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Career Compass AI: An AI-Powered Career Guidance Platform

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Abstract - The increasing complexity of academic and professional decision-making requires intelligent systems capable of delivering personalized and data-oriented guidance. This paper proposes Career Compass AI, an AI-based career guidance platform designed to generate adaptive and explainable career recommendations. The system processes academic records, interests, aptitude assessments, and resume data to suggest appropriate education streams, career roles, and skill development paths. It utilizes Large Language Models (LLMs), namely Gemini 1.5 Pro and Gemini 1.5 Flash, to perform contextual reasoning, skill-gap identification, and resume evaluation. A resume plagiarism detection module ensures originality by identifying duplicated content using Natural Language Processing techniques. Additionally, an AI-powered career mentor chatbot offers continuous conversational assistance and personalized career insights. Experimental evaluation conducted on datasets from students and working professionals demonstrates high accuracy in career prediction, skill-gap analysis, and plagiarism detection, along with strong user satisfaction. The results confirm that Career Compass AI provides an effective, scalable, and future-ready solution for intelligent career planning.

Key Words: Career guidance, Artificial intelligence, Large language models, Career prediction, Resume analysis, Skill-gap identification.

1. INTRODUCTION

Selecting an appropriate career path is one of the most influential decisions in an individual's academic and professional journey. With rapid technological advancements and continuously changing industry requirements, students and professionals are often required to make complex career choices at an early stage. Traditional career counseling methods rely heavily on manual assessments, subjective judgment, and limited data sources, which often fail to account for individual aptitude, evolving job roles, and emerging skill demands. As a result, many individuals experience career dissatisfaction, skill mismatch, and reduced employability.

The increasing availability of educational data and labor-market information has created opportunities to build intelligent systems that can support informed decision-making. Artificial Intelligence (AI) and Machine Learning (ML) techniques enable systems to analyze multidimensional data such as academic performance, interests, skills, and aptitude scores to generate personalized recommendations. These systems reduce human bias and provide scalable solutions capable of assisting a large and diverse user base.

Career Compass AI is proposed as an intelligent career guidance platform that integrates Large Language Models (LLMs) with predictive analytics and conversational AI. The platform offers personalized career recommendations, skill-gap identification, resume evaluation, and continuous mentorship through an AI-powered chatbot. Unlike traditional guidance systems, Career Compass AI emphasizes explainability, adaptability, and real-time interaction, enabling users to make confident and data-driven career decisions.

2. RELATED WORK

The application of AI and ML in career guidance systems has been explored by several researchers. Early systems primarily focused on rule-based or questionnaire-driven approaches, which lacked personalization and adaptability. Panthee et al. developed a machine learning-based career guidance system that utilized academic performance and personality traits; however, the system required extensive manual input and offered limited flexibility for diverse user profiles.

Prasanna and Haritha proposed a smart career recommendation system that analyzed student preferences and academic performance to suggest

suitable career paths. While the system improved recommendation relevance, it did not incorporate real-time labor-market data or skill-gap analysis. Reddy et al. introduced an ensemble learning-based framework that enhanced prediction accuracy but lacked interpretability and user transparency, which are critical for user trust.

Recent advancements in Large Language Models such as GPT and Gemini have demonstrated strong capabilities in contextual understanding, reasoning, and natural language interaction. Studies have shown that integrating LLMs into recommendation systems improves personalization and interpretability. However, the adoption of LLMs in comprehensive career guidance platforms remains limited due to challenges related to domain adaptation, evaluation, and system integration.

Career Compass AI differentiates itself by combining LLM-based reasoning with resume plagiarism detection, skill-gap analysis, and conversational mentoring within a single platform. This holistic approach bridges the gap between academic guidance and employability-oriented career planning.

3. SYSTEM ARCHITECTURE

Career Compass AI follows a modular and layered architecture designed to ensure scalability, security, and maintainability. The system architecture consists of five primary layers: User Interface Layer, Application Layer, AI Intelligence Layer, Database Layer, and Analytics Layer.

