HEALTHAI: Intelligent Healthcare Assistant using IBM Granite

- **INTRODUCTION**

- **Project Overview**

HEALTHAI: Intelligent Healthcare Assistant using IBM Granite is a generative AI-powered application designed to provide smart healthcare support to patients through an interactive and intuitive interface. The system leverages IBM's Granite language model to facilitate health-related conversations, predict diseases based on symptoms, suggest possible treatment plans, and display useful health analytics. Developed using Python and Streamlit, the application aims to simplify patient engagement and support early diagnosis and treatment planning through AI.

- **Purpose**

The primary purpose of this project is to harness the power of Generative AI for delivering accessible, reliable, and intelligent healthcare support. HEALTHAI serves as a virtual health assistant that helps users:

- Get instant responses to general health queries.
- Predict diseases based on symptoms using AI.
- Receive relevant treatment suggestions.
- View simple, clear analytics on health trends.

This project also demonstrates the practical application of IBM Granite models in solving realworld healthcare problems, fulfilling academic and internship goals under the IBM Generative AI program.

IDEATION PHASE

- **Problem Statement**

Date: 27 June 2025
Team ID: LTVIP2025TMID59346
Project Name: Health AI: Intelligent Healthcare Assistant Using IBM Granite.

Marks: 4 Marks

Customer Problem Statement Template

Create a problem statement to understand your customer's point & view. The Customer Problem Statement helps you focus on what mat-ters to create experiences people will love.

A well-articulated customer problem stament allows your team and your users to find the ideal solution your business faces. Throughout the process, you'll also be able to empathize with your customergur you better understand your

Template: https://miro.com/templeplates/customerproblem-statement/

Example:

Problem Statement (PS)	(i am)	I'm trying to	But	Which makes me feel
PS-1	a patient	manage my health effectively	I face dfficulty	frustrated and anxious about my well-being
I'm		manage my health effectively	I face continued and lacks proacessing and medicaic insdicas' the current healthcare system is fragmented and lacks proactive support	

- **Empathy Map Canvas**

Date: 27 June 2025
Team ID: LTVIP2025TMID59346
Project Name: Health AI: Intelligent Healthcare Assistant Using IBM Granite Maximum Marks: 2 Marks

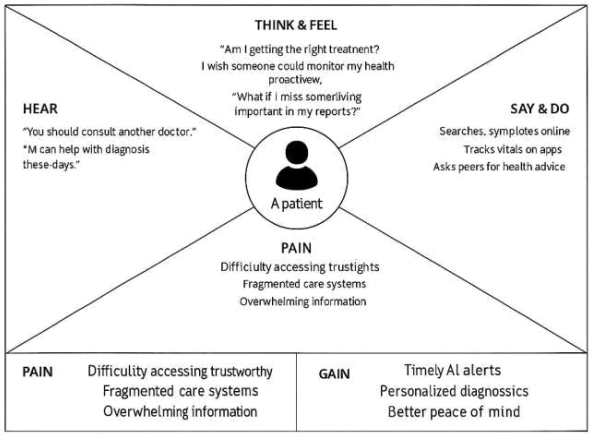
Empathy Map Canvas

An empathy map a simple, easy-to-digest visual that captures knowledge abou a user's behaviors and attitudes.

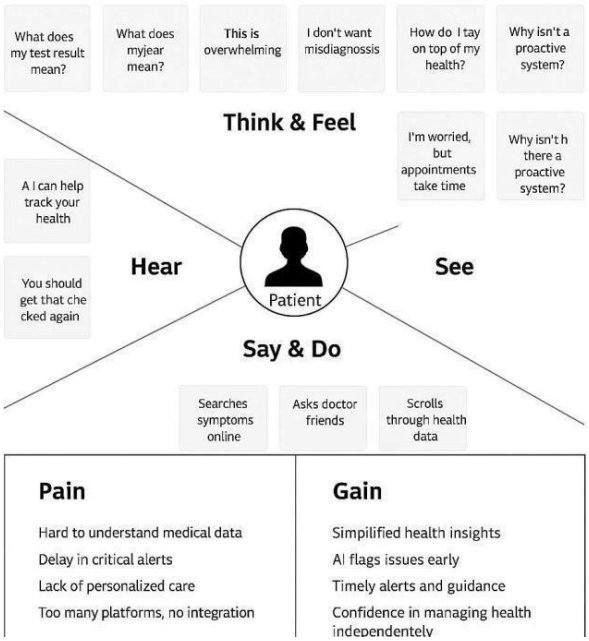
It is a useful to helping teams teans understand their users.

Creating an effective solution requires understanding their the person who is experiencing it, it. Exele participants consider how participants consider uset highs, lows, goals, and challenges

Example: ***Empathy Map***



Reference: https://www.mural.co/templates/empathy-map-canxas



- **Brainstorming**

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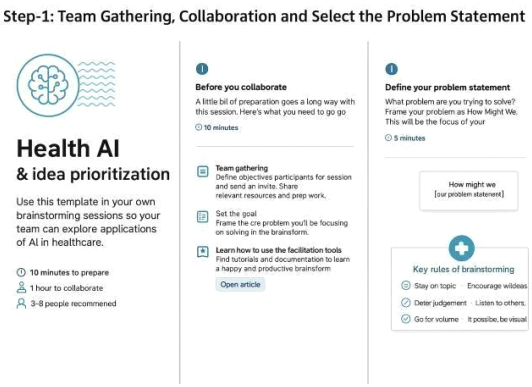
Project Name: Health AI: Intelligent Healthcare Assistant Using IBM Granite Maximum Marks: 4 Marks

