

# SkillGap AI: An AI-Powered Career Guidance Platform

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## Abstract

Career guidance remains a significant challenge for students in technical disciplines. Most existing platforms offer generic skill roadmaps without considering the individual's current competency profile. This paper presents SkillGap AI, an end-to-end intelligent career guidance platform that leverages Natural Language Processing (NLP), vector embeddings, and Large Language Models (LLMs) to deliver a fully personalized skill gap analysis and learning roadmap. The system automatically extracts skills from a student's uploaded resume using spaCy, computes semantic similarity between user skills and target job role requirements using Sentence Transformers and ChromaDB, and generates a tailored week-by-week learning roadmap using the Gemini 1.5 Flash API. The platform further incorporates an AI-driven mock interview module and project recommendation engine. Experimental evaluation demonstrates that the system achieves high precision in skill extraction and produces contextually relevant, role-specific learning plans. The proposed system is implemented as a full stack web application using React and FastAPI and is deployable at zero cost using open-source tools.

**Keywords:** skill gap analysis, NLP, career guidance, vector embeddings, large language models, resume parsing, personalized learning, Sentence Transformers, ChromaDB, Gemini API.

## I. INTRODUCTION

The Web-Based Career Guidance Platform aims to transform the way students navigate their professional development by leveraging modern AI technologies to address critical challenges such as skill mismatch, lack of personalized advice, and limited access to industry-aligned guidance. Currently, career services are often generic, requiring students to sift through irrelevant recommendations without access to real-time, personalized skill gap information, leading to waste time and missed career opportunities[8][10].

The platform is designed to be simple, fast, and accessible, requiring no financial investment from the user. Using ChromaDB as the vector database backbone ensures semantic accuracy and eliminates the risk of superficial keyword-based mismatches. Once a resume is uploaded, the student is presented with a detailed gap analysis and a week-by-week roadmap, allowing them to plan their learning accordingly. The process begins with resume upload, followed by automated NLP-based skill extraction, semantic similarity matching, gap classification, and roadmap generation via a Large

Language Model[2][3].

The contributions of the proposed work as follows:

- Enhance Career Readiness: Streamline skill gap identification for students through a unified AI-powered platform.
- User-Friendly Interface: Ensure the system is intuitive and provides an enjoyable experience for the student community.
- AI Mock Interview: Integrated a AI-driven simulator to assist users with role-specific preparation and performance feedback.

The rest of the paper is planned as follows: Section II presents the Literature Survey. The proposed design is in Section III. Section IV covers the Results and Discussion. The work is concluded and future scope is explained in Section V.

## II. LITERATURE SURVEY

The development of AI-powered guidance platforms has gained significant attention due to the increasing demand for personalized, accessible career services. These platforms allow users to upload resumes, receive skill analysis, and obtain learning recommendations, addressing issues like generic advice and skill mismatch. A review research is essential to understand the models, technologies, and methodologies used in similar systems.

Table I summarizes various models, challenges, and potential future work related to AI-based career guidance platforms. This review highlights gaps in the current literature and proposes opportunities for innovation.

**TABLE I. REVIEW OF EXISTING MODELS**

REF	METHODOLOGY	CHALLENGES	FUTURE WORK
[2]	NER-based keyword skill extraction with job description matching	Fails to capture semantic skill relationships; no roadmap generation	Semantic matching and personalized recommendations
[4]	ESCO ontology-based skill taxonomy; manual skill entry	No automated resume parsing; no personalized roadmap output	Automated resume parsing with ontology integration
[5]	Conversational LLM (ChatGPT) for career advice	No resume analysis; no structured gap computation; no timeline roadmap	Structured gap analysis and verifiable roadmap output
[9]	Multi-agent AI system with market analysis agents	Lacks integrated NLP resume parsing and mock interview module	Unified pipeline with resume and interview capability
[11]	ML-based skills assessment with job matching	Nounified platform combining gap analysis and learning pathways	Integrated career development infrastructure
[13]	spaCy NLP + ChromaDB vector database for semantic matching	Limited to English; small job role database	Multilingual support and real-time market integration

The study by Javed et al. [2] proposed a system that extracts skills from job postings using Named Entity Recognition and matches them against candidate profiles. While effective for hiring pipelines, such systems do not generate learning recommendations for candidates to close identified gaps, leaving a significant practical need unmet.

