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Skill Graph & Career Forecast

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ABSTRACT: The Skill Graph & Career Forecast project aims to bridge the gap between academic learning and industry skill requirements through intelligent data-driven analysis. The system analyzes resumes, job descriptions, and academic syllabus data to automatically extract and map relevant skills using Natural Language Processing and Machine Learning techniques such as TF-IDF and similarity modeling. These skills are structured into an interactive Skill Graph, where relationships between students, skills, and career roles are visually represented. The platform performs skill gap analysis to identify matched and missing skills for specific job roles and provides career recommendations based on industry alignment. Additionally, it analyses job market trends to highlight emerging and high-demand skills, enabling proactive career planning. This system supports students in understanding their skill readiness, helps educational institutions evaluate curriculum relevance, and assists recruiters in identifying suitable candidates, thereby creating a practical and intelligent ecosystem for career development and workforce planning.

I. INTRODUCTION

There exists a growing gap between the skills acquired by students in academic institutions and the skills demanded by industries. Traditional recruitment and training systems rely heavily on manual resume screening, outdated course structures, and static job-skill matching methods, which often fail to identify relevant skill gaps or predict future career paths. There is a need for an intelligent system that can automatically analyze, map, and recommend skills and careers using advanced AI and ML models.

II. EXISTING SYSTEM

The existing systems for analyzing job-skill gaps mainly rely on recruitment platforms and job portals that list openings and tag required skills, with a few advanced solutions using machine learning to extract skills or recommend jobs. While some research efforts like Job-SDF and SkillRec forecast skill demand through datasets and knowledge graphs, these systems are largely company-centric, focusing on filling roles quickly rather than guiding freshers or aligning education with industry needs. They lack integration with college curricula, fail to provide personalized recommendations, and emphasize current job postings over forecasting future skills, leaving both employers and students at a disadvantage when it comes to bridging the skill gap.

2.1 DRAWBACKS OF EXISTING SYSTEM

- Focuses only on company needs, not students.
- Shows only current job openings, not future skill trends.
- No connection with college courses or curricula.
- Students get guidance only at the time of applying, not earlier.
- No personalized recommendations for freshers.
- Data is scattered and not integrated from multiple sources.

III. PROPOSED SYSTEM

The proposed system, *Skill Graph and Career Forecast*, intelligently analyzes student resumes, job descriptions, and academic syllabus data to identify, evaluate, and relate skills using Artificial Intelligence and Machine Learning techniques. The system supports real-time resume upload and automatically extracts candidate skills through text analysis methods. A skill gap analysis is performed by comparing extracted skills with industry job requirements, enabling the system to recommend suitable career roles. An interactive Skill Graph visually represents the relationships between students, skills, and job roles, helping users understand skill readiness and deficiencies. Additionally, the

system analyzes job market trends to identify emerging and high-demand skills, supporting students, educational institutions, and recruiters in making informed decisions related to career planning, curriculum improvement, and workforce development.

ADVANTAGES OF THE PROPOSED SYSTEM

1. **Automated Skill Extraction:** The system automatically extracts skills from student resumes using AI-based text analysis, reducing manual effort and increasing accuracy..
2. **Skill Gap Identification:** It compares a student's existing skills with industry job requirements to clearly identify missing or weak skills
3. **Personalized Career Recommendations :** Based on the skill analysis, the system suggests suitable career roles that match the student's skill profile.
4. **Visual Skill Representation (Skill Graph) :** The interactive skill graph visually connects students, skills, and job roles, making it easier to understand skill relationships and readiness.
5. **Real-Time Resume Analysis :** Students can upload resumes in real time, and the system instantly analyzes and provides feedback.

IV. METHODOLOGY

4.1 Data Collection

The system collects datasets such as student resumes, job descriptions, academic syllabus information, and job market trend data. These datasets are stored in CSV format so that they can be easily processed and analyzed by the system.

4.2 Data Preprocessing

The collected data is cleaned using preprocessing techniques such as lowercasing, punctuation removal, duplicate removal, and normalization of skill names. These steps help improve data quality and ensure consistency across different datasets.

