

PROJECT TITLE: Intelligent Job Connector



**A Senior Project Software Requirement Specification (SRS) Document
Submitted for Partial Fulfillment of the Requirements for BSc. Degree in Software
Engineering**

DEPARTMENT OF SOFTWARE ENGINEERING

COLLEGE OF COMPUTING AND INFORMATICS

HARAMAYA UNIVERSITY

NOV.2024

HARAMAYA

DECLARATION SHEET

The Intelligent Job Connector SRS presented here is the work of the group members whose names are listed below, without any external help, under the supervision of Dr. Abdulgany K. All sources used in this document are in the appendix section. We understand and agreed that not following the guideline will lead us to a denial of passing to the next phase.

GROUP MEMBERS				
#	Name	ID	Signature	Date
1	Daniel Mesfin	1732/12		
2	Bekalu Atto	0232/12		
3	Kaytros Gecho	2183/12		
4	Abel Mulatu	0305/12		

Table 1 Group Members

I witnessed that this document was done according to the guidelines under my supervision. This final document incorporates my comments.

I have seen partially

I did not see at all

Remark

Dr. Abdulgany K.

Advisor Name

Signature

Date

DECLARATION SHEET.....	1
List of Tables	1
List of Figures.....	1
Abbreviation and Acronyms	2
Chapter One	3
Introduction.....	3
1.1 Document Scope	3
1.2 Document Purpose	6
1.3. Document Conventions.....	9
1.4. Intended Audience	9
1.5. Team Organization Table Group Members	12
Chapter two	14
2.1 SYSTEM OVERVIEW	14
2.2 Scope.....	18
2.3. User Classes and Characteristics	23
2.4 Business Rules	28
2.5 Operating Environment.....	29
Chapter Three.....	32
System Requirements.....	32
3.1. Functional Requirements	32
3.2. Use Cases	34
3.3. Data Requirements.....	43
3.4. Non-functional Requirements.....	48
Appendix.....	55

List of Tables

Table 1 Abbreviations and Acronyms	2
Table 2 Team Organization table	13

List of Figures

Figure 1 use case for Guest	35
Figure 2 use case for job seeker	36
Figure 3 use case for Employer	37
Figure 4 use case for Admin	38
Figure 5 work flow diagram	44
Figure 6 ER diagram	Error! Bookmark not defined.
Figure 7 group members	57

Abbreviation and Acronyms

1	SRS	Software Requirement Specification
2	HTML	Hyper Text Markup Language
3	CSS	Cascading Style Sheet
4	CV	Curriculum vitae
5	UML	Unified Modeling Language
6	API	Application Programming Interface
7	AWS	Amazon Web Service
8	GCP	Google Cloud Platform
9	CI/CD	Continuous Integration and Continuous Deployment
10	RBAC	Role Based Access Control
11	FAQs	Frequently Asked Questions
12	HTTP	HyperText Transfer Protocol
13	DBMS	Database Management System
14	JWT	Json Web Token
15	UI	User Interface
16	E.G	Example
17	SQL	Structured Query Language

Table 1 Abbreviations and Acronyms

Chapter One

Introduction

This document serves as a comprehensive guide to an innovative software solution designed to revolutionize the job search experience by seamlessly connecting job seekers and employers. It provides a detailed overview of the system's features, requirements, and interfaces, serving as a blueprint for the development team to ensure the successful implementation of the Intelligent Job Connector System.

The primary objective of this document is defining the objectives and requirements of the system. By defining the system scope, specifying functional and non-functional requirements, establishing system constraints, serving as a basis for design and development, facilitating communication and collaboration, and providing a reference for validation and verification, the SRS document ensures a shared understanding among stakeholders and contributes to the successful development and implementation of the Intelligent Job Connector System.

Throughout the development process, this document will act as an essential guide for the development team. It provides a clear roadmap and a comprehensive set of requirements, serving as a reference point to ensure that all stakeholders are aligned and that the system is developed to meet the highest standards of functionality and usability.

1.1 Document Scope

The SRS document of the Intelligent Job Connector system is a comprehensive description of the intended purpose and functionality of our software system product. It is a blueprint for the software development team to follow and helps ensure that the final product meets the client's needs and expectations. This document for the Intelligent Job Connector system software development project is typically organized into the following sections:

1. **Introduction:** This section provides a high-level overview of the Intelligent Job Connector System. It includes the document scope, document purpose, document conventions, intended audience and team organization.
2. **System Description:** This section provides a high-level overview of the Intelligent Job Connector System. It includes the system overview, system scope, user classes and characteristics, business rules, operating environment, design and implementation constraints, and assumptions and dependencies.
3. **System Requirements:** This section outlines the functional and non-functional requirements of the system. It is divided into the following subsections:
 - 3.1. **Functional Requirements:** This section describes the functional requirements of the system. It includes a list of features that the system must provide to its users.
 - 3.2. **Use Cases:** This section provides a detailed description of the use cases of the system. It includes a use case diagram and a use case description.
 - 3.3. **Data Requirements:** This section describes the data requirements of the system. It includes an overview of the data requirements, entity-attribute relationships, entity-relationship diagram, and data validation rules.
 - 3.4. **Non-Functional Requirements:** This section describes the quality constraints that the system must satisfy according to the project contract. It includes the performance requirements, usability requirements, security requirements and software quality attributes

The document is intended for different types of readers such as developers, project managers, marketing staff, users, testers, and documentation writers. Therefore, they are different. They might read the document with different purposes and intentions. So, the suggested sequence for reading the document, beginning with the overview sections and proceeding through the sections that are most pertinent to each reader type are as follow:

1. **Developers:** Developers should start by reading the Introduction section to understand the document scope to know what is and is not in the document. Then, they should read the Requirements section in detail, including the Functional Requirements, Use Cases, Data Requirements sub-sections.
2. **Project Managers:** Project managers should start by reading the Introduction section to understand the purpose and objective of the document. Then, they should read the system overview section to understand the system's scope, user classes and characteristics, business rules, operating environment, design and implementation constraints, and assumptions and dependencies. Then, they should focus on the business rules and assumptions and dependencies in chapter two of the system overview as they are helpful for them to make good decisions.
3. **System Administrators:** System Administrators should start by reading the Introduction section to understand the purpose and objective of the document for his/her general understanding about the document and also read about the document scope to easily grasp the main idea in the document. Then, they should read System Overview to understand the system's scope, user classes and characteristics, business rules, operating environment, design and implementation constraints, and assumptions and dependencies. Eventually, they should read the System requirements to help them understand the performance criteria, and overall system management.
4. **Marketing Staff:** Marketing staff should start by reading the System Overview section to understand the system's scope and user classes and characteristics. Then, they should read the System Overview section in detail to understand the system's business rules, operating environment, design and implementation constraints, and assumptions and dependencies.
5. **Users:** Users should start by reading the Functional Requirements section to understand the features that the system must provide to them. Then, they can read the Use Cases section to understand how the system works.

6. **Testers:** Testers should start by reading the Use Cases section to understand the system's use cases and how to test them. Then, they can read the Functional Requirements section to understand the features that the system must provide to its users.
7. **Documentation Writers:** Documentation writers should read the entire document to understand the system's purpose, functionality, and requirements in detail.

1.2 Document Purpose

The purpose of this document is to outline the main objectives of the SRS document for the Intelligent Job Connector System. The SRS document serves as a crucial foundation for the development and implementation of the system. It provides a comprehensive overview of the functional and non-functional requirements, system features, and constraints. By clearly defining the scope and functionality of the system, the SRS document ensures a shared understanding among stakeholders and guides the development process. This document serves as a reference for all parties involved in the project, facilitating effective communication, collaboration, and successful system development.

1.2.1 Objective

1.2.1.1 Define System Scope

One of the main objectives of the SRS document for the Intelligent Job ConnectorSystem is to define the system's scope. This includes identifying the boundaries and limitations of the system, specifying both the included and excluded functionalities. By clearly defining the system scope, the document ensures that all stakeholders have a shared understanding of what the system will and will not do. This helps in managing expectations and providing a clear direction for the development efforts.

1.2.1.2 Specify Functional Requirements

Another key objective of the SRS document is to specify the functional requirements of the Intelligent Job Connector System. These requirements define the behavior and functionality of the system. The document outlines the tasks, functions, and services that the system must perform to meet the needs of its users and stakeholders. By documenting these requirements, the SRS document ensures that the system is developed in a way that aligns with the intended purpose.

1.2.1.3 Specify Non-Functional Requirements

In addition to functional requirements, the SRS document also aims to specify non-functional requirements. These requirements define the quality attributes, performance expectations, and constraints that the system must adhere to. Non-functional requirements may include aspects such as usability, reliability, performance, security, and scalability. By documenting these requirements, the SRS document ensures that the system meets the desired levels of quality and performance.

