

FitHub: AI-Powered Solution for Malaysia's Obesity Crisis

Documentation

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1. Brief Introduction and Problem Framework

Malaysia faces a critical public health challenge, which is the rising rates of obesity among people of all ages, especially adults ranging from 20 to 35 year old. The National Health and Morbidity Survey (NHMS) 2023 shows that 54.4% of Malaysian adults are overweight or obese, representing a huge increase from 44.5% in 2011. This rapid escalation is due to multiple linked factors, which are unhealthy eating habits driven by convenience, sedentary lifestyles dominated by desk-based work and technology use, chronic sleep deprivation and phone addiction and huge stress in life and work. To support this, Google survey by FitHub documents that 85.2% of respondents thinks that high calorie intake is the cause of obesity, 81.5% of respondents also thinks that lack of exercises as another cause, 77.8% of respondents thinks that high stress and anxiety as the third major cause and 63% of respondents supports that insufficient sleep as one of the causes. NHMS also found that 95.1% of adults in Malaysia do not consume enough fruits and vegetables daily, as well one in two adults lead sedentary lifestyles, defined as spending over two hours a day sitting, lying down, or reclining while awake.

This issue should be aware and solved due to its dire consequences. Obese individuals face high risks of cardiovascular disease, type-2-diabetes, hypertension, and joint deterioration. Low self-confidence, depression, chronic stress, and social isolation will also be faced by an obese person. These conditions diminish quality of life, reduce workplace productivity, strain healthcare infrastructure and compromise overall societal well-being. With that, FitHub comes into help. FitHub is a comprehensive AI-powered mobile application that addresses Malaysia's escalating obesity issues through personalized workout and diet guidance and suggestions, motivation systems and community-driven support. The platform delivers an integrated ecosystem where users can build healthy habits while receiving continuous assistance with the help of analytical LLM agents.

FitHub addresses challenges faced by an obese individual through multiple layers of solutions, which are integration of artificial intelligence for personalized recommendations, gamification mechanics for sustained motivation, mental health support through stress management tools, comprehensive lifestyle management covering diet, exercise and sleep, and community engagement features that foster peer support and inspiration. Unlike conventional fitness applications that address isolated aspects of health, FitHub creates a complete environment where users receive tailored guidance of every health aspects based on their unique profiles, schedules and preferences.

2. Technical Implementation

2.1 Google Technology Implementation

FitHub implements Google's artificial intelligence tools in the application to form a dynamic and adaptive health companion.

Google AI Studio and Gemini API Integration: The application's core intelligence derives from Google's Gemini API, accessed through Google AI Studio. Gemini powers three critical systems within FitHub. Firstly, the FitLah AI assistant utilizes Gemini's advanced natural language processing capabilities to provide personalized health guidance. Unlike generic chatbots, FitLah accesses user-specific data from the Supabase database, including health metrics, exercise history and sleep patterns, enabling responses tailored to individual circumstances. When users inquire about meal planning or workout modifications, Gemini processes these queries against their personal health profiles, giving recommendations based on personal conditions, preferences and schedules.

Besides that, the PlanCalorie food recommendation engine utilizes Gemini's reasoning to analyze nutritional requirements against user preferences and location data. The system receives structured prompts containing user health status, caloric targets, macronutrient ratios, taste preferences, and geographical coordinates from Google Maps API. Gemini then generates meal suggestions that balance nutrition with practical accessibility, on top of the taste of the food. It is important as users love healthy food but prefer it to be tasteful as shown in the Google Survey by FitHub.

Furthermore, the MotionSense workout recommendation system utilizes Gemini to suggest exercise programs from the workout database containing calisthenics, yoga, gymnasium and cardiovascular exercises. The AI evaluates user fitness levels, physical limitations, available equipment and time constraints to construct effective workout plans that prevent injury while optimizing health results.

TensorFlow: Beyond Gemini's generative capabilities, FitHub implements custom machine learning models using TensorFlow for specialized analytical tasks. The CircadianSync sleep quality analyzer implies TensorFlow-based models to process audio data and calculating sleep quality scores. These models were trained on sleep research datasets and optimized for mobile deployment, ensuring accurate analysis without requiring continuous cloud connectivity or compromising user privacy.

Google Maps API: The integration of Google Maps API transforms food recommendations from theoretical suggestions into actionable choices. Firstly, strong LLM like Claude analyse the origin of the dishes based on the countries' restaurants and traditions, then suggests countries of the dishes in the database. Then, based on nutritional requirements, user preferences and location, Gemini will suggest the best fit of dishes for the user. This location-aware approach ensures that recommended meals remain practically accessible, significantly improving user compliance. The API also supports future features including outdoor running route suggestions and gym location services.

