An Intelligent Skill-Based Matching Framework for Automated Recruitment Using Web and Machine Learning Technologies

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Abstract
By allowing quicker connection between businesses and job seekers, the growing usage of internet job portals has significantly changed everyday recruitment procedures. Current hiring practices are frequently time-consuming, time-consuming, and prone to inefficiencies, which causes delays and mismatches between candidate abilities and job needs [1]. Current employment portals provide minimal support for intelligent matching, personalisation, and decision-making, with a primary focus on job posting and application submission [2]. In order to increase the precision, effectiveness, and transparency of the hiring process, this study suggests an intelligent web-based recruitment and job application system. While job searchers can search for appropriate positions, apply online, and track the development of their applications, recruiters can manage job posts, evaluate applicants, and check application status [3]. A skill-based matching system is integrated to help recruiters find qualified candidates more efficiently and to suggest appropriate opportunities to candidates [4]. The suggested method is significant since it increases matching accuracy, decreases manual labour, and improves the user experience for both recruiters and job seekers. Additionally, it offers a basis for the future incorporation of AI methods like applicant ranking, resume parsing, and customised suggestions [5]. This research advances the creation of more intelligent, dependable, and scalable recruitment systems by addressing significant drawbacks of current platforms. Because of this, researchers, developers, and companies looking to enhance digital recruiting procedures will find the study useful.
Keywords: intelligent recruitment system, skill-based matching, e-recruitment, job recommendation, web technologies

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I. Introduction

The rapid growth of internet-based technologies has transformed organizational processes across various domains, particularly in human resource management and recruitment. Online recruitment platforms enable organizations to advertise vacancies globally, collect applications electronically, and communicate with candidates remotely. These systems reduce geographical limitations, operational costs, and processing time associated with traditional paper-based recruitment methods. As a result, web-based job portals have become a fundamental component of modern hiring practices. Despite their widespread use, most existing recruitment platforms still rely heavily on simple keyword-based searching and manual filtering of candidate profiles. Recruiters are often required to review hundreds or thousands of applications for a single vacancy, many of which do not match the job requirements. This creates a significant administrative burden and increases the time required to fill positions. At the same time, job seekers often face difficulty in identifying roles that truly align with their skills, qualifications, and interests. A major limitation of current systems is their inability to understand the semantic relationships between skills, job roles, and candidate profiles. Similar skills may be described using different terminologies, and job requirements may be expressed using varied language across industries and organizations. However, keyword-based systems treat such variations as unrelated, which leads to inaccurate matching, missed opportunities for qualified candidates, and inefficient recruitment outcomes. Furthermore, recruitment platforms often lack intelligent mechanisms to rank and prioritize candidates based on relevance and suitability. Without structured analysis and automated support, recruiters must depend on subjective judgment and manual comparison of profiles, which may introduce bias and inconsistency into the selection process. This limits fairness and transparency in recruitment and reduces the reliability of hiring decisions. Another challenge lies in

the lack of structured workflow and transparency within recruitment systems. Candidates frequently have limited visibility into the status of their applications, while recruiters lack integrated tools for tracking application progress, managing interview stages, and maintaining systematic records. This reduces user trust, increases communication gaps, and makes the recruitment process less efficient and less accountable. As the volume of digital recruitment data continues to grow, scalability also becomes a critical concern. Systems must handle increasing numbers of users, job postings, and applications while maintaining performance, reliability, and usability. Without intelligent design and automation, recruitment platforms struggle to scale effectively and fail to support large-scale hiring needs. To address these limitations, there is a growing demand for intelligent recruitment systems that move beyond basic job listing and keyword matching. Such systems should incorporate structured skill analysis, semantic interpretation of profiles, automated decision support, and efficient workflow management. By modeling relationships between skills and job requirements, platforms can provide more relevant job recommendations and improve candidate-job alignment. Intelligent recruitment systems also have the potential to reduce manual effort, minimize bias, and improve fairness by applying consistent matching and ranking criteria. Data-driven approaches can support recruiters in making informed decisions while enhancing the objectivity and transparency of the hiring process. In addition, intelligent systems can enhance user experience by providing personalized job recommendations to candidates and intuitive management tools to recruiters. This improves engagement, reduces frustration, and increases satisfaction for both user groups, thereby strengthening the overall effectiveness of recruitment platforms. In this context, this research proposes an intelligent web-based recruitment and job application framework designed to improve the efficiency, accuracy, and transparency of digital hiring. The system integrates skill-based matching, role-based access control, and application tracking into a unified platform that supports both recruiters and job seekers. The proposed framework allows recruiters to post and manage job openings, review applicants, and track recruitment progress, while job seekers can search for relevant opportunities, apply online, and monitor their application status. Structured skill analysis is used to improve matching accuracy and reduce irrelevant results. The contributions of this work include the design of a scalable recruitment architecture, the development of a skill-based matching mechanism, and the demonstration of how intelligent web systems can support more efficient, fair, and transparent recruitment practices. This research aims to contribute toward the development of smarter digital hiring systems that better align organizational needs with candidate capabilities.

