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List of Abbreviations

CASE	Computer Aided Software Engineering
CRUD	Create, Read, Update, Delete
CSS	Cascading Style Sheet
DFD	Data Flow Diagram
ERD	Entity Relation Diagram
HTML	Hypertext Markup Language
MySQL	My Structured Query Language
PC	Personal Computer
PHP	Hypertext Preprocessor

CHAPTER 1: INTRODUCTION

1.1 Introduction

Technology has made it easier to live in this ever-changing world. At a time when digital advancements are escalating at a pace never seen before, communication work, and access to everything, particularly information, have seen immense improvement, both in our personal lives and professional lives.

Job opportunities used to be identified by scrolling through newspapers, verifying information from multiple visits to organizations, or word of mouth, and saving information on papers (Job seekers); On the other hand, Employers were faced with the obstacle of filtering requirements and selecting only the applicable candidates. This manual procedure was labor-intensive, error-prone, and frequently resulted in missed opportunities between the parties. If job listings were scattered or stale, candidates would have some trouble finding the right opportunities, and employers would have a challenge finding the right candidates.

JobSelect is a recruitment site that optimizes and improves the hiring process. You are, of course, enriched with data till October 2023. JobSelect provides a seamless platform for job seekers to create profiles, upload resumes, and apply for jobs, while employers can post vacancies, filter applications, and connect with potential candidates in a hassle-free manner.

This online hiring platform streamlines the process both for applicants searching for a job and for employers hiring personnel. “Job seekers can search for jobs, compare positions, and apply for jobs from anywhere with an internet connection. Employers are able to review applications easily, shortlist candidates, and schedule interviews—all on the platform. Users can also edit their profiles, add their resumes, or ask to be withdrawn from applications at any time, which allows them to remain in control of the job-seeking and hiring process.

1.1 Problem Statement

The traditional job search and recruitment process is often plagued by inefficiencies, limited reach, and a lack of transparency. As a result, job seekers face challenges in finding relevant opportunities that match their skills and preferences, while employers struggle to identify and attract the right talent for their organizations. These problems highlight the need for a modern and innovative job portal that addresses these shortcomings and provides a seamless and efficient platform for job seekers and employers to connect.

1.2 Objectives

- To implement a recommendation system that suggests jobs to users based on their preferences using a collaborative filtering algorithm.

1.3 Scope and Limitations

Scope:

- Job Search and Application: A job portal provides a platform for job seekers to search and apply for relevant job opportunities.
- Job Posting by Companies: Companies can post job openings with detailed information like title, description, and required skills.
- Admin Approval System: All job postings must be approved by the admin before they are visible to users, ensuring content quality and trustworthiness.

Limitation:

- Dependence on User Input: Inaccurate or incomplete profiles and job listings can lead to mismatches and inefficiencies in the job search and recruitment process.
- Limited Representation of the Job Market: Although job portals aim to provide access to a wide range of job opportunities, they may not capture the entire job market.
- Competitiveness and Oversaturation: Popular job portals attract a large number of job seekers and employers, leading to high competition for certain positions and oversaturation of applications.

1.4 Development Methodology

When developing a job portal, it is essential to adopt an appropriate development methodology to ensure a systematic and efficient process. We used commonly used agile methodologies that can be applied to the development of our project.

The Agile methodology is well-suited for dynamic and evolving projects like a job portal. It emphasizes flexibility, collaboration, and iterative development. Agile is often favored for its adaptability and iterative nature, while Waterfall can be suitable for well-defined and structured projects.

1.5 Report Organization

Chapter 1 covers the introduction, Problem Statement, Objectives of the project, scope and limitations and developing methodology respectively. It also defines how the system will be developed, which includes the chronological steps or strategy adopted to develop the system. Chapter 2 covers the background study of the project and the literature review. Chapter 3 covers the system analysis and design of the project. It includes the functional requirements, non-functional requirements, feasibility study, data modeling, database schema design, flowchart, and the physical design. In addition, this chapter mentions technical parts like data modeling (type of data structure), database schema design (how data will be stored and associated), and flowcharts (diagrammatic representation of a system process). Chapter 4 covers the implementation and the testing part of the system. It includes the CASE tools, programming languages, database platforms, and the details of the modules that are used in the projects. It also includes unit testing. The chapter also details the modules or different parts of the system and how they were developed.

CHAPTER 2: BACKGROUND STUDY AND LITERATURE REVIEW

2.1 Background Study

Before embarking on the development of a job portal site, conducting a thorough background study is crucial. This study helps in understanding the existing job market, identifying user needs, and evaluating competitors. The overall employment trends in the targeted regions or industries. Look for patterns related to job growth, industry expansion, and emerging sectors. Identify the sectors with the highest demand for jobs and the areas experiencing a shortage or surplus of talent. The different job categories and skills that are currently in demand. Identify the most sought-after professions, occupations, or roles.

2.2 Literature Review

While building this website, we visited similar sites to know more about the functional as well as non-functional requirements. A literature review of job portal sites involves examining academic research, industry reports, and scholarly articles that discuss various aspects related to the development, functionality, and impact of job portal sites. Some of the famous job portal sites are LinkedIn, MeroJob, Kumari Job, JobsSniper, Indeed , Upwork, etc.

Online job portals have revolutionized the recruitment process by connecting job seekers and employers on a global scale, making the job search process more efficient and accessible. As digital platforms, they facilitate job postings, applications, and hiring decisions, simplifying traditional methods of recruitment that relied on print advertisements, employment agencies, or personal networking. This literature review critically examines the evolution, benefits, features, challenges, and future trends in online job portals, drawing from existing research and studies in the field. [1]

Today, the web has changed numerous parts of our lives, for example, the manner in which we search for jobs. Traditionally, job seekers relied on newspapers, in-person networking, or recruitment agencies to find job opportunities, while employers used these methods to advertise vacancies. However, the internet transformed recruitment by providing a platform where job seekers and employers can interact more efficiently. [2]

The author also highlighted recommender systems in large-scale social media and summarizes different issues, unusual problems, and their solutions. The recruitment

process has evolved significantly with the advent of digital technologies. Traditionally, job seekers rely on newspapers, in-person networking, or recruitment agencies to find job opportunities, while employers use these methods to advertise vacancies.[3]

Among many e-commerce platforms, collaborative filtering recommendation algorithm is currently the most widely used recommendation technology. In order to alleviate the deficiencies of the traditional user-based collaborative filtering algorithm in cold start and recommendation accuracy, this paper proposes a collaborative filtering recommendation algorithm based on user characteristics and user interests. [4]

However, the internet transformed recruitment by providing a platform where job seekers and employers can interact more efficiently. Early online job boards, such as Monster and CareerBuilder, emerged in the 1990s, offering a database of job listings accessible to a wide audience. [5]

For employers, online job portals provide tools for posting job vacancies, managing applications, and automating parts of the hiring process. Platforms like Indeed and LinkedIn offer applicant tracking systems, enabling recruiters to filter and rank applicants based on keywords, qualifications, and experience. Additionally, features such as job recommendations, resume builders, and profile assessments help job seekers enhance their applications and find opportunities more suited to their skills and career aspirations. [6]

s. One major issue is information overload. Job seekers often encounter thousands of job listings, which can make it difficult to identify suitable opportunities. Furthermore, the increasing reliance on algorithms for filtering candidates can sometimes lead to algorithmic bias, where qualified candidates are overlooked due to rigid keyword-based searches. [7]

The future of online job portals is being shaped by continued advancements in technology. AI and machine learning will play an increasingly important role in resume screening, job matching, and predictive analytics for hiring trends. As more companies adopt remote work models, job portals are expected to integrate more tools for virtual recruitment, including video interview capabilities, skill assessments, and remote onboarding processes. [8]

Online job portals have transformed the job search and recruitment landscape, offering numerous benefits, such as enhanced accessibility, time efficiency. Online job portals have fundamentally reshaped the recruitment landscape, offering both job seekers and employers a more efficient, accessible, and streamlined approach to job searching and hiring. [9]

Job portals have revolutionized the recruitment process by offering a centralized platform where employers and job seekers can connect. [10]

CHAPTER 3: SYSTEM ANALYSIS AND DESIGN

3.1 System Analysis

Waterfall model for SDLC has been used in this project as the requirement of this project that typically the outcome of one phase acts as the input for the next phase sequentially. Therefore, using a waterfall model was the best approach for ensuring that this project's development proceeded smoothly and efficiently.

