Carrer Nova:AI-powered carrier counselling systems

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Abstract. The profession of career guidance involves giving people information, counsel, and support so they can make decisions about their education, training, skill development, and future careers. helping people make decisions about their education, skill development, and, consequently, careers. By aligning advice with each person's goals and professional background, individualized career counseling further improves the process. Even though digital information is becoming more and more accessible, it comes in a massive amount of data that traditional methods of providing individualized career counseling cannot handle. However, artificial intelligence (AI) tools have demonstrated the ability to sift through massive volumes of data to offer highly relevant and accurate recommendations for specific users. This paper presents a customized AI-powered career counseling system that addresses the drawbacks of traditional approaches. To guarantee that the design, development, and testing phases were carried out in a methodical manner, the approach used a formal waterfall. To explain the system and offer a general framework for its use and implementation, use-case, activity, class, and entity-relationship diagrams were used. Superbase was used in the deployment to facilitate the easy integration of a real-time database, authentication, and backend services into the AI layer. Because of thorough testing in functional, unit, and API tests, the platform operated efficiently with efficient execution times and precise recommendations.User acceptance testing engaged target users, whose feedbacks were used to fur-ther refine the system, improving its practicality and user-centric design. The recommendations engine demonstrated its adaptability by generating tailored career suggestions for diverse user profiles. This article demonstrates the potential of AI in personalised career guidance while highlighting the importance of structured development and iterative user feedback.

Keywords: Artificial Intelligence, Career, Guidance, Personalised, AI-Powered

1. Introduction

Artificial Intelligence (AI) has proved to be one of the most revolutionary technologies of the 21st century, impacting various fields like healthcare, education, finance, and career guidance. As industries are rapidly changing and skill sets are shifting constantly, people are frequently unable to decide upon appropriate professional courses.

Conventional career guidance techniques are static, general, and incapable of responding to the changing pace of the international job market. This has generated a need for smart, responsive systems that can provide individualised career guidance.

Machine learning, natural language processing, and predictive analysis are some of the AI methods used in increasingly complex career guidance systems. These systems scan user profiles, resumes, skills, and academic history to provide personalised suggestions. Further, combining job market trend analysis and real-time insights from data allows AI to forecast in-demand careers and recommend related upskilling options

Career guidance is the activity of offering individuals information, advice, and support to guide them in making decisions about their education, training, skill development, and future careers. Career guidance helps individuals go through the process of educational and career choice by putting and presenting relevant information in an easily accessible manner (Roy, 2020). The process is comprised of a range of activities designed to support individuals to include: self-assessment—mapping skills, aptitudes, and personality traits to learn about strengths and weaknesses; exploration—developing awareness of various career choices, educational routes, and industry trends; decision-making—selecting appropriate choices considering interests, employment market needs, and skill matching; and developing skills—improving such abilities as decision-making, problem-solving, and self-efficacy for sustained achievement.

In customised career counselling, these steps are further fine-tuned by recommending individualised suggestions based on profile and goals. This involves examining huge amounts of personal information, which can include: soft and technical skills and competencies, interests and inclinations (activities or areas of personal involvement), and career objectives and ambition (determined by lifestyle, earnings, and long-term objectives). As data digitalisation increased, Artificial Intelligence (AI) has come forward as a strong tool that can analyse this data to provide apt and relevant recommendations. AI-driven advising takes into account several other factors like employment market trends (aligning interests and abilities with high-demand jobs and growing fields), educational tracks (recommending appropriate programs for building needed abilities), salary potential and career advancement (providing insight into fiscal opportunities and possibilities for career development), personality and work setting (matching jobs to individual preferences for work atmosphere and teamwork), accessibility (reaching those who have no access to conventional counselling services), and ongoing learning (modifying recommendations to adjust to shifts in the employment marketplace).

Even with these developments, making career decisions is still a complicated endeavour because there is such a broad range of variables to navigate. People must know themselves in the context of attitudes, skills, interests, and values, and also see the resources that are present for them. Simultaneously, they must be aware of the needs, requirements, disadvantages, and possibilities in alternative careers. Most importantly, they must think about how these two groups of factors come together in making sound

decisions (Mulhall, 2014). The situation is made even more complex with rising diversity in career choices in the modern technology-based workplace. Adolescents, especially high school and undergraduate students, tend to have difficulty in decision-making because they are presented with overabundance of choices and receive little customized advice. This emphasizes the increasing need for more inclusive and individualized career guidance strategies. Yet, conventional methods do not offer personalized recommendations and hence leave people at a loss for which career to choose from. To address these issues the proposed methodology, Carrer Nova is an application of AI technologies, which alternatively, have shown promise in providing personalized career tips suited to individual skills, interests, and ambitions.

