RankRoute – Smart Pathway to Engineering College

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ABSTRACT

The increasing competition for engineering admissions in Telangana has made it challenging for students to select suitable colleges based on their rank, category, and preferences. The traditional counselling process often requires manual analysis of previous cutoff trends, which can be time-consuming and confusing. To address this issue, this project titled **"RankRouter: Smart Pathway to Engineering College"** proposes an intelligent recommendation system that assists students in making informed decisions during the TSEAMCET counselling process.

The system takes essential inputs such as student details, including name, gender, category, TSEAMCET rank, and preferred branches. It validates the input data and processes it using a structured recommendation module. The system retrieves college-related information such as available branches, previous year cutoff ranks, and fee structure from a centralized database maintained by the admin module.

Using this data, the system performs eligibility checking by comparing the student's rank with cutoff ranks for different colleges and categories. A priority score is then calculated based on factors such as rank difference, branch preference, and cutoff margins. Based on this score, colleges are categorized into safe, moderate, and risky options.

The system filters and sorts the eligible colleges to generate a ranked list of recommendations. The final output provides detailed information including college name, branch, cutoff rank, fee structure, and risk level, enabling students to make better choices. Additionally, an admin module is included to manage and update college data, ensuring that the system remains accurate and up-to-date. Overall, the proposed system simplifies the college selection process, reduces decision-making complexity, and improves the efficiency and accuracy of engineering admission guidance.

Keywords:

RankRouter, Engineering College Recommendation System, TSEAMCET Counselling, Smart Admission Guidance, College Selection System, Rank-Based Filtering, Cutoff Analysis, Personalized Recommendations, Decision Support System, Student Preference Analysis, Eligibility Checking, Priority Scoring, Risk Classification (Safe/Moderate/Risky), Web-Based Application, Data-Driven Decision Making, Admission Prediction, Educational Data Mining, Career Guidance System

1. Introduction

RankRoute – Smart Pathway to Engineering College

In today's highly competitive admission environment, engineering aspirants often face significant challenges in selecting the most suitable colleges based on their TSEAMCET rank. The process of choosing the right college is not only crucial for a student's academic journey but also plays a major role in shaping their future career. However, most students rely on manual methods such as browsing multiple websites, referring to previous years' cutoff lists, checking fee structures, and comparing college details from various sources. This approach is time-consuming, confusing, and prone to errors, often resulting in improper decision-making and missed opportunities.

To overcome these challenges, the **RankRoute – Smart Pathway to Engineering College** system is proposed as an intelligent web-based solution designed to simplify and optimize the college selection process. The application automatically generates a personalized and priority-based list of engineering colleges by considering key student inputs such as rank, category, gender, and branch preferences. In addition to recommending colleges, the system also provides essential details like fee structures, enabling students to make informed, accurate, and confident decisions during the counselling process. By transforming a complex manual process into a structured and automated system, RankRoute enhances efficiency, reduces confusion, and improves overall decision quality.

Existing System

In the current system, students depend heavily on manual research to identify suitable engineering colleges. They explore multiple sources such as official counselling websites, private portals, brochures, and cutoff data, which makes the process tedious and time-consuming. College selection is largely based on individual understanding and interpretation of scattered information, which often leads to confusion and inconsistency. Although some online tools are available, they typically

provide only a list of eligible colleges without arranging them in any meaningful priority order. As a result, students are still required to manually prepare their counselling preference lists, which increases the chances of mistakes.

Another major limitation of the existing system is the lack of centralized information regarding fee structures. Students must gather fee details from different platforms, which may not always be accurate or up to date. Moreover, there is no comprehensive system that simultaneously considers multiple important factors such as rank, category, gender, and branch preferences while generating recommendations. Due to the absence of structured guidance and intelligent analysis, students are more likely to make poor decisions, ultimately affecting their academic and career prospects.

