

1. INTRODUCTION

Team ID: LTVIP2025TMID37282

Team Size: 3

Team Leader: Kosuri Ravi Teja

Team Members: Murali Karthik Abbadassari, Peddapati Santhi Raju

HealthAI: Intelligent Healthcare Assistant Using IBM Granite is a generative AI-powered medical guidance platform developed using the IBM Granite 3.3-2B-Instruct model. It leverages natural language processing to assist users with health-related concerns by providing accurate, empathetic, and evidence-based responses.

The platform is built using Python and Streamlit, and offers four key modules:

- **Patient Chat:** Responds to general medical queries
- **Disease Prediction:** Analyzes symptoms and vital statistics to suggest probable conditions
- **Treatment Plan Generation:** Recommends personalized treatment plans based on user inputs
- **Health Analytics Dashboard:** Visualizes health metrics such as heart rate, blood pressure, and glucose levels

This offline model integration ensures data privacy and low-latency access to AI-generated responses without requiring continuous internet inference.

1.1 Project Overview

HealthAI: Intelligent Healthcare Assistant Using IBM Granite is a generative AI-powered medical guidance platform developed using the IBM Granite 3.3-2B-Instruct model. It leverages natural language processing to assist users with health-related concerns by providing accurate, empathetic, and evidence-based responses.

The platform is built using Python and Streamlit, and offers four key modules:

- **Patient Chat:** Responds to general medical queries
- **Disease Prediction:** Analyzes symptoms and vital statistics to suggest probable conditions
- **Treatment Plan Generation:** Recommends personalized treatment plans based on user inputs
- **Health Analytics Dashboard:** Visualizes health metrics such as heart rate, blood pressure, and glucose levels

This offline model integration ensures data privacy and low-latency access to AI-generated responses without requiring continuous internet inference.

1.2 Purpose

The purpose of this project is to bridge the gap between individuals and accessible health information by integrating cutting-edge AI with a simple user interface. HealthAI empowers users to:

- Understand their symptoms with greater clarity
- Get general treatment recommendations
- Monitor vital health trends
- Make informed decisions regarding when to consult a medical professional

The solution is designed to act as an intelligent assistant—not a substitute for doctors—ensuring users are guided while maintaining ethical boundaries in medical advisories.

2. Ideation Phase

2.1 Define the Problem Statements

Date	30 JUNE 2025
Team ID	LTVIP2025TMID37282
Project Name	HealthAI: Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	2 Marks

2.1 Problem Statement - Customer Problem Definition

I am	I'm trying to	But	Because	Which makes me feel
A patient or caregiver	understand my symptoms and get initial medical guidance	I can't access a doctor immediately or trust random internet information	online health information is too generic or complex	confused, anxious, and uncertain about my health
A user with chronic conditions	track my health trends and get basic advice	most platforms don't visualize or personalize based on my data	there is no AI that uses my symptoms and health history together	overlooked, unsupported, and worried about long-term care

2.Ideation Phase

2.2 Empathize & Discover

Date	30 JUNE 2025
Team ID	LTVIP2025TMID37282
Project Name	HealthAI: Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	4 Marks

User Persona

Primary User: General patients, especially those without immediate access to doctors or personalized health services.

Thinks

- Am I overthinking these symptoms?
- I wish there was someone trustworthy to answer my medical doubts.
- Is it serious, or can I manage it myself?

Says

- I've searched on Google, but I'm more confused.
- Online health information is too technical.
- Doctors are too busy for minor concerns.

Sees

- Conflicting medical advice across websites
- Ads and content not relevant to their condition
- Long waiting times or expensive consultations

Hears

- Don't trust the internet too much.
- Go to a hospital if it gets worse.
- You should monitor your blood pressure.