4.3 Feature Extraction

TF-IDF (Term Frequency–Inverse Document Frequency) vectorization is applied to convert textual data from resumes and job descriptions into numerical feature vectors. This allows the system to perform similarity analysis between different profiles.

4.4 Skill Extraction

Skills are extracted from uploaded resumes using rule-based keyword matching. The system compares resume content with a unified skill vocabulary derived from resumes, job descriptions, and syllabus data.

4.5 Skill Gap Analysis

The extracted resume skills are compared with job-required skills to identify both matched skills and missing competencies. This helps determine the readiness of a student for specific job role.

4.6 Career Recommendation

The system calculates cosine similarity between resume profiles and job profiles to recommend suitable career roles based on skill alignment.

4.7 Skill Graph Construction

An interactive skill graph is created where nodes represent students, skills, and job roles, and edges represent relationships between them.

4.8 Career Forecasting

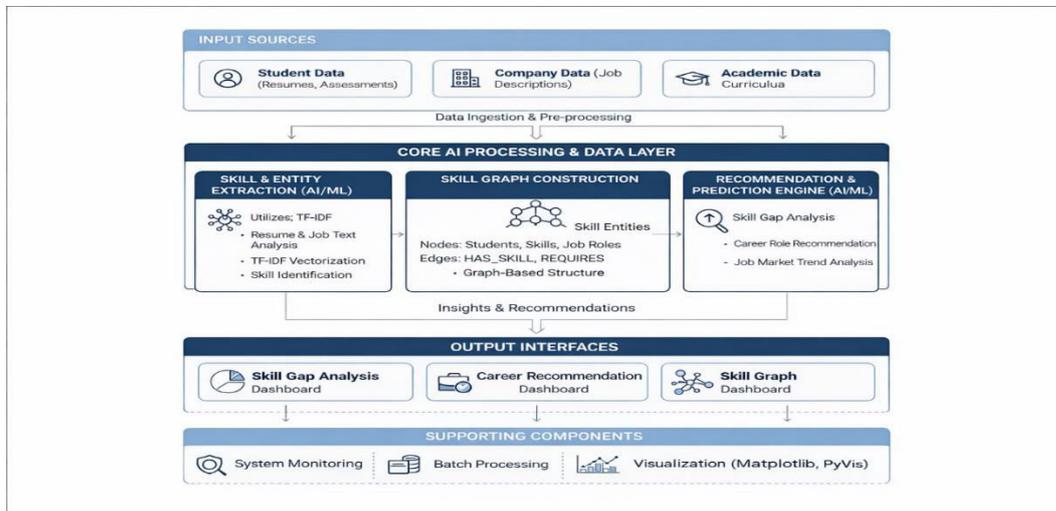
Job market trend data is analyzed to identify emerging and high-demand skills that are important for future careers.

4.9 Visualization

Streamlit dashboards along with Matplotlib and PyVis are used to visualize skill coverage, career recommendations, skill relationships, and future job trends in an interactive manner.

V. SYSTEM ARCHITECTURE

System architecture is a comprehensive blueprint that defines the structure, behavior, and interactions of various components within a system—whether it's a software application, a computer system, or a complex network of systems. It provides a high-level view of how the system is organized and how different parts such as hardware, software, data storage, processing units, communication protocols, and user interfaces interact to perform specific functions. In software systems, architecture describes how modules or services are divided, how they communicate (e.g., via APIs or message queues), and how data flows through the system. In hardware systems, it includes the design of processors, memory units, input/output devices, and how they are connected. System architecture also includes considerations for scalability (handling growth in users or data), security (protecting data and operations), maintainability (ease of updates and debugging), and performance (speed and efficiency).



