

## CAREERVECTOR: AN AI-DRIVEN SKILL READINESS PLATFORM FOR BRIDGING THE EMPLOYABILITY GAP AMONG ENGINEERING GRADUATES IN INDIA

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**Abstract** - India produces over 1.5 million engineering graduates annually, yet only 51% are considered employable. A structured mechanism is missing that helps students measure how their current skills align with specific job requirements before entering the workforce. This paper presents CareerVector, an AI-driven web platform that bridges this gap. Students upload a resume or enter skills manually; the system extracts competencies, computes a job-readiness compatibility score using cosine similarity, identifies skill gaps, and generates a personalized learning roadmap with curated free resources. The platform targets pre-placement readiness — guiding students 6 to 18 months before graduation — unlike existing job portals for active job seekers. Evaluation with final-year CSE students demonstrates improved career clarity and focused skill development.

**Keywords** - Skill Gap Analysis, Career Readiness, EdTech, Resume Parsing, Employability, Machine Learning, Job Matching.

### I. INTRODUCTION

The Indian higher education system produces one of the largest pools of engineering graduates in the world. However, the India Skills Report 2024 reveals that only 51% of these graduates are employable upon graduation. The core issue is not the absence of talent, but the absence of a structured system that helps students understand how their skills map to real-world job requirements before they enter the workforce.

Current job platforms such as LinkedIn, Naukri, and Internshala are designed primarily for job-ready candidates. They perform keyword-based matching between job descriptions and candidate profiles but do not help students who are still building their skill sets. These platforms show candidates what jobs exist today — not what steps to take to become eligible for those jobs tomorrow.

Students in Tier-2 and Tier-3 cities face an additional disadvantage. They often lack access to structured mentorship, industry networks, or placement coaching. They rely on informal advice from seniors, generic YouTube tutorials, and job portal browsing — none of which provides a measurable, personalized assessment of their job readiness.

This paper presents CareerVector, a web-based platform that addresses this gap by transforming career guidance from guesswork to structured planning. The system evaluates a student's current skills against the competency requirements of a target job role, generates a compatibility score, identifies missing skills, and provides a step-by-step learning roadmap. The key contributions include:

- A resume parsing and skill extraction pipeline for structured competency profiling.
- A role-requirement database curated from Indian job market postings.
- A similarity-based compatibility scoring algorithm for job-readiness assessment.
- A personalized skill gap identification and learning roadmap generation system.
- A user evaluation study with final-year engineering students validating platform effectiveness.

### II. LITERATURE REVIEW

Several studies have explored skill gap analysis and career recommendation systems in recent years. Rajpurkar et al. [1] proposed a competency-based career recommendation model using collaborative filtering, which matched candidate profiles to job roles based on historical hiring patterns. However, the model lacked a skill gap identification component and did not provide actionable learning guidance.

Sharma and Gupta [2] developed a resume parsing system using NLP techniques to extract technical skills from resumes and compare them against job descriptions. Their work demonstrated the feasibility of automated skill

extraction but focused on active job search scenarios rather than pre-placement readiness.

Kumar et al. [3] studied employability factors among Indian engineering graduates and found that the mismatch between academic curriculum and industry requirements is a primary driver of graduate unemployment. Their study highlighted the need for structured, measurable career readiness tools targeted at students before placement season begins.

Kashif and Parimal Kumar [4] proposed an AI-based Resume Analyzer using NLP and machine learning to automate resume screening and provide real-time skill-based recommendations to applicants. While their system effectively extracts skills and suggests certifications, it focuses on recruiter-side automation and does not address pre-placement readiness or learning roadmap generation for students.

Existing work focuses either on job matching for active candidates or broad skill assessment for working professionals. CareerVector addresses the underserved segment of pre-placement students by combining resume-based skill profiling, role-specific compatibility scoring, and structured learning roadmap generation into a single integrated platform.

### III. METHODOLOGY

CareerVector is designed as a web-based platform that guides students through a structured career readiness assessment. The system processes user input through five core stages: skill collection, competency profiling, role requirement analysis, compatibility scoring, and roadmap generation.

