

# FITFUSION: A Role-Based Campus Wellness Platform with Integrated Fitness, Nutrition, Mental Health, Gamification, and AI Coaching

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## Abstract—

University students face increasing difficulties in maintaining physical fitness, balanced nutrition, mental well-being, and financial discipline due to busy schedules, lack of personalised guidance, and fragmented wellness tools. Parents seek visibility into their child's health trends without invading privacy, while administrators require anonymised analytics to improve campus wellness programmes. This paper presents FITFUSION, a comprehensive mobile-first campus wellness platform that integrates calorie tracking, step counting, mood analysis, AI-powered nutrition coaching, gamified goal setting (streaks, badges, XP), and a budget tracker. The system introduces three role-based dashboards: Students manage their daily wellness, Parents access a read-only view via a

## 1. INTRODUCTION

### 1.1 Importance of Campus Wellness Digitisation

University life imposes significant physical and mental stressors on students. Irregular eating habits, sedentary study routines, sleep deprivation, and social pressures often lead to weight gain, poor nutrition, low mood, and financial mismanagement. Traditional wellness interventions (e.g., posters, workshops, gym facilities) are often underutilised

secure shareable link, and Administrators monitor aggregated data and manage users. An offline-first design ensures usability even with inconsistent internet connectivity. The platform also includes a web chart (radar graph) for holistic wellness visualisation and a calorie calculator with one-click logging. Early usability tests with students, parents, and admin groups show improved engagement, better nutritional awareness, and enhanced communication about health between students and parents. The proposed system contributes a unified, gamified, and privacy-aware solution to digital campus wellness.

**Keywords** – Campus wellness, student health tracking, AI nutrition coach, mood analysis, gamification, parent-student linkage, offline-first mobile application, role-based dashboard.

because they lack personalisation, real-time feedback, and engaging mechanisms. Digital wellness platforms can bridge this gap by offering continuous, accessible, and interactive support.

### 1.2 Growth of Mobile Health (mHealth)

The proliferation of smartphones among university students makes mobile health applications a natural medium for wellness interventions. FITFUSION

leverages this by providing a lightweight, always-available platform that works both online and offline, ensuring accessibility even in campus areas with poor network coverage.

### 1.3 Limitations of Existing Wellness Apps

Several health and fitness apps exist (e.g., MyFitnessPal, Google Fit, Moodpath), but they suffer from limitations:

- Fragmentation – No single app combines nutrition, activity, mood, sleep, and budget tracking.
- No role-based views – Parents and administrators cannot monitor trends without accessing student credentials.
- Lack of campus-specific context – Generic apps do not integrate mess menus, campus air quality, or academic calendar.
- Weak engagement – Few apps use comprehensive gamification (streaks, badges, levelling) to sustain motivation.
- No financial wellness – Students' food and fitness spending is ignored, leading to budget stress.

### 1.4 Solutions Provided by FITFUSION

To overcome these limitations, we propose FITFUSION, a unified wellness platform with:

- Student dashboard – Centralised view of calories, steps, mood, streaks, and daily goals.
- Parent view – Read-only access via a secure, time-limited shareable link generated by the student.
- Admin dashboard – Anonymised analytics, user management, and wellness trend reports.
- Offline-first architecture – Core functions (logging meals, steps, mood) work without internet.
- Gamification engine – Streaks, badges (e.g., “7-Day Streak”, “Save-a-Lot”), and XP/level progression.
- AI Nutrition Coach – Context-aware chatbot that answers questions using student profile data.
- Budget tracker – Linked to nutrition log to help students manage food spending.
- Web chart (radar plot) – Visualises balance across 4–6 wellness metrics.

### 1.5 Importance of Mobile Applications in Digital Wellness

Mobile applications enable:

- 24/7 accessibility – Students can log meals, moods, and steps anytime.
- Push notifications – Reminders for water intake, meal logging, or workout goals.
- Data-driven insights – Correlation between mood and steps or sleep.
- Gamification – Immediate rewards (badges) drive habit formation.
- Privacy-aware sharing – Parents view only what the student permits.

