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WEB- BASED SMART SKILLS AND JOB ROLE MAPPING SYSTEM USING DATA SCIENCE AND MACHINE LEARNING

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Abstract:
This paper presents a Web-Based Smart Skills and Job Role Mapping System that employs TF-IDF vectorization and Cosine Similarity to compute high-dimensional similarity scores between user skill vectors and job-role embeddings. A hybrid recommendation strategy integrates rule-based filtering for constraint-aware refinement. The backend architecture, implemented using Flask APIs, interfaces with a Streamlit-based frontend for real-time inference and visualization. The system additionally performs gap detection, dynamically generating task-oriented learning roadmaps backed by structured datasets. A dashboard module facilitates longitudinal progress tracking through analytical metrics. Experimental evaluation demonstrates low-latency inference and scalable deployment potential for AI-driven career guidance platforms.

Keywords: Skill Embedding, Cosine Similarity, Hybrid Recommendation, Flask API, Web-Based Career Guidance.

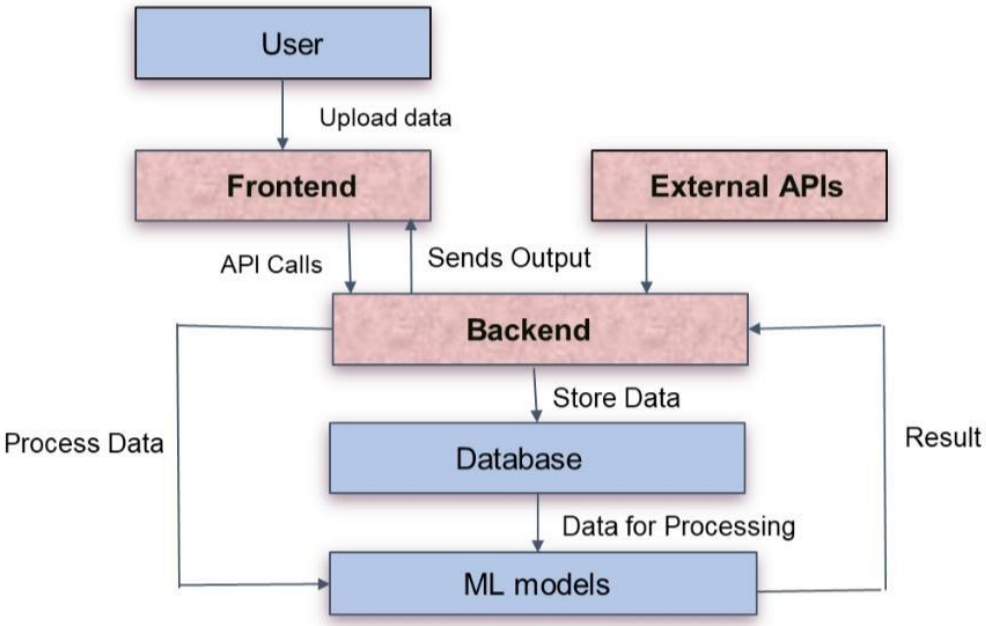
Introduction

In the dynamic job landscape, individuals frequently encounter challenges in aligning their existing competencies with relevant career opportunities. To address this, the Web-Based Smart Skills and Job Role Mapping System employs data-driven algorithms to recommend suitable job roles, identify corresponding skill gaps, generate structured upskilling pathways, and present progress insights through an interactive dashboard, thereby enhancing employability and enabling continuous professional development.

Proposed System

The proposed system architecture consists of The Frontend collects user skills and job preferences, while the Backend employs matching algorithms to recommend job roles and identify skill gaps. A centralized database stores user profiles and learning progress. The Visualization Module delivers real-time dashboards, enabling interactive monitoring of the upskilling journey.

The System Architecture Diagram:



Literature Review

It redefines the job-seeking experience by providing users with highly personalized and relevant job recommendations. The integration of collaborative filtering, deep learning, and adaptive learning techniques ensures precision in matching users with suitable opportunities [1]

By using the candidates' job preferences and profiles, the system could provide personalized job recommendations that enhanced the effectiveness of the job search process. [2]

This job Recommendation System has considered many parameters like marks, experience, skill etc. It allows the use of a variety of recommendation methods according to the preferences of the job recommender system designer. [3]

The main objective of this project is to recommend a suitable job for the candidates. This project has two pre-processing methods, one text mining method and one similarity function. [4]

Methodology

The proposed methodology follows a four-stage pipeline comprising data acquisition, preprocessing, similarity modeling, and system deployment. Job-role datasets containing skill requirements are collected from verified sources such as Kaggle and O*NET. Preprocessing operations, including text normalization, duplicate resolution, and synonym mapping, are applied to ensure terminological consistency. Skill descriptors are then transformed into numerical vectors using Term Frequency–Inverse Document Frequency (TF-IDF). Cosine Similarity is employed to compute relevance scores between user skill profiles and job-role embeddings, while a rule-based refinement layer filters outputs based on domain-specific constraints and prerequisite skills. The system backend is implemented using Flask REST APIs, interfaced with a Streamlit frontend for real-time interaction. A task generation module decomposes

missing skills into structured learning objectives. Progress is continuously monitored through an analytics-driven dashboard.

Research Gaps

Despite the increasing development of job recommendation and skill mapping systems, several gaps exist in the current research and implementations:

1. **Limited Semantic Understanding of Skills:**
   Most existing systems, including this project, rely on vector-based similarity measures (e.g., Cosine Similarity), which do not capture the deeper semantic relationships between skills or the contextual meaning of job descriptions.
2. **Static and Domain-Limited Datasets:**
   Many systems use pre-collected or static datasets, which may not reflect rapidly evolving industry requirements. Additionally, existing datasets often focus primarily on IT or technical domains, leaving non-technical roles underrepresented.
3. **Lack of Integration with Learning Platforms:**
   Current solutions rarely provide direct links to learning resources or real-time tracking of completed courses, which limits actionable guidance for users.
4. **Minimal Personalization:**
   Most job-role recommendation systems do not adapt dynamically based on user behavior, feedback, or career progression, reducing long-term engagement and effectiveness.
5. **Limited Scalability and Multi-Platform Accessibility:**
   Many systems are either desktop-based or single-platform web applications, which restricts accessibility for users across devices and locations.

Future Scope

To address these research gaps, the future scope of this project includes:

1. **Dynamic and Real-Time Data Integration:**
   Continuously fetch data from **Naukri and online learning platforms** to keep skill and job-role datasets updated and relevant.
2. **Integration with Learning Platforms:**
   Connect the system with platforms like **Coursera, Udemy, or LinkedIn Learning APIs** to track progress automatically and suggest tailored courses for missing skills.
3. **Expansion Across Domains:**
   Include **non-technical fields** such as management, healthcare, and creative industries to broaden applicability.
4. **Enhanced Personalization:**
   Implement **user feedback loops and AI-driven adaptive recommendations** to personalize the system for long-term career growth.
5. **Mobile Application Development:**
   Develop a **cross-platform mobile app** for enhanced accessibility and on-the-go skill tracking.

Conclusion

The Web-Based Smart Skills and Job Role Mapping System offers an intelligent, data-driven solution for personalized career guidance. By using machine learning, it recommends suitable job roles, identifies missing skills, and generates to-do lists for improvement. Its interactive dashboard helps users track progress and skill gaps effectively. Testing shows high accuracy, validating its approach. Though currently focused on technical fields, its scalable design allows future expansion. Overall, it empowers users to make informed career choices and enhance employability through continuous learning.

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