HealthAI: Intelligent Healthcare Assistant Using IBM Granite

Project Description

HealthAI is an intelligent healthcare assistant built using IBM Watson Machine Learning and Generative AI. The platform provides users with accurate, evidence-based medical insights and services through a user-friendly Streamlit interface. Key features include:

- **Patient Chat**: For responding to health-related queries.
- **Disease Prediction**: For evaluating symptoms and predicting conditions.
- **Treatment Plans**: For personalized treatment recommendations.
- **Health Analytics**: For visualizing and analyzing patient health metrics.

The application leverages IBM's Granite-13b-instruct-v2 model to process inputs and generate intelligent responses, ensuring personalized healthcare assistance. It emphasizes security through API key management and responsible data handling.

Technical Architecture

1. User Interface Layer (Streamlit)

- Facilitates interactions for Patient Chat, Disease Prediction, Treatment Plans, and Health Analytics.

2. Application Layer (Python/Streamlit)

- **Patient Chat**: `answer_patient_query()`
- **Disease Prediction**: `predict_disease()`
- **Treatment Plans**: `generate_treatment_plan()`
- **Health Analytics**: `display_health_analytics()`

3. Data Layer

- Manages patient data, health metrics, and session state.

4. AI Service Layer (IBM Watson ML)

- Powered by **IBM Granite 13B Instruct v2 Model** for natural language processing and generative reasoning.

Key Features & Implementation

Patient Chat

- Function: `answer_patient_query(query)`
- Uses IBM Granite to respond empathetically and informatively to user health questions.
- Prompt includes clear medical facts, limitations, and advice on seeking professional help.

Disease Prediction

- Function: `predict_disease()`
- Accepts symptoms, health metrics, and personal data.
- Predicts up to 3 potential conditions with likelihood and explanations.

Treatment Plans

- Generates therapeutic recommendations based on condition input.
- Incorporates medications, lifestyle changes, and testing recommendations.

Health Analytics

- Displays trends in heart rate, blood pressure, glucose levels, etc.
- Offers AI-driven health insights using visualizations and data metrics.

Scenarios

Scenario 1: Disease Prediction

User reports symptoms like fatigue, headache, and fever. System returns likely conditions with probability and next steps.

Scenario 2: Treatment Recommendation

User inputs a diagnosed condition and receives a treatment plan including medication and lifestyle advice.

Scenario 3: Health Monitoring

User accesses the Health Analytics dashboard to observe trends and receive improvement suggestions.

Scenario 4: Medical Q&A

User asks a health-related question and gets a structured, AI-generated response.

Project Workflow

Activity 1: Model Selection and Architecture

- 1.1 Select IBM Granite 13B model.
- 1.2 Define architecture linking frontend, backend, and AI.
- 1.3 Install libraries for Streamlit and IBM Watson ML.

Activity 2: Core Functionalities Development

- 2.1 Build Patient Chat, Disease Prediction, Treatment Plans, Health Analytics.
- 2.2 Manage and visualize health metrics.

Activity 3: `app.py` Development

- 3.1 Application logic and function integration.
- Import libraries
- Initialize Granite model
- Implement core functions
- Create tab-based layout
- 3.2 Create advanced prompting strategies.

Activity 4: Frontend Development

- 4.1 Design responsive Streamlit interface with sidebar navigation.
- 4.2 Use Plotly to generate charts (heart rate, BP, glucose, symptoms).

Activity 5: Deployment

- 5.1 Configure `.env` for API credentials.
- 5.2 Deploy using Streamlit Cloud and test responsiveness.

Milestones

Milestone 1: Model Selection & Architecture

- Identify and integrate IBM Granite model.
- Establish system architecture.

Milestone 2: Core Features

- Implement backend functions and health analytics utilities.

Milestone 3: `app.py` Development

- Organize code: Setup, Core, UI, Feature Logic.
- Implement advanced prompting logic.

Milestone 4: UI & Visualizations

- Layout design using Streamlit and CSS.
- Implement dynamic charts and indicators.

Milestone 5: Deployment

- Prepare secure deployment setup.
- Launch and test on hosting platform.

Exploring Website’s Web Pages

Patient Chat Page

- Chronological message interface.
- Verifiable, empathetic responses.

Disease Prediction Page

- Detailed symptom input form.
- Condition prediction with likelihood and explanation.

Treatment Plans Page

- Condition input and therapeutic response.
- Includes medical advisories.

Health Analytics Dashboard

- Trend line and pie charts.
- Metrics summary with color-coded statuses.
- AI-powered health insights.

Conclusion

HealthAI demonstrates how advanced AI models can be utilized to enhance healthcare accessibility and personalization. By integrating IBM’s Granite-13B model and leveraging Streamlit, the platform offers a comprehensive suite of features including:

- Empathetic AI chat
- Data-driven condition prediction
- Personalized treatment plans
- Interactive health monitoring

With a structured workflow and modular architecture, HealthAI lays a strong foundation for future enhancements like more advanced diagnostics, multi-language support, and expanded medical coverage.