Personalized Learning with Generative AI and LMS Integration

EduTutor AI - Project Report

INTRODUCTION

1.1 Overview

EduTutor AI is a lightweight, AI-powered learning assistant developed to enhance student education through personalized content generation. Designed with simplicity and accessibility in mind, the system uses IBM's Watsonx Granite large language models (LLMs) to provide interactive learning experiences directly through a FastAPI backend.

The platform enables students to:

- *Understand academic topics through natural language explanations.*
- *Generate custom quizzes from text input or uploaded PDF materials.*
- *Practice English or Hindi grammar and vocabulary interactively.*

Unlike traditional tutoring systems or static e-learning platforms, EduTutor AI uses prompt-based interactions with a generative model to create on-demand educational content tailored to each user's input. The application does not depend on third-party libraries like Hugging Face; instead, it connects directly to IBM Watsonx APIs, offering a secure and scalable deployment route.

With modules for concept understanding, automated assessment, and bilingual language support, EduTutor AI brings together modern AI capabilities to deliver a more engaging and personalized student learning experience.

1.2 Purpose

The purpose of EduTutor AI is to bridge the gap between traditional teaching methods and modern AI-based educational tools. The key goals of the system are:

- *To assist students in learning complex topics by generating simple and accurate explanations.*
- *To enable automated quiz creation from both typed topics and uploaded study material in PDF form, saving time and ensuring consistent practice.*
- *To provide interactive English and Hindi language learning support, including grammar correction and vocabulary improvement.*

By integrating IBM's enterprise-grade LLMs into a focused educational assistant, EduTutor AI aims to make quality tutoring and self-paced assessment tools accessible to all learners—especially in resource-constrained or bilingual environments.

2. Ideation Phase
2.1 Define the Problem Statements

Date	26 June 2025
Team ID	LTVIP2025TMID59663
Project Name	EduTutor AI: Personalized Learning with Generative AI and LMS Integration
Maximum Marks	2 Marks

Customer Problem Statement EduTutor AI:

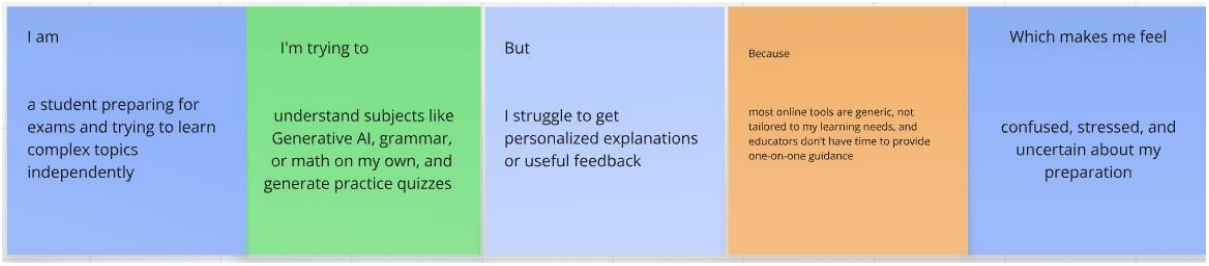
In today's fast-paced education system, students often face the challenge of understanding complex subjects without proper guidance. Many rely on online resources, but these are often generic, not personalized to the learner's pace or style. Meanwhile, educators are overwhelmed with the repetitive task of creating and evaluating quizzes manually for every student.

EduTutor AI aims to solve this by offering a personalized AI tutor that provides:

- Concept explanations simplified for different age levels
- Grammar and language learning support in English and Hindi
- Automated quiz and test generation from PDFs and topics

This solution empowers students to learn at their own pace with clarity, and enables educators to scale personalized learning experiences without increased workload.

Example:



Problem Statement (PS)	**I am (Customer)**	**I'm trying to**	**But**	**Because**	**Which makes me feel**
PS-1	a high school student preparing for exams	understand difficult topics and revise efficiently	I can't grasp the concepts fully and get no feedback	online resources are generic and teachers are not always available	frustrated, confused, and unsupported
PS-2	a teacher managing multiple students	generate personalized	I don't have time to prepare and evaluate tests for each student	manual creation and review takes too much effort	overwhelmed and limited in my teaching impact

2 Ideation Phase

2.2 Brainstorm & Idea Prioritization Template

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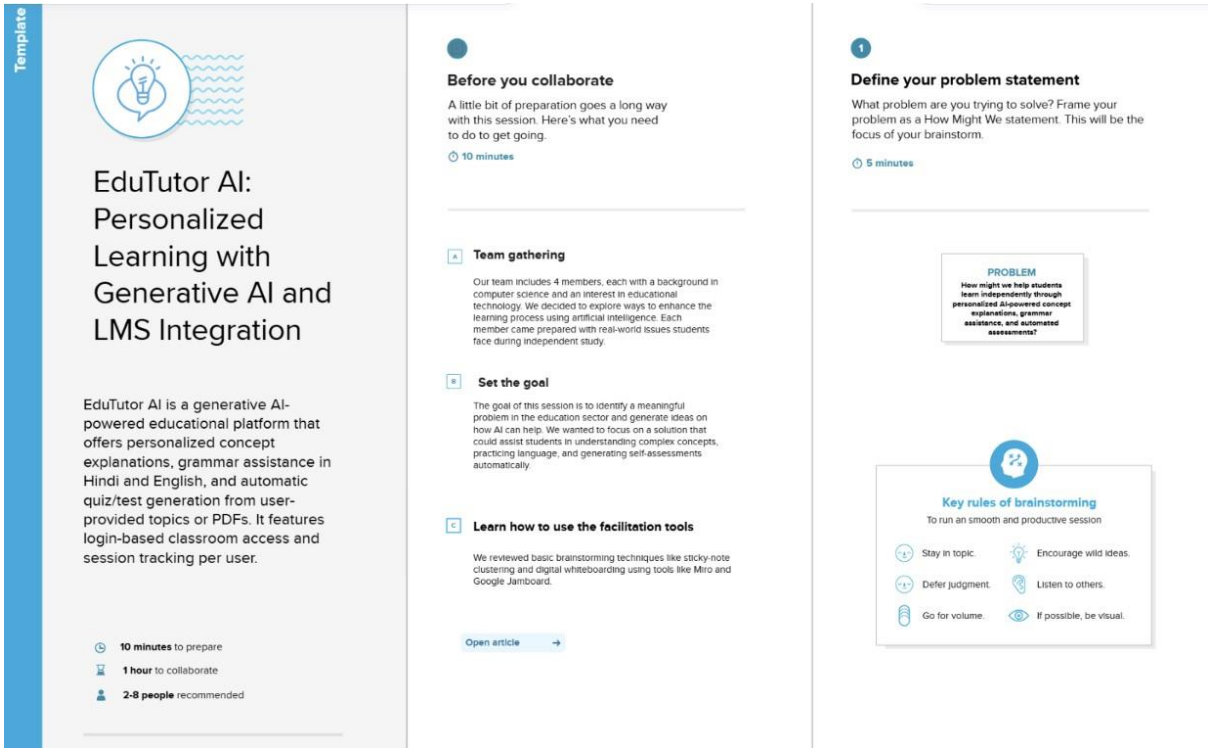
Maximum Marks	4 Marks

