

PATHWAY : PERSONALIZED AI-BASED CAREER GUIDANCE PLATFORM

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ABSTRACT : *Career planning today demands intelligent and personalized guidance as job markets evolve rapidly. This paper presents Pathway: AI Career Coach, an AI-powered web platform that offers tailored career recommendations, resume and cover letter generation, mock interview simulations, and industry insights. Built using Gemini 2.5 API with a modern full-stack framework (Next.js, Prisma ORM, Clerk, and NeonDB), the system provides context-aware guidance while maintaining scalability and data security.*

The solution addresses the gap in accessible, data-driven career support by automating essential processes and delivering personalized, real-time feedback to users. Results indicate that integrating generative AI with modern web systems enhances employability and user confidence in decision-making.

In conclusion, the AI Career Coach redefines digital career counseling by merging artificial intelligence and full-stack technologies to provide affordable, adaptive, and scalable guidance for learners and professionals alike.

Keywords — *Artificial Intelligence, Career Coaching, Generative AI, Large Language Models, Gemini API, Resume Generation, Interview Simulation, Personalized Career Guidance.*

I. INTRODUCTION

Career planning and professional development have become increasingly complex in the evolving digital economy. Students and early-career professionals often face uncertainty when selecting appropriate career paths due to limited access to personalized guidance and mentorship. Studies indicate that only a small proportion of graduates receive meaningful career counseling, despite the growing demand for skill-based employability and informed decision-making. Meanwhile, recent advancements in artificial intelligence (AI) have demonstrated significant potential in transforming the career advisory domain. Notably, Google's *Career Dreamer* employs AI-driven skill

mapping to suggest career trajectories, and LinkedIn Learning integrates conversational AI to offer real-time learning recommendations and professional insights.

To address these challenges, this paper presents **Full Stack AI Career Coach**, an intelligent, web-based platform designed to function as a virtual career advisor. The proposed system enables users to input academic and professional information—including skills, education, and experience—and subsequently receive tailored recommendations for career advancement. The platform provides multiple integrated modules such as **AI-powered resume and cover letter generation**, **AI-driven interview simulation with feedback**, and **industry insights dashboards** for data-backed decision-making. These features collectively enhance employability and readiness for job markets.

The system leverages **Google's Gemini 2.5 API** to generate context-aware, human-like responses that adapt to user profiles and evolving labor market trends. On the backend, a robust full-stack architecture is implemented using **Next.js** for frontend rendering, **Prisma ORM** with **NeonDB** for efficient data management, and **Clerk** for secure authentication. **Inngest** is integrated to automate background processing and ensure scalability in handling concurrent AI-driven tasks.

The major contributions of this research are as follows:

- 1. AI-Powered Career Guidance:** Integration of the Gemini 2.5 API to generate adaptive and contextually relevant recommendations for career paths, skills, and job readiness.
- 2. Full-Stack Architecture:** Development of a scalable and responsive system using Next.js, Prisma ORM, NeonDB, and Inngest for efficient performance and real-time data handling.
- 3. Automated Career Tools:** Implementation of AI modules for **resume and cover letter generation**, **AI mock interview simulation**, and **interactive industry insight dashboards**.

4. **Societal Impact:** Democratization of access to intelligent career guidance tools, reducing cost and

geographic limitations associated with traditional counseling systems.

II. LITERATURE REVIEW

Researchers have extensively explored the role of **Generative AI (GenAI)**, **Large Language Models (LLMs)**, and **machine learning (ML)** in education, recruitment, and career guidance. Collectively, studies indicate that multimodal AI systems such as **Google Gemini** and **GPT-based models** can revolutionize career development by offering scalable, personalized, and data-driven coaching.

Generative AI and LLMs in Education and Career Guidance

Álvarez Ariza et al. (2025) presented a scoping review of 146 studies using GenAI tools such as ChatGPT, Gemini, DALL·E, and GitHub Copilot in engineering and computing education. Their findings emphasize GenAI's transformative potential in promoting AI literacy and automation while addressing risks such as plagiarism and privacy concerns [1].