1.2.1.3 Establish System Constraints

The SRS document identifies and documents any constraints that may impact the design or implementation of the Intelligent Job Connector System. These constraints could be technical, organizational, or regulatory in nature. By explicitly documenting these constraints, the document helps in managing expectations and ensuring that the system is developed within the defined boundaries. This ensures that the system is feasible and aligns with the project's constraints and limitations.

1.2.1.4 Provide a Basis for System Design and Development

The SRS document serves as a foundation for system design and development activities. It provides developers with a clear understanding of the system's requirements, enabling them to design and implement the system effectively. The document acts as a guide for developers, informing them of the system's purpose, functionality, and constraints. This helps in ensuring

that the system is developed in a way that fulfills the specified requirements and meets the needs of the users and stakeholders.

1.2.1.5 Facilitate Communication and Collaboration

The SRS document acts as a communication tool between stakeholders involved in the Intelligent Job Connector System project. It helps in facilitating effective communication and collaboration among clients, developers, testers, and project managers. By providing a clear and comprehensive overview of the system's requirements, the document ensures that all parties have a shared understanding of what needs to be accomplished. This reduces the risk of miscommunication or misinterpretation and promotes collaboration towards the successful development and implementation of the system.

1.2.1.6 Serve as a Reference for Validation and Verification

The SRS document serves as a reference point for validating and verifying the Intelligent Job Connector System. It provides a benchmark against which the system's performance and functionality can be assessed. The document helps in conducting systematic testing, ensuring that the implemented system meets the defined requirements and performs as expected. It provides a basis for evaluating the system's compliance with the specified requirements and assists in identifying any gaps or deviations that need to be addressed.

1.3. Document Conventions

This document follows the IEEE standard for software requirements specification (IEEE Std 830-1998) [2]. The document is divided into four main sections: Introduction, System Overview, System Requirements, and Appendices. Each section has a number and a title, and may have one or more sub-sections with numbers and titles as well. The sub-sections are numbered according to the section they belong to, using a decimal notation. For example, the first subsection of section 3 is numbered 3.1, and the second subsection of section 3.1 is numbered 3.1.2.

The document uses the following fonts and styles:

- The document title is in Times New Roman, 16-point, bold, and centered.
- The section titles are in Times New Roman, 16-point, and left-aligned.
- The body text is in Times New Roman, 12-point, and justified.
- The captions for figures and tables are in Times New Roman, 10-point, italic, and centered below the figure or table.
- The references are in Times New Roman, 10-point, and left-aligned.

The document uses the following symbols:

- A bullet point (•) indicates a list item.
- A dash (-) indicates a sub-list item and also used as list item.

1.4. Intended Audience

The Job Connector System caters to a diverse range of audience, each with their specific interests and expectations. Understanding the needs of these audiences is crucial for developing a system

that meets their requirements. Here is a breakdown of the intended audience and their particular interests within the context of our Job Connector System:

Developers

Developers we(our team) involve in the project are key audiences who are interested in the technical aspects of the Job Connector System. We seek detailed information on the system's architecture, design specifications, programming languages, frameworks, and database structures. Clear documentation regarding the interaction and communication between different system components is essential for our effective contributions.

Project Managers (Advisors)

Project Managers our advisors play a vital role in overseeing the development of the Job Connector System. They are concerned with project scope and timelines. High-level requirements, project goals, and constraints are of particular interest to them. Additionally, they require information on project deliverables, milestones, dependencies and risk assessments to ensure successful project management.

Marketing Staff

Marketing Staff members are responsible for promoting the Job Connector System to potential users and clients. Any one who is interested in understanding the system's key features, unique selling points, and how it addresses specific market needs can be our marketing staff. Information on user interface design, user experience, and any marketing-related materials is crucial for their marketing efforts.

Users

The primary users of the Job Connector System are job seekers and employers. Job seekers need a user-friendly platform that simplifies their job search process and helps them find suitable employment opportunities. Employers seek a system that facilitates efficient recruitment activities, including posting job openings, reviewing applications, and communicating with candidates. Information on user interfaces, workflows, and specific user roles is important for both user groups.

Testers (Examiners)

Testers play a critical role in ensuring the quality and reliability of the Job Connector System. They are interested in detailed test scenarios, encompassing positive and negative test cases. Testers require clear information on expected system behavior, input conditions, and output expectations to effectively validate the system against the specified requirements. But in our case testers are examiners of our project who examine our work on the job connector system.

Documentation Writers

Documentation Writers(we) job connector system developers are also responsible for creating comprehensive user manuals and instructional documentation for the Job Connector System. we are interested in clear and concise information on user interfaces, system functionalities, and any specific instructions for users. Providing well-structured and easily understandable documentation is crucial for supporting system users.

By considering the specific interests and needs of these audience, the Job Connector System can be developed and tailored to meet their expectations, ensuring a successful and user-centric platform.

1.5. Team Organization Table Group Members

The team assembled for the Intelligent Job Connector System project comprises four diligent members, each entrusted with pivotal roles essential for the project's success.

#	Name	ID	Role
1	Daniel Mesfin	1732/12	<ul style="list-style-type: none">• Backend Developer and the implementation recommendation engine.• Document system, ensuring seamless integration.• Frontend developer
2	Bekalu Atto	0232/12	<ul style="list-style-type: none">• Backend Developer and the recommendation engine implementation.• Frontend developer and document the system.• UI design, ensuring an engaging user experience.
3	Kaytros Gecho		<ul style="list-style-type: none">• Backend developer proficiency and deployment mastery with dedicating adept skills to• Front-end developer, intricately weaving the document system into a cohesive whole.
4	Abel Mulatu	0305/12	<ul style="list-style-type: none">• He shoulders the critical responsibility of organizing documentation while actively contributing to the frontend development, solidifying the team's foundation with meticulous attention to detail and clarity.

Table 2 Team Organization table

Together, this eclectic ensemble intertwines their specialized skills, collectively steering the Intelligent Job Connector System project toward innovation and excellence.

Chapter two

2.1 SYSTEM OVERVIEW

2.1.1 Project Objective

2.1.1.1 General Objective

The general objective of this final year project is to develop a web based Intelligent Job Connector system using machine learning algorithms that recommend appropriate job to appropriate candidate by predicting compatibility

2.1.1.2 Specific Objectives

1. Facilitate Effortless Job Search

- Create a user-friendly interface that allows job seekers to easily navigate through job listings, filter results based on preferences, and apply for positions with minimal effort.

2. Empower Job Seekers with Comprehensive Profiles

- Provide job seekers with the tools and features necessary to create detailed profiles showcasing their skills, education, work experience, and other relevant information.

3. Streamline Job Posting and Management for Employers

- Enables employers to efficiently post and manage job listings, including specifying job titles, required skills, location, salary range, and application deadlines.

4. Foster Transparent Communication

- Implement a messaging system that facilitates direct communication between job seekers and employers, allowing for timely and clear exchanges.

5. Optimize the Matching Process

- Implement a recommendation engine that suggests jobs to job seekers based on their skills and preferences, enhancing the likelihood of successful matches.

6. Ensure Data Security and Privacy

- Implement robust security measures to safeguard user data and maintain the confidentiality of sensitive information.

7. Enhance User Experience and Accessibility

- Design the platform to be intuitive, responsive, and accessible to users of diverse backgrounds and abilities, ensuring an inclusive experience for all.

8. Enable Efficient Application Management for Employers

- Provide employers with tools to efficiently review and manage job applications, streamlining the hiring process.

9. Monitor and Analyze Platform Performance

- Implement tracking and analytics features to monitor user engagement, system performance, and other relevant metrics for continuous improvement.

10. Expand Geographic Reach

- Develop features and functionalities that allow the platform to transcend geographical barriers, enabling a broader reach for both job seekers and employers.

11. Support Scalability and Reliability

- Design the Intelligent Job Connector System with scalability in mind, ensuring it can handle increased user activity and data volume as the platform grows.

12. Promote User Engagement and Retention

- Implement features like notifications, personalized recommendations, and user feedback mechanisms to encourage ongoing engagement and retention.

By achieving these specific objectives, the Intelligent Job Connector aims to create a transformative platform that addresses the unique needs of both job seekers and employers, ultimately revolutionizing the way individuals find employment and businesses identify qualified talent.

2.1.2 Problem statement

The predominant challenge in today's dynamic job market lies in the shortcomings of existing systems, which fail to intelligently match candidates with suitable job opportunities while providing compatibility percentages. This central issue underscores the need for a more efficient and effective approach to connecting job seekers with employers.

Traditional job search and recruitment methods demand significant investments of time and effort from job seekers, who must navigate multiple platforms, meticulously craft resumes, and grapple with the relevance of their skills to various job listings. Meanwhile, employers face the arduous task of sifting through a deluge of applications to identify the most suitable candidates.

These challenges are further exacerbated by a lack of centralization and coordination in the job market, resulting in frustration and inefficiency on both sides. Moreover, geographical constraints often limit the reach of potential candidates and employers, hindering the establishment of meaningful professional connections.

