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CareerAI: An Intelligent Career Guidance Platform Leveraging AI, ML and NLP

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ABSTRACT: CareerAI is an AI-driven career guidance platform that bridges the gap between academic learning and industry demands. It uses machine learning and natural language processing to match resumes with job descriptions (via TF-IDF and cosine similarity) and compute a Job Readiness Score. The system includes an ATS-friendly resume builder, a career guidance chatbot, a job recommendation engine, and text-to-speech support for accessibility. In a pilot study with 100 users, CareerAI increased the average resume score from 48% to 76%, significantly improving ATS compatibility. These results demonstrate CareerAI's potential to personalize career advice and enhance resume quality.

I. INTRODUCTION

The transition from education to employment has become challenging due to a mismatch between academic knowledge and industry expectations. While institutions focus on theory, employers demand practical skills, leading to difficulties for graduates in securing jobs. Poor resume quality and lack of ATS optimization further contribute to rejections.

Existing career guidance platforms are often generic and fail to provide personalized recommendations based on individual skills and goals. This limits awareness of industry trends, required skills, and effective preparation strategies. To overcome these issues, this paper proposes CareerAI, a web-based AI-driven platform that offers personalized career guidance. It integrates ML and NLP to analyze resumes, identify skill gaps, and provide actionable recommendations. The platform combines resume analysis, mentorship, job suggestions, and learning resources into a single system.

Developed using Django MVT architecture, CareerAI ensures modularity and scalability. Overall, it aims to bridge the gap between academia and industry, enhance resume quality, and support data-driven career decisions through continuous and personalized guidance.

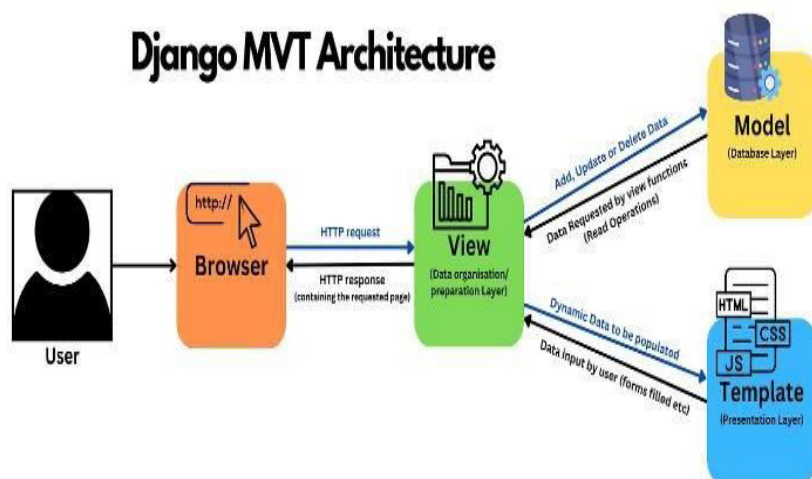


Fig. 1. Django MVT Architecture



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II. LITERATURE SURVEY

The integration of Artificial Intelligence (AI) in career guidance and recruitment has gained significant attention, with Machine Learning (ML) and Natural Language Processing (NLP) improving resume screening, job matching, and personalized recommendations.

S. Westman et al. [1] emphasized the need for personalized and adaptive career systems, noting that traditional methods fail to meet dynamic job market demands. They also highlighted concerns like data privacy and algorithmic bias.

Sudheer Devaraju [2] focused on NLP in recruitment, showing how techniques like tokenization, stop-word removal, and keyword extraction convert unstructured resumes into structured data for automated decisions.

Faruque et al. [3] developed an NLP-based career prediction system for computer science students using skills, interests, and academic data, but lacked real-time feedback and interaction.

Kulugh et al. [4] proposed a personalized AI career system using user profiling and recommendations, improving user satisfaction but missing resume optimization and ATS compatibility.

Nandi et al. [8] proposed *Sankalp*, an AI-powered career guidance system that provides personalized career recommendations but lacks resume analysis, ATS optimization, and resume-job matching.

However, existing systems still face key limitations: lack of end-to-end integration, poor ATS optimization, absence of real-time guidance, and limited accessibility. To overcome these issues, CareerAI integrates NLP-based resume analysis, ML-based matching, chatbot mentorship, and ATS-friendly resume generation into a unified platform, providing a complete AI-driven career guidance solution.

III. PROPOSED METHODOLOGY

CareerAI is a scalable, modular career guidance platform that integrates Machine Learning (ML) and Natural Language Processing (NLP) within a web-based system.

