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College Recommendation System for Engineering Students

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Abstract: Educational institutions play a crucial role in the growth and development of any nation. Therefore, it is imperative to find a suitable college for pursuing higher education. Our proposed system utilizes data analysis and data mining techniques, with a recommendation system being a critical part of it. The system uses data mining techniques to filter data and present relevant information. It caters to the needs of students, parents, and educationalists who seek guidance while searching for admission in engineering colleges. Many students with impressive scores miss out on their preferred colleges or courses due to lack of proper information. Therefore, we propose a recommendation system for engineering students that considers college NAAC grade and NBA grade.[2] this system will assist students and parents in selecting the desired college. The recommendation system is divided into three modules - Student, College, and Parent login modules, each with unique functions. Parents can also search for the best colleges based on different criteria.

Keywords: Educational institutions, growth and development, suitable college, higher education, proposed system, data analysis, data mining, recommendation system, students, parents, educationalists, admission, engineering colleges, college NAAC grade, NBA grade, missed opportunities, unique functions, parent login module, student module, college module.

I. INTRODUCTION

Information overload is a common issue on the internet, as a large amount of data is created and used by individuals, making it difficult for users to make decisions. To address this problem, Recommender Systems (RS) have been developed using data filtering and data mining algorithms, which are particularly important in the education and business sectors. Data mining queries can be defined as a task input to a data mining system, and decision tree algorithms are proposed as an effective way of selecting colleges for a course program [3]. However, a significant challenge in college recommendation systems is creating a database of all colleges and eliminating those where the candidate is ineligible. Each year, numerous students from different boards pass their HSC and enter senior colleges, and during the admission process, students must choose a minimum number of colleges in which they may be admitted. As a result, creating a list of eligible colleges requires significant manual effort to search and compare different prospects. The college admission process can be a tedious task for students as they have to manually search for and compare different colleges based on their eligibility criteria. In this project, our goal is to automate this process by developing a college recommendation system using data mining techniques [1].The objective of this system is to generate a list of colleges that are most suitable for the candidate based on their eligibility criteria. Additionally, the system will also provide the functionality of inter-college comparison to enable the candidate to make an informed decision. By automating the college list generation process, we aim to reduce the manual effort required by the candidates and make the process more efficient. This project will leverage data mining techniques to analyze large volumes of data from different colleges and identify the most suitable options for the candidate. The aim of this project is to automate the college list generation process using Data Mining techniques to generate a list of colleges where the candidate is most likely to be eligible. By reducing the manual work required to generate the list, the project aims to make the process more efficient for students and educational institutions alike.

1.1 System Flow

The Fig-1 below presents a visual representation of the system's flow, illustrating the step-by-step process of the student module and parent module. It depicts the functioning of both modules from the beginning to the end of the system.

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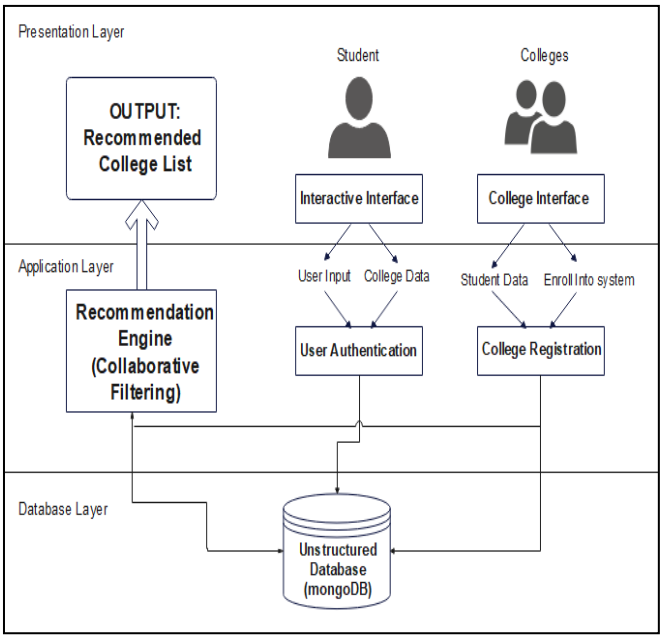

- **Data collection:** Collect college data including details such as courses offered, placement records, etc. Store the data in a MongoDB database [3].