Islam and Ahmed (2024) conducted a comparative evaluation of Google's **Gemini** framework, demonstrating its multimodal capabilities in text, vision, and reasoning. They concluded that Gemini's flexible architecture makes it well-suited for **career guidance platforms** requiring diverse inputs [2].

Raut and Katti (2024) reviewed the evolution of chatbots from rule-based to LLM-driven systems such as GPT, Ernie, and Gemini. They identified that **few-shot learning** and **reinforcement learning with human feedback (RLHF)** allow chatbots to provide interactive, context-aware, and personalized career guidance [3].

Sharma et al. (2023) similarly reviewed Gemini's educational applications, highlighting its potential in tutoring, intelligent support, and student decision-making [4].

AI in Resume Generation and Career Recommendation

Zinjad et al. (2024) proposed **ResumeFlow**, an LLM-based resume generator that customizes user résumés based on job descriptions through prompt engineering rather than fine-tuning. It extracts key job requirements and aligns them with user data to generate tailored outputs, while mitigating hallucination risks [5].

Complementary research by Patra et al. (2024) applied **retrieval-augmented generation (RAG)** to resume customization, grounding AI outputs in verified job data.

For personalized **career counseling**, Ghuge et al. (2023) developed an ML model employing **Support Vector Machines (SVM)** and **K-Nearest Neighbors (KNN)** to recommend suitable career paths from academic and extracurricular records. Their study showed that such systems improve career alignment and reduce misinformed decisions [6].

AI-Based Interview and Web Integration Systems

LLM-powered mock interview platforms integrate natural language processing (NLP) and sentiment analysis to simulate real-time interviews and provide feedback. Kevadiya and Patel (2025) reviewed these systems, observing their potential in self-assessment but also noting persistent challenges in accuracy, fairness, and bias mitigation [7].

Additionally, modern web frameworks now integrate LLM APIs (e.g., Gemini, GPT) to enable **interactive, cloud-based guidance platforms**. Using tools such as LangChain or RAG, developers embed AI modules for resume generation, Q&A sessions, and interview practice directly into web interfaces—enhancing accessibility and scalability.

Ethical and Societal Considerations

Chen (2023) cautioned that algorithmic hiring tools may reinforce discriminatory hiring practices by encoding human biases [8]. Fabris et al. (2025) echoed this, advocating the integration of fairness metrics and balanced datasets into AI recruitment systems [9].

Beyond fairness, transparency and **explainability** are essential to maintain user trust. Studies like Zinjad et al. (2024) emphasize alignment metrics to reduce hallucinated content, ensuring accountability in LLM outputs [5].

Bentley et al. (2024) further identified disparities in **digital confidence** among women, older adults, and low-

income groups, warning that without inclusive design, AI tools could worsen digital inequality [10].

Synthesis

Overall, the reviewed literature supports that integrating **multimodal LLMs** (e.g., **Gemini**) with **ML-driven personalization** and **ethical safeguards** can establish the foundation of an **AI Career Coach** that is accessible, trustworthy, and intelligent.

Such a system—like the proposed *Pathway: AI Career Coach*—can automate resume generation, career recommendations, and interview practice, while ensuring fairness, transparency, and equitable access.

III. PROPOSED SYSTEM

The **Full Stack AI Career Coach** is designed as a scalable, cloud-based platform that integrates advanced artificial intelligence with a modern full-stack web framework to deliver personalized career guidance. The proposed system aims to provide users with AI-driven resume generation, interview preparation, and career counseling through a unified and interactive web interface.

System Overview

The system architecture, illustrated in *Fig. 1*, consists of four major layers: **Client Side**, **Server Side**, **External Services**, and **Database & ORM Layer**. Each layer is responsible for handling a distinct set of functionalities, ensuring modularity, scalability, and secure data exchange.

1. Client Side:

The front-end interface is built using **Next.js 15** and **React 19**, providing users with a responsive and intuitive experience. The client interacts with the system through various modules, including AI chatbot, resume and cover letter generators, and the interview preparation dashboard. User authentication is handled via the **Clerk SDK**, which securely manages sign-up, login, and session persistence.