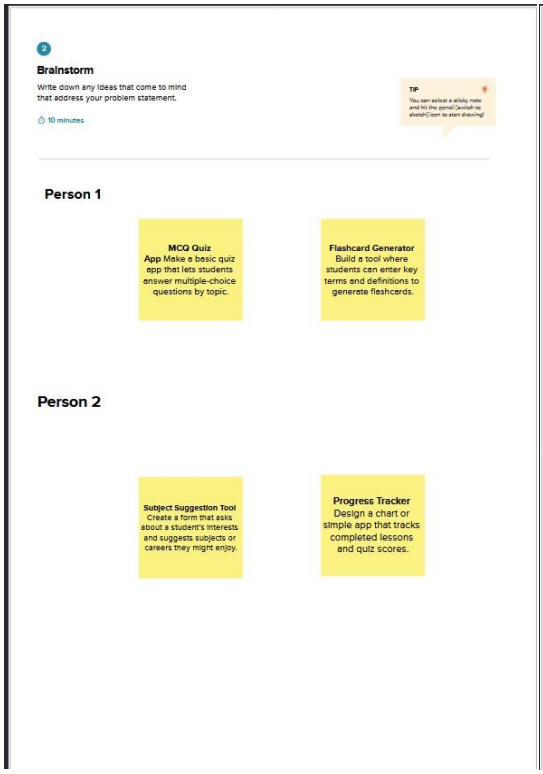
Brainstorm & Idea Prioritization EduTutor AI:

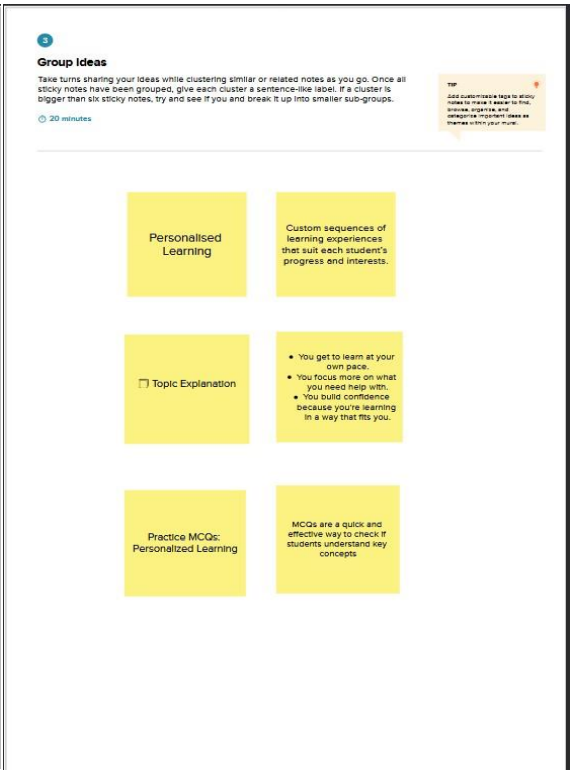
Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Step-1: Team Gathering, Collaboration and Select the Problem Statement

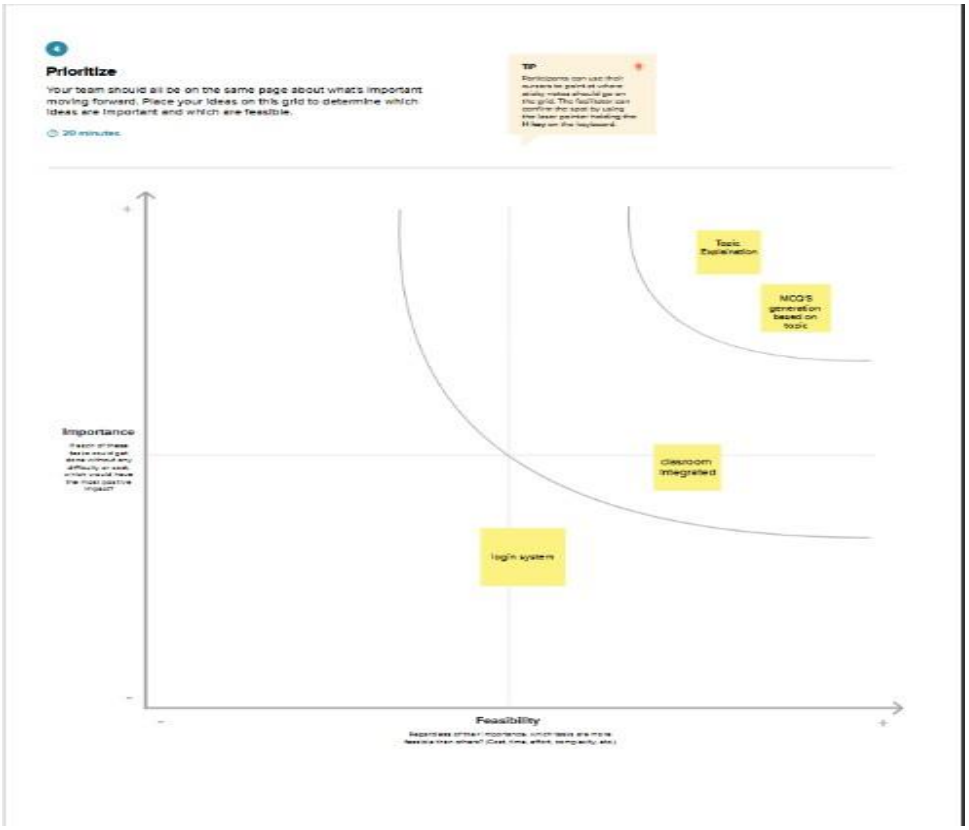


Step-2: Brainstorm, Idea Listing and Grouping





Step-3: Idea Prioritization



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2.3 Empathize & Discover

Empathy Map Canvas EduTutor AI:

SAYS

What the student/user verbally expresses:

- "I don't understand this topic, even after watching videos."
- "I need a simple explanation like a teacher would give."
- "I wish I could practice more questions like in school."

THINKS

What the user is thinking but might not say out loud:

- "Am I studying the right way?"
- "What if I fail the test because I missed something important?"
- "Other students probably have better help than I do."

