

**VIVEKANAND EDUCATION SOCIETY'S INSTITUTE OF
TECHNOLOGY**

(An Autonomous Institute Affiliated to University of Mumbai)

Department of Computer Engineering



Project Report on

Job Grove

Submitted in partial fulfillment of the requirements of the
degree

**BACHELOR OF ENGINEERING IN COMPUTER
ENGINEERING**

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**VIVEKANAND EDUCATION SOCIETY'S INSTITUTE OF
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CERTIFICATE

This is to certify that the Mini Project entitled “**Job Grove**” is a bonafide work of **Kavish Punjabi (D12B-45), Harsh Chandiramani (D12C-11), Aryan Hinduja (D12A-23), Akshita Bathija (D12C-7)** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of “**Bachelor of Engineering**” in “**Computer Engineering**” .

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Date:

Place:

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

JobGrove: Cultivating Careers, Growing Success will be a cutting-edge job portal website designed to make the job search process effortless for both job seekers and employers. Our platform will recognize the importance of matching skills with job requirements. We will have a vast network of employers and a diverse talent pool, which will allow us to simplify the hiring process and streamline job searches. Whether you're a company in need of exceptional talent or an individual pursuing your dream job, our user-friendly interface and advanced search capabilities will guarantee a seamless and rewarding experience. JobGrove will focus on simplicity, efficiency, and relevance, aiming to connect talented individuals with their dream opportunities and assist employers in finding the perfect candidates.

1. Introduction

1.1 Introduction

Our platform will be created with a single goal in mind: to transform the way job seekers and companies connect, making hiring processes easier and more efficient. We will take pleasure in providing a variety of creative features that empower both people and companies. Our user-friendly design and advanced search options will be here to provide an efficient and fulfilling experience. Our website will have a powerful search engine that will allow job searchers to search for jobs depending on their criteria, such as region, industry, experience level, and more. We will provide personalized job suggestions to job searchers, ensuring they find opportunities that match their talents and interests. Job seekers will be able to create comprehensive profiles, showcasing their accomplishments, experience, education, and certifications, making it easier for employers to find the perfect fit. Our platform will leverage cutting-edge technology to match job seekers with the most suitable job openings based on their skillset, increasing the chances of finding the right match. Job seekers will be able to submit applications directly through our portal, reducing the hassle and ensuring timely submissions. Employers will be able to track the performance of their job postings, gaining valuable data and insights to optimize their recruitment strategies effectively. By joining our job portal, you will open doors to limitless possibilities, embarking on a transformative journey towards achieving your goals.

1.2 Motivation

As we embarked on our journey of research and brainstorming, a prevalent issue that continued to surface was the complexity and inefficiency surrounding the job search process. The traditional methods of job hunting are often riddled with challenges, leaving job seekers frustrated and employers struggling to find the right talent. Under the guidance and inspiration of our mentor, we have conceived the idea for our revolutionary job portal website, 'JobGrove,' with a vision to transform the employment landscape for both job seekers and employers.

JobGrove aims to bridge the gap between job seekers and employers by offering a modern, user-friendly, and efficient platform. Our motivation for building this platform is rooted in addressing the pain points and challenges that both job seekers and employers encounter daily. JobGrove is committed to making job searching and hiring more efficient, empowering individuals to find the right career opportunities and helping businesses find the right talent. We are dedicated to leveraging technology to create a robust and user-centric job portal that will transform the employment landscape, connecting job seekers and employers seamlessly, and contributing to a brighter and more prosperous future for all.

1.3 Problem Definition

The conventional job search paradigm, as it stands today, is rife with inefficiencies that create significant obstacles for both job seekers and employers alike. These inefficiencies stem from various factors, including the overwhelming volume of job listings, the lack of personalized recommendations, and the disconnect between candidate skills and job requirements.

One of the primary challenges faced by job seekers is the sheer volume of job listings available on traditional job boards and recruitment platforms. With thousands of job postings spanning various industries and roles, navigating through this sea of opportunities can be daunting and time-consuming. Moreover, the relevance of these listings often leaves much to be desired, as job boards frequently fail to tailor recommendations to the specific skills and preferences of individual job seekers.

For employers, the challenges are equally daunting. With each job posting attracting a multitude of applications, sifting through resumes to identify the most qualified candidates becomes a Herculean task. The lack of effective screening mechanisms exacerbates this challenge, leading to prolonged hiring cycles and increased administrative burden.

Furthermore, the disconnect between candidate skills and job requirements compounds these challenges. Oftentimes, job postings may not accurately reflect the skills and qualifications necessary for success in a given role, leading to mismatches between candidates and job

opportunities. This not only prolongs the hiring process but also results in suboptimal hires, as employers struggle to identify candidates who possess the requisite skills and experience.

Overall, these inefficiencies impede the job search process for both job seekers and employers, resulting in frustration, wasted time, and missed opportunities. Addressing these challenges requires a paradigm shift in how job opportunities are presented, matched, and accessed, which is precisely what JobGrove aims to achieve with its innovative approach to job search and recruitment.

1.4 Existing Systems

In the real world, there are indeed numerous job portals and recruitment platforms that job seekers and employers utilize to navigate the job market. Platforms like Indeed, LinkedIn, Glassdoor, Monster, and CareerBuilder are among the most popular ones. Each of these platforms offers its own unique features and functionalities aimed at facilitating the job search and recruitment process. However, despite their ubiquity, these platforms often face limitations that hinder their effectiveness in addressing the complexities of the job market.

For instance, while these platforms do provide basic job posting and application submission functionalities, they often lack robust advanced search capabilities. Users may find it challenging to refine their job searches based on specific criteria such as skills, experience level, industry, location, and salary range. This limitation can result in job seekers being inundated with irrelevant job listings, making it difficult for them to identify opportunities that align with their qualifications and career goals.

Additionally, the personalized recommendation systems employed by these platforms are often rudimentary. They may rely on basic algorithms that recommend jobs based on keywords in a user's profile or browsing history, rather than taking into account a more comprehensive understanding of the user's skills, preferences, and career aspirations. As a result, job seekers may miss out on relevant opportunities that could be a perfect fit for their skill set and career trajectory.

Furthermore, the lack of integration with a diverse network of employers is a common issue faced by many job portals and recruitment platforms. While these platforms may have partnerships with a large number of companies, they may not encompass the full spectrum of industries, company sizes, and geographic locations. This limitation restricts the scope of job opportunities available to job seekers, particularly those seeking niche roles or employment in specific regions.

Overall, while existing job portals and recruitment platforms serve as valuable resources for job seekers and employers, they often fall short in terms of providing comprehensive solutions to the challenges inherent in the job search process. Addressing these limitations requires a concerted effort to develop more sophisticated search algorithms, enhance personalization capabilities, and forge partnerships with a diverse array of employers. This is precisely the aim of JobGrove: to offer a cutting-edge job portal that not only addresses these shortcomings but also sets new standards for efficiency, relevance, and user experience in the job search and recruitment space.

1.5 Lacuna of the existing systems

The lacuna in existing job portal systems represents a complex web of challenges that undermine the effectiveness of these platforms in facilitating successful job matches. These challenges span multiple dimensions, ranging from shortcomings in algorithmic matching to deficiencies in user experience design and reach.

Firstly, the absence of sophisticated algorithms for matching candidate skills with job requirements is a critical limitation of many existing job portals. While some platforms may employ basic keyword-based matching algorithms, these approaches often fail to capture the nuanced skill sets and experiences that candidates possess. As a result, job recommendations may lack relevance, leading to frustration and wasted time for both job seekers and employers. Sophisticated algorithms that take into account not only keyword matches but also contextual understanding of skills, experience levels, and career trajectories are essential for improving the quality of job matches and enhancing user satisfaction.

Moreover, the fragmented nature of existing platforms contributes to disjointed user experiences characterized by outdated interfaces and cumbersome navigation. Many job portals suffer from a lack of consistency in design and functionality, making it difficult for users to navigate seamlessly across different sections of the platform. Inconsistent user interfaces and clunky navigation systems detract from the overall user experience, leading to frustration and decreased engagement. Streamlining the user experience through intuitive interface design and seamless navigation pathways is crucial for enhancing user satisfaction and retention.

Furthermore, the limited reach of existing job portal systems poses a significant barrier to accessing a comprehensive pool of job opportunities. While some platforms may have partnerships with a large number of employers, they often fail to encompass the full spectrum of industries, company sizes, and geographic locations. This limitation restricts the diversity of job opportunities available to job seekers, particularly those seeking niche roles or employment in specific regions. Expanding the reach of job portal systems through strategic partnerships and integrations with a diverse array of employers is essential for ensuring that job seekers have access to a wide range of opportunities that align with their preferences and career goals.

In summary, addressing the lacuna in existing job portal systems requires a multi-faceted approach that encompasses improvements in algorithmic matching, user experience design, and platform reach. By leveraging sophisticated algorithms, streamlining user experiences, and expanding reach through strategic partnerships, job portal platforms can enhance their effectiveness in facilitating successful job matches and improving overall user satisfaction.

