PROJECT 3

INTELLIGENT PATIENT RISK ASSESSMENT & AGENTIC HEALTH SUPPORT SYSTEM

From Predictive Healthcare Analytics to Agentic Support

PROJECT OVERVIEW

This project involves the design and implementation of an **AI-based healthcare analytics system** that evolves into an agentic health support assistant.

In **Milestone 1**, the system uses classical machine learning techniques to analyze patient health data and predict health risks such as disease likelihood, readmission risk, or deterioration probability.

In **Milestone 2**, the same system is extended into an agent-based AI application that autonomously reasons about patient risk profiles, retrieves relevant medical guidelines, generates health summaries, and provides preventive care recommendations.

The project focuses on progressive development from traditional machine learning pipelines to agentic AI workflows using LLMs, tool orchestration, and state management.

CONSTRAINTS & REQUIREMENTS

TEAM SIZE	**API BUDGET**
3–4 Students	**Free Tier Only**
FRAMEWORK	**HOSTING**

LangGraph (Recommended)	**Mandatory**

APPROVED TECHNOLOGY STACK

LLMS (MILESTONE 2)

- Open-source models
- Free-tier APIs

AGENT FRAMEWORK

- LangGraph (Recommended)
- Chroma / FAISS (RAG)

ML & ANALYTICS (MILESTONE 1)

- Scikit-Learn (Logistic/Linear Regression)
- Neural Networks (Optional: MLP)
- Pandas/NumPy (Preprocessing)

UI FRAMEWORK

- Streamlit (Recommended)
- Gradio

HOSTING PLATFORM (MANDATORY)

- Hugging Face Spaces
- Streamlit Community Cloud
- Render (Free Tier)

WARNING: Localhost-only demonstrations will not be accepted.

MILESTONE 1: MACHINE LEARNING–BASED RISK ASSESSMENT

MID-SEM SUBMISSION

Objective: Design and implement a machine learning–based healthcare analytics system that predicts patient health risks using structured clinical data. This milestone focuses on classical ML workflows *without LLMs*.

Functional Requirements:

- Accept structured patient health data input.
- Perform data preprocessing and feature engineering.
- Predict patient risk using supervised learning models.
- Display predictions and basic insights via UI.

TECHNICAL REQUIREMENTS (ML)

- **Preprocessing:** Missing values, Scaling, Encoding.
- **Supervised:** Logistic Regression (Classification), Linear Regression (Risk Scores).
- **Optional:** Decision Trees, Neural Networks (MLP).
- **Evaluation:** Classification/Regression metrics.

INPUTS & OUTPUTS

- **Input:** Age, Vitals, Lab values, Medical history (CSV).
- **Output:** Risk prediction/score, Explanation of prediction.
- **Metrics:** Model performance graphs/scores.

MID-SEM DELIVERABLES

- Problem understanding & use case description.
- Input–output specification.
- System architecture diagram.
- ML model implementation code.
- Working local application with UI.
- Brief evaluation report.

MILESTONE 2: AGENTIC AI HEALTH SUPPORT ASSISTANT

END-SEM SUBMISSION

Objective: Extend the risk assessment system into an agentic AI health support assistant that autonomously reasons over patient data, retrieves medical knowledge, and generates structured health guidance.

Functional Requirements:

- Autonomously analyze risk predictions.
- Retrieve medical guidelines/content.
- Generate structured health summaries.
- Handle incomplete data tool failures gracefully.

TECHNICAL REQUIREMENTS (AGENTIC)

- **Framework:** LangGraph (Workflow & State).
- **RAG:** Vector DB (Chroma/FAISS) for guidelines.
- **State:** Explicit state management across steps.
- **Prompting:** Strategies to reduce hallucinations.

STRUCTURED OUTPUT

- **Risk Summary:** Patient risk profile & Key factors.
- **Recommendations:** Preventive care & Follow-up.
- **Sources:** Attribution to medical guidelines.
- **Disclaimer:** Mandatory medical advice disclaimer.

END-SEM DELIVERABLES

- Fully deployed public application.
- Agent workflow design docs.
- Structured health report generation.
- GitHub Repository & Complete Codebase.
- Demo Video (System walkthrough).

Final Artifacts: Hosted Link, GitHub Repo, Demo Video.

EVALUATION CRITERIA

PHASE	WEIGHT	CRITERIA
Mid-Sem (Milestone 1)	25%	• Correct application of ML concepts • Quality of data preprocessing & Feature selection • Model performance & Evaluation metrics • Code modularity & UI usability
End-Sem (Milestone 2)	30%	• Quality & reliability of agent reasoning • Correct RAG implementation & State management • Clarity/Structure of health reports • Ethical responsible AI & Deployment success