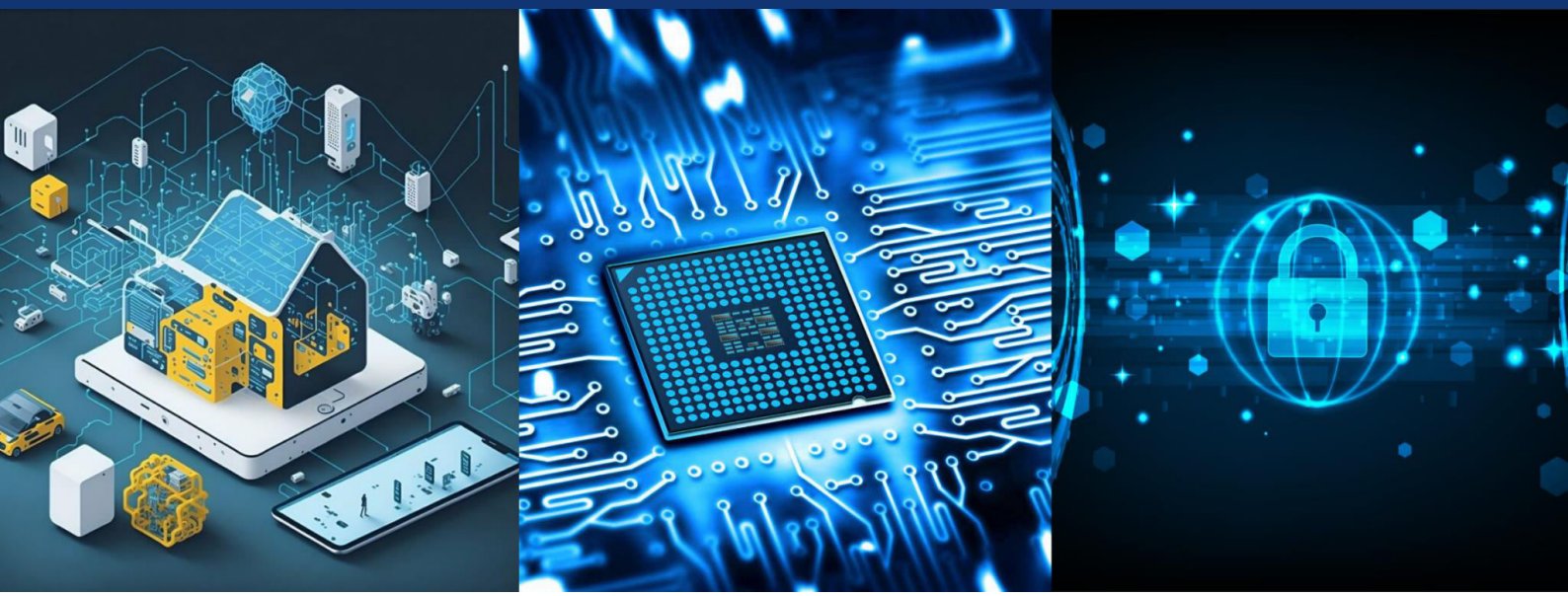
IJIRCCE

ISSN(O): 2320-9801

ISSN(P): 2320-9798



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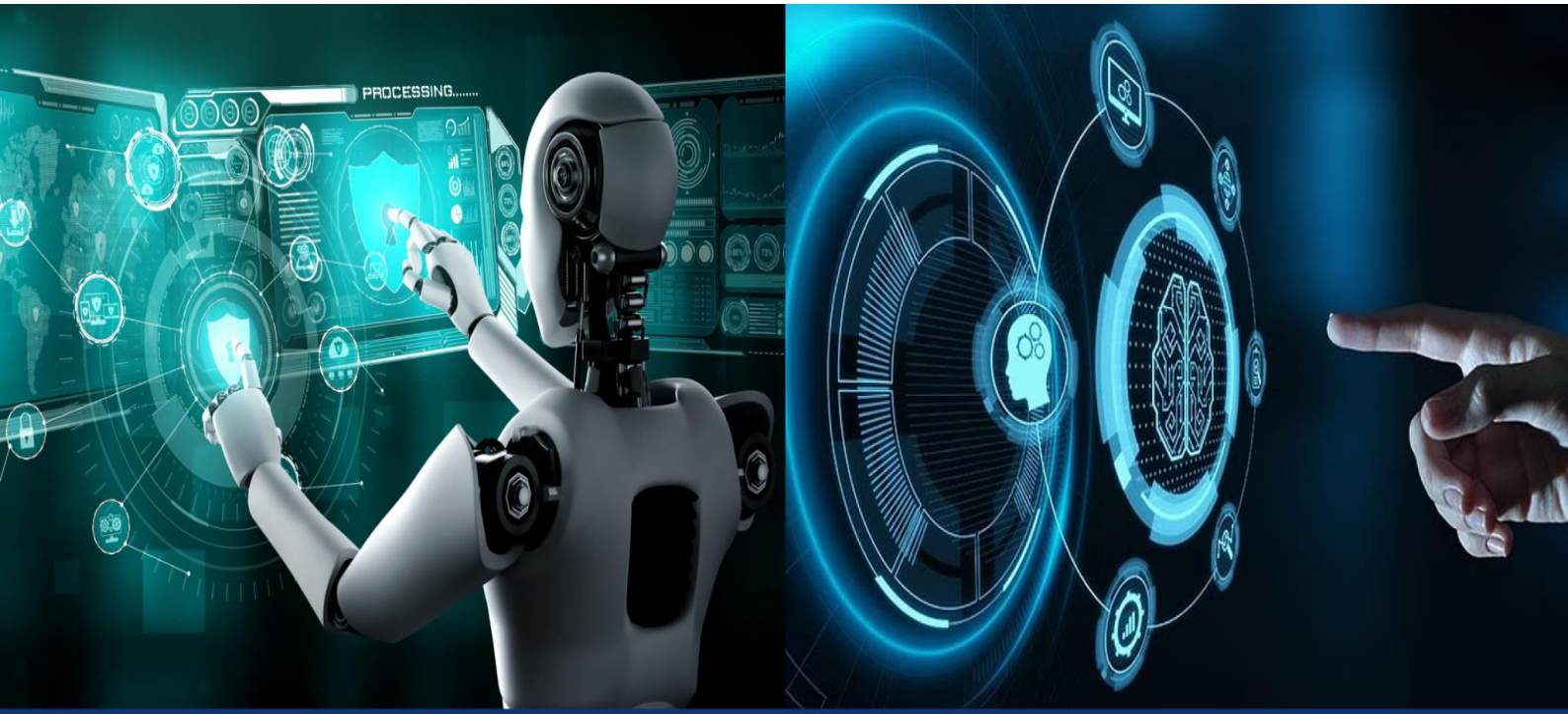

Impact Factor: 8.625

Volume 13, Issue 1, January 2025

© 2025 IJIRCCE | Volume 13, Issue 1, January 2025| DOI: 10.15680/IJIRCCE.2025.1301042

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Elective Recommendation System: A Personalised Approach to Academic Decision-Making using AI

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ABSTRACT: This project presents an "Elective Course Recommendation System" designed to guide students in selecting the most suitable electives based on their academic performance and interests. The system utilizes advanced artificial intelligence through the integration of OpenAI's GPT API, which enables it to provide intelligent and personalized recommendations. A solid backend is developed using Flask which serves as the core of the system, facilitating seamless communication between the user interface and the AI engine.

The foundation of the system lies in a well-structured database that stores detailed academic records of students, including performance metrics across various subjects. These records are analysed to understand the unique strengths and preferences of each student. By combining this analysis with information about available elective courses, the system ensures that recommendations are according to the individual needs of the students.

This approach not only simplifies the decision-making process but also promotes informed choices, empowering students to align their elective selection with their academic and career goals. The Elective Course Recommendation System serves as a valuable tool in academic counselling, showcasing the potential of AI to enhance educational experiences.

I. INTRODUCTION

In our educational institute students often face challenges in selecting the right electives that align with their interest, strength and career aspiration. With numerous elective options available choosing the right course can be overwhelming. This issue is also due to lack of guidance leading to decisions that may not maximize the student's academic performance or increase their CGPA. The main objective of this projective is to develop an Elective Recommendation System that provides the students personalized elective suggestion based on their previous academic performance and available elective options. The system uses machine learning and natural language processing techniques, including OpenAI's GPT-4, to offer recommendations.

