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AI-Powered Resume Enhancer and Job Role Recommendation System

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Abstract: *In the contemporary recruitment landscape, resumes function as the primary interface between candidates and potential employers. However, the widespread adoption of Applicant Tracking Systems (ATS) has significantly transformed the screening process, resulting in the automated rejection of a substantial proportion of resumes prior to human evaluation. These rejections are predominantly attributed to suboptimal formatting, insufficient keyword alignment, and lack of structural standardization, thereby excluding numerous qualified candidates at the preliminary stage.*

This research proposes an AI-Powered Resume Enhancer and Job Role Recommendation System that utilizes prompt engineering techniques in conjunction with advanced generative AI models to enhance resume quality and improve ATS compatibility. Unlike traditional approaches that rely on predefined rule-based systems, the proposed model leverages structured prompt design to guide the behavior of large language models accessed via the OpenRouter AI framework. The system performs semantic analysis of resume content, followed by contextual enhancement of grammar, formatting, and domain-specific keyword integration.

Furthermore, the system incorporates prompt-driven evaluation mechanisms to estimate ATS scores and determine job role suitability based on extracted skills, experience, and contextual relevance. The architecture is designed to simulate real-world recruitment workflows by integrating resume refinement, intelligent feedback generation, and role-based recommendation processes within a unified platform.

The proposed approach emphasizes flexibility, adaptability, and domain independence, as prompt engineering enables dynamic modification of system behavior without requiring retraining of models. Experimental usage indicates that the system effectively improves resume readability, keyword relevance, and structural coherence, thereby increasing the likelihood of passing automated screening stages. Overall, the system presents a scalable and efficient solution that bridges the gap between candidate profiles and industry requirements through AI-assisted optimization.

Keywords: Prompt Engineering, Resume Enhancement, Applicant Tracking System (ATS), Generative AI, OpenRouter AI, Natural Language Processing, Job Role Recommendation, Resume Optimization

I. INTRODUCTION

In recent years, the recruitment process has undergone a significant transformation with the integration of automated screening systems, particularly Applicant Tracking Systems (ATS). These systems are designed to handle large volumes of job applications by filtering and ranking resumes based on predefined criteria such as keyword relevance, formatting consistency, and structural organization. While ATS improves efficiency for recruiters, it simultaneously introduces a critical challenge for job seekers, as resumes that do not conform to system-specific expectations are often rejected before manual evaluation.

A major issue in this context is the lack of awareness and technical understanding among candidates regarding ATS optimization techniques. Resumes frequently fail to meet required standards due to improper formatting, absence of domain-specific keywords, and unstructured content representation. Consequently, even candidates with relevant

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qualifications and skills may be excluded during the initial screening phase. This creates a disconnect between candidate capabilities and recruitment outcomes, thereby reducing the overall effectiveness of the hiring process.

Additionally, the process of manually refining resumes to align with job descriptions and industry expectations is both time-consuming and inconsistent. Candidates often rely on generic templates or trial-and-error approaches, which do not guarantee improved performance in ATS-based evaluations. On the other hand, recruiters face challenges in accurately mapping candidate profiles to suitable job roles due to the variability in resume formats and content representation.

To address these challenges, this research proposes an AI-assisted system that utilizes **prompt engineering techniques** in conjunction with large language models accessed through the OpenRouter AI framework. Instead of relying on traditional rule-based or model-training approaches, the system is designed to dynamically process and enhance resume content by leveraging carefully structured prompts. These prompts guide the generative AI model to perform tasks such as contextual text refinement, keyword augmentation, structural reorganization, and semantic alignment with job-specific requirements.

The system also incorporates prompt-driven mechanisms for estimating ATS scores and recommending suitable job roles based on extracted candidate attributes, including skills, experience, and educational background. By simulating evaluation criteria commonly used in automated recruitment systems, the model provides users with actionable insights into resume performance and areas of improvement.

The primary objective of this work is to develop a scalable and intelligent platform that enhances resume quality, improves ATS compatibility, and facilitates effective job role recommendation without requiring complex model training pipelines. By leveraging the flexibility of prompt engineering, the system enables adaptive behavior across different domains and job profiles, making it a practical and efficient solution for modern recruitment challenges.

II. TECHNIQUES

A. Requirement Analysis

Requirement analysis is a foundational phase in the design and development of the proposed system, as it defines the functional capabilities and operational constraints necessary to achieve efficient resume enhancement and job recommendation. The primary objective of the system is to improve resume quality in alignment with Applicant Tracking System (ATS) standards while providing intelligent assistance in career decision-making.

From a functional perspective, the system must support resume ingestion in **PDF and TXT formats**, along with the ability to upload corresponding job descriptions for comparative analysis. It should be capable of extracting and interpreting key components of both documents, including skills, qualifications, project experience, and domain-specific terminology. The system must perform multiple operations such as resume enhancement, ATS score estimation, job role recommendation, skill gap identification, and bullet point generation.

