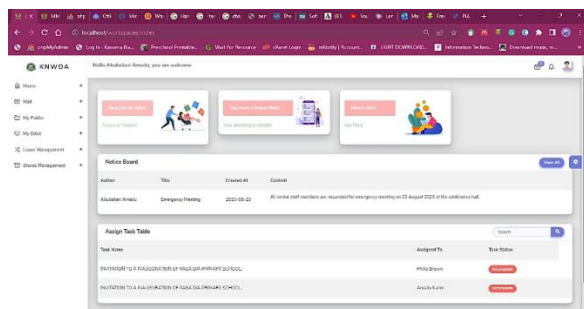


Figure. 10 Dashboard Interface

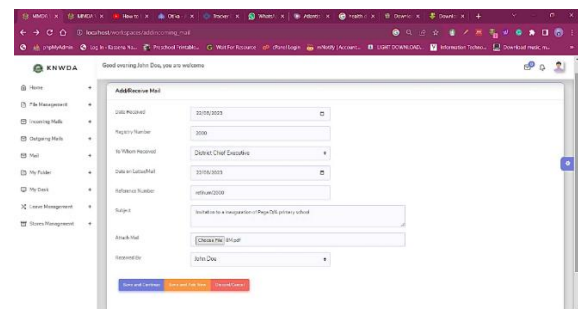


Figure. 11 interface for Adding incoming mail/letter

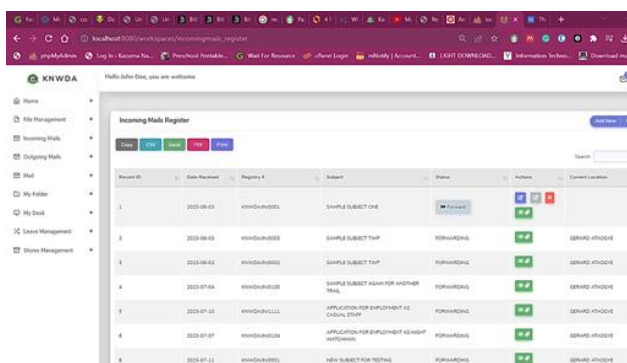


Figure. 12 Incoming Mails Register

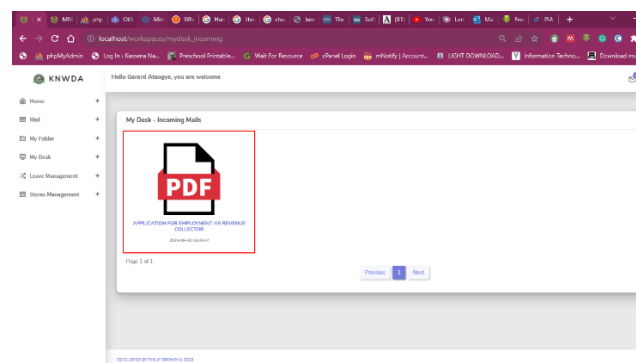


Figure. 13 Forward mail to Chief Executive's Desk

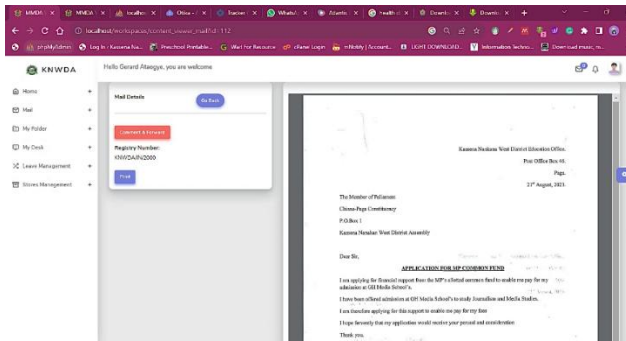


Figure. 14 Mail content viewer interface

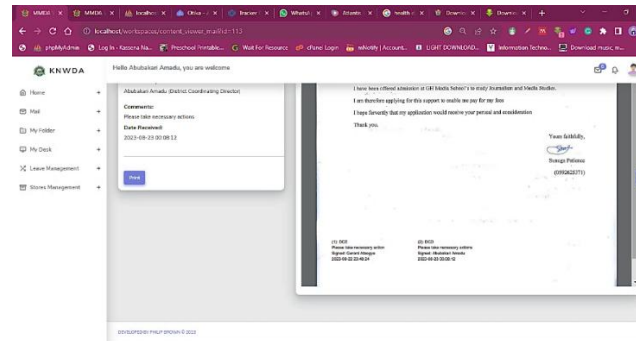


Figure. 15 Comments on mail

4.10. Internal Communication Module

Internal communication, commonly referred to as a Memorandum (Memo), is the formal method through which communication within the organization is conducted. It is typically initiated when an officer needs to perform a specific action or task, such as requesting funds for an activity. Figure. 16 illustrates the interface for composing a Memo within the system. By default, all memos are directed to the Coordinating Director. On this interface, users can view both pending and approved memos.

