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FACULTY OF TECHNICAL SCIENCES

ONLINE JOB PORTAL

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE AWARD OF BACHELOR OF SCIENCE (HONS) IN COMPUTER SCIENCE

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DECLARATION

I hereby declare that except for the work of other researchers which has been duly referenced, this submission is the original result of my own research undertaken under the supervision of Mr. David Sapunka Fornah. This submission has not been presented in whole or in part for the award of any other degree or diploma at any other university or institution of higher learning.

Department: Computer Science

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This project has been submitted for examination with my approval as the university.

Name	**Signature**
David Sapunka Fornah	……

CERTIFICATION

This is to certify that the project titled “Online Job Portal” has been acknowledged by the Faculty of Science and Technology at Central University. This work represents a comprehensive research effort on the chosen topic and has been successfully presented, fulfilling the academic requirements for the degree to which it has been submitted.

Signature: ……

Mr. David Sapunka Fornah Supervisor

Signature: ……

Isaac Muckson Sesay Dean of faculty

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LIST OF ACRONYMS

3NF	Third Normal Form
ACL	Access Control List
AES	Advanced Encryption Standard
AI	Artificial Intelligence
ANOVA	Analysis of Variance**.**
API	Application Programming Interface
AP	Application Processing
AWS	Amazon Web Services
BERT	Bidirectional Encoder Representations from Transformers
CDNs	Content Delivery Networks
CI	Continuous Integration
CPU	Central Processing Unit
CSRF	Cross-Site Request Forgery
DB	Database
DDoS	Distributed Denial of Service
DFD	Data Flow Diagram
DOI	Diffusion of Innovation
GDPR	General Data Protection Regulation
HCI	Human-Computer Interaction
HTTP	HyperText Transfer Protocol
IR	Information Retrieval
ISSM	Information System Success Model
JM	Job Matching

JS JavaScript

MFA Multi-Factor Authentication

NLP Natural Language Processing

NoSQL Not Only SQL

ORM Object-Relational Mapping

ORM Object-Relational Mapping

PCI-DSS Payment Card Industry Data Security Standard

RBAC Role-Based Access Control

SDLC Software Development Lifecycle

SSD Solid State Drive

SSL Secure Sockets Layer

TAM Technology Acceptance Model

UI User Interface

UNDP United Nations Development Programme

UTAUT Unified Theory of Acceptance and Use of Technology

TLS Transport Layer Security

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ABSTRACT

The integration of technology in employment solutions is transforming recruitment processes and bridging gaps between job seekers and employers worldwide through the use of advanced tools and platforms as it enhanced efficiency, accessibility, and user experience in job application management. Its simplifies recruitment processes and improving outcomes for both employers and job seekers which happens to be a crucial challenge the world over of which Sierra Leone is not an exception. Consequently, automotive job-matching systems are gaining significant traction in offering streamlined and effective solutions for employment challenges. Hence, this project developed and deployed an Online Job Portal that leverages secure data management, and user-friendly features with enhanced AI features to optimize recruitment.

The portal integrates modules for job seekers, administrators(employers**)**, each equipped with dashboards that enhance functionality and user experience. Employing agile methodologies complemented by modern development techniques, the project emphasizes a seamless and efficient platform to align with the objectives of improving employment accessibility and process efficiency. This results to a platform that addresses key challenges such as redundancy in job applications and inefficiencies in candidate screening, enabling a more effective hiring process. The research work was constraint by a variety of challenges but the notable one is: Resource limitations.

Future enhancements could focus on expanding geographical reach, incorporating predictive analytics, developing a Mobile Application, and developing additional tools for career development and training, further contributing to the evolving landscape of recruitment technology.

Keywords: Recruitment technology, User experience, Employment solutions, Job application management

CHAPTER ONE

Introduction

1.1 BACKGROUND

The ever-growing complexities in recruitment processes, coupled with inefficiencies in job application management, have become a pressing challenge for both job seekers and employers. Issues such as redundant applications, delays in hiring, and poor candidate screening often hinder effective recruitment, leaving both parties dissatisfied. This problem is exacerbated by the lack of user-friendly and transparent systems that can bridge these gaps. Motivated by the need to mitigate these challenges, this project seeks to develop an Online Job Portal designed to streamline and enhance the recruitment process, benefiting job seekers, employers, and administrators alike.

This chapter introduces the research project, emphasizing the critical role of efficient job application and recruitment management in enhancing employment processes. It defines the project's objectives and research questions, highlighting the importance of improving accessibility, accuracy, and efficiency in job matching and recruitment. The chapter also discusses the scope and limitations of the proposed project, addressing potential delimitations related to the geographical reach of the platform and the technology used. The aim is to demonstrate how such a system can modernize recruitment processes, benefiting job seekers, employers, and administrators.

For companies and job seekers alike, traditional approaches, such as managing applications manually or relying on fragmented systems, have proven inadequate (Lee, C., & Tan, Y., 2023). Challenges such as prolonged hiring times, errors from human intervention, a lack of transparency in the recruitment pipeline, and inefficient candidate screening have rendered traditional systems less effective. Lee and Tan (2023) argue that such inefficiencies lead to frustration, delays in filling vacancies, and missed opportunities for both employers and job seekers.

This research seeks to develop and implement an Online Job Portal aimed at enhancing the efficiency, accuracy, and transparency of the recruitment process. The study focuses on creating a secure, user-friendly platform that addresses the limitations of existing systems, such as inefficiencies in job matching, redundancies in applications, and poor user experience. By automating and restructuring recruitment tasks, the system will improve job matching accuracy and overall satisfaction for users. It offers a solution that ensures effective data management, secure application processing, and greater accessibility to employment opportunities.

In recent times, the wave of digital transformation within the employment sector has significantly impacted how recruitment processes are executed, improving the time taken and the accuracy achieved in hiring decisions. This transformation has made it possible to integrate all modules under a single platform (Brown, M., & Liu, S., 2023). This means that administrations, employers, and job seekers can seamlessly manage job postings, applications, and hiring processes through a dedicated Online Job Portal explicitly designed to improve efficiency, accuracy, and accessibility. This research work seeks to achieve these objectives, aligning with the broader goal of advancing recruitment technology and processes.

1.2 PROBLEM STATEMENT

In Sierra Leone, the reliance on traditional and fragmented recruitment processes has become a significant challenge, impacting both job seekers and employers. Despite the increasing adoption of technology in various sectors, these outdated systems result in inefficiencies such as delays in job matching, redundant applications, and poor candidate screening, hindering the effective delivery of employment opportunities. This study proposes the development and implementation of an Online Job Portal to modernize recruitment processes, enhance accuracy, and improve the overall experience for job seekers, employers, and administrators.

1.3 AIMS AND OBJECTIVES

This research work seeks to develop and deploy an Online Job Portal for Sierra Leone to streamline recruitment processes, enhance efficiency, accuracy, and transparency in job matching, and improve the overall experience for job seekers, employers, and administrators.

1.31 Objectives

In a bid to achieve the overall study goal, the researcher focuses on the following given set of objectives:

I. To design and develop a secure and user-friendly Online Job Portal.

II. To enhance the efficiency and accuracy of job matching and application processes.

III. To improve transparency and user experience for job seekers, employers, and administrators.

1.4 RESEARCH QUESTIONS

I. How can a secure and user-friendly Online Job Portal be designed and developed to meet the needs of job seekers, employers, and administrators in Sierra Leone?

II. How can the efficiency and accuracy of job matching and application processes be enhanced through the implementation of an Online Job Portal in Sierra Leone?

III. How can transparency and the user experience for job seekers, employers, and administrators be improved through the implementation of an Online Job Portal in Sierra Leone?

1.5 SIGNIFICANCE OF THE STUDY

Recruitment inefficiencies remain a significant challenge in Sierra Leone, where traditional methods of managing job applications and hiring processes often result in delays, redundancies, and poor candidate screening. These challenges hinder effective employment solutions, leaving job seekers frustrated and employers unable to find the right candidates efficiently.

Therefore, the development of an automated, web-based Online Job Portal is essential for this study to provide a robust solution that addresses these challenges. This project aims to bridge the existing gaps in the recruitment process by creating a system that streamlines job matching, application tracking, and communication between job seekers and employers. The portal has the potential to transform the recruitment

landscape in Sierra Leone by offering an integrated platform that manages all job-related activities accurately, transparently, and efficiently. It will significantly enhance the recruitment process by improving Job Matching (JM), Application Processing (AP), and providing comprehensive reporting for better decision-making.

1.6 SCOPE & LIMITATIONS

The proposed Online Job Portal for Sierra Leone will have certain limitations. First, it will initially focus on specific industries and job categories rather than covering all sectors of the job market. This limitation ensures that the system can be tested and refined before being expanded to accommodate a broader range of job types and industries.

Additionally, the portal will not include advanced features such as predictive analytics or artificial intelligence-powered resume screening during its initial phase. This means that employers will rely on traditional filtering options. And also may not include a Landing Page

Furthermore, the portal will not integrate with third-party payment gateways for services such as premium job postings or featured employer listings. Instead, it will focus on providing a platform for job seekers and employers to connect, with future plans to include additional monetization and integration features. This ensures that the initial version of the portal emphasizes its core functionality of improving recruitment processes while leaving room for scalability and enhancements in subsequent iterations.

1.7 Chapter Demarcation

Chapter 2: Literature Review

The literature review explores the evolution of online job portals, focusing on the transition from traditional recruitment methods to technology-driven platforms. It synthesizes research on user-friendly interface design, secure data management, and effective job search functionalities. Key areas examined include the significance of responsive design, accessibility considerations, and challenges specific to job portals in resource-constrained environments like Sierra Leone. Additionally, the review identifies gaps in existing systems, particularly in addressing inefficiencies in job application processes and the lack of inclusive platforms tailored to developing nations. It establishes a theoretical framework for designing an effective Online Job Portal that meets the needs of Sierra Leone's employment landscape.

Chapter 3: System Methodology and Design

This chapter details the systematic approach employed in designing, developing, and deploying the Online Job Portal. It outlines the use of Agile methodology to facilitate iterative development and adaptability throughout the project lifecycle. The chapter elaborates on the system's modular architecture, including the presentation, business logic, and data layers, with emphasis on the integration of Next.js, MongoDB, Prisma ORM, and Google AI. Furthermore, the methodology ensures the platform is optimized for mobile responsiveness and accessibility, creating an inclusive and seamless user experience across various devices.

Chapter 4: Results

This chapter evaluates the performance of the Online Job Portal by analyzing metrics such as user engagement, job matching accuracy, platform responsiveness, and system usability. It discusses the results of extensive system testing, highlighting its efficiency in managing job listings, user registrations, and application processes. Feedback from job seekers, employers, and administrators is incorporated to assess the portal's practical impact on addressing employment challenges in Sierra Leone. The results emphasize the system's success in streamlining job matching, improving application management, and fostering transparency in recruitment processes.

Chapter 5: Summary, Conclusion, and Recommendations

This chapter summarizes the research, underscoring the innovative approach of the Online Job Portal in addressing recruitment challenges through digital employment solutions. It highlights the portal's role in overcoming employment barriers by leveraging inclusive design and streamlined data management. The chapter also identifies the system's unique contributions, including its AI-powered features, mobile responsiveness, and tailored functionalities for Sierra Leone's job market. Recommendations include potential enhancements, such as expanded geographical coverage, integration of career development resources, and predictive analytics for personalized job recommendations. The conclusion reflects on the broader implications of the project, emphasizing its potential to foster economic empowerment, digital accessibility, and transformative recruitment practices in emerging economies.

CHAPTER TWO
Review Of Related Study Literatures

2.1 **INTRODUCTION**

This section provides the foundation for understanding Online Job Portals and their significance in the modern job market. It begins by exploring the theoretical frameworks and key computer science models that underpin the study, focusing on the theories, algorithms, and methodologies that inform the research. The review then examines the research objectives, emphasizing how prior studies align with or differ from the goals of the current investigation. Key gaps in the existing literature are also identified, illustrating areas that remain underexplored and where the current study aims to contribute. The section concludes with a synthesis of the literature, connecting theoretical insights to the research design and setting the stage for the investigation to come.

2.1.1 **Theoretical Framework**

The Online Job Portal aims to modernize and enhance the recruitment process by automating job matching, streamlining application management, reducing redundancies, and enabling transparent communication between job seekers and employers. This system leverages robust architectures, advanced filtering methods, and scalable technology to ensure efficient operations. Central to its success are intuitive user interfaces, administrator training, and phased implementation for seamless adoption.

The Diffusion of Innovation (DOI) theory, introduced by Rogers (2022), underpins the system's approach to adoption, focusing on how innovations are communicated and embraced by users over time. Additionally, Activity Theory, as developed by Engeström (2020), guides the understanding of user interactions within the system, emphasizing the context and tools that mediate job seekers’ and employers’ activities on the platform.

Further, the Technology Acceptance Model (TAM), proposed by Davis (2021), is instrumental in shaping the portal's design to enhance user satisfaction by addressing perceived ease of use and usefulness. By ensuring intuitive navigation and responsive features, the system meets the expectations of diverse stakeholders. Additionally, the Secure Software Development Life Cycle (SSDLC), as outlined by McGraw (2022), reinforces the importance of building security into each development phase, safeguarding user data and ensuring trust. Together, these theoretical frameworks provide a comprehensive foundation for developing a robust and user-centric Online Job Portal that addresses inefficiencies and fosters accessibility, accuracy, and satisfaction.

2.1.2 Contribution To The Study

The research contributes to the study by addressing critical challenges in the recruitment process, specifically inefficiencies, redundancies, and lack of transparency in traditional job-matching systems. By developing an Online Job Portal tailored to Sierra Leone’s employment landscape, the study introduces practical, technology-driven solutions that enhance usability, accuracy, and efficiency in job matching and application tracking. It bridges gaps in existing literature by applying innovative frameworks such as the Information System Success Model and emphasizing underexplored factors like transparency and adaptability.

Moreover, the study advances recruitment technology by integrating user-centric design principles, scalable architectures, and efficient data management techniques. It highlights the importance of customizable features that cater to diverse user needs, ensuring the system’s relevance across different industries. By focusing on key elements such as trust-building, user engagement, and transparency, the research not only addresses existing shortcomings in recruitment systems but also sets a foundation for future advancements in employment technology. This contribution is particularly significant for developing economies like Sierra Leone, where streamlined and accessible employment solutions can drive economic growth and digital transformation.

2.2 REVIEW OF RESEARCH OBJECTIVES

I. To Design And Develop A Secure And User-Friendly Online Job Portal

The objective of creating a secure and user-friendly Online Job Portal is critical to addressing inefficiencies in recruitment processes. Prior research has highlighted the importance of intuitive interfaces and robust authentication systems in ensuring accessibility and trust among users (Davis, 2021). By leveraging modern frameworks like Next.js, ShadcnUI, and Clerk, this study aims to deliver a platform that not only provides seamless navigation but also prioritizes data security, reducing risks associated with breaches and unauthorized access.

The portal's design focuses on inclusivity and responsiveness, ensuring that it caters to a diverse range of users across different devices and literacy levels. Special attention is given to creating an intuitive layout that allows users with limited technical knowledge to navigate effortlessly. Features like adjustable font sizes, and mobile-friendly interfaces further enhance accessibility, making the portal usable for a broad audience, including those in underserved regions.

To address security concerns, the portal implements end-to-end encryption for sensitive data to safeguard information. This ensures that job seekers, employers, and administrators can use the platform with confidence, knowing that their data is protected from unauthorized access and cyber threats.

In addition to technical functionality, the portal is designed to foster a positive user experience by incorporating features such as clear onboarding guides, real-time feedback on actions (e.g., application submissions and updates), and detailed help sections. These features aim to reduce user frustration and ensure that the platform meets the needs of all stakeholders effectively. By combining cutting-edge technology with a user-centric approach, this objective seeks to establish a reliable and efficient recruitment platform tailored to the unique challenges of Sierra Leone’s employment landscape.

II. To Enhance The Efficiency And Accuracy Of Job Matching And Application Processes

Improving job matching and application efficiency remains a key focus of this research. Studies (Rogers, 2022) have shown that technology adoption in recruitment significantly reduces redundancies and accelerates hiring timelines. By integrating AI-powered matching capabilities through Google AI and optimizing the backend with Prisma and MongoDB, the portal ensures precise alignment between job seeker qualifications and employer requirements. This approach minimizes mismatches and streamlines application tracking, fostering a more effective and satisfying recruitment experience for all stakeholders.

The integration of AI-powered tools allows the portal to analyze extensive datasets, identifying patterns and relationships between job descriptions and applicant profiles. This ensures that job seekers are presented with the most relevant opportunities while employers can identify candidates who best match their requirements. Advanced filtering options enable users to refine searches based on criteria such as experience, skills, location, and salary expectations, further enhancing the precision of job matching.

The backend optimization with Prisma and MongoDB ensures that the portal can handle large volumes of data efficiently, allowing for quick and accurate search queries even as the user base grows. This scalability is essential for accommodating the dynamic nature of the job market in Sierra Leone, where demand for employment solutions is steadily increasing.

Additionally, the portal incorporates real-time application tracking, allowing employers to monitor the progress of recruitment processes and job seekers to receive timely updates on their applications. Automated notifications and reminders ensure that no critical steps are missed, reducing delays and improving overall process efficiency.