1.6 Relevance of the Project

JobGrove's approach to addressing the shortcomings of existing job portal systems is comprehensive and innovative, focusing on key aspects that significantly impact the user experience and effectiveness of job searches and recruitment processes.

User-Friendly Interface:

JobGrove prioritizes the development of a user-friendly interface that ensures a seamless and intuitive browsing experience for both job seekers and employers. This includes clean and

modern design principles, intuitive navigation pathways, and clear labeling of features and functions. By simplifying the user interface, JobGrove aims to reduce friction in the job search process, allowing users to focus on finding relevant opportunities or identifying suitable candidates without unnecessary distractions or complexities.

Advanced Search Capabilities:

JobGrove sets itself apart by offering advanced search capabilities that empower users to refine their job searches with precision and granularity. This includes filters for skills, experience levels, industry sectors, geographic locations, and other relevant criteria. By providing robust search functionality, JobGrove enables users to narrow down their search results to only the most relevant job listings or candidate profiles, saving time and effort in the process.

Personalized Job Recommendations:

JobGrove leverages sophisticated algorithms and data analytics to deliver personalized job recommendations tailored to each user's skills, preferences, and career aspirations. By analyzing user profiles, search history, and interaction patterns, JobGrove can identify relevant job opportunities that align closely with a user's background and objectives. This personalized approach not only enhances the relevance of job recommendations but also increases the likelihood of successful matches between candidates and employers.

Focus on Simplicity, Efficiency, and Relevance:

At the core of JobGrove's philosophy is a commitment to simplicity, efficiency, and relevance in every aspect of its platform. Whether it's streamlining the job application process, optimizing search algorithms, or enhancing user engagement, JobGrove prioritizes solutions that prioritize these principles. By keeping the user experience straightforward and efficient, JobGrove ensures that users can navigate the platform effortlessly and achieve their goals with minimal friction.

Connecting Talented Individuals with Dream Opportunities:

Ultimately, JobGrove's goal is to connect talented individuals with their dream opportunities and assist employers in finding the perfect candidates. By providing a platform that combines advanced technology with human-centric design principles, JobGrove aims to facilitate

meaningful connections between job seekers and employers, leading to mutually beneficial outcomes. Whether it's landing a coveted job or hiring the ideal candidate, JobGrove strives to make the job search process effortless and rewarding for all users.

In summary, JobGrove's innovative approach to addressing the lacuna in existing job portal systems encompasses a range of features and functionalities designed to enhance the user experience, improve search efficiency, and increase the relevance of job matches. Through its commitment to simplicity, efficiency, and relevance, JobGrove aims to revolutionize the job search landscape and make a positive impact on the lives of job seekers and employers alike.

2. Literature Survey

2.1 Research Papers Referred

- **Paper1: Learning-Based Matched Representation System for Job Recommendation**

Published at: 14 November 2022

Publisher : MDPI

Location : Saudi Arabia

Abstract:

Job recommender systems (JRS) are a subclass of information filtering systems that aims to help job seekers identify what might match their skills and experiences and prevent them from being lost in the vast amount of information available on job boards that aggregates postings from many sources such as LinkedIn or Indeed. A variety of strategies used as part of JRS have been implemented, most of them failed to recommend job vacancies that fit properly to the job seekers profiles when dealing with more than one job offer. They consider skills as passive entities associated with the job description, which need to be matched for finding the best job recommendation. This paper provides a recommender system to assist job seekers in finding suitable jobs based on their resumes. The proposed system recommends the top-n jobs to the job seekers by analyzing and measuring similarity between the job seeker's skills and explicit features of job listing using content-based filtering. First-hand information was gathered by scraping jobs description from Indeed from major cities in Saudi Arabia (Dammam, Jeddah, and Riyadh). Then, the top skills required in job offers were analyzed and job recommendation was made by matching skills from resumes to posted jobs. To quantify recommendation success and error rates, we sought to compare the results of our system to reality using decision support measures.

Inference drawn:

- **Need for Job Recommender Systems (JRS):** The abstract highlights the need for job recommender systems, emphasizing the challenge faced by job seekers in

navigating through vast amounts of job postings available on platforms like LinkedIn or Indeed.

- **Challenges with Existing Strategies:** It suggests that existing strategies within JRS have limitations, particularly in accurately matching job vacancies to job seeker profiles, especially when dealing with multiple job offers.
- **Focus on Skills Matching:** The proposed system focuses on matching job seekers' skills with the requirements of job listings. It criticizes existing systems for treating skills as passive entities and proposes a method to actively match skills from resumes to job postings.
- **Content-Based Filtering Approach:** The proposed system utilizes a content-based filtering approach, analyzing and measuring the similarity between job seekers' skills and explicit features of job listings to make recommendations.
- **Data Collection and Analysis:** The study gathered first-hand data by scraping job descriptions from Indeed in major cities in Saudi Arabia (Dammam, Jeddah, and Riyadh). This data was then analyzed to identify top skills required in job offers.
- **Quantifying Recommendation Success:** The success and error rates of the recommendation system are quantified by comparing its results to real-world outcomes, using decision support measures.

- **Paper 2 : Prophet -- A Link-Predictor to Learn New Rules on NELL**

Published at: 23 January 2012

Publisher: IEEE

Location: Canada

Abstract:

Link prediction is a task that in graph-based data models, as well as, in complex networks not only to predict edges that will appear in a near future but also to find missing edges. NELL is a never ending language learner system that has the ability to continuously learn to extract structured information from unstructured text (fetched from web pages) and map this information to a continuously growing knowledge base. NELL's knowledge base can be seen as a complex network, allowing us to apply graph mining techniques to

extract new knowledge and enhance the system performance. In this paper we present Prophet, a link prediction component that can be connected to NELL allowing it to infer new rules and misplaced connections among nodes, thus, helping the never-ending system to learn more and better each day. We also show that the Prophet can extract new knowledge that cannot be obtained using traditional first order rule extraction procedures.

Inference drawn

- **Link Prediction in Graph-Based Data Models:** The abstract introduces link prediction as a task within graph-based data models and complex networks. It mentions that this task involves predicting both future edges and identifying missing edges within the network.
 - **NELL as a Continuous Learning System:** NELL (Never Ending Language Learner) is described as a system capable of continuously learning from unstructured text obtained from web pages. It maps this information into a growing knowledge base, essentially constructing a complex network.
 - **Application of Graph Mining Techniques:** The abstract suggests that the knowledge base generated by NELL can be treated as a complex network, enabling the application of graph mining techniques to extract new knowledge and improve system performance.
 - **Prophet's Unique Contribution:** It is stated that Prophet is capable of extracting new knowledge that cannot be obtained through traditional first-order rule extraction procedures, indicating its potential for uncovering novel insights within the knowledge base.
-
- **Paper3: Job Recommendation System, Machine Learning, Regression, Classification, Natural Language Processing**Engineering (CSDE)
Published at: 28 April 2021
Publisher: IEEE
Location: Australia

Abstract :

In today's highly competitive job market, it is becoming increasingly important for companies to hire employees who are best fit for a job and to ensure they retain these employees in the long run. Studies have shown that employees who find their job meaningful and satisfying are generally more productive and less likely to leave the job. Human Resource professionals therefore need to ensure that proper screening of candidates is conducted during the recruitment process and that they hire the best fit candidate for a job. Given the usually high number of applicants for a particular job, the recruitment process is time consuming and it is not always possible to conduct proper screening and interviews for each applicant. This paper presents the development of JobFit, a job recommendation system which makes use of a recommender system, machine learning techniques and past data to predict the best fit candidate for a job. The proposed job recommendation system takes as input the requirement of a job and the profile of the applicants and outputs a JobFit score indicating how fit each applicant is for the particular job. The system ultimately provides the HR professionals with a sorted list of all candidates with those who are more fit and apt for the job recommended first. This shall help to ensure the HR focus on the screening and interviews of only a small pool of candidates, the best ones recommended by the system, while at the same time be confident that the better candidates are not being missed.

Inference drawn

- **Importance of Hiring the Right Candidates:** The abstract emphasizes the importance for companies to hire employees who are the best fit for a job and to retain them in the long term. It suggests that employees who find their job meaningful and satisfying tend to be more productive and less likely to leave.
- **Challenges in Recruitment Process:** Due to the high number of applicants for a particular job, the recruitment process can be time-consuming. It may not always be feasible to conduct thorough screening and interviews for each applicant.
- **Introduction of JobFit:** The abstract introduces JobFit as a job recommendation system developed to address the challenges in the recruitment process. JobFit

utilizes a combination of recommender system and machine learning techniques, along with past data, to predict the best fit candidate for a job.

