Final Year Design Project

Web Scraping Based Job Searching System

By

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Abstract

The proposed job recommendation Platform is designed to enhance the employment-seeking experience by aggregating and organizing job listings from diverse online sources through web scraping techniques. The platform offers a user-centric interface that enables job seekers to filter opportunities based on individual preferences and qualifications. Employing sophisticated algorithms, the system delivers personalized job recommendations and timely alerts. A strong emphasis is placed on data privacy and security to safeguard user information. This comprehensive approach aims to streamline the job search process, facilitating the discovery of career opportunities that align with users' professional objectives.

Acknowledgements

We extend our heartfelt gratitude to our supervisor, **Prof. Dr. Hasan Sarwar**, for his invaluable guidance, expertise, and encouragement throughout the course of this project. His constructive feedback and continuous support were instrumental in shaping the direction of our work. We are also deeply thankful to **United International University** for providing the resources and infrastructure required to bring this project to fruition.

Sincere appreciation goes to Our Team Members for their thoughtful insights and collaboration, which enriched our understanding and approach. Lastly, we would like to acknowledge the unwavering support of our families and friends, whose encouragement and motivation helped us overcome challenges and stay committed to the successful completion of this project.

Publication List

[Optional] The main contributions of this research are either published or accepted or in preparation in journals and conferences as mentioned in the following list:

Journal Articles

Conference Papers

1. Web Scraping and Job Recommender System [1]

2. Design and Evaluation of a Personalized Job Recommendation System for Computer Science Students Using Hybrid Approach [2]

Additional Publications

Following is the list of relevant publications published in the course of the research that is not included in the thesis:

1.

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Chapter 1

Introduction

This project introduces a comprehensive and innovative platform designed to revolutionize the job search process by combining web scraping, machine learning, and automation technologies. The platform addresses the challenges faced by job seekers, such as navigating overwhelming job listings on existing platforms, by automating the extraction, organization, and filtering of job postings from multiple sources, including LinkedIn. Users can create personalized profiles detailing their education, skills, and experience, enabling the system to deliver tailored job recommendations, real-time notifications, and skill gap analysis.

Our project seeks to overcome this challenge by introducing an innovative approach to web scraping to automated job extraction from platforms like LinkedIn ,Bdjobs and more websites , customizable search filters, skill gap analysis, and trending skill suggestions. Additionally, the platform empowers users through professional growth tools such as course recommendations, interview preparation resources (tips, crash courses, and mock tests), and company reviews. Built using robust technologies like MySQL, Selenium, and puppeteer, the platform ensures real-time access to up-to-date job postings and empowers users with customizable search filters to streamline their job search. By providing a user-friendly interface and exporting job listings for further analysis, this project simplifies the job-hunting process, saves time, and enhances the ability of job seekers to make confident, data-driven career decisions.

1.1 Project Overview

In the modern competitive job market, identifying opportunities that align with one's skills, experience, and career goals is often a complex and time-consuming task . This platform addresses these challenges by integrating advanced web scraping and machine learning technologies to offer personalized job recommendations, skill development insights, and interview preparation tools, all in one place. This project aims to create a smart job search platform that leverages web scraping and machine learning to offer personalized job recommendations. Users can build profiles by providing details about their

education, experience, and skills, and the system will scrape job listings from various sources to match them with relevant job opportunities.

Key features include:

- Job Scraping and Storage:The platform scrapes and stores job listings, organizing them by title, company, skills, location, and experience.
- Personalized Job Suggestions: Job recommendations based on user's qualifications and preferences.
- Real-Time Alerts: Notifications about new job openings that fit user criteria.
- Skill Enhancement: Insights into trending skills and course recommendations for career growth.
- Interview Support: Access to mock tests, tips, and courses to help with interview preparation.
- Company Insights: Reviews to help users evaluate potential employers.

This platform aims to simplify the job search process, enhance skills, and equip users with the tools needed to succeed in their careers.

1.2 Motivation

Today's fast-changing job market, finding the right job has become more challenging than ever. Job seekers often feel overwhelmed by the huge number of job listings on platforms like LinkedIn and Bdjobs. Searching manually is time-consuming, and many job platforms do not provide the personalized tools needed to help users make smart career choices.

This project is motivated by the need to make job hunting easier, faster, and more effective. By using web scraping, automation, and machine learning, the platform aims to simplify the process of finding jobs. Instead of spending hours searching, users can rely on the platform to automatically gather and organize job postings from multiple sources. Another key motivation is to help job seekers grow professionally by offering features like skill gap analysis, trending skill suggestions, and personalized career advice. With real-time job updates, customizable filters, and an easy-to-use design, this platform makes the job search process smoother and saves valuable time.

The goal of this project is to use technology to change the way people look for jobs, making it not just about finding opportunities, but also about helping users prepare, grow, and succeed in their careers.

1.3 Objectives

In today's world, where job searching has become more challenging, success requires more than simply finding job listings—it calls for personalization, preparation, and growth. This project aims to transform the job search experience with the following objectives:

1. Develop an innovative job search platform that automates the extraction, organization, and filtering of job postings from multiple sources, including LinkedIn, Bdjobs, and other job websites.
2. Incorporate advanced web scraping technologies like Selenium and Puppeteer to ensure efficient and real-time job data extraction and updates.
3. Enable personalized user profiles where job seekers can input their education, skills, and experience to receive tailored job recommendations and skill gap analyses.
4. Provide customizable search filters to allow users to refine their job search based on specific preferences, such as location, industry, or required qualifications.
5. Empower users with professional development tools by offering features like skill gap analysis, trending skill suggestions, course recommendations, interview preparation resources (tips, crash courses, and mock tests), and company reviews.
6. Enhance the decision-making process for job seekers through data visualization and exportable job listings for further analysis and comparison.
7. Design a user-friendly interface to simplify the job search process, making it accessible and intuitive for users across all experience levels.
8. Save users' time and increase productivity by automating repetitive job search tasks, allowing them to focus on making strategic career decisions.
9. Support career advancement through skill-building recommendations and real-time notifications about job opportunities that match the user's profile.
10. Leverage robust backend technologies like MySQL to ensure data security, scalability, and efficient storage of job listings and user profiles.

1.4 Methodology

The development of this project follows a systematic approach to ensure functionality, reliability, and user satisfaction.To develop this project effectively, a structured methodology is adopted as follows:

1. **Requirement Analysis:** Gather and analyze user needs, including job profile creation, job recommendations, skill development, and interview preparation tools.

2. **System Design:** Design the platform architecture, including components for web scraping, database management, machine learning integration, and user interfaces.
3. **Data Collection:** Use web scraping techniques to extract job postings from various websites and store the data in a structured database.
4. **Profile and Matching System:** Develop a user profile system to capture education, skills, and experience. Implement a machine learning model to match user profiles with relevant job postings.
5. **Notification and Alert System:** Build a real-time notification system to inform users of new job postings matching their preferences.
6. **Skill and Career Development:** Integrate features to recommend trending skills, relevant courses, and interview preparation resources.
7. **Testing and Validation:** Test the platform for functionality, performance, and accuracy of job recommendations and notifications. Validate machine learning models with real-world data.
8. **Deployment and Feedback:** Deploy the platform and gather user feedback to make iterative improvements and ensure it meets user expectations.

This methodology ensures a robust, user-centered solution for enhancing the job search and career development experience.

1.5 Project Outcome

The project delivers a comprehensive platform that simplifies the job search process and enhances career development. Key outcomes include:

1. **Personalized Job Recommendations:** Tailored job suggestions based on users' education, skills, and experience.
2. **Real-Time Alerts:** Notifications for relevant job postings as they become available.
3. **Skill Enhancement:** Recommendations for trending skills and relevant courses to bridge skill gaps.
4. **Interview Preparation:** Tools like mock tests, expert tips, and crash courses to prepare users for interviews.
5. **Company Insights:** Access to reviews and ratings for informed decision-making.
6. **User Empowerment:** A streamlined, efficient, and growth-oriented job search experience that fosters long-term career success.

The platform successfully integrates advanced technologies to meet the evolving needs of job seekers.

1.6 Organization of the Report

This report is structured into several chapters to comprehensively document the development and functionality of the job listing platform. Each chapter addresses key aspects of the project:

Chapter 1: Introduction
This chapter provides an overview of the project, including the problem statement, motivation, objectives, and the scope of the platform. It sets the foundation for understanding the need for an intelligent job search and career development solution.

Chapter 2: Background
This chapter reviews existing job search platforms, technologies, and methodologies, identifying gaps and opportunities that this project aims to address.

Chapter 3: System Design and Architecture
This chapter details the system's architecture, including the database structure, machine learning model design, web scraping techniques, and user interface development.

Chapter 4: Implementation and Results
The implementation chapter explains how the platform's features were developed, such as job scraping, personalized recommendations, notifications, skill analysis, and interview preparation tools.It includes a discussion of results, challenges faced, and their resolution.

Chapter 5: Standards And Design Constraints
This section discusses project standards and design constraints, including compliance with software, hardware, and communication, and economic, environmental, ethical, social, and sustainability factors influencing project structure and implementation.

Chapter 6: Conclusion and Future Work
The final chapter summarizes the project outcomes, evaluates its success in achieving objectives, and discusses potential enhancements, such as expanding data sources or improving recommendation algorithms.

Each chapter is crafted to ensure a logical flow, providing a complete understanding of the project's development and its significance in solving real-world problems for job seekers.

Chapter 2

Background

Background chapter provides an overview of the context and significance of the project, highlighting the need for a smarter and more efficient job search process in today's competitive market.
The traditional approach to job hunting often requires significant time and effort, with candidates sifting through countless postings to find opportunities that align with their skills and career aspirations. Furthermore, many job seekers struggle to identify skill gaps or prepare effectively for interviews, which are crucial for securing desirable roles.
This project addresses these challenges by leveraging web scraping and machine learning to create a platform that not only matches users with relevant job opportunities but also equips them with tools for skill development and interview preparation. By offering a personalized and user-centric experience, the platform aims to redefine how individuals approach their career growth.

2.1 Preliminaries

This section provides the necessary background knowledge and foundational concepts to better understand the rest of the report. It covers key topics related to web scraping, machine learning, and system development, which are essential for the design and implementation of the job listing platform.

Web Scraping: Web scraping is the process of extracting data from websites using automated scripts or tools. In this project, web scraping is used to gather job listings from various online sources, such as job boards and company websites. The scraped data is then stored in a database for analysis and matching with user profiles. Understanding the basics of web scraping, such as HTML structure, data extraction techniques, and handling dynamic content, is crucial for the effective implementation of this feature.

Machine Learning: Machine learning is a subset of artificial intelligence that enables systems to learn from data and make predictions or decisions without being explicitly pro-

grammed. For this project, machine learning algorithms are used to analyze user profiles (such as education, experience, and skills) and match them with job listings that best fit the user's qualifications. Key concepts in machine learning, such as supervised learning, classification models, and recommendation systems, are essential for building a personalized job recommendation engine.

Database Management: A structured database is crucial for storing job listings, user profiles, and other related data. The platform uses a relational database system (e.g., MySQL or PostgreSQL) to store and manage this data, allowing for efficient retrieval and updates. Knowledge of database design, normalization, and querying techniques is vital for ensuring smooth data flow and scalability of the platform.

User Interface (UI) Development: The user interface is the front-end component that allows users to interact with the platform. It is developed using web technologies such as HTML, CSS, and JavaScript. A well-designed UI enhances the user experience, making it easier to create profiles, view job recommendations, and access other features such as notifications and interview preparation tools.
By understanding these foundational concepts, readers will gain insight into how the platform integrates web scraping, machine learning, and user-friendly design to offer an efficient and personalized job search experience.rest of the report

2.2 Literature Review

This section examines existing research and developments in the fields of web scraping, machine learning, and personalized job recommendation systems, providing a foundation for the design and implementation of the proposed job listing platform.

Web Scraping Techniques and Applications
Web scraping is a method used to extract data from websites through automated scripts. It involves parsing HTML structures to collect information, which is then stored in databases for further analysis. Advanced web scraping techniques have been developed to handle dynamic content and large-scale data extraction efficiently. A comprehensive review by ResearchGate discusses various methods and applications of web scraping, highlighting its importance in data mining and analytics.

Machine Learning in Job Recommendation Systems
Machine learning algorithms are pivotal in analyzing user profiles and matching them with suitable job opportunities. These algorithms learn from data to make predictions or decisions without explicit programming. A study published in the International Journal of Innovative Science and Research Technology reviews various recommendation models

and filtering techniques, emphasizing the role of machine learning in enhancing job recommendation systems. [3]

Design and Evaluation of a Personalized Job Recommendation System for Computer Science Students Using Hybrid Approach

Hybrid recommendation systems combine multiple algorithms to improve the accuracy and relevance of job suggestions. By integrating different models, these systems can overcome the limitations of individual approaches. The IEEE Xplore publication discusses the design and evaluation of a personalized job recommendation system for computer science students using a hybrid approach, demonstrating the effectiveness of combining multiple algorithms in job recommendations. [2]

Our project leverages advanced web scraping techniques and LLMs to create a personalized job recommendation platform, addressing challenges such as dynamic content handling and data scalability. Using tools like Puppeteer, we efficiently extract IT/Telecommunication job data from platforms like Bdjobs, overcoming pagination and AJAX-related issues. The scraped data is processed using optimized database structures and integrated with LLM-based algorithms to provide user-specific job recommendations. Building on prior research in automated job scraping and AI-driven recommendation systems, our platform offers a scalable and intelligent solution that enhances the job-seeking experience. [4]

Optimising Job Search using Web Scraping

Web scraping has been effectively utilized to aggregate job listings from various online sources, creating centralized platforms for job seekers. A paper in the International Research Journal of Engineering and Technology presents a web scraping portal that leverages this technology to organize and present job listings and internship opportunities, enhancing the job search experience.

