

Project Title:

Smart Quizzer AI – Adaptive AI-Based Quiz Generator

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1. Abstract

- Smart Quizzer AI is an **AI-powered adaptive quiz generation platform** designed to make learning more personalized, intelligent, and effective.
- The system creates **contextually relevant quiz questions** automatically from study materials such as PDFs, text documents, or URLs.
- It introduces the concept of **adaptive quizzes**, where the **difficulty level adjusts dynamically** based on each user's performance and accuracy.
- The platform integrates **multiple intelligent modules**, including:
 - AI Question Generation (Google Gemini AI)
 - Adaptive Quiz Engine (real-time difficulty adjustment)
 - Semantic Answer Evaluation (NLP-based)
 - Leaderboard and Gamification
 - Admin Dashboard and Analytics
- The platform's **interactive dashboards and leaderboards** provide engaging and competitive learning experiences.
- Overall, Smart Quizzer AI demonstrates the successful fusion of **AI, analytics, and adaptive learning**, transforming traditional quizzes into intelligent, data-driven educational tools.

2. Problem Statement

- Traditional quiz systems suffer from static and repetitive content, offering the same set of questions regardless of a learner's background or progress.
- All users face identical difficulty levels, which fails to accommodate individual skill variations or learning speeds.
- Lack of personalized feedback prevents learners from understanding their strengths and weaknesses effectively.
- Manual question creation consumes significant time and effort for educators, reducing scalability and flexibility.
- These systems lack adaptive mechanisms that respond to user performance in real time.
- There is no integrated analytics to track learner progress, identify weak areas, or visualize improvement trends.

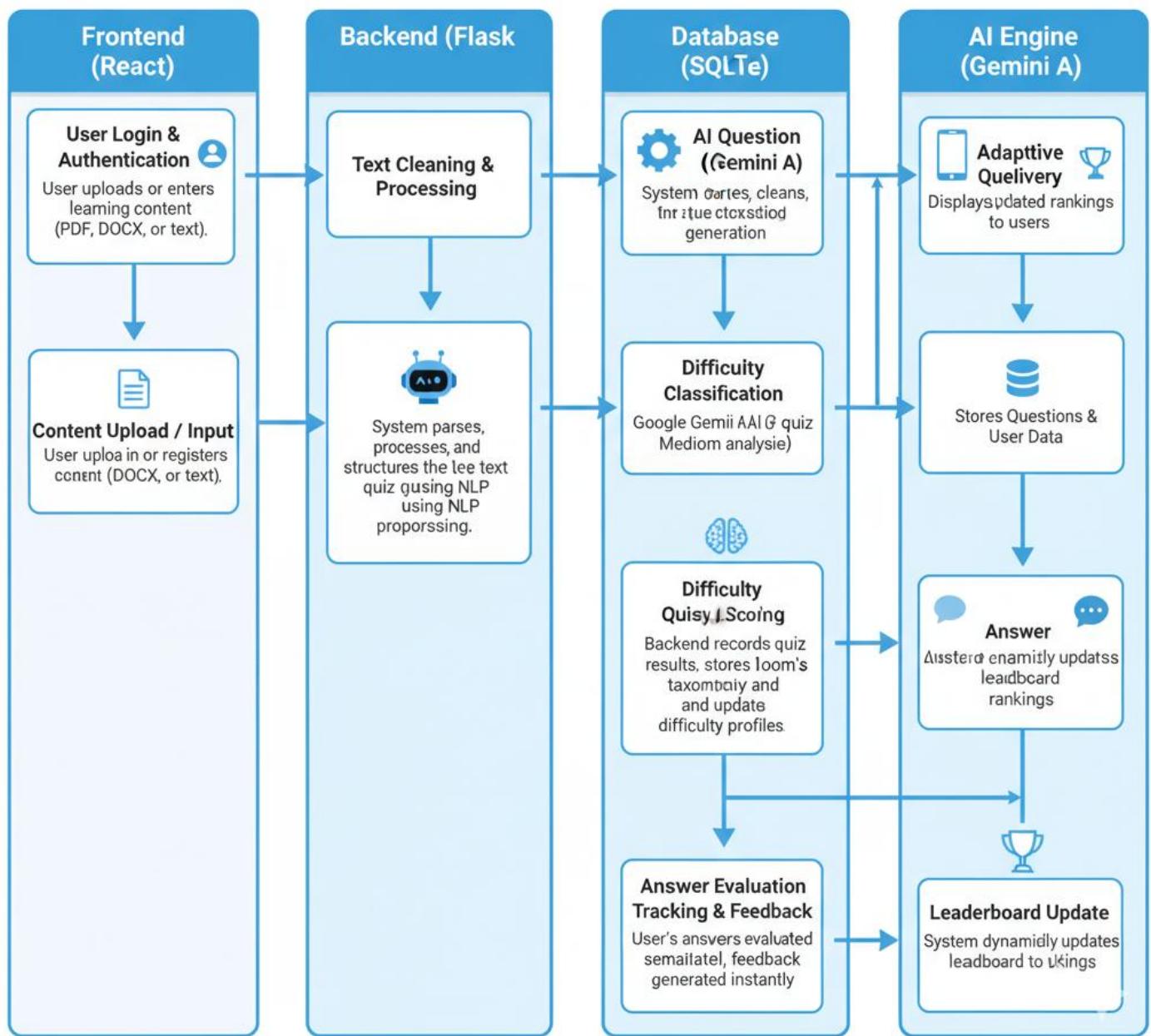
- As a result, traditional quiz tools provide limited engagement, low motivation, and inefficient learning outcomes, failing to meet the personalized needs of modern education.

