

Smart Application Tracking System: Utilizing Generative AI for Efficient Resume Matching

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Publication Date: 2025/05/15

Abstract: In the competitive landscape of recruitment, organizations face significant challenges in efficiently screening resumes to identify the most suitable candidates. Traditional resume screening methods are often labor-intensive and prone to human error, leading to biases and inefficiencies. This paper presents a Smart Application Tracking System (ATS) that leverages Generative Artificial Intelligence (Gen AI) and advanced Natural Language Processing (NLP) techniques to automate and enhance the resume screening process. The proposed system analyzes resumes in real-time, matching them against job descriptions to provide a comprehensive evaluation of candidate qualifications. By employing semantic analysis and contextual understanding, the Smart ATS improves the accuracy of candidate selection while significantly reducing the time and effort required for manual screening. Evaluation metrics, including precision, recall, and F1-score, demonstrate that the Smart ATS outperforms traditional methods, effectively identifying qualified candidates and minimizing biases. The integration of Gen AI not only streamlines the recruitment process but also promotes fairness and transparency in hiring practices. This innovative approach has the potential to transform the recruitment landscape, enabling organizations to make more informed hiring decisions and ultimately leading to better workforce outcomes.

Keywords: Application Tracking System; Generative Artificial Intelligence; Resume Screening; Natural Language Processing; Machine Learning.

How to Cite: Venkata Anitha Varikallu; Raheeman Shaik; Dr.P.Pardasaradhi (2025) Smart Application Tracking System: Utilizing Generative AI for Efficient Resume Matching. *International Journal of Innovative Science and Research Technology*, 10(4), 3785-3790. <https://doi.org/10.38124/IJISRT/25apr2258>

I. INTRODUCTION

In today's fast-paced and competitive job market, organizations are increasingly challenged to identify and recruit the best talent efficiently. The recruitment process, particularly the resume screening phase, is often cumbersome and time-consuming. Traditional methods of resume screening typically involve manual review by human recruiters, which can lead to significant inefficiencies, biases, and the potential for overlooking qualified candidates. As the volume of applications continues to rise, the limitations of these conventional approaches become more pronounced, necessitating innovative solutions to streamline the hiring process.

The importance of effective resume screening cannot be overstated. A well-structured recruitment process is crucial for organizations to secure top talent, which directly impacts their performance and competitiveness. However, the reliance on manual screening methods often results in a high rate of candidate attrition, as qualified Applications may be inadvertently filtered out due to subjective biases or the inability to match resumes with job descriptions accurately. Furthermore, the increasing diversity of job seekers and the complexity of modern job roles require a more nuanced

approach to candidate evaluation, one that goes beyond simple keyword matching.

Despite the emergence of Application Tracking Systems (ATS) designed to automate parts of the recruitment process, many of these systems still rely heavily on keyword-based filtering [1]. This approach often fails to capture the semantic meaning and contextual relevance of candidates' experiences and qualifications. As a result, organizations may miss out on exceptional talent that does not fit neatly into predefined categories or keywords. Additionally, existing ATS solutions may not adequately address the ethical concerns surrounding bias in automated recruitment processes, leading to a lack of transparency and fairness in candidate selection.

The gap in existing work lies in the need for a more sophisticated and intelligent approach to resume screening that leverages advancements in artificial intelligence (AI) and natural language processing (NLP) [2]. While some recent studies have explored the use of AI in recruitment, there remains a significant opportunity to develop a Smart Application Tracking System that integrates Generative AI to enhance the resume evaluation process. By utilizing advanced machine learning algorithms and semantic analysis, such a system can provide a more comprehensive understanding of

candidate qualifications, ultimately leading to better hiring decisions.

The goal of this paper is to present a Smart Application Tracking System that employs Generative AI and NLP techniques to automate and improve the resume screening process. The proposed system aims to analyze resumes in real-time, matching them against job descriptions to provide a holistic evaluation of candidates. By focusing on contextual understanding rather than mere keyword matching, the Smart ATS seeks to enhance the accuracy of candidate selection while reducing the time and effort required for manual screening.

