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# AI-Powered Student Assistance Chatbot for Department of Technical Education

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**ABSTRACT:** In today's competitive world, choosing the right career path and college can be a challenging task for students. To address this issue, we introduce the AP College Guide, an intelligent platform that assists students in career planning and college selection using advanced technologies such as Machine Learning (ML), Natural Language Processing (NLP), and database management. The system provides personalized guidance by analyzing user data and offering tailored recommendations. It includes features such as secure user registration with OTP authentication, a resume analysis and job recommendation model, and a caste rank-based college search.

The platform also integrates an AI driven chatbot to assist users with queries related to college admissions, courses, placements, and faculty. The chatbot also includes voice-to-text functionality and allows users to view their daily usage history on the dashboard. Additionally, sentiment analysis is performed on user feedback to improve platform performance. The resume analysis module categorizes resumes into different job domains and suggests relevant job roles based on extracted skills and qualifications. The chatbot, built using a Support Vector Machine (SVM) classifier, provides instant responses to user queries with high accuracy. Furthermore, a college prediction system enables students to find suitable institutions based on their academic scores and eligibility criteria. By leveraging AI-driven insights, the AP College Guide serves as a comprehensive solution for students, helping them make informed decisions about their careers and higher education.

**KEYWORDS:** Career Guidance, Job Recommendation, College Selection, Natural Language Processing (NLP), Machine Learning (ML), Chatbot, Sentiment Analysis, Resume Analysis.

## I. INTRODUCTION

The selection of both a suitable career path and matching college stands as a decisive decision for students though they face overwhelming confusion because of numerous available choices. The AP College Guide exists as an intelligent and user-friendly solution which assists students with career planning through ML and NLP technologies in college selection.

The platform, designed by Melior Analytics Group, generates customized job and higher education suggestions through user data processing to help students select suitable options. It includes multiple crucial features such as a job recommendation model based on resume analysis, caste rank-based college searching, and an AI-powered chatbot for immediate assistance. The chatbot also includes voice-to-text functionality and allows users to view their daily usage history on the dashboard. Additionally, sentiment analysis is performed on user feedback to ensure continuous improvement of the platform.

The job recommendation system utilizes user-resumes to extract qualified skills and procedures before generating appropriate job role suggestions. Based on academic scores and entrance exam results the college prediction system predicts the colleges students can successfully gain admission to AP College Guide serves students by uniting machine learning algorithms with database organization and NLP processes to link careers with student possibilities. Through this platform students can find complete career guidance and college selection resources in one centralized location thus improving efficiency and using data-based decisions.



## II. LITERATURE SURVEY

Traditionally students encountered severe challenges when deciding about their careers and picking colleges. Artificial intelligence (AI) machine learning (ML) with natural language processing (NLP) technologies made personalized career guidance recommendations accessible to users. These technologies produce smarter and customized decision-making methods which helps students manage numerous educational resources effectively. Machine learning systems in career guidance demonstrate exceptional capabilities by providing suitable job role matches to users according to their educational background and work experience alongside their career choices. The research team of Agarwal et al. (2017) established a job recommendation system through the combination of natural language processing algorithms for resume evaluation and job description comparison. The research team extracted essential skills and qualifications and job roles present in resumes before matching those elements with available positions. The proposed system used resume parsing and machine learning algorithms to strengthen job recommendation relevance which resulted in better job seeker decision making [1].

Sharma and Gupta (2019) created a comparable model which provided recommendations for colleges as its main target. The system created college predictions through an evaluation of students' academic achievements together with their exam test scores and educational preferences [2].

The development of personalized guidance systems is possible through the application of NLP technology for creating chatbots. The model developed by Ranjan et al. (2020) proved how NLP-based chatbots can process sophisticated college admission-related user inquiries[14]. The system acquired information from a question database about college courses along with faculty members and facilities and placement opportunities to supply immediate answers to users. Chatbots represent an efficient means to boost student connectivity and offer prompt educational institution information according to Ranjan et al. (2020) [4].