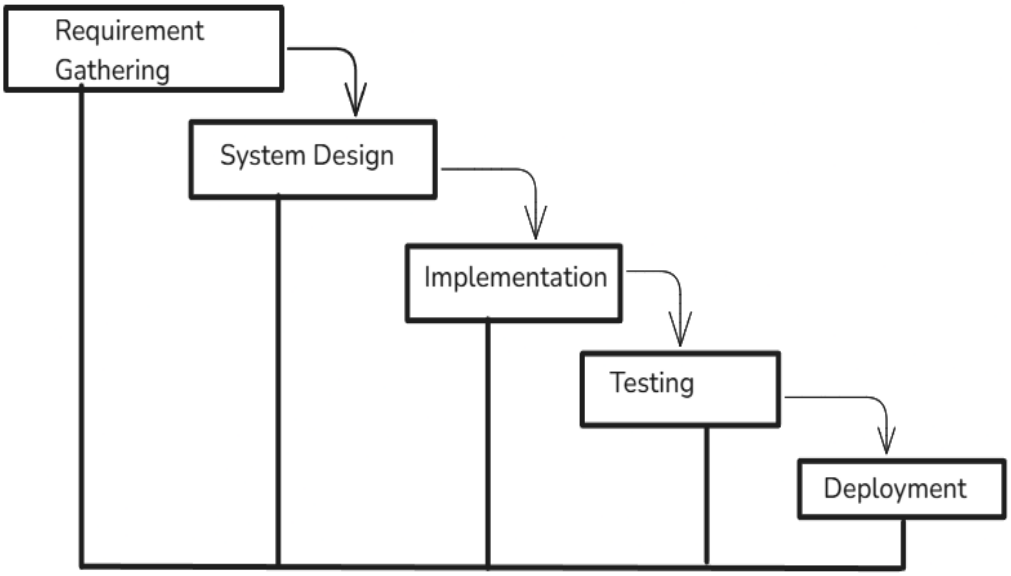


Figure 3.1: Waterfall Model

Here, in our project waterfall model has been used as the software model. In this project, any phase in the development process begins only if the previous phase is complete therefore, waterfall model has been used. By following the waterfall model, each phase is completed before moving to the next, ensuring structured development of a job portal that effectively uses collaborative filtering for personalized job recommendations.

3.1.1 Requirement Analysis

Requirement Analysis identifies the project's requirements in order to maximize its utility and benefits. It defines the key functional needs for users, including registration, job search, application features for job seekers, job posting, candidate search and management for employers. There are several techniques for gathering requirements and admin management requirements for efficient system operations.

i. Functional Requirements

The admin has access to the system, which allows them to perform CRUD operation. Login page allows applicants to register and login to the page. The applicant can also apply for a job, see recommendations but only after applying at least one job. The applicant can receive the message from the admin/staff in their own profiles. If the admin approves then the message is send as approved to the respective applicant. Hence the functional requirement of the system is the login and logout system of the admin/staff as well as the applicants.

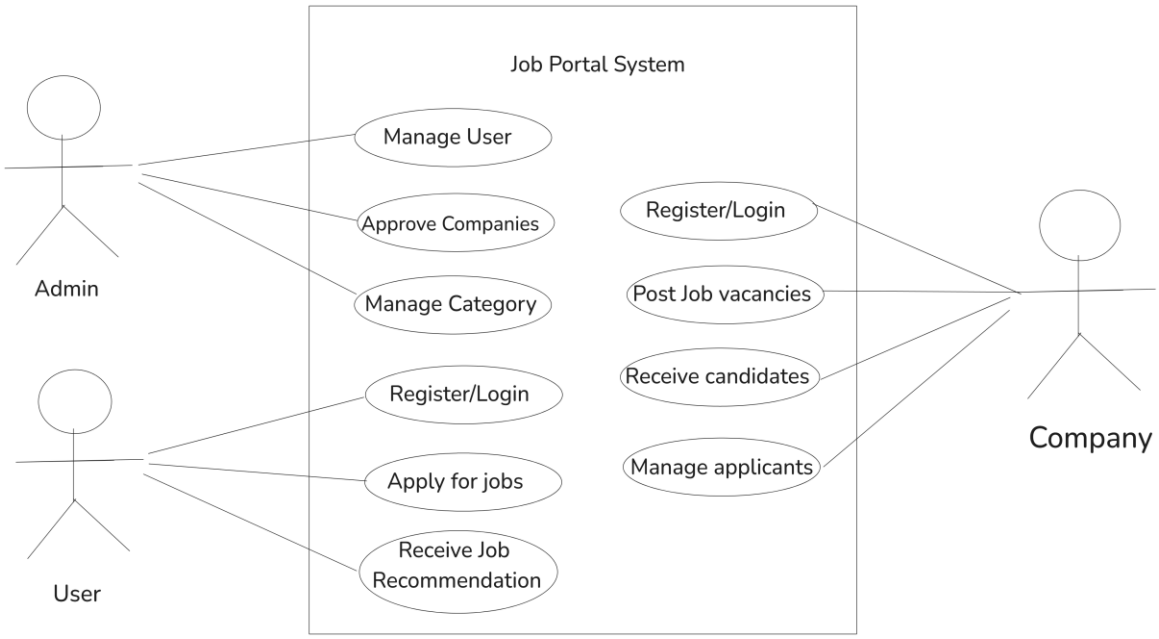


Figure 3.2: Use case Diagram

This use case diagram shows how the Job Portal System (JobSelect) works with three main users: Admin, User, and Company. The admin manages users, categories, and approves companies. Users can register, apply for jobs, and get job recommendations. Companies can register, post jobs, receive applications, and manage applicants. Each actor has specific roles to keep the system efficient and organized.

ii. Non-Functional Requirement

The non- functional requirements outline features of the system that are essential to its general functionality, usability, and maintenance but are not directly tied to any particular capabilities. JobSelect serves as a comprehensive platform for applying jobs as per their interest, streamlining the process with efficiency. This dynamic website facilitates the seamless applying for jobs, viewing the jobs with the important credentials according to the admin/staff.

3.1.2 Feasibility Analysis

A feasibility study assesses the viability of our project plan in order to determine whether we can proceed with the project. Technical feasibility, operational feasibility, and economic feasibility are all sorts of feasibility that are widely employed in this project.

•Technical Feasibility

By assessing the technical feasibility of JobSelect, you can identify potential challenges, plan for required infrastructure and technologies, and ensure a robust and scalable platform that meets the needs of job seekers and employers while maintaining security and performance standards.

•Operational Feasibility

By assessing the operational feasibility of JobSelect, you can determine its viability within the organization's existing operational context. This evaluation helps identify potential challenges, plan for necessary changes, and ensure the successful integration and operation of the portal to streamline recruitment processes and improve overall efficiency.

•Economic Feasibility

By conducting an economic feasibility analysis, you can determine the financial viability and potential return on investment of the site. This evaluation helps in making informed decisions regarding the allocation of resources, financial planning, and determining the overall viability of the project from an economic perspective.

- **Schedule Feasibility**

The schedule for different modules in this project can be seen as below in the following Gantt chart.

