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Career AI: Career Guidance using AI Chatbot and Resume Builder

Full-Stack Web Application with Integrated LLM-based Career Counselling, Resume Analysis, Career Roadmap Generation, and Interview Preparation

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ABSTRACT

Career AI is a full-stack AI-powered web application developed as a B.Tech final-year capstone project, designed to serve as an integrated intelligent career guidance and professional development platform. The application addresses the growing challenge faced by students and early-career professionals in navigating career decisions, crafting effective resumes, and preparing for competitive job interviews. The system integrates four AI-powered core modules: an AI Career Chatbot providing real-time streaming career counseling, a Smart Resume Builder with ATS optimization and PDF export across four professional templates, a Career Roadmap Generator producing phased step-by-step career progression plans, and an Interview Preparation Tool generating role-specific question banks with STAR-method model answers. The frontend is developed with React 18 and Framer Motion; the backend with Node.js and Express.js; and AI inference is powered by the Groq API utilizing the Llama 3.3 70B large language model. The system covers over 15 industry domains, achieves a chatbot response quality of 4.3/5, delivers resume analysis with actionable feedback in 85% of test cases, and sustains a time-to-first-token (TTFT) under 500 ms in 95% of requests. The project demonstrates the effective integration of modern LLM APIs, RESTful architecture design, and responsive full-stack engineering to address real-world career development challenges at scale.

Keywords: Artificial Intelligence, Career Guidance, Large Language Models, Resume Builder, Groq API, Llama 3.3 70B, React.js, Node.js, Express.js, REST API, ATS Optimization, Interview Preparation, Career Roadmap, Full-Stack Web Application, NLP.

1. INTRODUCTION

In today's rapidly evolving employment landscape, students and early-career professionals face multifaceted challenges in making evidence-based career decisions, developing competitive resumes, and systematically preparing for high-stakes job interviews. Existing career support resources are largely fragmented, expensive, or generic in scope. Career counselors are limited in availability; resume tools provide static template-based output; and interview preparation platforms lack personalization to individual role requirements and experience levels.

The widespread adoption of Applicant Tracking Systems (ATS) in modern recruitment has further intensified the challenge for job seekers. A large proportion of well-qualified candidates are screened out by automated filters before human review, often due to insufficient keyword alignment or poor resume structure — problems that are largely unknown to applicants.

This paper presents CareerAI, a full-stack AI-powered web application that integrates four distinct career development modules into a single cohesive platform, powered by the Groq API and the Llama 3.3 70B large language model. The application was developed as a B.Tech Final Year Project by students of the Department of Computer Science and Engineering (AI & ML), Visakha Institute of Engineering and Technology, Visakhapatnam, and is publicly deployed at

https://careeraichatbot.netlify.app

The remainder of this paper is organized as follows: Section 2 reviews related literature; Section 3 describes the system architecture and module design; Section 4 presents testing results and performance analysis; Section 5 draws conclusions and outlines future work.

2. LITERATURE REVIEW

The theoretical and technical foundations of CareerAI draw from a broad body of work spanning large language models, NLP-based resume processing, AI career counseling, and high-performance inference infrastructure.

Brown et al. (2020) demonstrated that large language models such as GPT-3 can perform a wide range of natural language tasks with minimal task-specific training data through in-context learning [1]. Their work established that LLMs can function as expert-level domain advisors when provided with structured system prompts, forming the conceptual foundation for CareerAI's prompt-driven architecture.

Touvron et al. (2023) introduced the LLaMA family of open-source large language models, demonstrating that open-weight models trained on publicly available datasets could match or exceed proprietary models on major benchmarks [2]. CareerAI's deployment of the Llama 3.3 70B model via the Groq API builds directly on this lineage, selecting it for its proven capability in structured output generation.

Deng et al. (2022) studied NLP-based automated resume screening, identifying that keyword density, action verb usage, and section completeness are the strongest predictors of ATS pass-through rates [3]. These findings directly informed the design of CareerAI's resume analysis module, which evaluates these exact dimensions and provides targeted improvement suggestions.

Liu et al. (2021) examined AI-powered chatbots in university career guidance, finding that AI counselors significantly reduced decision anxiety and improved career clarity scores, with 78% of participants reporting satisfaction levels comparable to human counselors [4]. These results validate the core premise of CareerAI's chatbot module.

