Skill2Career: AI-Powered Career Recommendation System

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***Abstract*— Selecting an appropriate career is a challenging task for students because decisions are often influenced by limited awareness, external opinions, or inadequate professional guidance. Traditional career counseling approaches generally fail to consider an individual's complete skill profile and rarely provide personalized recommendations. This work presents Skill2Career, an AI-driven career recommendation system that analyzes user competencies across multiple professional domains and suggests suitable career paths using a hybrid recommendation approach. The proposed framework integrates a supervised machine learning classifier with similarity-based matching to improve the accuracy and reliability of recommendations. In addition to identifying suitable careers, the system evaluates skill gaps, estimates career readiness, and provides personalized learning guidance to help users strengthen missing competencies. A web-based platform has been developed using Python and Flask to offer an interactive interface for skill assessment, recommendation history, career comparison, and report generation. Experimental evaluation demonstrates that combining machine learning with similarity analysis produces more meaningful and personalized recommendations than conventional single-method approaches. The proposed system serves as an effective career guidance tool that supports informed decision-making and encourages continuous skill development for students and early-career professionals.**

Keywords— Career Recommendation System, Artificial Intelligence, Machine Learning, Logistic Regression, Cosine Similarity, Skill Gap Analysis, Flask, Career Guidance.

I.INTRODUCTION

Career selection is one of the most important decisions in an individual's academic and professional journey. However, many students choose careers based on peer influence, social expectations, or limited knowledge of available opportunities rather than an objective assessment of their own skills. Several studies have emphasized the importance of intelligent career guidance systems that assist students in making informed career decisions through data-driven recommendations [1]. Access to professional career guidance is often limited, especially in regions where counseling services are expensive or unavailable. As a result, students may struggle to identify career paths that match their abilities and long-term goals [10].

Existing career guidance systems commonly rely on personality assessments, rule-based approaches, or traditional machine learning models. Recent surveys have reported that many recommendation systems are constrained by limited personalization, dependence on predefined rules, and insufficient consideration of user skills and career requirements [8]. While these methods provide useful recommendations, they have several limitations. Personality-based systems do not adequately represent an individual's technical competencies, rule-based systems become difficult to maintain as the number of careers and skills increases, and many machine learning approaches depend on resumes or prior work experience, making them less suitable for students who are beginning their careers. In addition, most existing solutions provide recommendations without explaining skill gaps or suggesting pathways for improvement [15].

To address these limitations, this work presents Skill2Career, an AI-powered career recommendation system that generates personalized career suggestions using a hybrid recommendation approach. Recent research has shown that integrating machine learning with skill-gap analysis and intelligent recommendation techniques improves both recommendation quality and user satisfaction [5]. The system evaluates user proficiency across multiple skill domains and combines a Logistic Regression classifier with cosine similarity to identify careers that closely match individual skill profiles. It further performs skill-gap analysis, estimates career readiness, and provides learning roadmaps to support continuous skill development. The application is implemented as a web-based platform using Python, Flask, SQLite, and Scikit-learn, offering features such as user authentication, recommendation history, career comparison, and report generation. The proposed system aims to assist students in making informed career decisions through structured, skill-based recommendations [4].

II.RELATED WORK

Lakshmi Prasanna and Hasritha (2019) presented a career guidance and recommendation system that assists students in selecting suitable career paths based on their academic performance and personal attributes [1]. The study evaluated several machine learning algorithms to determine the most appropriate approach for predicting career choices. The proposed system demonstrated that classification techniques can effectively analyze student-related information and generate meaningful career suggestions. The authors emphasized that data preprocessing and feature selection play an important role in improving prediction accuracy and reducing classification errors. Their work also highlighted the importance of providing students with technology-driven career guidance instead of relying only on traditional counseling methods. The study concluded that machine learning can support educational institutions in helping students make informed career decisions while improving the overall recommendation process. The proposed framework serves as a foundation for developing intelligent and personalized career guidance systems. **[1]**