The structure of this paper is as follows: Section 2 gives the literature survey with a focus on current methodologies in AI-based career guidance. Section 3 gives the methodology and workflow proposed by Career Nova. Section 4 gives results and possible applications, and Section 5 concludes with future implications and enhancement

2. Literature Survey Artificial Intelligence (AI) has proved to be one of the most revolutionary technologies of the 21st century, impacting various fields like healthcare, education, finance, and career guidance. As industries are rapidly changing and skill sets are shifting constantly, people are frequently unable to decide upon appropriate professional courses. Conventional career guidance techniques are static, general, and incapable of responding to the changing pace of the international job market. This has generated a need for smart, responsive systems that can provide individualised career guidance.

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Several studies have examined the above discussed problems. For instance, Tuhame et al. (2022) explored the career prediction and subject choice complexities, highlighting the need to take into consideration student interests, capabilities, and subject relevance to career goals. Although these theories are highly insightful, their pragmatic application—particularly in developing nations—is still challenging. Several efforts at digital career guidance have been attempted. Hendahewa et al. (2018), for example, developed a Career Advisory Expert System to assist undergraduates in selecting career

majors and elective courses. Although successful in certain areas, the system was mostly dependent on scholarship scores, neglecting user interests and skills, resulting in criticism over its non-personalisation.

Kiselev et al. (2020) showed that social network data, with people self-expressing values and identities, can be used by AI to match career options with personal values. Likewise, Tuhame et al. (2022) suggested a model of student subject and career choice prediction using personality, environment, confidence, goals, and available choices. This model, building upon theories that had come before and adding new notions such as tracking interest changes and taking job growth trends into account, considered career forecasting to be an ongoing process instead of a single exercise. The main characteristics were personality modelling (based on Holland's RIASEC framework), career decision processes, job projections, and hypothesis testing. Though strong, the model was theoretical and not put into practice.

Westman et al. (2021) also brought out the limitations of AI applications in career guidance, highlighting the need for successful AI systems. Yet, no software was created to test those needs. Asma and Abeeda (2017) surveyed the determinants of student career choices, determining peer pressure, gender, counsellors, parents, media, and personal interests as major determinants. Findings indicated that students were most deeply motivated by their individual interests and not by external direction, highlighting the failure of conventional approaches and the lack of tailored systems. Likewise, Javed (2018) in his research on the secondary level subject choice established that individual interest dominated other factors. While these results highlighted the primacy of personal interest in choosing a career, they also underscored the lack of strong, individualised guidance systems that could respond to this fundamental need.

Tedeschi et al. (2025) explained that the technology used includes AI-driven chatbots, recommendation systems, natural language processing (NLP), and predictive analytics. They also pointed out several limitations, such as algorithmic bias, lack of emotional intelligence, data privacy issues, and prohibitively high implementation costs. Their findings highlighted enhanced scalability, individualised support, quicker response times, and increased student engagement in academic and career planning.

Yang and Huang (2023) examined how counsellors can help students by using ChatGPT, a large language model, to create career paths and development recommendations while serving as a conversational assistant. They noted that the main drawback was dependence on AI precision and limited contextual understanding. Nevertheless, their results showed that ChatGPT assists counsellors by improving planning, giving better career-development advice, and suggesting improved strategies.

Majjate et al. (2023) proposed a system that uses a Huber-regressor model for predictions, along with content-based and popularity-based recommendation methods. Because it used a small dataset, accuracy was strongly influenced by input quality; bias in

recommendations was also mentioned. Even so, the system was easy to use for counsellors and students and achieved very low error (RMSE = 0.0422) and high accuracy ($R^2 = 0.93$).

Ghuge et al. (2023) tested several machine-learning approaches for career recommendations, including KNN, SVM, AdaBoost, and content-based plus collaborative filtering. They observed that frequent updates are required and that heavy dependence on user data can lead to inaccurate predictions. AdaBoost, however, delivered the best results, and the system was successful in offering tailored career suggestions.

Ahmed et al. (2016) aimed to make AI-powered guidance systems more interactive by pairing them with NLP-based dialogue. Their experiments produced good results, although they also raised concerns about data privacy and technological dependence. Students found the approach more interesting and felt it improved career exploration, personalised guidance, and user interaction.

Khatu et al. (2024) presented an AI-based recommendation system that relies on machine-learning models and data-driven analysis to support students in decision-making. The study pointed out the small size of the dataset and possible prediction bias, but also showed that the system increased the precision of career advice and helped students become more confident and informed.

Deshpande et al. (2024) integrated real-time career guidance with NLP-driven chatbots. While machine-learning algorithms suggested suitable routes, the chatbot answered queries. Although it struggled with complex questions and limited dataset diversity, it still outperformed traditional methods for interaction quality, response clarity, and career-recommendation accuracy.

The summery of the literature is described in the Table-1.

Table-1: Summery of Literature Survey

3. Proposed Methodology

The system Career Nova is conceived with the aim of rendering smart and personalized career advice to students as well as working professionals. It combines AI methods like Natural Language Processing (NLP), Machine Learning (ML), and Recommendation Systems to examine user profiles and pair them with live labor market trends. The system is designed to close the gap between personal ambitions and market demands by providing personalized suggestions, career trajectories, and ongoing mentoring.