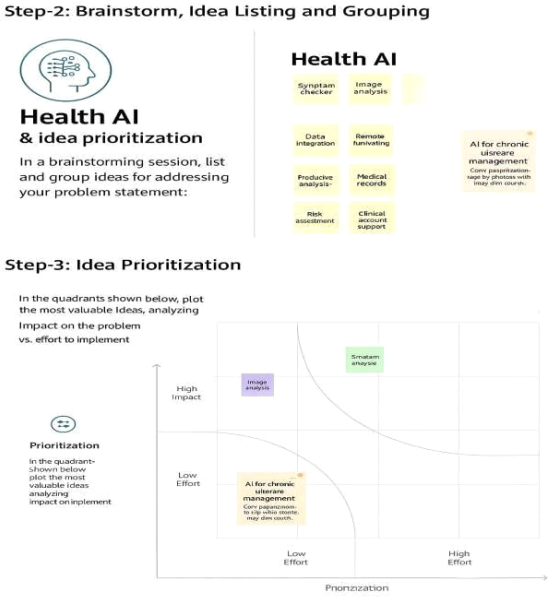
Brainstorm & Idea Prioritization in Health AI

Brainstorming in Health AI promotes free, creative thinking to generate innovative solutions for healthcare challenges using artificial intelligence. To collect a wide range of ideas from diverse team members, then prioritize based on impact, feasibility, and urgency. Encourage maximum idea
generation, regardless of practicality at first.

Cross-functional team members (AI developers, clinicians, analysts) co-create ideas. Ideal for distributed teams using tools like Miro or Mural.AI-driven symptom checking, disease prediction,



treatment plans, and patient engagement tools. Impact – Patient outcomes and healthcare system improvement. Feasibility – Technical readiness with health regulations. **Reference:** Brainstorm and idea prioritization template | Mural



- **REQUIREMENT ANALYSIS**
- **Customer Journey Map**

Health AI

- **Solution Requirement**

Solution Requirements (Functional & Non-functional)

Date	27 June 2025
Team ID	LTVIP2025TMID59346

Project Name	HealthAI-Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	4 Marks

Functional Requirements:

Following are the functional requirements of the proposed solution.

FRNo.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Disease Prediction	Symptom-based prediction Model scoring using IBM Granite AI
FR-4	Health Assistant Chat	Natural language query handling Context-aware health response

FR-5	Treatment Plan Recommendation	Display treatments based on disease Explain predicted outcome
FR-6	Health Analytics	View past predictions Graphs for health trends

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

Product Backlog, Sprint Schedule, and Etimation (4 Marks)

Functional Requirement	Sprint	Story ID	User Story / Task	Story Points	Priority
Registration	Sprint 1	US#4	As a user, I can register for the application (US3)	5	High
		US#2	As a user, oral responses can be analyzed using speech-to-text (US2)	8	High
Login	Sprint 1	US#3	As a user, health data can be input into system	7	High
		US#1	As a user, I can log in to the application	2	High
Dashboard	Sprint 2	US#1	As a user, I can view health data visualizations on the central (US5 dashboard	2	Medium

- **Data Flow Diagram**

Data Flow Diagram & User Stories

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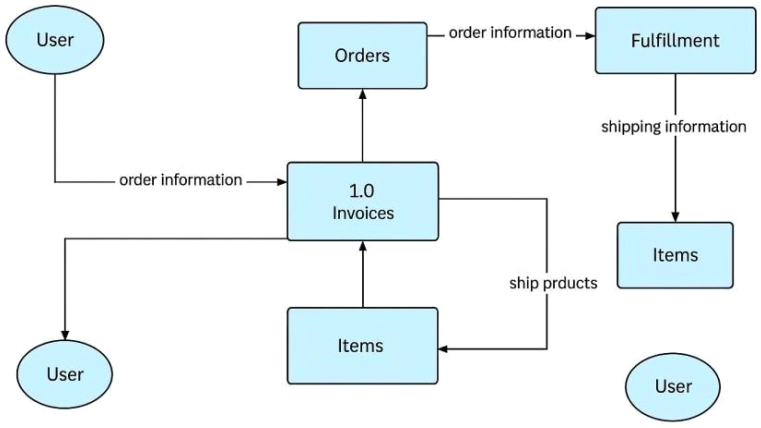
Maximum Marks	2 Marks

Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

Example: DFD Level 0 (Industry Standard)



Health AI

User Type	Functional Requirement	User Story / Task	Acceptance criteria	Priority	Rele
Customer (Mobile user)	Registration	As a user, I can register by providing an email and password.	Email and password can be used to log in	High	Spri 1
	USS1	As a user, I will receive confirmation email	Confirmation email received	High	Spri 1
Tester	USS2	As a user, I can enable systemwide speech-t-o-text	Speech-to-text is active throughout the app	Low	Spri 2
Administrator	USS3	As a tester, I can analyze speech responses	Speech responses are analyzed correctly	Medium	Spri 1
	USS4	As an admin, I can view health data visualizations		Sprint 1	Spri 1
Administrator	US4	As a tester, I can analyze speech responses	Speech responses are analyzed correctly	Medium	Spri 1
Visualizaation	US5	As a tester, I can analyze speech respenses	Health data visualizations are available	High	Spri 1

- **Technology Stack**

Technology Stack (Architecture & Stack)

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Maximum Marks	4 Marks

Technical Architecture – HealthAI

HealthAI's technical architecture is designed to provide intelligent, personalized, and accessible healthcare assistance using IBM's AI capabilities. The architecture bridges the gap between healthcare

user needs and AI-driven digital solutions by clearly defining modules, workflows, and technology integrations.

