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Job Search Agent Based System

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ABSTRACT

The rapid expansion of online recruitment platforms has significantly increased employment accessibility by providing job seekers with a vast number of opportunities across multiple industries. However, the large volume of job postings available on different platforms often makes it difficult for candidates to efficiently identify positions that match their skills, qualifications, and career interests. Job seekers are typically required to manually browse and filter numerous job listings while also managing applications across multiple websites. This process can be time-consuming, inefficient, and difficult to track effectively.

To address these challenges, this paper presents the design and implementation of a Job Search Agent Based System, an intelligent platform that automates resume analysis, skill extraction, and personalized job recommendation. The proposed system utilizes Natural Language Processing techniques to analyze unstructured resume documents and extract relevant information such as technical skills, educational background, and professional experience. The extracted information is then compared with job descriptions using similarity-based matching techniques to evaluate the compatibility between candidate profiles and job requirements.

Based on this comparison, the system generates a dynamic match score that ranks job listings according to their relevance to the candidate's profile. This enables job seekers to quickly identify suitable opportunities without manually reviewing large volumes of job postings. The system architecture integrates a responsive web-based frontend, a FastAPI-based backend, and a structured SQL database for efficient data processing, storage, and application tracking. The platform also provides centralized management of job applications, allowing users to monitor the status of applied positions and maintain organized records.

Keywords— Artificial Intelligence, Resume Parsing, NLP, Recommendation System, Skill Matching, FastAPI.

I. INTRODUCTION

The rapid growth of digital technologies has significantly transformed the recruitment industry, leading to the widespread adoption of online job portals and recruitment platforms. These platforms provide job seekers with access to thousands of employment opportunities across multiple domains and geographic locations [1]. While this digital transformation has increased accessibility and transparency in recruitment processes, it has also introduced new challenges for job seekers. The overwhelming number of job listings available on various platforms often makes it difficult for candidates to efficiently identify positions that align with their skills, qualifications, and career interests. Traditional job search mechanisms primarily rely on keyword-based matching techniques, which often fail to capture contextual meaning and personalized relevance, resulting in candidates spending excessive time browsing irrelevant job postings and manually managing their applications across different platforms [2].

Recent advancements in Artificial Intelligence (AI), Natural Language Processing (NLP), and machine learning have opened new possibilities for improving recruitment systems and job recommendation platforms. AI-driven recruitment solutions are capable of analyzing candidate resumes, extracting meaningful information, and comparing candidate profiles with job descriptions to identify the most suitable opportunities. Several studies have explored intelligent resume parsing and candidate-job matching techniques using NLP models to convert unstructured resume data into structured representations that can be processed computationally [3]. These systems improve recruitment efficiency by automating the screening process and enabling more accurate job recommendations.

Furthermore, modern research has focused on semantic similarity techniques and machine learning-based ranking models to enhance candidate-job matching accuracy. Methods such as resume embeddings, contextual skill extraction, and semantic similarity computation allow recruitment systems to evaluate the compatibility between candidate profiles and job requirements more effectively than traditional keyword-based approaches [9].

Emerging approaches using large language models and intelligent agents further enhance recruitment automation by enabling advanced resume analysis, skill extraction, and adaptive matching mechanisms [12]. Additionally, AI-driven recommendation frameworks utilize similarity metrics and ranking algorithms to prioritize job listings according to their relevance to candidate profiles, thereby improving the efficiency of the job search process [15].

Motivated by these advancements, this project proposes a Job Search Agent, an Artificial Intelligence-driven system designed to automate resume analysis, skill extraction, and intelligent job recommendation. The proposed system utilizes Natural Language Processing techniques to process unstructured resume documents and extract structured skill information. These extracted skills are then compared with job requirements using similarity-based computational models to determine candidate-job compatibility.