3.1 System Architecture Overview

The system uses the Django Model-View-Template (MVT) architecture:

Model Layer: Handles data (users, resumes, jobs, skills)

View Layer: Contains logic (analysis, chatbot, recommendations)

Template Layer: Manages UI (HTML, CSS, JavaScript)

This structure ensures modularity and scalability.

3.2 Data Collection and Preprocessing

Data sources include resumes (PDF), job descriptions, and user profiles.

Text extraction is done using PDFPlumber, followed by NLP preprocessing:

Tokenization -> Stop-word removal -> Normalization -> Keyword extraction

This prepares clean and structured data for analysis.

3.3 TF-IDF Vectorization

TF-IDF converts text into numerical vectors by assigning importance to words:

$$TF\text{-}IDF(t, d) = TF(t, d) \times IDF(t)$$

It helps represent resumes and job descriptions for comparison.

3.4 Cosine Similarity for Resume Matching

$$\cos(\theta) = \frac{A \cdot B}{\|A\| \|B\|}$$

1 → Perfect match

0 → No match

This is converted into a **Job Readiness Score (%)**.



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Doc 3	$\frac{1}{5}$	0	0	0	0	0	0	0	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$

Fig. 2. TF-IDF Based Resume Matching

3.5 Resume Analysis and Skill Gap Identification

The system performs:

Keyword matching Skill gap identification

Personalized recommendations

This provides actionable insights to improve employability.

3.6 ATS-Friendly Resume Builder

Generates structured resumes using templates and converts them to PDF via xhtml2pdf.

Features:

ATS-compatible formatting Keyword optimization Professional layout

3.7 Intelligent Career Chatbot

A rule-based NLP chatbot provides:

Career guidance Learning roadmaps Interview tips Project suggestions

It also uses gTTS for voice feedback to improve accessibility.



Fig. 3. AI Resume Builder Workflow

3.8 Job and Event Recommendation Engine

Provides recommendations for:

Jobs and internships Hackathons and events

Based on skills:

Resume analysis Career interests



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3.9 System Workflow Summary

1. User uploads resume
2. Text is extracted and preprocessed
3. TF-IDF vectorization is applied
4. Cosine Similarity computes match score
5. Skill gaps and recommendations are generated
6. Chatbot provides guidance
7. Resume is optimized if needed
8. Relevant jobs and opportunities are suggested

IV. SYSTEM ARCHITECTURE

CareerAI is a modular, scalable platform integrating AI components within a Django MVT-based web architecture, ensuring separation of concerns and extensibility.

4.1 Architectural Overview

The system consists of three layers:

1. Presentation Layer (Frontend)

Built using HTML, CSS, and JavaScript. Provides interfaces for resume upload, builder, chatbot, and job/event dashboards.

2. Application Layer (Backend)

Implemented in Django.

Handles authentication, resume analysis, chatbot logic, and ML/NLP integration.

3. Data Layer (Database)

Uses SQLite (development) and PostgreSQL (production).

Stores users, resumes, jobs, skills, and interaction data.

4.2 Core Modules and Their Interactions

- **Authentication & User Management** Manages registration, login, password security, and user profiles.
- **AI Resume Analyzer**
Performs PDF text extraction, NLP preprocessing, TF-IDF, and cosine similarity.
Outputs match score, skill gaps, and improvement suggestions.
- **ATS Resume Builder**
Creates structured resumes using templates and generates ATS-friendly PDFs via xhtml2pdf.
- **Intelligent Career Chatbot**
Provides real-time guidance, roadmaps, and interview tips using NLP.
Includes gTTS for voice feedback.
- **Job & Event Recommendation Module** Suggests jobs, internships, and events based on skills, analysis, and preferences.

4.3 Module Interaction Flow

1. User logs in
2. Uploads or builds resume
3. Resume analyzer computes match score
4. Skill gaps and suggestions are generated
5. Chatbot provides guidance
6. Recommendations are displayed
7. Resume is updated
8. Process repeats for improvement

4.4 Scalability and Design Considerations

The system supports scalability through modular design, separation of AI logic, database optimization, and cloud readiness. Future AI integrations can be added easily.