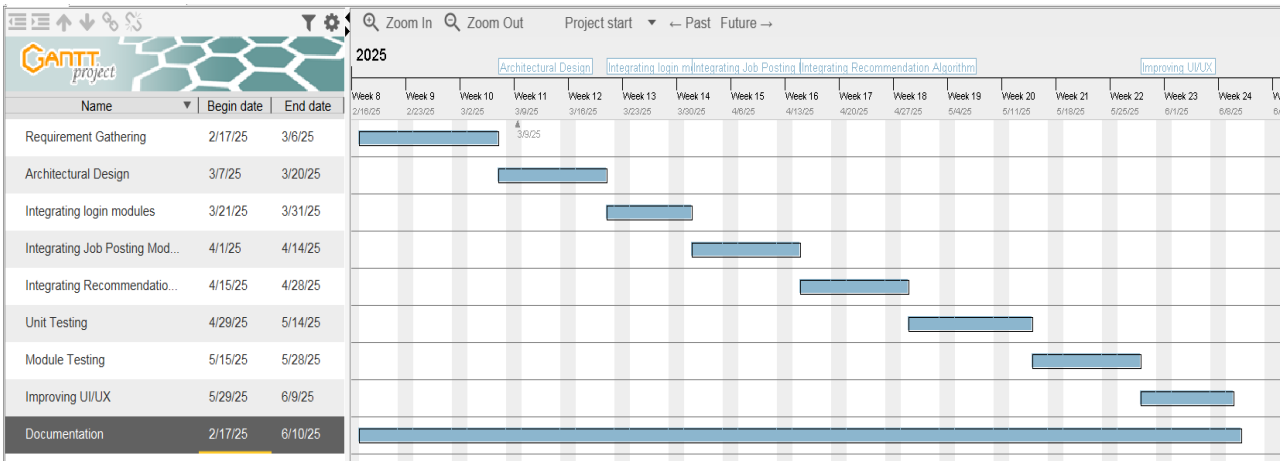


Figure 3.3 Gantt Chart

3.1.3. Data Modelling: ER Diagram

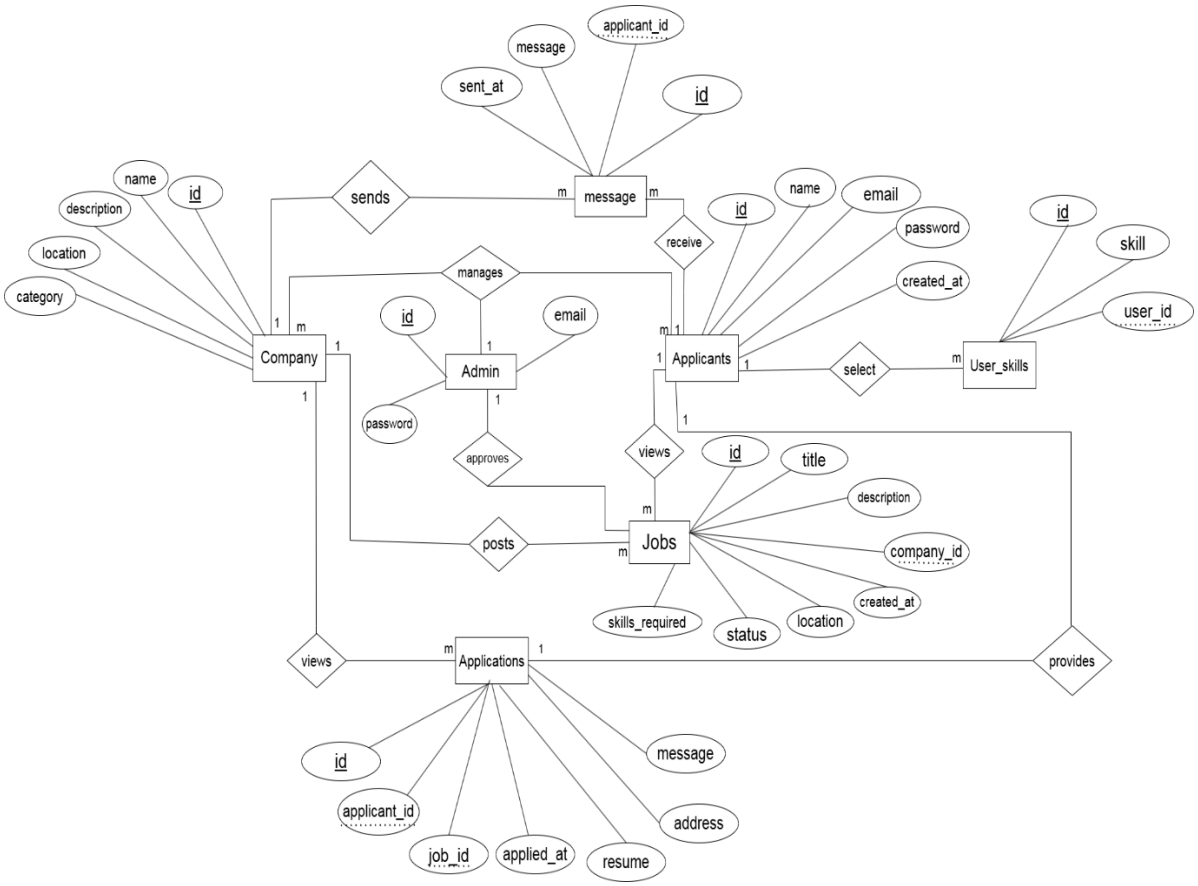


Figure 3.4 ER-Diagram

The Entity-Relationship Diagram (ERD) for JobSelect outlines the key entities and their relationships. It includes entities like company, applicant, Job, admins, Category. Users can have multiple job and applications, while company can post several job. The ERD serves as a visual representation of the database schema.

3.1.4 Process Modelling: DFD

The DFD (Data Flow Diagram) for JobSelect describes the overall "flow" of data on the project. It is used to document the transformation of data (input - output) for project development.

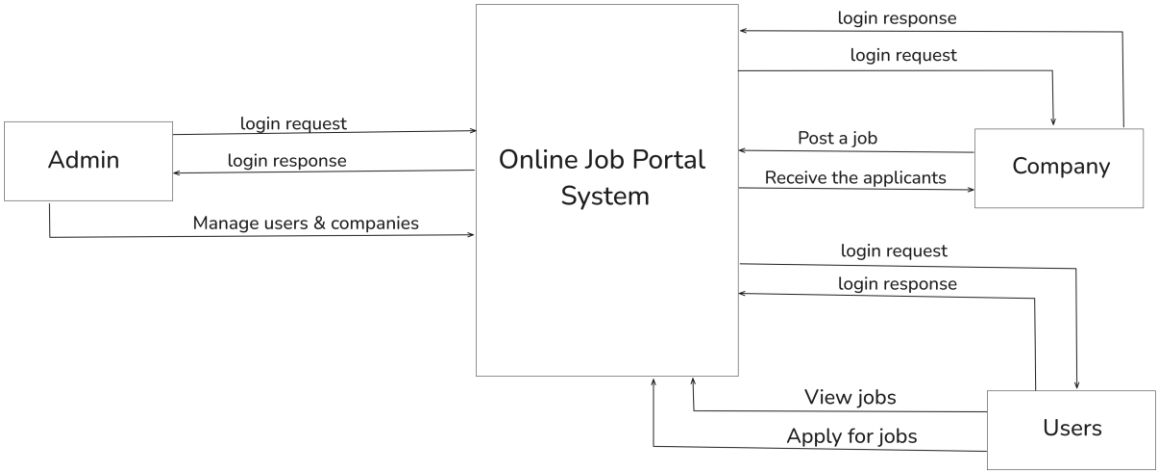


Figure 3.5: Level 0 DFD

DFD 0 contains the flow of the system where there is user, company and admin. Here, as shown in the diagram, applicants apply job, JobSelect request admin to approved. Similarly, Admin responses to the system that can be viewed by the applicants.

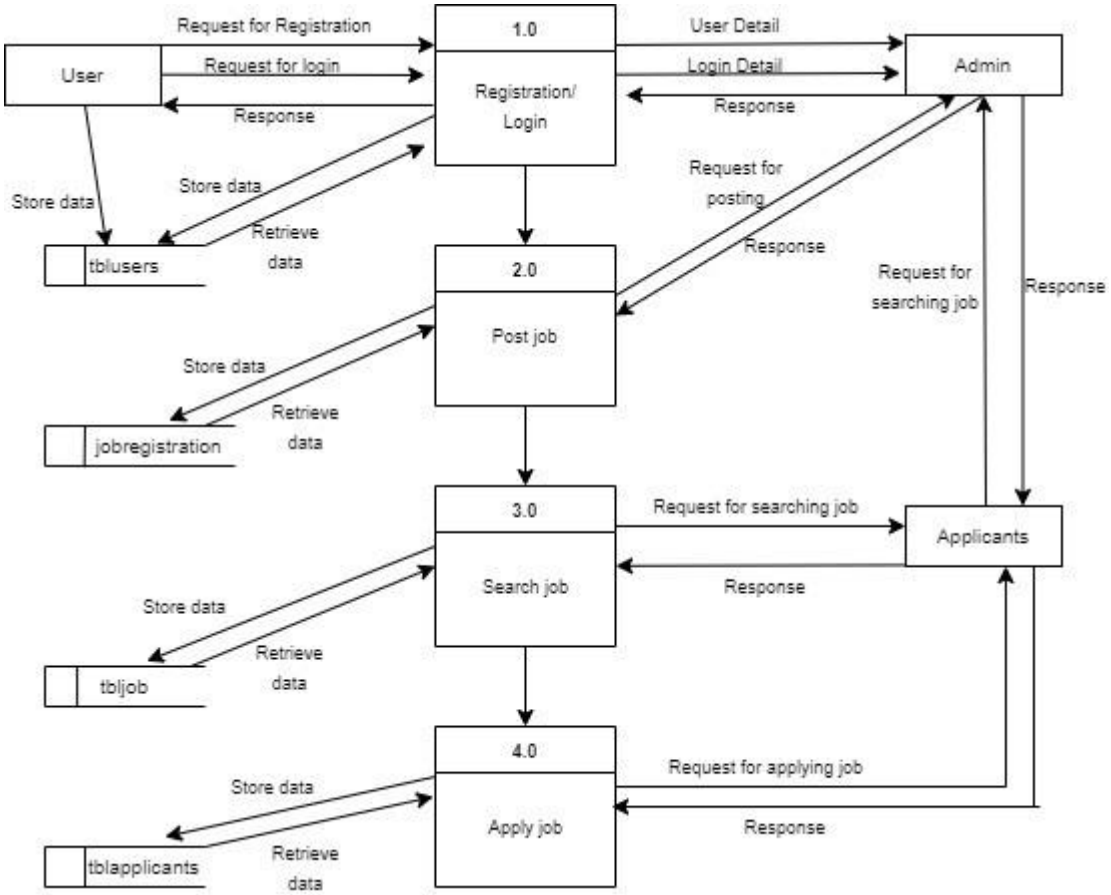


Figure 3.6: Level 1 DFD

The Level 1 DFD of the Online Job Portal System breaks down the main processes like registration/login, job posting, job searching, and applying for jobs. Users, companies, and admins interact with the system to perform these tasks. Each action stores or retrieves data from relevant tables like tblusers, tbljobs, and tblapplicants. The diagram shows how data flows smoothly between users and the system, ensuring efficient job portal operations.

