EduTutor AI: Personalized Learning with Generative AI and LMS Integration

The structure and style will mirror the sample doc you provided (with sections like Introduction, Project Overview, Architecture, Setup Instructions, Folder Structure, Running the Application, API Documentation, User Interface, Testing, Known Issues, Future Enhancements).

- EduTutor AI: Personalized Learning with Generative AI and LMS Integration

1. Introduction:

- Project Title: EduTutor AI: Personalized Learning with Generative AI and LMS Integration
- Team Member:A.Kishothpana
- Team Member:T.Nivedha
- Team Member:K.Lavanya
- Team Member:K.G.Jayasri

2. Project Overview:

- Purpose:

EduTutor AI is an AI-powered educational assistant designed to personalize learning for students and educators. It integrates Generative AI capabilities with Learning Management Systems (LMS) to enhance the teaching and learning experience. The system supports concept explanations and quiz generation, enabling learners to grasp difficult topics more easily and test their understanding in real time.
By leveraging IBM Granite's advanced LLM, the application provides interactive, adaptive, and student-centered learning experiences that can be accessed through a simple web interface.

- Features:

1. Concept Explanation

- Key Point: Provides detailed explanations of academic concepts.
- Functionality: Accepts a user-defined concept (e.g., "machine learning") and generates clear explanations with examples.

2. Quiz Generator

- Key Point: Generates practice quizzes for better retention.
- Functionality: Creates 5 quiz questions on a given topic (multiple choice, true/false, short answer), with an answer key provided at the end.

3. AI-Powered Insights

- Key Point: Uses IBM Granite LLM for adaptive learning.

Functionality: Generates context-aware explanations and questions tailored to user inputs.

4. User-Friendly Interface

- Key Point: Provides a simple, tab-based interactive UI.
- Functionality: Built with Gradio, featuring tabs for explanations and quizzes, with instant output.

5. Accessible Deployment

- Key Point: Runs locally or can be shared publicly.
- Functionality: Deployed using Gradio with share=True, enabling easy demonstrations and student access.

3. Architecture:

The architecture of EduTutor AI is designed to provide a seamless, AI-driven learning experience that integrates with educational workflows. It consists of four major layers: Frontend (Gradio), Backend (Python), LLM Integration (IBM Granite LLM), and Deployment Layer.

1. Frontend (Gradio)

Technology Used: Gradio (Blocks & Tabs).
Purpose: Provides an intuitive, web-based interface for students and teachers.
Design:
Concept Explanation Tab → Accepts a topic and displays an AI-generated explanation.
Quiz Generator Tab → Accepts a topic and returns 5 AI-generated quiz questions with answers.
Benefits:
Easy-to-use, interactive design.
No technical skills required from the user.
Tabbed navigation allows switching between features without confusion.

2. Backend (Python Application Logic)

Technology Used: Python 3.9+, Torch, Transformers.
Purpose: Manages the processing logic and orchestrates communication between user input, the AI model, and the interface.
Core Functions:

1. generate_response(prompt, max_length) → Handles prompt creation, tokenization, model inference, and decoding of responses.
2. concept_explanation(concept) → Builds a structured explanation prompt, ensuring clarity and detail.
3. quiz_generator(concept) → Creates quizzes with multiple question types and returns them with an answer key.
Error Handling: Manages edge cases such as empty inputs, excessively long queries, or unavailable GPU.

3. LLM Integration (IBM Granite LLM)

Model Used: ibm-granite/granite-3.2-2b-instruct.
Integration Method: Hugging Face Transformers library.
Key Steps:
Tokenization: User input is converted into tokens.
Model Inference: Tokens are processed by the Granite LLM to generate contextual responses.
Decoding: Tokens are decoded back into human-readable text.
Optimizations:
Runs on GPU (CUDA) if available for faster response.
Falls back to CPU for wider compatibility.
Uses temperature=0.7 and do_sample=True for controlled creativity.
Advantages:
Provides natural, conversational explanations.
Generates varied quiz questions for better assessment.

