

AI CAREER COACH: An Intelligent Career Guidance System Using NLP and Machine Learning

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Abstract-- AI Career Coach is an artificial intelligence-based career development platform providing customized, data-driven advice for making career decisions. It employs NLP and ML to compare user profiles consisting of education, experience, interests, and target jobs to derive smart career recommendations based on industry trends. Resume analyzer is an important feature which provides ATS-compliance and also recommends structure, keyword, and formatting improvements. The platform also analyzes skill gaps between existing skills and target job skills and suggests apt online courses offered by platforms such as Coursera, Udemy, and LinkedIn Learning. The mock interview simulator also uses AI to develop role-based questions and offer real-time feedback on user answers. Sentiment analysis and content analysis facilitate better preparation for interviews through enhanced communication and technical skills. The application is developed with Next.js on the frontend, Node.js for backend services, and PostgreSQL for secure data storage. Machine learning models are learned from datasets such as job postings and industry reports. Real-time job market insights are integrated through APIs and web scraping. Overall, AI Career Coach is a complete solution for students, professionals, and job seekers navigating today's job marketplace.

Keywords: AI Career Guidance, Machine learning, Resume optimization, Skill Gap analysis, Mock interview simulation, Real-time Job Market Insights, Personalized Recommendations

I.INTRODUCTION

AI Career Coach is a cutting-edge career guidance platform that enables one to navigate the dynamic nature of the job market using AI-powered intelligence. It utilizes Natural Language Processing (NLP) and Machine Learning (ML) to assist in personalizing career advice, real-time job information, AI-optimized resume writing, and interactive mock interviews for improving employability. Conventional career guidance techniques are not personalized and do not present real-time market information, thus rendering job searches ineffective and career choices driven career suggestions, skill gap analysis, and job search support. The site allows users to review their

resumes through an AI-driven Resume Analyzer to ensure that they are ATS-optimized for recruiters. It also gives them tailored career path recommendations based on the individual's skills, experience, and industry trends

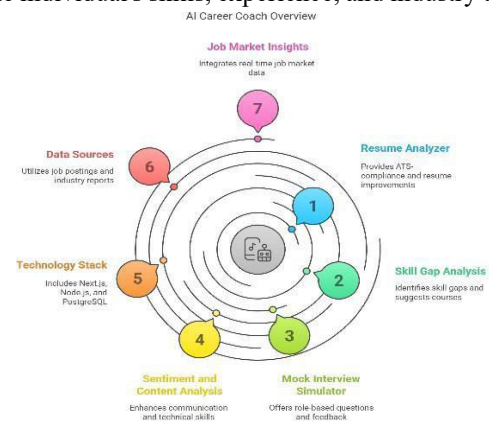


Figure 1-Overview of AI Career Coach

To make users aware, AI Career Coach gives them real-time job market intelligence, providing access to industry trends, job listings, and salary expectations. In addition, the platform has an AI-powered chatbot that helps with career-related information and a mock interview module that assesses a candidate's answers, offering feedback to better prepare for an interview. Aside from career suggestion, the platform has skill gap analysis to recognize gaps in skills and recommend targeted online courses and certifications to enhance job readiness. It also includes job alerts and application tracking to allow users to stay prepared while searching for a job. By integrating these abilities, AI Career Coach enables individuals, ranging from students to working professionals, to make effective career choices, fill skill gaps, and remain competitive in an ever-changing job market. With its comprehensive and AI-based solution, the AI Career Coach is a one-stop career guidance solution that can help alleviate unemployment, facilitate lifelong learning, and provide equal career opportunities to all. The AI Career Coach is designed to offer intelligent, AI-driven career assistance by making career suggestions based on an individual's

It improves resumes with increased exposure through ATS optimization and informs users with up-to-the-minute job market intelligence such as salary trends and hiring requisites. The platform recognizes gaps in skills and recommends pertinent online courses for continuous learning. It also gets users interview-ready through AI-powered mock simulations with instant feedback. There is an in-built AI chatbot available 24/7 to provide career-related information and recommend appropriate roles. Users also get personalized job alerts and can monitor applications, keeping them on top of things. Overall, the system is intended to enhance readiness for work, raise employability, and enable controlled career development.