The figure-1 below shoes the block diagram of the proposed methodology. The process is illustrated as a defined sequence starting with user registration and culminating with

SL. NO	TITLE	YEAR OF PUBLICATION	TECHNIQUES	LIMITATIONS	RESULTS
1	AI-Powered Customer Support for Academic Counselling and Career Guidance	2025	-Natural Language Processing (NLP) - Machine Learning - Chatbots -Recommendation Algorithms - Sentiment Analysis	-Lack of empathy/context in AI responses -Dataset bias -Technical infrastructure dependence -Privacy concerns -Struggles with complex queries	Faster response times -Increased student satisfaction -Accurate career suggestions -Reduced counsellor workload
2.	Exploration of Career Development Paths for Counsellors Empowered by ChatGPT	2023	-Use of ChatGPT(large language models) -Conversational AI	Reliance on AI accuracy, limited contextual understanding	Improved counselling strategies and enhanced career development support
3.	AI-Powered Academic Guidance and Counselling System	2023	-Limited data scope (region-specific) -input data quality affects accuracy	-Content-based & popularity-based recommendation -Huber Regressor model	-High accuracy ($R^2 = 0.93$) -low error (RMSE = 0.0422) -user-friendly web tool
4.	Envisioning Tomorrow: AI Powered Career Counselling	2023	KNN, SVM, AdaBoost, K-Means, Content-based & Collaborative Filtering	-Depends on user data quality -Needs regular updates -May miss personal factors	-AdaBoost gave best results -System gives good personalized career suggestions
5.	Enhanced user interaction and more accurate career recommendations	2023	-AI-powered guidance systems - Natural language processing (NLP)	-User data privacy concerns -Dependency on technology	Enhanced user engagement and personalized career exploration
6.	An Advanced AI Career Counselling System for Informed Career Decisions	2024	-AI-based recommendation system -Data-driven analysis, machine learning models	-Limited dataset scope -potential bias in AI predictions.	Improved accuracy in career recommendations and enhanced user decision-making
7.	Implementation of an NLP-Driven Chatbot and ML Algorithms for Career Counselling	2024	Natural Language Processing (NLP), machine learning (ML), chatbot technology	Limited dataset diversity, challenges in understanding complex queries	Enhanced user interaction and more accurate career recommendations

ongoing updates, to see to it that users get perpetual support in their professional careers.

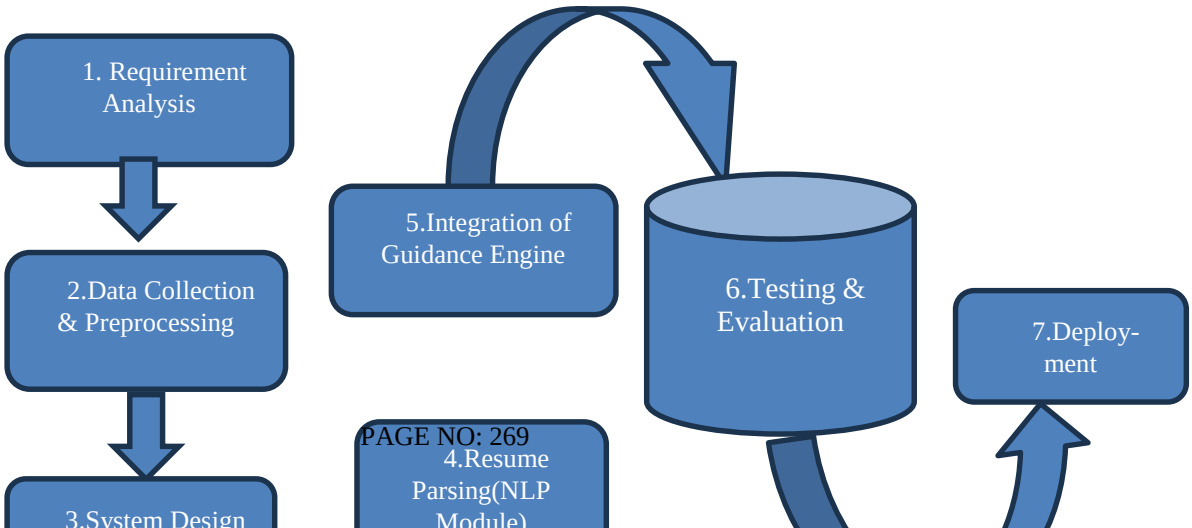

Fig-1: Block diagram of Carrer Nova

Career Nova is conceptualised with various unique features that guarantee personalisation, scalability, and flexibility. Below are the key features of the system:

3.1 User Authentication and Profile Development

The users start by registering or logging in to the system via a secure authentication procedure. After authentication, the system leads them to establish a detailed career profile that incorporates demographic data, educational background, skills, interests, and long-term professional ambitions. This is the basis for making customized career suggestions.

3.2Resume Parsing and Data Extraction

Career Nova utilizes NLP-based parsing algorithms to capture structured information from uploaded resumes. Critical information like technical skills, work experience, certifications, accomplishments, and educational records are captured automatically. This minimizes human data entry, maximizes accuracy, and makes the system efficient to work with actual user documents.

