Edu Tutor AI: Personalized Learning

Generative AI with IBM

1. Introduction

Project Title: Edu Tutor AI – Personalized Learning

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2. Project Overview

Purpose:

The purpose of Edu Tutor AI is to enhance learning experiences by offering personalized educational guidance using Generative AI. It aims to adapt to each student's learning style, pace, and strengths by leveraging AI-driven insights and interactive tools. Students receive tailored learning paths, helpful recommendations, and instant feedback to improve academic outcomes. Educators benefit from data-driven summaries, performance tracking, and content recommendations to support teaching strategies.

Features:

Conversational Interface

Key Point: Natural language interaction

Functionality: Students and teachers can ask questions and receive explanations in simple language.

Content Summarization

Key Point: Simplified learning materials

Functionality: Converts complex texts into easy-to-understand summaries for quicker comprehension.

Performance Forecasting

Key Point: Academic progress tracking

Functionality: Uses historical data to predict learning trends and suggest improvements.

Study Tips Generator

Key Point: Personalized study recommendations

Functionality: Offers tailored tips based on learning habits and challenges.

Feedback Loop

Key Point: Continuous improvement

Functionality: Collects user feedback to refine learning strategies and resources.

Assessment Analysis

Key Point: Insights on student strengths and weaknesses

Functionality: Breaks down test results to highlight areas for improvement.

Anomaly Detection

Key Point: Early warning for learning difficulties

Functionality: Flags unusual patterns in performance to help address issues promptly.

Multimodal Input Support

Key Point: Flexible learning tools

Functionality: Supports text, PDFs, and other formats for diverse learning materials.

User-Friendly Interface

Key Point: Accessible learning dashboard

Functionality: Provides an intuitive UI for students and teachers to track progress and interact with tools.

3. Architecture

Frontend (Streamlit):

An interactive web-based interface that allows easy navigation, access to learning modules, and real-time feedback.

Backend (FastAPI):

Handles API requests for content generation, performance tracking, and assessments with asynchronous and efficient data processing.

LLM Integration (IBM Watsonx Granite):

Uses Granite LLM models to generate explanations, summaries, and tailored content based on individual learning patterns.

Vector Search (Pinecone):

Enables semantic search across learning materials, making it easier for users to find relevant resources.

ML Modules (Forecasting & Anomaly Detection):

Incorporates machine learning models to predict learning trends and detect unusual patterns for intervention.

4. Setup Instructions

Prerequisites:

* Python 3.9 or later

* pip and virtual environment tools

* API keys for IBM Watsonx and Pinecone

* Internet access

Installation Process:

1. Clone the repository

2. Install dependencies

3. Configure credentials in .env

4. Run the backend server

5. Launch the Streamlit UI

6. Upload study materials and interact with the tools

5. Folder Structure

* app/: Backend logic and API routes

* ui/: Frontend components

* edu_dashboard.py: Entry script for launching the interface

* granite_llm.py: Handles AI-based content generation

* document_embedder.py: Converts and stores learning content

* performance_forecaster.py: Analyzes trends

* anomaly_checker.py: Flags irregularities in learning patterns

* report_generator.py: Creates personalized reports

6. Running the Application

* Start the backend using FastAPI

* Run the Streamlit UI for access

* Upload learning content, interact with AI modules, and generate reports

* All interactions are updated dynamically in real time

7. API Documentation

Available APIs include:

* /chat/ask: Ask learning-related questions

* /upload-doc: Upload educational resources

* /search-docs: Retrieve relevant learning materials

* /get-study-tips: Get personalized recommendations

* /submit-feedback: Share feedback for improvements

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8. Authentication

Supports secure deployments with token-based authentication, OAuth2, and role-based access controls for different users.

