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## AI CAREER PATH PREDICTOR

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### Abstract

In today's rapidly changing employment market, students and professionals often face difficulty selecting the right career path due to lack of personalized guidance, limited awareness of opportunities, and unclear understanding of their own abilities. Traditional career counseling methods are often expensive, manual, and generic in nature, which makes them less effective in modern times [1, 2]. This paper presents an intelligent recommendation platform named AI Career Path Predictor, designed using Artificial Intelligence and Machine Learning techniques. The system analyzes user skills, interests, and experience level to recommend suitable career roles such as Data Scientist, Software Engineer, UI/UX Designer, Financial Analyst, Digital Marketer, and others [3, 4]. The proposed model uses a Random Forest Classifier combined with rule-based analysis for higher prediction accuracy and better explainability. In addition to prediction, the system performs skill gap analysis and generates a personalized learning roadmap with structured monthly plans and learning resources [5, 6]. The application is developed using ReactJS frontend, Flask backend, and MySQL database. The system helps users make informed decisions, improve employability, and reduce career confusion through data-driven guidance [7, 8].

**Keywords:** Career Prediction, Artificial Intelligence, Machine Learning, Random Forest, Skill Gap Analysis, Recommendation System.

### 1. INTRODUCTION

Career selection plays a major role in shaping an individual's future, financial growth, job satisfaction, and personal development. However, many students complete their education without clarity regarding the professions that best match their abilities and interests. This often leads to wrong decisions and delayed career growth [1, 2]. Traditional career guidance methods rely on aptitude tests, counselors, and static web resources. These methods are limited in personalization and often fail to adapt to fast-changing industry trends. Modern job markets continuously create new roles in Data Science, Cloud Computing, Artificial Intelligence, UI/UX Design, and Cybersecurity [3, 4]. Artificial Intelligence offers a scalable and efficient solution by analyzing user profiles and generating intelligent recommendations instantly. AI systems can process multiple parameters such as technical skills, communication ability, interests, and prior experience to determine suitable career paths [5]. The proposed AI Career Path Predictor is a smart platform that predicts careers and provides improvement guidance. The system is useful for students, fresh graduates, job seekers, and working professionals planning career transitions [6, 7].

### 2. LITERATURE SURVEY

Traditional career recommendation systems were mainly based on psychometric tests and counselor opinions. These systems provided broad suggestions but lacked precision and personalization. Their recommendations were often static and not supported by real-time industry data [1, 2]. Recent research shows that AI-based recommendation systems provide more relevant career suggestions by using classification algorithms and user profiling methods. These systems analyze historical patterns and skills to predict suitable roles [3]. Skill gap analysis has become an important feature in modern platforms. It compares user capabilities against required industry competencies and identifies missing skills that need improvement.

This increases employability readiness [4]. Machine Learning algorithms such as Support Vector Machines, Naive Bayes, Decision Trees, and Random Forest are widely used for recommendation tasks. Among them, Random Forest gives higher robustness and accuracy because it combines multiple decision trees [5]. Although some systems recommend careers, many fail to provide

structured roadmaps, confidence scores, or user-friendly dashboards. Hence, there is a need for an integrated platform combining recommendation, skill analysis, and roadmap generation [6, 7].

### 3. PROBLEM STATEMENT

Students and professionals frequently struggle to decide which career path best suits their profiles. Lack of proper guidance leads to confusion, wasted learning effort, and career dissatisfaction. Many users are unaware of market demand and required skills [1, 3]. Traditional counseling systems are expensive and inaccessible to many people. Manual evaluation is time-consuming and depends heavily on counselor expertise. These systems cannot scale to support millions of users [2, 4]. Existing online quiz-based systems usually provide generic suggestions such as “You may become an engineer” without considering actual skills, strengths, or future learning plans. Such outputs are often unreliable [5]. Therefore, there is a need for an intelligent, automated, and scalable career guidance system that predicts suitable careers, identifies missing skills, and guides users toward professional growth [6, 7].

### 4. PROPOSED SYSTEM

The proposed AI Career Path Predictor accepts user input in the form of technical skills, soft skills, interests, and experience level. Based on these values, the system predicts the top matching careers using Machine Learning techniques [3, 5]. The platform supports multiple domains such as Data Science, Software Development, UI/UX Design, Marketing, Finance, Human Resources, and Project Management. This enables broad applicability for users from different backgrounds [4]. The system also performs skill gap analysis by comparing user-entered skills with predefined role requirements. Missing skills are highlighted clearly so that users understand what they need to learn next [6]. Finally, a personalized roadmap is generated in monthly phases with recommended resources such as courses, tutorials, certifications, and projects. This transforms prediction into actionable guidance [7, 8].

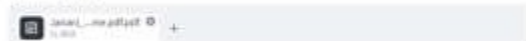
### 5. SYSTEM ARCHITECTURE

The system architecture consists of four layers Presentation Layer, API Layer, Intelligence Layer, and Data Layer. Each layer performs a dedicated task to ensure mod-ularity and scalability [5]. The Presentation Layer is built using ReactJS and provides responsive user interfaces for login, registration, skill input, dashboard, and results display [7]. The API Layer uses Flask to handle requests such as prediction, authentication, history retrieval, and roadmap generation. Flask acts as the communication bridge between frontend and backend services [6]. The Intelligence Layer contains the Random Forest model and rule-based logic for career matching, confidence scoring, and skill gap detection [3]. The Data Layer uses MySQL to store user credentials, prediction history, roadmap templates, and role requirements securely [8]. Flow: User → React Frontend → Flask API → ML Model → MySQL → Output Dashboard.

