IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DEVELOPMENT OF AN AI-POWERED JOB MATCHING AND PORTAL SYSTEM

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ABSTRACT:

In the realm of modern recruitment, the surge in applicants for a single job opening presents a formidable challenge for recruiters, necessitating a meticulous review of numerous resumes. This process is both time-consuming and arduous due to the inherent diversity in resume structures, sections, and formats submitted by applicants. To address this challenge and streamline the hiring process, our proposed solution is the Smart Resume Analyzer an innovative system rooted in Natural Language Processing (NLP). The extraction of critical information from resumes, such as contact information, skills, education, and job experience, requires the use of resume parsing. [1]

This system comprises two core components: Job Seekers and Recruiters. Job seekers upload their resumes, typically in PDF or DOC formats, initiating a parsing process for field extraction. Subsequently, the system conducts a thorough analysis, assigning a rank to each resume based on factors such as skills, educational background, and other relevant parameters. Furthermore, the system offers valuable feedback to applicants, recommending enhancements like skills, courses, or additional fields to boost their resume's ranking.

The analysis results and ranked resumes are stored in a database, furnishing recruiters with a comprehensive overview of the most qualified candidates for a specific role. This approach markedly reduces the time recruiters spend manually reviewing resumes, significantly enhancing the overall efficiency of the hiring process.

Keywords: Natural Language Processing (NLP), Recruitment, Resume Parsing, Resume Analyzer, Job portal

I. INTRODUCTION

In the contemporary landscape of recruitment, where organizations grapple with the daunting task of reviewing thousands or even lakhs of resumes for a single job profile, the need for a streamlined and efficient approach is evident. Recruiters face the challenge of analyzing diverse resumes with varying formats and structures, making the process both time-consuming and labor-intensive. Recognizing these hurdles, our proposed solution is the Smart Resume Analyzer, a sophisticated tool grounded in Natural Language Processing (NLP). Data is now a kind of capital, on par with financial and human capital in creating new digital products and services. With the explosion of information in the form of news, corporate files, medical records, government documents, court hearing and social media, everyone is flooded with information overload. Most of this information is unstructured i.e. free text and thus makes hard to have reasoning and interpretation.[2]

Comprising two essential components, Job Seekers and Recruiters, our system tackles the complexity of unstructured resumes submitted in different formats. Job seekers upload resumes in PDF or DOC formats, initiating a parsing process for field extraction. The system then conducts a comprehensive analysis,

assigning a rank to each resume based on factors like skills, education, and relevant parameters. Additionally, the system offers feedback to applicants, suggesting improvements such as recommended skills or additional fields to enhance their resume's ranking. The analysis results and ranked resumes are stored in a database, providing recruiters with a clear overview of the most qualified candidates for a specific role. This innovative approach significantly reduces the time recruiters spend manually reviewing resumes, offering a more efficient and objective hiring process.

Simultaneously, our Job Portal addresses the evolving landscape of education and employment. With the increasing trend of pursuing higher education for better qualifications and skills, the internet has played a crucial role in knowledge management and information dissemination. Universities, at the forefront of web portal development, have paved the way for comprehensive links to information resources.

The Job Portal, functioning as a knowledge management system, allows for information sharing over the internet. It caters to the needs of new students in selecting courses and majors. Moreover, the rising issue of unemployment among graduates has spurred the development of job portals as a means of efficiently searching for vacant positions. Our project focuses on the information needs of job seekers, providing a conceptual framework for the development of a web portal.

The Job Portal project's goals include creating a web portal that functions as a knowledge management system, determining the requirements of employers and job seekers, comprehending web portal features, and creating an online hiring system that gathers job requirements in accordance with industry demands. This web application facilitates communication between job seekers and employers, providing a platform for interaction and addressing the communication gap.

The Smart Resume Analyzer and the Job Portal collectively revolutionize the recruitment and job-seeking processes. The analyzer leverages AI and NLP to streamline resume analysis, while the portal serves as a comprehensive knowledge management system for the education and employment landscape. These innovative solutions contribute to a more efficient, user friendly, and technologically advanced approach to recruitment and job searching.

II.LITERATURE REVIEW

The recruitment process has significantly transformed with the advent of automated systems. Traditional methods, requiring substantial human effort and time, are being replaced by technologies that enhance efficiency and accuracy in candidate matching. Current advancements include systems that support multiple resume formats, such as .pdf and .docx, and can extract relevant information from various templates, thereby increasing the object detection range.

Advanced systems also integrate with social networks, scraping keywords from platforms like LinkedIn, GitHub, and Stack Overflow. By assessing keyword similarity, these systems categorize resumes into sectors such as Computer Science, Management, and Sales. Candidate evaluation has further improved through techniques like web crawling, text mining, and natural language processing. These methods enable the analysis of electronic resume in multiple languages, grading them according to job market demands using big data techniques.

Future enhancements will include more diverse resume templates and acceptance of various IEEE extended formats. Additionally, systems will manage job descriptions requiring complex evaluation criteria, such as soft skills and industry specific qualifications, to increase candidate matching accuracy. The main future scope involves parsing resumes from platforms like LinkedIn, GitHub, and Naukri.com, adding psychometric tests, and enlarging the resume dataset.

Future work will also involve ranking resumes and analyzing candidate information from social networking sites like Facebook and Twitter. This approach will ensure more accurate and authentic job offer decisions. By adopting techniques such as web crawling, text mining, and natural language processing, future systems will effectively match job candidates with recruiters, addressing both the needs of jobhunting candidates and talent-seeking recruiters.

Key Studies:

[1] Suleiman Ali Alsaif, Minyar Sassi Hidri, "Learning-Based Matched Representation System for Job Recommendation". This study explores a system that recommends jobs based on the similarity between job seekers' skills and job descriptions using content-based filtering.

[2] Elham Albaroudi, Taha Mansouri, "A Comprehensive Review of AI Techniques for Addressing Algorithmic Bias in Job Hiring". The focus is on is on analyzing how various AI techniques can be applied to mitigate algorithmic bias in recruitment processes, ensuring fairness and reducing discriminatory practices in job hiring.

[3] Jaroslaw Kurek, Tomasz Latkowski, "Zero-Shot Recommendation AI Models for Efficient Job–Candidate Matching in Recruitment Process".The focus is on zero-shot learning techniques, allowing models to adapt without extensive labeled data, thus improving scalability in dynamic job markets.

[4] Ashvini Chavan, Nikita Tatewar ,"AI Resume Analyzer".This paper presents a system combining resume analysis with job recommendations using NLP and machine learning models. It emphasizes data security and personalization, providing a detailed architecture for AI-powered job matching.

[5] Corné de Ruijt, Sandjai Bhulai, "Job Recommender Systems: A Review". This paper offers a comprehensive review of job recommender systems, focusing on content-based, collaborative filtering, and hybrid approaches, and discussing their advantages and challenges.

[6] Irfan Ali, Nimra Mughal, "Resume Classification System using Natural Language Processing and Machine Learning Techniques". The focus is on developing a system that utilizes NLP and machine learning methods to automate the classification of resumes, aiming to improve the efficiency and accuracy of candidate selection in recruitment processes.

[7] DongSeop Leea, MyoungHee Kimb, "Artificial Intelligence based Career Matching". The focus is on leveraging AI algorithms to enhance career matching processes by aligning individuals' skills and preferences with suitable career paths, improving job satisfaction and recruitment efficiency.