Memos sent to the user can also be viewed through this interface. Figure. 17 displays the interface for reading a memo. The recipient of the memo can add comments or notes and then forward it to the next officer for further action. Figure 18 illustrates the comments added to the memo, indicating the actions to be taken.

4.11. Stores Module

Figure. 19 displays the store's inventory, listing all available items along with their respective quantities. As new items are procured and issued, the quantities are updated accordingly, reflecting increases and decreases as inventory changes. Figure. 19 presents the user interface for submitting item requisitions from the organization's stores. Requested items are forwarded to the director or designated officer for approval. Figure. 20 illustrates the dashboard of the approver, displaying items that are pending approval. Figure 21 shows the interface used to approve requested items. Once approved, the requisition is forwarded to the storekeeper's dashboard for processing and issuance, as depicted in Figure 22.

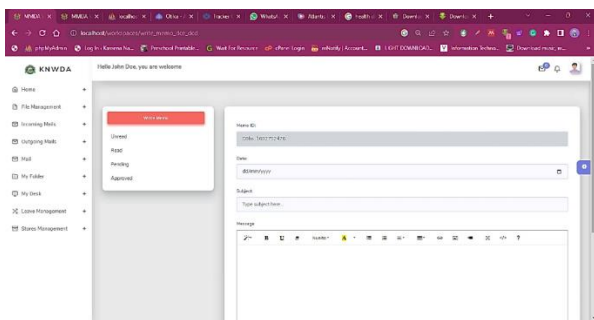


Figure. 16 Writing of Memo Interface

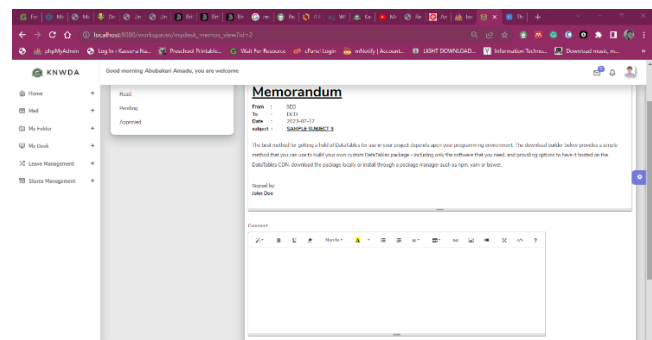


Figure. 17 Read memo interface

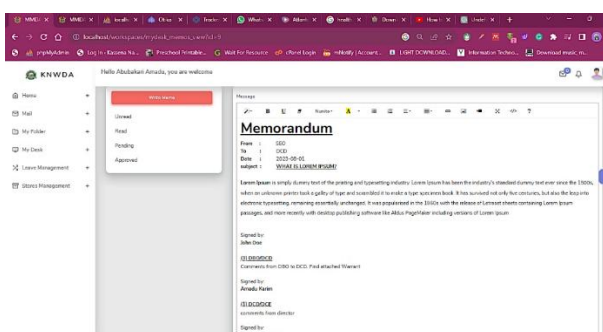


Figure. 18 Comments passed on memo

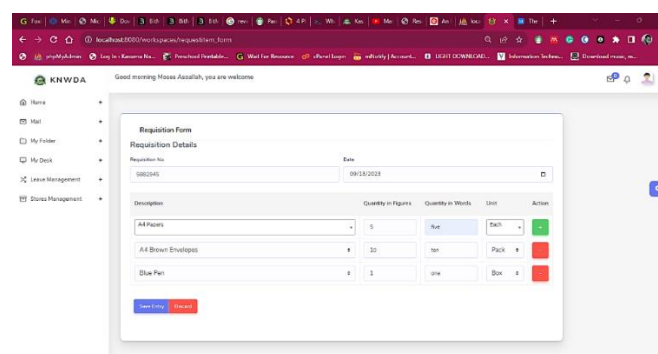


Figure. 19 Requisition Form

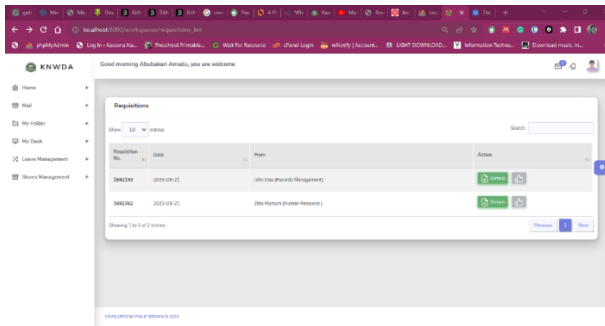


Figure. 20 Requested items pending approval

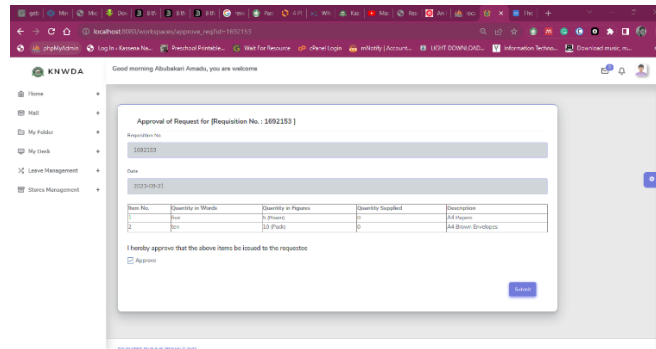


Figure. 21 Interface for approving requisition

The Stores Received Advice (SRA) is a form used to document items that have been procured or received by the organization. Figure. 23 displays the interface for the SRA. Once the storekeeper receives the procured items via the SRA, they undergo inspection by the Internal Audit Unit and the Coordinating Director for approval. Figure. 24 illustrates the interface used for the approval of these procured items.

Figure.25 presents the store ledger interface, which represents the various ledger books used to record both procured and issued items within the store. This interface serves as the transaction log for the store's inventory activities.

4.12. Human Resource and Leave Management Module

Figure. 26 displays the list of all MMDA staff members. Newly posted staff are initially registered in the system before they can create end-user accounts to perform their administrative tasks. Figure. 27 shows the form used to collect staff data during registration. The leave application process functions similarly to the Memorandum system, allowing users to request leave entitlements within a working year. Figure. 28 illustrates the leave application page, while Figure. 29 shows the leave request received by the applicant's supervisor for further action. The supervisor forwards the application to the Coordinating Director for approval, and then to the Human Resource Officer for processing. The system automatically calculates the requested leave days and compares them with the allowed leave entitlements.

