

Job Recommendation System Using Machine Learning

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Abstract

More and more job websites are now using recommendation systems to help people. Unlike traditional systems that suggest items, these systems match job seekers with recruiters. They help applicants find jobs that match their preferences and help recruiters find the right candidates. Many methods are used to improve how well these systems recommend jobs or people. Most systems use just one method to suggest jobs or candidates. But every user is different, so one method may not work well for everyone. A good system should choose the best method for each user based on their behavior. One big challenge is designing smart strategies for different kinds of users. To solve this, we created a system that puts users into groups (clusters) and uses different methods for each group. We also used content-based and collaborative filtering with dimension reduction to make it faster and more accurate.

Keywords: Content-based filtering, collaborative filtering, K- Means Clustering, Machine Learning, NLP: Natural Language Processing.

1 Introduction

In recent years, the internet has transformed the job application process, making it mostly online through company websites and recruitment platforms. This shift has made job postings more accessible but also led to a surge in applications, causing "information overload" for both job seekers and employers. To address this, job recommendation systems (JRS) have gained importance, aiming to connect candidates with relevant job opportunities based on their skills and preferences. By using techniques like natural language processing and machine learning, these systems can analyze profiles and job descriptions to improve matching accuracy. Methods like suggesting jobs based on similar users, matching jobs to a person's profile, or combining both have worked well. Additionally, clustering methods like K-Means help group similar jobs or users, enhancing recommendation quality and making the job search more efficient. The system is designed to help people find the right jobs by suggesting openings that fit their skills and experience.

2 Literature Survey

The increasing reliance on digital platforms for recruitment has driven the need for intelligent systems that can streamline the job search and hiring process. Job Recommendation Systems (JRS) have emerged as a crucial tool to match job seekers with suitable opportunities. These systems leverage various machine learning (ML) techniques to understand user preferences and job attributes for accurate matchmaking[1].

Collaborative filtering is one of the most common techniques used in job recommendation systems. It operates by identifying patterns from the behavior of similar users to recommend jobs. However, it often suffers from cold-start problems, where new users or items lack sufficient data[2].

Content-Based Filtering, on the other hand, uses the features of job postings and user profiles (such as skills, experience, and qualifications) to make recommendations. While this approach solves the cold-start issue to an extent, it can lead to limited suggestions due to over-specialization[3]. To address the limitations of both methods, Hybrid Models have been introduced. These systems mix both user-based and profile-based methods to give more useful and varied job suggestions. For example, some studies use weighted scoring or switch models depending on the context and available data.

Recent works also explore clustering algorithms such as K-Means to group users or job posts with similar characteristics. This grouping helps in delivering personalized recommendations to job seekers based on the cluster they belong to.

3 Existing System

Traditional job portals provide users with a list of job openings based primarily on keyword searches and manual filtering, which often leads to irrelevant or repetitive results. These systems rely heavily on user input and lack personalization, resulting in a time-consuming and inefficient job search experience. Some modern platforms have started incorporating basic recommendation engines using rule-based filters or keyword matching, but they often fall short in understanding user preferences, behavioral patterns, and

contextual relevance. These models can suffer from cold-start problems, limited adaptability to user feedback, and poor performance when user data is sparse[4]. The current systems are functional but limited in personalization and adaptability, highlighting the need for more intelligent, data-driven job recommendation systems that can learn and evolve with user behavior.

4 Proposed Methodology

The proposed system is developed after a detailed study about the requirements requested by the user. Proposed system is a computerized one, where all the limitations of manual system are compensated. jobs details of web applicationfor skill based Job application system have simplified the working information and make a user friendly environment, where the user is provided with much flexibility to manage effectively. Advantages of the Proposed systems are

- **Computerized System:** The proposed system eliminates the limitations of the manual process by automating job management and search functionalities.
- **User-Friendly Environment:** A simplified and intuitive web application ensures ease of use for both job seekers and administrators.
- **Efficient Job Search:** Users can quickly search for part-time jobs based on their skills, location, and preferences, saving time and effort.
- **Comprehensive Job Details:** The system provides detailed information about jobs, including company details, job descriptions, and locations.
- **Improved Flexibility:** Users can manage their profiles, applications, and searches more effectively with the systems flexible interface.