[8] Anna Lena Hunkenschroer, Christoph Luetge, "Ethics of AI-Enabled Recruiting and Selection: A Review and Research Agenda". Addresses ethical concerns and biases in job recommendation algorithms and proposes mitigation strategies.

[9] Yi-Chi Chou and Han-Yen Yu, "Based on the application of AI technology in resume analysis and job recommendation". The focus is on utilizing AI technologies to streamline resume analysis and job recommendation processes, improving the accuracy and efficiency of matching candidates to suitable job positions based on their skills and qualifications.

[10] Yiou Lin, Hang Lei, "Machine learned resume-job matching solution". The focus is on developing a machine learning-based approach to match resumes with job descriptions, enhancing the recruitment process by automating and optimizing the alignment between candidate qualifications and job requirements.

The studies collectively underscore the transformative potential of AI in job matching and recruitment processes. They highlight various methodologies, such as content-based filtering, zero-shot learning, and natural language processing, to enhance the efficiency and accuracy of job recommendations. Moreover, the emphasis on addressing algorithmic bias and ethical considerations reflects a growing awareness of the need for fairness in AI systems. By integrating advanced technologies while prioritizing ethical standards, these works contribute to more personalized and equitable job matching solutions, ultimately improving both candidate satisfaction and recruitment outcomes.

III.FUNCTIONAL AREA OF SMART RESUME

The functional area of a smart resume analyzer encompasses a wide range of capabilities and features designed to automate and enhance the resume evaluation process. Here are some key functional areas of a smart resume analyzer:

3.1. Resume Parsing:

Smart resume analyzers excel at parsing or extracting relevant information from resumes. They use natural language processing algorithms to extract data such as personal details, education history, work experience, skills, certifications, and contact information. This parsing capability allows for quick and accurate extraction of essential resume data.

3.2. Skill Assessment:

Smart resume analyzers can assess the skills mentioned in a resume and evaluate their relevance and proficiency level. By analyzing keywords, industry-specific terminology, and context, these analyzers provide insights into the candidate's skill set and their alignment with the job requirements.

3.3. Keyword Matching:

Resume analyzers employ keyword-matching techniques to compare the keywords in the resume against the desired skills and qualifications for a particular job. This functionality helps identify resumes that closely match the job requirements, ensuring that the most relevant candidates are selected for further consideration.

3.4. Resume Screening and Ranking:

Smart resume analyzers screen and rank resumes based on predefined criteria or job-specific requirements. They can automatically filter resumes based on the presence of specific skills, educational qualifications, work experience, or any other desired criteria. This capability saves significant time and effort for recruiters, allowing them to focus on the most promising candidates.

3.5. Feedback and Suggestions:

Resume analyzers provide valuable feedback and suggestions to job seekers to improve their resumes. They can identify areas for improvement, suggest relevant keywords, recommend additional skills to acquire, or highlight any inconsistencies or gaps in the resume. This feedback helps candidates tailor their resumes to better match the desired job requirements.

3.6. Formatting and Layout Optimization:

Smart resume analyzers can evaluate the formatting, layout, and structure of resumes. They provide suggestions for optimizing the presentation, readability, and organization of information. This ensures that the resume is visually appealing and easy to navigate for recruiters.

3.7. Analytics and Insights:

Resume analyzers generate analytics and insights by analyzing a large dataset of resumes. They can identify trends in skills demand, educational requirements, or industry-specific qualifications. These insights help recruiters align their hiring strategies, refine job descriptions, or identify emerging skill sets. In summary, the functional areas of a smart resume analyzer encompass resume parsing, skill assessment, keyword matching, resume screening and ranking, bias reduction, feedback and suggestions, formatting and layout optimization, as well as analytics and insights. These functionalities streamline the resume evaluation process, enhance candidate matching, and provide valuable insights for recruiters, ultimately leading to more efficient and informed hiring decisions.

IV.REQUIREMENT ANALYSIS

The system's functionalities are listed below. You are welcome to add more features to this list that you think fit. Additionally, in locations where the functional description. If insufficient, you can make reasonable assumptions and move forward. The HR department oversees creating positions. Generate candidates (those who want to apply for a position), start interviews before closing the position. Some interviewers will be informed of the interview schedule and then makes their way inside.

4.1. Generic:

- Enter the system by going to the application's first page and logging in. The welcome message should show your name and employee number.
- Modify the password after logging into the program.
- Review and edit his/her details.
- For system assistance, refer to the help section or contact support.

4.2. Recruiting companies:

- It should be possible to create a new opening.
- Should have the ability to modify any of the vacancy's editable details.
- Possess the ability to generate a new candidate.
- Possess the ability to modify any of the applicant's editable data.
- Have the capability to look up the application and vacancy numbers.
- Associate a candidate with a position – there should be multiple connections between the applicants and the position.
- Should be able to enter the interviewer's details, including date and time, and schedule the meeting.
- Should have the option to cancel or reschedule the interview.
- An HR representative is unable to" close" a position that is not theirs.

4.3. Job Seeker:

- Should be able to see every position that is set to be filled.
- Must be able to see the company's details.
- Ought to be able to see the job's specifics.
- Possess the ability to look for openings by application number and vacancy number.

4.4. Additional Information:

- The position should include the following information:

1) A sequential vacancy number should be generated by the system. This ought to be distinct and unchangeable in the future.
2) The default date of the vacancy's creation should be today. This cannot be altered in the future.
3) Owned by: The HR staff member who created the opening should be listed here by default. This worker will take ownership of the opening. Later, this can be altered.
4) The vacant position's status: open, closed, or suspended. This can be modified later by HR, but it should default to open.
5) The Job Title (e.g., Java Developer).
6) A thorough explanation of the position.

- The applicant's information ought to include these:

1) The applicant number should be generated progressively by the system. This ought to be distinct and unchangeable in the future.
2) The applicant's creation date should be set to today by default; this cannot be altered later.
3) The applicant's status: Not in Process, In Process, Hired, or Banned.
4) When an application is created, the applicant status should be set to" Not in Process," but as soon as a single vacancy is associated, the status should change to" In Process." If the applicant's status is either" Hired" or" Banned," no further vacancies can be associated with them. The HR Group has the ability to manually modify the status.

- The applicant-vacancy information needs to contain the following:

1) The name and applicant number should appear here.

2) The applicant's date of attachment to the opening should be displayed here, along with the vacancy number and title.
2) The applicant's status and the available position: interview scheduled, selected, rejected, or not required.
4) The" Schedule Interview" checkbox.
5) The Interviewer should receive an email notification as soon as the interview details are added and saved.

- Upon filling every position, the default status of the vacancy should be set to" Closed."
- If a position is marked as" Closed/Suspended," the HR department shouldn't be allowed to connect a candidate to it.
- A vacancy cannot be suspended or reopened once it has been closed.
- If the position is open, HR may alter its status to" Closed" or" Suspended."
- If the position is" Suspended," HR may alter its status to" Closed" or" Open."
- The applicant's status should automatically change to" Hired" as soon as the applicant-vacancy status changes to" Selected."
- The necessary security measures must be put into place.
- An email notification should be sent to the owner once the vacancy gets closed.

