

Design and Development of an Online Recruitment Systems for Small And Medium-Sized Enterprises In Zambia.

Mukelabai K Mutukwa, Mr Moses Mupeta

*Dept. of ICT School of Engineering
Information and Communication University Lusaka, ZAMBIA.*

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ABSTRACT

Recruitment is a critical process for small and medium-sized enterprises (SMEs), which often face challenges such as limited resources, high recruitment costs, and time constraints. This project introduces an Online Recruitment System (ORS) designed to streamline and automate the hiring process, making it more efficient, cost-effective, and scalable. The system provides a centralized platform where administrators can create and manage job openings, candidates can apply and take online tests, and recruitment activities are seamlessly coordinated to improve hiring efficiency.

SMEs play a vital role in economic growth and employment generation. However, many still rely on manual hiring processes that are time-consuming, prone to errors, and inefficient. This gap has driven the need for a comprehensive recruitment system that enables SMEs to identify and hire qualified candidates quickly and accurately, ultimately enhancing their productivity and competitive advantage.

The system is developed as a web-based application, ensuring scalability, adaptability, and ease of use. It features a structured backend, interactive user interface, and robust security mechanisms to protect sensitive recruitment data. Key functionalities include:

An admin dashboard that allows HR personnel to create, manages, and customizes recruitment tests for different job roles.

Test management modules where administrators can design multiple-choice, coding, or situational judgment tests, set time limits, and automate test evaluation.

User-friendly job seeker interface for candidates to register, apply for jobs, and take online assessments seamlessly.

Automated candidate evaluation and ranking, reducing manual effort and improving decision-making.

The ORS offers numerous benefits for SMEs, including reduced hiring time, enhanced accuracy in candidate selection, and cost savings. It is a scalable solution designed to grow with businesses, with future enhancements such as mobile accessibility, AI-powered candidate ranking, and advanced analytics for data-driven recruitment decisions.

The system follows a monolithic architecture, ensuring a compact, efficient, and easily deployable structure for SMEs. Key design elements include a centralized database, an intuitive user interface, and security-enhanced data handling mechanisms. The database architecture efficiently stores and manages job postings, applicant profiles, test results, and employer records, ensuring fast and organized data retrieval. The interface is designed for ease of use, allowing employers to effortlessly post jobs, filter applications, and oversee the recruitment workflow, while applicants can register, apply, and complete assessments seamlessly. Security is a priority, with role-based access control (RBAC), encrypted data storage, and authentication protocols to protect sensitive information.

The Implementation phase of this

System is built using Java Servlets and JSP for backend processing, while HTML, CSS, and JavaScript shape the interactive frontend. The database is powered by MySQL, enabling structured storage and rapid querying of applicant data. The recruitment platform integrates features such as automated application tracking, real-time test evaluation, and employer dashboards for efficient hiring decisions. Comprehensive testing and quality assurance measures, including unit tests, functional tests, and security evaluations, ensure system robustness, reliability, and a smooth user experience.

To measure the effectiveness, the evaluation phase of the system undergoes rigorous performance evaluation, user acceptance testing (UAT), and comparative analysis against traditional hiring methods. Key performance metrics such as response time, system stability, and user satisfaction—are assessed to validate its efficiency. Employer and applicant feedback is collected through usability surveys, ensuring that refinements are made to enhance workflow efficiency, accessibility, and overall system effectiveness.

Designed for on-premise deployment, the system can be easily installed on local enterprise servers or internal networks, making it an independent, cost-effective alternative to cloud-based solutions. The deployment process includes detailed installation guides, administrator training, and dedicated technical support to ensure a smooth transition for SMEs. On-going maintenance and updates focus on bug fixes, security enhancements, and feature upgrades to meet evolving recruitment needs. Future enhancements may introduce AI-driven candidate screening, mobile-friendly adaptations, and advanced analytics to further optimize hiring strategies.

By combining efficiency, security, and ease of use, this Online Recruitment System for SMEs offers a powerful yet accessible solution to streamline hiring processes. It empowers businesses to find the right talent faster, reduce hiring costs, and enhance workforce management, making recruitment more effective and scalable for growing enterprises.

I. INTRODUCTION

The Design and Development of an Online Recruitment System for Small and Medium-Sized Enterprises (SMEs) in Zambia aims to provide a streamlined and automated platform for connecting employers with young professionals seeking employment opportunities. This multi-user system enables administrators to create job postings, configure test categories, and manage assessment questions, while applicants can submit resumes, apply for jobs, and complete online tests. The project extends research on e-recruitment methods, evaluating digital hiring criteria and exploring effective recruitment strategies for SMEs.

In recent years, digital transformation in human resource management has gained prominence, emphasizing the role of technology-driven recruitment (Dhamija, 2019). The foundation of any company lies in its human capital, and

recruitment plays a strategic role in attracting high-quality employees essential for organizational success (Bondarouk et al., 2017). Online recruitment has evolved with Artificial Intelligence, machine learning, and social media platforms to enhance candidate sourcing and assessment (Van Esch et al., 2019). While e-recruitment offers speed, cost efficiency, and broader outreach, challenges such as limited assessment of executive talent and the difficulty of evaluating fresh graduates' potential persist (Thite, 2020).

For SMEs in Zambia, recruitment can be time-consuming, expensive, and difficult to manage manually. Research indicates that SMEs often struggle with attracting skilled talent due to limited financial resources and brand visibility (Musa Idris, 2023). The Online Recruitment System addresses these challenges by offering a digital solution to automate key stages of the hiring process. This web-based application provides tools for job management, online testing, and candidate evaluation, reducing administrative workload while ensuring a fair and structured recruitment process. The system is designed to operate within a Local Area Network (LAN) on a Windows-based Tomcat Server, making it particularly suitable for organizations with limited internet access (Kossivi et al., 2016).

