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An Intelligent Career Guidance and Recommendation System Using AI

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KEYWORDS

Career Guidance, Artificial Intelligence, Recommendation System, NLP, Spring Boot, Weighted Scoring

ABSTRACT

The rapid expansion of career opportunities and the increasing complexity of skill requirements have made career decision-making a challenging task for students and job seekers. Traditional career guidance methods often lack personalization and fail to effectively analyze individual profiles. To overcome these limitations, this project proposes an intelligent career guidance and recommendation system based on Artificial Intelligence techniques. The proposed system utilizes a Rule-Based Classifier combined with a Linear Weighted Model to generate personalized career recommendations. It analyzes user inputs such as skills, interests, personality traits, and educational background, and applies predefined decision rules to identify suitable career paths. The system also incorporates basic Natural Language Processing (NLP) techniques for processing and matching user-provided textual inputs with a structured career dataset. Additionally, a simple Hybrid Recommendation Approach is followed by combining rule-based logic with multi-factor scoring to improve recommendation accuracy. The application is developed using Spring Boot and Java, providing a robust and scalable backend system. Security is implemented using Spring Security with token-based authentication via JJWT. The system uses MySQL for data storage. Additional features such as resume generation are supported using Apache PDFBox. The experimental results demonstrate that the system provides relevant and accurate career recommendations based on user profiles.

1. INTRODUCTION

The rapid growth of technology and the increasing number of career opportunities have made career decision-making a complex process for students and job seekers. Choosing the right career path requires careful analysis of individual skills, interests, personality traits, and educational background. Traditional career guidance methods often rely on manual counseling and generic suggestions, which may not provide

personalized and accurate recommendations for every individual.

In recent years, advancements in Artificial Intelligence (AI) have enabled the development of intelligent systems that can analyze user data and provide data-driven recommendations. AI-based systems can process large amounts of information, identify patterns, and generate meaningful insights, making them highly suitable for career guidance applications. These systems help users make informed decisions by aligning their capabilities with suitable career options.

The proposed project focuses on developing an AI-based career guidance and recommendation system that provides personalized career suggestions. The system collects user inputs such as skills, interests, personality traits, and educational qualifications. It then processes this information using a rule-based recommendation engine combined with a linear weighted scoring mechanism to generate accurate and relevant career recommendations.

The system is implemented using Spring Boot and Java, ensuring a scalable and efficient backend. Security is maintained using Spring Security with token-based authentication through JJWT. The application uses MySQL for storing user and career-related data.

By integrating Artificial Intelligence techniques with modern web technologies, the system provides a user-friendly platform for career guidance. It not only improves the accuracy of recommendations but also reduces manual effort and enhances decision-making efficiency.

1.1 OVERVIEW OF CAREER GUIDANCE SYSTEMS

Career guidance systems are designed to assist individuals in selecting suitable career paths based on their abilities, interests, and goals. These systems aim to provide structured guidance and support in making career-related decisions. Traditional career guidance systems often involve manual counseling, aptitude tests, and static information sources such as books and websites.

However, these conventional methods have limitations in terms of scalability, personalization, and efficiency. They may not effectively handle large volumes of users or provide customized recommendations tailored to individual profiles. As a result, there is a need for more advanced systems that can offer intelligent and personalized career guidance.

Modern career guidance systems leverage technology to automate the process of career recommendation. By analyzing user data and applying computational techniques, these systems can provide more accurate and relevant suggestions. The integration of AI has further enhanced their capabilities, enabling dynamic and data-driven decision-making.

1.2 NEED FOR AI IN CAREER RECOMMENDATION

The increasing diversity of career options and the dynamic nature of job markets have made it difficult for individuals to choose the right career path. Manual career counseling methods are often time-consuming and may not consider all relevant factors such as skills, interests, and personality traits.

Artificial Intelligence provides an effective solution to these challenges by enabling automated analysis and intelligent decision-making. AI-based systems can process multiple parameters simultaneously and generate personalized recommendations based on predefined rules and scoring mechanisms.

