



# **A Smart Study Revision Tracker Using Spaced Repetition and AI for Enhanced Learning Retention**

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**ABSTRACT:** In modern education, students often invest significant time in studying but still struggle to retain information for extended periods. This issue largely arises due to the absence of a systematic and consistent revision strategy. To address this challenge, this paper presents a Smart Study Revision Tracker, a web-based application designed to enhance long-term learning retention through the integration of spaced repetition and artificial intelligence. The proposed system intelligently schedules revision sessions at scientifically optimized intervals based on the forgetting curve theory. In addition, it incorporates AI-powered quiz generation to promote active recall, which is a key factor in strengthening memory. The application is developed using modern technologies such as React.js for the frontend, Spring Boot for backend processing, PostgreSQL for data management, and the Google Gemini API for dynamic question generation.

Experimental evaluation demonstrates that the system improves memory retention, increases study consistency, and enhances overall learning efficiency when compared to traditional study methods. The results highlight the potential of combining AI with cognitive science principles to create effective and personalized learning tools.

**KEYWORDS:** Spaced Repetition, Artificial Intelligence, Learning Retention, Educational Technology, Quiz Generation, Smart Study System

## **I. INTRODUCTION**

Learning is not only about acquiring knowledge but also about retaining and recalling it effectively when needed. Many students face difficulties remembering previously studied material during exams, even after putting in considerable effort. This problem is often caused by irregular revision habits and the absence of structured planning.

The concept of the forgetting curve, introduced by Hermann Ebbinghaus, explains how memory retention declines over time if information is not reviewed periodically. Although this theory is widely recognized, many learners still follow unorganized study approaches that do not reinforce knowledge effectively.

To overcome these challenges, there is a need for an intelligent system that automates revision planning and encourages active recall. The Smart Study Revision Tracker proposed in this paper combines spaced repetition techniques with AI-driven quiz generation to provide a structured, adaptive, and efficient learning experience.

**Volume 15, Issue 4, April 2026****|DOI: 10.15680/IJRSET.2026.1504233|****II. LITERATURE REVIEW**

Research in educational psychology and technology has consistently shown that spaced repetition is an effective method for improving long-term memory retention. By distributing revision sessions over time, learners are more likely to retain information compared to massed learning (cramming).

Existing platforms such as Anki and Quizlet utilize spaced repetition principles. However, these tools often depend heavily on manual input, such as creating flashcards, which can be time-consuming and less engaging for users. Moreover, many current systems lack advanced personalization and intelligent feedback mechanisms. They do not fully adapt to individual learning behaviors or dynamically adjust content based on performance. The proposed system addresses these limitations by integrating automated scheduling, AI-based quiz generation, and performance tracking into a single unified platform.

**III. PROBLEM STATEMENT**

Students frequently struggle to retain information effectively due to several interconnected challenges:  
Lack of structured revision planning:

Many students revise topics randomly without following scientifically optimized intervals. This unstructured approach leads to inefficient reinforcement of knowledge and faster forgetting.

Irregular study habits:

Inconsistent study schedules prevent continuous engagement with the material. Long gaps between study sessions weaken memory retention and reduce learning effectiveness.

Absence of self-assessment mechanisms:

Without regular quizzes or testing, students are unable to evaluate their understanding or identify weak areas that require additional focus.

Inefficient use of study time:

Learners often spend too much time on familiar topics while neglecting more difficult or important subjects, leading to imbalanced preparation.

Low engagement and motivation:

Traditional revision methods can become repetitive and boring, reducing student interest and consistency over time.

These issues highlight the need for a smart system that ensures timely revision, continuous assessment, and optimized learning strategies.

**IV. PROPOSED SYSTEM****A. System Overview**

The proposed Smart Study Revision Tracker is a web-based application designed to assist students in organizing their study routines and revising topics at scientifically determined intervals. It combines cognitive learning principles with artificial intelligence to create a more effective and personalized learning environment.