A critical requirement of the system is the implementation of **skill gap analysis**, where the resume content is compared against the uploaded job description to identify missing or insufficient skills. The system must also provide actionable recommendations by suggesting relevant learning resources or courses to bridge these gaps. Additionally, the **bullet point generation module** should generate concise, ATS-friendly project descriptions based on user-provided project titles and summaries.

From a system-level perspective, the application must include a secure **user authentication mechanism**, allowing users to create accounts and access personalized data. The integration of a **SQLite database** is essential for storing user information, resumes, and job descriptions, as well as enabling retrieval of previously saved data.

Non-functional requirements include system scalability, low latency in AI response generation, data privacy, and ease of use. The system should be adaptable across multiple domains without requiring structural modifications, which is facilitated through prompt engineering techniques.

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B. Software Requirement Specification

The proposed system is implemented using a combination of modern programming tools and AI frameworks that enable efficient processing and enhancement of textual data.

The backend is developed using **Python**, which provides flexibility and extensive support for text processing and API integration. The user interface is built using **Streamlit**, allowing the development of an interactive and responsive web-based application for uploading resumes, job descriptions, and viewing results.

The core intelligence of the system is driven by **OpenRouter AI**, which provides access to advanced generative language models. Instead of relying on traditional model training, the system utilizes **prompt engineering techniques** to guide the behavior of these models for tasks such as resume enhancement, ATS evaluation, skill gap analysis, and job role recommendation.

For data storage and management, the system integrates a **SQLite database**, which is used to store user credentials, uploaded resumes, job descriptions, and generated outputs. This enables persistent data storage and retrieval, allowing users to access previously saved records.

Text extraction from uploaded documents is handled using appropriate Python libraries, ensuring accurate parsing of both PDF and TXT formats. The system architecture is designed to efficiently manage data flow between the user interface, database, and AI processing modules.

C. Proposed Methodology

The proposed system follows a structured and multi-stage methodology that integrates prompt-driven AI processing with database management to deliver comprehensive resume enhancement and job recommendation functionalities.

The process begins with **user authentication**, where users log in to the system to access personalized features. Once authenticated, users can upload resumes (in PDF or TXT format) and corresponding job descriptions through the web interface. The system also provides an option to retrieve previously stored documents from the SQLite database.

In the next stage, **data preprocessing** is performed to extract textual content from the uploaded documents. This involves parsing the resume and job description, removing unnecessary formatting elements, and structuring the content into meaningful segments such as skills, experience, and project details.

The core processing stage involves **prompt-engineered AI interaction**, where carefully designed prompts are used to guide the OpenRouter AI model. These prompts instruct the model to perform multiple tasks, including:

- **Resume Enhancement:** Improving grammar, sentence structure, readability, and keyword alignment
- **ATS Score Estimation:** Evaluating the resume based on formatting, keyword relevance, and structural completeness
- **Job Role Recommendation:** Mapping extracted skills and experience to suitable job roles
- **Skill Gap Analysis:** Comparing resume content with job description to identify missing skills and suggest improvement areas
- **Course Recommendation:** Providing relevant learning resources to address identified skill gaps
- **Bullet Point Generation:** Generating ATS-friendly project descriptions based on project title and input details

Each of these tasks is executed through specifically designed prompts that ensure context-aware and accurate outputs without requiring separate model training.

The final stage involves **output generation and presentation**, where the system displays the enhanced resume, ATS score, recommended job roles, identified skill gaps, and generated bullet points. Users can review these outputs and make iterative improvements as needed.

This methodology ensures a cohesive integration of AI capabilities with user interaction and data management, resulting in a flexible, scalable, and efficient system for resume optimization and career guidance.

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III. ARCHITECTURE

The architecture of the proposed **AI-Powered Resume Enhancer and Job Role Recommendation System** is designed using a modular, layered approach to ensure scalability, flexibility, and efficient data processing. The system integrates prompt engineering techniques with generative AI models through the OpenRouter framework to perform multiple resume optimization and job recommendation tasks within a unified workflow.

The architecture consists of several interconnected layers, each responsible for a specific functionality in the overall system pipeline. These layers collectively facilitate data acquisition, processing, enhancement, analysis, and output generation.