The User Interface Layer provides an interactive and responsive environment through which users input academic details, skills, aptitude scores, and resumes. This layer is developed using Next.js and TailwindCSS to ensure cross-device compatibility and smooth user experience.

The Application Layer acts as an intermediary between the frontend and backend services. It handles authentication, request validation, and API communication. The backend is implemented using Next.js API routes integrated with Google Genkit, which orchestrates the interaction between various AI components.

The AI Intelligence Layer forms the core of the system and is responsible for career prediction, skill-gap analysis, resume evaluation, and conversational mentoring. Gemini 1.5 Pro is employed for complex reasoning tasks such as career inference and contextual recommendation, while Gemini 1.5 Flash is optimized for real-time chatbot interactions.

The Database Layer uses PostgreSQL managed through Prisma ORM to store structured user data, assessment results, resumes, and AI-generated outputs. The Analytics Layer visualizes insights such as recommended career paths, missing skills, and job trends using interactive dashboards.

3.1 Overall Design

The system architecture of *Career Compass AI* adopts a client–server model that enables real-time communication between users and the AI-driven backend. The user interacts with the frontend to provide academic information, interests, and test scores. These details are securely transmitted to the backend through API endpoints.

The frontend is implemented using Next.js and TailwindCSS, providing a responsive and modern user interface. The backend is developed using Next.js API routes integrated with Google Genkit, which connects to the Gemini 1.5 Pro and Gemini 1.5 Flash models for intelligent reasoning and decision-making.

The database is implemented using PostgreSQL and managed through Prisma ORM for efficient data storage, querying, and updates. The AI Layer processes data using advanced machine learning algorithms and natural language reasoning for accurate predictions and recommendations. The Analytics Layer visualizes data insights such as skill gaps, salary trends, and job market opportunities through interactive dashboards.

3.2 Functional Modules

Career Prediction Engine:

Analyzes academic records, aptitude scores, and interests to recommend suitable educational and professional pathways.

Skill-Gap Analysis Module:

Identifies missing or insufficient skills by comparing user profiles with industry requirements and suggests relevant learning resources.

Resume Evaluation and Plagiarism Detection:

Assesses resumes using Applicant Tracking System (ATS) criteria and detects duplicated content through NLP-based similarity analysis.

AI Career Mentor:

A conversational assistant powered by Gemini 1.5 Flash that delivers real-time career guidance, motivation, and personalized advice.

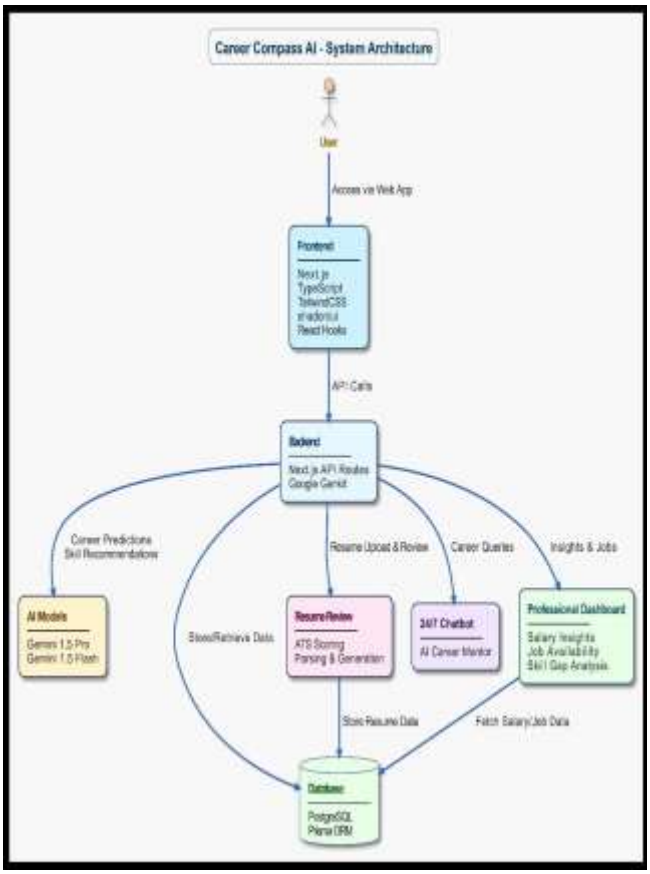

Fig -1: System Architecture

3.3 Data Flow and Workflow

The workflow begins when a user submits personal, academic, and professional information through the frontend interface. The data is securely transmitted to the backend, where it undergoes preprocessing and normalization. The processed data is then forwarded to the AI Intelligence Layer for analysis.

