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One Stop Personalized Career and Education Advice System A Comprehensive Research Paper

Shubham Kawade[1], Swamini Kawade[2], Priya Khaire[3], Vaishnavi Chevale[4]
[1,2,3]Department of Computer Science and Application,
[4]Assistant Professor, Faculty of Science and Technology
JSPM University Pune
kawadeshubham32@gmail.com[1], kawadeswamini22@gmail.com[2], priyakhaire8@gmail.com[3],
Vhc.scos@jspmuni.ac.in[4]

Abstract: *The One Stop Personalized Career and Education Advice System functions as an intelligent career guidance platform which supports students who need help with their academic and professional decisionmaking through its advanced Artificial Intelligence capabilities. The system combines a RetrievalAugmented Generation (RAG) framework with the Google Gemini large language model to deliver users customized recommendations that consider their specific situation. It enables users to explore suitable career paths, identify skill gaps, and create structured learning roadmaps, which they can customize according to their unique requirements. ATF-IDF-based knowledge retrieval mechanism enables the platform to extract pertinent information from a compilation of career paths and academic programs, which serves as the foundation for AI-generated answers. The hybrid recommendation algorithm establishes career suggestions through skill matching, interest alignment, and educational background evaluation. The system provides an AI-enabled chatbot, a course recommendation system, and ongoing student profile maintenance to deliver better individualized experiences to users. The system uses a comprehensive full-stack architecture which implements React for its user interface, FastAPI for its server functions, and MongoDB for its data preservation purposes to create a system that can grow and function as separate components. The experimental results show that the system provides better relevance and usability results than existing career guidance systems. The solution demonstrates how combining LLMs with structured retrieval methods creates dependable AI-based advisory systems which provide users understandable guidance..*

Keywords: Artificial Intelligence (AI), Career Guidanc Language Models (LLMs), Personalized Recommendation System, Skill Gap Analysis, Learning Roadmap Generation, TF-IDF, Google Gemini, FullStack Development, FastAPI, React, MongoDB, Education Technology (EdTech)

I. INTRODUCTION

The career paths which students choose along with their educational paths face major difficulties because they must deal with both educational information and changing job markets which create uncertainty about their future employment options. The primary obstacles in traditional career guidance systems arise from their dependency on assessment results which do not suit individual needs and their ability to provide general career guidance. The result of this situation leads students to experience confusion while they choose their careers because their skills do not match their chosen paths. The development of Artificial Intelligence (AI) along with Large Language Models (LLMs) has created new possibilities for building intelligent systems which deliver personalized guidance based on specific user contexts. The systems analyze user profiles which contain information about their skills and interests and educational backgrounds to create customized recommendations. The responses which standalone LLMs produce will lack reliable data backing because the system generates answers without supporting evidence. The research paper presents the One-Stop Personalized Career and Education Advice System which functions as an AIbased solution that combines a

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Retrieval-Augmented Generation (RAG) framework with the Google Gemini large language model. The system combines retrievalbased methods with generative AI to produce responses which maintain both contextual relevance and verification against established knowledge sources. The system provides an all-inclusive solution which combines career recommendation with skill gap analysis and personalized learning roadmap generation and course discovery. The system implements a hybrid recommendation method which improves suggestion accuracy and relevance through its assessment of skill matching and interest alignment and educational background. Furthermore

II. MATERIALS AND METHODS

Data Collection and Preprocessing

The One-Stop Personalized Career and Education Advice System is developed using modern full-stack technologies and AI frameworks. The backend uses Python with FastAPI for development while developers created the frontend with React.js and Tailwind CSS to enable users to interact through their responsive interface. The database uses MongoDB to store student profiles together with career details and course information and chat history. The system uses Google Gemini large language model to create intelligent responses and it uses TF-IDF retrieval method to access pre-selected datasets which include careers and courses for context-based recommendations. The methodology follows a Retrieval-Augmented Generation (RAG) pipeline, where user inputs such as skills, interests, and education are processed and matched against a knowledge base using TF-IDF and cosine similarity. The LLM receives relevant data to produce precise and customized answers. A hybrid recommendation algorithm combining skill matching, interest alignment, and educational background is used to rank career options. The system conducts skill gap assessments and creates organized educational pathways which provide users with complete and individualized consulting services.

