

# Career Compass: AI-Driven Placement Prediction and Personalized Career Development

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**Abstract** — Career Compass is an AI-powered job recommendation and career development system aimed at optimizing university students' job placement outcomes. This version integrates advanced ML models, user feedback loops, and dynamic APIs. Key features include university shortlisting via the Gemini API, AI-powered mock interviews, a resume generator with feedback, an ATS score calculator, real-time news API, and an AI assistant for career guidance. This paper explores the architecture, implementation, and performance of Career Compass, demonstrating improvements in precision, recall, and user satisfaction.

**Keywords** - AI-powered job recommendation system, Career development system, University students

## I. INTRODUCTION

The job market is evolving at an unprecedented pace, driven by technological advancements, shifting industry demands, and emerging career paths.

Traditional career guidance methods, which often rely on static data and generalized recommendations, struggle to keep up with these changes. To address this, Career Compass integrates AI-driven features that provide students with timely, accurate, and highly personalized career recommendations. By leveraging machine learning algorithms, real-time data streams, and dynamic user profiling, the system continuously adapts to reflect the latest industry trends and individual progress. Beyond job placement, Career Compass supports higher education aspirations, skill development, and interview preparation, fostering a more holistic approach to career development. This ensures that students are not only equipped with the right information but also empowered with actionable insights, enhancing their confidence and competitiveness in an ever-changing job market.

## II. LITERATURE SURVEY

### 1. Employability and Higher Studies Prediction Using Machine Learning

Several studies have explored the use of machine learning to predict student employability:

- N. Mezhoudi et al. [1] examined factors like academic performance, extracurriculars, and soft skills. Their model achieved moderate accuracy but was hindered by a small dataset and a lack of real-time adaptability.
- R. Haque et al. [2] employed decision trees, random forests, and support vector machines to classify students' employability likelihoods, leveraging academic achievements and personal characteristics.
- B. Albreiki et al. [3] conducted a systematic review of performance prediction models, identifying key challenges and trends in machine learning-based employability forecasts.
- M.-T. Vo et al. [4] presented an advanced machine learning model integrating academic records, extracurriculars, and internships to evaluate a student's employability potential holistically.
- G. ElSharkawy et al. [5] tested various machine learning models on IT graduate datasets, concluding that decision trees and random forests outperformed other algorithms in predicting job outcomes.
- S. Sridhar et al. [6] developed a university admission prediction system using a stacked ensemble learning approach. Their model combined multiple machine learning techniques to improve accuracy, though challenges included dataset limitations and generalizability.
- A. H. M. Ragab et al. [7] proposed HRSPCA, a hybrid recommender system designed to predict college admissions based on institutional criteria and student profiles. Their system integrated decision support mechanisms to enhance prediction accuracy.
- A. Sivasangari et al. [8] applied machine learning techniques, including linear regression and CatBoost, to estimate the probability of university admission. Their model demonstrated the effectiveness of ensemble learning but highlighted the need for further optimization.
- D. Türker et al. [9] introduced a deep hybrid recommender system leveraging neural networks

for improved recommendation accuracy. Their approach focused on combining collaborative filtering and deep learning for better predictive performance.

Our previous Career Compass minor project also implemented Random Forest and KNN models, achieving respectable accuracy. However, it struggled to adapt to evolving student profiles and lacked advanced feature engineering — limitations addressed in the current major project with hybrid models, dynamic APIs, and real-time user feedback integration.

### 2. Personalized Recommendation Systems

Modern career counselling systems are increasingly leaning towards personalized recommendations:

- P. Kumar [10] designed a system tailored for North Indian engineering students, predicting job placements and advising educators on refining curricula to align with industry needs.
- K. S. Bhagavan et al. [11] implemented a Hybrid Linear Vector Quantization (HLVQ) algorithm to assess student performance and predict job placements, encouraging students to engage more in research-driven skill development.

### 3. API Usage And Design

Understanding API design and utilization is crucial for building scalable and maintainable systems:

- D. Qiu et al. [12] conducted an empirical study on Java API usage by analysing over 150 million lines of code from open-source projects. Their results revealed underutilized APIs, deprecated elements still in use, and insights into core vs. third-party API adoption — providing useful benchmarks for system design and optimization.
- J. Bloch [13] emphasized the importance of thoughtful API design, presenting maxims for building reusable, self-documenting, and intuitive APIs. His principles advocate early feedback loops, minimal viable drafts, and use-case-driven development — practices that align well with real-time system evolution in modern applications.