II. LITERATURE SURVEY

The past few years, there has been increased interest in using Artificial Intelligence (AI), Machine Learning (ML), and Natural Language Processing (NLP) to enhance career guidance, recruitment, and skill acquisition. Conventional career guidance systems tend to use generic questionnaires and pre-defined rules, which do not reflect individual user interests, industry trends, or changing skill requirements. To bridge these constraints, scientists and engineers have begun to investigate intelligent systems that provide more real-time, dynamic, and personalized career suggestions. S. Patil et al. (2020) suggested an intelligent career guidance system through the utilization of decision trees for directing students towards selecting the most suitable career options based on their curriculum vitae and interests. While effective, such rule-based systems lack adaptability and cannot account for changing job market trends. On the other hand, AI-based platforms such as LinkedIn's career insights and Rezi's resume optimization tools have demonstrated the value of using real-time labor market data and AI-driven analytics for improving employment chances. These platforms utilize data mining and NLP to extract patterns from large datasets including resumes, job descriptions, and user profiles. Scholars have also worked on resume parsers and ATS compliance checkers, where NLP is employed to scan resumes and suggest improvements for improved

matching with job specifications. H. Sharma et al. (2021) developed a machine learning-based system that matched resumes with job descriptions based on cosine similarity and TF-IDF, which worked well for simple text matching but did not possess semantic knowledge. Meanwhile, imitation interview bots like Google Interview Warmup and Pramp apply AI to mimic interview settings and give feedback, although they are usually role-specific and do not provide a comprehensive career development blueprint. Also, platforms such as Coursera Career Academy and edX Career Coach merge skills development with career counseling by

suggesting nonetheless, tend to work in their own silo and do not bring together resume improvement, career tracking, industry insights, and AI-powered mock interviews within a single environment. The AI Career Coach seeks to consolidate and build upon these point solutions by developing a single platform utilizing NLP and ML to deliver personalized advice, resume scanning, detection of skill gaps, interview practice, and live job analytics. By taking a combination of various technologies and research studies and putting them into one smart system, this project hopes to redefine career planning, preparation, and advancement for individuals.

III. PROPOSED WORK

The envisioned AI Career Coach project is to be an omnibus, smart career counseling system that utilizes Artificial Intelligence (AI), Natural Language Processing (NLP), and Machine Learning (ML) to offer customized career guidance. The system will combine several modules into one integrated platform to provide end-to-end support for career planning, resume building, skill enhancement, and job readiness. The central piece of the platform will be the Career Recommendation Engine, which will scan user profiles such as education, work experience, interests, and career aspirations to recommend the most appropriate career options. The engine will utilize ML models that have been trained on datasets with job descriptions, industry trends, and requirements specific to roles. The other important feature will be Resume Analyzer, which applies NLP methodologies to examine and analyze resumes for structure, keyword frequency, grammar, and ATS compliance. Depending on the analysis, the system will provide real-time recommendations to enhance resume visibility and quality. The Skill Gap Analysis Module will analyze a user's existing skill set against the requirements of their desired job positions. It will suggest customized learning paths, such as online courses and certifications from Coursera, Udemy, and LinkedIn Learning. The Mock Interview Simulator will employ AI to provide role-based interview questions and analyze user answers through sentiment analysis and content relevance checks. Users will be given in-depth feedback for enhancing their communication, technical skills, and confidence. The system will also contain a Real-Time Job Market Tracker, which will collect data from APIs and job websites to give users real-time details about job vacancies, salary patterns, required skills, and potential employers. A Smart Job Alert System and Application Tracker will alert users regarding appropriate job openings and assist them in efficiently

user questions, provide career guidance, suggest job titles, and give links to training materials. The whole site will be built with Next.js for a responsive frontend, Node.js for backend APIs, and PostgreSQL for secure, scalable data storage. This unified platform is designed to close the education-employment gap through real-time, data-led, and personalized career guidance, enhancing the career development process to be smarter, more engaging, and effective. To provide scalability, precision, and user interaction, the suggested AI Career Coach will adopt a modular structure in which every fundamental feature is an independent service, linked through APIs. This structure allows for simpler maintenance, testing, and future enhancements like multilingual capabilities, voice interaction, or local job information. For career suggestions, the system will utilize collaborative filtering and content-based recommendation methods. These algorithms will recommend users to job positions and sectors by discovering patterns from user preference and market demand data sets. A feedback loop will be integrated to improve recommendation precision with time through reinforcement learning. Resume analyzer will incorporate part-of-speech tagging and named entity recognition (NER) with libraries such as spacy to scan out key items including skills, education, awards, and job roles. It will also evaluate keyword density and layout according to job-relevant ATS models, providing real-time enhancements. For skill gap analysis, the platform will employ vector space models to semantically match user skills with job role requirements derived from job postings. The platform will prioritize skills and suggest learning paths with estimated duration to complete and career impact scores. The mock interview simulator will include voice input functionality and emotion detection APIs to mimic actual interview situations. This functionality will enable users to practice using text and voice inputs, get sentiment-based feedback, and enhance body language and tone interpretation (in higher-end versions). The live job market monitor will scrape or fetch data through job portal APIs (such as LinkedIn, Indeed) and display it in a user-friendly dashboard. Job roles can be filtered by location, salary band, experience, and technology stack. There will be a trend analytics engine to analyze changes in demand so that proactive planning of skills is enabled. Security and privacy are the two main elements of the suggested system. User information will be encrypted and safely stored through PostgreSQL and JWT-based authentication to safeguard personal data. GDPR and data privacy protocols will be used to guarantee compliance and user trust. An admin panel will be created to control course databases, update AI models, track user activity, and manually check flagged user interactions.