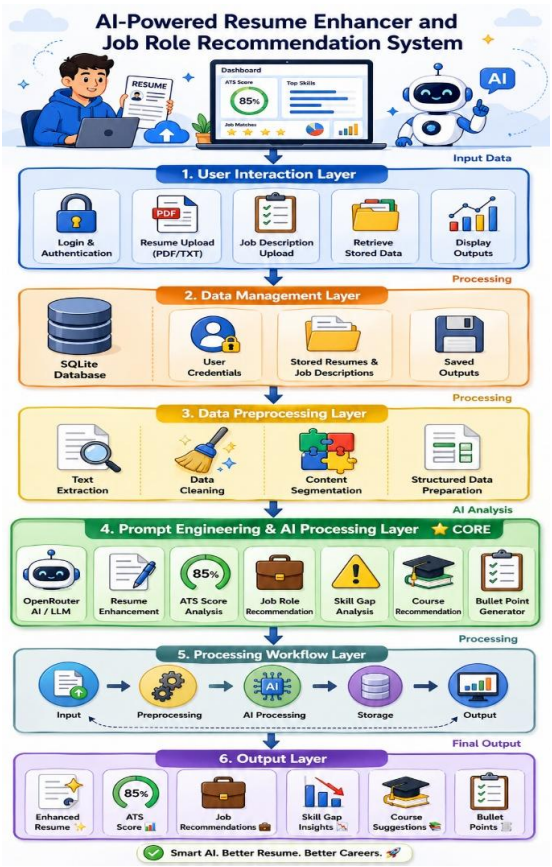

Fig 1 Architecture of the AI-Powered Resume Enhancer and Job Role Recommendation System

The proposed architecture consists of the following major layers:

A. User Interaction Layer

The User Interaction Layer acts as the interface between the end user and the system. It is implemented using a web-based environment that enables users to interact with the system seamlessly.

This layer supports functionalities such as:

- User registration and login authentication
- Resume upload in PDF and TXT formats
- Job description upload for comparative analysis
- Retrieval of previously stored resumes and job descriptions from the database
- Display of generated outputs including enhanced resumes, ATS scores, and recommendations

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The interface is designed to be intuitive and user-friendly, ensuring accessibility for users with minimal technical expertise while maintaining efficient navigation across different modules.

B. Data Management Layer

The Data Management Layer is responsible for storing, retrieving, and managing user-related data and uploaded documents. This layer is implemented using a **SQLite database**, which provides lightweight yet efficient data storage capabilities.

The database maintains:

- User credentials for authentication
- Uploaded resumes and job descriptions
- Previously generated outputs and processed results

This layer ensures persistent data storage, enabling users to access and reuse previously uploaded documents without the need for repeated uploads. It also plays a critical role in maintaining data integrity and supporting system continuity across sessions.

C. Data Preprocessing Layer

The Data Preprocessing Layer handles the extraction and structuring of textual content from uploaded resumes and job descriptions. Since resumes may be uploaded in PDF or TXT formats, this layer ensures consistent processing irrespective of input format.

- The key operations performed in this layer include:
- Text extraction from documents
- Removal of formatting inconsistencies and noise
- Segmentation of content into meaningful components such as skills, experience, and education
- Preparation of structured input for AI-based processing

This layer acts as a bridge between raw input data and the AI processing modules, ensuring that the extracted content is clean, organized, and suitable for further analysis.

D. Prompt Engineering and AI Processing Layer

This layer forms the core intelligence of the system and is responsible for performing all major analytical and enhancement tasks. It utilizes **OpenRouter AI** to access generative language models and applies **prompt engineering techniques** to control and guide model outputs.

Instead of relying on pre-trained task-specific models, the system uses carefully designed prompts to dynamically instruct the AI model to perform various operations, including:

- **Resume Enhancement:** Refinement of grammar, sentence structure, and formatting, along with contextual keyword optimization
- **ATS Score Estimation:** Evaluation of resume quality based on relevance, structure, and completeness
- **Job Role Recommendation:** Identification of suitable job roles by analyzing extracted skills and experience
- **Skill Gap Analysis:** Comparison between resume content and uploaded job description to identify missing skills
- **Course Recommendation:** Suggestion of relevant learning resources to address identified skill gaps
- **Bullet Point Generation:** Creation of concise, ATS-friendly project descriptions based on user-provided inputs

The use of prompt engineering provides flexibility, as system behavior can be modified by altering prompt structures without requiring model retraining. This significantly enhances adaptability across different domains and job roles.

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E. Processing Workflow and Integration Layer

The Processing Workflow Layer manages the sequential execution of system operations and ensures smooth data flow between different modules.

The workflow follows these steps:

- User uploads resume and job description
- Data preprocessing extracts and structures content
- Prompt-engineered AI processing performs enhancement and analysis
- Results are generated and stored in the database
- Outputs are displayed to the user

This layer ensures synchronization between input processing, AI execution, and output delivery, maintaining consistency and efficiency throughout the system.

F. Output Layer

The Output Layer is responsible for presenting the final results generated by the system in a clear and interpretable format. This includes:

- Enhanced resume content
- Estimated ATS score with qualitative feedback
- Recommended job roles based on profile analysis
- Identified skill gaps along with improvement suggestions
- Suggested courses for skill enhancement
- Generated ATS-friendly bullet points for projects

The outputs are displayed through the user interface, allowing users to review, analyze, and iteratively refine their resumes. This layer plays a crucial role in delivering actionable insights that directly contribute to improved job application success.