4. Deployment Layer

Powered By: Gradio's hosting mechanism.
Modes of Deployment:
Local Deployment: Runs on http://127.0.0.1:7860 when executed locally.
Public Access: With share=True, generates a temporary public link for student/teacher collaboration.

Scalability:

Can be hosted on cloud platforms for integration into real-world LMS systems.

Supports classrooms, online tutoring, and remote education scenarios.

4. Setup Instructions:

Prerequisites

Python 3.9 or later

pip & virtual environment tools

Hugging Face transformers, torch, gradio libraries installed

Installation

1. Clone the repository

git clone <your_repo_link>

cd edututor-ai

2. Install dependencies

pip install -r requirements.txt

3. Run the application

python edututorai.py

5. Folder Structure:

```
EduTutorAI/
edututorai.py    -     # Main application script
requirements.txt  -   # Dependencies
README.md     -   # Project documentation
data/                    - # (Optional) Sample input/output
outputs/             -   # (Optional) Generated quizzes/explanations
```

6. Running the Application:

1. Start the app:

python edututorai.py

2. Gradio launches a local server → http://127.0.0.1:7860

3. If share=True, a public link is generated.

4. Navigate between tabs:

Concept Explanation Tab → Enter a concept → Get detailed explanation.

Quiz Generator Tab → Enter a topic → Receive 5 quiz questions + answers.

7. API Documentation (Future Expansion):

Planned API endpoints for LMS integration:

POST /explain-concept → Input: concept, Output: detailed explanation.

POST /generate-quiz → Input: topic, Output: quiz + answers.

GET /lms-integration → Retrieve personalized content recommendations from LMS.

8. User Interface:

Tab Layout:

- Concept Explanation → Text input + button → Explanation output.
- Quiz Generator → Text input + button → Quiz output.
- Design: Minimal, student-friendly, accessible on browser.
- Interaction: Real-time AI responses.

9. Testing:

- Unit Testing: For functions generate_response(), concept_explanation(), quiz_generator().
- Manual Testing: UI tested by entering various concepts/topics.

Edge Cases:

- Long concepts truncated properly.
- Invalid/empty inputs handled gracefully.