- **Functionality of JobFit:** The system takes into account the job requirements and the profiles of the applicants as input and outputs a JobFit score for each applicant, indicating how suitable they are for the particular job. This enables HR professionals to focus their attention on a smaller pool of candidates recommended by the system.
- **Benefits of JobFit:** By providing HR professionals with a sorted list of candidates ranked based on their suitability for the job, JobFit helps streamline the recruitment process. It ensures that the best candidates are not overlooked while minimizing the time and effort spent on screening and interviewing less suitable candidates.

- **Paper4: Resume Screening using NLP and LSTM**

Published at: 16 August 2022

Publisher: IEEE

Location: Nepal

Abstract:

We all are aware that getting a job is not at all an effortless task. The job market is highly competitive. It is important for job seekers to create a professional resume. A resume is a formal document used by individuals to present their backgrounds and skill sets. A resume mainly consists of the individual's educational background, technical skills, work experience, social skills, and awards or publications(if any). This is the first document that describes the individual to an employer or a recruiter. It portrays the individual's image before the interview. Hence, it is essential that one should have an apt resume ready before applying for any company or job. We have proposed a system that will create a formal resume for the user and suggest/predict jobs for the user based on his/her skills. The prediction will help the user in applying for jobs that are aligned with his/her interests and skills. The Resume Builder Application will help users build his/her personal resume. The Resume Builder will also, based on the user's technical skills, suggest to the user jobs and companies appropriate for him/her.

Inference drawn:

- **Significance of Resumes in Job Seeking:** The abstract highlights the importance of having a professional resume in a highly competitive job market. A resume is described as a formal document that showcases an individual's background and skill sets to potential employers or recruiters.
- **Components of a Resume:** It mentions that a resume typically includes sections such as educational background, technical skills, work experience, social skills, and any awards or publications. These components collectively provide an overview of the individual to the employer before an interview.
- **Purpose of the Proposed System:** The abstract introduces a proposed system designed to address the challenges of resume creation and job seeking. The system aims to automatically generate a formal resume for users and provide job recommendations based on their skills.
- **Functionality of the System:** The system, referred to as the Resume Builder Application, will assist users in creating their personal resumes. Additionally, it will analyze the user's technical skills and suggest jobs and companies that align with their interests and skills.
- **Benefits for Job Seekers:** By automating the resume creation process and providing personalized job recommendations, the system aims to streamline the job-seeking process for users. It helps users present themselves effectively to potential employers and increases the likelihood of applying for jobs that match their qualifications and interests.

- **Paper 5: Resume Builder Application with Automated Job Prediction**

Published at : January 2023

Publisher : ProQuest

Location : India

Abstract :

Resume screening is the process of determining whether a candidate is qualified for a position based on their education, experience, and other information contained on their resume. Only if the resume of an experienced employee/fresher matches the job

description will they be called for an interview. Manual examination of resumes might be a burdensome task. Manually doing it would take a long time. Companies utilize tracking systems to shortlist personnel based on their abilities. The most prevalent reason for rejection is a mismatch between the job role and the applicant's skill set. It is vital for job seekers to understand which job categories they should apply to based on their skill set. This project intends to develop an application that will categorize CVs according to the skills they contain into various job options. As a result, these programs aid job seekers in evaluating what types of positions they are qualified for based on their resume skills. Upgrades in application innovation for misconduct will probably result in higher overall expenditure in this area. This work also strives to make grouping more important by combining multiple classes into larger groups. At last, the analysis has been presented with a wide range of classifiers and new approaches have been suggested.

Inference drawn:

- **Significance of Resume Screening:** The abstract emphasizes the importance of resume screening in the hiring process, highlighting that it involves assessing candidates' qualifications based on their education, experience, and other information provided in their resumes.
- **Challenges with Manual Screening:** Manual examination of resumes is described as a burdensome and time-consuming task. To alleviate this, many companies utilize tracking systems to shortlist candidates based on their abilities.
- **Mismatch Between Job Roles and Skills:** A common reason for rejection is identified as a mismatch between the job role and the applicant's skill set. This underscores the importance of aligning job applications with the candidate's skills.
- **Development of an Application:** The abstract introduces a project aimed at developing an application that categorizes resumes based on the skills they contain into various job options. This application is intended to assist job seekers in identifying suitable job opportunities based on their skill sets.
- **Importance of Application Innovation:** There is a recognition of the importance of continuous innovation in application technology to address issues such as misconduct and improve overall efficiency in the hiring process.






- **Improving Categorization:** The project also aims to improve the categorization process by combining multiple classes into larger groups, making the classification more meaningful and efficient.
- **Evaluation and Suggestions:** The abstract mentions the analysis of various classifiers and suggests new approaches to enhance the effectiveness of the categorization process.






2.2 Inference drawn

- **Diversity in Offerings:** Different platforms cater to different aspects of the job search process, including resume building, job recommendations, application tracking, and virtual job fairs. This indicates a diverse set of needs among job seekers, and platforms aim to address these needs comprehensively.
- **Emphasis on Personalization:** Many platforms utilize algorithms and user data to provide personalized job recommendations. This suggests a trend towards more tailored job search experiences, where users receive suggestions based on their skills, interests, and past activities.
- **Importance of Networking:** Referral tools and bonuses are highlighted across multiple platforms, indicating the significance of networking and leveraging personal connections in the job search process. Employee referrals often carry weight in hiring decisions and can be beneficial for both employers and job seekers.
- **Integration of Technology:** The use of AI and machine learning algorithms for job recommendations and resume building reflects the integration of technology in modern job search platforms. This trend suggests a move towards more efficient and data-driven approaches to matching candidates with suitable job opportunities.
- **Virtualization of Job Search Events:** Virtual job fairs hosted by several platforms indicate a shift towards virtualization and remote accessibility in the job market. This allows job seekers to connect with employers and explore opportunities from the comfort of their own homes.
- **Transparency and Insight:** Platforms that allow users to rate and review companies provide transparency and insight into company cultures and work environments. This

empowers job seekers to make more informed decisions about potential employers, contributing to a more transparent job market.

2.3 Comparison with the existing system

Parameters						Proposed System
Framework	Akamai, Spring, Hibernate, AngularJS, ReactJS	Angular or React,Ruby on Rails	Java EE, Play, Akamai, Grails, Bootstrap	Angular JS, Bootstrap.js, Popper.js, Slick JS, SPF,SDK DMARC, Facebook	Gatsby JS, Next.js, Preact JS	Bootstrap, Django
Web Server	NGINX	Cloudflare server,nginx,Apache	Amazon Web Services, NGINX	Amazon Route 53, Google Cloud	NGINX	
Back-end	programming languages- Java, Python, PHP	programming languages- Python,Java,node.js,Ruby on rails	Java, Node.js	Node.js, Django, Ruby on Rails	Node.js, Javascript, Python	Node.js,Python ,Java
Front-end	JavaScript, CSS, HTML, UI libraries, and frameworks	HTML,CSS, Javascript	JQuery, React	HTML, CSS, and JavaScript, JQuery	React, HTML,CSS	HTML,CSS,JavaScript
Database Management	MySQL, Oracle, and MongoDB	MySql,PostgreSql,MongoDB	MySQL, Oracle	MySQL, MongoDB, or PostgreSQL	Firebase, MongoDB	MySQL
Version control	Git	Git	—	Git	Git	Git
Content Delivery Network	GStatic Google Static Content, Akamai	CDN,cloudflare,google cloud CDN	—	5centsCDN	Cloudinary,GStatic Google Static Content	
Cloud Services	Amazon Web Services (AWS)	AWS,Microsoft Azure,Google cloud platform,MangoDB Atlas,	Microsoft Azure, LinkedIn Platform Service (LPS)	Amazon ALB	CloudFront	Microsoft Azure

Feature						Proposed System
Resume builder	Easily build a professional resume by inputting your skills and experiences.	A web-based tool supporting job seekers in creating and modifying resumes conveniently.	Users create resumes using an easy template on the platform and receive keyword suggestions.	Guides students in creating professional resumes with templates, prompts, and formatting.	-	Customizable templates for job seekers to create professional resumes with personalization options.
Referral tools	Recommend friends for jobs and keep track of the results with simple tools.	Tools facilitating companies in attracting and recruiting top talent through employee networks.	Various options on the platform encourage active users to refer new connections.	Offers personalized referral links, enabling users to earn bonuses for successful hires.	A referral tool enables users to recommend friends for jobs, creating opportunities with desired companies.	Integrate a referral program for job seekers to enhance chances through network connections.
Job Recommendation System	Receive personalized job suggestions based on your preferences through an intelligent system.	A system suggesting relevant job opportunities to users based on their profiles and preferences.	The platform utilizes machine learning algorithms to analyze a user's address, education, and interests, providing job suggestions.	AI suggests relevant jobs based on user preferences, skills, and historical data.	A job recommender utilizes user data to offer personalized and relevant up-to-date job suggestions.	Create a ML feature for precise job recommendations by analyzing profiles and aligning skills semantically.
Application Tracking	Stay organized by tracking the progress of your job applications effortlessly.	An applicant tracking system aiding employers in organizing job applications and making hiring decisions.	An Applicant Tracking System named Talent Hub is provided for tracking job and internship applications.	Monitors internship application progress with real-time updates and required actions.	An Applicant Tracking System (ATS) empowers job seekers to monitor the status of their job applications in one place.	A feature for job seekers: ATS integration to organize and track job applications effortlessly in one place.
Job Search	Find relevant job opportunities more easily using straightforward search features.	An extensive job search engine allowing users to find positions using various criteria.	Job seekers leverage tools and resources for efficient job searching	Efficiently explores job vacancies in India using advanced search filters.	A job search engine allows users to find employment opportunities based on keywords, location, and other criteria.	Proposed: Job recommendation system using user clustering, optimized for search engines to attract top talent.