Functional Requirements

The RankRoute system is designed with multiple functional modules to ensure efficient operation and user interaction. The **User/Student Module** allows students to enter their personal and academic details, including name, gender, category, and rank. Students can also select their preferred engineering branches and submit the input to the system. Based on this information, they can view a list of recommended colleges and compare them based on fee structures and other relevant parameters. This module serves as the primary interface between the user and the system, interacting directly with the recommendation engine.

The **Recommendation Module** acts as the core logic unit of the system and is responsible for processing user inputs and generating results. It first validates the entered student details and retrieves relevant college and cutoff data from the database. The module then compares the student's rank with previous cutoff ranks to determine eligibility. Based on this comparison, it calculates a priority score for each college and filters out suitable options. Additionally, it assigns a risk indicator—such as Safe, Moderate, or Risky—to help students understand their chances of admission. The module also retrieves fee structure details and generates a final priority-wise list of colleges. This module plays a central role by receiving input from the student, interacting with the admin-maintained database, and returning structured recommendations.

The **Admin Module** is responsible for managing and maintaining the system database. It allows administrators to add new college details, update cutoff ranks, modify fee structures, and delete outdated records. By ensuring that all information remains accurate and up to date, the admin module supports the proper functioning of the recommendation system and enhances the reliability of the results provided to students.

Computational Resources

The implementation of the RankRoute system requires both hardware and software resources to ensure smooth operation. From a hardware perspective, the system can run efficiently on a standard computer with an Intel i3 processor or higher, along with a minimum of 4 to 8 GB of RAM. A storage capacity of at least 20 GB is required, and the system should support a 64-bit architecture. The application can be accessed using a desktop or laptop, making it convenient for users.

On the software side, the system is developed using modern web technologies. The frontend is built using HTML, CSS, and JavaScript to provide an interactive and user-friendly interface. The backend is implemented using Python with the Flask framework, which handles server-side processing and application logic. The database used for storing college details, cutoff ranks, and user data can be either SQLite or MySQL, depending on the scalability requirements. The application is compatible with web browsers such as Google Chrome and Mozilla Firefox, ensuring accessibility across different platforms. Development and testing are carried out using tools like Visual Studio Code or PyCharm, and the system is deployed using a local Flask development server.

Overall, RankRoute combines intelligent processing with a simple interface and efficient resource utilization, making it a practical and effective solution for engineering college selection.

Explanation of Block Diagram

The block diagram represents the overall architecture and working flow of the **RankRoute – Smart Pathway to Engineering College** system. It mainly consists of four major components: the **User**, **Admin**, **Recommendation Engine**, and the **Database**, which interact with each other to provide accurate and personalized college recommendations.

The **User module** is the entry point of the system where students interact with the application. Users are required to enter their details such as rank, category, gender, and branch preferences. After submitting these inputs, the system processes the data and allows users to view results and check the priority of recommended colleges. This module ensures a simple and user-friendly interface for students to access personalized recommendations.

The **Admin module** is responsible for maintaining and managing all the data required by the system. The admin can add new colleges, update cutoff ranks, manage existing data, and maintain records. This ensures that the system always works with accurate and up-to-date information. The admin module plays a crucial role in keeping the database reliable and relevant for recommendation generation.

The **Recommendation Engine** is the core component of the system where all processing takes place. It receives input data from the user module and performs several operations such as input validation, data retrieval from the database, eligibility checking based on rank and category, and priority assignment. After analyzing all parameters, it generates a list of recommended colleges categorized based on priority or risk level. This module acts as the brain of the system by applying logic and algorithms to produce meaningful results.

The **Database** stores all essential information required for the system to function effectively. It includes college data, cutoff records, branch details, fee information, and updated records maintained by the admin. The recommendation engine retrieves data from this database to perform analysis and also updates it when necessary. The database ensures data consistency, storage, and quick access during processing.