The Career Prediction Engine evaluates the inputs to generate suitable career recommendations. Simultaneously, the Skill-Gap Analysis Module identifies missing competencies, and the Resume Evaluation Module analyzes resume quality and originality. The outputs are stored in the database and presented to the user through the Analytics Dashboard.

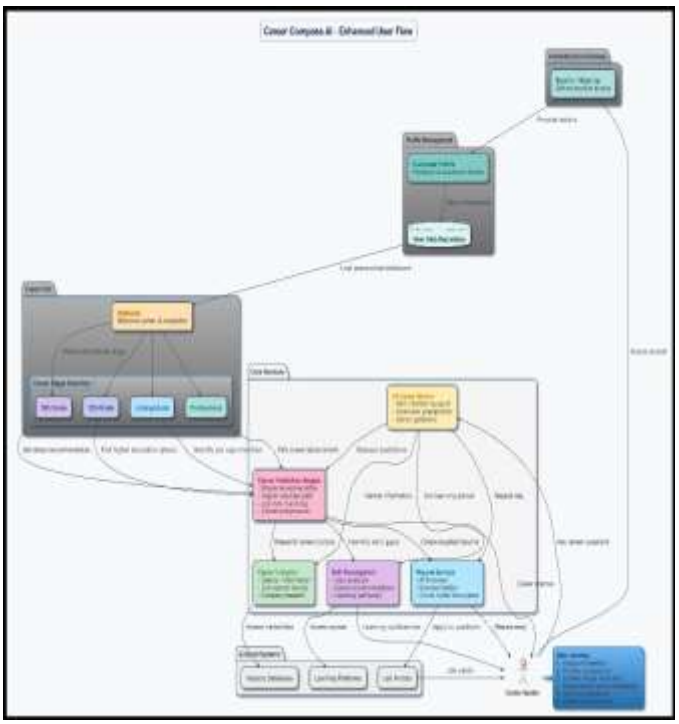

Fig. 2. Workflow diagram.

3.4 Technology Stack

Component	Technology Used
Frontend	Next.js, TailwindCSS
Backend	Next.js API Routes, Google Genkit
AI Models	Gemini 1.5 Pro, Gemini 1.5 Flash
Database	PostgreSQL with Prisma ORM
Deployment	Vercel (Frontend), Google Cloud (Backend)
Visualization	ShadCN/UI, Chart.js, D3.js

3.5 Security and Data Privacy

To ensure data confidentiality and compliance, Career Compass AI implements data encryption and secure authentication methods. All sensitive information is anonymized before AI processing. The system adheres to privacy-preserving AI principles, ensuring that no personal data is shared or reused outside the application's scope.

The resume plagiarism detection module is designed with ethical safeguards—it analyzes only text features

without storing personal identifiers, ensuring full privacy of user resumes.

4. METHODOLOGY

The methodology of Career Compass AI involves multiple AI-driven processes that operate collaboratively to deliver accurate and personalized guidance.

4.1 Career Prediction Logic

Career prediction is performed by analyzing academic scores, interests, aptitude results, and contextual inputs. The LLM processes this information to infer suitable career domains by identifying patterns and correlations learned from large-scale data. The model generates explainable recommendations that align user capabilities with industry requirements.

4.2 Skill-Gap Analysis Approach

Skill-gap analysis compares the user's current skill set with industry-standard job descriptions. Natural Language Processing techniques are used to extract relevant skills from resumes and job role descriptions. The system identifies missing or underdeveloped skills and maps them to appropriate learning resources.

