

AI Job & Skills Recommendation System Using CrewAI

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Abstract—In today's rapidly evolving technological world, students and job seekers often face challenges in selecting the right career path and identifying the skills required to remain competitive in the job market. Traditional job portals mainly focus on job listings and fail to provide personalized guidance, skill-gap analysis, and future career recommendations. To overcome these limitations, this research proposes an AI-Based Job and Skill Recommendation System using CrewAI, a multi-agent artificial intelligence framework that enables collaborative decision-making among intelligent agents. The proposed system analyzes user profiles, educational background, interests, technical skills, certifications, and current market trends to provide accurate and personalized job recommendations. Multiple AI agents work together to perform specialized tasks such as profile analysis, skill matching, market trend analysis, career prediction, and roadmap generation. The system also identifies missing skills required for selected job roles and generates a structured learning roadmap to improve employability.

Index Terms—CrewAI Multi-Agent System

- AI Job Recommendation
- Artificial Intelligence
- Career Recommendation System
- Learning Roadmap Generation
- Skill Gap Analysis
- Personalized Career Guidance

I. INTRODUCTION

In the modern digital era, career selection has become increasingly complex due to rapid technological advancements, changing industrial demands, and the emergence of new job roles. Students and job seekers often struggle to identify suitable career opportunities because they lack proper guidance regarding required skills, market trends, and future job demands. Most traditional recruitment platforms only provide job advertisements without analyzing the candidate's profile deeply or suggesting personalized improvement strategies.

Artificial Intelligence has transformed many industries by enabling intelligent decision-making systems. AI-based recommendation systems are now widely used in e-commerce, entertainment, healthcare, and education. Applying AI to career guidance can help users discover suitable job opportunities, identify skill gaps, and build structured learning paths.

This project proposes an AI Job & Skill Recommendation System using CrewAI, where multiple AI agents collaborate to analyze user data and generate intelligent recommendations. CrewAI is a multi-agent orchestration framework that allows autonomous agents to communicate and perform specialized tasks efficiently. In the proposed system, different agents are responsible for profile analysis, job matching, skill recommendation, trend analysis, and roadmap generation.

The system helps:

- Students choose suitable career paths
- Professionals upgrade their technical skills
- Recruiters identify suitable candidates
- Institutions provide better placement guidance

The proposed research combines AI, machine learning, Large Language Models (LLMs), and multi-agent collaboration to create a smarter and more adaptive career recommendation ecosystem.

II. LITERATURE REVIEW

[1] Job Recommendation through Progression of Job Selection

This paper presents a machine learning-based recommendation model that captures user preferences over time and improves recommendation accuracy using Bi-LSTM and attention mechanisms. The research addresses cold-start problems and personalized recommendation challenges in recruitment systems. The study demonstrates that

embedding-based recommendation approaches significantly improve matching efficiency.

[2] Job Recommendation System using Machine Learning

The authors developed a recommendation system that evaluates candidate suitability using regression, classification, and Natural Language Processing techniques. The system calculates a JobFit score to rank candidates according to employer requirements. This paper highlights the importance of machine learning in candidate-job matching processes.

[3] Intelligent Job Recommendation System based on Semantic Embeddings

This research introduces semantic embeddings and NLP-based similarity matching between resumes and job descriptions. The proposed system improves recommendation precision by understanding contextual relationships between skills and job roles.

[4] Unlocking AI Creativity: Multi-Agent Approach with CrewAI

This paper explains the architecture of CrewAI and demonstrates how multiple AI agents collaborate to solve complex tasks. The study proves that agent-based systems provide modularity, scalability, and efficient task management in AI applications.

[5] Exploration of LLM Multi-Agent Applications using LangGraph + CrewAI

This paper explores Large Language Model-based autonomous agents integrated with CrewAI. It highlights collaborative reasoning, workflow orchestration, and AI automation capabilities that can be applied to recommendation systems.

Research Gap:

Existing systems mainly focus on either job recommendation or resume screening. Most platforms lack:

- Personalized learning roadmaps
- Skill-gap analysis
- Multi-agent collaboration
- Real-time market trend analysis
- Career growth prediction

The proposed system addresses these limitations using CrewAI-based intelligent agents

III. SYSTEM OVERVIEW

Main Components

1. User Profile Agent

Collects and analyzes:

- Educational qualification
- Skills
- Interests
- Certifications
- Experience

2. Job Matching Agent

Matches user profiles with job requirements using AI and NLP techniques.

3. Skill Gap Analysis Agent

Identifies missing skills required for selected job roles.

4. Market Trend Analysis Agent

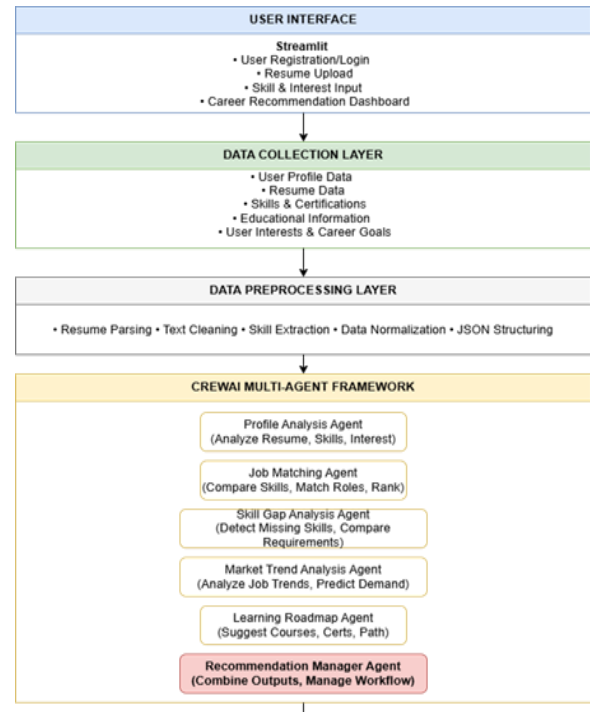
Analyzes current industry trends and future demand.