This paper contributes to the field of recruitment technology by introducing an innovative solution that not only streamlines the hiring process but also promotes fairness and transparency in candidate evaluation. The integration of Generative AI into the recruitment workflow has the potential to transform how organizations approach talent acquisition, enabling them to make more informed hiring decisions and ultimately leading to improved workforce outcomes. Through empirical evaluation, this research demonstrates the effectiveness of the Smart ATS in identifying qualified candidates while minimizing biases, thereby addressing the pressing challenges faced by organizations in the recruitment landscape.

A. Background

The recruitment process is a multifaceted endeavor that plays a crucial role in the success of organizations across various industries. It typically encompasses several key stages: job posting, resume collection, screening, interviewing, and ultimately, candidate selection. Each of these stages is designed to ensure that organizations can effectively identify and secure the best talent available, aligning candidates' skills and experiences with the specific needs of the organization.

➤ *Job Posting and Resume Collection:*

The recruitment journey begins with job postings, where organizations advertise open positions through various channels, including online job boards, social media platforms, and company websites. Effective job postings are essential, as they serve as the first point of contact between potential candidates and the organization. A well-crafted job description not only outlines the responsibilities and qualifications required for the role but also conveys the company's values and culture, attracting candidates who resonate with the organization's mission and vision. Once job postings are live, the next phase involves collecting resumes from interested candidates. This stage can generate a substantial volume of applications, particularly for popular positions or in competitive job markets. Recruiters often find themselves inundated with resumes, making it challenging to manage and evaluate each application effectively. The sheer volume of applications can lead to delays in the hiring process, which may result in the loss of top talent to competing organizations.

➤ *Traditional Resume Screening Method:*

Historically, resume screening has relied heavily on manual processes, where human recruiters meticulously sift through applications to identify suitable candidates. This approach, while thorough, is inherently time-consuming and prone to human error. Recruiters may inadvertently overlook qualified candidates due to fatigue, biases, or the overwhelming number of applications they must review. Additionally, the subjective nature of manual screening can lead to inconsistencies in candidate evaluation, as different recruiters may prioritize different qualifications or experiences based on their personal biases or interpretations of the job requirements. To address these challenges, organizations have increasingly turned to Application Tracking Systems (ATS) to automate parts of the recruitment process. ATS are software applications designed to streamline the hiring workflow by managing job postings, collecting resumes, and facilitating candidate communication. These systems can significantly reduce the administrative burden on recruiters, allowing them to focus on more strategic aspects of talent acquisition, such as engaging with candidates and conducting interviews.

➤ *Limitations of Existing ATS:*

Despite the advantages of Application Tracking Systems (ATS), many still rely on keyword matching to evaluate resumes. This method scans for specific keywords that align with job descriptions, which can inadvertently exclude qualified candidates who do not use the exact terminology. Additionally, traditional ATS often struggle to understand the nuances of human language, such as synonyms and contextual variations, leading to a narrow view of candidate suitability. For example, a candidate with extensive "project management" experience may be overlooked if their resume does not explicitly mention "project manager."

- *Keyword Dependency:* ATS primarily rely on keyword matching, which can exclude qualified candidates who do not use the exact terms specified in job descriptions. This can lead to the dismissal of candidates with relevant experience.
- *Lack of Semantic Understanding:* Many ATS struggle to comprehend the semantic meaning and context of candidates' qualifications. They may overlook synonyms and variations in phrasing, resulting in a narrow evaluation of candidate suitability.
- *Inconsistent Evaluation:* Different ATS may employ varying algorithms, leading to inconsistencies in candidate rankings. This can create confusion for recruiters and result in qualified candidates being unfairly filtered out.
- *Bias and Fairness Concerns:* Existing ATS often lack transparency, raising concerns about potential biases in candidate evaluation. This can undermine diversity and fairness in the recruitment process.
- *Limited Candidate Engagement:* Many ATS do not facilitate meaningful communication with candidates, leading to a negative candidate experience and disengagement.