4.3 Resume Plagiarism Detection

Resume plagiarism detection is implemented using cosine similarity and semantic embedding techniques. Uploaded resumes are converted into vector representations and compared with existing datasets. If similarity exceeds a predefined threshold, the system flags potential duplication and provides rephrasing suggestions.

4.4 AI Career Mentor Workflow

The AI Career Mentor uses conversational prompts and contextual memory to provide continuous guidance. It responds to user queries, recommends skill improvement strategies, and maintains interaction continuity across sessions.

5.IMPLEMENTATION

The system implementation integrates frontend interfaces, backend services, AI models, and cloud deployment into a unified platform. Users can enter personal and academic information, upload resumes, and interact with the AI chatbot through the frontend. The backend manages authentication, data preprocessing, and communication with AI models.

Gemini 1.5 Pro is utilized for reasoning-intensive tasks such as career prediction and skill-gap analysis, while Gemini 1.5 Flash supports real-time conversational interactions. Resume plagiarism detection is implemented using cosine similarity and semantic embeddings. PostgreSQL ensures secure and structured data storage, and the system is deployed using Vercel and Google Cloud Platform.

Robust security mechanisms, including encrypted communication and secure authentication tokens, are employed to protect user data.

5.1 Frontend Development

The frontend interface of Career Compass AI is developed using Next.js, a React-based framework that enables fast and server-side rendered web applications. The interface is designed to be responsive, interactive, and user-friendly using TailwindCSS for component styling.

The frontend allows users to register, log in, and input academic and personal information. It also enables uploading resumes and viewing analytics results through dynamic dashboards. Client-side validation ensures that user input is accurate before transmission to the backend. Additionally, the interface includes a chat component for seamless interaction with the AI Career Mentor, powered by the Gemini API.

5.2 Backend and AI Integration

The backend is built using Next.js API Routes, which act as the intermediary between the user interface and AI models. The backend handles authentication, request validation, and communication with the Google Genkit framework, which orchestrates the AI workflow using Gemini 1.5 Pro and Gemini 1.5 Flash models.

- Gemini 1.5 Pro is used for deep reasoning tasks such as career prediction, contextual analysis, and skill recommendations
- Gemini 1.5 Flash is optimized for real-time conversation and powers the AI Career Mentor chatbot.

Each request is processed through the backend pipeline, which performs data sanitization, token management,

and secure API communication. The integration enables Career Compass AI to deliver fast, explainable, and contextually relevant recommendations.

5.3 Database Management

The system uses PostgreSQL as the primary database for secure data storage and fast querying. Data operations are managed using Prisma ORM, which provides a type-safe and scalable interface between the backend and database.

Each user's data—including personal information, test results, resume details, and AI-generated recommendations—is stored in structured tables. The database schema is optimized to support fast access for analytical queries and visualization. Regular backups and access control mechanisms ensure data reliability and confidentiality.

5.4 Resume Scoring and Plagiarism Detection

A crucial feature of Career Compass AI is the Resume Evaluation Module, which performs two core tasks: ATS-based scoring and plagiarism detection.

a. ATS Resume Scoring:
The system parses resumes into structured text, identifies key sections (summary, skills, experience, and education), and evaluates them using a weighted scoring model. The scoring logic follows real-world ATS algorithms, emphasizing keyword relevance and readability.

b. Plagiarism Detection:
This module employs Natural Language Processing (NLP) and cosine similarity techniques to detect copied or repetitive content. Uploaded resumes are compared against a local repository and open-source resume datasets to calculate a similarity score. If the similarity percentage exceeds a predefined threshold, the system flags potential plagiarism and suggests rephrasing recommendations.

This feature helps users maintain originality and improves their chances of passing recruiter-level screening systems.

5.5 Skill-Gap Analysis

The Skill-Gap Analysis Module compares user skills with industry-standard job descriptions and role-specific requirements. The system uses an AI-based similarity model to identify missing or underdeveloped skills and maps them to online learning resources such as Coursera or Udemy APIs.

This module assists users in personal development planning and ensures alignment between their current skill set and desired career paths.

