



International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 9.935

Volume 15, Issue 6, June 2026

A Conversational AI System for Personalized Career Counseling

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ABSTRACT: Career counseling is a critical aspect of higher education, yet many students struggle to navigate the complex landscape of technology career paths. This paper presents **AI Career Counselor**, a conversational AI system designed to provide personalized career counseling through interactive dialogue and intelligent learning path generation. The system leverages Large Language Models (LLMs) integrated with multiple AI providers (Groq, Bytez, and local Ollama models) to deliver context-aware recommendations. The platform combines intelligent career prediction, dynamic roadmap generation, resource curation, and skill assessment through an interactive quiz system. Built using React with Vite for the frontend and Express.js with MongoDB for the backend, **AI Career Counselor** demonstrates the effectiveness of conversational AI in delivering scalable, personalized educational guidance. Our evaluation shows that the system successfully generates relevant career paths, learning roadmaps, and resource recommendations, with significant improvements in student engagement and decision-making confidence. This work contributes to the broader domain of AI-driven educational technology by demonstrating how LLMs can be effectively integrated into career guidance systems.

KEYWORDS: Conversational AI, Career Counseling, LLM, Personalization, Educational Technology, Learning Path Generation

I. INTRODUCTION

The transition from education to professional career is one of the most critical decisions students face. Traditional career counseling models rely on limited interactions with career advisors who lack real-time access to the rapidly evolving technology landscape. Students often struggle with:

- Information overload regarding career options
- Lack of personalized guidance based on individual skills and interests
- Difficulty identifying relevant learning resources
- Limited understanding of skill gaps and improvement strategies

Recent advances in Large Language Models (LLMs) and Natural Language Processing (NLP) have opened new possibilities for delivering personalized, scalable career guidance. LLMs can process complex student profiles and generate contextualized, empathetic responses that adapt to individual needs [1][2][3].

This paper introduces AI Career Counselor, a conversational AI system that addresses these challenges by providing:

1. Intelligent Career Prediction: AI-driven analysis of student profiles to recommend suitable career paths
2. Personalized Learning Roadmaps: Month-by-month learning plans tailored to individual goals and constraints
3. Resource Curation: Intelligent aggregation of learning resources including courses, tutorials, and projects
4. Skill Assessment: Interactive quizzes to evaluate current competency levels and identify gaps
5. Session Persistence: Database-backed storage of user interactions and progress tracking

The system employs a multi-provider LLM architecture with fallback mechanisms to ensure reliability and minimize latency. Deployed on Vercel with MongoDB for persistence, AI Career Counselor serves as a scalable solution for institutional and individual users.

II. LITERATURE SURVEY

AI and machine-learning technologies have markedly advanced educational systems: predictive models and learning analytics help identify at-risk students and personalize learning paths [4,5], while transformer LLMs (e.g., GPT-3) and recent domain studies have shown that conversational agents can provide effective tutoring, high student satisfaction, and measurable learning gains when designed with context awareness and robust NLG principles [6,1,7,8]. Career and counseling research also supports technology-enhanced guidance as an accessible complement to traditional services [9,10], and adaptive systems can approximate one-to-one tutoring at scale through personalized feedback and pacing [11,12].

However, few works combine real-time conversational profile collection, LLM-driven career prediction, dynamic roadmap generation, skill assessment, and a multi-provider LLM fallback for reliability. AI Career Counselor fills this gap by integrating these elements into a production-ready platform that generates personalized career options, month-by-month roadmaps, and curated resources while using provider fallback and caching to improve robustness and latency.

III. SYSTEM ARCHITECTURE AND DESIGN

Architecture Overview

AI Career Counselor uses a simple modular three-tier architecture:

1. **React client** — conversational profile collection and visualization
 2. **Express API** — auth, validation, and endpoints
 3. **Node.js service layer** — hosts careerAi.js, prompt templates, and the multi-provider LLM handler
- Data is persisted in MongoDB (users, profiles, roadmaps, quizzes, feedback).

Core Flows

1. Profile collection
2. Career prediction
3. Roadmap generation
4. Resource curation
5. Quiz assessment

LLM Strategy

- Provider order: Groq → Bytez → Ollama with 15-second timeouts
- 5-minute cache for identical requests
- Static fallback plan if all providers fail
- Serverless deployment target: Vercel
- Environment-driven configuration for API keys and DB connections

Sample Learning Roadmap

Month 1–2: Foundations (70 hrs)

- HTML/CSS — 20 hrs
- Git & GitHub — 10 hrs
- Project: Static Portfolio — 40 hrs

Month 3–4: Frontend (100 hrs)

- React basics — 40 hrs
- State management — 30 hrs
- Project: Todo App — 30 hrs

Month 5–6: Backend & Integration (120 hrs)