It follows principles of modular design, AI integration, secure backend logic, and interactive frontend experiences**.**

References – Adapted for HealthAI

- C4 Model – Software Architecture Visualization Used as the base modeling approach to define different levels of HealthAI's architecture (context, container, component). https://c4model.com/

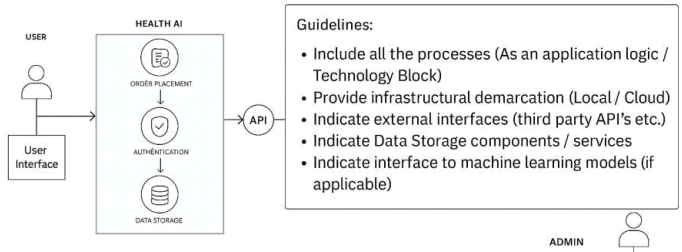
- IBM Order Processing System (Pandemic Reference) Inspired HealthAI's backend design by using modular components and AI-powered services similar to order-processing use cases. https://developer.ibm.com/patterns/online-order-processing-system-during-pandemic/

- IBM Cloud Architecture Center Provided best practices and patterns for integrating AI models and deploying cloud-based healthcare applications. https://www.ibm.com/cloud/architecture

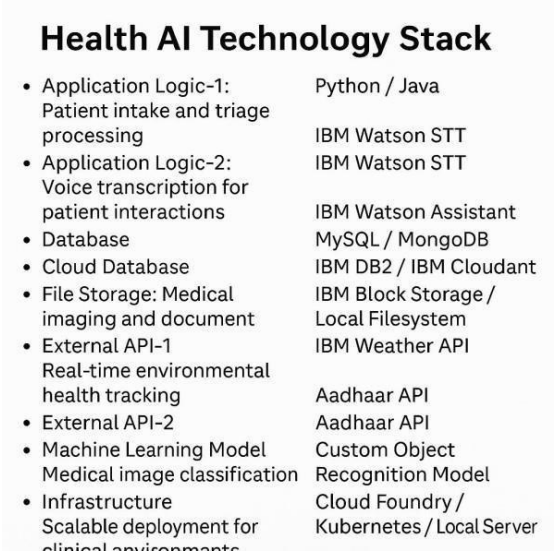
- AWS Architecture Best Practices Used as a comparative reference to validate HealthAI's scalability, resilience, and service-based integration approach. https://aws.amazon.com/architecture

- How to Draw Useful Technical Architecture Diagrams Guided the creation of simplified, functional diagrams for HealthAI's backend and AI data flow. https://medium.com/theinternalstartup/how- to-draw-useful-technical-architecture-diagrams-2d20c9fda90d

Health AI



S.No.	Component	Description	Guideïnees
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	



- **PROJECT DESIGN**
- **Problem Solution Fit**

Problem – Solution Fit Template :

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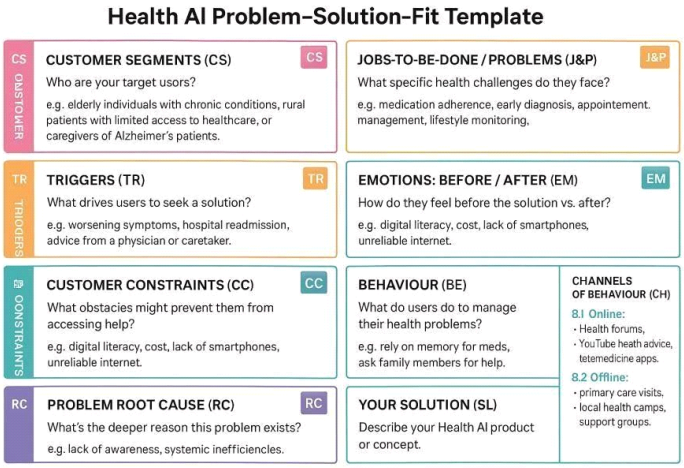
Maximum Marks	2 Marks

Problem – Solution Fit Template : HealthAI solves a frequent and urgent problem: lack of easy access to valid healthcare information and insights. It taps into the existing behavior of users searching for medical information online and replaces it with a credible, AI-powered platform.

Purpose :

- ✔ Solve complex health-related problems using intelligent and accessible AI assistance
- ✔ Increase solution adoption by reflecting how users already seek medical information online
- ✔ Improve communication using conversational chat and visual analytics
- ✔ Build user trust with consistent, evidence-based responses



References :

- https://www.ideahackers.network/problem-solution-fit-canvas/
- https://medium.com/@epicantus/proble HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"m HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"- HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"solutio HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"n HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"-fi HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"t HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"- HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"canva HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"s HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"- HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"aa3dd59cb4 HYPERLINK "https://medium.com/%40epicantus/problem-solution-fit-canvas-aa3dd59cb4fe"fe

- **Proposed Solution**

Date	27 June 2025
Team ID	LTVIP2025TMID59346
Project Name	HealthAI-Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	2 Marks

Proposed Solution Template:

Project team shall fill following information in the proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Identify a pressing issue in healthcare your AI aims to adress
2.	Idea / Solution description	Summarize your Health AI solution and how it works
3.	Novelty / Uniqueness	What makes your idea different from existing healthcare technologies?
4.	Social Impact / Customer Satisifaction	How will it improve lives, patient outcomes, or user experience?
5.	Business Model (Revenue Model)	How will your solution generate revenue or remain sustainable?

- **Solution Architectur**

Date	27 June 2025

Team ID	LTVIP2025TMID59346
Project Name	HealthAI-Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	2 Marks

✓ **Solution Architecture – HealthAI**

Solution architecture in HealthAI serves as the bridge between real-world healthcare challenges and advanced AI-driven technology. It outlines how HealthAI is built to deliver accurate, personalized, and responsive medical support**.**

🎯 **Goals of HealthAI's Solution Architecture:**

- Identify the most effective AI-driven technology to solve the problem of inaccessible or unreliable healthcare information.
- Design the complete structure — from user input (like symptoms or questions) to backend AI processing using IBM Granite and secure API handling.
- Define key features and development phases, including modules like:
  - Patient Chat o Disease Prediction o Treatment Plan Generation o Health Analytics

 Key Characteristics of the HealthAI Architecture:

Modular and Scalable Design: Each core functionality is independently built using Python and Streamlit.

AI Integration: IBM Granite (13B Instruct v2) is used to process all medical queries and generate accurate, natural-language responses.

. User Interface: Streamlit provides an intuitive frontend with form-based inputs, chatbot interfaces, and dynamic visualizations using Plotly.

Data Flow: User inputs are sent to the AI model via a central shared function (shared_model.py), processed securely, and returned in structured output.

Security: Environment variables (.env) are used for API key management to protect sensitive credentials.

