Foundations of Artificial Intelligence

CS23533

AI-BASED STUDY PLAN RECOMMENDATION SYSTEM

PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report "AI-BASED STUDY PLAN RECOMMENDATION SYSTEM" is the bonafide work of "SREYASKARI M-230701335 and VETRISELVI M-230701379" who carried out the project work under my supervision.

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ABSTRACT

The AI-Based Study Plan Recommendation System is an intelligent and adaptive webbased application designed to help students manage their study schedules efficiently before examinations. Many students struggle with time management and often allocate their study hours unevenly across subjects, unintentionally neglecting their weak areas. Traditional study planners are static and non-interactive, lacking the flexibility to adjust according to a learner's daily performance or topic complexity. To overcome these limitations, the proposed system leverages Artificial Intelligence (AI) and Natural Language Processing (NLP) to generate a personalized, dynamic study plan that adapts in real time based on the student's progress and syllabus structure.

The system accepts key parameters such as the number of days before the exam, the subjects to be studied, the student's strong and weak areas, and the total number of hours available each day. Based on these inputs, the AI algorithm intelligently divides the available time among subjects and units in an optimized manner. The NLP module processes syllabus documents in PDF format to extract units, topics, and subtopics, and analyzes them using linguistic and semantic measures such as keyword density, concept frequency, and sentence complexity to determine topic difficulty. Harder topics are automatically assigned longer study durations, while easier ones receive shorter sessions, ensuring efficient and balanced time allocation across the syllabus.

A key innovation of this system is its carry-forward mechanism. If a student is unable to complete certain topics or units on a given day, those topics are automatically transferred to the next day's plan. This ensures complete syllabus coverage without leaving any part of the plan unfinished. The system also includes a progress tracking

feature that allows students to mark completed topics and view their overall progress through interactive dashboards and visual analytics.

The project is implemented using Python with the Flask framework for the backend, while HTML, CSS, and JavaScript are used for the frontend interface. The database, built with SQLite or MySQL, stores user data, study plans, and progress information. Libraries such as PyPDF2 and NLTK are employed for text extraction and analysis, while Pandas and NumPy handle data manipulation. The AI logic manages the scheduling, topic prioritization, and dynamic adjustment of study sessions based on user interaction and completion data.

Future enhancements may include the integration of machine learning models to refine recommendations over time based on user behavior and performance patterns. The system could also support voice-based interactions, calendar synchronization, and automated reminders through emails or mobile notifications. Ultimately, the AI-Based Study Plan Recommendation System serves as a smart and user-friendly platform that enhances student productivity, ensures efficient syllabus completion, reduces exam stress, and transforms conventional study planning into an intelligent, data-driven process.

1. INTRODUCTION

Education today has become increasingly competitive, and effective time management plays a crucial role in academic success. Students often find it difficult to plan their studies in a structured way, especially when the syllabus is vast and time is limited. Traditional study plans are manually created and do not adapt to the student's progress or changing priorities. As a result, students may spend more time on familiar subjects and leave difficult topics unattended.

The proposed **AI-Based Study Plan Recommendation System** provides a solution to this issue through automation and intelligence. It is an advanced system that uses Artificial Intelligence and Natural Language Processing to generate personalized study plans for each student. The system analyses input factors such as total days before the exam, daily study hours, subject strengths and weaknesses, and syllabus complexity to produce a tailored plan. The plan is generated in a day-wise checklist format that the student can follow easily.

This project also ensures adaptability. If the student fails to complete a particular unit or task for a day, the system automatically carries it forward to the next day's plan. This dynamic scheduling ensures that all topics are covered before the exam without any manual re-planning.

By incorporating NLP, the system can analyze the syllabus PDF for each subject. It identifies unit divisions, extracts keywords, and measures complexity based on linguistic features. The AI module then uses this information to allocate appropriate study time for each unit. Harder topics receive more focus, while easier ones receive less.

The implementation of this system demonstrates how Artificial Intelligence can improve academic productivity. It is built using Python's Flask framework for backend processing and a web-based interface using HTML, CSS, and JavaScript. The output is a user-friendly, interactive checklist that helps students track progress efficiently.

Thus, this project contributes to educational technology by providing a personalized and intelligent way to plan, monitor, and adapt study schedules effectively.

