

# A Natural Language Processing–Based Chatbot for Enhancing Corporate Customer Service and Engagement

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## Abstract:

Increasing competitiveness in campus placements requires the development of intelligent systems capable of providing accurate predictions about placements and effective career planning. In this paper, we introduce Smart Career Navigator, an AI-enabled platform for aiding both students and placement officers in the modern campuses. The suggested system uses student academic record, technical abilities, and behavioral qualities to make placement predictions and career advice. The placement prediction is achieved via a Random Forest machine learning algorithm that helps to make unbiased decisions regarding candidates' potential placement ability. Following the prediction results, the system recommends career options to the student and reveals skill shortages. Data security is assured by applying the approach of secure authentication, role-based access control, and data encryption. The experimental study proved higher prediction accuracy compared to traditional approaches.

**Keywords:** Placement prediction, Career planning, Machine learning, Random Forest, Student analytics, Artificial intelligence

## I. INTRODUCTION

The placement process at universities is essential in helping students plan careers and developing the university's image. In view of the ever-increasing number of students and recruiting companies, conventional ways of managing placements have proven to be ineffective and error-prone. Large amounts of data on academics, skills, and behavior are currently available but not properly used. Machine learning algorithms provide efficient tools for processing data and forecasting placement outcomes. Accurate forecasting will allow students to assess their preparedness for work. The purpose of this study is to develop a tool that utilizes machine learning methods to forecast placement results and help students make informed career choices.

## II. LITERATURE SURVEY

Some researchers have conducted studies on the use of machine learning algorithms in predicting the performance and placements of students. The conventional method utilized statistical modeling and rule-based approaches. But, as per recent studies, the prediction can be significantly improved by using some supervised learning algorithms such as Decision Trees, Naïve Bayes, and Support Vector Machine.

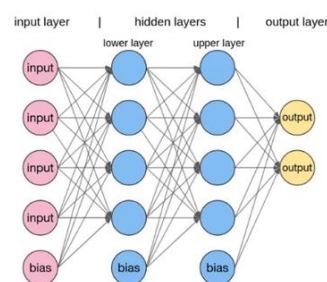
Random Forest is one example of ensemble technique that has proven more accurate and reliable. Additionally, several works discuss career recommendation systems that make predictions based on skills and previous data. Nevertheless, most of these systems have not incorporated the ability to forecast the placements of students.

### III. PROBLEM IDENTIFICATION

The placement process in campus involves human judgment and predetermined eligibility criteria that do not necessarily capture the actual placement preparedness of a student. The students do not have access to individualized feedback about appropriate career directions and the skills they need to develop to achieve their goals. It is a challenge for placement officers to handle large amounts of data concerning the skills and educational performance of the students. In addition, most campus placement systems utilize historical placement records to little extent in predicting future placements. Consequently, there is inaccurate identification of candidates and delayed decisions made by recruitment companies and firms. Skill mismatch still persists between candidates and jobs offered. Thus, a data-driven and intelligent system is essential in predicting placements.

### IV. PROPOSED SYSTEM

The proposed Smart Career Navigator system is an artificial intelligence-based solution to predict placement success rates and help students plan their careers. This system evaluates student academic results, technical knowledge, and behaviors. For prediction purposes, a machine learning model based on Random Forest algorithm is used to achieve high prediction accuracy rates. The predicted results help to formulate career suggestions and skill gaps. Role-Based Access Control is utilized to protect student data from unauthorized access by other users.



**Fig. 1. Overall architecture of automobile production workflow automation system.**

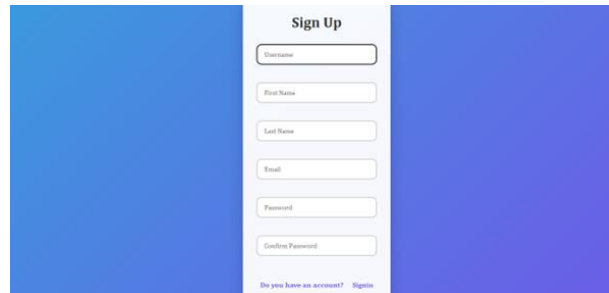
### V. SYSTEM ARCHITECTURE

#### Smart Career Navigator System Design

Smart Career Navigator system design uses a web-based client-server model, where there is an easy and secure communication between users. Students, placement officers, and administrators use the browser interface based on their roles to access the system. The system gathers information about students' academic records, skills, and behavior, which are stored in an encrypted database. Machine learning performs predictions using the Random Forest algorithm on the stored data for predicting the readiness for placement. Prediction results are then passed to the recommendation engine to recommend suitable career pathways and skills development. There is security in the system to authorize access to the system's

resources based on the user's credentials and roles. Analytics and reporting tools are available for performance monitoring and tracking predictions' outcomes.