Personalized Job Recommendation Systems

Personalized job recommendation systems aim to provide job seekers with opportunities that align with their skills, experience, and career goals. LinkedIn's job recommendation system, as detailed in a study by Stanford University, utilizes advanced algorithms to match users with relevant job postings, demonstrating the effectiveness of personalized recommendations in professional networking platforms.

Personalized Job Opportunity Finder powered by Web Scraping

This paper discusses the development of a job portal utilizing web scraping techniques

to gather and analyze job listings from multiple platforms. The portal enables job seekers to find suitable job opportunities by automating the data collection process, providing valuable insights into the job market, and sending email notifications for relevant jobs. While web scraping offers efficiency and real-time data, ethical and legal considerations are emphasized, as unauthorized scraping can lead to legal issues. The proposed system offers streamlined registration, job search capabilities, and personalized recommendations for job seekers.

A Study On Web Scraping Of Selected Job Portals

The paper presents a job search engine that automates the process of gathering and organizing job postings from platforms like LinkedIn using web scraping techniques. It utilizes technologies such as BeautifulSoup, Selenium, Flask, PostgreSQL, and Python Requests. The system collects job data, stores it in a database, and presents it to users through a simple, user-friendly web interface. Users can filter job listings by preferences, receive real-time updates, and export the data. This approach aims to save time, simplify job searches, and help users find relevant opportunities more efficiently. The project demonstrates how web scraping can improve job search processes and career development.

Building a job portal using web scraping.

This paper discusses the development of a job portal utilizing web scraping techniques to gather and analyze job listings from multiple platforms. The portal enables job seekers to find suitable job opportunities by automating the data collection process, providing valuable insights into the job market, and sending email notifications for relevant jobs. While web scraping offers efficiency and real-time data, ethical and legal considerations are emphasized, as unauthorized scraping can lead to legal issues. The proposed system offers streamlined registration, job search capabilities, and personalized recommendations for job seekers.

2.2.1 Similar Applications

In the realm of job search platforms, several web and mobile applications incorporate features akin to our proposed project, utilizing technologies such as web scraping and machine learning to enhance user experience. Below is a summary of notable applications:

LinkedIn

Overview: A professional networking site designed for business connections, job searching, and sharing work experiences.
Features:

Digital resumes through user profiles. Job board for applications. AI-powered tools, including a writing assistant.
Source: Business Insider

Robert Half Mobile App

Overview: A mobile application offering personalized job recommendations and the latest openings at top companies.
Features: Customizable profiles with job type, pay rate, and location preferences. Skill matching for job applications. Time report submissions and direct deposit setup.
Source: Robert Half

Handshake

Overview: A platform connecting students and recent graduates with employers, providing personalized job recommendations.
Features: Customized job and event recommendations based on user profiles and interests. Access to career center resources, employer information, events, fairs, articles, and appointments.
Source: App Store

Simplify
Overview: A platform that provides personalized job recommendations, resume crafting, and application tracking.
Features: Job matches from various companies. AI-powered resume builder. Job application autofill and tracking.
Source: Simplify

Kadoa
Overview: An AI-powered web scraper transforming job postings into structured data feeds for market intelligence and recruitment.
Features: Real-time job intelligence with rapid detection of new listings and changes. Automated data extraction for market analysis.
Source: Kadoa

Jobspikr
Overview: An AI-powered job scraping tool providing access to the latest labor market insights from numerous job data sources.
Features: Real-time job data extraction. Labor market trend analysis.
Source: Jobspikr

Glassdoor
Overview: A platform offering job listings, company reviews, and salary information to assist in job searches.
Features: Access to company reviews and ratings. Salary insights and job listings. Mobile app for on-the-go job applications.
Source: CIO

Indeed
Overview: A comprehensive job search engine that aggregates listings from various sources, offering tools for resume building and job applications.
Features: Extensive job database with filtering options. Resume upload and application tracking. Upcoming AI tool, Pathfinder, to connect job seekers with career opportunities matching their skills.
Source: Business Insider

These applications demonstrate the integration of advanced technologies to provide personalized and efficient job search experiences, aligning with the objectives of our proposed platform.

2.3 Gap Analysis

The gap analysis highlights the limitations of existing platforms in providing a unified solution for job seekers. While platforms like LinkedIn and Indeed offer personalized job recommendations and company reviews, they lack features such as skill gap analysis, trending skill suggestions, and comprehensive interview preparation tools. Other platforms like Simplify and Kadoa focus on specific functionalities but fail to integrate these into a holistic solution. This holistic approach addresses the limitations of individual platforms, like LinkedIn's limited skill suggestions or Simplify's lack of mock tests, by incorporating robust features like crash courses, mock interviews, and real-time updates. With advanced tools, our platform empowers users to bridge skill gaps, stay competitive, and access tailored opportunities in today's job market.

Our proposed platform addresses these gaps by offering real-time web scraping, customizable filters, mock tests, and crash courses, along with a unified interface. This approach ensures a seamless, efficient, and growth-oriented experience for users. The project addresses gaps in personalized job recommendations, skill development tools, interview preparation, and real-time job scraping efficiency.When comparing existing platforms like LinkedIn, Robert Half, Handshake, Simplify, Kadoa, Jobspikr, Glassdoor, and Indeed, the following gaps emerge, highlighting the distinct advantages of our proposed platform:

Feature	LinkedIn	Robert Half	Handshake	Simplify	Kadoa	Jobspikr	Glassdoor	Indeed	Proposed Platform
Personalized Job Recommendations	Yes	Yes	Yes	Yes	No	No	No	Yes	yes
Trending Skill Suggestions	Limited	No	No	No	No	No	No	No	Yes
Interview Preparation Tools	Limited	No	No	No	No	No	No	No	Yes
Web Scraping and Real-Time Updates	No	No	No	No	No	Yes	No	No	Yes
Company Reviews and Ratings	Yes	No	No	No	No	No	Yes	Yes	Yes
Mock Tests and Crash Courses	No	No	No	No	No	No	No	No	Yes
Unified Platform for All Features	No	No	No	No	No	No	No	No	Yes

Figure 2.1: Gap Analysis

2.3.1 Related Research

The development of job recommendation platforms has been extensively explored in existing literature, highlighting the integration of advanced technologies such as web scraping, machine learning, and natural language processing. Studies reveal that platforms like LinkedIn and Indeed effectively use AI algorithms for personalized job recommendations and resume analysis. For example, LinkedIn employs collaborative filtering and deep learning to match users with relevant opportunities, while Indeed offers filtering tools and upcoming AI enhancements for better job matching.

Research also emphasizes the potential of web scraping tools like BeautifulSoup and Selenium to aggregate job postings from multiple sources, as seen in platforms like Kadoa and Jobspikr. These tools enable real-time data extraction and labor market analysis. Similarly, Simplify and Handshake focus on user-centric features such as skill-matching, resume crafting, and customizable job recommendations, providing valuable insights into enhancing user engagement.

Despite these advancements, existing platforms face limitations, including inadequate skill development resources and lack of comprehensive interview preparation tools. This project builds upon the gaps identified in the literature by integrating features like tailored skill enhancement suggestions, mock interview resources, and advanced web scraping for a user-friendly job recommendation experience

2.4 Summary

The background chapter highlights the need for a smarter job search process, addressing inefficiencies in traditional job hunting. It introduces the project's use of web scraping, machine learning, and system design to provide personalized job recommendations, skill development tools, and interview preparation resources. Preliminaries cover foundational concepts like data extraction, recommendation algorithms, and database management. The literature review explores existing techniques, hybrid systems, and ethical concerns in web scraping, while comparing similar applications to identify gaps for improvement in job search platforms.

Chapter 3

Project Design

Project Design chapter outlines the architectural framework, system components, and design considerations of the job recommendation platform. It covers the functional and non-functional requirements, context diagram, data flow diagram (Level 1), and user interface design. These elements collectively illustrate how the system is structured to address user needs and operational objectives.

3.1 Requirement Analysis

3.1.1 Functional and Nonfunctional Requirements

Functional Requirements:

1. **User Profile Management:**
   Enable users to create and update profiles with details such as education, experience, and skills.
   Allow users to customize their career preferences for personalized recommendations.

2. **Job Scraping and Aggregation:**
   Scrape job postings from multiple sources, such as LinkedIn and BDJobs.
   Consolidate scraped job listings into a centralized, organized repository.

3. **Personalized Recommendations:**
   Use machine learning algorithms to suggest jobs that align with user profiles.
   Include hybrid recommendation techniques for improved accuracy.

4. **Real-Time Notifications:**
   Send instant alerts for new job postings that match user preferences.

5. **Skill Gap Analysis and Suggestions:**
   Identify gaps in user skills compared to job market trends.
   Recommend relevant courses for professional development.

6. **Interview Preparation Tools:**
   Provide mock tests, expert tips, and crash courses for interview readiness.

7. **Company Insights:**
   Display company reviews, ratings, and related insights for informed decision-making.

8. **Data Export:**
   Allow users to export job search results for further analysis.

3.1.2 Context Diagram

The **Context diagram** illustrates a job search platform utilizing web scraping and machine learning. It supports job seekers with features like job recommendations, salary predictions, job alerts, company reviews (via LLM), and mock interviews. Additional functionality includes language translation when needed. An admin oversees data management and user approvals to maintain system functionality.

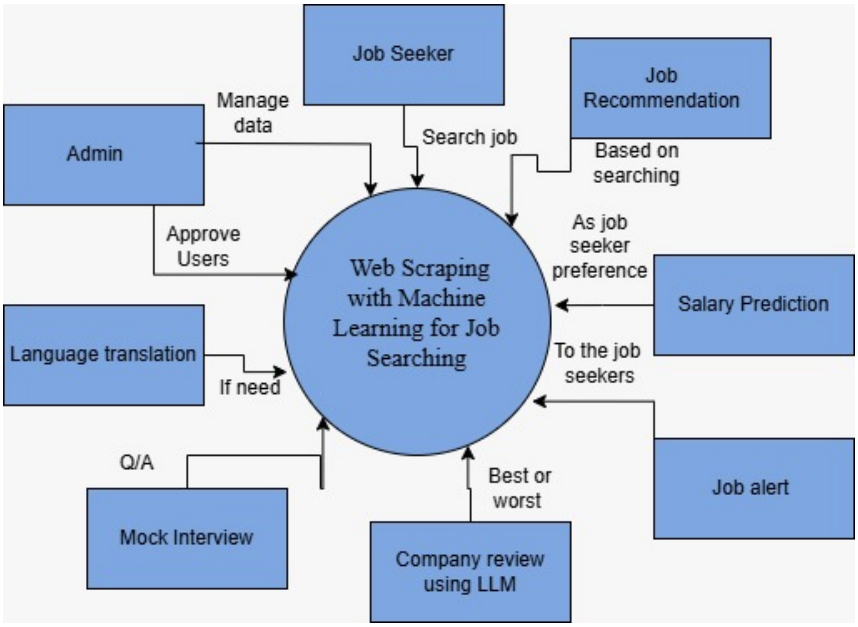


Figure 3.1: Context Diagram

3.1.3 UI Design

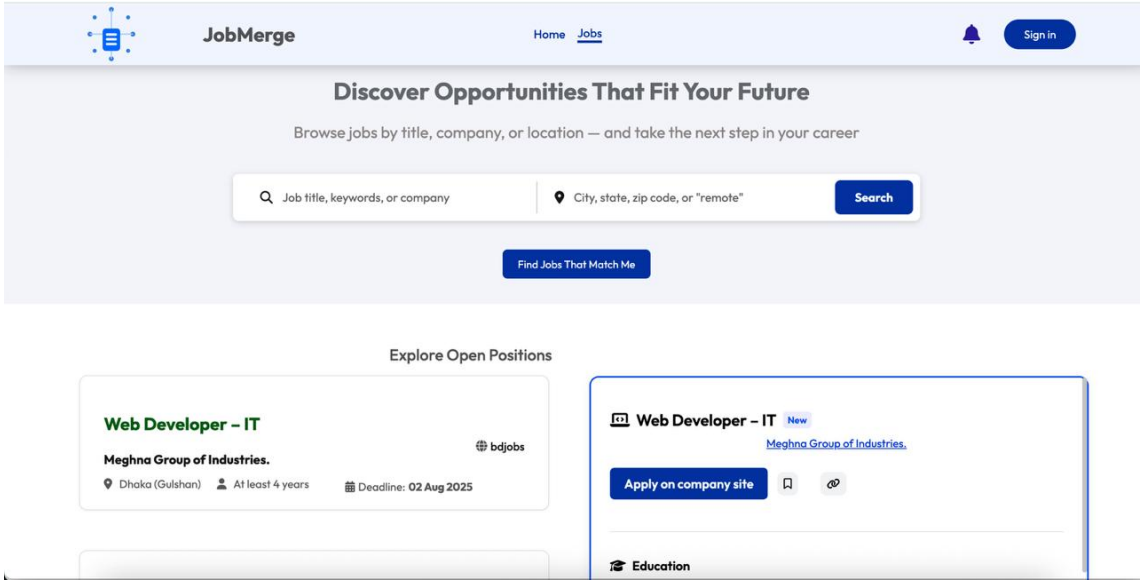


Figure 3.2: Home page– Job Search Interface

Description : The homepage provides a streamlined job search interface, allowing users to filter job listings by title, company, or location. It features a personalized job match button, displays open positions, and enables users to explore detailed job descriptions and apply directly via company websites.