In addressing these issues, our innovative system strives to provide a comprehensive solution by intelligently recommending appropriate candidates for specific job openings, complete with compatibility percentages. By doing so, we aim to streamline the job search and recruitment processes, enhancing the experience for job seekers and employers alike.

Why Is It a Problem?

1. Inefficiency and Time-Consuming

- Existing System job search and recruitment processes can be arduous and time-consuming, causing frustration for job seekers and employers.

2. Lack of Centralization

- The absence of a centralized platform results in scattered job listings and resumes, making it difficult to identify the right opportunities and candidates.

3. Geographical Limitations

- Geographical barriers restrict the scope of potential connections, limiting opportunities for both job seekers and employers.

4. Uncertain Relevance of Skills

- Job seekers often face uncertainty regarding the applicability of their skills to specific job listings, leading to apprehension and doubt.

5. Fragmented Job Market

- The existing job market is highly fragmented, making it challenging for job seekers to discover relevant opportunities across various industries, job types, and locations.

6. Inefficient Job Matching

- Conventional job-seeking platforms often struggle to provide accurate job matching that aligns with the unique skills, experiences, and preferences of job seekers.

7. Limited Networking Opportunities

- Traditional job search platforms do not always offer robust networking and mentorship features to empower job seekers in their professional journeys.

8. Privacy and Security Concerns

- Concerns regarding data privacy and security are growing, with job seekers and employers seeking platforms that ensure the protection of their sensitive information.

9. User Experience Gaps

- User interfaces and experiences on current platforms may not meet the evolving expectations and needs of job seekers and employers.

10. Scarcity of Holistic Solutions

- The job-seeking ecosystem is missing a holistic and inclusive platform that brings together job search, professional networking, skill development, and employer branding under one comprehensive solution.

2.2 Scope

The scope of the Intelligent Job Connector encompasses the development, deployment, and maintenance of a comprehensive web-based application. It includes the following aspects:

1. Recommendation Engine Implementation

- Developing algorithms and mechanisms for job recommendations based on user profiles and preferences.

2. User Authentication and Authorization

- Secure user registration, login, and role-based access control (job seeker, employer, admin).

3. User Profile Creation

- Ability for job seeker to create detailed profiles including skills, education, work experience, and contact information.

s

4. Resume/CV make or Upload

- Option for workers to upload or make their resumes or CVs for a more comprehensive overview.

5. Job Listings Posting

- Employers can post detailed job listings with information such as job title, description, required skills, location, salary range, and application deadline.

6. Search and Filter Functionality

- Job seekers can search for jobs based on criteria like location, job type, salary range, etc.
- Advanced filtering options for more refined searches.

7. Job Application Submission

- Job seeker can apply for jobs directly through the platform, with notifications sent to employers upon receiving new applications.

8. Messaging System

- Integrated messaging system for direct communication between job seekers and employers.

10. Rating and Reviews

- Ability for Job seekers and employers to leave reviews and ratings for each other post-job completion.

11. Notifications

- Implementation of email or push notifications for important events new messages, job application updates.

12. Dashboard for Employers

- Employers have a dedicated dashboard to manage job listings, view applications, and communicate with potential hires.

13. Admin Panel

- A comprehensive panel for site administrators to manage users, review reported content, and monitor overall system health.

14. Visual Enhancements

- Ensuring an intuitive and visually appealing user interface for a seamless user experience.

15. Accessibility and Mobile Responsiveness

- Ensuring the platform is accessible to users with disabilities and functions well on various devices.

16. Real-time Messaging

- Integration of real-time messaging technology for instant communication between users.

17. Data Analytics and Reporting

- Tools for tracking user engagement, job listing performance, and other relevant metrics.

2.1.4 Significance of the Project

The significance of our project Intelligent Job Connector Systems lies in their ability to overcome the inefficiencies and complexities of traditional job hunting and recruitment processes by adding power. The most expected potential significance of our projects are:

1. Reduced Unemployment:

An Intelligent Job Connector system can help connect job seekers with employers more efficiently, reducing the time and effort required to find suitable employment. Improved Job Matching: By providing a centralized platform that connects job seekers with employers, an Intelligent Job Connector system can help improve the quality of job matching. Job seekers can search for jobs based on their skills, experience, and location, and apply for them directly through the platform. Employers can post job openings and receive applications from candidates through the platform.

2. Increased Access to Opportunities:

An Intelligent Job Connector system can help overcome geographical barriers by providing opportunities for both job seekers and employers to establish meaningful professional connections regardless of their location. The platform should also support multiple languages to cater to users from diverse backgrounds.

3. Improved Skills Development:

An Intelligent Job Connector system can provide career advice to help job seekers navigate the job market. It also gives personalized suggestion on trending job opening which help the job seeker move to trending careers making it more wanted by employers

4. Increased Efficiency:

By providing a centralized platform that connects job seekers with employers, a Intelligent Job Connector system can help overcome the inefficiencies and complexities of traditional job hunting and recruitment processes in Ethiopia. The proposed system can help connect job

seekers with employers more efficiently and provide opportunities for both parties to establish meaningful professional connections.

2.1.5 Technologies and tools will be used to build the system

The technologies used in a system like the Intelligent Job Connector System can vary based on the specific requirements, preferences of the development team, scalability needs, and the nature of the project. Here are some common technologies that could be utilized across different aspects of such a system:

1. Backend Development

- Python Programming Languages
- Django Frameworks
- MySQL Databases
- Server-side Technologies like Docker for containerization, NGINX for web server, and Kubernetes for orchestration.

2. Machine Learning and Recommendation Engine

- Machine Learning Libraries scikit-learn for building recommendation algorithms and models
- Data Processing Pandas for data manipulation and analysis.

3. Frontend Development

- Languages HTML, CSS, JavaScript (ES6+).
- Frameworks/Libraries React.js
- Styling CSS preprocessors tailwind CSS and Bootstrap for enhanced styling.
- State Management Redux, Vuex, or React Context API for managing state.

4. Documentation and Version Control

- Documentation google
- Version Control Git for version control and collaborative development.

5. Security and Authentication

- Security Measures Libraries and frameworks for implementing secure authentication and authorization, such as JSON Web Tokens (JWT), OAuth.
- Encryptions/TLS for secure communication, bcrypt for password hashing.

6. Deployment and Infrastructure

- Virtual Machine in our Local Computers
- GitHub Actions for continuous integration and deployment.

The specific choice of technologies may vary depending on factors like project requirements, scalability, performance, team familiarity, and budget constraints. The selection of these technologies should be guided by the needs of the project and the expertise of the development team.

2.3. User Classes and Characteristics

The description of the characteristics, needs, and expectations of the users who will be interacting with the system is crucial for understanding the user perspective and tailoring the system to meet their requirements.

1. Job Seekers

- Characteristics:
 - Diverse demographic backgrounds, education levels, and professional experiences.
 - Varying levels of technical proficiency.

- Needs:
 - Easy navigation and user-friendly interface for efficient job searching.
 - Accurate and personalized job recommendations based on skills and preferences.
 - Seamless profile creation and maintenance features.
- Expectations:
 - Receive timely and relevant job alerts.
 - Intuitive platform that streamlines the application process.

2. Employers:

- Characteristics:
 - Human resources professionals, hiring managers, and small business owners.
 - Varied industries and organizational sizes.
- Needs:
 - Efficient candidate search and filtering capabilities.
 - Clear and concise job posting and management tools.
 - Integration with existing HR systems if applicable.
- Expectations:
 - Access to a diverse pool of qualified candidates.
 - User-friendly employer dashboard for managing recruitment activities.

3. System Administrators:

- Characteristics:

- IT professionals responsible for system deployment and maintenance.

- Needs:

- Robust system management tools and reporting capabilities.

- Clear documentation for system configuration and troubleshooting.

- Expectations:

- Smooth deployment and ongoing system reliability.

- Efficient tools for monitoring and resolving technical issues.

4. Developers and System Architects:

- Characteristics:

- Technical experts involved in system design and implementation.

- Needs:

- Detailed technical documentation for system architecture.

- Access to development environments and APIs for integration.

- Expectations:

- Clear coding standards and guidelines.

- Collaboration tools for effective communication during development.

5. Security Analysts:

- Characteristics:

- Professionals focused on ensuring system security and data protection.

- Needs:

- Clear security requirements and guidelines.

- Access to tools for monitoring and responding to security incidents.

- Expectations:

- Implementation of robust security measures.

- Regular security audits and updates.

6. User Interface Designers:

- Characteristics:

- Design professionals responsible for creating an intuitive user interface.

- Needs:

- Design specifications and guidelines for creating a visually appealing interface.

- Collaboration with developers for seamless integration of design elements.

- Expectations:

- Positive user feedback on the platform's user interface.