By addressing inefficiencies in traditional recruitment methods, such as manual job matching and delayed communication, the portal fosters a streamlined experience for all stakeholders. It not only saves time and resources but also enhances user

satisfaction by delivering accurate and reliable results, setting a new standard for recruitment systems in Sierra Leone.

III. To Improve Transparency And User Experience For Job Seekers, Administrators(Employers)

Transparency and user experience are key pillars in the development of the Online Job Portal. In the recruitment process, transparency is crucial in building trust and fostering engagement among users. Studies (McGraw, 2022) emphasize the importance of providing clear, accessible information to create a sense of accountability and improve user satisfaction. This research focuses on improving transparency by ensuring that job seekers, employers, and administrators have clear visibility into the entire recruitment process.

The portal offers real-time updates on job listings, application statuses, and employer profiles, allowing users to track the progress of their applications and understand where they stand in the hiring process. By providing detailed job descriptions, application timelines, and information on employer credentials, transparency is enhanced, reducing uncertainty for all parties involved. Job seekers can view whether their application has been reviewed, shortlisted, or rejected, while employers can easily track candidates' progress through each stage of the recruitment pipeline. This level of visibility ensures users are always informed, improving communication and reducing frustration.

For employers and administrators, the portal includes comprehensive reporting tools to monitor recruitment performance. These tools provide data on metrics such as application volume, time-to-hire, and candidate engagement, enabling employers to make informed decisions. Administrators can oversee the entire process to ensure smooth operations, handle disputes, and maintain the integrity of the portal. These insights also help identify areas for system improvements, ensuring that the platform remains effective and relevant over time.

The user experience is further improved by the incorporation of intuitive features such as personalized dashboards, easy-to-navigate job search filters, and user-friendly interfaces that allow all users, regardless of technical proficiency, to engage with the portal comfortably. Mobile responsiveness ensures that users can access the portal

from various devices, making it accessible even to those with limited access to computers. Clear navigation paths, helpful tips, and consistent design patterns promote ease of use, ensuring that the platform is welcoming and efficient for both employers and job seekers.

By focusing on transparency and enhancing the user experience, this objective aims to create a recruitment platform that fosters trust, efficiency, and satisfaction, ultimately setting a new standard for online job portals in Sierra Leone.

2.3 RESEARCH GAPS

After a thorough review of existing literature on online job portals, several research gaps persist that hinder the development of more efficient and user-friendly recruitment systems. A significant challenge is privacy and data security concerns remain inadequately addressed, particularly regarding the sensitive personal and professional data shared by job seekers and employers. There is also a lack of transparency in the job application process, leading to frustration and disengagement among users. Furthermore, while some portals have implemented basic features, there is a need for deeper integration with AI technologies and real-time application tracking to further enhance user experience and recruitment efficiency.

However, the ‘Online Job Portal ’ project addresses these critical gaps by integrating advanced AI-powered job matching algorithms through Google AI, ensuring more accurate and relevant functions for job seekers. The portal enhances data security with robust encryption and role-based access controls, ensuring the protection of sensitive personal and organizational data. By incorporating real-time application tracking, users can easily monitor their progress throughout the recruitment process, improving transparency and user trust. Additionally, the platform is designed to scale, with integration capabilities for future features like predictive analytics and third-party service integrations. This forward-thinking approach positions the portal as an innovative solution to modernize the recruitment process in Sierra Leone, ultimately improving efficiency, transparency, and user satisfaction.

2.4 SUMMARY

The literature review for the Online Job Portal examines key objectives focused on optimizing the recruitment process, ensuring data accuracy and security, and enhancing the overall user experience for job seekers, employers, and administrators. The first objective emphasizes ensuring the accuracy and security of data through real-time validation, and secure, scalable databases. The review highlights the importance of ensuring job seekers are matched with the most relevant opportunities based on their skills and qualifications. It also stresses the need for robust data encryption and role-based access controls to protect sensitive user and employer data throughout the recruitment process, ensuring data integrity and confidentiality.

The second objective explores enhancing the overall user experience by prioritizing intuitive design, comprehensive user support, and effective training. User-friendly interfaces, tailored to meet the needs of diverse user groups, are vital for ensuring accessibility and smooth interactions. The development of responsive, adaptable interfaces that work seamlessly across devices is crucial for providing a positive experience for job seekers and employers alike. Additionally, comprehensive support tools, such as FAQs, are emphasized to help users navigate the platform effectively. Continuous feedback collection from users and regular system updates based on their insights are essential for maintaining the portal's relevance and improving its functionality over time. This approach ensures that the portal remains effective, secure, and user-centered, fostering a seamless recruitment experience.

CHAPTER THREE
Methodology and Design

3.1 RESEARCH DESIGN

The development of the Online Job Portal for Sierra Leone follows a structured computational framework that integrates advanced software architectures and efficient system integration to achieve the following objectives: designing and developing a secure and user-friendly portal, enhancing the efficiency and accuracy of job matching and application processes, and improving transparency and user experience for job seekers, employers, and administrators. The design leverages Next.js for server-side rendering and static site generation, ensuring optimal performance and scalability. ShadcnUI enhances the user interface, offering a responsive and accessible design, while Clerk provides secure authentication for seamless login and user management.

For efficient data handling, Prisma ORM is used to manage interactions between the backend and the MongoDB database, ensuring a robust data management system. Integration with Google AI powers intelligent job-matching algorithms, improving the relevance of job recommendations. Additionally, Firebase supports real-time notifications, keeping users updated on critical activities like job applications and new postings. This comprehensive design approach ensures the portal addresses employment challenges in Sierra Leone while remaining scalable, efficient, and user-focused.

3.2 SYSTEM ARCHITECTURE

The Online Job Portal follows a modular, service-oriented architecture, with distinct modules for Admin, Company, and Job Seeker. The system is built on a robust backend using Next.js, a powerful React framework that supports server-side rendering and static site generation for faster load times and seamless user experiences. ShadcnUI ensures a modern, responsive design with intuitive user interfaces. Authentication and user management are handled securely through Clerk, while Prisma facilitates seamless database management. Data is stored in MongoDB, a scalable NoSQL database capable of managing large volumes of data efficiently. Google AI powers intelligent features such as job matching and recommendation systems, enhancing the overall functionality of the platform. Firebase supports real-

time data synchronization and additional cloud-based services, ensuring a highly responsive system.

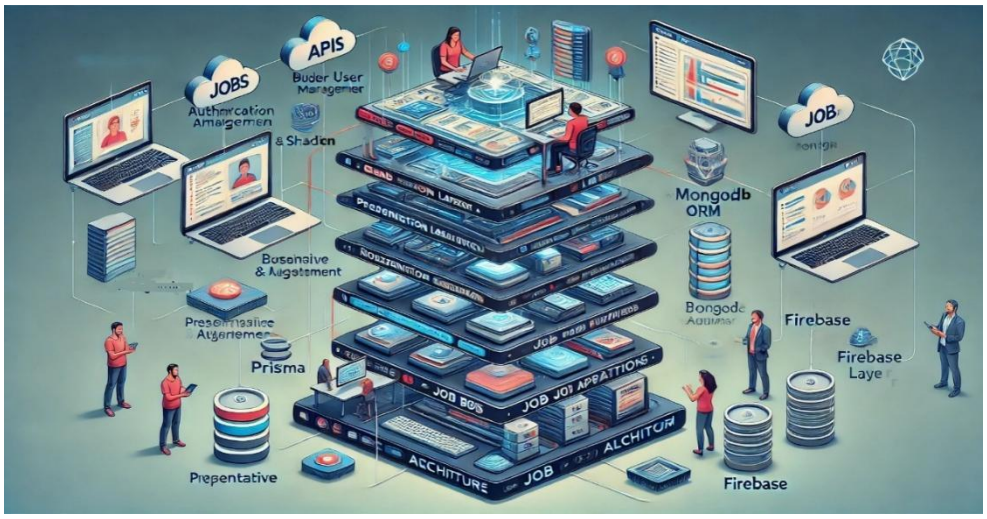


Figure 1: showing A real-time web application architecture diagram with multiple users, a modular three-tier architecture. DALL·E (2025)

3.2.1 Modules

3.2.1.1 Job Seeker Module

This module is designed to offer an intuitive interface for job seekers, enabling them to browse job listings, search for relevant opportunities, and apply for jobs. It also provides features for users to create and manage their profiles, upload resumes, track the status of their applications, and save job postings for later. Additionally, job seekers can receive personalized job recommendations and updates through notifications.

3.2.2 Company Employer Module

This module allows companies to manage their recruitment process effectively. Employers can create and update company profiles, post job vacancies, and manage applications from job seekers. The module includes tools for reviewing applicants, scheduling interviews, and updating job status. Employers can also view analytics, such as the number of applicants for a job, and interact with job seekers through the portal.

3.2.3 Admin Module

This module serves as the control center of the system, enabling administrators to oversee and manage all aspects of the platform. The admin can manage user accounts (both job seekers and companies), approve or reject job postings, and monitor system activity. Additional features include managing categories and tags for jobs, activating or deactivating user accounts, sending notifications to users, and generating detailed reports on jobs posted, applications submitted, and platform feedback.

3.3 SYSTEM ENVIRONMENT

The hardware configuration for the Online Job Portal includes a dedicated or cloud-based server equipped with at least a 4-core CPU, 8 GB RAM, and 10 GB SSD storage to ensure efficient handling of system operations and data. End-users can access the platform using devices such as desktops, laptops, tablets, or smartphones with a minimum configuration of a dual-core processor, 2 GB RAM, and sufficient storage. A stable, high-speed internet connection with a minimum bandwidth of 50 Mbps is recommended for smooth interaction with the system.

In terms of software configuration, the server operates on a Linux-based operating system, ensuring reliability and scalability. The platform supports multiple client-side operating systems, including Windows, macOS, Android, and iOS. The backend leverages Next.js for server-side operations, while the frontend utilizes ShadcnUI components for an intuitive user interface. MongoDB serves as the database management system, providing secure, scalable, and flexible data storage, while Prisma ORM ensures seamless integration between the application and the database. Web servers such as Apache or Nginx efficiently handle HTTP requests. Version

control is managed using Git, promoting a reliable development workflow, while SSL/TLS certificates guarantee data encryption and secure communication between users and the server.

To enhance functionality, the system integrates APIs like Google AI and Clerk, enabling advanced features such as job matching, user authentication, and data-driven insights. Firebase is incorporated to provide real-time features and additional cloud capabilities, improving overall performance and user engagement. These configurations collectively ensure the platform is robust, scalable, and user-friendly.

3.3.1 System Design Diagram

The system design diagrams provide a visual representation of the architecture, interactions, and processes within the Online Job Portal. These diagrams illustrate the relationships between key components such as Admin, Company, and Job Seeker modules, as well as backend systems, external integrations, and workflows. They enable stakeholders to understand the system’s flow, functionality, and critical features, ensuring effective communication and streamlined development.

3.3.1.1 Data Flow Diagram

The Data Flow Diagram (DFD) for the Online Job Portal illustrates the flow of information between key components such as Admin, Company, and Job Seeker modules. It identifies the primary processes, data stores, and external entities, highlighting how data such as job listings, applications, user profiles, and feedback is input, processed, and output within the system. The DFD ensures a clear understanding of the system's operations, data movement, and interactions, enabling efficient system analysis and development.

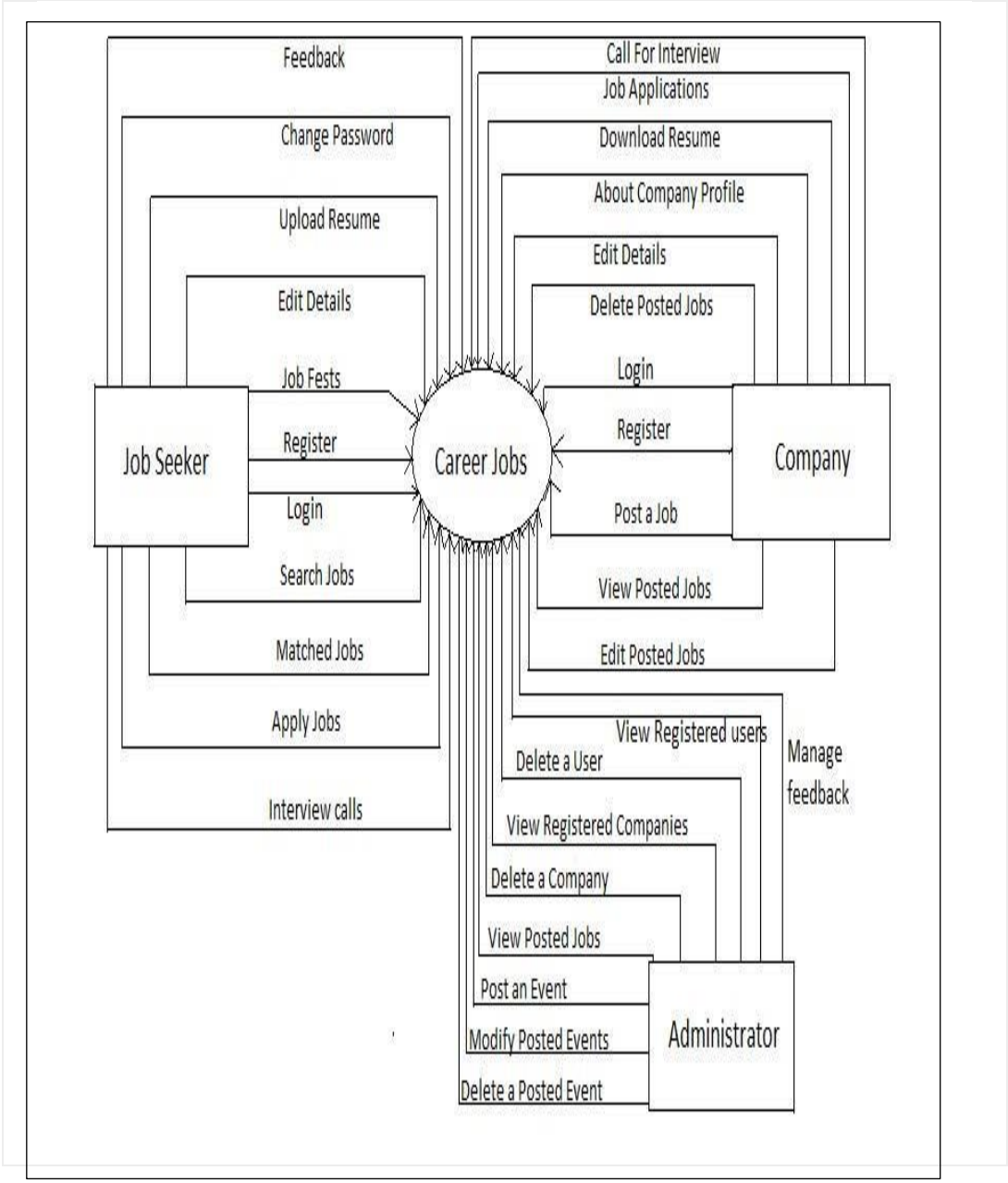


Figure 2: *Showing Data Flow level 0(Context Level) Diagram (Research Activity January, 2025.)*

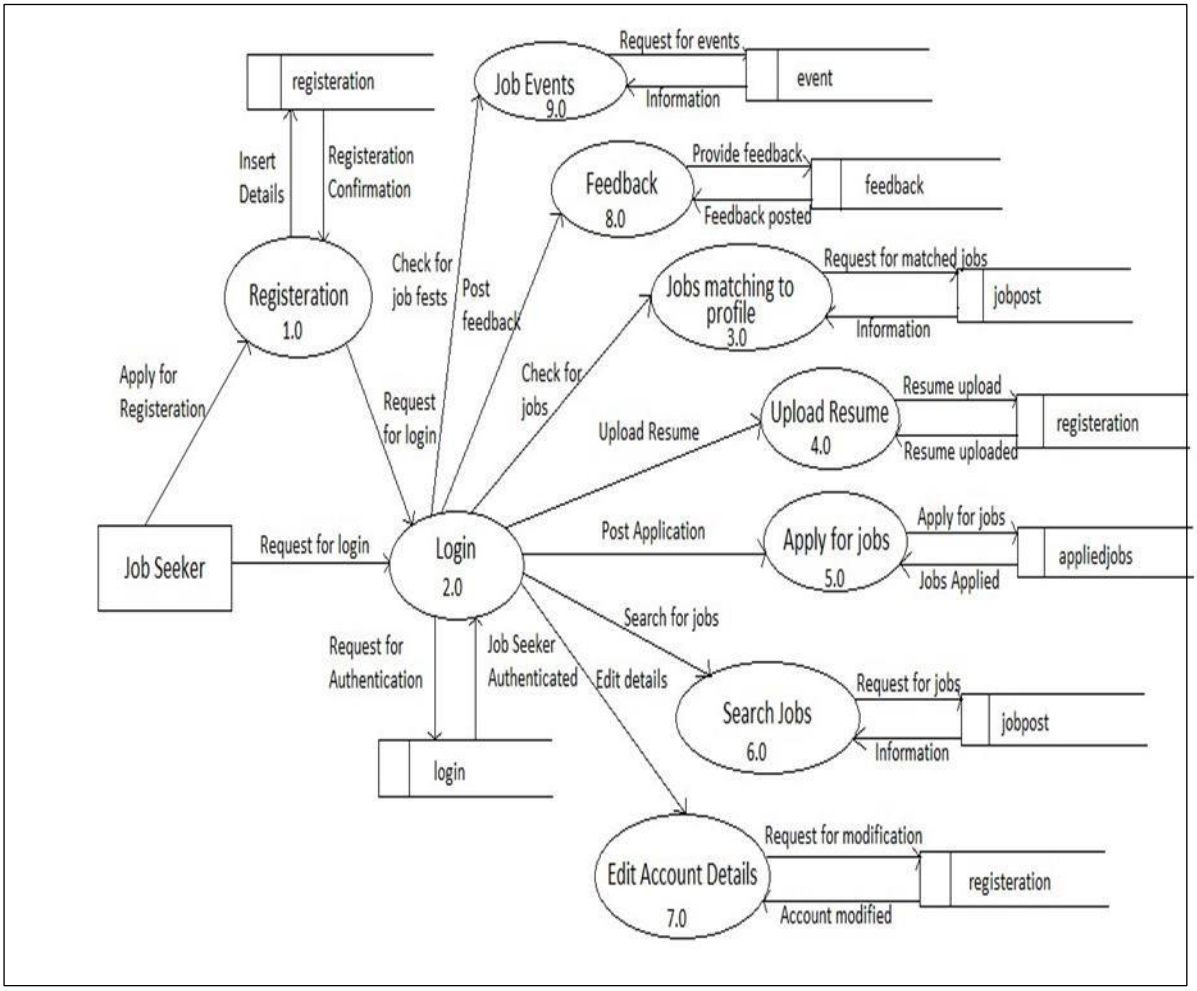


Figure 3: *Showing Level 1(JobSeeker) Diagram (Research Activity January, 2025.)*