The system consists of two primary modules:

Administrator Module: Enables HR personnel or recruiters to create and manage job postings, test categories, assessment questions, and test settings. Recruiters can design tests that accurately evaluate candidates' skills and qualifications (Chapman & Gödöllei, 2017).

User Module: Provides job seekers with the ability to submit resumes, apply for job vacancies, and complete online assessments. This feature allows organizations to pre-screen candidates efficiently before proceeding to further hiring stages.

The Online Recruitment System offers several key advantages:

Cost-effectiveness: Reduces reliance on physical resources and manual processes (Holm, 2012).

Standardized assessment: Ensures consistency in candidate evaluations.

Scalability: Handles high volumes of applications simultaneously, minimizing processing delays.

For Zambian SMEs and startups, this system provides a modern recruitment solution without requiring significant financial investment. The system incorporates error-handling mechanisms to minimize downtime and includes an installer and comprehensive documentation for easy deployment.

Although currently restricted to LAN use, this system represents a significant step toward digital recruitment in Zambia. As digital transformation continues to gain momentum, this Online Recruitment System offers a practical, scalable, and efficient solution for SMEs, aligning with the country's broader digitalization goals (Njuguna, 2021).

1.Motivation and significance of the study

The motivation behind developing the Online Recruitment System stems from the pressing need for efficient recruitment processes within organizations in Zambia and beyond. In an increasingly competitive job market, organizations face the challenge of attracting, screening, and hiring qualified candidates quickly and effectively. Traditional recruitment methods often involve significant time and resources, leading to delays in filling positions and potential losses in productivity. By leveraging technology, this project aims to streamline the recruitment process, making it more efficient and user-friendly for both employers and candidates.

Moreover, as Zambia continues to embrace digital transformation, there is an urgent need for modern solutions that align with the country's developmental goals. The Online Recruitment System is designed to cater to the specific challenges faced by small and medium-sized enterprises (SMEs), which form the backbone of the Zambian economy. These businesses often lack the resources and infrastructure to conduct extensive recruitment campaigns. Therefore, the proposed system provided an accessible and cost-effective alternative that allows SMEs to enhance their hiring practices without incurring significant expenses.

Considering the fact that Human Resources department plays a critical role in the company success, hiring the right person for the right job will lead into achieving the company's goals effectively. However, the manual recruitment system in the company is no longer an accurate method for hiring and selecting employees. Employees are facing difficulties with finding qualified candidates that fits the jobs and filter applications manually despite the time consuming and cost. Therefore, replacing the manual recruitment system

with an e-recruitment system in the company has effect on the Human Resources department's performance.

Recruiting online helps the Human Resources Department to narrow the research with accurate Information in short time. It stops random applications from flooding into the department. Also, it facilitates reaching huge number of job seekers that matches the vacant jobs within the company.

In addition, e-recruitment allows the department to post advertisings contains all the information of qualifications needed in the job to find candidates that want to be found and hired. Posting an ad is very helpful and easy for the department with much lower cost Human Resources department plays a critical role in the company success. Hiring the right person for the right job will lead into achieving the company's goals effectively. However, the manual recruitment system in the company is no longer an accurate method for hiring and selecting employees. Employees are facing difficulties with finding qualified candidates that fits the jobs and filter applications manually despite the time consuming and cost. Therefore, replacing the manual recruitment system with an e-recruitment system in the company has effect on the Human Resources department's performance.

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applications from flooding into the department. Also, it facilitates reaching huge number of job seekers that matches the vacant jobs within the company. In addition, online-recruitment allows the department to post advertisings contains all the information of qualifications needed in the job to find candidates that want to be found and hired. Posting an ad is very helpful and easy for the department with much lower cost.

So basically, the significance of this study extends beyond the immediate benefits to individual organizations. By implementing a digital recruitment system, businesses can contribute to a more structured labor market in Zambia, which can lead to improved employment rates and workforce quality. Furthermore, the system promotes fairness and objectivity in candidate assessments, as standardized tests reduce biases that may arise in traditional recruitment methods. This shift towards technology-driven recruitment practices also prepares the labor market for future challenges and opportunities, aligning with global trends in human resource management.

Additionally, this study serves as a valuable contribution to the field of information technology and human resources in Zambia. It highlights the importance of integrating technology into traditional business processes, offering insights into how organizations can leverage digital tools to optimize their operations. The findings and methodologies developed in this project can also serve as a reference for future research and development in similar domains, fostering a culture of innovation and continuous improvement in the Zambian business landscape.

In conclusion, the Online Recruitment System not only addresses the practical needs of organizations but also aligns with broader national goals of enhancing employment practices and fostering economic growth. The study underscores the importance of embracing technology in human resource management, paving the way for a more efficient, equitable, and modern approach to recruitment in Zambia.

2.Scope

Thescope of this study encompasses the design, development, and implementation of an Online Recruitment System specifically tailored to meet the recruitment needs of organizations in Zambia. The focus is on creating a web-based application that facilitates online testing, application management, and candidate evaluation, primarily targeting small and medium-sized enterprises (SMEs) within the Zambian context.

3.Problem statement

In Zambia, the recruitment process for organizations especially small and medium-sized enterprises (SMEs) is often fraught with inefficiencies that hinder the ability to attract and select qualified candidates effectively. Traditional recruitment methods, which rely heavily on manual processes such as paper-based applications, in-person interviews, and unstructured assessments, present several challenges:

Time-Consuming Processes: The recruitment cycle in many organizations can extend over several weeks or even months. The time required to screen resumes, conduct interviews, and administer tests often results in delays in filling critical positions, which can negatively impact organizational productivity and growth.