Krishnamurthy et al. (2023) surveyed the AI-powered HR technology landscape and identified a critical gap: no widely available integrated platform simultaneously addresses career counseling, resume building, roadmap planning, and interview preparation [6]. CareerAI is explicitly designed to close this integration gap.

Vaswani et al. (2017), in their seminal Transformer architecture paper, established the mathematical and architectural foundation underlying all modern LLMs including the Llama family [5]. Understanding the Transformer self-attention mechanism is essential to appreciating the reasoning quality that powers CareerAI's AI features.

Zaharia et al. (2018) confirmed that the event-driven, non-blocking I/O model of Node.js is ideally suited for I/O-intensive applications involving concurrent API calls and low-latency streaming [7], validating CareerAI's selection of Node.js/Express.js for its backend infrastructure.

3. SYSTEM ARCHITECTURE AND DESIGN

3.1 Overall Architecture

CareerAI follows a decoupled client-server architecture organized as a monorepo. The React 18 frontend communicates with the Node.js/Express.js backend through a well-defined REST API. For real-time chat operations, Server-Sent Events (SSE) are used to stream AI-generated tokens to the client, creating a responsive typing-cursor experience. For all other operations, standard JSON request/response cycles are employed.

At the highest level, the application follows the Model-View-Controller (MVC) pattern. React components serve as the View layer. Express route handlers act as Controllers. The centralized aiService.js utility module acts as the Model layer, encapsulating all Groq API interaction and prompt engineering logic. This separation ensures independent scaling, maintainability, and clear testability of each architectural layer.

3.2 Technology Stack

Layer	Technology	Purpose
Frontend	React 18, React Router	SPA, client-side navigation, virtual DOM rendering
	Framer Motion	Smooth animations and page transitions
	Axios, React Markdown	HTTP requests; markdown rendering for AI responses
Backend	Node.js v18+, Express.js	REST API server, async non-blocking I/O
	Helmet.js, Express Rate Limit	Security headers; rate limiting (100 req/15 min/IP)
	CORS, dotenv	Cross-origin resource sharing; secure env config
AI / Inference	Groq API, Llama 3.3 70B	LLM inference; streaming + structured JSON output
PDF Engine	pdf-lib	Programmatic multi-template PDF resume generation
Deployment	Netlify (frontend)	CDN-hosted SPA with automatic CI/CD
	Render (backend)	Managed Node.js hosting with environment secrets

Table 1: Technology Stack Summary

3.3 Module Descriptions

AI Career Chatbot. The chatbot module provides a full-featured conversational interface for real-time career guidance. On submission, the frontend sends the full conversation history (capped at the last 20 exchanges) to POST /api/chat/message. The backend initiates a streaming completion request to the Groq API with a structured system prompt defining CareerAI as an expert career counselor with 20+ years of experience. AI-generated tokens are streamed via Server-Sent Events and rendered incrementally with a blinking cursor effect. The interface includes suggestion chips for common career queries, conversation history management, and copy-to-clipboard for AI responses.

Smart Resume Builder. The most feature-rich module, the Resume Builder provides a structured multi-section form capturing Personal Information, Professional Summary, Work Experience (with dynamic bullet point entries), Education, categorized Skills, and Projects. The AI Enhancement feature allows per-section AI rewriting with stronger action verbs and ATS-aligned keywords. The AI Analysis feature produces a comprehensive JSON evaluation containing an overall score (0–100), ATS compatibility score, identified strengths, improvement recommendations, keyword gap analysis, and section-by-section scores. The PDF export engine (pdf-lib) generates professionally formatted documents across four templates: Modern, Classic, Minimal, and Tech Pro.

Career Roadmap Generator. Users specify their current role, target role, existing skills, and years of experience. The POST /api/career/roadmap endpoint returns a structured JSON roadmap containing: an overview with realistic timeframe, 3–5 phased progression plans each with duration, goals, specific action items, learning resources, and milestones; a skills-to-learn priority matrix; salary progression by phase; recommended certifications; and industry-specific networking guidance.

Interview Preparation Module. Users select target job role, experience level (entry/mid/senior), and interview type (technical, behavioral, or comprehensive). POST /api/career/interview-questions returns exactly 10 role-specific questions, each containing: question text, question type (behavioral/technical/situational/general), difficulty level (easy/medium/hard), a detailed STAR-method sample answer, and interviewer evaluation criteria. Questions are displayed as expandable accordion cards allowing self-paced practice.