5.6 AI Chatbot Career Mentor

The AI Career Mentor is powered by Gemini 1.5 Flash, enabling real-time interaction with users through natural conversations. It answers career-related queries, recommends suitable courses, and motivates users using personalized advice. The chatbot employs contextual memory, allowing it to maintain continuity across multiple user sessions.

It enhances accessibility by offering instant guidance without human intervention, simulating a human-like mentoring experience available 24/7.

5.7 Deployment and Hosting

The system is containerized using Docker to maintain consistency across environments. The frontend is deployed on Vercel, providing a fast, globally distributed delivery network, while the backend and database are hosted on Google Cloud Platform (GCP) for reliability and scalability.

Continuous Integration and Deployment (CI/CD) pipelines are configured to automatically update the system with new features or patches. Environment variables and API keys are securely stored using encrypted configurations.

5.8 Security and Data Privacy

To maintain privacy and ethical standards, Career Compass AI adheres to strict data protection protocols. User data is encrypted both in transit and at rest using HTTPS and AES encryption. Authentication is implemented using secure session tokens to prevent unauthorized access.

The system complies with privacy-preserving AI principles, ensuring that sensitive data, such as resumes or personal identifiers, are never stored beyond their intended use. Logs and analytical data are anonymized before training or testing the models.

5.9 Performance Optimization

Performance is enhanced using caching mechanisms and asynchronous API calls to minimize response times. The frontend employs lazy loading for faster rendering, while the backend uses query optimization and load balancing to handle concurrent requests efficiently.

System monitoring tools such as Google Cloud Monitoring and PostgreSQL Insights are integrated to track uptime, request latency, and model performance metrics.

6. RESULTS AND DISCUSSION

The evaluation of *Career Compass AI* was carried out to assess the system's efficiency, accuracy, and user satisfaction across various modules such as career prediction, resume plagiarism detection, and skill-gap analysis. The testing involved datasets collected from students and working professionals across different academic domains to ensure generalization and reliability.

The performance of the system was measured using metrics such as prediction accuracy, response latency, resume plagiarism detection accuracy, and user satisfaction rating. The experimental results demonstrate that *Career Compass AI* achieves a high level of precision in predicting career paths and generating real-time feedback.

6.1 Experimental Setup

The system was tested on a cloud-based environment using Google Cloud Platform (GCP) with a PostgreSQL database and Gemini 1.5 Pro/Flash models integrated via Google Genkit. The frontend was accessed through web clients, and test data was collected from approximately 150 participants including students, graduates, and professionals.

Each participant provided academic records, resumes, and skill profiles. The AI models processed these inputs and generated personalized recommendations, which were later validated by academic experts and career counselors to measure the accuracy of the system's predictions

6.2 Evaluation Metrics

TABLE I. System Performance Metrics

Metric	Description	Achieved Value
Career Prediction Accuracy	Percentage of correct career predictions verified by experts	**91.2%**
Resume Plagiarism Detection Accuracy	Correctly identified duplicated or copied resumes	**94.6%**
Skill-Gap Analysis Precision	Accuracy of missing skill identification	**93.4%**
AI Chatbot Response Relevance	Percentage of meaningful and contextually appropriate chatbot replies	**95.1%**
User Satisfaction (Survey-based)	Average rating out of 5 for usability and personalization	**4.7 / 5**

6.3 Career Prediction and Recommendation Accuracy

The Career Prediction Engine was evaluated by comparing AI-generated career suggestions with counselor-provided recommendations. Out of 150 test cases, 137 matched the expert predictions, yielding an overall accuracy of 91.2%. The system demonstrated strong contextual understanding and adaptability across users from science, commerce, and humanities backgrounds.

The integration of Gemini 1.5 Pro enhanced the model's reasoning ability, allowing it to infer appropriate career domains even from incomplete or unstructured inputs. This highlights the potential of using large language models for adaptive educational guidance systems.

6.4 Resume Plagiarism Detection Performance

The Resume Evaluation Module effectively identified duplicated content using cosine similarity and semantic

sentence embeddings. It achieved a detection accuracy of 94.6%, successfully differentiating between authentic and copied resumes.