Kumar and Jain (2018) attempted to develop a career counselor system which suggested career options by merging information from user-owned personal factors such as qualifications and skills with information from external market based data[15]. The research established that AI systems performing career guidance by processing internal user information alongside external environmental data would generate superior predictive results. Through their research the authors showed that machine learning methods enable the study of job trends combined with user profile data to generate appropriate career path recommendations [3].

Educational platforms now show an increasing interest in sentiment analysis as this tool helps both users and developers understand feedback and create better user experiences. The researchers analysed student text responses to identify which platform elements users approved or disapproved. The evaluation of user feedback through this approach enhances service delivery and generates essential findings about necessary developmental areas [5].

The academic field has seen increasing interest in caste-based college admissions particularly in India since caste reservations dominate educational admissions processes Through this method colleges can automate traditionally complex manual operations to achieve full transparency while decreasing human mistakes [6].

The body of research about AI applications in career guidance alongside college selection processes continues to grow at a fast pace. AP College Guide enhances student career and educational planning by integrating various AI technologies including machine learning and NLP and sentiment analysis therefore producing improved decision outcomes.[7]

AI developed new capabilities for college selection according to Gupta et al. (2021) through their implementation of machine learning models which matched student preferences and educational histories for recommendation purposes. The study established that AI-based tools gain knowledge through user engagement to enhance the precision of their suggestion systems [8].

Implementing AI capabilities to evaluate student input and track student involvement allows educational programs to undergo sustained development. Sentiment analysis through AI enables educational institutions to gain instant feedback understanding about student experience which allows them to improve their service delivery.[9]

Sentiment analysis powered by AI allows educational institutions to gauge student emotions and satisfaction levels. By evaluating feedback from surveys, discussion forums, and social media, AI can identify areas of improvement within the educational system<sup>10]</sup>

One of the most significant benefits of AI in education is personalized learning. AI algorithms analyse student performance and learning styles to tailor content accordingly [12]. This ensures that students receive materials suited to their pace and comprehension level, promoting a more effective learning process. Such personalization helps bridge learning gaps and enhances overall academic performance.[11]

While AI offers numerous benefits in education, it also presents several challenges. Data privacy concerns, potential biases in AI algorithms, and the need for significant infrastructure investment are some obstacles institutions face. Additionally.

The integration of AI in education raises ethical concerns, including data security, algorithmic bias, and the fairness of AI-driven decisions [13]. Safeguarding student data and maintaining human oversight are essential to prevent AI from reinforcing inequalities in education.

### III. METHODOLOGY

The AP College Guide is built using an intelligent system that leverages various machine learning (ML) algorithms, natural language processing (NLP) techniques, and structured data management to provide career and college recommendations to students. The following methodology outlines the core components and processes that power the platform.

#### A. System Overview

The platform, designed by Meliora Analytics Group, consists of several interconnected modules that work together to analyse data, provide job recommendations, and guide students in their college selection process. These modules include user registration with OTP authentication, resume analysis, job recommendation, caste rank-based college search, feedback analysis, and AI-powered chatbot assistance. The chatbot also includes voice-to-text functionality and allows users to view their daily usage history on the dashboard. Additionally, sentiment analysis is performed on user feedback to ensure continuous improvement of the platform.

The core of the system involves processing the user's data to provide accurate recommendations based on their qualifications, skills, and preferences. The use of machine learning models helps improve the relevance of these recommendations over time as the system processes more data.