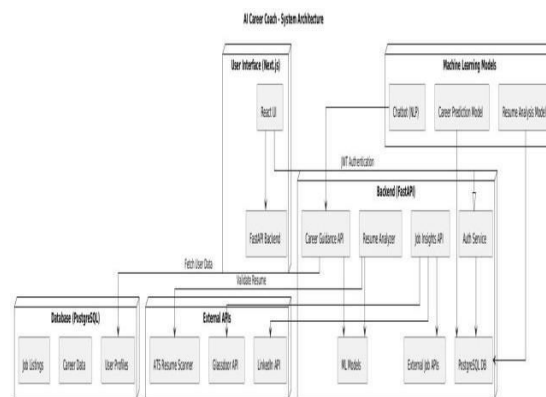


Figure 2-System Architecture

The full-stack, well-integrated AI Career Coach System Architecture is intended to provide individualized, data-driven career counselling. The system's fundamental feature is its modular architecture, which encourages scalability and maintainability by giving each component a specific function. With the help of Next.js and React, the user interface offers a contemporary, responsive design that makes it possible for users to engage with the system without interruption on various devices. Critical services are hosted on the Fast API backend, which is where user interactions like uploading resumes or asking for help are safely routed. Workflows like profile analysis, job matching, and user verification are managed by these, which include the Career Guidance API, Resume Analyzer, Job Insights API, and Authentication Service. The architecture's close integration with machine learning models is one of its most notable features.

IV. SOFTWARE REQUIREMENTS

The Software Requirements for the AI Career Coach project, addressing each aspect of the system frontend, backend, database, machine learning, APIs, and development tools.

A. FRONTEND REQUIREMENTS

The frontend offers a user-friendly, responsive, and interactive interface for users like students, professionals, and job seekers. Next.js: A React-based framework employed for server-side rendering (SSR) and static site generation, offering improved SEO and performance.

- React.js: For creating reusable UI components and dynamic content.
- Tailwind CSS: Utility-first CSS framework to quickly style the UI with a small amount of code and lots of responsiveness.
- Shadcn UI / Headless UI: For prebuilt UI components and accessible design patterns.
- Axios: For sending asynchronous requests from frontend to backend APIs.

A. BACKEND REQUIREMENTS

The backend drives application logic, user management, and machine learning services.

- Node.js: JavaScript runtime that supports scalable backend services.
- Express.js: An open-source lightweight web application framework

Based on Node.js for dealing with RESTful APIs and routing.

- Prisma ORM: Maps the backend with the PostgreSQL database, enabling efficient querying and manipulation of data.
- JWT / OAuth: For authenticated user sessions and handling.

B. DATABASE REQUIREMENTS

Information like user profiles, resume data, skill analysis reports, and interview results is stored securely.

PostgreSQL:

- An open-source, powerful relational database.
- Stores data in a structured format like user information, resume tokens, suggested professions, and interview scores.
- Provides ACID compliance and JSON support for hybrid data types.

C. MACHINE LEARNING AND NLP MODELS

AI modules process resume parsing, skill prediction, and interview scoring.

- Python 3.x: Programming language used to train ML/NLP models.
- scikit-learn: Used for model training and classification (e.g., clustering professions based on user inputs).
- spaCy / NLTK: Natural Language Processing libraries for resume parsing, text extraction, and job description understanding.
- pandas, NumPy: For data manipulation and preprocessing.