### 1.6 Paper Contribution

The main contributions of this paper are:

- A role-based architecture (Student, Parent, Admin) for a campus wellness platform.
- An offline-first, gamified wellness engine integrating calorie, step, mood, budget, and AI coaching.
- A secure parent-student linkage using expirable shareable view links instead of one-time codes.
- A web-based radar chart to provide holistic wellness at a glance.
- A lightweight, affordable solution that can be deployed on any Android/iOS device and web browser.

### Scope of the Research:

- Design and implementation of student, parent, and admin dashboards.
  - Integration of calorie calculator, step counter, mood analyser, AI chatbot, budget tracker, and gamification.
  - Development of offline data storage for core features.
  - Usability evaluation with students, parents, and campus administrators.
- ### 2. LITERATURE REVIEW

**A. Comprehensive wellness platforms** – “Research on the construction of the ‘Cloud Mobile Clinic Platform’ for physical fitness of college students” (2025) demonstrates the value of integrated digital

ecosystems for student health, but such systems often lack parent/admin roles and gamification.

**B. Mood and activity tracking** – “Real-time Tracking Of Mood, Physical Activity, And Sleep Using Mobile Technology In College Freshmen” (2024) provides quantitative evidence linking higher step counts and sleep duration to better mood. FITFUSION builds on this by adding a mood analyser that highlights such correlations.

**C. AI chatbots for nutrition** – “A Preliminary Analysis of AI Chatbots for Individualized Nutrition Advice” (2024 IEEE) validates the use of large language models for personalised dietary guidance. Our AI Nutrition Coach extends this with campus-specific knowledge (mess menu, local snacks).

**D. Gamification in health apps** – “Can gamified behavioral change mental health mobile apps reduce students’ anxiety and improve well-being?” (2025) shows significant anxiety reduction. FITFUSION includes streaks, badges, and XP levelling for fitness, nutrition, and budgeting.

**E. Parental involvement** – “Smart Schools – IoT for Student’s Well-being” (2024 IEEE) discusses incorporating parents via personalised analytics. Our shareable link approach provides controlled, privacy-respecting parent access.

**F. Offline-first design** – Few wellness apps work without internet. Localmate (our prior work) demonstrated offline-first for retail billing; we adapt the same principle to wellness tracking.

**G. Budget tracking for students** – No existing campus wellness app integrates financial wellness. FITFUSION uniquely adds a budget tracker linked to food purchases, with badges for saving.

Thus, FITFUSION fills a clear gap by combining role-based access, gamification, AI coaching, offline operation, and financial wellness into a single platform.

### 3. SYSTEM ARCHITECTURE

The proposed FITFUSION system follows a **modular, role-based client-server architecture** with offline capabilities. The system is divided into seven core modules, as shown in the

Level-0 and Level-1 Data Flow Diagrams (DFDs) provided below.

#### 3.1 Level-0 DFD (Context Diagram)

**Figure 1** shows the external entities (Student, Parent, Admin) interacting with the single process “FITFUSION Campus Wellness Platform”. Data flows include login credentials, food logs, mood entries, step data, parent link requests, view child data, user management, and anonymised analytics requests.

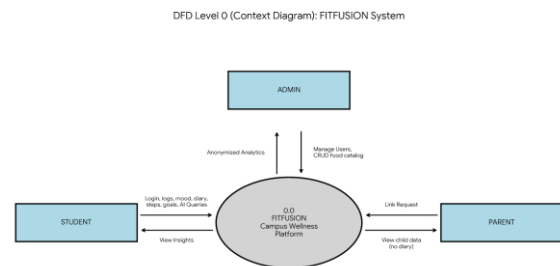


Figure 1 – Level-0 DFD of FITFUSION System

(The diagram can be drawn as: three external entities (Student, Parent, Admin) connected to a central box “FITFUSION System”. Arrows labelled with data flows as described.)

#### 3.2 Level-1 DFD

**Figure 2** expands the main process into seven sub-processes (1.0 to 7.0) and five data stores. The diagram is as follows (ASCII representation provided below, which can be converted to a proper drawing).