II. LITERATURE SURVEY

1. Machine Learned Job Recommendation

This research proposes a machine learning–based job recommendation system that matches job seekers with

relevant job postings by analyzing user profiles and job descriptions. The system uses ranking algorithms to recommend job opportunities based on candidate preferences and skill similarity.

2. BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding

This research introduces BERT, a transformer-based language model that significantly improves contextual understanding in natural language processing tasks. BERT has shown strong performance in entity recognition, question answering, and text classification. In job recommendation systems, BERT can be used to analyze resumes and job descriptions to understand semantic similarity between candidate skills and job requirements.

3. Hybrid Job Recommendation System Using Content-Based and Collaborative Filtering

This study proposes a hybrid job recommendation system that combines content-based filtering and collaborative filtering techniques. Content-based filtering analyzes job descriptions and user profiles, while collaborative filtering identifies patterns in user behavior and preferences.

4. Resume Parser and Job Recommendation System using Machine Learning

This research focuses on developing a resume parsing system that extracts structured information such as skills, education, and experience from unstructured resumes. The extracted data is then used to recommend suitable job opportunities based on skill matching.

III. EXISTING SYSTEM

In the current job recruitment ecosystem, job seekers typically rely on online job portals such as LinkedIn, Indeed, Naukri, and Glassdoor to search for employment opportunities. These platforms allow users to manually search for jobs using filters such as job title, location, salary range, and experience level. Although these systems provide access to a large number of job listings, they mainly depend on keyword-based search mechanisms. As a result, users often need to spend significant time browsing through numerous job postings to find positions that match their skills and qualifications.

Traditional job search systems lack deep analysis of candidate profiles and resumes. Most platforms do not automatically analyze the user's resume to understand skills, education, or experience in detail. Instead, job recommendations are usually based on basic profile information or user activity history. This often leads to irrelevant job suggestions and increases the difficulty for job seekers to identify the most suitable opportunities.

Another limitation of existing systems is the absence of an effective matching score between resumes and job descriptions. Users are typically required to manually compare their qualifications with job requirements, which can be inefficient and time-consuming. Additionally, job information is distributed across multiple job portals, requiring users to visit different platforms to explore available opportunities.

Therefore, despite the availability of numerous online recruitment platforms, existing job search systems still face challenges such as lack of intelligent resume analysis, limited personalization, inefficient job matching, and time-consuming manual job searching.

IV.PROPOSED SYSTEM

To overcome the limitations of existing job search systems, this research proposes an Intelligent Agent Based Job Search System that automatically recommends suitable job opportunities by analyzing a user's resume. The proposed system utilizes artificial intelligence techniques, natural language processing, and intelligent agents to provide personalized job recommendations.

In this system, users upload their resumes to the platform, and the system automatically extracts important information such as skills, education, experience, certifications, and technical competencies using Natural Language Processing (NLP) techniques. The extracted information is then analyzed and compared with job descriptions collected from multiple job portals such as LinkedIn and Indeed.

The intelligent agent continuously gathers job postings from different job portals and stores them in the system database. A similarity matching algorithm is used to compare the candidate's resume with job descriptions to determine how well the candidate's profile matches each job requirement. Based on this analysis, the system calculates a matching score for each job opportunity.

The system then ranks the available job postings according to their matching scores and recommends the most suitable job opportunities to the user. This approach helps users quickly identify the jobs that best match their qualifications and reduces the time spent searching for jobs manually.

The proposed system provides several advantages, including improved job matching accuracy, personalized job recommendations, automated resume analysis, and integration of job listings from multiple job portals. By combining intelligent agents with machine learning and natural language processing techniques, the system aims to enhance the job search process and assist users in finding relevant employment opportunities more efficiently

V METHODOLOGY

The methodology of the Job Search Agent Based System focuses on automating resume analysis, skill extraction, job matching, and recommendation generation using Artificial Intelligence and Natural Language Processing techniques. The system follows a structured pipeline that processes user input, extracts relevant information, computes similarity between candidate skills and job requirements, and provides ranked job recommendations.