2. Server Side :

The backend utilizes **Next.js API Routes** and **Node.js controllers** to manage business logic and process client requests. Incoming API calls from the client are routed to the appropriate service layer for data handling, AI response generation, or file management. The system employs **Prisma ORM** for structured interaction with the database, enabling efficient read/write operations while maintaining data integrity.

3. External Services :

The system integrates with multiple external services to enhance performance and intelligence. The **Gemini 2.5 API** serves as the core large language model,

generating contextual and human-like responses for resume optimization, interview simulations, and career recommendations. **Clerk.io** handles authentication verification, ensuring that user sessions are secure and tokens are validated before backend processing. For file storage, services like **AWS S3** or **Cloudinary** are used to store generated resumes and cover letters, while only metadata and file URLs are persisted in the primary database.

4. Database and ORM Layer:

Data persistence is achieved using **NeonDB**, a serverless PostgreSQL-based database optimized for scalability and developer efficiency. The **Prisma ORM** acts as the data access layer, mapping application entities such as users, resumes, and interview sessions to relational database models. This design ensures

reliable, high-performance data operations across all modules.

The **System Architecture Diagram (Fig. 1)** illustrates the interaction between client-side components, server-side business logic, external services (Gemini API, Clerk.io, and Cloud Storage), and the database & ORM layer (Prisma ORM with NeonDB).