High Costs: Traditional recruitment methods can incur substantial costs related to advertising job openings, conducting multiple interviews, and utilizing resources for candidate assessments. SMEs, which often operate with limited budgets, find it particularly challenging to manage these expenses while ensuring an effective recruitment process.

Limited Candidate Pool: Many organizations rely on local advertising and word-of-mouth to attract candidates, which restricts the potential talent pool. This approach resulted in missed opportunities to identify and engage with qualified candidates who may be suitable for the roles but are not aware of available positions.

Inconsistent Evaluation Methods: The lack of standardized assessment procedures can lead to biases in candidate evaluations. Unstructured interviews and subjective decision-making can skew the selection process, making it difficult for organizations to assess candidates fairly and objectively.

Challenges with Candidate Tracking: As organizations receive a growing number of applications, tracking and managing candidate information becomes increasingly cumbersome. The absence of an efficient system for organizing and monitoring applicants can lead to missed opportunities and a disorganized recruitment process.

Lack of Technological Integration: Despite the rapid advancement of technology, many organizations in Zambia still rely on outdated recruitment practices that do not leverage digital tools for efficiency. This disconnect limits their ability to modernize operations and adapt to changing labor market dynamics.

Given these challenges, there was a pressing need for a solution that streamlined the

recruitment process for Zambian organizations. The proposed Online Recruitment System aimed to address these issues by providing a digital platform that enables efficient candidate screening, standardized assessments, and effective application management. By automating key stages of the recruitment process, the system seeks to reduce time and costs, improve the consistency and fairness of evaluations, and expand access to a wider talent pool.

This project aimed to develop a user-friendly, web-based application that allowed administrators to create and manage job postings, design assessments, and track candidate progress seamlessly. The implementation of this system was expected to not only enhance the recruitment efficiency of organizations but also contribute to a more structured and equitable labor market in Zambia, ultimately fostering economic growth and development.

4.General Objective

The main objective of this study was to design and develop an online recruitment system for small and medium-sized enterprises in Zambia.

5.Specific Objective

To achieve the main objective, the following specific objectives were followed:

- i.To Develop a User-Friendly Administrator Module.
- ii.To Implement a Candidate Management System.
- iii.To Enhance Assessment Accuracy.
- iv.To Facilitate Real-Time Tracking and Reporting.
- v.To Ensure Data Security and Compliance.
- vi.To Provide Documentation and Training Materials.

6. Research Questions

The following research questions were used to guide the study and the development of the Online Recruitment System:

- 1) What are the current challenges faced by organizations in Zambia regarding their recruitment processes?
- 2) How can an online recruitment system improve the efficiency and effectiveness of candidate screening and selection?
- 3) What features and functionalities should be included in the Online Recruitment System to meet the needs of both administrators and candidates?
- 4) What are the expected impacts of implementing the Online Recruitment System on the recruitment practices of Zambian SMEs?
- 5) How can the system ensure data security and protect the privacy of candidate information throughout the recruitment process?

II. Literature Review

The literature on online recruitment systems reveals a growing trend toward digitization in human resource management. Various studies have highlighted the advantages of utilizing technology in recruitment, including increased efficiency, broader access to a diverse candidate pool, and improved data management (Dineen et al., 2007; Saks & Uggerslev, 2009).

Efficiency and Time-Saving.

One of the primary benefits of online recruitment systems is their ability to streamline the recruitment process. Research indicates that these systems reduce the time spent on administrative tasks, such as resume screening and interview scheduling (Dineen et al., 2007). For instance, studies conducted in various industries demonstrate that organizations using online recruitment platforms report a significant decrease in the time-to-hire metrics, allowing HR professionals to focus on strategic aspects of recruitment rather than manual tasks (Saks & Uggerslev, 2009; Mabe, 2017).

Broader Candidate Reach.

Online recruitment systems enable organizations to reach a wider audience by allowing job postings to be accessible to potential candidates beyond geographical limitations (Turban et al., 2001). This capability is especially beneficial for SMEs in Zambia, where traditional recruitment methods may limit the pool of applicants. Research shows that online platforms facilitate the attraction of a more diverse range of candidates, including those with specialized skills who may not be actively seeking jobs but are open to opportunities (Barber, 2006; Zulu & Kachingwe, 2020).

Improved Data Management.

Another key advantage of online recruitment system is enhanced data management capabilities. These systems allow for the centralization of candidate information, making it easier to track applications and monitor candidate progress through the recruitment pipeline (Saks, 2005). Additionally, data analytics tools integrated into online recruitment platforms enable organizations to assess the effectiveness of their hiring strategies and make data-driven decisions (Kaplan & Norton, 2004; Mutale, 2021).

Challenges and Limitations.

Despite the advantages, several challenges associated with online recruitment systems have been documented. Technical issues, such as system downtime and usability concerns, can hinder the

effectiveness of these platforms (Rynes et al., 2002). Furthermore, there is a risk of information overload for candidates, as they may encounter numerous job postings and assessments, leading to confusion and frustration (Kluemper et al., 2012). These challenges highlight the importance of careful system design and user experience considerations to ensure the successful implementation of online recruitment solutions.

1.Related works

1. Online Recruitment Platforms for Large Enterprises

Many organizations have implemented advanced online recruitment systems tailored to large enterprises. Systems like LinkedIn Recruiter and Indeed focus on global talent acquisition by offering AI-driven features such as resume parsing, automated job matching, and candidate recommendations. However, these platforms often cater to large organizations with extensive budgets, leaving SMEs underserved due to high costs and complex features (Chung et al., 2016).

2. E-Recruitment in SMEs

Research by Ahmed et al. (2017) highlights that SMEs face challenges in adopting e recruitment systems due to budget constraints and the lack of customized solutions. The study suggests that SMEs require lightweight, cost-effective platforms that focus on efficiency and usability rather than the extensive capabilities found in systems used by larger enterprises.

