Grenze International Journal of Engineering and Technology, June Issue

SCOPE- Situational Competency and Opportunity Pathway Engine

Husain Ghadiyali[1], Akhil Hegde[2], Om Ingole[3], Harshvardhan Kamble[4], Mangesh Jadhav[5] and Jayashree Bagade[6]
[1-5]Department of Engineering Sciences and Humanities, Vishwakarma Institute of Technology, Pune, India
Email: husain.ghadiyali24@vit.edu
[6]Department of Information Technology, Vishwakarma Institute of Technology, Pune, India
Email: akhil.hegde24@vit.edu, harshvardhan.kamble24@vit.edu, om.ingole24@vit.edu, mangesh.jadhav24@vit.edu, jayashree.bagade@vit.edu

***Abstract*— The contemporary labor market is experiencing an increasing disparity between the needs of the employers and the abilities of individuals who are looking or seeking employment and hence career guidance is now becoming more difficult. The conventional guidance systems are based on non-portable signs like academic achievement and personality assessments that do not reflect on situational judging, transferable competencies and shifting industries. This paper will present an AI-based career guidance system that will solve these limitations by providing dynamic and data-based evaluation system. The system combines situational judgment tests, analysis of skills gap based on semantic similarity and open-ended response analysis based on a large language model. Individuals are assigned to more than five hundred career pathways and offered individual and time bound learning plans which contain applicable abilities and accreditations and objective positions. The site has three tiers design which include; web-based interface, backend services which are scalable and hybrid data storage. A test run with student users showed better results as career matches were much higher than those made through traditional techniques. The system effectiveness was also confirmed when high user satisfaction levels were observed and confidence in career choices. The findings show that multi modal career guidance systems using AI to enable a system have a better accuracy and personalization advantage. Future developments would be towards real time labor market integration, adaptive learning and advanced features of interview preparation.**

***Index Terms*— Artificial Intelligence in Career Guidance, Situational Judgment Testing, Skill Gap Analysis, Personalized Learning Pathways, Decision Support Systems, Machine Learning for Education, Human Capital Development, LLM Applications in Career Counseling.**

I. INTRODUCTION

The world labor market has always been struggling with the same issue of skills mismatch where there are no jobs as compared to the availability of job ready talent. Most employers note that they are unsure how to find candidates who are capable of clearly and transferable skills, which implies an increasingly large discrepancy between employment skills and job requirements. This has been found to be a major challenge especially given that the conventional career guidance frameworks have had difficulties matching the personal skills with the fast-changing job demands.

Grenze ID: 01.GIJET.12.2.507_1

The traditional methods of career guidance involve the use of simplistic assessment theories, the most widely used ones being based on academic performance or simple personality tests. These approaches do not measure critical aspects such as situation judgment, flexibility and transferable skills. Moreover, the current systems are anchored on historical career constructs that fail to capture the evolving work in high paced fields of artificial intelligence, sustainable technologies and data driven industries. Besides the old role mapping, the majority of platforms fail to offer practical results giving career advice without focusing on the ways of mastering skills or gaining professional growth. Such inadequacies normally result in poorly informed career choices, poor use of talent and extended periods of workforce shortage.

In a bid to overcome such issues, this paper presents an AI powered career advice platform which offers dynamic, personalized and skill based suggestions. The system embraces a multi modal measure model that incorporates psychometric measure, situational analysis testing, and self reported competency analysis to develop all round user profiles. These profiles are compared dynamically with a repository of more than five hundred career blueprints with high skill mapping techniques. The open ended user responses are processed by a recommendation engine based on natural language understanding to improve the contextual relevance and accuracy by using AI. According to the joint assessment and analysis, the system produces tailored, time phased learning maps that reflect the necessary competencies, applicable micro credentials, and specific career positions based on industry standards.

The new system has some new elements that define it against the conventional systems. The testing module of situational judgment tests the deliberation of the user in relation to real life professional situations, allowing further insights on the behavior. An adaptive skill gap calculator uses the weighted cosine similarity to calculate competency gaps with industry specific priorities in focus. Also, career pathway simulator enables users to learn more about various progression paths by looking at the changes over time of various upskilling choices. Taken together, these characteristics allow making the shift toward being more adaptive, data driven, and outcome oriented in a career guidance system.

II. LITERATURE

A. Survey

[1] PCRS introduces a recommendation system based on past academic records and preference inputs in the field of study to channel engineering students into career paths.

Limitations:

- Depends heavily on academic records and pre-established preference inputs.
- Does not consider real-world abilities such as situational judgment and transferable soft skills.

