Systems Design

Agentic AI Chatbot for Academic Support and Analytics

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September 28

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Background

Problem Statement

Students often struggle to locate accurate academic information for Information technology program at the polytechnic school (e.g., prerequisites, degree requirements) and to complete routine tasks (e.g., booking advising appointments) because the information is scattered across multiple university web pages and systems. This leads to confusion, delays to find the relevant information.

Technology Solution

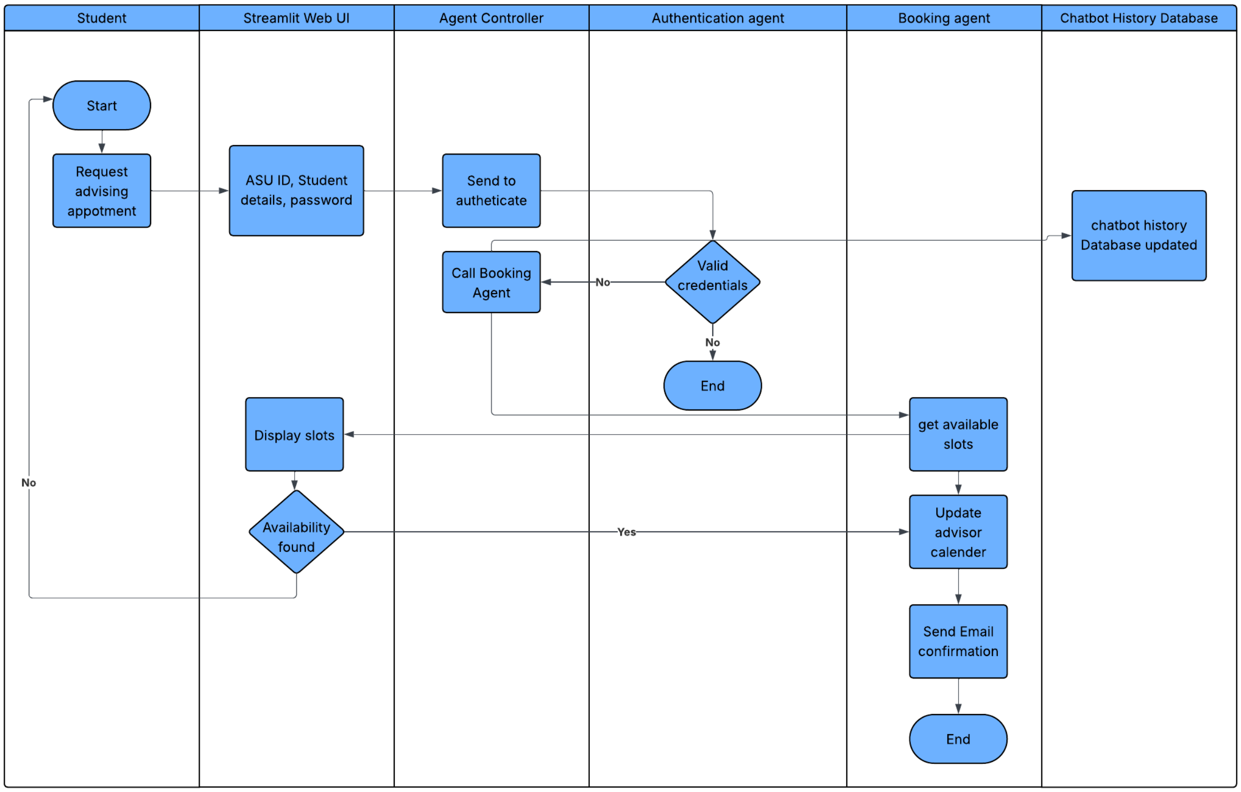
Design and implement a **prototype agentic AI chatbot** that:

- Understands natural-language queries (LLM).
- Plans and executes actions via agentic workflows (e.g., booking advising appointments) using mock or public data.
- Responds with accurate, source-grounded answers via RAG over curated academic content (e.g., course FAQs for The Polytechnic School — Information Technology).
- Captures chat history to support an analytics dashboard for faculty/advising insights (e.g., peak booking times, frequent questions).