10. Screenshots:

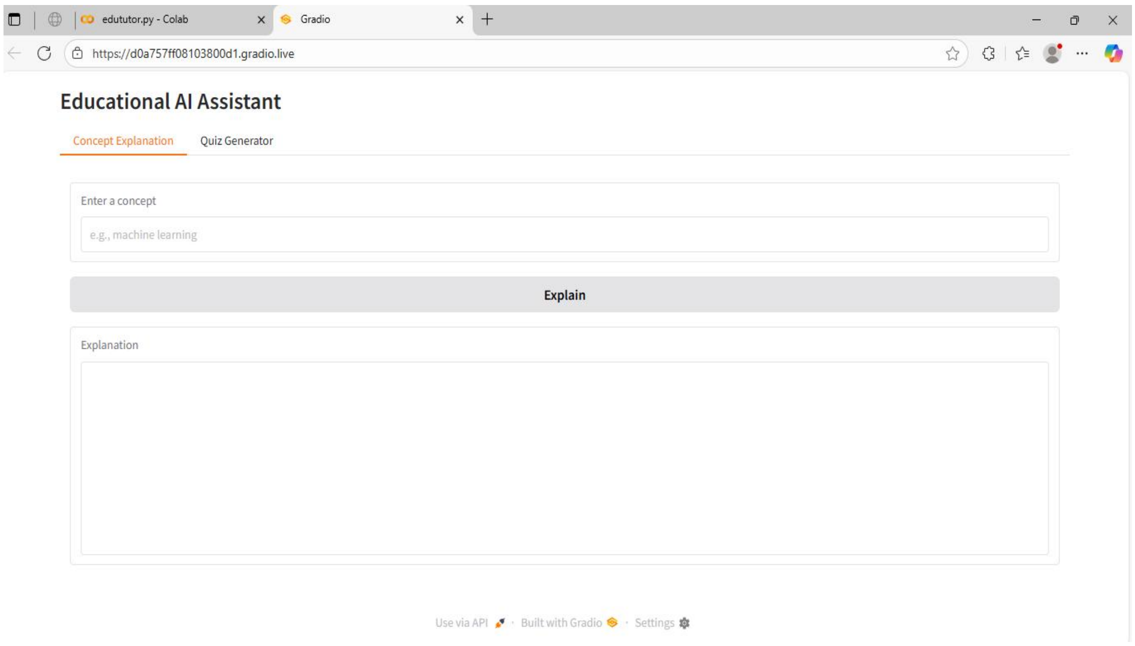
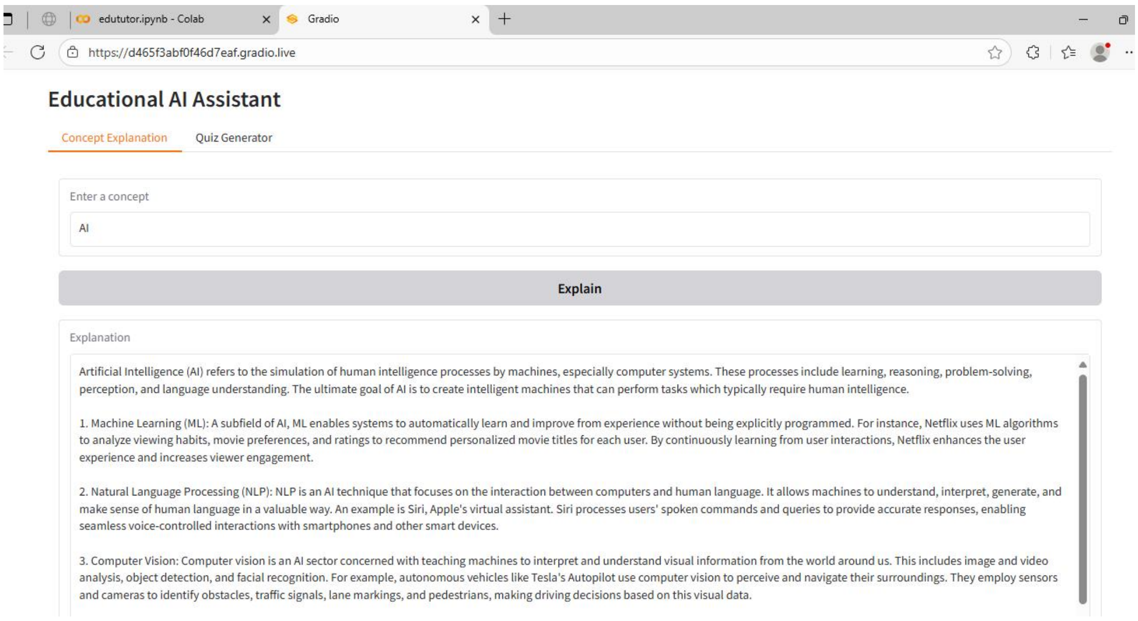