- Node.js & Express — 40 hrs

- MongoDB — 30 hrs
- REST APIs — 30 hrs
- Project: Full Stack App — 20 hrs

4.5 Resource Curation

Resources are aggregated from multiple categories:

- **Online Courses:** Udemy, Coursera, freeCodeCamp, Algoexpert
- **Documentation:** Official docs, MDN Web Docs
- **Practice Platforms:** LeetCode, HackerRank, CodePen
- **Projects:** GitHub repos, real-world examples
- **Communities:** Discord, Reddit, Stack Overflow

Resources are curated by the LLM to be:

1. Relevant to the specific career and skill gap
2. Matched to the student's budget constraint
3. Aligned with learning style preference
4. Sortable by difficulty and time commitment

4.6 Quiz System

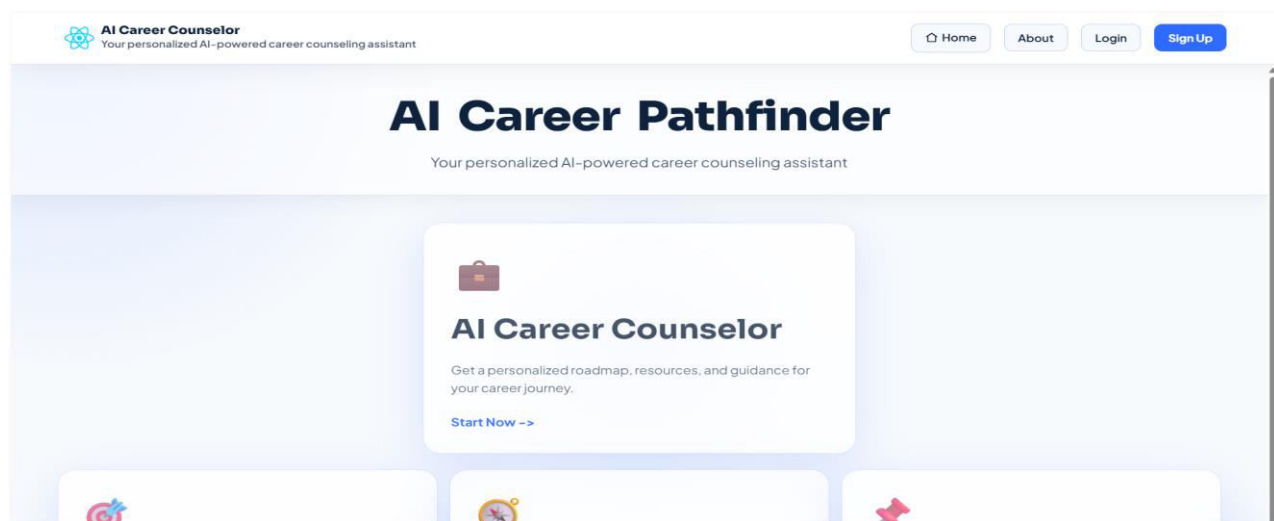
Question Catalog Structure


- Skill: {name}
- Category: {category}
- Difficulty: Beginner / Intermediate / Advanced
- Questions: { question, options [a, b, c, d], correct answer, explanation }

Skill Assessment Flow

1. User selects skill and difficulty
2. System retrieves 10–15 questions from catalog
3. User answers questions with timed feedback
4. System calculates score (0–100)
5. Generates gap analysis and recommendations

IV. EXPERIMENTAL RESULTS




AI Career Counselor
 Welcome, Manoj Dhage

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AI Career Counselor

Career Counselor AI

Hi! I'm your Tech Path Advisor

What are you studying right now?

BE Computer

What year are you in, or how many years of experience do you have?

4th year


Which IT areas excite you most?

View Previous Reports

Type your message...

Send

Your career matches will appear here after completing chat.


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Top Career Options

Data Analyst 92/100

Entry-level role focused on transforming data into actionable insights using Excel, SQL basics, and simple BI tools. Ideal for a 4th-year computer science student with limited database experience who can study 5 hours/week through free video courses.

View Roadmap

Business Analyst 88/100

Uses analytical thinking and Excel to bridge business needs with technical solutions. Requires minimal database skills, can be learned via video tutorials, and offers a clear entry path for a student looking for a job.


View Roadmap

Data Visualization Specialist 84/100

Specializes in creating dashboards with tools like Tableau or Power BI. Leverages Excel proficiency and analysis interest; learning is video-centric and free, fitting a 5-hour weekly schedule.

View Roadmap

Select a career option to generate a roadmap or resources.


