

# Job Application Automation Using Agentic AI: A Multi-Agent Framework for Automated Job Application

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**Abstract**—This project presents an Automated Job Application System built using Crew AI, a multi-agent orchestration framework that automates the entire job application process. It employs specialized agents—such as the Resume Parser, Job Scraper, Job Matcher, Tailor, Application, Tracker, Compliance, and Supervisor Agents—to collaboratively handle tasks like extracting resume data, retrieving and ranking job postings, generating tailored application materials, and submitting applications through APIs or for manual review. By integrating Natural Language Processing (NLP), Large Language Models (LLMs), and agent-based coordination, the system achieves scalable, personalized, and transparent automation that reduces candidate effort, improves application quality, and enables progress tracking. The project ultimately transforms the job search into a structured, efficient, and intelligent process, with future enhancements planned for job recommendations, multilingual support, and broader ATS integration.

**Index Terms**—Automated Job Application System, Crew AI, Resume Parsing and Tailoring, Multi-Agent Framework, Job Matching and Application Automation, NLP and LLM's.

## I. INTRODUCTION

Early In today's competitive job market, the process of applying for jobs can be overwhelmingly time-consuming and labor-intensive for candidates [10]. Job seekers often find themselves spending hours editing resumes, searching for suitable positions, and meticulously filling out repetitive application forms [10][5]. For recruiters, manually reviewing the sheer volume of resumes submitted to online platforms is slow, expensive, and challenging [3][9]. Early attempts to streamline this involved online job listings and basic resume parsers, but these often relied on simple keyword matching and lacked the

sophistication to accurately assess candidate-job fit or automate the application submission itself [9][5][7]. These traditional methods struggle with the heterogeneity of resume formats and the nuances of job requirements, leading to inefficiencies for both applicants and employers [5][1].

Recently, the integration of advanced Artificial Intelligence (AI) paradigms, particularly Large Language Models (LLMs) and Deep Learning (DL), has begun to transform recruitment processes [2][9]. Deep learning models have improved tasks like natural language understanding, enabling better extraction of semantic information from resumes and job descriptions beyond simple keywords [3][5][7]. The capabilities of LLMs are now being leveraged to automate parts of the hiring workflow, such as generating personalized job descriptions or summaries [7]. AI-driven tools are increasingly used for resume screening, classification, and ranking, aiming to improve efficiency and reduce human bias [1][9][5]. While tools exist for specific sub-tasks like resume parsing or job recommendation [5][7], a comprehensive, automated end-to-end application system remains a complex challenge [2].

This emerging field is now embracing Agentic AI, representing a significant advancement where AI systems undertake autonomous decision-making and collaborative task execution with reduced human intervention [4]. The core concept involves structuring complex processes as a collaboration between specialized AI agents [4][9]. In the context of job applications, this translates to a system where distinct agents handle specific steps: parsing resume details, searching job platforms like LinkedIn [10], intelligently matching candidate profiles with job requirements [3][8], and automatically filling out application forms [10]. This paper presents a multi-agent framework leveraging Agentic AI to automate

the job application process. This framework aims to significantly enhance efficiency for job seekers by orchestrating specialized AI agents (e.g., Resume Analyzer, Job Matcher, Form Filler) to deliver a seamless, automated application experience based on user-provided profile information and job preferences [4][9].

## II. RELATED WORK

The manual nature of recruitment, especially resume screening, is highly time-consuming and inefficient [10][3]. Early automation attempts focused on discrete tasks like resume parsing using NLP techniques [5] or job recommendation via collaborative/content-based filtering [2]. Intelligent recruitment platforms began integrating these features to connect students and enterprises [6]. However, these initial tools often failed to provide a fully integrated workflow and struggled with deep semantic understanding [9].

Key research gaps emerged:

- Lack of Integration: Systems often handled parsing [5] or recommendations [2] separately, without automating the end-to-end application process [10].
- Semantic Understanding Gap: Keyword-based matching [9] proved insufficient for true person-job fit assessment [3], especially with vocabulary differences between resumes and job posts [8].

Deep Learning (DL) models, particularly transformers like BERT [3][9], significantly improved text representation, enabling better semantic matching [8][3]. Graph Neural Networks (GNNs) were also applied for resume classification [7]. More recently, Large Language Models (LLMs) introduced advanced context-aware evaluation and generation capabilities into the hiring process [9][1]. This led to the current paradigm of Agentic AI and Multi-Agent Systems (MAS) [4][9]. Frameworks like CrewAI [4] or those using Retrieval-Augmented Generation (RAG) [9] structure the process using specialized agents (e.g., resume extractor, evaluator) [9]. These agents collaborate [4] to handle complex, multi-step tasks like parsing, matching, and potentially automated form filling [10], addressing both the integration and semantic gaps identified in earlier systems [9].

## III. METHODOLOGY

This system utilizes a multi-agent framework to automate job applications based on user input. It integrates AI components for an autonomous Perception -> Planning -> Execution workflow [4][9], coordinated by a platform like CrewAI [4].