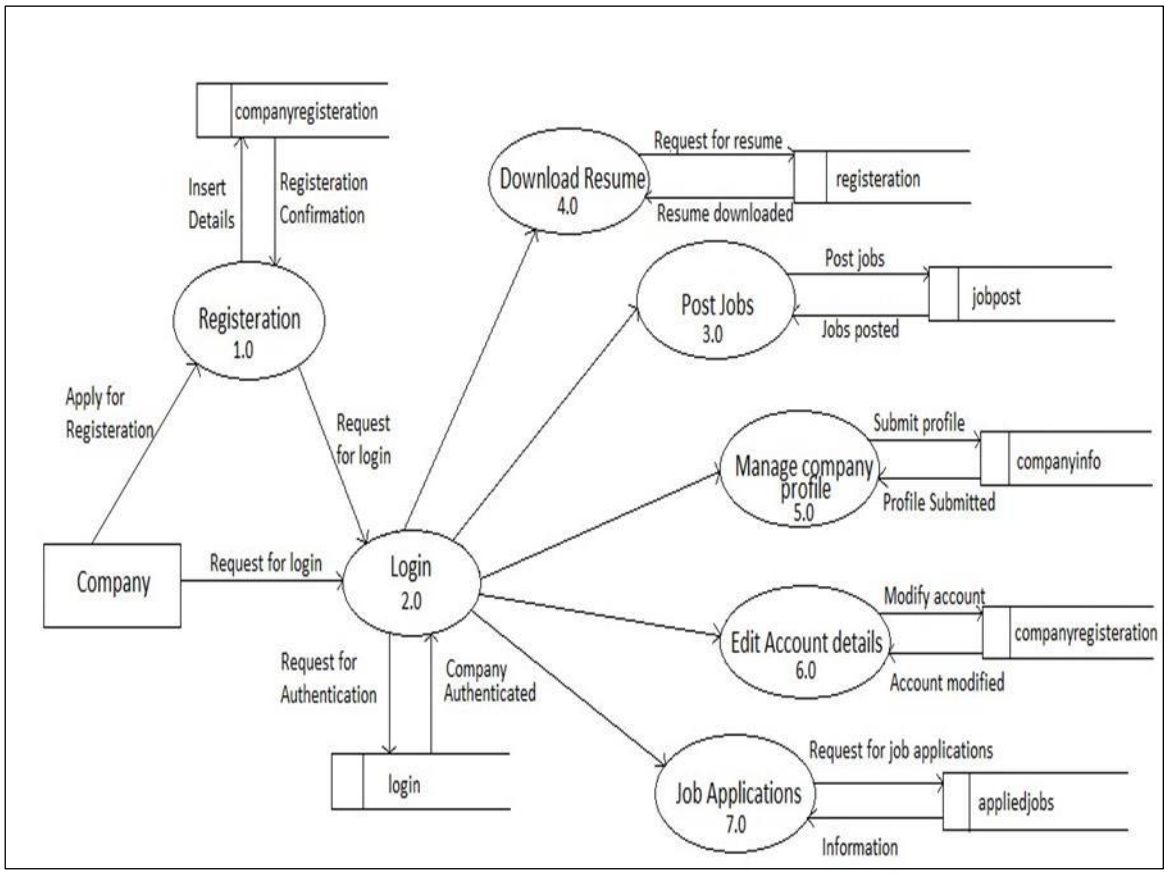


Figure 4: *Showing Level 1(Company) Diagram (Research Activity January, 2025.)*

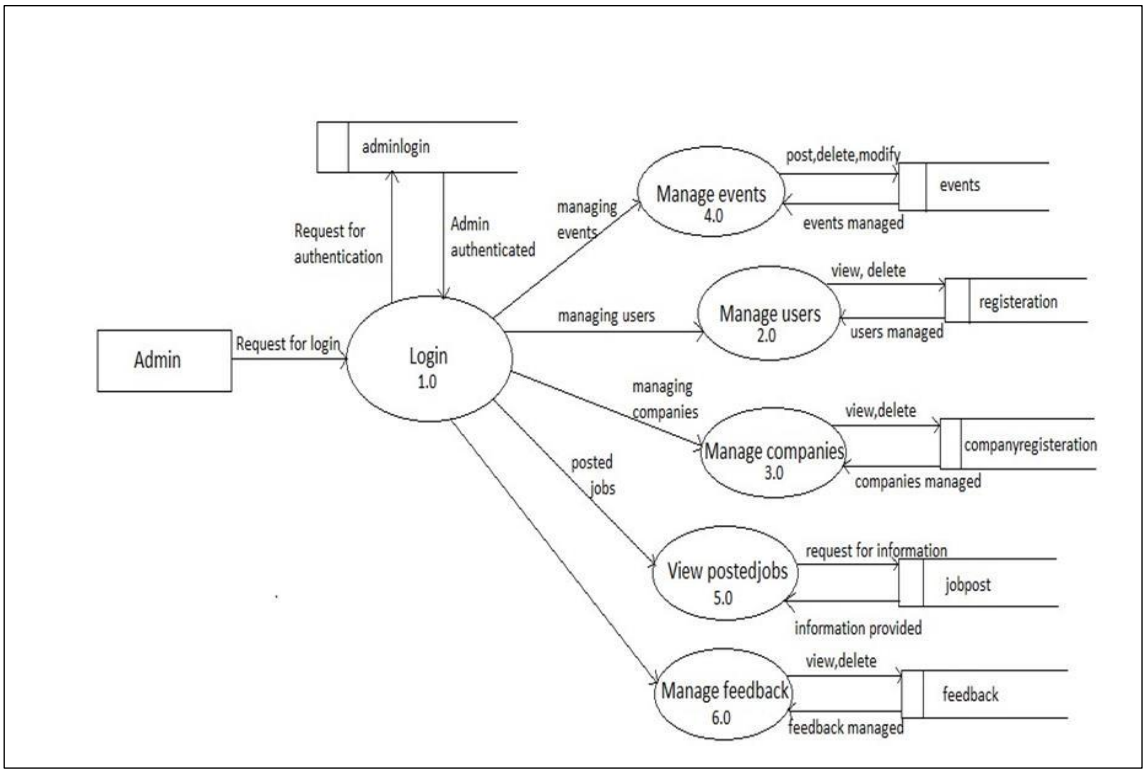
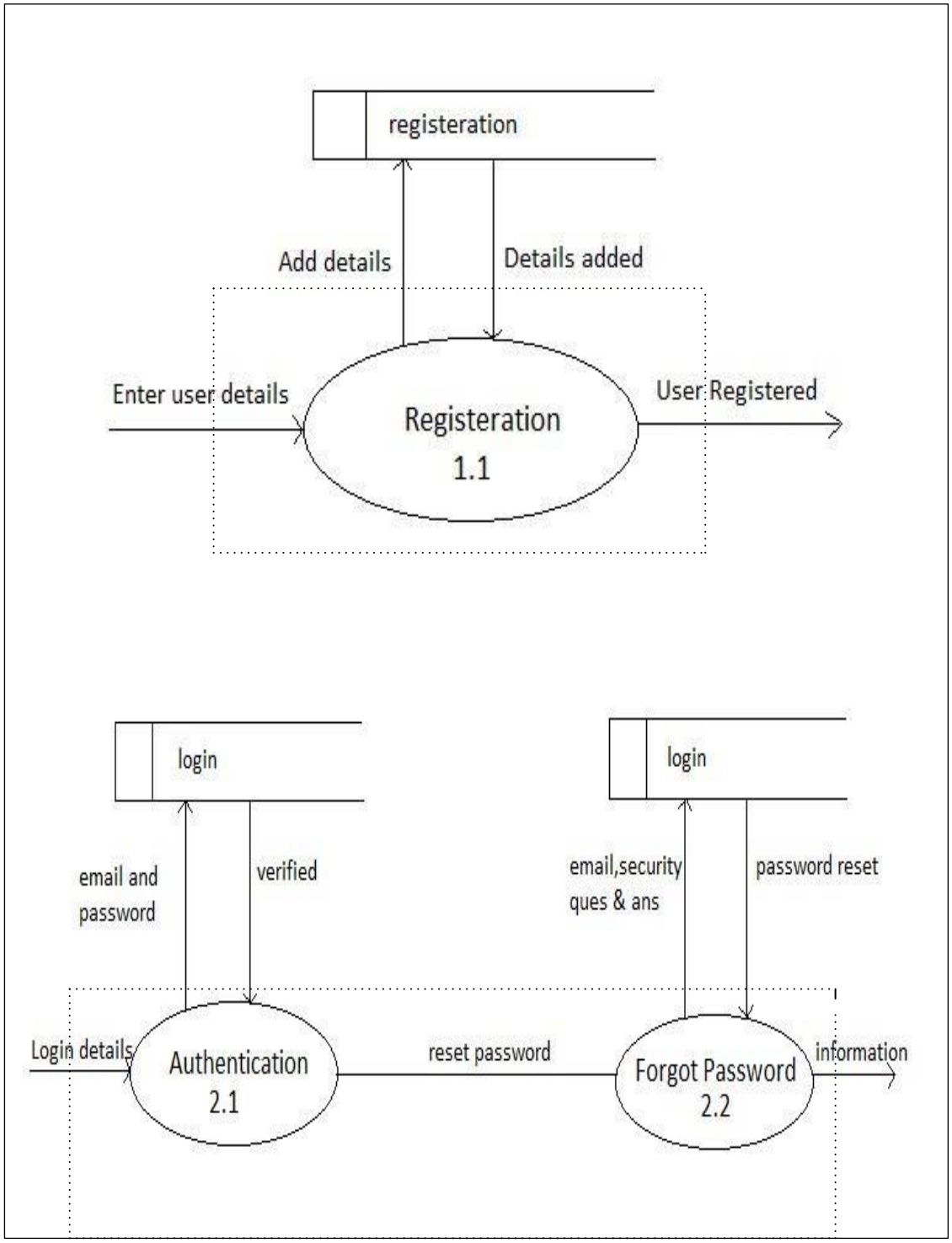


Figure 5: *Showing Level 1(Admin) Diagram (Research Activity January, 2025.)*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Login details
Authentication
2.1
reset password
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2.2
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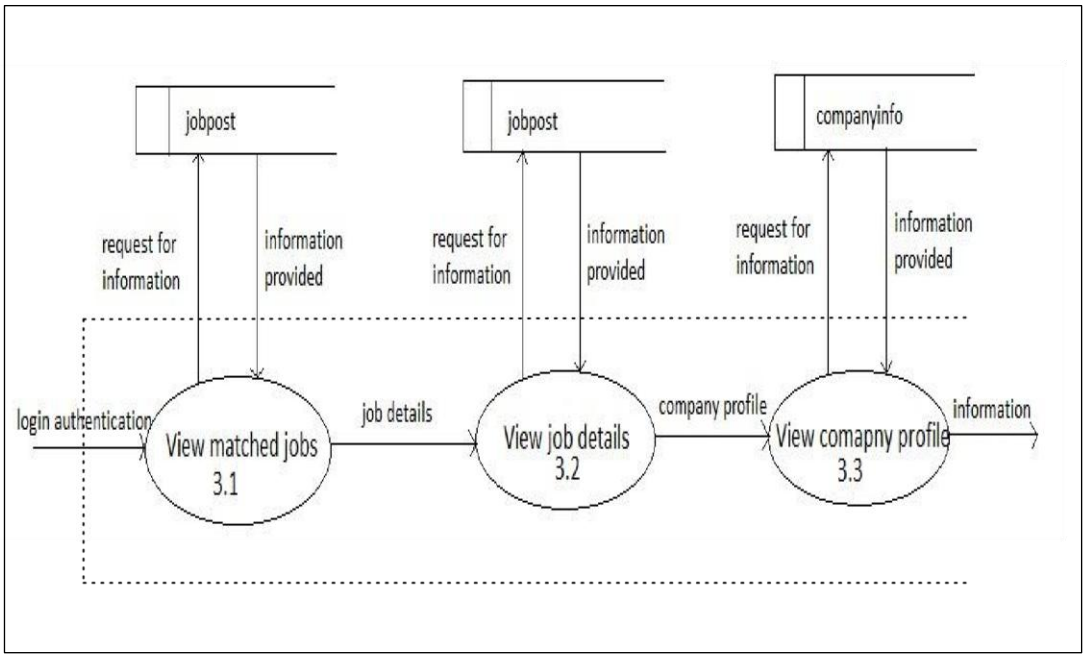
jobpost
jobpost
companyinfo
request for information
information provided
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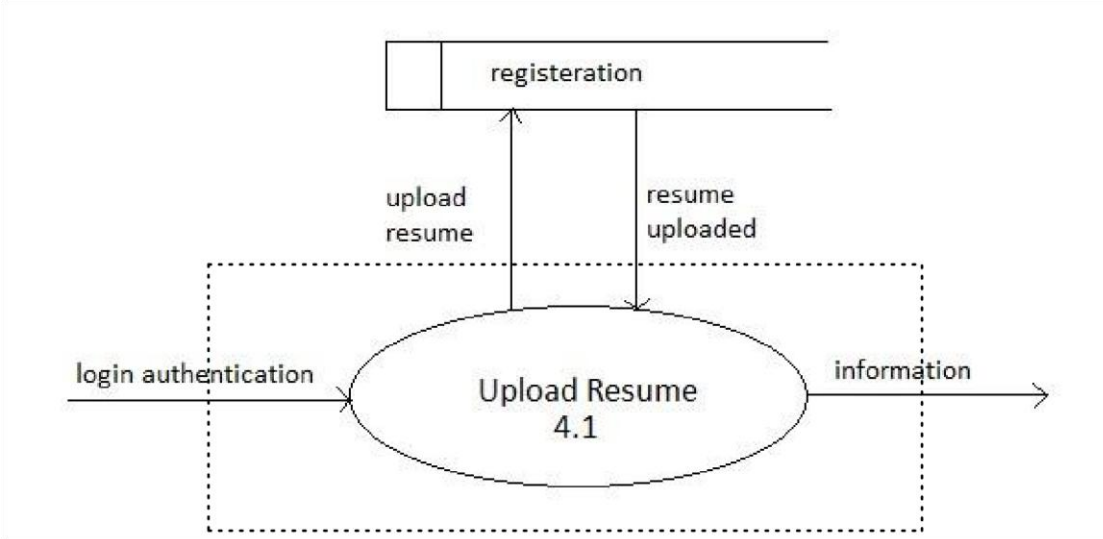
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Upload Resume 4.1
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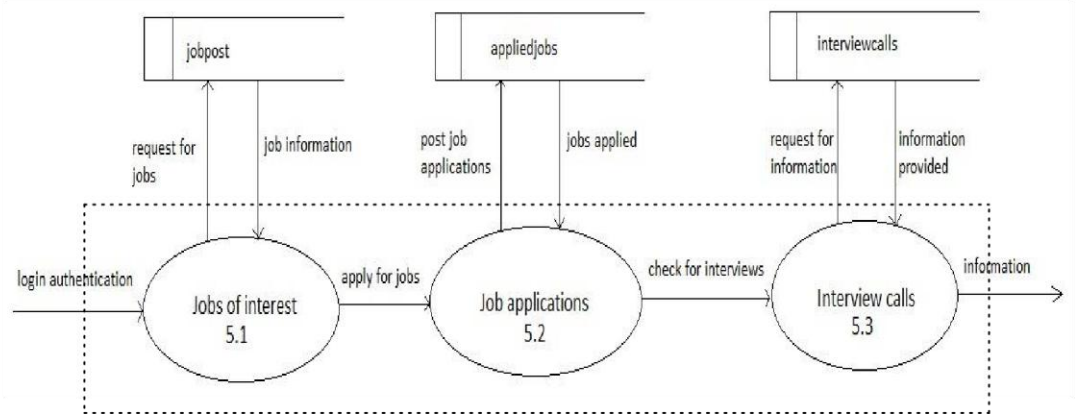
jobpost
appliedjobs
interviewcalls
request for jobs
job information
post job applications
jobs applied
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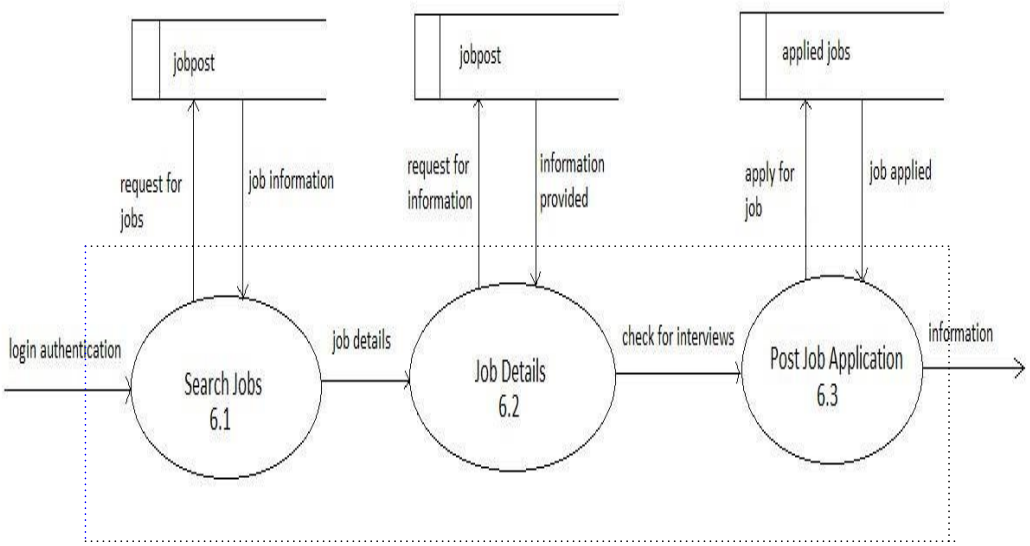
Jobs of interest 5.1
apply for jobs
Job applications 5.2
check for interviews
Interview calls 5.3
information