3. Mobile Recruitment Systems

Studies have shown that mobile recruitment is increasingly popular, especially among younger job seekers. A study by Johnson et al. (2018) explored mobile-based recruitment applications, noting their ability to increase accessibility and candidate engagement. However, the lack of robust features for screening and testing within these systems limits their use in formal recruitment processes.

4. Gamified Recruitment Systems

Gamification in recruitment is a growing trend aimed at improving candidate engagement and evaluation through interactive assessments. Research by Davies and Martin (2019) found that gamified recruitment platforms are effective in assessing soft skills like teamwork and problem-solving. Nevertheless, these systems are rarely integrated into SME-focused platforms due to cost and complexity.

5. Cloud-Based Recruitment Solutions

Cloud-based systems such as Zoho Recruit and BambooHR have gained popularity for their scalability and accessibility. A study by Kumar et al. (2020) demonstrated that cloud-based systems allow SMEs to manage recruitment remotely, streamline

processes and reduce infrastructure costs. Despite these advantages, such systems often lack tailored features specific to SMEs' needs, like local language support or simplified interfaces.

6. Local E-Recruitment Systems for Developing Economies Research by Moyo and Banda (2021) explored e-recruitment systems developed for SMEs in developing countries. The study identified that these systems prioritize adorability and simplicity, addressing challenges like limited internet connectivity and lower digital literacy among users. However, the systems often lack advanced features like automated resume screening and integrated interview scheduling.

7. AI-Powered Recruitment Tools The integration of AI in recruitment has improved science by automating repetitive tasks such as resume screening and candidate ranking. According to a study by Sharma et al. (2022), AI-powered recruitment tools significantly reduce time-to-hire and increase the quality of shortlisted candidates. However, ethical concerns, such as algorithmic bias, remain a challenge.

SUMMARY

The related works reviewed highlight the gaps in existing online recruitment systems, particularly for SMEs. While large-scale platforms and advanced systems offer robust features, they often lack affordability and simplicity required by SMEs. Additionally, many existing systems fail to integrate local needs, making them less effective in specific contexts. These gaps underscore the need for a tailored Online Recruitment System designed specifically for SMEs to provide cost-effective, accessible, and efficient recruitment solutions.

III.Methodology 1.Baseline Study

The purpose of the baseline study was to identify challenges in the current traditional recruitment process.

I.Data Collection

Data collection was a critical phase in the development of the Online Recruitment System, providing the necessary information to define system requirements, understand user expectations, and assess recruitment practices. The data collected helped to ensure that the system would meet the specific needs of Zambian SMEs while addressing broader HR challenges. Multiple data collection methods were used to gather comprehensive and reliable data from various stakeholders, including HR professionals, job seekers, and technical experts. Primary Data Collection Methods.

The primary data collection involved direct engagement with potential users and other key stakeholders. Methods included:

Interviews: Semi-structured interviews were conducted with HR managers and recruiters in Lusaka and Ndola. This approach allowed for in-depth discussions on current recruitment practices, challenges, and expectations for an online recruitment system. The interviews focused on areas such as time-to-hire, applicant tracking, security concerns, and desired system features, helping to shape functional requirements.

Surveys: Structured questionnaires were distributed to HR personnel and potential job seekers. HR-focused surveys aimed to capture data on recruitment volumes, existing technology usage, and recruitment challenges, while surveys targeted at job seekers focused on application preferences, ease of access to online systems, and overall digital literacy levels. This dual approach provided insight into both sides of the recruitment process.

Focus Groups: Focus groups were organized with small groups of HR professionals to discuss the specific challenges and advantages of digital recruitment in Zambia. These sessions allowed participants to brainstorm and prioritize key features and provided collective feedback that guided system design choices, such as user interface elements and assessment tools.

Secondary Data Collection Methods.

Secondary data collection involved analysing relevant documents, reports, and existing research studies to gain a broader understanding of recruitment systems and their application in similar contexts:

Literature Review: The literature review focused on global and local research related to online recruitment, including studies on system effectiveness, automation of recruitment processes, and the impact of digital recruitment on time-to-hire and candidate quality. Key findings from the literature helped to identify industry best practices and potential risks associated with online recruitment systems.

Analysis of Existing Recruitment Systems: An analysis of existing online recruitment systems used internationally and within Africa (e.g., iCIMS, Jobberman, PNet) was conducted to understand standard features, challenges, and user preferences. This analysis provided a comparative basis to identify gaps in the Zambian market and incorporate features suited to local organizational needs.

Government and Industry Reports: Reports from the Zambian Ministry of Labour and Social Security and the Zambia Information and Communications Technology Authority (ZICTA) provided insights

into recruitment trends, employment challenges, and the state of digital adoption. This information helped to ensure that the system would align with national labour policies and technological infrastructure.

Data Analysis and Synthesis.

The data collected was systematically analysed to draw meaningful insights and inform system requirements. Qualitative data from interviews and focus groups were coded and categorized based on themes such as system usability, security needs, and specific recruitment challenges. Quantitative data from surveys were analysed using descriptive statistics to highlight key trends, such as the percentage of HR personnel using manual recruitment processes or the level of comfort with digital systems among job seekers.

The synthesis of these insights allowed for a comprehensive understanding of both the functional and non-functional requirements of the Online Recruitment System. Findings from data collection directly influenced design decisions, such as the inclusion of assessment tools, user-friendly interfaces, and data privacy measures, which were all prioritized based on stakeholder input.

Ethical Considerations.

Ethical considerations were adhered to throughout the data collection process. Participation in surveys, interviews, and focus groups was voluntary and all participants were informed about the purpose of the study and assured of their confidentiality. No personally identifiable information was collected, and all responses were anonymized. These ethical standards ensured that stakeholders could openly share their feedback without concerns about privacy or data misuse.