3.2 System Design

3.2.1 Architectural Design

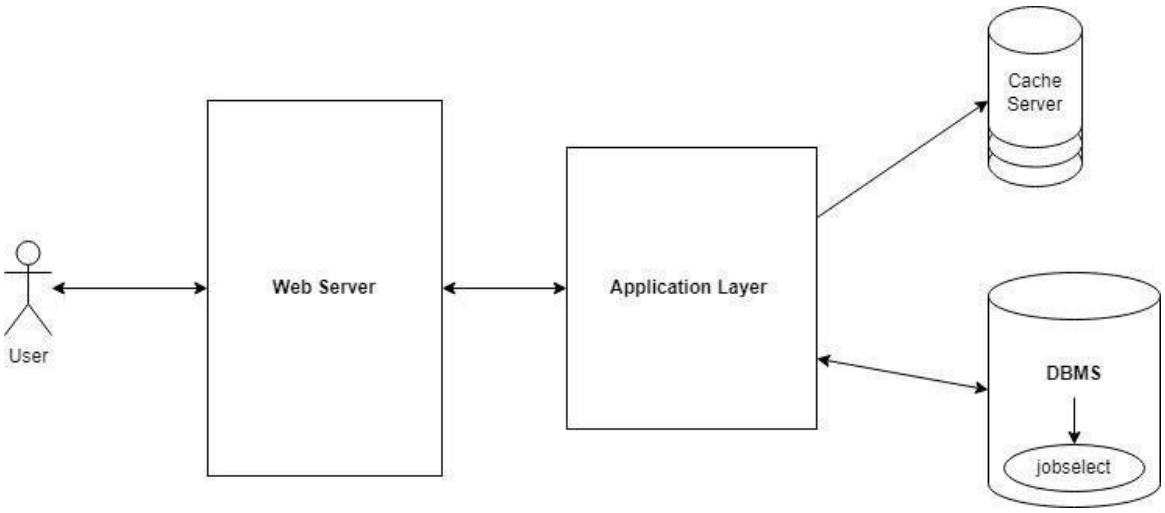


Figure 3.7 Architectural Design

The diagram illustrates a web application architecture where a user interacts with a web server, which communicates with an application layer that handles business logic. The application layer retrieves data either from a cache server, which stores frequently accessed information for faster performance, or from a DBMS (Database Management System), which contains persistent data such as job, categories etc in a "jobselect" database. This setup optimizes data retrieval by first checking the cache to reduce database load, ensuring efficient access to job information for the user.

3.2.2 Database Schema Design

A database schema defines how data is organized in a relational database. This includes logical constraints such as table names, fields, data types, and relationships between these entities. Schemas often use a visual representation to convey the architecture of a database and form the basis of an organization's data management conventions.

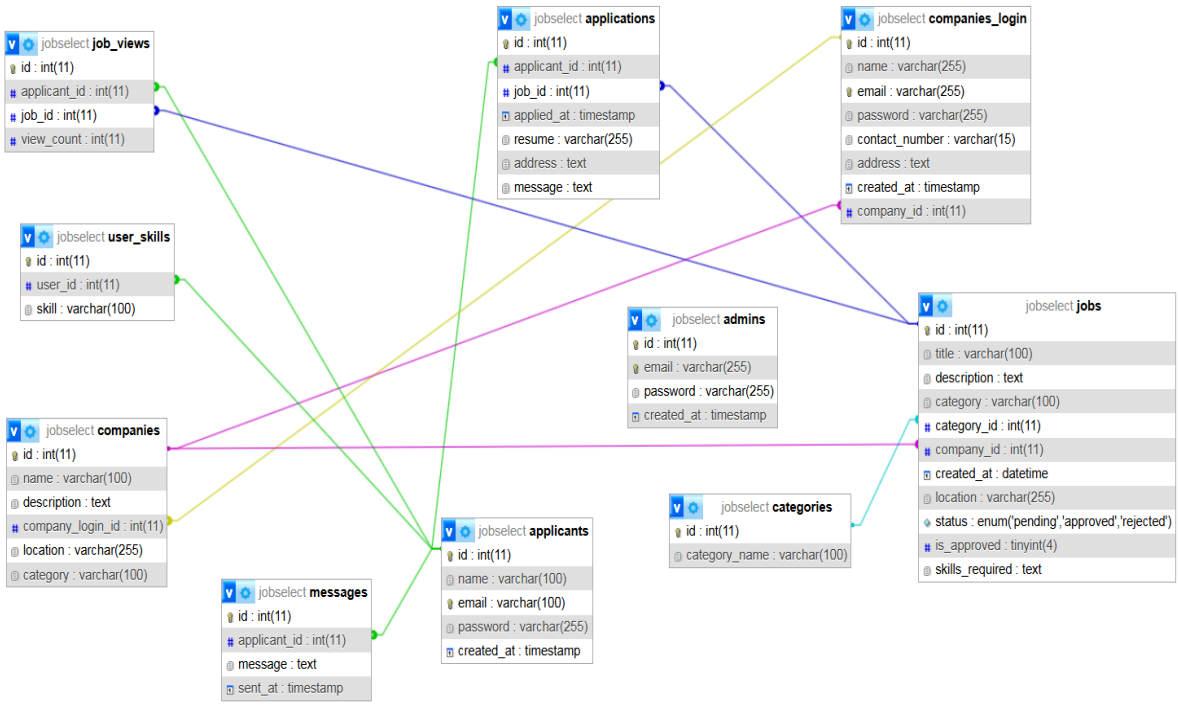


Figure 3.8 Database Schema

The above figure is all about the tables created in the database which shows the relationship between each other according to the structure of ER Diagram. Here most of the table have foreign keys and primary key. All the tables are connected with the help of arrows.

3.2.3 Flowchart

Flowchart for Admin

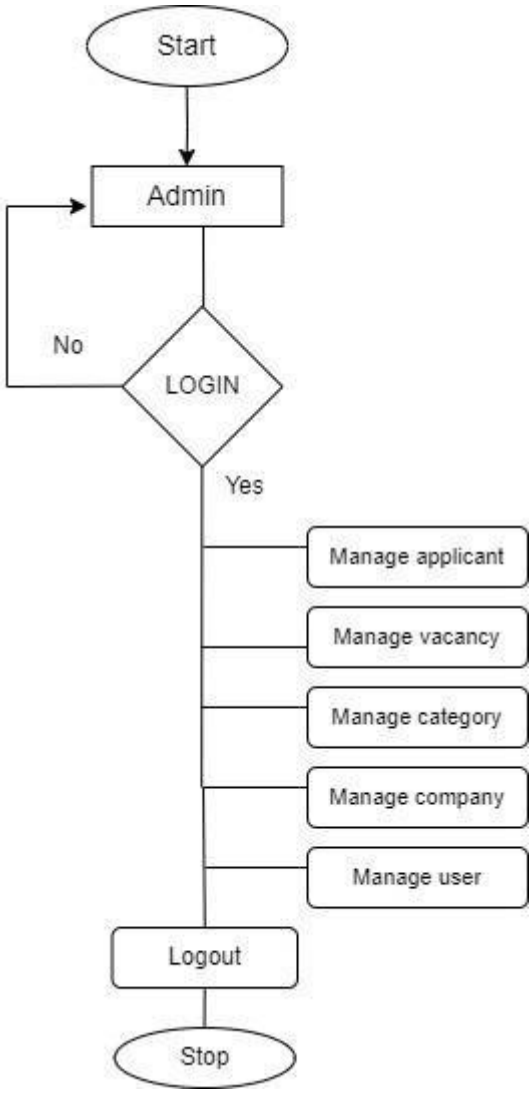


Figure 3.9 Flowchart for Admin

This flowchart represents the process for an admin managing a system. It begins with the admin attempting to log in. If the login is unsuccessful, the process loops back to retry. Once logged in, the admin gains access to several management functions, including managing applicants, vacancies, categories, companies, and users. After completing these tasks, the admin can log out, and the process ends.

Flowchart for Company

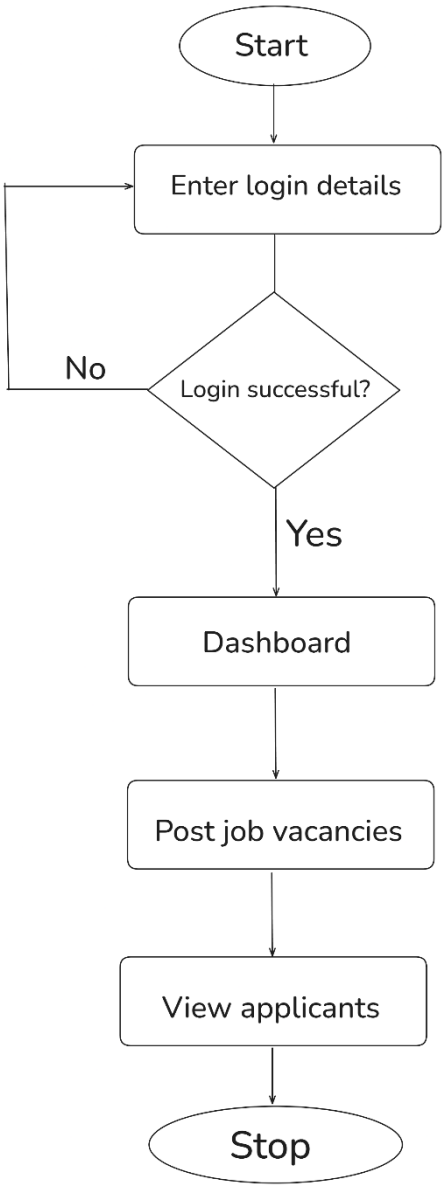


Figure 3.10: Flowchart for company

The company flowchart shows how a company logs in or registers, then posts jobs on the portal. After posting, it can view applicants who applied and shortlist suitable candidates. This helps the company manage recruitment in a structured and easy way.