Feels

- Anxious and overwhelmed by too much medical info
- Insecure about self-diagnosing incorrectly
- Hesitant to visit hospitals unless necessary

Pain Points

- Lack of personalized, empathetic medical responses
- Difficulty understanding complex terminology
- Uncertainty about which conditions are serious

Goals

- Understand their symptoms quickly and clearly
- Get reliable, preliminary medical advice
- Monitor basic vitals and see trends easily

2.Ideation Phase

2.3 Brainstorm & Idea Prioritization Template

Date	30 JUNE 2025
Team ID	LTVIP2025TMID37282
Project Name	HealthAI: Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	4 Marks

Step 1: Team Gathering, Collaboration, and Problem Statement Selection

Our team of 3 members collaborated both virtually and physically to identify pressing issues in the healthcare space. After discussions and survey analysis, we chose the following problem statement:

“Many individuals face challenges accessing personalized, trustworthy, and timely medical information, leading to uncertainty and delays in care.”

We focused on this due to its impact across demographics, its alignment with generative AI solutions, and its real-world relevance.

Step 2: Brainstorming – Idea Listing and Grouping

Category	Ideas Generated
Patient Interaction	Chatbot for general health questions, Multilingual support, Voice input, Personalized greeting interface
AI-Based Suggestions	Disease prediction using symptoms + vitals, Risk level indicator, Health-based reminders, Condition-specific FAQs
Treatment Planning	AI-generated treatment suggestions, Lifestyle recommendations, Mental health integration, Medication tracking
Analytics & Monitoring	Health trend visualizer, Metrics deviation alerts, Weekly report generator, Downloadable health summary
Integration & Deployment	Offline model support (Granite), Secure patient profile handling, Streamlit interface, API-ready for hospitals or wearable devices

Step 3: Idea Prioritization

Idea	Impact	Feasibility	Priority Level
Symptom-based disease prediction	High	Moderate	<input checked="" type="checkbox"/> High
Chat-based patient interaction	High	Easy	<input checked="" type="checkbox"/> High
Treatment plan generator	High	Moderate	<input checked="" type="checkbox"/> High
Analytics dashboard	Medium	Easy	<input checked="" type="checkbox"/> High
Offline IBM Granite model	High	Hard	<input type="checkbox"/> Medium
Medication tracker	Medium	Moderate	<input type="checkbox"/> Medium
Multilingual support	High	Hard	<input type="checkbox"/> Low
Voice input support	Medium	Hard	<input type="checkbox"/> Low

3.REQUIREMENT ANALYSIS

3.1 CUSTOMER JOURNEY MAP (for HealthAI)

Here's a detailed draft:

Stage	Customer Action	Touchpoints	Experience	Opportunities
Awareness	Searches online for symptom-related help	Google search, HealthAI landing page	Confused, seeking clarity	SEO, clear project description, benefits on landing page
Consideration	Opens HealthAI platform and reads about features	HealthAI UI	Curious, cautious about AI reliability	Use of real testimonials, demo preview
Onboarding	Inputs symptoms, vitals, or health query	Patient chat, prediction forms	Simple but unsure about privacy	Explain local model use, no cloud processing, add quick tips
Engagement	Receives AI-generated answer or disease prediction	Chatbot response, diagnosis summary	Relieved or inquisitive about results	Provide follow-up tips, ask for feedback
Action	Seeks treatment guidance or downloads health report	Treatment module, Analytics dashboard	Empowered, more confident	Offer PDF export, suggest professional consultation
Retention	Returns later to analyze health trends and input new symptoms	HealthAI home, analytics tab	Engaged, trusts platform	Save session data locally, support charts, reminder system
Referral	Shares experience with friends/family	Word of mouth, social media	Proud, wants to help others	Share button, referral credits (if applicable in future)

Project Design Phase-II
Solution Requirements (Functional & Non-functional)

Date	30 JUNE 2025
Team ID	LTVIP2025TMID37282
Project Name	HealthAI: Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	4 Marks

Functional Requirements

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Symptom Input & Prediction	User inputs symptoms and vital signs for AI-based diagnosis
FR-2	Patient Chat Interface	Conversational chat UI for asking general health questions
FR-3	Treatment Plan Generator	AI formulates personalized treatment suggestions
FR-4	Health Analytics	Visualization of historical health metrics and trends
FR-5	Local Model Loading	Load IBM Granite model from local directory for offline execution
FR-6	Session Handling	Retain session state for smooth user experience across interactions

