Health AI: Intelligent Healthcare Assistant

Team Members

- Team Member 1: Pradeep Kumar P
- Team Member 2: Ganesh S
- Team Member 3: Joshva A
- Team Member 4: Madhan A

Project Overview

The **Health AI Chatbot** is a Streamlit-based web application powered by IBM Watsonx Granite LLM, offering personalized healthcare management, predictive analytics, and chat-based guidance. Its design allows both patients and admins to interact, track health metrics, and leverage AI-driven symptom analysis. It aligns with modern, feature-rich architectures championed by IBM for scalable health or smart city assistants.

Key Features

- **Conversational Health Assistant:**
  Natural language chat powered by IBM Watsonx Granite. Patients ask health queries and get empathetic, AI-generated responses.
- **Symptom-Based Predictions:**
  Records symptoms and generates structured predictions, including likely conditions, confidence scores, recommended actions, and lifestyle advice.
- **Health Metrics Dashboard:**
  Patients log, track, and visualize metrics (blood pressure, heart rate, weight, etc.) using a secure internal database with interactive Streamlit charts.
- **Role-Based Access:**
  Separate login/signup for patients and admins, including secure hashed passwords. Admins can oversee multiple patients.
- **Data Management:**
  Automatic health data generation and robust storage with SQLite. Support for chat histories and report logging.

- **Customizable Recommendations:**
  Built-in health tips and personalized messages to encourage healthy behavior (e.g., reminders for drinking water).

Architecture

Frontend (Streamlit)

- **Multi-Page UI:**
  The interface comprises login/signup, dashboards, chat, and metric pages, organized with columns, tabs, and navigation cards for easy access.
- **Real-Time Interaction:**
  Conversations and metrics update instantly using Streamlit's rerun mechanism, forms, and session state variables.
- **Styling:**
  Custom CSS and card layouts focus on readability and beginner user experience.

Backend

- **Database Layer (SQLite):**
  Patient profiles, user accounts, chat history, health metrics, predictions, and admin-patient chat are all managed through a set of normalized database tables. Encapsulated via the DatabaseManager class for easy CRUD operations.
- **AI Layer (Watsonx Granite):**
  Uses langchain_ibm and custom prompt templates for chat and prediction tasks.
  Centralized through the HealthAI class, which wraps model calls and prompt engineering.
- **Role Management:**
  Patients are mapped to admins for tailored interaction; role selection and access control are handled at signup.

Extended Ecosystem (IBM Model)

- **Document Analysis:**
  Future extensions include PDF/CSV uploads, semantic vector search using Pinecone, and real-time policy summarization (see IBM sample document for smart city deployment analogues).
- **API Connectivity:**
  IBM Watsonx and FastAPI for backend expansion, including endpoints for chat, metrics, tips, and feedback, tested via Swagger UI.

Setup and Installation

Prerequisites

- Python 3.9 or above
- pip, virtualenv
- IBM Watsonx API credentials
- Internet access

Installation Steps

1. Clone the project repository.
2. Install required packages via requirements.txt (includes Streamlit, langchain_ibm, pandas, plotly, sqlite3, dotenv).
3. Configure API keys and environment variables in .env or Streamlit Cloud secrets: WATSONX_URL, WATSONX_APIKEY, WATSONX_SPACE_ID, WATSONX_MODEL_ID.
4. Initialize the SQLite database (automatically via code).
5. Run on local machine using the command:

   streamlit run healthAI.py

Troubleshooting

- Ensure .env is present and valid; handle missing API keys using application error messages.
- Windows users should check file paths and command prompt locations, as specified in previous documentation.

Usage Flow

1. **Account Creation**
   Users choose patient or admin role during signup. Patient accounts are required to be linked to an existing admin. Passwords are hashed for security.
2. **Login**
   On successful login, session state tracks current user, role, and profile.
3. **Main Dashboard**
   Overview of available features: chat, health data, predictions, visualizations.
4. **Chat Interaction**
   Patients and admins engage with the AI assistant for health queries. Previous chat context used to maintain session relevance.
5. **Health Metrics Visualization**
   Patients can record and view metrics for blood pressure, heart rate, weight, temperature, and more.
6. **Symptom Prediction**
   Enter symptoms and receive structured analysis with confidence scores, recommendations, and AI-generated reports.
7. **Admin Features**
   Admins manage patients, check conversations, and send messages (optional future upgrade: see citizen feedback loop, vector document search).