V.MODELING

The suggested system is a responsive web application created with the streamlit framework and Python programming language. Python's nltk and spacy libraries will be used for Natural Language Processing (NLP). The resume's extracted fields will be analyzed using a variety of methods, including regular expressions. The resume system will evaluate the resume based on analysis, and it will provide recommendations based on the score. We will match the necessary talents on the resume with the skills listed there, and we'll offer recommendations. The application data will be stored in a database and utilized by recruiters for decision-making and data visualization. Recruiters will get access to candidate reports based solely on their resumes, which are concise and useful for the hiring process, this system is included in Automatic Tracking System (ATS) of an applicant.

VI.SYSTEM DESIGN

A new online employment site was suggested using data from the literature research and the needs of the identified job seekers. This website serves as a knowledge management tool for both employers and job seekers. The accomplishment of this study's goals is the primary motivation for the system's design. The results of the surveys, which were covered in the previous chapter, were used to determine the needs of job seekers for the new portal. The new portal functions as a web-based tool that meets the demands of the jobless as job seekers in the system, organizations as employers, students and users who are currently employed as general users. The Administrator is regarded as a distinct user type that oversees, regulates, and has access to the entire process in the system.

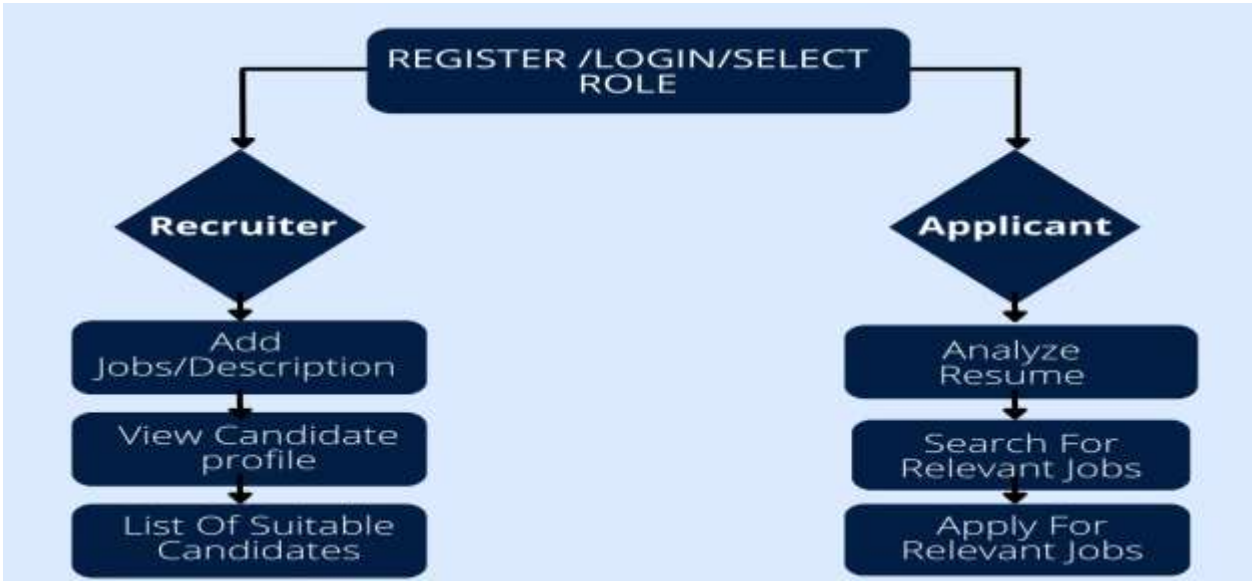

Fig. 1. Block diagram of methodology used.

6.1. STEPS FOR RESUME PROCESSING

STEP 1: The applicant must upload their resume to the portal for review and analysis.

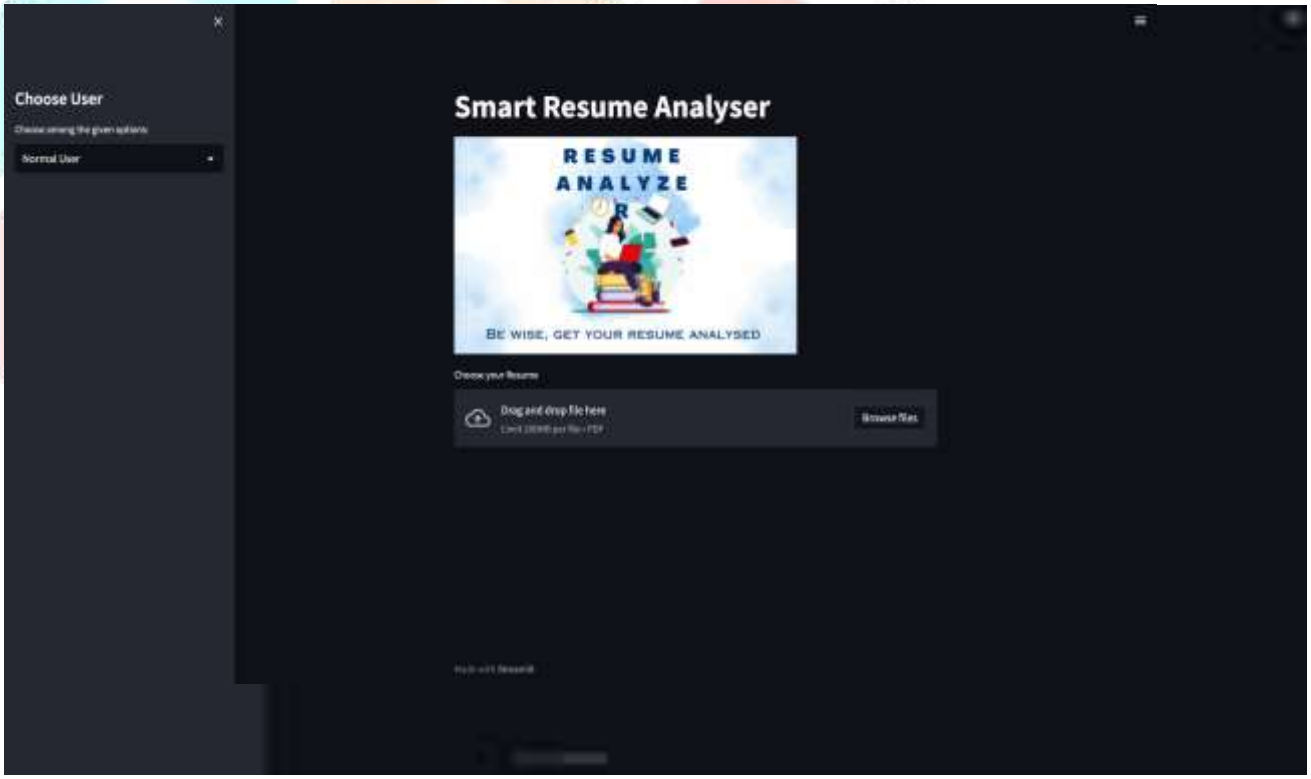

Fig. 2. Shows the result of Step 1.

STEP 2: The applicant's fundamental information will be extracted from the resume via the resume parser.

