



## CAPSTONE PROJECT

# AI-Powered Study Buddy

PRESENTED BY

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# OUTLINE:

- **Problem Statement** (Should not include solution)
- **Proposed System/Solution**
- **System Development Approach** (Technology Used)
- **Algorithm & Deployment**
- **Result (Output Image)**
- **Conclusion**
- **Future Scope**
- **References**

# PROBLEM STATEMENT:

- Students often struggle to understand complex academic concepts while studying independently, with no personalized help available outside classroom hours.
- Searching online frequently yields lengthy, irrelevant, or overly technical results that do not match the student's current level of understanding.
- Teachers and tutors are not always available for instant doubt resolution — especially in the evenings, weekends, or during exam season.
- There is no dedicated, on-demand tool that can explain topics in simple language, summarize notes, and generate quizzes or flashcards tailored to each student's need.

Existing study tools lack AI-driven adaptability, making self-study inefficient and frustrating for a large number of learners.

# PROPOSED SOLUTION:

- The proposed system is an **AI-Powered Study Buddy** web application that uses large language models (LLMs) to assist students with their academic learning in real-time. The solution consists of the following components:
- **Explain Mode:**
- Breaks down any complex topic into simple, student-friendly language with step-by-step explanations.
- **Summarize Mode:**
- Accepts pasted notes or text and returns concise, digestible bullet-point summaries.
- **Quiz Me Mode:**
- Generates on-demand multiple-choice and short-answer questions to enable active recall and self-assessment.
- **Chat Interface:**
- Natural conversational UI available 24/7 with no waiting time, powered by Google Gemini AI.
- **Secure Backend Integration:**
- All AI API requests are handled through Supabase Edge Functions, ensuring secure communication and protecting API credentials from being exposed on the client side.

# SYSTEM APPROACH:

## Frontend:

React.js with TypeScript and Tailwind CSS for a responsive, modern, and accessible user interface.

## Backend / Serverless:

Edge Functions (serverless) to securely handle AI API calls without exposing credentials to the client.

## AI Model:

Google Gemini via AI Gateway — used for topic explanation, note summarization, and quiz generation.

## Architecture:

Client → Edge Function → Gemini LLM → Streams token-by-token response back to the UI in real-time.

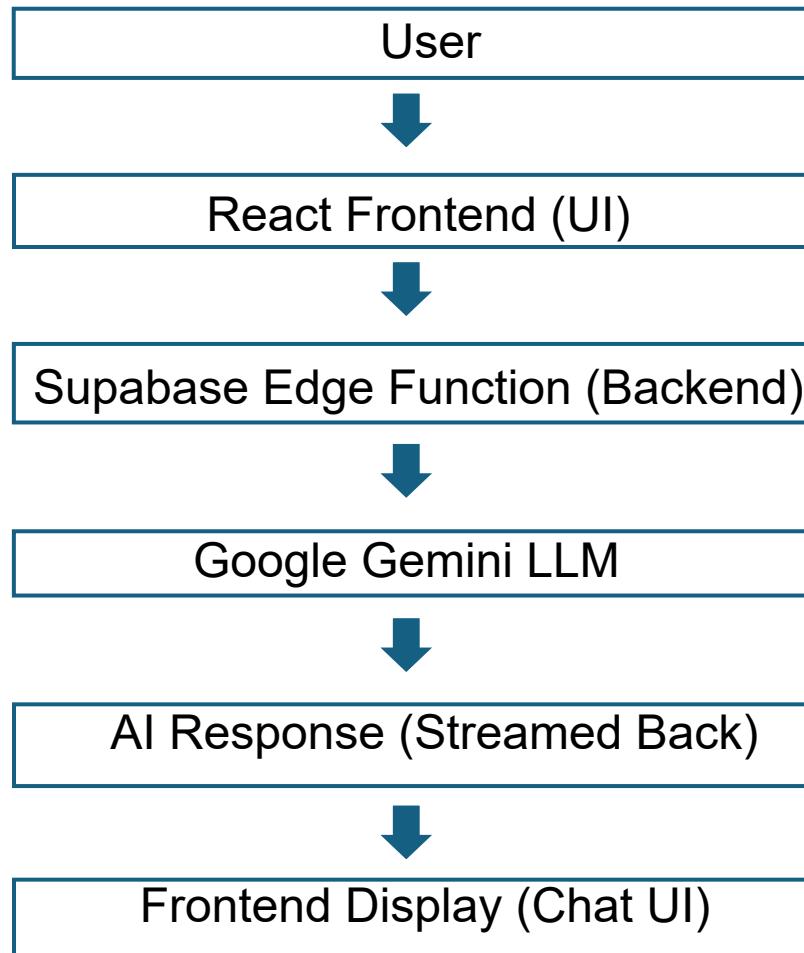
## Libraries & Tools:

react-markdown (render AI output), lucide-react (icons), Vite (build tool), Bun (runtime).