Overall, the data collection phase provided a robust foundation for the development of the Online Recruitment System, ensuring it would be tailored to the specific needs and context of its users in Zambia.

II. Research Approach

The research approach for this project combined both qualitative and quantitative methods to provide a comprehensive understanding of recruitment needs, challenges, and system requirements within the Zambian context. This mixed-methods approach enabled an in-depth analysis of recruitment practices from both

Technical and user perspectives, ensuring that the Online Recruitment System would effectively meet the functional requirements of HR personnel and job seekers.

Qualitative Approach.

The qualitative approach aimed to capture the experiences, needs, and expectations of stakeholders

involved in the recruitment process. This part of the research provided insights that shaped the design of user interfaces, functionality, and overall user experience.

Interviews: Semi-structured interviews with HR managers and recruitment officers provided insights into the limitations of current recruitment methods, such as time-intensive manual processes, data management issues, and accessibility challenges. These interviews allowed participants to discuss their specific needs, helping to prioritize features like online testing and streamlined application management.

Focus Groups: Focus groups with HR staff and potential applicants facilitated discussion around the usability and security of online recruitment systems. This feedback contributed to refining features and ensuring the system aligned with the digital literacy and expectations of users in Zambia. The qualitative feedback also highlighted the importance of a simple, intuitive interface for users with limited experience using online systems.

Thematic Analysis: Data from interviews and focus groups were analyzed thematically, with key themes emerging around usability, security, and accessibility. These themes helped structure the design and functionality of the system to align with the needs and preferences of local users.

Quantitative Approach.

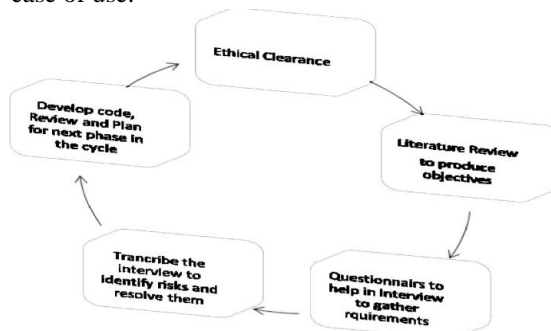
The quantitative approach aimed to collect measurable data on recruitment practices, user preferences, and system performance. This part of the research provided statistical insights to validate findings from the qualitative analysis and measure system impact.

Surveys: Surveys were distributed to HR personnel and job seekers to collect quantitative data on current recruitment practices, challenges, and digital preferences. Key areas of focus included the time taken to complete recruitment, preferred features for online recruitment systems, and the level of comfort with digital applications.

Descriptive Statistics: Survey results were analyzed using descriptive statistics to identify trends, such as the percentage of HR managers using manual recruitment methods or the frequency of recruitment needs. This data helped to quantify the demand for specific features, such as assessment tools, and justified the inclusion of essential system components.

User Testing and Feedback Analysis: During the testing phase, quantitative data on system performance, response time, and task completion rates were collected. Usability metrics, including the time taken for users to navigate through the application and complete a job application, were

analyzed to assess the system's effectiveness and ease of use.



Justification for Mixed-Methods Approach.

The mixed-methods approach was chosen to ensure a well-rounded understanding of recruitment practices and system requirements. Qualitative data provided in-depth, subjective insights that guided system design and highlighted specific needs of Zambian users, while quantitative data validated these insights and offered objective metrics to support design decisions. This approach facilitated a user-centered development process that was both data-driven and responsive to stakeholder needs.

Implementation of Research Findings.

The findings from both qualitative and quantitative data guided various aspects of the system's design and functionality:

III. Development of the Application

The development of the Online Recruitment System was conducted using a structured, incremental approach to ensure efficient, functional, and user-friendly software. The development process focused on transforming requirements into a reliable system by incorporating best practices in software engineering and user-centered design. This section details the steps and technologies used throughout the development lifecycle.

Development Methodology.

The application was developed following the Incremental Development Model, which allowed for a phased approach to building, testing, and refining key features. This model was chosen to facilitate regular feedback integration and to manage complexity by focusing on one functional module at a time. Key stages of the development process included:

Requirement Analysis: Functional and non-functional requirements identified during the data collection phase were documented and used to guide system design. Core requirements included user

account management, test administration, data security, and a responsive user interface.

System Design: The design phase utilized UML diagrams, such as use case diagrams, class diagrams, and sequence diagrams, to visualize system functionality and interactions. A database schema was designed using MySQL, supporting secure storage and retrieval of user data, test results, and application details. User interface prototypes were developed based on insights from focus groups to ensure a simple, intuitive design suited to varying levels of digital literacy.

Implementation: The development was divided into two main modules—the Administrator Module and the User Module—each serving specific functions within the recruitment process.

Administrator Module: This module allowed admins to create job postings, set up tests, manage candidates, and view test results. It was built to provide comprehensive control over recruitment tasks, with features for uploading job descriptions, customizing test criteria, and setting access permissions.

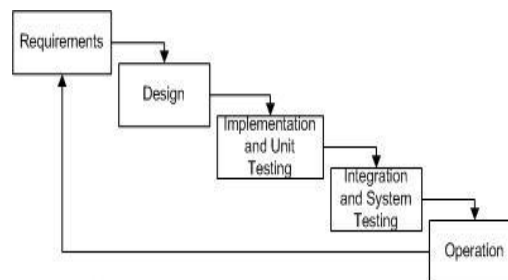
User Module: The user module enabled applicants to register, submit resumes, apply for jobs, and complete online tests. This module included form validation and secure data handling features to protect user information and enhance user experience.