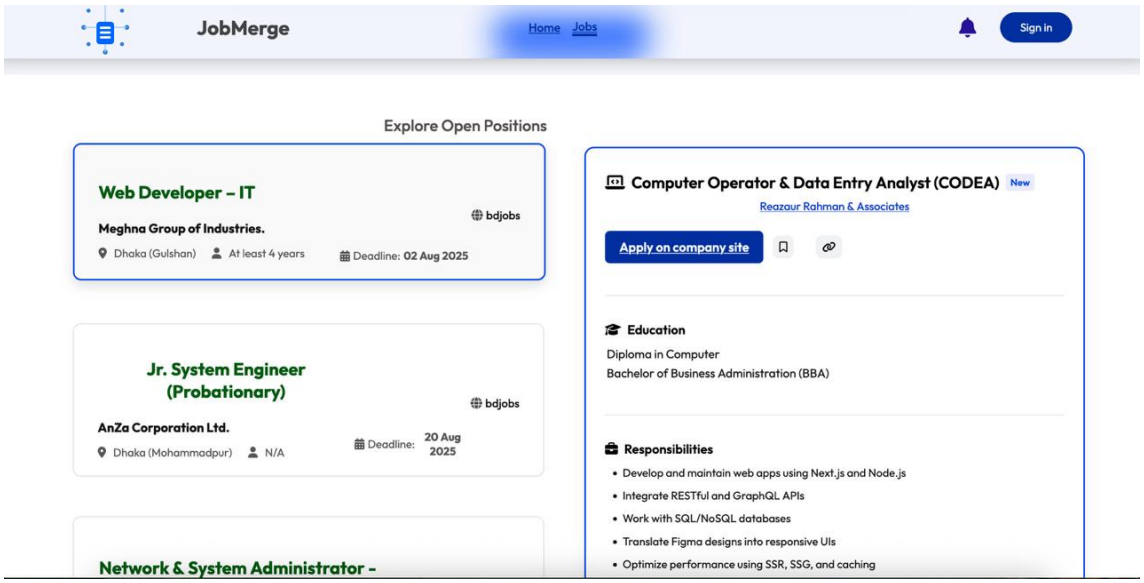


Figure 3.3: Job Description

Description : JobMerge offers a dynamic job listing interface displaying current openings with detailed job descriptions. Each listing includes roles such as Web Developer, Jr. System Engineer, and Data Entry Analyst, showcasing company name, location, experience required, deadline, and key responsibilities. Selected jobs display full descriptions, including qualifications, tasks, and application links.

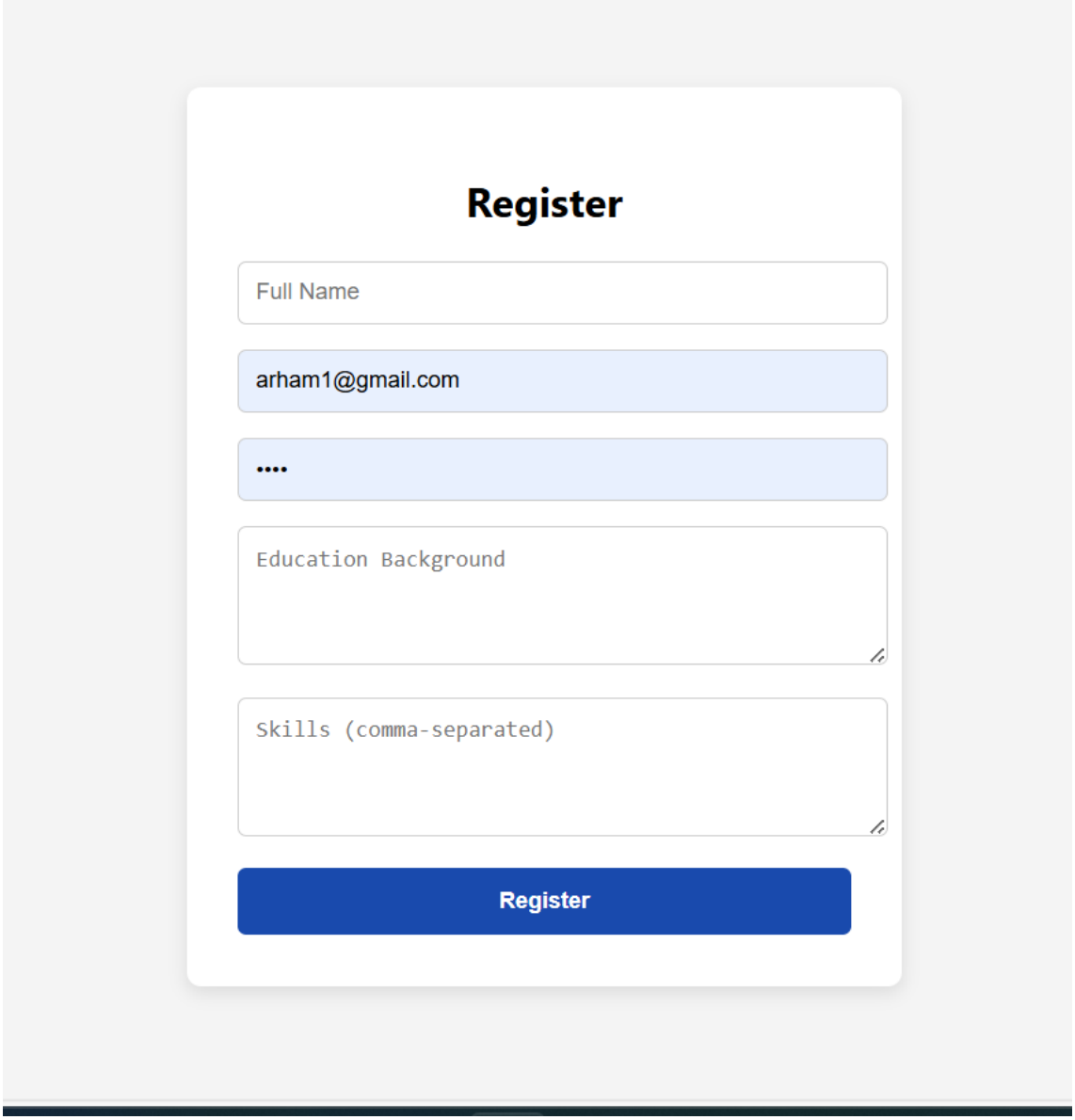


Figure 3.4: Registration

Description : The registration form provides a user-friendly interface where individuals can enter their full name, email address, password, education background, and a list of skills. This collected data is used to create personalized user profiles, which are essential for generating accurate and relevant job recommendations based on qualifications and career preferences.

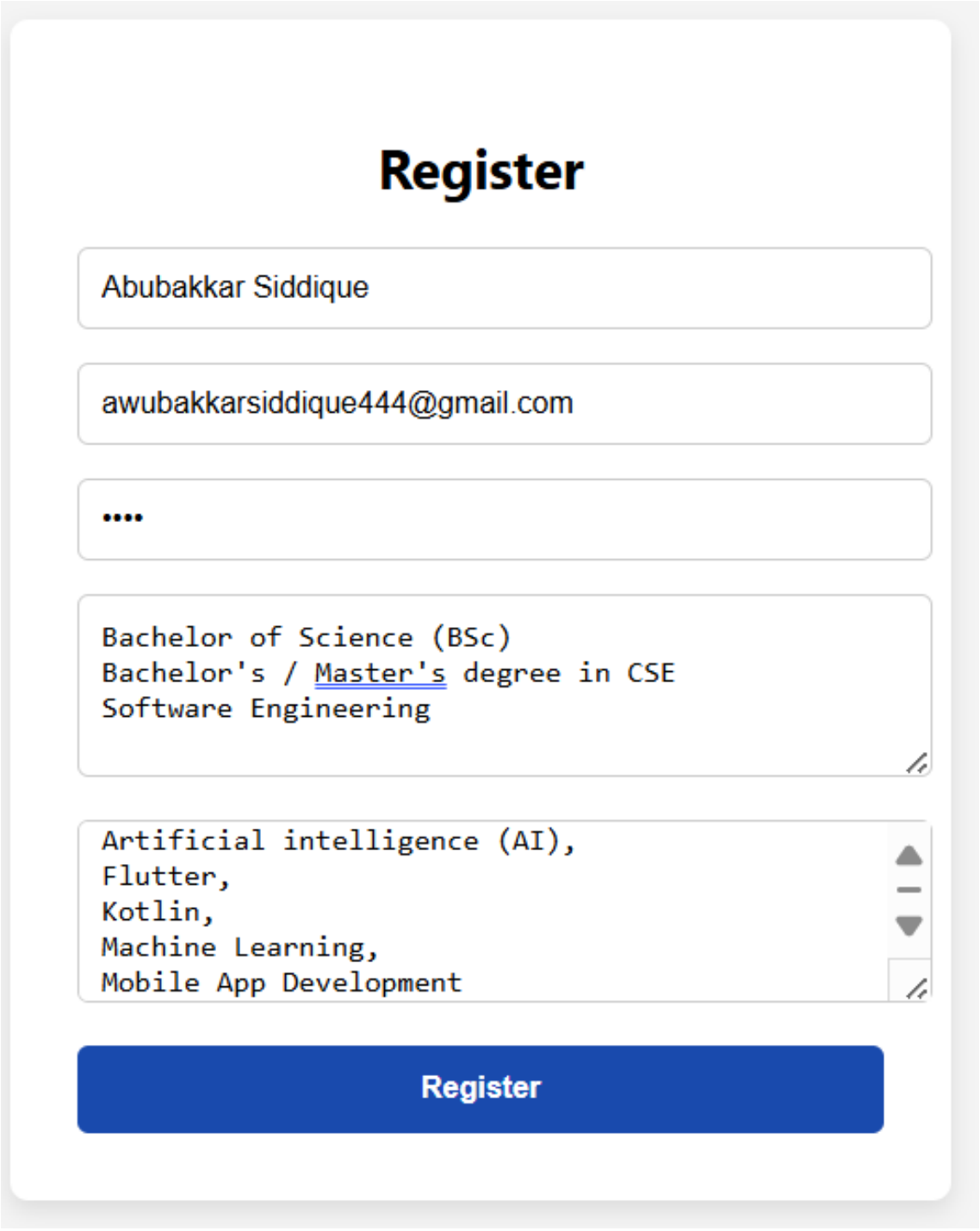


Figure 3.5: Registration Details

Description : The registration form allows users to sign up by entering their name, email, password, educational background, and technical skills. The form supports multi-line academic and skill inputs, such as "Bachelor of Science in CSE" and skills like "AI, Flutter, Kotlin, Machine Learning." A "Register" button finalizes the process.

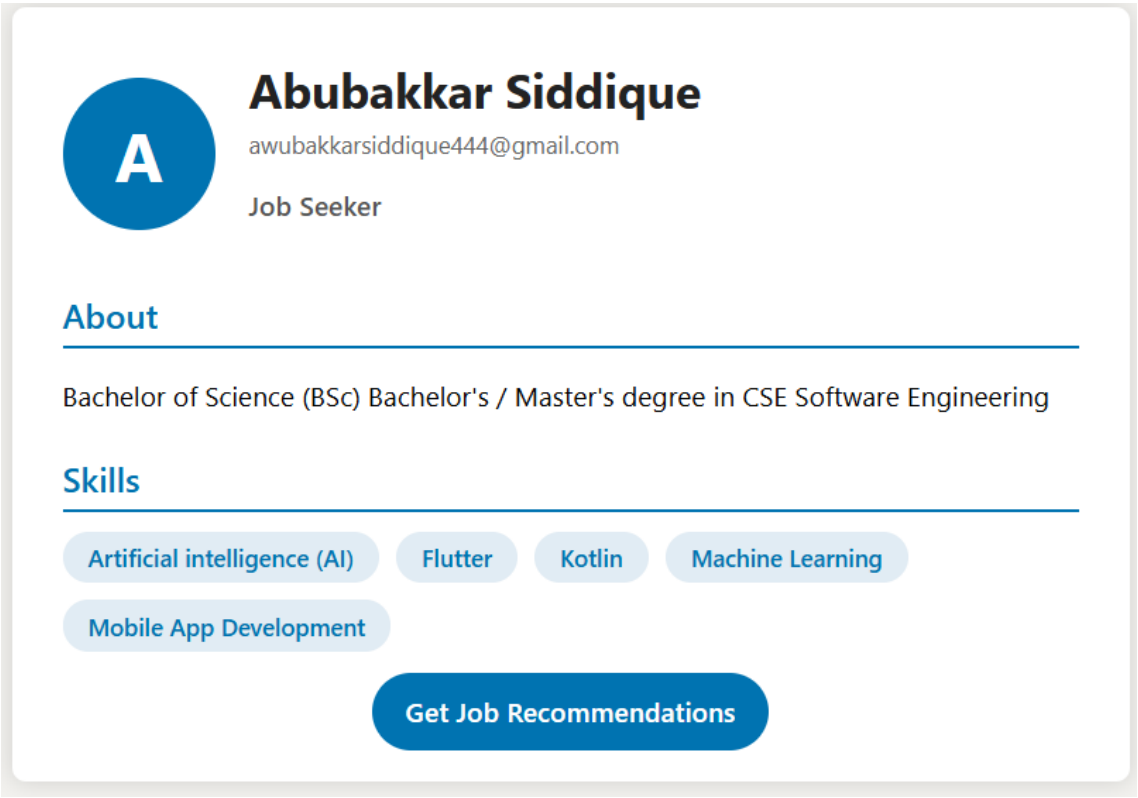


Figure 3.6: Profile

Description : This profile interface displays key job seeker information. It features the user's name, email, and role ("Job Seeker"), along with an "About" section summarizing academic qualifications (BSc/Master's in CSE Software Engineering). Skills are shown as clickable tags, including AI, Flutter, Kotlin, Machine Learning, and Mobile App Development. A prominent button allows users to generate tailored job recommendations.