7. Testing Teams:

- Characteristics:

- Quality assurance professionals responsible for system testing.

- Needs:

- Test cases and scenarios covering all functional and non-functional requirements.

- Access to testing environments that replicate the production system.

- Expectations:

- Identification and resolution of all software bugs and issues.

8. Project Managers:

- Characteristics:
 - Professionals overseeing the development and deployment of the system.
- Needs:
 - Regular updates on project progress and potential roadblocks.
 - Collaboration tools for effective communication with various teams.
- Expectations:
 - Timely delivery of the system within the specified scope and quality.

9. Stakeholders and Decision Makers:

- Characteristics:
 - Executives and key individuals within the organization.
- Needs:
 - Periodic updates on project status and alignment with organizational goals.
 - Clear insights into the system's impact on business objectives.
- Expectations:
 - Successful implementation of the system to achieve strategic goals.

Understanding the diverse characteristics, needs, and expectations of these user groups is essential for creating a system that caters to the specific requirements of each stakeholder. This information serves as a foundation for developing user stories, scenarios, and acceptance criteria that guide the development and testing processes.

2.4 Business Rules

1. Matchmaking Algorithm Rule

- The system shall employ algorithms analyzing job requirements and candidate profiles (including skills, experience, education, location, and preferences) to facilitate suitable job matches.

2. User Preference and Customization Rule

- Users (job seekers and employers) shall be empowered to set personalized preferences, priorities, and filters for job searches and candidate selections, including options for customizable notifications and recommended matches.

3. Compliance and Regulatory Rule

- The platform shall adhere to legal and compliance standards pertaining to job postings, candidate data privacy, equal employment opportunities, and local labor laws.

4. Scalability and Performance Rule

- The platform shall establish scalable guidelines to accommodate increased user traffic and data volume while optimizing performance for seamless user experiences.

5. Feedback and Rating Mechanism Rule

- Feedback and rating mechanisms shall be in place for both employers and job seekers, enabling collection post-interactions or job placements to improve matching accuracy and user satisfaction.

6. Matching Accuracy Improvement Rule

- Continuous analysis and refinement of algorithms shall be conducted to enhance the accuracy of job matches based on user feedback and system-generated data, possibly integrating machine learning.

7. Communication and Notification Rule

- The system shall define timely and relevant communication protocols between employers and job seekers regarding application statuses, interview schedules providing users with customizable notification preferences.

8. Security and Data Protection Rule

- The platform shall employ robust security measures encompassing encryption, access control, and other protocols to safeguard sensitive user data and communications.

9. Feedback Loop and Continuous Improvement Rule

- A continuous feedback loop shall be established to gather insights from user interactions and system performance, enabling regular assessment and refinement of business rules based on data analytics and user behavior to enhance platform effectiveness.

2.5 Operating Environment

The operating environment for the Intelligent Job Recommender System encompasses the hardware, software, network, and external factors that influence the system's performance and functionality. A comprehensive understanding of the operating environment is crucial for system design, development, and deployment. Here is a breakdown of the key components of the operating environment:

2.5.1 Hardware Requirements:

1. Server Infrastructure:

- The system will require dedicated servers to host the application, database, and other relevant components.
- Server specifications should consider factors such as processing power, memory, and storage to handle concurrent user requests and data storage requirements.

2. Client Devices:

- Job seekers, employers, and other users will access the system from various client devices, including desktop computers, laptops, tablets, and smartphones.
- Ensures compatibility with a range of devices and screen sizes for a responsive user experience.

3. Network Infrastructure:

- Reliable network connectivity is essential for communication between clients and the system servers.
- The system should be designed to handle both high and low bandwidth scenarios to accommodate users with different internet connection speeds.

2.5.2 Software Requirements:

4. Operating System:

- Specify the compatible operating systems for the server environment Windows Server.

5. Web Server:

- Choose a web server Apache for hosting the web application.

6. Database Management System (DBMS):

- Select a reliable DBMS MySQL to store and manage user profiles, job listings, and other relevant data.

7. Programming Languages and Frameworks:

- Specify the programming languages Python and framework Django used for system development.
- Ensures compatibility with the chosen web server and database.

8. Security Software:

- Implement security software and protocols to protect the system from potential threats.
- Uses encryption protocols HTTPS for secure data transmission.

9. Compliance Requirements:

- Ensure compliance with relevant industry standards, data protection regulations, and any legal requirements.
- Implements measures to protect user privacy and sensitive information.

10. Scalability and Performance:

- Design the system to be scalable, allowing for an increase in the number of users and data volume.
- Implements performance monitoring tools to identify and address potential bottlenecks.

11. Availability and Reliability:

- Implement measures load balancing and redundancy to ensure high availability and reliability of the system.

12. User Authentication and Authorization:

- Implement secure user authentication mechanisms
- Defines user roles and permissions to control access to different system features.

Chapter Three

System Requirements

3.1. Functional Requirements

3.1.1 User Management:

- User registration and login: Users should be able to create profiles and provide information about their skills, experience, education, and career goals.
- Profile editing and management: Users should be able to update and manage their profiles as their skills and career aspirations evolve.
- Search and filtering: Users should be able to search for jobs based on various criteria, such as keywords, location, industry, and salary range.
- Job recommendations: The system should recommend relevant jobs to users based on their profile information and job search criteria.
- Application management: Users should be able to view and manage their job applications.
- Saved searches and jobs: Users should be able to save their search criteria and jobs for future reference.

3.1.2 Job Posting and Management:

- Employers should be able to post job openings with detailed descriptions and requirements.
- Employers should be able to manage their job postings, including reviewing applications and filtering candidates.

3.1.3 Matching and Recommendation System:

- The system should accurately match job seekers with relevant job opportunities based on their skills, experience, and education.
- The system should consider both hard and soft skills, as well as transferable skills, in its matching process.
- The system should be able to incorporate user feedback and learn from user behavior to improve its recommendations over time.

3.1.4 Data Management:

- The system should be able to store and manage large amounts of data, including user profiles, job postings, skill taxonomies, and user activity data.
- The system should be able to process data in real-time to provide accurate and timely recommendations.
- The system should ensure data security and privacy through encryption and access control measures.

3.1.5 Additional Requirements:

- The system should be user-friendly and accessible to users of all technical backgrounds.
- The system should be responsive and perform well on all devices, including desktops, tablets, and smartphones.
- The system should be able to handle a large number of users and job postings without performance degradation.

3.2. Use Cases

3.2.1. Use Case Diagram

A use case describes a sequence of actions and interactions between users and the system to accomplish a particular goal. The following are our use case diagrams.

