



Automatic HR Recruitment System: A MultiStage Evaluation Approach

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Abstract. In response to the challenges of identifying ideal candidates in the dynamic job market, this paper introduces an Automated HR Recruitment System utilizing Natural Language Processing (NLP) and machine learning algorithms. The system automates candidate assessments, ensuring efficiency and precision in overcoming traditional recruitment hurdles. Employing a tailored technical test integrated with real-time NLP analysis expedites evaluations, guaranteeing a comprehensive and unbiased assessment of candidates' capabilities. The system accelerates candidate screening, enhances accuracy in shortlisting, and offers an intuitive interface for easy customization of screening criteria, aligning with organizational needs. The "Automatic HR Recruitment System" stands as a transformative innovation, providing organizations with a competitive edge in identifying top talent through seamless automation and user customization.

Keywords: Natural Language Processing, Machine Learning, Candidate Assessment, Technical Test.

1 Introduction

In the fast-paced and dynamic landscape of the contemporary job market, the process of identifying and selecting suitable candidates for job roles has become increasingly complex. With a multitude of applicants vying for positions, traditional recruitment methods often fall short, impeding team progress and delaying the acquisition of the right talent. This challenge is not exclusive to employers, job-seekers, too, face hurdles as they navigate the often-lengthy journey to in-person interviews. Compounded by the fatigue that recruiters may experience by the end of a demanding day, the traditional selection process may inadvertently lead to biases and suboptimal hiring decisions. To address these challenges, we present the Automatic HR Recruitment System, a novel

approach to candidate evaluation. By harnessing the power of Natural Language Processing (NLP) and advanced machine learning algorithms, this system aims to automate and optimize the assessment of candidates. Our innovative hiring process incorporates a multi-stage evaluation approach, starting with a tailored technical test that allows us to delve deeper into candidates' skills and knowledge. This paper explores the development and application of the Automatic HR Recruitment System, shedding light on the integration of NLP in the examination monitoring process. By providing insights into candidates' responses in real-time, we aim to enhance the objectivity and thoroughness of the evaluation process. This not only streamlines candidate assessments but also contributes to a more robust and insightful selection process. In addition to practical applications, this research investigates the technical intricacies of the system's development, delving into the algorithms employed in NLP and machine learning. We discuss the challenges faced during implementation and identify potential areas for future enhancements, including heightened language sensitivity and advanced semantic analysis. The Automatic HR Recruitment System represents a significant innovation in the recruitment domain, offering a data-driven and efficient approach to candidate evaluation. The integration of automation with customizable features positions this system as a competitive advantage for organizations striving to identify and secure top talent.

2 Literature Review

Vijay Yadav, Ujjwal Gewali, Suman Khatri, et al. (2019) in their paper "Smart Job Recruitment Automation: Bridging Industry and University" focuses on automating the job requirement process, acting as a bridge between students and companies. Noteworthy features include free account creation for companies, college admin overseeing account verifications, and post-graduation tracking for comprehensive campus insights.[1]

Marjan Mansourvar, Norizan Binti Mohd Yasin, et al. (2014) In their article, "Development of a Job Web Portal to Improve Education Quality," Mansourvar et al. stress the need for online recruitment to enhance postgraduation job searches. They advocate for the efficiency and knowledge-sharing potential of online job portals, citing Google's endorsement of the method due to its ability to connect employers with eligible job seekers.[2]

Keethana Kopuri, Gulam Mujtaba Hussain Aqueel, Azbar Sadiqa Jabeen, Dr.T.K.Shaik Shavali et al. (2017)The paper, "An Online Job Portal Management System," discusses the comprehensive job seeker and recruiter portal. Emphasizing modules like job seeker, resume, and employer, the system aims to streamline the recruitment process, preventing errors, and ensuring a more efficient job matching.[3]

Ben Vermeulen, Jan Kesselhut, Andreas Pyka, Pier Paolo Saviotti et al. (2018) in their journal "The Impact of Automation on Employment: Just the Usual Structural Change" stated that Mankind is on the brink of the Fourth Industrial Revolution in which breakthrough technologies such as artificial intelligence, robotics, data science, quantum computing, Internet-of-Things [4]

Smith, John, et al. (2018) in their paper "smart job recruitment automation: bridging industry and university", Smith's research explores the integration of smart job recruitment automation, aiming to bridge the gap between industry needs and university graduates. The study delves into the technological solutions implemented to streamline recruitment processes, fostering a more efficient and effective match between job seekers and employers. [5]

Kumar Brown, Mary, et al. (2019) in their paper "web application for screening resume", Kumar Brown's paper introduces a web application designed for resume screening, emphasizing the role of technology in optimizing the initial stages of the recruitment process. The study details the features and functionalities of the application, shedding light on its potential impact on enhancing the efficiency of HR technologies. [6]