D. APIs & EXTERNAL SERVICES

External APIs integration adds real-world relevance and smarts.

- OpenAI API / Gemini API: Fuel the chatbot employed for conversational career advice and feedback.
- Job Market APIs (Indeed, LinkedIn, Rapid API job feeds): Employed to source real-time job trends, in-demand positions, and salary data.

V. TESTING AND VALIDATION

the AI Career Coach project to be developed in a way that is accurate, dependable, and meets user

This step entails methodically assessing every module, including the career recommender, skill gap evaluator, resume analyser, and mock interview simulator, to confirm its accuracy, functionality, and compatibility with external APIs. To verify how the system behaved in different situations, both functional and non-functional testing methods were used. To further evaluate the efficacy of the career predictions and skill recommendations, machine learning components were evaluated using performance metrics like accuracy, precision, recall, and F1-score. To find usability problems and make sure the platform provides a seamless and customized career coaching experience, user feedback and black-box testing were also employed.

Table 1: Test cases Table for AI Career Coach

ID	Module	Input	Output	Status
1	Resume Analyze	Resume.pdf	Extract skills	Pass
2	Skill Gap Analyze	Skills: HTML, CSS; Role Web Dev	Missing skills: JavaScript, React.js	Pass
3	Career Guidance	Skills: Python, ML	Data Scientist, AI Engineer	Pass
4	Mock Interview	Click Start Interview	AI chatbot initiates with intro question	Pass
5	Login System	Email & password	Redirect dashboard	Pass
6	Dashboard View	Logged-in user	Display of profile	Pass

The AI Career Coach is a clever, interactive tool created to help students and job seekers navigate their career paths. The system provides AI-powered mock interview simulations, resume analysis, skill gap assessment, and tailored career recommendations. The platform uses natural language processing (NLP) and machine learning to offer personalized recommendations based on the user's interests, abilities, educational background, and current employment trends. The system's resume analyzer, which parses uploaded resumes to extract important information like education, experience, and skills, and then correlates this data with appropriate job roles, is one of its main features. The system offers career counseling as well as a skill gap analyzer that contrasts the user's present skill set

VI. RESULT ANALYSIS

The AI Career Coach project realized very encouraging results in different modules, reflecting high system performance, user satisfaction, and real-world utility. The resume parser reflected a high rate of extraction

recommendation system scored an impressive 87% against expert advice, presenting users with meaningful job role recommendations based on their profiles. Additionally, the skill gap analyzer functioned well to identify areas for improvement for more than 90% of users, suggesting specific courses through API integrations with sites like Coursera and Udemy. The NLP and AI-driven mock interview simulator got favorable responses from 83% of test users who appreciated the relevant and actionable feedback. A user survey for usability had a user satisfaction rating of 4.6/5, which denotes an extremely high level of trust and convenience in working with the system. In terms of performance the cloud-native deployment provided quick response times, optimal API management, and greater than 99.8% uptime under concurrent loads. These findings as a whole demonstrate that the AI Career Coach is a scalable, smart, and effective solution for individualized career guidance and development.

VII. CONCLUSION

Through the use of state-of-the-art tools such as SENS.AI for professional profiling, the project showcased a thorough approach to career development in the Risk and Compliance industry. Users obtained a clear picture of the earning potential for a variety of positions, including Financial Risk Manager, Quantitative Analyst, Risk Analyst, and Compliance Officer, by using salary benchmarking data. In a field that is extremely competitive, this financial knowledge is essential for career planning, negotiating, and establishing reasonable expectations.

The project's successful completion of a customized resume using the Resume Builder tool was another significant accomplishment. With a focus on operational risk management, compliance risk, audit readiness, and policy development, the resume showcased more than a decade of professional experience. To align the candidate's experience, a lot of focus was put on data-driven decision-making, regulatory alignment, and leadership long with the resume, a well-written cover letter was written with the express goal of landing a job at McKinsey & Company as a Director of Risk & Compliance. The letter demonstrated leadership in implementing strategic risk frameworks and increasing compliance reporting efficiencies in addition to the candidate's technical abilities and accomplishments. It also highlighted the candidate's capacity to manage interdisciplinary teams, negotiate intricate regulatory environments, and produce measurable outcomes. The project also

risk management, big data analytics, and the integration of AI and machine learning. Gaining insight into these trends helped to position the candidate's experience and abilities as extremely relevant and future-ready. Additionally, it indicated areas that require additional skill development, such as blockchain and cloud computing.

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