Siswipraptini et al. (2024) proposed a personalized career-path recommendation model designed for information technology students by combining educational data with machine learning techniques [4]. The framework integrates multiple factors, including academic records, personality traits, and job-related skills, to generate career recommendations that better reflect individual capabilities. The authors used a personalized Naïve Bayes model and educational data mining methods to improve recommendation quality. Their evaluation showed that combining academic and behavioral information produces more reliable recommendations than using a single source of data. The study also emphasized the importance of aligning educational outcomes with industry requirements to improve student employability. The results demonstrated that personalized recommendation models can provide practical guidance while supporting students in identifying career opportunities that match their interests, knowledge, and professional goals. **[4]**

Shahzada et al. (2025) introduced an AI-powered career recommendation system that combines psychometric analysis, skill assessment, and large language models to deliver personalized career guidance [5]. The proposed framework evaluates user skills, identifies knowledge gaps, and recommends suitable career paths together with learning resources for skill improvement. The system focuses not only on predicting career options but also on explaining the reasons behind each recommendation and suggesting future learning directions. The authors reported that integrating artificial intelligence with skill-gap analysis improved recommendation relevance and user satisfaction. The study further highlighted the value of explainable recommendations in increasing user confidence during career planning. By combining intelligent analysis with personalized feedback, the proposed system demonstrates how modern AI techniques can enhance career counseling and support continuous professional development. **[5]**

Qian, Lu, and Jin (2020) presented a comprehensive study on the role of artificial intelligence in recommender systems and discussed how intelligent algorithms improve personalized decision-making across multiple application domains [11]. The work examined recommendation approaches based on machine learning, deep learning, and user preference analysis while highlighting their strengths and limitations. The authors emphasized that modern recommender systems benefit from combining multiple sources of information to increase recommendation accuracy and adapt to changing user behavior. They also discussed the importance of feature engineering, data quality, and continuous model improvement in achieving reliable recommendations. The study concluded that artificial intelligence has significantly enhanced the effectiveness of recommendation systems by providing personalized, scalable, and adaptive solutions suitable for real-world applications, including education, healthcare, and career guidance. **[11]**

Sandra et al. (2025) developed a smart career advisor based on machine learning techniques to assist students in selecting careers that align with their skills and interests [18]. The proposed framework analyzes user profiles and compares them with predefined career requirements to generate personalized recommendations. The authors emphasized that intelligent recommendation systems can reduce uncertainty during career planning by providing structured and data-driven guidance. Their evaluation indicated that machine learning models improve recommendation quality by identifying relationships between user characteristics and career opportunities. The study also highlighted the importance of continuously updating career datasets to maintain recommendation accuracy as industry requirements evolve. The proposed system demonstrates that integrating machine learning with career advisory platforms can provide practical support for students and job seekers while encouraging informed career planning and long-term professional growth. **[18]**

III.DATASET DETAILS

The proposed Skill2Career: AI-Powered Career Recommendation System utilizes a synthetically generated structured dataset instead of relying on publicly available career recommendation datasets. The dataset is developed from a manually designed career–skill matrix that represents 62 career categories and 108 skill attributes organized across eight professional domains. Each skill is assigned an importance level indicating whether it is a core, supporting, or non-required competency for a particular career. To train the recommendation model, the career–skill matrix is expanded into 7,440 synthetic skill profiles, with multiple profile variations created for every career to represent different levels of user proficiency and skill combinations. Before training, user skill ratings are normalized to produce consistent feature vectors suitable for machine learning and similarity-based analysis. The processed dataset is used by the Logistic Regression classifier and the cosine similarity module to generate personalized career recommendations, estimate career readiness, and identify skill gaps. The dataset is maintained in CSV format and accessed through the application's data management module, providing a structured and scalable foundation for recommendation, analysis, and future model enhancement.

