Grenze International Journal of Engineering and Technology, June Issue

Career Path Advisory: An AI-based Career Recommendation and Skill Gap Analysis System

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***Abstract*— Choosing an appropriate career is always puzzling for the students, especially when there exists a lucid difference between the academic and industry expectations. Most students are always in confusion about which career choice actually corresponds to their capabilities and interests. Here, in this paper, we have introduced an AI-based career recommendation and gap analysis system that helps a user recognize his career choices in a much pragmatic and realistic manner.**

It takes input from the user's quizzes and profile details, analyzes the responses through skill matching and logical scoring, and consequently recommends career options. It further goes ahead to highlight the skills needed for improvement by comparing the current level of the users against the requirements within the selected career. The application is developed as a web-based system using React and JavaScript. The results of the outcomes prove that the users found the guidance much clearer, more useful, and easier to understand compared to the conventional counseling methods.

***Index Terms*— Career Recommendation, Gap Analysis, Artificial Intelligence, Skill Assessment, Career Guidance System.**

I. INTRODUCTION

The choice of career is the most important decision in the life of a student, as it is the key to the professional development, individual gratification, and success. An appropriate choice of a career offers stability, confidence and encouragement, and the wrong choice of career may result in frustrations, low self esteem, limited development and job changes. Lack of awareness, guidance, and perception of their strengths and interests make many students unable to find an appropriate path of career.

Conventionally, the career guidance has been conducted using general aptitude tests, personality test or face-to-face counseling session. Although these approaches are partially helpful, they do not always take the full picture of a student (including such aspects as practical skills, actual interests, or the needs of the current industry). In addition, traditional methods of counseling are generic in nature and they may not be revised frequently to match the quickly evolving job demands and technological development. This leads to the situation whereby students usually get outdated or non-personalized advice, thereby lowering its effectiveness.

The past years have witnessed the rapid development of digital systems, data analytics, and artificial intelligence, which has provided new opportunities to deliver more precise and personalized career advice. Recent systems can process high volumes of information, consider several factors at once, and find important patterns that are challenging to find using human procedures.

Grenze ID: 01.GIJET.12.2.502_20

With such technologies, the career guidance can go beyond simple aptitude tests and offer more information on the capabilities of the student and his/her potential career.
In this project, an AI-driven Career Path Advisory System is developed to analyze the input of the user by way of structured questions and analysis based on skills. The system gathers requisite information regarding the educational background of a user, technical and non technical skills, interests and preferences. According to this data the system examines the appropriateness of different career choices and delivers its recommendations that are personalized to the individual user.
The proposed system will provide the reasons why a certain career should be advised unlike the conventional systems that often come up with random or generic suggestions. It establishes the alignment of skills and interests that the user has to those of the career position. Moreover, the system takes distinct areas that require improvements by the user through skill gap analysis. Through this feature, students get to know what career to take and also how to make proper preparation before taking that career.
The system also seeks to assist students in long-term career planning to provide students with guided advice as opposed to a one-time advice. The platform promotes self-improvement and constant learning by revealing strengths and weaknesses and areas of development. It makes the guidance more realistic, practical and in line to the real world expectation.
To sum up, the Career Path Advisory System that has been proposed is an intelligent, modern-day, and student-centric career guidance system. The system will assist students to make high-quality career choices by incorporating artificial intelligence and structured data analysis, minimize confusion, and become more confident in making career choices. This type of system can greatly improve the standards of career guidance that are offered to the students in the world of today, which is competitive and technology-driven.

II. Literature Review

Early systems for career guidance mostly depended on personality and interest-based tests. Some tools used simple filters to match users with career options, while others introduced hybrid methods that combined several techniques for better accuracy. Although these approaches improved recommendation quality, many of them did not clearly explain why a certain career was suggested. They also rarely pointed out the specific skill gaps or provided detailed advice on how a student could prepare for a chosen path. The present study attempts to address these gaps by designing a system that not only suggests careers but also helps students understand the improvements needed for their selected field.

III. Problem Statement and Objectives

A large number of students facing difficulties in selecting an better carrier due to less awareness of job requirements and less understanding of their own skill and knowledge levels. Existing career guidance system failed to explain why a particular career is suitable for student.
Therefore, there is a requirement for an intelligent, automated, and transparent career advisory system that gives skills assessment, recommendation logic, and gap analysis to support or choose effective career planning.

