Project Design – Part 1: System Architecture

A Gen AI-powered initiative by Google Research

A Research Project by Google Research – Health AI Division

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June 2025

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1. System Overview

NutriGen is built with a modular and scalable architecture, utilizing a client-server model backed by RESTful APIs, secure Firebase-based authentication, and third-party AI & nutrition data integrations. It's optimized for performance, extensibility, and maintainability.

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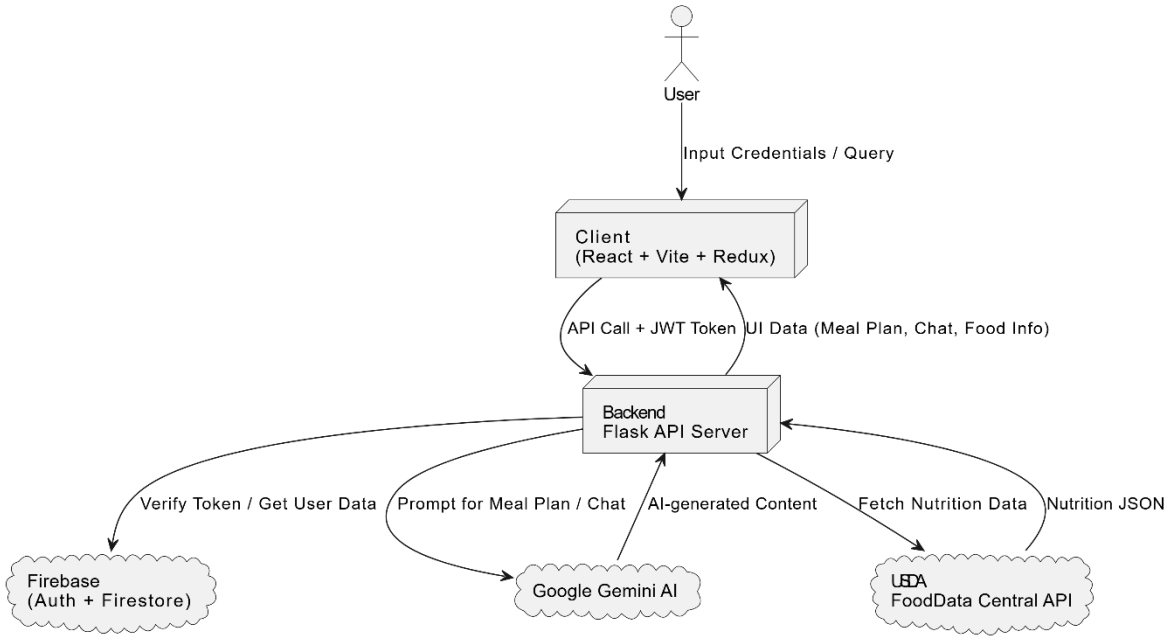
2. Detailed Architecture Diagram



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3. Component Details

Component	Tech Stack & Role
Client (Frontend)	React (with Vite for fast builds), TailwindCSS, React Router, Redux Toolkit
Server (Backend)	Python Flask app with modular routes and JWT-based authentication
Database	Firebase Firestore (NoSQL) — real-time, secure, and scalable cloud DB
Authentication	Firebase Auth — Email/password-based login, persistent login

Component	Tech Stack & Role
AI Engine	Google Gemini AI — Powers chat assistant and personalized meal plan generator
Nutrition API	USDA FoodData Central — For food info, micro/macro nutrients via REST API

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4. Security Considerations

- JWT-based authentication protects all routes.
- All API keys are stored securely in .env and not exposed in frontend.
- Firebase Admin SDK handles token verification server-side.
- CORS policies configured to allow specific domains only.

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5. Deployment Architecture

Tier	Platform	Tools Used
Frontend Hosting	Firebase Hosting / Netlify	GitHub CI/CD
Backend Hosting	Render / Railway / GCP	Gunicorn / Flask
Database	Firebase Firestore	Secured with IAM
AI APIs	Google AI Studio (Gemini)	Rate-limited, scalable