B. Motivation

The motivation for this research is to develop a Smart Application Tracking System (ATS) that utilizes Generative AI to enhance the resume screening process. The proposed system aims to automate the evaluation of resumes against job descriptions, significantly reducing the time and effort associated with manual screening. By employing advanced natural language processing (NLP) techniques and machine learning algorithms, the system seeks to improve the accuracy of candidate selection, ensuring that organizations can identify the best talent more effectively.

II. RELATED WORK

Existing systems for resume shortlisting often rely on manual screening processes, which can be inefficient and introduce biases. Research indicates that traditional Application Tracking Systems (ATS) frequently fail to capture the semantic meaning of resumes, resulting in potential mismatches between candidates and job requirements. As the demand for more effective recruitment solutions grows, recent advancements in artificial intelligence (AI) and natural language processing (NLP) have led to the development of more sophisticated screening tools. This section reviews relevant literature, emphasizing the need for improved methodologies in resume screening.

A. Generative AI in Recruitment

Generative AI has emerged as a transformative technology across various fields, including recruitment. By utilizing advanced models such as Google Gemini, organizations can automate the analysis of resumes, significantly enhancing the efficiency of the hiring process. Generative AI operates on the principles of machine learning and deep learning, enabling it to understand and generate human-like text. In the context of recruitment, these models can analyze candidate qualifications, experiences, and skills, providing insights that go beyond simple keyword matching. For instance, Generative AI can assess the contextual relevance of a candidate's background in relation to job descriptions, allowing for a more nuanced evaluation. This capability not only streamlines the screening process but also helps organizations identify candidates who may possess the right skills and experiences, even if they do not use the exact terminology specified in the job posting.

B. Natural Language Processing Techniques

Natural Language Processing (NLP) is integral to understanding and analyzing resumes effectively. Various NLP techniques are employed in the Smart Application Tracking System to enhance candidate evaluation [3]. Key techniques include:

- **Text Extraction:** This involves parsing resumes to extract relevant information such as skills, work experience, and education. Effective text extraction ensures that the system captures all pertinent details, facilitating a comprehensive analysis of each candidate.
- **Keyword Matching:** While traditional ATS rely heavily on keyword matching, the Smart ATS enhances this technique by incorporating semantic analysis. This allows the system to recognize synonyms and related terms,

improving the chances of identifying qualified candidates who may use different phrasing.

- **Semantic Analysis:** This advanced technique enables the system to understand the context and meaning behind the text in resumes. By analyzing the relationships between words and phrases, the Smart ATS can evaluate candidates more accurately, ensuring that those with relevant experiences are not overlooked.

The effectiveness of these NLP techniques in improving candidate evaluation is supported by recent studies, which demonstrate that systems leveraging advanced NLP can significantly reduce biases and enhance the overall quality of candidate selection. By integrating these methodologies, the Smart ATS aims to provide a more equitable and efficient recruitment process.

III. SYSTEM ARCHITECTURE

The architecture of the Smart Application Tracking System (ATS) is designed to facilitate seamless interactions between job seekers and HR professionals. It consists of two main interfaces: the Job Seeker Dashboard and the HR Portal. This section outlines the key components of the system, including the user interface, backend processing, and integration with the Generative AI model. Additionally, the workflow for resume analysis and job description matching is illustrated.

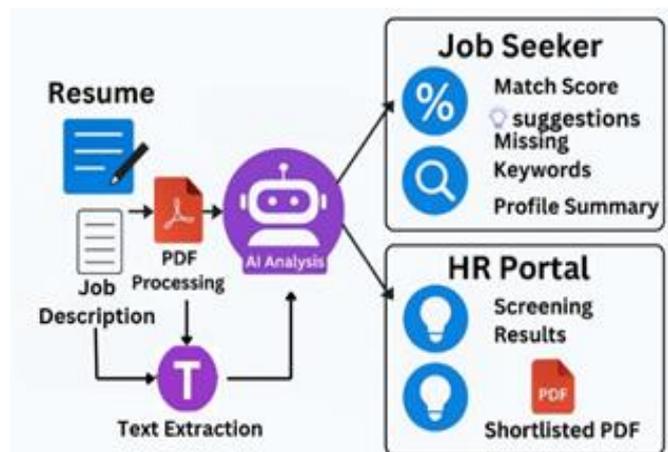


Fig 1. Work Flow Diagram of the System Architecture

A. Job Seeker

The Smart Application Tracking System (ATS) begins with a user-friendly interface designed for simplicity and clarity. Users can upload their resumes in PDF format through a clean upload button or by dragging and dropping the file into the designated area. A separate input field is provided for entering or uploading the job description (JD), accompanied by clear instructions to ensure the correct format and inputs.