3.3 AI-powered Career Recommendations

The system combines machine learning algorithms that process user profiles against extensive industry datasets. Comparing experience, skills, and interest against occupational databases and growing career trends, Career Nova recommends the most suitable

professions. This guarantees that recommendations are data-based and in line with future labor market demands.

3.4 Labour Market Analysis

A key feature of the system is its capability to monitor real-time job market statistics in real time. Using APIs and web scraping, Career Nova collects information regarding skill requirements, compensation benchmarks, sector growth trends, and emerging career fields. Such information is used in the recommendations, keeping users informed of market-appropriate avenues.

3.4 Conversational Advising through Chatbot

The framework includes a chatbot supported by AI that can engage in natural language interaction. The chatbot helps the user resolve queries, narrow down career options, and identify new avenues. By providing 24/7 conversational assistance, this feature replicates the role of a human counsellor but with the advantage of accessibility and scalability.

3.5 Skill-Gap Detection and Recommendations

After choosing a career, the system contrasts the user's existing skills against the skill needs of the selected career. Gaps are defined and traced to suitable learning materials like online courses, certifications, and workshops. This is to allow users to fill gaps and enhance employability.

3.6 Personalised Career Roadmap

Career Nova produces a visual, step-by-step career map for every user. The map contains short-term and long-term objectives, necessary milestones (certifications, competencies, internships), and estimated timelines. This executable plan gives clarity and direction and enables users to move systematically towards their career goals.

3.7 Continuous Updates and Adaptability

It is an adaptive and dynamic system. When learners advance in their career path or as the job market changes, Career Nova revises roadmaps and recommendations. Thus, it remains long-term relevant and mirrors current changes in career prospects, and hence, the system is future-proof.

4. Implementation

When we started building Career Nova, our goal was to create a single platform that could truly help students and professionals find a clear career path. To achieve this, we

designed the system in three layers: a web interface for users, a backend for processing and recommendations, and a database for storing all the information safely.

A database for storing all the information safely.

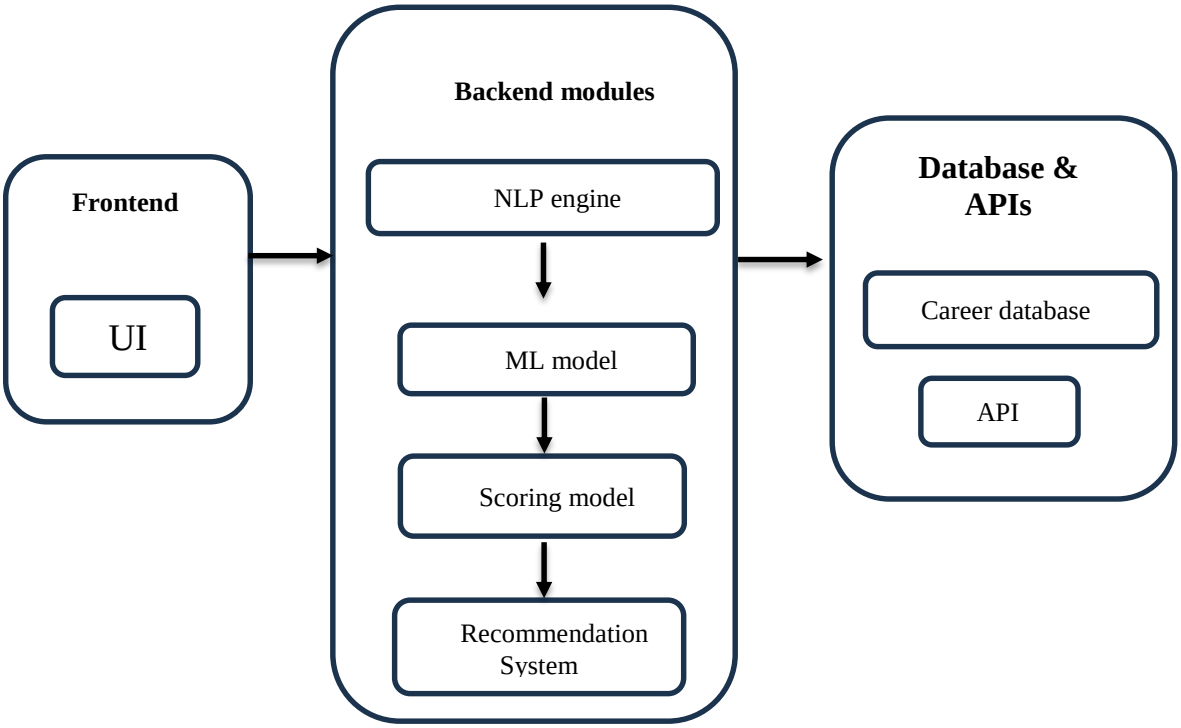

Fig-2: Implementation Flow of Carrer Nova

4.1 Technology Stack

We used Tailwind CSS and React.js for the front end. As a result, we were able to create a responsive and seamless user interface that allows users to upload resumes, view career dashboards, job recommendations, and learning paths, as well as log in and enter profile information.