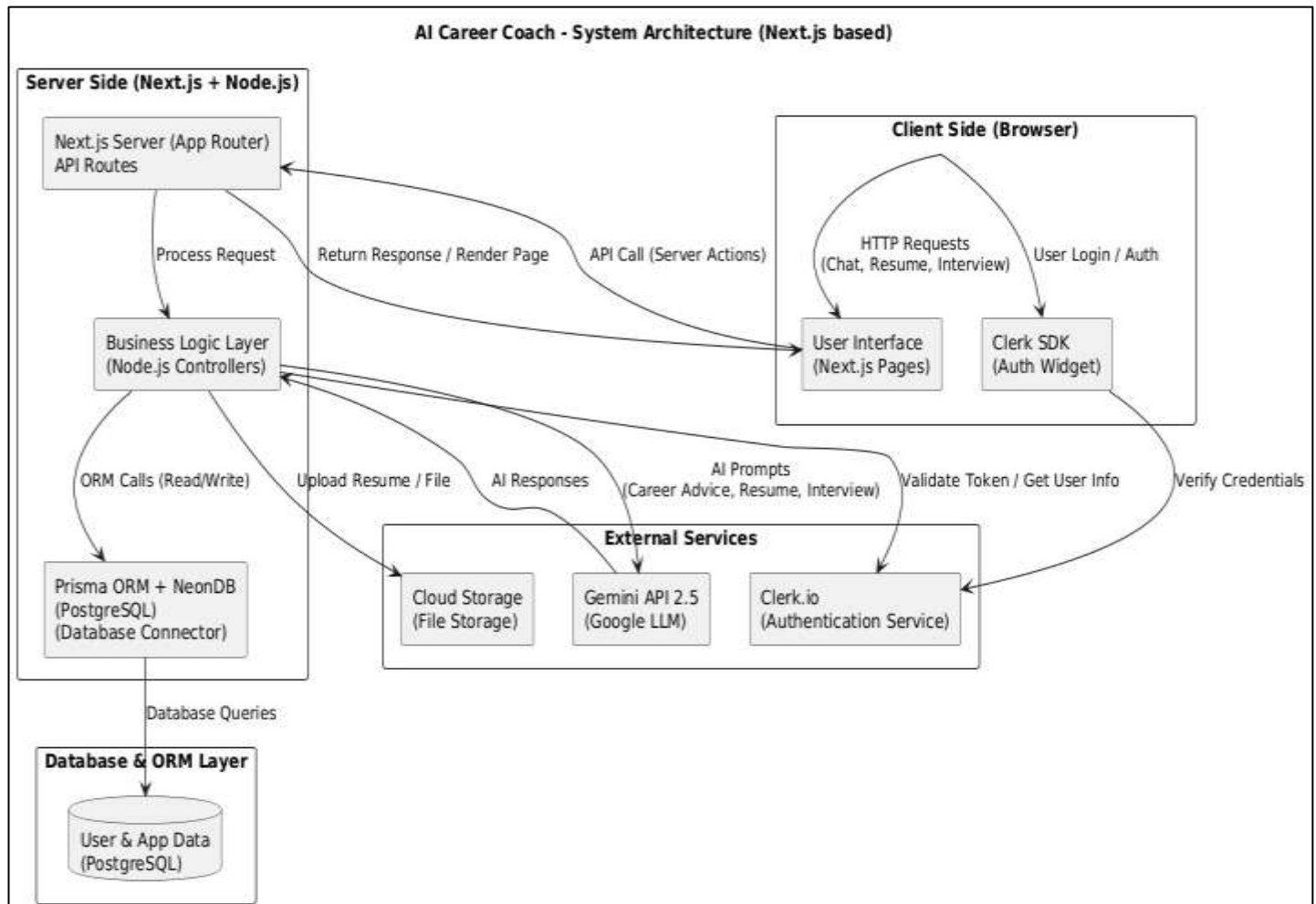


Fig. 1. System architecture of the AI Career Coach showing interactions between client, server, external services, and database layers.

IV. METHODOLOGY

The methodology of the *AI Career Coach* system is designed to establish a scalable, AI-driven full-stack platform that assists users in their career development journey through intelligent automation and contextual personalization. The system integrates advanced technologies such as **Gemini 2.5 API**, **Next.js**, **Prisma ORM**, **Clerk**, and **NeonDB** to deliver end-to-end functionality.

A. System Workflow Overview

The workflow is modular and event-driven, following a client-server architecture optimized for scalability and responsiveness.

The process can be summarized as follows:

1. User Authentication:

Users register and log in through **Clerk**, which issues secure authentication tokens to control access.

2. Frontend Interaction:

The user engages with the interface built using **Next.js 15** and **React 19**, initiating actions such as resume generation, AI interview practice, or chatbot consultations.

3. Backend Request Handling:

All user actions trigger API calls routed to the backend (Next.js API Routes), where tokens are verified, and relevant services are called.

4. Database Operations:

The backend interacts with **NeonDB** (via **Prisma ORM**) to read or update user data, such as profiles, resumes, or AI chat history.

5. AI Integration:

The **Gemini 2.5 API** processes natural language prompts to generate tailored outputs—resumes, cover letters, or interview feedback.

6. Response Rendering:

The generated responses are sent back to the frontend, formatted for display, and optionally stored for later access.

B. Use Case Representation

The system supports multiple functional modules, all driven by user interactions. The **Use Case Diagram (Fig. 2)** illustrates the major functionalities and actors involved in the *AI Career Coach* system.

Fig. 2. Use case diagram showing primary interactions between users, admin, and system modules in the AI Career Coach platform.

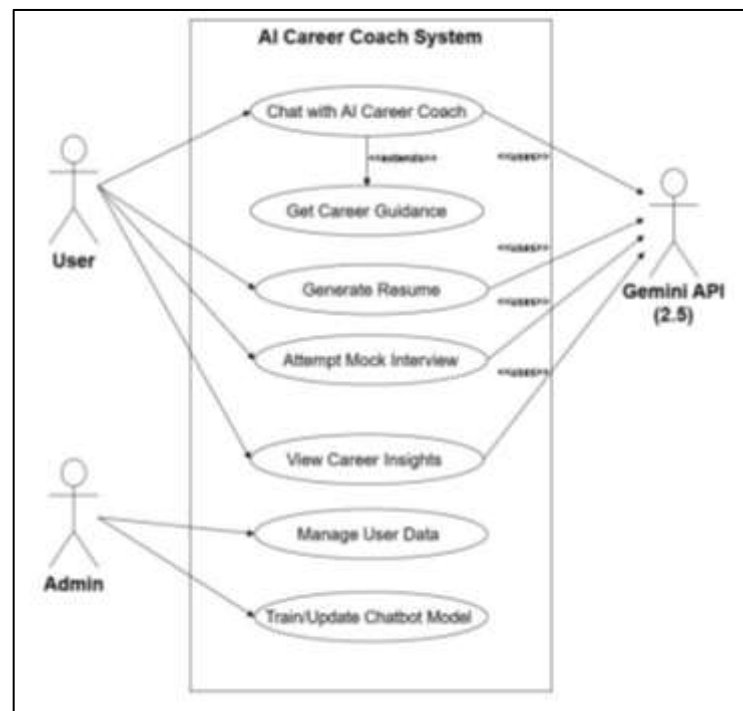
Explanation:

The system supports two main actors — **User** and **Admin**.

- The **User** can authenticate via Clerk, generate AI-driven resumes and cover letters, engage in mock

interviews, consult the AI chatbot for career guidance, and access an interactive industry insights dashboard.

- The **Admin** manages user activity, system monitoring, and data integrity. This structure ensures usability and



administrative control within a unified architecture.

C. Sequence of Operations

The detailed sequence of system interactions is shown in **Fig. 3**, illustrating communication between the frontend, backend, authentication layer, database, and AI engine.

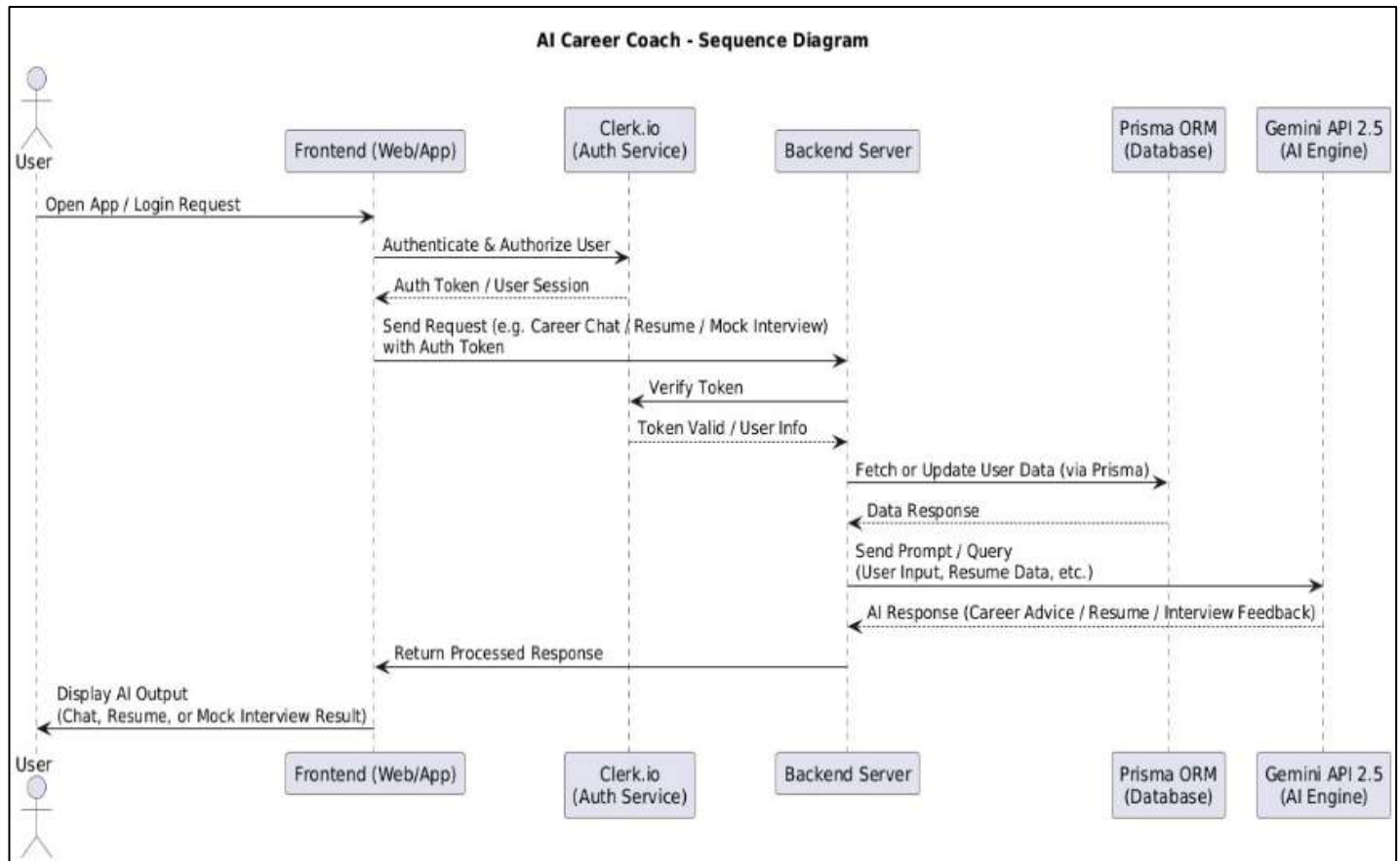


Fig. 3. Sequence diagram illustrating the request–response flow between system components during AI-powered operations.

D. Workflow Summary

The *AI Career Coach* system follows a modular methodology integrating authentication, database management, and AI-powered services through a unified full-stack framework. The combination of **Gemini 2.5**, **Next.js**, and **Prisma ORM** enables secure, dynamic, and context-aware career guidance. Asynchronous processing with **Inngest** ensures that resource-intensive tasks (like resume rendering and interview simulations) are handled efficiently.

This architecture ensures scalability, reliability, and adaptability—laying the foundation for a production-ready AI-powered career guidance system.

V. RESULTS AND DISCUSSION

The proposed *AI Career Coach* platform is expected to deliver measurable improvements in personalized career guidance, content generation, and overall user engagement. By integrating the **Gemini 2.5 API** with a full-stack architecture built using **Next.js**, **Prisma**, and **NeonDB**, the system enables seamless interaction between users and AI-driven services such as resume generation, mock interview preparation, and tailored career counseling.

The resume and cover letter modules are anticipated to generate professional, context-aware documents in real time, reducing the time users typically spend on manual drafting. Similarly, the **AI-based mock interview system** is designed to simulate real interview scenarios by generating dynamic, role-specific questions and providing automated feedback on user responses. This feature can significantly improve a user's communication confidence and self-assessment ability.