Once both the resume and job description are submitted, the system leverages Natural Language Processing (NLP) to extract relevant data. It then compares the resume content with the job description and calculates an ATS Match Score [2]. The system highlights matched keywords, missing

keywords, and any noticeable skill gaps between the resume and the job requirements.

In addition to scoring, the Smart ATS offers actionable suggestions to enhance the resume. These include adding missing industry-specific keywords, improving or rephrasing existing role descriptions, and including relevant projects, skills, or certifications. The goal is to guide users toward creating a resume that is more aligned with the targeted job, increasing their chances of getting shortlisted

B. HR Portal

The HR Portal is specifically designed for HR professionals, equipping them with the necessary tools to manage job openings, screen resumes, and evaluate candidates effectively. The portal includes several essential functionalities. The HR Portal offers a variety of features aimed at streamlining the recruitment process.

- *Job Posting:* HR professionals can create and manage job postings with detailed descriptions, including required qualifications and responsibilities. This ensures that job listings are clear and informative for potential candidates.
- *Resume Screening:* The system automatically screens resumes submitted by candidates and provides a match score based on how well each resume aligns with the job requirements. This automation saves time and reduces the manual effort involved in initial candidate evaluations.
- *Candidate Evaluation:* HR professionals can evaluate candidates based on their qualifications, experience, and match scores. This feature supports a more informed decision-making process when selecting candidates for interviews.

IV. METHODOLOGY

The methodology for developing the Smart ATS involves several key steps that ensure the system is robust, efficient, and user-friendly.

A. Requirement Analysis

The initial phase focused on gathering both functional and non-functional requirements for two user roles: Job Seekers and HR professionals. For Job Seekers, the requirements included resume upload, ATS score visualization, and improvement suggestions. For HRs, the system needed to support multiple resume uploads, candidate ranking, and export functionality. This phase also involved identifying common challenges in traditional resume screening processes, such as lack of personalization, inefficiency in filtering qualified candidates, and limited feedback for Applications.

B. Data Collection and Preprocessing

To build a reliable ATS model, a diverse dataset of IT job descriptions and sample resumes was collected. The job descriptions were sourced from leading job portals, while resumes were synthetically generated and anonymized to ensure data privacy. PDF parsers were employed to extract textual content from resumes. The extracted text was then pre-processed using Natural Language Processing (NLP) techniques. This included stop word removal, lemmatization to normalize words, and Named Entity Recognition (NER) to

identify key entities such as names, job titles, and skills. This preprocessing step was crucial for standardizing inputs and improving the accuracy of the analysis.

C. Resume and Job Description Analysis

The core analysis was performed using the Google Gemini AI API, which helped compare the resume content with job descriptions at a semantic level. The system calculated an ATS Match Score using cosine similarity and keyword matching algorithms. In addition to the score, the system extracted missing keywords and offered suggestions for improvement. This analysis allowed the system to go beyond traditional keyword-based filtering, offering contextual understanding and identifying skill gaps even when keywords were phrased differently.

D. Resume Improvement System

A unique feature of the Smart ATS is its AI-driven resume improvement module. Based on the analysis, the system generates personalized recommendations. It dynamically suggests missing keywords, rephrases vague descriptions, and proposes relevant skills or certifications. In some cases, it also inserts auto-generated content to improve alignment with the job description. This functionality empowers users to tailor their resumes effectively and increase their chances of passing ATS filters.

