

Principles of Large Language Models

Smart MCQ Quiz Generator

1. Project Overview

The **Smart MCQ Quiz Generator** is an **AI-powered assessment platform** that dynamically generates multiple-choice questions (MCQs) based on user-defined topics and difficulty levels. Built with **Streamlit**, the application integrates **Llama 3 (via Ollama)** and **Google Gemini** models to create **RAG based** structured quizzes with detailed explanations, personalized analytics, and feedback.

The system is designed to support learners, educators, and professionals by providing **adaptive quizzes, concept reinforcement, and performance analysis**, making it a valuable tool in **education and skill development**.

2. Objectives

- Automate the generation of **topic-specific MCQs** with accurate explanations.
 - Enhance **learning outcomes** through personalized feedback.
 - Provide **performance analytics** for self-evaluation and progress tracking.
 - Deliver a **scalable, user-friendly platform** adaptable to multiple domains.
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3. Key Features

3.1 Quiz Generation

- Generates quizzes across **three structured categories**:
 - Basic Concepts
 - Advanced Concepts
 - Current Trends
- Supports **custom difficulty levels** (Beginner, Intermediate, Advanced).
- Offers different **question styles** (Conceptual, Application, Scenario-based).
- **RAG based** from the existing question
- Option to include **diagram-based questions**.

3.2 Question Validation & Parsing

- Ensures each MCQ has:
 - Exactly **4 options**.
 - A clearly marked **correct answer**.
 - A detailed **explanation**.
- Provides **error handling** for malformed questions.

3.3 Performance Analytics

- Displays **section-wise scores, accuracy rates, and performance levels**.
- Interactive **visualizations using Plotly**.
- Tracks **historical performance trends** across multiple quiz sessions.

3.4 Personalized Feedback

- AI-powered analysis of incorrect answers.
 - Identifies **weak areas and recurring mistakes**.
 - Recommends **study resources and related concepts**.
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4. System Architecture

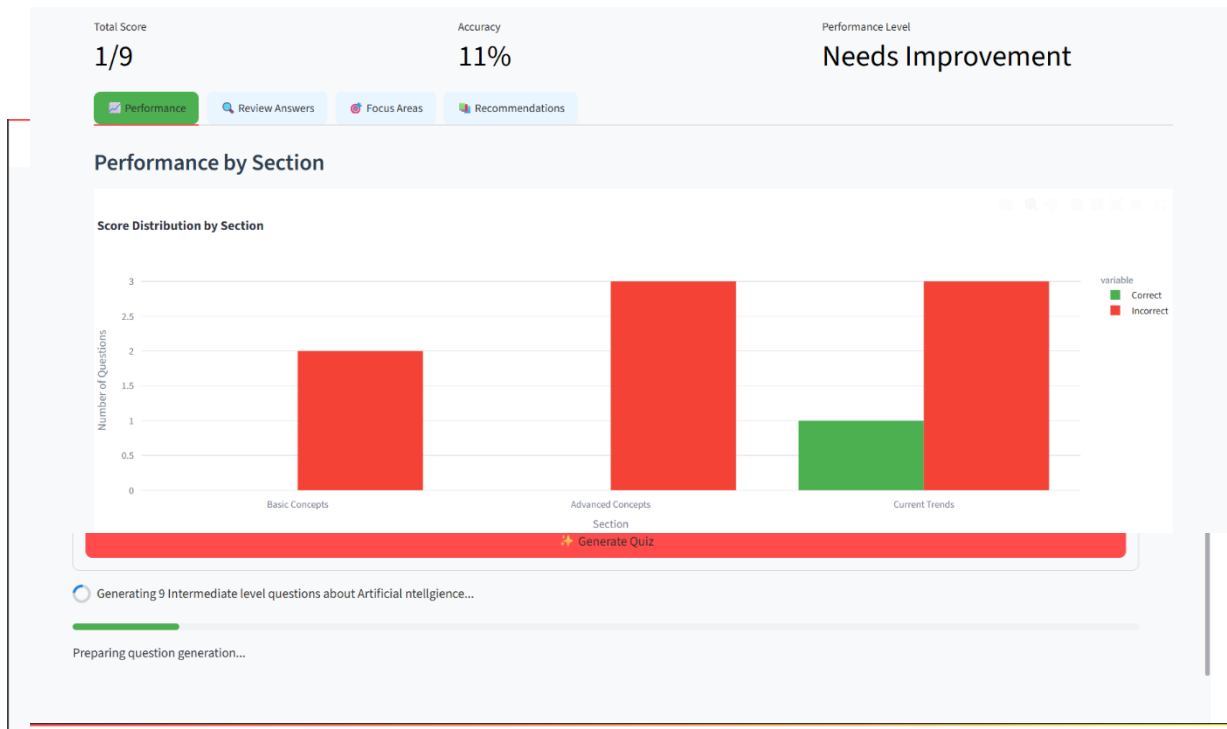
- **Frontend/UI:** Streamlit (lightweight, interactive dashboards).
 - **AI Models:**
 - **Llama 3 (Ollama)** for structured MCQ generation.
 - **Google Gemini (via google-generativeai)** for flexible content creation.
 - **Visualization:** Pandas + Plotly for results and analytics.
 - **Helper Modules:**
 - `helper_functions.py` → Question validation, parsing, analytics.
 - `model.py` → Model initialization and response handling.
 - `question_generator.py` → Main Streamlit app with UI/UX.
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5. Workflow