Stitch AI for UI/UX Design: Stitch AI accelerates visual design by generating professional interface components based on natural language descriptions. This allows rapid prototyping and iteration without requiring extensive graphic design expertise, particularly valuable for screens requiring complex layouts including the dashboard, leaderboard, and community feeds. The generated designs maintain consistency while reducing development time allocated to visual refinement.

Google Colab: Google Colab is a cloud-powered application that allows me to train my machine learning models using virtual machines that has strong GPU by Google. It allows me to use stronger GPU since my PC does not built in a strong GPU for fast, efficient training, as well it also prevents power consumption by running locally.

Google Antigravity: Google Antigravity is a coding IDE that integrates AI agent assistance to boost up development, while its clean and accessible features allow me to review codes and files. It helps me as a beginner to understand more about full-stack development and agent-driven build architecture.

2.2 Technical Stack used

FitHub's technical stack is a chosen set of tools aimed at speeding development, supporting multiple platforms, cutting operational costs and focus on future scaling. Each tool meets specific needs while fitting into a single system design.

Next.js: Next.js provides fast server-side rendering and static page generation for better performance and SEO. It has built-in routing and API routes, so pages and backend endpoints live in one project. It works well with React components and can improve load times by pre-rendering content.

PostgreSQL: PostgreSQL is a reliable relational database with strong correctness (ACID) and rich query features. It supports advanced functions, indexes, and extensions (like PostGIS) for complex data needs. It scales with proper indexing and can enforce row-level security for user data protection.

React TSX: React with TypeScript (TSX) gives typed components that catch errors early and improve developer tooling. TSX keeps UI code clear by combining markup with logic in components. It encourages reusable components and predictable props/contracts across the app.

Express: Express is a simple Node.js web framework for building REST APIs and server logic. It uses middleware for authentication, validation, and error handling, making routes modular and testable. Express is lightweight and quick to set up for backend services.

Node.js: Node.js runs JavaScript on the server, enabling the same language across frontend and backend. Its asynchronous I/O model handles many simultaneous requests efficiently. The large npm ecosystem provides ready libraries for databases, auth, testing, and deployment.

Vercel for Deployment: Vercel provides fast and simple deployment with automatic builds from Git repositories. It supports serverless functions and edge deployment, improving performance and scalability without managing servers. It also includes automatic HTTPS, global CDN and preview deployments, making testing and production releases easier and reliable.

Git and GitHub: Git is used for version control to track code changes, manage history, and allow safe experimentation through branches. GitHub provides cloud hosting for Git repositories, enabling backup, collaboration, and team workflows. It also supports pull requests, issue tracking, and integration with deployment tools like Vercel for automated builds and releases.

Flutter Framework for Cross-Platform Application Development: Flutter is the main framework, letting one Dart codebase run on Android, iOS, and Windows. This boosts development speed, keeps the user experience consistent and lowers support overhead. Its model and widget library speed up polished UI building for all platforms, and many third-party packages cover state, APIs and local storage. Flutter was chosen over React Native or native development for better performance, Dart's stronger typing, and clearer docs for FitHub's needs.

Supabase for Backend Infrastructure: Supabase supplies the backend such as PostgreSQL, auth and REST APIs. It was chosen over Firebase and custom builds after weighing cost, features and scale. It is due to its open-source flexibility and vendor independence, PostgreSQL's power for leaderboards and rankings, row-level security for strict access control of personal health data and a generous free tier for early stages with predictable scaling costs.

Gemini API: Gemini provides the intelligence layer and was chosen over OpenAI, Anthropic, or open-source options because of cost at scale, multimodal handling, strong reasoning for meal and workout planning, easy integration with Google services (like Google Maps), and it aligns with GDDoC's AI requirements. Ollama LLM is used as a cost-saving backup for development and testing while Gemini runs production workloads.

TensorFlow for Custom Machine Learning: TensorFlow powers model for CircadianSync sleep analyzer. It was chosen because models can be fine-tuned on sleep datasets, optimized for mobile via TensorFlow Lite, run inference locally for privacy and offline use, and benefit from mature tooling and docs. Python is used for training and evaluation, and trained models are exported for the Flutter app.

Google Maps API for Location Services: Maps makes food recommendations actionable by finding user location and provide suggestion based on geolocation. It provides geocoding with simple implementation and affordable scaling, matching user demand for convenient, reachable suggestions.

Development and AI Coding Assistants: Tools like Google AI Studio, GitHub Copilot and Google Antigravity speed work by generating boilerplate, proposing implementations, spotting bugs and linking docs. Using these assistants increased individual developer output and enabled completing a complex app and documentation within 40 days by directing AI to implement well-specified tasks rather than coding every line manually.