Flowchart for User

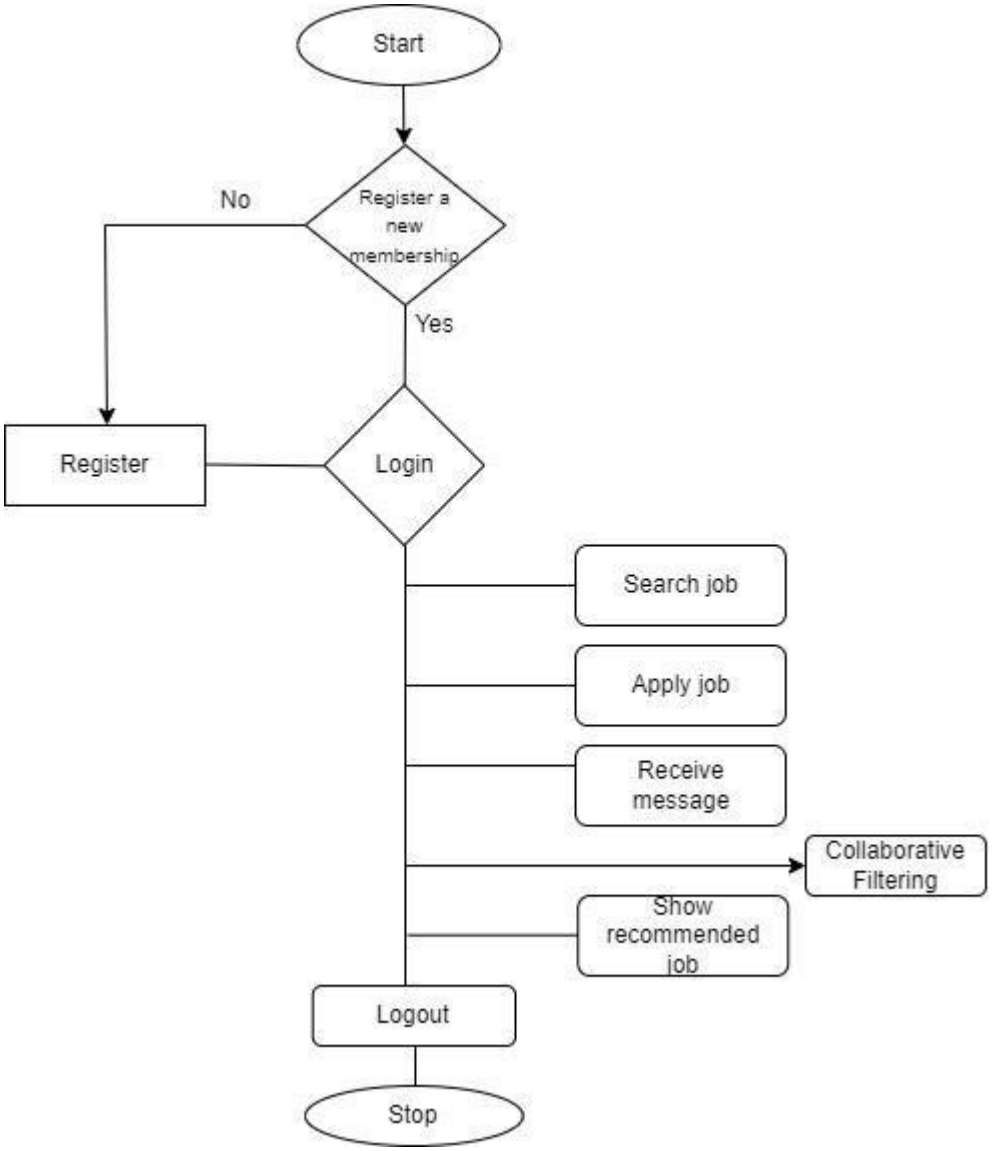
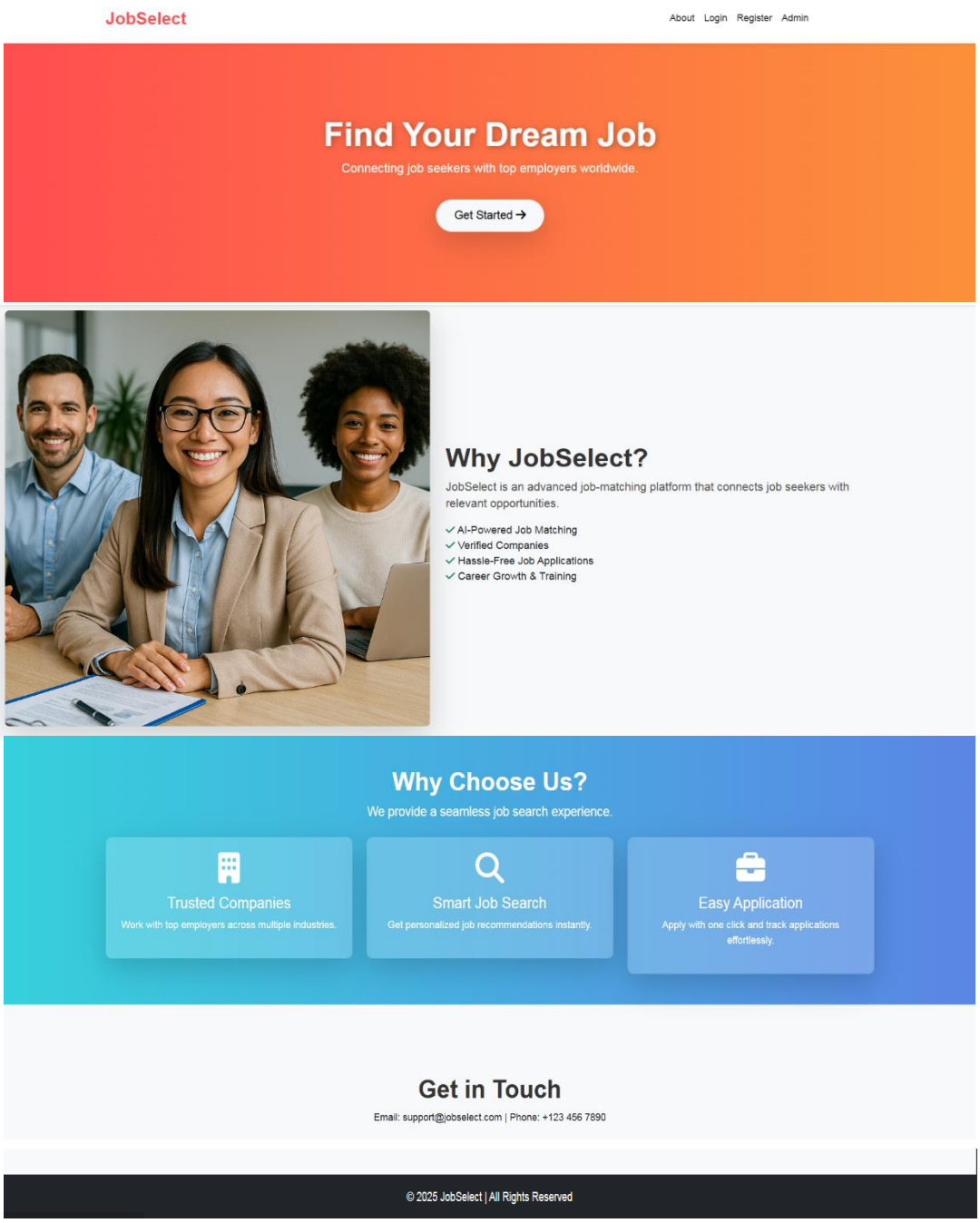


Figure 3.11 Flowchart for User

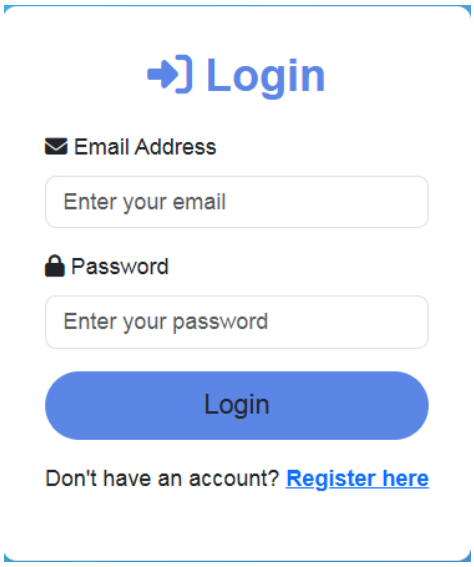
This flowchart outlines the process for a user interacting with a job application system. It starts with the decision to register for a new membership. If the user does not have an account, they are directed to register. If they are already registered, they log in and gain access to various functions such as searching for jobs, applying for jobs, receiving messages, and viewing recommended jobs through collaborative filtering. After completing these tasks, the user can log out, and the process ends.

3.2.4 Interface Design (UI/UX)

Home Page:



Login Form:



3.3 Algorithm Details

For JobSelect, we have chosen Matrix Factorization, which means a simple embedding model. It is a class of Collaborative Filtering Algorithm used in recommender systems. It is based on the idea that people who share the same interest in certain kinds of items will also share the same interest in some other kind of items unlike content based which basically rely on metadata while it deals with real life activity.

This code implements a job recommendation system using matrix factorization to predict user preferences based on visit counts. It retrieves job view data from a database and constructs a user-item matrix ® where each entry represents the number of times an applicant viewed a particular job. Using matrix factorization, the system decomposes this matrix into two smaller matrices, P for applicants and Q for jobs, with latent factors that capture hidden patterns. After generating predicted ratings for each applicant-job pair and shows the categorized highest visit count as well. Finally, it displays the top job recommendations for a logged-in applicant based on a Collaborative filtering algorithm.