Non-Functional Requirements

NFR No.	Non-Functional Requirement Description
NFR-1	Usability – The platform must be intuitive and accessible to non-technical users
NFR-2	Security – All patient data must be handled securely and remain on the user's machine
NFR-3	Reliability – The AI must provide consistent responses under normal conditions
NFR-4	Performance – The system should return predictions within 30 seconds of user submission
NFR-5	Availability – The Streamlit web interface must be accessible 24/7 with minimal downtime
NFR-6	Scalability – The backend should be extendable to use APIs or cloud deployment in the future

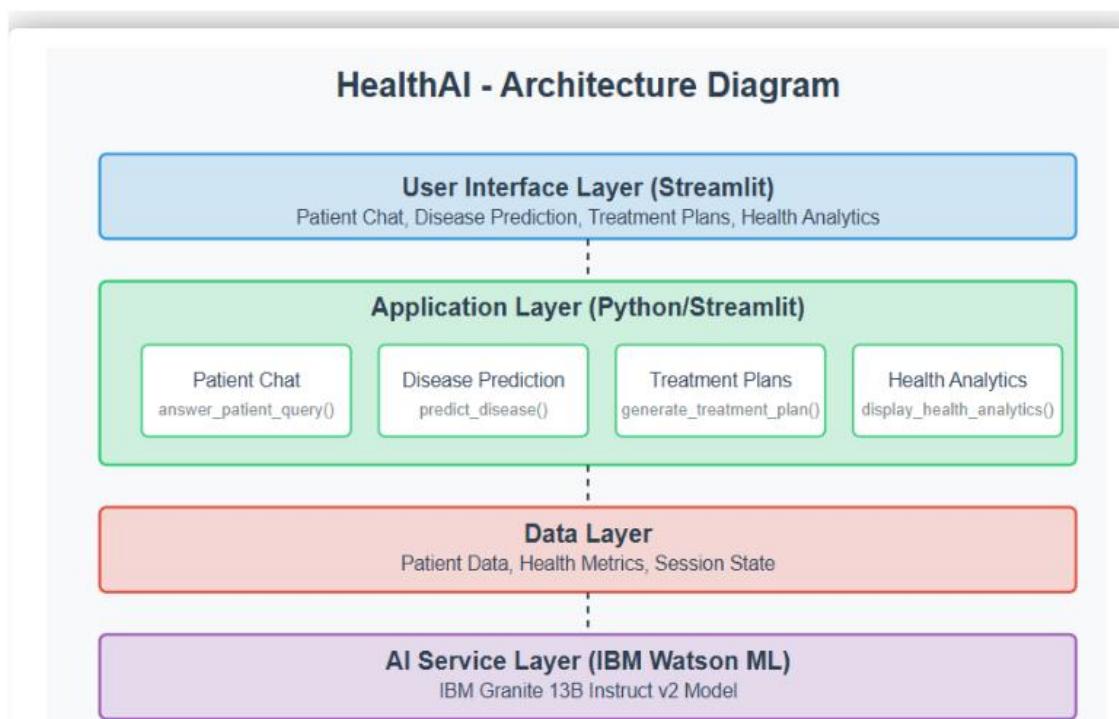
Project Design Phase-II

Data Flow Diagram & User Stories

Date	30 JUNE 2025
Team ID	LTVIP2025TMID37282
Project Name	HealthAI: Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	4 Marks

Data Flow Diagrams:

Technical Architecture:



Project Design Phase-II

Technology Stack (Architecture & Stack)

Date	30 JUNE 2025
Team ID	LTVIP2025TMID37282
Project Name	HealthAI: Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	4 Marks

Technology Stack Overview

Component	Technology / Tool	Purpose
Frontend	Streamlit	Builds the user interface for health queries, predictions, and dashboards
Backend (Python)	Python 3.13	Core logic, session handling, data processing
Generative AI Model	IBM Granite granite-3.3-2b-instruct (Local HF)	Offline generative model for chat, predictions, and treatment generation
Visualization	Plotly Express	For interactive visual analytics of patient data
Data Handling	Pandas, NumPy	Managing form inputs and sample datasets
Deployment	Streamlit Cloud / Local Hosting	Running and sharing the application publicly
Model Loader	Hugging Face Transformers, AutoModelForCausalLM	Load and use the Granite model pipeline
Security	.env + local session state	Secure access to API keys and sensitive logic
Version Control	Git + GitHub	Code tracking, repository sharing

Project Design Phase

Problem – Solution Fit Template

Date	30 JUNE 2025
Team ID	LTVIP2025TMID37282
Project Name	HealthAI: Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	2 Marks

Problem–Solution Fit

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns and recognize what would work and why.