Overall, the block diagram illustrates how the system integrates user input, administrative control, intelligent processing, and data storage to generate accurate and structured college recommendations. This interaction between modules ensures that the system is efficient, reliable, and capable of assisting students in making informed decisions during the counselling process.

ARCHITECTURE

SOFTWARE ARCHITECTURE
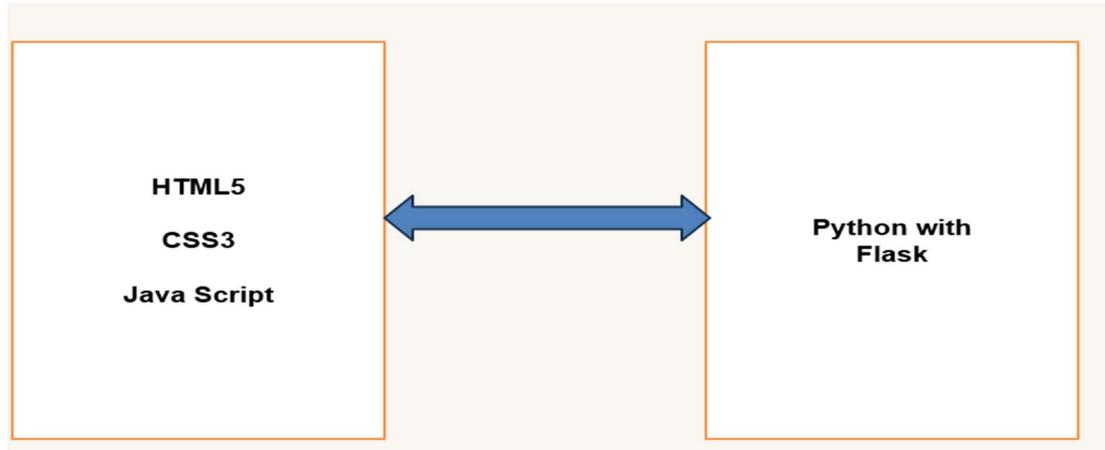
Figure 1
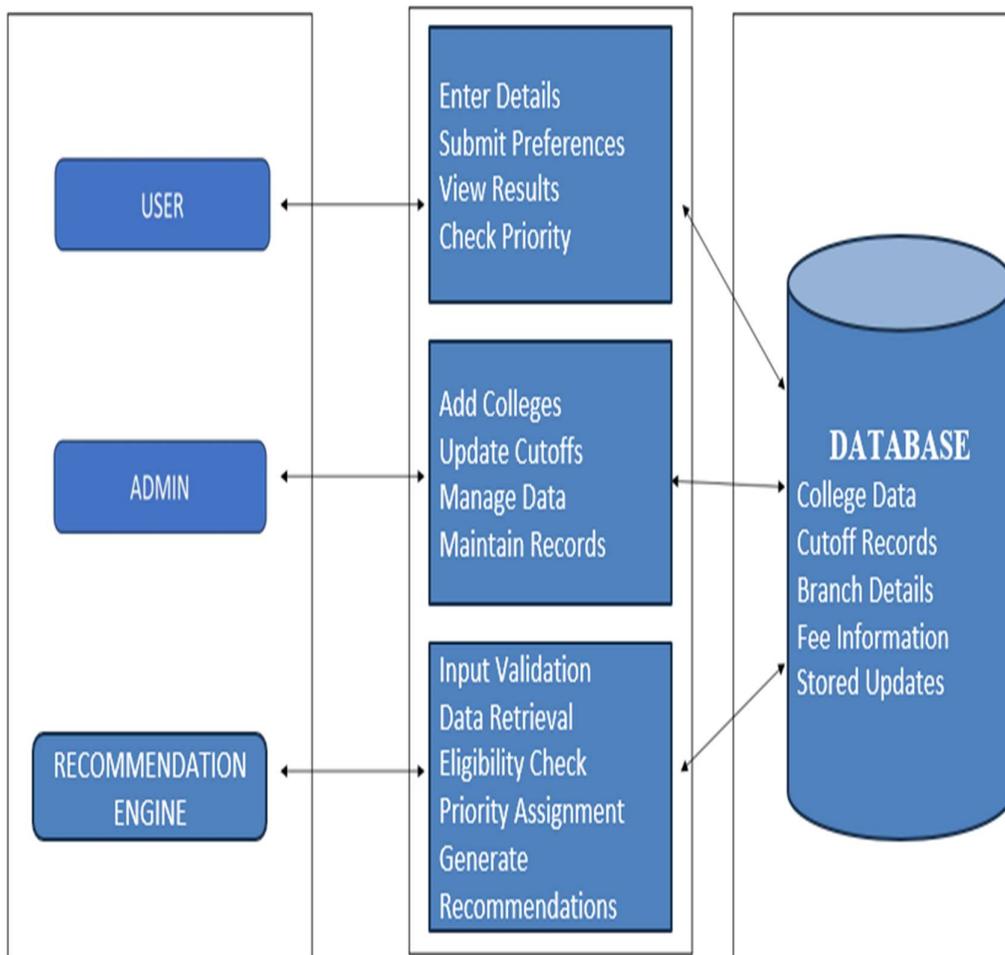
TECHNICAL ARCHITECTURE