**B. Key Features**

Spaced Repetition Scheduling:

The system automatically schedules revision sessions based on the forgetting curve. Topics are revisited at increasing intervals, ensuring that information is reinforced just before it is likely to be forgotten.

**AI-Based Quiz Generation:**

The application generates dynamic quizzes using AI, enabling students to test their understanding through multiple-choice questions and other formats. This promotes active recall, which significantly improves memory retention.

**Adaptive Performance Tracking:**

The system continuously monitors user performance, including quiz scores and revision frequency. Based on this data, it adjusts future schedules and difficulty levels to match the learner's progress.

**Personalized Learning Experience:**

Each user receives a customized study plan tailored to their learning speed, strengths, and weaknesses, making the system highly adaptive.

**User-Friendly Interface:**

The application is designed with simplicity and usability in mind, ensuring that students can easily navigate features such as dashboards, planners, and quizzes.

V. METHODOLOGY

**A. Spaced Repetition Algorithm**

The system uses a progressive scheduling approach where revision intervals gradually increase over time (e.g., 1 day, 3 days, 7 days). This method ensures efficient reinforcement of knowledge and minimizes forgetting.

**B. AI Integration**

The AI module generates questions based on user-provided topics and adapts the difficulty level according to performance. Students who perform well receive more challenging questions, while those struggling receive simpler ones for better understanding.

**C. System Architecture**

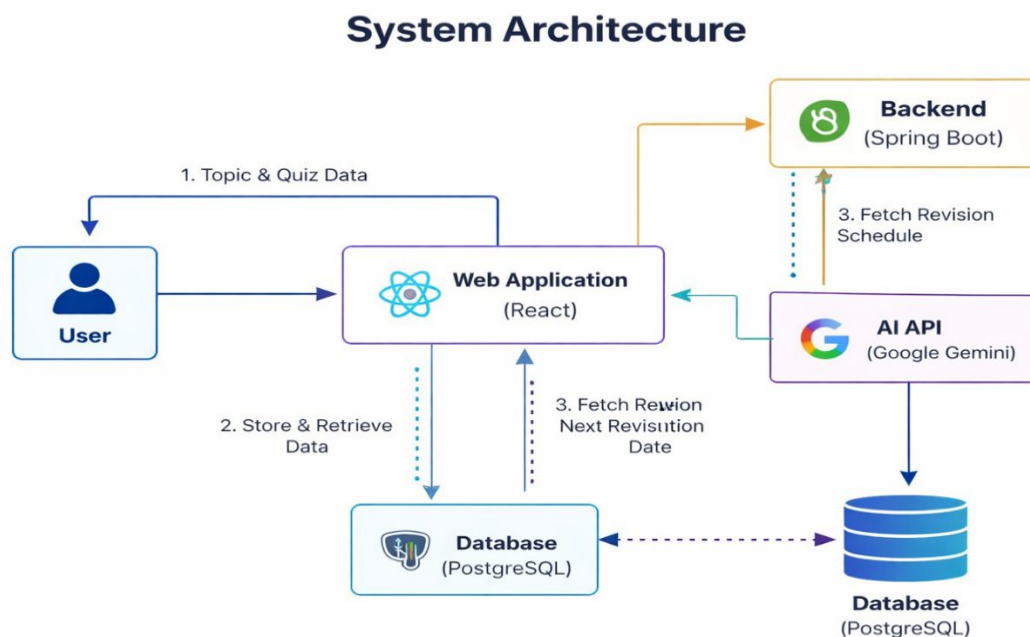
The system architecture consists of four main components:

Frontend: Handles user interaction and visualization

Backend: Processes application logic and APIs

Database: Stores user data, schedules, and results

AI Module: Generates quizzes dynamically



## VI. IMPLEMENTATION

### A. Frontend

The frontend is developed using React.js and includes features such as dashboards, planners, and quiz interfaces. It ensures smooth interaction and a responsive user experience.

### B. Backend

The backend is built using Spring Boot, which manages application logic, handles API requests, and ensures efficient communication between components.

### C. Database

PostgreSQL is used for storing user information, study schedules, and quiz results securely and efficiently.