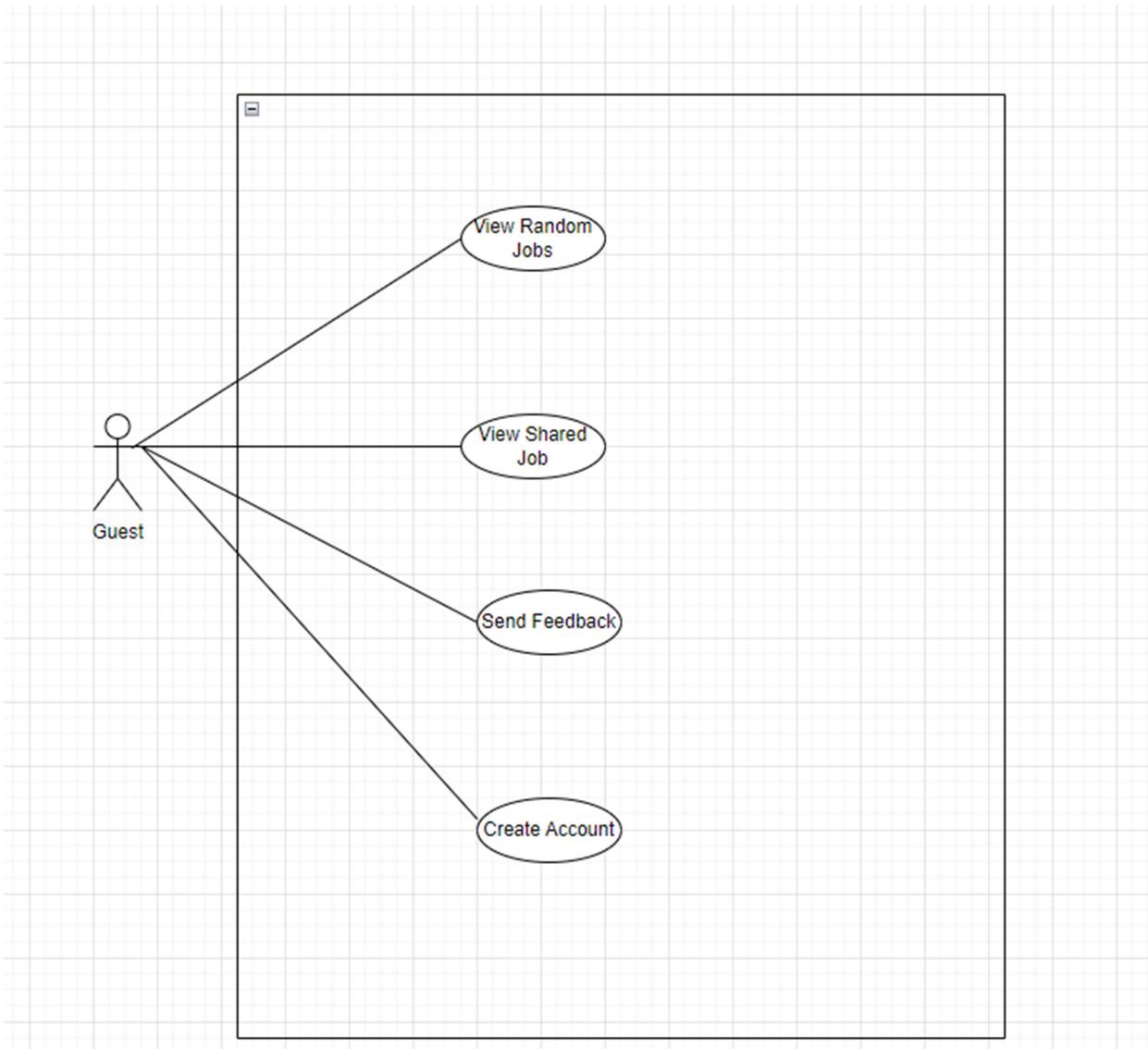


Figure 1 use case for Guest

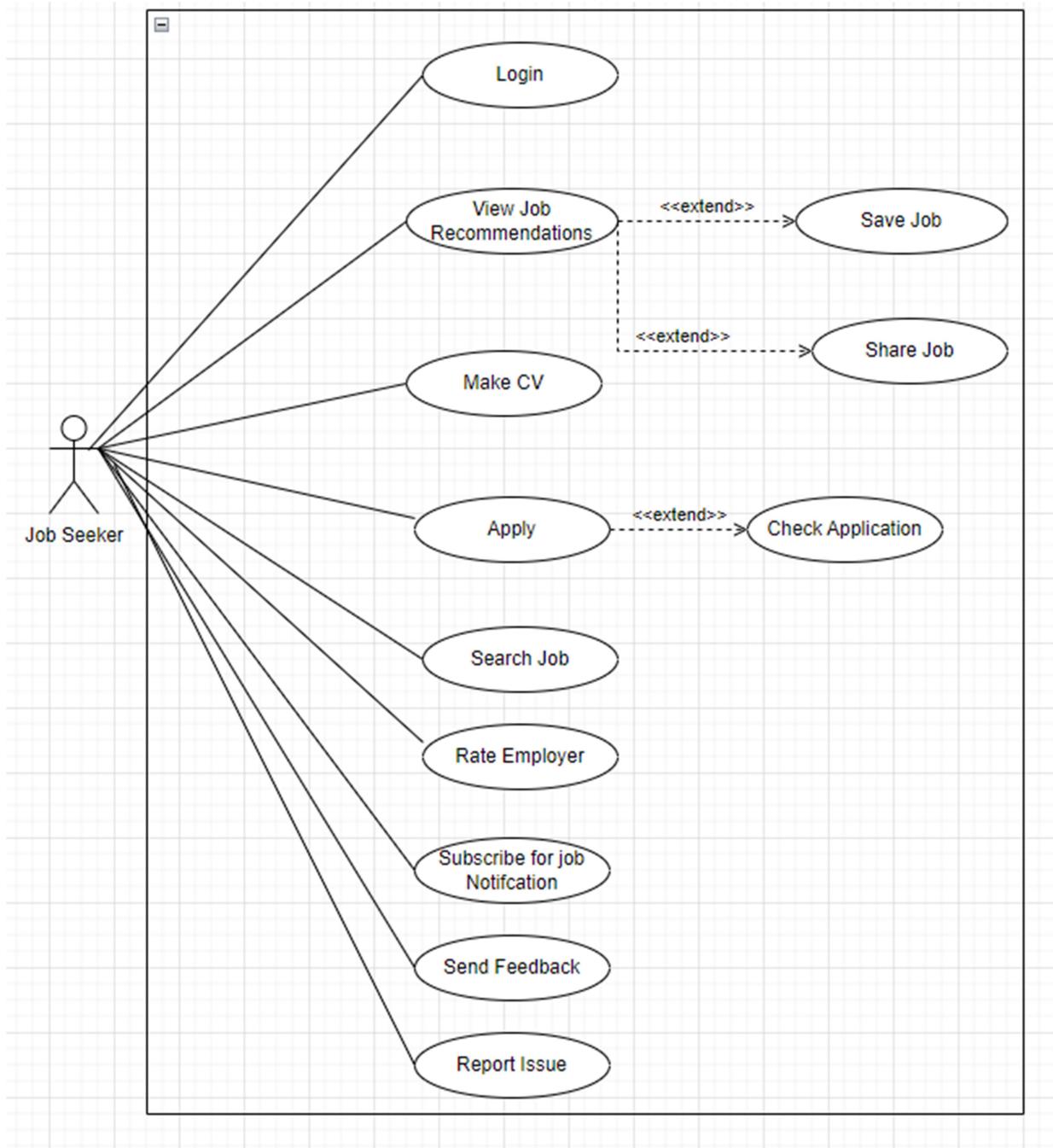


Figure 2 use case for job seeker

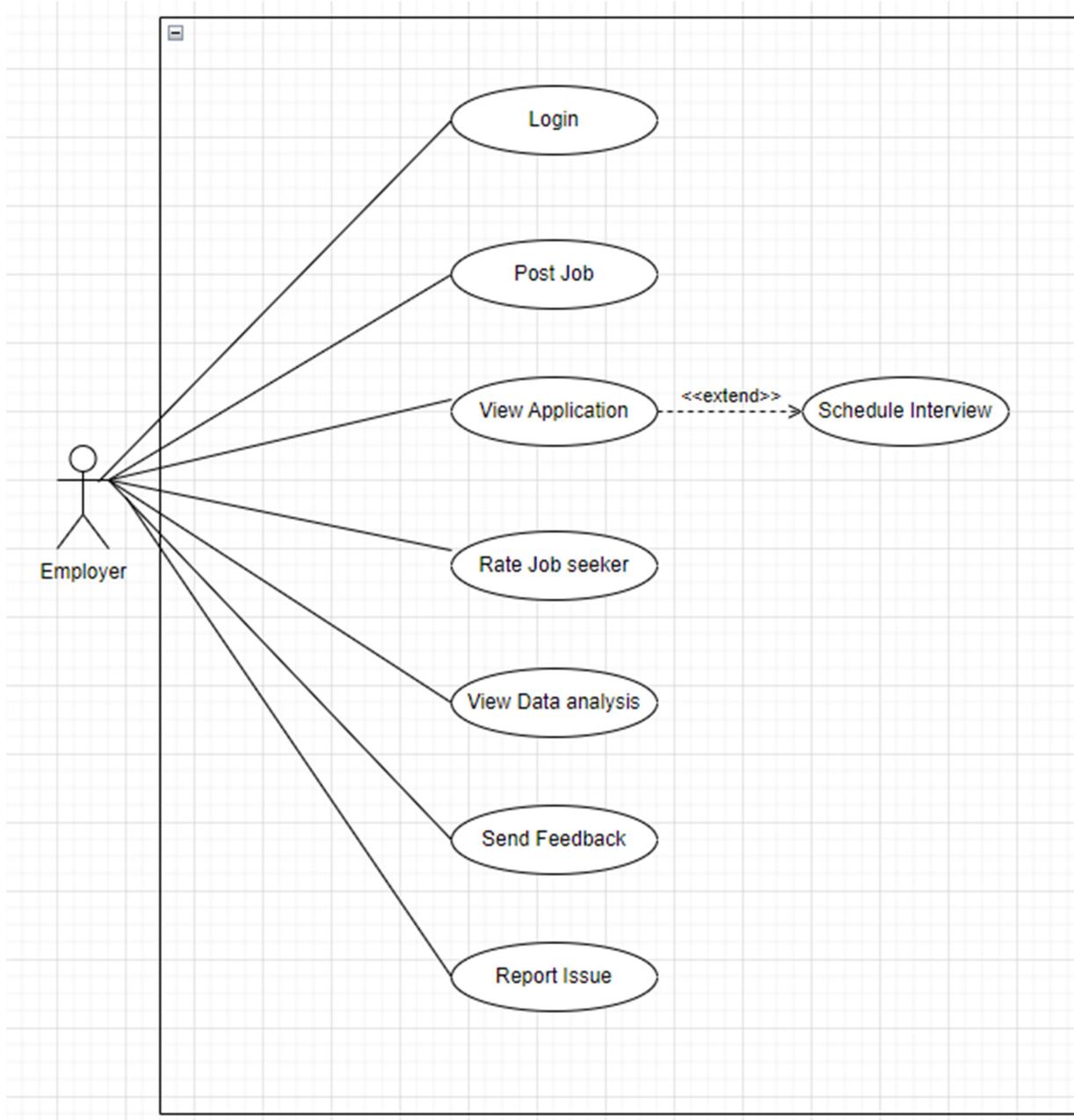


Figure 3 use case for Employer

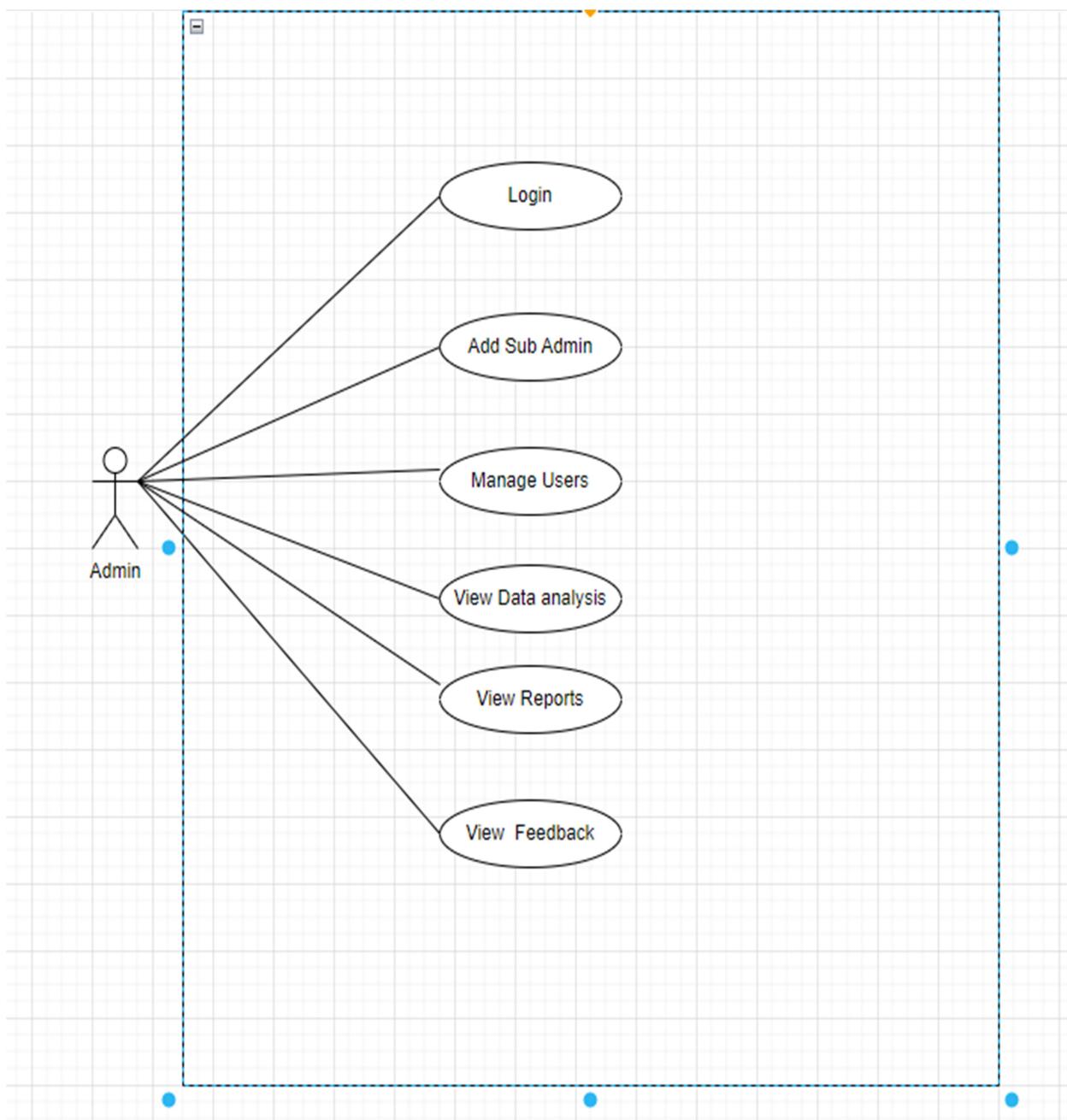


Figure 4 use case for Admin

3.2.1. Use Case Description

In the Intelligent Job Connector system, there are three main actors: job seekers, employers, and admins. Here's a description of each actor and their primary actions within the system:

1. Job Seeker

- **Description** Job seekers are individuals looking for employment opportunities. They create profiles on the platform to showcase their skills, experience, education, and other relevant information.

- Main Actions

- **Create Profile** Job seekers can create comprehensive profiles detailing their qualifications, work experience, education, certifications, contact information, and a resume upload.

- **Search and Apply for Jobs** They can search for job listings based on various criteria like location, job type, salary, and apply to positions that match their skills and interests.

- **Communication Interact with employers** through messaging or other communication channels available on the platform.

- **Receive Notifications** Receive updates about job application statuses, messages from employers, recommended job openings based on their profile, etc.

- **Review and Edit Profile** Update their profiles, including adding new skills, experiences, or modifying existing information.

- **Receive Job Recommendations:** View Job Posting Details, Search job

- **Make Cv**

2. Employer:

- Description: Employers are entities or companies looking to hire employees for job positions they've posted on the platform.

- Main Actions:

- **Post Job Listings:** Employers can create detailed job postings specifying job title, job description, required skills, location, salary range, application deadline, and other relevant information.

- **Review Applications:** Access and review job applications submitted by job seekers for their posted positions.

- **Communicate with Job Seekers:** Contact job seekers directly through the platform's messaging system to schedule interviews, discuss job details, or request further information.

- **Manage Job Listings:** Edit, update, or remove job postings as needed.

- **View Job Seeker Profiles:** Access and view profiles of job seekers who have applied for their job listings.

3. Admin:

- Description:

Admins oversee and manage the entire system, ensuring its smooth operation, security, and user satisfaction.

- Main Actions:

- **User Management:** Manage user accounts, including verification, approval, suspension, or banning of accounts violating platform policies.

- **Content Moderation:** Monitor and moderate job postings, profiles, and messages to ensure they adhere to platform guidelines and standards.

- **System Maintenance:** Ensure the system is running smoothly, address technical issues, perform backups, and handle any server-side or database-related tasks.
