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AI-Based Career Guidance System

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Abstract

Choosing the right career is one of the most important decisions for students. Traditional career guidance systems are often static, based on outdated datasets, and fail to provide dynamic, personalized advice. This research proposes an AI-Based Career Guidance System that leverages Generative AI (Gemini API) to generate real-time recommendations tailored to a student's academic performance and interests. Unlike conventional models, this system does not rely on pre-stored datasets but dynamically analyzes inputs to suggest relevant career paths. User profiles and AI-generated suggestions are stored securely in MongoDB Atlas, with JWT authentication ensuring safe access. The system is lightweight, scalable, and designed to be user-friendly, making it suitable for educational institutions and self-guided learners.

Introduction

Career selection is a crucial step in shaping the future of students. Many learners face confusion when deciding on academic streams or job opportunities, and traditional methods such as counseling sessions or rule-based tools often lack personalization. With rapid advancements in Artificial Intelligence (AI), dynamic career recommendation systems can now analyze multiple factors including academic scores, interests, and emerging job markets.

Our proposed AI-Based Career Guidance System provides:

Tailored career suggestions based on student interests and academic percentage. Secure storage of profiles and results in MongoDB Atlas. Real-time recommendations generated by Gemini API, ensuring up-to-date insights. A lightweight web-based interface with login, input, and result display features.

This system is not only efficient but also scalable, making it adaptable to different education levels, from school students to college graduates exploring career opportunities.

Literature Survey

AI has increasingly been applied in education and career guidance over the past decade.

Recommender Systems in Education: Research by Manouselis et al. (2011) highlights the role of recommender systems in e-learning environments, showing how personalization improves learning and decision-making【1】.

AI-Based Career Counseling: Alvi et al. (2019) proposed an AI-driven framework for career counseling that used machine learning models to recommend career options based on student performance【2】.

NLP and Generative AI: Recent advancements in large language models (LLMs) like GPT and

Gemini have enabled context-aware recommendations beyond fixed datasets. Studies such as Brown et al. (2020) have shown the potential of generative AI in providing human-like suggestions【3】.

Career Guidance with Big Data: Research by Nayak & Pati (2022) explored AI-powered platforms that combine academic results, psychometric assessments, and labor market trends to give holistic career recommendations【4】.

Data Security in Educational AI Systems: Bawa & Gill (2020) emphasized the importance of authentication and encryption in AI-based education platforms to ensure privacy【5】.

Building on these studies, our work integrates **Generative AI with a secure, lightweight backend architecture** to create a practical career guidance tool for students.

Proposed Methodology

The proposed methodology integrates AI-based career recommendation generation with a robust and secure backend infrastructure. The system is designed to be interactive, scalable, and reliable while ensuring data privacy for students. The complete methodology is explained step by step as follows:

A. Data Collection and Preprocessing

Students begin by submitting their basic academic details (such as marks or percentages) along with their areas of interest. These inputs are first verified on the frontend to prevent incorrect or incomplete submissions. Unlike traditional systems that depend on a fixed, pre-built dataset, this system does not rely on storing large static data. Instead, it leverages the Gemini API, which dynamically interprets and analyzes each student's inputs in real time, making the process flexible and adaptable.

B. AI Recommendation using Gemini API

The Gemini API functions as an intelligent virtual career counselor. It is prompted with structured queries, for example:
"You are a career guidance assistant. Interests: [user's interests]. Academic percentage: [user's percentage]. Recommend suitable career paths and provide reasons for each suggestion."
Based on this input, the API generates a clear, well-organized list of career options, each accompanied by a justification. A key benefit of this approach is that recommendations are not restricted to a predefined catalog. Instead, they evolve continuously, reflecting up-to-date industry trends, emerging career domains, and modern skill requirements.

C. Backend & Security

The backend is implemented using Node.js with Express for handling API requests and managing communication between the frontend, AI, and database. To ensure user security, JWT (JSON Web Token) authentication is employed, which allows safe login sessions and token-based access control. Sensitive credentials such as JWT_SECRET, MONGODB_URI, and GEMINI_API_KEY are managed through environment variables to prevent unauthorized exposure and maintain system integrity.

D. Database Management

For persistent storage, MongoDB Atlas is used as the cloud-based database solution. The database is structured into dedicated collections, including:

- User Collection: Stores login and authentication details.
- StudentProfile Collection: Maintains individual student information such as academic performance and interests.
- Suggestion Collection: Saves AI-generated career recommendations for each student.

This separation of collections ensures organized data management and efficient retrieval of records.