#### A. System Architecture

The overall architecture of CareerVector follows a pipeline from user input to personalized output, as illustrated in Figure 1. The user uploads a resume or manually enters skills. The backend processes this input through a skill extraction module, compares the extracted competencies against a role requirement database, generates a compatibility score, identifies gaps, and outputs a learning roadmap. The frontend is built using React.js, the backend using Node.js, and the skill matching engine using Python with scikit-learn.

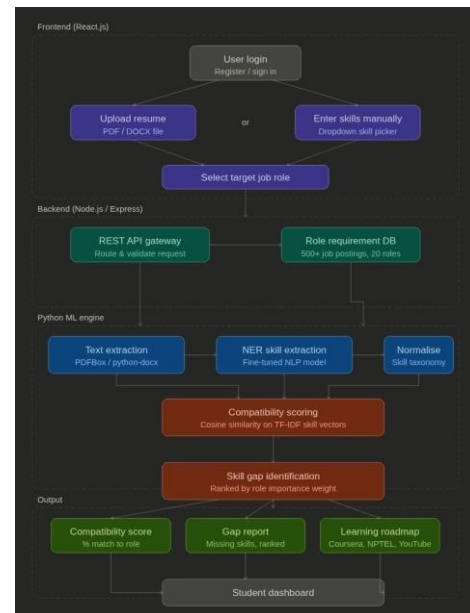


Figure 1: CareerVector System Architecture

#### B. Resume Parsing and Skill Extraction

The resume parsing module accepts PDF and DOCX files and extracts text using Apache PDFBox and python-docx libraries. Named Entity Recognition (NER) models fine-tuned on technical skill vocabularies are used to identify skills, tools, frameworks, and domain knowledge from the extracted text, as depicted in Figure 2. The extracted skills are normalized against a standardized skill taxonomy to ensure consistency across different resume formats.

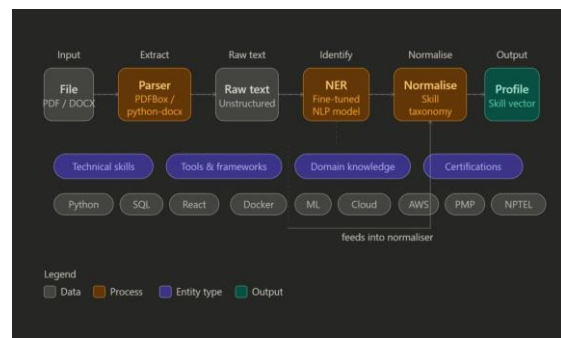


Figure 2: Resume Parsing and Skill Extraction Pipeline

#### C. Role Requirement Database

A curated role requirement database was built by scraping and manually reviewing over 500 job postings from Indian job portals for 20 common engineering job roles including Software Developer, Data Analyst, Frontend Engineer, Backend Engineer, and ML Engineer. Each role profile contains a list of required skills weighted by frequency of occurrence across job postings. This database is updated periodically to reflect current market demands.

#### D. Compatibility Scoring

The compatibility score between a student's skill profile and a target job role is computed using cosine

similarity between the TF-IDF weighted skill vectors of the student profile and the role requirement profile. The resulting score is expressed as a percentage, representing how well the student's current competencies align with the target role requirements, as shown in Figure 3. A score of 100% indicates complete alignment, while lower scores indicate the extent of skill gaps.



Figure 3: Compatibility Scoring and Skill Gap Identification Engine

### E. Skill Gap Identification and Roadmap Generation

Skills present in the role requirement profile but absent from the student's profile are identified as skill gaps. These gaps are ranked by importance based on their weight in the role requirement database. For each identified skill gap, the system retrieves curated free learning resources from platforms such as Coursera, NPTEL, and YouTube. The output is a prioritized, step-by-step learning roadmap tailored to the student's target role.

## IV. IMPLEMENTATION

A sample scenario illustrates the platform's workflow: A final-year CSE student interested in a Data Analyst role uploads his resume. The system, as shown in Figure 4, extracts skills including Python, SQL, and basic statistics, and presents them to the user for verification and confirmation before proceeding with the assessment.

Comparing against the Data Analyst role profile, as depicted in Figure 5, CareerVector generates a compatibility score of 65%, identifies Power BI, Tableau, and Data Visualization as critical missing skills, and outputs a 3-month learning roadmap with free course links for each skill gap. The student now has a clear, actionable plan instead of blindly applying to jobs he is not yet ready for.