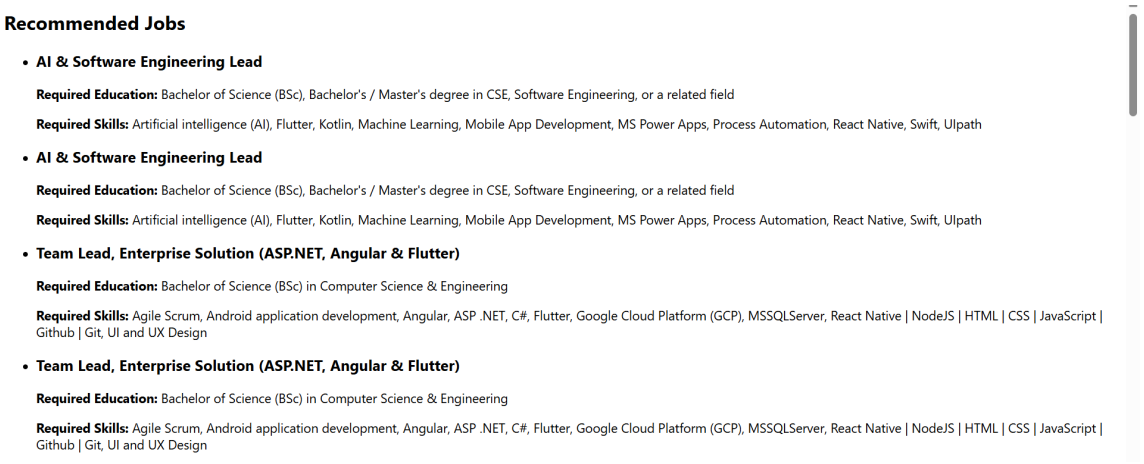


Figure 3.7: Scraping Job

Description : This section dynamically lists personalized job suggestions based on the user's profile and skills. Each job entry includes the job title, required education (BSc or Master's in CSE), and a detailed list of required skills such as AI, Flutter, Kotlin, React Native, and more. Roles like "AI Software Engineering Lead" and "Team Lead, Enterprise Solution" are highlighted. The recommendations match the candidate's qualifications and streamline job discovery.

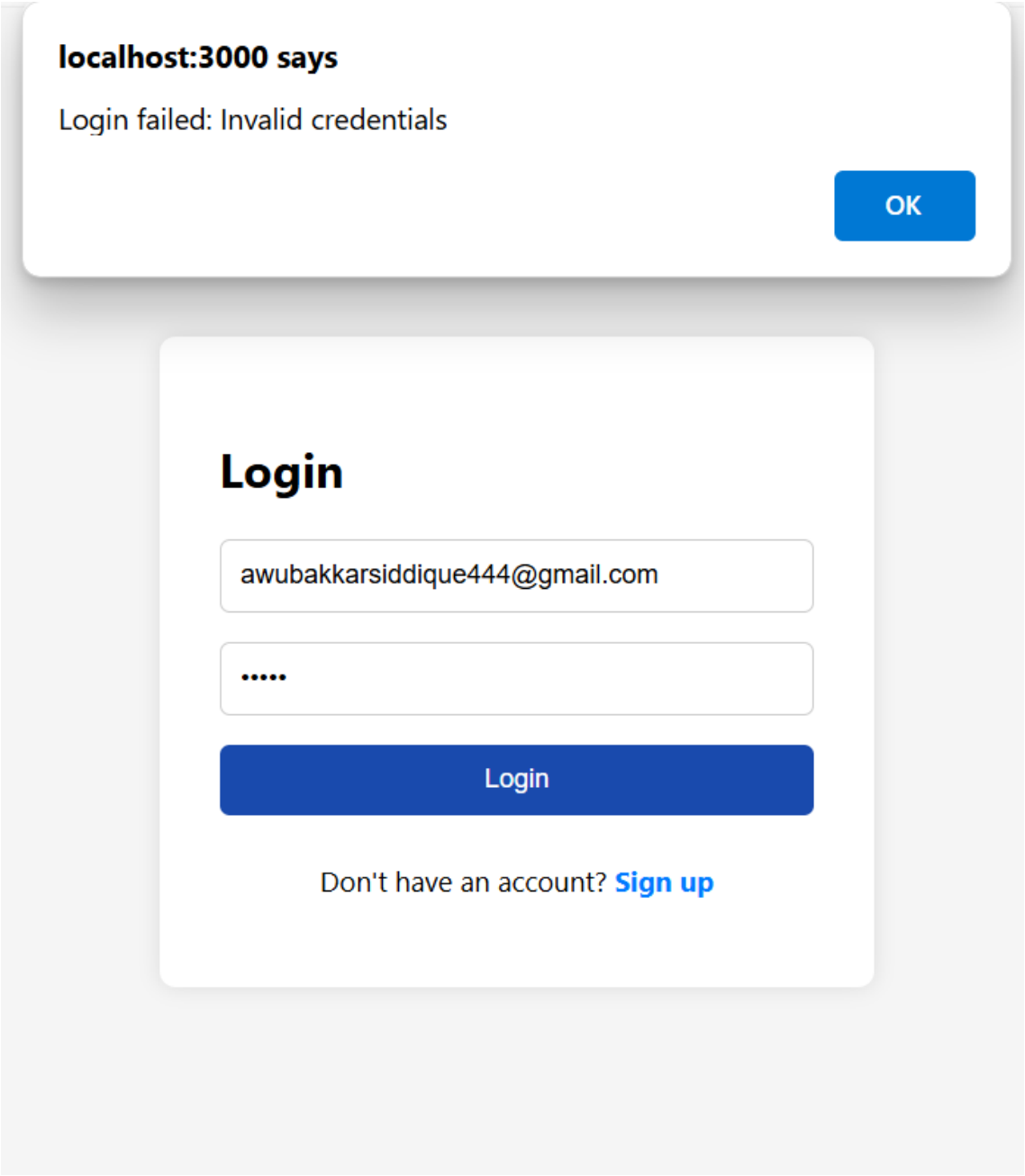


Figure 3.8: Log in with Incorrect Password

Description : The login screen allows users to sign in using their email and password. In this case, an error alert appears from localhost:3000, stating "Login failed: Invalid credentials", indicating incorrect email or password. The interface also includes a link to sign up for new users who don't have an account.

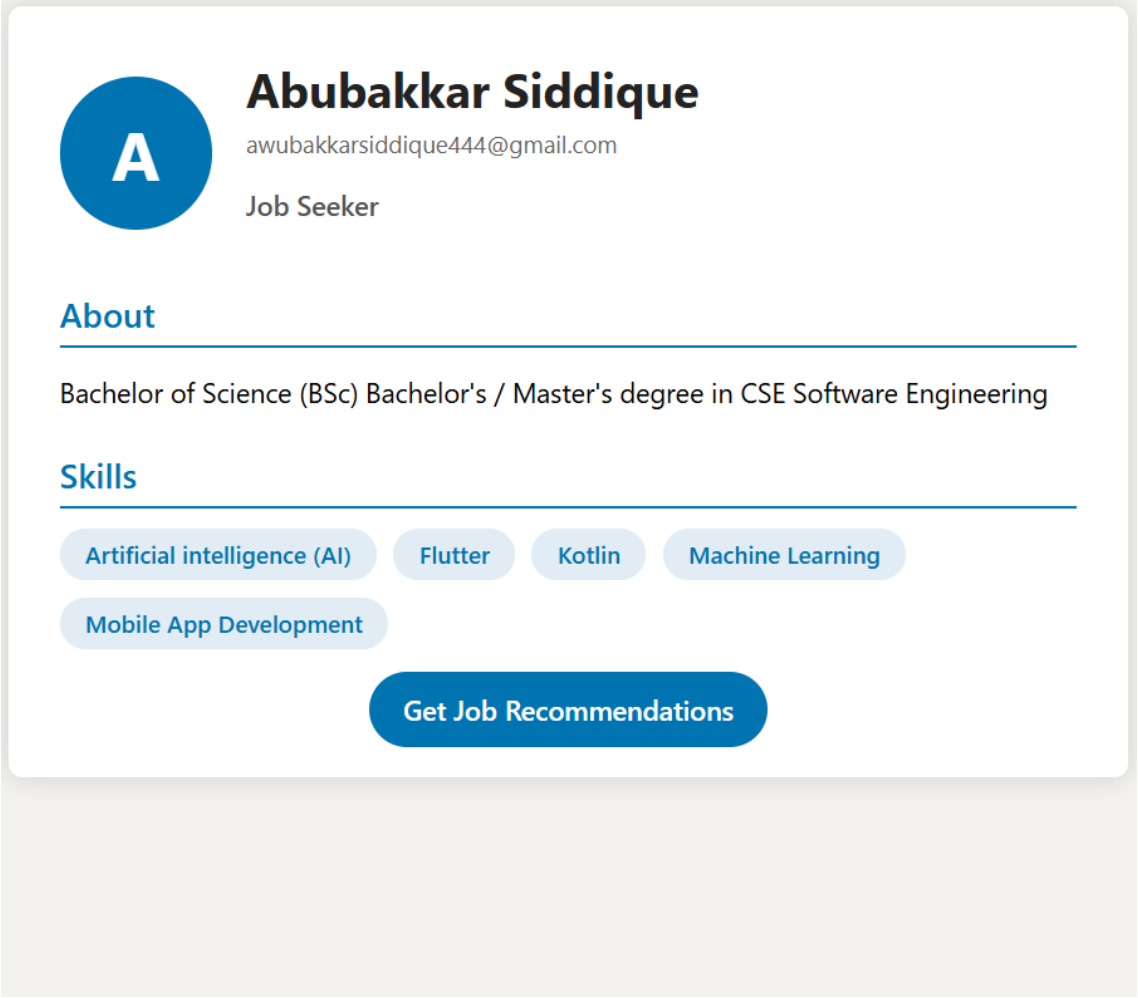


Figure 3.9: After login Profile

Description : This JobMerge profile interface presents the user's name, email, and academic background in Software Engineering. It highlights core technical skills like AI, Flutter, and Machine Learning using visual tags, and includes a prominent button to generate personalized job recommendations instantly..

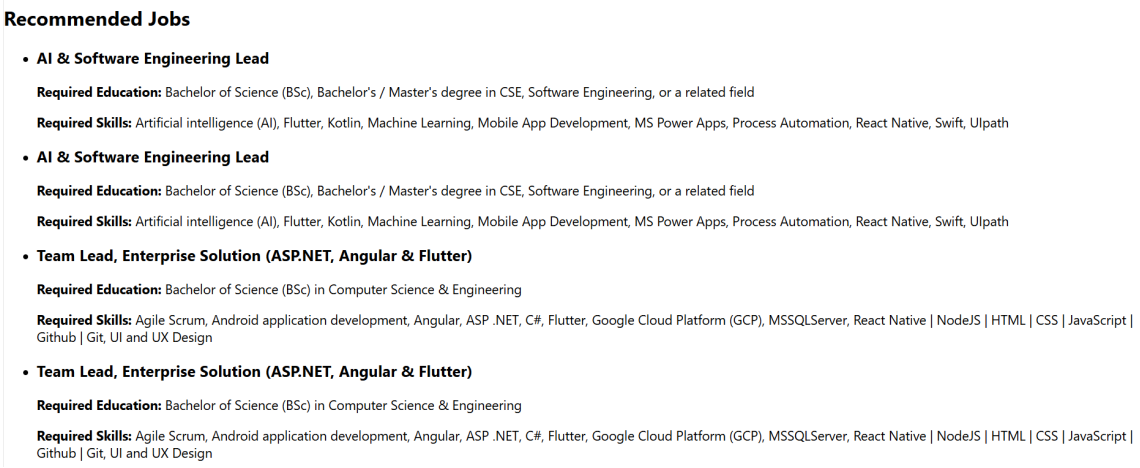


Figure 3.10: Job Recommendations

Description : The Recommended Jobs section displays tailored listings based on the user's profile. It includes job titles, required education, and detailed skill sets for roles like AI Lead and Team Lead in Enterprise Solutions, aligning with the user's technical strengths.