3. Objectives

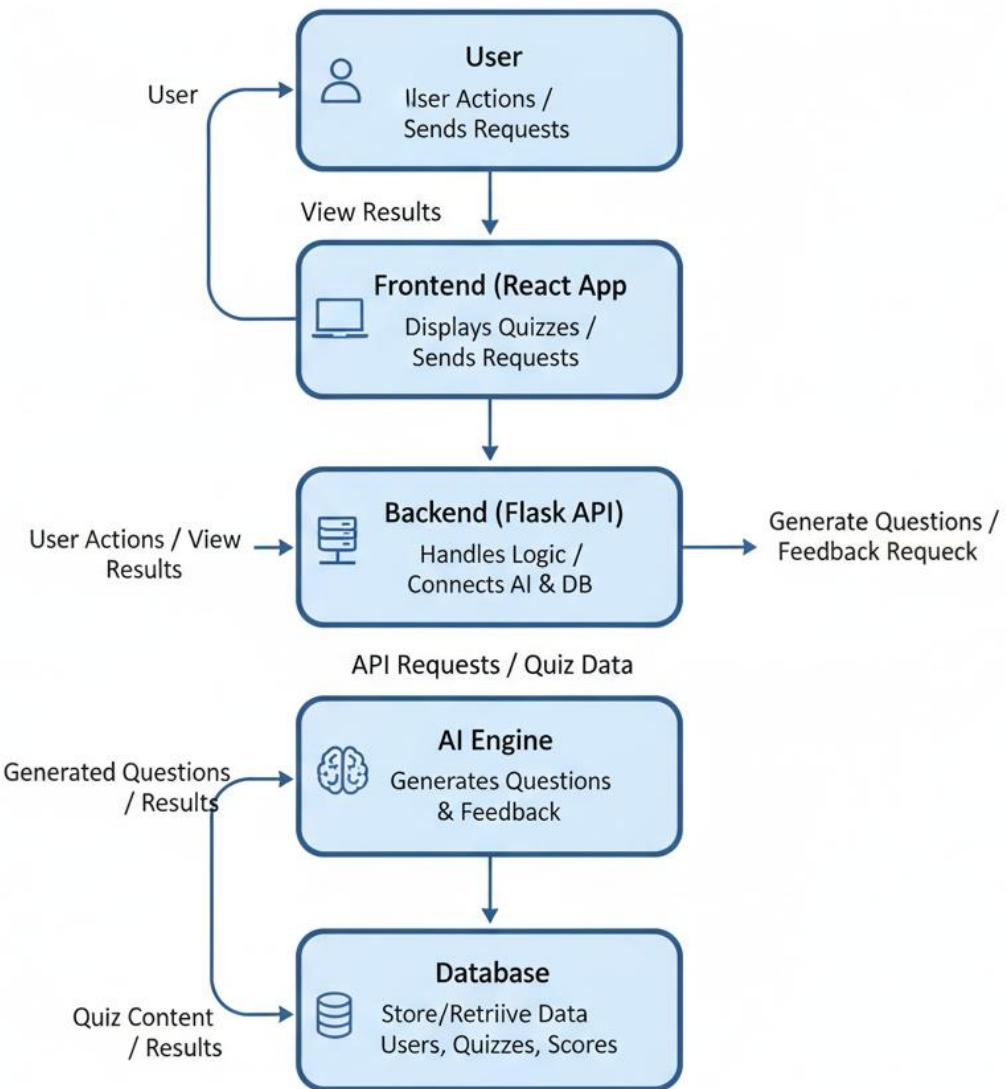
- Develop an **AI-driven adaptive quiz platform** that personalizes learning experiences in real time.
- Implement **automatic question generation** from educational materials using NLP and AI models.
- Design a **semantic answer evaluation system** to assess conceptual understanding rather than exact matches.
- Provide **instant performance feedback and analytics** to enhance learner insight and engagement.
- Enable **progress tracking and topic-based recommendations** for continuous improvement.
- Build a **responsive, user-friendly interface and admin dashboard** for efficient management and monitoring.