E. System Workflow

1. A student registers or logs into the system securely.
2. The student enters their academic percentage/marks and preferred interests.
3. The backend processes this profile and forwards the details to the Gemini API.
4. The Gemini API analyzes the data and responds with a tailored set of career suggestions.
5. The generated recommendations are stored in MongoDB Atlas for future reference.
6. The results are displayed to the student in an easy-to-read format through the frontend interface.

This methodology ensures that the system is dynamic, secure, and student-focused, offering personalized career recommendations backed by AI while maintaining data confidentiality and accuracy.

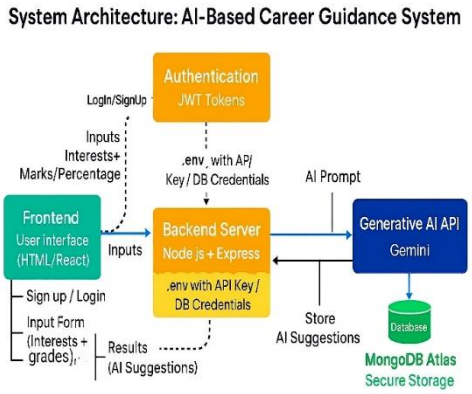


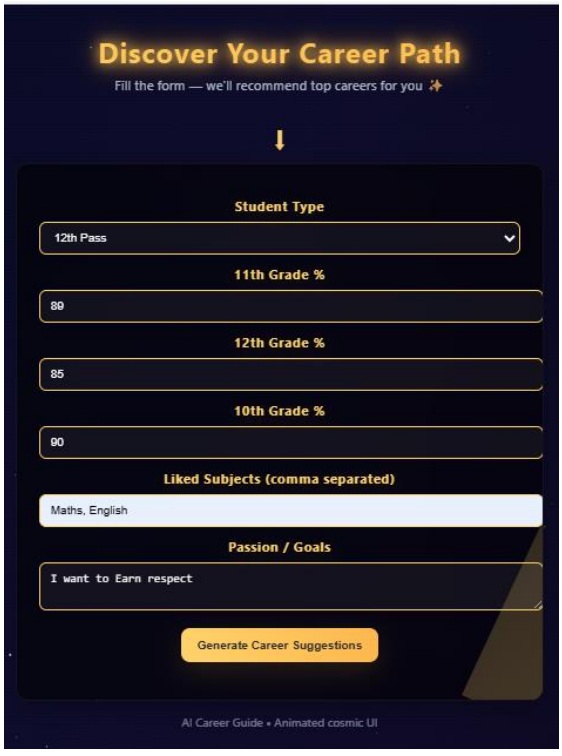
Fig 1: Block Diagram of AI-Based Career Guidance System

Results

The system is designed to provide:

Interface (Filling Form)

Form interfaces act as the main channel for collecting and processing user information in digital systems. They simplify interactions such as registration, login, surveys, and transactions by presenting clear fields and guiding users step by step. Well-designed forms improve usability, reduce errors, and increase completion rates, making them essential for both user satisfaction and system efficiency.



Personalized Career Suggestions

Recommendations tailored to academic scores and interests. AI-generated reasoning explaining why a career fits the student's profile.

Security and Scalability

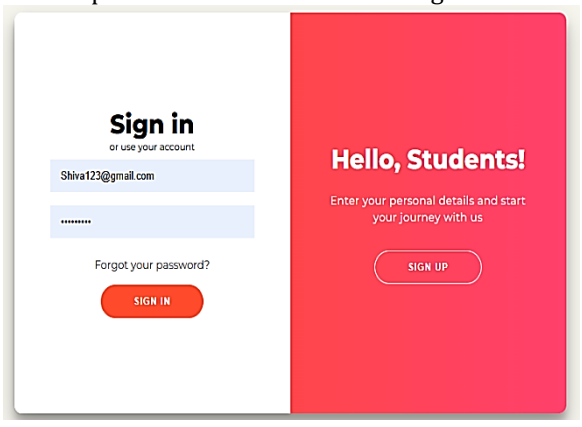
JWT ensures secure authentication. Cloud-based **MongoDB Atlas** allows scalability to thousands of users.

Usability

Simple, web-based interface for registration, input, and result display. Career history stored for future reference.

Efficiency

No heavy model training or datasets required. Fast responses due to Gemini API integration.



Discussion

The integration of Generative AI into a secure backend infrastructure distinguishes the proposed system from conventional static career guidance platforms. Traditional models typically depend on fixed, pre-labeled datasets, which limit their ability to adapt to new professional domains. Such systems often become outdated quickly, as they cannot incorporate recently

emerging career fields without significant manual updates. In contrast, the framework introduced in this study employs the Gemini API, which dynamically generates tailored recommendations for each student. This adaptability ensures that the system remains relevant in rapidly evolving job markets and can guide learners toward both established and novel career opportunities.