#### AI Career Path Predictor

Enter skills manually OR upload your resume

Upload Resume (PDF)



Enter your skills (comma separated)

#### Detected Skills From Resume



Predict Career Path

Predict Career Path

### Career Recommendations

#### Data Scientist

Match Score: 50.0%

Works on data analysis and predictive models.

##### Skills you have

- sql
- python

##### Skills you need to learn

- machine learning
- statistics

##### Suggested skills to explore

- deep learning
- data visualization
- pandas

#### Web Developer

Match Score: 66.7%

Builds websites and web applications.

##### Skills you have

- css
- html

##### Skills you need to learn

- javascript

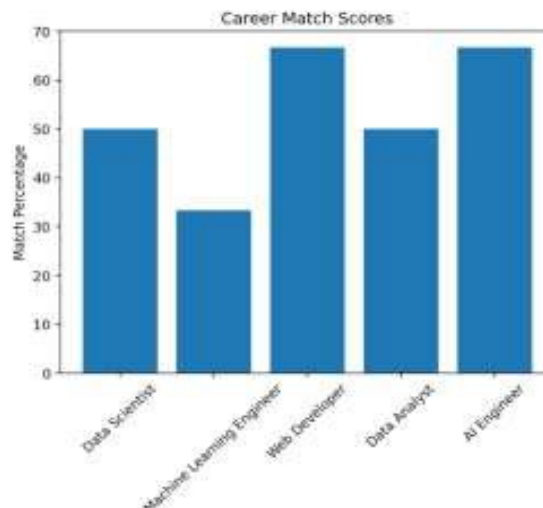
##### Suggested skills to explore

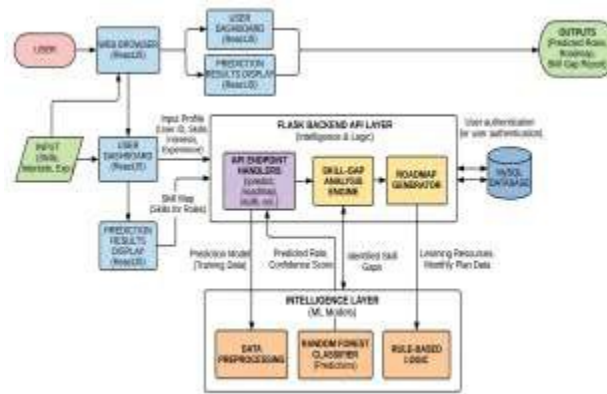
- react
- nodejs
- uideign

##### Career Roadmap

1. Learn HTML
2. Learn CSS
3. Learn JavaScript

Career Match Visualization





## 6. IMPLEMENTATION DETAILS

Python was used as the primary programming language because of its strong ecosystem for Machine Learning and backend development. Libraries such as Scikit-learn, Pandas, and NumPy were used for data processing and model training [5]. ReactJS was used for frontend development because it provides reusable components, dynamic rendering, and responsive user experience. Bootstrap was used for styling and theme support [7]. The Random Forest Classifier was trained on a dataset containing user profiles mapped to career categories. Features included skills, interests, and experience levels. The model learned patterns that associate profiles with professions [3, 4]. The backend uses Flask APIs such as /register, /login, /predict, and /roadmap. Axios was used in React to connect with backend APIs and exchange JSON responses [6]. MySQL stores user accounts, selected skills, prediction outputs, and previous us-age history. Passwords are protected using hashing mechanisms for security [8].

## 7. RESULTS

The developed system was tested with multiple user profiles and produced relevant predictions with high consistency. For a user having Python, SQL, Statistics, and Machine Learning skills, the top prediction was Data Scientist with 94% confidence [3, 5]. The second and third recommendations for the same profile were Data Analyst (82%) and ML Engineer (76%). This shows the model can rank related career options effectively [4]. Skill gap analysis successfully detected missing competencies such as Tableau, Big Data Tools, and A/B Testing for the Data Scientist role. This helps users understand industry expectations clearly [6]. The roadmap generator created a four-month plan containing courses, project suggestions, and certification paths. User feedback indicated the system was practical, easy to use, and helpful in planning future careers [7, 8].

## 8. FUTURE SCOPE

The system can be enhanced by integrating live job market APIs such as LinkedIn, Indeed, and Glassdoor. This would allow recommendations based on current demand, salaries, and hiring trends [1, 2]. Natural Language Processing can be added so users may describe themselves in free text, and the system can automatically detect skills and interests [5]. A mobile application can be developed using React Native to improve accessibility for smartphone users. Push notifications can remind users about roadmap progress [7]. Resume generation features, mentor matching, multilingual support, and progress tracking dashboards can further transform the system into a complete career development platform [6, 8].

## 9. CONCLUSION

The AI Career Path Predictor effectively demonstrates how Artificial Intelligence can be leveraged to address modern challenges in career guidance. In today's fast-changing job market, individuals often struggle to choose the right career path due to a lack of proper guidance, awareness, and structured planning. This system overcomes those limitations by intelligently analyzing user inputs such as skills, interests, educational background, and prior experience. Based on this data, the platform generates accurate, relevant, and practical career recommendations, helping users make informed decisions about their future [3, 5]. Unlike traditional career guidance systems, which typically provide only generic suggestions, the proposed model goes a step further by identifying gaps in the user's current skill set. It not only predicts suitable career paths but also highlights the missing competencies required to achieve those roles. Furthermore, it generates a personalized learning roadmap that guides users step-by-step on how to acquire the necessary skills. This feature significantly enhances the usefulness of the system, transforming it from a simple prediction tool into a complete career development assistant [6].

## 10. References

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