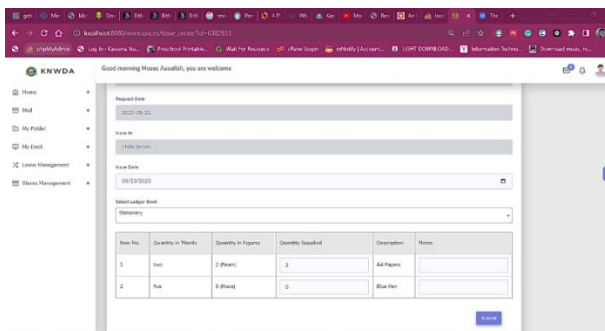


Figure. 22 Stores Issue Voucher form

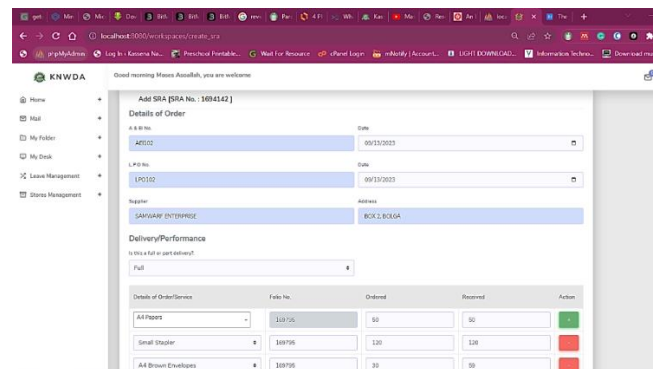


Figure. 23 Stores Received Advice Form

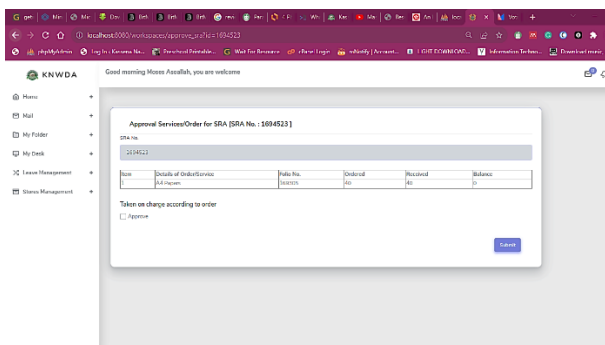


Figure. 24 Approval and inspection of SRA form

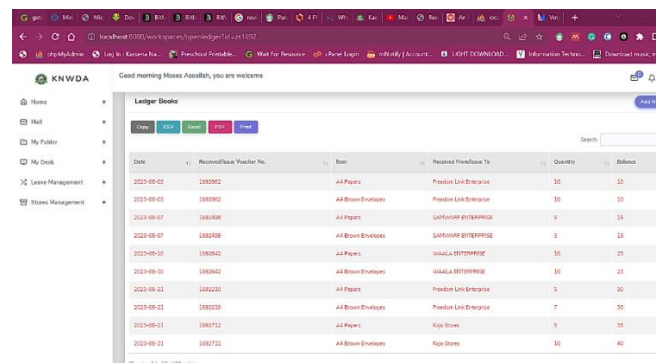


Figure. 25 Stores Ledger interface

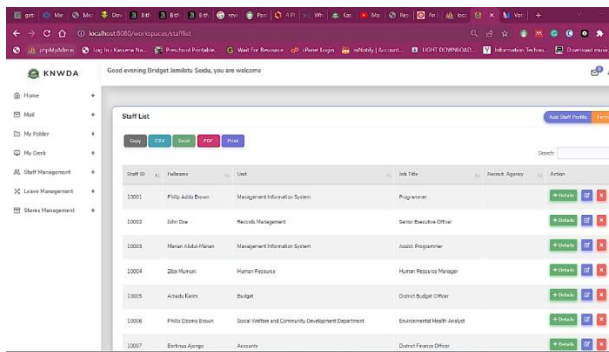


Figure. 26 Staff List

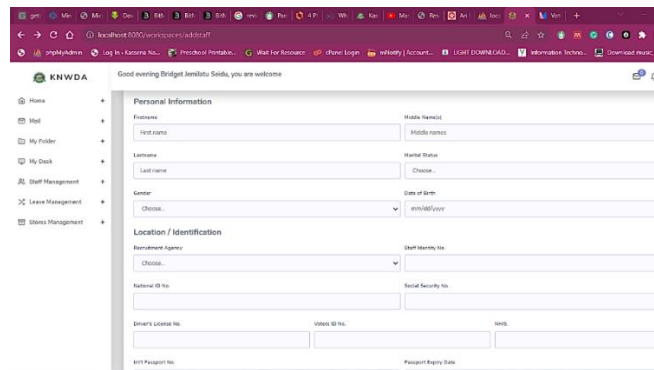


Figure. 27 Staff Registration Form

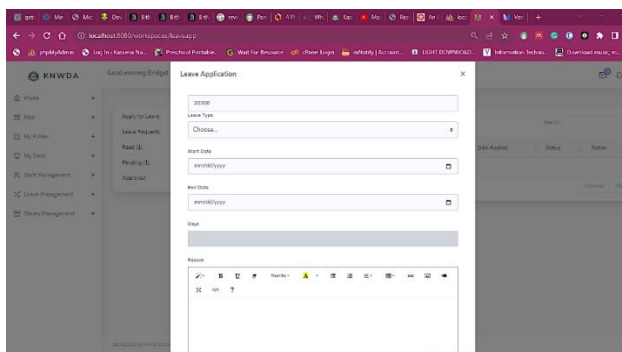


Figure. 28 Leave application form

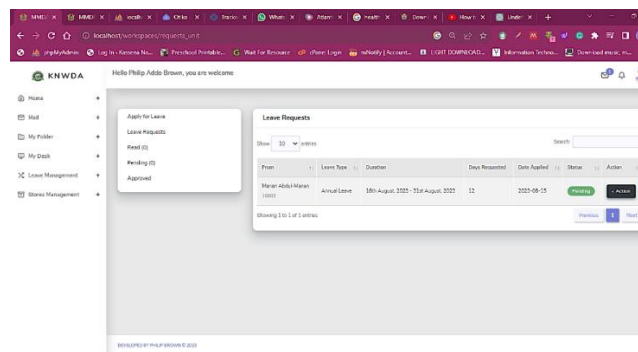


Figure. 29 Staff Registration Form

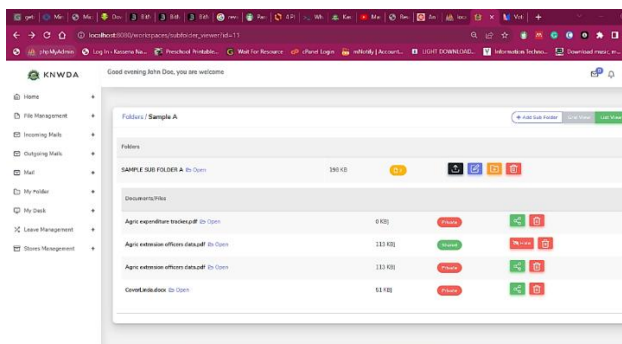


Figure. 30 Created Folders/Directories for file/documents storage and sharing

4.13. Reports and Directories

The system provides functionality for users to create directories for storing files and documents, ensuring data protection and preventing potential loss. This feature also facilitates easy sharing of files or documents with specific users or staff within the organization, eliminating the need for flash drives. Figure 30 displays the interface for creating folders and their contents, showing the files that have been shared.

5. Discussions

The research results underscore the effectiveness of the proposed online integrated business operation management system for Ghana's Metropolitan, Municipal, and District Assemblies (MMDAs) in enhancing operational efficiency, data security, scalability, policy alignment, and resilience. By automating traditional paper-based workflows, the system significantly reduces manual processes, improving inter-departmental coordination and access to information. Its MySQL-based database ensures secure and transparent data management, mitigating risks of loss and enabling real-time administrative tracking. Developed using the Rapid Application Development (RAD) methodology, the system adapts to user feedback, offering scalability and flexibility for evolving administrative needs. Additionally, it aligns with national directives, addressing key performance indicators for electronic

correspondence and data management. The system also strengthens resilience by enabling effective remote operations, ensuring continuity during disruptions such as pandemics or natural disasters, and supporting hybrid work environments to reduce vulnerabilities in public sector operations. This research underscores the importance of embracing digital transformation within the public sector. While the system addresses immediate operational challenges, its long-term benefits include fostering a culture of innovation, encouraging data-driven decision-making, and supporting national development goals. It also highlights the potential of such solutions in replicating success across other developing countries with similar challenges in local governance. The research validates the system's capability to modernize Ghana's MMDAs, making them more efficient, resilient, and prepared for future challenges. The results call for strategic investment in ICT infrastructure and training to maximize the benefits of digital transformation in public administration.