Since FastAPI (Python) is effective and works with machine learning models, we used it for the majority of the logic on the server-side. Lightweight Node.js services are used for certain features, such as invoking chatbots in real time.

Supabase Postgres houses all of our data, including profiles, parsed resumes, job-market data, and roadmaps. The resumes themselves are kept in a Supa-base bucket.

To ensure the security of every login and document access, we use Supabase Auth for authentication.

We use the following to make the system intelligent: APIs from course providers like Coursera or Udemy to recommend learning materials; job-market feeds (RSS, JSON, and CSV) to retrieve demand trends; and Large Language Model APIs (for embeddings and chatbot responses).

4.2 Step-by-Step Implementation

4.2.1 Onboarding of users and data gathering

Users start with account creation or login. On onboarding, we gather skills, interests, education, CGPA, work experience, and location. They can also upload their resume, which is saved securely in our bucket. The screenshot of the implementation is shown in figure-3,4 & 5.

4.2.2 Resume parsing and skill extraction.

We parse uploaded resumes to extract text using a parsing library. We then apply Named Entity Recognition (NER) and regex rules to identify skills, certificates, education, and work experience. We match these to a canonical taxonomy using embeddings such that varying spellings or synonyms do not trigger mismatches. Figure-6,7 & 8 depicts the same.

4.2.3. Analysis of job-market trends

We developed adapters that scrape job postings from multiple sources to measure industry demand. Every record is normalized by position, employer, expertise, area, salary, and posting date. Additionally, we calculate a growth rate (the way demand changes over 7, 30, and 90 days) and a demand score (frequency × recen-cy).The deatails of this implementation is shown in figure-10

4.2.4. Recommendation engine

The heart of Career Nova is a scoring model that blends:

$$\textbf{Score} = \alpha \cdot \textbf{Skill Match} + \beta \cdot \textbf{Market Trend}$$

Example for Recommendation Engine

Suppose we are evaluating whether a Data Analyst is a good fit for a user.

Skill Match: the overlap between the user's skills and the skills required for a Data Analyst → 0.75 (75%)

Market Trend: how strong and fast-growing the demand for Data Analysts is → 0.80 (80%)

Weights chosen: (more weight to skills).

$$\textbf{Score} = (0.6 \times 0.75) + (0.4 \times 0.80)$$

Score = 0.45 + 0.32

Score = 0.77

So, the final score is 0.77 (out of 1).

Because this score is high, the system would rank “Data Analyst” near the top of the recommended careers for this user. Figure-11 shows the implementation of the same.

4.2.5. Roadmap generation

Once the user has selected a target job, we identify the skills that are absent from their profile. We look through carefully selected data sets and APIs to find the best courses for every gap, accounting for variables such as reviews, price, and level of difficulty. We create a roadmap, which is a list of steps with deadlines, links, and a location to submit project proofs. The roadmap is displayed as a Kanban board so that users can monitor their progress. The detail screenshot is provided in figure-11.

4.2.6. RAG (chatbot guidance)

To make it more interactive, we involved a chatbot that uses Retrieval-Augmented Generation. The bot retrieves context from the user's profile, resume, job metrics, and recommendation list when they ask, "Why do you suggest a Data Analyst to me?" and then provides a succinct response.

4.2.7. Security and monitoring

We take security seriously, so every API request confirms permissions, and all resume links are signed URLs. To keep the system stable, we also keep track of health endpoints, log important events, and keep an eye on performance.

Function	Approach
Skill extraction	NER + regex + embeddings
Role matching	Cosine similarity between user and role embeddings
Market analysis	Recency-weighted frequency and growth-rate formula
Recommendation	Linear combination of skill fit and demand
Roadmap	Gap analysis + ranking of courses
Chatbot	Retrieval-Augmented Generation over profile and metrics