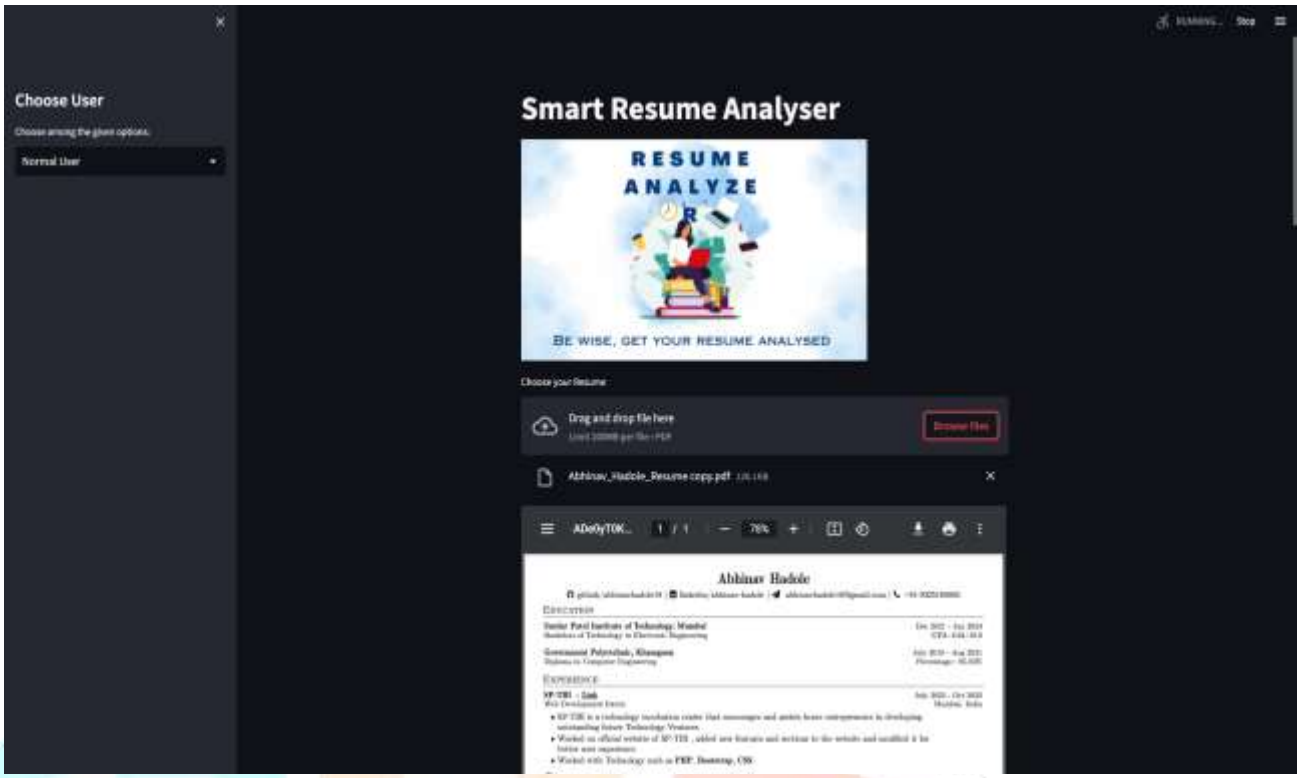

Fig. 3. Shows the result of Step 2, where the user uploads their resume.

STEP 3: The Resume Parser will extract the skills that the job seeker has. The analyzer will compare these skills to predefined skills and suggest required skills to the applicant.

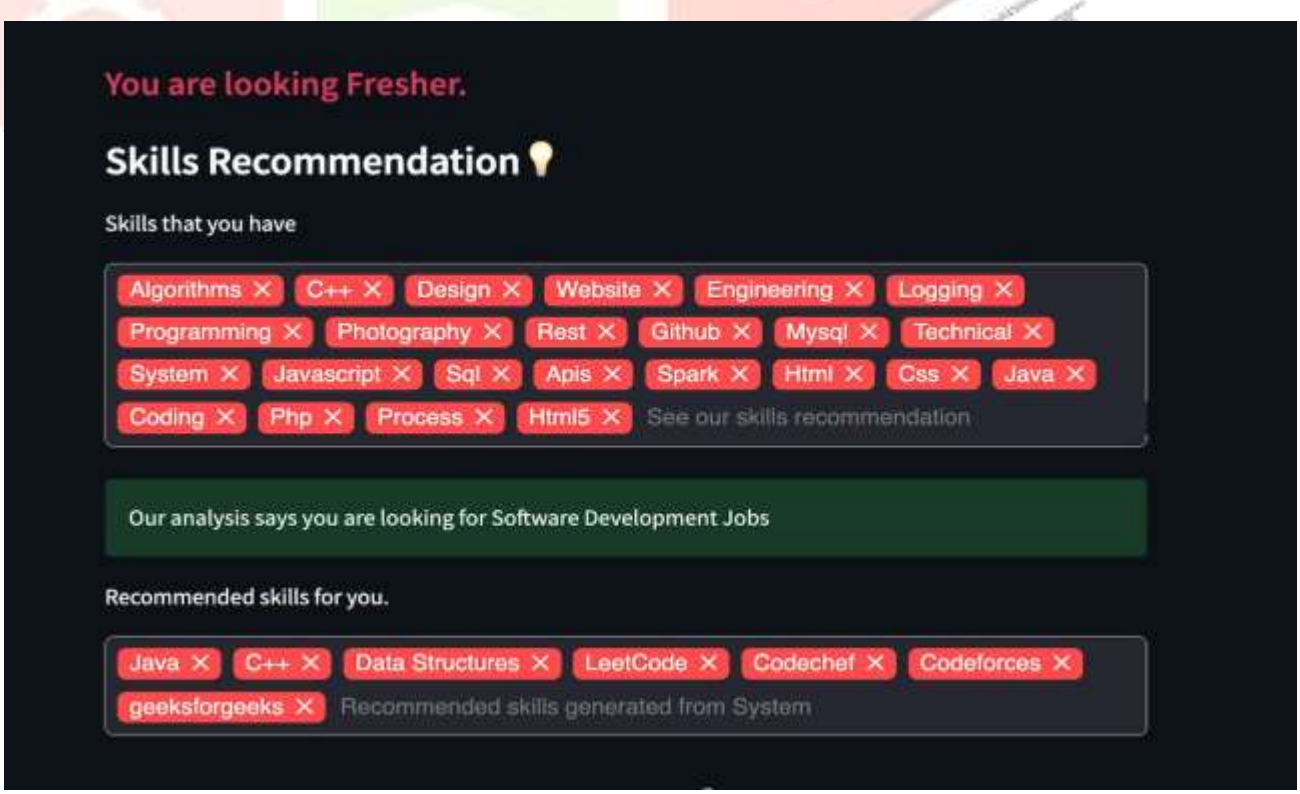

Fig. 4. Shows the recommended skills by the model in Step 3.

STEP 4: All extracted fields will be stored in a database.