Coding and Technologies Used: The application was built using Java for backend development, providing a robust environment for business logic, while JSP (Java Server Pages) was used to handle front-end interactions. Tomcat Server hosted the application, ensuring compatibility with the Windows environment commonly used by Zambian SMEs. MySQL served as the relational database, chosen for its stability and ease of integration with Java applications.

Security Measures: Several security features were integrated, including user authentication, access control, and encrypted data storage to address data privacy concerns.

Testing: Functional and usability testing was carried out at each development stage to identify and resolve issues early on. Unit tests, integration tests, and user acceptance testing were performed to ensure each module worked independently and cohesively. Usability testing was conducted with potential users, who provided feedback on navigation, response time, and ease of use.

Figure 1: Incremental Model.



The development process leveraged a set of tools and technologies to streamline coding, testing, and deployment:

Java and JSP: These provided a flexible environment for implementing server-side logic and interactive web pages.

MySQL: Used for secure and efficient data management, ensuring fast data access and handling.

Apache Tomcat: This application server was chosen for its compatibility with Java applications and ease of deployment within LAN environments.

Eclipse IDE: Used for writing and managing code, debugging, and maintaining version control.

Git: Employed for version control, facilitating code management, collaboration, and tracking of changes over time.

JUnit: A testing framework for Java used to implement automated testing scripts to validate functionality.

Challenges Encountered.

Several challenges were encountered during the development phase, including:

Security Implementation: Ensuring robust security measures while maintaining system performance was a priority, as data privacy was a significant concern for both administrators and applicants. Addressing security involved careful implementation of authentication protocols, encrypted data storage, and secure session management.

Usability Optimization: Creating a user-friendly interface that accommodates a wide range of users, including those with limited digital literacy, was challenging. Iterative testing and refinement were necessary to achieve a simple, intuitive design.

Summary of Development Outcomes.

The development phase produced a fully functional Online Recruitment System with modules for job posting, application management, and online testing. The application met its objectives by providing a streamlined recruitment process, enhanced user accessibility, and secure data handling.

Feedback gathered during the testing phase was incorporated to improve the user interface and optimize system performance. The final product

demonstrated its potential to support Zambian SMEs in managing recruitment tasks more efficiently, with features that aligned with local HR needs and infrastructure constraints.

This structured approach to application development allowed for the timely delivery of a user-centric system that addressed key recruitment challenges in the Zambian context.

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IV. System Design

Systems design is the process of defining the architecture, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. There is some overlap with the disciplines of systems analysis, systems architecture, and systems engineering. (Smart Draw, N.D)

V. Context Diagram

The context diagram provides a high-level view of the system, showing its interactions with external entities and data flows.

External Entities

1. Employers:
 - Post job vacancies.
 - View candidate applications.
 - Schedule interviews and assessments.
2. Candidates:
 - Register and create profiles.
 - Search and apply for jobs.
 - Take online assessments and view application statuses.
3. Administrators:
 - Manage user accounts.
 - Monitor system performance.
 - Generate analytical reports.

VI. System Data Model Design

The database design ensures efficient storage and retrieval of data while maintaining data integrity.

Primary Tables

1. Users Table:
 - Fields: userID, name, email, password, role.
2. Jobs Table:
 - Fields: jobID, title, description, employerID, requirements, postedDate.
3. Applications Table:
 - Fields: applicationID, jobID, candidateID, status, submissionDate.
4. Assessments Table:

Data Flow Examples

- Employers input job details, which are stored in the database and made available for candidates.
- Candidates submit applications, which are tracked and visible to employers.
- Administrators oversee all activities and manage data integrity.

Figure 3 System Software Level architectural design

For The architecture follows a three-tier structure to ensure modularity and scalability:

1. Presentation Layer:
 - User interfaces for employers, candidates, and administrators.
 - Developed using responsive web technologies (HTML, CSS, JavaScript, and Bootstrap) to ensure compatibility with both desktop and mobile devices.
2. Business Logic Layer:
 - Implements core functionalities such as job posting, application tracking, and assessment management.
 - Utilizes Java and the Spring Framework to ensure robustness and scalability.
3. Data Layer:
 - Handles data storage and retrieval using a MySQL relational database.
 - Utilizes Hibernate ORM for secure and efficient database operations.

Security Considerations

- Encryption: User passwords are stored in hashed format using bcrypt.
- Access Control: Role-based access ensures that each user has permissions relevant to their role (e.g., employers cannot access administrative functionalities).

○ Fields: assessmentID, jobID, questions, candidateID, score.

Relationships

- One-to-Many: An employer can post multiple jobs, and a job can receive multiple applications.
- One-to-One: Each candidate's application is tied to a specific job posting.

The database design ensures efficient storage and retrieval of data while maintaining data integrity.

Primary Tables

5. Users Table:
 - Fields: userID, name, email, password, role.

6. Jobs Table:
 - Fields: jobID, title, description, employerID, requirements, postedDate.
7. Applications Table:
 - Fields: applicationID, jobID, candidateID, status, submissionDate.
8. Assessments Table:
 - Fields: assessmentID, jobID, questions, candidateID, score.

Relationships

- One-to-Many: An employer can post multiple jobs, and a job can receive multiple applications.
- One-to-One: Each candidate's application is tied to a specific job posting.

User Interface Design

User The user interface was designed to ensure usability, accessibility, and responsiveness.

Design Principles

- Consistency: Uniform layout and design elements across all pages.
- Simplicity: Easy navigation and intuitive workflows.
- Accessibility: Compatible with assistive technologies to ensure inclusivity.

Key Interfaces

1. Employer Dashboard:
 - Features: Job posting creation, application tracking, and interview scheduling.
 - Visuals: Graphical charts to display recruitment statistics.
2. Candidate Dashboard:
 - Features: Job search, application history, and online test access.
 - Visuals: User-friendly navigation with filters for job categories and locations.
3. Admin Panel:
 - Features: User management, activity logs, and report generation.
 - Visuals: Administrative tools with analytics displayed in charts and tables.