IV.PROPOSED METHODOLOGY

The proposed Skill2Career: AI-Powered Career Recommendation System employs a hybrid recommendation methodology to identify career opportunities that best match an individual's skills. The recommendation process begins by collecting user ratings for 108 skills grouped into eight professional domains. These ratings are normalized to construct a standardized feature vector that accurately represents the user's competency profile. This preprocessing step ensures consistency in the input data before it is forwarded to the recommendation engine. The primary recommendation model is based on Logistic Regression, which is trained using a synthetically generated dataset containing 7,440 skill profiles across 62 career categories. Logistic Regression serves as the main decision-making component by estimating the probability that a user's skill profile belongs to each career category. The algorithm was selected because it provides reliable classification performance, produces well-calibrated probability scores, and supports efficient prediction for large-scale recommendation tasks. To improve recommendation quality, the system incorporates Cosine Similarity as a secondary matching technique. This method measures the similarity between the normalized user skill vector and predefined career skill profiles, allowing the system to identify careers with closely related competency requirements. The final recommendation score is calculated by combining the Logistic Regression probability with the similarity score, resulting in a balanced ranking of suitable career options. After generating recommendations, the system performs skill-gap analysis to estimate career readiness and identify missing core and supporting skills. The complete framework is implemented as a web-based application using Python, Flask, SQLite, and Scikit-learn, enabling users to receive personalized career recommendations, compare career options, and review previous analyses through an interactive interface.

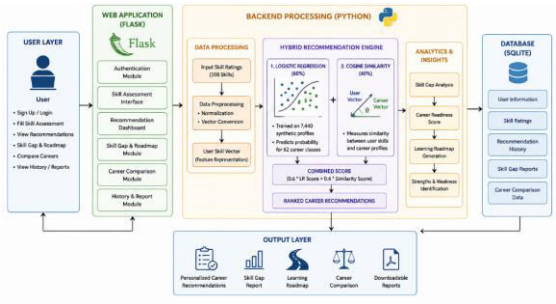

Figure 1: System Architecture of the Proposed Skill2Career: AI-Powered Career Recommendation System

Figure 1 illustrates the architecture of the proposed Skill2Career: AI-Powered Career Recommendation System, which integrates user skill assessment, machine learning, similarity analysis, and database management to generate personalized career recommendations. The process begins with the User

Layer, where users register, log in, and provide ratings for 108 skills across multiple professional domains. These inputs are processed through a Flask-based web application, where authentication, recommendation, career comparison, and report management are handled. The collected data undergo preprocessing and normalization before being forwarded to the Hybrid Recommendation Engine. The recommendation engine primarily uses Logistic Regression to predict suitable career categories, while Cosine Similarity measures the similarity between user skills and career profiles to improve recommendation accuracy. The generated recommendations are further analyzed to identify skill gaps, estimate career readiness, and produce learning roadmaps. Finally, all user information, recommendation history, and analytical results are stored in the SQLite database and presented through an interactive interface for effective career planning.