A critical aspect of this system lies in its data security and privacy features. By implementing JWT (JSON Web Token) authentication, the platform ensures that user sessions remain protected through token-based verification. Furthermore, sensitive details, including academic records and personal preferences, are securely stored using cloud-based databases (MongoDB Atlas). Such mechanisms are vital for real-world deployment, where trust and compliance with data protection standards are essential.

Despite its strengths, the framework is not without limitations. The reliance on stable internet connectivity can pose accessibility challenges in areas with poor infrastructure. Additionally, the system's dependence on API quotas and usage limits may restrict its performance during peak demand or when deployed at scale. These constraints highlight areas where optimization or hybrid approaches may be required for broader adoption.

Conclusion & Future Work

This research introduced an AI-driven Career Guidance System that combines Generative AI (Gemini API), a secure backend developed in Node.js with Express, and a scalable cloud-hosted database (MongoDB Atlas). Unlike static, dataset-driven tools, the system dynamically produces personalized and real-time career recommendations. This not only improves the accuracy of guidance but also ensures that students receive advice aligned with current industry demands. The incorporation of strong security protocols further strengthens its suitability for deployment in educational environments where data privacy and trust are critical.

To extend the capabilities of the proposed system, several enhancements are envisioned for future work:

1. Holistic Student Profiling: Expanding the input parameters beyond academic marks and interests by incorporating skills, hobbies, and personality traits to enable more comprehensive career guidance.
2. Multilingual Support: Integrating regional and national languages such as Hindi, Marathi, and other Indian languages to make the platform accessible to a wider demographic of students.
3. Mobile Application Development: Designing a dedicated mobile app to increase accessibility and convenience, especially for students in rural and semi-urban areas.
4. Ecosystem Integration: Establishing connections with job portals, internship platforms, and online learning systems to provide students with actionable pathways following the AI-generated recommendations.
5. Conversational AI Assistant: Embedding an AI-powered chatbot capable of real-time Q&A sessions to address career-related doubts, making the system more interactive and user-friendly.

Future Enhancements:

While the proposed AI-based career guidance framework demonstrates strong potential, several enhancements can further expand its scope, usability, and impact. The following future directions are envisioned:

1. Integration of Skills, Hobbies, and Personality Traits

At present, the system primarily analyzes academic performance and self-reported interests. However, a more holistic assessment of students can be achieved by incorporating additional dimensions such as technical skills, extracurricular activities, hobbies, and personality characteristics. This multi-dimensional profiling would allow the AI model to generate career suggestions that are not only academically suitable but also aligned with students' natural aptitudes and behavioral tendencies. For instance, students with strong problem-solving abilities and logical reasoning could be guided toward engineering or data science, while those with creative hobbies such as writing or design could be directed toward media, content creation, or design-related careers.

2. Support for Multiple Languages

To ensure inclusivity and broaden the system's accessibility, the platform can be extended to support regional and national languages such as Hindi, Marathi, Tamil, and others. This multilingual capability would enable students from diverse linguistic backgrounds to interact with the system in their preferred language. Such an addition would make the guidance process more relatable and user-friendly, particularly for students in rural or semi-urban areas where English proficiency may be limited.

3. Development of a Mobile Application

A dedicated mobile application would significantly enhance accessibility by allowing students to access career recommendations

directly from smartphones. With the increasing reliance on mobile devices among students, a lightweight, user-friendly app could ensure continuous availability of the system's services. Features such as offline caching of results, push notifications, and personalized dashboards could further improve usability, making the system highly practical for everyday use.

4. Connection with Job Portals and Online Learning Platforms

Beyond providing recommendations, the system could be integrated with job search portals, internship platforms, and online learning providers. This connection would allow students to act immediately on the AI's suggestions by enrolling in relevant skill-development courses, applying for internships, or exploring job opportunities aligned with their recommended career paths. Such an ecosystem-driven approach would transform the platform from a guidance-only tool into a complete career development solution.

5. AI-Powered Chatbot Assistant for Real-Time Career Q&A

To increase interactivity, an AI-based chatbot can be embedded into the platform. This chatbot would serve as a virtual career counselor capable of answering real-time queries from students, clarifying doubts, and providing instant information about career options, eligibility criteria, and skill requirements. Such a conversational interface would make the system more engaging, reduce dependency on human counselors, and ensure that students receive timely, personalized support.

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