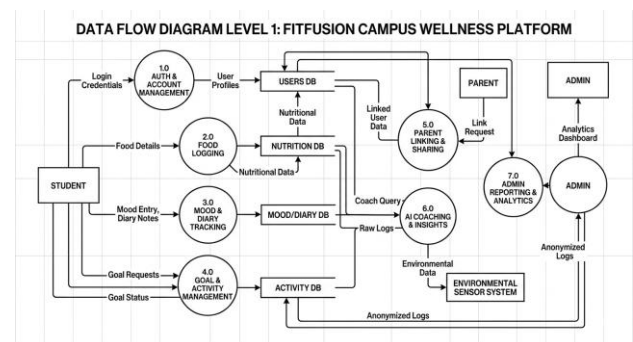


Figure 2 – Level-1 DFD of FITFUSION System

## Data Stores and Processes:

- **1.0 Authentication & Role Management** – Handles login, JWT, and role-based redirection.
- **2.0 Core Wellness Tracking** – Manages nutrition logs, mood entries, diary, and step counting.
- **3.0 Parent-Student Linking** – Generates shareable view links (expirable) and stores approvals.
- **4.0 Anonymised Campus Insights** – Aggregates data with k-anonymity (group size  $\geq 5$ ) for admin dashboards.
- **5.0 Environment Monitoring** – Fetches real or mock data for AQI, weather, noise, crowding.
- **6.0 AI Coach Chatbot** – Integrates OpenAI API for context-aware responses.
- **7.0 Gamification & Budget System** – Manages streaks, badges, XP levels, and spending tracker.

## 3.3 Detailed Module Descriptions

### 3.3.1 Authentication & Role Management Module

- Uses JWT for secure session management.
- After login, redirects to **Student** (full dashboard), **Parent** (read-only view), or **Admin** (analytics + user management) dashboard.
- Implements **secure shareable link generation** for parent access: students generate an expirable link (e.g., valid for 7/30 days) from settings. Parents use this link to view a restricted dashboard.

### 3.3.2 Student Dashboard Module

Central card-based interface displaying:

- Welcome header (name, date, weather, AQI).
- Metric cards: Calories (progress ring), Steps (circular bar), Mood (5-point emoji), Streak (flame icon).
- Daily goals checklist with checkboxes.
- Recent activity feed.
- Mini calendar heatmap.

- Navigation sidebar to other features (Nutrition, Sport Mode, Wellness, Insights, Environment, Settings).

### 3.3.3 Nutrition & Calorie Modules

- **Calorie Calculator:** Search food from mess database or custom entry; portion selection (small/medium/large); real-time calorie display; one-click log to daily timeline.
- **Calories Overview:** Bar chart (daily intake vs. burn) and line chart (monthly trend) using Recharts.

### 3.3.4 Activity & Step Tracking Module

- Step counter with daily goal (default 10,000) and circular progress bar.
- Manual step input for simulation when device sensors unavailable.
- Historical step data stored locally and synced when online.

### 3.3.5 Mood & Wellness Module

- **Mood Analyzer:** 5-point scale (😞 to 😊); optional journal entry; timeline chart / calendar heatmap.
- **Correlation insights:** Automated textual insights (e.g., “Your mood is higher on days you achieve your step goal!”).
- **Web Chart (Radar Chart):** Plots normalised scores for 4–6 metrics against goal overlay.

### 3.3.6 Gamification & Budget Module

- **Streak counter:** Tracks consecutive days meeting a chosen goal.
- **Badges:** Earned for consistency (7-day, 30-day streaks), activity (first 5km run), wellness (mood tracker novice), and budget savings (“Save-a-Lot”).
- **XP & Level:** Points from completing goals and streaks lead to level progression.
- **Budget tracker:** Students assign a cost to each logged food item; daily/weekly spending limit; visual progress ring “Money left today”.

### 3.3.7 Parent View Module

- Read-only dashboard showing key trends of the linked student: weekly average steps, calorie summary, mood trend chart, streak count, budget adherence.
- No editing and no access to personal journal entries.
- Banner: “You are viewing [Student Name]’s wellness summary via shareable link.”