6. Conclusion

In conclusion, the successful development of this software marks the result of thorough planning, collaborative effort, and a steadfast dedication to fulfilling user needs. From the early stages of user requirement analysis to the final implementation, we overcame challenges, made informed decisions, and adhered to a structured methodology to deliver a robust, user-friendly solution tailored for the District Assemblies in Ghana. Of particular significance is the software's potential in critical scenarios, such as during the COVID-19 pandemic, where its features would facilitated rapid response, enhanced collaboration, and efficient communication. The software's design prioritizes intuitive navigation and responsiveness, ensuring a seamless experience across a variety of devices. Through iterative usability testing, we refined the interface, incorporating valuable user feedback to optimize the software's functionality. Ultimately, the successful deployment of this software not only demonstrates our technical capabilities but also reflects a user-centric approach embedded in every phase of its development. This project represents a significant step towards modernizing administrative processes within the District Assemblies, empowering them to better serve the public while adapting to evolving challenges and allowing staff to work remotely. The online integrated business operation management system for Ghana's Metropolitan, Municipal, and District Assemblies (MMDAs) faces several limitations that could affect its implementation and effectiveness. Resistance to change among employees accustomed to traditional workflows poses a significant challenge, alongside infrastructure constraints such as unreliable internet connectivity in rural areas. Additionally, limited training and capacity-building initiatives may lead to underutilization of the system, while the financial burden of initial deployment; including hardware, software, and infrastructure costs; could delay adoption. Security concerns, particularly regarding data breaches, highlight the need for robust cybersecurity measures. Furthermore, the coexistence of legacy systems with the new platform creates integration challenges that could hinder seamless operation. Future research should address these issues by exploring strategies for behavioral change, enhancing training programs, improving cybersecurity protocols, and developing cost-effective, scalable, and interoperable deployment models. Moreover, long-term impact assessments and sustainability efforts, such as leveraging green ICT practices and extending internet infrastructure, are critical to ensuring the system's success and adaptability in addressing digital governance needs.

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