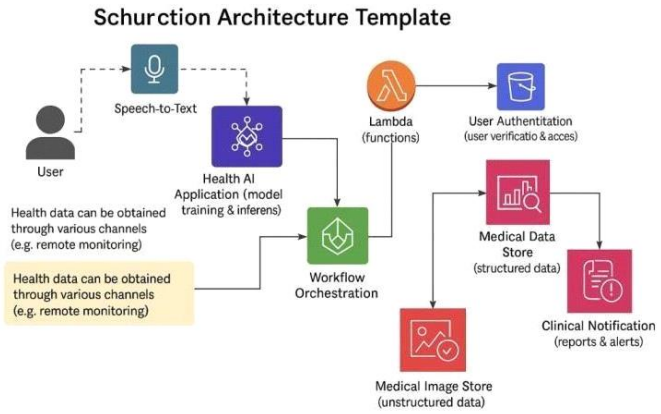


Figure 1: Architecture and data flow of the health AI system

- **PROJECT PLANNING & SCHEDULING**

5.1 Project Planning

Project Planning Template (Product Backlog, Sprint Planning, Stories, Story points)

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Project Name	HealthAI-Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	4 Marks

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Functional Requirement	Sprint	User Story / Task	Story Points	Priority
Registration	Sprint 1	As a user, I can register for the application (US1)	5	High
Registration	Sprint 1	As a user, real responses can be analyzed using speeh-to-text (US2) (US2)	8	High
Login	Sprint 1	As a user, health data can be input into system (US3)	7	High
Dashboard	Sprint 2	As a user, I can log in to the application (US4)	4	Medium
Dashboard	Sprint 2	As a user, I can view health data visualizations on the central dashboard (US5)	2	Medium

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

Product Backlog, Sprint Schedule, and Etimation (4 Marks)

Functional Requirement	Sprint	Story ID	User Story / Task	Story Points	Priority
Registration	Sprint 1	US#4	As a user, I can register for the application (US3)	5	High
		US#2	As a user, oral responses can be analyzed using speech-to-text (US2)	8	High
Login	Sprint 1	US#3	As a user, health data can be input into system	7	High
		US#1	As a user, I can log in to the application	2	High
Dashboard	Sprint 2	US#1	As a user, I can view health data visualizations on the central (US5 dashboard	2	Medium

- **FUNCTIONAL AND PERFORMANCE TESTING**

6.1 Performance Testing

Functional & Performance Testing Template

Date	27 June 2025
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Project Name	HealthAI-Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	