Mathematical formula:

The goal is to decompose this matrix into two-dimensional matrices, P and Q, such that

$$R \approx P \times Q^T$$

Where:

- P is an N× K matrix (N = number of applicants, K = number of latent factors).
- Q^T is a K× M matrix (M = number of jobs).
- R is the original interaction matrix (N = applicants, M = jobs)
- K is the number of latent factors (dimensions) representing hidden patterns in the data.

$$R\hat{}ij=\sum_{k=1}^{K} PikQkj$$

- It represents the predicted interaction between user i(applicants) and item j (job).
- P is a matrix that contains user-related latent factors (applicants).
- Q is a matrix that contains item-related latent factors(jobs).
- Both matrices have dimensions based on the number of latent factors K.

CHAPTER 4: IMPLEMENTING AND TESTING

4.1 Implementation

4.1.1 Tools used

Frontend:

- HTML: The job portal's base, HTML, provides the forms, headers, and text formatting that are used throughout its web pages.
- CSS: With the use of layouts, colors, typefaces, and responsive design components, CSS designs the HTML elements to improve the employment portal's overall aesthetic appeal and user experience.
- Bootstrap: Bootstrap is a popular front-end framework for developing responsive, mobile-first websites. It provides a wide range of ready-made components and utilities to streamline the design and development process.

Backend:

- PHP: PHP (Hypertext Preprocessor) is a widely-used server-side scripting language that is especially suited for web development. PHP is open-source and is used to create dynamic and interactive web pages

Database:

- XAMPP: XAMPP is a local development environment that includes MySQL (or MariaDB), Apache, PHP, and Perl, allowing you to run a web server on your local machine.

Server:

- Apache Web Server: The Apache Web Server (often referred to simply as Apache) is one of the most widely used and popular open-source web server software.

Platform: Windows.

Code Editor: Visual Studio Code.

Browsers: Brave, Google Chrome.

4.1.2 Implementation Details of Modules

The modules involved are:

1. **User Authentication Module**

The user authentication module has been successfully implemented. Users (both job seekers and companies) can register using a secure sign-up process that includes email verification. Passwords are securely stored using hashing. The login system also includes session management to prevent unauthorized access. Different dashboards are available based on user roles (admin, user, and company), ensuring that functionalities are restricted as per their access level.

2. Job Posting and Approval System (Company & Admin Module)

This module allows registered companies to post job vacancies in various categories. Each job post includes details like job title, description, required skills, category, and deadline. Once a job is posted, it goes into a pending approval state. The admin can then view, approve, or reject the job post. Only approved jobs are visible to job-seeking users. This ensures that spam or irrelevant postings do not appear on the platform.

3. **Job Application System (User Module)**

Users can view approved job listings based on their selected skill interests or job category. They can apply to jobs directly from the portal by submitting their resume and other required details. Each user has a dedicated application dashboard where they can track the status of their applied jobs (e.g., pending, shortlisted, or rejected). This module allows efficient application handling and record keeping.

4.2 Testing s

Table 4.1 Test case for Unit Testing of login and logout operation

Test case	Steps	Test Data	Results	Status
1.	Enter a valid email and password.	Email: rahita@gmail.com Password: 1234546	The user should redirect to the home page.	Pass

2.	Enter invalid email or password.	Email: asdf@gmail.com Password: hello	The user should not be redirected to the home page and stay in the login page until a valid email or password is entered.	Pass
3.	Do not fill any field.	Empty	Alert box will be displayed.	Pass
4.	If you do not have any account, click on register.	Register Account.	It will display to form a filling page.	Pass
5.	Press log out.	Log out	Redirected to the index page.	Pass
6.	Shows recommended job	Recommended jobs	Appears the recommended job	Fail

Table 4.2 Test case of unit testing for admin

Test case	Steps	Test Data	Results	Status
1.	Log in as an admin	Email: admin Pw: admin123	Redirected to dashboard page.	Pass
2.	Press users panel	users	Admin can manage users.	Pass
3.	Press manage categories	category	Admin can manage the categories	Fail
4.	Press companies	Companies registered	Admin can delete companies.	Pass

5.	Press applicants panel	Applicants	Admin can delete applicants.	Pass
7.	Press logout	Logout	Redirected to the login page.	Pass

Table 4.3: Test case Company

Test case	Steps	Test Data	Results	Status
1.	Company Registration with empty fields	Company name: Email: Password:	All fields are required	Pass
2.	Invalid Email format	Email: company.com	Please include an @ in the email.	Pass
3.	Invalid password format	Password 12345	Password must contains lower letter and upper letter	Fail
4.	Job posting without required fields	Job title: Description: Category:	All job fields are required	Pass
5.	Job visibility before approval	Post a new job	Job should not be visible to users until approved	Pass

Task Completed

- User, Company, and Admin can log in
- The user can view the jobs approved by the admin
- The user can apply for the job
- Admin can accept or reject the job
- Admin can manage users and companies
- The company can post the job and manage the jobs

Task Remaining

- Recommendation algorithm
- Company restriction and company allow to see the recommended user.

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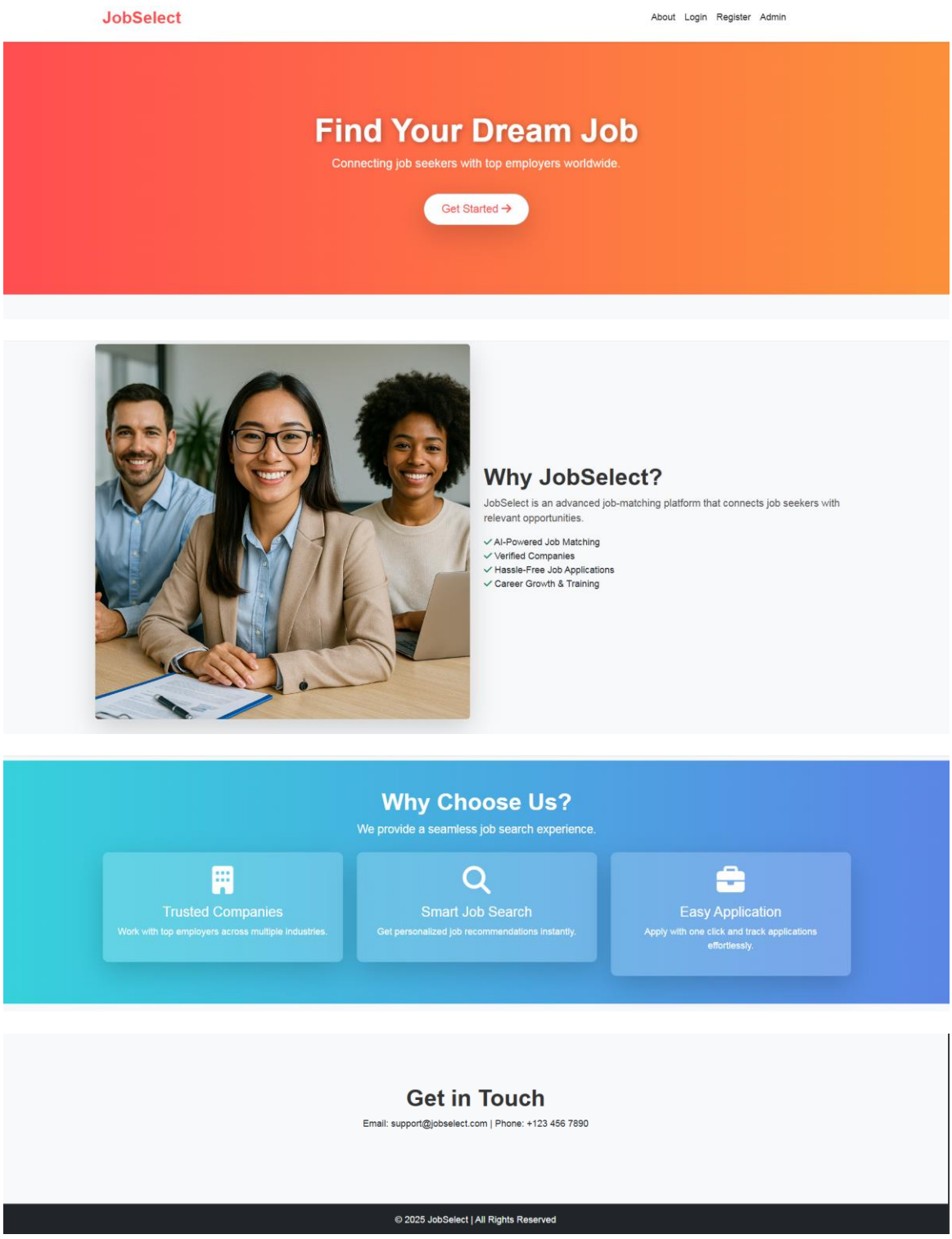
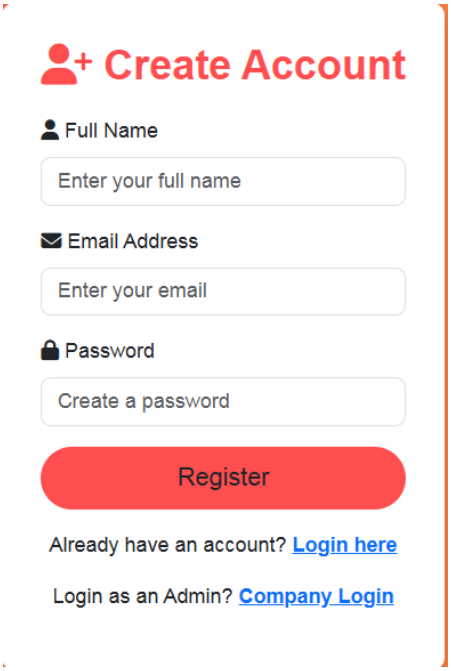
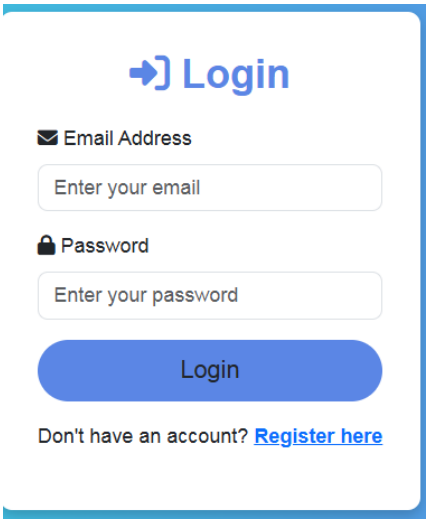
Appendices