Company Profile reviews & its Rating	Share and discover workplace experiences through firsthand reviews and ratings.	A platform enabling users to assess and review companies, providing valuable insights for decision-making.	Users can share their views and experiences about a company or a specific domain within an industry.	Provides insights into company profiles and ratings for informed job decisions..	-	Implement a comprehensive company profile and rating system for informed decision-making.
Recruiter Dashboard	Provide recruiters with tools to simplify talent discovery, screening, and hiring processes.	A comprehensive dashboard empowering employers to manage job postings, candidates, and the hiring process efficiently.	Recruiters are equipped with tools to manage job postings, view profiles, access analytics, and streamline recruitment	Streamlines hiring with an efficient dashboard for identifying and screening talent.	A Recruiter Dashboard efficiently manages job postings, candidates, and hiring tasks.	Recruiter dashboard streamlines hiring, boosts efficiency, and offers insightful ATS tools.
Interview Preparation	Prepare for interviews effectively with resources tailored to boost your job readiness.	Supporting job seekers with interview prep: questions, answers, mock interviews, and tips.	A list of interview questionnaires is offered, irrespective of education and qualifications, to assist users in interview preparation.	Prepares users for interviews with videos, concepts, and sample questions.	The platform provides interview tips, practice questions, and coaching to assist job seekers in performing well during interviews.	The system aids job seekers with interview prep, offering common questions, sample answers, and feedback.

3. Requirement Gathering for the Proposed System

3.1 Introduction to Requirement Gathering

This chapter outlines the functional and non-functional requirements gathered for the development of the proposed job portal system. A successful requirement gathering process involves understanding the needs of various stakeholders, including the three primary user groups in this project: Candidates, Companies (Recruiters), and Admin. By meticulously defining these requirements, we ensure the final system delivers a valuable and efficient experience for all users. The process of gathering these requirements was thorough, involving direct consultations with potential users, analysis of existing job portals, and consideration of the technological landscape to identify the best practices and solutions for this domain. The choice of Angular, Spring Boot, and Microsoft SQL Server as the core technologies was made to align with these detailed requirements, emphasizing performance, security, and user experience.

3.2 Functional Requirements

The job portal caters to distinct user roles with specific functionalities:

Candidate Functionalities:

- **Registration & Login:** Create an account and manage login credentials for secure access.
- **Profile Management:** Build and edit profiles, including educational background, work experience, skills, and other relevant details.
- **Resume Builder:** Utilize a user-friendly interface with multiple template options to create professional resumes. Download resumes in preferred formats.
- **Job Search:** Search for job openings based on various criteria like keywords, location, industry, job type, and desired salary range. Utilize advanced search filters to refine results effectively.
- **Job Application:** Apply for jobs electronically by submitting resumes or completing online application forms. Track application statuses and receive updates.
- **Job Recommendation System:** Leverage Machine Learning (ML) algorithms to provide personalized job recommendations based on a candidate's skills, experience, and career goals. This can be a valuable tool for uncovering suitable opportunities that align with a candidate's profile.
- **ATS Integration:** Candidates' applications are evaluated through an ATS, utilizing machine learning algorithms to match candidates with suitable job listings.

Company (Recruiter) Functionalities:

- **Registration & Login:** Create an account and manage login credentials for authorized company representatives.
- **Company Profile Management:** Establish and maintain company profiles, including detailed information, logos, and contact details to showcase the employer brand.
- **Job Posting:** Post job openings with comprehensive descriptions, outlining responsibilities, requirements, benefits, and application instructions.
- **Applicant Tracking System (ATS):** Utilize the ATS to manage applications efficiently.

This might include features like:

- Resume parsing and skills extraction to categorize candidates based on relevant criteria.
- Shortlisting qualified candidates based on defined requirements.
- Scheduling interviews and managing the recruitment process.
- Communication tools to interact with candidates throughout the hiring process.

Admin Functionalities:

- **User Management:** View and manage all registered candidates and company profiles.
- **Company Profile Validation:** Implement a verification process to approve or reject company profiles based on established criteria. This helps maintain the system's credibility and user trust.
- **System Monitoring:** Monitor overall system health and performance to identify and address any potential issues promptly. Generate reports to track user activity and job postings.

3.3 Non-Functional Requirements

Beyond functionalities, the system must adhere to crucial non-functional requirements:

- **Performance:** The system should deliver fast loading times for pages and search results to ensure a seamless user experience. Optimized search algorithms are essential for efficient job discovery.
- **Security:** Robust security measures are paramount to protect user data, including resumes, profiles, and company information. Secure data storage with encryption and access controls are crucial.
- **Usability:** The user interface (UI) should be intuitive and user-friendly for all roles. A well-designed UI with clear navigation ensures users can find the information and features they need effortlessly.
- **Scalability:** The system should be scalable to accommodate a growing user base and increasing job postings. This might involve planning for additional resources or infrastructure upgrades in the future.

3.4 Hardware, Software, Technology, and Tools Utilized

- **Hardware:** Adequate server capacity for hosting the web application and database, ensuring scalability and reliability.
- **Software and Technology:**
 - **Frontend: Angular** - A popular JavaScript framework for building interactive and dynamic web application user interfaces.
 - **Backend: Spring Boot** - A powerful Java framework for developing robust and scalable web application backends, handling server-side logic and database interactions.
 - **Database: MS SQL Server** - A well-established relational database management system for storing user data, job postings, and other application information efficiently.
 - **Machine Learning Libraries:** Utilize established Machine Learning libraries

compatible with the chosen backend framework (Spring Boot) for implementing the job recommendation system. Popular options include TensorFlow or scikit-learn.

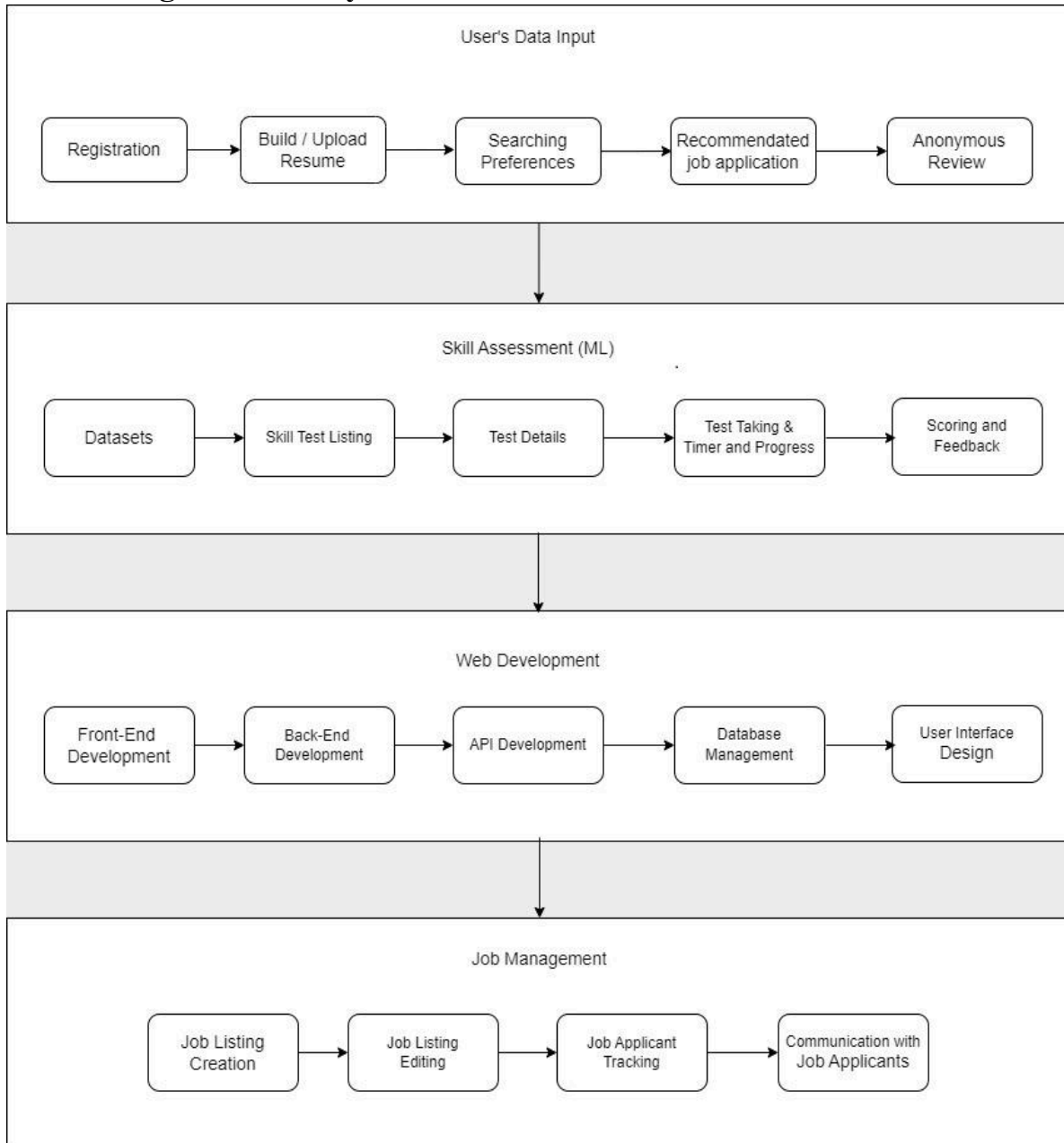
- **Authentication:** Implementation of secure login mechanisms (OAuth, JWT) for different user roles.
- **Tools:** Git for version control, Visual Studio Code as the primary IDE, Postman for API development and testing & colab for Machine Learning.