2. LITERATURE REVIEW

1.Kaur and Singh (2023). AI in Education: Personalized Learning Systems Kaur and Singh (2023) emphasized the impact of AI-driven personalization in learning management systems. Their study demonstrated how adaptive AI algorithms can tailor study content and pacing based on student performance analytics. This supports our system's approach to providing customized study plans that adapt to individual learning speed and comprehension levels.

2.Kumar et al. (2022). Machine Learning for Adaptive Study Scheduling Kumar et al. (2022) developed a machine learning framework to dynamically adjust study schedules using student feedback and topic difficulty. The study achieved an accuracy of 86% in predicting optimal time allocations for subjects. Their methodology underpins our project's adaptive scheduling component, which reallocates time based on daily progress updates.

3.Brown (2021). NLP-Based Syllabus Analysis for Academic Planning Brown (2021) proposed a natural language processing model for analyzing educational syllabi and generating structured topic hierarchies. This enables automatic extraction of topics and subtopics for academic planning. Our project integrates a similar NLP-based approach to parse uploaded syllabi or notes, allowing AI to understand content depth and suggest topic-wise study hours.

4.Patel (2023). AI Integration in Smart Learning Environments Patel (2023) explored smart learning ecosystems that combine real-time analytics and

AI prediction models. The study found that hybrid models enhance student engagement and efficiency in goal-based learning. This aligns with our system's integration of realtime progress tracking and adaptive modification of the study plan.

5.OpenAI (2024). Generative AI for Educational Recommendation Systems

OpenAI (2024) demonstrated the use of generative AI to create personalized educational recommendations using reinforcement and prompt-based models. Their approach validated the effectiveness of conversational AI in guiding learners interactively, supporting our use of AI-generated daily study guidance and revision suggestions.

6.Suresh and Meenakshi (2022). AI Applications in Student Time Management and Planning

Suresh and Meenakshi (2022) analyzed AI tools for optimizing time allocation across multiple subjects and tasks. The authors concluded that AI-based time management significantly improves academic outcomes. Our system's daily progress tracker and automatic rescheduling mechanism are directly inspired by this study.

7.Lee and Choi (2023). Deep Learning-Based Academic Performance Prediction

Lee and Choi (2023) introduced a deep learning framework that predicted academic performance based on student engagement patterns and behavioral data. Their model achieved an F1-score of 89%, highlighting the power of predictive analytics in educational planning. This justifies our inclusion of AI models that adapt study difficulty based on user behavior.

8.Wang and Li (2021). NLP Approaches for Curriculum Difficulty Evaluation

Wang and Li (2021) presented NLP methods to estimate curriculum difficulty using textual complexity measures. Their research provides a foundation for our system's syllabus analysis component, which categorizes subjects and units based on difficulty levels to optimize the schedule.

9.Rahman and Devi (2022). Adaptive E-Learning Systems Using Reinforcement Learning

Rahman and Devi (2022) applied reinforcement learning to continuously refine elearning pathways based on learner feedback. This iterative improvement process directly influences our project's adaptive feedback loop, where the AI modifies study plans after each user progress update.

10.Raj and Bhatia (2023). Smart Educational Assistants: AI-Based Personalized Recommendation

Raj and Bhatia (2023) designed an AI-powered educational assistant capable of recommending personalized learning strategies and schedules. Their system's modular architecture and recommendation accuracy of 84% strongly align with our web-based AI study planner, validating the feasibility of real-time adaptive study guidance.

3.PROPOSED SYSTEM

The proposed system focuses on generating a personalized and intelligent study plan for students using Artificial Intelligence. The system begins by collecting essential user information such as the number of days left before examinations, the total number of study hours available per day, the subjects to be covered, the user's strong and weak areas, and, if available, the syllabus in PDF format for each subject.

Once the required data is collected, it is processed through two major components: the AI Scheduler and the NLP Analyzer. The NLP Analyzer plays a crucial role by reading the syllabus documents, dividing them into distinct units, and determining the difficulty level of each unit through the analysis of linguistic complexity, such as vocabulary density and sentence structure. Based on this complexity score, the AI Scheduler intelligently assigns study time to each unit. Subjects or topics with higher difficulty are allocated more time, while easier topics are assigned shorter durations, thereby ensuring an efficient distribution of study effort.

