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Career Lens

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Abstract- — Career decision-making among engineering students is often influenced by trends rather than a proper evaluation of individual skill sets, leading to skill–career mismatch. This project presents CareerLens, an explainable skill-based career recommendation system designed to guide students in selecting suitable academic streams and job roles. The system analyzes user-provided technical skills along with proficiency levels, maps them to predefined career requirements, and computes readiness scores to generate personalized recommendations. Additionally, it identifies skill gaps and suggests improvements to enhance career readiness. By emphasizing transparency, interpretability, and skill-driven guidance, CareerLens aims to bridge the gap between student capabilities and evolving industry demands.

Keywords: Career Recommendation System, Skill-Based Analysis, Decision Support System, Explainable Systems, Career Guidance, Readiness Assessment

I. INTRODUCTION

In the modern digital era, technological advancements have significantly transformed the landscape of education, employment, and career development. The field of Computer Science and Engineering, in particular, has witnessed rapid growth with the emergence of domains such as Artificial Intelligence, Machine Learning, Data Science, Cloud Computing, and Software Engineering. These domains have created a wide range of career opportunities; however, they have also introduced complexity in choosing the most suitable career path.

Engineering students often face confusion while selecting their academic streams or job roles due to a lack of structured guidance and awareness of industry requirements. Career decisions are frequently influenced by peer pressure, social trends, or the perceived popularity of certain fields rather than a proper evaluation of individual skills and interests. This leads to a mismatch between student capabilities and career choices, which can negatively impact professional growth and employability.

II. LITERATURE SURVEY

[1] P. C. Siswipraptini et al., "Personalized Career-Path Recommendation Model for Information Technology Students," IEEE Access, 2024
This paper proposes a personalized career recommendation model specifically designed for Information Technology students. The system analyzes student profiles, including academic performance and interests, to suggest suitable career paths. It emphasizes the importance of personalization in improving recommendation accuracy. However, the model primarily focuses on academic data and lacks detailed analysis of technical skill proficiency. The concept of personalization presented in this work strongly supports the foundation of CareerLens, which enhances it further by incorporating skill-based evaluation and explainable outputs.

[2] N. Kamal et al., "Recommender System in Academic Choices of Higher Education: A Systematic Review," IEEE Access, 2024
This paper provides a comprehensive review of recommender systems used in higher education for course and career selection. It examines various techniques, including content-based filtering, collaborative filtering, and hybrid approaches. The study highlights key challenges such as lack of personalization, scalability issues, and limited adaptability to individual user profiles. It also identifies the need for systems that can provide accurate and user-specific recommendations. These findings justify the development of CareerLens, which addresses these challenges through a skill-based and user-centric approach.

[3] E. Masciari, A. Umair, and M. H. Ullah, "A Systematic Literature Review on AI-Based Recommendation Systems and Their Ethical Considerations," IEEE Access, 2024
This paper reviews AI-based recommendation systems with a focus on ethical considerations such as transparency, fairness, and bias. It highlights the limitations of black-box models, which often lack explainability and can lead to reduced user trust. The study emphasizes the importance of interpretable systems that allow users to understand how recommendations

are generated. This directly aligns with the core design of CareerLens, which prioritizes explainability by providing clear reasoning, skill matching, and gap analysis for each recommendation.

Table 1 Comparison Table of Literature Survey

S. No	Author(s)	Title	Methodology Used	Findings from the Reference Paper
1.	P. C. Siswipraptini et al. (2024)	Personalized Career-Path Recommendation Model for Information Technology Students	Used personalized recommendation techniques based on student profiles, academic data, and structured datasets to suggest career paths.	Demonstrated that personalized systems improve recommendation accuracy and relevance. However, it mainly relies on academic data and lacks detailed skill-based and explainable analysis.
2.	N. Kamal et al. O. (2024)	Recommender System in Academic Choices of Higher Education: A Systematic Review	Reviewed various recommendation techniques such as content-based, collaborative filtering, and hybrid approaches for academic decision-making.	Identified challenges like lack of personalization and adaptability. Highlighted the need for user-centric systems, supporting the development of skill-based recommendation systems like CareerLens.
3.	E. Masciari et al. (2024)	A Systematic Literature Review on AI-Based Recommendation Systems and Their Ethical Considerations	Analyzed AI-based recommendation systems focusing on transparency, fairness, and ethical aspects of decision-making models.	Emphasized the importance of explainability and user trust. Highlighted limitations of black-box models, supporting the need for transparent systems like CareerLens.