## Deployment:

Hosted on a cloud platform with automatic scaling, zero-config CI/CD, and instant edge function deployment.

# SYSTEM ARCHITECTURE DIAGRAM



# ALGORITHM & DEPLOYMENT:

- **Input Processing:**
  - The user selects a mode (Explain / Summarize / Quiz Me / Chat) and types a question or pastes study notes into the chat interface.
- **Prompt Engineering:**
  - A context-aware system prompt is constructed based on the selected mode, instructing the AI to behave as a tutor with the correct output format.
- **AI Inference:**
  - The prompt is sent securely to Google Gemini LLM via a backend edge function. The model generates and streams the response token-by-token.
- **Output Rendering:**
  - Markdown-formatted AI responses are rendered in the chat UI — supporting bullet lists, bold text, code blocks, and headings.
- **Deployment Pipeline:**
  - Code changes trigger an automatic build via Vite; edge functions deploy instantly to the global CDN.

# RESULT:

The AI-Powered Study Buddy was successfully built and deployed as a fully functional web application. Key outcomes:

- **Explain Mode** successfully breaks down complex topics (e.g., Photosynthesis, Newton's Laws, Binary Search) into clear, student-friendly explanations in seconds.
- **Summarize Mode** condenses long paragraphs or pasted notes into concise, structured bullet-point summaries.
- **Quiz Me Mode** generates relevant multiple-choice and short-answer questions from any topic, enabling active recall and self-testing.
- Real-time streaming ensures fast response delivery — users begin reading AI output within 1–2 seconds of sending their query.
- The chat interface is fully responsive and works on desktop, tablet, and mobile browsers without any installation.

**Study Buddy**

AI-powered learning assistant

 Explain Summarize Quiz Me Chat

## What would you like to learn?

Pick a mode above and ask anything. I'll explain concepts, summarize notes, or quiz you on any topic.

**Explain**

Break down complex topics

**Summarize**

Condense your notes

**Quiz Me**

Test your knowledge

Enter a topic to explain (e.g., Photosynthesis, Newton's Laws)...





Study Buddy

AI-powered learning assistant



Explain

Summarize

Quiz Me

Chat

Explain the importance of AI

Think of Artificial Intelligence (AI) as a "brain" made of software. It allows computers to learn from data, recognize patterns, and make decisions—tasks that usually require human intelligence.

The importance of AI lies in its ability to handle massive amounts of work faster and more accurately than humans. Here is a breakdown of why AI is a game-changer today:

#### 1. Handling "Big Data"

We create more data every second than humans could ever analyze. AI is essential because it can scan millions of files in seconds to find trends.

**Example:** Predicting weather patterns by looking at decades of global temperature data instantly.

#### 2. Automating Boring or Dangerous Tasks

AI can take over "repetitive" work (like sorting emails) or "dangerous" work (like defusing bombs or exploring deep oceans).

**The Benefit:** This frees up humans to do creative or social jobs that AI can't do yet.

**Example:** Robots in factories that assemble cars with 100% precision 24 hours a day.

#### 3. Personalization

AI learns what you like and tailors your digital world to fit you. Without AI, the internet would feel cluttered and disorganized.

**Example:** Netflix or Spotify algorithms. They use AI to suggest your next favorite show or song based on what you've listened to before.

#### 4. Improving Healthcare



Study Buddy

AI-powered learning assistant



Explain

Summarize

Quiz Me

Chat

summary of AI

Here is a concise summary of the core concepts, types, and impacts of **Artificial Intelligence (AI)**.

### 1. Definition of AI

**Core Concept:** AI is a branch of computer science focused on building smart machines capable of performing tasks that typically require human intelligence.

**Goal:** To enable computers to learn, reason, solve problems, perceive environments, and understand language.

### 2. The Three Levels of AI

AI is generally categorized by its capabilities:

**Narrow AI (Weak AI):** Designed to perform a specific task (e.g., facial recognition, Siri, or Google Search). This is the only type of AI that currently exists.

**General AI (Strong AI):** A theoretical version of AI that can understand and learn any intellectual task a human can do.

**Super AI:** A hypothetical level where AI surpasses human intelligence across all fields, including creativity and social skills.

### 3. Key Subfields & Technologies

**Machine Learning (ML):** A subset of AI where systems "learn" from data patterns rather than following strict programming.

**Deep Learning:** A sub-type of ML based on **Neural Networks** (inspired by the human brain) that processes data in layers to solve complex problems like image and speech recognition.