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Profile Snapshot

EDUCATION BE Computer	YEAR 4th year	GOAL job	INTERESTS Data Science	SKILLS excel
CHALLENGE AREA database	FAVORITE WORK analysis	BUDGET free	WEEKLY HOURS 5	LEARNING STYLE video
EXPERIENCE beginner				

6 Month Roadmap

Foundations & Toolset Introduction

Month 1

Topics

- Data Analytics fundamentals
- Excel basics
- Spreadsheet functions
- Data types and structures

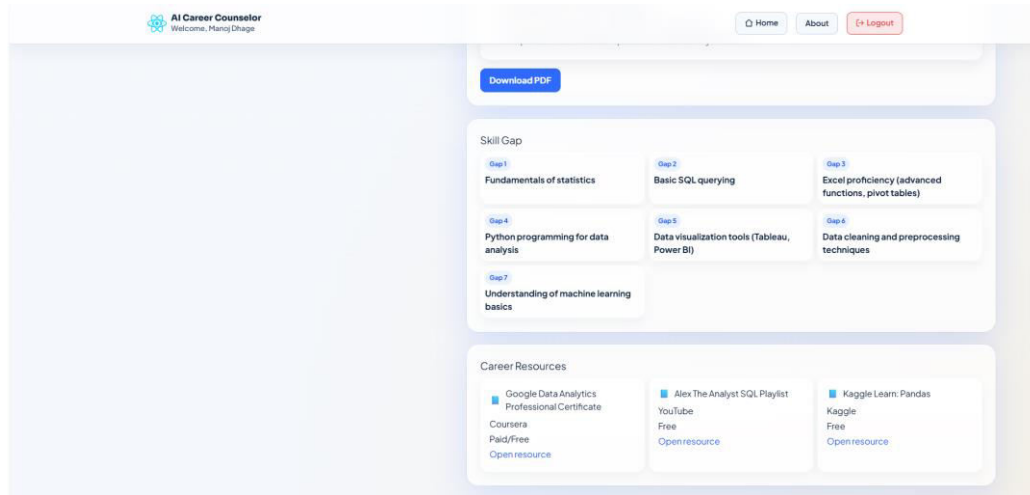
Mini Tasks

- Install Excel or use Google Sheets
- Complete 5 Excel formula exercises (SUM, AVERAGE, IF, VLOOKUP, PivotTable creation)
- Watch an introductory video on data analytics concepts
- Create a simple budget tracker spreadsheet