## VII. RESULTS AND ANALYSIS

The system was tested on a group of students over a defined period. The findings revealed:

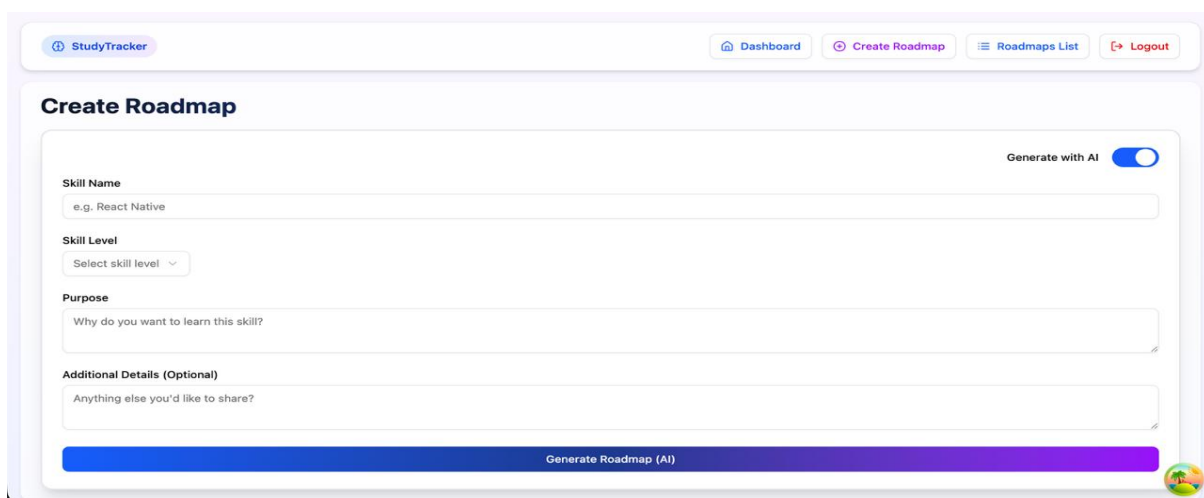
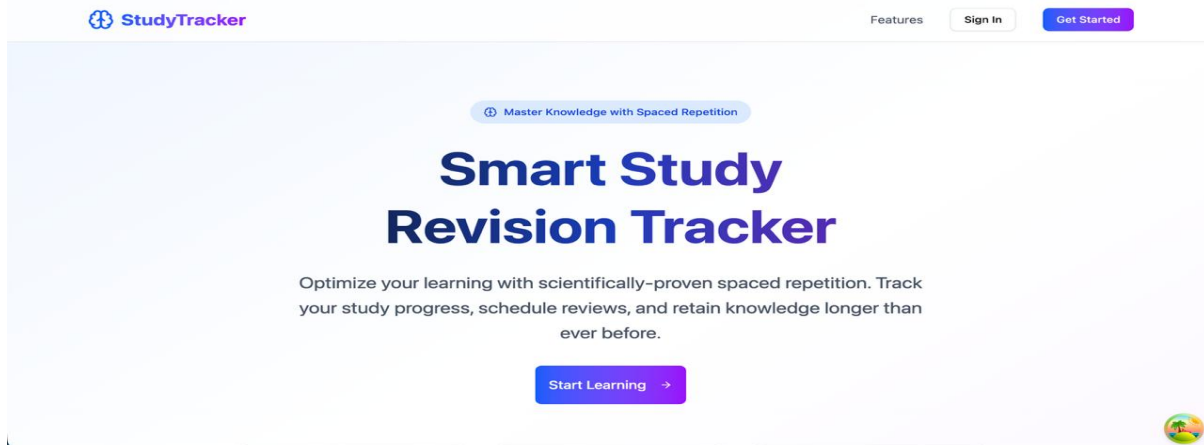
Noticeable improvement in long-term memory retention