4. System Overview

- **User Interaction:** Learners register or log in, then select a topic or upload their own study material.
- **AI Question Generation:** The system uses **Gemini AI** to generate contextually relevant quiz questions from the provided content.
- **Adaptive Difficulty:** The **Adaptive Quiz Engine** dynamically adjusts question difficulty (Easy, Medium, Hard) based on user performance and past accuracy.
- **Semantic Evaluation:** Answers are analysed using **Natural Language Processing (NLP)** to assess conceptual similarity instead of keyword matching.
- **Real-Time Feedback & Analytics:** Users receive instant feedback, performance summaries, and visual analytics to track their progress.
- **Gamification & Leaderboards:** The platform updates global leaderboards and awards badges to enhance user motivation and engagement.



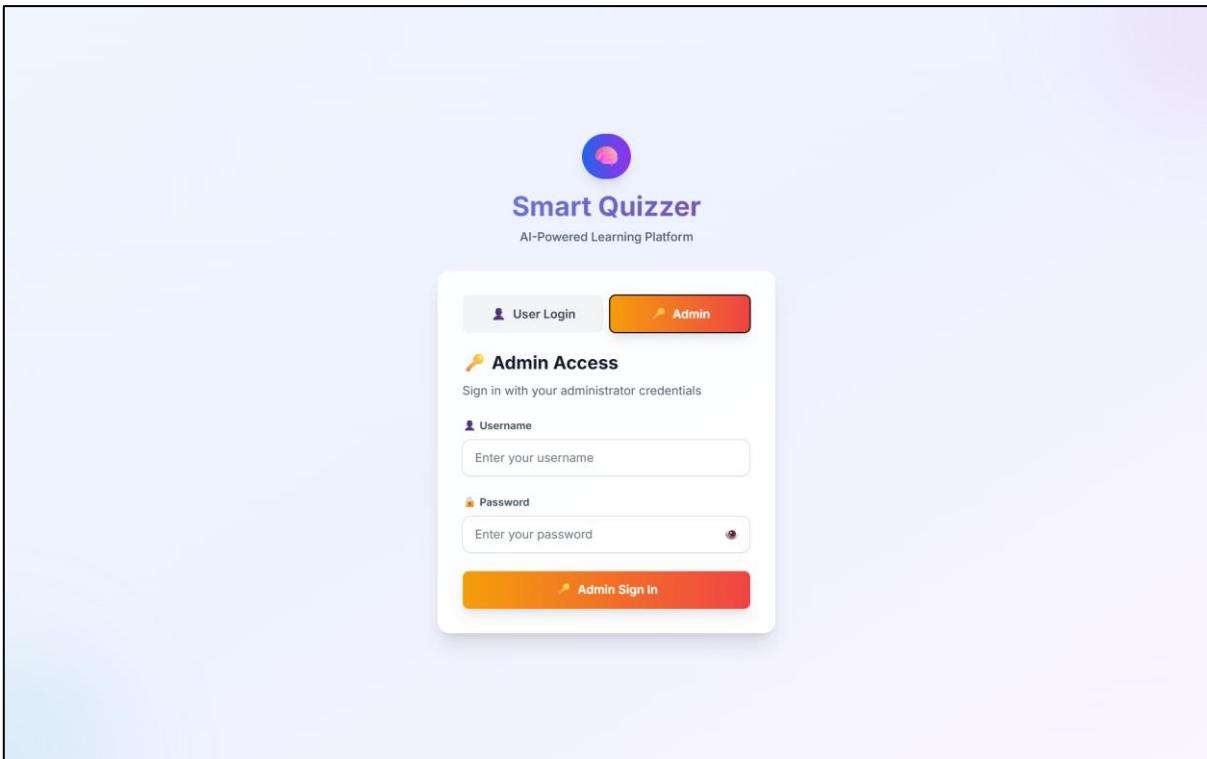
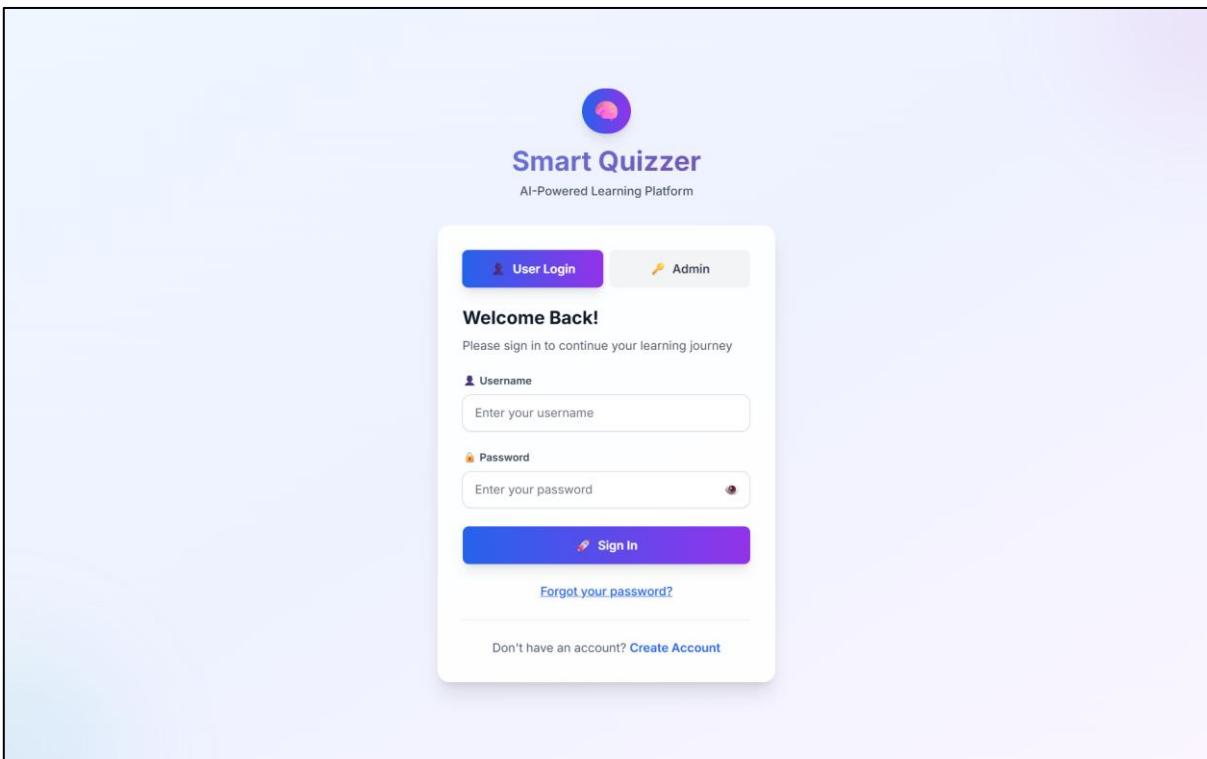
5. Architecture Diagram



6. Module Descriptions

Module 1: User & Profile Management

- Handles user **registration and login** (email/password with JWT or OAuth).
- Maintains personalized **user profiles** with subjects of interest and preferred difficulty.
- Tracks **performance history**, quiz progress, and improvement trends.
- Provides real-time synchronization of user data between frontend and backend.



The screenshot shows the User Profile page. At the top, there's a back button, a user icon, and the title "User Profile". Below that, a sub-header says "Manage your account settings and preferences". The main area has a profile card for "John Doe" with a purple circular icon containing a white "J". The card displays the following information: Member Since: 4/11/2025, Quizzes Taken: 58, Average Score: 68.3%, and a skill level of "Intermediate". To the right is a "Profile Information" section with fields for Full Name (John Doe), Email Address (john@example.com), Username (john), and Skill Level (Intermediate). A blue "Edit Profile" button is located at the top right of this section.