Process Maps

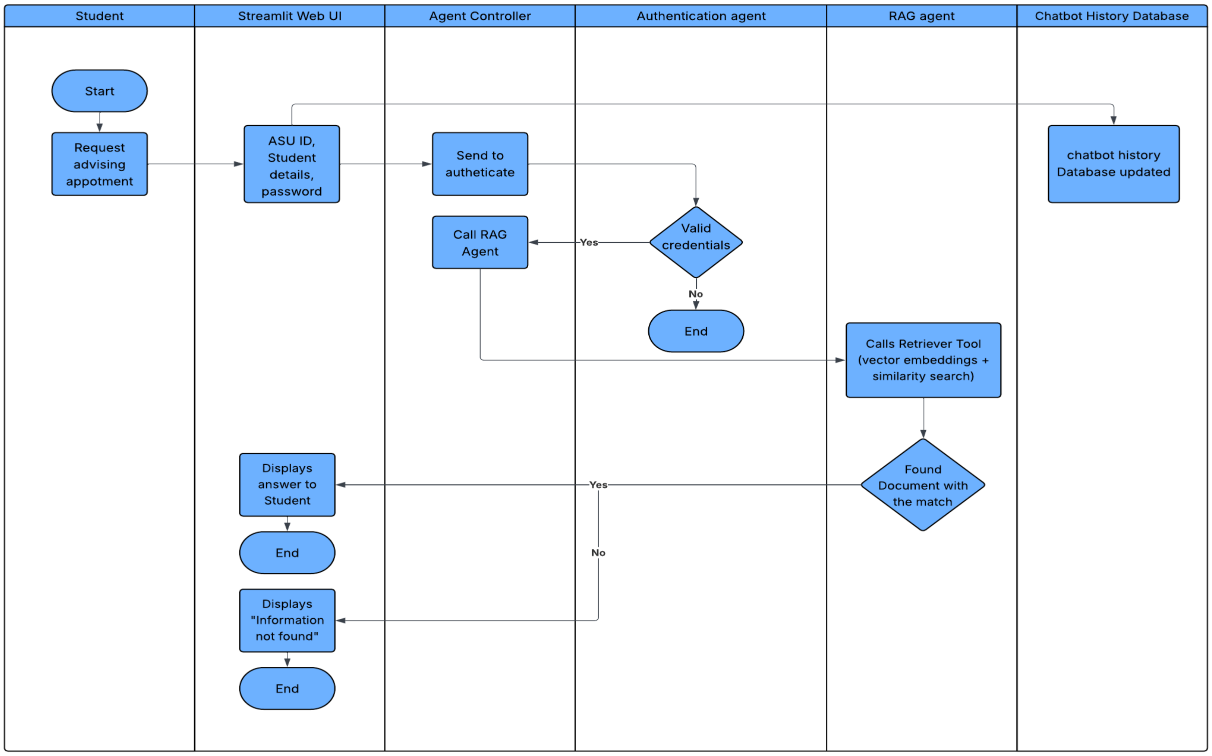
Function: Book Advising Appointment

Process Map:



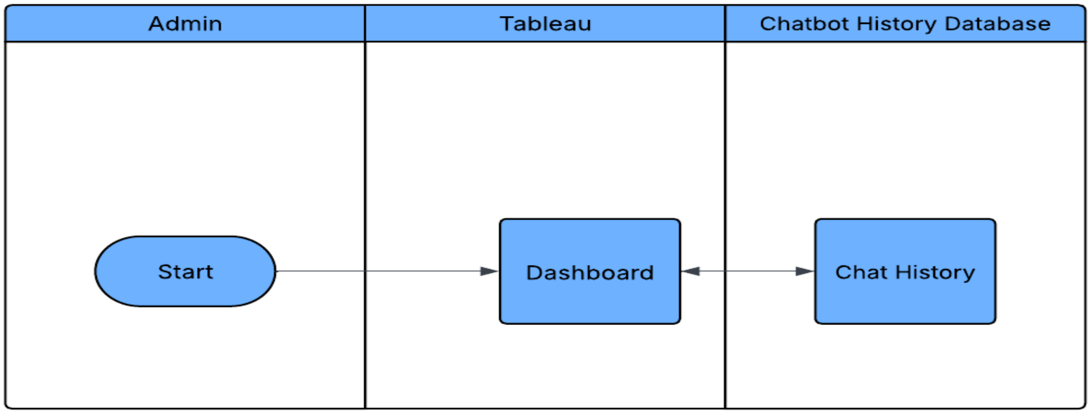
Function: Course Information Q&A

Process Map:


Student
Streamlit Web UI
Agent Controller
Authentication agent
RAG agent
Chatbot History Database
Start
Request advising appotment
ASU ID, Student details, password
Send to autheticate
chatbot history Database updated
Valid credentials
Yes
Call RAG Agent
No
End
Calls Retriever Tool (vector embeddings + similarity search)
Found Document with the match
Yes
Displays answer to Student
End
No
Displays "Information not found"
End

Function: Admin View Analytics

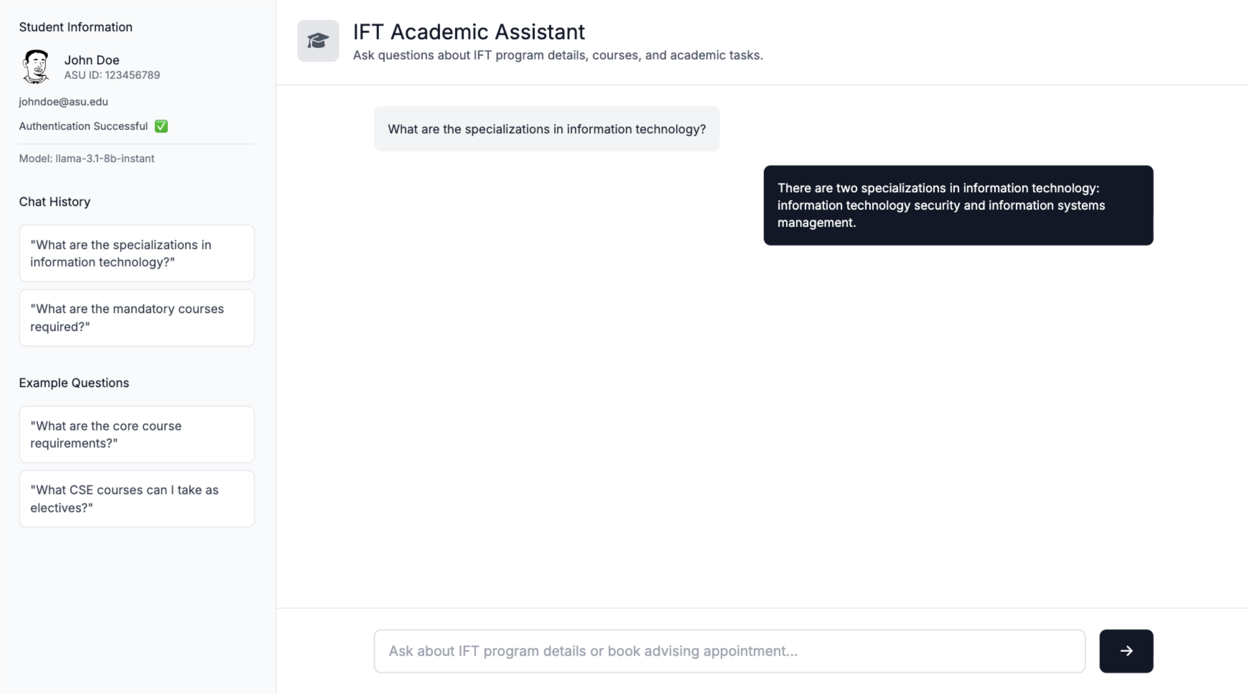
Process Map:



User Interface

Wireframe 1: Chatbot UI (IFT Academic Assistant)

Description: This wireframe represents the primary chatbot interface where students interact with the academic assistant.