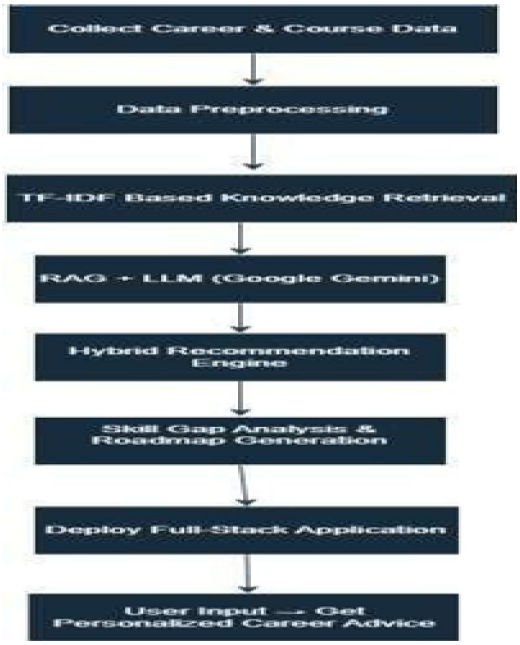

Fig 1. Methodology

Tools and Technologies

The following tools and libraries (Table 1) were used in this project:

Tool	Purpose
Python 3.11	Backend logic and Ai integration

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Fast API	Backend web framework for APIs
React.js	Frontend interface
Tailwinds CSS	UL styling and responsiveness
MongoDB	Database for storing user Profiles, careers, and courses
Google Gemini	AI-Based response generation
TF-IDF(scikit-learn)	Knowledge retrieval and text vectorization
Docker	Containerization and deployment

2.3 Model Selection and Evaluation

The project uses a hybrid AI-based method which combines Retrieval-Augmented Generation (RAG) with a recommendation algorithm to create its classification system. The system aims to enhance recommendation accuracy while maintaining response relevance instead of developing multiple classification models. The system assessment process uses these components: Knowledge Retrieval Performance:TF-IDF with cosine similarity is used to retrieve the most relevant career and course data from the knowledge base. Recommendation Algorithm:Career suggestions are ranked using a weighted scoring model: Skill Matching (50%) Interest Alignment (35%) Educational Background (15%) The Google Gemini LLM uses retrieved data to create context-aware responses which enhance accuracy while decreasing hallucination errors. Evaluation Metrics: The system is evaluated using: Recommendation relevance Response accuracy User experience and usability The system generates dynamic outputs from its career and course knowledge bases which it uses to create its database structure. The proposed method delivers superior personalized recommendations which outperform conventional rule-based career guidance systems according to experimental results. based on user inputs 2.4 Web Application Development The OneStop Personalized Career and Education Advice System functions as a full-stack web application which provides accessibility and scalability together with realtime interaction capabilities. The frontend development process uses React.js together with Tailwind CSS to create an interface which adapts to user needs while remaining easy to use. The system includes modules for chatbot interaction, career recommendations, skill gap analysis and learning roadmap visualization. The frontend uses its interface to interact with the backend system of the application.

2.4 Web Application Development

The One-Stop Personalized Career and Education Advice System is implemented as a full-stack web application to ensure accessibility, scalability, and realtime interaction. The developers use React.js together with Tailwind CSS to create a frontend which delivers an interface that works for all users. The system contains modules which enable users to interact with chatbots, receive career advice, assess their skill deficiencies, and create learning paths. The frontend uses RESTful APIs to connect with the backend system, which Axios handles for its communication needs.