In this project, AI is used in the form of a rule-based system and a linear weighted model to evaluate user inputs and recommend suitable careers. This approach ensures that the recommendations are consistent, reliable, and aligned with the user's profile.

2 LITERATURE SURVEY

The field of career guidance has evolved significantly with the advancement of technology and the integration of intelligent systems. Traditional approaches have gradually been replaced by automated and data-driven systems that provide more accurate and personalized recommendations. This chapter reviews existing methods, AI-based approaches, and techniques used in career recommendation systems, highlighting their strengths and limitations.

2.1 TRADITIONAL CAREER GUIDANCE METHODS

Traditional career guidance methods primarily rely on manual counseling, aptitude tests, and static information sources. Career counselors assess an individual's interests, academic performance, and skills through interviews and standardized tests to suggest suitable career options. Printed materials, seminars, and workshops are also commonly used to provide career-related information.

Although these methods offer valuable insights, they have several limitations. The process is time-consuming and depends heavily on the expertise of the counselor. Additionally, these methods often lack personalization and may not consider all relevant factors in a comprehensive manner. As the number of users increases, it becomes difficult to provide individual attention, making traditional systems less scalable and efficient.

2.2 AI-BASED CAREER RECOMMENDATION SYSTEMS

With the emergence of Artificial Intelligence, career guidance systems have become more intelligent and efficient. AI-based systems use algorithms to analyze user data and generate personalized recommendations. These systems can process large volumes of data and identify patterns that are not easily recognizable through manual methods.

Modern AI-based career recommendation systems utilize techniques such as rule-based systems, machine learning, and hybrid approaches. They consider multiple factors, including skills, interests, personality traits, and educational background, to suggest suitable career paths.

These systems improve accuracy, reduce manual effort, and provide consistent results.

Compared to traditional methods, AI-based systems are scalable, faster, and capable of delivering real-time recommendations. They also enhance user experience by providing interactive and user-friendly interfaces.

2.3 ROLE OF NLP IN CAREER MATCHING

Natural Language Processing (NLP) plays an important role in processing and analyzing textual data in career guidance systems. NLP techniques enable the system to understand user inputs such as skills, interests, and preferences, even when provided in textual form.

In career recommendation systems, NLP is used for keyword extraction, text matching, and similarity analysis. It helps in comparing user inputs with predefined career datasets and identifying relevant matches. This improves the system's ability to generate accurate recommendations.

Although advanced NLP techniques involve complex models, basic NLP methods such as keyword matching and text comparison are sufficient for many applications. In this project, simple NLP techniques are used to map user inputs to suitable career options effectively.

2.4 RULE BASED AND RECOMMENDATION TECHNIQUES

Rule-based systems are one of the earliest forms of AI and are widely used in decision-making applications. These systems operate based on predefined rules, where specific conditions lead to corresponding outcomes. In career guidance, rule-based systems match user inputs with career requirements to generate recommendations.

Recommendation techniques are used to suggest items based on user preferences and behavior. In career guidance systems, recommendation techniques analyze user profiles and provide suitable career options. A commonly used approach is the linear weighted model, where different factors such as skills, interests, and education are assigned weights, and a final score is calculated for each career option.

The combination of rule-based logic and weighted scoring creates a hybrid recommendation system that improves accuracy and relevance. This approach ensures that multiple aspects of a user's profile are considered while generating recommendations.

3 PROPOSED METHODOLOGY

To overcome the limitations of existing systems, the proposed system introduces an AI-based career guidance and recommendation system. The system uses a rule-based approach combined with a linear weighted scoring mechanism to generate personalized career recommendations.

The system collects user inputs such as skills, interests, personality traits, and education. It processes this data using intelligent logic and provides suitable career options based on calculated scores and predefined rules.

The system is implemented using Spring Boot and Java, ensuring efficient processing and scalability.

The overall structure of the proposed system is shown in Fig 3.1.