II.   Literature Review

[1]This paper presents the design and development of a web-based online job portal intended to simplify the recruitment and job search process for students and recruiters. The system provides dual login functionality, allowing students to search and apply for jobs and recruiters to post vacancies and manage applications. It uses modern web technologies such as React, Node.js, and MongoDB to implement features like advanced job filtering, profile management, and resume uploads. The study demonstrates improved accessibility, reduced manual effort, and better organization of recruitment activities compared to traditional methods. However, the system largely focuses on automation and usability and does not deeply address intelligent matching, bias reduction, or semantic understanding of skills and job requirements.

[2] This paper addresses the inefficiency, high cost, and limited reach of traditional recruitment processes and proposes a web-based e-recruitment platform to automate hiring activities. The system enables job seekers to create profiles, upload resumes, and search for jobs, while recruiters can post vacancies and communicate with candidates through the platform. The implementation uses modern web technologies such as ReactJS, NodeJS, MongoDB, OAuth authentication, and resume parsing to improve usability, security, and responsiveness. The study demonstrates improved efficiency and user engagement compared to conventional portals. However, the system primarily focuses on automation and interface design and does not deeply incorporate intelligent semantic matching, bias mitigation, or advanced AI-driven recommendation mechanisms.

[3]This paper presents the design of an online job portal intended to reduce the gap between job seekers and recruiters by providing a centralized web-based recruitment platform. The system supports job searching, resume uploading, recruiter queries, and automated email notifications using a modular architecture with Job Seeker, Recruiter, and Admin components. It is developed using the WISDM (Web Information Systems Development Methodology), which integrates organizational, technical, and human-computer interaction aspects. The study emphasizes usability, automation, and accessibility across devices. However, the system primarily focuses on functional automation and does not incorporate intelligent semantic matching, advanced recommendation, or bias-aware candidate ranking mechanisms.

[4]This paper presents the design and implementation of *Werk*, a web-based job portal aimed at improving the efficiency, accessibility, and transparency of digital recruitment. The system enables job seekers to create profiles, upload resumes, search for jobs, and track applications, while employers can post vacancies, review candidates, and manage recruitment workflows through a centralized dashboard. The platform emphasizes user experience, global reach, and ethical recruitment practices by reducing information gaps and improving accessibility for underrepresented groups. It focuses on security, privacy, and administrative oversight to ensure

trust and system integrity. However, the system primarily relies on functional automation and does not deeply integrate advanced intelligent matching, semantic analysis, or bias-aware ranking techniques.

[5]This paper presents a review of online job portals and their role in modern recruitment by analyzing how web-based platforms replace traditional hiring methods. The authors discuss how job portals enable employers to post vacancies and allow job seekers to search, apply, and share knowledge efficiently through a centralized system. The study highlights benefits such as reduced recruitment cost, wider reach, faster processing, and improved access to job information for students and unemployed graduates. It also emphasizes the importance of job portals as knowledge-sharing systems that support decision-making and career planning. However, the paper is mainly conceptual and survey-based and does not propose or evaluate any intelligent matching algorithms, semantic skill analysis, or bias-aware ranking mechanisms.