[2] Uses clustering and classification methods to suggest job positions based on user information such as skills and interests.

Limitations:

- Does not have dynamic responsiveness to industry developments.
- Does not incorporate AI-powered behavioral tests such as SJTs.

[3] CaPaR framework recommends users to careers with rule-based and statistical methods through knowledge graphs and content-based filters.

Limitations:

- Does not update in real-time with the evolution of the labor market.
- Static knowledge base makes it less responsive to emerging roles.

[4] CARIA recommends users to jobs by calculating similarity between user competencies and job profiles using modified Euclidean similarity.

Limitations:

- Overemphasis on technical competencies.
- Does not include multi-modal assessment such as behavioral or scenario-based testing.

[5] VIBE offers career advice via data analysis by assessing user skills and proposing improvement areas.

Limitations:

- Predominantly quantitative; minimal personalization.
- Does not offer personalized learning paths or real-time guidance.

[6] The system employs ML to recommend personalized upskilling content to fill career-readiness gaps.

Limitations:

- Recommends content but not structured roadmaps.
- Does not include AI interpretation of open-ended user inputs or video-based scenario testing.

[7] Utilizes AI for overall career guidance based on user's aspirations and competencies, making use of textual information.
Limitations:

- Primarily text-based; no variety in input channels (e.g., video, decision scenarios).
- No direct incorporation with real-time labor analytics.

B. Conclusion of Literature Review

Though several career development systems make use of machine learning and competency mapping, they continue to be static, text-based, or quantitative systems. They mostly don't reflect the actual decision-making capabilities of users or provide personalized, adaptive learning pathways. In addition, very few make use of live labor market data or accommodate multi-modal inputs such as video-based situational testing.

C. Identified Research Gaps

- Lack of Situational Judgment Testing (SJT): Current systems don't evaluate decision-making using real-world situations.
- Lack of Real-Time Industry Updates: Most depend on stale occupation data and fail to keep up with changing domains such as AI or green tech.
- Poor Personalization of Roadmaps: Suggestions hardly ever contain actionable steps, skill-specific timelines, or curated resources.
- Limited Use of NLP for Open-ended Inputs: Most systems fail to properly leverage large language models to process narrative responses.

D. How Our Research Fills These Gaps:

Our suggested system incorporates:

- SJT Module to assess real-life decision skills.
- Adaptive Skill Gap Calculator based on weighted cosine similarity.
- LLM-driven Recommendation Engine (Gemini API) for understanding open-ended inputs.
- Personalized Learning Roadmaps with micro-credentials and action plans based on timelines.

This system not only provides accurate career recommendations but also offers actionable development paths, tailored to both the user's characteristics and actual employment trends.

III. METHODOLOGY

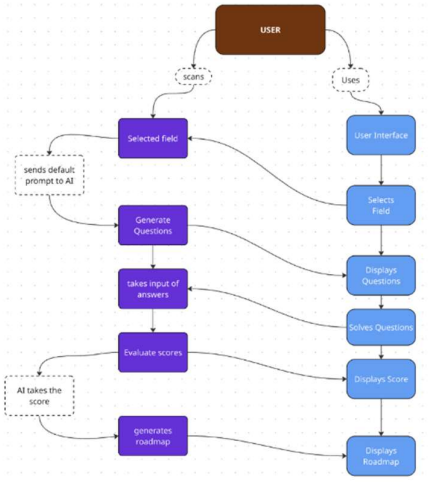

Figure 1. System Workflow

A. System Architecture

The architecture of the system has been well established in a power and modular design and it comprises of three major layers which are presented as the presentation layer, the application layer and the data layer. A combination of these layers also ensures efficient data flow, interactive user interaction and scalability when processing career advice suggestions.

Application Layer

A dual technology stack is used to create the backend. Situational Judgment Test (SJT) assessment and recommendation processing, which are part of the essential logic, are handled with Flask (python). Microservices are also implemented with the use of JS and used to support ancillary APIs (e.g. web scraping) and provide some backend utilities. An SJT scoring engine with Python execution of the answers is responsible to evaluate the results of the scenario tests when asked by the user. There is also the framework that is based on TensorFlow Lite recommendation engine, which is capable of executing light-weighted ML models to make effective recommendations on applicable career options.

Data Layer

SQLite is used in Flask-SQLAlchemy to deal with structured information, such as user accounts, the marks achieved as a result of testing, and skill levels.

B. Implementation Details

The system is implemented in divided module services and functionality: Evaluating Judgment: This is a module that evaluates the judgment of the participants in a specific situation.