Artificial Intelligence (AI) is the ability of a machine to read, understand,



Study Buddy

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Explain

Summarize

Quiz Me

Chat

quiz on Ai

Here is a 5-question quiz on the basics and current state of Artificial Intelligence.

**AI Study Buddy Quiz: Introduction to Artificial Intelligence****1. What is the primary difference between "Narrow AI" and "General AI" (AGI)?**

- A) Narrow AI is faster, while General AI is more accurate. B) Narrow AI is designed for a specific task, while General AI can perform any intellectual task a human can. C) Narrow AI requires a human operator, while General AI operates entirely on its own. D) Narrow AI uses hardware, while General AI only uses software.

**2. In the context of Machine Learning, what is "Supervised Learning"?** 

- A) A process where the AI learns by trial and error without any data. B) A process where the AI observes human behavior to learn social cues. C) A model trained on a labeled dataset, where the "answer key" is provided. D) A method where the AI creates its own rules without any programmer input.

**3. Which subfield of AI focuses on enabling computers to understand, interpret, and generate human language?**

- A) Computer Vision B) Robotics C) Natural Language Processing (NLP) D) Genetic Algorithms

**4. What is a "Neural Network" in Artificial Intelligence?**

- A) A physical computer chip made of organic material. B) A mathematical model inspired by the structure and function of the human brain. C) A social network used by AI researchers to share data. D) A security firewall used to protect AI from viruses.

**5. Large Language Models (like GPT-4) use a specific architecture that allows them to process long sequences of data efficiently. What is this architecture called?**

- A) The Binary Engine B) The Transformer C) The Logic Gate D) The Turing



Study Buddy

AI-powered learning assistant



Explain

Summarize

Quiz Me

Chat

how ai helps in leaning any topic

Hello there! I'm your **AI Study Buddy**, and I'm excited to explain how AI (like me!) can act as a powerful tool in your learning journey.

Think of AI not as a way to "skip" the work, but as a **24/7 personal tutor** that adapts to your specific needs. Here are the primary ways AI helps you learn any topic:

### 1. Breaking Down Complex Concepts

Sometimes textbooks use jargon that sounds like a foreign language. AI can simplify these.

**The "ELI5" Method:** You can ask an AI to "*Explain Quantum Physics like I'm 5 years old.*" It will use analogies (like comparing atoms to LEGO bricks) to help you get the basic idea before moving to harder details.

### 2. Personalized Learning Pace

In a classroom, the teacher has to move at a speed that suits everyone.

**Infinite Patience:** AI never gets tired of questions. You can ask "Why?" or "How?" ten times in a row until it finally "clicks" for you.

**Customized Examples:** If you love basketball, the AI can explain math using basketball stats to make it more interesting for you.

### 3. Summarization and Note-Taking

If you have a 50-page research paper or a long video transcript, AI can help you digest it quickly.

**Key Takeaways:** AI can extract the 5 most important points from a long text.

**Structural Help:** It can help you organize your messy notes into a clean, bulleted

# CONCLUSION:

- The AI-Powered Study Buddy effectively addresses the gap between students' learning needs and the availability of instant, personalized academic support — making quality education assistance accessible 24/7.
- By leveraging modern large language models (Google Gemini), the tool makes self-study more efficient, interactive, and engaging for students across all subjects and academic levels.
- The project demonstrates how AI and modern web technologies can be combined to create meaningful, impactful educational tools with minimal infrastructure overhead.
- It successfully showcases full-stack development skills — integrating a React frontend, serverless backend, AI API integration, and real-time streaming — as a complete capstone project.
- The application is live, deployed, and accessible to students immediately without any signup or installation required.

# FUTURE SCOPE:

- **Voice Interaction:** Add speech-to-text input and text-to-speech output so students can have verbal conversations with the AI tutor.
- **PDF / Document Upload:** Allow students to upload their own study materials (PDF, DOCX) for automatic summarization and quiz generation.
- **User Authentication & Progress Tracking:** Implement login/signup to save chat history, track learning progress, and personalize the experience over time.
- **Multi-Language Support:** Enable responses in regional Indian languages (Hindi, Kannada, Tamil, etc.) to support students studying in their native language.
- **Spaced Repetition Flashcards:** Build a flashcard system using AI-generated quiz questions with spaced repetition scheduling for optimal long-term retention.
- **Classroom Integration:** Allow teachers to assign specific topics and track student engagement and quiz scores through a teacher dashboard.

# REFERENCES:

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- Vaswani et al. (2017). Attention Is All You Need. arXiv:1706.03762 — foundational paper on transformer architecture used by modern LLMs.
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- GitHub Link: <https://github.com/Suvasini911/StudyPal-AI>

# Thank You

For Your Valuable Time & Attention