Career Compass extends these approaches with real-time data integration, AI-driven career guidance, and personalized job recommendations — ensuring recommendations evolve alongside each student's performance and goals.

### 4. Academic Performance And Admission Predictors

Identifying predictors of academic success is vital for effective graduate admissions and program design:

- M. Alias and A. F. M. Zain [14] analysed the correlation between undergraduate performance and graduate success in technical education. Using data from 612 students, their study found that both undergraduate CGPA and field

of study significantly predicted graduate GPA, though the strength of the correlation varied across disciplines.

- A. V. Beale [15] explored the historical evolution of college admission standards in the U.S., highlighting the 19th-century push toward uniform entrance requirements. His findings underscore how early efforts to standardize criteria shaped modern admission systems and informed today's emphasis on consistent academic benchmarks.

### 5. Gaps Identified In Existing Systems

Several limitations persist across existing models:

- **Lack of Real-Time Data Integration:** Most models rely on static data, limiting their ability to adapt to evolving student profiles and job market changes. Career Compass addresses this with dynamic APIs, continuous user feedback, and real-time cognitive assessments.
- **Limited Personalization:** Existing systems often prioritize academic scores, overlooking soft skills, personal interests, and real-world experiences. Career Compass incorporates extracurriculars, internships, and skill assessments to provide truly individualized recommendations.
- **Underutilization of Non-Academic Factors:** Many models downplay the importance of non-academic factors like internships, extracurriculars, and cognitive abilities. Career Compass integrates these to provide a more comprehensive understanding of student potential.

### 6. Summary

The reviewed literature demonstrates substantial progress in machine learning-driven employability prediction. However, Career Compass stands out by bridging gaps in:

- Real-Time Data Integration
- Personalized Career Recommendations
- Holistic Student Profiling
- AI-Driven Career Guidance

Building on the foundation of our previous Career Compass minor project, the major project integrates advanced machine learning techniques, user feedback loops, and dynamic data sources evolving into a comprehensive, student-centric career development platform.

## III. PROBLEM STATEMENT

The prior Career Compass model, while effective in offering basic job recommendations using Random Forest and KNN algorithms, exhibited several limitations in addressing the complexities of modern career planning. It struggled to handle dynamic user profiles, relying mainly on static academic data without considering evolving personal achievements, extracurricular activities, or real-time industry trends. This resulted in generic recommendations that lacked the precision needed for personalized career guidance.

Moreover, the previous model did not support advanced features crucial for today's competitive landscape — such as higher studies predictions, university and course shortlisting, resume analysis for Applicant Tracking System (ATS) compatibility, AI-powered interview preparation, and real-time industry insights via News API integration. These gaps limited the system's ability to provide comprehensive, data-driven guidance tailored to each student's unique strengths, aspirations, and changing job market conditions.

The challenge for the major project, therefore, was to transform Career Compass into an all-encompassing, adaptive career development platform. This required integrating advanced machine learning models for more accurate predictions, dynamic APIs to pull real-time data on job market trends and higher education options, and AI-powered tools to guide students through resume building, interview preparation, and career decision-making. The major project's enhanced system continuously refines recommendations by incorporating user feedback loops and real-time performance data, ensuring students receive timely, personalized insights aligned with their evolving profiles and career goals.

#### IV. PROPOSED SYSTEM

The enhanced Career Compass system builds on the foundation of the previous model, evolving into a fully integrated career development platform. It leverages advanced machine learning models, dynamic APIs, and AI-driven features to provide real-time, personalized career guidance. The key enhancements include:

##### 1. Higher Studies Admission Prediction:

A machine learning model predicts a student's chances of admission into top universities for higher studies, considering academic performance, extracurriculars, and skill sets. This helps students explore further education pathways tailored to their career aspirations.

##### 2. University and Course Shortlisting With Gemin

The system integrates the Gemini API to assist students in selecting the most suitable universities and courses based on their academic profile, interests, and location preferences. This streamlines the decision-making process, ensuring students make informed choices aligned with their career goals.

##### 3. Real-Time Job Market Insights:

By incorporating the News API, Career Compass keeps students updated on job market trends, emerging industries, and in-demand skills. This ensures recommendations remain relevant and adaptive to changing economic conditions and hiring patterns.