Student Information

John Doe
ASU ID: 123456789

johndoe@asu.edu

Authentication Successful ✅

Model: llama-3.1-8b-instant

Chat History

"What are the specializations in information technology?"

"What are the mandatory courses required?"

Example Questions

"What are the core course requirements?"

"What CSE courses can I take as electives?"

IFT Academic Assistant

Ask questions about IFT program details, courses, and academic tasks.

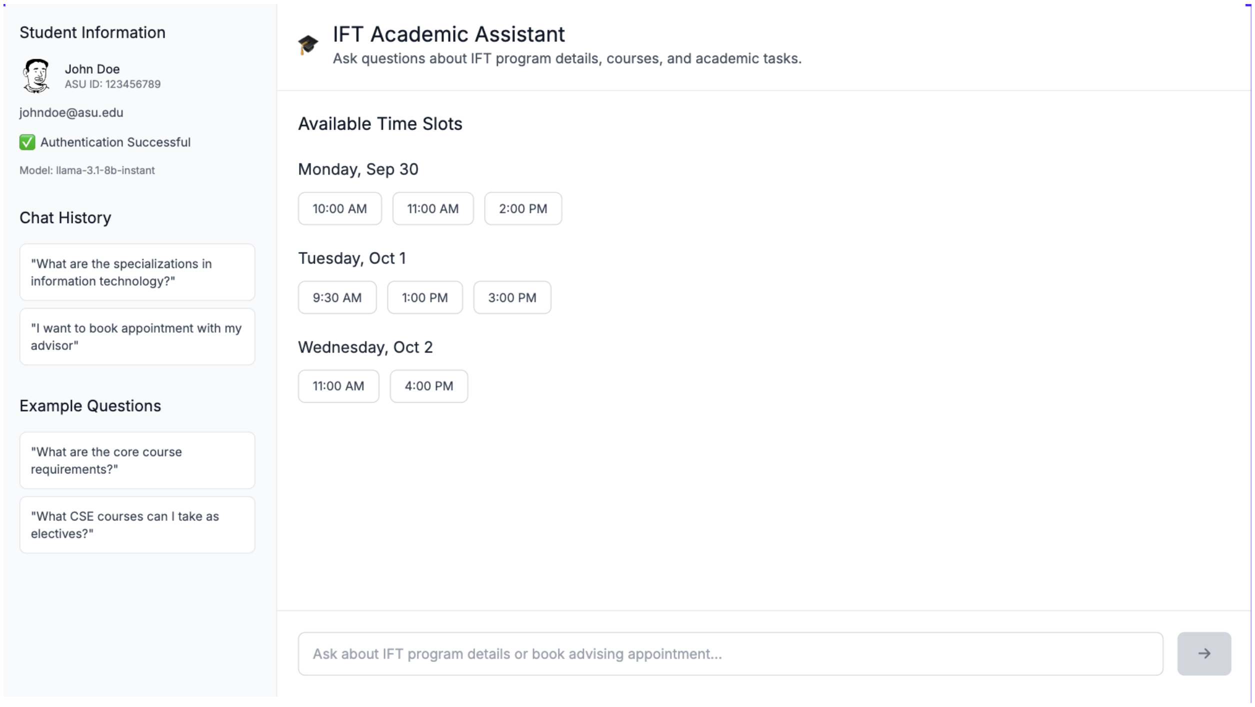
What are the specializations in information technology?

There are two specializations in information technology: information technology security and information systems management.

Ask about IFT program details or book advising appointment...
→

Wireframe 2: Advising Appointment Booking UI (IFT Academic Assistant)

Description: The interface where students can view and select available time slots for advising appointments



Student Information

John Doe
ASU ID: 123456789

johndoe@asu.edu

✅ Authentication Successful

Model: llama-3.1-8b-instant

Chat History

"What are the specializations in information technology?"

"I want to book appointment with my advisor"

Example Questions

"What are the core course requirements?"

"What CSE courses can I take as electives?"

