

◇ Project Overview

- This AI-powered adaptive learning chatbot will provide personalized education by leveraging LLMs (e.g., Gemini API), Streamlit for frontend, Fast API for backend, and Supabase for authentication and data storage. It includes recommendations, interactive learning, and AI-driven Q&A.

◇ Key Features & Components

1. Data Preparation & Vector Database Integration

- ✓ Clean and preprocess course-related text data.
- ✓ Convert text into numerical vectors using embeddings (e.g., BERT, GPT).
- ✓ Store in a vector database (e.g., FAISS, Qdrant) for efficient retrieval.

2. LLM & RAG (Retrieval-Augmented Generation) Pipeline

- ✓ Use Lang Chain & Crew AI for conversation handling.
- ✓ Integrate LLMs like Gemini API for dynamic content generation.
- ✓ Implement context-aware memory (e.g., track last 20 interactions).
- ✓ Enable file uploads (PDF, Excel, TXT) for knowledge retrieval.

3. User Authentication & Data Management

- ✓ Implement user sign-up, login, and profile management via Supabase or Firebase.
- ✓ Store learning history, progress, and chatbot interactions securely.
- ✓ Use OAuth & data encryption (bonus).

4. Frontend Development (Streamlit)

- ✓ Design intuitive UI with at least 5 interactive pages.
- ✓ Allow users to add/view courses, navigate materials (videos, quizzes).
- ✓ AI-generated recommendations based on progress & interests.

5. Backend Development (Fast API)

- ✓ Create REST APIs for user & course management.
- ✓ Implement chatbot communication endpoints.
- ✓ Store & retrieve user progress, learning data.

6. Deployment

- ✓ Host on Streamlit Community Cloud or other open-source deployment platforms.
- ✓ Deploy Fast API backend (bonus: Docker, Kubernetes).

◇ Potential Enhancements & Additional Features

- ✓ Gamification: Add leaderboards, achievements, and rewards to increase engagement.
- ✓ Speech-to-Text Learning: Let users speak to the chatbot instead of typing.
- ✓ Adaptive Difficulty Levels: Adjust question difficulty based on student performance.
- ✓ Multimodal Learning: Support text, audio, and video explanations.
- ✓ Real-Time Collaboration: Allow group discussions or peer interactions.

Database

1 Users Table (*users*)

Stores **user authentication details, roles, and preferences.**

Column Name	Type	Description
Id	PK	Unique User ID
full name	Text	User's full name
Email	Text (Unique)	Email for Authentication
password_hash	Text	Hashed Password
Role	Text	"student", "Admin" or "Instructor"
Bio	Text	Short user bio
Linkedin_url	TEXT (URL)	LinkedIn Profile
Github_url	TEXT (URL)	GitHub Profile
created_at	TIMESTAMP	Account Creation Date
updated_at	TIMESTAMP	Last Profile Date
profile_picture	Text (URL)	Optional Profile Picture
preferences	JSON	Stores language, theme, notification settings

2 Courses Table (*courses*)

Stores all available courses, topics, and difficulty levels.

Column Name	Type	Description
Id	PK	Unique Course ID
Title	Text	Course Title
Description	Text	Detailed Course Info
Level	Text	"Beginner", "Intermediate" or "Advanced"
Category	Text	eg. "AI", "Data Science", "Cybersecurity: ...
Instructor_id	(FK)	Links to user.id
Price	FLOAT	Course Price (if Paid)
Thumbnail_url	TEXT	Course Image URL
Total_Hours	FLOAT	Course Length in Hours
Created_at	TIMESTAMP	Account Creation Date
updated_at	TIMESTAMP	Last Profile Date

3 Videos Table (*Videos*)

Each Course has multiple Videos

Column Name	Type	Description
Id	PK	Unique Video ID
Course_id	FK	Links To course.id
Title	Text	Video Title
Video_url	Text	URL to hosted video
Duration	Text	Video length in minutes
Order_index	Int	Ordering of lesson
Created_at	TIMESTAMP	Creation Date
updated_at	TIMESTAMP	Last Update Date

4 Enrollments Table (*enrollments*)

Tracks which users are enrolled in which courses.

Column Name	Type	Description
Id	PK	Unique enrollment ID
User_id	FK	Links to user.id
Course_id	FK	Links to course.id
Status	Text	"Unpaid", "Active", "Completed"
Progress	FLOAT	Percentage Progress (0~100%)
Started_at	TIMESTAMP	Enrollment Start Date

5 Quizzes Table (*quizzes*)

Each course has multiple quizzes.