The process begins with resume submission, where users upload their resumes through the system's web interface. The uploaded resumes are typically in unstructured formats such as PDF or DOCX. These documents are processed using Natural Language Processing techniques to extract relevant textual information. During the resume parsing stage, the system analyzes the resume content and identifies important attributes such as technical skills,

educational qualifications, and professional experience. Text preprocessing steps including tokenization, stop-word removal, and normalization are applied to convert raw resume text into structured data that can be processed computationally.

After extracting candidate skills, the system collects job description data from the job database. Each job listing contains structured information such as required skills, job title, job description, and other relevant metadata. The system then performs skill matching and similarity computation between the candidate's resume and available job postings. A basic similarity score is calculated using the equation 1:

$$S = (|R \cap J| / |J|) \times 100 \qquad \text{E.q 1}$$

where R represents the set of skills extracted from the resume and J represents the set of skills required for a job position. This metric measures the percentage of job-required skills that are present in the candidate's resume.

To enhance the accuracy of matching, the system also employs vector-based similarity techniques such as TF-IDF and cosine similarity. These techniques convert textual information from resumes and job descriptions into numerical vectors and compute similarity scores based on contextual relevance rather than simple keyword matching. This improves the ability of the system to understand semantic relationships between different skills and job requirements.

Once similarity scores are computed, the system applies a ranking mechanism to prioritize job listings based on their relevance to the candidate's profile. Jobs with higher similarity scores are ranked higher and presented to the user through the dashboard interface. The system also maintains a centralized application tracking module, which allows users to monitor their applied jobs and track application status.

The entire system is implemented using a layered architecture consisting of presentation, application, and data layers. The presentation layer provides the user interface for resume upload and job recommendation display. The application layer, implemented using the FastAPI framework, handles resume parsing, similarity computation, and authentication processes. The data layer utilizes a structured SQL database to store user data, extracted skills, job listings, similarity scores, and application records. This methodology enables the system to automate job search tasks and provide efficient, personalized job recommendations for users.

VI . SYSTEM ARCHITECTURE

The proposed system follows a three-layer modular architecture as given in Figure 1:

A. Presentation Layer

The frontend is developed using HTML, CSS, and JavaScript. It provides interfaces for user authentication, resume upload, job recommendation display, and application tracking dashboard. The design ensures responsive layout and smooth interaction with backend services.

B. Application Layer

The backend is implemented using Python and FastAPI due to its high performance and asynchronous capabilities. This layer handles resume parsing, skill extraction, similarity computation, authentication management, and API communication.

C. Data Layer

An SQL database is used to store user profiles, extracted skills, job metadata, similarity scores, and application statuses. Proper indexing ensures efficient data retrieval and scalability. The Intelligent Agent module operates within the application layer and performs NLP processing and ranking logic