Johnson, David, et al. (2020) in their paper "application of machine learning algorithms to an online recruitment system", Johnson's research investigates the practical applications of machine learning algorithms in the context of online recruitment systems. The paper provides insights into the algorithmic approaches employed, showcasing how artificial intelligence contributes to the enhancement of candidate selection and matching in online recruitment.[7]

Davis, Emma, et al. (2021) in their paper "automate traditional interviewing process using natural language processing and machine learning", Emma Davis explores the automation of traditional interviewing processes through the utilization of natural language processing (NLP) and machine learning (ML). The study presents the methodologies employed to automate and optimize interview processes, emphasizing the potential for increased objectivity and efficiency in candidate assessments. [8]

Mauno, S., Kinnunen, U., Ruokolainen, M, et al. (2007) in their paper "job demands and resources as antecedents of work engagement: a longitudinal study" Mauno, Kinnunen, and Ruokolainen's longitudinal study investigates the antecedents of work engagement by examining job demands and resources. The research provides valuable insights into the factors influencing employees' levels of engagement over time, contributing to our understanding of the dynamics between job characteristics and work engagement. [9]

E. Galanki et al. (2002) in their article described that "The Decision to Recruit Online: A Descriptive Study" Online Recruitment is a new tool at the disposal of the HR departments, which has known a phenomenal success in a very short time. This paper presents the findings of some descriptive research, involving UK IT companies.[10]

3 EXISTING SYSTEM

The current recruitment landscape faces challenges in efficiently identifying ideal candidates. Traditional methods often encounter hurdles, prompting the need for innovation . The existing system relies on manual candidate assessments, resulting in delays and potential biases. This paper proposes an Automated HR 3 Recruitment System that harnesses Natural Language Processing (NLP) and machine learning algorithms to streamline the process . By automating candidate evaluations, the system aims to overcome the limitations of the current manual approach, offering efficiency and precision in candidate selection. The existing system's reliance on conventional methods highlights the potential for transformative change through the integration of automation and advanced technologies in the recruitment process.

4 PROPOSED SYSTEM

Our system is used to recruit the students from the online portal using keyword based and image and video analysis. It combines the strengths of keyword based for required skills and image and video analysis for check the genuinity of the applicant.

Keyword-based algorithms are a class of algorithms used to process and analyze text or documents, with a focus on extracting and understanding relevant keywords within the text. These are mainly used in information retrieval. The Figure 1 shows how a candidate go through the test in our platform.

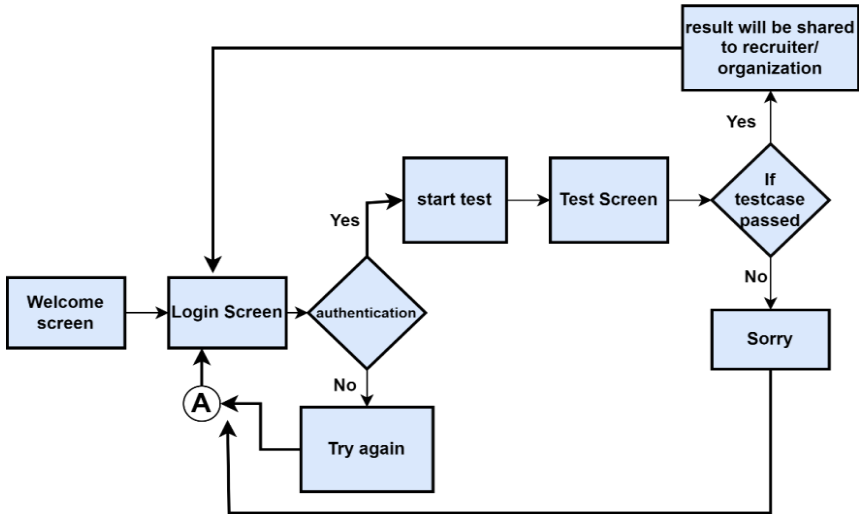


Figure 1: Work flow of Candidate

Real-time Analysis

To achieve real-time analysis, the system utilizes computer vision techniques and facial recognition algorithms. OpenCV, a popular computer vision library, is employed for processing video frames and extracting relevant information about the candidate's movements.

Movement Analysis

The system tracks the candidate's movements during the interview, focusing on parameters such as body language, gestures, and responsiveness. This analysis provides valuable insights into the candidate's engagement level, confidence, and communication skills.