- **Data preprocessing:** Clean and preprocess the college data. This includes removing duplicates, handling missing values, and converting data into a suitable format for analysis.

- **Data storage:** Store the preprocessed college data in a MongoDB database for efficient retrieval.

- **User input:** Collect input from the user, including their preferred branch and merit score and region.

- **Data mining:** Use collaborative filtering techniques to analyze the college data and identify colleges that are similar to the user's preferences. Collaborative filtering involves analyzing the preferences and behavior of similar users to generate recommendations.

- **Recommendation generation:** Based on the analysis, generate a list of recommended colleges for the user based on their entered branch preference, merit score and preferred region.

- **Output:** Display the recommended colleges to the user on the system's user interface.

- **Feedback:** Collect feedback from users on the recommendations and use it to improve the recommendation algorithm.

Overall, the system flow involves collecting and preprocessing college data, user input, collaborative filtering, recommendation generation, and output generation, all powered by a MongoDB database.

II. LITERATURE SURVEY

A. College Recommendation System.

Selecting a college is a critical decision that necessitates extensive research and analysis. Students must consider various factors, such as campus facilities, faculty, extracurricular activities, infrastructure, and other criteria. They even scour college reviews to verify the accuracy of the information [1].

B. Design of Higher Education Information Recommendation System Based on Data Mining.

A personalized information recommendation service is being offered to college and university students, which aims to provide them with information tailored to their interests. As the education system advances and information technology develops, an increasing number of teaching resources are becoming available for college education. Consequently, college teaching management is becoming more rigorous [2].

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C.A Machine Learning based Recommender System for Improving Students Learning Experiences.
The paper presents a recommender system that utilizes various machine learning algorithms to predict appropriate actions based on course specifications, academic records, and assessments of course learning outcomes. The problem was formulated as a multi-label multi-class binary classification task, and several problem transformation and adaptive techniques, including one-vs.-all, binary relevance, label powerset, classifier chain, and ML-KNN adaptive classifier, were employed to handle the dataset. There is no plagiarism in this statement [3].

D. College Recommendation system for Admission.
Many students who achieve excellent grades may miss out on admission to their desired college or program due to insufficient information about the college or program. To address this issue, we suggest implementing a recommendation system for universities. This system would consider various factors such as the college's NAAC and NBA grades, campus placement records, and feedback from alumni students to make recommendations to prospective students. By utilizing this recommendation system, students will have access to more comprehensive information about colleges and programs, allowing them to make informed decisions about their education.[4]

III. SYSTEM MODULES

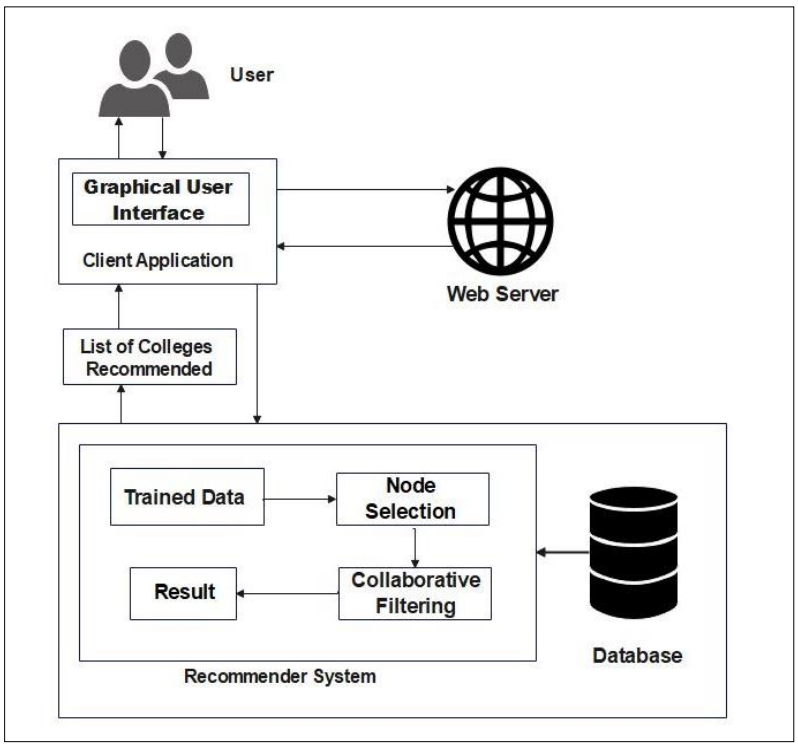

Fig -2: System Architecture

A college recommendation system with three modules - parent, student and college, can be designed using the following system architecture:

- **User Interface:** The user interface will be the front-end of the system, where users will interact with the system. It will be designed to be user-friendly and easy to use. Each module will have a separate user interface for the user to interact with [4].

1. Student Module: The student module will have the following components:

- **Input Module:** This module will allow students to enter their merit score, branch, and region preferences.
- **Recommendation Engine:** The recommendation engine will use machine learning algorithms to suggest colleges based on the student's inputs. The engine will also consider other factors such as the student's academic performance, extracurricular activities, and other criteria set by the college.
- **Output Module:** This module will display the recommended colleges to the student.

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2. College Module: The college module will have the following components:

- **Input Module:** This module will allow colleges to enter their admission criteria, course details, and other relevant information.
- **Data Management Module:** This module will store and manage the data entered by colleges.
- **Recommendation Engine:** The recommendation engine will use machine learning algorithms to suggest colleges to the students based on the colleges' admission criteria and course details.
- **Output Module**: This module will display the recommended colleges to the student.

3. Parent Module: The parent module will have the following components:

- **Input Module:** This module will allow parents to enter their child's details, such as name, age, and academic performance.
- **Recommendation Engine:** The recommendation engine will use machine learning algorithms to suggest colleges based on the student's inputs. The engine will also consider other factors such as the student's academic performance, extracurricular activities, and other criteria set by the college.
- **Output Module:** This module will display the recommended colleges to the parent.
- **Database:** The database will store all the data entered by students, parents, and colleges. It will be designed to handle large amounts of data and allow for quick and efficient data retrieval. We have utilized data from the Maharashtra Common Entrance Test (MHT-CET) cell for the past three years to generate recommendations for colleges based on merit scores for specific departments.
- **Security:** The system will be designed with security measures in place to protect the data entered by users. This will include authentication and authorization protocols to ensure that only authorized users can access the system.
- **Integration:** The system will be designed to integrate with other systems, such as payment gateways, to allow for a seamless user experience.

Overall, this system architecture will allow students, parents, and colleges to interact with the system and get personalized college recommendations based on their preferences and criteria.

IV. PROPOSED SYSTEM

The proposed system is a college recommendation system that utilizes data mining techniques to provide students with a list of recommended colleges based on their region, branch, and CET score. The system is developed using Node.js and JavaScript for server-side processing and Angular for client-side rendering. The system consists of three main components: data preprocessing, data mining, and recommendation generation. The data preprocessing component involves collecting and cleaning the data from various sources, including college information, student data, and CET score data.

The cleaned data is then stored in a database, which is accessed by the data mining component [2].The data mining component is responsible for analyzing the data using various data mining algorithms, such as decision trees, association rule mining, and clustering. The data mining algorithms are applied to the input data to identify patterns and relationships among the data. The output of the data mining component is a set of rules and patterns that are used to generate recommendations [5]. The recommendation generation component takes the output of the data mining component as input and generates a list of recommended colleges based on the user's input. The recommendations are generated using a combination of the data mining algorithms and user preferences. The system also provides the user with the option to filter and sort the recommendations based on various criteria. Overall, the proposed system provides an efficient and accurate solution for college recommendation based on the user's input. The use of data mining algorithms ensures that the recommendations are based on patterns and relationships among the data, rather than on arbitrary rules or preferences.

5.1 Algorithms

The system utilizes two popular machine learning algorithms, Naive Bayes and Collaborative Filtering, to effectively address the problem at hand. These algorithms have proven to be highly accurate in recommending the best college and minimizing the time required for students to search for colleges.