Home Page

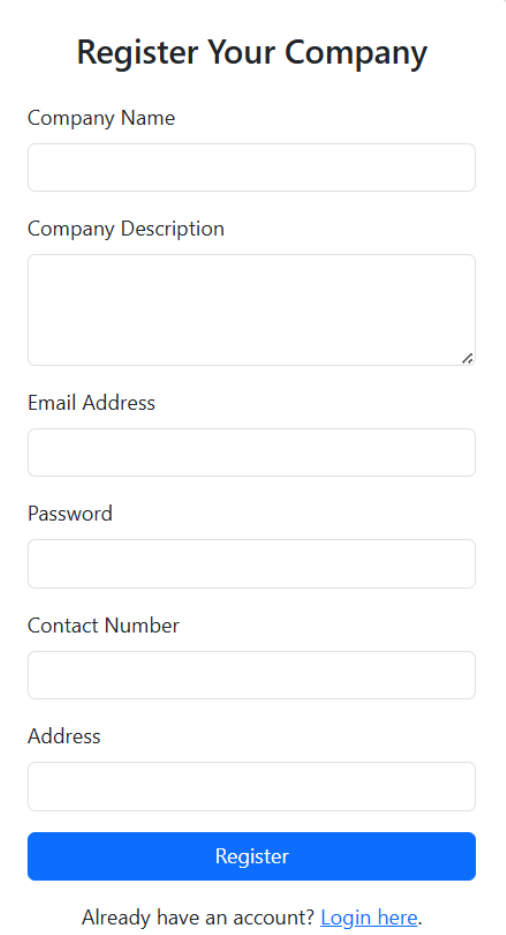


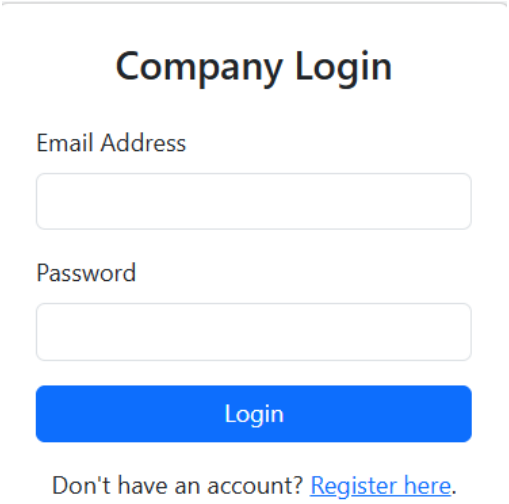
Registration Module



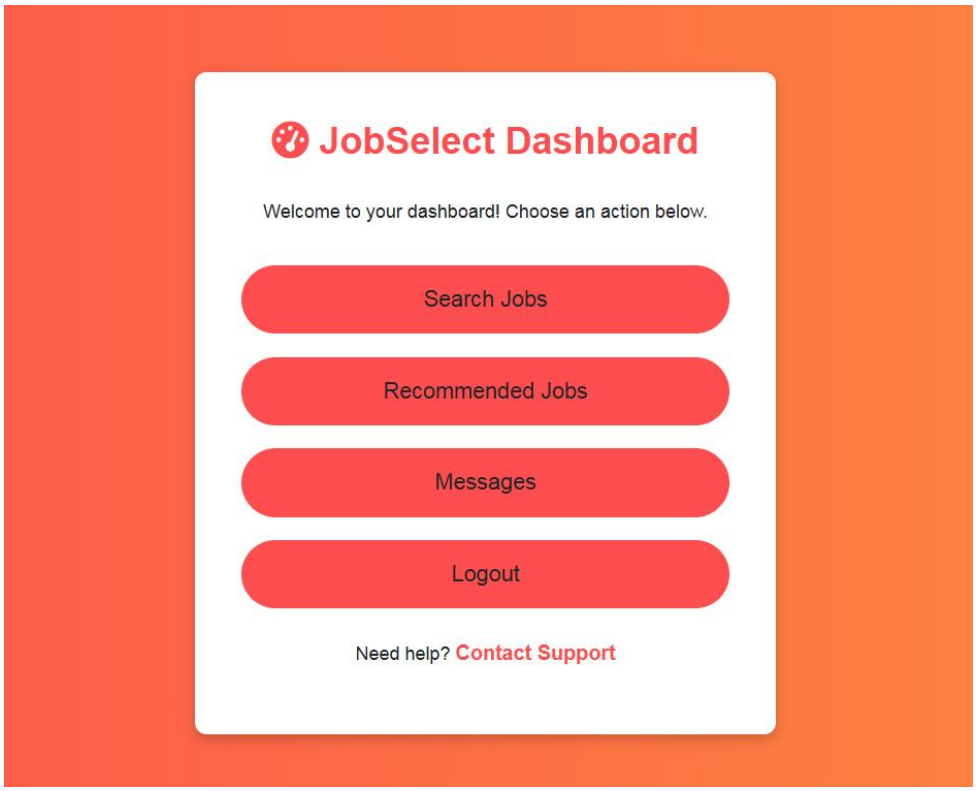


For Company

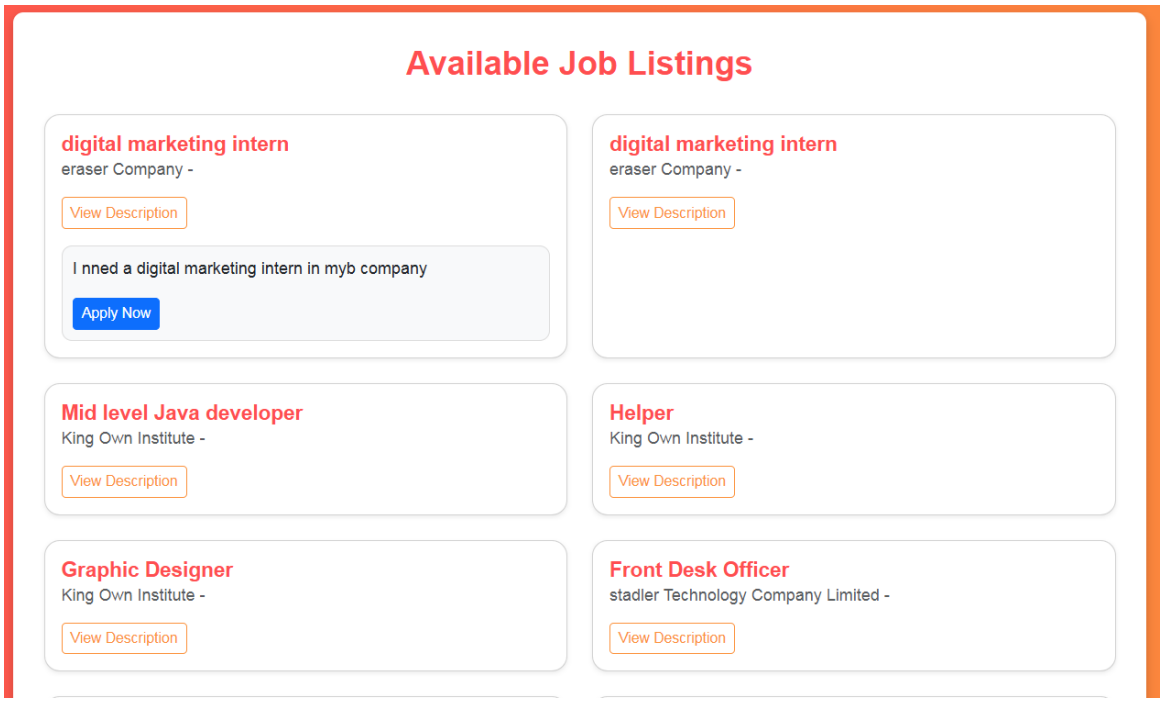




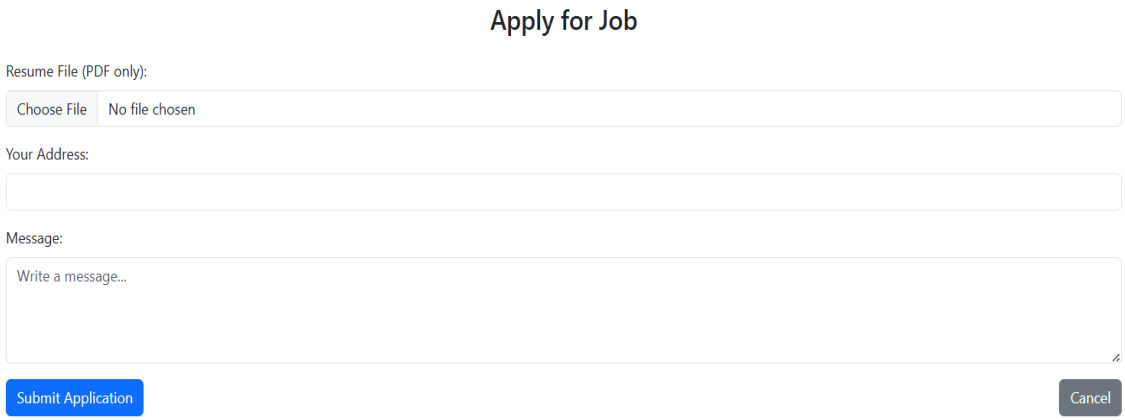
User Module:



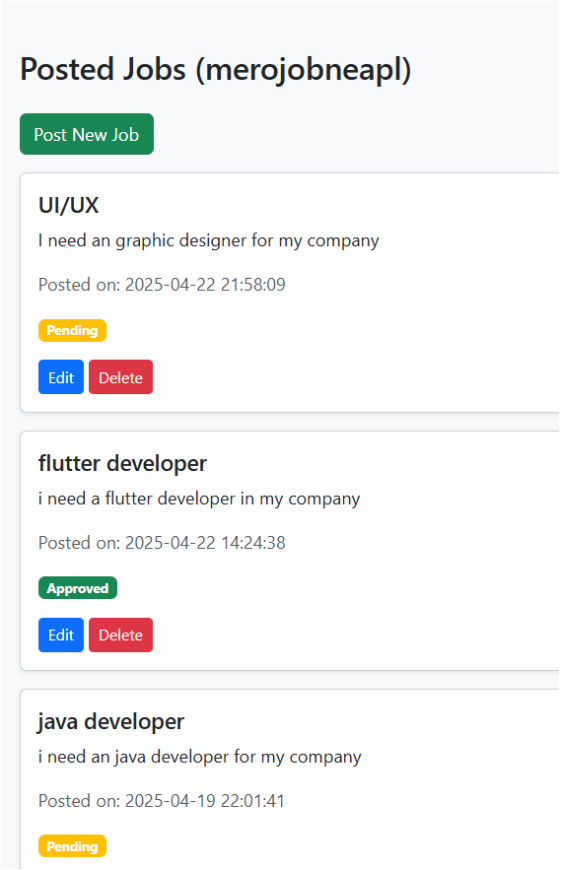
Search Job:

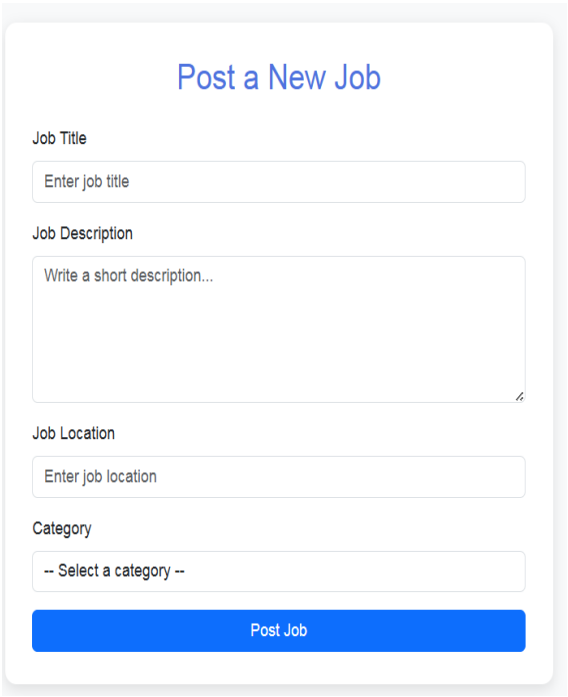


Applying for a job

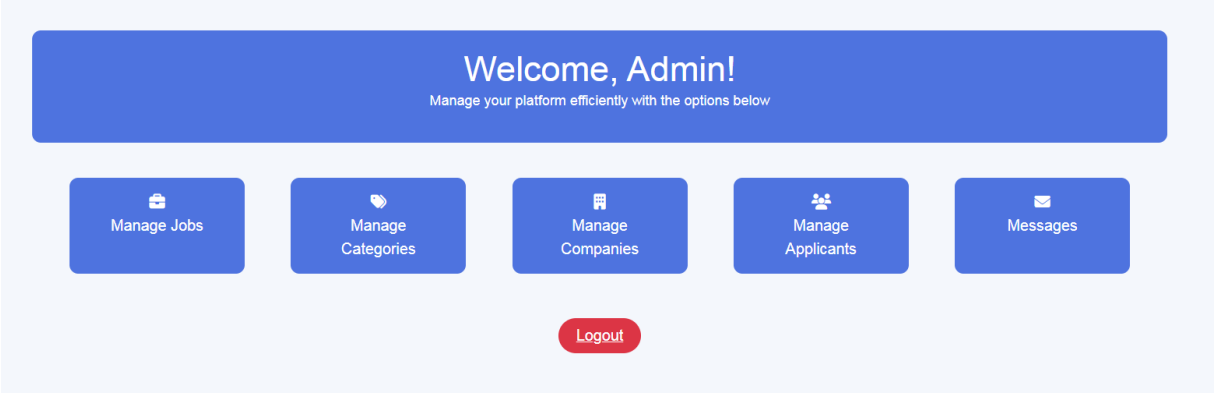


Company Dashboard

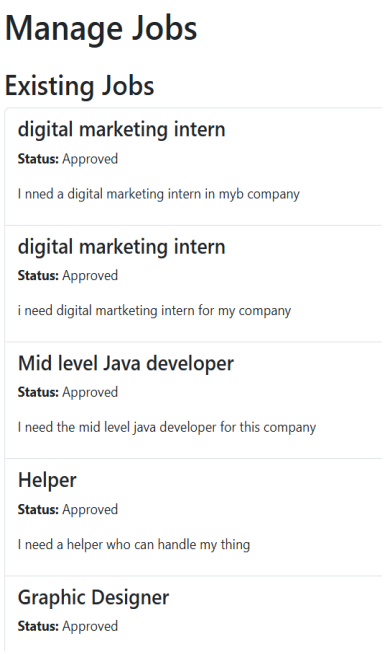




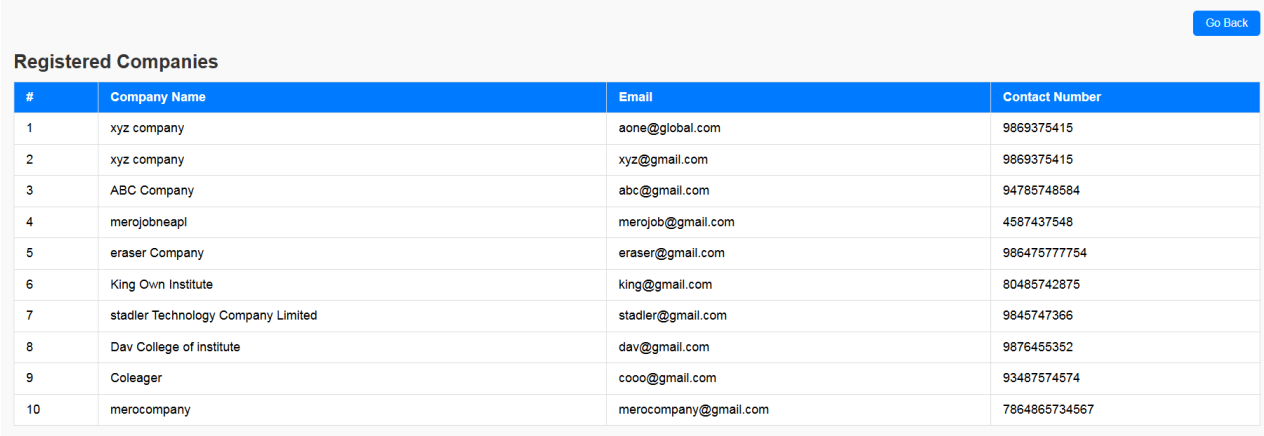
Admin Dashboard



Manage jobs



Manage Companies



#	Company Name	Email	Contact Number
1	xyz company	aone@global.com	9869375415
2	xyz company	xyz@gmail.com	9869375415
3	ABC Company	abc@gmail.com	94786748584
4	merojobneapl	merojob@gmail.com	4587437548
5	eraser Company	eraser@gmail.com	986475777754
6	King Own Institute	king@gmail.com	80485742875
7	stadler Technology Company Limited	stadler@gmail.com	9845747366
8	Dav College of institute	dav@gmail.com	9876455352
9	Coleager	cooo@gmail.com	93487574574
10	merocompany	merocompany@gmail.com	7864865734567

Manage Applicants