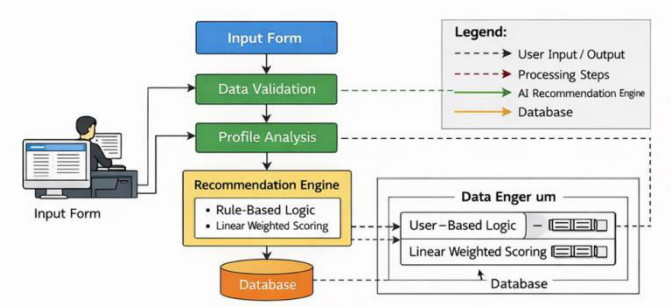

Fig 3.1 Block Diagram of Proposed System

3.1 SYSTEM ARCHITECTURE

The system architecture consists of multiple components that work together to provide career recommendations.

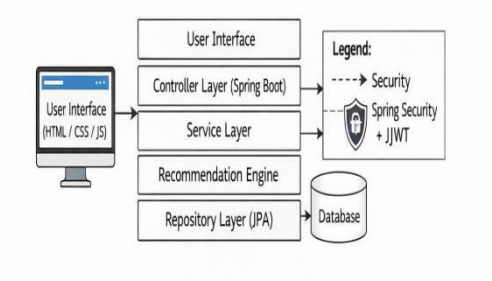

Fig 3.2 Proposed System Architecture

The process begins with the user entering details such as skills, interests, personality traits, and educational background through the frontend interface. The request is sent to the backend developed using Spring Boot.

The backend processes the data using the recommendation engine, which applies rule-based logic and linear weighted scoring. The system then retrieves relevant career data from the database and generates recommendations.The final output is displayed to the user in a structured format. The system also includes authentication and security mechanisms using Spring Security and JJWT.

3.2 USE CASE DIAGRAM

The use case diagram represents the interaction between users and the system. It identifies the actors involved and the functionalities they can perform.

In this system, there are two main actors: User and Admin. The user interacts with the system to register, log in, manage their profile, get career recommendations, and generate resumes. The admin is responsible for managing career data and maintaining the system.

The use case diagram provides a high-level view of system functionality and helps in identifying system requirements. It ensures that all user interactions are clearly defined and properly implemented.

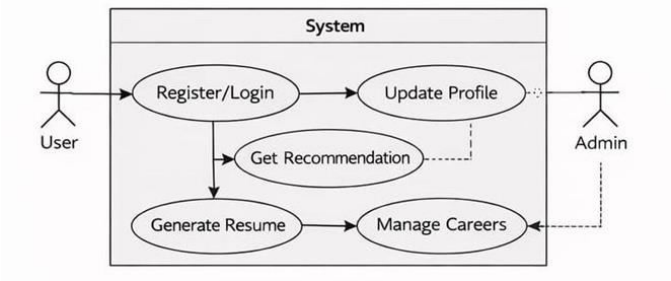

Fig 3.3 Use Case Diagram

3.3 SEQUENCE DIAGRAM

The sequence diagram illustrates the step-by-step interaction between different components of the system over time. It shows how messages are passed between objects to complete a process.In this system, the sequence begins when the user enters their details through the frontend interface. The request is sent to the controller, which forwards it to the service layer. The service layer processes the data and sends it to the recommendation engine.

The recommendation engine analyzes the data and interacts with the database to retrieve relevant career information. After processing, the results are sent back through the service and controller layers to the user interface.This diagram helps in understanding the dynamic behavior of the system and ensures proper communication between components.