Architecture Workflow Summary

The overall system workflow can be summarized as follows:

- The user logs into the system and uploads a resume along with a job description
- The system preprocesses the uploaded documents to extract structured content
- Prompt-engineered AI modules analyze and enhance the resume
- ATS score, job recommendations, skill gaps, and bullet points are generated
- Results are stored in the database and presented to the user

This architecture ensures a seamless integration of user interaction, data management, and AI-driven processing, resulting in an efficient and scalable system for resume enhancement and career guidance.

IV. OVERVIEW OF THE SYSTEM

A. Information Gathering

The system collects resumes (PDF/TXT) and job descriptions from authenticated users and retrieves previously stored data using a SQLite database [1].

B. Identifying Key Factors

Key features such as skills, education, and experience are extracted, and keyword alignment with job descriptions is analyzed to identify missing competencies [2].

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C. AI-Based Processing and Optimization

Prompt engineering with generative AI models via OpenRouter is used for resume enhancement, ATS scoring, job role recommendation, skill gap analysis, and bullet generation [3].

D. Decision Support and Output Generation

The system generates enhanced resumes, ATS scores, job recommendations, and skill improvement suggestions, which are displayed to users for iterative refinement [4].

V. RESULTS OF EXPERIMENTS

A. Objective of Experiments

The objective of the experiments is to evaluate the effectiveness of the system in improving resume quality, enhancing ATS compatibility, and generating relevant job role recommendations using prompt-engineered AI processing [4].

B. Input Processing and Validation

The system was tested using multiple resumes in PDF and TXT formats along with corresponding job descriptions. The preprocessing module successfully extracted and structured textual content for further analysis without significant data loss.

C. Resume Enhancement Performance

The AI-driven enhancement module improved grammar, formatting, and keyword alignment of resumes. The enhanced outputs were observed to be more structured and ATS-compliant, which aligns with findings in AI-based text optimization systems [3].

D. ATS Score Evaluation

The system generated ATS scores based on keyword relevance, structural organization, and content completeness. Improved scores were observed after enhancement, indicating better alignment with automated screening criteria [4].

E. Job Role Recommendation Results

The system successfully recommended job roles based on extracted skills and experience. The recommendations were contextually relevant and aligned with the candidate profile and job description.

F. Skill Gap Analysis Results

The system effectively identified missing skills by comparing resume content with job descriptions and provided appropriate course suggestions. This aligns with NLP-based approaches for semantic comparison and information extraction [2].

G. Bullet Point Generation Output

The bullet generation module produced concise and ATS-friendly project descriptions based on user inputs. These outputs improved clarity and strengthened the presentation of project experience in resumes.

H. System Performance and Usability

The system demonstrated efficient performance with minimal response delay in AI processing. The integration of authentication and database storage improved usability by enabling secure access and retrieval of previously processed data [1].

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VI. CRITICAL ANALYSIS

A. Dependency on Prompt Quality

System performance depends heavily on prompt design, as output accuracy is directly influenced by the structure and clarity of prompts provided to the AI model [3].

B. Non-Deterministic Outputs

The generative nature of the system may produce varying results for similar inputs, affecting consistency in ATS scoring and recommendations.

C. Input Quality Sensitivity

The effectiveness of enhancement and analysis depends on the completeness and clarity of the uploaded resume and job description [2].

D. Data Privacy Concerns

Processing and storing sensitive resume data requires secure handling to prevent potential privacy risks [1].

VII. SUGGESTIONS FOR FURTHER RESEARCH

A. Integration with Job Portals

The system can be enhanced by integrating with real-time job portals to provide live job recommendations and direct application support.

B. Advanced Personalization

Future improvements can include personalized recommendations based on user preferences, career goals, and historical data.

C. Multilingual Support

The system can be extended to support multiple languages, enabling wider accessibility for users from different regions.

D. Enhanced Skill Recommendation

More advanced course and certification suggestions can be integrated to provide structured learning paths for skill development.

VIII. CONCLUSION

The proposed **AI-Powered Resume Enhancer and Job Role Recommendation System** present an efficient and practical solution to challenges in modern recruitment processes. By leveraging prompt engineering techniques with generative AI, the system enhances resume quality, improves ATS compatibility, and provides relevant job role recommendations without requiring complex model training.

The integration of features such as skill gap analysis, course suggestion, and ATS-friendly bullet generation enables users to better align their profiles with industry requirements. Additionally, the inclusion of authentication and database support ensures a structured and user-centric workflow.

Overall, the system demonstrates how AI-assisted approaches can simplify resume optimization, support informed career decisions, and improve the chances of successful job applications.

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