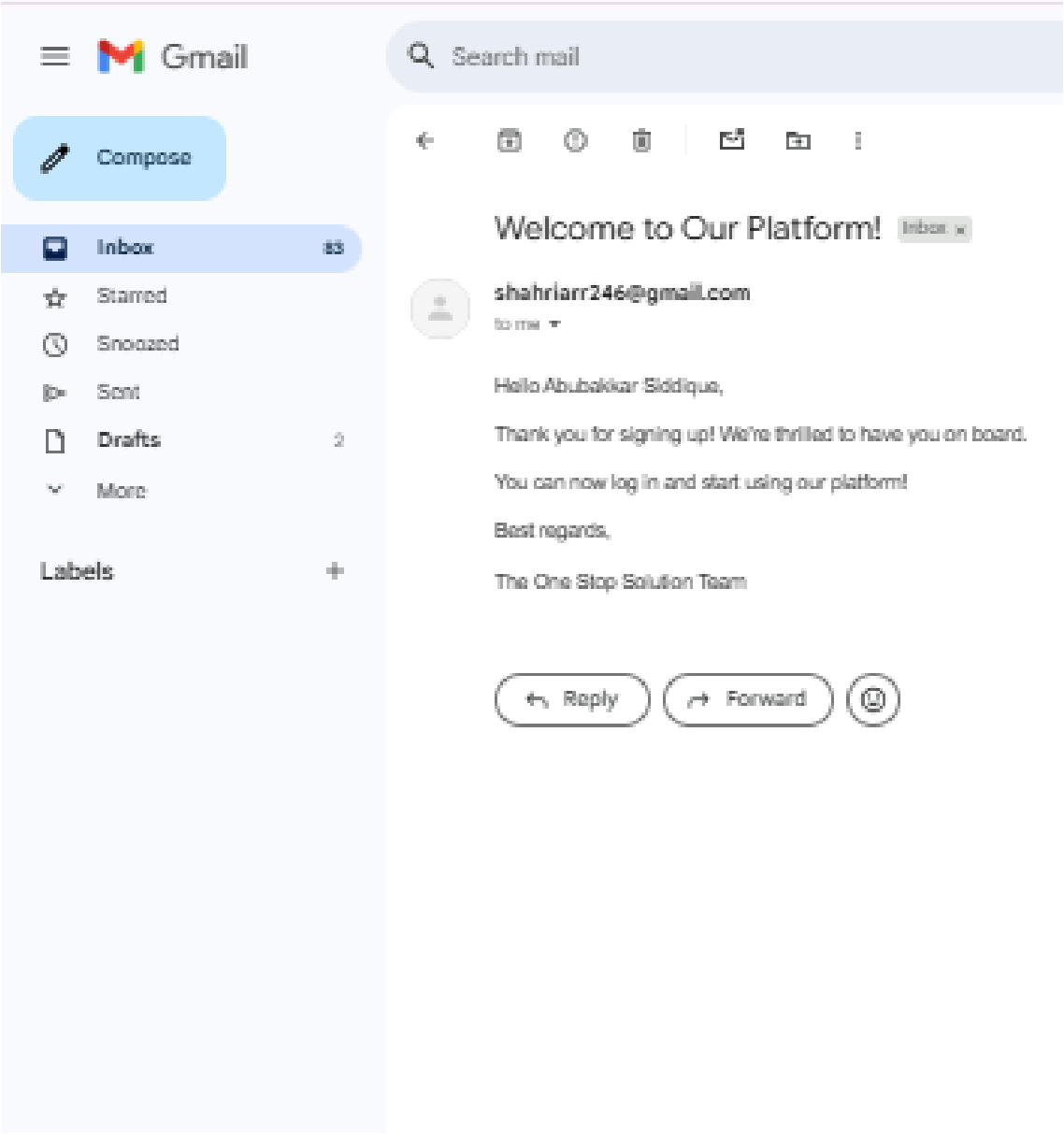


Figure 3.11: Registration confirmation mail

Description : The email confirms successful registration, addressed to Abubakkar Siddique. It warmly welcomes the user, thanking them for signing up and encouraging them to log in and start using the platform. The message is sent by JobMerge.

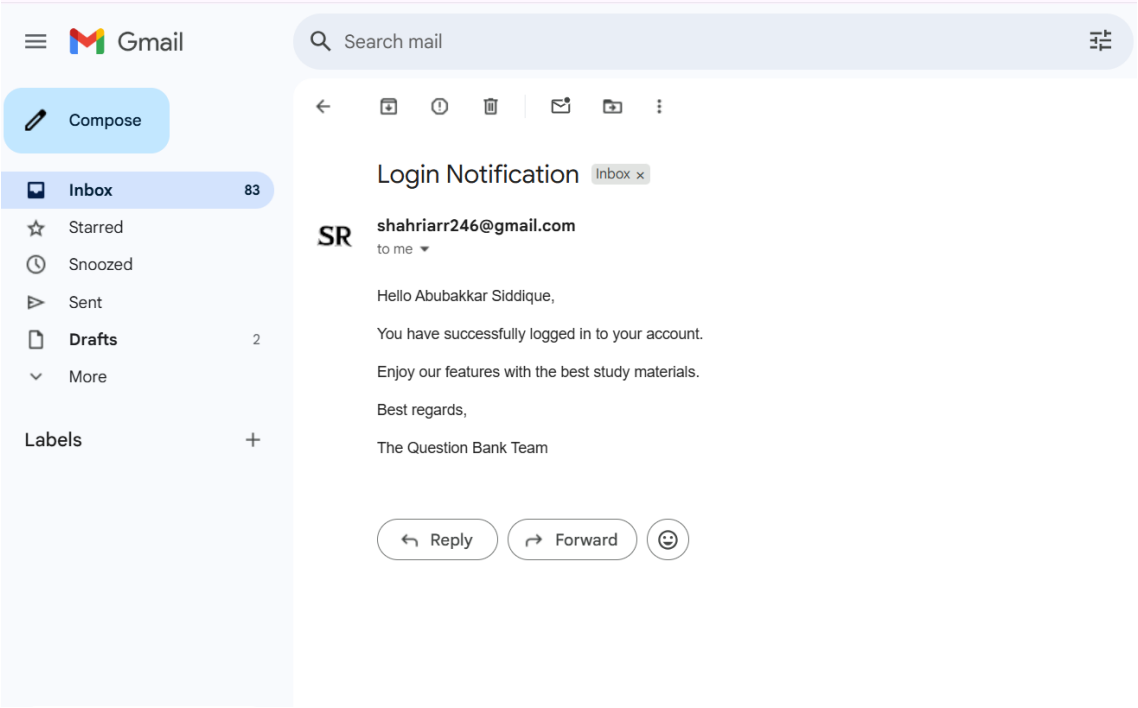


Figure 3.12: Login confirmation Mail

Description : The email confirms a successful login for Abubakkar Siddique. Sent by The Question Bank Team, it welcomes the user and encourages exploration of platform features, including access to study materials. The subject is titled "Login Notification."

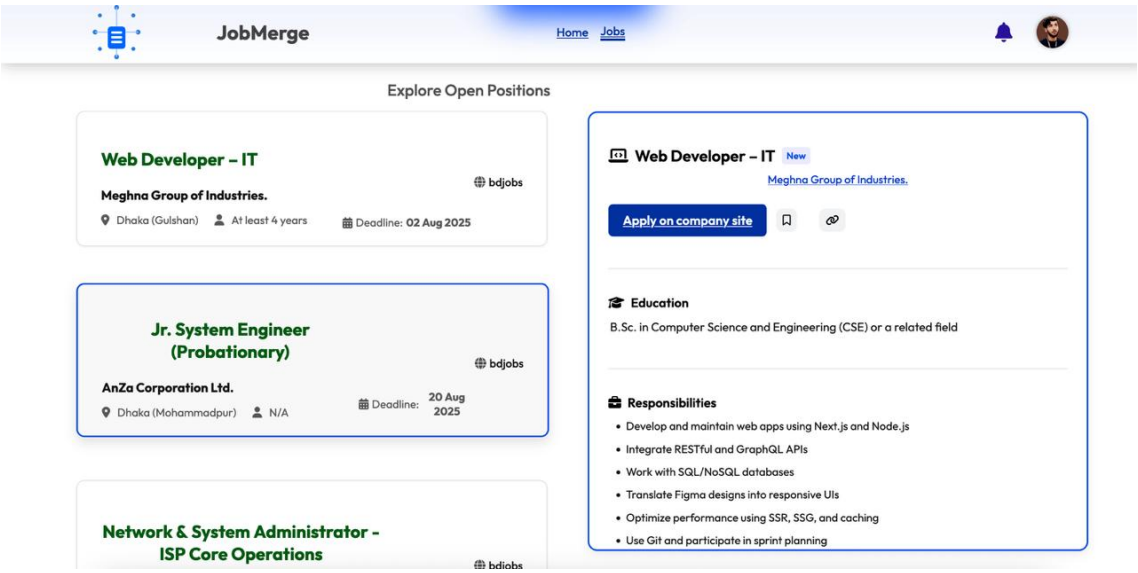


Figure 3.13: Web Developer role details

Description : The JobMerge platform displays detailed job listings after login. Users can view job roles like Web Developer with education requirements, responsibilities, and apply links. Listings include company names, deadlines, and filtering options for smooth and personalized job exploration.

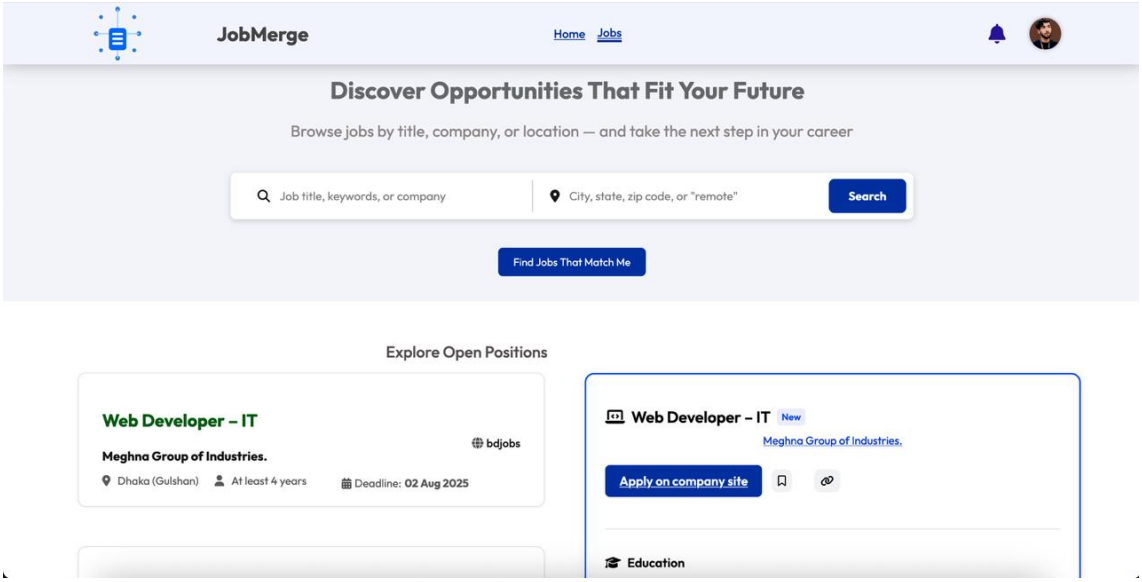


Figure 3.14: Job search page

Description : The JobMerge dashboard enables users to search jobs by title, company, or location. It features a search bar, matching job button, and categorized listings. Job details, including responsibilities and qualifications, are shown dynamically for selected roles like Web Developer – IT.

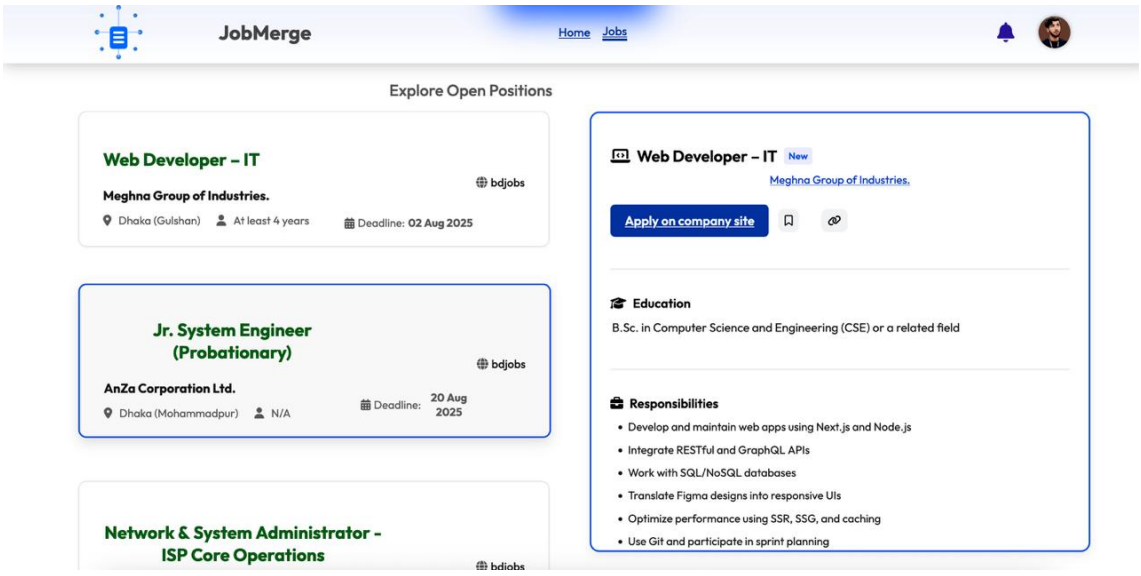


Figure 3.15: Job details

Description : The JobMerge interface displays job listings with detailed descriptions on selection. Users can view qualifications, responsibilities, deadlines, and location for roles like "Web Developer – IT," and apply via an external company site using the provided button.