[6]This paper analyzes and compares traditional software development methodologies such as SDLC, Waterfall, OOAD, and RAD with the Web Information Systems Development Methodology (WISDM) for web application development. It highlights that traditional methods are often rigid and poorly suited for the dynamic, multimedia-rich, and user-centric nature of web systems. The authors propose WISDM as a multiview, socio-technical framework that integrates organizational, informational, technical, human-computer interaction, and work design perspectives. The study demonstrates that WISDM better addresses usability, stakeholder involvement, and evolving requirements in web projects. However, the paper remains methodological and conceptual in nature and does not validate WISDM through large-scale empirical implementation or performance evaluation on real-world systems.

[7]This paper examines the application of data-driven and intelligent techniques in improving recruitment and candidate selection processes. It highlights the limitations of traditional keyword-based filtering and manual screening, emphasizing issues such as low matching accuracy, recruiter overload, and biased decision-making. The authors propose the use of structured data analysis and automated recommendation mechanisms to improve relevance and efficiency in candidate-job matching. The study discusses how intelligent systems can enhance personalization and reduce human effort in recruitment workflows. However, the paper remains largely conceptual and does not provide extensive empirical validation or large-scale experimental results to demonstrate the effectiveness of the proposed approach.

[8]This paper presents the design and implementation of an AI-based job portal aimed at improving job matching accuracy and enhancing the recruitment experience for both job seekers and employers. The system uses similarity algorithms such as Jaccard similarity, percentage similarity, and range overlap to compare resumes with job descriptions and generate relevance scores. It incorporates automated resume parsing using NLP, personalized job recommendations, recruiter dashboards, and online skill assessments to support data-driven hiring. The platform demonstrates improved efficiency, reduced administrative workload, and faster time-to-hire compared to traditional portals. However, the system focuses primarily on similarity-based matching and does not deeply address bias mitigation, explainability of AI decisions, or privacy-preserving data handling mechanisms.

[9] This paper presents the design and implementation of an online job portal developed using the Python Django framework to support job searching, job posting, and recruitment management. The system allows job seekers to register, search for jobs, apply, and track application status, while employers can post vacancies and select suitable candidates. It uses the MVT (Model–View–Template) architecture and a string matching algorithm based on Naive Bayes and Rabin–Karp techniques to improve keyword matching and error correction in searches. The platform emphasizes usability, automation, and accessibility, and claims improvements in efficiency, speed, and user-friendliness compared to traditional systems. However, the system mainly focuses on functional automation and basic string-based matching and does not incorporate advanced semantic understanding, bias mitigation, or privacy-preserving intelligent recommendation mechanisms.

[10]This project presents the design and development of a College Job Portal intended to automate and centralize the on-campus recruitment process involving students, companies, and the college administration. The system enables students to register profiles, receive job notifications, apply for positions, and track selection status, while companies can post vacancies, review applications, conduct interviews, and issue offer letters through the platform. The college acts as the administrator, verifying student data and managing job distribution. The portal is implemented using PHP, MySQL, and the WAMP stack and follows the waterfall development model. However, the system relies largely on manual verification and basic filtering and does not yet incorporate intelligent skill matching, semantic analysis, or automated interview scheduling and evaluation.

III. Problem Statement

The widespread adoption of web-based recruitment platforms has improved accessibility, reach, and efficiency in the hiring process. However, most existing systems continue to rely heavily on keyword-based search, basic filtering, and manual screening to match candidates with job opportunities. This approach fails to capture the semantic meaning of skills, experiences, and job requirements, leading to inaccurate matching and irrelevant results. As a consequence, qualified candidates may be overlooked while unsuitable profiles are shortlisted, reducing the overall effectiveness and fairness of digital recruitment. Additionally, recruiters face

increasing workload due to the high volume of applications, while job seekers experience difficulty in identifying positions that truly align with their capabilities and interests.

Although several platforms have introduced automation, dashboards, and even basic AI-based similarity matching, these solutions primarily focus on usability and efficiency rather than deeper intelligence and transparency. Current systems often lack structured skill interpretation, explainability of recommendations, bias-aware decision support, and privacy-conscious handling of sensitive personal data. Many approaches remain conceptual or limited in empirical validation, and practical systems frequently prioritize functional automation over intelligent reasoning. As a result, recruitment platforms still struggle with challenges such as recruiter overload, inconsistent candidate evaluation, potential bias, limited personalization, and insufficient trust in system-generated recommendations.