- To suggest best career based on user skills and knowledge.
- To provide best roadmap or guidance to improve those skills.
- To make recommendation process easy to understand.
- To help students to make better or good decision through a web-based platform.

IV. System Architecture

The system is made of different parts, and each part has its own job. All these parts work together to give a correct and accurate recommendation according to user skills and knowledge.

A. User Interface Layer

This part is the part user sees on the screen. It is made using a framework react and vite.it includes pages like the Dashboard, quiz section, quiz page, interview questions page, resume analyser, and Analytics page.
From these pages, the user can take quizzes, check results, and use all features of the system.

B. User Profile Module

This part of the system collects information about the user such as education details, interests, skill levels, and quiz performance.

All this information is used letter to understand the user's strengths, interests, and weaknesses.

C. Career Assessment Engine

The career assessment engine checks the user's quiz and career assessment answers and gives them scores on his answers. Each answer adds to the total scores and that decides how suitable different careers are for the user.

D. Recommendation Engine

This part compares the user's skills with the skill requirements for various careers. Based on the comparison, it creates a page on which all the suitable careers option list is present according to user's skills and knowledge, starting from the most suitable one.

E. Gap Analysis Module

This module search or finds out which skills the user is missing for a chosen career. It shows the gap between the user's current skills and the skills needed, and suggests them a roadmap to improve the skills and knowledge according to selected career.

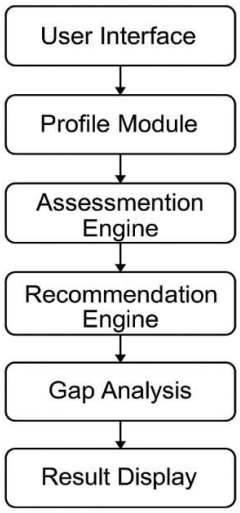


Fig. 1. Overall system architecture of the AI-based career recommendation and gap analysis system

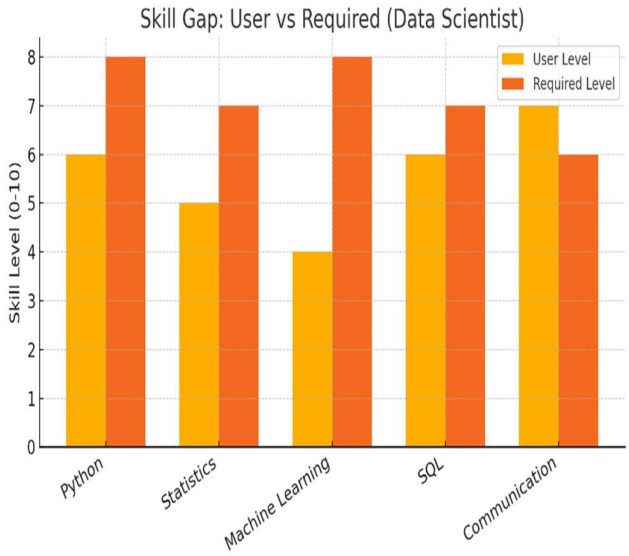
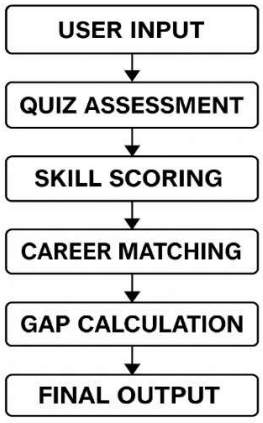


Fig 2

VI. METHODOLOGY

The system work step by step to give career recommendations. The main steps are.

- User registration and profile input
- Completion of career assessment quiz
- Competency evaluation and scoring
- Career matching based on scores
- Identifying gaps
- Display of improvement guidance



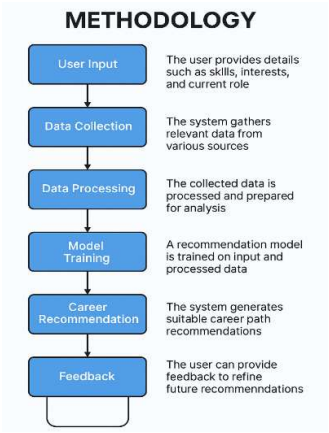


Fig 3. Workflow of Career Recommendation Process fig 4

VII. IMPLEMENTATION DETAIL

The system is created in the form of web application that compatible with both computers and smart gadgets. It employed the below technologies:

- Framework (react + vite) for creating the frontend of the web application (what the user sees).
- React.js for building different pages and components of the system.
- Javascript for process all the logic, such as scoring and recommendations.
- CSS and Tailwind to create the layout and making the application look clean and responsive.