The screenshot shows the Quiz History page. At the top, there's a back button, a quiz icon, and the title "Quiz History". Below that, a sub-header says "Track your learning progress". The main area starts with an "Overview" section showing 58 Total Quizzes, 53 Completed, and an Average Score of 68%. Below this is a "Recent Quizzes" section. It lists three quizzes under the Mathematics category, all at the Beginner level. The first two quizzes are completed, with scores of 66.7% and 100.0% respectively. The third quiz is still in progress. Each quiz entry includes the date (7/11/2025), time (11:29 am or 09:09 am), and a "View Results" button.

Module 2: Content Ingestion & Parsing

- Enables uploading or importing learning materials (**PDFs, URLs, or pasted text**).
- Applies **NLP preprocessing** for text cleaning, tokenization, and segmentation.
- Converts raw text into structured **knowledge chunks** for question generation.

- Supports scalable ingestion for multi-topic content.

The screenshot shows the 'Custom Content Upload' section of a learning platform. It includes fields for 'Text Input', 'File Upload', and 'Web URL'. A text area for entering content is present with a note: 'Paste or type any educational content here. Our AI will analyze it and generate personalized quiz questions...'. Below this is a note: 'Minimum 10 characters required. Longer content generates better questions.' and a character count of '0 characters'. A blue button labeled 'Analyze & Process Text' is at the bottom. To the right is a 'Quiz Settings' panel with sections for 'Difficulty Level' (Beginner, Intermediate, Advanced) and 'Number of Questions' (3, 5, 7, 10). A green button labeled 'Generate Quiz from Content' is also in this panel. A note at the bottom right says 'Upload content first to enable quiz generation'.

Module 3: Question Generator Engine

- Uses **Gemini AI** or transformer-based models for automatic question creation.
- Generates various formats: **MCQs, True/False, Fill-in-the-Blank, Short Answers.**
- Incorporates **Bloom's taxonomy** to control difficulty progression.
- Dynamically adjusts tone and context based on uploaded study material.

The screenshot shows the 'Smart Quizzer' interface. On the left is the 'Start New Quiz' section, which includes a 'Select Topic' dropdown with 'Choose your learning topic...', a 'Skill Level' section with 'Beginner' (selected), 'Intermediate', and 'Advanced' options, and a 'Number of Questions' section with '5 Questions' selected. A green button labeled 'Start Quiz Adventure →' is at the bottom. On the right is the 'Your Profile' sidebar, featuring a profile picture with a 'J', the name 'John Doe' (@john), and email 'john@example.com'. It also shows skill level 'Intermediate', member since '4/11/2025', and navigation links for 'Custom Content Upload', 'View Quiz History', and 'Analytics Overview'.

Smart Quiz Session

Welcome back, John Doe

Mathematics | Beginner | Question 1 of 3

Progress: 33% Complete
Keep going!

MCQ Beginner 0:10

Which of these shapes has 3 sides?

A) Square
B) Circle
C) Triangle
D) Rectangle

Excellent! Explanation: A triangle is defined by having three sides and three angles.

1/3 Progress 33.3% Score 8s Time Taken

Adaptive Learning Insights: Next Difficulty: EASY Streak: 1 correct Confidence: 50% Reason: maintaining level

Back to Dashboard Flag Question Feedback Next Question →

Module 4: Adaptive Learning Engine

- Monitors **real-time performance** during quizzes.
- Adapts **difficulty levels** based on accuracy and speed metrics.
- Recommends future questions or topics depending on performance trends.
- Implements a **feedback loop** for AI learning improvement.

Smart Quiz Session

Welcome back, John Doe

Mathematics | Beginner | Question 2 of 3

Progress: 67% Complete
Keep going!

True/False Beginner 2:06

$5 + 2 = 7$ is a true statement.

True
False

Excellent! Explanation: Adding 5 and 2 together results in 7.