Column Name	Type	Description
Id	PK	Unique Interaction ID
Course_id	FK	Links to course.id
Title	TEXT	Quiz Title
Created_At	TIMESTAMP	Creation date
Updated_at	TIMESTAMP	Updated date

6 Questions Table (*questions*)

Stores questions for quizzes

Column Name	Type	Description
Id	PK	Unique Question ID
Quiz_id	FK	Links to quizzes.id
Question_text	TEXT	Question Content
Type	TEXT	"MCQ", "Short Answer", "True/False"
Correct_Answer	TEXT	Correct Answer
Created_At	TIMESTAMP	Creation date
Updated_At	TIMESTAMP	Updated date

7 Assignment Table (*Assignments*)

Stores questions for quizzes

Column Name	Type	Description
Id	PK	Unique Assignment ID
Course_id	FK	Links to course.id
Title	TEXT	Assignment Title
Description	TEXT	Instructions
Deadline	TIMESTAMP	Submission Deadline
Created_At	TIMESTAMP	Creation Date
Scope Pass Grade	INT	The grade to pass the Assignment

8. Submissions Table (*submissions*)

Tracks student assignment submissions.

Column Name	Type	Description
Id	PK	Unique Submission ID
User_id	FK	Links to users.id
Assignment_id	FK	Links to Assignment.id
File_url	TEXT	Link to submission
Grade	Float	Score given by the instructor
Submitted_at	TIMEASTAMP	Submission Time
Attempts	INT	Attempts (0,1,2)
Status	TEXT	"Not Submitted", "Pending", "Failed", "Passed"

9. QA Section Table (qa)

Stores student-instructor discussions for each course.

Column Name	Type	Description
Id	PK	Unique QA ID
Course_id	FK	Links to courses.id
student_id	FK	Links to users.id (Student)
Instructor_id	FK	Links to users.id (Instructor)
Question	TEXT	Question Asked
Answer	TEXT	Instructor's Answer
Created_at	TIMESTAMP	TIMESTAMP

10. Chatbot Interactions Table (interactions)

Stores chatbot questions and responses.

Column Name	Type	Description
Id	PK	Unique Interaction ID
User_id	FK	Links to users.id
Query	TEXT	User Question
Response	TEXT	AI-Generated Response
timestamp	TIMESTAMP	When the message was sent

11. Course Reviews & Ratings

- Allow students to rate courses (1-5 stars) and leave reviews.
- Helps new learners decide which courses are high-quality.

Column Name	Type	Description
Id	PK	Unique Review ID
Course_id	FK	Links to courses.id
User_id	FK	Inks to users.id
Rating	FLOAT	1–5-star rating
review	TEXT	User Feedback
Created_At	TIMESTAMP	Timestamp

12. Certificates & Badges

- Generate completion certificates for students.
- Add achievement badges for milestones (e.g., "100% Course Completion", "Top Quiz Scores").

Column Name	Type	Description
Id	PK	Certificate ID
User_id	FK	Links to users.id
Course_id	FK	Links to courses.id
Certification_URL	TEXT	Download Link
Issued_at	TIMESTAMP	When Issued

Column Name	Type	Description
Id	PK	Badge ID
User_id	FK	Links to users.id
Badge_type	TEXT	"QUIZ MASTER", "TOP Performer"
Earned_At	TIMESTAMP	TIMESTAMP

13. Live Classes & Webinars

- Allow instructors to schedule live sessions.
- Integrate Zoom, Google Meet, or WebRTC.

Column Name	Type	Description
Id	PK	Unique Session ID
Course_id	FK	Links to courses.id
Instructor_id	FK	Links to users.id
Title	TEXT	Session Title
Meeting_link	TEXT	Zoom/ Google Meeting Link
Start_time	TIMESTAMP	Schedule Time
duration	INT	Duration in minutes

14. Discussion Forums & Peer Learning

- Course forums where students discuss topics and ask questions.
- Helps peer-to-peer learning.

Column Name	Type	Description
Id	PK	Post ID
User_id	FK	Links to users.id
Course_id	FK	Links to courses.id
Post_title	TEXT	Discussion Topic
Post_content	TEXT	Content of Post
Created_At	TIMESTAMP	Timestamp

Column Name	Type	Description
Id	PK	Comment ID
Post_id	FK	Links to form_post.id
User_id	FK	Links to users.id
Comment_text	TEXT	Content of the comment
Created_at	TIMESTAMP	Timestamp

15. Payment System & Subscriptions (OPTIONAL)

Column Name	Type	Description
Id	PK	Payment ID
User_id	FK	Links to users.id
Course_id	FK	Links to courses.id
Subscription_plan	TEXT	"Monthly", "Annual"
Amount	FLOAT	Payment Amount
Payment_status	TEXT	"Success", "Pending", "Failed"
Created_at	TIMESTAMP	Timestamp

16. AI-Based Personalized Course Recommendations (Optional)

- AI recommends new courses based on user interests & past enrollments.

Column Name	Type	Description
Id	PK	Recommendation ID
User_id	FK	Links to users.id
Recommended_course_id	FK	Suggested courses.id
Confidence_Score	FLOAT	AI Confidence Score (0~1)
Created_at	TIMESTAMP	TimeStamp

17. Leaderboards & Gamification

- Show top learners based on quiz scores, progress, and engagement.

Column Name	Type	Description
Id	PK	Leaderboard ID
User_id	FK	Links to users.id
Course_id	FK	Links to courses.id
Score	FLOAT	Total Points
rank	INT	Position on Leaderboard
Updated_at	TIMESTAMP	Timestamp