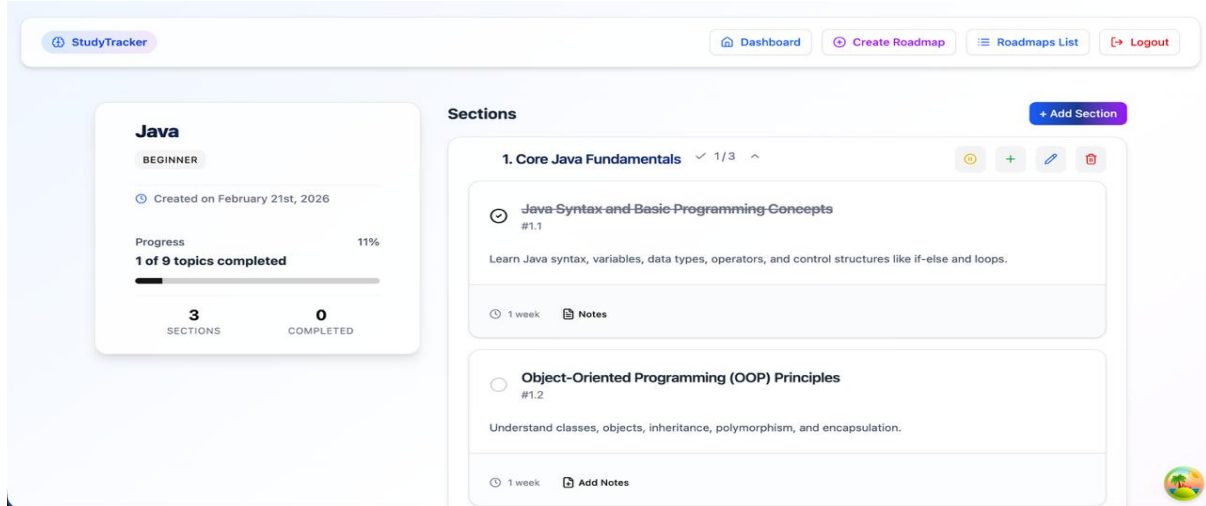
Increased consistency in study habits

Better time management and reduced procrastination

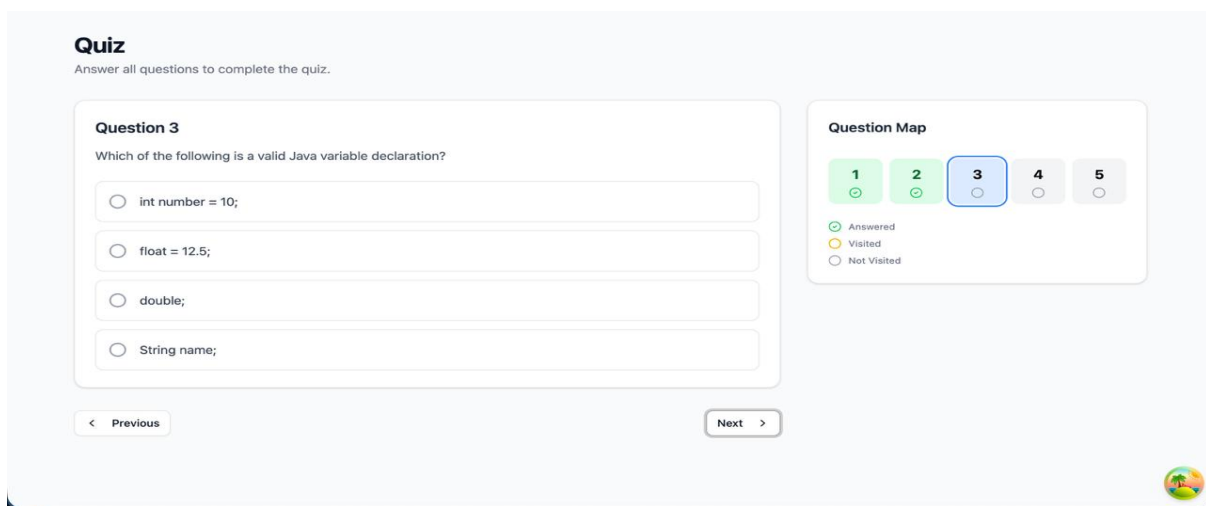
Higher engagement due to interactive quizzes

Users reported that the system made studying more structured, less stressful, and more effective compared to traditional methods.