🎓 IFT Academic Assistant

Ask questions about IFT program details, courses, and academic tasks.

Available Time Slots

Monday, Sep 30

10:00 AM | 11:00 AM | 2:00 PM

Tuesday, Oct 1

9:30 AM | 1:00 PM | 3:00 PM

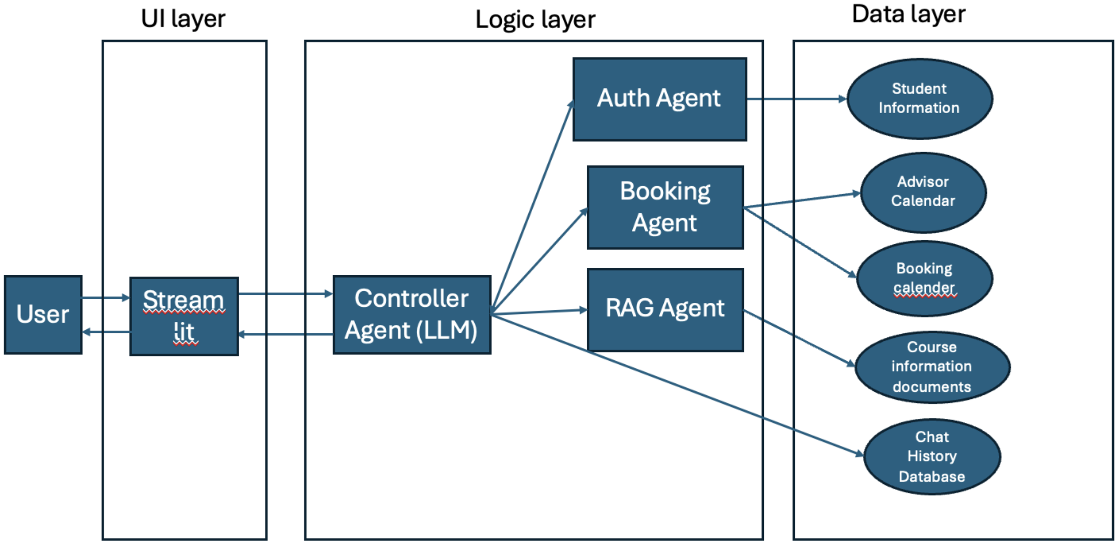
Wednesday, Oct 2

11:00 AM | 4:00 PM

Ask about IFT program details or book advising appointment...