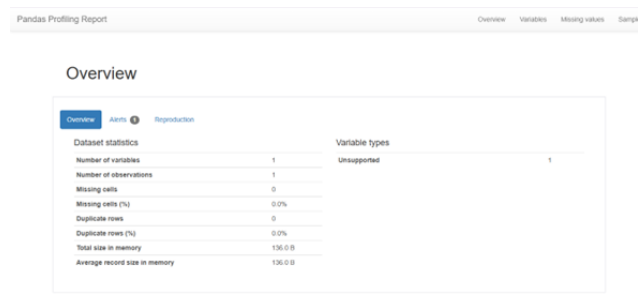
## VI. MODULE DESCRIPTION



The image shows a 'Sign Up' form with the following fields: Username, First Name, Last Name, Email, Password, and Confirm Password. At the bottom, there is a link that says 'Do you have an account? Signin'.

**Fig. 2. Secure login interface for authorized users.**

The Smart Career Navigator framework is made up of several modules, which work together to make sure that its operation is efficient. The authentication module takes care of authentication and authorization, ensuring that students, placement officers, and administrators have secure logins and roles assigned. The student database management module takes care of collecting and storing data relating to academic performance, technical skills, and student profile information. The prediction module utilizes the Random Forest algorithm for predicting the readiness of students for placement. According to the predictions from the algorithm, the career recommendations module comes up with personalized jobs for each student and skill gaps.



The image shows a 'Pandas Profiling Report' with an 'Overview' section. It contains a table with dataset statistics and variable types.

Dataset statistics		Variable types	
Number of variables	1	Unsupported	1
Number of observations	1		
Missing cells	0		
Missing cells (%)	0.0%		
Duplicate rows	0		
Duplicate rows (%)	0.0%		
Total size in memory	136.0 B		
Average record size in memory	136.0 B		

**Fig. 3. Administrator dashboard for access control and report approvals.**

## VII. SECURITY MODEL

The Smart Career Navigator adopts an effective security mechanism for safeguarding data related to students and their placements. Secure methods are used for ensuring that only valid users can access the data. The role-based access control prevents certain functionalities for specific users. All the information about the students and prediction data is stored in an encrypted database. There are secure ways of transmitting the data from the client to the server. Logs are kept for auditing user behavior and detecting any intrusion or abuse. Input validation is there to guard against any modification in data.

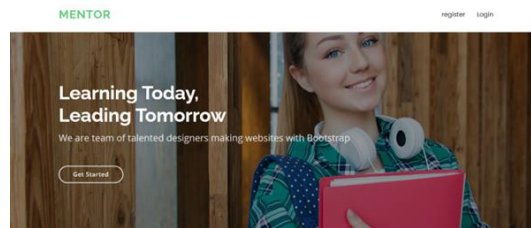
## VIII. ALGORITHM DESCRIPTION

The Smart Career Navigator system uses the Random Forest algorithm for placement prediction due to its accuracy and robustness. Random Forest is an ensemble learning technique that constructs multiple decision trees during the training phase. Each tree is trained on a randomly selected subset of the dataset

using bootstrap sampling. At each decision node, a random subset of features is considered to reduce correlation among trees. For placement prediction, student academic performance, technical skills, and behavioral attributes are used as input features. Each decision tree independently predicts the placement outcome. The final prediction is obtained through majority voting among all trees. This approach reduces overfitting and improves generalization. Hence, Random Forest provides reliable and accurate placement forecasting results.

## IX. RESULTS AND DISCUSSION

The Smart Career Navigator system has been tested on a dataset comprising of academic profiles of students, their skill sets, and placement history records. A few machine learning algorithms have been considered, and their performances were analyzed through comparisons. From among the algorithms chosen for comparison, Random Forest performed best in terms of accuracy and stability. This system has proven effective for predicting the placement readiness of different categories of students. Comparison studies show better performance than traditional classifiers like Decision Tree and Naïve Bayes classifiers. The career suggestion module generated relevant suggestions for jobs according to predictions from the system. Skill gap analysis enabled students to determine areas of improvement for placements.



**Fig. 4– Final Testing Output**

## X. CONCLUSION

The Smart Career Navigator framework offers an innovative AI-based approach for placement forecasting and career guidance within contemporary university settings. The application of the Random Forest model allows for accurate prediction of placement suitability through evaluation of students' academic, technical, and behavioral performance records. The developed methodology facilitates personalized career guidance and skills analysis to foster students' personal growth. Experimentation yielded higher accuracy than conventional approaches. The system helps placement agents select appropriate candidates more effectively. Data security and role-based access control guarantee reliable performance. The flexible design allows for increased amounts of data.

## XI. FUTURE WORK

Any future improvements of the Smart Career Navigator solution will concentrate on refining its predictive capabilities and increasing its functionality. Deep-learning algorithms could be employed in order to analyze student behavior. Real-time evaluation of skills and ongoing performance monitoring could be used for more accurate forecasts of placement. Feedback from the industry, information about placement of alumni, and performance during internships could be analyzed for more accurate career advice. Interaction with the learning management system might allow automatic identification of skills gap for each individual student. Cloud computing technologies and even edge computing solutions can



help achieve higher levels of scalability and reactivity. Blockchain technology and other advanced security measures could be introduced. Multi-institution support is possible.

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