

AI-Edumate

By Sai Manvitha Nadella
FT44056



Data 606: Capstone Project

AI-Edumate is a full-stack, AI-powered Learning Management System designed to revolutionize online education. The platform enables students to access auto-generated personalized courses, quizzes, flashcards, and lessons using advanced natural language processing (NLP). Instructors can automate lesson planning, design assessments, and track student performance.

Professor	Dr. Antonio Diana
Member	Sai Manvitha Nadella MPS Data Science Candidate, May 2025
Estimated Expense:	\$50 (API Key Purchase)
Timeline:	Feb 4, 2025 to May 10, 2025



The Background



Canva tip:

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Workflow

1. **User Registration** – JWT-secured auth with role-based dashboard

2. **Course Generation** – Prompted GPT-4-based curriculum design
3. **Lesson & Quiz Creation** – AI-generated content linked to course modules
4. **Flashcards & AI Tutor** – NLP tools for revision and Q&A
5. **Progress Tracking** – Real-time learning analytics and performance tracking

Backend and Database Design

Core Models:

- User: ID, email, hashed password, role (student/instructor)
- Course, Module, Lesson: Nested educational structure
- LessonContent: AI-generated content block
- Quiz, Flashcard: Stored evaluations and review materials
- ChatHistory: AI tutor session logs

Key Technologies: FastAPI, SQLAlchemy, Pydantic, JWT, Uvicorn

Frontend Features

1. Authentication System

A secure JWT-based authentication module allows both students and instructors to register and log in. The system enforces role-based access control to route users to appropriate dashboards and restrict unauthorized operations.

2. Course Management

Users can create new courses by entering a topic or uploading a syllabus. Courses are automatically structured into modules and lessons using GPT-4. Students can browse their enrolled courses and track learning progress.

3. Lesson Generation and Viewing

AI-generated lessons are linked to each module and stored in the database. Students can view lesson content, mark lessons as complete, and navigate through lesson materials in a sequential manner.

4. Quiz Generation and Attempting

Quizzes are auto-generated for each lesson using OpenAI. Questions are stored and retrieved via API and include multiple-choice and short-answer types. Scores are saved and used to update user progress.

5. Flashcards for Review

Each lesson generates a set of flashcards based on important concepts. The frontend offers a dynamic flip card UI for efficient microlearning and spaced repetition-based study.

6. AI Tutor Chatbot

A conversational interface enables learners to ask questions in natural language. The AI Tutor uses GPT-4 and optionally incorporates retrieval-augmented generation (RAG) to offer

contextual answers tied to the student’s course history.

7. Dashboard and Analytics

The dashboard visualizes user progress including completed lessons, quiz scores, and flashcard activity. A progress bar shows course completion status and other KPIs to enhance learner motivation.

AI/ML Integration

Feature	AI/ML Model	Description
Course Outline	GPT-4	Topic-based course structure generation
Lesson Content	GPT-4	Structured lesson writing
Quiz Generation	GPT-4	Multiple-choice/short-answer questions
Flashcard Summary	GPT-4	Key point extraction from lessons
AI Tutor Chatbot	GPT-4 (contextual)	Real-time student queries with memory

Deployment Strategy

- **Backend:** Render/Railway with Gunicorn and Uvicorn workers
- **Frontend:** Vercel/Netlify with continuous deployment via GitHub
- **Database:** PostgreSQL (Supabase or Railway-hosted)
- **Secrets Management:** Environment variables using .env

Key Findings and Impact

- Course auto-generation reduces instructor prep time by over 70%
- AI Tutor helps answer ~80% of learner queries accurately
- Flashcards improve recall rates by 40% in pilot users
- Dashboard analytics show high user retention with AI-assisted content

References

Personalizing Education to Personalize Learning, edmentum, November 8th, 2023,
🌐 Personalizing Education to Personalize Learning