jobpost
jobpost
applied jobs
request for jobs
job information
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information provided
apply for job
job applied
login authentication
Search Jobs 6.1
job details
Job Details 6.2
check for interviews
Post Job Application 6.3
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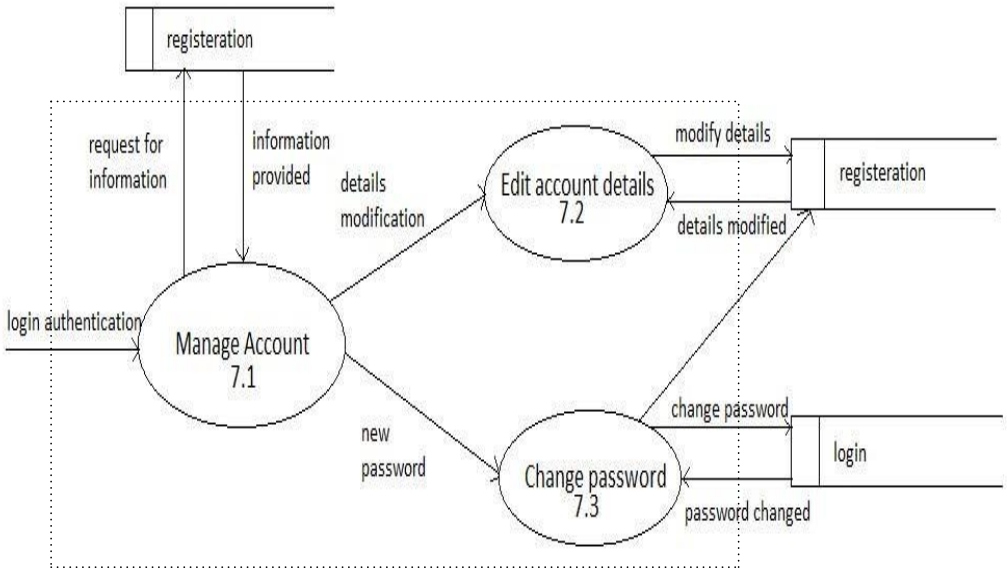
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Edit account details 7.2
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Manage Account 7.1
change password
new password
Change password 7.3
login
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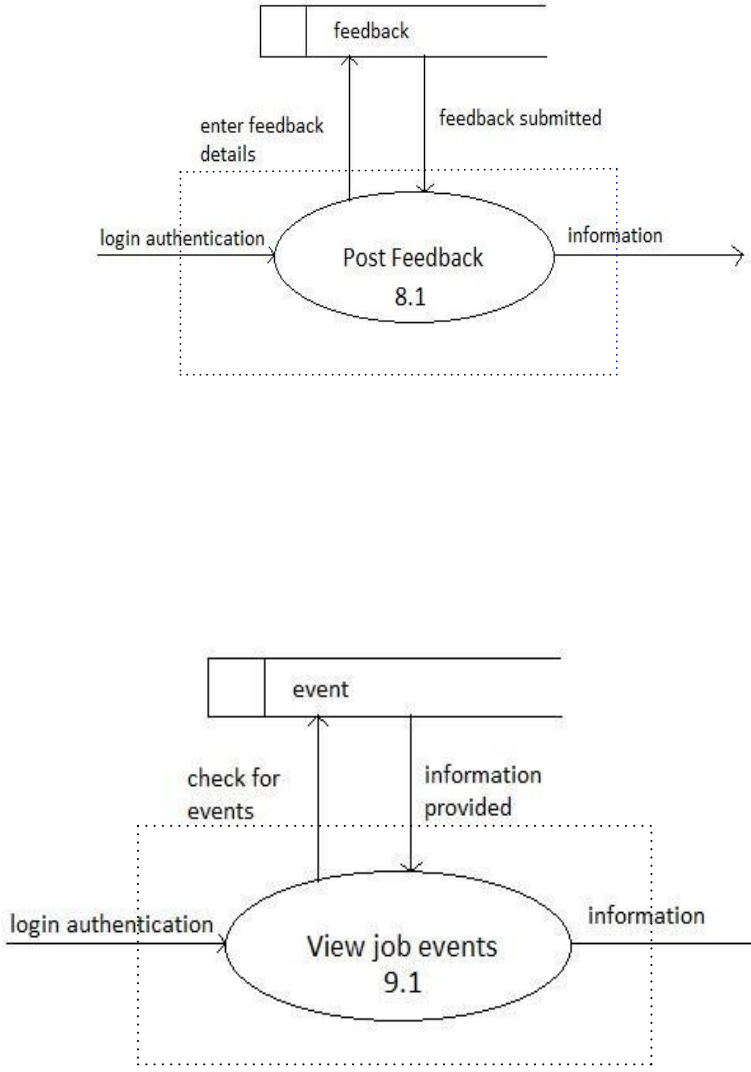
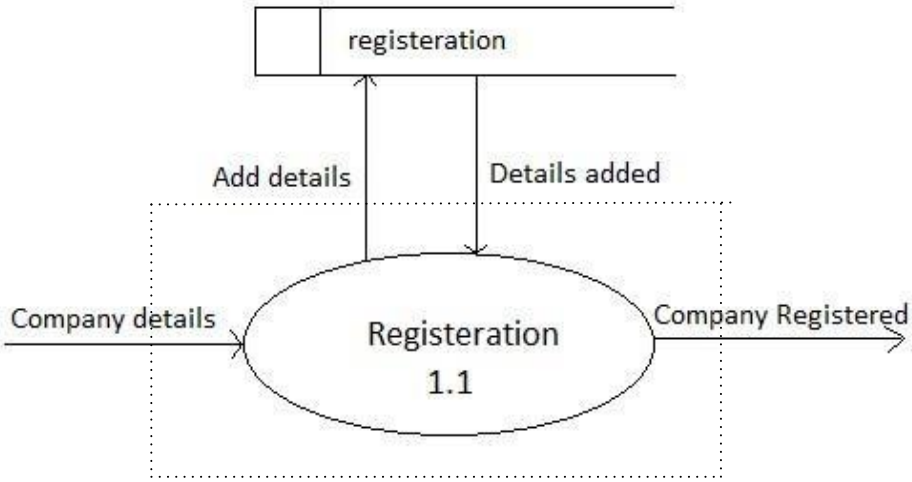
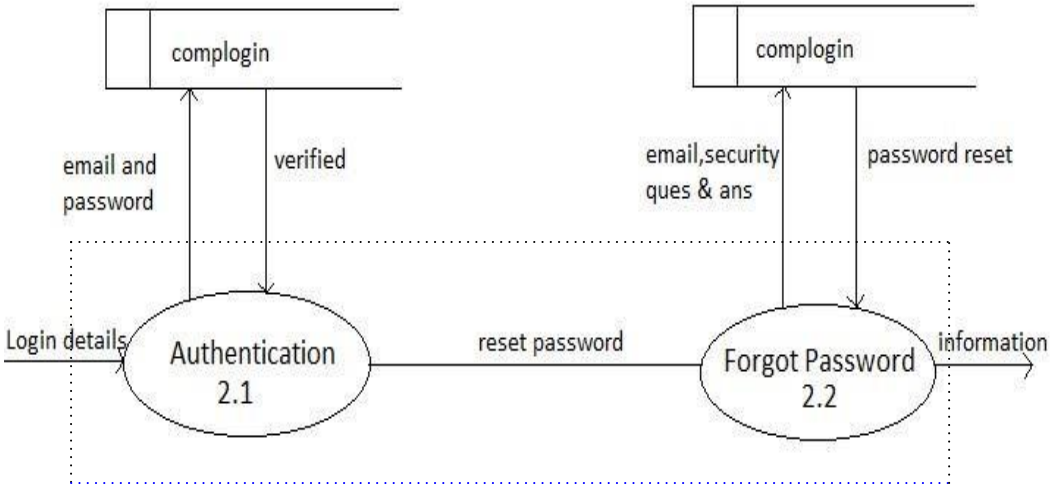


Figure 6: *Showing Level 1(Admin) Diagram (Research Activity January, 2025.)*


registeration
Add details
Details added
Company details
Registeration
1.1
Company Registered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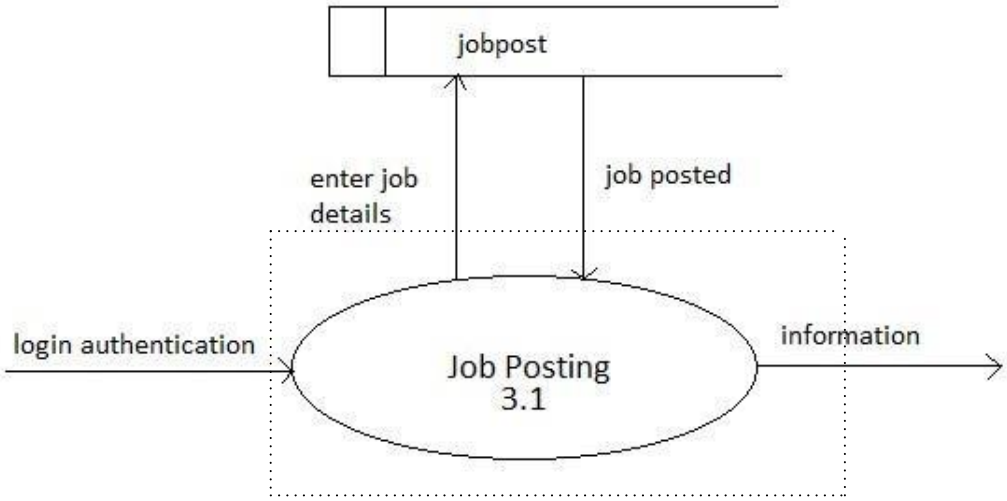
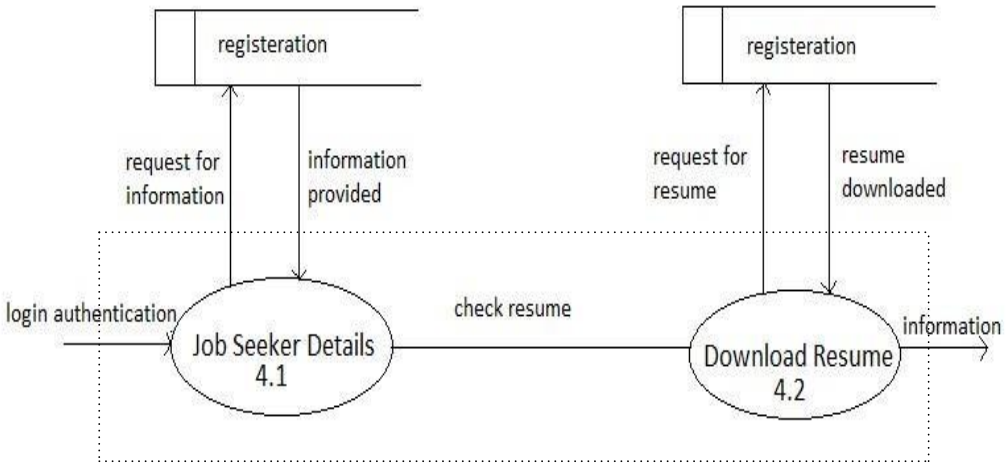

jobpost
enter job details
job posted
login authentication
Job Posting
3.1
information


registeration
registeration
request for information
information provided
request for resume
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Job Seeker Details
4.1
check resume
Download Resume
4.2
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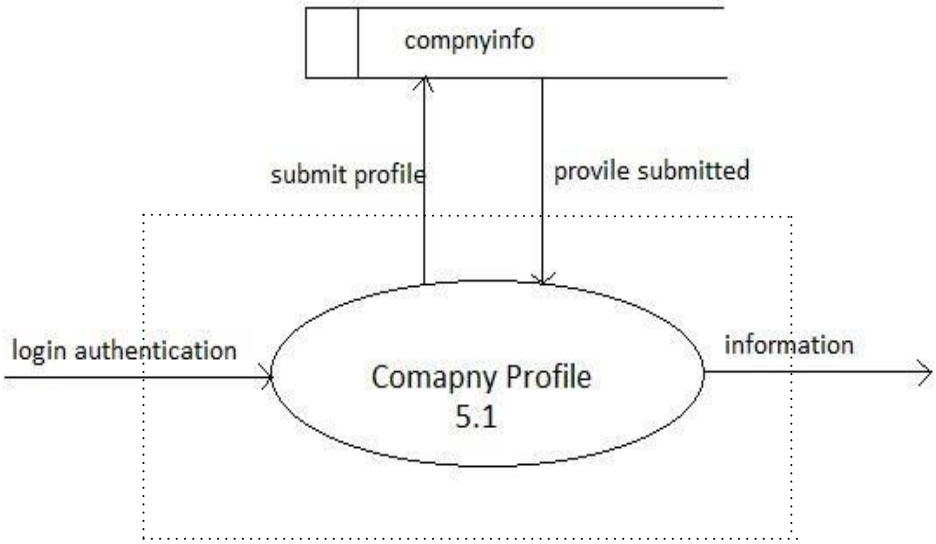
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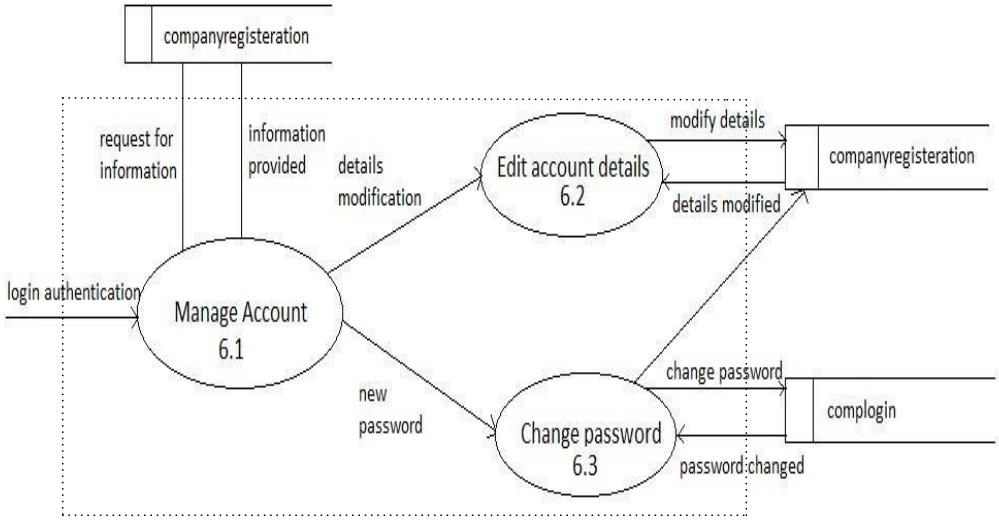
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Edit account details
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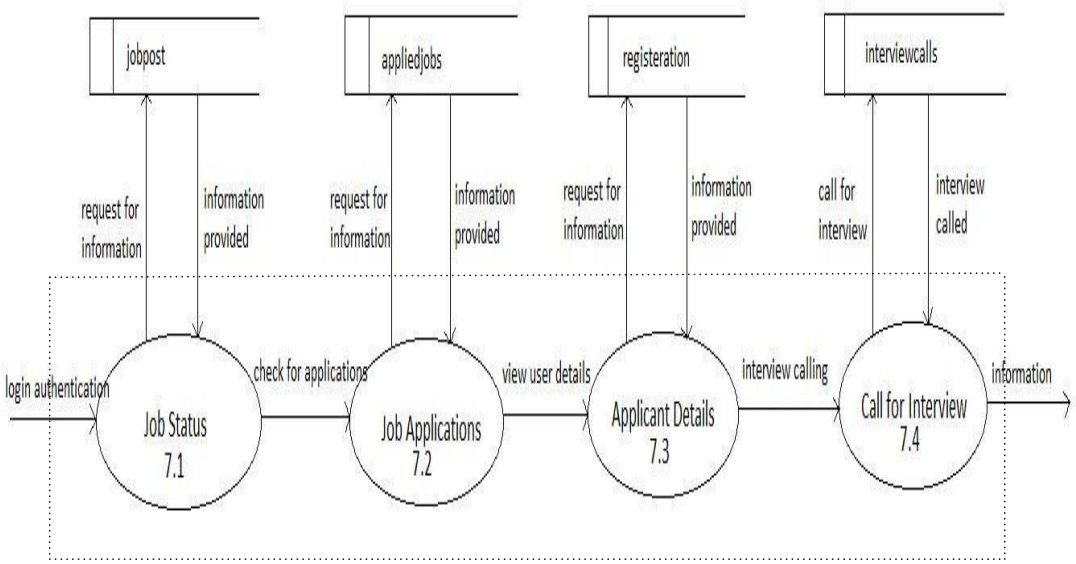


