HealthAI: Intelligent Healthcare Assistant Using IBM Granite Documentation

1.Introduction

- Project title : HealthAI - Intelligent Healthcare Assistant Using IBM Granite
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2.project overview

- Purpose :

  The purpose of HealthAI is to assist patients, healthcare professionals, and general users by providing intelligent, AI-powered healthcare support. By leveraging LLMs (IBM Watsonx Granite) and real- time data, HealthAI offers:

  - Symptom-based disease predictions
  - Personalized treatment and lifestyle recommendations
  - Medical history–aware suggestions
  - Easy access to reliable healthcare information

  This assistant acts as a decision-support partner for medical professionals and a guidance tool for patients, ensuring better health awareness, preventive care, and timely medical attention.

- Features:

  Symptom Analysis (Disease Prediction)

  Key Point: Early health risk detection

  Functionality: Users enter symptoms, and the system predicts possible conditions with recommendations.

  Personalized Treatment Plans

  Key Point: Tailored healthcare guidance

  Functionality: Provides lifestyle, medication, and diet suggestions based on user profile (age, gender, history).

Medical History Integration *Key Point: Context-aware AI Functionality: Takes into account allergies, past conditions, or chronic diseases.*

Medication & Lifestyle Advice
Key Point: Preventive healthcare support
Functionality: Takes into account allergies, past conditions, or chronic diseases.

Report Summarization
Key Point: Simplified medical understanding
Functionality: Converts long medical documents or reports into easy-to-read summaries.

Anomaly Detection (Vitals/Reports)
Key Point: Early warnings
Functionality: Flags abnormal patterns in patient vitals or lab reports.

Multimodal Input Support
Key Point: Flexible healthcare data handling
Functionality: Accepts text, PDFs, and CSVs (lab reports, prescriptions, datasets).

Gradio UI (Frontend)
Key Point: User-friendly interface
Functionality: Provides a clean, accessible dashboard for patients and doctors.

3. Architecture

Frontend (Gradio)

- Built using Gradio for interactive UI.
- Pages include:
    - Symptom analysis
    - Treatment recommendations
    - File upload (medical history/reports)
    - Chat assistant for health queries

Backend (FastAPI)

- FastAPI powers all API endpoints:
    - Symptom analysis
    - Report summarization
    - Treatment plan generation
    - Chatbot responses

Vector Database (Pinecone)

- Stores medical knowledge base embeddings.
- Supports semantic search of medical literature and reports.

ML Modules (Forecasting & Anomaly Detection)

- Forecast patient vitals trends.
- Detect anomalies in medical records or lab results using Scikit-learn and pandas.

4.Setup Instructions

Prerequisites:

- Python 3.9+
- pip + virtual environment tools
- API keys for IBM Watsonx and Pinecone
- Internet access

Installation Process:

1.Clone the repository
2.Install dependencies via requirements.txt
3.Configure .env with API keys (IBM, Pinecone)
4.Start the FastAPI backend
5.Launch the Gradio UI
6.Upload symptoms/data and interact with the assistant

5. Folder Structure

- app/ – Backend logic (APIs, models, integrations)
- app/api/ – Symptom analysis, treatment, summarization routes
- ui/ – Gradio UI components
- granite_llm.py – Handles IBM Watsonx Granite integration
- medical_embedder.py – Converts medical docs into embeddings (Pinecone)
- anomaly_checker.py – Detects unusual patterns in health data
- report_generator.py – AI-generated medical summaries and recommendations

6. Running the Application

1.Start the FastAPI backend server
2.Run the Gradio UI
3.Navigate across modules (symptoms, treatment, reports)
4.Upload medical files for summarization/predictions
5.Interact with the chatbot for personalized health guidance

7. API Documentation

- POST /symptoms/analyze → Returns possible conditions
- POST /treatment/plan → Generates treatment plan POST
- /upload-doc → Upload and embed reports GET /search-
- docs → Retrieve similar medical documents GET /health-
- tips → AI-powered wellness tips POST /feedback →
- Collects patient feedback

8. Authentication

For secure deployment:

- Token-based authentication (JWT/API keys)
- Role-based access (doctor, patient, admin)
- Future: Session tracking and patient history