II. LITERATURE REVIEW

In 'Personalized Course Recommendation Based on Academic Performance' paper presents a course recommendation system that selects courses for students based on past academic performance, by using collaborative filtering and machine learning techniques which ensures recommended courses are in line with a student's strengths and objectives. This concept is very much related to the Elective Recommendation System, which uses AI to make recommendations tailored to the user, thereby making course selection more personalized and effective.

In 'Embedding AI in Academic Advising to Enhance Student Choice of Courses' paper presents how artificial intelligence, specifically NLP, may improve course selection by understanding and analyzing both structured and unstructured data. The system they designed adapts to the individual needs of students and gives accurate and meaningful recommendations. Likewise, the Elective Recommendation System uses GPT-4 in analyzing student data to give them electives that fit best their performance and aspirations.

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In 'AI-Based Systems for Enhancing Decision Support in Education' This research focuses on how AI decision support systems change education by giving personalized guidance to students. The paper further discusses the significance of developing transparent and trustable AI systems. Building on these concepts, the Elective Recommendation System uses GPT-4 to provide smart elective recommendations while ensuring the recommendations are understandable and clear for students.

III. WORK FLOW OF DESIGN SYSTEM

Elective Recommendation System is a web application that could be used for making the process of elective selection smooth for the students. The backend framework used in the development of this model is Flask. Where in the Flask API processing student information interacts with the GPT-4 model electives recommendations are going to be produced. Meanwhile, the friendly interference is carried out by implementing the Front-end based on HTML, CSS and JAVASCRIPT and through easy and responsive CSS design, engagement with the users will be achieved.

Proposed Methodology

Preprocessing of the dataset- The dataset 'student_data.csv' included student's ID (roll numbers) along with their performance gained from past semester's courses with CGPA. Data preprocessing includes finding missing and inconsistent data. All numeric data is normalized and marks are transformed into a form which would be best suited for analysis.

Backend Development- Framework used is "Flask" because it is light and flexible by nature. An API endpoint /API/recommend was created to process requests from frontend, process the input and return recommendation. The CORS – Cross Origin Resource Sharing- is enabled to communicate between the frontend and the backend.

OpenAI GPT-4 Integration:

This assignment was done so that the recommendations made for electives could be altered to the needs of the students with the use of student performance metrics. The Open AI was safely integrated with the GPT- 4 model where it is given details of the student academic background and what electives one is provided them with.

Design a prompt- The student with the student id: {student_id} has marks in the following: {student_marks}. The student may opt for any of the electives available: {electives}. Based on the result brought out by the performance of the student, suggest an appropriate elective for the student that the student may benefit from.

This Formatted approach made it clear to the model of what was required that resulted in useful output.

Recommendation Flow:

Front end makes a Post request to API with Student Id (A unique ID of the student) and a list of electives available for the student. Backend fetches the marks of the student from the database and it processes the marks and options of electives and sends it to GPT-4 API with a request to suggest. After the processing is done, the suggested recommendation is returned back to the API and then forwarded to the frontend as a response in JSON format.

Testing and validation:

The system is tested on various student details to ensure accurate recommendations.

IV. SYSTEM DESIGN AND IMPLEMENTATION

Data Management and Structure of the Dataset:

Structure in Dataset: The student_data.csv file consists of: student id: Roll number of each student.
Subject columns: Marks for different subjects, input to recommendations.
Data Loading: Reading and processing the CSV file by the Pandas library.

System Structure:

Backend Framework: the usage of Flask makes it extremely simple, and for that we are using it here, it is perfect at handling any kind of API requests and responses.
Data Storage: the csv file of the dataset (student_data.csv) stores the record of the student's academics.

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Recommendation Logic: Using the GPT API from OpenAI, smart recommendations are generated based on the performance of students and available elective courses.

API Design:
Method: POST
JSON response in the form of the suggested elective. It searches for missing or invalid data within the API request. It returns adequate error messages for the error such as missing inputs and student IDs that are not found.