Figure 7: *Showing Level 2(Company) Diagram (Research Activity January, 2025.)*

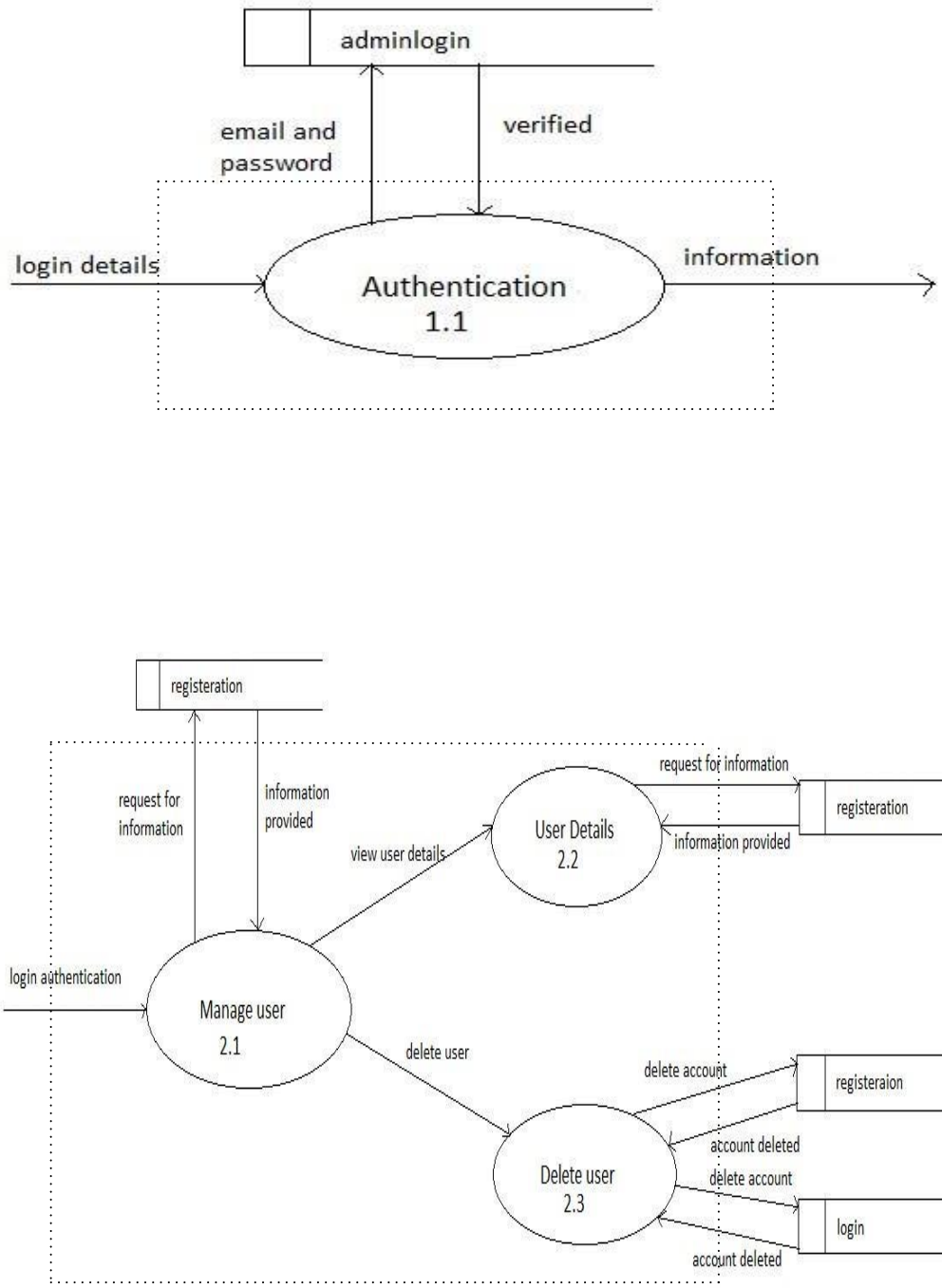


Figure 8: *Showing Level 2(Admin) Diagram (Research Activity January, 2025.)*

3.3.1.2 Use Case Diagram

The Use Case Diagram for the Online Job Portal represents the interactions between users (actors) and the system's functionalities. It highlights the roles of the primary users, including Job Seekers, Companies (Employers), and Administrators, and their engagement with the system's key features such as job searching, job posting, profile management, application tracking, and system management. This diagram provides a comprehensive overview of the system's user-centric functionalities and their interactions.

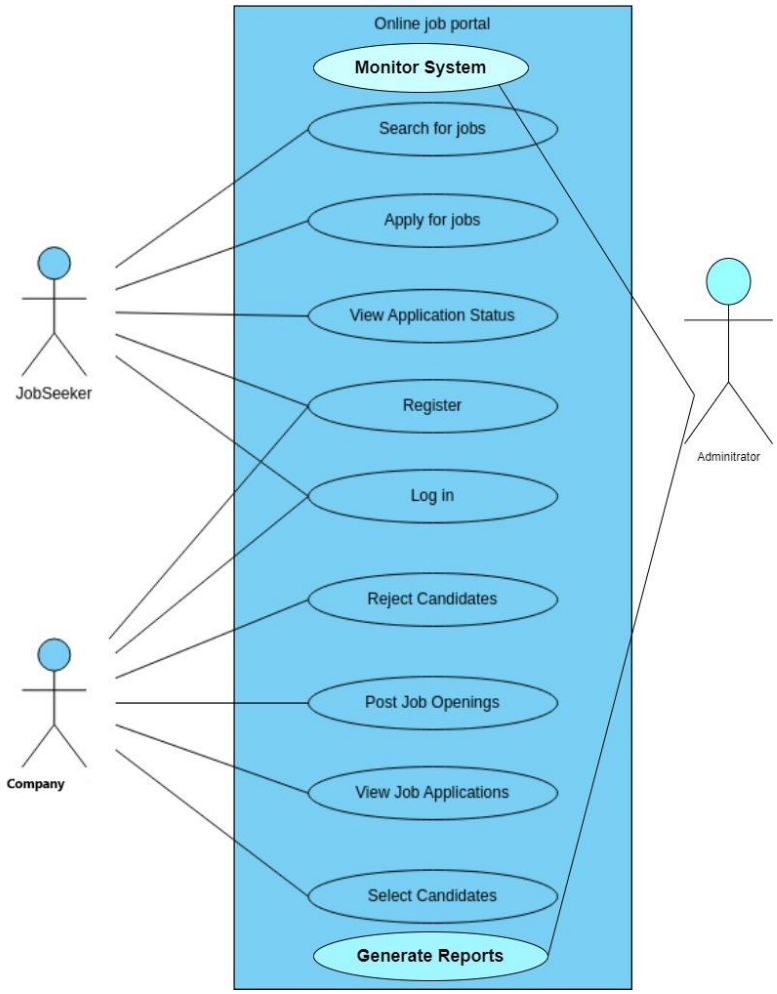


Figure 9: *Showing Use case diagram (Research Activity January, 2025.)*

3.3.1.3 Sequence Diagram

The Sequence Diagram for the Online Job Portal outlines the sequence of interactions between system components (Job Seeker, Company, Admin, Database, Authentication System) and processes over time. It focuses on the order in which key operations occur, such as how a Job Seeker searches for jobs, applies for a job, and how the system processes and tracks the application. Similarly, it shows how an Employer posts a job, manages job listings, and how the Admin manages user accounts and generates reports. This diagram helps visualize the dynamic behavior of the system and the interactions between users and the backend processes.

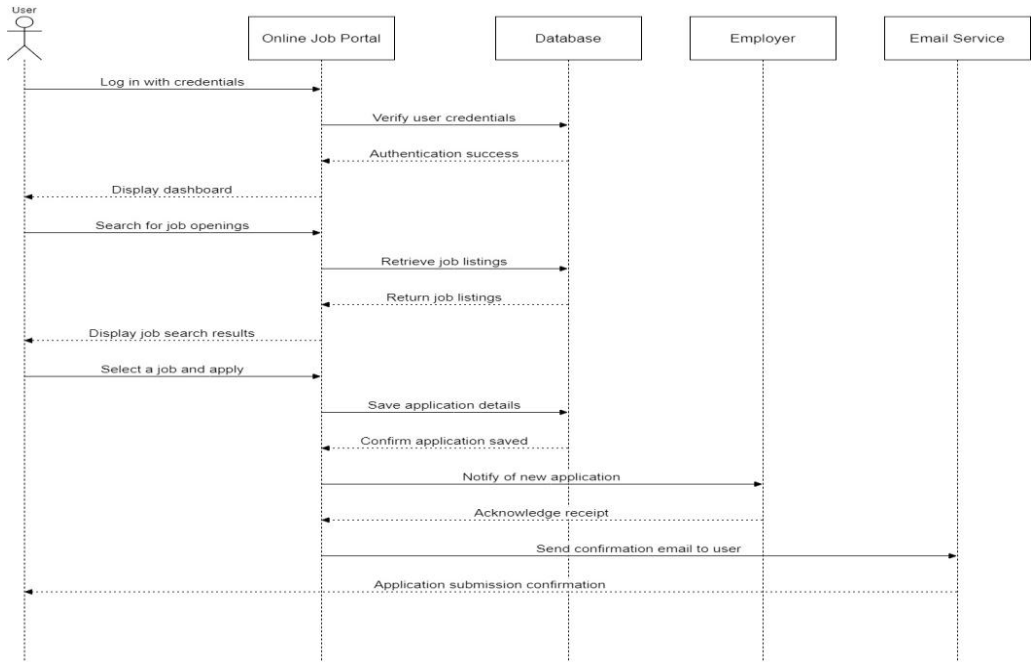


Figure 10: S*howing Sequence Diagram***.** *Diagram (Research Activity January, 2025.)*

3.3.1.4 ER-DIAGRAM

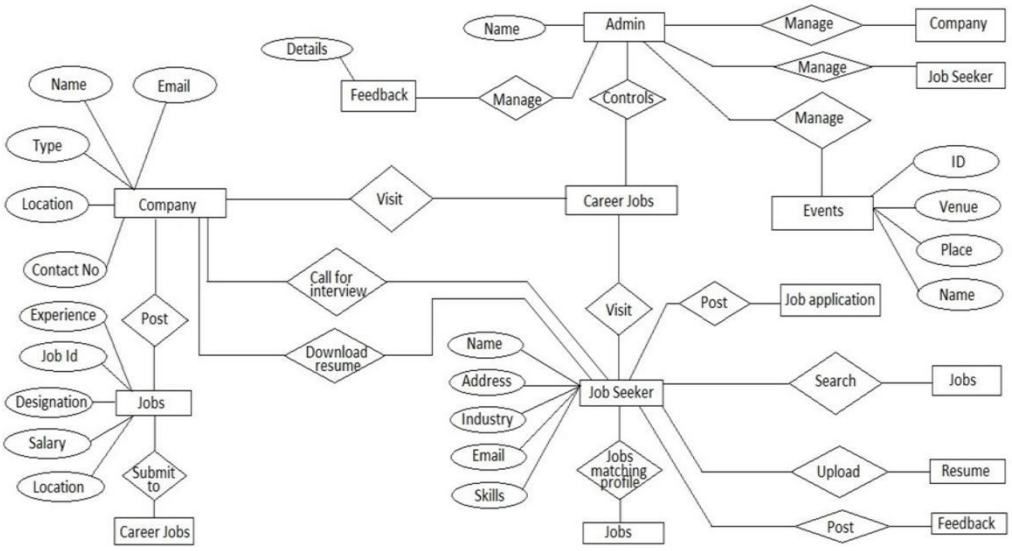


Figure 11: S*howing E-R Diagram. Diagram (Research Activity January, 2025.)*

3.3.2 Features of the Software and Tools

The Online Job Portal integrates a variety of features and tools to ensure efficiency, usability, and scalability, tailored to the needs of job seekers, employers, and administrators in Sierra Leone. Speed optimization is achieved through efficient backend processing, optimized database queries, caching mechanisms, and the use of modern frontend libraries, enabling fast loading times and smooth user interactions. The platform provides a user-friendly interface that allows Job Seekers to browse job listings, apply for positions, and manage their applications. Employers can post job opportunities, manage listings, and review applications, while Administrators are equipped with tools to manage users, approve or reject job postings, and generate detailed reports.

Security is prioritized with robust measures such as SSL/TLS encryption, password hashing, and role-based access control to protect user data and ensure secure system interactions. The platform also supports real-time job posting and application tracking, automated email notifications, and feedback collection, enhancing the overall functionality and user engagement. The system is built with scalability in

mind, allowing it to accommodate increasing user demands without compromising performance. Together, these features create a secure, efficient, and user-focused platform for managing job applications and listings.

3.4 USER INTERFACE DESIGN

The user interface (UI) of the Online Job Portal is crafted to offer a seamless, accessible, and visually appealing experience for users, ensuring a straightforward and efficient workflow. Job Seekers benefit from intuitive navigation with clear menus, advanced search options, and well-organized job categories, enabling them to find and apply for opportunities tailored to their preferences. Similarly, Employers can easily post jobs, manage listings, and track applicants, while navigation pathways guide all users through the system effortlessly. The platform minimizes the learning curve by providing interactive elements and a streamlined process for job applications and management.

To ensure broad accessibility, the platform follows responsive design principles, making it compatible across desktops, tablets, and mobile devices. This adaptability ensures seamless usability regardless of device or screen size, broadening its reach to diverse users. Secure authentication and user management features, powered by Clerk, guarantee smooth login, registration, and profile management experiences, enhancing trust and convenience.