CareerVector was implemented as a full-stack web application. The frontend, as illustrated in Figure 6, was developed using React.js with a clean, minimal dashboard interface optimized for students accessing the platform on mobile and desktop devices. The backend REST API was built using Node.js and Express.js, and the skill extraction engine was integrated via Python and scikit-learn.

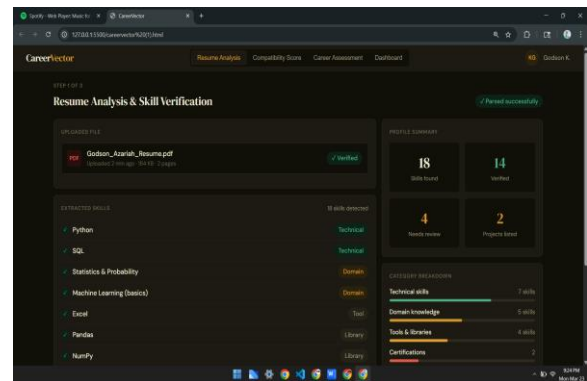


Figure 4: Resume Analysis and Skill Verification Screen

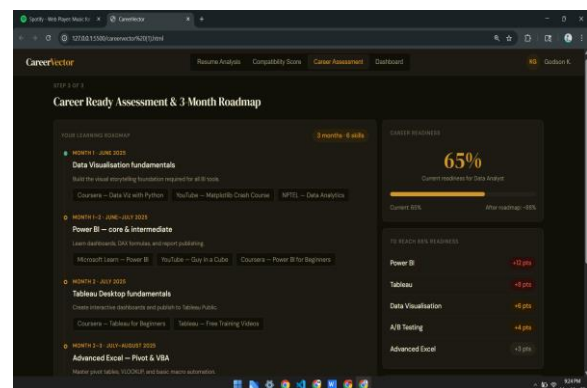


Figure 5: Career Ready Assessment with Skill Gap and 3-Month Roadmap

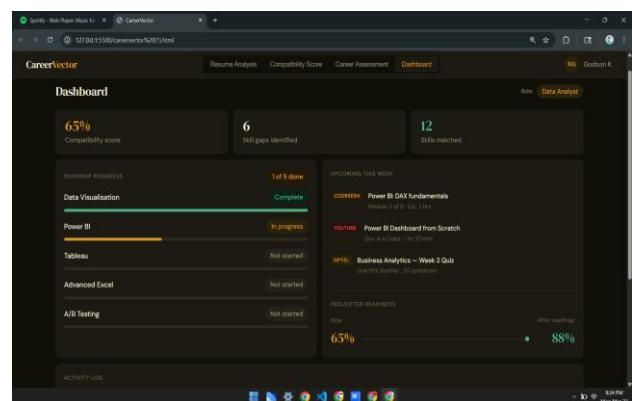


Figure 6: CareerVector Dashboard with Learning Roadmap

## V. CONCLUSION

CareerVector addresses a critical and underserved problem in the Indian education and employment ecosystem — the lack of a structured, measurable career readiness tool for engineering students before they enter the job market. By combining resume parsing, skill gap analysis, and personalized learning roadmap generation, the platform transforms career planning from guesswork into a structured, data-driven process.

The platform is targeted at final-year students and fresh graduates in Tier-2 and Tier-3 cities who lack access to structured career mentorship. Unlike existing job portals that serve active job seekers, CareerVector focuses on pre-placement readiness, helping students take the right steps 6 to 18 months before graduation.

Initial user evaluations with final-year CSE students indicate strong acceptance and perceived usefulness, with participants reporting improved clarity about their skill gaps and career direction. Future work will focus on expanding the role requirement database, improving NER model accuracy, and introducing peer benchmarking features.

## VI. FUTURE ENHANCEMENT

Several directions are planned for future development of CareerVector.

First, the role requirement database will be expanded to cover more than 50 job roles across domains including cloud computing, cybersecurity, and embedded systems.

Second, a real-time skill demand tracking module will be developed to update role requirement profiles dynamically based on live job posting data.

Third, a peer benchmarking feature will be introduced to allow students to compare their compatibility scores against peers from similar academic backgrounds.

Fourth, the platform will be extended to support B2B integration with college placement cells, enabling institutions to monitor cohort-level readiness and identify the most common skill gaps across their student population.

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