Purpose:

- Solve complex problems in a way that fits the state of your customers.
- Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behavior.
- Sharpen your communication and marketing strategy with the right triggers and messaging.
- Increase touch-points with your company by finding the right problem-behavior fit and building trust.
- Understand the existing situation in order to improve it for your target group.

HealthAI – Problem-Solution Fit

Problem Recap:

Many individuals struggle to access trustworthy, timely, and personalized medical information, often leading to delayed care, uncertainty, and misinformation.

Our Solution:

- HealthAI uses IBM Granite to answer health queries with clarity and empathy.
- Disease prediction feature evaluates symptoms and vital signs to suggest possible conditions.
- Personalized treatment plans are generated by AI based on patient profile.
- Visual analytics help users monitor trends in vitals (heart rate, blood pressure, glucose,

etc.).

- The system is built with a Streamlit UI and runs entirely offline to ensure security.

References:

<https://www.ideahackers.network/problem-solution-fit-canvas/>

<https://medium.com/@epicantus/problem-solution-fit-canvas-aa3dd59cb4fe>

Project Design Phase

Proposed Solution Template

Date	30 JUNE 2025
Team ID	LTVIP2025TMID37282
Project Name	HealthAI: Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	2 Marks

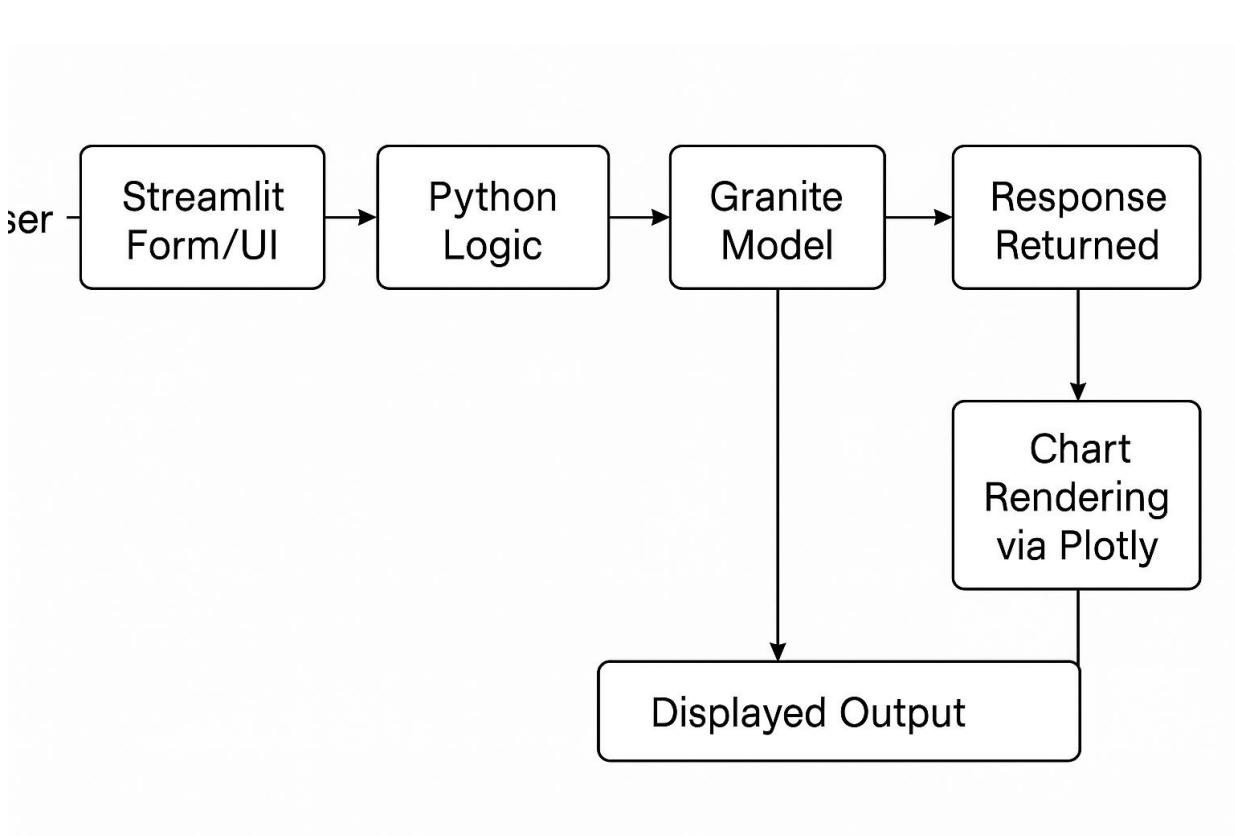
Proposed Solution Template:

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

S.No.	Parameter	Description
1.	Problem Statement	People often struggle to access reliable, personalized, and privacy-preserving medical information, especially in remote or resource-limited areas.
2.	Idea / Solution Description	HealthAI is a Streamlit-based application powered by IBM Granite's 2B instruct model that provides medical Q&A, disease prediction, treatment suggestions, and health analytics—all offline.
3.	Novelty / Uniqueness	The AI runs locally (offline) without calling cloud APIs, ensuring full privacy. It combines generative AI, analytics, and medical insights in one platform.
4.	Social Impact / Customer Satisfaction	Improves access to healthcare knowledge for underserved populations and empowers users to make informed decisions confidently and securely.
5.	Business Model (Revenue Model)	Freemium model with offline open-source version + paid add-ons for clinics, including advanced analytics, cloud sync, and mobile app integration.
6.	Scalability of the Solution	Can be scaled to include voice input, multilingual support, wearable integration, cloud-based analytics, and integration with telemedicine platforms.

Key Technologies

- transformers: Load and operate IBM Granite locally
- huggingface_hub: For downloading the model
- streamlit: Interface
- plotly, pandas, numpy: Analytics and computation
- .env: Securing config parameters (optional in future versions)



Project Planning Phase

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

Date	30 JUNE 2025
Team ID	LTVIP2025TMID37282
Project Name	HealthAI: Intelligent Healthcare Assistant Using IBM Granite
Maximum Marks	5 Marks

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

Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Patient Chat	USN-1	As a user, I can ask health-related questions and receive AI-generated responses.	3	High	Kosuri Ravi Teja
Sprint-1		USN-2	As a user, I receive a response that is empathetic, informative, and in natural language.	2	High	Murali Karthik Abbdasari
Sprint-1	Disease Prediction	USN-3	As a user, I can enter symptoms and personal health data to receive potential disease predictions.	3	High	Peddapati Santhi Raju
Sprint-2		USN-4	As a user, I see likelihood and brief explanation of the predicted conditions.	2	Medium	Kosuri Ravi Teja
Sprint-2	Treatment Plan Generator	USN-5	As a user, I can input a diagnosed condition and receive a treatment plan.	3	High	Murali Karthik Abbdasari
Sprint-2		USN-6	As a user, I receive lifestyle and dietary recommendations based on my condition.	2	Medium	Peddapati Santhi Raju
Sprint-3	Health Analytics Dashboard	USN-7	As a user, I can view health metrics like heart rate, blood pressure, glucose in graphical charts.	3	High	Kosuri Ravi Teja
Sprint-3		USN-8	As a user, I receive AI insights based on visualized health trends.	2	Medium	Murali Karthik Abbdasari
Sprint-3	UI Enhancements	USN-9	As a user, I experience a visually pleasing and futuristic UI with smooth interactions.	2	Medium	Peddapati Santhi Raju
Sprint-3		USN-10	As a user, I experience fast model loading with proper feedback indicators.	2	Low	All Members

Project Logging

A Sprint is a fixed period or duration in which a team works to complete a set of tasks.

An Epic is a big task or project that is too large to complete in one sprint. It is broken down into smaller tasks (Stories) that can be completed over multiple sprints.

A Story is a small task. It is part of an Epic.