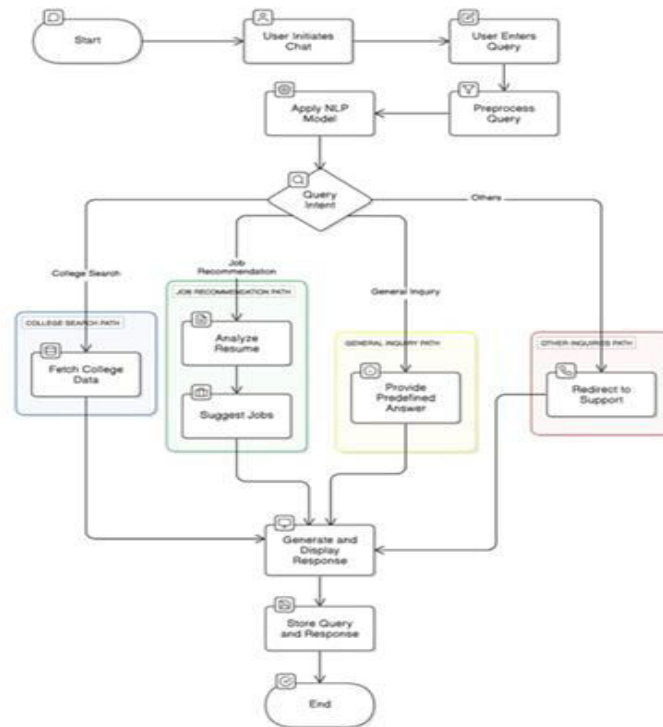


Fig. 1. System Architecture

#### B. User Registration and OTP Authentication

The platform requires users to register with their email addresses. Upon registration, a one-time password (OTP) is sent to the user's email for verification. This OTP ensures that the user is authentic and prevents unauthorized access to personal information. Once authenticated, users can modify their profile details in the "My Profile" section.[8]

#### C. Resume Analysis and Job Recommendation Model

A key feature of the AP College Guide is the resume analysis module. Users upload their resumes, which are then analysed using a machine learning model that extracts important features such as skills, qualifications, and experience. The system categorizes the resumes based on the extracted information and suggests relevant job roles. This is done using a Natural Language Processing (NLP)-based classifier that compares the resume data with a pre-existing dataset of job descriptions. The model's output is a list of job recommendations, ranked by relevance to the user's profile. The system also logs accuracy metrics and the performance of the model, ensuring that future recommendations are more accurate. The job recommendation model uses the following classification algorithm:

$$P(y|x) = \frac{P(x|y)P(y)}{P(x)}$$

Where:  $P(y|x)$  is the probability of a job category  $y$  given the features in the resume  $x$ .  $P(x|y)$  is the likelihood of the features appearing in the job category  $y$ .  $P(y)$  is the prior probability of the job category.  $P(x)$  is the total probability of the features appearing in any job category.

#### D. Caste Rank-Based College Search

Students can also search for colleges based on their caste rank, a critical feature in India's education system. The system uses Pandas to fetch relevant data from a database and provides users with a list of colleges where they are likely to be eligible for admission. This search considers factors like the student's caste rank and academic

performance. The user simply inputs their caste rank, and the system matches them with colleges that have available seats for their category. This helps students make informed decisions about where to apply.

#### E. Feedback Analytics

The system also incorporates feedback analytics, allowing users to submit feedback about their experience with the platform. This feedback is analysed using sentiment analysis techniques, which classify the feedback into positive, neutral, or negative categories. This helps improve the system's overall user experience by addressing areas of concern. The sentiment analysis algorithm applied to the feedback data is based on the following approach:

$$S = \frac{\sum_{i=1}^N \text{score}_i}{N}$$

Where: S is the sentiment score. Score<sub>i</sub> is the sentiment score of individual feedback entries. N is the total number of feedback entries.

#### F. Chatbot Assistance using NLP

The platform also features an NLP-powered chatbot that assists users in answering common queries related to college admissions, resume analysis, and career guidance. The chatbot is trained using a large dataset of real-world questions and responses, allowing it to classify user queries into categories such as Admissions, Courses, Faculty, and more. The chatbot uses a Support Vector Machine (SVM) classifier to categorize queries. The training data consists of labelled examples of queries that correspond to specific categories. The SVM model works by finding a hyperplane that best separates the different query categories in a high-dimensional space. The SVM classifier's objective function is:

$$\text{minimize } \frac{1}{2} ||w||^2 \text{ subject to } y_i(w^T x_i + b) \geq 1, \forall i$$

Where: w is the weight vector that defines the hyperplane. - x<sub>i</sub> are the feature vectors of the input queries. - y<sub>i</sub> are the class labels (+1 or -1). - b is the bias term.