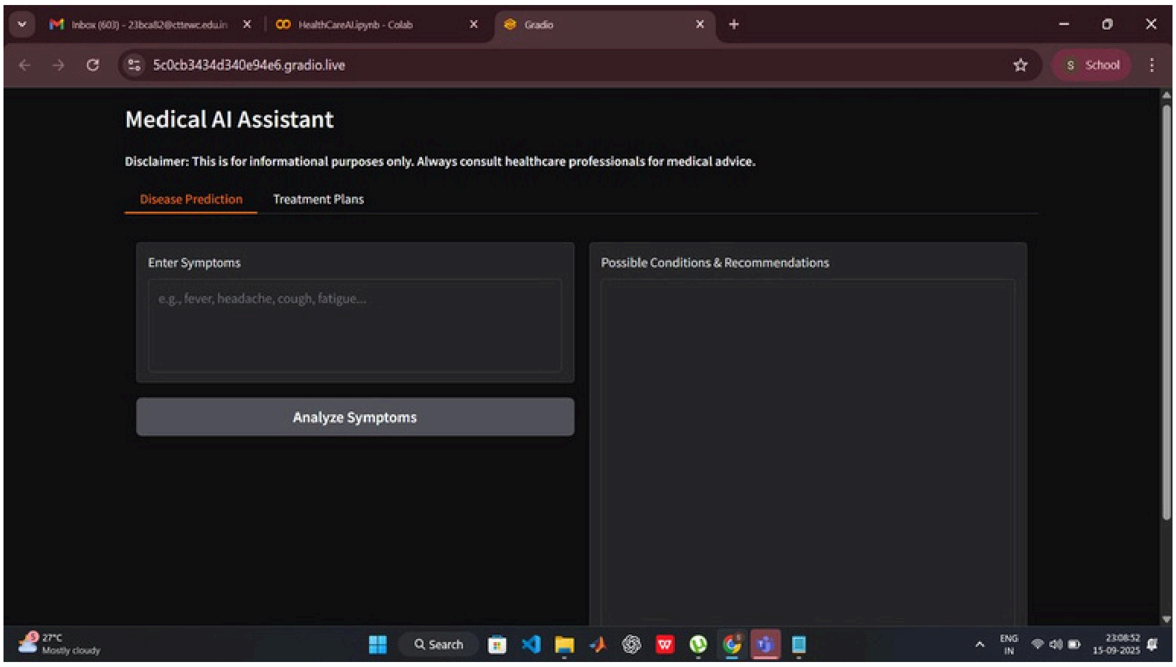
9. User Interface

- Tabs: Disease Prediction | Treatment Plans | Medical Report Summarization
- Input: Symptoms, medical history, reports
- Output: Possible conditions, lifestyle tips, and AI-generated reports
- Extra: PDF download of treatment plan

10. Testing

- Unit Testing: For prediction and summarization modules
- API Testing: Swagger/Postman
- Manual Testing: User flows in Gradio
- Edge Case Testing: Rare symptoms, empty inputs, invalid files

11.Screenshots


Medical AI Assistant

Disclaimer: This is for informational purposes only. Always consult healthcare professionals for medical advice.

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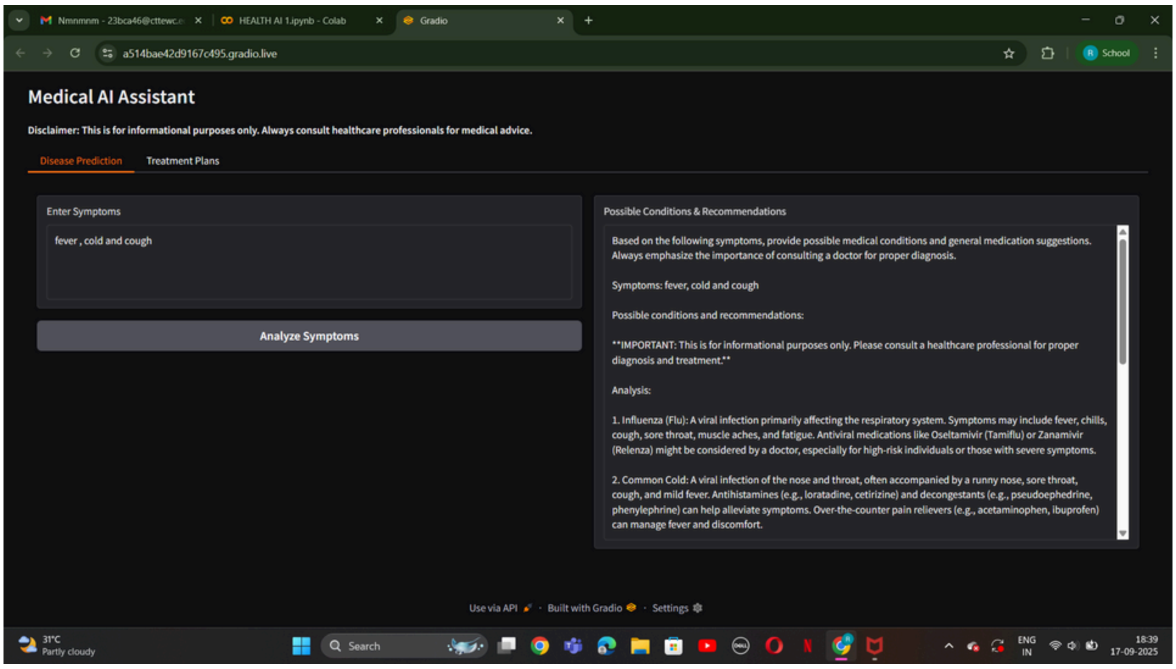
Disease Prediction
Treatment Plans
Enter Symptoms
e.g., fever, headache, cough, fatigue...
Analyze Symptoms
Possible Conditions & Recommendations