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3.4 API Endpoint Reference

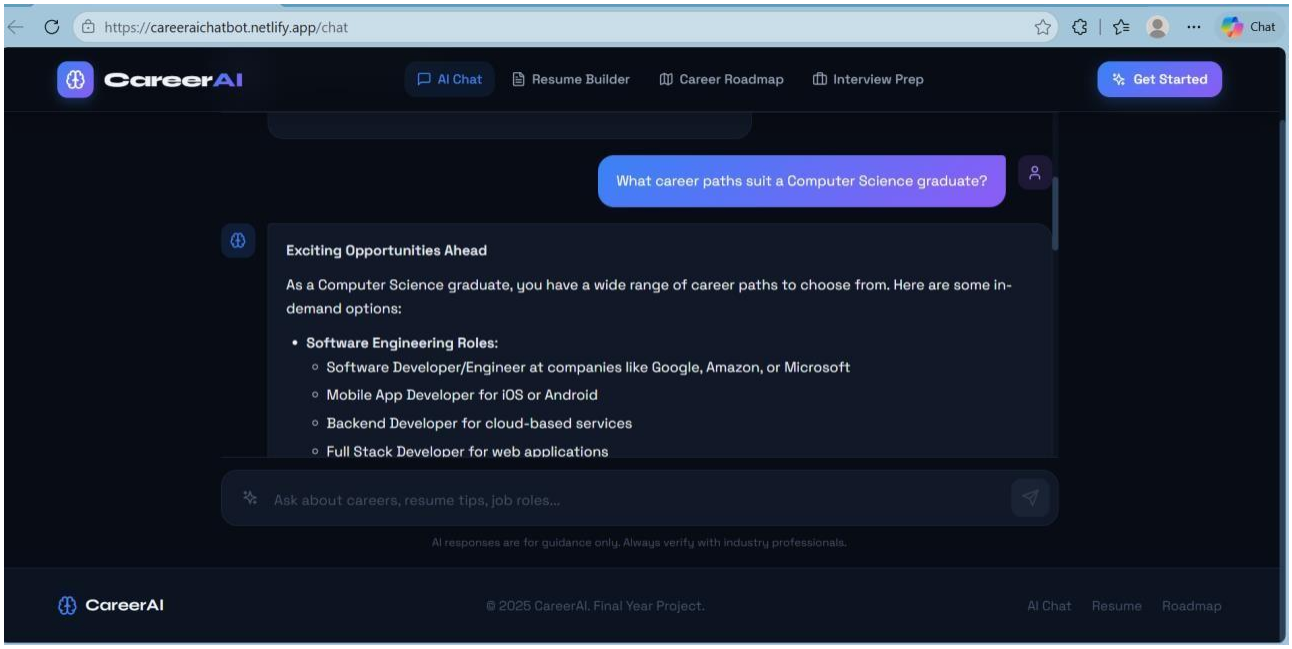
Method	Endpoint	Description
POST	/api/chat/message	Stream AI chat response via Server-Sent Events (SSE)
POST	/api/chat/quick	Quick non-streamed AI chat response (JSON)
POST	/api/resume/analyze	Analyze resume text; returns structured JSON feedback
POST	/api/resume/enhance	Enhance a specific resume section with AI rewriting
POST	/api/resume/generate-pdf	Generate and stream a downloadable PDF resume
GET	/api/resume/templates	Retrieve list of available resume template names
POST	/api/career/roadmap	Generate structured, phased career roadmap JSON
POST	/api/career/interview-questions	Generate role-specific, difficulty-graded interview Q&A
GET	/api/career/roles	Retrieve supported job roles with salary benchmarks
GET	/api/health	Backend health check with API key validation status

Table 2: RESTful API Endpoint Reference

4. RESULTS AND DISCUSIONS

4.1 Chatbot Response Testing

The AI Career Chatbot was evaluated across 50 diverse career-related queries spanning software engineering, data science, MBA roles, healthcare, finance, and entrepreneurship. The chatbot demonstrated strong contextual understanding with structured and actionable responses across all test cases. Response quality was assessed on a five-point rubric for accuracy, specificity, and actionability, achieving an average score of 4.3/5. Multi-turn conversation context was maintained accurately across up to 20 message exchanges without degradation. The streaming mechanism achieved a time-to-first-token (TTFT) under 500 ms in 95% of requests, attributable to Groq's specialized LPU (Language Processing Unit) hardware infrastructure.