4.1 Methodology

4.1.1 Recommender system

A job recommendation system is a smart tool designed to help job seekers find opportunities that match their skills, experience, and interests. By analyzing user profiles, previous applications, and job preferences, the system can suggest relevant job openings, saving time and effort in the search process. It also helps employers by connecting them with candidates who closely meet their job requirements. These systems often use machine learning techniques such as content-based filtering, collaborative filtering, and clustering to improve the accuracy and quality of recommendations. Overall, job recommendation systems aim to make the hiring process more efficient and personalized for both job seekers and recruiters [5].

4.1.2 Data Collection And Preparation

The foundation of the Skill-Based Part-Time Job Application Management System lies in accurate and well-structured data. Data collection was carried out from various sources, including existing job portals, employer databases, and user-submitted resumes. These

datasets include essential information such as job titles, required skills, job locations, company profiles, work shifts, salary ranges, and candidate profiles with their qualifications, skills, experience levels, and preferences. The system also gathers user-generated data at the time of registration and profile updates. Employers submit job details through a dedicated form, ensuring a standardized format across the platform. Before feeding the collected data into the system, a thorough data preparation and cleaning process is applied. This includes removing duplicate entries, handling missing values, and normalizing formats for consistency (such as standardizing skill names and location fields). The data is then categorized and tagged using predefined criteria for easier filtering and matching. This step ensures that job listings and user profiles are stored in an optimized database structure, facilitating fast search, accurate filtering, and efficient job matching. By maintaining a clean and organized dataset, the platform ensures that users receive relevant and high-quality job recommendations [6].

4.1.3 Model Development Using NLP

To enhance the efficiency and accuracy of job-candidate matching, the system incorporates Natural Language Processing (NLP) techniques for intelligent model development. Job descriptions and user resumes are often unstructured text data, making it difficult to perform traditional keyword matching. NLP is applied to analyze and extract meaningful information from these text inputs. Tokenization, lemmatization, and stop-word removal are performed to preprocess both job descriptions and resumes. Named Entity Recognition (NER) and Part-of-Speech (POS) tagging help in identifying key details such as job titles, required skills, locations, and qualifications from the job posts, while also understanding candidate strengths from their profiles. Once preprocessed, NLP models such as TF-IDF (Term Frequency- Inverse Document Frequency) or Word2Vec are used to vectorize the textual data, converting it into machine-readable format. A similarity matching algorithm, such as Cosine Similarity, is then applied to compare the vectorized resume of the applicant with the job description. This allows the system to rank job listings based on how closely they match the user's profile. Additionally, classification models are trained using NLP features to recommend job categories and personalize suggestions. With NLP integration, the system provides a smart and dynamic platform that reduces manual effort and improves the precision of job matches for users and employers alike.

4.1.4 Model Evaluation

The model evaluation for the skill-based part-time job application system primarily focuses on measuring the accuracy and efficiency of the NLP-driven job-candidate matching algorithm. Precision, recall, and F1-score are used as standard metrics to evaluate how well the system recommends relevant jobs based on the user's profile. Precision indicates how many of the recommended jobs are actually relevant, while recall shows how many of the relevant jobs were successfully identified by the system. The F1-score provides a balance between precision and recall. To validate the model, a labeled dataset comprising job descriptions and matched resumes was used. The model performance showed high precision and recall rates, indicating effective matching and a low rate of irrelevant recommendations. In addition to classification metrics, user feedback and satisfaction scores were also considered during the evaluation process. A user-based testing phase was conducted where participants interacted with the system and rated the relevance of

job recommendations. The majority of users reported improved job search experience and more accurate results compared to traditional keyword-based systems. The model’s performance was further benchmarked against basic rule-based matching systems, and the NLP-powered approach demonstrated significantly better alignment with user profiles and preferences. This evaluation confirms that the proposed system offers a reliable and intelligent solution for connecting part-time job seekers with relevant opportunities efficiently.