2/3 Progress 66.7% Score 4s Time Taken

Adaptive Learning Insights: Next Difficulty: EASY Adjusted: Stable Streak: 2 correct Confidence: 50% Reason: maintaining level

Back to Dashboard Flag Question Feedback Next Question →

The screenshot shows the 'Learning Analytics' section of a web application. At the top, there are navigation links for 'Back', 'Go To', 'Profile', and 'Logout'. The main area displays 'AI Learning Recommendations' for three subjects: Biology, Science, and History. Each recommendation includes a 'Learn [Subject]' button. Below these are two more sections: 'Practice True/False questions' and 'You're performing well at Beginner difficulty'. At the bottom, there are buttons for 'Take Another Quiz' and 'View History'.

Module 5: Web Interface + Quiz UI

- Built using **React** for an interactive and responsive user experience.
- Supports **adaptive question sequencing** and timer-based quizzes.
- Displays **results summary**, score, and semantic feedback instantly.
- Integrates **real-time user leaderboard** based on accuracy and completion time.

The screenshot shows the 'Quiz Results' section after completing a Mathematics quiz. The top bar shows 'Back', 'Quiz Results' (with a blue icon), 'Mathematics | Beginner | Score: 67%', 'Go To', 'Profile', and 'Logout'. The main area displays a summary: '66.7%' (2 out of 3 correct) with a gold medal icon, and a message 'Not bad! Consider reviewing the topic more.' Below this are three metrics: '3 Total Questions', '2 Correct Answers', and '0m 14s Time Taken'. A dark box at the bottom left shows 'LIVE Audio Captions' with a summary: 'Congratulations! You have completed the Mathematics quiz. Performance Summary: You answered 2 out of 3 questions correctly Your final score: 67% Time: 14 seconds Feedback: You're Speaking...'. A 'Real-time captions' link is also present. At the bottom right, there's a 'Question Review' section for Q1 MCQ Beginner, showing a question about shapes and a checked answer.

Quiz Results

Mathematics | Beginner | Score: 67%

[Feedback](#) [Hide](#)



66.7%
2 out of 3 correct

Not bad! Consider reviewing the topic more.

3 Total Questions	2 Correct Answers	0m 14s Time Taken
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Performance Analysis



Score Breakdown
67%
2 Correct, 1 Incorrect



Question Type Performance

MCQ	1/1 (100%)
True/False	1/1 (100%)
Fill-in-the-blank	0/1 (0%)

Quiz Results

Mathematics | Beginner | Score: 67%

5 + 2 = 7 is a true statement.

Explanation: Adding 5 and 2 together results in 7.
Time taken: 4 seconds

Q3 Fill-in-the-blank Beginner

One half can be written as the fraction _____.
Your answer: 3
Correct answer: 1/2

Explanation: One half is represented numerically as a fraction with 1 as the numerator and 2 as the denominator.
Time taken: 2 seconds

Leaderboard - Mathematics

Your Current Rank		Latest Score			
#2	66.7%	Score	Accuracy	Time	Status
#1	Priya Nair @priya	66.7% (2/3)	66.7% 	330m 30s	✓ Complete
#2	John Doe (You) @john	66.7% (2/3)	66.7% 	334m 50s	✓ Complete

[Back to Dashboard](#) [Take Another Quiz](#) [Print Results](#)

[← Back](#) **Learning Analytics** [Go To](#) Welcome back, **Priya Nair** [Profile](#) [Logout](#)

Track your progress and performance

[Overview](#) [Badges](#) [AI Insights](#)

33
Total Quizzes

58%
Average Score

313
Questions Answered

Performance Trends & Topic Insights

Weekly Performance Report
4/11/2025 - 11/11/2025

Quizzes Completed 7 +5 from last week	Average Accuracy 81.0% +27.6% from last week	Total Questions 21 correct	Current Streak 1 day
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You're Improving!
Keep up the great work! Your scores are trending upward.

Topic Performance Breakdown

Computer Science 66.7% 1 quiz completed	Mathematics 86.7% 5 quizzes completed	Science 66.7% 1 quiz completed
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[← Back](#) **Learning Analytics** [Go To](#) Welcome back, **Priya Nair** [Profile](#) [Logout](#)

Track your progress and performance

Excellent dedication! You've completed 7 quizzes this week!

Historical Performance

Avg Accuracy 60.2%	Total Quizzes 14	Current Streak 1
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Overall Performance

Legend: Excellent (90%+) Good (70-89%) Needs Work (<70%)

Your Overall Progress

Overall Performance 58%

Keep practicing! You're improving!