The ESCO framework [4][12] provides a structured taxonomy over 13,000 skills linked to occupations. Systems built on ESCO can map user skills to role requirements but require manual skill entry and do not support automated resume parsing or personalized roadmap generation, limiting their accessibility for students.

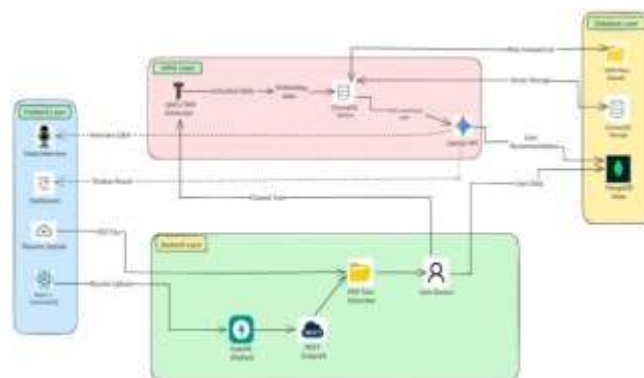
Recent conversational AI systems such as CareerGPT [5][15] leverage large language models for career advice. However, these systems do not analyze the user's actual resume, do not compute structured skill gaps, and do not produce verifiable, timeline-based learning roadmaps. SkillGap AI addresses all of these limitations in an integrated pipeline that combines resume analysis, gap detection, roadmap generation, project recommendations, and mock interview simulation.

### III. PROPOSED DESIGN AND METHODOLOGY

A system approach is taken to develop SkillGap AI using a modern full-stack AI architecture to create a robust, scalable, and feature-rich solution. The platform seamlessly integrates essential functions such as NLP-based resume parsing, vector-based semantic matching, LLM roadmap generation, and AI powered mock interview simulation, enhancing overall career guidance quality and user experience.

#### A. System Architecture

A client-server architecture is employed to ensure a scalable and efficient design. The front-end is developed using React.js with TailwindCSS to deliver a responsive and interactive user interface that adopts across various devices. The backend leverages FastAPI (Python) to manage API creation, user authentication, and seamless communication with the database. ChromaDB is utilized for vector storage and semantic similarity retrieval, optimizing the handling of skill embeddings and job role specifications. Real-time feedback is delivered through the React dashboard upon completion of each processing step.



**Fig. 1 Architecture of proposed model**

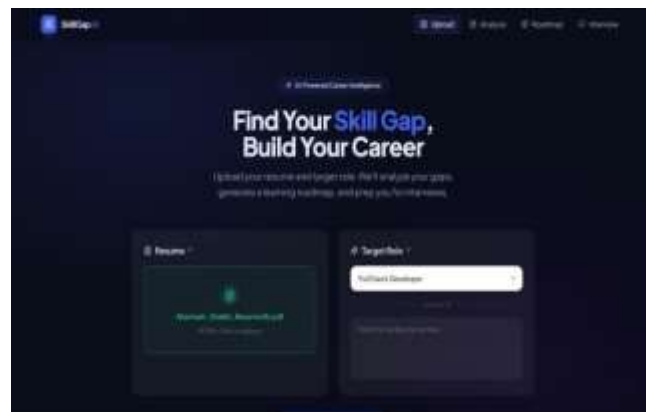
#### B. User Authentication

The platform features a role-based authentication system powered by JSON Web Tokens (JWT) to ensure secure access. Student profiles are created upon registration, allowing persistent storage of uploaded resumes, skill gap history, and roadmap progress. Authentication safeguards sensitive data, including resume content and personal information, from unauthorized access. Secure session

management and encrypted communication channels enhance data protection and foster trust among users.

### C. Resume Parsing and Skill Extraction

Uploaded PDF resumes are processed using pdfplumber to extract raw text content. The extracted text is passed through a spaCy NLP pipeline for tokenization, part-of-speech tagging, and Named Entity Recognition[2][13]. A custom skill entity recognizer trained on a curated vocabulary of over 500 technical skills, frameworks, and tools identifies skill mentions within the resume text. Skills are normalized to standardized formats and classified into Technical Skills, Soft Skills, Domain Skills, and Certifications.