DOES

What actions or behaviors the student takes:

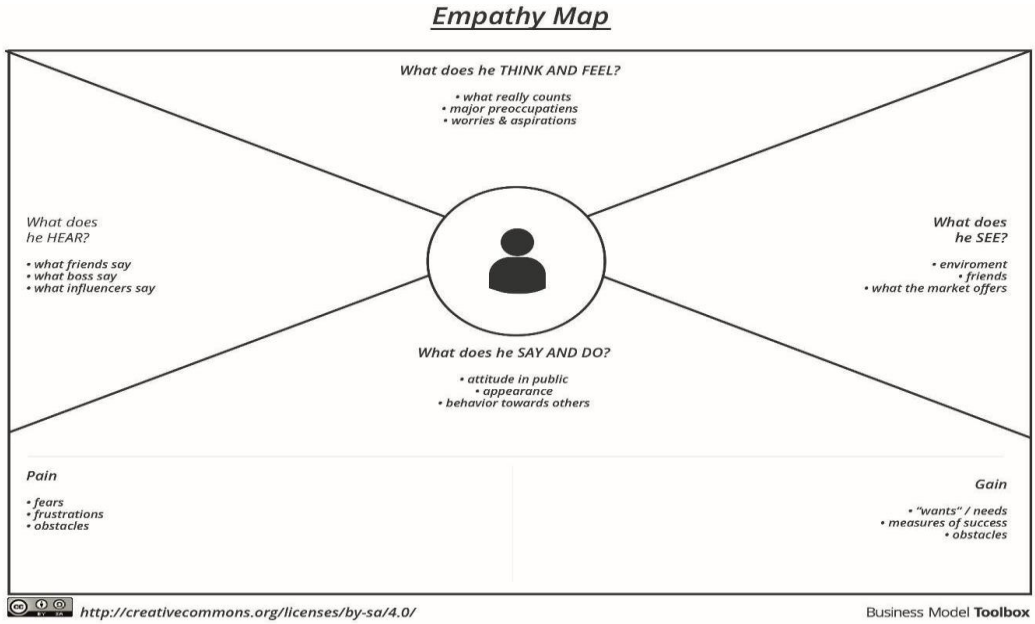
- Searches YouTube or websites for topics
- Uploads books or PDFs to extract questions
- Tries apps for grammar and test prep
- Attempts mock tests but gets no explanations

FEELS

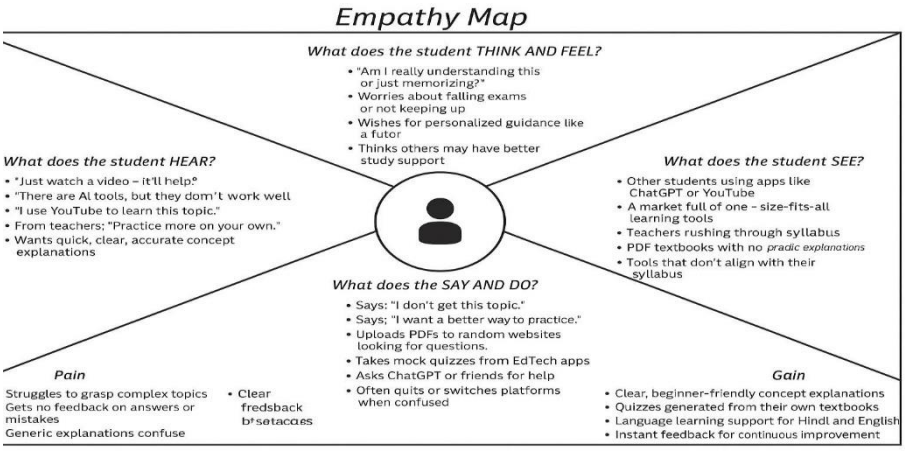
What emotions the user experiences:

- Anxious and overwhelmed before exams
- Relieved when they finally understand a topic
- Disappointed by one-size-fits-all apps
- Excited when learning becomes personalized

Example:



Example: EduTutor AI



3. Requirement Analysis

3.1 Solution Requirements (Functional & Non-functional)

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Functional Requirements

The following are the core functional requirements for the EduTutor AI application, based strictly on the current feature set outlined in the README.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Input Handling	Accept topic input from user through a text field
FR-2	Explanation Generation	Send topic to IBM Watsonx model Display explanation using Streamlit
FR-3	MCQ Generation	Generate multiple-choice questions (MCQs) from the given topic Display MCQs with correct answers
FR-4	Credential Configuration	Allow user to enter IBM Watsonx API key and project ID in app.py

Non-Functional Requirements

The following are the non-functional requirements for the current version of EduTutor AI.

NFR No.	Non-Functional Requirement	Description
NFR-1	Usability	The Streamlit interface should be simple and intuitive for quick interaction.
NFR-2	Security	IBM Watsonx credentials should be kept secure and not hard-coded for public use.
NFR-3	Reliability	System should consistently produce valid explanations and MCQs for well-formed inputs.
NFR-4	Performance	Output should be generated within 2–4 seconds under normal load.
NFR-5	Deployment Simplicity	App should run with minimal setup using 'streamlit run app.py'.

3. Requirement Analysis

3.2 Data Flow Diagram & User Stories

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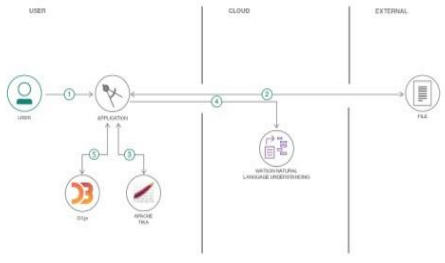
Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

A **Data Flow Diagram (DFD)** is a graphical tool used to model the flow of data within a system. It shows how data is **input, processed, stored, and output** in a clear and systematic way. For EduTutor AI, the DFD outlines how users interact with the system through the interface and how their data is processed by the AI model and other components.

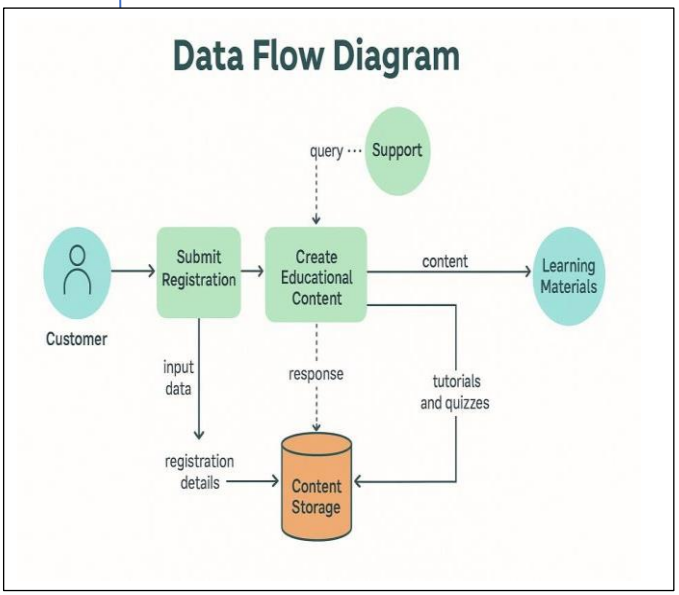
Example: (Simplified)

Flow



1. User configures credentials for the Watson Natural Language Understanding service and starts the app.
2. User selects data file to process and load.
3. Apache Tika extracts text from the data file.
4. Extracted text is passed to Watson NLU for enrichment.
5. Enriched data is visualized in the UI using the D3.js library.