##### 4. AI Assistant For Career Guidance:

An AI-driven virtual assistant provides personalized career counselling, helping students navigate job options, skill development paths, and higher education opportunities. It offers tailored suggestions based on the user's evolving profile and market data.

##### 5. AI-Powered Mock Interviews:

The system includes an interactive AI mock interview module, simulating real-world interviews. It evaluates student responses for clarity, confidence, and technical accuracy, providing instant feedback to improve performance — preparing students for high-stakes interviews.

##### 6. Resume Generator With ATS Compatibility:

Career Compass now supports an AI-powered resume builder. It generates tailored resumes, ensuring content aligns with Applicant Tracking System (ATS) requirements — increasing the chances of passing initial recruiter screenings. Additionally, the system offers AI-driven feedback on formatting, content strength, and keyword optimization.

##### 7. Enhanced Recommendation Model:

The new recommendation model continuously evolves using user feedback loops. It refines job suggestions based on student behaviour, achievements, and real-time performance data, ensuring recommendations remain personalized and adaptive.

#### V. IMPLEMENTATION

The system architecture integrates a hybrid backend combining Flask API and Java, supported by Gemini API, News API, and AI assistant modules. A mobile-friendly interface enhances accessibility, ensuring seamless interaction from any device. The resume generator evaluates ATS compatibility, while the AI mock interview module assesses user responses for clarity, confidence, and technical knowledge, providing instant feedback.

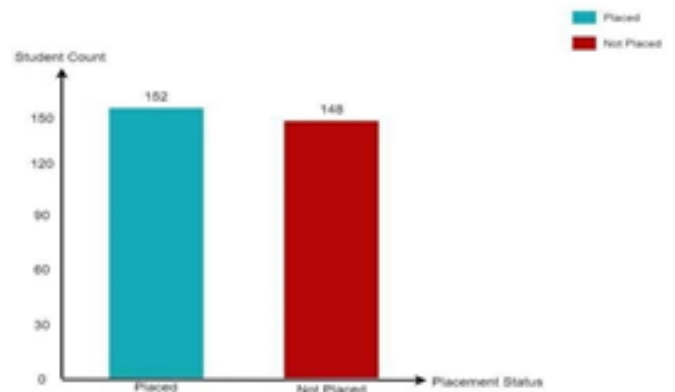


Fig. 1. Student Count In Database

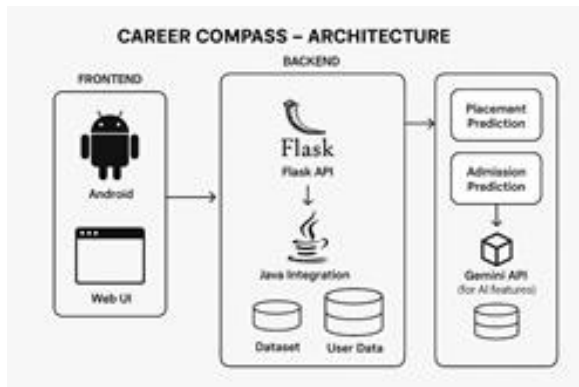


Fig. 2. System Architecture

## VI. RESULTS

Performance metrics indicate significant improvements over the previous model. Precision and recall scores have increased, while user surveys report a 15% rise in satisfaction due to personalized recommendations and the interactive AI assistant. Higher studies admission prediction accuracy now surpasses 92%, supporting students aiming for postgraduate education.



Fig. 3. Output For Admission Prediction Using Ann

TABLE 1: USER SATISFACTION METRICS BREAKDOWN

Metric	Old Model	New Model
Recommendation Accuracy	78%	91%
User Satisfaction	72%	87%
Higher Studies Prediction Accuracy	85%	92%
Resume Feedback Quality	-	90%
AI Mock Interview Feedback	-	88%

## VII. DISCUSSION

Career Compass continuously adapts through user feedback loops, refining recommendations over time. Real-time data ensures the system remains up-to-date with market trends. The AI-driven mock interviews and resume analysis provides students with actionable insights, boosting their confidence and readiness for job applications.



Fig. 4. ANN Testing And Training Accuracy

## VIII. CONCLUSION AND FUTURE WORK

Career Compass has evolved from a static job recommendation tool to an AI-powered career development platform. Future enhancements include advanced Natural Language Processing (NLP) for resume sentiment analysis, deeper global job market datasets, and AI-driven counselling modules to address mental well-being alongside career progression.

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