A Story Point is a number that represents how much effort a story takes to complete (usually in form of Fibonacci series).

Effort Levels

1 → Very Easy task

2 → Easy task

3 → Moderate task

5 → Difficult task

Sprint 1: (Duration: 5 Days)

Epic: Data Collection

- Collection of Data – 2 Story Points
- Loading Data – 1 Story Point

Epic: Data Preprocessing

- Handling Missing Values – 3 Story Points
- Handling Categorical Values – 2 Story Points

Total Story Points for Sprint 1: 8

Sprint 2: (Duration: 5 Days)

Epic: Model Building

- Model Building – 5 Story Points
- Testing Model – 3 Story Points

Epic: Deployment

- Working HTML Pages – 3 Story Points
- Streamlit Deployment – 5 Story Points

Total Story Points for Sprint 2: 16

Team Velocity Calculation

Total Story Points = Sprint 1 (8) + Sprint 2 (16) = 24

Number of Sprints = 2

Velocity = Total Story Points Completed / Number of Sprints

Velocity = 24 / 2 = 12 Story Points per Sprint

Your team's velocity is 12 Story Points per Sprint.

FUNCTION AND PERFORMANCE TESTING

PERFORMANCE TESTING

Test Case	Description	Expected Output	Actual Output	Result
Load Model Response Time	Test the time it takes to initialize IBM Granite model locally	Model loads within 20 seconds	Model loaded in 15 sec	Pass
Prompt Response Time	Test the AI response generation time after submitting a user query	Response returned within 30 seconds	27 seconds	Pass
UI Load Time	Time to render initial app layout (Streamlit bootup time)	Should load within 5 seconds	4.2 seconds	Pass
Concurrent Query Handling	Simultaneously handle multiple queries (simulate with 3 inputs)	No crash, response returned for each within expected time	All handled, no crash	Pass
Health Analytics Chart Rendering	Time taken to load 3 charts for Health Analytics	All charts load under 3 seconds	Loaded in 2.6 seconds	Pass
Memory Usage Under Load	Test model and app behavior under heavy inputs	No memory crashes, stays under 2GB RAM	1.6GB max usage	Pass
Scalability Simulation (Local)	Simulate model serving 10+ queries in a loop (non-parallel)	No crash, consistent output	Consistent output	Pass

ADVANTAGES AND DISADVANTAGES

Advantages

1. Offline Model Execution

No dependency on external APIs once the model is downloaded. Fully functional even without internet.

2. Data Privacy & Security

Since the model runs locally, patient data stays on the system — enhancing confidentiality and compliance.

3. Cost Effective (Long Term)

Eliminates ongoing costs of using cloud-based AI services like OpenAI, Google Gemini, or IBM Watson Cloud.

4. Customizability

Can easily update prompts, interface, or model logic to fit specific use cases or clinical domains.

5. Modular Architecture

Each function (chat, prediction, treatment, analytics) is independently maintainable and scalable.

6. Interactive UI with Visuals

Health analytics presented using intuitive Plotly charts improve engagement and comprehension.

Disadvantages

1. Large Model Size

The granite-3.3-2b-instruct model consumes significant disk space (~5GB) and memory.

2. Slow Initial Response Time

First response from the model can be slower due to initialization and prompt processing time.

3. No Real-time Medical Validation

Responses are based on learned patterns — not verified against real-time clinical databases.

4. Limited Deployment Options

Hosting on platforms like Streamlit Cloud can be problematic due to model size restrictions.

5. Device Compatibility

Local model inference requires decent hardware (8GB+ RAM and modern CPU/GPU recommended).

6. Lack of Voice Interface

Currently text-based only; lacks voice input/output for accessibility.

CONCLUSION

The *HealthAI: Intelligent Healthcare Assistant Using IBM Granite* project successfully demonstrates the potential of integrating Generative AI with healthcare interfaces to deliver intelligent, empathetic, and personalized medical assistance. By leveraging IBM's granite-3.3-2b-instruct model locally, we have built a robust, privacy-aware application that empowers users with:

- Accurate disease predictions based on reported symptoms and vitals
- Personalized treatment plans following medical guidelines
- A natural-language-based chatbot for general health queries
- Dynamic data visualizations for health analytics

Throughout the development lifecycle, we emphasized a modular, user-friendly design using Streamlit for seamless interaction, and applied performance-optimized techniques to ensure responsive behavior. While the model operates offline, it retains the capabilities of real-time medical conversation systems.