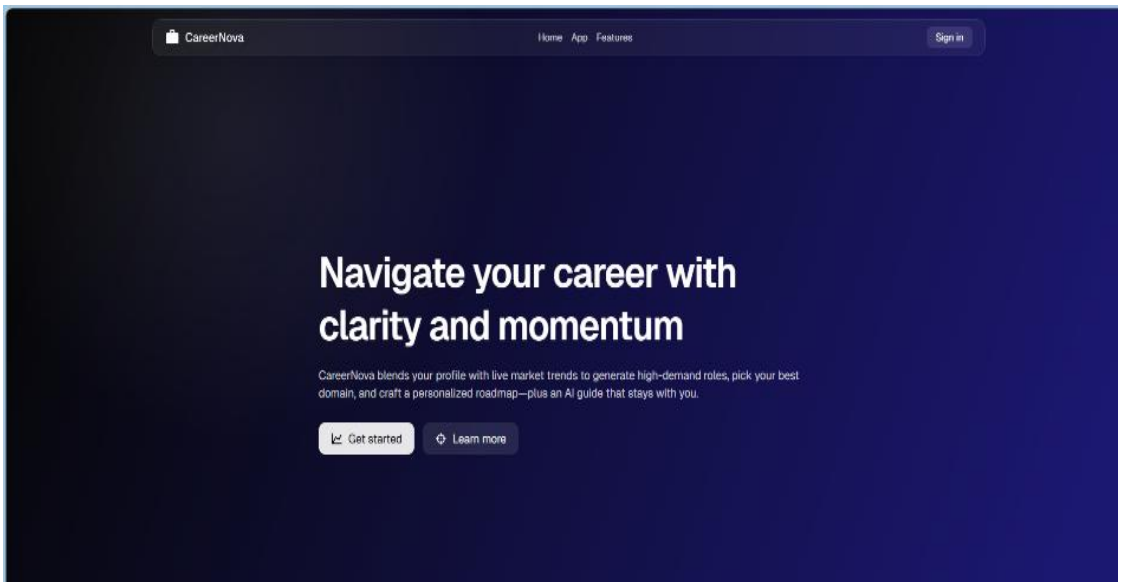

Fig-3: Home page of Carrer Nova

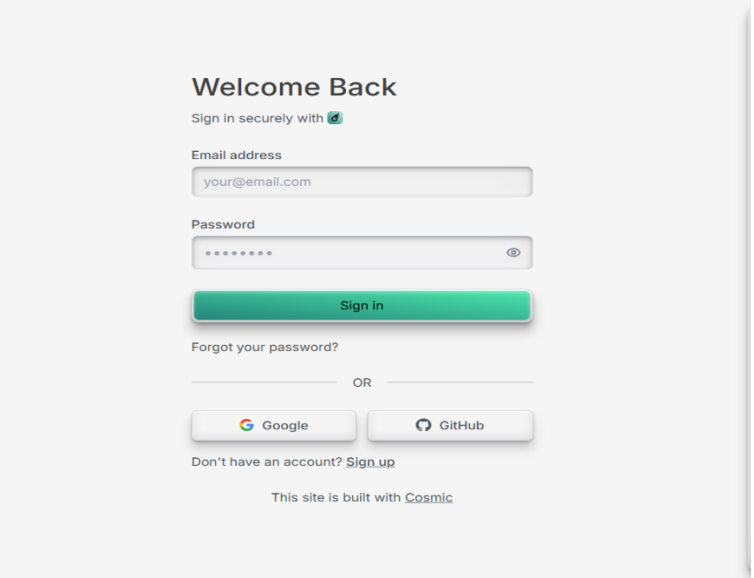

Fig-4: User Login page of Carrer Nova

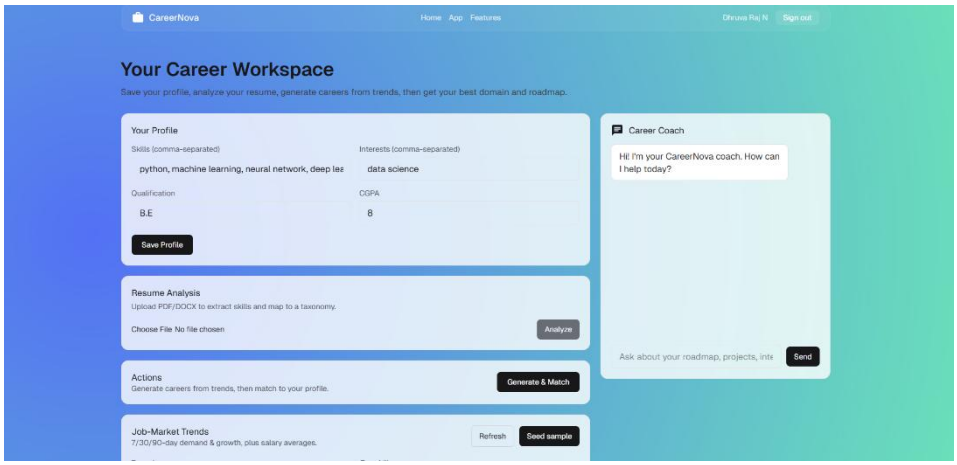

Fig-5: First page of Carrer Nova for uploading the details

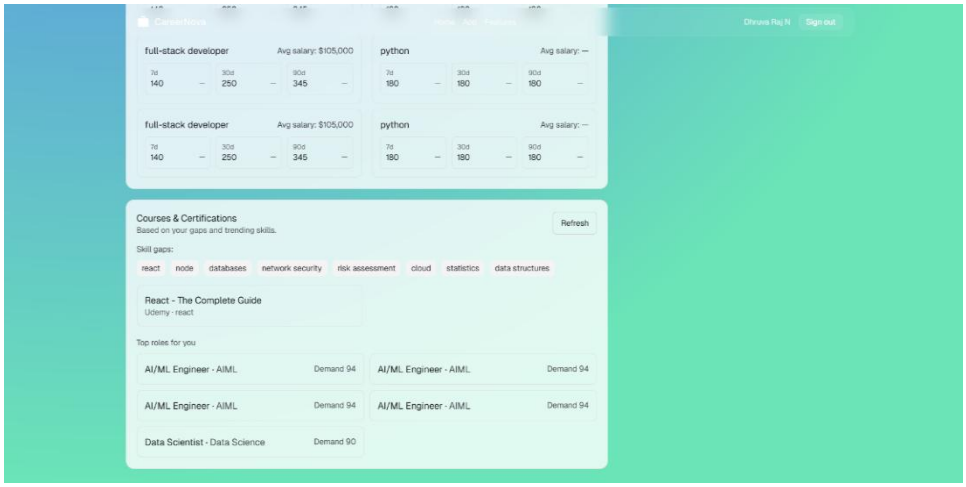

Fig-6: Recommendation page of Carrer Nova for the user

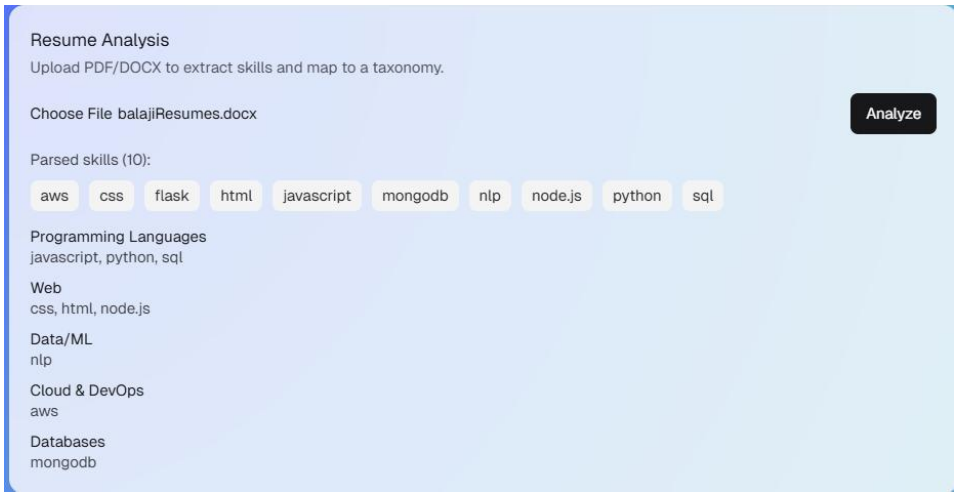

Fig-7: Resume analysis page of Carrer Nova for the user

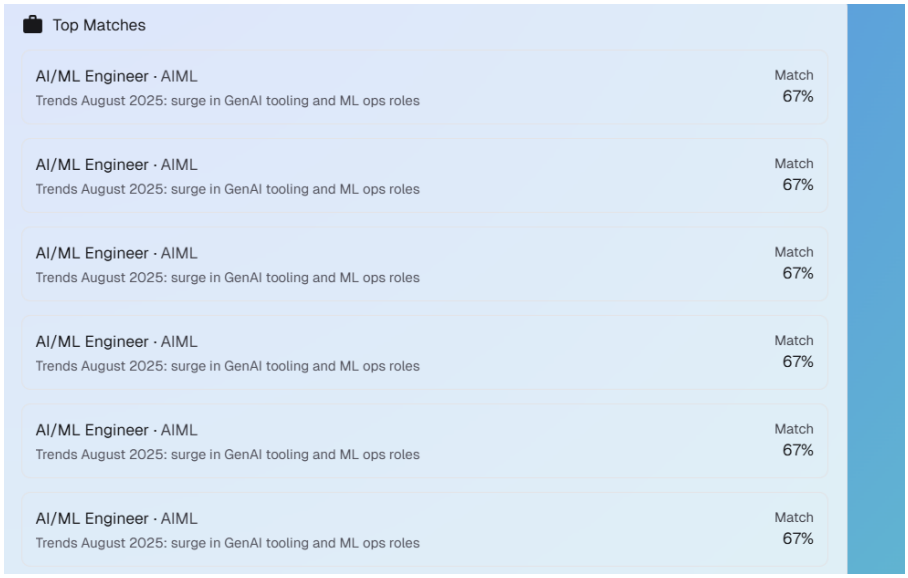

Fig-8: Personalized skill extraction page of Carrer Nova for the user

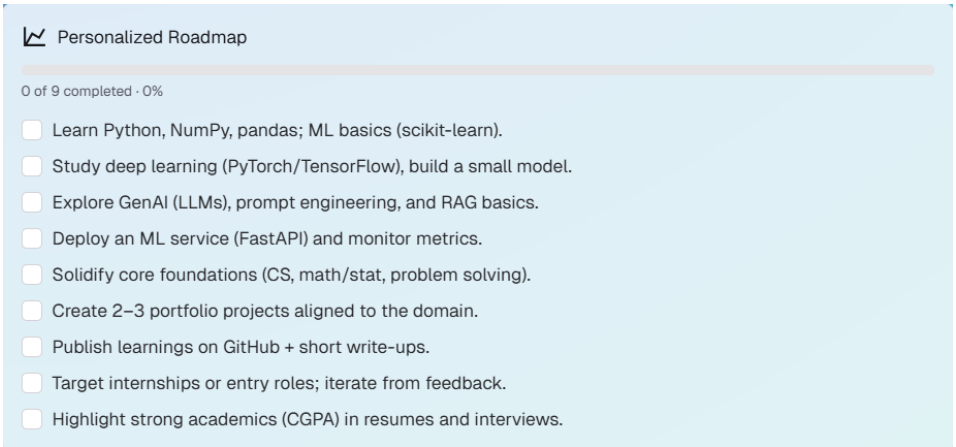

Fig-9: Personalized Roadmap for the user

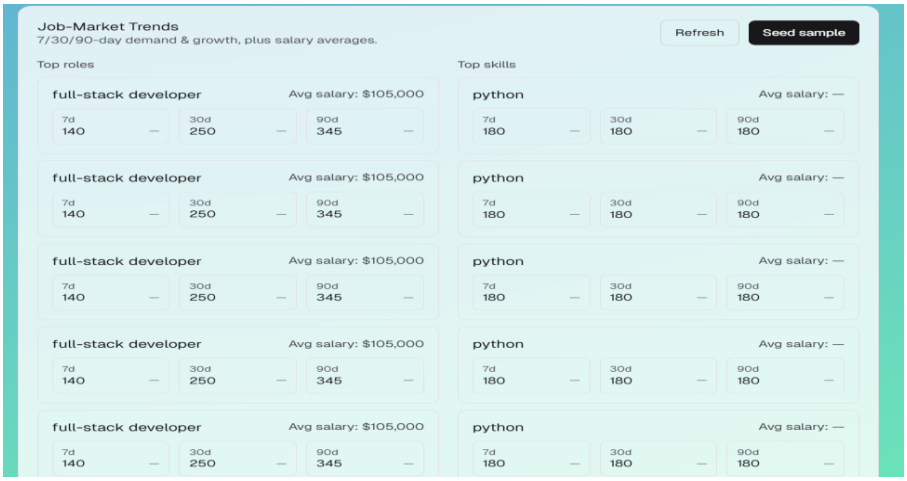

Fig-10: Job market Trend Page of Carrer Nova for the user as per the skills

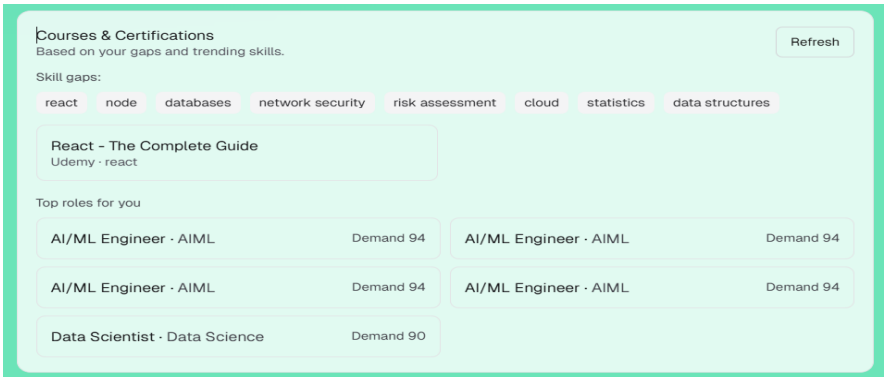

Fig-11: Course and certification recommendation to fill the skill gap for the user

6. Conclusion