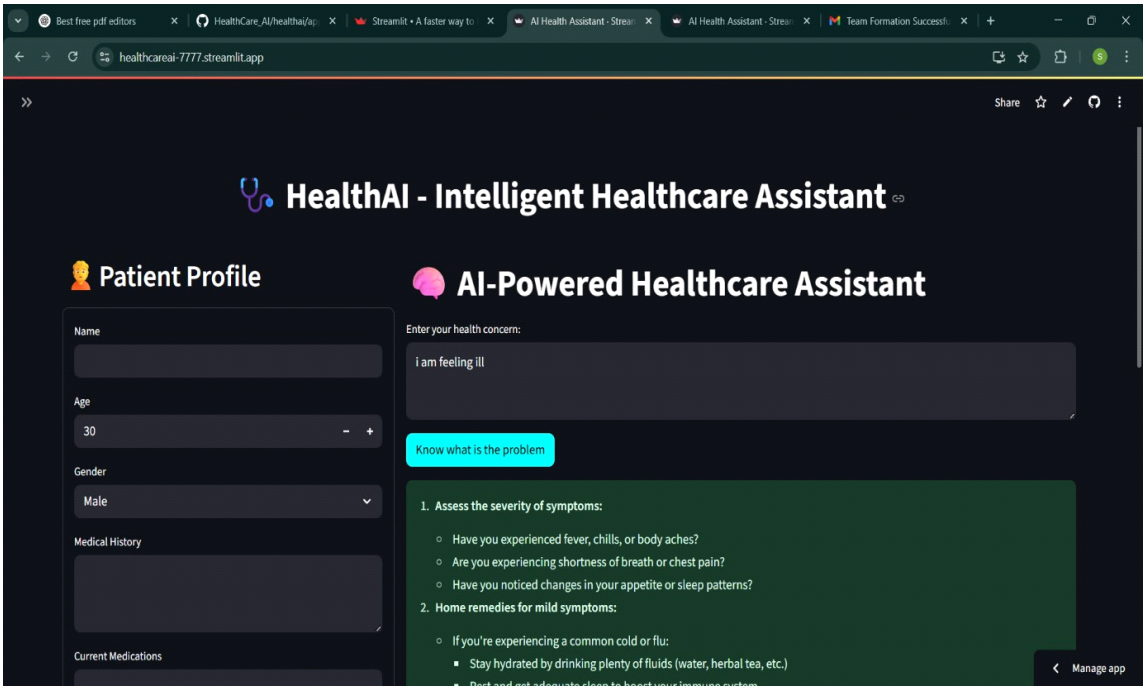
Model Performance Test

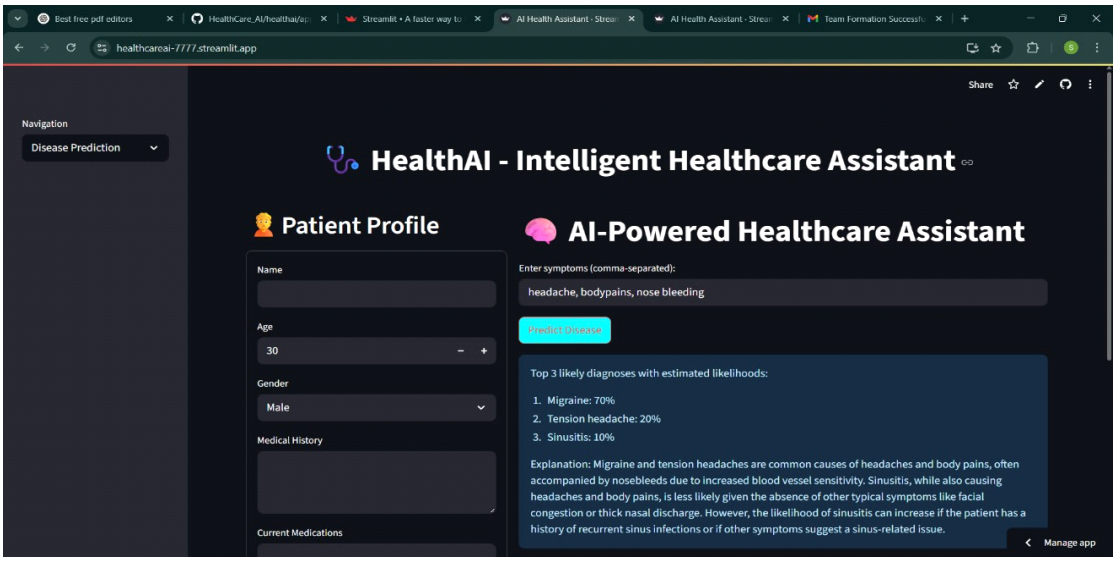
Test Scenarios & Result

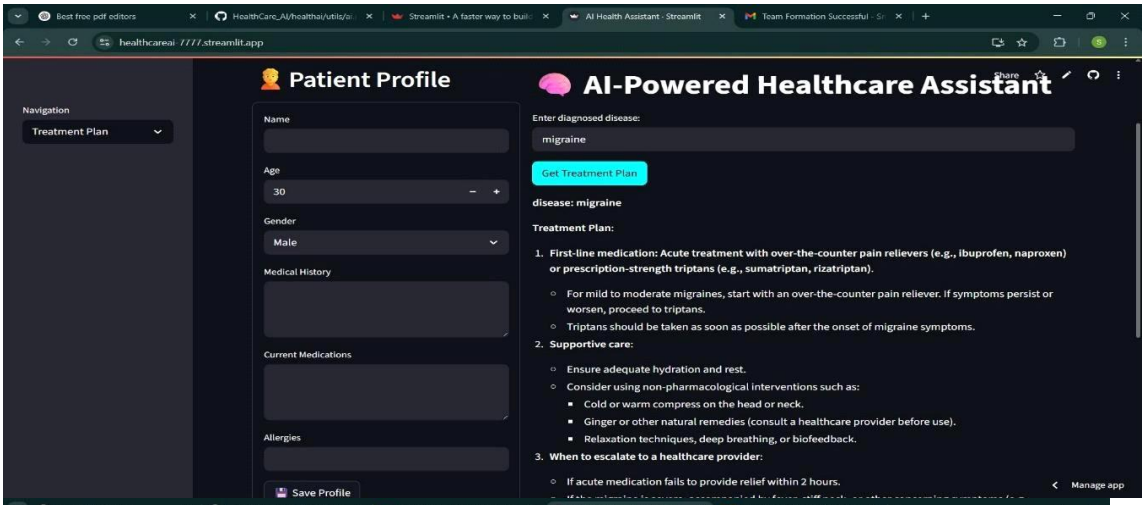
Health AI Test Scenarios & Results

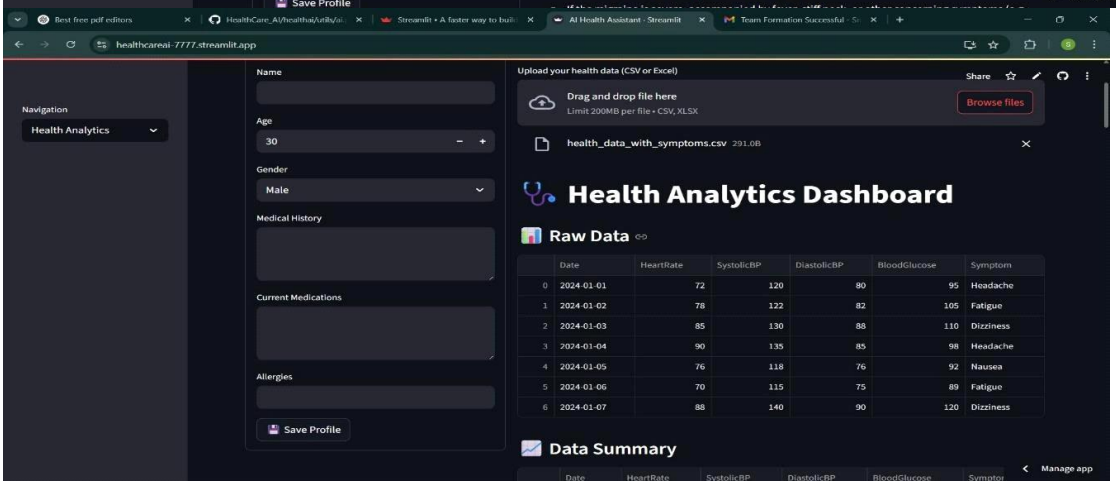
Test Case	Scenario (What to test)	Expected Result	Result
HT-A1	Input Validation	Valid inputs accepted	Pass
HT-A2	Name Input	Accepts alph, values	Accepts valid values
HT-A3	Symptom Input	Logg correctly	Symptoms log correcty
HT-A4	Content Generation	Created accurately	Generated accurately
HT-A5	API Connection	API responds	API responds
HT-A6	Response Time	Should be accepstable	Within an acceptable
HT-A7	User submitty multiple inputs	Should not slow	Pass
HT-A8	Upload transfer speed during micage	Should not lag	Should not lag