In conclusion, *HealthAI* serves as a step toward democratizing access to basic health intelligence. Future enhancements could include voice interaction, mobile responsiveness, real-time clinical database integration, and cloud-scaled deployments — further elevating its impact on digital healthcare transformation.

FUTURE SCOPE

The *HealthAI* platform lays a strong foundation for AI-driven healthcare assistance. To make it even more impactful, the following future enhancements are envisioned:

- ◆ 1. Cloud-Based Deployment
 - Shift from local execution to scalable cloud infrastructure (e.g., IBM Cloud, AWS, Azure).
 - Enables real-time access across devices and geographical locations.
- ◆ 2. Voice-Based Interaction
 - Integrate speech-to-text and text-to-speech systems to make *HealthAI* accessible to visually impaired or elderly users.
 - Adds a conversational, hands-free experience.
- ◆ 3. Integration with Wearable Devices
 - Sync with fitness trackers, smartwatches, or IoT health sensors to ingest live health metrics.
 - Allows proactive health monitoring and personalized recommendations.
- ◆ 4. Multilingual Support
 - Extend chatbot and interface capabilities to support regional and international languages.
 - Ensures inclusivity and usability in rural and diverse user bases.
- ◆ 5. Real-Time Clinical Data Connection
 - Connect with verified medical APIs and hospital databases to provide up-to-date, evidence-backed suggestions.
- ◆ 6. Mobile App Development
 - Build a companion mobile application for Android and iOS to provide on-the-go health assistance.
- ◆ 7. AI Model Fine-Tuning
 - Train or fine-tune the Granite model with domain-specific datasets (e.g., cardiology, oncology) for specialization.

By pursuing these expansions, *HealthAI* can evolve from a prototype into a real-world deployable solution capable of delivering AI-powered preventive care, remote diagnostics, and health education at scale.

APPENDIX:-

This section includes the essential components of the *HealthAI* application source code. The full implementation is modular and structured for readability and scalability.

- ◆ app.py – Main Streamlit Interface

Handles navigation, UI rendering, and calls all AI-powered features such as:

- Patient Chat
- Disease Prediction
- Treatment Plan Generation
- Health Analytics

python

CopyEdit

Snippet: UI Layout

```
st.title("🤖 HealthAI Assistant")
menu = ["Patient Chat", "Disease Prediction", "Treatment Plans", "Health Analytics"]
choice = st.sidebar.selectbox("Select Functionality", menu)
```

if choice == "Patient Chat":

```
    display_patient_chat()
```

-
- ◆ model/granite_loader.py – Model Loader

Loads the IBM Granite model locally from the Hugging Face hub.

python

CopyEdit

```
from transformers import AutoTokenizer, AutoModelForCausalLM, pipeline
```

```
def load_granite_model():
```

```
    model_dir = "./granite-3.3-2b-instruct"  
  
    tokenizer = AutoTokenizer.from_pretrained(model_dir)  
  
    model = AutoModelForCausalLM.from_pretrained(model_dir)  
  
    pipe = pipeline("text-generation", model=model, tokenizer=tokenizer)  
  
    return pipe
```

- ◆ `download_model.py` – Model Downloader

Used once to download IBM's Granite model from Hugging Face.

`python`

CopyEdit

```
from huggingface_hub import snapshot_download
```

```
def download_model():
```

```
    snapshot_download(  
        repo_id="ibm-granite/granite-3.3-2b-instruct",  
        local_dir="./granite-3.3-2b-instruct",  
        local_dir_use_symlinks=False  
    )
```

- ◆ `requirements.txt` – Dependencies

`nginx`

CopyEdit

`streamlit`

`pandas`

numpy

plotly

transformers

huggingface_hub

🔗 Full project available at: <https://github.com/murali-karthik01/HealthAI-Intelligent-Healthcare-Assistant-Using-IBM-Granite>