Figure 2

Testing

Overview

The RankRoute system was tested at multiple levels to ensure that it delivers accurate, reliable, and user-friendly college recommendations based on the inputs provided by students. Testing plays a crucial role in verifying that the system performs all intended functions correctly and handles different user scenarios effectively. The testing process focused on validating several important aspects of the application, including the correct filtering of colleges based on parameters such as rank, category, gender, and region. It also ensured the accuracy of the sorting mechanism used to display colleges in a meaningful priority order, helping students make better decisions during counselling.

In addition, the system was tested for proper handling of user inputs, including edge cases such as extreme rank values, missing fields, or invalid data entries. The functionality and responsiveness of the web interface were also evaluated to ensure that users can interact with the system smoothly across different devices and browsers. Another key aspect of testing involved verifying the correct retrieval of data from the dataset, ensuring that college details, cutoff ranks, and fee structures are accurately displayed. Through these comprehensive tests, the system was validated to generate appropriate recommendations and present them clearly to the user, thereby improving reliability and user confidence.

Test Objectives

The primary objective of testing the RankRoute system was to ensure that all components function correctly and meet the intended requirements. One of the key goals was to verify the accurate processing of user inputs, ensuring that the system correctly interprets details such as rank, category, gender, and branch preferences. Another important objective was to validate the filtering logic used to determine eligible colleges based on predefined criteria, ensuring that only relevant options are presented to the user.

Testing also focused on verifying the correctness of the sorting mechanism, which arranges colleges based on rank suitability and priority, allowing students to easily understand their best options. Additionally, the system was tested for its ability to handle invalid or incomplete inputs gracefully, ensuring that appropriate error messages or prompts are displayed without causing system failure. Finally, ensuring the accurate and clear display of results in the user interface was a major objective, as it directly impacts user experience and decision-making. Overall, these testing objectives ensured that the RankRoute system is robust, reliable, and capable of assisting students effectively in their college selection process.

TEST CASES

Test Case ID	Description	Input	Expected Result	Status
TC-01	Check valid input	Correct user data	Input accepted	Pass