DFD of EduTutor



User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance Criteria	Priority	Release
Customer (Mobile user)	Streamlit UI	USN-1	As a user, I can register for the application by entering my name and password	I can access my account/dashboard	High	Sprint-1
		USN-2	As a user, I can log into the application using name & password.	Login should redirect me to the dashboard	High	Sprint-1
	Concept Explanation	USN-3	As a user, I can enter a concept and get a simplified explanation.	The concept is clearly explained in an easy way	High	Sprint-1
	MCQ Generation	USN-4	As a user, I can enter atopic it generates questions for practice.	A quiz with relevant questions is generated	High	Sprint-2
		USN-5	As a user, I can choose a language (English/Hindi) to learn grammar and parts of speech.	Language learning content is displayed	Medium	Sprint-2

3. Requirement Analysis

3.3 Technology Stack (Architecture & Stack)

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Maximum Marks	4 Marks

Architecture Layers & Flow

Layer	Technology	Description
User Interface Layer (Local)	Streamlit	Collects user input such as concept/topic; displays explanations and MCQs
Application Logic Layer (Local)	Python	Handles prompt generation, session management, and quiz formatting logic
AI Model Layer (Cloud)	IBM Watsonx via ibm-watsonx-ai SDK	Uses Granite model (granite-3-8b-instruct) to generate topic explanations and MCQs
Data Storage Layer (Local)	In-memory Dictionary (Python)	Temporarily stores session data and results during runtime
External Interfaces	IBM Watsonx API Credentials	Secure communication with IBM foundation model APIs

Table 1: Components & Technologies

S.No	Component	Description	Technology
1	User Interface	Interactive UI for input and output display	Streamlit
2	Application Logic	Prompt construction, logic handling, and output formatting	Python
3	Session Handling	Tracks user inputs/output per session	Python in-memory structures
4	External API	Accesses IBM Watsonx foundation model	IBM Watsonx AI SDK (ibm-watsonx-ai)
5	Machine Learning Model	Performs natural language generation	granite-3-8b-instruct
6	Infrastructure	Execution environment for app	Local Runtime / Cloud-hosted via Hugging Face Spaces

Table 2: Application Characteristics

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S.no	Characteristic	Description	Technology
1	Open-Source Frameworks	Built using open tools	Streamlit, Python, IBM SDK
2	Security Implementations	Credentials stored securely (locally or in Hugging Face secrets)	API Key + Project ID
3	Scalability	Modular layers (UI → Logic → Model); extendable	Streamlit + API-based logic
4	Availability	Run locally or deploy on Hugging Face Spaces or Streamlit Cloud	Python + Streamlit Cloud
5	Performance	Fast text generation via optimized cloud APIs	IBM Watsonx optimized models

4. Project Design
4.1 Problem – Solution Fit Template

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Maximum Marks	2 Marks

Problem – Solution Fit EduTutor AI:

Problem

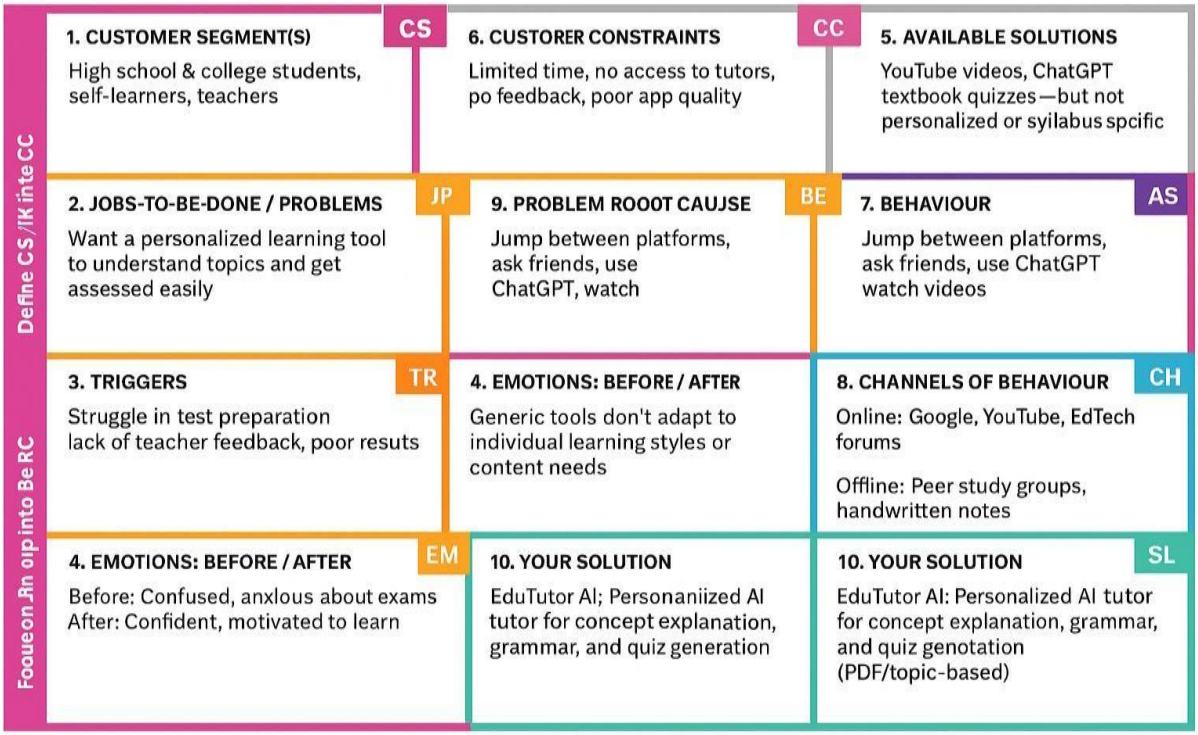
Many students struggle to understand complex academic concepts on their own and lack the ability to assess their knowledge effectively. Despite the abundance of content online, these materials are often generic, not tailored to individual learning styles, languages, or needs. Simultaneously, educators lack tools to personalize instruction or quickly generate and evaluate assessments for each student. This gap leads to confusion, low confidence, poor academic performance, and overburdened educators.

Solution

EduTutor AI is a personalized learning platform that uses generative AI to explain concepts in a simplified manner, offer grammar assistance (in Hindi and English), and automatically generate quizzes and tests from topics or uploaded PDFs. It includes:

- Concept explanations tuned for age and subject level
- MCQ’S generators

This solution directly addresses students' needs for clarity, practice — while reducing effort for educators in content preparation.


Define CS /IK inte CC
Foouеon An oip into Be RC
1. CUSTOMER SEGMENT(S)
CS
High school & college students, self-learners, teachers
6. CUSTORER CONSTRAINTS
CC
Limited time, no access to tutors, po feedback, poor app quality
5. AVAILABLE SOLUTIONS
YouTube videos, ChatGPT textbook quizzes—but not personalized or syilabus spcific
2. JOBS-TO-BE-DONE / PROBLEMS
JP
Want a personalized learning tool to understand topics and get assessed easily
9. PROBLEM ROOOT CAUJSE
BE
Jump between platforms, ask friends, use ChatGPT, watch
7. BEHAVIOUR
AS
Jump between platforms, ask friends, use ChatGPT watch videos
3. TRIGGERS
TR
Struggle in test preparation lack of teacher feedback, poor resuts
4. EMOTIONS: BEFORE / AFTER
Generic tools don't adapt to individual learning styles or content needs
8. CHANNELS OF BEHAVIOUR
CH
Online: Google, YouTube, EdTech forums
Offline: Peer study groups, handwritten notes
4. EMOTIONS: BEFORE / AFTER
EM
Before: Confused, anxlous about exams
After: Confident, motivated to learn
10. YOUR SOLUTION
EduTutor Al; Personaniized Al tutor for concept explanation, grammar, and quiz generation
10. YOUR SOLUTION
SL
EduTutor Al: Personalized Al tutor for concept explanation, grammar, and quiz genotation (PDF/topic-based)