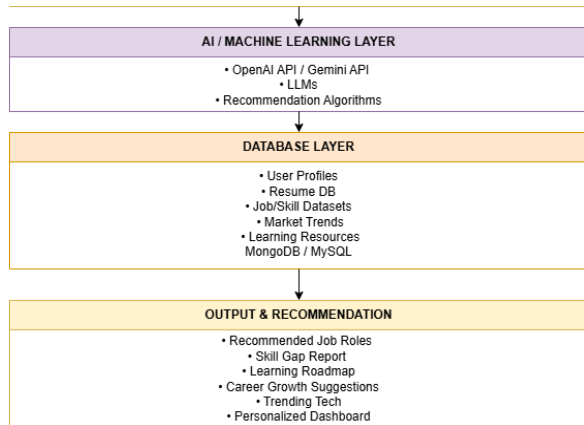
5. Learning Roadmap Agent

Generates personalized learning paths and certification suggestions.

6. Recommendation Manager Agent

Coordinates all agents using CrewAI workflow orchestration.





IV. METHODOLOGY AND IMPLEMENTATION

The proposed methodology follows a multi-agent AI workflow:

Step 1: Data Collection

The system collects user profile information including:

- Education
- Technical skills
- Interests
- Resume data

Step 2: Preprocessing

The collected data is cleaned, normalized, and converted into structured JSON format.

Step 3: AI-Based Profile Analysis

CrewAI agents analyze the profile and identify suitable career domains.

Step 4: Job Recommendation

The system compares user profiles with job databases using NLP similarity matching.

Step 5: Skill Gap Identification

The recommendation engine identifies missing technical and soft skills.

Step 6: Learning Roadmap Generation

The system suggests:

- Online courses
- Certifications
- Technologies to learn
- Career progression plans

Step 7: Output Generation

The final recommendation report is displayed through Streamlit or Flask UI.

V. TECHNOLOGY STACK

Component	Technology
Programming Language	Python
AI Framework	CrewAI
LLM API	OpenAI API / Gemini API
Frontend	Streamlit / Flask
Database	MongoDB / MySQL
Development Tools	VS Code, GitHub

Key Features of the Timetable Generation Workflow

- Recommends suitable job roles based on user profile, education, skills, and interests.
- Multiple AI agents collaborate using CrewAI for intelligent career guidance and recommendation generation.
- Identifies missing technical and soft skills required for selected job roles.
- Generates personalized learning roadmaps with suggested courses and certifications.
- Analyzes current industry trends and in-demand technologies for accurate career suggestions.
- Performs resume and profile analysis to extract important qualifications and skills.
- Uses Natural Language Processing (NLP) for intelligent job and skill matching.
- Provides an interactive and user-friendly dashboard for better user experience.
- Generates dynamic and personalized recommendations in real time.
- Supports scalable architecture for future integration with live job portals and APIs.

VI. RESULTS AND DISCUSSION

The proposed system is expected to:

- Provide accurate job recommendations
- Improve skill-gap analysis
- Generate personalized learning roadmaps
- Reduce confusion in career selection
- Increase employability of students
- Enhance AI-based counseling efficiency

VII. LIMITATIONS

- Incorrect or incomplete user profile data may reduce recommendation accuracy.

- The current system may not directly connect with live job portals or LinkedIn APIs.
- Recommendations depend on the quality of AI models and training data.
- CrewAI and LLM APIs require a stable internet connection and API access.
- Initial implementation may support only selected technical or professional domains.
- Large Language Model APIs may increase operational costs for large-scale usage.
- User resumes and personal information require secure storage and protection.
- The system currently focuses on job and skill recommendations, not interview performance analysis.
- Some skills and job roles may overlap, creating ambiguity in recommendations.
- If market trend data is outdated, recommendations may become less effective.

VIII. FUTURE SCOPE

Future enhancements may include:

- LinkedIn API integration
- Real-time job portal connectivity
- Resume ranking system
- AI interview preparation assistant
- Voice-enabled AI counselor
- Predictive salary analysis
- Mobile application support

IX. CONCLUSION

The AI Job & Skill Recommendation System using CrewAI presents an innovative approach for intelligent career guidance using multi-agent artificial intelligence. By combining AI recommendation systems, NLP, LLMs, and CrewAI orchestration, the proposed framework provides accurate job matching, skill-gap identification, and personalized learning roadmaps.

The system improves decision-making for students and job seekers while reducing dependency on traditional static job portals. The research demonstrates the effectiveness of multi-agent AI collaboration in recommendation systems and opens opportunities for future AI-powered educational and recruitment platforms.

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