[Take Another Quiz](#) [View History](#)

The screenshot shows the 'Learning Analytics' dashboard for a user named Priya Nair. At the top, there are buttons for 'Go To', 'Profile', and 'Logout'. Below that, a navigation bar has 'Overview' (selected), 'Badges' (highlighted in blue), and 'AI Insights'. The main section is titled 'Your Badges' with a purple header. It displays 'Badge Collection' statistics: 8 Badges Earned, 340 Total Points, and 38% Completion. Below this are three tabs: 'All Badges' (selected), 'Milestones', and 'Special'. A grid of badges is shown, each with an icon, name, description, points, and rarity. Some badges have completion status and dates.

Badge	Description	Points	Rarity	Status	Completion
First Quiz	Complete your first quiz	10	Common	Completed	1/1/2025
Quiz Master	Complete 10 quizzes	25	Common	Pending	1/1/2025
Quiz Legend	Complete 50 quizzes	50	Rare	Pending	
Quiz Titan	Complete 100 quizzes	100	Rare	Pending	
Perfect Score	Get 100% on any quiz	20	Common	Pending	1/1/2025
Perfectionist	Get 100% on 5 quizzes	10	Rare	Pending	
Flawless Victory	Get 100% on 10 quizzes	20	Epic	Pending	
Speed Demon	Complete a quiz in under 2 minutes	50	Rare	Completed	4/11/2025
Lightning Fast	Complete 5 quizzes in under 2 minutes each	150	Epic	Completed	4/11/2025
On Fire	Get 5 correct answers in a row	15	Common	Completed	8/11/2025
Unstoppable	Get 10 correct answers in a row	10	Rare	Pending	
Legendary Streak	Get 20 correct answers in a row	20	Legendary	Pending	
Daily Habit	Complete quizzes on 7 consecutive days	10	Rare	Pending	
Dedicated Learner	Complete quizzes on 30 consecutive days	100	Epic	Pending	
Sharpshooter	Maintain 90%+ accuracy over 10 quizzes	10	Rare	Pending	

Module 6: Admin Dashboard & Feedback

- Provides admins with a **global leaderboard and analytics dashboard**.
- Allows **moderation** of AI-generated questions and user reports.
- Displays system-wide metrics: quiz performance, user engagement, topic insights.
- Includes **feedback management** for continuous AI model refinement.

The screenshot shows the 'Admin Dashboard' for a System Administrator (Administrator). At the top, it says 'Logged in as System Administrator' and has a 'Logout' button. Below that is a navigation bar with 'Overview' (selected), 'Users', 'Leaderboard', 'Moderation', and 'Feedback'. There's also an 'Auto-refresh' toggle switch set to 'On'.

The main area has four large cards:

- Total Users:** 12 (2 active today)
- Total Quizzes:** 658 (Avg Score: 70.3%)
- Questions Generated:** 6376 (Question mark icon)
- Flagged Content:** 29 (Requires review)

Admin Dashboard

Manage users, moderate content, and monitor platform health

Logged in as
System Administrator
Administrator

[Logout](#)

Auto-refresh On

[Overview](#) [Users](#) [Leaderboard](#) [Moderation](#) [Feedback](#)

[Global Leaderboard](#) Live Updates ON Last updated: 8:03:07 pm [Refresh](#)

Search by username or email... Filter by topic... [Search](#)

[Recent Activity](#) [User Statistics](#)

Performance Leaderboard (12 users ranked)

Showing each user's most recent quiz attempt, ranked by: 1) Correct Answers (higher is better), 2) Time Taken (faster is better)

RANK	USER	TOPIC	CORRECT ANSWERS	ACCURACY	TIME TAKEN	SUBMITTED AT
#1	arjun Arjun Mehta	Chemistry	14/15	93.3%	7m 0s	3/11/2025 5:17:02 pm
#2	meera Meera Joshi	Mathematics	12/15	80%	11m 0s	3/11/2025 10:12:11 am
#3	deepak Deepak Gupta	Computer Science	10/15	66.7%	13m 0s	3/11/2025 8:34:42 am
#4	admin1 System Administrator	Computer Science	8/13	61.5%	25m 0s	3/11/2025 11:35:41 am

Admin Dashboard

Manage users, moderate content, and monitor platform health

Logged in as
System Administrator
Administrator

[Logout](#)

Auto-refresh On

[Overview](#) [Users](#) [Leaderboard](#) [Moderation](#) [Feedback](#)

User Feedback 65 Total Feedbacks

deepak deepak.gupta@gmail.com 6/11/2025 at 9:48:42 pm ★★★★★ (5/5)

Excellent coverage of the topic.