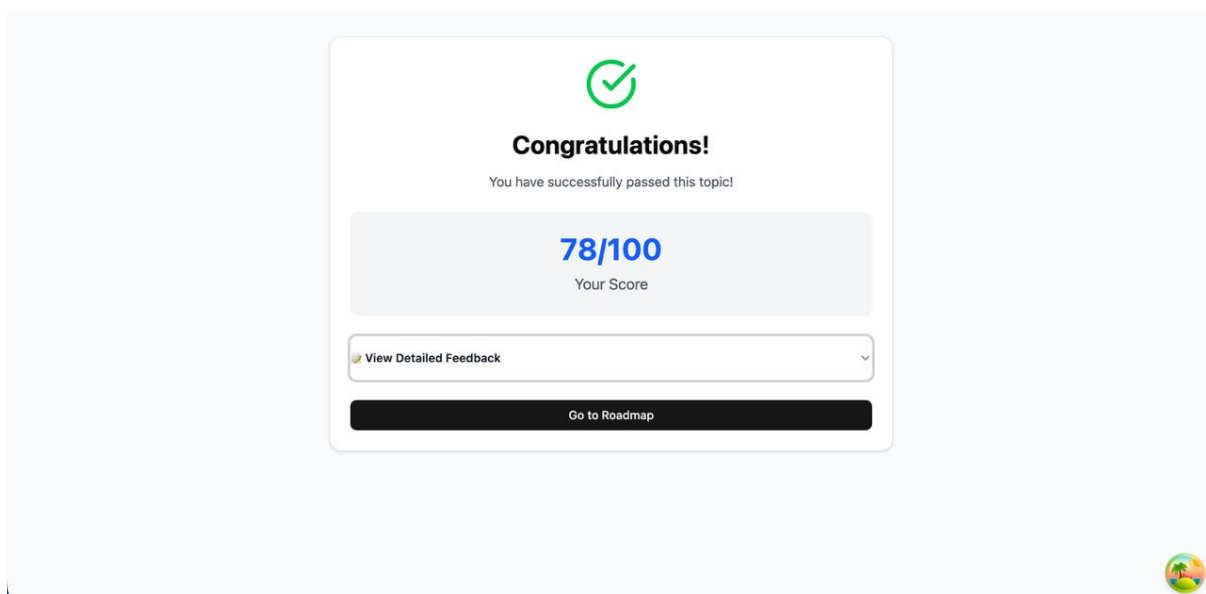




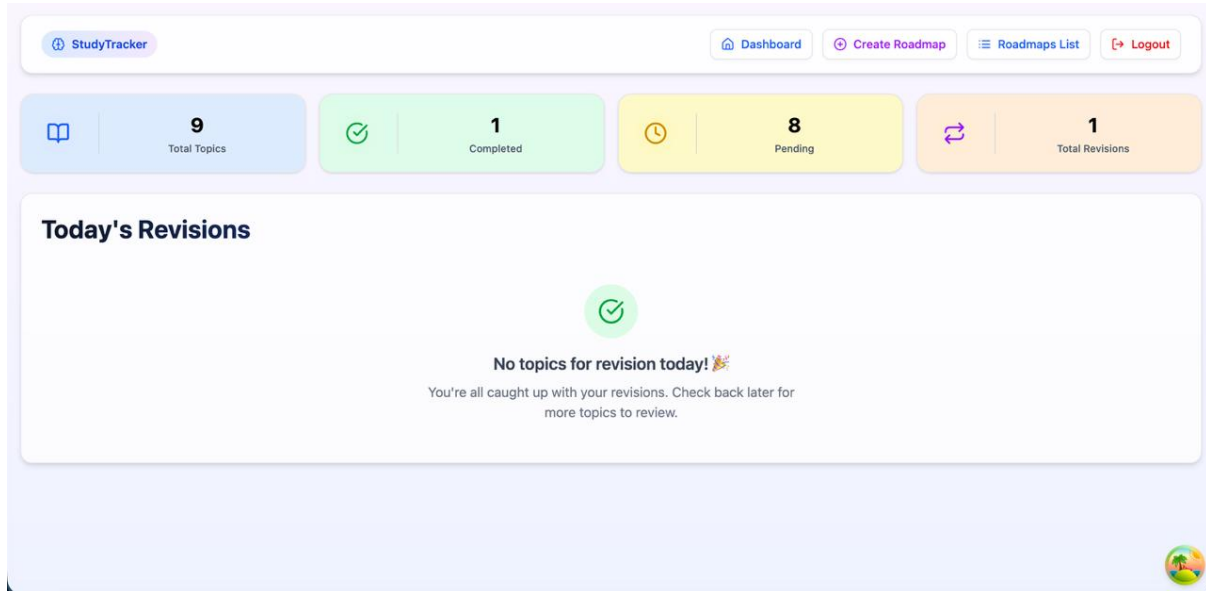
The dashboard shows a 'StudyTracker' section for 'Java' at the 'BEGINNER' level, created on February 21st, 2026. It indicates that 1 of 9 topics is completed (11% progress). The 'Sections' list includes '1. Core Java Fundamentals' (1/3) with sub-sections: 'Java Syntax and Basic Programming Concepts' (#1.1) and 'Object-Oriented Programming (OOP) Principles' (#1.2). Navigation links include Dashboard, Create Roadmap, Roadmaps List, and Logout.



The 'Quiz' section asks to answer all questions to complete the quiz. 'Question 3' asks: 'Which of the following is a valid Java variable declaration?' with options:  int number = 10;  float = 12.5;  double;  String name;. A 'Question Map' shows 5 questions, with question 3 highlighted as 'Answered'. Navigation buttons for 'Previous' and 'Next' are present.



The 'Congratulations!' screen displays a green checkmark and the message: 'You have successfully passed this topic!'. The score is shown as '78/100 Your Score'. There is a 'View Detailed Feedback' button and a 'Go to Roadmap' button.



### VIII. ADVANTAGES

Enhanced long-term retention:

Structured revision based on scientific principles helps students remember information for longer durations.

Improved study organization:

Automatically generated schedules reduce the burden of planning and help students stay consistent.

Active learning approach:

AI-generated quizzes encourage participation and deeper understanding of concepts.

Personalized experience:

The system adapts to each user's learning behavior, ensuring effective and relevant study plans.

Reduced academic stress:

Organized schedules and clear guidance help students manage their workload more efficiently.

### IX. LIMITATIONS

Dependence on internet connectivity:

As a web-based system, continuous access to the internet is required for proper functioning.

Accuracy of AI-generated content:

The quality of quizzes depends on the AI model, which may occasionally generate less accurate or ambiguous questions.

Initial setup effort:

Users need to input topics and preferences initially, which may require time and effort.

### X. FUTURE SCOPE

Development of a mobile application for increased accessibility

Integration of advanced machine learning models for deeper personalization

Addition of voice-based interaction features

Incorporation of gamification elements such as rewards and progress tracking

Integration with e-learning platforms for seamless study management

#### XI. CONCLUSION

The Smart Study Revision Tracker offers an effective solution to the problem of poor learning retention by combining spaced repetition with AI-driven quiz generation. The system introduces a structured, adaptive, and interactive approach to studying, which enhances both efficiency and understanding. The results demonstrate its potential to significantly improve academic performance and learning consistency. With further advancements, such systems can play a crucial role in shaping the future of personalized education.

#### REFERENCES

- [1] H. Ebbinghaus, Memory: A Contribution to Experimental Psychology
- [2] Cepeda et al., "Distributed Practice in Verbal Recall Tasks," Psychological Science
- [3] React.js Documentation
- [4] Spring Boot Documentation
- [5] PostgreSQL Documentation
- [6] Google Gemini API Documentation



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