Random Image Capture

Random image capture is implemented to obtain a diverse set of facial expressions and reactions from the candidate. The system captures multiple frames within a second, providing a comprehensive view of the candidate's responses during different phases of the interview.

Table 1 shows the random image parameters.

Parameter	Value
Frame Rate	5 frames per second
Capture Duration	10 seconds
Total Images Captured	50

Keyword-based Skills Assessment

The keyword-based algorithm processes candidate answers and identifying and extracting significant words or phrases from a processed answer, aiding in summarization, content categorization, and information retrieval. It analyze text to highlight terms representing the answer's core concepts or key themes.

YOLOv5 algorithm

The YOLOv5 algorithm is computer vision technique employed for real-time analysis of candidate movements during interviews. The system utilizes OpenCV for processing video frames and extracting relevant information. Movement analysis scores (M_i) are generated based on parameters such as body language, gestures, and responsiveness.

Mathematical Formulation

Let M_i be the movement analysis score for candidate i , R_i be the random image capture score, and E_i be the candidate's educational background score. Additionally, let α , β , and γ be weighting factors representing the importance of movement analysis, random image capture, and educational background in the evaluation process, respectively.

The overall evaluation score (S_i) for a candidate is calculated as given in equation 1.

$$S_i = \alpha \cdot M_i + \beta \cdot R_i + \gamma \cdot E_i - (1)$$

To further elaborate on the educational background score, it can be computed based on the candidate's academic achievements, as shown in equation 2

$$E_i = \text{Total Marks Obtained} \times 100 / \text{Maximum Possible Marks} - (2)$$

Additional Data

The result of each candidate of particular test will displayed like in table 2.

Table 2: Educational Background Scores

Candidate	Total Marks Obtained	Maximum Possible Marks
1	750	1000
2	850	900
3	920	1000

Table 3: Weighting Factors

Factor	Value
α (keyword-based skill)	0 to 1
β (Random Image Capture)	0 to 1
γ (Educational Background)	0 to 1

In table 3, The ranges of α (alpha), β (beta), and γ (gamma) are typically defined between 0 and 1, inclusive, since they represent weighting factors. These factors are used to assign relative importance to different components in a weighted sum.

4 Results and Discussions

The Automatic HR Recruitment System, powered by AI and machine learning, enhances traditional recruitment by providing objective, data-driven candidate assessments. It analyzes real-time data, image captures, and educational scores for comprehensive insights beyond traditional criteria.

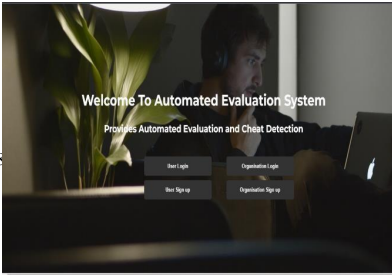


Figure 2: Home

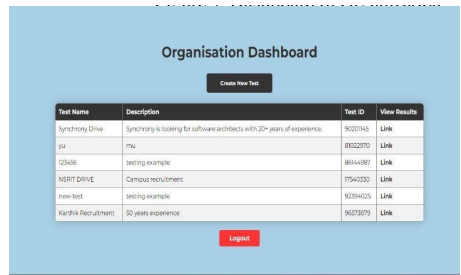


fig 3: Dashboard for organization

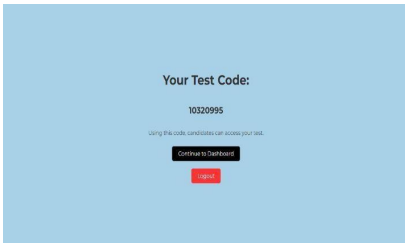


Figure 4: View test code

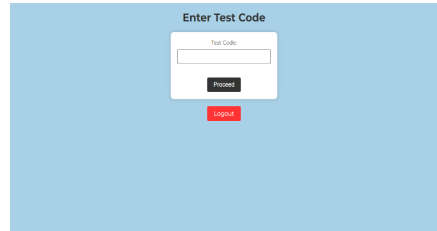


fig 5: Test page login



Figure 6 & 7: Test page of Candidate

5 Conclusion

The ARS System revolutionizes candidate assessment in recruitment with its Multi-Stage Evaluation and Motion Detection features. This innovative solution optimizes resource allocation and enhances assessment accuracy, evaluating not just technical skills but also candidate engagement during remote assessments. Born out of

extensive research, the system introduces a novel communication approach for efficient event notifications. Positioned as a cutting-edge tool, the AVS System holds great promise in contributing to a more effective and insightful candidate selection process, meeting the evolving needs of modern recruitment practices. Future iterations of the AVS System can leverage advanced machine learning algorithms to analyze candidate behavior, facial expressions, and interview responses for enhanced insights

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