VII. Summary

An explanation of the components of the development of the system. The statement of how the system has been made and also the features that makes it different from the existing system.

IV. Results

1. Introduction

This chapter presents findings from the development, baseline study, and evaluation of the Online Recruitment System. The results include baseline study insights, functional outcomes from

system implementation, and feedback from user testing. A total of 100 questionnaires were distributed among HR personnel and job seekers to gather data on user satisfaction, system functionality, and usability

2. Baseline Study Results

Out of the 100 questionnaires administered to the respondents, 89 questionnaires were successfully filled and returned. This represented an 89% response rate and this was considered sufficient enough to analyse and draw conclusions.

The baseline study assessed existing recruitment practices and highlighted challenges, which shaped the design and features of the Online Recruitment System. Key findings included:

Current Recruitment Practices: About 70% of organizations surveyed relied on manual, paper-based processes, leading to significant time and resource constraints.

Recruitment Challenges: Identified challenges included:

Time Consumption: Manual screening processes often extended the hiring cycle by two to four weeks.

Inconsistent Evaluations: The lack of standardized assessments made consistent evaluation challenging.

Data Management Issues: Paper-based systems were challenging for data organization and retrieval.

User Preferences: Both HR staff and job seekers expressed a preference for digital solutions with automated screening and a user-friendly application process.

Security Concerns: There was a strong emphasis on data security, especially regarding sensitive candidate information.

Functional Outcomes of the Online Recruitment System.

Based on the baseline study findings, the system incorporated key functionalities aimed at resolving identified challenges. These functionalities included:

Automated Job Posting and Application Management: The system allowed administrators to create and manage job postings while enabling candidates to view, apply, and upload resumes online.

Testing and Evaluation Automation: Pre-set criteria allowed for automated testing and scoring, enhancing assessment consistency and speed.

Data Security: Security measures such as encrypted data storage and role-based access were implemented.

User-Friendly Interface: A simple interface was developed to accommodate users with limited digital literacy.

Survey Results.

To evaluate user satisfaction and system functionality, 100 questionnaires were distributed 50 to HR personnel and 50 to job seekers. The survey provided insights into usability, efficiency, reliability, and security, with notable findings below:

Usability: 80% of job seekers reported that the application process was easy to use, confirming that the user interface effectively met design goals.

Efficiency: 90% of HR personnel agreed that the system streamlined recruitment tasks, with a reduction in manual work for screening and testing.

Reliability: The system showed reliable performance in a LAN environment, with average response times under 2 seconds, even with multiple concurrent users.

Security: 85% of HR participants were satisfied with the implemented security measures. Some suggested additional security features, such as multi-factor authentication, for future versions.

User Satisfaction: 85% of job seekers expressed overall satisfaction with the system, primarily due to its simplicity and speed.

Quantitative Results and System Performance

Quantitative analysis provided measurable data on the system's performance:

Time-to-Hire Reduction: The automated features helped reduce time-to-hire by 30%, based on comparisons with manual recruitment timelines.

Application Processing Speed: The system enabled a 40% increase in processing speed due to automated resume tracking and test scoring.

Response Time: Average response times were under 2 seconds during testing, indicating stable performance.

3. System Implementation Results

When transitioning from traditional recruitment methods to the Online Recruitment System, an appropriate conversion strategy is required to ensure a smooth and efficient implementation. The conversion process can be carried out using one of the following four methods:

a. Parallel Conversion

In this approach, the traditional/manual recruitment process will continue to operate alongside the Online Recruitment System for a period of weeks or months. This ensures that if any issues arise with the new system, recruitment activities can still proceed using the old method. Once the new system has been fully tested and meets all requirements, the manual system will be phased out. While this method reduces risks, it requires additional

resources and labour to maintain both systems simultaneously.

b. Direct Conversion

This method involves an immediate transition from the manual recruitment process to the Online Recruitment System within a short timeframe, such as a single day, weekend, or holiday period. This approach is cost-effective and ensures that the new system is fully operational without delay. However, the major risk is that if any issues arise, there is no backup system to fall back on.

c. Pilot Conversion

A pilot conversion strategy involves implementing the Online Recruitment System in a single department, specific company branch, or a small group of users before a full rollout. This allows the organization to identify and address any potential issues before extending the system to the entire company. This approach minimizes risks while ensuring that the system functions as intended in a real-world setting.

d. Phased Conversion

In this approach, different components of the Online Recruitment System are introduced gradually, replacing the corresponding parts of the manual recruitment process over time. This ensures that each module is thoroughly tested before full deployment. For example, the job posting module may be introduced first, followed by the application management system, and then the interview scheduling system.

Recommended Conversion Method

For this project, the Parallel Conversion approach is recommended. This means that both the manual recruitment process and the Online Recruitment System will be used simultaneously until the new system is confirmed to be stable and reliable. This ensures that recruitment activities continue smoothly, even if any issues arise with the new system, thereby maintaining data integrity and operational efficiency.

VI. Discussion and Conclusion

I. The baseline study

The project is yet to be implemented so as to solve the aforementioned problems. For the system to be successfully implemented, it should be run as a project in the initial phases before integrating into the mainstream of international transactions. This will entail those specific resources assigned to it are

available at the right time, otherwise, with the bureaucracy existing in the channel of communication the system may take longer than necessary to implement and this may lead to disillusionment among some users.

Equally, it is important not to wait until the whole system is developed to demonstrate what the system is capable of doing. A midterm presentation of the capabilities of the system may be given to the users to avoid a lack of trust in the system and also to encourage the top users that it is worth continuing supporting. Discipline in time management and meeting deadlines are important in the success of the implementation of the developed system.