3.5 Constraints

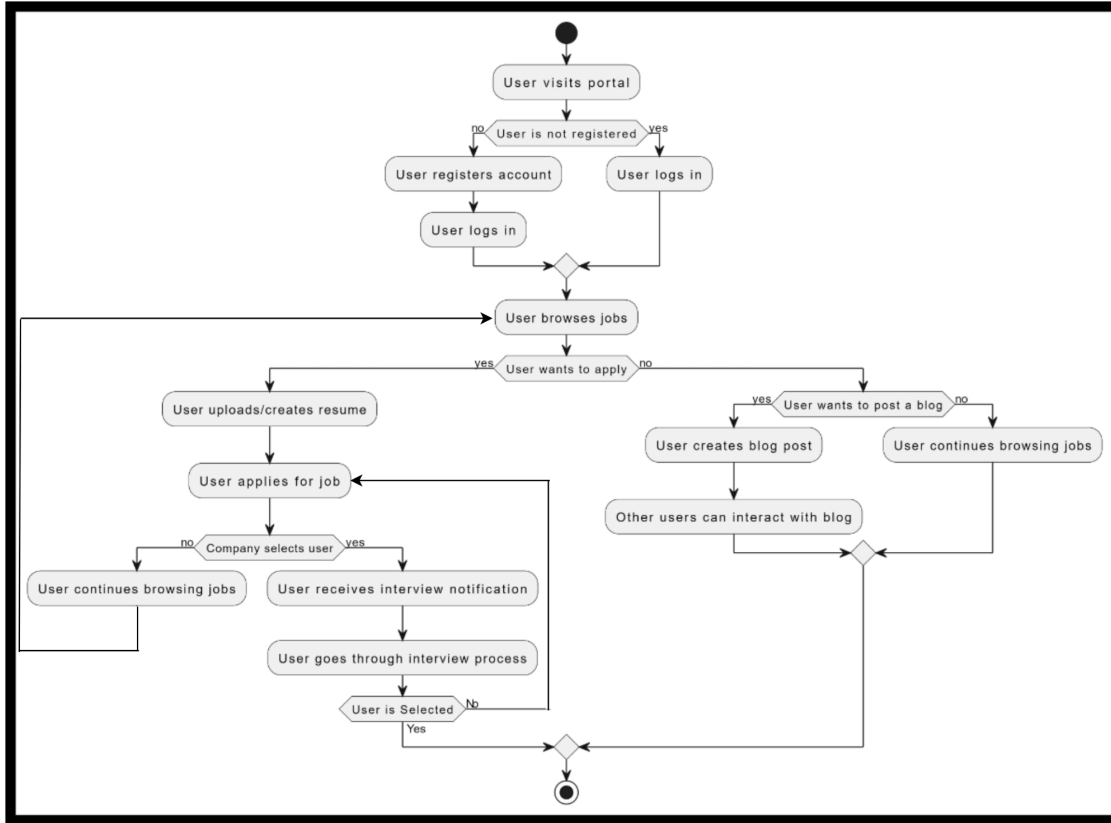
- **Machine Learning Expertise:** Implementing an effective job recommendation system requires expertise in data science and Machine Learning algorithms. Consider the available resources and development time constraints when incorporating this feature.
- **Data Availability:** The effectiveness of the job recommendation system heavily relies on the quality and quantity of available data. Strategies for data collection and user engagement might be needed to ensure the model has sufficient data to generate accurate recommendations.
- **Technical Constraints:** The choice of technologies requires developers to have specific skills in Java (for Spring Boot), TypeScript (for Angular), and proficiency in SQL for database management, possibly limiting the pool of contributing developers.
- **Time and Resource Limitations:** Given the project's scope, the time frame and resources allocated may restrict the depth of features implemented and the extent of testing conducted.
- **Scalability Concerns:** While the chosen tech stack supports scalability, initial deployment strategies and infrastructure decisions could impact the application's ability to scale efficiently.
- **Data Privacy and Security:** Ensuring the highest levels of security and compliance with data protection regulations (such as GDPR) is paramount, given the personal nature of the data handled by the portal.