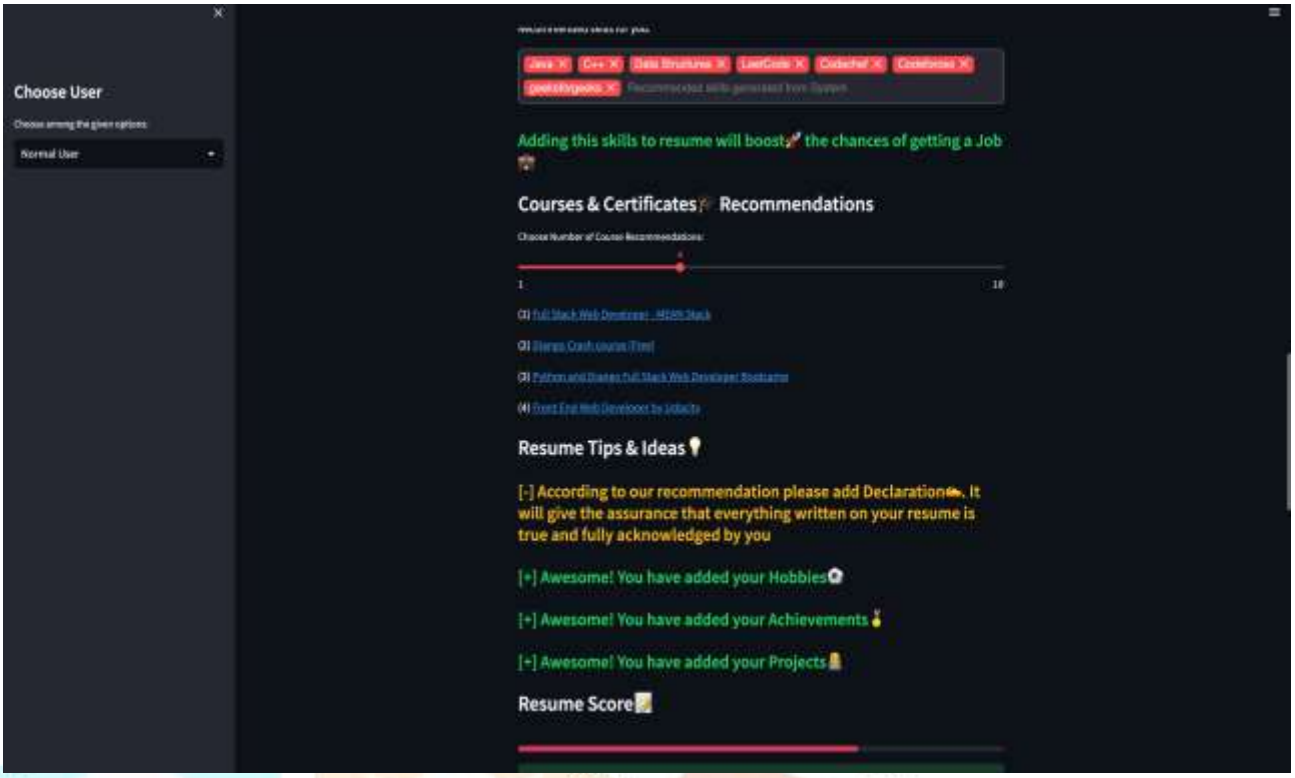

Fig. 5. Shows the resume score in Step 4.

STEP 5: The landing page for a recruiter.

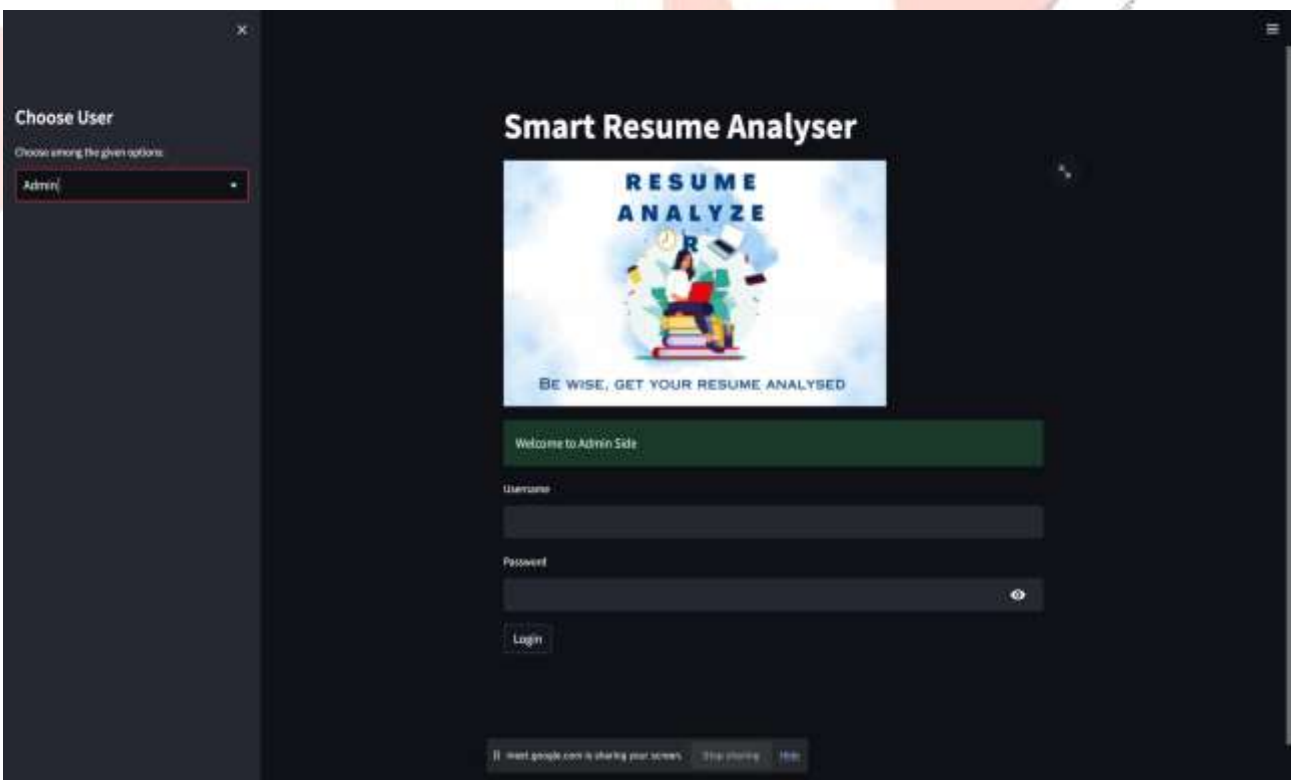

Fig. 6. UI of the Admin Page in Step 5.

STEP 6: The Admin, acting as the Recruiter, has access to the resume score and applicant data, which helps in making informed selections. Reports that the admin can view on the portal are displayed in the following figure. The administrator can also obtain these reports.