OpenAI GPT Integration:
Prompt Engineering: A formatted prompt is designed to query the GPT API. This includes:
Student ID, Academic performance (marks in various subjects), number of elective options available.
API Interaction: The openai.ChatCompletion.create() method invokes the OpenAI GPT API.
Handling of Response: The response from GPT is parsed and returned as the elective needed

Workflow of Implementation:
Set up Flask app with enabling CORS to accept cross-origin requests. Then Load in CSV dataset as Pandas Data-Frame during the app setup. This serves the user request through the endpoint /api/recommend. GPT Integration: Handles input request processing including call to GPT API for retrieval of recommendation; then outputs the recommendation. Then the result is returned in structured JSON.

Security:
For security it makes use of os. getenv for environment variables which are responsible for managing OpenAI API key. Then the inputs are validated pretty well to avoid misuse and error.
CORS: Only the registered domain can interact with the backend.

Unit Testing:
Test each module for data retrieval, request validation, and invoking of GPT API.
Testing Integration: Here the end-to-end process of a system should be tested wherein the dataset and the flask application should integrate flawlessly with the GPT API.
Performance Testing: Someone should measure the time responses associated with API calls and process those GPT recommendations.
Error Conditions: Missing or invalid input, Invalid student id, GPT API fail.

Deployment:
Hosting: The application can be hosted on AWS, Heroku or even on local server.
Production Configurations: Debug mode should be disabled.
API key, environment settings: should be kept private in the configured file.

V. DETAILED WORKFLOW

User Interaction (Frontend Interface) - The Students will access the system via a web interface (index.html). Then, they should input their Student ID, and a list of elective options in the form. Upon clicking the "Submit" button, a POST request must be sent to the backend API (/api/recommend) with the entered data. In the Backend API, the request is handled where the Flask application (app.py) is used to handle incoming POST requests at the /api/recommend endpoint. The (API) extracts the student_id and elective_options from the JSON payload sent by the frontend. For backend, a CSV file should be used, loaded with student information, including their academic performance in different subjects and electives. The student_id is used to fetch the corresponding student's record. If the student_id is not found in the dataset, an error is returned to the frontend. Elective - Specific Data Preparation - The student's outcome in key elective-attached subjects (e.g., Cloud Computing, Data Analysis, etc.) is taken out of the database in the form of a dictionary. It is checked that the list of electives that is entered by the student is compatible with the dataset. GPT-4 API Integration - A prompt is formed for GPT-4 [in the form of] a planned message, including Student Name, Student ID, and List of available electives. The made-up Frontend Response Display - The backend passes recommendation (or error message) to the frontend in the form of JSON response and the frontend shows this data. It happens, that the system updates the database with the details entered that is the student ID, and the elective choices are given, system

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embeds the recommended elective subject and the reason why the student has to choose that one.

VI. RESULTS AND OUTCOMES

The model used GPT-4 to make recommendation based on each student's academic performance in your previous courses like their student marks and their elective choices. Thus, every student gets customized recommendation when they enter their Roll number and the elective options.

Since the model recommends the elective with suited explanation on why the student needs to select the recommended elective subject which is entirely based on the previous academic performance and acquired marks. Hence a simplified decision-making process. The model takes the details from student performance dataset and uses that to feed into GPT-4 so that recommendations are data-driven. This perfectly fits into working with structured data with AI even when the data is sparse or incomplete. The Flask application used in the model to create an interface where the students can enter their roll number and elective course options to receive the recommendation making it easier for the students to interact with the application. The model's design using the Flask application ensures that the model can handle multiple users and datasets without much modifications making it scalable and efficient for the users.

VII. CONCLUSION

The recommendation system shows an effective application of both Machine Learning and Natural Language processing techniques in guiding students towards more informed academic choices. The OpenAI GPT model is utilized, and individual's performance data from a particular student is fed into the system to make personal recommendations for electives. This approach not only simplifies the decision-making process for students but also showcases the potential of AI in enhancing educational systems. The use of Flask-based API ensures seamless interaction between the recommendation engine and the user interface, making the system scalable and user-friendly. Future improvements could be involved in developing the functionality of the system to accommodate more than one language that can broaden the reach to various educational institute across different places and make it more accessible. In conclusion, this project highlights how AI can revolutionize education and set the stage for future innovation in academic counselling and support system.

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