Therefore, there is a clear need for an intelligent, structured, and transparent recruitment system that moves beyond simple keyword matching and manual processing. Such a system should support skill-based analysis, meaningful job–candidate alignment, efficient workflow management, and responsible handling of personal data, while remaining scalable and user-friendly. Addressing these limitations is essential to improve matching accuracy, reduce manual effort, enhance fairness and transparency, and ultimately enable more reliable and effective digital recruitment practices.

IV. Proposed Solution

The proposed solution is a web-based intelligent recruitment and job application system designed to improve the efficiency, accuracy, and transparency of the hiring process. The system provides a centralized platform where job seekers can create profiles, upload resumes, search for relevant job opportunities, and track application status, while recruiters can post vacancies, specify skill requirements, and manage candidate applications. It follows a structured client–server architecture with role-based access to ensure secure and organized interaction between users and the system. By incorporating skill-based matching and automated workflow management, the proposed solution reduces manual effort, improves the relevance of candidate–job matching, and enhances the overall recruitment experience for both recruiters and job seekers.

V. Methodology

This section describes the architecture, tools, features, and functional components of the proposed intelligent recruitment and job application system. The methodology explains how the system is designed, implemented, and operated to support efficient job posting, candidate search, application management, and skill-based matching.

System Architecture
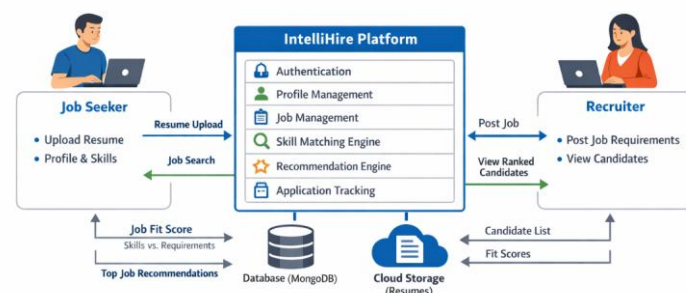
The proposed system follows a client–server architecture in which users interact with the platform through a web interface, and all data processing and storage are handled on the backend server. The system consists of three primary user roles: Job Seeker, Recruiter, and Administrator (Backend). Each role has defined permissions and access levels to ensure secure and structured operation.

Job seekers access the system through the client interface to create profiles, upload resumes, search for jobs, and apply for relevant positions. Recruiters use the platform to post job openings, specify required skills, view applicant profiles, and manage the recruitment workflow. The backend server processes all requests, performs matching between job requirements and candidate profiles, manages authentication and authorization, and stores all data in the database.

The server handles profile management, job posting management, application tracking, and matching logic. Uploaded resumes and profile images are stored using cloud-based storage, while structured data such as user profiles, job postings, and application status are stored in the database. This separation of concerns ensures scalability, data integrity, and efficient system performance.

Tools and Technologies
The system is developed using a modern web technology stack to ensure reliability, scalability, and maintainability.
The frontend is implemented using EJS templates for dynamic page rendering, along with HTML, CSS, and JavaScript for user interface design and interaction. This enables responsive and interactive user experiences across different devices.
The backend is developed using Node.js with the Express framework to handle server-side logic, routing, and API services. MongoDB is used as the database to store user profiles, job postings, application data, and system logs due to its flexibility in handling semi-structured data.
Cloudinary is used for secure storage and retrieval of uploaded resumes and images. GitHub is used for version control and collaborative development. The system is hosted on a server environment that supports Node.js execution and database connectivity.

Features of the System
The proposed system includes a set of core features designed to support digital recruitment activities.
Job seekers can register and manage their profiles, upload resumes, search for jobs based on keywords and skills, apply for job postings, and track the status of their applications. Recruiters can create company profiles, post job vacancies, specify required skills, view and filter applications, and shortlist candidates.
The system supports role-based authentication and authorization to ensure that users can access only the functionalities permitted for their role. Application tracking features allow both job seekers and recruiters to monitor progress at different stages of recruitment.
The system also prepares the foundation for future enhancements such as intelligent resume parsing and automated candidate ranking, although these are not part of the current implementation.