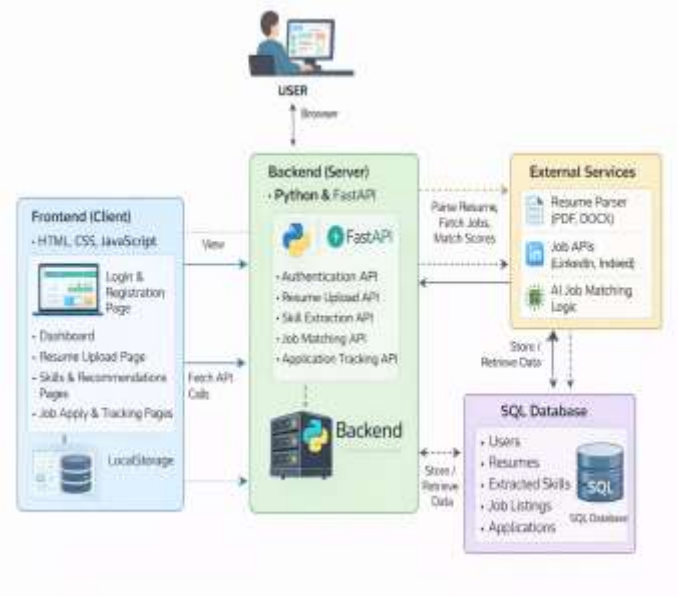

Fig 1 Proposed System Architecture

VII.IMPLEMENTATION

The proposed Intelligent Agent Based Job Search System is implemented using a combination of web technologies, natural language processing techniques, and intelligent data retrieval mechanisms. The system is designed to automatically analyze user resumes, collect job postings from multiple job portals, and recommend relevant job opportunities based on similarity matching.

1. System Development Environment

The system is implemented using a modern web-based architecture that allows users to upload resumes and receive job recommendations through an interactive interface. The frontend of the system is developed using HTML, CSS, and JavaScript, which provide a user-friendly interface for resume upload and job recommendation display. The backend of the system is implemented using Python, which performs resume parsing, skill extraction, and job matching operations. A database management system such as MySQL is used to store user profiles, extracted skills, and collected job postings.

2. Resume Upload and Parsing

The first step of the system involves allowing users to upload their resumes in formats such as PDF or DOCX. Once the resume is uploaded, the system processes the document using a resume parsing module. The resume parser extracts important

information such as: Candidate name, educational qualifications, technical skills, Work experience, Certifications, Contact information. Text extraction from resumes is performed using libraries such as **PyPDF2** for PDF files and **python-docx** for DOCX files. After extracting the text, Natural Language Processing techniques are applied to identify relevant keywords and skill sets present in the resume**.**

3.Skill Extraction using NLP

The extracted resume text is processed using Natural Language Processing (NLP) techniques to identify the candidate's skills and competencies. Tokenization, stop-word removal, and text normalization are applied to clean the text data.

A predefined skills dictionary or dataset containing common technical and professional skills is used to identify relevant skills within the resume. Named Entity Recognition (NER) techniques are also used to detect entities such as organizations, job roles, and educational qualifications.The extracted skills are then stored in the system database and used as input for the job matching process.

4.Job Data Collection from Job Portals

The system uses an intelligent agent module to collect job postings from multiple job portals such as LinkedIn, indeed, or other job listing websites. This process can be implemented using publicly available job APIs. Which are used to automatically extract job details including**:**

Job Title, Job location, Job Discription, Skills.

These job postings are stored in the system database and updated periodically to ensure that users receive the latest job opportunities**.**

5. Resume–Job Matching Algorithm

Once the resume skills and job descriptions are collected, the system performs a matching process to identify suitable job opportunities. The matching algorithm compares the candidate's extracted skills with the required skills listed in job descriptions.

Text similarity techniques such as:

1. Cosine Similarity
2. TF-IDF (Term Frequency – Inverse Document Frequency)
3. Word embeddings

are used to measure the similarity between the resume and job descriptions.

The similarity score is calculated using the formula:

Matching Score=Number of Matching SkillsTotal Required Skills×100Matching\ Score = \frac{Number\ of\ Matching\ Skills}{Total\Required\Skills}\times 100Matching Score=Total Required SkillsNumber of Matching Skills×100

Based on the similarity score, each job posting is assigned a matching percentage that indicates how well the job matches the candidate's resume

6. Job Recommendation and Ranking

After calculating the matching scores, the system ranks job postings according to their similarity scores. Jobs with the highest matching scores are displayed at the top of the recommendation list**.**

This ranking mechanism helps users quickly identify the most suitable job opportunities without manually searching through multiple job portals.

VIII. MATHEMATICAL MODEL

Let:

R = Set of skills extracted from resume

J = Set of required skills in job description

The Match Score (S) is defined as:

$S = (|R \cap J| / |J|) \times 100$

Where:

$|R \cap J|$ represents the number of matching skills

$|J|$ represents total required skills

For enhanced comparison, vector space modeling is used.