#### G. Implementation Technologies

The backend of the platform is built using Django, a high level Python web framework that simplifies web application development. For data processing, Pandas is used to filter and retrieve relevant college details based on user input. Machine learning models for job recommendation and resume analysis are implemented using libraries such as Scikit learn. The NLP chatbot utilizes the Natural Language Toolkit (NLTK) and other Python-based NLP libraries to process user queries effectively

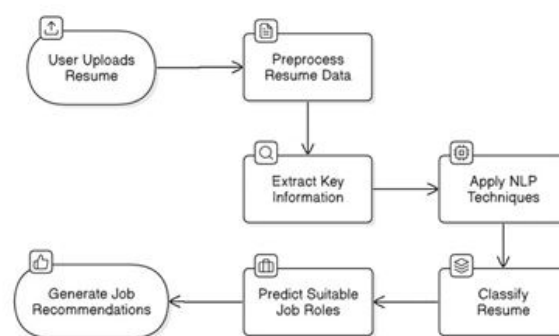


Fig. 2. Methodology Overview

The platform's architecture and workflow ensure seamless interaction between users and the system. The use of machine learning, NLP, and database management guarantees that the platform remains efficient and relevant to the user's needs.

#### IV. IMPLEMENTATIONS

The AP College Guide is an integrated platform designed to assist students with career planning and college selection. The system is developed using a combination of advanced technologies including Django for the backend, machine learning models for data analysis, and natural language processing (NLP) for chatbot assistance. This section provides a detailed overview of the implementation process.

##### A. System Architecture

The AP College Guide is composed of several modules that work cohesively to provide users with personalized career and college guidance. The system architecture is divided into modules including user registration, resume analysis, job recommendation, caste rank-based college search, feedback analytics, and the NLP-powered chatbot. The backend is built using Django, a high-level Python web framework that promotes rapid development and clean, pragmatic design. The machine learning models, including those for resume analysis and job recommendations, are implemented using popular libraries like Scikit-learn.

##### B. User Registration and OTP Authentication

The system begins with a secure user registration process. After entering their details, users receive an OTP (One-Time Password) sent to their registered email for verification. This process ensures that only legitimate users are allowed to access the platform. Once authenticated, users are granted access to their personal profile, where they can modify their details as needed.

##### C. Resume Analysis and Job Recommendation Model

The resume analysis and job recommendation model is one of the core features of the platform. After a user uploads their resume, the machine learning model processes the data and extracts key features such as skills, experience, and qualifications. Based on this information, the resume analysis is performed using a Natural Language Processing (NLP) classifier that identifies key elements from the resume and maps them to appropriate job categories. This enables the system to suggest relevant job roles to users, improving the efficiency of their job search. The algorithm behind the job recommendation system operates as follows:

$$P(y|x) = \frac{P(x|y)P(y)}{P(x)}$$

Where  $P(y|x)$  is the probability of a job category  $y$  based on the features extracted from the resume  $x$ .  $P(x|y)$  is the likelihood of the features in the resume for a given job category.  $P(y)$  is the prior probability of a particular job category.  $P(x)$  is the total probability of the features appearing across all job categories. Once the job categories are identified, the system displays a list of relevant job roles, ranked based on their relevance to the user's profile.

##### D. Caste Rank-Based College Search

For users in India, caste rank plays a significant role in college admission. The AP College Guide allows students to search for colleges based on their caste rank. The system fetches data from a large database using the Pandas library, which is then displayed to the user, showing a list of colleges that match their caste rank and academic background. By entering their caste rank, students are provided with a list of colleges where they are likely to be eligible for admission. This feature helps students make informed decisions by narrowing down their options based on their eligibility criteria.