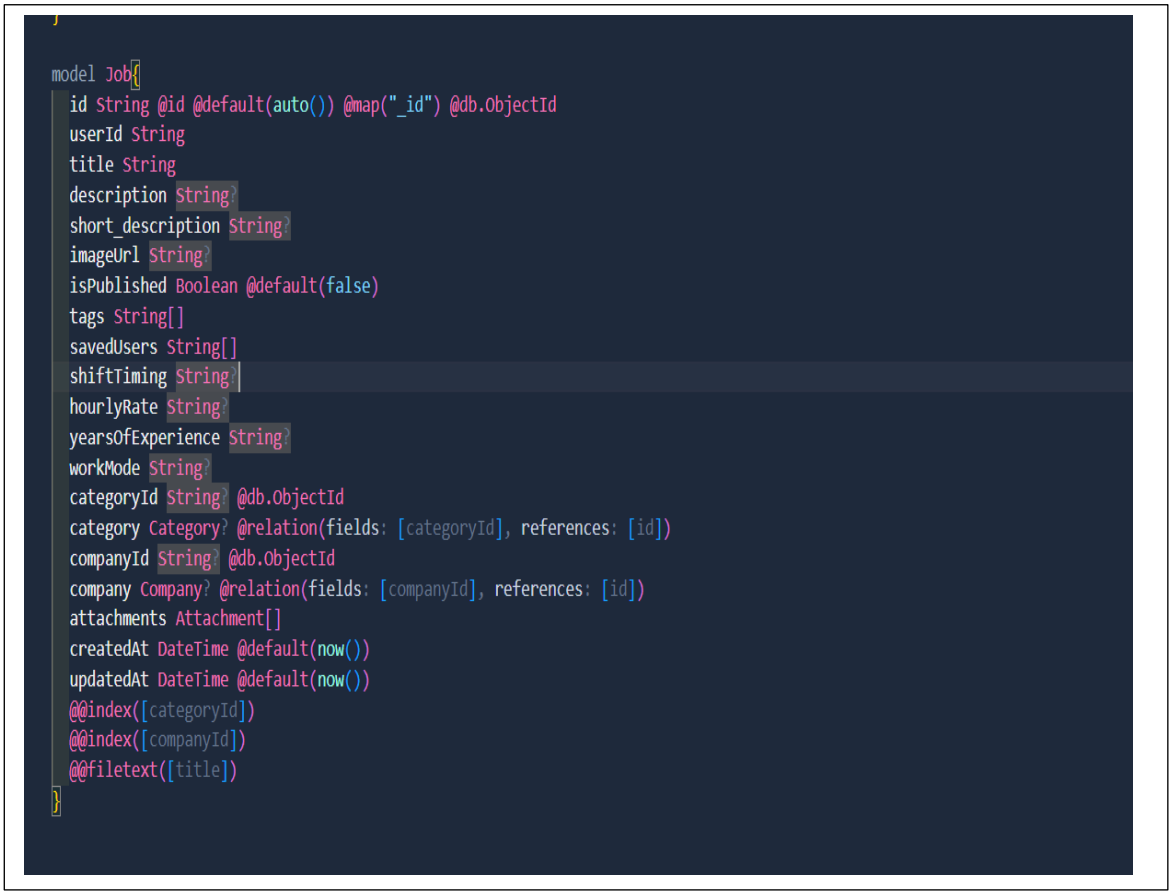
3.5 DATABASE AND DATA MANAGEMENT DESIGN

The Online Job Portal employs a robust and scalable database design to efficiently handle data for users, companies, job listings, and applications while maintaining security and performance. The database is structured using a NoSQL MongoDB schema to ensure that all critical information, including user profiles, job postings, resumes, and application statuses, is stored accurately and can be accessed efficiently. Key components of the schema include:

- **User Data**: Stores information about job seekers and employers, including personal details, resumes, and application histories.
- **Job Listings**: Captures job details such as title, description, category, tags, salary, and associated company information.
- **Company Profiles**: Maintains records of employer profiles, contact information, and posted jobs.
- **Applications**: Tracks job applications, including submission dates and statuses, for easy monitoring and management.

Data security is ensured through encryption protocols, secure authentication mechanisms, and regular database audits. Prisma ORM simplifies interactions between the backend and the MongoDB database, providing a seamless data flow. The system is designed with scalability in mind, ensuring that as the user base grows, the platform can maintain high performance. By prioritizing efficient data management, the portal ensures a seamless experience for all stakeholders while maintaining data integrity and security.

3.51 Database Schema



```
model Job{
  id String @id @default(auto()) @map("_id") @db.ObjectId
  userId String
  title String
  description String?
  short_description String?
  imageUrl String?
  isPublished Boolean @default(false)
  tags String[]
  savedUsers String[]
  shiftTiming String?
  hourlyRate String?
  yearsOfExperience String?
  workMode String?
  categoryId String? @db.ObjectId
  category Category? @relation(fields: [categoryId], references: [id])
  companyId String? @db.ObjectId
  company Company? @relation(fields: [companyId], references: [id])
  attachments Attachment[]
  createdAt DateTime @default(now())
  updatedAt DateTime @default(now())
  @@index([categoryId])
  @@index([companyId])
  @@filetext([title])
}
```

DataTable1: Showing Database Schema for Job (Research activity January, 2025.)

```
type AppliedJob{
  jobId String
  appliedAt DateTime @default(now())
}
```

DataTable2: Showing Database Schema For Application (Research activity January, 2025.)

```
model Company{
  id String @id @default(auto()) @map("_id") @db.ObjectId
  userId String
  name String
  description String?
  logo String?
  coverImage String?
  mail String?
  website String?
  linkedIn String?
  address_line_1 String?
  address_line_2 String?
  city String?
  state String?
  zipcode String?
  jobs Job[]
  followers String[]
  overview String?
  whyJoinUs String?
  createdAt DateTime @default(now())
  updatedAt DateTime @default(now())
}
```

DataTable3: Showing Database Schema For Company (Research activity January, 2025.)

3.6 SOFTWARE ENGINEERING PRACTICES

The development of the Online Job Portal follows a comprehensive software development lifecycle (SDLC), ensuring a structured and efficient process for building a scalable, secure, and user-friendly platform. The project incorporates key phases, each addressing important aspects of the system's design, implementation, testing, and maintenance. Additionally, the system follows established software engineering practices to ensure high-quality deliverables, maintainability, and effective collaboration across the development team.

3.61 System Development Lifecycle

The development of the Online Job Portal adheres to a structured web-based development lifecycle, starting with planning and requirements gathering. This initial phase involves collaborating with key stakeholders, including Job Seekers, Employers, and system administrators, to understand their needs, goals, and expectations. The primary focus is on both functional requirements (such as job posting, application management, and user profiles) and non-functional requirements (such as security, performance, and scalability). Requirements are carefully analyzed to ensure feasibility, and use cases and user stories are developed to capture typical interactions between users and the system. A detailed project plan is created, outlining the timeline, milestones, resource allocation, and risk management strategies.

Following the planning phase, the design and implementation phase begins. This involves creating the system architecture, designing the user interface, and developing the software components. The architecture is designed to define client-server interactions, manage user and job-related data, handle job applications and notifications, and ensure system scalability and security. The user interface is tailored to the needs of Job Seekers, Employers, and Administrators, with wireframes and prototypes developed to visualize the layout and interaction flow. The technical implementation uses technologies such as Next.js**,** ShadcnUI**,** Prisma**,** MongoDB**,** Clerk**,** and Google AI to build core components and implement business logic for handling user interactions, job postings, applications, and notifications.

Testing and deployment follow the implementation phase to ensure that the system works as expected and meets all specified requirements. This includes unit testing of individual components, integration testing to verify seamless interaction between

system components, and system testing for overall functionality, security, performance, and user acceptance. Once deployed to the production environment, the system integrates with authentication services (Clerk), database management (MongoDB), and AI-powered job-matching features. Ongoing maintenance and updates are essential to keep the system running efficiently, address user-reported issues, and introduce new features based on feedback. Regular updates, bug fixes, and continuous improvements ensure that the system remains effective and adapts to changing user needs.

3.62 Agile Methodology

The development of the Online Job Portal follows an Agile methodology, with iterative sprints focusing on delivering incremental improvements. The project team works in close collaboration with stakeholders to define priorities, plan sprints, and release updates based on feedback. This approach ensures flexibility, continuous testing, and rapid response to changes, allowing the system to evolve and meet user expectations efficiently.

Figure 14: Showing Agile Methodology in System Development
Retrieved from https://targettrend.com/agile-methodology-meaning-advantagesdisadvantages-more

The development of the Online Job Portal employs the Agile methodology, which emphasizes flexibility, collaboration, and iterative development. The project is broken into smaller, manageable iterations called sprints, with each sprint focused on delivering specific features or system components. Agile's iterative process allows the

development team to deliver incremental value in each sprint, providing opportunities for stakeholders to review progress and provide feedback regularly.

Collaboration among cross-functional teams comprising developers, designers, QA specialists, and system architects is at the heart of the Agile approach. Frequent communication ensures that all aspects of the system are addressed and that development is aligned with user expectations. Use cases and user stories are updated after each sprint, reflecting the evolving needs of the system and its users. This approach enables the project to adapt quickly to changing requirements, ensuring that the final product effectively meets user needs.

The adoption of the Agile methodology ensures that the development of the Online Job Portal is efficient, flexible, and focused on delivering value to users. Agile's iterative approach, combined with continuous feedback, allows for rapid adaptation to new requirements and user needs. By fostering collaboration across various teams and stakeholders, the system is developed with a focus on high quality, maintainability, and user-centered design.

3.7 SCALABILITY AND PERFORMANCE OPTIMIZATION

The scalability and performance optimization of the Online Job Portal are essential to ensure a smooth user experience as user demand and data volume grow. The system must efficiently manage increasing numbers of job seekers, employers, job listings, applications, and transactions while maintaining fast response times and high availability. To achieve this, both vertical and horizontal scaling strategies are employed.

Vertical Scaling involves enhancing the capacity of individual servers by upgrading hardware resources such as CPU, RAM, and storage. This ensures the system can handle larger datasets, including extensive user profiles, job listings, and application histories, without compromising performance. High-performance storage solutions, like SSDs, are used to speed up database query responses, allowing the system to retrieve job and company data quickly.

Horizontal scaling is achieved by adding more servers to distribute traffic and computational load, ensuring the system can support multiple concurrent users without delays. Load balancing evenly distributes incoming user requests across servers, preventing bottlenecks, particularly during peak times such as job fairs or application deadlines. Caching solutions like Redis or Memcached store frequently accessed data, such as job listings and application statuses, reducing database load and enhancing performance. Database optimization, including indexing and structuring for efficient transactions, ensures quick retrieval of essential data. Additionally, distributed computing frameworks and cloud platforms like AWS or Google Cloud provide auto-scaling capabilities to dynamically adjust resources based on traffic demands, ensuring cost-effective scalability and consistent high performance.

Performance optimization strategies include asynchronous processing for background tasks like notifications, managed by tools such as Celery, to prevent interference with real-time operations. CDNs serve static assets globally, reducing main server loads and enhancing content delivery speeds for users worldwide. Scalability challenges, such as handling high user volumes and database growth, require minimizing network latency, optimizing read-heavy operations, and improving the efficiency of computationally intensive features like real-time job matching. Multi-threading and asynchronous I/O improve responsiveness during peak usage. Robust error-handling mechanisms ensure data consistency and integrity across distributed systems, safeguarding job listings, applications, and user profiles even during failures. Together, these strategies ensure the portal remains fast, scalable, and user-friendly as it grows.

3.8 SECURITY DESIGN

The security of the Online Job Portal is paramount, as it handles sensitive personal, professional, and financial data, including user profiles, job listings, application histories, and payment transactions. To protect user accounts, the system employs secure authentication methods, including hashed and salted passwords using algorithms like SHA-256 and multi-factor authentication (MFA) for added security. All sensitive data exchanged between the client and server is encrypted using Transport Layer Security (TLS), ensuring confidentiality and integrity through HTTPS-enforced communication. The system also incorporates secure session

management, generating unique session tokens stored in HTTP-only cookies, which are invalidated upon logout or inactivity to prevent unauthorized access.

The portal safeguards against common vulnerabilities such as Cross-Site Request Forgery (CSRF) and Cross-Site Scripting (XSS) through measures like unique CSRF tokens and sanitized user-generated content. As the system integrates online payments, it complies with PCI-DSS standards, employing tokenization to protect sensitive payment information while relying on trusted payment gateways like Stripe or PayPal. Additionally, role-based access control (RBAC) restricts permissions based on user roles, ensuring job seekers, employers, and administrators have access only to relevant functionality. Regular security audits, vulnerability assessments, and proactive system updates ensure the platform remains robust against evolving threats.

The Web Service Feature enables seamless communication between the Online Job Portal and external services, such as payment gateways, email/SMS notifications, and third-party tools. A centralized configuration file manages critical settings like API keys, database connections, and environment-specific variables for streamlined operations. Access is strictly managed through API key authentication, role-based access control, and access control lists (ACL), while security measures like SSL/TLS encryption, input validation, and firewalls protect data integrity. Additional safeguards, such as rate limiting, IP whitelisting, and comprehensive audit logs, prevent unauthorized access, mitigate risks like DDoS attacks, and ensure compliance with security standards.

3.9 DATA COLLECTION METHODS

For the Online Job Portal project, data collection was focused on gathering user interaction and performance metrics to better understand system usage and identify areas for improvement. Techniques employed included system logs and analytics, to automatically collect data on user activity such as job searches, job applications, profile updates, and interactions with job recommendations, which were processed to identify behavior patterns. Performance monitoring tools were also used to record system performance, including load times and response rates during high-traffic periods, helping assess the scalability and efficiency of the platform. Lastly, A/B testing was utilized to compare different versions of features or UI designs, with the

resulting data used to assess user preferences and identify design elements that contribute to better engagement and performance.

3.10 DATA ANALYSIS PROCEDURES

The collected data was thoroughly analyzed to evaluate the system's performance, user engagement, and effectiveness. Various methods were used for data analysis, including descriptive statistics to summarize key metrics like the average number of applications per user, job seeker demographics, and peak traffic times. Predictive analytics was employed to analyze historical data, such as user behavior and job search trends, to forecast peak usage times, job seeker preferences, and future trends in job applications. Segmentation analysis was conducted to categorize users based on demographics, behavior, and location, allowing for tailored job recommendations and improved personalization. Hypothesis testing, including chi-squared tests, paired t-tests, and ANOVA, was used to assess the effectiveness of system features, such as the impact of personalized job recommendations on application rates. Heatmap analysis helped visualize user interactions with the interface, identifying areas where users spent the most time or encountered difficulties, which assisted in optimizing the design. Finally, performance analysis was conducted to evaluate server response times, load times, and system scalability, particularly during peak usage periods, ensuring the platform met required performance standards.

3.11 ETHICAL CONSIDERATIONS

Ethical considerations are vital when developing and operating the Online Job Portal, especially when handling user data, ensuring fairness, and providing a transparent service. The portal prioritizes key ethical principles to ensure responsible, equitable, and secure practices for both job seekers and employers.

1. **Privacy and Data Protection**

Maintaining user privacy and data confidentiality is of utmost importance. The system ensures that personally identifiable information (PII) such as names, contact details, job history, resumes, and application data is securely stored and processed. All

sensitive user data is anonymized where necessary, and strict access controls are in place to ensure that only authorized personnel, such as recruiters or platform administrators with specific permissions, can access personal information. User authentication mechanisms, including multi-factor authentication (MFA) and role-based access controls (RBAC), are implemented to enhance security.

Data encryption is used to protect information both at rest and in transit. Secure communication protocols, such as Transport Layer Security (TLS), are employed to safeguard data during transmission, while encryption algorithms such as AES-256 are applied to stored data, ensuring that user information remains secure even in the event of a system breach.

2. **Compliance with Data Protection Regulations**

The system complies with relevant global data protection regulations, including the General Data Protection Regulation (GDPR) in the European Union and the California Consumer Privacy Act (CCPA) in the United States. Compliance ensures that users have control over their data, including the ability to request access, deletion, or correction of their information. Transparency is ensured by clearly informing users about the data being collected, its intended use, and any third parties with whom it may be shared.

Informed consent is obtained from users during the registration and application processes, ensuring they understand how their data will be used. The system allows users to opt-in for notifications or marketing communications and provides the ability to opt-out at any time.

3. **Transparency and Accountability**

Transparency in the system's operations is essential for building trust with users. The job application process, recruiter selection algorithm, and job matching mechanisms are designed to be clear and understandable, allowing users to make informed decisions. The system provides users with clear information about the job listings, company profiles, and application status, ensuring that the process is fair and transparent.

The recommendation algorithm, which suggests jobs to job seekers, is built using explainable machine learning models. These models include mechanisms that allow users to understand why a particular job was recommended based on factors such as job seeker preferences, qualifications, and past application behavior. In the event of complaints or disputes, the system maintains an audit trail of actions taken, ensuring accountability and providing a way to resolve issues fairly.

3.12 IMPORTANCE OF ETHICAL CONSIDERATIONS IN DATA USAGE

User data is central to the portal's functionality and must be handled responsibly to ensure ethical standards are met. This includes building user trust by keeping their data safe and using it solely for its intended purposes. Informed consent is crucial, ensuring users are fully aware of how their data will be used and have control over it. Additionally, fair treatment must be guaranteed, ensuring that no user is unfairly disadvantaged or discriminated against based on their personal data or characteristics.

The platform also employs proprietary software for job matching and recruitment management, which raises ethical considerations. Transparency is essential, ensuring users understand how algorithms function, particularly in job recommendations and employer visibility. Accountability is critical, requiring developers to design and maintain the software to the highest ethical standards to ensure fairness, security, and privacy. Furthermore, proprietary systems must prioritize accessibility, ensuring they do not create barriers or introduce inequalities in access to job opportunities.

The Online Job Portal offers a seamless and user-friendly experience for job seekers and employers, but it faces certain limitations and challenges. In terms of system performance and scalability, high user traffic during peak times can lead to slower response times, even with cloud infrastructure, especially for smaller providers. Data quality and accuracy issues, such as incomplete or inaccurate user profiles, may result in suboptimal job recommendations and errors during applications. Additionally, job availability and quality can pose challenges, as employers might not update postings in real-time, leading to discrepancies, while job seekers' preferences may not always align with available opportunities. Bias in recommendation algorithms is another concern, as these systems may unintentionally favor certain users, highlighting the need for regular audits to ensure fairness.