V.RESULT AND DISCUSSION

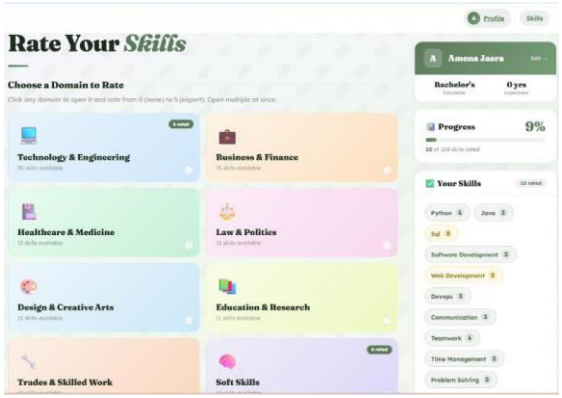

Figure 2: Skill Rating Interface

Figure 2 presents the Skill Rating Interface of the proposed Skill2Career: AI-Powered Career Recommendation System. This interface enables users to evaluate their proficiency across multiple professional domains before generating career recommendations. The skills are organized into categories such as Technology & Engineering, Business & Finance, Healthcare & Medicine, Law & Politics, Design & Creative Arts, Education & Research, Trades & Skilled Work, and Soft Skills, allowing users to navigate and assess their abilities in a structured manner. A progress indicator displays the completion status of the assessment, while the user profile section provides basic account information. As users assign ratings to their skills, the responses are recorded and prepared for further processing by the recommendation engine. The collected skill data are later normalized and analyzed using the hybrid recommendation model to identify suitable career paths, estimate career readiness, detect skill gaps, and generate personalized learning recommendations. The interface provides a simple and organized environment for collecting accurate user input before the recommendation process begins.

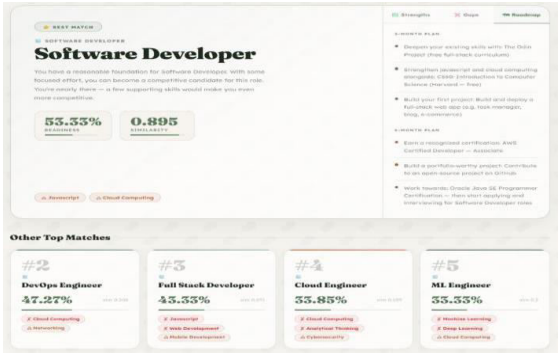

Figure 3: Career Recommendation Dashboard

Figure 3 illustrates the Career Recommendation Dashboard of the proposed Skill2Career: AI-Powered Career Recommendation System. After the user completes the skill assessment, the dashboard displays the most suitable career recommendation based on the hybrid recommendation model. The interface presents the recommended career title along with a career readiness percentage and a matching score, helping users understand how closely their skills align with the selected profession. It also highlights the user's strengths, identifies missing or weak skills, and provides personalized recommendations for improving competencies required for the chosen career. In addition to the primary recommendation, the dashboard displays several alternative career options ranked according to their matching scores, allowing users to compare related career paths. The recommendation results are generated using the combined output of Logistic Regression and Cosine Similarity, while the analytical information supports users in identifying skill gaps and planning future learning activities for better career development.

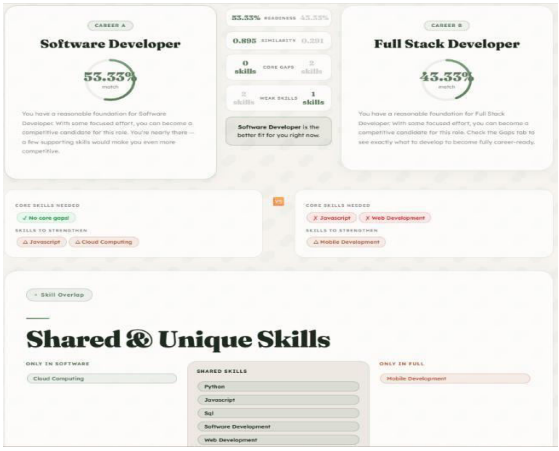

Figure 4 presents the Career Comparison

Interface of the proposed Skill2Career: AI-Powered Career Recommendation System. This module enables users to compare two career options side by side based on their current skill profile. For each career, the interface displays the career readiness percentage, matching score, and the number of identified skill gaps, allowing users to understand how well their existing competencies align with each profession. The system also highlights core skills that require improvement and distinguishes them from the skills already possessed by the user. In addition, a Shared and Unique Skills section compares the competencies common to both careers and those that are specific to each profession. This comparison helps users recognize the similarities and differences between career paths and supports informed career selection. By presenting detailed analytical information in a structured format, the interface assists users in identifying the additional skills required to transition toward their preferred career and plan their future learning objectives effectively.