Fig 1.educational ai assistant



AI

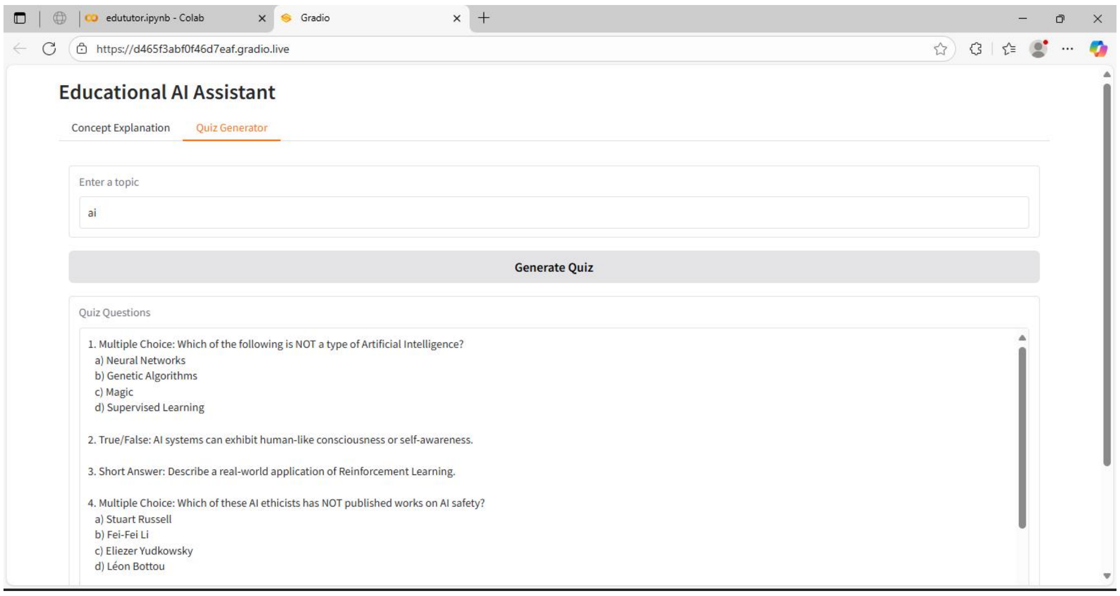
Artificial Intelligence (AI) refers to the simulation of human intelligence processes by machines, especially computer systems. These processes include learning, reasoning, problem-solving, perception, and language understanding. The ultimate goal of AI is to create intelligent machines that can perform tasks which typically require human intelligence.

1. Machine Learning (ML): A subfield of AI, ML enables systems to automatically learn and improve from experience without being explicitly programmed. For instance, Netflix uses ML algorithms to analyze viewing habits, movie preferences, and ratings to recommend personalized movie titles for each user. By continuously learning from user interactions, Netflix enhances the user experience and increases viewer engagement.

2. Natural Language Processing (NLP): NLP is an AI technique that focuses on the interaction between computers and human language. It allows machines to understand, interpret, generate, and make sense of human language in a valuable way. An example is Siri, Apple's virtual assistant. Siri processes users' spoken commands and queries to provide accurate responses, enabling seamless voice-controlled interactions with smartphones and other smart devices.

3. Computer Vision: Computer vision is an AI sector concerned with teaching machines to interpret and understand visual information from the world around us. This includes image and video analysis, object detection, and facial recognition. For example, autonomous vehicles like Tesla's Autopilot use computer vision to perceive and navigate their surroundings. They employ sensors and cameras to identify obstacles, traffic signals, lane markings, and pedestrians, making driving decisions based on this visual data.

Fig 2.concept explanation



ai

1. Multiple Choice: Which of the following is NOT a type of Artificial Intelligence?
   a) Neural Networks
   b) Genetic Algorithms
   c) Magic
   d) Supervised Learning

2. True/False: AI systems can exhibit human-like consciousness or self-awareness.

3. Short Answer: Describe a real-world application of Reinforcement Learning.

4. Multiple Choice: Which of these AI ethicists has NOT published works on AI safety?
   a) Stuart Russell
   b) Fei-Fei Li
   c) Eliezer Yudkowsky
   d) Léon Bottou

Fig 3.ai-quiz generator

11. Known Issues:

- Long responses may get truncated due to max token limits.
- First-time model load may cause latency.
- No authentication in current version.
- Limited to text input (no multimedia integration yet).

12. Future Enhancements:

LMS Integration: Seamless syncing with Moodle, Canvas, Google Classroom.

Multimedia Content: Support for diagrams, video explanations.

Adaptive Learning: Personalized pathways based on student progress.

Authentication & Roles: Teacher/student logins with history tracking.

Cloud Deployment: Host on scalable cloud platforms for real-world classrooms.