VI. RESULTS AND OUTPUT:

Step 1: Student Selection from Dataset

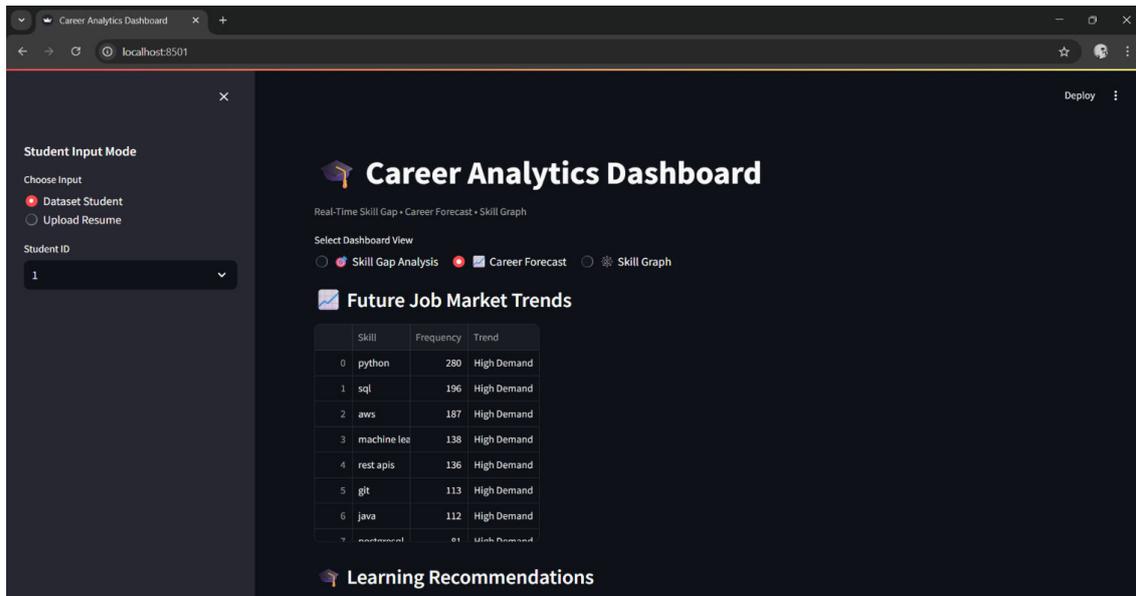
The system allows users to select a Student ID from the available dataset instead of uploading a resume. Based on the selected student record, the system retrieves the corresponding skills and career analysis results from the database.



Fig: resume upload

Step 2: Resume Upload / Student Input

The student either selects a dataset profile or uploads a resume (PDF/DOCX). The system extracts skills and relevant information using NLP-based processing.



STEP : 3 Skill Graph Analysis

The system extracts and analyzes the student's skills from the resume or dataset. It compares these skills with industry-required skills and identifies strengths and missing competencies.