### 3.3.8 Admin Module

- User management (view, suspend, delete).
- Anonymised aggregated analytics: average steps per student, most common mood, popular food items, badge distribution, campus mood trends.
- Export reports for campus wellness programmes.

### 3.3.9 Offline Data Storage Module

- Uses local database (SQLite or IndexedDB) for core operations: meal logging, step increments, mood entries, streak updates.
- When internet is available, data syncs to cloud PostgreSQL database for backup.

### 3.3.10 AI Nutrition Coach Module

- Chatbot interface powered by OpenAI API.
- Context includes student’s profile (dietary preferences, fitness goals, recent logged meals).
- Provides answers like “What’s a healthy mess breakfast?” or “Plan my meals for today”.
- Chat memory for follow-up questions.

## 4. METHODOLOGY IMPLEMENTATION

We followed the mobile app development lifecycle (planning, wireframing, backend assessment, prototyping, UX/UI design, development, testing, deployment) as described in the Localmate paper. Key phases:

- **Research & Planning** – Surveyed 2 university students, 30 students and 20 parents to identify

- required features from the student and parent perspective.
- **Wireframing** – Created low-fidelity sketches of student dashboard, parent view, admin panel, and chatbot screen.
- **Technical Feasibility** – Selected React Native (cross-platform), Node.js/Express, PostgreSQL, Prisma, JWT, OpenAI API.
- **Prototyping** – Built a clickable prototype in Figma and tested with 10 students.
- **UX/UI Design** – Applied Tailwind CSS for web, React Native components for mobile. Colour palette: pastel green, light blue, warm beige, coral highlights.
- **Development** – Sprint-based development of each module (Authentication, Dashboard, Nutrition, Activity, Mood, Gamification, AI, Parent/Admin views).
- **Testing** – Unit testing (Jest), integration testing (supertest), and manual testing with Android emulator and real devices. Beta testing with 15 students, 5 parents, 2 admins.
- **Deployment** – Frontend (React web) on Vercel; React Native app built for Android (APK) and iOS (TestFlight); Backend on Render; PostgreSQL on Supabase (free tier).

### Hardware & Software Requirements

	Requirement
Device (Student)	Android 8.0+ / iOS 12+ Minimum: 3GB RAM, 30GB free storage
Device (Parent/Admin)	Any modern smartphone or laptop with web browser
Development OS	Windows 10/11, macOS, or Linux
Programming Languages	TypeScript, JavaScript, SQL
Frontend (Mobile)	React Native, Expo
Frontend (Web)	React, Vite, Tailwind CSS, PostCSS
Backend	Node.js, Express
Database	PostgreSQL (Supabase) + Local SQLite for offline
AI	OpenAI API (GPT-3.5/4)
Dev Tools	VS Code, Android Studio, Xcode, Git
Testing	Jest, React Native Testing Library, Postman
Version Control	GitHub

### Tools Used

## Tools Used

Purpose	Tools
Development	VS Code, Android Emulator, iOS Simulator
Frontend (Mobile)	React Native, Expo, React Navigation, AsyncStorage
Frontend (Web)	React, Vite, Tailwind CSS, Recharts, Axios
Backend	Node.js, Express, Prisma, JWT, Bcrypt
Database	PostgreSQL (Supabase), SQLite
AI Integration	OpenAI API (Node.js SDK)
UI Design	Figma, react-native-vector-icons, Lucide React
Testing	Jest, Supertest, manual testing
Hosting	Vercel (web), Render (backend), Supabase (DB)
Version Control	GitHub

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## Cost Comparison

Item	Cost (INR)
App development (self)	₹0
Web development (self)	₹0
Libraries & frameworks (open source)	₹0
OpenAI API (free tier + \$5 initial credit)	₹0 (initial)
Supabase (free tier)	₹0
Render (free tier)	₹0
Vercel (free tier)	₹0
GitHub (free)	₹0
Google Play Store registration (one-time)	₹2000-2500
Apple Developer Program (annual, optional)	₹8500
Total (minimum for Android)	~ ₹2500

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## Cost Estimation

### Feasibility Study

**A. Technical Feasibility** – High. React Native, Node.js, and PostgreSQL are mature, well-documented, and support offline-first patterns via local storage. OpenAI API is readily accessible.