##### E. Feedback Analytics

The platform also includes a feedback analytics module where users can provide feedback on the system's performance. This feedback is collected and analysed using sentiment analysis techniques. The system categorizes feedback into positive, negative, or neutral sentiments, providing valuable insights into areas that may need improvement. The sentiment analysis process is executed using the following formula



$$S = \frac{\sum_{i=1}^N \text{score}_i}{N}$$

Where, S is the sentiment score for the overall feedback.  $\text{score}_i$  represents the sentiment score for each feedback entry. N is the total number of feedback entries. This continuous analysis of feedback ensures that the platform evolves over time to meet the needs and expectations of its users.

#### F. NLP-Based Chatbot Assistance

The platform features a chatbot powered by NLP, which helps users by answering questions related to college selection, resume analysis, and other career-related queries. The chatbot is trained using real-world queries, and it classifies user queries into different categories such as Admissions, Courses, Faculty, Facilities, Placements, etc. The chatbot uses the Support Vector Machine (SVM) algorithm to classify user queries. The SVM works by separating different classes in a multi-dimensional space. The SVM's objective function is:

$$\text{minimize } \frac{1}{2} \|w\|^2 \text{ subject to } y_i(w^T x_i + b) \geq 1, \forall i$$

Where, w is the weight vector that defines the separating hyperplane:  $x_i$  are the feature vectors representing the input queries.  $y_i$  is the class label (+1 or -1) corresponding to each query. - b is the bias term  
Using the trained model, the chatbot is able to provide relevant answers to user queries, enhancing the overall user experience.

#### G. Technology Stack

The platform is implemented using the following technologies: Django for backend development: It handles user requests, authentication, and serves the frontend: Pandas for data processing: Pandas is used for filtering, analysing, and retrieving relevant data from the databases. Machine Learning Models: The job recommendation and resume analysis models are implemented using Scikit-learn, which provides a range of algorithms for predictive modelling. Natural Language Processing (NLP): The chatbot utilizes libraries like NLTK and SpaCy to understand and process user queries. The combination of these technologies ensures a seamless and efficient operation of the AP College Guide, providing students with accurate and personalized guidance. The implementation process ensures that users can easily interact with the platform while receiving personalized job recommendations and college guidance. The combination of machine learning and NLP allows for a highly dynamic and efficient user experience, making the AP College Guide a comprehensive tool for career and education assistance.

## V. RESULTS AND DISCUSSIONS

This section reveals the experimental results from the AP College Guide platform with subsequent discussion about the gathered data. Various machine learning techniques together with NLP models existed within the system to deliver customized educational and career recommendation services to students. The platform obtained these results by combining user interactions with model developments.

#### A. Performance of the Resume Analysis and Job Recommendation Model

An assessment of the resume analysis and job recommendation model took place through evaluation of 725 job applications. The classification system examined resumes through individual skills and education requirements and professional background to match them with suitable job positions. The application taxonomy included assessment of Information Technology alongside Business Development and Finance and Healthcare and multiple other sectors.

#### Key Results:

The model demonstrated excellent performance by properly assigning job categories to resumes. Through its data generation process the model produces detailed job listings containing organizational information and job descriptions and position names and model-generated recommendation sections. The job recommendation system can achieve higher performance through additional model inputs such as employee preferences for work locations and yearly compensation expectations.



**B. Accuracy and Performance of the Chatbot Model**

Support Vector Machine (SVM) trained the chatbot model which underwent testing about its ability to sort user inquiries under five sections including Admissions and Courses and Faculty together with Placements and Research. The system proved to be accurate at returning suitable answers to user inquiries.