4. Project Design Phase
4.2 Proposed Solution Template

Date	27 June 2025
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Maximum Marks	2 Marks

Proposed Solution EduTutor AI:

Project team shall fill the following information in the proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Students face difficulties in understanding complex topics independently and lack access to personalized learning . Teachers also struggle with time-consuming quiz generation and individual evaluation.
2.	Idea / Solution description	EduTutor AI is a generative AI-powered educational platform that offers personalized concept explanations, grammar assistance in Hindi and English, and MCQ'S generation from user-provided topics . It features login-based classroom access and session tracking per user.
3.	Novelty / Uniqueness	Unlike generic platforms, EduTutor AI can offer desirable explanation and generate personalized quizzes. It combines LMS features with generative AI for both concept delivery and adaptive assessment in multiple languages.
4.	Social Impact / Customer Satisfaction	It enhances accessibility to quality education for students without tutors, supports regional languages, and reduces the workload on teachers. Students gain confidence and clarity, while teachers benefit from automation.
5.	Business Model (Revenue Model)	Freemium model: free access to basic features (concepts, quizzes), with premium plans for advanced features like PDF uploads, progress analytics, custom LMS integration for schools/colleges. Additional revenue through institutional licensing.
6.	Scalability of the Solution	The solution is cloud-based and can support millions of users with the same backend. It can scale across languages, educational levels, and institutions globally, and easily integrate with other EdTech platforms or LMS providers.

4. Project Design Phase
4.3 Solution Architecture

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Maximum Marks	4 Marks

Solution Architecture

Solution architecture outlines how the system components are organized to achieve the project's functional goals. It bridges the gap between business requirements and technical implementation in a structured and scalable way.

Purpose

EduTutor AI is designed to offer a personalized learning experience using generative AI capabilities provided by IBM Watsonx. The platform provides users with the ability to input a topic and receive either a clear explanation or a set of quiz questions. The entire application is built using Python and Streamlit, without any complex backend frameworks or third-party language model integrations such as Hugging Face.

Architecture Overview

The system architecture is composed of three primary layers:

1. User Interface Layer (Streamlit)

This layer is responsible for interacting with the user through a web-based UI built entirely in Streamlit. It provides:

- A text input field for entering concepts or topics
- A mode selector to switch between "Explain" and "Quiz"
- A display area to show either the explanation or the generated quiz
- A simple, responsive interface that runs locally or in the cloud

2. Logic & Processing Layer (Python)

This layer contains the core application logic, which includes:

- Handling user input and selection of modes
- Formatting prompts for explanation or quiz generation
- Managing user session data using Python dictionaries (if applicable)
- Communicating with the IBM Watsonx API
- Optionally handling file input and parsing via PyPDF2 (for PDF-to-quiz functionality)

3. AI Model Layer (IBM Watsonx Granite API)

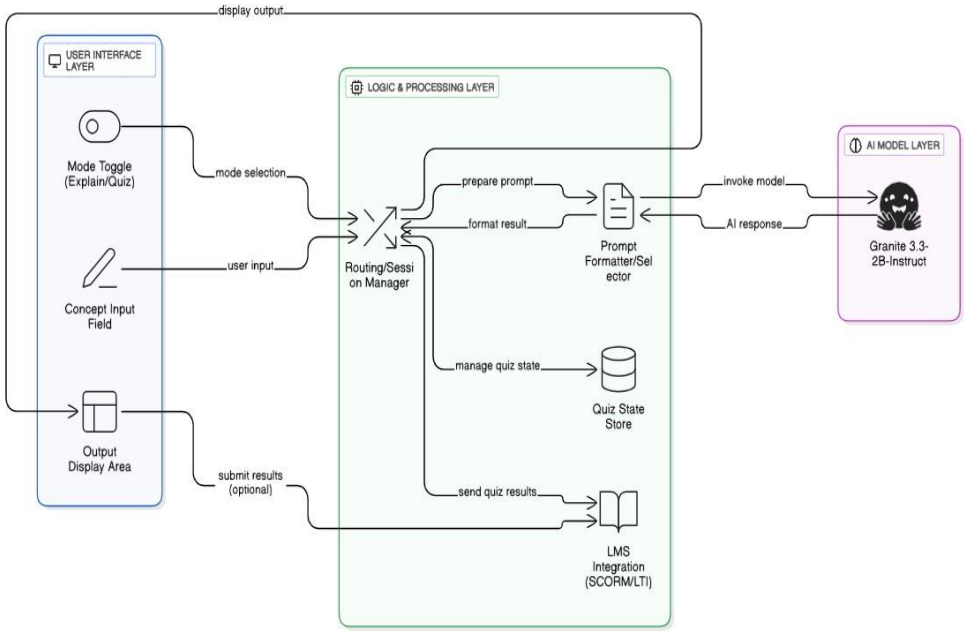
This layer integrates directly with IBM Watsonx, utilizing the Granite 3.3-2B-Instruct model via secure API calls. It performs:

- Concept explanation generation based on natural language input
- Topic-based quiz generation (5 MCQs with options and correct answers)
- Language-specific responses when needed (e.g., English/Hindi grammar lessons)

Data Flow Summary

1. The user interacts with the Streamlit interface to enter a concept or topic.
2. The Python backend detects the selected mode (Explain or Quiz) and prepares the appropriate prompt.
3. The prompt is sent to the IBM Watsonx API using the provided credentials.
4. The AI model processes the input and returns a response.
5. The response is formatted and displayed to the user in the Streamlit interface.

Example - Solution Architecture Diagram:



5. Project Planning Phase

5.1 Project Planning Template (ProdBacklog, Sprint Planning, Stories, Story points)

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Maximum Marks	5 Marks

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

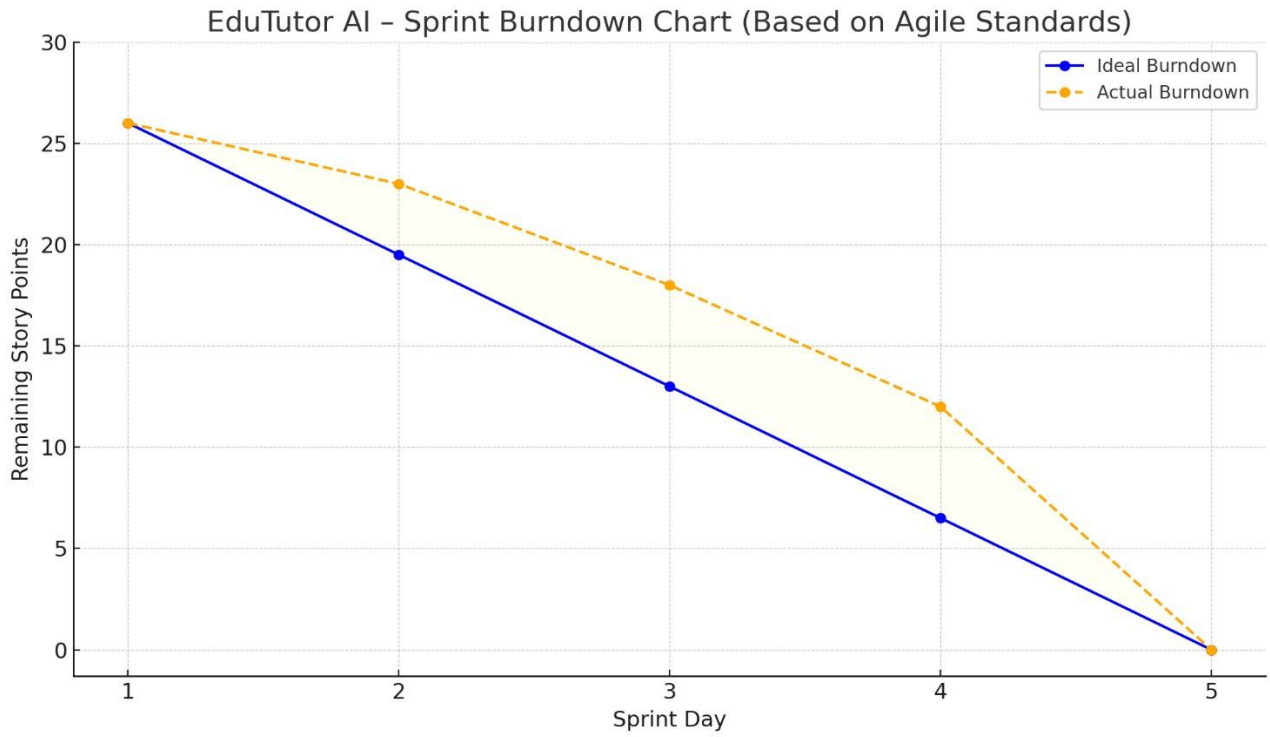
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Streamlit UI	**USN-1**	**As a user, I can register using a username and password.**	**2**	**High**	**varsha ,nazima**
Sprint-1	Output Formatting	**USN-2**	**As a user, I can log in to my account with name and password.**	**2**	**High**	**varsha**
Sprint-1	Mode Switching Logic	**USN-3**	**As a user, I can track my sessions after login.**	**2**	**Medium**	**nazima**
Sprint-2	MCQ Generator Prompting	**USN-4**	**As a user, I can enter a concept and get Algenerated explanation.**	**3**	**High**	**varsha**
Sprint-2	Answer Formatting	**USN-5**	**As a user, I can choose Hindi or English and learn grammar basics.**	**3**	**High**	**nazima**
Sprint-3	Watsonx Integration	**USN-6**	**As a user, I can upload a PDF and receive a quiz based on the content.**	**5**	**High**	**varsha**
Sprint-3	Streamlit Deployment	**USN-7**	**As a user, I can enter a topic and receive a custom quiz.**	**3**	**Medium**	**nazima**
Sprint-3	Error Handling	**USN-8**	**As a developer, I can create a multi-tab UI using Gradio.**	**3**	**High**	**varsha**

Imagine we have a 5-day sprint duration, and the velocity of the team is 13 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

AV = sprint duration / velocity = 13 / 5 = 2.6

Burndown Chart:

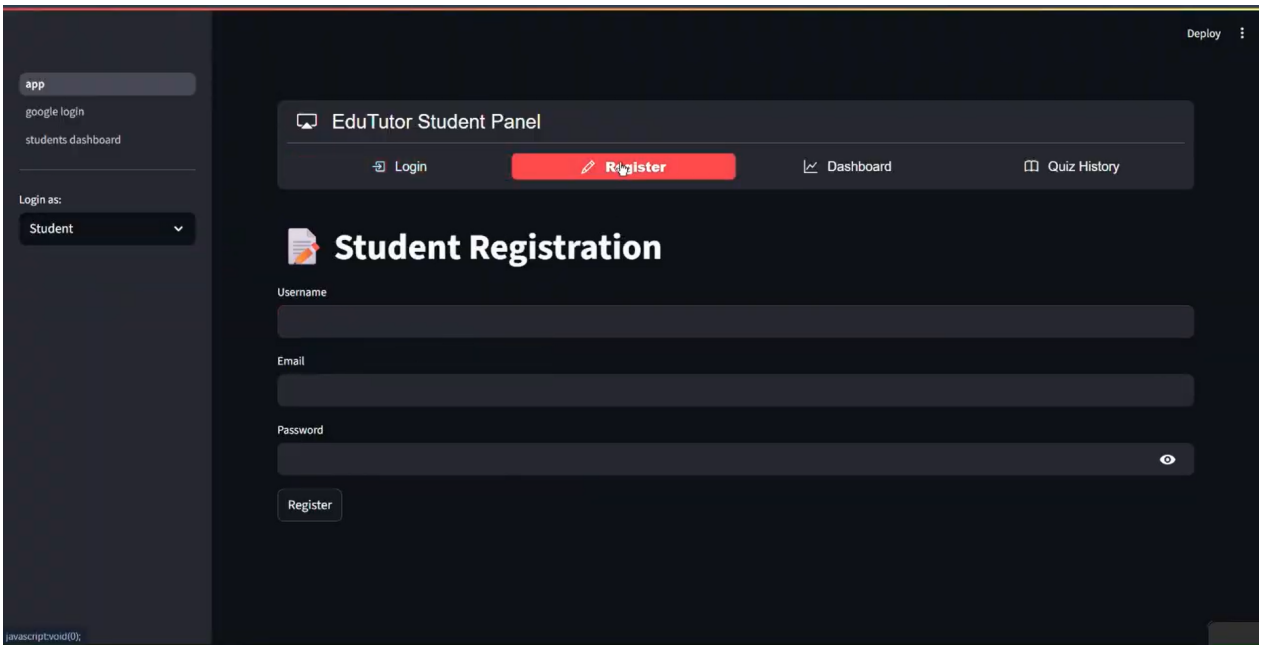
A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.