1. **User Input:** Topic, difficulty, number of questions, model choice, and style.

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2. **Prompt Creation:** System generates structured prompts for the selected AI model.
3. **AI Response Parsing:** Output is validated and parsed into sections.
4. **Quiz Interaction:** Users attempt questions via the interactive Streamlit interface.
5. **Result Processing:** Scores, accuracy, and performance metrics are calculated.



Current Trends

Q1. In Reinforcement Learning, the 'exploration-exploitation tradeoff' refers to the fundamental dilemma of choosing between:

- ☐ Using a large model versus a small model
- ☐ Maximizing immediate rewards versus long-term rewards
- ☐ Trying new, uncertain actions to gather information versus choosing the action known to yield the best reward
- ☐ Training on a simulated environment versus a real-world environment

Q2. Techniques like RLHF (Reinforcement Learning from Human Feedback) are increasingly used in the fine-tuning of large language models. What is the primary purpose of this technique?

- ☐ To reduce the computational cost of pre-training
- ☐ To align model outputs with human preferences and make them safer
- ☐ To significantly increase the model's knowledge base
- ☐ To enable the model to write its own source code

Q3. What is the primary objective of the field known as Explainable AI (XAI)?

6. **Feedback & Recommendations:** AI analyzes wrong answers and suggests improvements.

✓ Successfully generated 9 questions about:

Artificial intelligence
Difficulty: Intermediate | Style: Mixed

Basic Concepts

Q1. A machine learning model is trained on a dataset of images where each image is explicitly labeled as either 'cat' or 'dog'. Which type of learning is this an example of?

- ☐ Reinforcement Learning
- ☐ Unsupervised Learning
- ☐ Supervised Learning
- ☐ Semi-supervised Learning

Q2. What is the term for a model that performs exceptionally well on its training data but poorly on new, unseen test data?

- ☐ Underfitting

Topic: Artificial intelligence

Total Score

1/9

Accuracy

11%

Performance Level

Needs Improvement

Performance

Review Answers

Focus Areas

Recommendations

Answer Review

Basic Concepts (0/2 correct)

Q1. A machine learning model is trained on a dataset of images where each image is explicitly labeled as either 'cat' or 'dog'. Which type of learning is this an example of?

✗ Your answer: Reinforcement Learning

Correct answer: Supervised Learning

Explanation

This is Supervised Learning because the model learns from a dataset where each input (image) is paired with a correct output or label ('cat' or 'dog'). The goal is for the model to learn a mapping function that can predict the output for new, unseen inputs.

6. Tech Stack

- **Programming Language:** Python
- **Libraries/Frameworks:** Streamlit, Pandas, Plotly, Streamlit Extras
- **AI Models:** Llama 3 (Ollama), Google Gemini
- **Others:** AsyncIO (for non-blocking generation), Regex (for parsing)

7. Limitations

- Relies on **AI model consistency** — occasionally outputs may deviate from expected format.

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- Currently limited to **MCQs** (no short-answer or case-based questions).
 - Lacks **persistent user accounts** (progress is session-based).
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8. Future Enhancements

- **Adaptive Quizzing:** Adjust difficulty based on learner performance.
 - **Gamification:** Add streaks, levels, and badges.
 - **Content Authoring:** Generate quizzes from user-uploaded documents.
 - **Multilingual Support:** Expand quiz generation into non-English languages.
 - **Voice-Based Interaction:** Allow spoken questions/answers.
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9. Conclusion

The **Smart MCQ Quiz Generator** demonstrates how **LLMs can transform learning and assessment** by generating personalized, structured, and interactive quizzes. With its **blend of AI-powered question creation and real-time analytics**, the platform bridges traditional testing with modern adaptive learning. Future enhancements will further expand its potential into **multilingual, voice-based, and collaborative education platforms**.