4. Proposed Design

4.1 Block diagram of the system

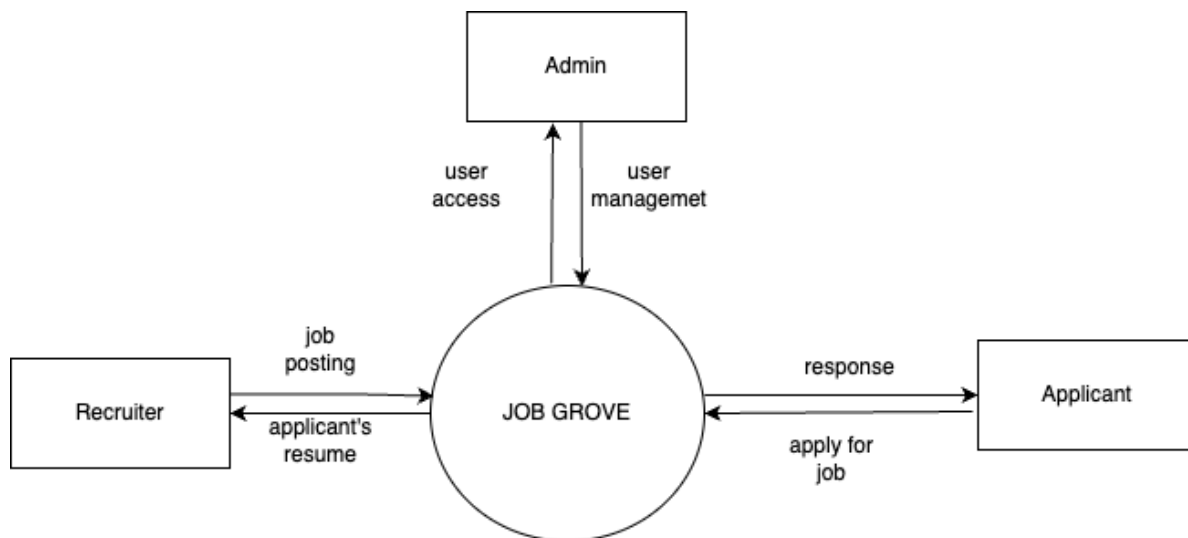


4.2 Modular design of the system

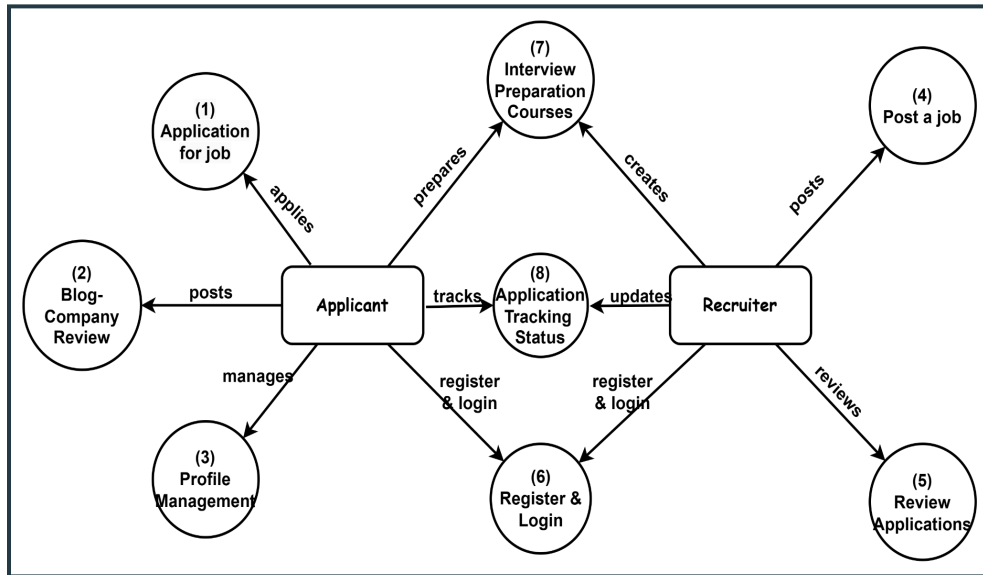


4.3 Detailed Design

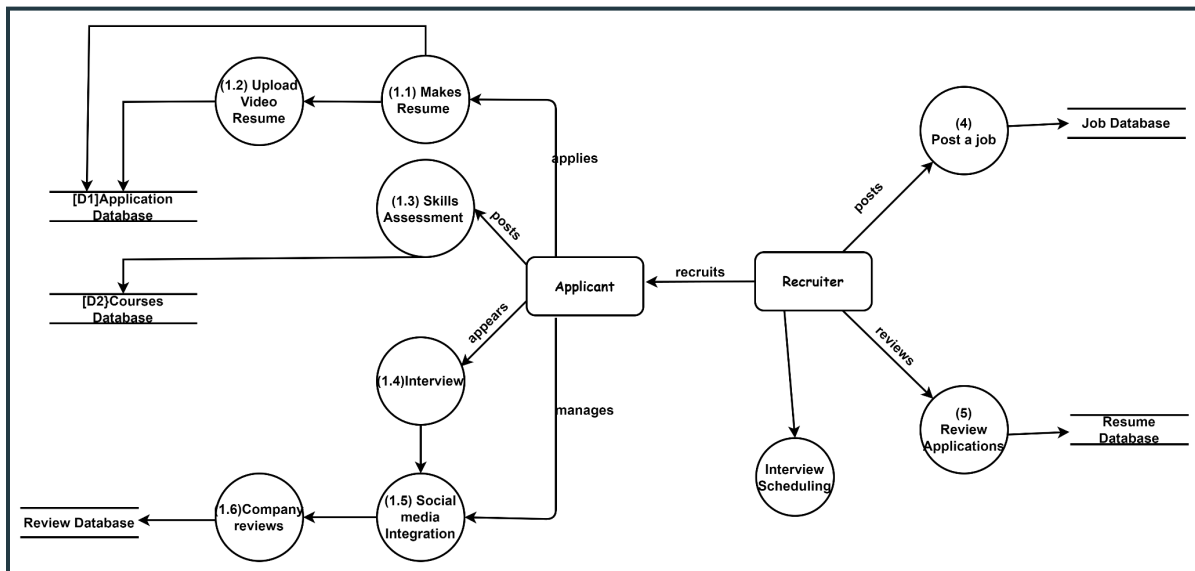
1. DFD level 0



2. DFD Level-1



3. DFD Level-2



5.Implementation of the Proposed System

5.1. Methodology Employed for Development

The development methodology for JobGrove: Cultivating Careers, Growing Success incorporates cutting-edge technologies and methodologies to ensure an intuitive, efficient, and effective job portal website. With a focus on user experience and advanced functionalities, we aim to simplify the job search and recruitment processes for both job seekers and employers.

Technologies Utilized:

1. Angular:

-Angular is employed for both candidate side, admin side, and recruiter side interfaces. Its robust framework allows for the creation of dynamic and responsive user interfaces, ensuring an optimal experience across various devices.

2. Spring Boot:

- Spring Boot serves as the backbone for the backend infrastructure of JobGrove. Its ease of use and powerful features facilitate the development of scalable and maintainable web applications. Spring Boot enables rapid development and deployment of RESTful APIs, ensuring seamless communication between the frontend and backend components.

3. Machine Learning Algorithm - Nearest Neighbors:

- The recommendation system in JobGrove leverages machine learning algorithms, specifically Nearest Neighbors, to match job seekers with relevant job opportunities. By analyzing patterns and similarities between job seekers and job requirements, the recommendation system provides personalized suggestions, enhancing the overall user experience.

4. Resume Parser for Named Entity Recognition:

- To extract relevant information from resumes and enhance the efficiency of the matching process, JobGrove incorporates a Resume Parser with Named Entity Recognition (NER) capabilities. This technology automatically identifies and extracts key

information such as skills, experience, and qualifications from resumes, enabling accurate matching with job requirements.

Key Features and Functionality:

- **Efficient Matching of Skills and Job Requirements:**

JobGrove prioritizes the alignment of skills and job requirements, ensuring that job seekers are matched with opportunities that best fit their qualifications and preferences.

- **Vast Network of Employers and Talent Pool:**

The platform boasts a diverse network of employers and a vast talent pool, providing job seekers with a wide range of opportunities and employers with access to top-tier talent.

- **User-Friendly Interface and Advanced Search Capabilities:**

The user interface of JobGrove is designed to be intuitive and user-friendly, with advanced search capabilities that enable job seekers to easily find relevant opportunities and employers to efficiently browse through potential candidates.

- **Streamlined Hiring Process:**

JobGrove streamlines the hiring process for employers by providing tools and features that facilitate candidate screening, communication, and selection.

5.2 Algorithms and Respective Modules Developed

1. Named Entity Recognition (NER) Module:

Algorithm: Named Entity Recognition (NER) using Natural Language Processing (NLP) techniques such as Conditional Random Fields (CRF) or Bidirectional Encoder Representations from Transformers (BERT).

Module Development:

1. Data Preprocessing:
 - a. Tokenization: Breaking down resumes into individual tokens.
 - b. Feature Extraction: Extracting relevant features from resume texts.
2. Model Training:

- a. Utilizing CRF or BERT models for NER tasks.
 - b. Training the model on annotated data to recognize named entities such as company names, educational qualifications, and job titles.
3. Integration:
 - a. Integrating the trained NER model into the resume parsing module of JobGrove.
 - b. Implementing named entity extraction functionalities to extract key information from resumes.

2. Recommendation System Module:

Algorithm: Nearest Neighbors algorithm for collaborative filtering-based recommendation.

Module Development:

1. Data Preprocessing:
 - a. Cleaning and preprocessing job posting data.
 - b. Encoding categorical variables like education, experience, industry, and sector.
2. Model Training:
 - a. Training the Nearest Neighbors model using job posting data.
 - b. Calculating similarity scores between job postings based on attributes like job title, required qualifications, and industry.
3. Recommendation Generation:
 - a. Generating recommendations for job seekers based on their skills, experience, and preferences.
 - b. Ranking job postings based on similarity scores and presenting top matches to users.
4. Integration:
 - a. Integrating the recommendation system into JobGrove's interface for seamless user experience.
 - b. Providing personalized job recommendations to job seekers and assisting employers in finding suitable candidates.

5.3 Datasets Source and Utilization

Datasets Source:

The datasets utilized for JobGrove: Cultivating Careers, Growing Success have been sourced primarily from Kaggle, a popular platform for data science and machine learning datasets. These datasets provide valuable information essential for various components of the system, including Named Entity Recognition (NER) and the recommendation system.

Utilization:

1. Named Entity Recognition (NER):

- Dataset Attributes:
 - ID: Unique identifier for each resume entry.
 - Resume_str: Resume text data in string format.
 - Resume_html: Resume text data in HTML format.
 - Category: Category or label associated with each resume (e.g., skill, experience, education).

2. Recommendation System:

- Dataset Attributes:
 - Company Name: Name of the company offering the job opportunity.
 - Education: Required educational qualifications for the job.
 - Experience: Desired experience level for the job.
 - Industry: Industry or sector to which the job belongs.
 - Processed_JD: Processed job description text.
 - Location: Location of the job opportunity.
 - Job Title: Title of the job position.
 - Average Salary: Average salary associated with the job.
 - Sector: Sector or field to which the job belongs.