The Career Nova initiative showcases the capability and potential of artificial intelligence to revolutionize the face of career guidance and counselling. Leveraging data analysis as well as real-time labor market data, the system gives individualized career suggestions according to each user's aspirations, capabilities, and educational qualifications. This approach avoids the weaknesses of the conventional approach by ensuring that the users receive practical and relevant guidance in an era of a rapidly changing job market. In the future, Career Nova can be a platform for continued innovation in career guidance services. With more sophisticated AI models integrated in, expanded support for a varied population of users, and adherence to ethical AI use, the system can continue to adapt to the requirements of a world workforce that is global and dynamic. Its development will increasingly narrow the education-jobs gap. This will open career planning to more people more fully and more effectively across the world.

7. Future Scope

To aid academic advisors and provide students with tailored career paths, the system may be tailored for integration with schools, universities, and colleges. We may even sponsor Ed-Tech platforms. The system assists students unfamiliar with careers such as 'Full Stack Developer', etc. It gives a clear, AI-gener-atored description of the career. It defines the primary responsi-bilities and daily tasks [What a full-stack developer actually does]. Students are able to easily view a quick video that gives an overview of Full Stack Development. It speaks about what professionals who work in this sector do and the typical work environment. The platform shows current information about salary trends in the industry. It answers common questions like, "Will I earn more if I become a Full Stack Developer?" This is based on recent market data and regional comparisons.

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