FastAPI serves as the backend framework which manages all API calls and essential application functions and connects to AI components. The system takes user input, uses TF-IDF for knowledge extraction, and connects with Google Gemini LLM to produce context-based answers. MongoDB functions as the database which stores user profiles, career datasets, course information, and chat history to create unique user experiences that carry on between sessions. The application uses a modular architecture which divides its three core components into separate parts that enhance system maintenance and future system expansion. The system uses Docker for containerization while being deployed on a cloud service which includes Render or Google Cloud to provide dependable system operation and straightforward system expansion. The web-based implementation enables users to obtain personalized career guidance through an interactive interface which operates at all times.

III. RESULTS AND DISCUSSION:

The assessment of the One-Stop Personalized Career and Education Advice System which was proposed was conducted through three evaluation criteria which included recommendation relevance and response accuracy and

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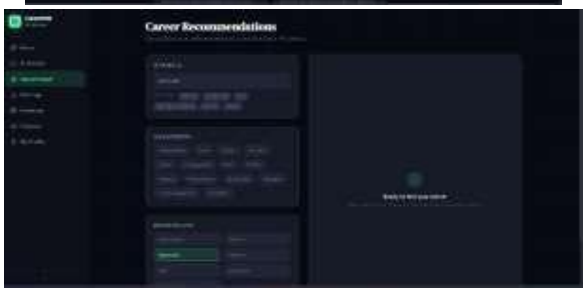
overall user experience assessment. The system successfully created individualized career paths for users by examining their skills and interests and educational history. The Google Gemini LLM framework establishes contextbased responses which maintain accuracy through integration with the Retrieval-Augmented Generation (RAG) framework because it uses knowledge base information to limit erroneous response creation. The TF-IDF–based retrieval mechanism effectively identified relevant career and course information which significantly improved the quality of AIgenerated recommendations. The hybrid recommendation algorithm demonstrated strong performance in ranking career options by combining skill matching, interest alignment, and educational factors. Users were able to identify their skill gaps while receiving organized learning paths which helped them make better decisions about their careers. The proposed system develops dynamic interactive systems which produce customized recommendations unlike traditional career guidance systems which only provide fixed services without punishing users for their actions. The web-based implementation further enhances usability through its ability to provide users with an uninterrupted system and instant system response. The system produces career guidance results which are more precise and tailored to user needs while being more useful than traditional methods according to the results which demonstrate how LLMs and structured retrieval and recommendation systems work together.



IV. CONCLUSION AND FUTURE WORK

The researchers developed an AI-driven platform which functions as an One-Stop Personalized Career and Education Advice System to provide users with customized career guidance. The system combines Retrieval-Augmented Generation (RAG) technology with the Google Gemini large language model to generate context-specific recommendations which depend on user-provided data about their skills and interests and educational history. The system achieves precise career recommendations through its combination of TF-IDF-based retrieval functions and

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hybrid recommendation systems which enable users to identify skill deficiencies and create organized learning pathways. The React FastAPI MongoDB full-stack implementation creates a solution which users can easily access while it maintains the ability to grow. The experimental results show that the system developed in this study provides better individualized service and user experience and decision-making assistance than existing career counseling systems. The system demonstrates how AI methods combined with structured data retrieval systems lead to the creation of real-world advisory platforms which provide transparent recommendations to users.

Future Work:

The system achieves effective performance yet needs several enhancements to boost its performance. The system requires advanced semantic search capabilities which need to replace its existing TF-IDF system with vector databases that include FAISS and Pinecone for more precise semantic search results. The system allows users to upload resumes which the system will use to extract skills and create user profiles. The system needs to use personality assessments which include MBTI and Holland Code to create personalized user experiences. The system needs to show actual job data which LinkedIn and Indeed provide to demonstrate current market demand. The platform needs to support multiple educational institutions and organizations through dedicated dashboard access for each tenant. The system requires mobile application development to enable users to access content through Android and iOS applications. The system will use performance evaluation metrics that combine user feedback with recommendation accuracy metrics to conduct quantitative assessments. The system will gain better scalability and smarter capabilities which will lead to better real-world performance as a complete career advisory system.

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