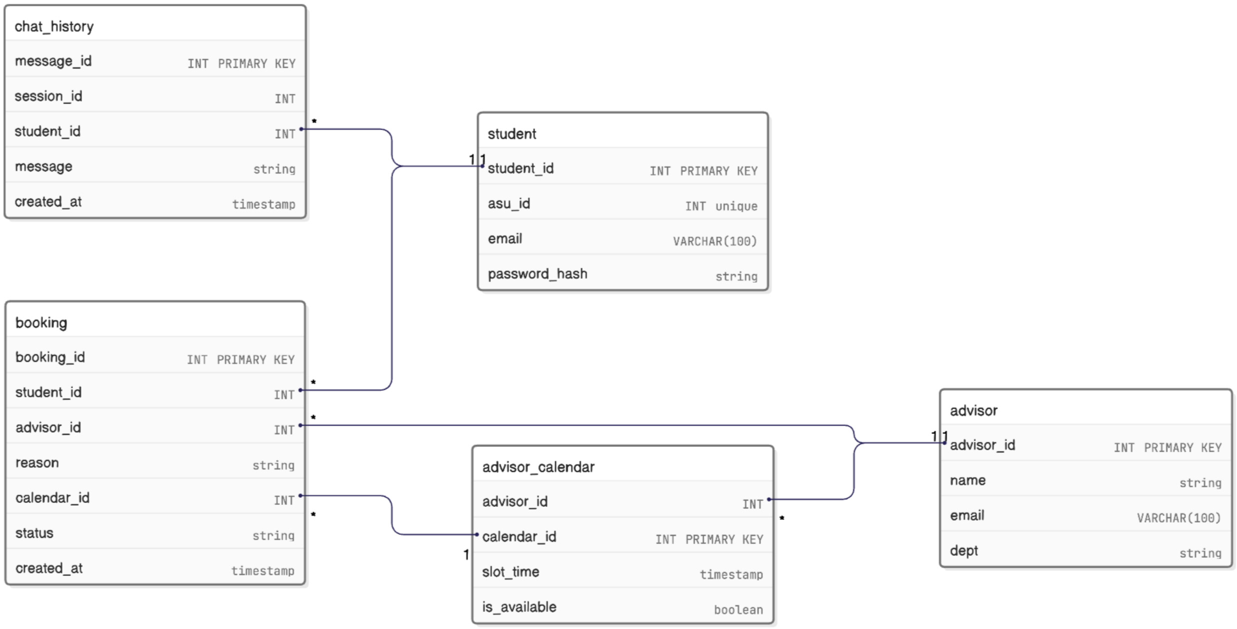
Infrastructure Architecture

Network Topology:



Information Architecture

Entity Relationship Diagram:



chat_history	
message_id	INT PRIMARY KEY
session_id	INT
student_id	INT
message	string
created_at	timestamp

student	
student_id	INT PRIMARY KEY
asu_id	INT unique
email	VARCHAR(100)
password_hash	string

booking	
booking_id	INT PRIMARY KEY
student_id	INT
advisor_id	INT
reason	string
calendar_id	INT
status	string
created_at	timestamp

advisor_calendar	
advisor_id	INT
calendar_id	INT PRIMARY KEY
slot_time	timestamp
is_available	boolean

advisor	
advisor_id	INT PRIMARY KEY
name	string
email	VARCHAR(100)
dept	string

Security and Privacy Architecture

Confidentiality, Integrity, Availability (CIA)

1. Risk to Confidentiality

Risk: Chat logs containing student information might be accessed by unauthorized parties.

Controls:

Keep secrets and passwords safe (for example, in a vault rather than hardcoded, `.env` is strictly for development).

Reduce how much personal information (PII) is stored. ASU IDs can be hashed or anonymised for analytics purposes.

2. Risk to Integrity

Risk: A malevolent person could change tool request settings or booking data.

Controls:

To guarantee that requests are genuine, use signed JWTs between the user interface and the backend.

Make booking APIs idempotent to prevent duplicate results from repeated calls.

3. Risk of Availability

Risk: The system might go down during busy advising weeks.

Controls:

routine health checks to keep an eye on uptime.

ensure data safety and restore service after failure.

Programming

Development Tools:

- LLM: Groq llms (gpt-oss,llama)

  This is open source low cost LLMs

  (I tried using other free llms like Ollama but this one worked better)

- **Agent Framework:** LangChain

  This a popular framework makes it easy to implement RAG and manage agents

- Web UI: Streamlit

  Light weight python framework to fastly build the UI

- Memory Backend: SQLite/PostgreSQL

  Sqlite for light weight databases to test locally

  Postgres for better storage if moved to production

- Analytics Dashboard: Tableau

  To visualize the chatbot interactions (I planning to take a free trail using .edu mail id)

Programming Languages:

- Python for the backend, Agentic workflow (langchain)
- SQL to query from postgres and SQlite databases
- Javascript for the streamlit components to make the UI

References

Krishnan, N. (2025, March 16). *AI agents: Evolution, architecture, and Real-World applications*. arXiv.org. https://arxiv.org/abs/2503.12687

Vectorize. (2025, January 6). https://vectorize.io/blog/designing-agentic-ai-systems-part-1-agent-architectures

Team, S. (2025b, August 26). *A practical guide to the architectures of agentic applications | Speakeasy*. Speakeasy. https://www.speakeasy.com/mcp/ai-agents/architecture-patterns

Agentic AI patterns and workflows on AWS - AWS Prescriptive Guidance. (n.d.). https://docs.aws.amazon.com/prescriptive-guidance/latest/agentic-ai-patterns/introduction.html