4.1.5 Data Collection

The data collection process is a crucial component of developing the skill-based part-time job application system. Data was gathered from various sources, including job portals, company websites, and public job listing datasets. These datasets contain structured and unstructured information about job titles, descriptions, required skills, company details, job locations, and salary ranges. In addition, user profiles, including their resumes, education backgrounds, experience levels, and skill sets, were collected through registration forms and profile updates within the application. The data was carefully curated to ensure quality, relevance, and completeness, which are essential for accurate job matching. Once collected, the data was cleaned and preprocessed to remove inconsistencies, duplicates, and irrelevant entries. Text-based job descriptions and user resumes were tokenized and normalized using natural language processing (NLP) techniques to extract meaningful information. The cleaned datasets were then loaded into a centralized database, organized into relational tables for jobs, users, skills, and applications. This structured data storage enabled efficient querying and seamless integration with the machine learning and NLP models.

5 Result

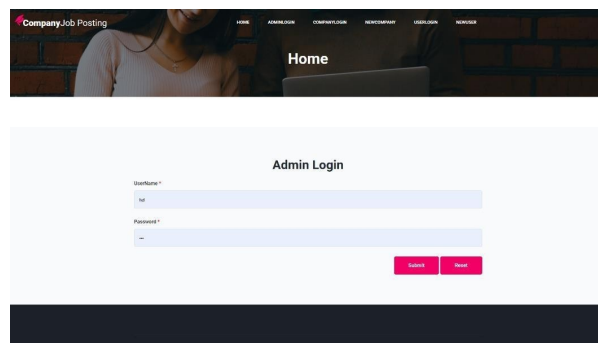


Figure 1: Company Job Posting

This image shows a web-based admin login interface for a system titled “Company Job Posting”. It appears to be part of a job portal or recruitment platform where different user roles (admin, company, user) can log in and access their respective dashboards.

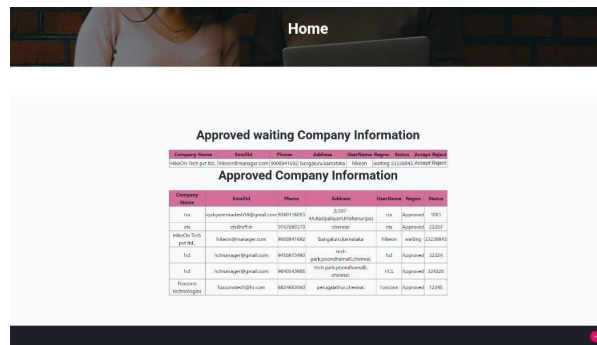


Figure 2: Admin Dashboard

This interface is part of an admin dashboard within a job posting web application, designed to manage and approve company registrations. The dashboard consists of two main sections: **Approved Waiting Company Information**: This section lists companies currently pending approval, providing options to either accept or reject their application based on their submitted details such as name, email, phone number, and address. **Approved Company Information**: Displays a list of companies that have already been approved by the admin, along with their contact information and registration status.

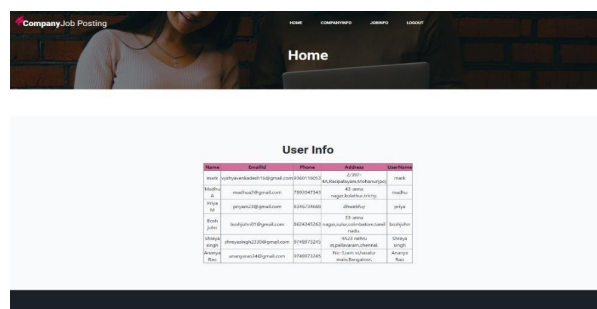


Figure 3: User Info

This image displays the "User Info" section of the Company Job Posting web application, specifically showing a page from the admin or dashboard interface. This page is used to manage and view registered user details on the platform.