III. SYSTEM ARCHITECTURE

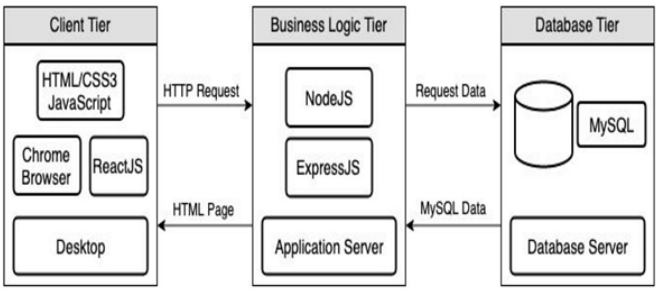

Figure 1 System Architecture

The CareerLens system follows a three-tier architecture consisting of the Frontend (Presentation Layer), Backend (Application Layer), and Database (Data Layer). This architecture ensures separation of concerns, easy maintenance, and efficient processing of user data.

Frontend (Presentation Layer)
The frontend provides an interactive interface for users to input their skills and view results. Users can select technical skills along with proficiency levels and receive recommendations. This layer is developed using React.js, ensuring responsiveness and a smooth user experience.

Backend (Application Layer)
The backend is responsible for processing user inputs and generating recommendations. It implements a rule-based logic system that compares user skills with predefined requirements of career streams and job roles. Based on this comparison, the system calculates readiness scores and identifies skill gaps. This layer is implemented using Python with Flask/FastAPI.

Database (Data Layer)
The database stores all essential information, including skill sets, career streams, job roles, and their corresponding requirements. MongoDB/Firebase is used for efficient storage and retrieval of data.

System Workflow
1. User selects skills and proficiency levels
2. Data is sent to backend
3. Backend processes data using rule-based logic
4. Matching careers and jobs are identified
5. Results with readiness scores and suggestions are displayed

IV. PROPOSED METHODOLOGY

The proposed system, CareerLens, follows a skill-based, rule-driven methodology to provide personalized and explainable career recommendations. The system is designed to analyze user skills, map them to predefined career requirements, and generate meaningful insights regarding suitable streams and job roles.

Step 1: Data Collection

The system begins by collecting user input in the form of:

- Technical skills (e.g., Python, Machine Learning, SQL)
- Proficiency levels (Beginner, Intermediate, Confident)

These inputs represent the user's current skill profile and form the basis for further analysis.

Step 2: Skill Mapping
The collected skills are mapped against a predefined dataset that includes:

- Career streams (AI & ML, Data Science, Software Development, etc.)
- Job roles under each stream
- Required skills and their importance levels

This mapping helps identify the relevance of user skills to different career options.

Step 3: Scoring and Analysis
The system applies a weighted scoring mechanism to evaluate the alignment between user skills and job requirements.

- Each skill is assigned a weight based on proficiency
- A matching score is calculated for each job role
- A readiness percentage is generated

This step determines how well a user fits a particular career path.

Step 4: Recommendation Generation
Based on the calculated scores, the system:

- Recommends suitable career streams
- Suggests relevant job roles
- Ranks them based on readiness level

Only roles meeting a minimum threshold are recommended to ensure accuracy.

Step 5: Explainability and Feedback
To enhance user understanding, the system provides:

- Matching skills
- Missing skills (skill gaps)
- Suggestions for improvement

This ensures transparency and helps users take actionable steps toward career growth.

Step 6: Result Presentation
The final output is displayed in a user-friendly format, including:

- Recommended streams with match percentage
- Job roles with readiness scores
- Personalized improvement suggestions

V. ALGORITHMIC FLOW OF THE SYSTEM

- User selects skills and proficiency levels
- System retrieves job and skill data from database
- User skills are matched with job requirements
- Readiness score is calculated using weighted values
- Decision rules are applied to filter suitable roles
- System recommends career streams and job roles
- Skill gaps and improvement suggestions are generated
- Final results are displayed to the user

