**FUNCTIONAL AND PERFORMANCE TESTING**

**6.1 Functional Testing**

Functional testing verifies that all components of HEALTH-AI perform according to the specified requirements. It ensures that the system behaves as expected when users input symptoms or health queries.

**🧪 Test Scenarios and Results**

| **Test Case ID** | **Test Scenario** | **Input Example** | **Expected Output** | **Actual Result** | **Status** |
| --- | --- | --- | --- | --- | --- |
| FT-01 | Symptom Input Accepted | “I have headache and nausea.” | System parses input and sends query to AI model. | Passed | ✅ |
| FT-02 | Disease Prediction Provided | “Chest pain and shortness of breath.” | Returns list of probable diseases with % confidence. | Passed | ✅ |
| FT-03 | Natural Remedies Included in Output | “Back pain” | Provides home remedies and advice for back pain. | Passed | ✅ |
| FT-04 | Multi-turn Conversation Supported | “What if I also have fever?” | AI responds considering previous input context. | Passed | ✅ |
| FT-05 | Visualization Displayed Correctly | Any symptom input | Bar chart with disease likelihood shown. | Passed | ✅ |
| FT-06 | Invalid Input Handling | “asdfghjkl” | System returns helpful error or prompt to rephrase. | Passed | ✅ |

**📌 Summary of Functional Testing**

* All **core functions**—symptom input, AI processing, output generation, chart visualization—were verified.
* The system correctly handles **contextual questions**, improving conversational flow.
* Input validation avoids system crashes on invalid or meaningless inputs.
* Functional testing was conducted manually via Google Colab interface during development.

**6.2 Performance Testing**

Performance testing measures the responsiveness, stability, and efficiency of HEALTH-AI under typical usage scenarios.

**⚡ Performance Metrics**

| **Metric** | **Measurement** | **Target** | **Result** |
| --- | --- | --- | --- |
| Response Time | Time from user input to response display | < 5 seconds | Average ~3.2 seconds |
| API Availability | Uptime of Hugging Face API | > 99% uptime | 99.5% uptime |
| Memory Usage | RAM usage during execution | < 1GB | ~750 MB |
| Concurrent User Handling | Simulated load testing | N/A (single user prototype) | Single-user stable |

**🔧 Testing Tools and Methodology**

* **Response Time:** Measured using Python time module during interaction cycles.
* **Stability:** Evaluated by continuous session runs for several hours.
* **Error Rates:** Monitored exceptions and API errors; none critical observed.
* **Load Testing:** Limited to manual simulation due to single-user prototype nature.

**Performance Optimization Techniques Applied**

* Caching repeated queries to reduce API calls (basic implementation).
* Minimal pre-processing on user input to reduce latency.
* Efficient parsing and visualization generation to keep UI responsive.

**📊 Performance Testing Charts**

*Include charts such as:*

* **Response Time Over Multiple Queries**: Line graph showing response times per query.
* **Memory Usage Snapshot**: Pie or bar chart of memory allocation during sessions.

**Summary:**

The HEALTH-AI system demonstrates **stable functional behaviour** and **responsive performance** within acceptable latency limits for an AI-powered chatbot. While real-world multi-user load testing is outside the current scope, the prototype is solid for individual use.