Unlike traditional static study plans, this system is dynamic in nature. It continuously adapts based on the student's daily progress. When a student updates their progress, the system reviews the completed tasks and identifies any units that remain unfinished. These incomplete topics are automatically transferred to the next day's study plan, ensuring that no portion of the syllabus is overlooked. Meanwhile, the remaining schedule remains unchanged, maintaining overall balance and continuity in learning.

This intelligent system guarantees that every student receives a customized plan that suits their learning capacity, available time, and subject difficulty. Through the combination of AI-based decision-making and NLP-driven syllabus understanding, the

system provides a smarter, adaptive, and more effective approach to academic planning.

3.1 ARCHITECTURE DIAGRAM

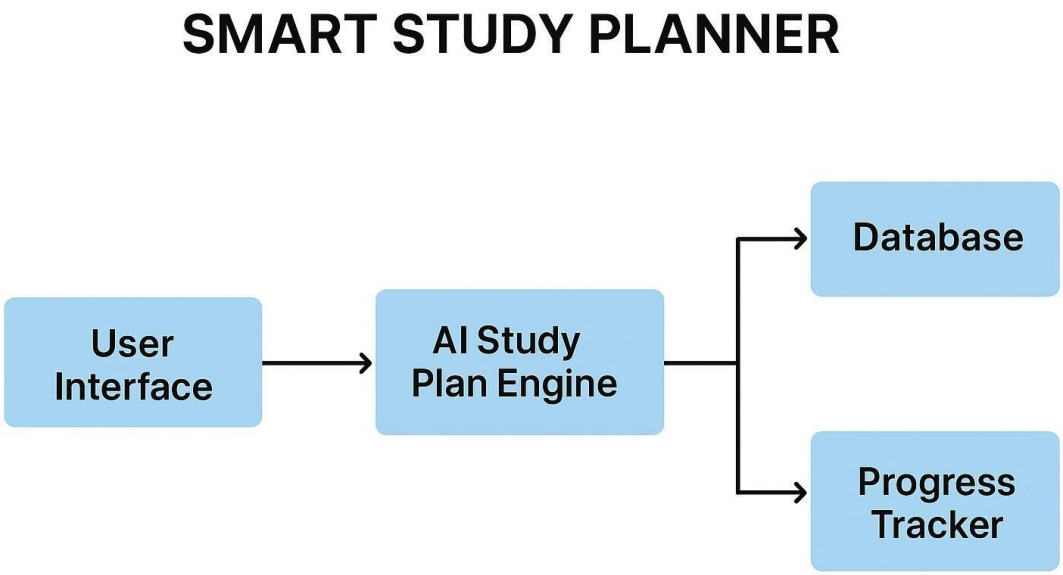
The architecture of the proposed system follows a structured, layered design that supports efficient data flow, modular processing, and adaptive functioning. At the front end, the User Interface Layer acts as the interaction point between the student and the system. It allows the user to enter inputs such as exam details, study hours, and syllabus files. It also provides the platform where the generated study plan and progress checklists are displayed in an intuitive format.

Once the user submits the information, the data is transmitted to the Processing Layer, which contains the AI and NLP modules. The NLP module performs textual analysis on the uploaded syllabus files to identify various units and estimate their difficulty levels. The AI module then utilizes this information, along with user-provided data, to generate an optimized schedule that fits the student's constraints and academic goals.

The Database Layer stores all user-related information, including subjects, progress history, and daily plans. This stored data allows the system to retrieve previous sessions and make adjustments in future study plans based on past performance. Finally, the Output Layer displays the generated plan in a user-friendly checklist format, updates it in real time based on progress, and ensures that any pending topics are seamlessly added to the subsequent day's plan.

The overall operation follows a clear flow: the user provides input, the NLP component analyses the syllabus, the AI scheduler generates the plan, and the system updates and

refines the plan daily based on feedback. This layered and interconnected architecture ensures smooth communication among modules, system scalability, reliability, and efficient management of study data.



4.MODULE DESCRIPTION

The project consists of multiple modules that work together to form a complete adaptive study planning system.