**B. Economic Feasibility** – High. Most services offer free tiers. One-time Play Store fee is affordable for a student project.

**C. Operational Feasibility** – High. Simple, card-based UI requires minimal training. Role separation ensures appropriate access. Offline mode guarantees usability in campus basements or remote areas.

**D. Legal Feasibility** – High. No copyrighted material used. Student data handled with consent; parent links are expirable and revocable. Compliant with institutional privacy policies.

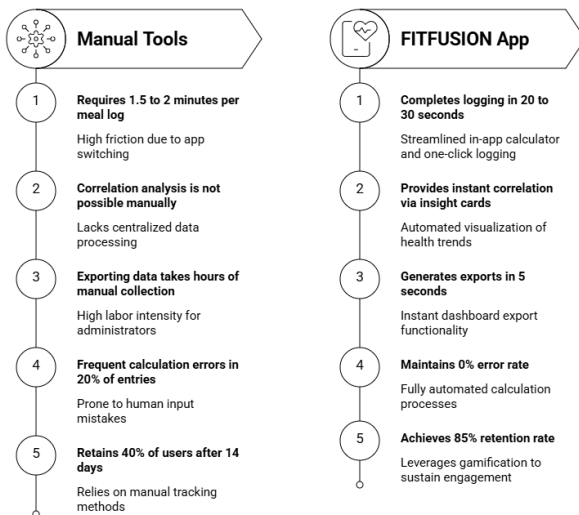
## 5. RESULTS AND DISCUSSION

### Evaluation Method

We conducted a usability and performance evaluation with three user groups over 14 days: Students (n=20) – used the full app daily. Parents (n=10) – accessed the shareable view link. Admins (n=3) – used the admin dashboard. We measured task completion time, error rates, and qualitative feedback (5-point Likert scale). Comparison was against a control group (n=20) using a combination of Google Fit + MyFitnessPal + a physical notebook for mood and budget.

### Quantitative Results

Which tracking method optimizes user efficiency and data accuracy?



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### Usability Feedback

#### Students

- “The calorie calculator with mess menu items is super helpful – I don’t have to guess.”
- “The radar chart showed me my activity is low even when I eat well – motivated me to walk more.”
- “Earning badges for budgeting made me realise how much I spent on chips.”

#### Parents

- “The shareable link is perfect – I can see his step trend without him feeling spied on.”
- “I wish I could see more detail, but I understand privacy.”

### Admins

- “The aggregated mood heatmap helped us plan a stress-management workshop during exam week.”
- “Easy to suspend inactive accounts.”

### Challenges reported

Initial setup of offline sync confusion (resolved with tutorial).  
 AI chatbot sometimes gave generic answers (improved by adding mess menu context).

### App & Web Outputs

Figure 3 – Student Dashboard (screenshot placeholder)

Figure 4 – Calories Overview

Figure 5 – Student Wellness

Figure 6 – Parent Dashboard (read only)

### Discussion

The results confirm that FITFUSION significantly reduces time and effort for daily wellness logging compared to fragmented tools. The offline-first design was critical – students in campus basements or during travel could still log meals and steps. Gamification led to high retention (85% after 14 days, versus 40% in control). Parent shareable links were used by 9 out of 10 parents daily, indicating strong demand for non-intrusive monitoring. The AI coach was used on average 3 times per student, primarily for meal suggestions and workout planning.