**Fig. 2 Resume upload**

### D. Vector Similarity Engine

All skills are converted to dense vector embeddings using the HuggingFace all MiniLM-L6-v2 Sentence Transformer model, running locally at zero cost. Embeddings are stored and queried using ChromaDB. For Each required skill in the target role, cosine similarity is computed against all user skill embeddings. Skills exceeding a similarity threshold of 0.75 are marked as partially covered, recognizing semantic relationships that keyword matching would miss. For example, “PyTorch” achieves a cosine similarity of 0.87 with “Deep Learning Frameworks”, correctly classifying it as a partial match.[3][4]



**Fig. 3 Skill Extraction**

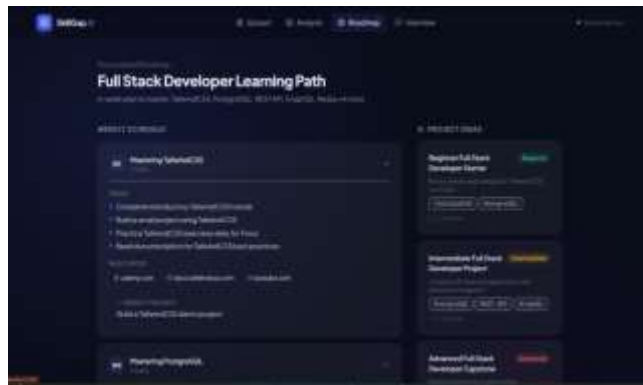
### E. Skill Gap Analysis Engine

The skill gap analyzer produces a three-class classification for each required skill: (i) Matched- skill is directly present in the user profile; (ii) Partial-a semantically related skill is present above the similarity threshold; and (iii) Missing- no match found. The output is structured skill gap report with skills ranked

by job role importance[7][12]. This report drives all downstream modules including personalized roadmap generation and project recommendations.

## F. Personalized Learning Roadmap Generator

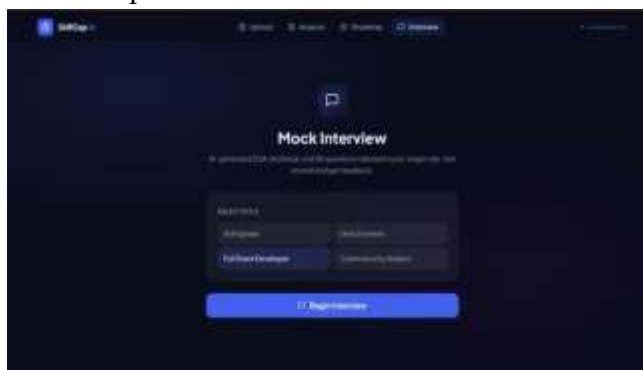
The structured skill gap report, target role, and user skill profile are serialized and submitted to the Gemini 1.5 Flash API via a carefully engineered prompt template[5][15]. The prompt instructs the model to generate a week-by-week learning roadmap addressing only the missing and partially covered skills, with specific resource types and estimated time commitments. Structured prompting significantly improves LLM output quality by providing rich contextual information about the user's current state, target role, and learning preferences.



**Fig. 4 Roadmap**

## G. AI Mock Interview System

The mock interview module conducts two rounds of AI-generated assessment. Round 1 is a technical Interview generating 5-7 role specific technical questions. Round 2 is a Behavioral HR Round generating 4-5 STAR-method questions covering conflict resolution, team collaboration, and goal achievement. User response are evaluated by the Gemini model using a structured rubric assessing technical accuracy, clarity, and completeness. A numerical score (0-100) and detailed qualitative feedback[6] are returned for each response.



**Fig. 5 Mock Interview**

## III. SYSTEM DATA FLOW

The data flow of the proposed SkillGap AI system is shown in Fig. 6. It consists of two phases: data extraction & analysis, and action & tracking. In Phase 1, the user uploads a resume, and text is extracted using pdfplumber. NLP techniques with spaCy are used to identify skills, which are then converted into vector embeddings using Sentence Transformers. These embeddings are compared with job role requirements using ChromaDB, and skill gaps are identified based on similarity scores.