Let:

Vr = TF-IDF vector of resume

Vj = TF-IDF vector of job description

Cosine Similarity is calculated as:

$Similarity = (Vr \cdot Vj) / (||Vr|| \times ||Vj||)$

This allows contextual similarity detection beyond exact keyword matching.

IX.CONCLUSION

In this study, an Intelligent Agent Based Job Search System was developed to improve the efficiency of the job search process by automatically recommending suitable job opportunities based on a user's resume. The proposed system utilizes Natural Language Processing (NLP) techniques to extract relevant information such as skills, education, and experience from uploaded resumes. These extracted features are then compared with job descriptions collected from multiple job portals to identify the most relevant job opportunities.

The system incorporates an intelligent agent that gathers job postings from various online job platforms and stores them in a centralized database. A similarity matching algorithm is used to compare candidate skills with job requirements and calculate a matching score for each job listing. Based on this score, the system ranks and recommends the most suitable jobs to the user. This approach significantly reduces the time and effort required for manual job searching and helps users quickly identify opportunities that match their qualifications.

The experimental results demonstrate that the proposed system effectively analyzes resumes, identifies relevant skills, and recommends appropriate job opportunities with improved accuracy compared to traditional keyword-based job search methods. By integrating artificial intelligence, natural language processing, and intelligent agents, the system provides a more personalized and efficient job search experience.

In conclusion, the proposed Intelligent Agent Based Job Search System enhances the recruitment process by automating resume analysis and job matching. The system has the potential to assist job seekers in finding relevant job opportunities more efficiently while also helping recruiters identify suitable candidates.

X. LIMITATIONS

Although the proposed Intelligent Agent Based Job Search System provides an efficient approach for recommending suitable job opportunities based on user resumes, certain limitations exist in the current implementation.

1. One of the primary limitations is the dependence on resume formatting and content quality. The accuracy of the resume parsing and skill extraction process may vary depending on how the resume is structured. If the resume contains non-standard formats, images, or complex layouts, the system may not correctly extract all relevant information such as skills or experience.

2. Another limitation is related to job data collection from external job portals. The system relies on web scraping or external APIs to gather job postings from platforms such as LinkedIn or Indeed. Changes in website structure, restrictions on automated scraping, or limited API access may affect the efficiency and reliability of job data retrieval.

3. The current system mainly focuses on skill-based matching, which may not fully capture other important factors such as soft skills, candidate preferences, company culture, or job role expectations. As a result, some recommended jobs may not perfectly match the candidate's career goals.

XI.FUTURE SCOPE

The proposed Job Search Agent system can be further enhanced by integrating advanced deep learning techniques to improve the accuracy and intelligence of job recommendations. One potential improvement is the incorporation of transformer-based language models such as BERT, which can provide deeper semantic understanding of resumes and job descriptions. These models are capable of capturing contextual relationships between skills, job roles, and professional experience, enabling the system to generate more precise and personalized job recommendations. In addition, the system can be extended by integrating real-time job data from multiple recruitment platforms through official APIs such as LinkedIn, Indeed, and other job portals. This integration would allow the system to automatically fetch and update job listings, ensuring that users receive the most recent and relevant job opportunities. Another important enhancement involves the development of a mobile application version of the system. A mobile platform would allow users to upload resumes, view recommended jobs, and track applications directly from their smartphones, thereby improving accessibility and user engagement. Furthermore, personalization features such as user preference learning, career path recommendations, and intelligent notification systems could be incorporated to provide a more tailored job search experience. Overall, these future enhancements involving deep learning models, real-time data integration, improved personalization, and mobile accessibility can significantly increase the effectiveness, scalability, and usability of the Intelligent Agent Based Job Search System, making it a more powerful and practical solution for modern job seekers in an increasingly digital recruitment environment.

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