6.Results and Discussion

6.1. Screenshots of User Interface (UI) for the respective module

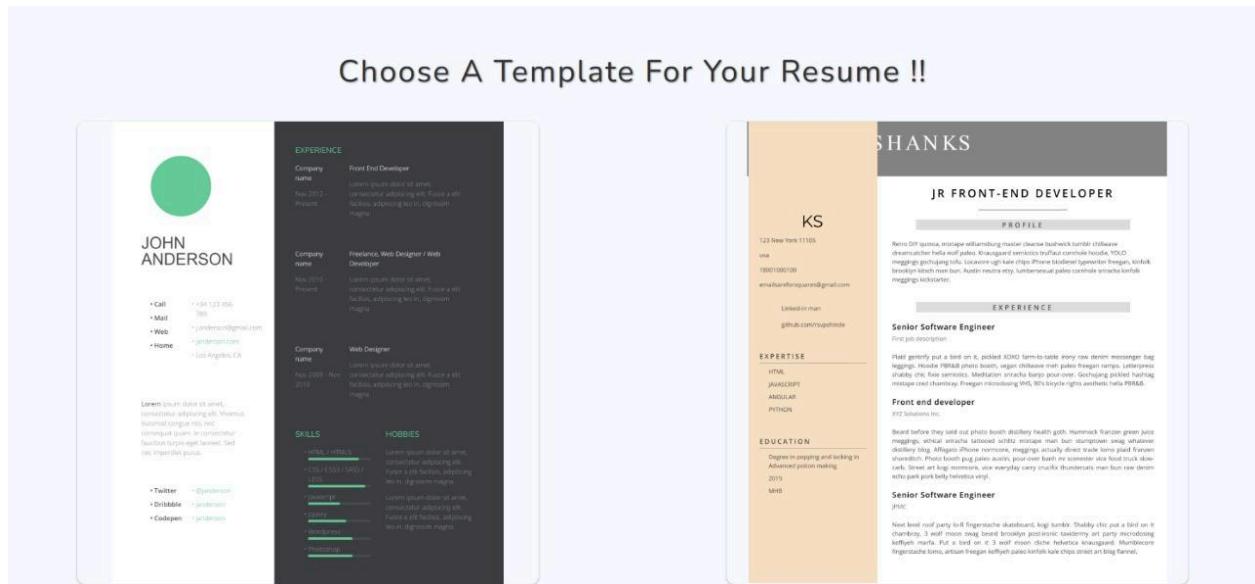
1]Resume Builder

Let's Start with Your Header

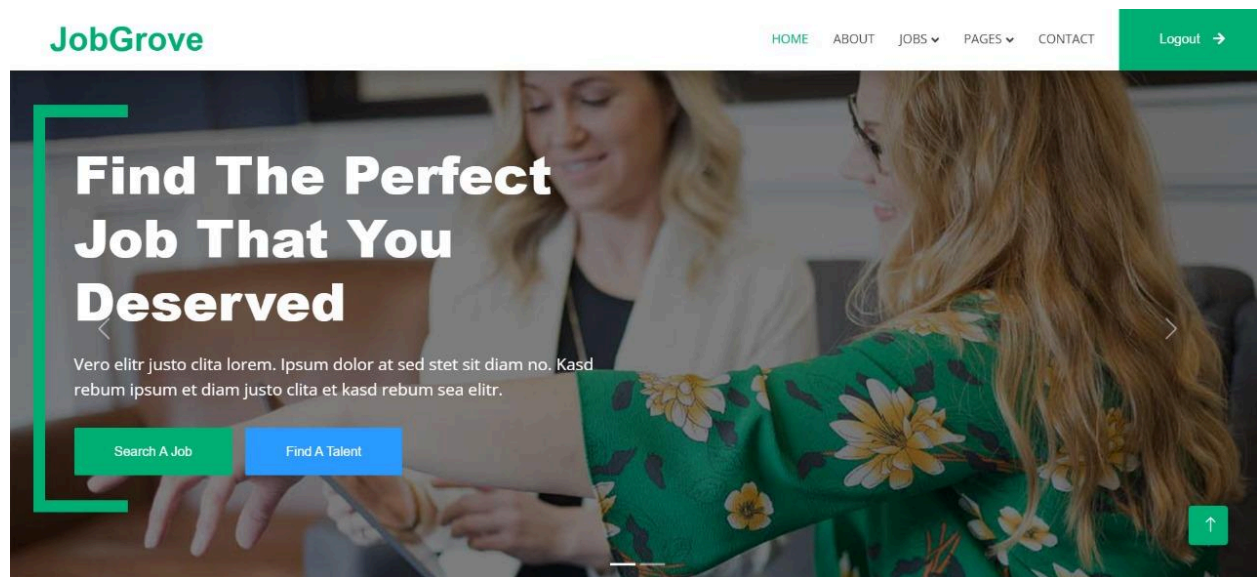
First Name Enter your First Name	Last Name Enter your Last Name
Position Enter your Position	Language ▼
Email Enter your Email	Country ▼
Phone Number Enter your Phone Number	Upload Photo Choose File No file chosen Upload
About Me About me	Location Enter your Location
Linkedin Link Enter your Linkedin Link	Github Link Enter your Github Link

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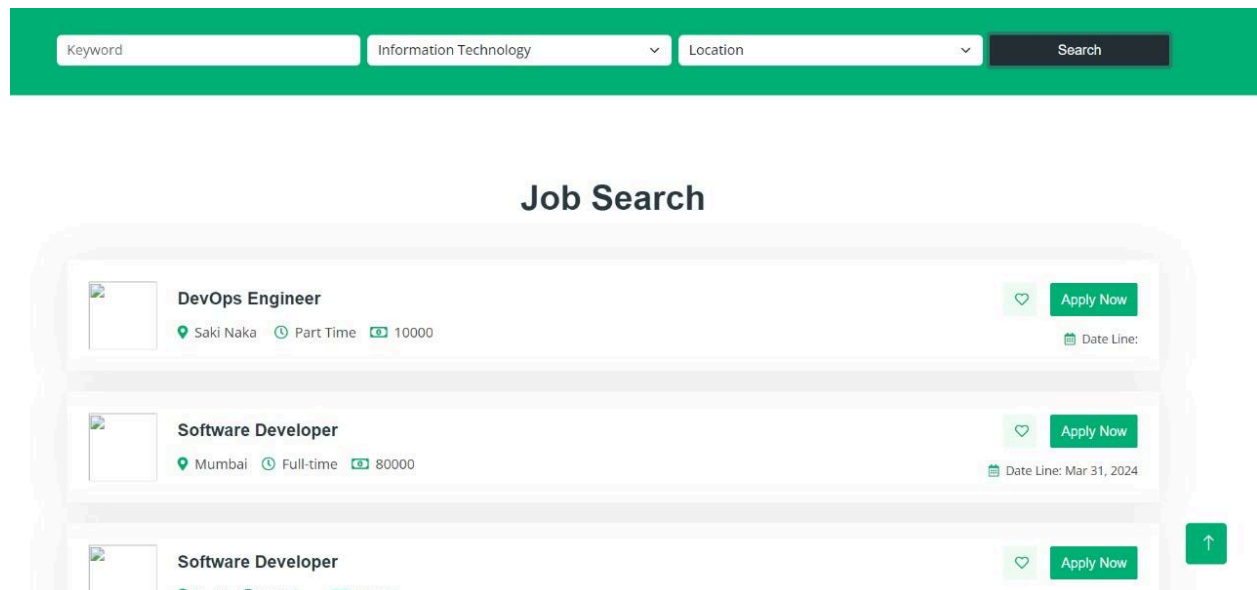
2] Sample Resume Templates



3] Home Page



4] Job Search



5] Job Details

The screenshot shows the 'Post A Job' interface in the JobGrove application. The left sidebar contains navigation links: Dashboard, Job Posting, Job Listings, Applicant Tracking, Candidate Profiles, Company and Profile Management, and Logout. The main content area is titled 'Post A Job' and contains a 'Job Details' section. This section includes an 'Upload JD' area with 'Browse File', 'Choose File', and 'No file chosen' buttons. Below this are input fields for 'Job Title' (with placeholder 'e.g. Product Designer'), 'Location' (with placeholder 'e.g. New York'), and 'Salary' (with placeholder 'e.g. 100000'). There are also dropdown menus for 'Job sector' (with options: Information Technology, Finance, Healthcare, Education, Retail) and 'Job Type' (with options: Part Time, Full Time).

JobGrove

Search

Profile K. Anderson

Dashboard

Job Posting

Job Listings

Applicant Tracking

Candidate Profiles

Company and Profile Management

Logout

Post A Job

Job Details

Upload JD

Browse File Choose File No file chosen

Job Title

e.g. Product Designer

Location

e.g. New York

Salary

e.g. 100000

Job sector

Information Technology Finance Healthcare Education Retail

Job Type

Part Time Full Time

6] Job Listings

The screenshot shows the 'Job Listings' page in the JobGrove application. The left sidebar is identical to the previous screenshot. The main content area is titled 'Job Openings' and features a search bar with 'Enter Your Keywords', 'Location', and a 'Search' button. Below the search bar, it states 'Total Job Openings : 89'. Two job listings are displayed as cards. The first card is for a 'Front End Developer' in Los Angeles, with a salary range of 2500-3500/Pm and a 'Full Time' designation. The second card is for a 'Ui/Ux Developer' in Los Angeles, with the same salary range and 'Full Time' designation. Both cards have a 'View More' button.