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A. Collaborative Filtering Algorithm:

1. Collect user behavior data (i.e., past interactions with colleges).
2. Create a user-college interaction matrix.
3. Apply matrix factorization to the interaction matrix to identify latent factors.
4. Use the identified factors to make college recommendations for new users.
5. Evaluate the performance of the recommendation system using metrics like RMSE or precision/recall.

B. Naive Bayes Algorithm:

1. Collect admission data for various colleges, including the merit score, region, and branch data.
2. Segmenting the data into training and testing sets.
3. Preprocess the data to remove any missing values or outliers.
4. Train a Naive Bayes classifier using the training data.
5. Use the trained classifier to predict the likelihood of admission to a college based on merit score and other factors for each test data point.
6. Evaluate the performance of the Naive Bayes classifier using metrics like accuracy or F1 score.

To compare the performance of collaborative filtering and Naive Bayes algorithms, we can use evaluation metrics such as accuracy, precision, recall, and F1-score.

Compare the performance of these two algorithms using a confusion matrix:

Table 1: Confusion Matrix

Parameters	**Actual Positive**	**Actual Negative**
Predicted Positive	**True Positive**	**False Positive**
Predicted Negative	**False Negative**	**True Negative**

True Positive (TP): The number of instances that are actually positive and are correctly predicted as positive by the model.

False Positive (FP): The number of instances that are actually negative but are incorrectly predicted as positive by the model.

False Negative (FN): The number of instances that are actually positive but are incorrectly predicted as negative by the model.

True Negative (TN): The number of instances that are actually negative and are correctly predicted as negative by the model.

You can use these values to calculate the following evaluation metrics:

- **Accuracy:** It is the proportion of correctly classified data points.
  (TP + TN) / (TP + TN + FP + FN) ….. (1)

- **Precision:** It is the proportion of correctly predicted positives.
  TP / (TP + FP) ….. (2)
- **Recall:** It is the proportion of actual positives correctly identified.
  TP / (TP + FN) ….(3)
- **F1-score:** It is defined as the harmonic mean of precision and recall, and can be calculated using the following formula:
  2 * (precision * recall) / (precision + recall) ….. (4)

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V. RESULT ANALYSIS

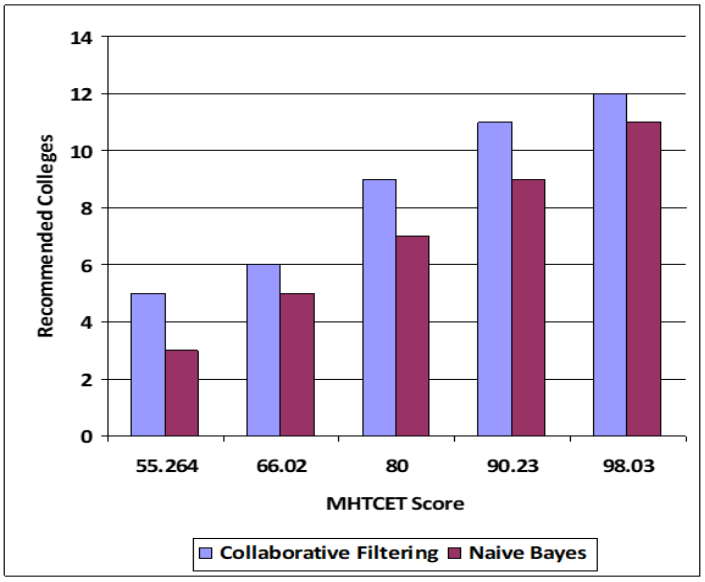
Once we have calculated these metrics for both algorithms, we can create a graph to compare their performance.

Table 2: Performance Measurement

Sr. No	MHTCET Score	Collaborative Filtering	Naive Bayes
1.	55.264	5	3
2.	66.02	6	5
3.	80.0	9	7
4.	90.23	11	9
5.	98.03	12	11

Table 3: Accuracy

	Collaborative Filtering	Naive Bayes
Accuracy	**0.92**	**0.85**



VI. CONCLUSION

Using this college recommendation system student can get easy to choose desired college and branch. Student can choose college as per his requirements. Such as he can choose college on the basis of Marks, Branch, category etc.

This system also helps Parents to choose college on the basis of college Fee structure, college Location etc. This system Provide the information of college to the student so they can easily choose the best college.

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