Folder Organization

Folder/File	Purpose
healthAI.py	Main Streamlit app logic and UI
health_ai.db	SQLite database (created at runtime)
.env / secrets	API keys and configuration
(future additions)	For extensions: FastAPI, document handler, vector search

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Testing and Reliability

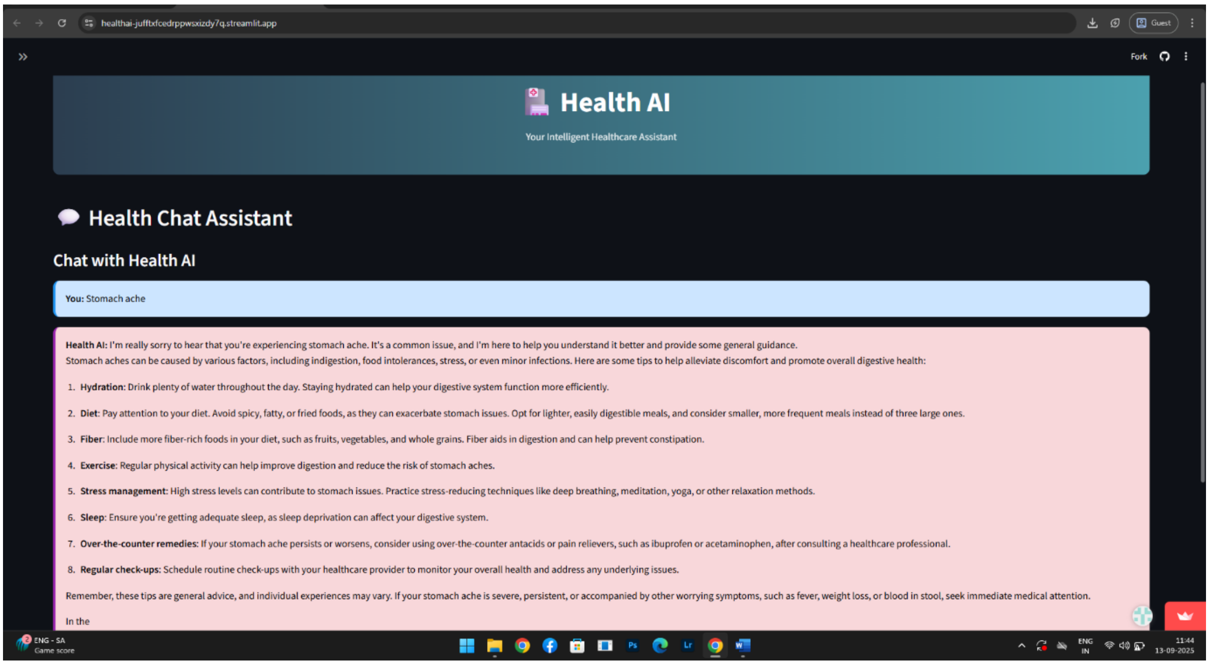
- Unit tests for API and utility functions using sample data.
- Manual validation for login, chat, metric recording, and predictions.
- Edge case handling for user creation, API errors, and invalid inputs.

Known Issues and Future Enhancements

- Improve session isolation for multi-user deployments.
- Currently, the AI model is configured with a limit on the **maximum number of tokens or responses per interaction** (e.g., max_new_tokens = 500), which restricts very long or deeply detailed answers.
- This token limit can sometimes cause responses to be **cut off prematurely** or result in incomplete explanations.
- Future upgrades could include increasing token limits, enabling multi-turn dialogue continuity, or splitting responses for longer queries.
- Potential rate limits on IBM Watsonx API may affect extensive usage availability.

Output Screen Shot

chat assistant:



Health AI

Your Intelligent Healthcare Assistant

Health Chat Assistant

Chat with Health AI

You: Stomach ache

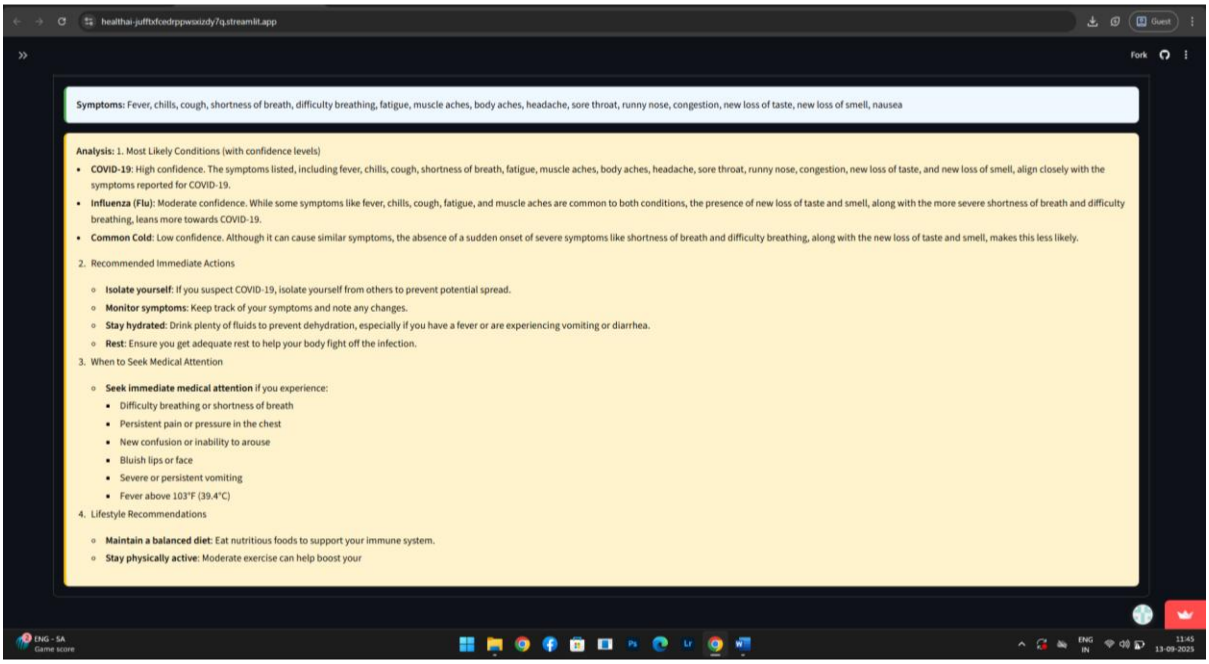
Health AI: I'm really sorry to hear that you're experiencing stomach ache. It's a common issue, and I'm here to help you understand it better and provide some general guidance.
Stomach aches can be caused by various factors, including indigestion, food intolerances, stress, or even minor infections. Here are some tips to help alleviate discomfort and promote overall digestive health:

1. **Hydration:** Drink plenty of water throughout the day. Staying hydrated can help your digestive system function more efficiently.
2. **Diet**: Pay attention to your diet. Avoid spicy, fatty, or fried foods, as they can exacerbate stomach issues. Opt for lighter, easily digestible meals, and consider smaller, more frequent meals instead of three large ones.
3. **Fiber**: Include more fiber-rich foods in your diet, such as fruits, vegetables, and whole grains. Fiber aids in digestion and can help prevent constipation.
4. **Exercise**: Regular physical activity can help improve digestion and reduce the risk of stomach aches.
5. **Stress management**: High stress levels can contribute to stomach issues. Practice stress-reducing techniques like deep breathing, meditation, yoga, or other relaxation methods.
6. **Sleep**: Ensure you're getting adequate sleep, as sleep deprivation can affect your digestive system.
7. **Over-the-counter remedies:** If your stomach ache persists or worsens, consider using over-the-counter antacids or pain relievers, such as ibuprofen or acetaminophen, after consulting a healthcare professional.
8. **Regular check-ups:** Schedule routine check-ups with your healthcare provider to monitor your overall health and address any underlying issues.

Remember, these tips are general advice, and individual experiences may vary. If your stomach ache is severe, persistent, or accompanied by other worrying symptoms, such as fever, weight loss, or blood in stool, seek immediate medical attention.

In the

symptom prediction:



Symptoms: Fever, chills, cough, shortness of breath, difficulty breathing, fatigue, muscle aches, body aches, headache, sore throat, runny nose, congestion, new loss of taste, new loss of smell, nausea

Analysis: 1. Most Likely Conditions (with confidence levels)

- **COVID-19**: High confidence. The symptoms listed, including fever, chills, cough, shortness of breath, fatigue, muscle aches, body aches, headache, sore throat, runny nose, congestion, new loss of taste, and new loss of smell, align closely with the symptoms reported for COVID-19.
- **Influenza (Flu)**: Moderate confidence. While some symptoms like fever, chills, cough, fatigue, and muscle aches are common to both conditions, the presence of new loss of taste and smell, along with the more severe shortness of breath and difficulty breathing, leans more towards COVID-19.
- **Common Cold**: Low confidence. Although it can cause similar symptoms, the absence of a sudden onset of severe symptoms like shortness of breath and difficulty breathing, along with the new loss of taste and smell, makes this less likely.

2. Recommended Immediate Actions
    - **Isolate yourself**: If you suspect COVID-19, isolate yourself from others to prevent potential spread.
    - **Monitor symptoms**: Keep track of your symptoms and note any changes.
    - **Stay hydrated**: Drink plenty of fluids to prevent dehydration, especially if you have a fever or are experiencing vomiting or diarrhea.
    - **Rest**: Ensure you get adequate rest to help your body fight off the infection.
3. When to Seek Medical Attention
    - **Seek immediate medical attention** if you experience:
        - Difficulty breathing or shortness of breath
        - Persistent pain or pressure in the chest
        - New confusion or inability to arouse
        - Bluish lips or face
        - Severe or persistent vomiting
        - Fever above 103°F (39.4°C)
4. Lifestyle Recommendations
    - **Maintain a balanced diet**: Eat nutritious foods to support your immune system.
    - **Stay physically active**: Moderate exercise can help boost your

Conclusion

Intelligent Healthcare Assistant acts as a compassionate, adaptable companion—much like a caring medical advisor one can consult anytime. It listens to patient concerns, provides instant explanations and guidance for symptoms, and strives to predict health risks, all while carefully safeguarding sensitive health information with secure, respectful communication. The assistant is approachable: engaging users through voice, natural conversation, and clear visualizations, ensuring interactions feel familiar and personalized—not mechanical or cold.