1. Agentic Architecture and Input Processing The system employs collaborating agents [4].
  - Input/Perception: The user uploads a resume and provides job search criteria (role, location) via an interface [6][10].
  - Planning: An initial agent interprets the goal and creates a task sequence for specialized agents [4][9].
2. Resume and Job Data Analysis Accurate matching requires understanding candidate profiles and job needs [3][5].
  - Resume Analysis Agent: Uses NLP (e.g., spaCy) to extract structured data (skills, experience, education) from the resume [5][7].
  - Job Retrieval Agent: Scrapes job platforms (e.g., LinkedIn) [10] or uses APIs based on user criteria to find relevant job listings [2].
3. Multi-Agent Execution and Automation Specialized agents perform the core application tasks [4][9].
  - Job Matching Agent: Compares extracted resume features to job requirements [3] using semantic similarity (e.g., SBERT embeddings [8], cosine similarity [7]) to rank opportunities.
  - Application Filling Agent: Navigates application forms on supported sites using web automation (e.g., Selenium) [10] and fills fields using the parsed resume data [10].
  - (Optional) Tracking Agent: Monitors application status where possible [10].
4. Technology Stack The system uses Python with CrewAI [4] for orchestration, NLP libraries (spaCy [5]), possibly embeddings (BERT [8][9]), and web automation (Selenium [10]).

## IV. RESULT AND ANALYSIS

The application of Agentic AI frameworks to job application automation demonstrates significant potential in streamlining complex and repetitive tasks for job seekers [10]. Systems built on these principles report high success rates in core automation

components:

- **High Accuracy in Resume Analysis:** Automated systems utilizing NLP and ML techniques consistently achieve high accuracy in parsing resumes and extracting relevant structured information like skills, experience, and education [5][7]. Models like Random Forest, SVM, or GNNs trained on labeled datasets effectively predict job domains or classify resumes based on content [5], achieving F1-scores around 0.92 [5]. Named Entity Recognition (NER) plays a critical role in identifying key details accurately [5].
- **Effective Person-Job Fit Matching:** Techniques like cosine similarity applied to learned representations enable more nuanced, context-aware matching between candidate profiles and job descriptions [7][8], improving the relevance of recommendations [2]. LLM-based evaluators show strong correlation with human HR judgments [9]. Feature fusion techniques integrating textual and entity-based features also contribute [3].
- **Successful Task Automation Execution:** Systems integrating web automation tools like Selenium demonstrate the capability to automatically navigate websites and populate online application forms using extracted resume data [10], drastically

reducing manual effort and time spent per application [10]. Multi-agent frameworks effectively coordinate these steps—from job searching on platforms like LinkedIn [10] to criteria-based filtering and final submission [10], showcasing the power of collaborative AI agents [4].

Analysis reveals key areas of impact and remaining challenges:

- **Bridging the Integration Gap:** Agentic AI, especially through multi-agent systems [4][9], effectively overcomes the fragmentation seen in earlier tools by successfully integrating disparate recruitment tasks. These tasks include initial resume parsing to extract key candidate information [5][7], active job searching across platforms based on user criteria [2], sophisticated semantic matching to determine person-job fit [3][8], and the final automated submission of applications [10]. This creates a cohesive, automated workflow [6], progressing beyond siloed functionalities towards genuine end-to-end

solutions [2]. Such orchestration, often managed by frameworks like CrewAI [4], allows these complex, multi-step processes inherent in job hunting to be managed autonomously by specialized agents working in concert [4].

- **Addressing Semantic Understanding & Adaptability:** While advanced models provide deeper semantic understanding [9][8][7], challenges remain with interpreting nuanced or implicitly stated job requirements [3], and ensuring the extracted features truly capture candidate suitability across diverse roles [3][5]. RAG integration shows promise in allowing dynamic adaptation to company-specific criteria without retraining [9].
- **Ensuring Fairness, Transparency, and Robustness:** While modular agent frameworks [4] and context-aware LLMs with RAG [9] may offer increased explainability over monolithic models [9], careful auditing, bias mitigation strategies [1], and adherence to ethical guidelines are crucial [1][6]. Adapting to frequent website structure changes also impacts system robustness [10]. Building trust in these automated systems is vital for adoption by both candidates and

recruiters [1][2]. Overall, Agentic AI, with its capacity for autonomous decision-making [4] and collaborative task execution [4], is poised to transform the job application process, though technical and ethical challenges require ongoing attention.

## V. CONCLUSION

This paper presents a cohesive framework for Job Application Automation using Agentic AI that employs a multi-agent architecture to transform the manual application process into an intelligent, automated workflow. The system addresses the traditional challenges of inefficiency and the time-consuming nature of searching for and applying to jobs. It achieves this by leveraging LLMs and specialized agents within a collaborative structure, converting user inputs (resume, preferences) into actionable plans executed via a perception -> planning -> execution pipeline. The core architectural innovation involves orchestrating specialized agents (e.g., Resume Analyzer, Job Matcher, Form Filler) for sequential tasks, enabling functions like semantic

resume parsing, intelligent person-job fit matching and automated form submission using web automation. While significantly boosting efficiency, careful consideration of fairness and transparency remains crucial. This synthesis paves the way for advanced job-seeking tools, combining autonomous agent capabilities with user control to streamline the recruitment process.

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