3. Implementation Details

3.1 Application Functionalities

FitHub contains seven linked modules that together tackle obesity with personalized, sustainable behavior change. Each module is based on user insights and health research.

PlanCalorie as an Intelligent Food Recommendation System: PlanCalorie is FitHub's nutrition engine. During Sign Up, users enter personal information and condition. The app computes calorie and macronutrient targets and uses Gemini to make meal suggestions. Prompts include user needs, cuisine preferences, cooking difficulty, budget, and location from Google Maps. Gemini matches these to nutrition knowledge to recommend meals that suit health and taste. For home cooks it gives recipes and step-by-step instructions, meanwhile for those who prefer dining out, Maps finds suitable nearby restaurants with distance and estimated nutrition. If users struggle, Gemini suggests simpler alternatives or substitutions. This practical approach addresses users who need tasty food and those with busy schedules.

MotionSense as Personalized Workout Planning: MotionSense builds custom exercise plans from a database of calisthenics, yoga, running and gym. It uses fitness level, limits, time and goals to create safe, progressive plans. Initial assessments set baselines, and Gemini selects exercises, sets, reps, rest and sequencing. Future plans include real-time pose analysis via device cameras and TensorFlow pose models.

FitLah as a Personalized AI Health Assistant: FitLah is the user's AI companion, powered by Gemini and Supabase database. It personalizes replies using health metrics and user information. Users can ask for workout changes for injuries, recipe swaps for allergies, gain motivation, or even release stress when talking to it!

CircadianSync as Sleep Quality Management: FitHub notice that sleep deprivation as a cause of obesity, and CircadianSync comes into play. CircadianSync links sleep quality to weight management. Users set sleep targets and can enforce app restrictions after set times, with a buffer for urgent needs. The app enters low-power mode during sleep to save battery and may track sleep by audio using TensorFlow models to estimate duration, stages and quality of sleep.

ZenZone as Mental Health and Stress Management Zone: Since stress and anxiety is also another cause of obesity, ZenZone appears to be a unique function of FitHub as a health app. ZenZone provides stress tools such as guided breathing exercises and calming mini-games. An optional AI counseling feature offers empathetic, evidence-based coping tips but does not replace clinical care. As a long-term alternative, FitHub plans to collaborate with psychology professionals and counsellors to provide online assistance and counseling.

Gamification and Tournament System: To improve motivation, FitHub uses gamification, badges, leaderboards, a reward shop and monthly tournaments with big point rewards. Users can gain points when they do workouts, follow meal plans, sleep on time, relax themselves, and earn streaks by continuously committing their health plans. Leaderboards and gamification boosts user's interest and motivation to compete with each other in a friendly way, in the meantime improving their health and tackling obesity.

Community Platform and E-Funding: Community features let users share achievements, encourage peers, join discussions to reduce isolation. E-funding lets users and sponsors support development while keeping the app free for everyone, preserving accessibility and public-health goals.

3.2 Why FitHub Stands Out?

FitHub differs from other apps by combining multiple capabilities that are usually separate, creating a full obesity-management ecosystem rather than a single-focus tracker or planner.

Comprehensive Integration of Multiple Health Dimensions: Most apps focus on one area; FitHub links nutrition, exercise, sleep, motivation and mental health so they reinforce each other. It is due to the fact that obesity is caused by multiple linked factors (as mentioned in 1).

FitLah AI assistant as a partner of the app: It is not a general chatbot, it will provide responses based on user's health condition and feelings. Most fitness app does not have an personalized assistant to help users.

Personalization Through AI Rather Than Generic Recommendations: Unlike apps that offer basic filters, FitHub uses Gemini to generate truly personalized suggestions tailored to each user's health data, tastes, schedule, budget and location. Workouts and advice evolve with user progress, making personalization more effective and sustainable.

Location-Aware Food Suggestion Through Google Maps Integration: By linking recommendations to user's location, FitHub makes suggestions actionable rather than idealistic.

Mental Health Integration Within Physical Health Context: FitHub contains mental health tools with nutrition and exercise features, recognizing stress, sleep, and emotions as part of obesity. This reduces stigma, treats wellbeing holistically and maintaining user's positive thinking.

Gamification Designed for Long-Term Engagement: FitHub builds deep gamification such as XP systems, streaks, tournaments and reward shops, so health tasks become intrinsically motivating.

Sustainability Through Free Access and E-Funding: FitHub keeps all core features free, funded by voluntary contributions and partners rather than paywalls, ensuring access for lower-income users and maximizing public health impact.