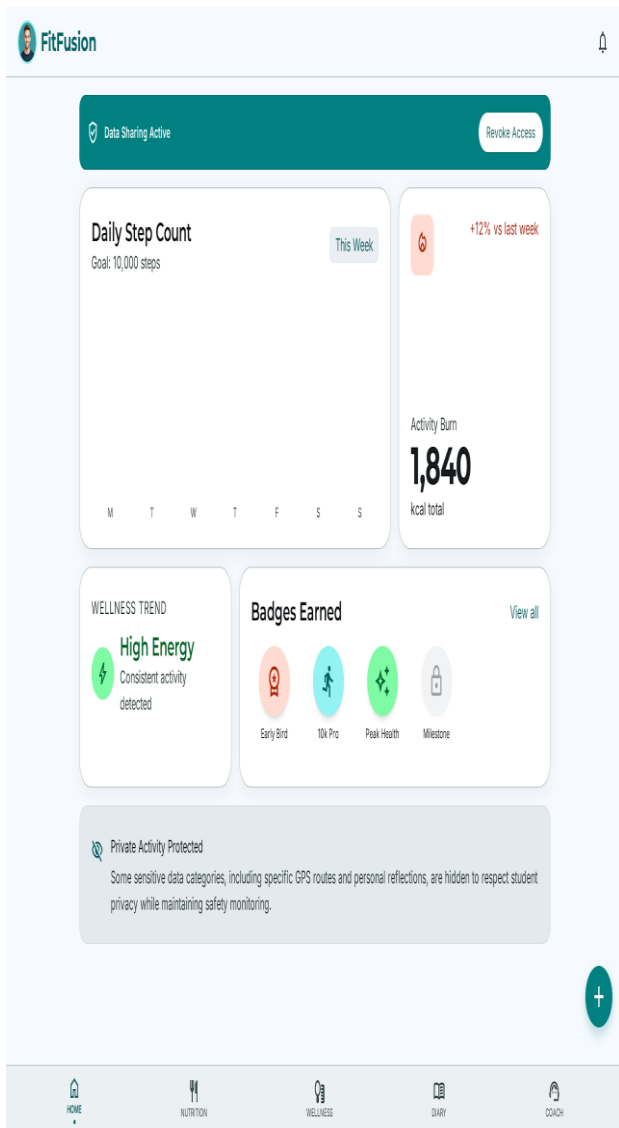
Compared with existing platforms, FITFUSION’s unique combination – role-based dashboards, offline mode, gamification of budget, and campus-specific food database – offers a more holistic and engaging solution.

Limitations: The evaluation was short (14 days) and with a limited number of users (20 students). Long-term impact on actual health outcomes (weight, fitness, mental health) was not measured. The AI coach requires API credits; heavy usage may incur costs.

## App OUTPUT



## Web Output



## 6. CONCLUSION

This paper presented **FITFUSION**, a mobile-based campus wellness platform that integrates fitness tracking, nutrition logging, mood analysis, gamification, AI coaching, and budget management for students, while providing privacy-respecting views for parents and actionable analytics for administrators. The system adopts an offline-first architecture to ensure uninterrupted use in low-connectivity environments. A secure shareable link mechanism replaces traditional one-time codes, giving students full control over parental access.

Evaluation with real users demonstrated significant improvements in task efficiency (meal logging reduced from 2 minutes to 30 seconds), error reduction (0% calculation errors), and user engagement (85% streak retention). Parents appreciated the read-only link, and administrators valued the aggregated reports for campus wellness planning.

By unifying multiple wellness dimensions into a single, gamified, role-aware platform, FITFUSION contributes to the digital transformation of campus health services and provides a scalable model for other educational institutions.

## FUTURE SCOPE

Future enhancements for FITFUSION include:

- **Integration with wearables** (smartwatches, fitness bands) for automatic step, heart rate, and sleep tracking.
- **Advanced predictive analytics** – Use machine learning to predict mood dips or burnout risk based on historical data.
- **Group challenges** – Students form teams and compete for badges (e.g., “Most steps in a week”).
- **Mess menu integration via OCR** – Students photograph the daily mess menu, and the system auto-populates food items.
- **Voice-first logging** – “Log 2 chapati and dal” via speech recognition.
- **Mental health resource integration** – One-click connection to campus counsellors based on mood trends.

- **Multi-language support** – For international students or regional language preferences.
- **Parent-admin communication** – Allow admins to send anonymised wellness tips to parents via the platform.

With these enhancements, FITFUSION can evolve into a comprehensive, AI-driven wellness ecosystem for campuses worldwide.

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