Medical AI Assistant

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Enter Symptoms: fever , cold and cough

Possible Conditions & Recommendations

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Based on the following symptoms, provide possible medical conditions and general medication suggestions.
Always emphasize the importance of consulting a doctor for proper diagnosis.

Symptoms: fever, cold and cough

Possible conditions and recommendations:

**IMPORTANT: This is for informational purposes only. Please consult a healthcare professional for proper
diagnosis and treatment.**

Analysis:

1. Influenza (Flu): A viral infection primarily affecting the respiratory system. Symptoms may include fever, chills,
cough, sore throat, muscle aches, and fatigue. Antiviral medications like Oseltamivir (Tamiflu) or Zanamivir
(Relenza) might be considered by a doctor, especially for high-risk individuals or those with severe symptoms.

2. Common Cold: A viral infection of the nose and throat, often accompanied by a runny nose, sore throat,
cough, and mild fever. Antihistamines (e.g., loratadine, cetirizine) and decongestants (e.g., pseudoephedrine,
phenylephrine) can help alleviate symptoms. Over-the-counter pain relievers (e.g., acetaminophen, ibuprofen)
can manage fever and discomfort.
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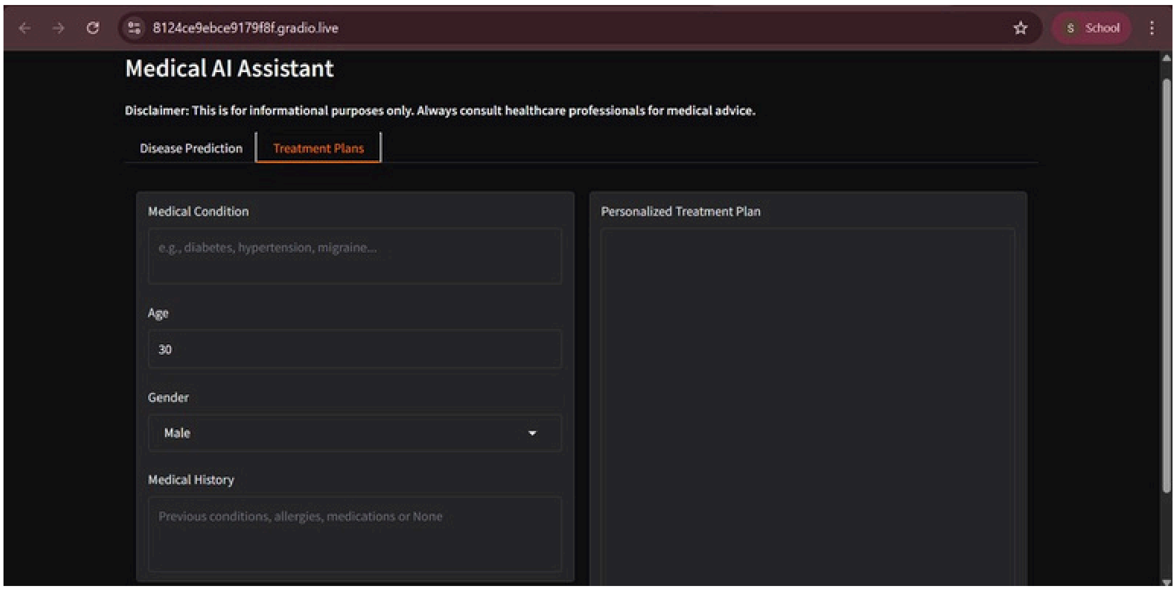