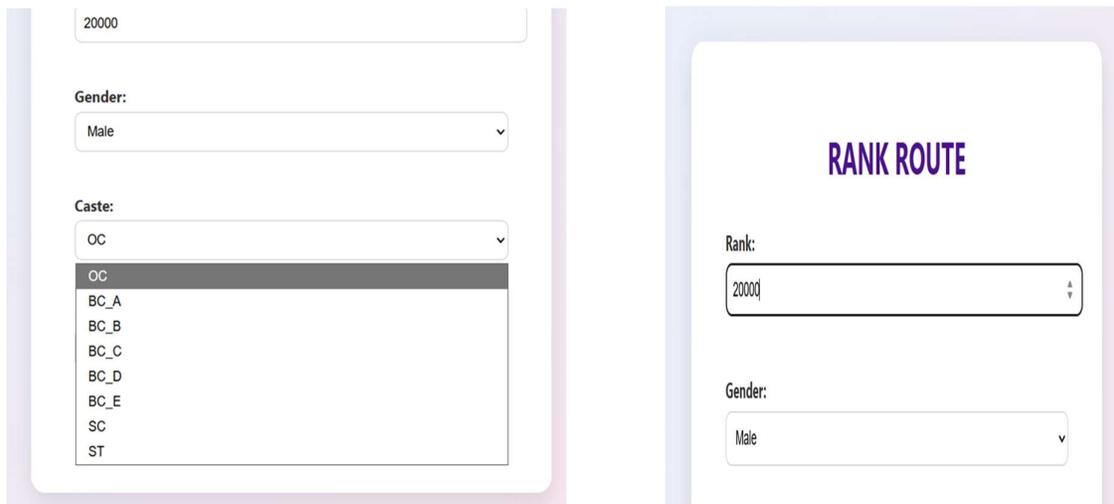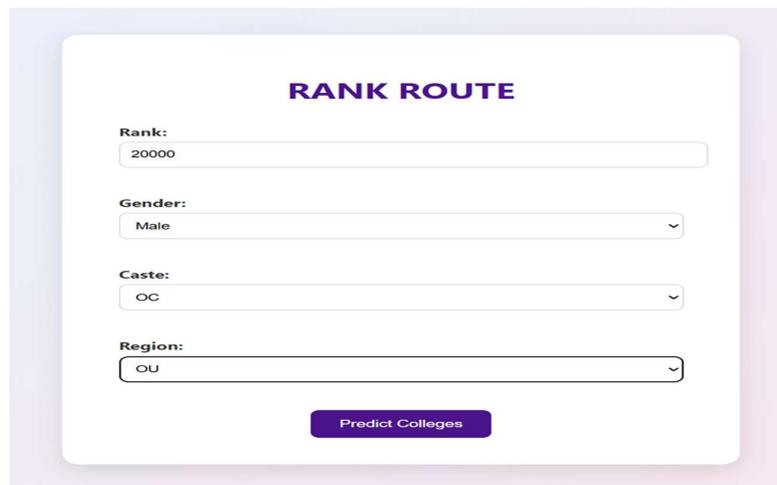| TC-02	Check invalid input	Empty/incorrect data	Error message displayed	Pass
TC-03	Data processing check	Valid dataset	Data processed correctly	Pass
TC-04	Result generation	User inputs	Accurate output generated	Pass
TC-05	Output display	Processed data	Results shown properly	Pass

SCREENSHOTS

Figure 7

Conclusion

The Rank Route system was successfully designed and implemented to assist students in making informed academic decisions based on their performance and preferences. The project effectively accepts user input, processes the data accurately, and provides reliable predictions and recommendations.

Through proper testing, all core functionalities of the system were verified and found to be working as expected. The system demonstrates good accuracy, efficiency, and usability, making it a useful tool for students during the decision-making process.

Future Scope

The Rank Route system has great potential for future enhancements in terms of accuracy, usability, and real-world application. The system can be improved by integrating real-time admission data and updated cut-off ranks to provide more precise predictions. The use of advanced machine learning algorithms can further enhance the accuracy and intelligence of recommendations. In addition, the system can be upgraded to offer personalized suggestions based on students' interests, skills, and career goals. Developing a mobile application and improving the user interface will make the system more accessible and user-friendly. Expanding the database to include more colleges, courses, and historical data can increase its effectiveness. Furthermore, adding multi-language support and integrating career guidance features such as job trends and future opportunities can make the system more comprehensive and beneficial for a wider range of users.

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