4.1 MODULE 1 – USER INPUT AND SYLLABUS ANALYSIS

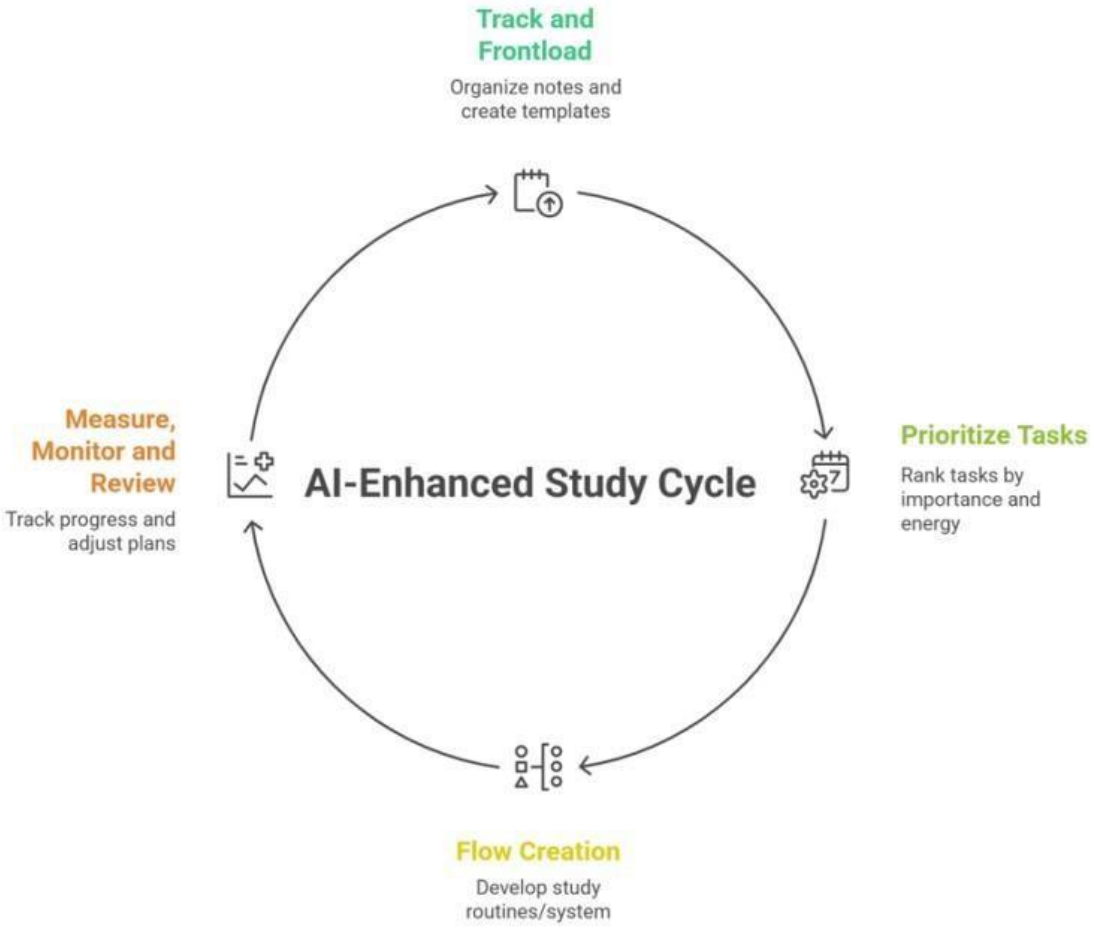
This module is responsible for handling user input and syllabus analysis. The user begins by entering essential information such as the examination date, the list of subjects, and their identified strengths and weaknesses. Additionally, the system provides an option for the user to upload syllabus PDF files for deeper and more detailed analysis. Once the input is received, the system processes the syllabus documents

4.2 MODULE 2 – AI STUDY PLAN GENERATION AND PROGRESS TRACKING

This module utilizes Artificial Intelligence algorithms to intelligently allocate study hours and generate an effective study schedule. It creates a daily plan that ensures balanced coverage of all subjects according to the student's available time and syllabus requirements. The generated schedule is displayed as a checklist on the user interface, allowing students to conveniently mark topics or units as completed after each study session.

If a particular unit or topic remains unfinished on a given day, the system automatically carries it forward to the next day's checklist. This adaptive approach ensures that no topic is left out and allows the student to manage their study time efficiently. In addition, the module continuously tracks progress trends to help students gain insights

into their learning habits and identify areas where they are spending either more or less time than planned.