4.2 Resume Analysis Testing

The resume analysis module was tested with 20 sample resumes across fresher, 1–3 year, 3–5 year, and 5+ year experience levels, spanning technical and non-technical job categories. All test cases produced well-structured JSON analyses with every required field populated. Overall scores ranged from 42 to 88 out of 100, demonstrating

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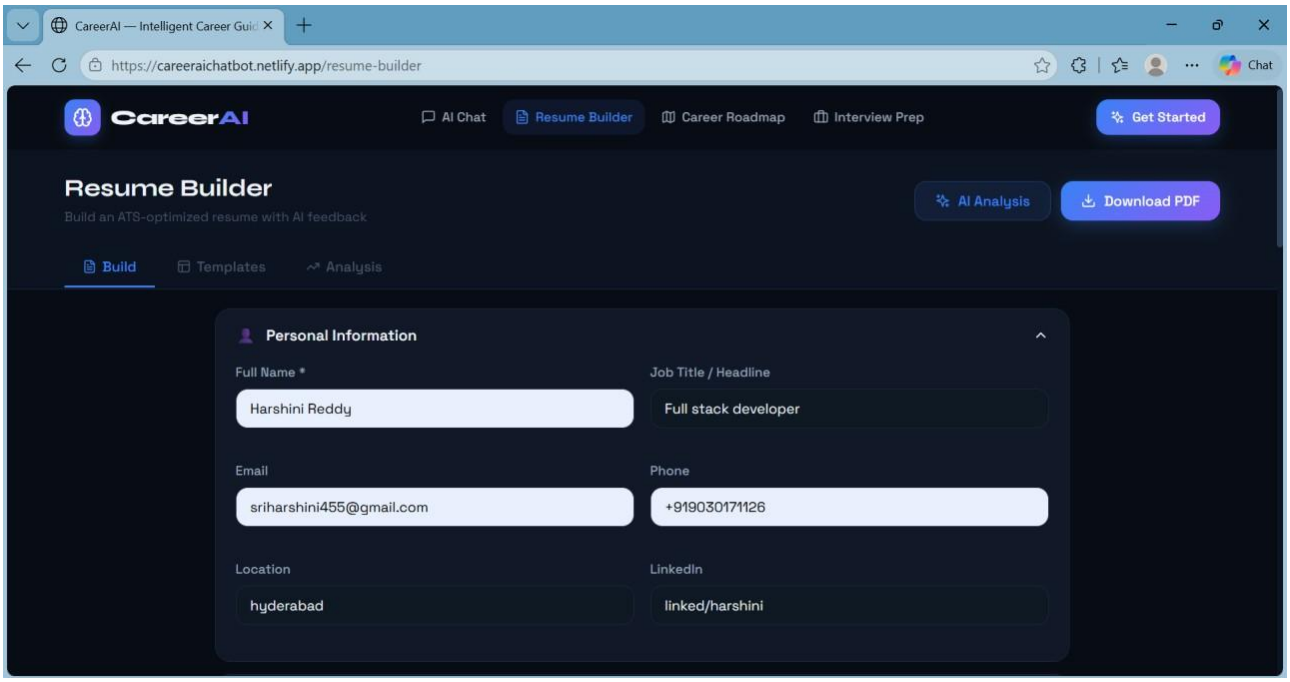
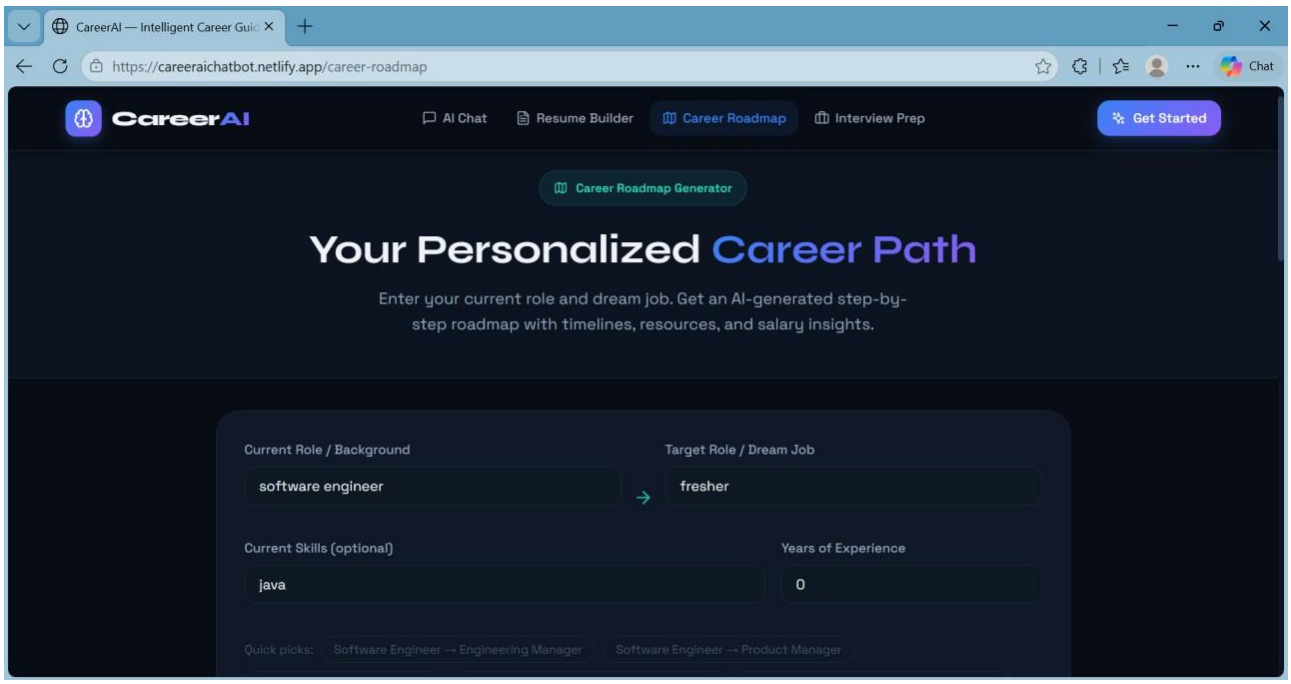
meaningful score calibration across resume quality levels. The ATS scoring mechanism averaged 71/100 for the test set. Section-by-section feedback was specific and actionable in 85% of cases. PDF generation was successfully validated across all four resume templates