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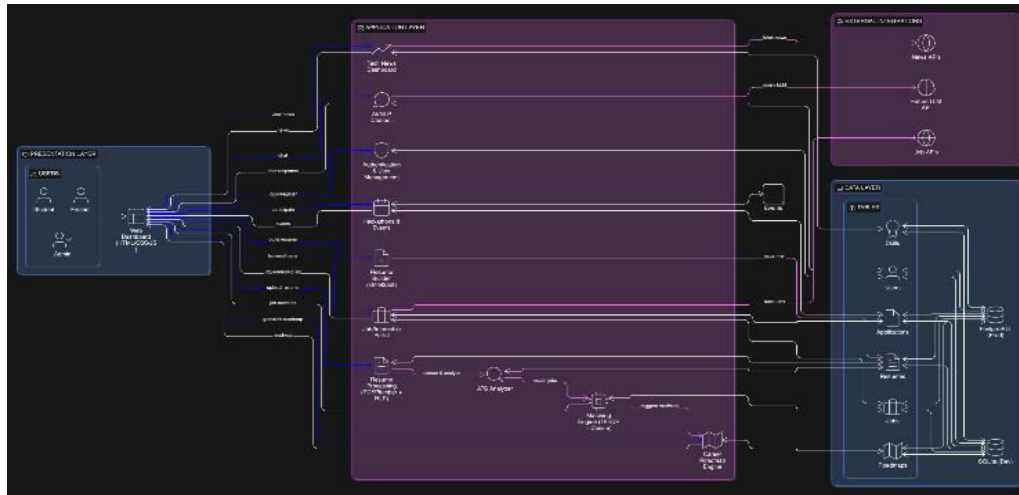


Fig. 4. Platform Workflow Blue Print

V. RESULTS AND EXPERIMENTAL ANALYSIS

An experimental study with 100 students evaluated improvements in resume quality and job readiness.

5.1 Experimental Setup

Sample: 100 participants

Duration: 2 weeks

Metrics: Match score, ATS score, confidence, skill gaps

Process: Upload → Analyze → Improve → Re-evaluate

5.2 Performance Metrics

1. Resume Match Score

Before: 48%

After: 76%

Improvement: +28%

2. ATS Compatibility

Pass Rate: 45% → 82%

Keyword Optimization: Low → High Formatting: Moderate → High

3. Skill Gap Reduction

Missing skills reduced Relevant skills increased

4. Interview Confidence

Confidence: 5/10 → 8/10 Preparedness improved

5.3 System Performance Evaluation

Response Time: < 2 seconds Matching Accuracy: High Scalability: Efficient

5.4 Discussion

CareerAI significantly improves resume quality, ATS performance, skill identification, and user confidence. The integration of ML and NLP enables accurate, personalized, and data-driven career guidance, effectively bridging the gap between academia and industry.



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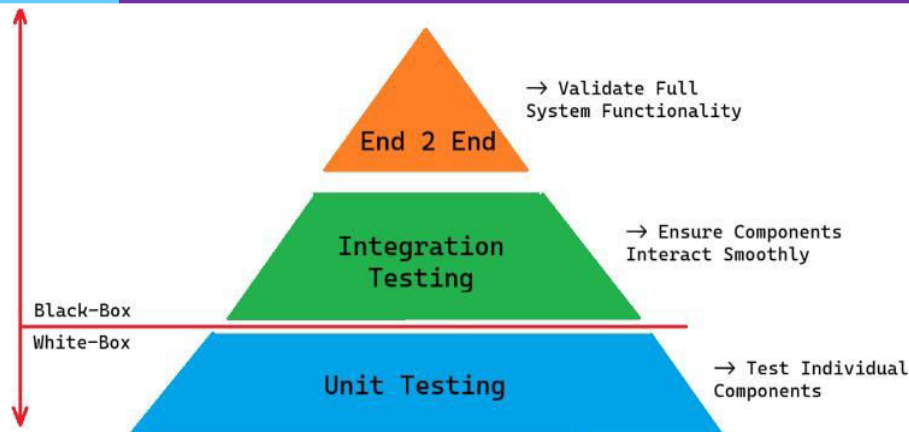


Fig. 5. Testing Pyramid

VI. CONCLUSION AND FUTURE WORK

6.1 Conclusion

CareerAI is an AI-driven career guidance platform that integrates Machine Learning (ML) and Natural Language Processing (NLP) to provide personalized career guidance, resume analysis, and skill development. Using TF-IDF and Cosine Similarity, the system evaluates resume-job compatibility through a Job Readiness Score, improving ATS compatibility and employability. Experimental results demonstrate improvements in resume quality, skill identification, and interview readiness. The Django MVT-based architecture ensures scalability and maintainability, making CareerAI an effective solution for bridging the gap between academia and industry.

6.2 Future Work

Future enhancements can further strengthen the system's intelligence and applicability:

Deep Learning Integration: Incorporate transformer-based models (e.g., BERT) for context-aware semantic matching.

Adaptive Learning System: Recommend courses dynamically and track user progress.

Mobile Application: Improve accessibility with real-time notifications and mobile support.

Job Market Analytics: Integrate live data to identify trending skills and demand patterns.

Behavior-Based Personalization: Enhance recommendations using user interaction data.

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