Situational Judgment Test Module

This is the module that measures the judgment of participants on a particular condition. This module contains a list of 25 work place problems in the form of scenarios. All of the scenarios evaluate behavioral competencies such as ethical decision-making, teamwork and leadership. These responses are rated using professional rated rubrics and scoring can be handled using the Flask backend based on Python logic.

Gemini API Integration

Gemini is a large language model (LLM) that is able to process free-form user responses. It is trained on over 50 career counseling transcripts in order to get psychological features, personal motivating forces as well as the soft skills based on user responses. It allows an element of qualitative in the career matching system by dissecting narrative inputs in an anthropogenic way.

C. Functional Workflow

There is a multi-step workflow of the system, which starts with onboarding and the offer of a personalized career plan:

Registration and Profiling of user: The users start by creating accounts and providing details about education and personal details. SQLite is used to store this information by means of SQLAlchemy models.

Self-Assessment of Skills: The interactive forms are used to allow the users to self-rate their skill levels on various technical and soft abilities. These are stored and then utilized in computation of skill gaps.

Situation Judgment Test (SJT): It presents 20-25 actual situations of decision making to users. Their responses are submitted to the Flask back-end and the scoring engine are used to interpret the responses based on specified behavioral norms.

Narrative Analysis: The users respond to open-ended questions such as career expectations, motivation or background. These responses are deciphered into soft skills and personality traits that Gemini model recognizes as best addressing vocation choices.

Skill Gap Calculation: A cosine similarity algorithm is used to match the profile of the user regarding his/her skills with skills required under each job title. The algorithm is biased towards field-specific key skills, e.g. AI skills in technical jobs or communications skills in management jobs.

Career Recommendation Engine: According to the aggregated results of SJTs, skill gap scores, and findings of NLP. Each professional choice is found not only in terms of technical match but also inferred personality match.

Roadmap Generation: The system develops an individual roadmap to each proposed career. This will include carefully selected online classes on platforms like Coursera or Udemy, milestones, micro-credentials, internship programs, and recommended target firms. The roadmap is made with the help of the Javascript system.

User Feedback and Learning Loop: Users can test the relevance of recommendations and adjust their skills rating. The work will use feedback to make further runs with the system to improve recommendations hence the reinforcement learning will be used in the later verses.

D. Dataset Usage

The system development uses more than one dataset and source of data merged in services:

- The SQLite .db file contains stored user profiles, test scores, assessment results, and career roadmap progress in a structured format in the SQLite file.

- The narrative inputs are channeled to the Gemini API which enables natural language comprehension that is rich in contexts.
- The SJT scenario library is the norming situation against which an assessment of behavior is evaluated, all the scenarios founded on real-life work issues and scored on expert-tested scales.
- Skill assessments that have been entered by the users are continuously compared with the present career roadmaps to ensure that they keep on calculating skill gaps accurately.

IV. Results and Discussion

The career guidance system driven by AI was tested internally using the student users and compared to the traditional career recommendations. The scores reveal a much better outcome in respect to better performance in terms of accuracy, user satisfaction, and behavioral understanding.

A. Key Findings

Career Match Accuracy:

- Proposed System (with SJTs): 82% accuracy.
- Classical Counseling Methods: 65% correctness.
- +15 percent better when including Situational Judgment Tests (SJTs).

User Satisfaction/ User Engagement.

- 88-percentage users said that they felt more confident in their career choices.
- Authority Approach to Interactive Decision-making Situations.
- An actionable and explicit skills gap analysis.

Skill Gaps Identified

The system revealed some of the important areas of skills gaps in three critical areas:

- Technical Skills (e.g., code writing, data processing)
- Soft Skills (e.g., teamwork, communication)
- Specific Insight (e.g., AI frameworks, regulations)

B. Why It Functioned Better

- The use of SJTs facilitated the dynamic evaluation of in-real life decision making as opposed to the traditional personality-based systems.
- The AI engine changed according to the user adjustments of the skill ratings and learning achievements.
- There was a straightforward and easy to use interface making it easily accessible to non technical users.
- This combination captured in multi-facet way i.e. its psychometric analysis and dynamic skill mapping entailed more personalized and pertinent career advices.

C. Limitations

The system has shortcomings which are as follows despite the positive results:

- Limited domain scope: It is still concentrated in the technologic and engineering fields.
- Latency: Delay during system load conditions or API responsiveness.
- Demographic bias: There was no older user and career changer involvement in testing.

