

HealthFlow AI – System Design Document

1. Design Overview

HealthFlow AI is designed as a modular, scalable, and Responsible AI-based system that supports healthcare and life-sciences workflows. The system assists doctors, researchers, and patients without replacing human decision-making.

2. High-Level Architecture

User (Doctor / Patient / Researcher) → Frontend Web Application → Backend API Server → AI Processing Layer (LLMs) → Ethics & Validation Layer → Output to User

3. System Components

3.1 Frontend Layer

- Web-based responsive interface
- Role-based access (Doctor, Patient, Researcher)
- Features: Document upload, summaries, chatbot interface

3.2 Backend Layer

- API server for request handling
- Input validation and routing
- Logging and monitoring support

3.3 AI Processing Layer

- Large Language Models (LLMs)
- NLP pipelines for summarization and simplification
- Prompt engineering with safety constraints

3.4 Ethics & Validation Layer

- Prevents diagnostic or treatment outputs
- Adds disclaimers to responses

- Supports human-in-the-loop validation

3.5 Data Layer

- Synthetic and publicly available datasets only
- No storage of real patient data
- Secure metadata and logs storage

4. Use Case Design

Actors: Doctor, Patient, Researcher

Use Cases:

- Upload document → Generate summary
- Ask health-related question → Simplified explanation
- Upload research paper → Extract key insights
- Generate structured documentation

5. Process Flow (Document Summarization)

1. User uploads document
2. Frontend sends request to backend
3. Backend validates input
4. AI processes the content
5. Ethics layer validates output
6. Final response delivered to user

6. Wireframe Design (Conceptual)

- Home dashboard with role selection
- Document upload and summary page
- Chatbot interface with visible disclaimers

7. Technology Stack

Frontend: React.js, HTML, CSS, JavaScript

Backend: Python (FastAPI / Flask)

AI & NLP: Large Language Models, NLP summarization

Database: MongoDB / PostgreSQL (metadata only)

Deployment: Cloud platform (Prototype)

8. Estimated Implementation Cost

Frontend Development – ■15,000

Backend Development – ■20,000

AI Integration – ■25,000

Cloud Hosting – ■10,000

UI/UX Design – ■5,000

Total Estimated Cost – ■75,000

9. Design Principles

- Responsible AI by default
- Transparency and explainability
- Human-centric support system
- Scalable and modular architecture

10. Future Design Enhancements

- Voice-based assistant
- Multilingual support
- Mobile application
- Secure hospital integration (with approvals)