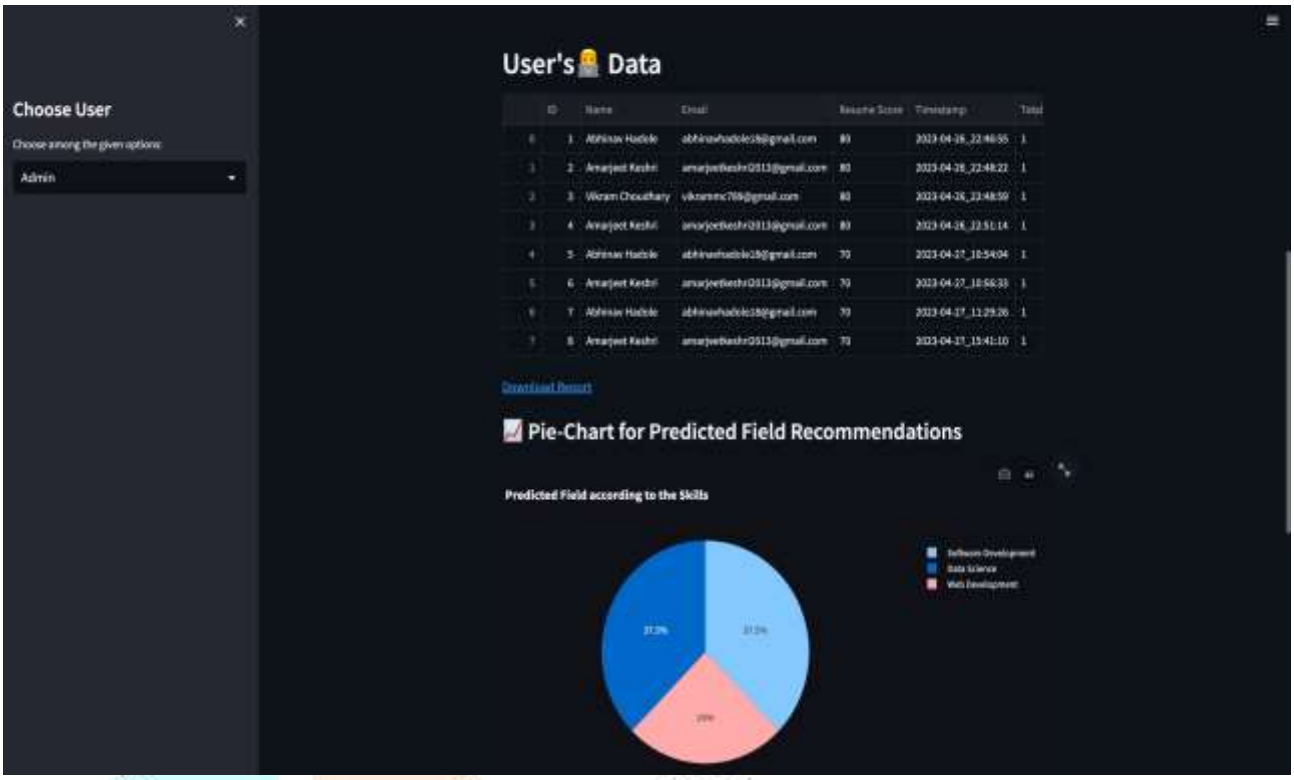

Fig. 7. Shows the reports that the admin can extract in Step 6.

6.2. EMPLOYEE SECTION:

6.2.1. Add Jobs:

This feature allows employers to seamlessly post job listings, providing detailed information about job re-querulents, responsibilities, and company details. Employers can efficiently create and manage job opportunities to attract potential candidates.

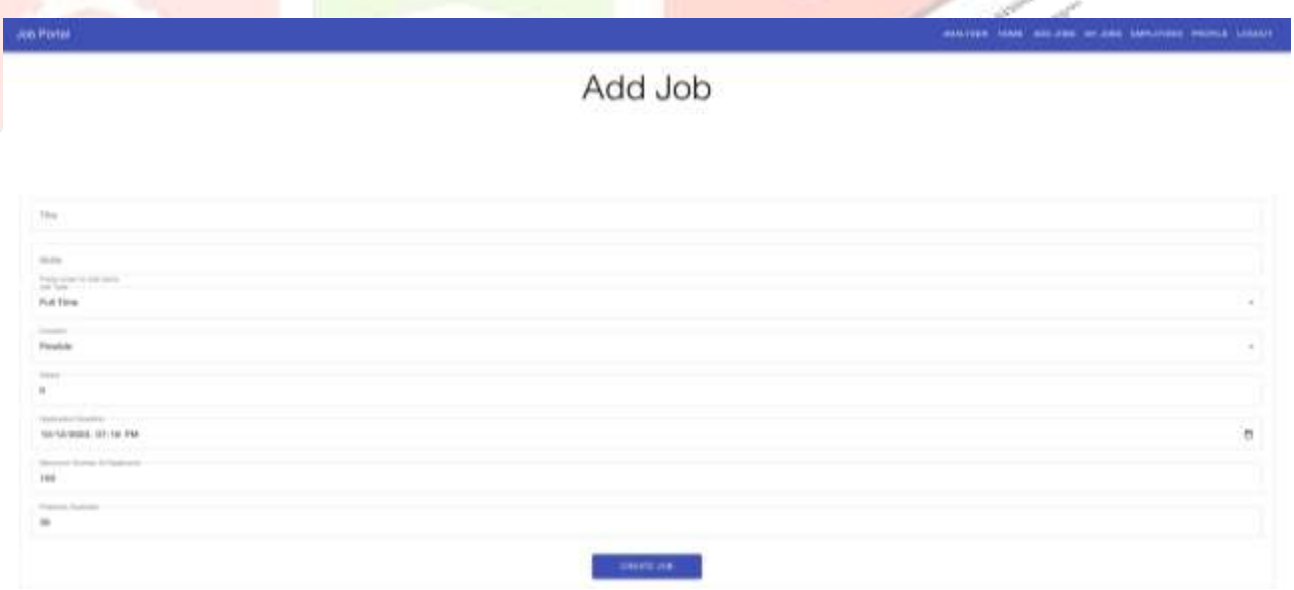

Fig. 8. Shows the interface for adding jobs in the Employee Section.

6.2.2. View Candidate Profile:

Employers can access comprehensive profiles of job applicants, including details extracted through the resume analyzer. This feature provides a holistic view of candidates' skills, experiences, and sentiments, aiding employers in making informed decisions during the hiring process.

Fig. 9. UI Candidate Profile

6.2.3. List Suitable Jobs:

Based on the skills and qualifications extracted from candidate resumes, this functionality automatically suggests suitable jobs to applicants. Employers can efficiently match candidate profiles with open positions, streamlining the shortlisting process.