Privacy and security risks remain significant, despite robust security measures, as evolving threats demand continuous adaptation. Adoption and accessibility challenges also arise, with high fees potentially limiting usage for small businesses and users with limited internet or technical skills facing difficulties. Data processing and algorithmic limitations, including slower processing times for large datasets and potential biases in machine learning models, further impact system performance. Additionally, the platform's user interface may pose navigation challenges for users with disabilities or limited technical expertise, necessitating ongoing accessibility enhancements. Addressing these limitations is vital for optimizing performance, improving user experience, and ensuring inclusivity.

CHAPTER FOUR

Implementation, Testing, Maintenance And Result

4.1 EXPLORATION AND INSTALLATION

The exploration and installation process is critical for setting up the Online Job Portal system. This phase involves identifying the necessary tools, libraries, and configurations required to develop and deploy the system effectively. Proper exploration ensures that all components, both hardware and software, are compatible and optimized for the system's functionality, while installation lays the foundation for its operation.

During the exploration phase, the system's requirements are analyzed to select the appropriate tools and frameworks. Key technologies such as Next.js, ShadcnUI, Clerk, Prisma, and MongoDB are explored for building a responsive, scalable platform. Integration with Google AI for advanced job matching and authentication tools such as Clerk for secure user access is also evaluated. These components are chosen to ensure the platform meets user needs while aligning with industry best practices.

The installation phase involves setting up the required software and tools. Node.js and its ecosystem serve as the foundation, along with libraries and frameworks such as Next.js for front-end and back-end development, Prisma for database management, and MongoDB as the database server. Development environments like Visual Studio Code are configured for coding, debugging, and testing. Following installation, initial tests are conducted to confirm successful setup and functionality of all components. This structured approach ensures a smooth setup and a strong foundation for system development and deployment.

4.1.1 Full-Scale Implementation and Scale-Up

The full-scale implementation of the Online Job Portal involves deploying the system across all targeted users, ensuring seamless functionality in a real-world environment. This phase integrates all system components, including software modules for user authentication, job listings, job applications, and AI-driven job matching. Real-world testing validates the platform's ability to manage user profiles, search queries, and job

applications efficiently. Training sessions are conducted for job seekers, employers, and administrators to ensure familiarity with the platform's features and operations.

Scaling up focuses on improving the platform's capacity to accommodate a growing user base. As the number of users and job postings increases, the database is optimized for faster queries, and cloud-based services are incorporated to enhance scalability. Additional features, such as advanced analytics, mobile app integration, and support for multi-language functionality, are added to improve usability and accessibility. These efforts ensure the platform remains efficient, reliable, and user-friendly as its audience expands.

4.2 SYSTEM TESTING AND SPECIFICATION

System testing ensures the reliability, accuracy, and performance of the Online Job Portal. Both front-end and back-end components undergo rigorous testing to verify compliance with functional and non-functional requirements, resolving potential issues to guarantee smooth operation.

4.2.1 Frontend Testing Strategies

Frontend testing ensures that the user interface is intuitive, responsive, and aligned with the needs of users, including job seekers, employers, and administrators. It involves unit testing, which focuses on verifying individual UI components such as login forms, job search filters, and dashboard elements to ensure proper functionality and responsiveness. Functional testing evaluates whether the interface behaves as intended when interacting with users, such as ensuring job applications are successfully submitted or notifications are displayed correctly. Integration testing ensures seamless interaction between front-end components and back-end services, verifying that features like job recommendations are correctly displayed based on user profiles.

4.2.2 Backend Testing

Backend testing validates the system's database and server-side processes to ensure data integrity, reliability, and functionality. It begins with schema testing, which verifies the database structure, including relationships between tables like jobs, companies, and user profiles, ensuring they are correctly designed to meet the

system's requirements and support seamless data interactions. Query testing follows, where database queries are thoroughly examined for accuracy and efficiency, ensuring that actions such as retrieving job listings, updating user profiles, or filtering job search results are performed swiftly and without errors, even under high data loads. Additionally, API testing plays a crucial role in confirming that endpoints for core functionalities like user authentication, job search, job applications, and tracking return accurate and consistent results. These tests also ensure that APIs are secure, handle edge cases gracefully, and integrate seamlessly with front-end components, providing a smooth user experience across all modules of the system. This comprehensive approach to backend testing guarantees the robustness and reliability of the Online Job Portal's infrastructure.

4.3 SYSTEM PERFORMANCE TESTING AND USER TRAINING ACTIVITIES

I. System Performance Test

Performance testing evaluates the efficiency and scalability of the Online Job Portal under real-world conditions. Stress testing assesses the platform's ability to handle peak usage periods, such as high job application volumes or simultaneous user activity. Load testing ensures response times for key features like job recommendations, user authentication, and job searches remain consistent under heavy usage. Security testing is also performed to safeguard sensitive user data, such as personal information and job application history, from unauthorized access. These tests confirm the system operates efficiently and securely, even under demanding conditions.

II. User Training Activities

User training sessions equip job seekers, employers, and administrators with the knowledge to effectively navigate and utilize the platform. Training covers features such as profile setup, job posting, job searching, application tracking, and generating reports. Hands-on sessions enable users to practice these tasks, fostering familiarity with the platform. User manuals and video tutorials are provided for additional support, ensuring a smooth onboard process for all users.

4.3.1 Database Server Validation Test, User Acceptance Test, and User Training Activities

I. Database Server Validation Test

The database server validation test plays a crucial role in evaluating the accuracy and efficiency of back-end operations. This process ensures that the database infrastructure operates seamlessly, facilitating the smooth interaction between various system components. Specifically, it assesses the integrity of database relationships, such as linking job applications to user profiles and job listings. These tests verify that the relational structure functions as expected, preventing errors like broken associations or orphaned records. Furthermore, the evaluation of query performance ensures that data retrieval is both fast and reliable, enhancing the overall user experience. This step is essential for optimizing the platform's responsiveness, especially when handling large datasets or complex queries.

In addition to performance assessments, the validation process thoroughly examines data consistency and integrity. Operations such as adding, updating, or deleting records are carefully tested to confirm they do not compromise the system's stability or accuracy. For instance, when a job application is deleted, the system ensures that corresponding records are either updated appropriately or remain unaffected, depending on the defined relationships. Moreover, backup and recovery mechanisms are rigorously tested to safeguard against data loss. These mechanisms ensure that critical data can be restored promptly in case of unexpected failures or disasters, thereby guaranteeing uninterrupted platform functionality. By addressing these aspects, the validation test ensures that the database effectively supports the platform's operational and reliability requirements.

II. User Acceptance Test (UAT):

User Acceptance Testing (UAT) is a critical phase in the development process, as it evaluates the platform from the perspective of end users. This ensures that the system is functional, intuitive, and aligned with user needs. Job seekers actively test features such as job search, profile management, and application submission. They verify that job listings are easily searchable, filters work as expected, and application processes are straightforward. On the other hand, employers test functionalities like job posting, editing, and applicant tracking. These tests help confirm that employers can

efficiently post jobs, review applications, and manage the recruitment process. This hands-on testing provides invaluable insights into how the platform performs under real-world conditions and helps uncover usability or functionality issues that may not have been apparent during earlier testing phases.

The feedback gathered during UAT plays a pivotal role in refining the platform. End users report any issues they encounter, such as unclear interfaces, slow loading times, or errors in specific workflows. Additionally, they may suggest enhancements to improve usability or add features that better meet their needs. Developers analyze this feedback to identify and resolve potential issues, ensuring the platform delivers a seamless experience. UAT concludes only when users confirm that the system meets their expectations and requirements. This final approval is essential for deployment, as it validates that the platform is ready for launch and capable of fulfilling its intended purpose. By incorporating end-user feedback, UAT ensures that the final product is user-friendly, functional, and well-suited to the target audience.

User Training Activities

Training sessions are designed to provide users with a thorough understanding of the platform's key features and functionalities. These sessions focus on critical tasks such as managing user profiles, posting jobs, searching for opportunities, and tracking applications. Step-by-step demonstrations are conducted to showcase how each feature works, ensuring users understand the system's capabilities. For example, job seekers are guided through creating and updating profiles, applying for jobs, and monitoring their application status. Similarly, employers are shown how to post job listings, review applications, and communicate with candidates. This targeted approach ensures that users from all sides of the platform are equipped to navigate and utilize its features effectively.

To reinforce learning, practical exercises are incorporated into the training sessions, giving users hands-on experience with the system. By simulating real-world scenarios, these exercises help users build confidence in performing tasks independently. Comprehensive user manuals, filled with detailed instructions and troubleshooting tips, are also provided as reference materials. Additionally, ongoing technical support is made available to address any challenges users might encounter after the training

sessions. This combination of interactive training, practical resources, and accessible support ensures that users feel confident and capable of integrating the platform into their workflows, promoting seamless adoption and effective utilization of the system.

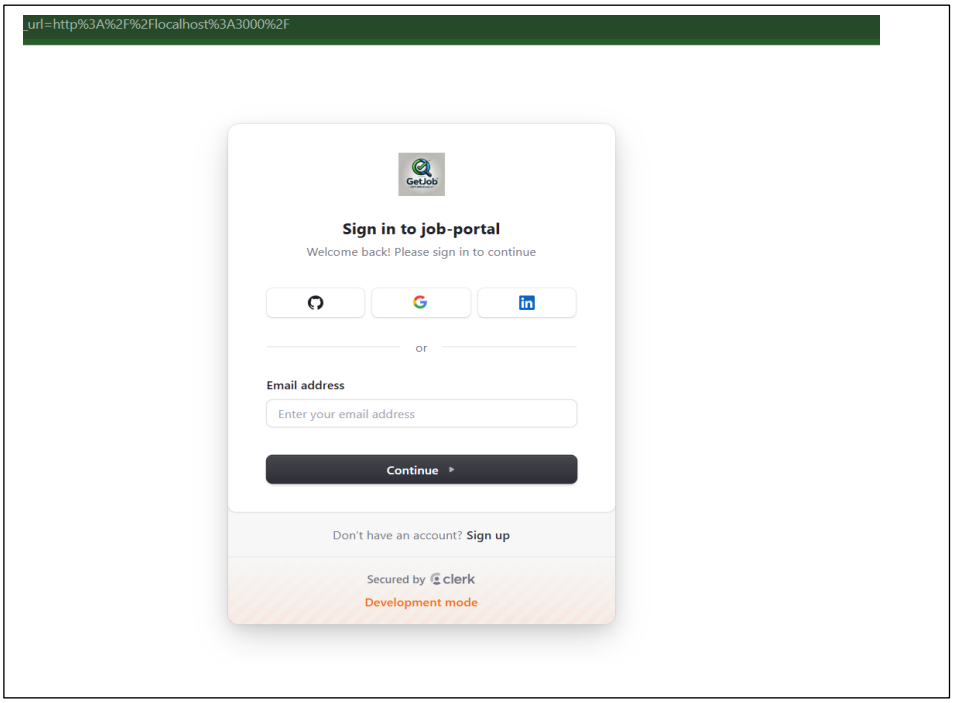


Figure 12: Showing Login Page (Research activity January, 2025.)

4.4 SYSTEM SECURITY AND MAINTENANCE

I. System Security

The platform incorporates robust security measures to safeguard sensitive data and ensure user privacy. One of the primary protections is the use of strong encryption protocols for sensitive information, such as user profiles, job application details, and communication between users. This encryption ensures that data remains secure both at rest and during transmission, making it inaccessible to unauthorized individuals. Additionally, API endpoints are carefully secured to prevent unauthorized access or exploitation. By implementing strict access controls and validating requests, the platform ensures that only authenticated and authorized users can interact with the system's resources. These measures form the foundation of a secure environment, protecting critical information from potential breaches.

To further enhance security, the platform employs multiple layers of protection against cyber threats. Regular security updates are applied to patch vulnerabilities and keep the system resilient against emerging threats. Firewalls are implemented to monitor and control incoming and outgoing network traffic, preventing unauthorized access and malicious activities. Secure authentication mechanisms, including multi-factor authentication (MFA), add an additional layer of protection by requiring users to verify their identity through multiple factors, such as a password and a one-time code sent to their device. Together, these measures create a comprehensive security framework that ensures the platform remains protected from cyberattacks, instilling trust and confidence among users.

II. Maintenance Strategies

Preventive Maintenance focuses on proactively ensuring the platform operates at peak performance by addressing potential issues before they arise. This includes conducting regular system audits to identify and mitigate vulnerabilities, optimizing database performance to handle growing amounts of data efficiently, and applying software updates to keep the platform compatible with the latest technologies. For example, audits may uncover outdated dependencies or areas of inefficiency in the codebase, which are addressed promptly to maintain system stability. By implementing these measures, preventive maintenance minimizes the risk of unexpected failures and ensures the platform can consistently meet user demands.

Corrective Maintenance involves the swift resolution of issues that disrupt normal operations. This includes addressing server downtimes, fixing API errors, and resolving user-reported bugs. For instance, if users report difficulties in submitting job applications or accessing job listings, corrective actions are immediately undertaken to identify the root cause and restore functionality. The goal is to minimize downtime and ensure a seamless user experience. This reactive approach ensures that any interruptions are resolved quickly, reinforcing the reliability and trustworthiness of the platform.

Predictive Maintenance takes a forward-looking approach by analyzing system logs, performance metrics, and usage patterns to identify and address potential issues before they escalate. For example, monitoring server load may reveal patterns of increased traffic at specific times, prompting adjustments to infrastructure capacity to

prevent slowdowns or crashes. Similarly, analyzing error logs can help identify recurring problems that need attention. By proactively addressing these insights, predictive maintenance reduces the likelihood of disruptions and ensures the platform remains scalable, secure, and reliable over time. Together, these maintenance strategies ensure the Online Job Portal consistently serves its users effectively while adapting to evolving needs and challenges.

CHAPTER FIVE

Summary, Conclusion, And Recommendations

5 .1 SUMMARY OF KEY FINDINGS OF THE RESULT

The development of the Online Job Portal successfully delivered a secure, efficient, and user-friendly platform for streamlining the recruitment process in Sierra Leone. The system achieved significant improvements in job matching, application tracking, and profile management, reducing manual intervention and optimizing the hiring process's overall efficiency. The AI-powered job-matching feature demonstrated high reliability in recommending relevant job listings and candidates, effectively aligning job seekers with suitable opportunities. The results further underscored the value of a well-structured database and a seamless user interface in enhancing system usability and performance, meeting the platform's objectives to provide an inclusive and functional digital employment solution.

5.2 DISCUSSION OF FINDINGS

The findings validate the research objectives by demonstrating the system’s capability to enhance recruitment processes for job seekers, employers, and administrators. They highlight how leveraging advanced web technologies improves the accuracy and efficiency of job matching while streamlining the hiring workflow. This study offers valuable insights for the field of computer science, particularly in the areas of employment technology and data-driven platforms. It illustrates the practical application of modern development techniques in creating solutions that reduce inefficiencies in the recruitment process, transforming the job market into a more accessible and efficient ecosystem.

The platform’s ability to handle high traffic volumes without performance degradation underscores the importance of adopting robust, cloud-based infrastructures. The scalability and reliability provided by cloud technologies ensure uninterrupted access and functionality during peak periods, such as job application deadlines or mass recruitment drives. This aspect is particularly critical in regions with limited technical resources and infrastructure challenges, such as Sierra Leone.

Furthermore, the study emphasizes the importance of user-centric design in creating intuitive, inclusive, and accessible interfaces. This approach ensures that diverse user

groups, including job seekers, employers, and administrators, can interact seamlessly with the platform regardless of their technical expertise or socio-economic background. These findings reflect the broader need for digital solutions that prioritize inclusivity, leaving no user behind.

The research contributes to the field of computer science by bridging the gap between theoretical advancements in technology and real-world applications. It demonstrates how web development technologies and cloud-based solutions can enhance employment accessibility, offering a blueprint for similar initiatives in other developing countries. By connecting job seekers with previously inaccessible opportunities, such platforms have the potential to act as catalysts for economic growth, fostering social and financial inclusion.

However, challenges remain. Reliable internet access remains a significant barrier, particularly in rural areas where connectivity is limited or unavailable. Addressing this issue requires partnerships with telecommunications providers and policymakers to improve digital infrastructure. Additionally, digital literacy gaps must be bridged through targeted training programs and community outreach initiatives. Equipping users with the skills to navigate digital platforms will ensure broader adoption and extend the system's benefits to a larger audience.

In summary, the findings illustrate that a well-designed, technology-driven job portal has the potential to revolutionize the employment landscape in resource-constrained settings. It offers immediate benefits to job seekers and employers while laying the groundwork for broader socio-economic development through improved access to opportunities. For sustained impact, it is essential to address systemic challenges, including infrastructure development and digital literacy training. This holistic approach will ensure that technological advancements are accompanied by the necessary support to maximize their potential and create a more inclusive employment ecosystem.

5.3 COMPARISON WITH LITERATURE

The findings of this research align closely with existing literature on online job portals, which emphasizes the importance of responsive design, scalable infrastructure, and user-friendly interfaces in enhancing recruitment efficiency and accessibility. Studies conducted in developed countries frequently highlight the role of intuitive navigation and advanced algorithms in meeting diverse user requirements. This research extends these principles by adapting them to Sierra Leone's unique socio-economic context, addressing challenges such as limited digital infrastructure, inconsistent electricity supply, and varying levels of technological literacy.