**Key Results:**

The model performed with accuracy levels varying between 86.46% and 94.94% throughout the different test runs. The classified query categories achieved precision between 87.75% to 94.87% and recall between 86.53% to 94.76%. Users received organized correct information about college admissions and faculty teams and placements data from different educational institutions through the chatbot system. The chatbot demonstrates strong capabilities in processing and sorting user inquiries, enabling student users to receive immediate and appropriate responses. With additional training data applied to the chatbot system, responses can be further enhanced, particularly in category classification. Additionally, the chatbot includes a voice-to-text feature and provides a dashboard where users can view the daily usage history of the chatbot.

**C. College Guide (Caste Rank-Based Search) Results**

Students obtained meaningful insights from the caste rank based college search because it utilized their academic standings and caste levels. The system efficiently acquired data from a big college dataset which presented appropriate colleges to users based on their educational records and caste standing.

**Key Results:**

Users could access a college list on the platform that corresponded with their academic background and caste rank. The search engine delivered results which enabled students to select better institutions by better making decisions. Sector performance demonstrated strong results because the caste rank-based search featured an accurate output. Additional filtering features including specific location choices and chosen programs should be implemented in the next version of the platform because they would enhance the customization of the college recommendation process.

**D. Feedback Analytics and Sentiment Analysis**

Feedback analysis was essential for understanding the users' sentiments about the platform through its operations. A sentiment analysis methodology examined user feedback which allocated feedback into three categories: positive, negative and neutral sentiments.

**Key Results:**

Most feedback signals positive sentiments about the platform since users found its functionality and ease of use satisfactory. Customers reported two main unsatisfactory aspects: the limited quantity of career suggestions along with inadequate search parameterization in the college directory functions. The received feedback served to determine specific improvements that would enhance user experience on the platform. The sentiment analysis system used user feedback to determine implementation order for platform upgrades thus promoting continuous platform enhancements.

**Discussion**

The outcome data retrieved from the AP College Guide platform shows its capability as a detailed program for college and career guidance services. The system delivers an accessible platform that helps students receive adapted job listings as well as college selection recommendations derived from their academic information and individual data. Through the implementation of machine learning and NLP technology students can access advice that specifically matches their skill level and qualifications together with their personal preferences. The system delivered good results in general but additional improvements could optimize its performance. The platform shows potential to become an even better tool for students who want to make educated choices about their academic path because developers continue to add new improvements.

**VI. CONCLUSION AND FUTURE WORK****A. Conclusion**

The AP College Guide project brings together machine learning technology and natural language processing methods and data management systems to develop a personalized system for career development and college selection. The system functions as an intelligent platform which helps students obtain individualized job suggestions from their

academic information together with their resumes and supports their college selection through caste ranking and other evaluative criteria... Feedback analytics within the platform serves as a fundamental function to enhance system performance enabling users to establish priority rankings for required features alongside platform optimization. Students can benefit tremendously from AP College Guide which guides their choices during the process of career development and college selection.

#### **B. Future Work**

There are multiple opportunities for future development which will enhance both capabilities and user experience of the AP College Guide as a strategic decision-making tool. The recommendation system must receive enhancement because it lacks sufficient personalization elements during both job suggestion and college search operations. One way to enhance the platform's search effectiveness would be through added features that allow users to provide their job area choices and suitable salary ranges together with particular course requirements. The job recommendation model becomes more precise by adding external elements like job market trends and regional requirements and talent demand information as system input. The platform would enable students to start job applications and college applications directly from the integrated system. User experience benefits from continuous model updates which happen through repeating model training on fresh datasets so the system can adapt to job market changes and academic requirements. Students would access User Interface enhancements that make the platform easier to understand would improve the entire user experience. Interactive dashboards in combination with better visualization tools supported by smoother navigation enable the platform to provide enhanced student engagement.

Students benefit significantly from AP College Guide as they handle challenges in career preparation and college choice selection processes. Regular platform updates alongside additional functionality development will transform the system into an advanced solution for students who want career help during their college admission process.

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