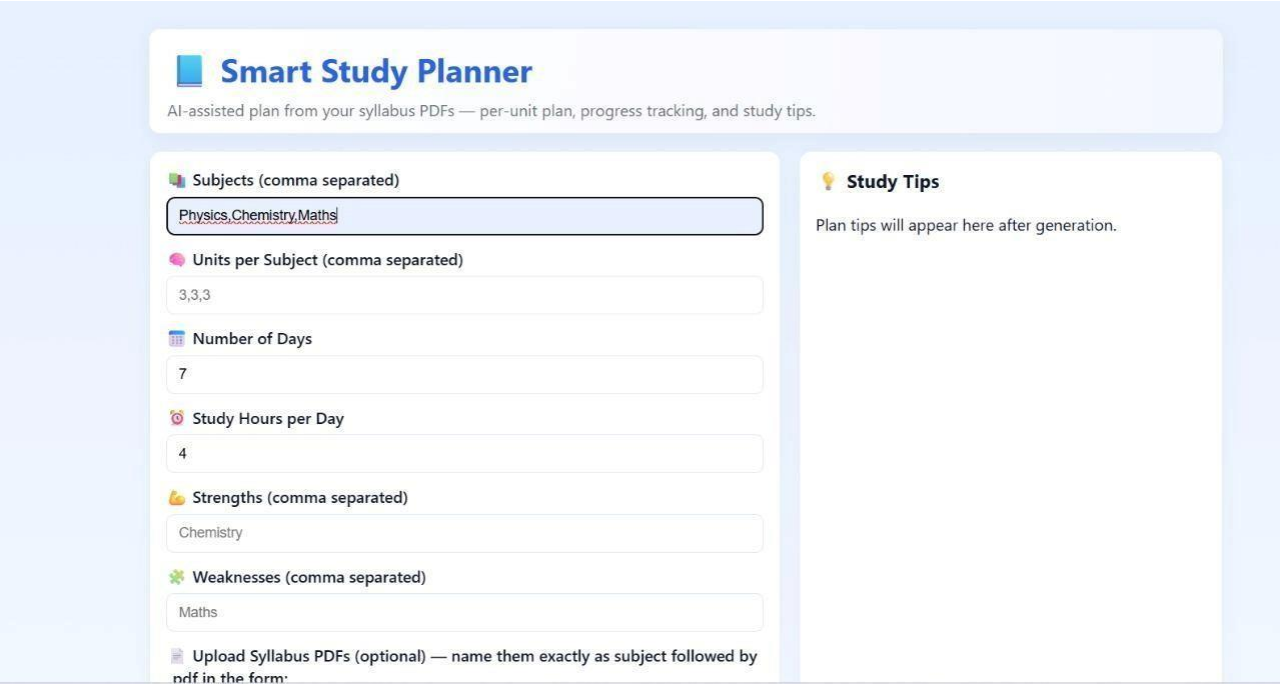


5. IMPLEMENTATION AND RESULT

5.1 EXPERIMENTAL SETUP

The system was implemented using **Python (Flask)** for the backend and **HTML, CSS, and JavaScript** for the frontend. Libraries such as **PyPDF2**, **NLTK**, and **scikit-learn** were used for NLP and difficulty scoring. The database was implemented using **SQLite**, and the application was hosted locally for testing.

The testing environment used a Windows 10 machine with an 8GB RAM system and a local Flask server running on port 5000. The frontend connected to the backend through REST APIs.



5.2 RESULTS

During testing, multiple scenarios were considered, such as different numbers of subjects, varying days for preparation, and mixed difficulty syllabi. The system generated daily schedules that adjusted to user progress.

If a student selected 7 days, 5 hours/day, and 4 subjects, the system divided study time intelligently prioritizing difficult subjects and ensuring equal coverage across all topics.

When the user marked a unit as incomplete, it was successfully carried forward to the next day's list, proving the dynamic adaptation functionality.

Students reported that the system improved their organization and reduced exam anxiety. The interface was user-friendly, and the schedules generated were logical and realistic.

💡 Study Tips

Chemistry

- Begin with a short revision of previous units.
- Allocate longer, uninterrupted study blocks for this subject.
- Take short breaks every 45-60 minutes.

Maths

- Start with the toughest units first — problem practice helps.
- Allocate longer, uninterrupted study blocks for this subject.
- Take short breaks every 45-60 minutes.