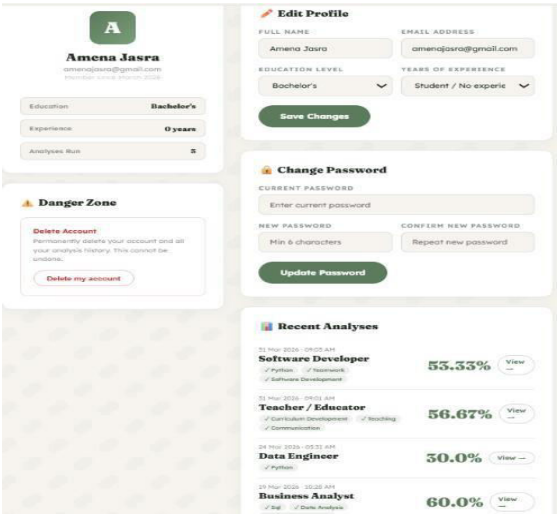

Figure 5: User Profile and Analysis History Interface

Figure 5 illustrates the User Profile and Analysis History Interface of the proposed Skill2Career: AI-Powered Career Recommendation System. This module enables users to manage their personal information, including educational qualification and experience details, through an editable profile section. The interface also provides options for updating account credentials, allowing users to securely change their passwords whenever required. A dedicated analysis history section stores previously generated career recommendations, displaying the recommended career along with the corresponding career readiness percentage for each assessment. Users can revisit earlier analyses, review their recommendation results, and monitor changes in their career preferences over time. In addition, account management features, including profile updates and account deletion, are provided to ensure secure and flexible user management. By combining profile management with historical recommendation records, this interface offers a centralized environment where users can maintain their information, access previous analyses, and track their career development throughout their interaction with the system.

DISCUSSION

The proposed Skill2Career: AI-Powered Career Recommendation System combines skill assessment, machine learning, similarity analysis, and web technologies into a unified framework for personalized career guidance. The system follows a structured workflow consisting of user registration, skill evaluation, data preprocessing, career recommendation, skill-gap analysis, and result visualization. Users begin by rating their proficiency across 108 skills grouped into eight professional domains through an interactive web interface. The collected responses are preprocessed and normalized to generate standardized feature vectors suitable for recommendation analysis. These feature vectors are then supplied to a Logistic Regression model, which serves as the primary recommendation algorithm by estimating the probability of user suitability across multiple career categories. To improve the quality of recommendations, the predicted probabilities are combined with Cosine Similarity, which measures the closeness between the user's skill profile and predefined career skill requirements. The hybrid recommendation engine produces a ranked list of suitable career options based on the combined scores. The system further performs skill-gap analysis to identify missing core competencies, evaluate supporting skills, estimate career readiness, and generate personalized learning roadmaps for skill improvement. User profiles, assessment results, recommendation history, and analytical reports are maintained in an SQLite database, allowing users to review previous analyses and compare different career options. The complete framework is implemented using Python, Flask, Scikit-learn, and SQLite, providing an interactive environment for career planning. Experimental observations indicate that the proposed system generates meaningful and personalized career recommendations while supporting users in identifying skill deficiencies and planning their professional development through a structured and user-friendly recommendation process.

VI.CONCLUSION

This work presents Skill2Career: AI-Powered Career Recommendation System, a web-based

framework developed to assist students and early-career professionals in selecting suitable career paths through intelligent skill analysis. The proposed system integrates user skill assessment, data preprocessing, machine learning, similarity analysis, and career guidance within a unified architecture. User proficiency is collected across multiple professional domains and transformed into standardized feature vectors through normalization. A Logistic Regression model serves as the primary recommendation algorithm by estimating the suitability of users for different career categories, while Cosine Similarity is incorporated to strengthen the matching process by comparing user skills with predefined career profiles. The system further performs skill-gap analysis, estimates career readiness, and provides personalized learning roadmaps to help users improve the competencies required for their preferred careers. User profiles, recommendation history, and analytical results are securely maintained in an SQLite database and presented through a Flask-based interactive web application that supports career comparison, report generation, and history management. The implementation demonstrates that the proposed framework delivers accurate and meaningful career recommendations while simplifying the career decision-making process through personalized analysis and structured guidance. The modular design of the system also provides flexibility for future enhancements. Further improvements may include integrating advanced deep learning models, incorporating real-world employment and labor market datasets, supporting dynamic job market analysis, expanding career categories, and developing mobile-based applications to improve accessibility, recommendation quality, and overall user experience.