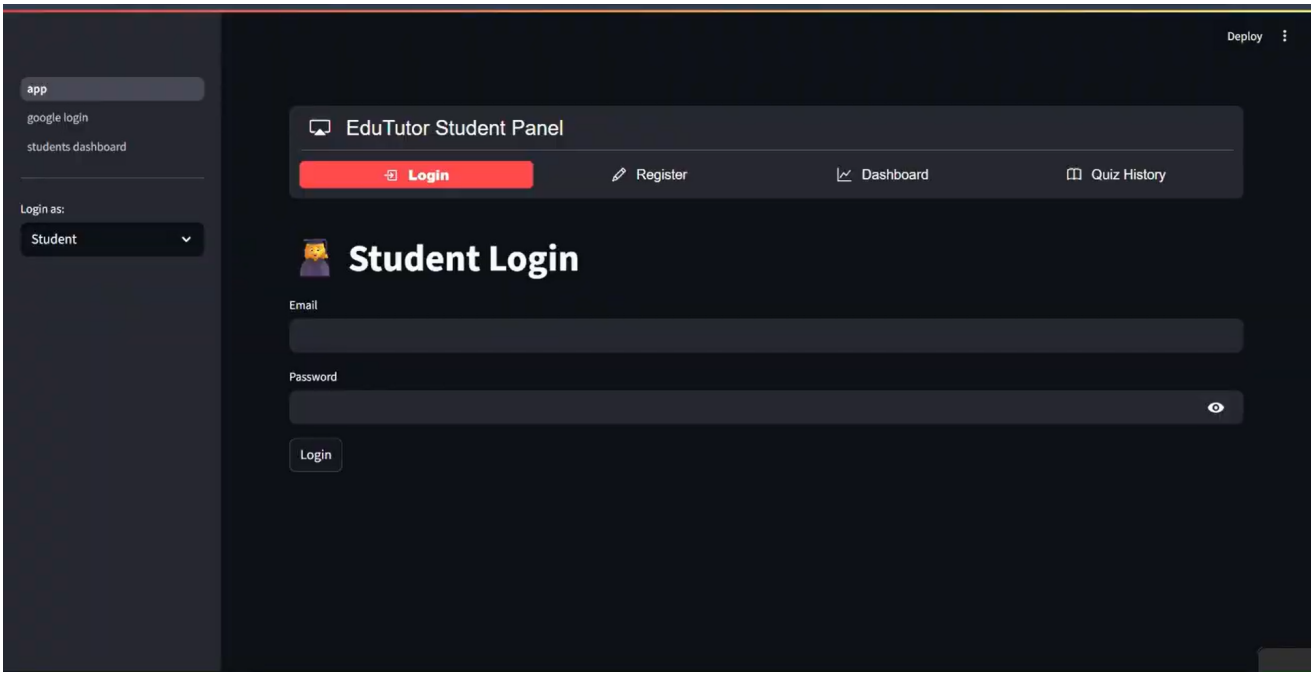


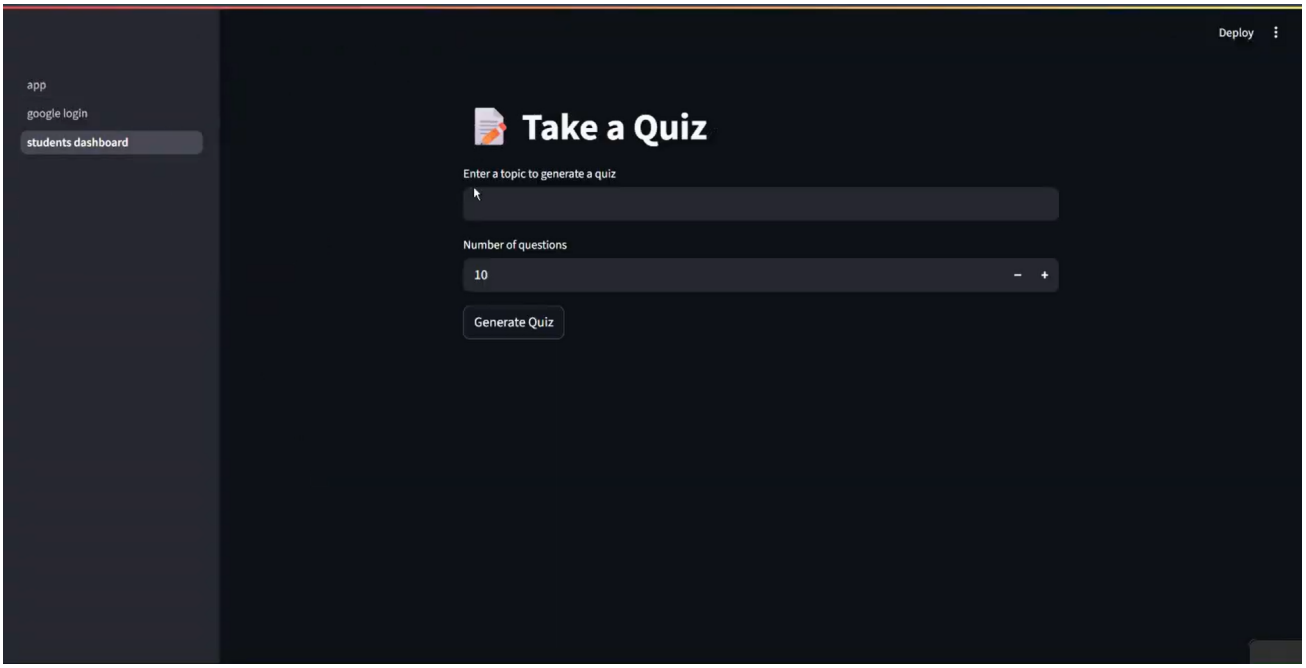
https://www.visual-paradigm.com/scrum/scrum-burndown-chart/

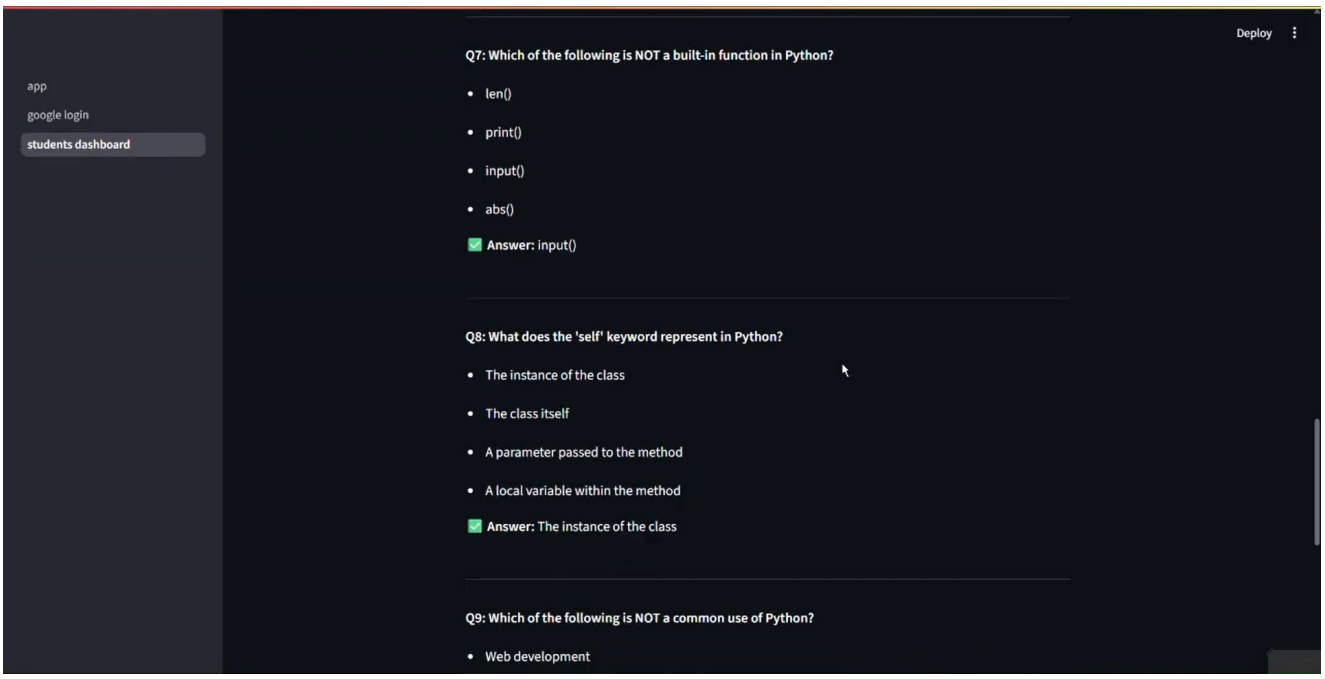
https://www.atlassian.com/agile/tutorials/burndown-charts