Unlike prior research that often focuses on advanced ecosystems in developed nations, this study prioritizes lightweight, mobile-friendly interfaces to support users with low-end devices and limited bandwidth. Offline functionalities and optimized data storage solutions were integrated to ensure usability in areas with unreliable connectivity, making the platform functional even under suboptimal network conditions.

Moreover, this research contributes to the field by incorporating localized features, such as job categories tailored to Sierra Leone's primary industries and employment trends. These customizations, absent in many global job portal systems, enhance the relevance of the platform for its intended users. Through its focus on scalable infrastructure and advanced web technologies like cloud computing and machine learning, the platform demonstrates the potential of these tools to support employment accessibility in emerging economies. By addressing these nuanced challenges, the study provides a valuable perspective on the development of digital solutions that bridge the digital divide and enhance employment opportunities in resource-constrained settings.

5.4 PRACTICAL APPLICATIONS

The outcomes of this research have significant practical implications for regions facing employment challenges, digital infrastructure limitations, and socio-economic constraints. The Online Job Portal provides a transformative solution by offering a scalable and efficient platform for streamlining recruitment processes. By reducing the time, effort, and costs associated with traditional hiring methods, the portal delivers considerable value to employers. Its streamlined approach to candidate sourcing, screening, and selection enables organizations to fill vacancies quickly and with better-qualified candidates, thereby improving operational efficiency.

For job seekers, the platform offers enhanced access to diverse employment opportunities, overcoming barriers such as geographic, economic, and technological constraints. The Advanced Job Search feature, powered by a recommendation system, analyzes user profiles, skills, and preferences to improve the relevance of job suggestions. This personalized and efficient approach significantly increases the likelihood of job seekers finding positions that align with their qualifications and career aspirations, addressing a critical challenge in Sierra Leone's job market.

The system's robust infrastructure ensures consistent performance during peak usage periods, maintaining reliability and trustworthiness. This scalability is particularly vital in regions with limited digital resources, where system stability under fluctuating conditions is often a challenge.

Beyond Sierra Leone, the portal's design principles and features serve as a replicable model for other regions facing similar socio-economic challenges. Its success demonstrates how contextually tailored technological solutions can contribute to global efforts in digital empowerment, economic inclusion, and employment accessibility. By addressing the specific needs of resource-constrained environments, the portal highlights the potential for digital innovation to create widespread opportunities in developing economies.

5.5 CONCLUSIONS DRAWN FROM THE RESEARCH

This research concludes that an Online Job Portal, designed with a focus on user experience, scalability, and contextual relevance, can significantly improve the job search process for both job seekers and employers. By addressing challenges such as inefficient recruitment processes and limited access to employment opportunities, the platform demonstrates its ability to drive meaningful change in the employment landscape.

The integration of cloud-based solutions ensures that the system remains robust, scalable, and capable of handling large-scale usage without compromising performance. Additionally, features such as responsive design, advanced job-matching algorithms, and localized job categories enhance the platform's usability and relevance.

Overall, the project exemplifies how technology can address systemic challenges and drive socio-economic development in resource-constrained regions. By creating a platform tailored to Sierra Leone's needs, this research highlights the transformative potential of digital solutions in improving access to employment opportunities and fostering economic growth.

5.6 RECOMMENDATIONS FOR FUTURE RESEARCH

Future research on the job portal could explore the integration of predictive analytics and AI-powered resume screening to enhance the matching process between job seekers and employers. By leveraging data trends and machine learning algorithms, the platform could anticipate user needs more accurately, improving the overall job-matching experience. Additionally, incorporating advanced filtering options and personalized recommendations would streamline job searches and make the process more efficient for both users and employers.

The inclusion of third-party payment gateways should also be considered for the future to enable features such as paid job postings and employer subscriptions. This would not only provide a revenue stream for the platform but also offer employers more visibility and tailored options for their job listings. Furthermore, research into mobile application development could expand the platform's accessibility, allowing users to engage with the portal seamlessly on their mobile devices.

Lastly, as the job portal evolves, expanding its coverage to other industries and regions should be explored. Tailoring the system to accommodate various job sectors and geographic areas would ensure its scalability and adaptability. Additionally, prioritizing security improvements, such as data encryption and multi-factor authentication, would protect user data and strengthen the platform's reliability and trustworthiness.

5.7 FINAL THOUGHTS

The development of the online job portal has been an exciting journey, with significant progress made in creating a platform that connects job seekers with employers. By focusing on essential features such as job listings, profile management, and application tracking, the portal has addressed key needs in the recruitment process. While the initial version is designed with specific industries and job categories in mind, the potential for growth is immense, with the possibility to integrate more advanced technologies in the future.

This platform not only aims to streamline the hiring process but also provides a valuable opportunity to study and improve the dynamics between job seekers and employers in Sierra Leone. The research and development phases have highlighted areas for improvement and expansion, with a clear path to incorporating features like predictive analytics, AI-based matching, and mobile app support. Future research will be critical in ensuring that the portal continues to evolve and meet the ever-changing demands of the job market.

Ultimately, the online job portal is an important step toward modernizing recruitment practices and creating a more efficient job market in Sierra Leone. As the platform continues to develop, it holds the potential to make a lasting impact on the region's employment landscape, fostering connections, growth, and opportunities for job seekers and employers alike.

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Research Activity. (2025, January). *Figure 12: Showing Login Page*.

DALL·E. (2025). *Figure 1: Showing a real-time web application architecture diagram with multiple users, a modular three-tier architecture*.

Research Activity. (2025, January). *Figure 2: Showing Data Flow level 0 (Context Level) Diagram*.

Research Activity. (2025, January). *Figure 3: Showing Level 1 (Job Seeker) Diagram*.

Research Activity. (2025, January). *Figure 4: Showing Level 1 (Company) Diagram*.

Research Activity. (2025, January). *Figure 5: Showing Level 1 (Admin) Diagram*.

Research Activity. (2025, January). *Figure 6: Showing Level 1 (Admin) Diagram*.

Research Activity. (2025, January). *Figure 7: Showing Level 2 (Company) Diagram*.

Research Activity. (2025, January). *Figure 8: Showing Level 2 (Admin) Diagram*.

Research Activity. (2025, January). *Figure 9: Showing Use Case Diagram*.

Research Activity. (2025, January). *Figure 10: Showing Sequence Diagram*.

Research Activity. (2025, January). *Figure 11: Showing E-R Diagram*.

APPENDIX - A

Research Study Activity Gantt Chat

Activity Label	Research Activities	Activity Mode of Execution	Dependent upon	Research Activities/Study Duration estimated per-week											
Integrated Research Methodology															
1. Qualitative Research Approach															
				1	2	3	4	5	6	7	8	9	10	11	12
A	Proposal	Parallel	None												
B	Review of Related Literature	Dependent upon	A												
C	Schedule Development for Data gathering and participant selection	Parallel	B												
D	Pilot and final Data Collection phase	Dependent upon	A, B & C												
E	Analysing facts insights from the findings	Dependent upon	D												
F	write-up of the study report	Dependent upon	A, B, C, D & E												
Software Development Approach															
2. Agile Development Model															
I	Requirement gathering and Analysis	Parallel	None												
J	Design	Parallel	I												
K	Implementation (Coding/development)	Dependent upon	J												
L	Testing and Integration/Deployment	Dependent upon	K												
M	Maintenance	Dependent upon	I, J, K & L	Commence after the above stated activities are completed											

Source: *David Sapunka Fornah (January 2023)*

APPENDIX – B

Research Study Quad Chart

Problem Statement and Study Justification:

Central University-Sierra Leone (CUSL) is an expanding institution with almost 1,000 students. However, traditional paper-based registers used for manual attendance tracking are inefficient, prone to errors, and lack the capability to verify students' authenticity, resulting in potential proxy attendance and compromised attendance data reliability.

However, a native mobile attendance system with facial recognition feature could address these challenges by providing a more accurate, convenient, and cost-effective way to mark attendance.

Study Methodology:

➢ **Integrated Approach**

A. Qualitative Approach

Qualitative method of data collection via interviews, focus groups, and observations to get insights into the traditional system and discover methods of building algorithms for development.

B. Software Development Approach

The system will be developed using the agile methodology, a flexible and iterative approach that emphasizes collaboration, rapid development, and customer feedback. The team will use a variety of tools and techniques to ensure the quality of the system.

Tools Technologies: Flutter, Dart, TensorFlow, ML Kit

Aim

The aim of the proposed project is to a system that will revolutionize the attendance tracking process by leveraging facial recognition technology and mobile devices, thereby enhancing efficiency, accuracy, and security in attendance management.

Objective

1. To design and develop a user-friendly mobile application for attendance tracking.
2. To integrate facial recognition technology for student identification.
3. To provide real-time attendance monitoring for faculty.

Expected Outcome

At the end of the development period, the preliminary supposition will be a mobile application with face recognition features that will be helping lecturers for tracking student's attendance at Central University Mile 91.

The study findings will also serve as a reference material to other researchers, and help addressing related issues of attendance management in any learning institution. Importantly, completing the study will serve as partial fulfilment for the award of a BSc Hons Degree in Business Information Technology.

Source: *Study material September (2023)*

APPENDIX – B

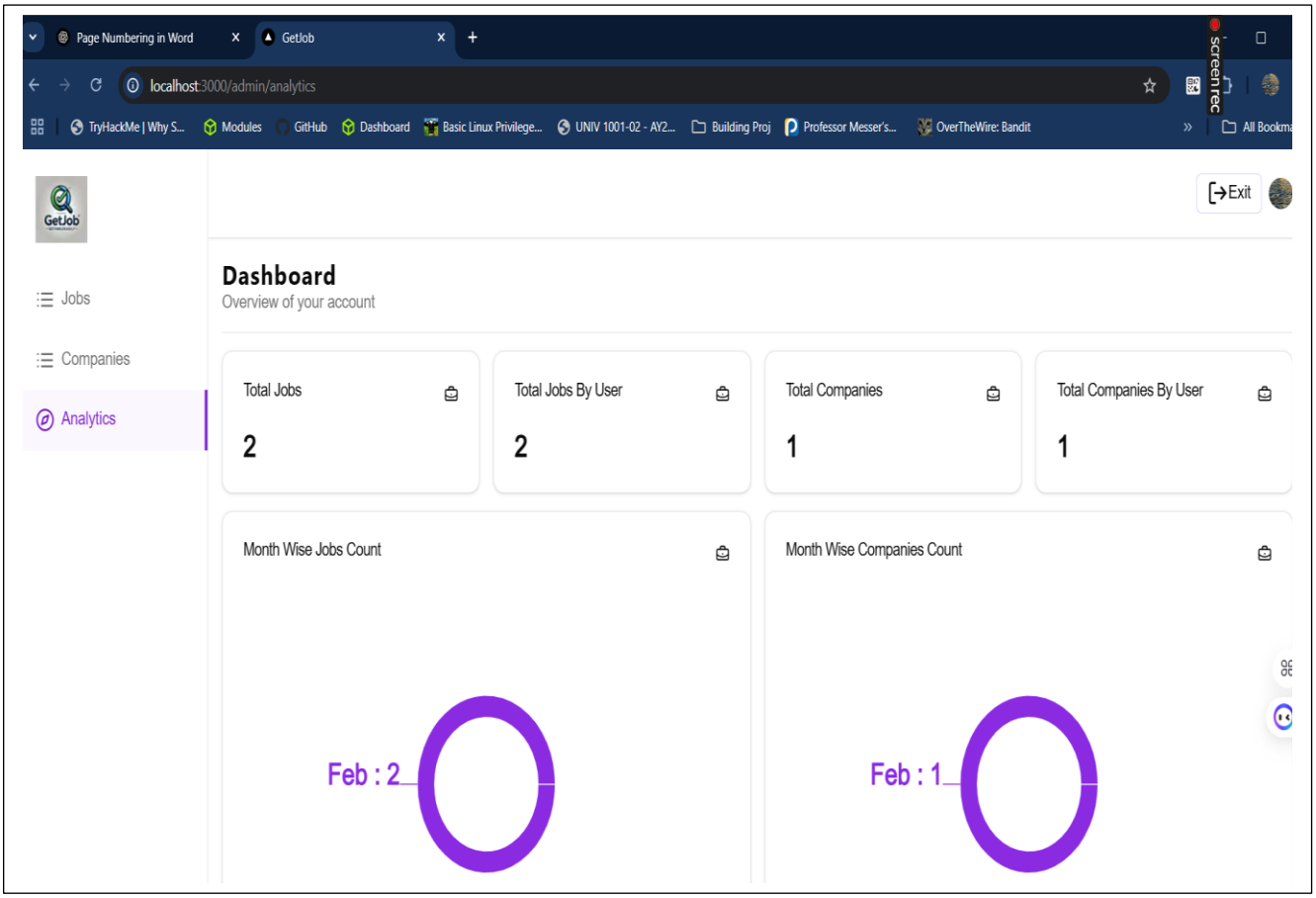
ADMIN ANALYTICS

```
import {
  getPeiGraphCompanyCreatedByUser,
  getPeiGraphJobCreatedByUser,
  getTotaCompaniesOnPortal,
  getTotalCompaniesOnPortalByUserId,
  getTotalJobsOnPortal,
  getTotalJobsOnPortalByUserId,
} from "@/actions/get-overview-analytics";
import Box from "@/components/box";
import { OverviewPieChart } from "@/components/overview-pie-chart";
import { Card, CardContent, CardHeader, CardTitle } from
"@/components/ui/card";
import { Separator } from "@/components/ui/separator";
import { auth } from "@clerk/nextjs/server";
import { BriefcaseBusiness } from "lucide-react";
import { redirect } from "next/navigation";

const DashboardAnalyticsPage = async () => {
  const { userId } = auth();
  if (!userId) {
    redirect("/");
  }

  const totalJobsOnPortal = await getTotalJobsOnPortal();
  const totalJobsOnPortalByUser = await
getTotalJobsOnPortalByUserId(userId);
  const totalCompanniesOnPortal = await getTotaCompaniesOnPortal();
  const totalCompaniesOnPortalByUser = await
getTotalCompaniesOnPortalByUserId(
    userId
  );

  const graphJobTotal = await getPeiGraphJobCreatedByUser(userId);
  const graphCompanyTotal = await
getPeiGraphCompanyCreatedByUser(userId);

  return (
    <Box className="flex-col items-start p-4">
      <div className="flex flex-col items-start">
        <h2 className="font-sans tracking-wider font-bold text-2xl">
          Dashboard
        </h2>
        <p className="text-sm text-muted-foreground">
          Overview of your account
```

```
        </p>
      </div>

      <Separator className="my-4" />

      <div className="grid gap-4 w-full grid-cols-1 md:grid-cols-4">
        {/* total jobs on the portal */}
        <Card>
          <CardHeader className="items-center justify-between flex-
row">
            <CardTitle className="text-sm font-medium">Total
Jobs</CardTitle>
            <BriefcaseBusiness className="w-4 h-4" />
          </CardHeader>
          <CardContent className="text-2xl font-bold">
            {totalJobsOnPortal}
          </CardContent>
        </Card>

        {/* total jons on the portal by the user */}
        <Card>
          <CardHeader className="items-center justify-between flex-
row">
            <CardTitle className="text-sm font-medium">
              Total Jobs By User
            </CardTitle>
            <BriefcaseBusiness className="w-4 h-4" />
          </CardHeader>
          <CardContent className="text-2xl font-bold">
            {totalJobsOnPortalByUser}
          </CardContent>
        </Card>
        {/* total companies on the portal */}
        <Card>
          <CardHeader className="items-center justify-between flex-
row">
            <CardTitle className="text-sm font-medium">
              Total Companies
            </CardTitle>
            <BriefcaseBusiness className="w-4 h-4" />
          </CardHeader>
          <CardContent className="text-2xl font-bold">
            {totalCompanniesOnPortal}
          </CardContent>
        </Card>
        {/* total companies on the portal by user */}
        <Card>
```

```
          <CardHeader className="items-center justify-between flex-
row">
            <CardTitle className="text-sm font-medium">
              Total Companies By User
            </CardTitle>
            <BriefcaseBusiness className="w-4 h-4" />
          </CardHeader>
          <CardContent className="text-2xl font-bold">
            {totalCompaniesOnPortalByUser}
          </CardContent>
        </Card>

        {/* month wise jobs count */}

        <Card className="col-span-1 md:col-span-2">
          <CardHeader className="items-center justify-between flex-
row">
            <CardTitle className="text-sm font-medium">
              Month Wise Jobs Count
            </CardTitle>
            <BriefcaseBusiness className="w-4 h-4" />
          </CardHeader>
          <CardContent className="text-2xl font-bold">
            <OverviewPieChart data={graphJobTotal} />
          </CardContent>
        </Card>
        {/* month wise companies count */}

        <Card className="col-span-1 md:col-span-2">
          <CardHeader className="items-center justify-between flex-
row">
            <CardTitle className="text-sm font-medium">
              Month Wise Companies Count
            </CardTitle>
            <BriefcaseBusiness className="w-4 h-4" />
          </CardHeader>
          <CardContent className="text-2xl font-bold">
            <OverviewPieChart data={graphCompanyTotal} />
          </CardContent>
        </Card>
      </div>
    </Box>
  );
};

export default DashboardAnalyticsPage;
```

APPENDIX – B



Admin Analytics