3.2 Detailed Methodology and Design

In the development of our system, we followed a structured methodology to ensure scalability, performance, and maintainability. This section outlines the design decisions, architectural flow, and the alternate approaches we considered.

3.2.1 Alternate Solutions Considered

Before finalizing our approach, we analyzed several alternative methods and technologies:
Manual Job Data Collection: One approach was to manually collect job listings and input them into a database. However, this was time-consuming, error-prone, and not scalable for large datasets or real-time updates.
Third-Party APIs: Some job platforms offer APIs for accessing job listings. However, due to limited access, rate limits, or lack of support for local job boards like BDJobs, this option was not feasible.
Python-based Scraping (e.g., using BeautifulSoup): We considered using Python with BeautifulSoup and Requests for scraping. Although this approach is effective, it lacks dynamic rendering capabilities required to scrape JavaScript-heavy websites like BDJobs.com.

3.2.2 Chosen Methodology and Justification

We selected a Node.js backend with Puppeteer for headless browser automation, along with MySQL as the database. The reasons include:

- **Dynamic Content Rendering:** Puppeteer can interact with JavaScript-rendered pages, making it suitable for dynamic job listing websites.
- **Efficient and Fast Scraping:** Puppeteer supports headless browsing with control over timing and selectors, helping avoid anti-scraping mechanisms.
- **Data Storage and Retrieval:** MySQL provides a structured and query-efficient solution for storing scraped job data with fields such as title, education, skills, and job link.
- **Ease of Integration with Express.js:** The Express framework allows for rapid development of REST APIs and HTML endpoints for scraping triggers and viewing scraped results.

3.2.3 System Design Overview

The system design follows a modular architecture:

- **Scraping Module:** Utilizes Puppeteer to extract job details like title, required education, skills, and the job link.

- **Database Module:** MySQL stores the structured data, ensuring persistent and queryable records.
- **Server Module:** Express.js handles routing for scraping and rendering the results via API or HTML.

This architecture ensures flexibility for future extension, such as:

- Adding user authentication to protect the scrape function.
- Supporting multiple job platforms.
- Integrating with a frontend framework like React or deploying as a mobile app.

3.3 Project Plan

The project has been structured into six key phases, each organized chronologically and visualized using a Gantt chart to ensure clarity in scheduling and execution. The plan spans from November 2024 to October 2025, covering all major stages from research and design to development, deployment, and post-launch maintenance.

1.Project Initiation (Nov 4 – Nov 18, 2024): This initial phase focused on defining the problem statement, setting objectives, identifying stakeholders, and assigning roles within the team. Key project documentation and planning were also completed.

2.Research Design (Nov 20, 2024 – Jan 27, 2025): In this phase, system requirements were gathered, user needs were analyzed, and design mockups, wireframes, and architecture plans were prepared. This formed the blueprint for development.

3.Development Phase (Feb 25 – July 10, 2025): The main development work was carried out during this period. The team implemented frontend and backend functionalities, integrated the database, and developed the core features of the system.

4.Testing Debugging (July 22 – August 25, 2025): Comprehensive testing is being conducted to ensure the system meets functional and non-functional requirements. This includes unit testing, integration testing, and user acceptance testing, followed by necessary bug fixes.

5.Deployment Launch (August 27 – September 5, 2025): The system will be deployed in a live environment. Final verification, data migration (if needed), and performance optimization will be performed before official rollout.

6.Post-Launch Support (September 10 – October 15, 2025): After deployment, the focus will shift to performance monitoring, addressing user feedback, fixing any real-time issues, and implementing small improvements to enhance user experience.

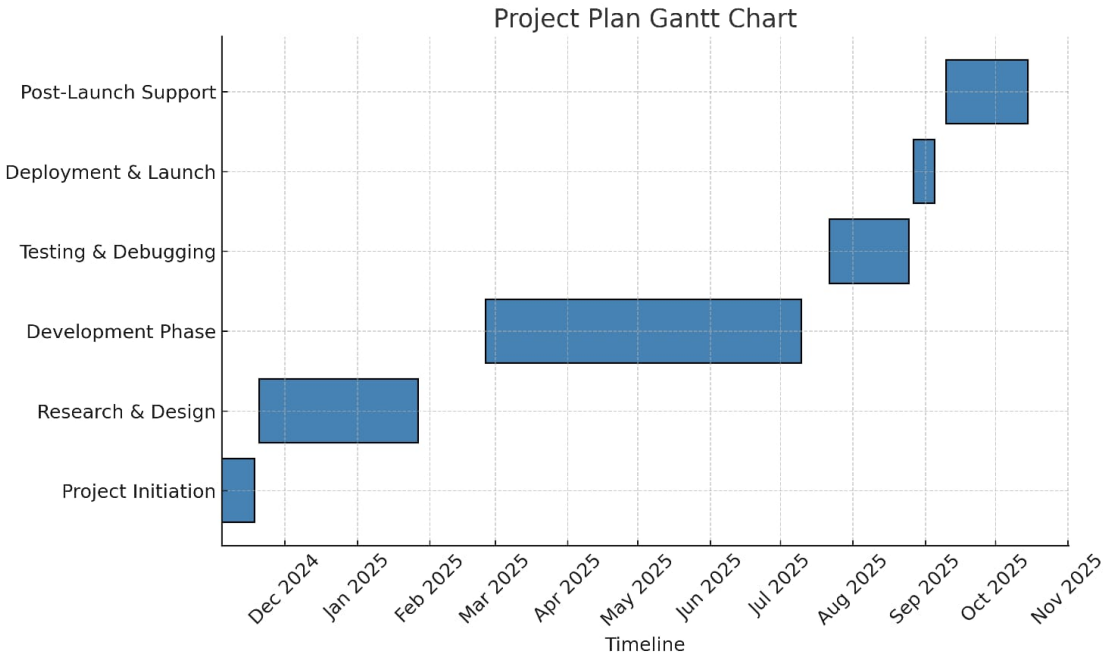


Figure 3.16: Gantt Chart

This phased approach, supported by a detailed Gantt chart, ensures structured progress and timely delivery. Each stage builds upon the previous one, helping the team stay aligned with both technical goals and academic deadlines.

3.4 Task Allocation

Here's a task allocation plan for our project :

Team Member-1 : Nafisa Zaman
Role: **Project Manager**

- Plan and tracks project progress
- Ensures deadlines are met
- Communicates with faculty and team members

Team Member-2 : Shahriar Rahman
Role: **Backend Developer**

- Implements server-side logic using Node.js
- Develops job scraping functionality with Puppeteer
- Ensures database integration

Team Member-3 : Asif
Role: **Frontend Developer**

- Creates the user interface using Next.js
- Ensures a user-friendly and responsive design
- Integrates APIs and backend logic

Team Member-4 :Abubakkar Siddique
Role: **Database Administrator**

- Designs and manages the MySQL database
- Ensures efficient data storage and retrieval
- Performs regular data backup

Team Member-5 : Sabrina Zaman
Role: **QA Tester**

- Conducts manual testing to identify bugs
- Ensures that features work as intended
- Prepares testing reports

Team Member-6 :Safrin Sanzida Islam
Role: **Documentation Presentation Leadr**

- Prepares project documentation
- Creates presentation slides
- Manages reports and delivers project presentation

3.5 Summary

This chapter outlines the system architecture and design of the job recommendation platform. It covers functional requirements such as user profile management, job scraping, personalized recommendations, real-time notifications, skill gap analysis, interview preparation tools, company insights, and data export. The context diagram highlights the system's integration with web scraping and machine learning. Methodology discusses alternative solutions and justification for the chosen design. The project plan defines timelines and milestones, while task allocation assigns roles for efficient implementation.

Chapter 4

Implementation and Results

4.1 Environment Setup

The environment setup was a critical phase to ensure the seamless development and execution of the job recommendation platform. The following technologies and tools were used:

- Backend: Node.js was used for server-side development, ensuring efficient handling of user requests and system operations.
- Frontend: Next.js provided a robust framework for developing a responsive and user-friendly interface.
- Database: MySQL was utilized to store and manage user profiles, job postings, and related data.
- Web Scraping: Puppeteer, a headless browser automation tool, was employed to scrape job postings from various sources effectively.
- Testing Tools: Manual testing was conducted to ensure the platform's functionality, usability, and reliability.

The environment setup involved installing and configuring all necessary dependencies, creating database schemas, and setting up APIs to integrate different system components. The system was deployed on a local machine for development and testing purposes.

4.2 Testing and Evaluation

The project underwent rigorous manual testing to evaluate its performance and functionality. Key testing activities included:

Unit Testing: Each module, such as job scraping, user profile creation, was tested individually to verify functionality.

Integration Testing: The interaction between different modules, including the frontend, backend, and database, was evaluated for seamless data flow.

System Testing: The entire platform was tested as a whole to ensure it met the specified requirements.

Performance Testing: The platform's performance was evaluated by scraping large volumes of data and handling multiple user profiles simultaneously.

Usability Testing: The user interface was tested to assess its ease of navigation and user-friendliness.

Testing revealed some minor issues, such as latency during scraping and incomplete job postings due to changes in source website structures, which were addressed promptly.Missing Data from some url link , Some unneccessary data was addeed during the prototyping.

4.3 Results and Discussion

The project successfully achieved its main goal of building an effective and personalized job recommendation platform. The key achievements are:

Efficient Job Scraping: We used Puppeteer, a tool for web scraping, to collect job postings from BdJobs, focusing on the IT/Telecommunication category. The tool managed challenges like dynamic web pages and pagination, ensuring all relevant job data was extracted, including job titles, descriptions, required skills, and deadlines.

Handling Dynamic Websites: Puppeteer made it possible to work with websites that load content dynamically. It handled tasks like scrolling, clicking buttons, and dealing with pop-ups, making sure no job postings were missed.

Improved Speed and Performance: The scraping process was optimized to handle large amounts of data quickly without slowing down. Techniques like limiting requests and running multiple tasks at once helped ensure the system worked efficiently.

Organized Data Storage: The scraped job postings were stored neatly in a database, making it easy to search and retrieve information. The database was designed to handle different job details and adapt to future needs.

Personalization Ready: This scraping system provided the foundation for a recommendation engine. The engine will match jobs to users based on their skills, preferences,

```
PS D:\projects> cd backend
PS D:\projects\backend> node server.js
Server running at http://localhost:9000
Error during scraping: connect ECONNREFUSED ::1:3306
Category not found, using default.
Posted date not found.
Job inserted: Full Stack Developer (AngularJS & NodeJS)
Category not found, using default.
Posted date not found.
Job inserted: Software Developer(Web)
Category not found, using default.
Posted date not found.
Job inserted: Technical Support Personnel
Category not found, using default.
Posted date not found.
Job inserted: Digital Operations Analyst (Web Developer)
Category not found, using default.
Posted date not found.
Job inserted: Web & Software Developer(Full Stack )
Category not found, using default.
Posted date not found.
Job inserted: Administrator, IT Operations Center
Category not found, using default.
Posted date not found.
Job inserted: Digital Marketing Intern
Category not found, using default.
Posted date not found.
Job inserted: Wordpress Developer
Category not found, using default.
Posted date not found.
Job inserted: Social Media Executive
Category not found, using default.
```

Figure 4.1: Scraped Job

and career goals using filters and machine learning techniques.

User Profile Matching: The platform effectively matched user profiles with job postings using machine learning models. This resulted in high relevance and user satisfaction in job recommendations.

UI/UX Success: Next.js enabled the creation of an intuitive, responsive interface, which was highly rated during user testing.

Challenges and Solutions:

Challenge-1: Handling CAPTCHA-protected websites during web scraping.
Solution: Integrated Puppeteer's automation capabilities with third-party CAPTCHA-solving APIs.
Challenge-2: Ensuring the database remained synchronized with rapidly changing job postings.
Solution: Implemented scheduled scraping tasks and data deduplication techniques.