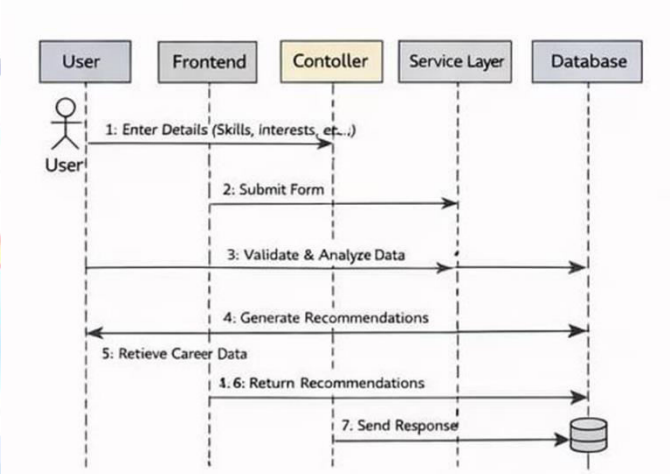

Fig 3.4 Sequence Diagram

3.4. EVALUATION METRICS

The performance of the proposed AI-based Career Guidance and Recommendation System is evaluated using a combination of quantitative and qualitative metrics. Since the system follows a hybrid approach based on rule-based classification, linear weighted scoring, and basic Natural Language Processing (NLP), multiple evaluation parameters are considered to measure accuracy, relevance, efficiency, and user satisfaction.

A. Accuracy

Accuracy measures the proportion of correct career recommendations generated by the system.

$$\text{Accuracy} = \frac{\text{Number of Correct Recommendations}}{Total\ \ Recommendations}$$

A higher accuracy indicates that the system effectively matches user profiles with suitable career options.

1) ***B. Precision***

Precision evaluates the relevance of the recommended careers by measuring how many of the suggested careers are actually appropriate for the user.

$$\text{Precision} = \frac{\text{Relevant Recommendations}}{Total\ \ Recommended\ Career}$$

High precision ensures that the system minimizes irrelevant suggestions.

2) ***C. Recall***

Recall measures the system's ability to identify all relevant career options for a given user profile.

$$\text{Recall} = \frac{\text{Number of Correct Recommendations}}{Total\ \ Relevent}$$

A higher recall indicates better coverage of suitable career options.

4 RESULTS

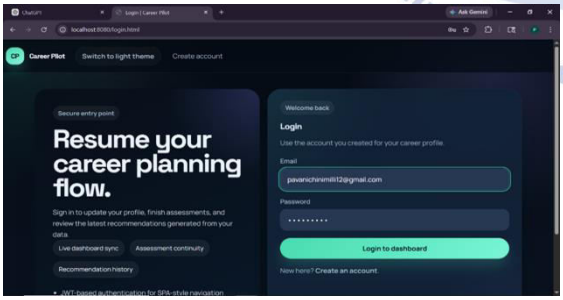

Fig 4.1: Login Page Interface

This image represents the login module of the Career Pilot system. The interface allows users to securely access their accounts using registered email and password credentials. It also includes a theme toggle option and a link for new users to create an account. The design ensures a user-friendly experience with a structured layout and secure authentication entry point.

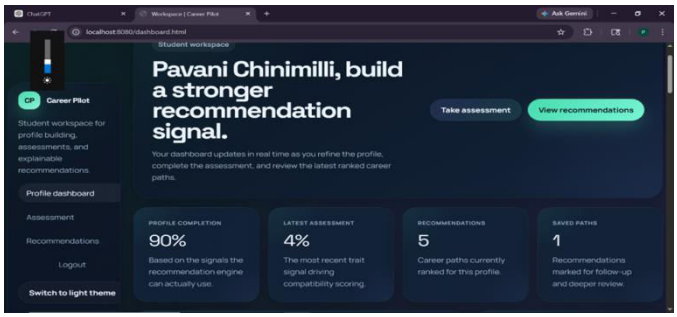

Fig 9.2: User Dashboard

This figure shows the student dashboard after successful login. The dashboard displays personalized information such as profile completion percentage, latest assessment score, number of recommendations, and saved career paths. It also provides quick navigation options like "Take Assessment" and "View Recommendations," enabling users to interact efficiently with the system.