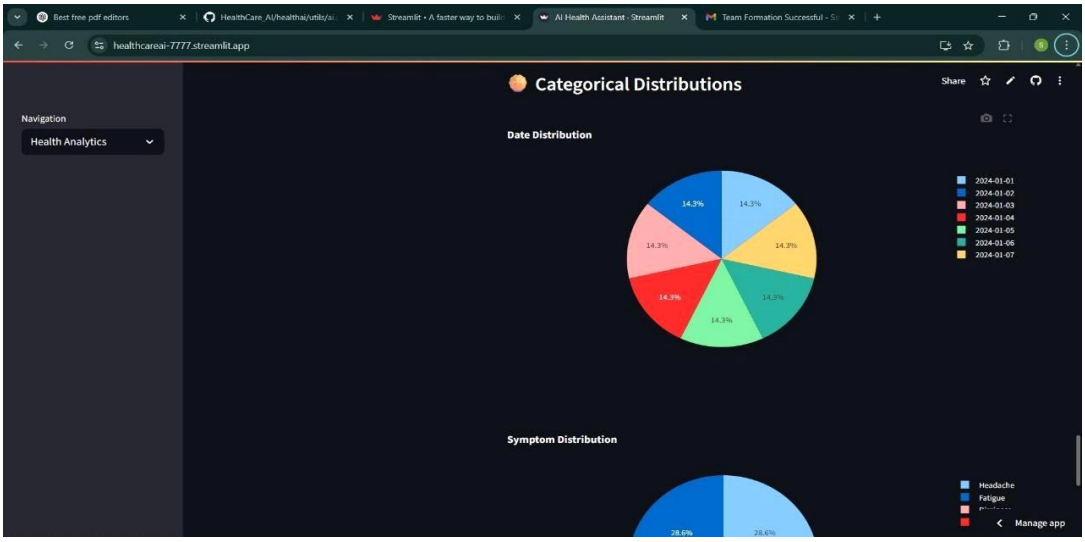
- **RESULTS**
- **Output Screenshots**




healthcareai-7777.streamlit.app
Share
Navigation
Disease Prediction
HealthAI - Intelligent Healthcare Assistant
Patient Profile
Name
Age
30
Gender
Male
Medical History
Current Medications
AI-Powered Healthcare Assistant
Enter symptoms (comma-separated):
headache, bodypains, nose bleeding
Predict Disease
Top 3 likely diagnoses with estimated likelihoods:
1. Migraine: 70%
2. Tension headache: 20%
3. Sinusitis: 10%
Explanation: Migraine and tension headaches are common causes of headaches and body pains, often accompanied by nosebleeds due to increased blood vessel sensitivity. Sinusitis, while also causing headaches and body pains, is less likely given the absence of other typical symptoms like facial congestion or thick nasal discharge. However, the likelihood of sinusitis can increase if the patient has a history of recurrent sinus infections or if other symptoms suggest a sinus-related issue.
Manage app


healthcareai-7777.streamlit.app
Share
Navigation
Treatment Plan
Patient Profile
Name
Age
30
Gender
Male
Medical History
Current Medications
Allergies
Save Profile
AI-Powered Healthcare Assistant
Enter diagnosed disease:
migraine
Get Treatment Plan
disease: migraine
Treatment Plan:
1. First-line medication: Acute treatment with over-the-counter pain relievers (e.g., ibuprofen, naproxen) or prescription-strength triptans (e.g., sumatriptan, rizatriptan).
For mild to moderate migraines, start with an over-the-counter pain reliever. if symptoms persist or worsen, proceed to triptans.
Triptans should be taken as soon as possible after the onset of migraine symptoms.
2. Supportive care:
Ensure adequate hydration and rest.
Consider using non-pharmacological interventions such as:
Cold or warm compress on the head or neck.
Ginger or other natural remedies (consult a healthcare provider before use).
Relaxation techniques, deep breathing, or biofeedback.
3. When to escalate to a healthcare provider:
If acute medication fails to provide relief within 2 hours.
Manage app


healthcareai-7777.streamlit.app
Navigation
Health Analytics
Name
Age
30
Gender
Male
Medical History
Current Medications
Allergies
Save Profile
Upload your health data (CSV or Excel)
Drag and drop file here
Limit 200MB per file • CSV, XLSX
Browse files
health_data_with_symptoms.csv 291.0B
Health Analytics Dashboard
Raw Data
Date HeartRate SystolicBP DiastolicBP BloodGlucose Symptom
0 2024-01-01 72 120 80 95 Headache
1 2024-01-02 78 122 82 105 Fatigue
2 2024-01-03 85 130 88 110 Dizziness
3 2024-01-04 90 135 85 98 Headache
4 2024-01-05 76 118 76 92 Nausea
5 2024-01-06 70 115 75 89 Fatigue
6 2024-01-07 88 140 90 120 Dizziness
Data Summary
Manage app



- **ADVANTAGES & DISADVANTAGES**

Advantages:

- ✓ 24/7 Accessibility: Users can access healthcare assistance anytime without waiting for a doctor.
- ✓ AI-Powered Responses: Quick and intelligent answers using IBM Granite enhance user experience.
- ✓ Early Disease Prediction: Helps in identifying potential health issues at an early stage.
- ✓ Modular System: Divided into four independent modules for better organization and usability.
- ✓ User-Friendly Interface: Built using Streamlit, it provides a simple and intuitive experience.
- ✓ Cost-Effective: Reduces the need for continuous human supervision in basic healthcare queries.

Disadvantages:

- ✗ Not a Replacement for Doctors: Cannot replace actual medical consultation or diagnosis.
- ✗ Depends on Internet Connection: Requires stable internet to function effectively.
- ✗ Limited to Pretrained Knowledge: IBM Granite model may not always be updated with the latest medical information.

- ❌ Security & Privacy: Requires strict handling of user data for ethical and legal compliance.