- **Resolve Disputes:** Intervene in case of disputes between job seekers and employers, or any issues reported by users.
- **Analytics and Reports:** Generate reports on user activities, job listing trends, application stats, etc., to gain insights and improve the platform's performance.

4. Job Recommendations:

- **Profile Analysis:** The system analyzes a job seeker's profile, including their skills, work experience, education, location preferences, industry interests, and any other relevant information provided.
- **Algorithmic Processing:** Utilizing algorithms, the system matches the job seeker's profile attributes with the characteristics of available job listings within the system's database.
- **Recommendation Generation:** Based on the profile analysis and algorithmic matching, the system generates a list of job recommendations that closely align with the job seeker's qualifications and preferences.
- **Presentation to User:** These recommendations are then presented to the job seeker through their dashboard or as notifications, allowing them to view and consider these suggested job opportunities.

Main Functions of Job Recommendations in the System:

- **Enhanced User Experience:** Job recommendations improve the overall user experience by presenting relevant job opportunities tailored to the job seeker's profile, reducing the time spent searching for suitable positions.

- **Increased Job Matching Accuracy:** By utilizing algorithms and profile analysis, the system aims to provide more accurate and personalized job suggestions, increasing the likelihood of matching the right job seekers with the right positions.
- **Efficiency in Job Searching:** Job recommendations streamline the job search process, offering suggestions that closely fit the job seeker's qualifications and preferences, thereby enhancing the efficiency of the job-seeking process.
- **Promotion of Active Engagement:** Providing tailored job recommendations encourages job seekers to remain active on the platform, engaging with suggested opportunities and potentially applying to relevant positions.
- **Continuous Improvement:** The system may track user interactions with recommended jobs (e.g., clicks, applications), using this data to refine and improve future job recommendations, creating a feedback loop to enhance the recommendation engine's accuracy over time.

Use Case in the System:

- Use Case Name: "Receive Job Recommendations"
- Actor: Job Seeker
- Brief Description: The job seeker logs into their account and is presented with a set of recommended job listings based on their profile and preferences.
- Preconditions: Job seeker has created a profile with relevant details.
- Post conditions: Job seeker views recommended job listings and can choose to explore further or apply to these suggested positions.
- Flow of Events:
 1. Job seeker logs into the system.
 2. The system analyzes the job seeker's profile data.