Short Answer Hard Question ID: 2008 [View Question](#)

Question Preview:
"Science question 2 (Hard)"

john john@example.com 2/11/2025 at 4:48:11 pm ★★★★★ (5/5)

Excellent coverage of the topic.

True/False Medium Question ID: 2526 [View Question](#)

Question Preview:
"Chemistry question 7 (Medium)"

Admin Dashboard

Manage users, moderate content, and monitor platform health

Logged in as
System Administrator
Administrator

[Logout](#)

Auto-refresh On

[Overview](#) [Users](#) [Leaderboard](#) [Moderation](#) [Feedback](#)

Flagged Questions

Questions flagged by users for review

Filter: [Pending](#) [Resolved](#) [All](#) [29 pending](#)

MCQ	Medium	1 flag	PENDING
Science question 6 (Medium)			
Flag Reason: Question text is unclear or ambiguous			
Flagged by: anjali (anjali.das@gmail.com)		2/11/2025 at 8:52:03 pm	
View Question		Mark as Resolved	Delete Question
MCQ	Easy	1 flag	PENDING
Physics question 15 (Easy)			
Flag Reason: Answer explanation is insufficient			
Flagged by: rohit (rohit.verma@gmail.com)		31/10/2025 at 3:52:03 pm	
View Question		Mark as Resolved	Delete Question

Admin Dashboard

Manage users, moderate content, and monitor platform health

Logged in as
System Administrator
Administrator

[Logout](#)

Auto-refresh On

[Overview](#) [Users](#) [Leaderboard](#) [Moderation](#) [Feedback](#)

User Management

USER	EMAIL	SKILL LEVEL	QUIZZES	JOINED	ACTIONS
admin1 System Administrator	admin1@smartquizzer.com	Advanced	68	4/11/2025	View
john John Doe	john@example.com	Intermediate	59	4/11/2025	View
ravi Ravi Kumar	ravi.kumar@smartquizzer.com	Advanced	64	4/11/2025	View
sneha Sneha Reddy	sneha.reddy@smartquizzer.com	Advanced	72	4/11/2025	View
arjun Arjun Mehta	arjun.mehta@smartquizzer.com	Advanced	59	4/11/2025	View
priya Priya Nair	priya.nair@gmail.com	Beginner	34	4/11/2025	View
rohit Rohit Verma	rohit.verma@gmail.com	Beginner	37	4/11/2025	View

7. Technology Stack

Layer	Technology	Purpose
Frontend	React, TypeScript, Tailwind CSS	Builds an interactive, responsive, and adaptive quiz interface.
Backend	Flask (Python)	Handles RESTful API endpoints, adaptive logic, and data routing between components.
Database	SQLite	Stores user profiles, quiz results, leaderboard data, and performance analytics.
AI Engine	Gemini AI, Sentence Transformers	Generates quiz questions dynamically and evaluates semantic similarity in answers.
Tools & Libraries	Docker, Git, Axios, pdfplumber, NLTK	Used for containerization, version control, API requests, content extraction, and NLP preprocessing.

8. Future Enhancements

- Integration of **voice-based quizzes** using speech recognition for hands-free interaction.
- Support for **multilingual question generation** to cater to diverse learners.
- Implementation of **AI-driven personalized study plans** based on user progress trends.
- Development of a **mobile application** for on-the-go adaptive learning.
- **LMS integration** for institutional adoption and curriculum alignment.
- Incorporation of **predictive analytics with machine learning** to forecast learner outcomes.

9. Conclusion

- **Smart Quizzer AI** effectively bridges the gap between **artificial intelligence and modern education**, transforming passive learning into an adaptive and personalized experience.
- Its **real-time adaptability** dynamically adjusts question difficulty, ensuring efficient and engaging learning tailored to each user's performance.
- With integrated **analytics, feedback, and gamified elements**, the platform promotes continuous improvement and motivation.
- The system's **robust architecture and scalability** make it suitable for both **academic institutions and enterprise-level training environments**, setting a foundation for the future of intelligent learning systems.