Medical AI Assistant

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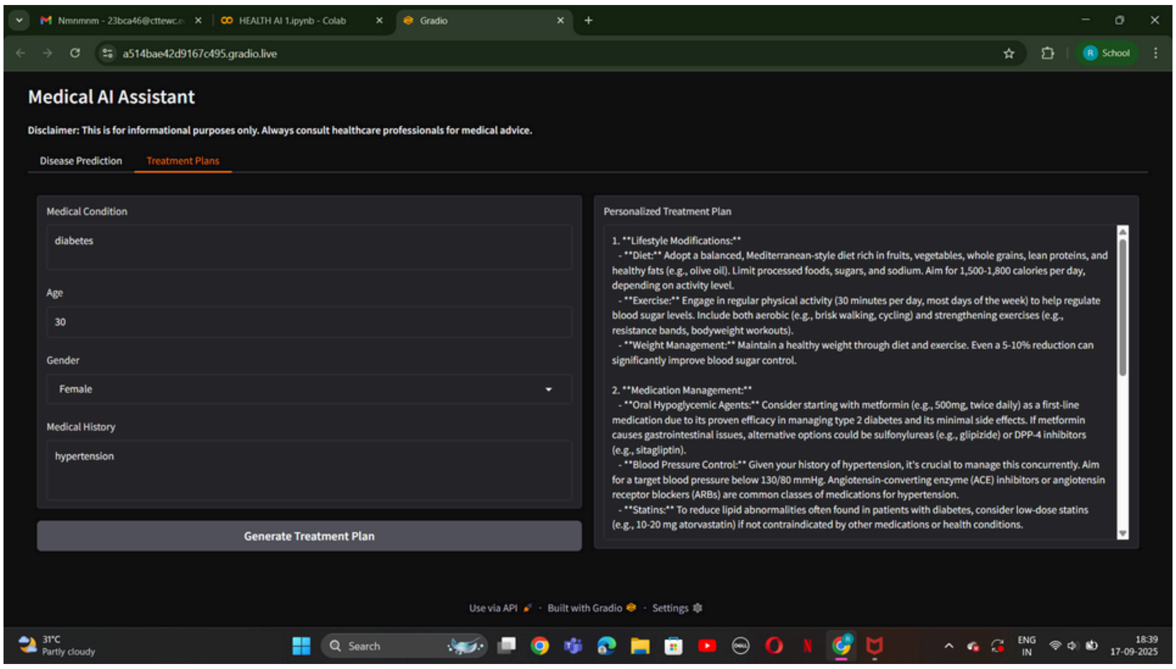
Medical Condition: e.g., diabetes, hypertension, migraine...

Age: 30

Gender: Male

Medical History: Previous conditions, allergies, medications or None

Personalized Treatment Plan



Medical AI Assistant

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Medical Condition: diabetes

Age: 30

Gender: Female

Medical History: hypertension

Personalized Treatment Plan

```
1. **Lifestyle Modifications:**
  - **Diet:** Adopt a balanced, Mediterranean-style diet rich in fruits, vegetables, whole grains, lean proteins, and
healthy fats (e.g., olive oil). Limit processed foods, sugars, and sodium. Aim for 1,500-1,800 calories per day,
depending on activity level.
  - **Exercise:** Engage in regular physical activity (30 minutes per day, most days of the week) to help regulate
blood sugar levels. Include both aerobic (e.g., brisk walking, cycling) and strengthening exercises (e.g.,
resistance bands, bodyweight workouts).
  - **Weight Management:** Maintain a healthy weight through diet and exercise. Even a 5-10% reduction can
significantly improve blood sugar control.

2. **Medication Management:**
  - **Oral Hypoglycemic Agents:** Consider starting with metformin (e.g., 500mg, twice daily) as a first-line
medication due to its proven efficacy in managing type 2 diabetes and its minimal side effects. If metformin
causes gastrointestinal issues, alternative options could be sulfonylureas (e.g., glipizide) or DPP-4 inhibitors
(e.g., sitagliptin).
  - **Blood Pressure Control:** Given your history of hypertension, it's crucial to manage this concurrently. Aim
for a target blood pressure below 130/80 mmHg. Angiotensin-converting enzyme (ACE) inhibitors or angiotensin
receptor blockers (ARBs) are common classes of medications for hypertension.
  - **Statins:** To reduce lipid abnormalities often found in patients with diabetes, consider low-dose statins
(e.g., 10-20 mg atorvastatin) if not contraindicated by other medications or health conditions.
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12. Known Issues

- Limited accuracy for rare diseases
- Dependent on quality of medical dataset embeddings
- Requires medical professional validation

13. Future enhancement

- Real-time IoT integration (patient monitoring)
- Voice-based interaction for accessibility
- Multi-language support
- Integration with hospital EHR systems