9. User Interface

* Sidebar for navigation

* Summary cards for progress tracking

* Tabs for study tips and performance insights

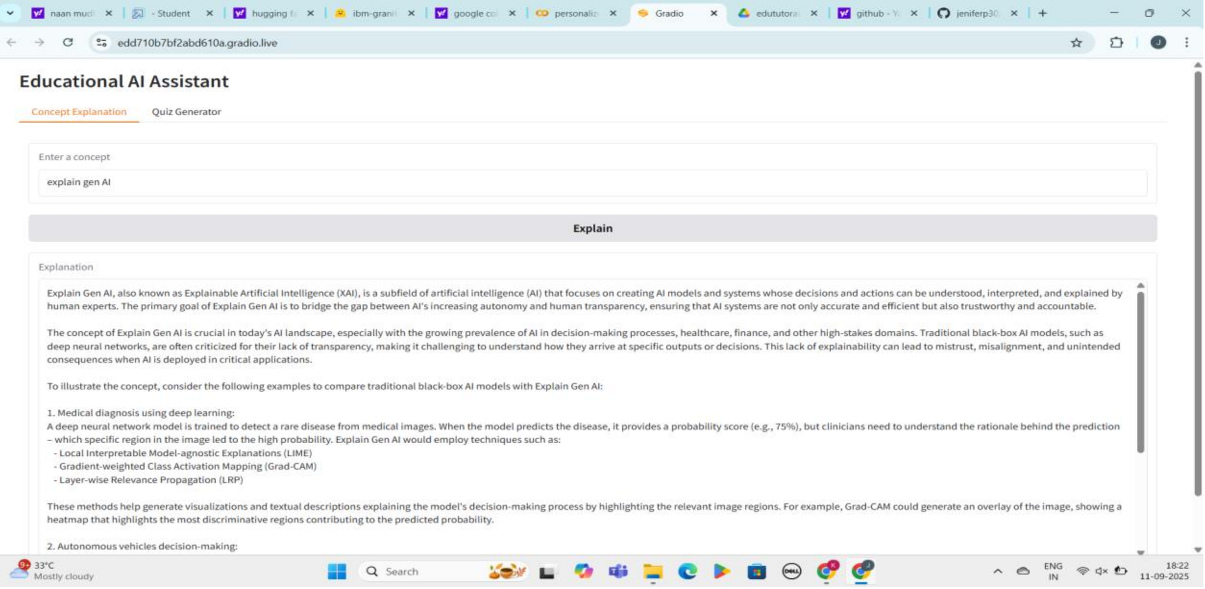
* Real-time feedback and report downloads

10. Testing

operation Includes unit tests, API validation, manual testing, and edge case handling to ensure smooth and reliability.

11. Screenshots

OUTPUT: The program has been executed and the output page is view and create a Quiz Generator.



Educational AI Assistant

Concept Explanation Quiz Generator

Enter a concept

explain gen AI

Explain

Explanation

Explain Gen AI, also known as Explainable Artificial Intelligence (XAI), is a subfield of artificial intelligence (AI) that focuses on creating AI models and systems whose decisions and actions can be understood, interpreted, and explained by human experts. The primary goal of Explain Gen AI is to bridge the gap between AI's increasing autonomy and human transparency, ensuring that AI systems are not only accurate and efficient but also trustworthy and accountable.