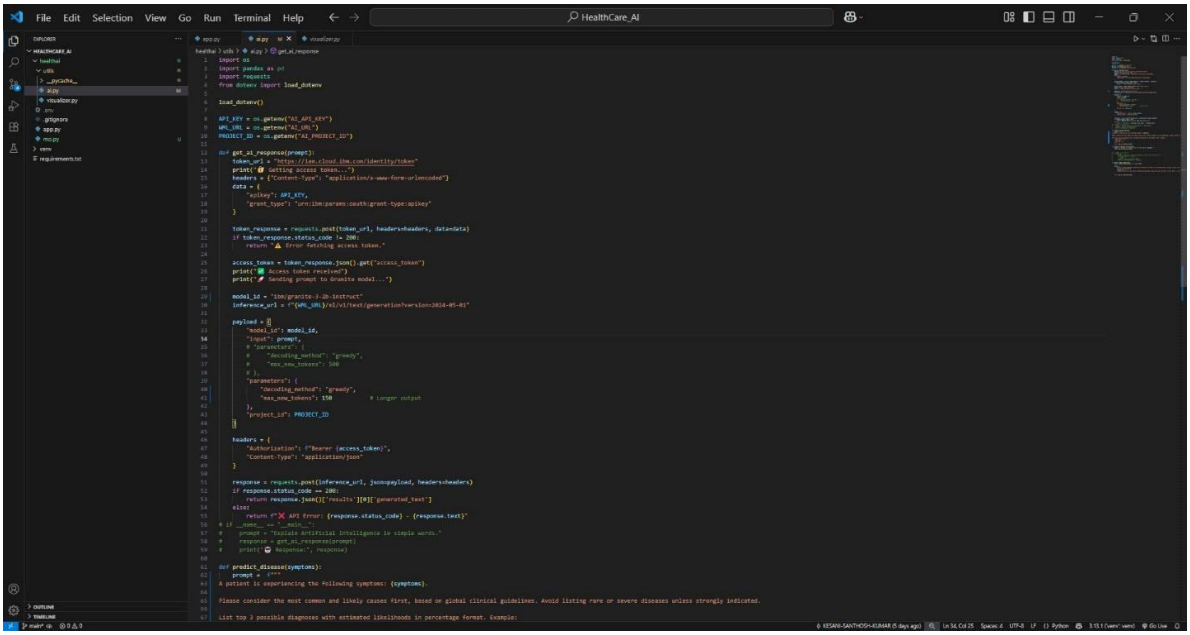
- **CONCLUSION**

The HEALTHAI project demonstrates how generative AI, specifically IBM Granite, can be effectively integrated into healthcare applications. By providing intelligent responses to user queries, disease prediction, treatment suggestions, and health analytics, this system can assist users in managing their health proactively. Though it is not a substitute for professional medical advice, it acts as a supportive tool that can bridge the gap between users and healthcare information in real time.

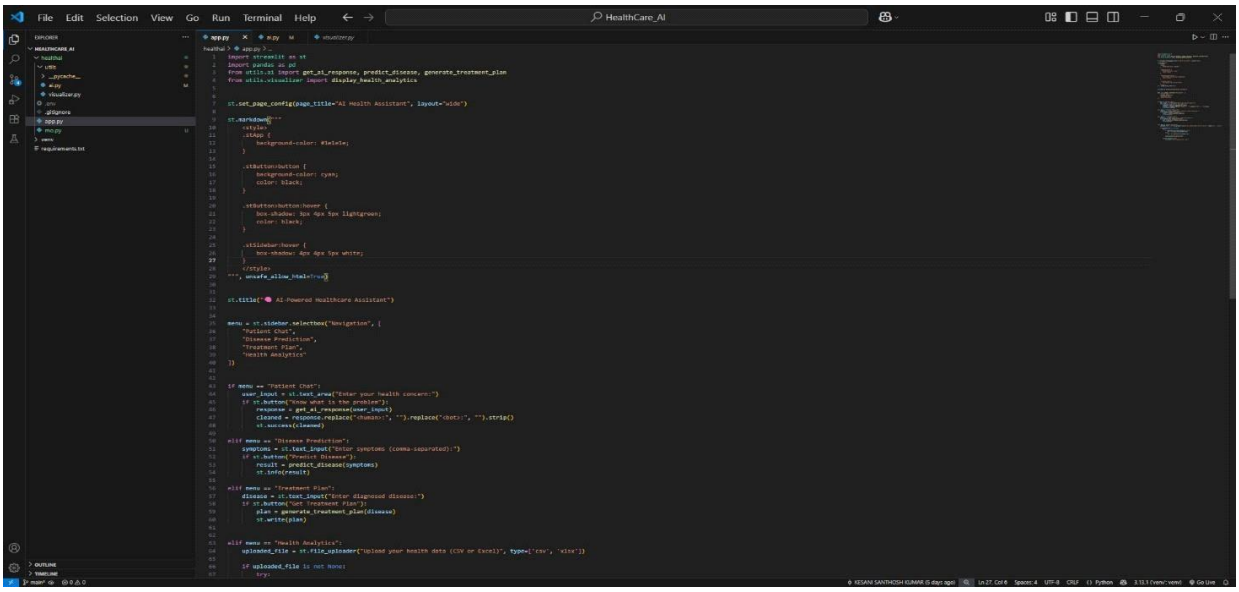
- **FUTURE SCOPE**

  - 🔬 Integration with Real Medical Records: In future, the system can be connected to Electronic Health Records (EHR) for more personalized responses.
  - 📱 Mobile App Development: A dedicated mobile version can improve accessibility on smartphones.
  - □ More Advanced AI Models: Upgrading to future IBM Granite versions or fine-tuning with medical datasets for better accuracy.
  - 🌐 Multi-Language Support: Expanding to regional languages can make it more inclusive.
  - 🔒 Enhanced Security Measures: Implementing data encryption and secure login to protect user privacy**.**
  - 🧑□ Doctor Integration: Providing live chat features with real doctors or teleconsultation options.