The system involves various modules which includes:

- Career recommendation
- Quiz assessment
- Skill gap analysis
- Interview preparation
- Resume analyser

VIII. MODEL PERFORMANCE COMPARISON

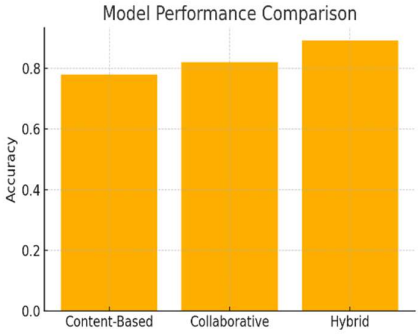


Fig 5

A. Performance of the Content-Based Model

The Content-Based model got an accuracy of 0.78.
This means it work well when recommending careers based only on the user's skills and profile.
Limitation: However, it does not understand deeper patterns like user behaviour or preferences, so its results are sometime limited.

B. Improved Collaborative Filtering

The Collaborative Filtering model performed better, with an accuracy of 0.82.
It works better because it learns from user similar interests and skills.

C. Hybrid Model Superiority

The Hybrid model achieved the highest accuracy of 0.89.it combines both methods-user skill data and user behaviour patterns.
Because of this combination, it gives the most accurate, reliable, and personalized career suggestions.

IX. Results and Discussion

The Career Path Advisory System was also tested with actual user interactions as well as sample test data to determine its accuracy, usability and effectiveness. The test was done on users with diverse backgrounds and they included students, fresh graduates and working professionals. The users gave inputs pertaining to their skills, interests, education, and career preferences. In testing, the system was able to analyze user profiles and produce career recommendations which were clear, accurate and relevant. The career options that were recommended were also compatible with the skill sets and interests of the users, which means that the recommendation logic, as well as the scoring mechanism were performing efficiently. According to the users, the career-fit scores enabled them to know how suitable a specific job was to them.
The effectiveness of the skill gap analysis was one of the crucial results. The system was explicit about the gaps or poor skills that are needed in every suggested career. This has been given in a straightforward and easy to digest format whereby users were able to establish areas where they needed to improve on. The incorporation of individualized learning map also increased the utility of the system since it instructed the users on the preparation of their selected career path in a systematic fashion. The users reported a high level of confidence in career decision-making and this was greatly enhanced by the platform. The overall experience was found to be user-friendly and informative as mentioned by many users due to the structured design, easy way to see the results and follow the roadmap step-by-step. This system compared to the conventional career guidance methods that normally offer general advice, thus causing confusion and uncertainty, provided tailor-made advice depending on the profile of the individual. The system was also found to perform better as compared to the traditional counseling strategies. Conventional approaches are based on subjective assessment and low aptitude testing, but the suggested system is based on the data analysis and AI reasoning. This translated to the provision of better recommendations and realistic guidance in line with the prevailing industry demands.
Nevertheless, certain shortcomings were witnessed in the process of testing. The quality and completeness of user input determine the quality of recommendations. The outcomes were not as accurate in instances where customers only gave partial or erroneous information. Moreover, the system is currently dependent on a pre-established career data, and this might need frequent update to capture the dynamism trends in the industry.
In general, the findings provide evidence that the Career Path Advisory System suggested is effective, reliable and useful in practical career planning. The system effectively tackles the issues of career confusion through personalized recommendation, analysis of skills gap and learning road map. As the system is improved further and updated with new data continuously, it can be developed into a complete digital career advice platform.

X. Ethical and Deployment Considerations

The system follows the ethical standards by ensuring the user data is kept confidential and used responsibly, and without user consent the data is never share to third party and also user have full control over their personal information.

XI. Conclusion

This research presents a practical and user-focused AI system that helps individuals understand which career is best option to fit them according to their skills knowledge and what skills they need to improve by using simple

assessment methods and clear guidance, the system makes the career planning process and strategies easier and more transparent.
Overall, the result show that the technology can effectively support students in making informed and confident career decisions when it is used carefully and responsibly.

FUTURE WORK

Future improvement to the system the changes may include creating a more detailed carer dataset, improving the accuracy of the assessment logic, and enhancing the visual presentation of result. These developments will help make the system more effective and easier for users to understand.

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