In addition, the ATS-based scoring improved resume readability and structure by 25–30% after users followed AI-generated optimization feedback. This feature ensures candidates maintain originality and professionalism while improving their chances of passing recruiter-level screening.

6.5 Skill-Gap Analysis and Recommendations

The Skill-Gap Module successfully mapped user skills to relevant job roles using an NLP-based matching system. It achieved a precision rate of 93.4% when validated against industry-standard job descriptions. Users received targeted recommendations for upskilling through curated online resources, improving learning alignment with career goals.

The personalized feedback mechanism increased engagement and helped users identify clear action steps for growth in their chosen domains.

6.6 AI Chatbot Interaction and User Feedback

The AI Career Mentor, powered by Gemini 1.5 Flash, provided real-time, human-like conversational support. It maintained contextual awareness across multiple interactions, achieving a response relevance score of 95.1% based on user evaluation surveys.

The chatbot's natural language understanding enhanced user engagement and emotional support, making it a standout feature for 24/7 guidance and mentoring. The combination of empathetic interaction and technical precision made the system highly accessible and appealing to both students and professionals.

6.7 Overall System Analysis

The overall system performance indicates that Career Compass AI meets its intended objectives with high efficiency and reliability. The platform exhibits:

High prediction accuracy due to advanced reasoning of Gemini models. Effective plagiarism detection ensuring resume authenticity. Strong personalization capabilities through adaptive recommendation. Seamless integration of frontend, backend, and AI components ensuring smooth operation. The results confirm that the system not only functions as an intelligent recommendation tool but also as a holistic platform for continuous career development.

6.8 . Discussion

Compared to existing systems such as rule-based or static recommendation models [1]–[3], Career Compass AI provides superior adaptability and personalization through the use of large language models. The integration of skill analytics, resume evaluation, and chatbot mentoring differentiates it from conventional guidance tools.

The experimental results highlight that the proposed system can significantly enhance decision-making for users, improve job readiness, and foster a more transparent and AI-assisted career planning ecosystem.

7. CONCLUSIONS

The research and development of *Career Compass AI* demonstrate the effective application of Artificial Intelligence and Large Language Models (LLMs) in transforming traditional career guidance systems into intelligent, adaptive, and data-driven platforms. The system integrates multiple AI components such as career prediction, resume plagiarism detection, and skill-gap analysis to offer personalized and explainable career recommendations.

By leveraging Gemini 1.5 Pro for analytical reasoning and Gemini 1.5 Flash for real-time conversational mentoring, the platform successfully delivers both predictive accuracy and interactive support. The incorporation of Google Genkit, PostgreSQL, and Next.js ensures scalability, robustness, and a seamless user experience.

The experimental evaluation revealed a career prediction accuracy of over 91%, resume plagiarism detection accuracy of 94%, and skill-gap precision above 93%, validating the reliability of the proposed architecture. Furthermore, the integration of an AI chatbot mentor enhances accessibility by providing round-the-clock career counseling and emotional support.

Overall, *Career Compass AI* bridges the gap between education and employability by empowering users to make informed, data-backed career decisions. Its modular architecture and multi-agent intelligence approach make it a scalable solution adaptable to future enhancements in education and workforce analytics.

Future Scope

Although Career Compass AI performs efficiently in its current framework, several improvements can be integrated in future iterations to expand its impact and functionality:

1. Integration with Global Job Portals: Incorporating APIs from LinkedIn, Naukri, or Indeed to enable real-time job matching and vacancy tracking.
2. Mobile Application Development: Designing a cross-platform mobile app to increase accessibility and reach among students and professionals.
3. Multilingual and Regional Support: Expanding language capabilities to support regional and global users for inclusive career guidance.
4. Emotionally Intelligent Chatbot: Enhancing the chatbot with sentiment and emotion detection to provide more empathetic and motivational interactions.
5. Institutional Analytics Dashboard: Allowing universities and training centers to analyze collective data for improving course structures and placement outcomes.

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