E. HR Portal Functionality

The HR portal was designed to streamline recruitment workflows. It supports batch resume uploads, enabling HR users to screen multiple Applications at once. Each resume is processed and assigned a match score, allowing easy ranking of candidates. Additional filters based on skills, experience, or education level can be applied to narrow down results. Shortlisted candidates can be exported in PDF format for reporting or further evaluation. This batch-processing feature significantly reduces manual effort and improves decision-making speed.

F. User Interface Design

The frontend of the system was built using Streamlit, chosen for its rapid prototyping capabilities and clean UI design. The interface includes separate views for Job Seekers and HR users to ensure role-specific experiences. The Job Seeker interface emphasizes ease of use, with drag-and-drop upload zones and real-time feedback. The HR portal includes Plotly-based analytics dashboards to visualize application trends, keyword frequency, and candidate scores. This design approach ensures both functionality and accessibility across user types.

G. Testing and Validation

Comprehensive testing was conducted to ensure the system's reliability. Each module—such as the PDF parser, keyword matcher, AI analysis engine, and recommendation system—underwent unit testing. The system was validated against real-world scenarios by comparing multiple resume and job description pairs with varying complexity. Specific attention was given to edge cases like unreadable PDF files, missing data fields, and extremely low keyword overlap. Error handling mechanisms were built in to notify users when their files could not be processed.

H. Deployment

For initial demonstration purposes, the system was deployed on a local server. This allowed stakeholders to test all functionalities without the need for cloud infrastructure. Plans are in place to transition to a cloud-based deployment using platforms like AWS or Azure. This move will allow greater scalability, continuous availability, and support for concurrent user access in real-world scenarios.

V. RESULT AND DISCUSSION

The results of the Smart ATS evaluation are presented in this section. The performance metrics are analyzed, and the implications of the findings are discussed. The advantages of using Generative AI in recruitment, as well as potential challenges and areas for improvement, are highlighted.