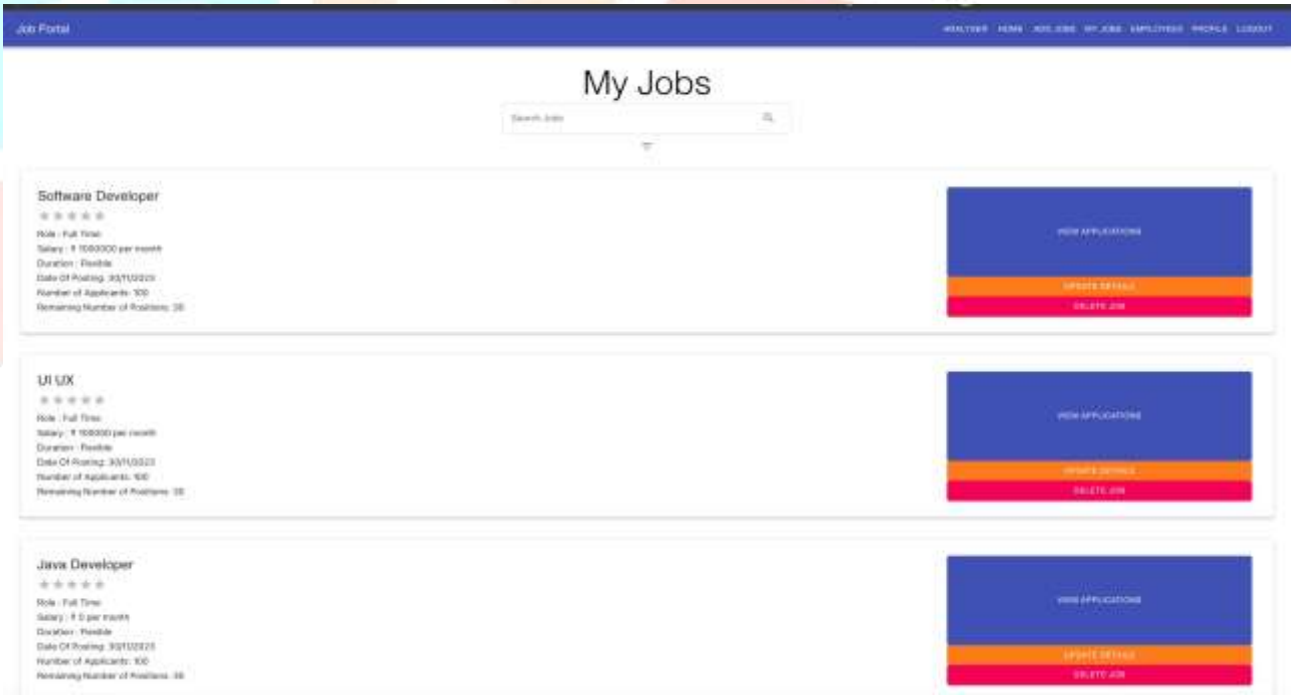

Fig. 10. User can view suitable jobs.

6.3. CANDIDATE SECTION:

6.3.1. Analyze Resume:

This feature allows employers to seamlessly post job listings, providing detailed information about job requirements, responsibilities, and company details. Employers can efficiently create and manage job opportunities to attract potential candidates.

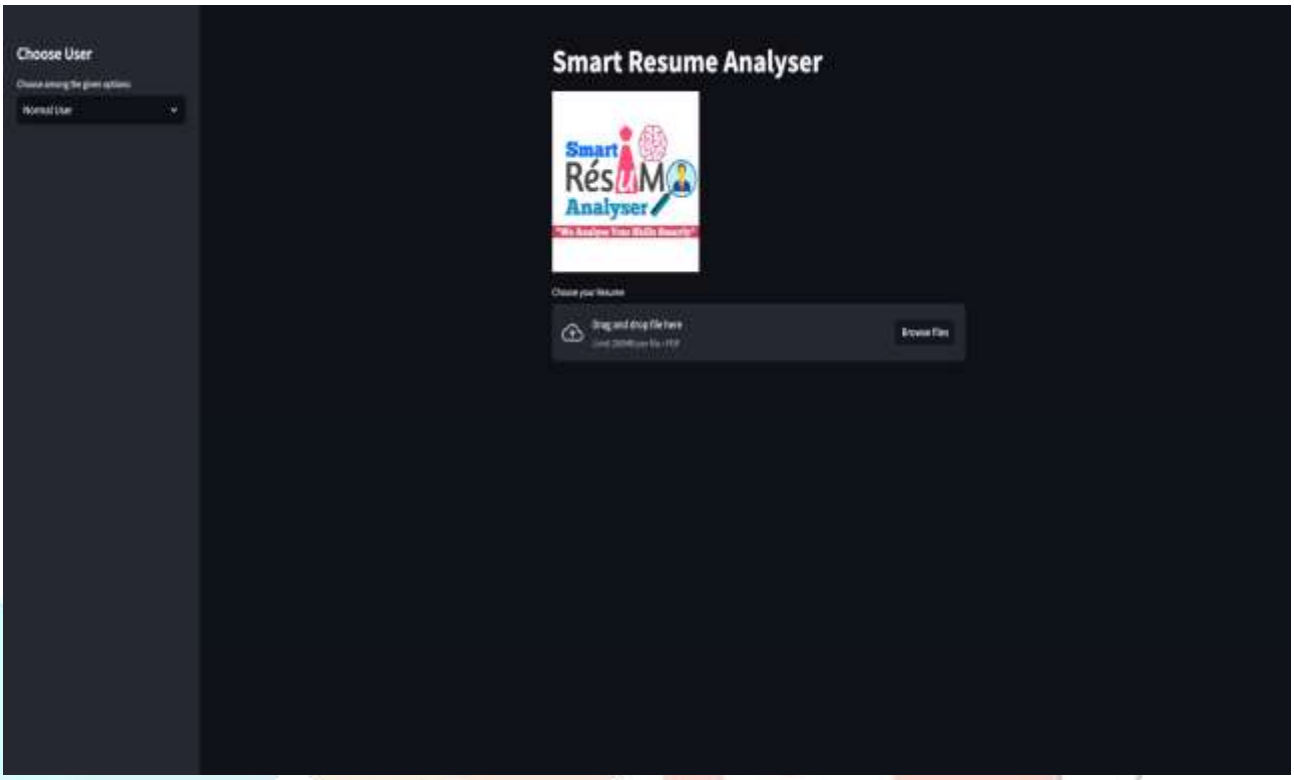

Fig. 11. admin can Add jobs.

6.3.2. Search for Job:

Based on the skills and qualifications extracted from candidate resumes, this functionality automatically suggests suitable jobs to applicants. Employers can efficiently match candidate profiles with open positions, streamlining the shortlisting process.

Fig. 12. User can search for jobs.

6.3.3. Apply for Job:

Candidates can directly apply for jobs through the integrated job portal. The system streamlines the application process, allowing job seekers to submit their resumes and cover letters seamlessly. This feature enhances the overall user experience for candidates seeking employment opportunities.

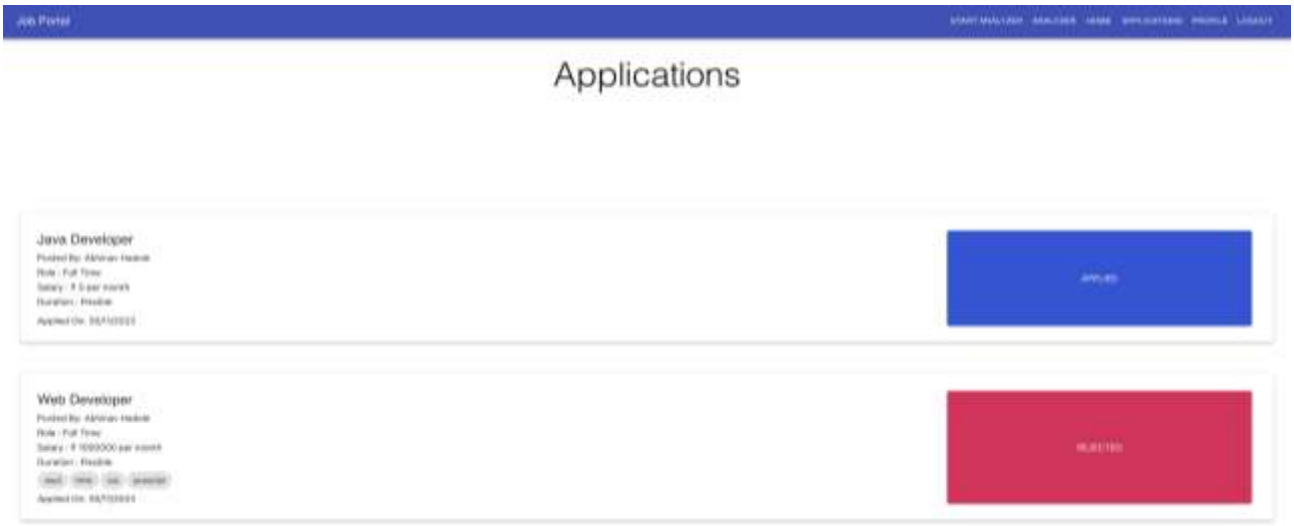

Fig. 13. User can view the jobs that they have applied for.