The **career guidance chatbot** and **industry insights dashboard** together are expected to help users make data-informed career decisions by analyzing market trends, job demand, and skill relevance. Through these features, the system not only automates routine career-preparation tasks but also democratizes access to personalized coaching, which is often inaccessible due to geographical or cost constraints.

Performance-wise, the system is expected to maintain fast API responses, reliable authentication via **Clerk**, and secure data management through **NeonDB**. The asynchronous task handling using **Inngest** will further enhance scalability and ensure that resource-intensive operations like file storage or background AI prompts do not disrupt user interactions.

VI. CONCLUSION AND FUTURE WORK

The *AI Career Coach* represents an effort to merge artificial intelligence with modern full-stack web technologies to provide personalized, efficient, and scalable career support. By automating core aspects of career preparation—resume writing, cover letter drafting, mock interviews, and real-time career counseling—the platform addresses key challenges faced by students and early professionals who lack access to one-on-one guidance.

From a technical standpoint, the integration of **Gemini 2.5 API** with **Next.js**, **Prisma**, and **NeonDB** establishes a robust foundation for future enhancements. The modular design ensures adaptability, allowing for additional AI-driven functionalities such as recruiter-style evaluations or portfolio optimization.

Future work will focus on expanding the system's intelligence and inclusivity. Planned improvements include:

- **Multilingual and regional support** to reach a broader user base.
- **Integration of live recruiter feedback loops** for more realistic assessment.
- **Advanced analytics** to track user progress and recommend skill-learning paths.
- **Model fine-tuning** to adapt AI suggestions for specific industries and domains.

In conclusion, the proposed system has the potential to bridge the existing gap between career aspirations and practical preparation by offering an accessible, AI-augmented platform that empowers users to navigate their career journeys confidently and efficiently.

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