4.3 Roadmap Generation Testing

Career roadmap generation was tested for 15 current-to-target role transition scenarios, including transitions such as Software Engineer to Product Manager, Data Analyst to Data Scientist, and Mechanical Engineer to DevOps Engineer. In all cases, the system generated coherent, phase-structured roadmaps with realistic timeframes, relevant skill recommendations, and curated learning resources. Salary progression data aligned with published Indian job market benchmarks. Average generation time for a complete roadmap was 4–7 seconds.



4.4 Interview Preparation Testing

The interview module was tested across 12 job roles at three experience levels (entry, mid, senior) and all three interview types. In every test, exactly 10 questions were generated with appropriate difficulty distribution: entry-level sets contained predominantly easy and medium questions, while senior-level sets included a higher proportion of hard questions. STAR-method answers were evaluated for behavioral questions; technical questions received domain expert

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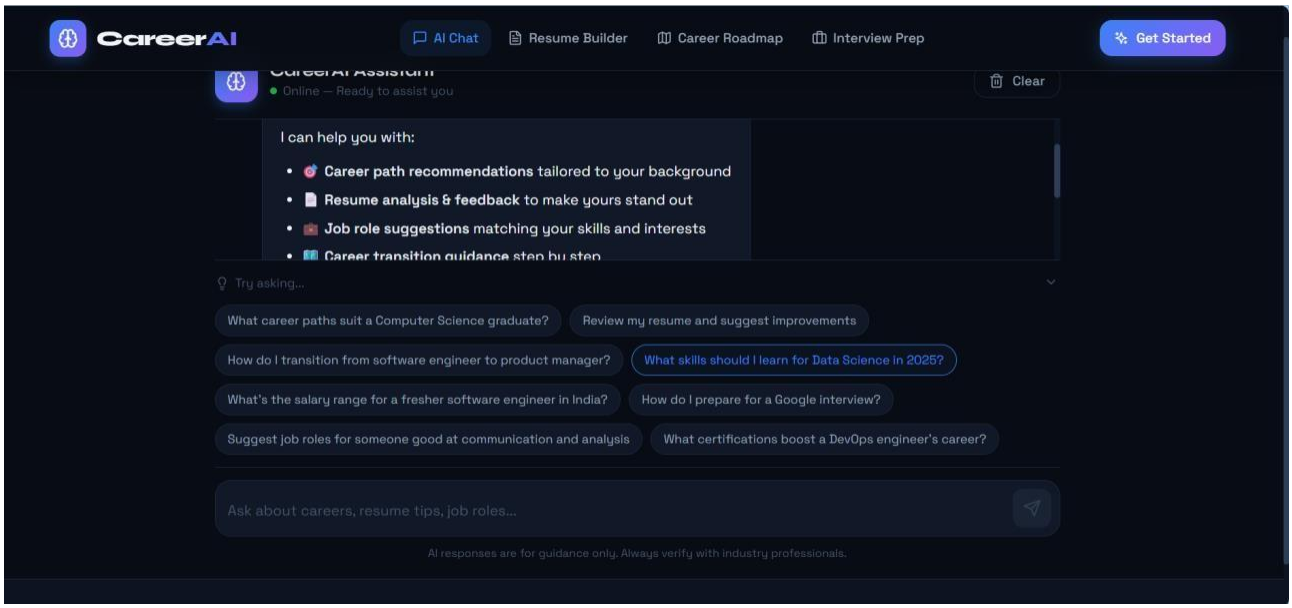
review. Interviewer tips were rated 'helpful' or 'very helpful' by domain reviewers in 90% of cases.