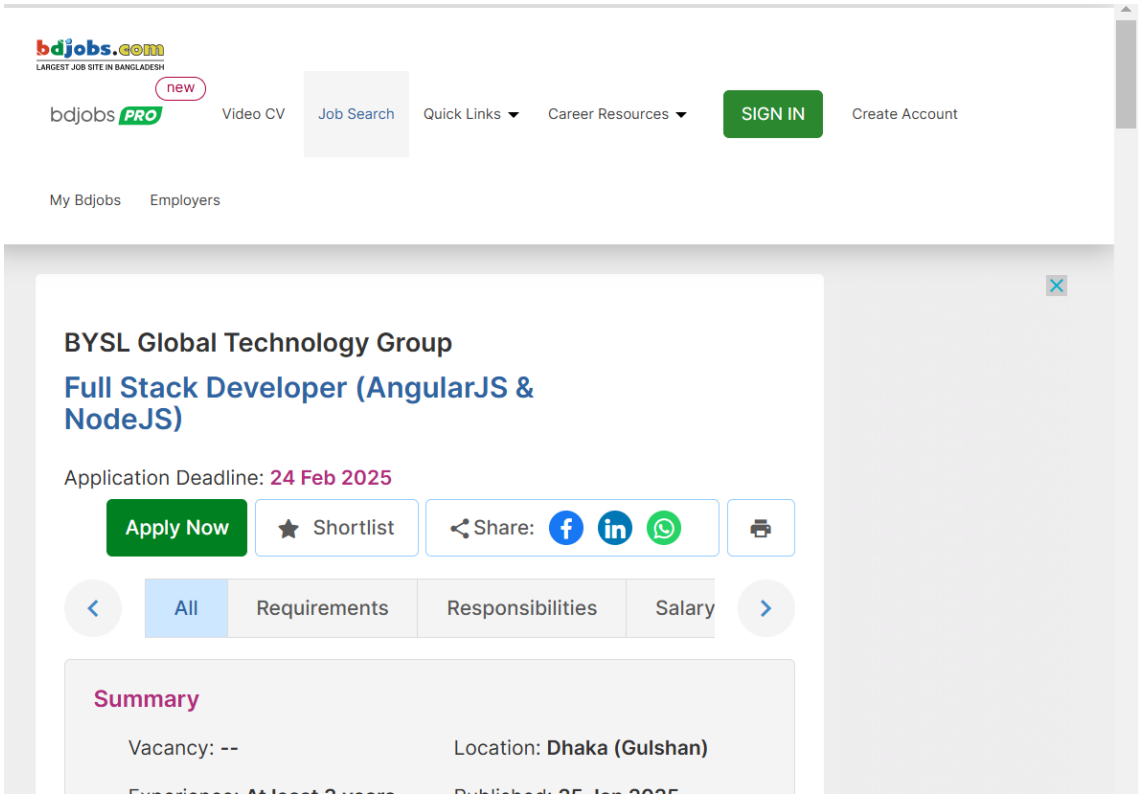


Figure 4.2: Selected Job Site

Impact:
The platform reduced the effort required for job searching while enabling skill development and career planning.

4.4 Summary

The implementation of the job recommendation platform involved setting up an environment using Puppeteer, MySQL, Node.js, and Next.js. Through manual testing, the platform's functionality, performance, and usability were thoroughly evaluated. The results demonstrated its effectiveness in scraping job postings, generating personalized recommendations, and providing a seamless user experience. Challenges related to data accuracy and manual testing effort were identified, offering insights for future improvements.

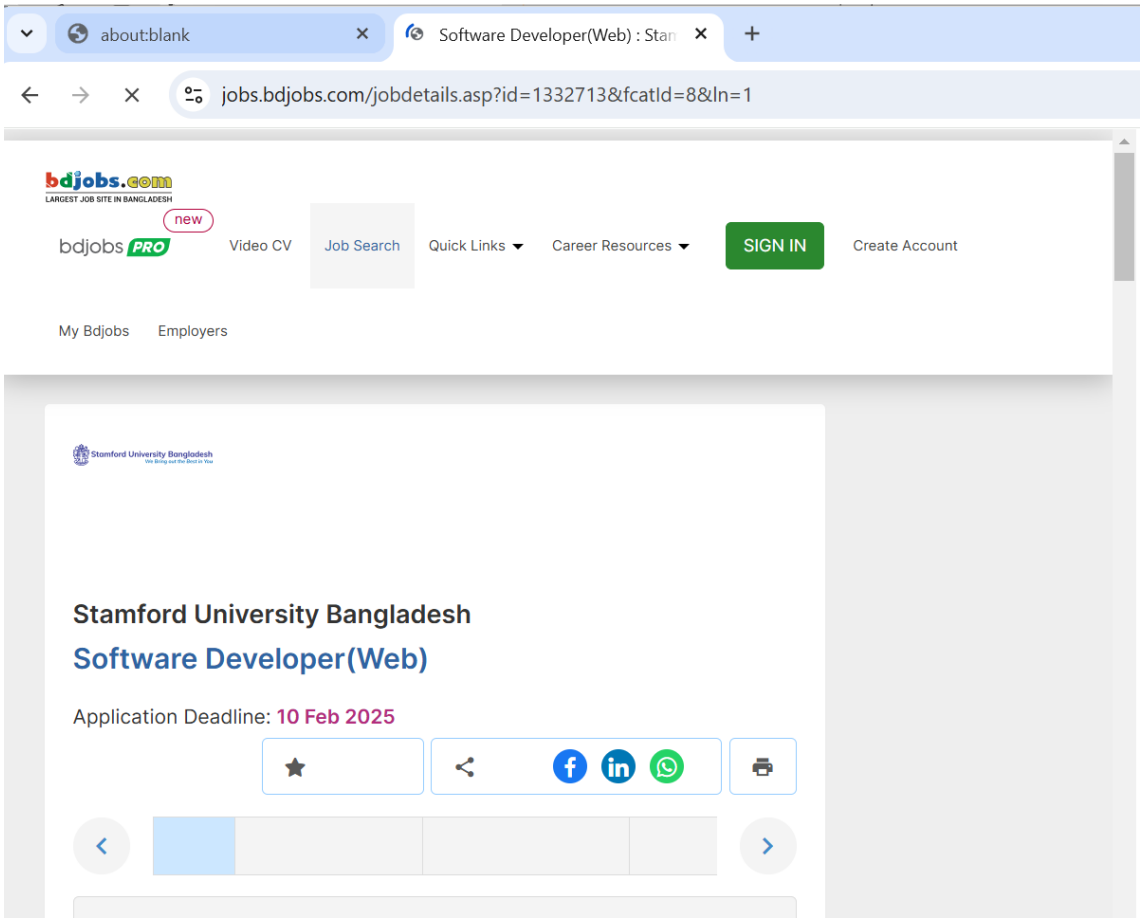
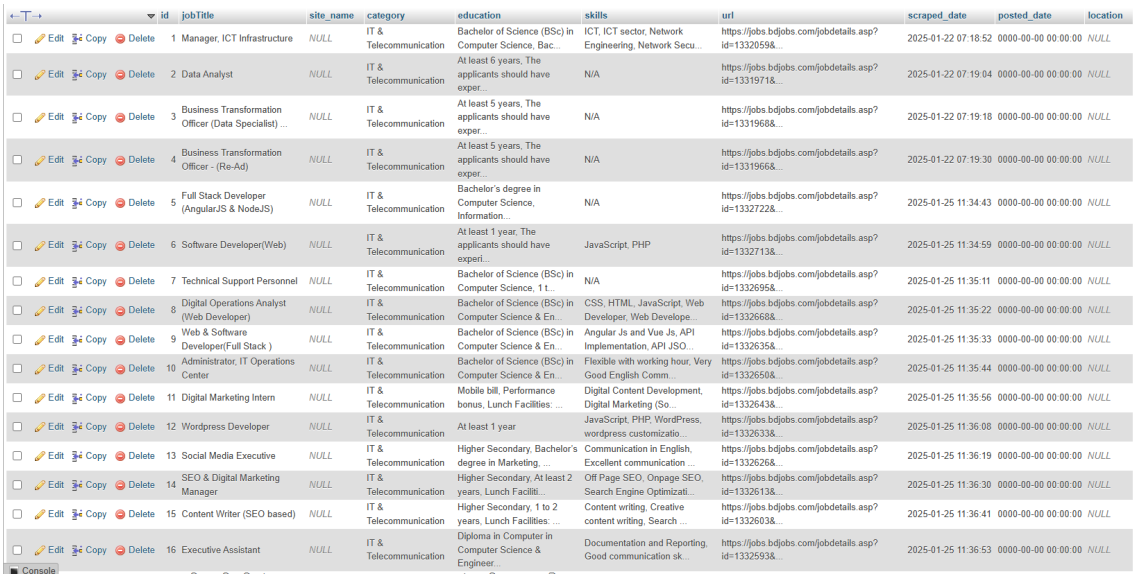


Figure 4.3: Scraping Real time Jobs



	id	jobTitle	site_name	category	education	skills	url	scraped_date	posted_date	location
Edit Copy Delete	1	Manager, ICT Infrastructure	NULL	IT & Telecommunication	Bachelor of Science (BSc) in Computer Science, Bac...	ICT, ICT sector, Network Engineering, Network Secu...	https://jobs.bdjobs.com/jobdetails.asp?id=1332059&...	2025-01-22 07:18:52	0000-00-00 00:00:00	NULL
Edit Copy Delete	2	Data Analyst	NULL	IT & Telecommunication	At least 6 years, The applicants should have exper...	N/A	https://jobs.bdjobs.com/jobdetails.asp?id=1331971&...	2025-01-22 07:19:04	0000-00-00 00:00:00	NULL
Edit Copy Delete	3	Business Transformation Officer (Data Specialist) ...	NULL	IT & Telecommunication	At least 5 years, The applicants should have exper...	N/A	https://jobs.bdjobs.com/jobdetails.asp?id=1331968&...	2025-01-22 07:19:18	0000-00-00 00:00:00	NULL
Edit Copy Delete	4	Business Transformation Officer - (Re-Ad)	NULL	IT & Telecommunication	At least 5 years, The applicants should have exper...	N/A	https://jobs.bdjobs.com/jobdetails.asp?id=1331966&...	2025-01-22 07:19:30	0000-00-00 00:00:00	NULL
Edit Copy Delete	5	Full Stack Developer (AngularJS & NodeJS)	NULL	IT & Telecommunication	Bachelor's degree in Computer Science, Information...	N/A	https://jobs.bdjobs.com/jobdetails.asp?id=1332722&...	2025-01-25 11:34:43	0000-00-00 00:00:00	NULL
Edit Copy Delete	6	Software Developer(Web)	NULL	IT & Telecommunication	At least 1 year, The applicants should have experi...	JavaScript, PHP	https://jobs.bdjobs.com/jobdetails.asp?id=1332713&...	2025-01-25 11:34:59	0000-00-00 00:00:00	NULL
Edit Copy Delete	7	Technical Support Personnel	NULL	IT & Telecommunication	Bachelor of Science (BSc) in Computer Science, 1 t...	N/A	https://jobs.bdjobs.com/jobdetails.asp?id=1332695&...	2025-01-25 11:35:11	0000-00-00 00:00:00	NULL
Edit Copy Delete	8	Digital Operations Analyst (Web Developer)	NULL	IT & Telecommunication	Bachelor of Science (BSc) in Computer Science & En...	CSS, HTML, JavaScript, Web Developer, Web Develope...	https://jobs.bdjobs.com/jobdetails.asp?id=1332688&...	2025-01-25 11:35:22	0000-00-00 00:00:00	NULL
Edit Copy Delete	9	Web & Software Developer(Full Stack)	NULL	IT & Telecommunication	Bachelor of Science (BSc) in Computer Science & En...	Angular Js and Vue Js, API Implementation, API JSO...	https://jobs.bdjobs.com/jobdetails.asp?id=1332635&...	2025-01-25 11:35:33	0000-00-00 00:00:00	NULL
Edit Copy Delete	10	Administrator, IT Operations Center	NULL	IT & Telecommunication	Bachelor of Science (BSc) in Computer Science & En...	Flexible with working hour, Very Good English Comm...	https://jobs.bdjobs.com/jobdetails.asp?id=1332650&...	2025-01-25 11:35:44	0000-00-00 00:00:00	NULL
Edit Copy Delete	11	Digital Marketing Intern	NULL	IT & Telecommunication	Mobile bill, Performance bonus, Lunch Facilities: ...	Digital Content Development, Digital Marketing (So...	https://jobs.bdjobs.com/jobdetails.asp?id=1332643&...	2025-01-25 11:35:56	0000-00-00 00:00:00	NULL
Edit Copy Delete	12	Wordpress Developer	NULL	IT & Telecommunication	At least 1 year	JavaScript, PHP, WordPress, wordpress customizatio...	https://jobs.bdjobs.com/jobdetails.asp?id=1332633&...	2025-01-25 11:36:08	0000-00-00 00:00:00	NULL
Edit Copy Delete	13	Social Media Executive	NULL	IT & Telecommunication	Higher Secondary, Bachelor's degree in Marketing, ...	Communication in English, Excellent communication ...	https://jobs.bdjobs.com/jobdetails.asp?id=1332626&...	2025-01-25 11:36:19	0000-00-00 00:00:00	NULL
Edit Copy Delete	14	SEO & Digital Marketing Manager	NULL	IT & Telecommunication	Higher Secondary, At least 2 years, Lunch Faciliti...	Off Page SEO, Onpage SEO, Search Engine Optimizati...	https://jobs.bdjobs.com/jobdetails.asp?id=1332613&...	2025-01-25 11:36:30	0000-00-00 00:00:00	NULL
Edit Copy Delete	15	Content Writer (SEO based)	NULL	IT & Telecommunication	Higher Secondary, 1 to 2 years, Lunch Facilities: ...	Content writing, Creative content writing, Search ...	https://jobs.bdjobs.com/jobdetails.asp?id=1332603&...	2025-01-25 11:36:41	0000-00-00 00:00:00	NULL
Edit Copy Delete	16	Executive Assistant	NULL	IT & Telecommunication	Diploma in Computer in Computer Science & Engineer...	Documentation and Reporting, Good communication sk...	https://jobs.bdjobs.com/jobdetails.asp?id=1332593&...	2025-01-25 11:36:53	0000-00-00 00:00:00	NULL

Figure 4.4: Database

Chapter 5

Standards and Design Constraints

This section outlines the standards and design constraints considered during the development of the project. It discusses software, hardware, and communication standards that ensure compliance and interoperability. Additionally, it highlights design constraints such as economic, environmental, ethical, social, and sustainability factors that influenced the project's structure and implementation.