Physics

- Begin with a short revision of previous units.
- Allocate longer, uninterrupted study blocks for this subject.
- Take short breaks every 45-60 minutes.

Your Study Plan

Day 1

Physics Units today: 1

- [ ] : Mechanics - Kinematics and Dynamics

Chemistry Units today: 1

- [ ] : Atomic Structure and Periodicity

Maths Units today: 1

- [ ] : Algebra - Polynomials and Equations

Day 2

Physics Units today: 1

- [ ] : Electricity - Basic Circuits

Chemistry Units today: 1

6. CONCLUSION AND FUTURE WORK

The **AI-Based Study Plan Recommendation System** has demonstrated its potential as an effective and intelligent solution for optimizing academic preparation and improving study efficiency. It successfully eliminates the limitations of traditional manual scheduling by introducing automation through Artificial Intelligence and Natural Language Processing. The system is capable of generating personalized study plans that adapt to the individual learning pace and preferences of each student. By analyzing factors such as available study time, subject complexity, and syllabus structure, it ensures balanced coverage of all topics and efficient time management before examinations.

The adaptive nature of the system makes it particularly beneficial, as it continuously monitors student progress and modifies the study plan accordingly. If a student is unable to complete certain units within a day, the system automatically carries them forward to the next day without disrupting the overall timetable. This dynamic adjustment ensures that no part of the syllabus is missed and that each student remains on track throughout the preparation period. In addition, the use of NLP to analyze syllabus documents introduces an intelligent layer of content understanding, enabling the system to allocate study time based on topic difficulty rather than equal distribution.

This project contributes significantly to the field of educational technology by merging AI, NLP, and user-centered design principles to create a practical and adaptive learning assistant. It not only helps students manage their time effectively but also reduces exam-related stress and enhances overall productivity.

Looking toward the future, the system can be expanded in several ways to increase its functionality and accessibility. Integration with mobile applications can provide instant notifications and reminders, ensuring that students remain consistent with their study plans. Incorporating AI-based performance prediction models can help forecast academic outcomes and identify subjects that require additional focus. Cloud-based storage and synchronization would allow students to access their study plans from any device, providing flexibility and convenience. Moreover, connecting the system with online learning platforms could allow it to recommend relevant study materials, tutorials, and quizzes, creating a more comprehensive smart learning environment.

Overall, this project represents an important step toward the development of intelligent educational tools that personalize learning experiences, promote time management, and ultimately enhance academic performance.

REFERENCES

1. Kaur, S., & Singh, A. (2023). “AI in Education: Personalized Learning Systems.” *IEEE Access*, Vol. 11, pp. 10145–10158.
2. Kumar, R., Sharma, P., & Nair, V. (2022). “Machine Learning for Adaptive Study Scheduling.” *International Journal of Computer Applications*, Vol. 185(7), pp. 23–29.
3. Brown, J. (2021). “NLP-Based Syllabus Analysis for Academic Planning.” *ACM Computing Surveys*, Vol. 53, Issue 4, pp. 1–18.
4. Patel, R. (2023). “AI Integration in Smart Learning Environments.” *Springer Nature*, pp. 88–99.
5. Open AI. (2024). “Generative AI for Educational Recommendation Systems.” *Open AI Research Reports*, 2024.
6. Suresh, K., & Meenakshi, R. (2022). “Artificial Intelligence Applications in Student Time Management and Academic Planning.” *Journal of Emerging Technologies in Education*, Vol. 9(3), pp. 56–62.
7. Lee, H., & Choi, Y. (2023). “Deep Learning-Based Academic Performance Prediction Using Study Behavior Data.” *IEEE Transactions on Learning Technologies*, Vol. 16(2), pp. 205–214.
8. Wang, X., & Li, M. (2021). “Natural Language Processing Approaches for Curriculum Difficulty Evaluation.” *Elsevier Procedia Computer Science*, Vol. 199, pp. 1208–1217.
9. Rahman, A., & Devi, L. (2022). “Adaptive E-Learning Systems Using Reinforcement Learning Models.” *International Journal of Advanced Research in Computer Science*, Vol. 13(6), pp. 401–408.

10. Raj, D., & Bhatia, T. (2023). “Smart Educational Assistants: AI-Based Personalized Recommendation and Scheduling Systems.” *International Conference on Artificial Intelligence and Applications (ICAI)*, IEEE Xplore, pp. 301–308.