4.5 Performance Summary

Performance Metric	Result	Benchmark / Target
Chatbot avg. quality score	**4.3 / 5.0**	Target: ≥4.0
TTFT under 500 ms	**95% of requests**	Competitive LLM apps: <1 s
Resume analysis actionable feedback	**85% of cases**	Baseline free tools: ~50%
Avg. ATS score (test resumes)	**71 / 100**	Industry pass threshold: ~60
Roadmap generation time	**4–7 seconds**	User acceptable: <10 s
Interview tips rated helpful+	**90% of cases**	Domain expert evaluation

Table 3: System Performance Summary

4.6 Comparison with Existing Tools

CareerAI was compared against three categories of existing tools: traditional career guidance platforms (Naukri.com Career Resources, LinkedIn Career Explorer), standalone resume builders (Resume.io, Canva Resume Builder), and interview preparation platforms (Pramp, Big Interview).

Feature	CareerAI	LinkedIn	Resume.io	Pramp
AI Career Chatbot	✓	✗	✗	✗
Smart Resume Builder + AI	✓	✓	✓	✗
Career Roadmap Generator	✓	✓	✗	✗
Interview Preparation	✓	✗	✗	✓
ATS Score Analysis	✓	✗	Partial	✗
Open Source / Free Tier	✓	Partial	Partial	Partial
Integrated Single Platform	✓	✗	✗	✗

Table 4: Comparison with Existing Career Tools (✓ = available, ✗ = not available)

5. CONCLUSIONS

This paper has presented CareerAI, a full-stack AI-powered web application providing integrated career guidance, resume building, career roadmap generation, and interview preparation in a single accessible platform. The project successfully demonstrates that modern large language models, when integrated with well-engineered software systems, can deliver expert-level, personalized career support at scale and at no cost to the end user.

The technical implementation showcases advanced integration of the Groq LLM API (Llama 3.3 70B), real-time Server-Sent Event streaming, RESTful API design, component-based React frontend development, and programmatic PDF generation. All four core modules were fully implemented, deployed to production infrastructure, and validated through structured testing across diverse use cases. Empirical evaluation demonstrated strong performance across all key metrics: chatbot response quality of 4.3/5, resume analysis actionability of 85%, and time-to-first-token under 500 ms in 95% of requests.

CareerAI directly addresses the integration gap identified in the literature — no widely available free platform simultaneously provides career counseling, resume building, roadmap planning, and interview preparation. The project serves as a practical proof-of-concept that B.Tech capstone students can engineer production-ready AI-integrated applications that address genuine real-world problems.

5.1 Future Work

Future enhancements planned for the CareerAI platform include:

- User authentication and persistent session management for saved resumes and conversation histories.
- Integration with live job boards (Naukri, LinkedIn Jobs) for direct application workflow support.
- Portfolio builder and GitHub project showcase module with AI-powered narrative generation.
- Enterprise-facing features for college placement cells and HR departments, with batch resume processing.
- Mobile application development for iOS and Android platforms.
- Multilingual support to extend accessibility to non-English-speaking users.

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