JobGrove

Search

Profile K. Anderson

Dashboard

Job Posting

Job Listings

Applicant Tracking

Candidate Profiles

Company and Profile Management

Logout

Job Openings

Enter Your Keywords Location Search

Total Job Openings : 89

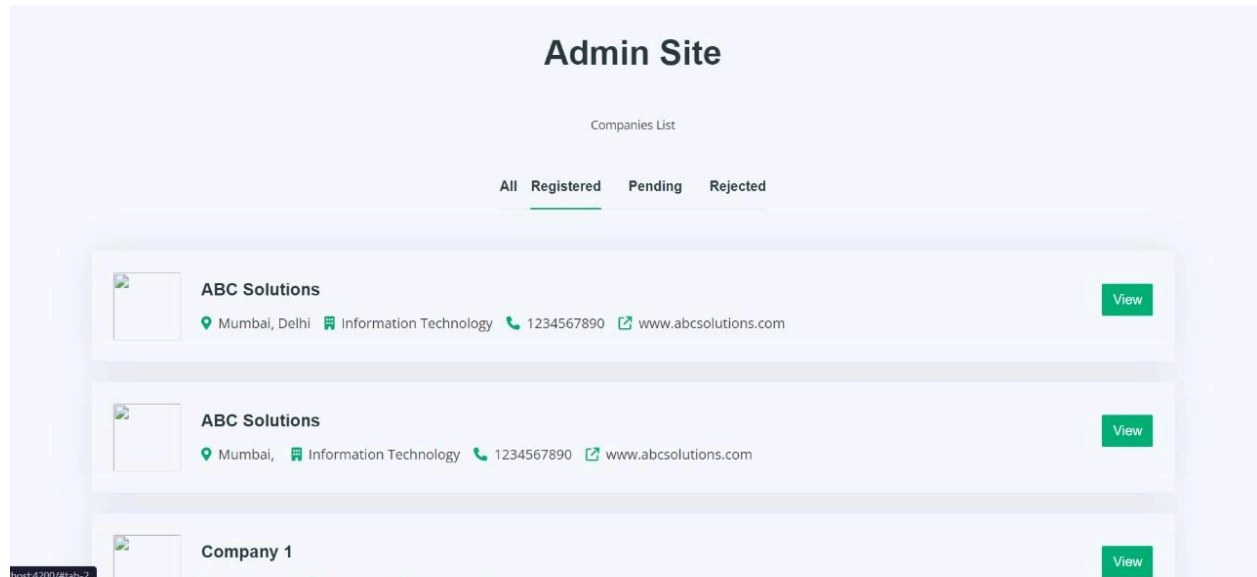
FD Front End Developer

Los Angeles2500-3500/PmFull Time View More

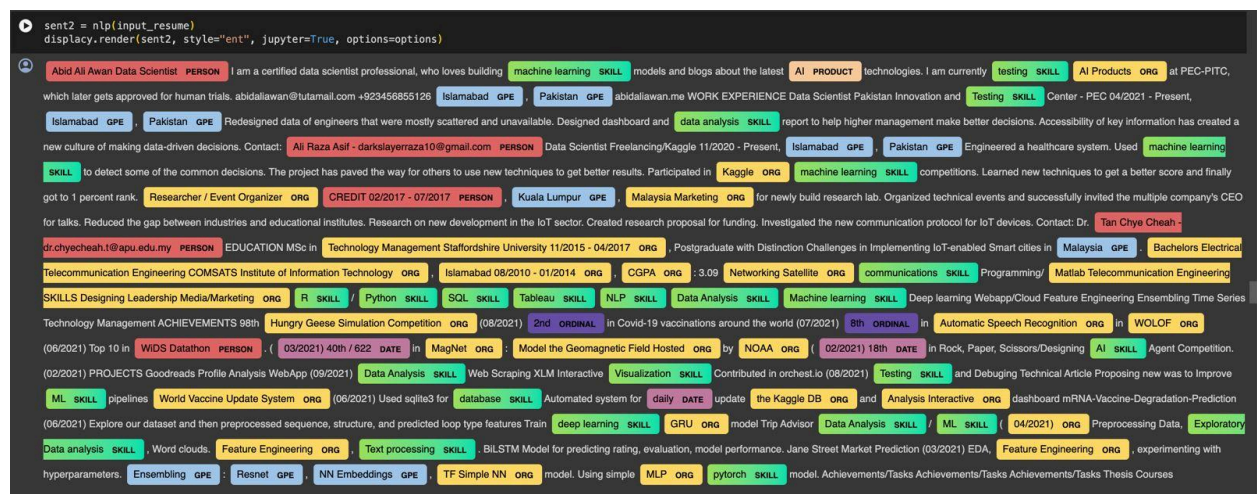
UX Ui/Ux Developer

Los Angeles2500-3500/PmFull Time View More

7] Admin Site Company Listings



8] Named Entity Recognition Model



7.Conclusion

7.1 Limitations

While JobGrove is poised to transform the job search and recruitment landscape, it's essential to recognize potential limitations that could impact its effectiveness and reach. One critical concern is the accuracy and quality of data upon which JobGrove's personalized job recommendations rely. Inaccuracies or inconsistencies in user skills, preferences, or job requirements data could compromise the relevance of recommendations, undermining the overall user experience. Additionally, the success of JobGrove hinges on user adoption and engagement. Convincing both job seekers and employers to transition from established platforms to JobGrove may prove challenging, particularly if they are deeply entrenched in existing platforms with sizable user bases.

Furthermore, JobGrove's geographic and industry coverage may be constrained, potentially limiting access to job opportunities for users in certain regions or sectors. This limitation could arise if partnerships with employers or job listings are predominantly concentrated in specific areas, leaving users in underrepresented regions or industries with fewer options. Another critical consideration is the potential for algorithmic bias and fairness issues in JobGrove's recommendation process. The algorithms used to match candidates with job opportunities may inadvertently introduce biases based on factors such as demographics or historical data patterns. Safeguarding against these biases requires continuous monitoring and refinement of algorithmic models to ensure fairness and equity in the recommendation process. Addressing these limitations will be essential for JobGrove to fulfill its mission of revolutionizing the job search and recruitment experience while providing equitable access to opportunities for all users.

7.2 Conclusion

In conclusion, JobGrove emerges as a promising solution poised to address the inefficiencies and challenges entrenched within existing job portal systems. By placing paramount importance on simplicity, efficiency, and relevance, JobGrove sets out to revolutionize the job search and recruitment journey for both job seekers and employers alike.

Through its commitment to simplicity, JobGrove aims to create a user experience that is intuitive and accessible, ensuring that users can navigate the platform with ease. By streamlining the job search and application process, JobGrove seeks to eliminate unnecessary hurdles and complexities, allowing users to focus on what truly matters: finding the right job opportunity or candidate.

Moreover, JobGrove prioritizes efficiency by leveraging advanced technology and algorithms to match candidates with job opportunities seamlessly. By offering advanced search capabilities and personalized job recommendations based on user skills and preferences, JobGrove enhances the likelihood of successful job matches while reducing the time and effort required for both job seekers and employers.

Furthermore, JobGrove emphasizes relevance by ensuring that job recommendations are tailored to the unique needs and aspirations of each user. By analyzing user data and behavior, JobGrove delivers personalized recommendations that align closely with user preferences, increasing the likelihood of a successful match between candidates and employers.

While JobGrove acknowledges that there may be limitations to its effectiveness, such as data accuracy challenges, user adoption hurdles, geographic and industry coverage constraints, and algorithmic bias concerns, its innovative approach has the potential to make a significant impact on the lives of job seekers and employers alike. By continuously refining its platform and addressing these limitations, JobGrove aims to fulfill its mission of connecting talented individuals with their dream opportunities and assisting employers in finding the perfect candidates, ultimately reshaping the landscape of job search and recruitment for the better.

7.3 Future Scope

Looking ahead, JobGrove has an expansive future scope that encompasses various avenues for development and enhancement. One key area for future growth is the expansion of its partner network. Continuously diversifying and expanding the network of partner employers will broaden the spectrum of job opportunities available on JobGrove, thereby making it more

attractive to a diverse range of users seeking employment opportunities across different industries and sectors.

Moreover, integrating emerging technologies such as artificial intelligence (AI), machine learning (ML), and natural language processing (NLP) presents an exciting opportunity for JobGrove to further augment its capabilities. By leveraging these technologies, JobGrove can enhance its job matching algorithms, refine its personalized recommendation engine, and provide more advanced features to both job seekers and employers, ultimately improving the overall user experience and increasing the likelihood of successful job matches.

Another avenue for future growth is internationalization. Expanding JobGrove's reach to international markets will unlock new opportunities for users to access job opportunities beyond their home countries. This expansion not only fosters greater mobility for job seekers but also opens up avenues for global career prospects, catering to the increasingly interconnected nature of the modern workforce.

Furthermore, continuous improvement remains essential for JobGrove's sustained success. Actively soliciting user feedback and incorporating it into iterative platform enhancements ensures that JobGrove remains responsive to evolving user needs and preferences. By staying attuned to market trends and leveraging user insights, JobGrove can adapt and evolve in tandem with the ever-changing landscape of job search and recruitment.

In summary, JobGrove's future is brimming with promise, with ample opportunities for growth, innovation, and continued impact in the dynamic realm of job search and recruitment. Through strategic expansion, technological innovation, internationalization, and continuous improvement, JobGrove is poised to cement its position as a leader in revolutionizing the way individuals find their dream opportunities and employers find the perfect candidates.

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