4. Technical and Developmental Challenges

AI Personalization Accuracy: This is the major technical challenge when building the app, which is AI prompt engineering. Since I do not touch much about prompt engineering previously, I almost overlooked that AI chatbot response need humanity and feelings, and I forget to fix a role and set constraints for the AI. However, when I do checking with everything sent to the AI model and its responses, I found out this problem. Since I do not know how to actually prompt AI effectively, I search for prompt engineering courses online to learn more about it, as well asks AI for suggestions and controlling of agents effectively. Finally, AI responses are more humane and caring, not just machine texts and dull responses. From this incident, I learnt that prompt refinement and testing were always required when using AI in generating responses.

Timeline Pressure: The 40-day of period is short for allocating time for the full application development, documentation, video editing, attending courses alongside with the hackathon and a one-week buffer due to Chinese New Year Celebration. With that, a timetable is scheduled to execute tasks effectively. Since the hackathon focuses more on idea generation, I would prioritize documentation and idea displaying first, then creating the MVP of the application. Day 1 – 15 would be idea generation, definition of problem statement, identifying solutions, conducting survey, documentation writing and completing KitaHack's Google Form filling. Then, day 16 – 20 would be video generation for the hackathon, day 21 – 24 would be frontend UI designing, day 25, 26 and day 35 – 40 would be backend and database architecture, deployment and GitHub push. On the last day, I would also do final checking and submission. This time allocation allows me to complete tasks on time, however implementation of more advanced features and completion of the app is not complete and will be done after the submission deadline.

Resource Constraints and Cost Optimization: This development does not take any financial costs, thus multiple use of free tiers and open-source tools have to be done, hence influencing architecture. Apart from that, choosing Supabase over Firebase traded some features for zero operational costs and better Postgre handling early on.

User Data Privacy and Security: Handling sensitive user data required multi-layer and complete protections. With that, I face challenges choosing available tools with high-end security and user privacy. To solve this, I compared tools and platforms based on their security features, and choose the most viable ones. Beside that, I also utilizes chatbots to ask them about security features that have to be included in my application. For example, I had chosen Supabase for row-level security that isolates user data, all backend communication and messages uses HTTPS, sleep audio analysis runs locally via TensorFlow, prompt design avoids sending identifiable data to Gemini, prevention of SQL injection and implementation of identification and authentication by user's UUID.

5. Future Development and Expansion Strategy

FitHub's future roadmap covers short-term and long-term scaling and expansion. This is to ensure short-term quality to boost credibility in users, as well preparing for long-term scaling and collaborations.

(i) Short-term (1-2 months):

Integration of Google Maps API in workout location, jogging routes and nearby restaurants: Based on user data, FitHub will suggest nearby gym and parks based on user specific location, as well as suggest suitable restaurants that sells healthy food for users. This feature does not exist in the app yet but will be added in short term.

Real-Time Motion Analysis and Form Correction: MotionSense will add on-device computer vision and pose estimation (TensorFlow, MediaPipe) for live form feedback with overlays showing corrections. Models trained on pro demos will run locally to protect privacy while reducing injury risk and improving results.

Geographical Expansion Across Asia: After Malaysia and Southeast Asia region, FitHub will globalize for the whole Asia region by adding regional cuisines, climate-aware workouts and language/cultural tuning.

(ii) Long-term (1-3 years):

Advanced AI Capabilities and Full Gemini Integration: As funding and scale grow, FitHub will move to full Gemini use across features, so it improves consistency and overall accuracy of the AI response.

Smartwatch and Wearable Integration: Integrating Apple Watch, Samsung, and Pixel Watch with the app will provide continuous heart rate, calorie burn, sleep (HRV), automatic activity logging, and persistent reminders on top of all the additional features in the app. This is a strategy to attract smartwatch users to integrate FitHub as part of their healthy lifestyle plan.

Partnerships: FitHub can offer partnership with charities, fundraisers and corporate wellness programs by utilizing the existing e-funding, community and tournament system, to reach a larger audience, sustain growth and attract users.

Advanced Mental Health and Professional Counseling: ZenZone will cooperate with therapist and psychologist for counseling, video consults and text messaging with AI-assisted triage to flag users needing professional care, therefore combining AI access with human clinical expertise.

Community Features and Large Challenges and Competitions: FitHub will increase engagement by hosting national or global competitions and health care challenges that will inspire more people to step on the journey of fitness and well-being, and attract users from all around the world to use the app. With that, I could improve societal overall health and popularize my app effectively.

Conclusion

Overall, FitHub is a multi-functioning health application that implements AI models and API integrations to guide obese people to reach their health goals and maintain a healthy lifestyle. While the application is in a starting phase, I will consistently fix weaknesses and enhance application features by user testing, further investigation and surveys. With that, I get to scale and expand my app, as well as serve users from all around the world. I hope FitHub will become a reality for people who suffers obesity and the app will truly help them.

Appendices

Google Survey by FitHub: *Survey that understand how the people in Malaysia thinks about obesity.*

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