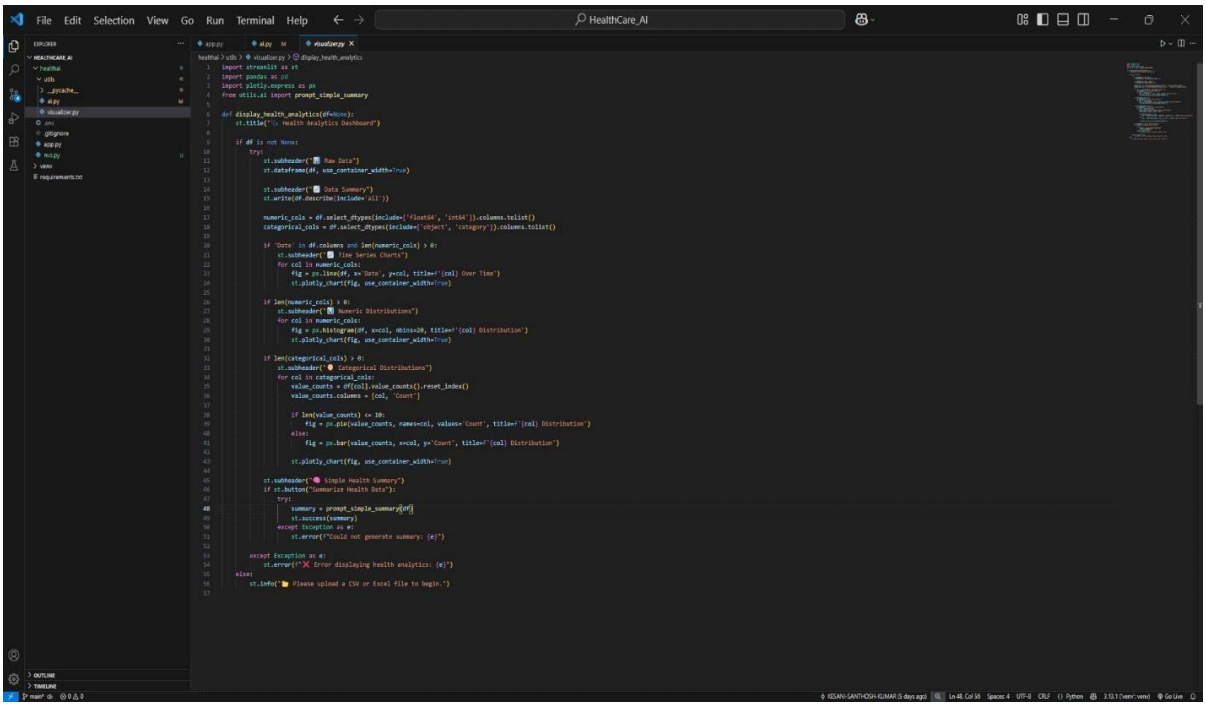
Source Code(if any)



```
import os
import pandas as pd
import requests
from dotenv import load_dotenv

load_dotenv()

API_KEY = os.getenv("AI_API_KEY")
URL_URL = os.getenv("AI_URL")
PROJECT_ID = os.getenv("AI_PROJECT_ID")

def get_ai_response(prompt):
    token_url = "https://iam.cloud.ibm.com/identity/token"
    print("🔐 Getting access token...")
    headers = {"Content-Type": "application/x-www-form-urlencoded"}
    data = {
        "apikey": API_KEY,
        "grant_type": "urn:ibm:params:oauth:grant-type:apikey"
    }

    token_response = requests.post(token_url, headers=headers, data=data)
    if token_response.status_code != 200:
        return "⚠️ Error fetching access token."

    access_token = token_response.json().get("access_token")
    print("✅ Access token received")
    print("🚀 Sending prompt to Granite model...")

    model_id = "ibm/granite-3-2b-instruct"
    inference_url = f"{URL_URL}/ml/v1/text/generation?version=2024-05-01"

    payload = {
        "model_id": model_id,
        "input": prompt,
        # "parameters": {
        #     "decoding_method": "greedy",
        #     "max_new_tokens": 500
        # }
        "parameters": {
            "decoding_method": "greedy",
            "max_new_tokens": 150          # Longer output
        },
        "project_id": PROJECT_ID
    }

    headers = {
        "Authorization": f"Bearer {access_token}",
        "Content-Type": "application/json"
    }

    response = requests.post(inference_url, json=payload, headers=headers)
    if response.status_code == 200:
        return response.json()['results'][0]['generated_text']
    else:
        return f"❌ API Error: {response.status_code} - {response.text}"
# if __name__ == "__main__":
#     prompt = "Explain Artificial Intelligence in simple words."
#     response = get_ai_response(prompt)
#     print("🤖 Response:", response)

def predict_disease(symptoms):
    prompt = f"""
A patient is experiencing the following symptoms: {symptoms}.

Please consider the most common and likely causes first, based on global clinical guidelines. Avoid listing rare or severe diseases unless strongly indicated.

List top 3 possible diagnoses with estimated likelihoods in percentage format. Example:
```



```
import streamlit as st
import pandas as pd
from utils.ai import get_ai_response, predict_disease, generate_treatment_plan
from utils.visualizer import display_health_analytics

st.set_page_config(page_title="AI Health Assistant", layout="wide")

st.markdown("""
    <style>
    .stApp {
        background-color: #e1e1e1;
    }

    .stButton>button {
        background-color: cyan;
        color: black;
    }

    .stButton>button:hover {
        box-shadow: 0px 0px 0px 5px lightgreen;
        color: black;
    }

    .stSidebar:hover {
        box-shadow: 0px 0px 0px 5px white;
    }
    </style>
""", unsafe_allow_html=True)

st.title("🩺 AI-Powered Healthcare Assistant")


menu = st.sidebar.selectbox("Navigation", [
    "Patient Chat",
    "Disease Prediction",
    "Treatment Plan",
    "Health Analytics"
])

if menu == "Patient Chat":
    user_input = st.text_area("Enter your health concern:")
    if st.button("Know what is the problem"):
        response = get_ai_response(user_input)
        cleaned = response.replace("<human>:", "").replace("<bot>:", "").strip()
        st.success(cleaned)

elif menu == "Disease Prediction":
    symptoms = st.text_input("Enter symptoms (comma-separated):")
    if st.button("Predict Disease"):
        result = predict_disease(symptoms)
        st.info(result)

elif menu == "Treatment Plan":
    disease = st.text_input("Enter diagnosed disease:")
    if st.button("Get Treatment Plan"):
        plan = generate_treatment_plan(disease)
        st.write(plan)


elif menu == "Health Analytics":
    uploaded_file = st.file_uploader("Upload your health data (CSV or Excel)", type=['csv', 'xlsx'])

    if uploaded_file is not None:
        try:
```



Dataset Link GitHub & Project Demo Link

Both the dataset and the project demo video are uploaded to the GitHub repository and can be accessed via the following link:

https://github.com/KESANI-SANTHOSH-KUMAR/HealthCare_AI