3. Based on this analysis, the system generates a list of job recommendations.
4. The job seeker views these recommendations on their dashboard or through notifications.
5. The job seeker can explore the recommended job listings in more detail or take action apply, save, dismiss based on their preferences.

3.3. Data Requirements

3.3.1. Overview

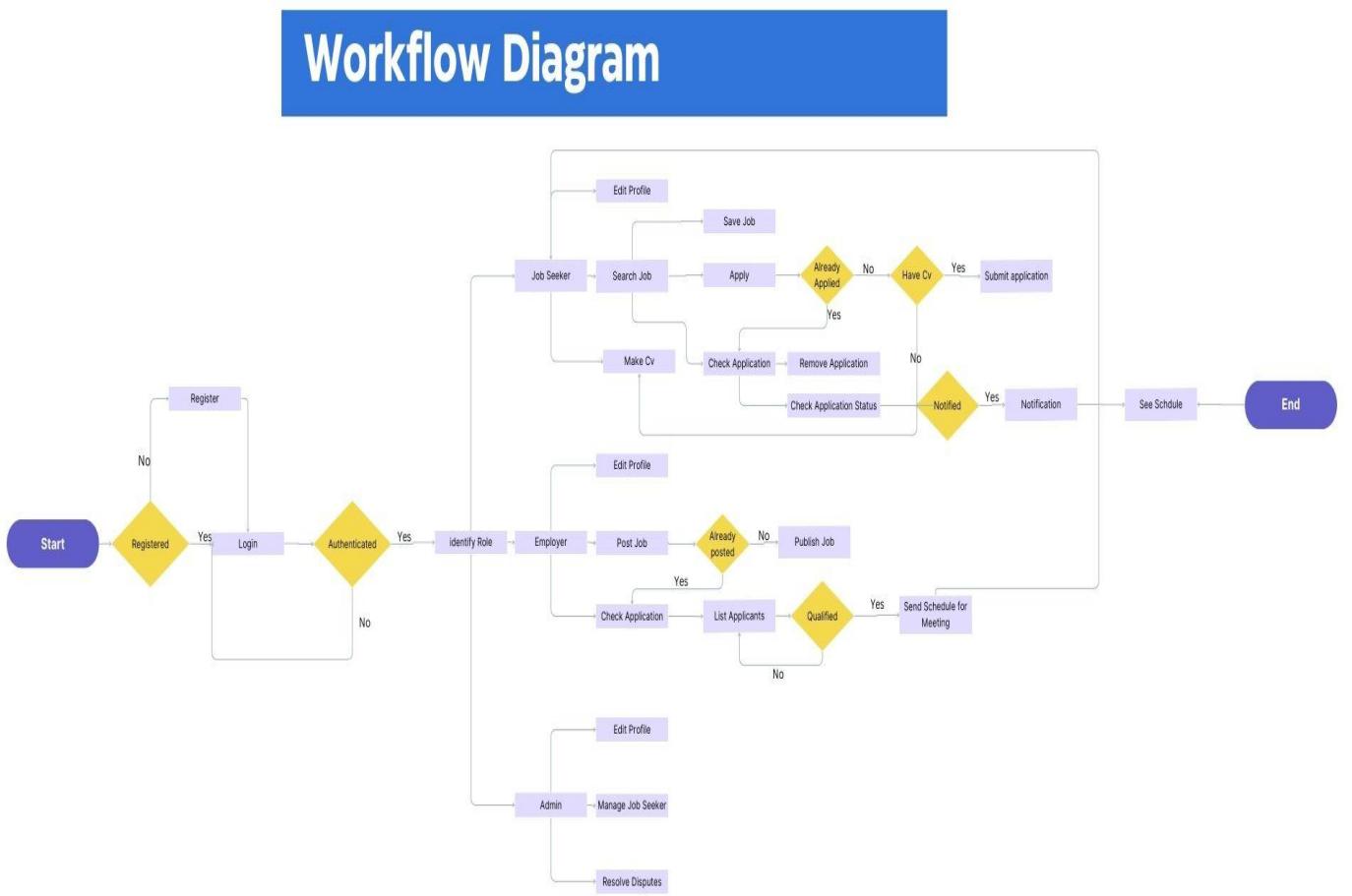


Figure 5 work flow diagram

3.3.2. Entity, Attribute and Relationships

Entities, Attributes, and Relationships you can expect in our Intelligent Job Connector system.

Job Seeker

Attributes: UserID (unique identifier), Name, Email, Password, Phone, Address, Profile Picture,Age

Relationships: Users can have relationships with other entities such as Job Applications and message with employers. They can be managed by system admin, apply for jobs.

Admin:

Attributes: AdminID (unique identifier), Name, Email, Password,Role

Relationship: Admin can manage employers and seekers.

Message:

Attributes: Date ,Content, Subject,ReceivedID,SenderID,MessageID.

Relationship: Messages can be sent to seekers and employers.

Employers:

Attributes: CompanyName,Phone,EmployerID,Email Address

Relationship: Employers can send messages and post jobs. And also can be managed by system admin and check for the applied jobs.

Application:

Attributes: Coverletter, ApplicationID, DateOfApplication, Status

Relationship: Application can be checked by both employers and seekers

Job:

Attributes: JobTitle, JobListingID, JobDescription, Salary, RequiredSkills, Experience

Relationship: Job can be searched by job seeker and can be posted by employers and can have type

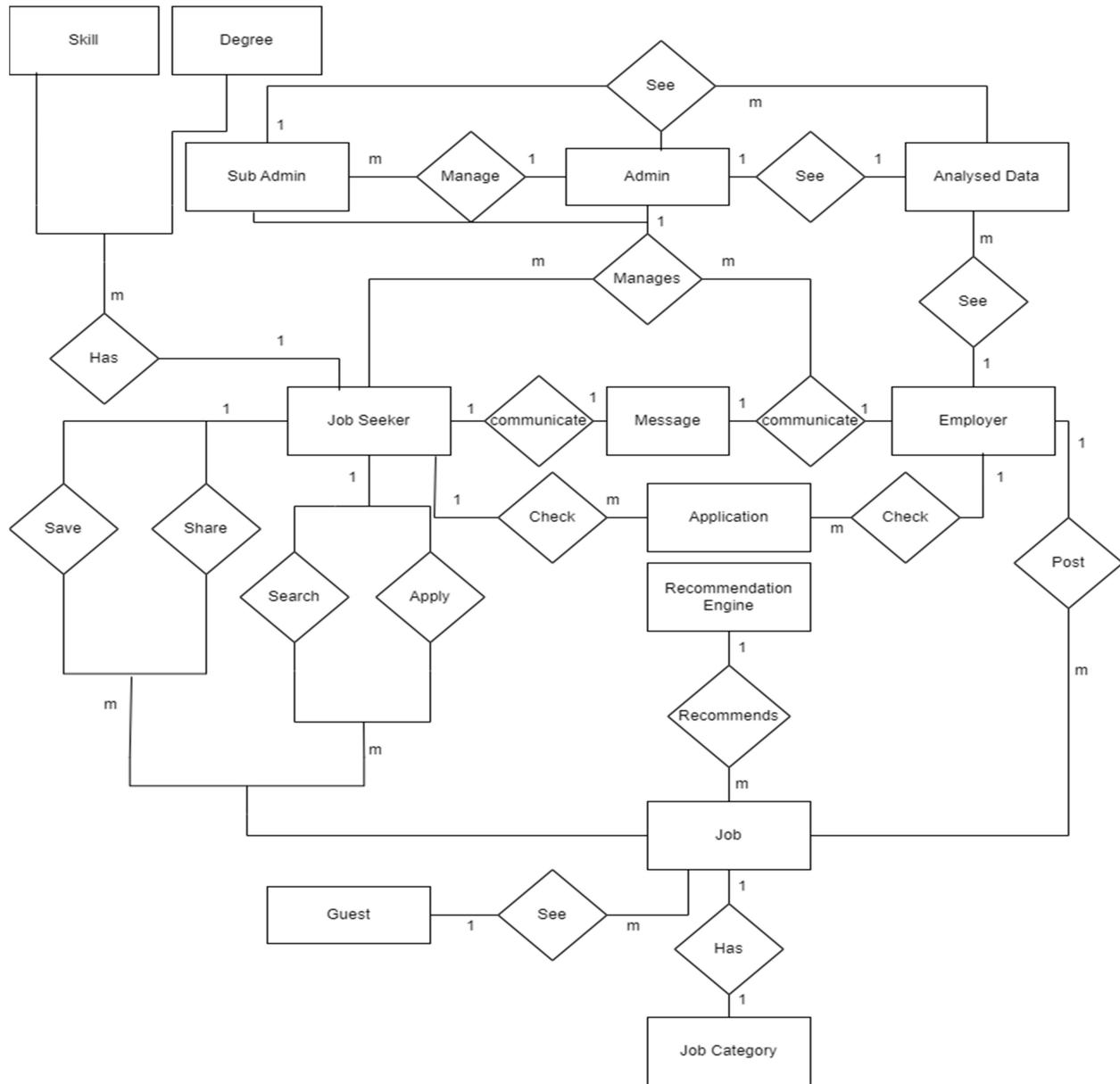
Job Type

Attributes: JobName, Role, JobID, ..