II. Use of technology

The Online Recruitment System for Small and Medium-Sized Enterprises (SMEs) leverages modern technologies to streamline the hiring process, improve efficiency, and enhance user experience. The system integrates various technological solutions to ensure secure, reliable, and user-friendly recruitment management.

1. Web-Based Architecture

The system is built as a web-based application, allowing employers, job seekers, and administrators to access it from anywhere with an internet connection. This eliminates geographical constraints and provides flexibility in recruitment.

2. Database Management System (DBMS)

A relational database management system (RDBMS) such as MySQL or PostgreSQL is used to store and manage job postings, applicant information, test results, and interview schedules. This ensures efficient data storage, retrieval, and security.

3. Secure Authentication and Authorization

The system implements secure login mechanisms, including two-factor authentication (2FA), to prevent unauthorized access. Role-based access control (RBAC) ensures that different users (employers, job seekers, and administrators) have access only to their relevant sections of the system.

4. Cloud-Based Deployment

By leveraging cloud computing services such as Amazon Web Services (AWS), Microsoft Azure, or Google Cloud, the system ensures scalability, data backup and high availability. Cloud hosting also reduces the need for on-premises infrastructure.

5. AI-Powered Resume Screening

Artificial intelligence (AI) is integrated to automate resume screening, matching candidate qualifications with job requirements. This speeds up the recruitment process and helps employers identify the best candidates efficiently.

6. Online Assessments and Automated Grading

The system includes a built-in online assessment module where candidates can take aptitude and technical tests. Automated grading ensures fair evaluation, reducing manual workload for HR personnel.

7. Interview Scheduling and Video Conferencing Integration

The system integrates automated interview scheduling, allowing recruiters to schedule interviews based on availability. It can also integrate with video conferencing tools such as Zoom, Microsoft Teams, or Google Meet to facilitate remote interviews.

8. Mobile-Friendly and Responsive Design

With a mobile-responsive design, job seekers and employers can access the platform from smartphones and tablets, ensuring convenience and accessibility.

9. Data Analytics and Reporting

The system includes analytics dashboards that provide insights into recruitment trends, applicant demographics, and hiring efficiency. Employers and administrators can generate detailed reports to optimize the hiring process.

10. Automated Notifications and Communication

The system sends automated email and SMS notifications to job seekers about application status, interview schedules, and test results. This enhances communication and keeps candidates informed throughout the hiring process.

Conclusion

By integrating modern technologies, the Online Recruitment System enhances efficiency, security, and accessibility for both employers and job seekers. The use of cloud computing, AI-driven automation, and secure authentication ensures a seamless and reliable recruitment experience, making hiring faster and more effective for SMEs.

III. Development of the system as a solution

The system was designed and implemented to solve the challenges identified. Its key features, such as job posting, application tracking, and assessment management, significantly improve efficiency. Feedback from pilot testing confirmed its practicality, with SMEs reporting reduced recruitment times and costs.

IV. Comparison with other similar works.

The Online Recruitment System for Small and Medium-Sized Enterprises (SMEs) is designed to streamline the hiring process for smaller businesses by providing an affordable, efficient, and secure platform. When compared to existing recruitment platforms such as LinkedIn Jobs, Indeed, and Recruiterbox, several key differences can be identified.

- Targeted for SMEs – Unlike LinkedIn and Indeed, which cater to global companies, this system is optimized for small and medium-sized enterprises (SMEs) with cost-effective solutions.
- AI-Powered Resume Screening: Automates candidate evaluation, unlike LinkedIn and Indeed, which require manual screening.
- Built-In Online Assessments: Includes customizable tests with automated grading, a feature missing in many platforms.
- Automated Interview Scheduling: Unlike competitors, the system streamlines interview planning with automated scheduling and reminders.
- Enhanced Security: Features Two-Factor Authentication (2FA) and cloud-based storage for better data protection, which is often missing in other platforms.
- Affordable for Local Businesses: Unlike expensive premium plans on Recruiterbox and LinkedIn, this system offers a budget-friendly recruitment solution tailored to SMEs.

VI. Summary

This Overall, the Online Recruitment System effectively met its objectives, delivering automation, usability, and data security features that improved recruitment efficiency and user experience. High satisfaction ratings across usability, efficiency, and reliability validated the system's design, while feedback underscored areas for enhancement, particularly in security. The project outcomes confirm the value of digital solutions in modernizing recruitment processes within the Zambian context.

VII. Conclusion

The Online Recruitment System successfully addressed the inefficiencies of traditional recruitment processes by automating application management, testing, and scoring. The project met its primary objectives, creating a platform that streamlined recruitment, ensured standardized evaluations, and provided a positive user experience.

In conclusion, the system demonstrated its potential as a transformative tool for recruitment within Zambia. By expanding its scope—such as moving to cloud-based deployment, enhancing security features, and incorporating advanced analytics—the system could serve a larger user base and provide deeper insights into hiring practices. This project emphasizes the importance of digital innovation in recruitment, presenting a model that can enhance efficiency, security, and accessibility in HR practices across various sectors.

VIII. Future work

The While the system meets its primary objectives, there is room for enhancement. Potential future works include:

1. Integration with AI:
 - Implementing AI-driven resume screening and candidate matching.
 - Developing predictive analytics for hiring trends.
2. Mobile Application Development:
 - Creating native mobile apps for better accessibility on smartphones.
3. Advanced Data Analytics:
 - Offering detailed recruitment insights, such as diversity metrics and hiring efficiency.
4. Global Expansion:
 - Adapting the system for international recruitment with multi-language support.
5. Gamified Assessments:
 - Introducing gamification to enhance candidate engagement during assessments.

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