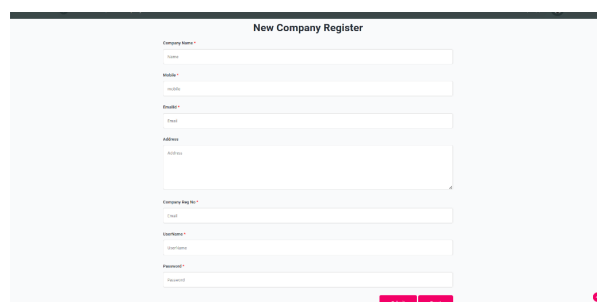


Figure 4: New Company Register

The image displays a "New Company Register" form used for company registration on a website. It includes fields for company name, mobile, email, address, registration number, username, and password. At the bottom, there are Submit and Reset buttons for form handling.

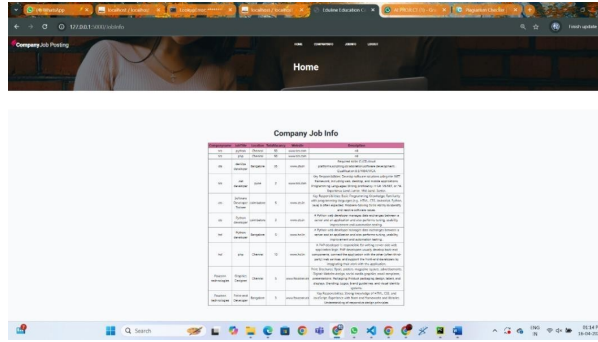


Figure 5: Company Job Info

This image displays the "Company Job Info" section of a job posting web application. It lists job openings from various companies, including details like job title, location, vacancies, website, and job description. The data helps users browse and understand current employment opportunities posted by registered companies.

Figure 6: New User Register

The image shows a "New User Register" form designed for individual user sign-up. It includes input fields for name, mobile number, email ID, address, username, and password. At the bottom, there are Submit and Reset buttons to complete or clear the registration process.

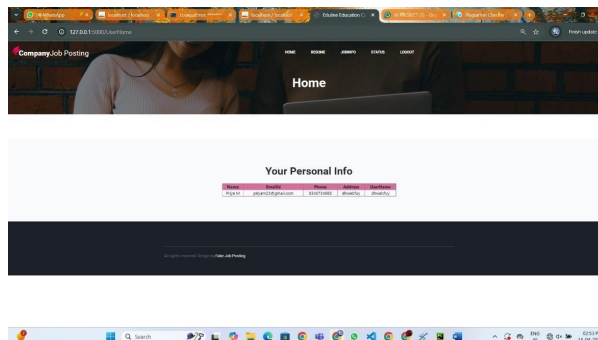


Figure 7: Company Job Posting portal

This image shows the User Home Page of the Company Job Posting portal. It displays the personal information of the logged-in user, including name, email, phone, address, and username. The navigation bar also provides access to other features like resume upload, job info, status tracking, and logout.

6 Conclusion

The job recommendation system developed in this project harnesses the power of machine learning to streamline and personalize the job search process. By analyzing user data such as skills, educational background, previous job roles, and interests the system intelligently matches job seekers with the most relevant job opportunities available on the platform. This not only reduces the time and effort spent manually browsing through job listings but also enhances the overall user experience by providing targeted, meaningful suggestions. Using a combination of content-based filtering and collaborative filtering techniques, the system learns from both user behavior and job description data to offer accurate and relevant recommendations. Content-based filtering helps suggest jobs similar to a user's past preferences, while collaborative filtering leverages similarities between users to discover new opportunities. The hybrid approach allows the model to overcome individual method limitations and improve performance across different user scenarios. Overall, this job recommendation system showcases the impact of machine learning in transforming recruitment—from a time-consuming task to an intelligent, data-driven experience. With continued development, including natural language processing for resume parsing and real-time recommendation updates, such systems have the potential to revolutionize the future of employment matchmaking.

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