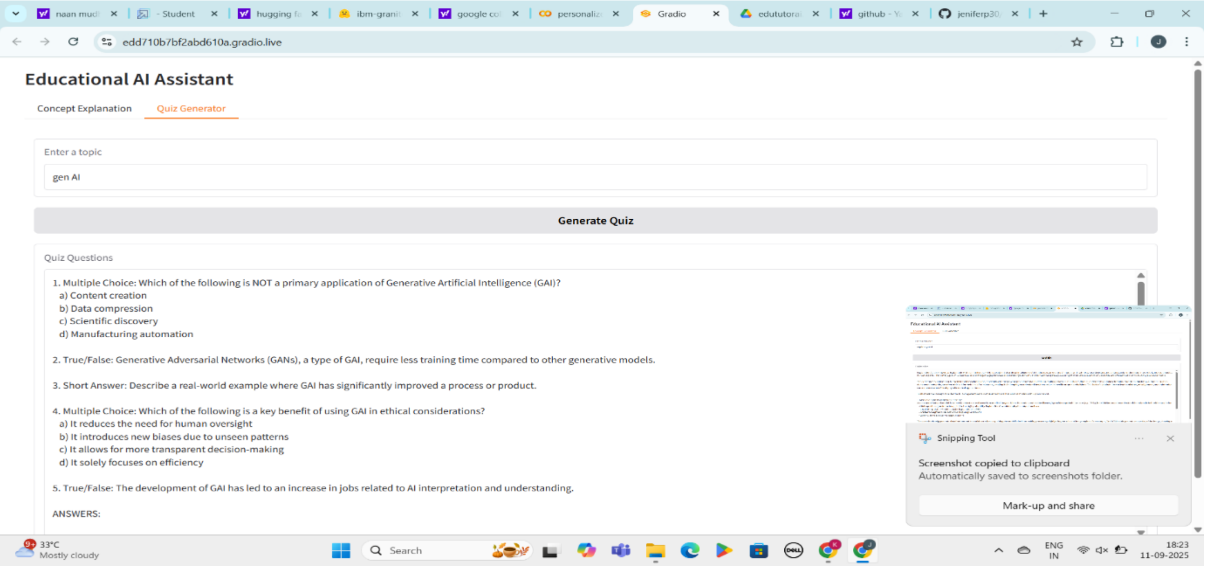
The concept of Explain Gen AI is crucial in today's AI landscape, especially with the growing prevalence of AI in decision-making processes, healthcare, finance, and other high-stakes domains. Traditional black-box AI models, such as deep neural networks, are often criticized for their lack of transparency, making it challenging to understand how they arrive at specific outputs or decisions. This lack of explainability can lead to mistrust, misalignment, and unintended consequences when AI is deployed in critical applications.

To illustrate the concept, consider the following examples to compare traditional black-box AI models with Explain Gen AI:

1. Medical diagnosis using deep learning:
A deep neural network model is trained to detect a rare disease from medical images. When the model predicts the disease, it provides a probability score (e.g., 75%), but clinicians need to understand the rationale behind the prediction – which specific region in the image led to the high probability. Explain Gen AI would employ techniques such as:
 - Local Interpretable Model-agnostic Explanations (LIME)
 - Gradient-weighted Class Activation Mapping (Grad-CAM)
 - Layer-wise Relevance Propagation (LRP)

These methods help generate visualizations and textual descriptions explaining the model's decision-making process by highlighting the relevant image regions. For example, Grad-CAM could generate an overlay of the image, showing a heatmap that highlights the most discriminative regions contributing to the predicted probability.

2. Autonomous vehicles decision-making:



Educational AI Assistant

Concept Explanation Quiz Generator

Enter a topic

gen AI

Generate Quiz

Quiz Questions

1. Multiple Choice: Which of the following is NOT a primary application of Generative Artificial Intelligence (GAI)?
 a) Content creation
 b) Data compression
 c) Scientific discovery
 d) Manufacturing automation

2. True/False: Generative Adversarial Networks (GANs), a type of GAI, require less training time compared to other generative models.

3. Short Answer: Describe a real-world example where GAI has significantly improved a process or product.

4. Multiple Choice: Which of the following is a key benefit of using GAI in ethical considerations?
 a) It reduces the need for human oversight
 b) It introduces new biases due to unseen patterns
 c) It allows for more transparent decision-making
 d) It solely focuses on efficiency

5. True/False: The development of GAI has led to an increase in jobs related to AI interpretation and understanding.

ANSWERS:

Screenshot copied to clipboard
Automatically saved to screenshots folder.

12. Known Issues

1. Data Privacy and Security Risks

Managing sensitive student information requires robust encryption and authentication methods. Without proper safeguards, data breaches or misuse may occur.

2. Accuracy and Relevance of AI Suggestions

AI-generated summaries, study tips, and performance forecasts may sometimes be inaccurate or not fully aligned with individual learning needs.

3. Limited Offline Functionality

Edu Tutor AI depends on internet connectivity for real-time interactions and cloud-based services, which restricts access in areas with poor network coverage.

13. Future Enhancements

* Integration with more educational resources

* Advanced AI-based recommendations

* Gamified learning experiences

* Mobile app version

* Enhanced security and user tracking.