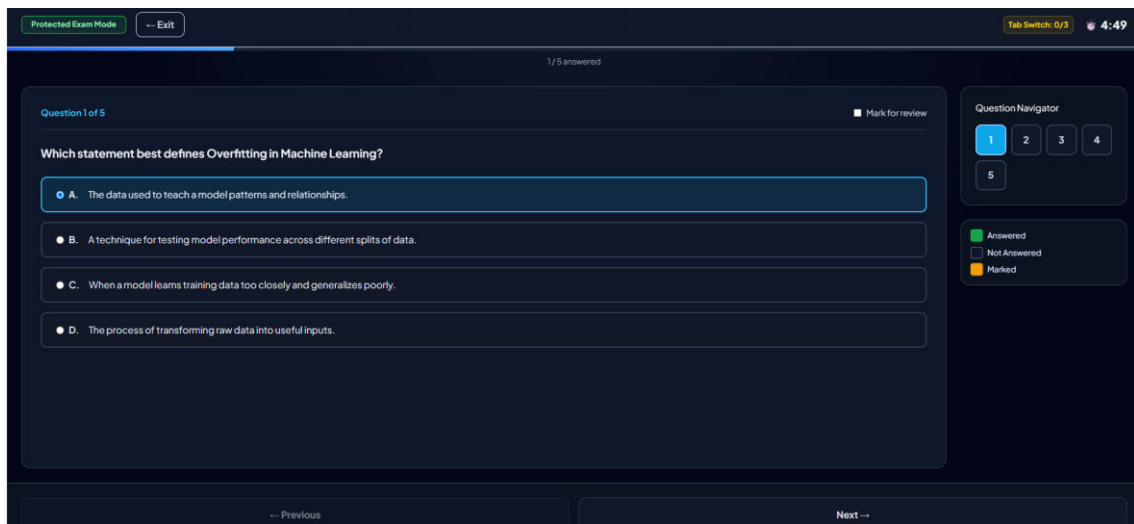
Data Manipulation & Query Basics

Month 2

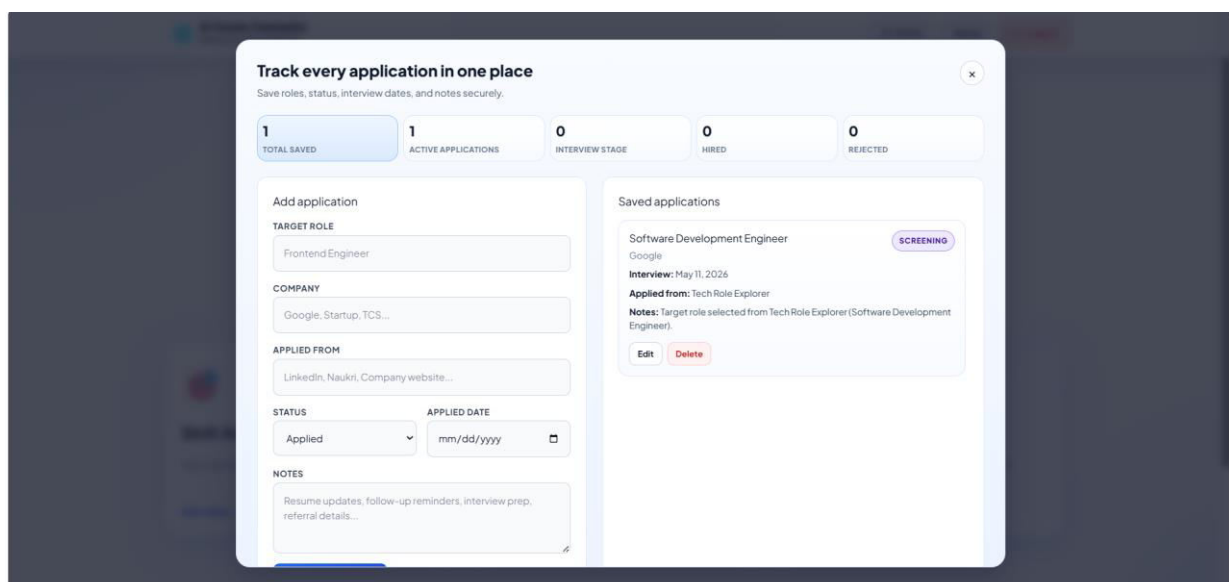
Topics



The screenshot shows the 'AI Career Counselor' dashboard. At the top, it says 'Welcome, Manoj Dasga' and has navigation links for Home, About, and Logout. A 'Download PDF' button is visible. The main content is divided into two sections: 'Skill Gap' and 'Career Resources'. The 'Skill Gap' section lists seven areas: Fundamentals of statistics, Basic SQL querying, Excel proficiency (advanced functions, pivot tables), Python programming for data analysis, Data visualization tools (Tableau, Power BI), Data cleaning and preprocessing techniques, and Understanding of machine learning basics. The 'Career Resources' section lists three resources: Google Data Analytics Professional Certificate, Alex The Analyst SQL Playlist, and Kaggle Learn: Pandas, each with details on where to find it (YouTube, Coursera) and whether it's free or paid.



The screenshot shows a 'Protected Exam Mode' interface. It features a 'Tab Switch: 0/3' indicator and a clock showing '4:49'. The main question is: 'Which statement best defines Overfitting in Machine Learning?'. There are four multiple-choice options: A. The data used to teach a model patterns and relationships. B. A technique for testing model performance across different splits of data. C. When a model learns training data too closely and generalizes poorly. D. The process of transforming raw data into useful inputs. A 'Question Navigator' on the right shows five questions, with the first one selected. A legend indicates 'Answered' (green), 'Not Answered' (grey), and 'Marked' (orange). Navigation buttons for 'Previous' and 'Next' are at the bottom.



The screenshot shows a job application tracking dashboard titled 'Track every application in one place'. It includes a summary section with statistics: 1 TOTAL SAVED, 1 ACTIVE APPLICATIONS, 0 INTERVIEW STAGE, 0 HIRED, and 0 REJECTED. Below this is a form to 'Add application' with fields for 'TARGET ROLE' (Frontend Engineer), 'COMPANY' (Google, Startup, TCS...), 'APPLIED FROM' (LinkedIn, Naukri, Company website...), 'STATUS' (Applied), and 'APPLIED DATE' (mm/dd/yyyy). There is also a 'NOTES' field with the text 'Resume updates, follow-up reminders, interview prep, referral details...'. To the right, a 'Saved applications' section shows a card for 'Software Development Engineer' at 'Google', with an interview date of 'May 11, 2026', applied from 'Tech Role Explorer', and a 'SCREENING' status. It also has 'Edit' and 'Delete' buttons.

V. CONCLUSION

AI Career Counselor demonstrates that a conversational, LLM-driven system can deliver personalized career counseling at scale by combining profile-aware prompts, dynamic roadmap generation, resource curation, and quiz-based assessment. The production-ready multi-provider architecture (Groq → Bytez → Ollama) with caching and fallback improves reliability and latency, and user studies indicate high acceptance and relevance of recommendations.

While the system shows strong practical promise, it requires internet access, benefits from fuller profile completion, and depends on ongoing prompt and model maintenance to remain current. Future work includes peer-learning features, automated progress tracking with adaptive roadmaps, direct job-market integration, mobile and multi-language support, and continued evaluation to ensure fairness, privacy, and real-world effectiveness.

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