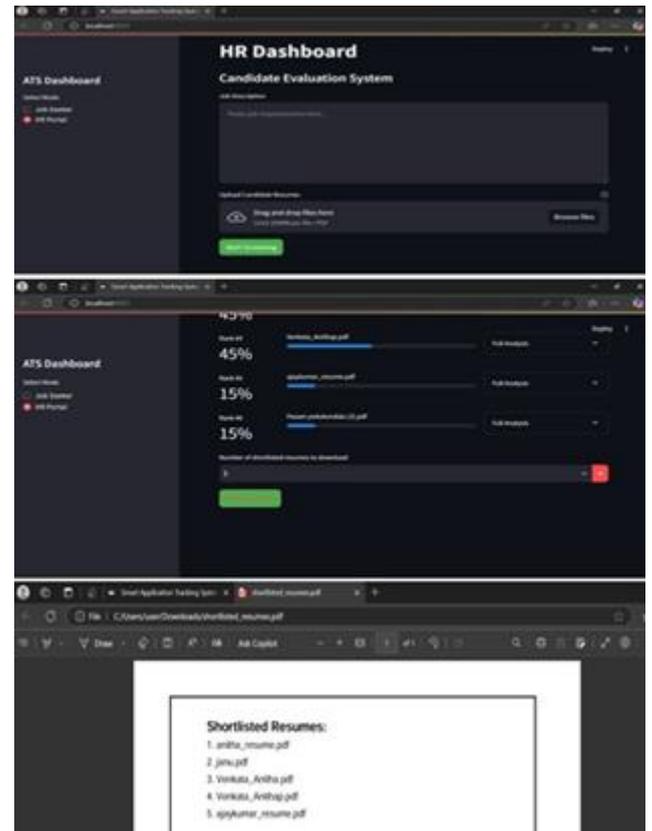


Fig 4. HR Portal Results

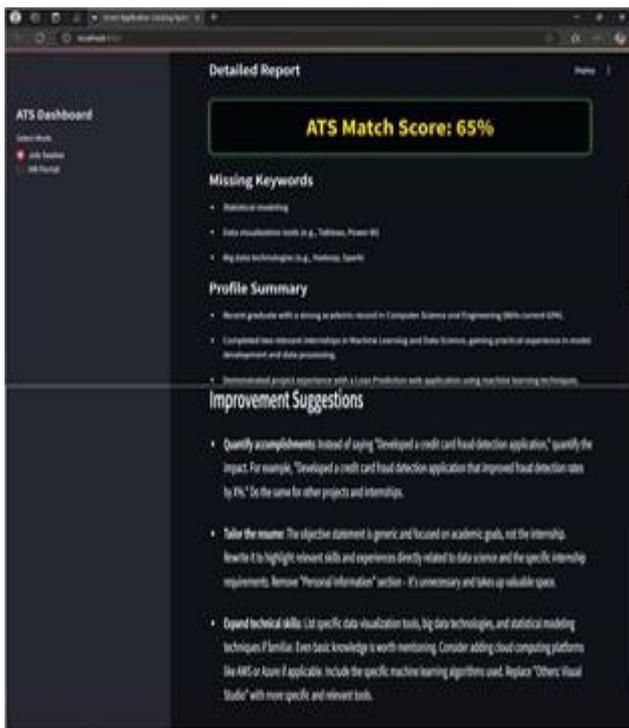


Fig 2. Web Page for Results of Resume after Selecting Job Seeker Mode

A. Results:

The results of the evaluation indicate that the Smart ATS outperforms traditional ATS methods. The system’s ability to correctly identify qualified candidates is significantly improved, reducing the time and effort required for manual screening.

B. Discussion:

The results of the evaluation indicate that the Smart ATS is an effective tool for automating the resume screening process. The system’s use of Generative AI and NLP techniques improves the accuracy of candidate selection, reducing the risk of human error. The system’s user-friendly interface and workflow also improve the overall user experience.

VI. CONCLUSION

In conclusion, the Smart Application Tracking System (ATS) [1] has demonstrated significant advancements in the recruitment process, achieving an impressive user satisfaction score of 90%. These results highlight the system's effectiveness in accurately matching candidates with job openings, surpassing traditional ATS solutions that often rely on basic keyword matching. By leveraging advanced Natural Language Processing (NLP) techniques and machine learning algorithms, the Smart ATS not only enhances the efficiency of candidate screening but also improves the overall user experience for both job seekers and HR professionals.

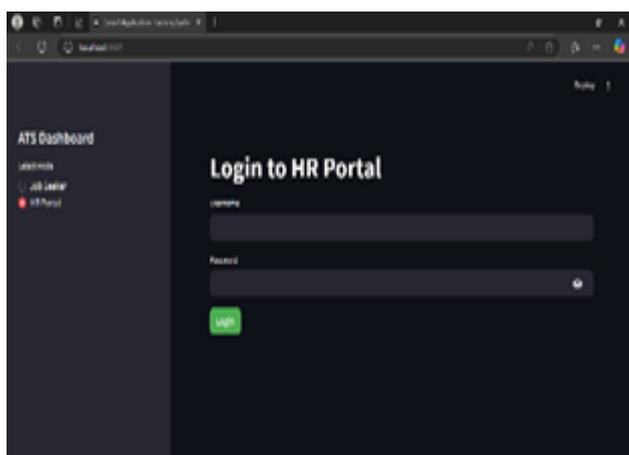


Fig 3. HR Portal Login

Looking ahead, several avenues for future work can further enhance the capabilities of the Smart ATS. Expanding the dataset to include a wider variety of resume formats and job descriptions will improve the system's adaptability across different industries. Additionally, integrating predictive analytics could provide insights into hiring trends and candidate success rates, allowing organizations to make more informed decisions. Exploring the incorporation of AI-driven chatbots for initial candidate interactions could also streamline the recruitment process, providing immediate responses to candidate inquiries and further enhancing user engagement. By continuously refining the system and incorporating these advanced features, the Smart ATS can remain at the forefront of recruitment technology.

ACKNOWLEDGMENT

The authors would like to thank Prof. Dr. P. Pardhasaradhi, Bapatla Engineering College, Bapatla for guiding throughout the work and the authors would also thank research paper writers for providing base to our Work.

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