FUNCTIONAL AND PERFORMANCE TESTING

1. Functional Testing

Functional testing was conducted to validate that all modules of 'Advancing Nutrition Science through Gemini AI' operate according to the defined requirements. The system includes Tailored Meal Planning, Dynamic Nutritional Insights, and Virtual Nutrition Coaching.

1.1 Functional Test Cases

Test Case ID	Module	Test Scenario	Expected Result	Status
FT-01	Meal Planning	Enter user preferences and generate 7-day plan	Personalized meal plan displayed correctly	Pass
FT-02	Nutritional Insights	Enter food item and analyze	Nutritional table and bar chart displayed	Pass
FT-03	Virtual Coaching	Ask nutrition-related question	Relevant AI-generated advice displayed	Pass
FT-04	Input Validation	Enter invalid calorie value	System restricts invalid input	Pass
FT-05	Navigation	Switch between scenarios	Correct module loads without error	Pass

2. Performance Testing

Performance testing was performed to evaluate system responsiveness, stability, and scalability under normal usage conditions.

2.1 Performance Metrics

Metric	Measured Value	Status
Average API Response Time	< 3 seconds	Acceptable
Dashboard Load Time	< 2 seconds	Acceptable
Concurrent Request Handling	Stable under multiple users	Pass
Data Rendering Accuracy	100%	Pass

3. Summary

The system demonstrated high reliability and efficiency during testing. All functional modules operated correctly, and performance benchmarks were achieved within acceptable thresholds. The application is stable and ready for deployment.

4. Results

The system successfully generated personalized meal plans, nutritional insights, and AI-based coaching responses. All modules functioned correctly during testing. The Gemini API integration produced context-aware responses with an average latency of less than 3 seconds.

4.1 Output Screenshots

Below are the key output interfaces of the system:

- Tailored Meal Planning Interface
- Dynamic Nutritional Insights Dashboard
- Virtual Nutrition Coaching Chat Interface

(Screenshots of the application interfaces should be inserted here.)

5. Advantages & Disadvantages

5.1 Advantages

- Provides instant personalized meal planning.
- Real-time nutritional breakdown and visualization.
- AI-powered virtual nutrition coaching.
- User-friendly and interactive interface.
- Scalable through Gemini API integration.

5.2 Disadvantages

- Requires stable internet connection.
- Depends on external API availability.
- Suggestions depend on prompt quality.
- Does not replace certified medical advice.

6. Conclusion

The project 'Advancing Nutrition Science through Gemini AI' demonstrates how Generative AI can enhance personalized nutrition guidance. By integrating Gemini API with a Streamlit-based web application, the system delivers intelligent meal planning, nutritional analysis, and coaching support efficiently. The system achieved stable performance and accurate functional outputs.

7. Future Scope

Future enhancements may include:

- Integration with wearable health devices.
- Database storage for user history and analytics.
- Mobile application deployment.
- Multilingual support.
- Advanced personalization using health datasets.
- Real-time barcode scanning with computer vision.