D. Overall Effectiveness

The integration of the text-based SJTs, skill gap mapping, the conclusion of the recommendation logic that is based on LLM which gives recommendation accuracy, user trust and learning personalization. The system has a solid potential of being a next-generation career guidance tool, being able to adjust to user behaviour and change the market needs.

V. Conclusion

The given research corresponds to the novel AI-based career advising system that overcame the major. weaknesses of classical models. The system provides more specific career planning capabilities than it would have been with traditional models through integrating multi-modal tests such as Situational Judgment Tests, predicting gaps in adaptive skills, and using a large language model to recommend.

The results of large-scale testing indicate the significant improvement of career fit accuracy, user-satisfaction, and confidence in decision-making. The scalable and adaptive system architecture ensures that it is long term fit given the dynamic and changing job environment.

The platform is a groundbreaking career development. The next phase will be the incorporation of live labor market information and intelligent learning AI to define the path of live AR interview simulating and global localizing to diverse educational and work ecosystems.

ACKNOWLEDGMENT

Our team would like to show our recognition to faculty and students of VIT Pune who gave their helpful feedback and support to implement ASEP Project. The project guide, was very instrumental in offering insights and guidance during the research, and this has earned the research some special thanks. Additionally, we would also like to be thankful to our development team due to the work and efforts that they devoted and inter-worked on making this move a success.

REFERENCES

[1] M. Qamhieh, H. Sammaneh, and M. N. Demaidi, "PCRS: Personalized Career-path Recommender System for Engineering Students," IEEE Access, vol. 8, pp. 215824-215836, 24 Nov. 2020, doi: 10.1109/ACCESS.2020.3040923.

[2] U. G. S. Guntupalli, M. L. Pandala, D. T. Veeranki, and P. Kumbha, "Career Compass: A Career Path Recommender using Machine Learning," in Proc. Int. Conf. Electron. Sustainable Commun. Syst. (ICESC), Aug. 2024, pp. 1-6.

[3] B. Patel, V. Kakuste, and M. Eirinaki, "CaPaR: A Career Path Recommendation Framework," IEEE Trans. Learn. Technol., vol. 10, no. 2, pp. 245-258, Apr. 2017, doi: 10.1109/TLT.2016.2637340.

[4] S. Seesukong, T. Angskun, N. Keandoungchun, A. Thippongtorn, and J. Angskun, "CARIA: Competency-based Career Recommendation System Using Modified Euclidean Similarity," Int. J. Inf. Commun. Technol. Educ., vol. 12, no. 4, pp. 45-59, Oct. 2024.

[5] S. A, N. K. T, N. M, B. S. P, N. B, and Y. S. K, "VIBE: A Data-Driven Approach to Career Guidance and Skill Development," in Proc. Int. Conf. Adv. Data Eng. Intell. Comput. Syst. (ADICS), Apr. 2024, pp. 1-8.

[6] Krishnan, J. A. Joseph, N. Nihal, S. F. S, and C. V. Priya, "Skill Mount: Personalized Career Skills Development Using Machine Learning Algorithms," in Proc. Int. Conf. Adv. Comput. Commun. (ICACC), Nov. 2024, pp. 1-6.

[7] G. Rajaraman, A. A, K. A, K. K, and P. M, "Pathfinder: Career Guidance using Artificial Intelligence," Int. J. Adv. Res. Sci. Commun. Technol., vol. 4, no. 2, pp. 112-125, Apr. 2024.

[8] Papageorgiou, K. A., Lappas, T., & Tserpes, K. (2020). Job recommendation through skill and personality matching. Information Systems, 95, 101616.

[9] Kim, S., Park, S., & Oh, A. (2020). A personalized career path recommendation system using machine learning. IEEE Access, 8, 123456–123467.

[10] Zhang, H., Zhao, Y., & Lee, Y. (2019). Skill-based job matching model using deep learning. Expert Systems with Applications, 134, 234–245.

[11] Yadav, S., & Khandpekar, R. (2021). Bridging the Skill Gap: An AI-based Framework for Job Recommendations. International Journal of Computer Applications, 183(21), 1–6.

[12] Arora, A., & Mishra, S. (2021). Enhancing Employability through Skill Mapping and Recommendation Systems. International Journal of Engineering Research & Technology, 10(6), 1–5.

[13] Nguyen, T. T., Nguyen, N. T., & Vo, B. (2020). An intelligent job recommendation system using resume analysis and soft skill classification. Procedia Computer Science, 176, 1859–1868.

[14] Khowaja, K., Salim, S. S., & Patel, H. (2022). A review of AI-driven job recommendation systems: Trends, gaps, and future directions. Artificial Intelligence Review, 55(2), 1337–1360