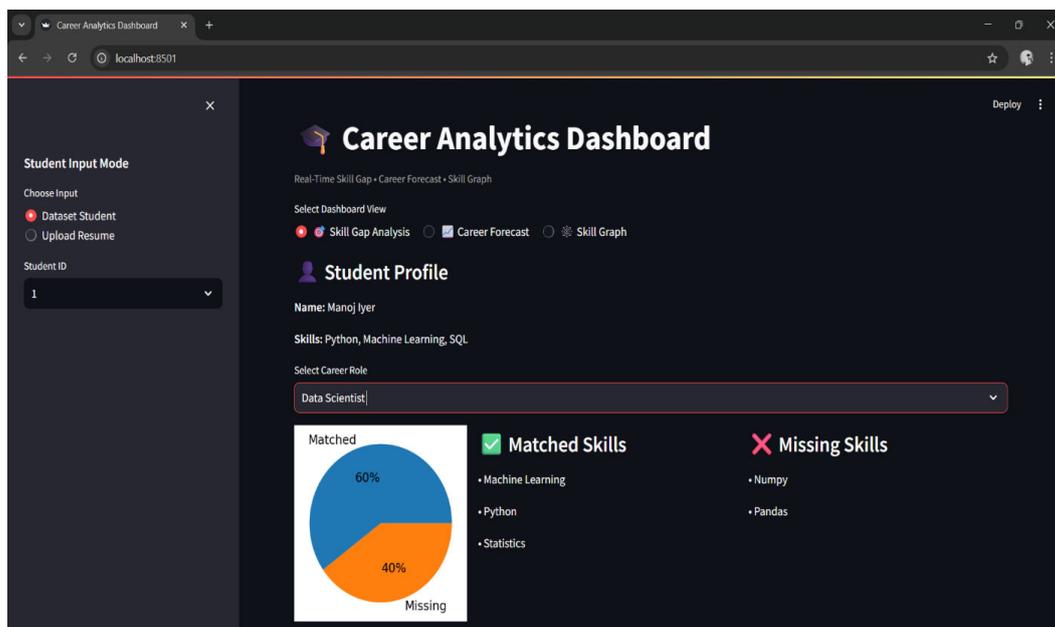


Fig : career Forecast

Step 4: Career Forecast

Based on market trend data and skill demand frequency, the system predicts future job opportunities and highlights emerging and high-growth career roles.

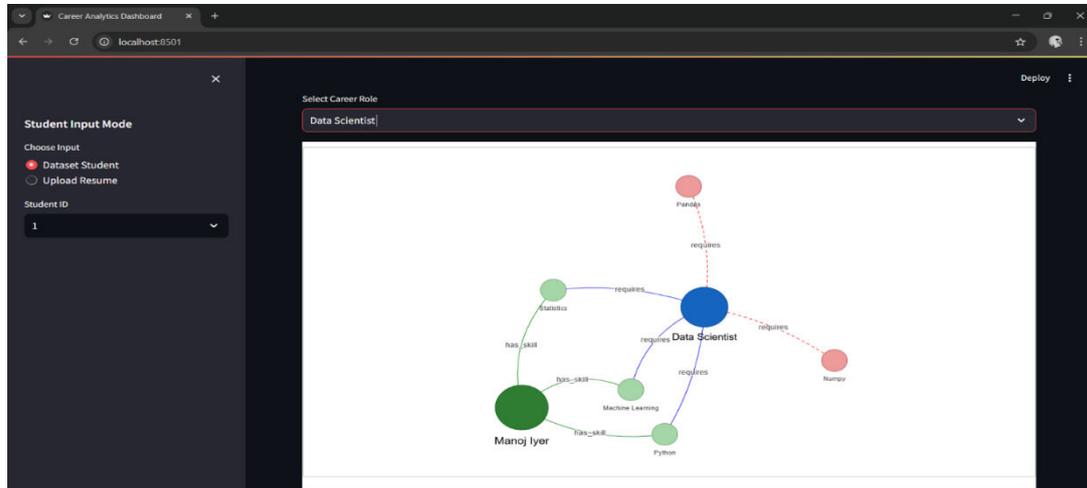


Fig : graph display

VII. CONCLUSION

The Skill Graph and Career Forecast project successfully demonstrates how data-driven techniques can be used to bridge the gap between academic learning and industry skill requirements. By analyzing resumes, job descriptions, and curriculum data, the system provides meaningful insights into a student's skill readiness and career alignment. The integration of Natural Language Processing techniques such as TF-IDF and similarity-based matching enables effective extraction and comparison of skills from unstructured textual data.

The project offers a comprehensive skill gap analysis by identifying matched and missing skills for selected job roles. This allows students to understand their current competencies and focus on acquiring relevant skills required by the industry. The use of interactive dashboards enhances usability by presenting analytical results in an intuitive and visually appealing manner. Additionally, the skill graph visualization helps users clearly understand the relationships between students, skills, and job roles, making complex information easier to interpret.

The career forecasting module further strengthens the system by providing insights into emerging and high-demand skills based on job market trends. This feature helps students make informed decisions about future learning and career planning. The system also demonstrates flexibility by supporting real-time resume uploads, enabling dynamic skill extraction without relying solely on pre-existing datasets.

VIII. FUTURE SCOPE

The Skill Graph and Career Forecast system can be further enhanced by integrating advanced NLP and deep learning techniques to improve skill extraction and semantic understanding. Future versions of the system can incorporate real-time job market data from job portals and APIs to ensure updated and accurate career predictions. The platform can also include personalized learning recommendations such as online courses and certifications to help students close their skill gaps. Additionally, the system can be expanded for institutional use, allowing colleges to analyze student skill trends and update their curriculum accordingly. Improved interactive graph visualization and scalable deployment can make the system more efficient and suitable for large-scale real-world applications.

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