VII.RESULTS AND DISCUSSION

The implementation of the Resume Analyzer and Job Portal Integration has yielded significant outcomes for both employers and candidates. The NLP-based resume analysis ensures a comprehensive understanding of candidate profiles, extracting valuable information such as skills, experiences, and sentiments. This has led to more informed hiring decisions and a reduction in the time spent on manual resume screening. The job portal integration streamlines the application process for candidates, allowing for direct and efficient submissions. The skill-matching and recommendation system has enhanced the quality of job recommendations, increasing the likelihood of suitable matches between candidates and job opportunities. Employers, in turn, benefit from a simplified job posting process and automated candidate shortlisting based on precise skill alignment.

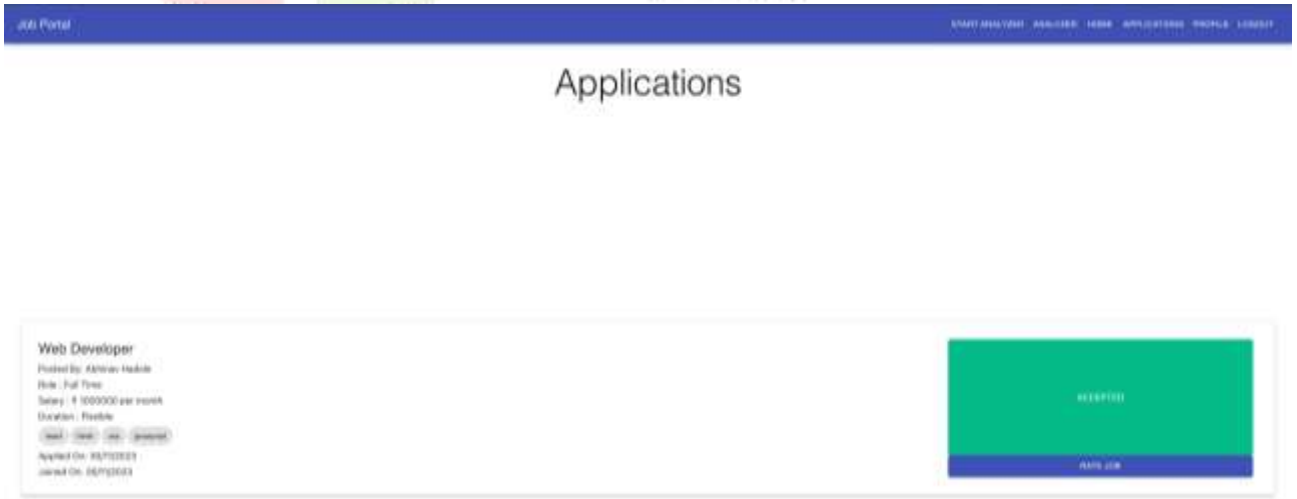

Fig. 14. Admin can accept/reject the candidate application.

VIII.RESULTS AND DISCUSSION

The implementation of the Resume Analyzer and Job Portal Integration has the ability to address key challenges in the recruitment process. The NLP-driven resume analysis provides a deeper understanding of candidate profiles, transcending traditional keyword-based matching. Employers can make data driven decisions, resulting in more accurate candidate selection. The job portal integration has created a centralized platform that not only facilitates seamless communication between employers and candidates but also enhances the overall user experience. The recommendation system has proven effective in guiding candidates to relevant job opportunities, increasing their chances of finding suitable employment. The one-year milestone signifies the project's stability and reliability, as evidenced by positive user feedback and increased adoption rates. Ongoing improvements and updates, guided by user feedback and emerging trends, will further refine, and optimize the system for the evolving needs of the dynamic job market. Overall, the project marks a successful convergence of NLP and job portal functionality, shaping a more efficient and user centric approach to talent acquisition.

IX.FUTURE SCOPE

9.1. Integration of Emerging Technologies:

Explore the integration of emerging technologies such as machine learning and artificial intelligence to further enhance the recommendation system. Implement algorithms that adapt to changing job market trends and evolving skill requirements. The intention of this research is to profile the candidates accordingly and provide more information and guidance to help interviewers to be more fair, objective and consistent in their evaluation and then making the hiring decision. [3]

9.2. Incorporate Diversity and Inclusion Features:

Introduce features that promote diversity and inclusion in the hiring process. Develop algorithms that ensure fair and unbiased candidate evaluation, reducing the impact of unconscious biases in recruitment.

9.3. Skill Development Recommendations:

Expand the recommendation system to not only match candidates with jobs but also provide suggestions for skill development. Offer personalized learning paths to help candidates acquire the skills needed for their desired roles.

9.4. Real-time Communication Platform:

Implement a real-time communication platform within the job portal, allowing employers and candidates to interact seamlessly. This can include chat features, video interviews, and collaborative tools to streamline the hiring process.

9.5. Block chain for Credential Verification:

Explore the use of blockchain technology to enhance the credibility of candidate credentials. Implement a secure and transparent system for verifying educational and professional qualifications, adding an extra layer of trust to the hiring process.

9.6. Predictive Analytics for Recruitment Trends:

Develop predictive analytics tools to forecast recruitment trends and identify emerging job sectors. This will assist both employers and candidates in staying ahead of industry changes and aligning their strategies accordingly.

9.7.User Experience Enhancements:

Continuously refine the user interface and experience based on user feedback. Implement features that make the platform more intuitive, accessible, and user-friendly for both employers and candidates.

X.CONCLUSION

Our combined efforts in developing the Smart Resume Analyzer and the Job Portal have successfully addressed the challenges in modern recruitment. The Job Portal aims to create a user-friendly web platform that caters to various users and resolves prevalent issues faced by job seekers and companies. The advantages of the portal include achieving project targets, maintaining standardized content and services, and offering high-level management with enhanced flexibility.

Simultaneously, the Smart Resume Analyzer utilizes artificial intelligence and natural language processing to automate and enhance the resume screening process. It parses resumes, identifies skills, analyzes experiences, and evaluates qualifications, providing recruiters with valuable insights. The analyzer generates a resume score, offers career recommendations, and suggests improvements such as resume writing tips, relevant courses, and skills enhancement. This innovative tool streamlines hiring processes, saving time and improving the accuracy of candidate evaluations. This study has designed only information model of CV for an applicant. Hence, the system has no advanced searching function to find a desired company. [4]

With user and admin sections, the Smart Resume Analyzer caters to a broad audience, revolutionizing the way resumes are analyzed in the recruitment process. Collectively, these two systems offer a comprehensive solution for optimizing resumes, exploring career opportunities, and advancing recruitment processes through technological innovation.

XI.ACKNOWLEDGEMENT

The authors would like to acknowledge the support of Bhartiya Vidya Bhavan's Sardar Patel Institute of Technology (SPIT), Mumbai in providing essential data and information relevant to this research. We would also like to specially thank Electronics department of SPIT for their support.

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