Functionalities of the System
The system provides end-to-end recruitment functionality starting from job posting to candidate selection.
User registration and authentication allow secure access to the platform. Profile management enables users to update their personal and professional information. Job management allows recruiters to create, update, and remove job postings. Application management supports submission, review, and status updates of job applications. The matching mechanism compares candidate skills with job requirements to identify relevant matches and improve the relevance of search results. This reduces manual screening effort and improves recruitment efficiency. The administrative backend supports system monitoring, data management, and user management to ensure reliable operation and data integrity.

VI.   Results and Discussion
System Performance and Efficiency
       The IntelliHire system was successfully implemented as a full-stack web application using Node.js, Express, MongoDB, and EJS. The platform supports core recruitment operations such as user authentication, job posting, job searching, application submission, and status tracking. During testing, the system demonstrated stable performance for typical user workloads, with fast response times for job search queries and dashboard operations. The skill-based matching mechanism produced relevant job recommendations based on profile and job skill overlap, which reduced the need for manual job filtering by users. Recruiters were able to manage job postings and review applicants efficiently through a centralized dashboard, reducing administrative effort. Overall, the system showed improved efficiency compared to traditional manual or basic job portal workflows.

User Experience and Responsiveness
The role-based interface design ensured that job seekers and recruiters had access only to relevant features, improving usability and reducing interface complexity. Job seekers found it easy to create profiles, upload resumes, search for jobs, and track application status. Recruiters could easily post jobs, view applicants, and update application statuses in real time.
The system was tested across different screen sizes and browsers, and it maintained consistent responsiveness and layout behavior. The structured workflows and clear navigation reduced confusion and improved transparency in the recruitment process, leading to a more positive user experience.

VII.   Challenges and Limitations
       While the system achieved its primary objectives, certain limitations were identified. The current skill-matching mechanism is rule-based and does not yet use advanced machine learning models, which limits its ability to understand complex resumes or infer implicit skills. Resume parsing and intelligent ranking are planned features but were not implemented in the current version.

Another limitation is that system performance may degrade under very high user loads without further optimization or scaling infrastructure. Additionally, the system depends on the accuracy of user-provided profile data, which may affect recommendation quality if information is incomplete or incorrect.

Despite these limitations, the system provides a strong foundation for future enhancements and demonstrates the feasibility of building an intelligent, automated recruitment platform.

VIII. Conclusion

This research presented the design and development of IntelliHire, an intelligent job recruitment and application portal, based on insights obtained from a detailed literature review of ten existing research works in the domain of online recruitment systems, recommendation platforms, and automated hiring solutions. The literature analysis highlighted key challenges such as inefficient manual shortlisting, lack of personalization, limited transparency, and absence of intelligent decision-support mechanisms in traditional job portals. These findings directly influenced the system requirements and architectural design of the proposed solution.

Based on these observations, IntelliHire was proposed as a role-based, skill-oriented recruitment platform that supports automated job posting, searching, application tracking, and recommendation. The system integrates structured data handling with a skill-matching mechanism to improve alignment between candidates and job requirements. The implemented system demonstrated improved efficiency, usability, and transparency when compared to conventional recruitment approaches, thereby validating the effectiveness of the proposed solution.

Experimental evaluation and testing showed that the platform performs reliably for core recruitment tasks and provides a smooth user experience for both recruiters and job seekers. The centralized dashboards, application tracking, and match-percentage indicators contributed to reduced manual effort and clearer decision-making during the recruitment process.

However, the system also has certain limitations. The current matching algorithm is rule-based and does not yet incorporate advanced artificial intelligence or machine learning techniques such as resume parsing, semantic skill extraction, or predictive ranking models. Additionally, system scalability under very large user volumes and dependency on user-provided data accuracy remain open challenges.

Future work will focus on integrating AI-based resume parsing, natural language processing for skill extraction, machine learning-based applicant ranking, and predictive job recommendations. Further enhancements will also include performance optimization, scalability improvements using cloud-native architectures, and enhanced data analytics for recruiters. These developments aim to transform IntelliHire into a fully intelligent, adaptive, and scalable recruitment ecosystem capable of supporting modern hiring needs at scale.

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