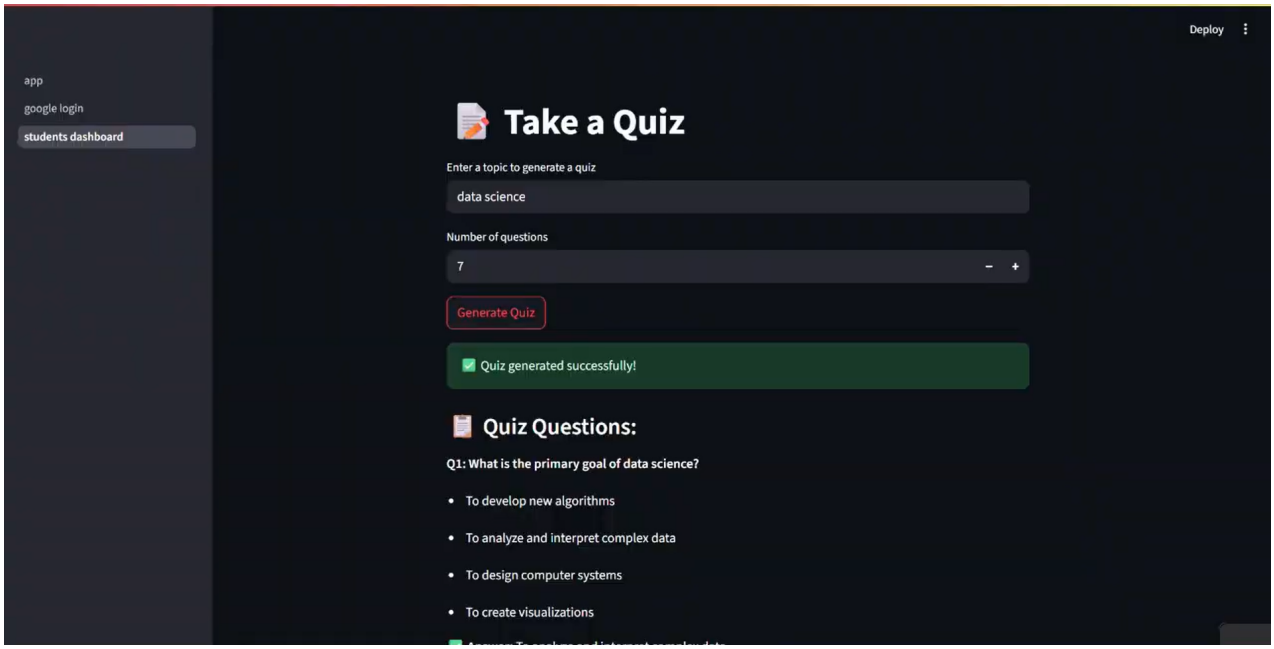
6.RESULTS

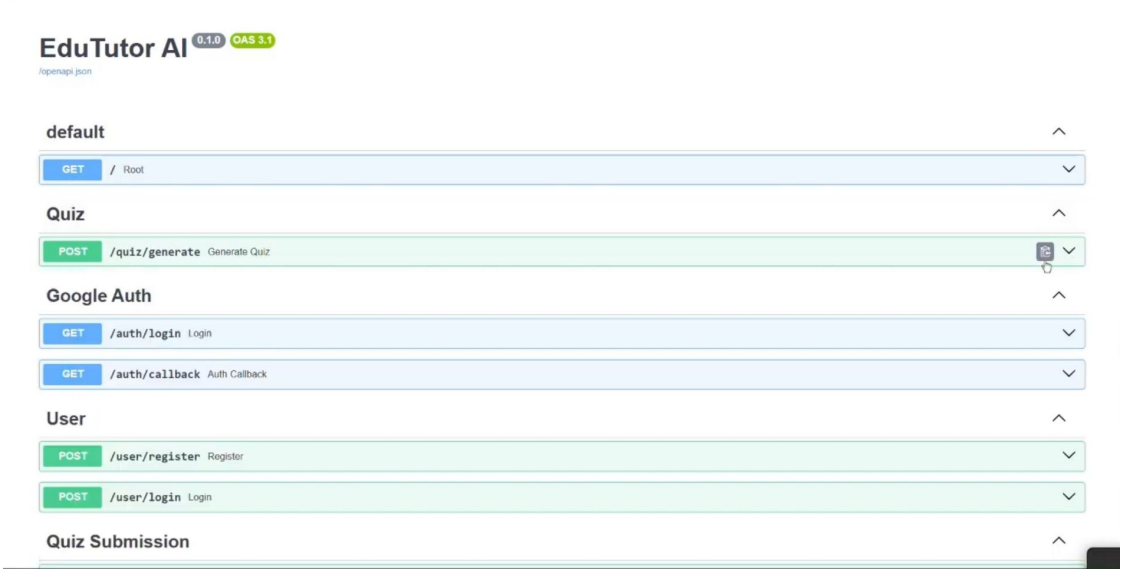

Deploy
app
google login
students dashboard
Login as:
Student
EduTutor Student Panel
Login
Register
Dashboard
Quiz History
Student Registration
Username
Email
Password
Register


Deploy
app
google login
students dashboard
Login as:
Student
EduTutor Student Panel
Login
Register
Dashboard
Quiz History
Student Login
Email
Password
Login


Deploy
app
google login
students dashboard
Take a Quiz
Enter a topic to generate a quiz
Number of questions
10
Generate Quiz


Deploy
app
google login
students dashboard
Q7: Which of the following is NOT a built-in function in Python?
len()
print()
input()
abs()
Answer: input()
Q8: What does the 'self' keyword represent in Python?
The instance of the class
The class itself
A parameter passed to the method
A local variable within the method
Answer: The instance of the class
Q9: Which of the following is NOT a common use of Python?
Web development





8.ADVANTAGES & DISADVANTAGES

Advantages:

- Quick and personalized learning

- Minimal setup required

- AI-generated quizzes improve retention

Disadvantages:

- Dependency on internet and IBM API

- May require fine-tuning for specific subjects

9. CONCLUSION

EduTutor AI offers an innovative approach to personalized learning. It bridges the gap between traditional study methods and AI-powered solutions by providing instant explanations and quizzes. The platform enhances the learning process and makes education more interactive and effective.

10. FUTURE SCOPE

- Add support for diagram-based explanations

- Include multilingual quiz support

- Integrate with platforms like Google Classroom

- Track student progress and analytics

11. APPENDIX

GitHub & Project Demo Link: https://github.com/SK-LIYA/EduTutor-AI