Relationship: Job Type has a type of some kind of job.

3.3.3. Entity-Relationship Diagram

ER Diagram



3.3.4. Data Validation Rules

To ensure the accuracy and integrity of the information provided our Intelligent Job Connector system is expected to implement a comprehensive set of data validation rules. These rules play a crucial role in ensuring that the data entered by users is of high quality and reliable.

By enforcing these data validation rules, we can identify and address any inconsistencies, errors, or missing information in the submitted job applications. This helps prevent the occurrence of incomplete or inaccurate data, which can lead to misunderstandings or inefficiencies in the hiring process. Our data validation rules cover various aspects of the job application, including required fields, field length limits, email and phone number formats, date validation, uniqueness of certain fields, range validation for numeric input, file upload formats, and cross-field validation.

By validating required fields, we ensure that all necessary information is provided by the user, minimizing the chances of incomplete applications.

The field length limits help maintain consistency and prevent excessively long or short entries that may distort the data.

Validating email and phone number formats ensures that the provided contact information is accurate and can be easily reached. Similarly, date validation ensures that the specified dates are entered correctly, reducing any confusion or discrepancies.

To maintain uniqueness, we validate certain fields to ensure that the values entered are not already in use by another user. This prevents duplicate entries and ensures that each user has a unique identifier within the system.

Range validation helps maintain the integrity of numeric input, such as years of experience or salary expectations. By enforcing predefined minimum and maximum values, we ensure that the entered data falls within acceptable ranges.

The system allows file uploads, we validate the file format and size to ensure compatibility and prevent any potential issues during the application review process.

Lastly, cross-field validations rules help maintain logical consistency between related fields. For example, if a job application includes start and end dates, we ensure that the end date is not earlier than the start date.

3.4. Non-functional Requirements

3.4.1 Performance Requirements

3.4.1.1 Response Time

- **Recommendation generation:** The system should generate personalized job recommendations for users quickly, ideally within a few seconds.
- **Search:** The system should allow users to search for jobs based on specific criteria and return relevant results.
- **Application submission:** The system should process job applications submitted by users efficiently and inform them of the up to date status of their application.

3.4.1.2 Scalability

- The system should be able to handle a large number of users and jobs without performance degradation and should serve smoothly.
- The system should be able to scale horizontally to accommodate increasing demands.

3.4.1.3 Accuracy

- The system should recommend jobs that are relevant to the user's skills, experience, and preferences.
- The system should learn and adapt to user behavior to improve the accuracy of its recommendations over time.

3.4.1.4 Availability

- The system should be highly available and accessible to users 24/7.
- The system should have redundancy and disaster recovery measures in place to ensure uptime.

3.4.1.5 Security

- The system should protect user data, including resumes, applications, and personal information.
- The system should have robust security measures in place to prevent unauthorized access and data breaches.

3.4.2 Usability Requirements

3.4.2.1 User Interface:

- **Simple and clean:** The user interface should be clean and uncluttered, with a clear visual hierarchy.
- **Easy to navigate:** Users should be able to easily find the information they are looking for, with intuitive menus and navigation buttons.
- **Responsive design:** The user interface should be responsive and adapt to different screen sizes and devices.

3.4.2.2 User Interaction:

- **Minimal input:** The system should require minimal input from users, focusing on pre-populated information.
- **Clear instructions:** The system should provide clear and concise instructions for users, guiding them through the process of finding jobs and submitting applications.
- **Interactive elements:** The system should incorporate interactive elements to engage users, such as interactive filters, job descriptions.
- **Feedback:** The system should provide users with immediate feedback on their actions, such as confirming successful submissions and highlighting errors.

3.4.2.3 Information Architecture:

- **Logical organization:** Information should be organized in a logical and hierarchical manner, making it easy for users to find relevant content.
- **Clear labels:** All labels and buttons should be clear and concise, using plain language that is easy to understand.
- **Search ability:** The system should provide users with a powerful search function to find specific jobs.
- **Help and support:** The system should provide users with access to help and support resources, such as FAQs, and contact information for customer support.

3.4.2.4 Testing and User Feedback:

- The system should be tested extensively with users to identify and address any usability issues.
- User feedback should be incorporated into the design and development process to ensure that the system meets the needs of its users.

3.4.2.5 Security Requirements

An intelligent job recommendation system handles sensitive user data, including personal information, job applications, and resumes. Therefore, it is crucial to implement robust security measures to protect this data from unauthorized access, data breaches, and other security threats. Here are some key security requirements for such a system:

3.4.2.5.1 Authentication and Authorization:

- **Strong authentication methods:** The system should use strong authentication methods
- **Authorization controls:** The system should enforce strict authorization controls to ensure that users only have access to the data and functionalities they are authorized to use.
- **Role-based access control:** Implement role-based access control (RBAC) to restrict access to sensitive information based on user roles and permissions.
- **Least privilege principle:** Adhere to the principle of least privilege, granting users only the minimum level of access necessary to perform their tasks.

3.4.2.5.2 Data Security:

- **Data access control:** Implement data access controls to restrict access to sensitive data based on the principle of least privilege.
- **Data backup and recovery:** Establish a robust data backup and recovery strategy to ensure data availability in case of system failures or security incidents.
- **Data retention and deletion:** Define clear policies for data retention and deletion to comply with relevant data privacy regulations.

3.4.2.5.3 Application Security:

- **Secure coding practices:** Follow secure coding practices to minimize the risk of software vulnerabilities.
- **Input validation and sanitization:** Validate and sanitize user input to prevent malicious attacks such as SQL injection and cross-site scripting.
- **Session management:** Implement secure session management practices to prevent session hijacking and other session-related attacks.

3.4.2.5.4 Operational Security:

- Logging and monitoring: Implement comprehensive logging and monitoring systems to detect and investigate suspicious activity.
- Incident response: Develop and test a comprehensive incident response plan to respond effectively to security incidents.
- Security awareness and training: Provide regular security awareness and training to all users and system administrators.

3.4.2.5.5 Compliance with Data Privacy Regulations:

- Implement data privacy controls to protect user privacy and comply with regulatory requirements.
- Provide users with clear and concise privacy notices and policies outlining how their data is collected, used, and shared.

3.4.2.6 Software Quality Attributes

3.4.2.6.1 Reliability:

- High uptime: The system should be highly available with minimal downtime to ensure continuous service for users.
- Fault tolerance: The system should be able to recover gracefully from failures and continue operating without significant data loss.
- Data accuracy: The system should ensure the accuracy and integrity of data to provide reliable job recommendations and search results.

3.4.2.6.2 Performance:

- Responsiveness: The system should respond quickly to user requests and provide recommendations and search results.
- Scalability: The system should be able to handle a large number of users and jobs efficiently without performance degradation.
- Resource efficiency: The system should use resources efficiently and avoid unnecessary processing or data consumption.

3.4.2.6.3 Usability:

- User-friendly interface: The user interface should be intuitive and easy to navigate for users of all technical abilities.

3.4.2.6.4 Security:

- Data security: The system should ensure the confidentiality, integrity, and availability of user data.
- Authentication and authorization: Implement robust authentication and authorization mechanisms to prevent unauthorized access.

- Vulnerability management: Regularly scan and patch the system for vulnerabilities to minimize security risks.

3.4.2.6.5 Maintainability:

- Modular design: The system should be designed with modularity in mind to facilitate future maintenance and updates.
- Clean code: The code should be well-documented, easy to understand, and maintain.
- Testability: The system should be designed to be easily testable to ensure its functionality and quality.

3.4.2.6.6 Portability:

- The system should be portable across different operating systems and platforms to ensure its compatibility with a wide range of user devices.
- The system should be written in a language that is platform-independent to facilitate future migration or deployment on different platforms.

Additional Quality Attributes:

- Interoperability: The system should be able to interoperate with other systems and applications, such as job boards and applicant tracking systems.
- Extensibility: The system should be designed to be extensible to accommodate future features and functionalities.
- Internationalization: The system should be able to support multiple languages and cultural norms to cater to a diverse user base.

Appendix

1. SRS document outline
2. **Publisher: IEEE**,830-1998 - IEEE Recommended Practice for Software Requirements Specifications. Available: <https://ieeexplore.ieee.org/document/720574>
3. HaHu Organization:"HaHu Jobs | Home", Available: <https://hahu.jobs/>
4. ethiojobs:"New Jobs in Ethiopia 2023,Vacancy", Available: <https://www.ethiojobs.net/>
5. indeed: "Job Search | Indeed", Available: <https://www.indeed.com/>



Figure 7 group members