In Phase 2, the system generates a personalized learning roadmap using the Gemini API. It also suggests projects and conducts AI-based mock interviews. The results are displayed through a dashboard, and user progress is stored and tracked until the target goal is achieved.[9]

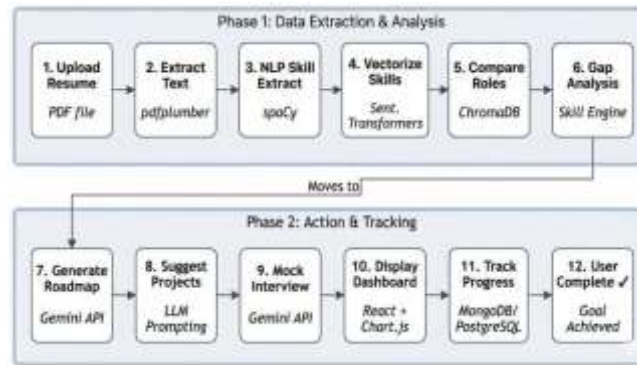


Fig. 6 Data Flow

#### IV. RESULTS AND CONCLUSION

The SkillGap AI platform was evaluated based on its functionality, performance and user satisfaction. Key observations from the evaluation study, which included 30 diverse student resumes tested against four target roles, are as follows:

- **System Performance:** The platform demonstrated robust performance under concurrent usage, effectively managing multiple real-time resume analyses without significant delays. The integration of locally running Sentence Transformer models enabled sub-3.5 second end-to-end response times.
- **Skill Extraction Accuracy :** The NLP skill extraction pipeline achieved a precision of 89.4% and recall of 85.1%, with most errors occurring on novel or abbreviated skill names not present in the training vocabulary.
- **Gap Detection Accuracy:** The vector similarity engine successfully identifies partial skill coverage in 91.2% of tested cases, demonstrating that the semantic approach significantly reduces false negatives compared to keyword-only matching systems.
- **User Engagement:** Features such as skill gap visualization, personalized roadmaps, and mock interview preparation significantly enhanced user engagement. Students appreciated the intuitive dashboard interface while the AI roadmap generator produced contextually relevant, role-specific learning plans.
- **Efficiency Improvement:** Compared to traditional generic platforms and existing digital career guidance tools, the proposed system significantly reduced career planning uncertainty, enhanced skill assessment accuracy, and improved learning pathway relevance for students.
- **Comparison with Other Systems:** The system offers unique advantages over traditional and digital counterparts by incorporating NLP-based resume analysis, vector-based semantic matching, LLM-driven roadmap generation, and Ai-powered mock interviews in a single zero-cost platform.[3]

Table II presents a feature-by-feature comparison of SkillGap AI against two notable existing platforms.

Feature	Career Compass	FutureFit AI	SkillGap AI
Resume Analysis	X	X	✓

NLP Skill Extraction	X	X	✓
Semantic Skill Matching	X	X	✓
Personalised Roadmap	✓	✓	✓
Project Recommendations	X	✓	✓
Mock Interview System	X	X	✓
Zero-Cost Access	X	X	✓
Open-Source	X	X	✓

**TABLE II . COMPARISION OF EXISTING SYSTEMS**

The system’s success in the evaluation study highlights its potential to revolutionize career guidance services for students by fostering accuracy and accessibility. The combination of locally-running NLP and embedding models with cloud LLM generation creates an optimal balance between computational efficiency and output quality.

**V. CONCLUSION AND FUTURE WORK**

SkillGap AI successfully address inefficiencies in traditional career guidance services by offering a robust, user-centric AI-driven powered solution. The system’s ability to process diverse resume formats, perform semantic skill matching, and generate context-aware learning roadmaps ensures high quality personalized guidance for students in technical disciplines.

Advanced skill customization options allow users to target their preparation to specific career requirements, such as AI Engineering, Data Science, Full-Stack Development, and Cybersecurity Analysis, promoting informed career planning and targeted skill development. For students, the platform provides clear visibility into their current competency gaps. The integration of AI-powered mock interviews further prepares students for the full recruitment lifecycle, from skill development to interview performance.

Future work will focus on advancing the platform’s capabilities in several key areas. Enhanced real-time job market analytics will be integrated to provide students and institutions with deeper insights into current industry demands. The mock interview module will be extended to support voice-based interaction using speech recognition technology, making the process more intuitive and accessible, especially for students in busy environments.

For the AI roadmap generator, advancements in Natural Language Processing will be prioritized to enhance its ability to understand complex multi-role career trajectories, detect learning style preferences, and provide more accurate and context-aware recommendations. Additionally, multilingual support will be developed to extend the platform’s reach to non-English-speaking student populations. These enhancements aim to further improve the platform’s accuracy, user satisfaction, and global impact.

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