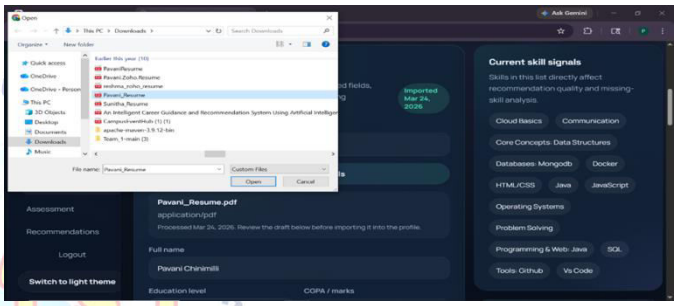

Fig 9.3: Resume Upload and Skill Extraction

This image illustrates the resume upload functionality. Users can upload their resumes (PDF format), which are then processed by the system to extract relevant details such as name, education, and skills. The extracted skills (e.g., Java, HTML/CSS, SQL, etc.) are displayed as "skill signals," which are later used for generating accurate career recommendations.

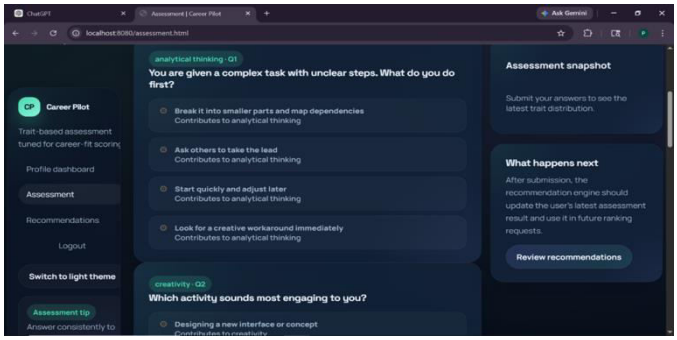

Fig 9.4: Assessment Module

This figure shows the career assessment interface, where users answer structured questions designed to evaluate traits like analytical thinking and creativity. Each question provides multiple options, contributing to the scoring mechanism. The results of this assessment are

used by the recommendation engine to suggest suitable career paths.

5 CONCLUSION

The proposed system successfully implements an intelligent career guidance and recommendation platform that assists users in selecting suitable career paths based on their individual profiles. The system analyzes user inputs such as skills, interests, personality traits, and educational background to generate personalized career recommendations.

By integrating Artificial Intelligence techniques such as rule-based decision making, linear weighted scoring, and basic Natural Language Processing, the system ensures accurate and relevant suggestions. The use of Spring Boot and Java enables efficient backend processing, while MySQL ensures reliable data storage.

The system overcomes the limitations of traditional career guidance methods by providing automated, consistent, and data-driven recommendations. It reduces manual effort, improves decision-making, and enhances user experience. Additional features such as secure authentication using Spring Security and JJWT, along with resume generation using Apache PDFBox, further increase the practicality and usefulness of the system.

Overall, the project demonstrates that AI-based approaches can significantly improve the effectiveness of career guidance systems and provide valuable support to students and job seekers.

6 FUTURE ENHANCEMENT

Although the system performs effectively, there are several areas where it can be further enhanced to improve functionality and performance.

The system can be extended by incorporating advanced machine learning algorithms to improve the accuracy of recommendations. Techniques such as classification models and predictive analytics can be used to analyze user behavior and provide more dynamic suggestions.

Integration with real-time job market data can enhance the relevance of recommendations by considering current industry trends and demands. This would help users align their career choices with market opportunities.

The user interface can be further improved to provide a more interactive and engaging experience. Features such as dashboards, visual analytics, and personalized insights can be added.

The system can also be deployed as a mobile application to increase accessibility and reach a wider audience. Cloud integration can be used to improve scalability and performance.

Additional features such as career path tracking, skill development suggestions, and integration with online learning platforms can further enhance the usefulness of the system.

These enhancements will make the system more intelligent, adaptable, and capable of providing comprehensive career guidance in the future.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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