REFERENCES

[1] L. Prasanna and D. Hasritha, “Student Career Guidance and Recommendation System,” International Journal of Engineering Development and Research, 2019.

[2] M. Vakil, S. Kumar, A. Yadav, S. Singh, and K. Garg, “Career Recommendation System,” International Journal of Innovative Research in Technology, 2025.

[3] S. El-Keiey, D. ElMenshawy, and E. Hassanein, “Career Recommendation Based on Feature Selection for Undergraduate Students Using Machine Learning Techniques,” International Journal of Advanced Computer Science and Applications, 2025.

[4] P. C. Siswipraptini, H. L. H. Warnars, A. Ramadhan, and W. Budiharto, “Personalized Career-Path Recommendation Model for Information Technology Students in Indonesia,” IEEE Access, 2024.

[5] A. Shahzada, I. Hussain, N. Shaheen, S. M. Hussain, T. F. Khan, and M. Shehzad, “CareerLLAMA: An AI-Powered Personalized Career Recommendation System with Psychometric and Skill Gap Integration,” Spectrum of Engineering Sciences, 2025.

[6] J. T. Iorzua, T. Moses, O. J. Agushaka, D. K. Kwaghtyo, and T. Godswill, “A Machine Learning Based Approach to Course and Career Recommendation System,” Journal of Computer Technology & Applications, 2025.

[7] B. Patel, V. Kakuste, and M. Eirinaki, “CaPaR: A Career Path Recommendation Framework,” 2017.

[8] A. Shah, R. Pati, A. Pimplikar, S. Puthran, and A. Singh, “Review of Approaches Towards Building AI-Based Career Recommender and Guidance Systems,” 2024.

[9] B. Daga, J. Checker, A. Rajan, and S. Deo, “Computer Science Career Recommendation System Using Artificial Neural Network,” International Journal of Computer Trends and Technology, 2020.

[10] D. M. Ndolo, “Job Recommendation Systems: A Literature Review,” International Journal of Innovative Science and Research Technology, 2023.

[11] Q. Zhang, J. Lu, and Y. Jin, “Artificial Intelligence in Recommender Systems,” Springer, 2020.

[12] M. Kumar, A. Raj, and S. Kumar, “Career Counselling Recommendation System,” 2025.

[13] C. U. Kumar, G. S. Teja, P. Lalitha Devi, B. Sumanth, and T. Veerraju, “Career Path Recommendation Adaptive Learning Using Artificial Intelligence,” International Journal of Science and Research Archive, 2026.

[14] X. Qian and K. Hui, “SkillRec: A Data-Driven Approach to Job Skill Recommendation for Career Insights,” 2023.

[15] C. Wang, K. Wang, A. Bian, R. Islam, K. N. Keya, J. Foulds, and S. Pan, “User Acceptance of Gender Stereotypes in Automated Career Recommendations,” 2021.

[16] A. Karunamurthy and R. Sujitha, “AI-Driven Resume Screening and Job Recommendation System,” International Journal of Research and Scientific Innovation, 2026.

[17] M. Keerthi and K. Kajal, “AI-Powered Career Path Recommender,” International Journal of Sciences and Innovation Engineering, 2025.

[18] R. Sandra, L. G., S. M., J. R., and M. V., “Smart Career Advisor: A Machine Learning Based Recommendation System,” International Journal of Scientific Research in Science and Technology, 2025.

[19] A. Khatri, B. Bhosale, P. Karad, R. Mahendra, R. Mahendra, and S. Eshwar, “Smart Career Recommendation System Powered by Artificial Intelligence for Optimized Career Planning and Decision-Making,” International Journal of Advanced Research in Science, Communication and Technology, 2025.