5.1 Compliance with the Standards

Only mention the standards that are related to your project. This list is not complete. For each of the standards discuss the alternates with pros and cons and rationale of selection.

5.1.1 Software Standards

The software standards followed in this project ensure the development of a reliable, secure, and maintainable system.

Key standards include:

- **Software Requirements Specification:**Applied to structure the documentation of functional and non-functional requirements.
- **Software Design Description:**Used for maintaining consistent and understandable design artifacts.
- **OWASP Security Guidelines:** Adopted to protect the platform against common vulnerabilities like SQL injection, XSS, and data breaches.
- **W3C Web Standards:** Ensured compliance with HTML5, CSS3, and JavaScript specifications to achieve browser compatibility and accessibility.

5.1.2 Hardware Standards

5.1.3 Communication Standards

Communication standards ensure smooth data transmission between the front end, back-end, and external systems:

- **HTTP/HTTPS Protocols:** All API communications are secured with HTTPS using SSL/TLS encryption.
- **RESTful API Design:** Ensures consistent and scalable communication between frontend (Next.js) and backend (Node.js + Express).
- **JSON Format for Data Exchange:** Lightweight and widely accepted format for transmitting structured data between client and server.
- **WebSocket (optional/future):** Considered for implementing real-time notifications (e.g., job alerts) in future updates.

5.2 Design Constraints

The design of the job recommendation platform is influenced by various constraints that guide its development, deployment, and impact. These constraints ensure that the platform aligns with practical, ethical, and societal considerations while addressing economic, environmental, and sustainability goals.

5.2.1 Economic Constraint

- **Constraint:** The project is designed with limited funding, necessitating the use of cost-effective tools and technologies.
- **Impact on Design:** Open-source technologies such as Python, MySQL, and Selenium were chosen to minimize licensing costs. The hosting architecture prioritizes affordable options like shared or cloud-based hosting platforms.
- **Mitigation:** Efficient resource allocation and optimization techniques, such as data deduplication, were implemented to reduce operational costs.

5.2.2 Environmental Constraint

- **Constraint:** The platform must minimize its environmental footprint, particularly in terms of energy consumption for servers and data storage.
- **Impact on Design:** The use of cloud services was optimized to leverage energy-efficient data centers. Data processing is scheduled to reduce unnecessary computational overhead.

- **Mitigation:** By implementing efficient algorithms and optimizing server usage, the platform reduces energy consumption while maintaining performance.

5.2.3 Ethical Constraint

- **Constraint:** The platform must adhere to ethical guidelines concerning data collection, user privacy, and transparency.
- **Impact on Design:** Features such as user consent for data collection, adherence to GDPR standards, and anonymization of sensitive information were incorporated.
- **Mitigation:** Clear privacy policies and user agreements ensure ethical handling of user data, and encryption mechanisms protect sensitive information.

5.2.4 Health and Safety Constraint

- **Constraint:** The platform should not induce stress or harm to users, particularly those actively seeking employment.
- **Impact on Design:** A user-friendly interface with intuitive navigation and visually appealing elements reduces cognitive load. Notifications are designed to be informative rather than overwhelming.
- **Mitigation:** Regular usability testing ensures that the platform maintains a balance between engagement and user comfort.

5.2.5 Social Constraint

- **Constraint:** The platform must be inclusive and accessible to users from diverse backgrounds, including individuals with disabilities.
- **Impact on Design:** Accessibility features, such as screen reader compatibility and keyboard navigation, are integrated into the user interface. Multilingual support ensures broader accessibility.
- **Mitigation:** Compliance with W3C accessibility standards and continuous feedback from diverse user groups help create a socially inclusive platform.

5.2.6 Political Constraint

- **Constraint:** The platform must comply with legal and regulatory requirements in various jurisdictions, particularly regarding data scraping and employment laws.
- **Impact on Design:** The scraping mechanism respects robots.txt files and adheres to platform-specific terms of service. Country-specific legal requirements for job postings are considered.
- **Mitigation:** Legal consultation and compliance audits ensure adherence to regional laws, reducing risks associated with political constraints.

5.2.7 Sustainability

- **Constraint:** The platform must support long-term scalability and adaptability while considering environmental and economic sustainability.
- **Impact on Design:** Modular architecture enables future enhancements without requiring significant redesign. Efficient database structures ensure scalability.
- **Mitigation:** Periodic reviews and updates maintain platform relevance and sustainability, while energy-efficient practices support environmental goals.

By acknowledging these constraints, the design of the platform balances functionality, ethical responsibility, and sustainability, ensuring a positive impact on users and society.

5.3 Cost Analysis

Provide a cost analysis in terms of budget required and revenue model. In case of budget, you must show an alternate budget and rationales.

5.4 Complex Engineering Problem

P1: Depth of Knowledge Required Mapping to Knowledge Profile:
WK3, WK4, WK5, WK6, The project involves systematic, theory-based knowledge of engineering fundamentals (WK3) to design and optimize algorithms for scraping and machine learning. The project leverages specialized knowledge (WK4) in areas like natural language processing, recommendation systems, and dynamic content rendering. Knowledge of engineering design principles (WK5) is required to build the platform's architecture and ensure efficient system integration. Knowledge of engineering practice (WK6) is critical for addressing real-world challenges, such as handling large datasets and avoiding scraping bans.

P2: Range of Conflicting Requirements:
Conflicting priorities include: Ensuring user needs (e.g., real-time job recommendations) are met while maintaining compliance with legal and ethical considerations (e.g., LinkedIn API policies). Balancing system performance with resource constraints such as bandwidth and server capacity. Mitigating conflicts between stakeholders (users, employers, and job boards).

P3: Depth of Analysis Required
The system requires Abstract thinking to create personalized job recommendations based on user input, utilizing machine learning algorithms to process and analyze vast amounts of data. Designing models for skill gap analysis and predictions for trending skills. Original problem-solving approaches to overcome anti-bot mechanisms on platforms like LinkedIn.

P4: Familiarity of Issues:
The issues tackled, such as scraping dynamic job postings with anti-bot mechanisms, are infrequent and unique to this domain. Integrating user profiles with scraped data for real-time processing requires novel solutions not commonly encountered in typical job board systems.

P5: Extent of Applicable Codes:
There is a lack of established standards or codes for ethical web scraping and automated data extraction. The team must design proprietary methods for maintaining data integrity and compliance while developing novel techniques for scalable, efficient scraping.

P6: Extent of Stakeholder Involvement and Needs:
The platform serves diverse stakeholders, including: Job seekers: Requiring user-friendly interfaces and tailored recommendations. Companies: Expecting compliance with legal terms and unbiased recommendations. Educational providers: Demanding integration of skill enhancement tools and resources.

P7: Interdependence:
The project comprises multiple interconnected components: Web scraping tools for data extraction. ML algorithms for personalized recommendations and analytics. Notification systems for real-time alerts. A user-friendly interface to display results. Failures in any component (e.g., scraping accuracy) can disrupt the entire system, requiring a robust, integrated design.

5.4.1 Complex Problem Solving

Table 5.1: Mapping with Complex Problem Solving.

P1 Dept of Knowledge	P2 Range of Conflicting Requirements	P3 Depth of Analysis	P4 Familiarity of Issues	P5 Extent of Applicable Codes	P6 Extent of Stakeholder Involvement	P7 Interdependence
✓	✓	✓	✓	✓	✓	✓

In this section, provide a mapping with problem solving categories. For each mapping add subsections to put rationale (Use Table 5.2). For P1, you need to put another mapping with Knowledge profile and rational thereof.

Table 5.2: Mapping with complex problem solving.

P1 Dept of Knowledge	P2 Range of Conflicting Requirements	P3 Depth of Analysis	P4 Familiarity of Issues	P5 Extent of Applicable Codes	P6 Extent of Stakeholder Involvement	P7 Interdependence
✓	✓	✓	✓	✓	✓	✓
Requires in-depth knowledge of web scraping, machine learning, and engineering principles (e.g., WK3, WK4, WK5, WK6).	Involves resolving conflicting priorities such as balancing legal compliance, system performance, and user experience.	Requires advanced analysis for creating machine learning models, skill gap analysis, and anti-bot mechanisms using abstract and creative thinking.	Tackles infrequently encountered issues, such as adapting scraping strategies to dynamic websites like LinkedIn.	Limited codes or standards govern ethical scraping and data processing, requiring proprietary methods to ensure compliance and efficiency.	Involves diverse stakeholders, including job seekers, employers, and educational providers, necessitating balancing varying needs and integrating feedback.	The platform integrates multiple subsystems (scraping, machine learning, notifications, profiles) requiring high interdependence to ensure seamless functionality across the system.

5.4.2 Engineering Activities

In this section, provide a mapping with engineering activities. For each mapping add subsections to put rationale (Use Table 5.4).

5.5 Summary

This chapter outlines compliance with software, hardware, and communication standards while addressing economic, environmental, ethical, social, and sustainability constraints. Cost-effective tools, energy-efficient algorithms, GDPR compliance, and accessibility features were integrated to ensure affordability, reduced environmental impact, data privacy,

Table 5.3: Mapping with Complex Engineering Activities.

A1 Range of Resources	A2 Level of Interaction	A3 Innovation	A4 Consequences for Society and Environment	A5 Familiarity
✓	✓	✓	✓	✓
The platform uses a broad range of resources, including technologies (web scraping, machine learning), large datasets, and human resources (stakeholder feedback, technical expertise).	The project involves interaction across teams—technical teams working with non-technical stakeholders and clients to balance the system's requirements and usability.	The system uses innovative machine learning models for personalized job recommendations and advanced scraping techniques for dynamic job listings.	The platform aims to reduce unemployment by matching people with appropriate jobs and enhancing professional growth, which has positive societal impacts. However, data scraping could have minor environmental consequences.	This project faces challenges integrating different technical domains (scraping, AI, and UI), which are relatively unfamiliar in the context of a unified job search platform.

and inclusivity. Complex engineering problems were tackled using advanced knowledge in scraping, machine learning, and system integration. The design balanced conflicting requirements, stakeholder needs, and interdependencies, ensuring scalability, sustainability, and robust functionality for a user-focused job recommendation platform.

Table 5.4: Mapping with complex engineering activities.

A1 Range of resources	A2 Level of Interaction	A3 Innovation	A4 Consequences for society and environment	A5 Familiarity
√	√			

Chapter 6

Conclusion

The conclusion provides an overview of the project, emphasizing its purpose, achievements, and contributions. It discusses how the platform addresses the challenges faced by job seekers through innovative solutions such as personalized job recommendations, skill development tools, and advanced web scraping techniques. Furthermore, it explores the project's impact on career development and offers suggestions for future enhancements to ensure its continued relevance and success.

6.1 Summary

The job recommendation platform was designed to address challenges faced by job seekers, providing innovative solutions through web scraping, machine learning, and automation. By aggregating job postings from multiple sources and offering personalized recommendations, skill gap analysis, and career development tools, the platform delivers a seamless job search experience. Features such as interview preparation resources, real-time notifications, and company insights enhance its usability and relevance. The project successfully demonstrates how technology can simplify and optimize the job search process while empowering users to achieve their career goals.

6.2 Limitation

Despite its achievements, the platform has some limitations:

1. Scalability Constraints: Managing large volumes of job postings and user data in real-time may require additional optimization.

2. Data Accuracy: The reliance on web scraping may result in outdated or incomplete job postings due to changes in source website structures.

3. Limited Source Integration: The current implementation is restricted to a few job portals, limiting the diversity of job opportunities available.

4. Legal and Ethical Considerations: Compliance with data usage policies of different job platforms poses a challenge and requires ongoing monitoring.

5. Technical Complexity: The use of advanced technologies such as machine learning and web scraping increases the complexity of system maintenance.

6.3 Future Work

Several avenues for future improvement and expansion of the platform have been identified:

1. Expanded Job Sources: Integrate additional job portals and online platforms to broaden the scope of opportunities available to users.

2. AI-Driven Features: Enhance the recommendation engine with advanced machine learning models to improve accuracy and user satisfaction.

3. Real-Time Updates: Develop robust mechanisms to handle dynamic changes in job portal structures, ensuring continuous data accuracy.

4. Multilingual Support: Introduce support for multiple languages to cater to a more diverse user base.

5. Mobile Accessibility: Create a mobile application for increased accessibility and convenience.

6. Ethical and Legal Safeguards: Implement strict adherence to legal standards and explore partnerships with job platforms to ensure ethical compliance.

7. Advanced Analytics: Provide users with insights into job market trends, salary expectations, and in-demand skills for better career planning.

8. User-Centric Development: Continuously refine the platform based on user feedback and emerging technologies to maintain its relevance and effectiveness.

By addressing these areas, the platform can evolve into a more robust, scalable, and user-centric solution, offering an unparalleled job search experience in a dynamic and competitive job market.

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