VI. OUTPUT SCREENS

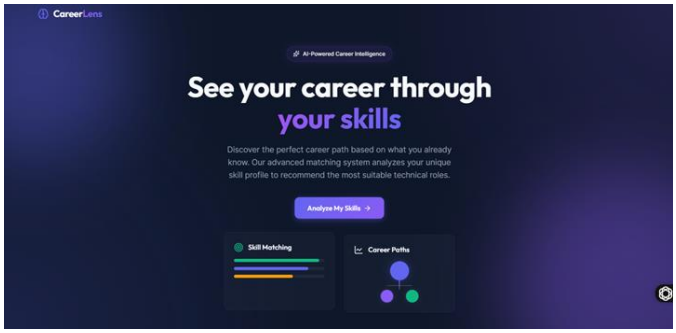

Fig 1: Home screen of the CareerLens

Fig 2: Data vizualization

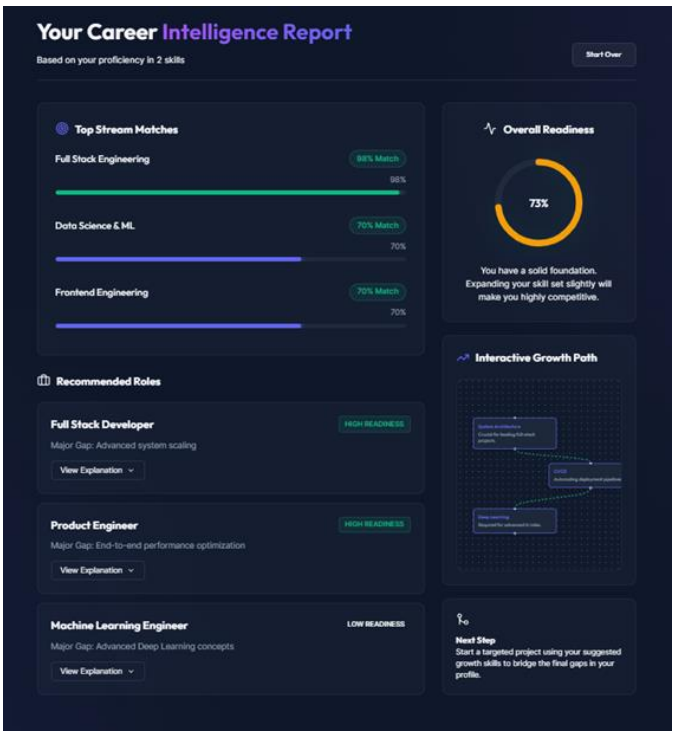

Fig 3: Recomendation

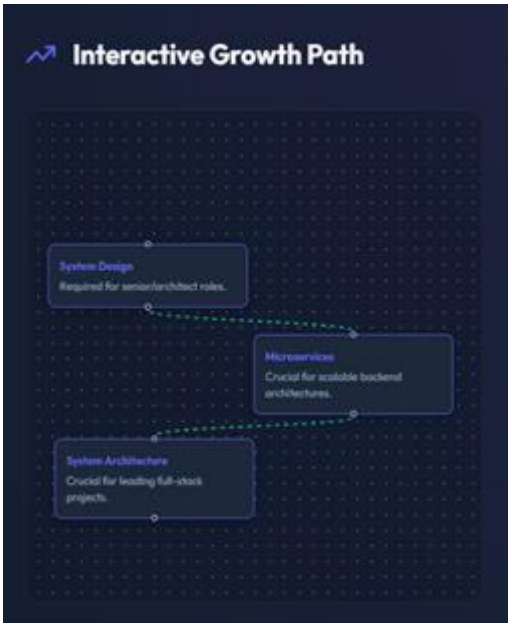

Fig 5: Real-Time AI prediction

VII. CONCLUSION

The project CareerLens presents an effective and user-friendly solution for career guidance based on individual skill sets. It addresses the common problem of career confusion among students by providing structured, skill-driven recommendations for suitable streams and job roles.

The system uses a rule-based approach to analyze user skills, calculate readiness levels, and generate personalized suggestions. By incorporating explainability, CareerLens not only recommends career paths but also highlights skill gaps and provides guidance for improvement, enabling informed decision-making.

Overall, the project successfully demonstrates how technology can be used to bridge the gap between student capabilities and industry requirements. It offers a scalable and practical solution that can be further enhanced with advanced technologies in the future

Compliance with ethical standards
Disclosure of conflict of interest
The authors declare that there is no conflict of interest regarding the publication of this paper.

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1. P. C. Siswipraptini et al., “Personalized Career-Path Recommendation Model for Information Technology Students,” IEEE Access, vol. 12, 2024.
2. N. Kamal et al., “Recommender System in Academic Choices of Higher Education: A Systematic Review,” IEEE Access, vol. 12, 2024.
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