GreenPass

Your Personal Carbon Budget, Rewarded.

A mobile application to track carbon emissions, reward eco-friendly behaviour, and help users stay within their personal carbon budget — one smart choice at a time.

Project Title	GreenPass — Digital Carbon Tracker & Reward Platform
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Platform	React Native (iOS & Android)
Category	Environment / Sustainability / AI

1. Executive Summary

GreenPass is a cross-platform mobile application that empowers individuals to track their daily carbon emissions, stay within a personalised carbon budget, and earn real-world rewards for making eco-friendly choices. The app covers all major emission sources — driving, electricity, food, and flights — and translates raw data into actionable insights through an AI-powered suggestion engine.

The core value proposition rests on three pillars: visibility (users see exactly where their emissions come from), accountability (a daily carbon budget creates measurable limits), and motivation (a GreenCoins reward system makes sustainability tangible and rewarding).

GreenPass is built using React Native and Expo, backed by a Node.js REST API and Firebase, making it deployable on both iOS and Android from a single codebase.

2. Problem Statement

Climate change is the defining challenge of our generation. While governments and corporations are the largest emitters, individual lifestyle choices collectively contribute approximately 70% of global carbon emissions. The core barrier to behaviour change is not a lack of willingness — it is a lack of awareness and feedback.

2.1 Key Challenges

- Most people have no idea what their personal carbon footprint looks like on a daily or weekly basis.
- Existing sustainability apps focus on awareness alone, with no reward mechanism to drive consistent behaviour change.
- Carbon data is scattered across energy bills, fuel receipts, and food labels — there is no single unified view.
- Guilt-based messaging drives disengagement rather than action.

2.2 The Opportunity

GreenPass fills this gap by combining real-time tracking, a gamified budget system, and a tangible rewards engine into a single intuitive mobile experience. By making carbon data personal and actionable, the app turns abstract climate data into daily micro-decisions that users actually enjoy making.

3. Project Objectives

- Build a cross-platform mobile app (iOS + Android) using React Native and Expo.
- Enable users to track emissions from driving, electricity, food, and flights.
- Assign a personalised daily carbon budget based on global climate targets (1.5°C pathway).
- Implement a GreenCoins reward system where staying within budget earns redeemable points.
- Provide an AI-powered suggestion engine that gives personalised daily tips to reduce emissions.
- Display progress through interactive charts, streaks, and weekly comparisons.
- Partner with brands (simulated for the project) to offer real-world discount redemptions.

4. Core Features

4.1 Carbon Dashboard

The home screen shows the user's real-time carbon budget, how much they have used today, and a ring-style progress indicator. Colour coding (green/amber/red) gives instant feedback on budget health. Weekly spark-line charts track progress over time.

4.2 Activity Tracking

Users log activities across four categories. The app calculates emissions automatically using verified emission factor databases.

Category	How It Works
Driving	GPS auto-detection or manual km entry. Multiplied by vehicle emission factor (petrol, diesel, EV).
Electricity	Manual kWh entry or utility bill upload. Uses India grid emission factor of 0.82 kg CO_2/kWh.
Food & Diet	Users select meal type from presets. Emission factor applied per meal category.
Flights	Departure and arrival city input. Distance calculated and multiplied by aviation emission factor.

4.3 GreenCoins Reward System

Every day a user stays within their carbon budget, they earn GreenCoins. Coins accumulate and can be redeemed for partner discounts, public transit passes, or donated to certified carbon offset projects.

4.4 AI Suggestion Engine

The backend analyses the user's recent activity patterns and surfaces three personalised tips each day. For example: switch to metro tomorrow (save 1.8 kg CO_2), set AC to 24°C (save 0.4 kg), or try a plant-based dinner (save 1.2 kg). Each tip shows the estimated saving clearly.

4.5 Community Challenges

Users can join city-level or friend-group challenges. Leaderboards display GreenCoins rankings to drive friendly competition and group accountability.

5. Technology Stack

Layer	Technology
Frontend	React Native 0.73 + Expo SDK 51
Navigation	React Navigation 6
State Management	Redux Toolkit
Charts & Graphs	Victory Native
Backend	Node.js 20 + Express.js
Database	Firebase Firestore (real-time NoSQL)
Authentication	Firebase Auth (email + Google OAuth)
GPS Tracking	expo-location
Push Notifications	expo-notifications
Emissions API	carbon-interface.com API
Maps & Distance	Google Maps Distance Matrix API
AI Tips Engine	OpenAI GPT-4o-mini (fine-tuned prompts)
Hosting	Firebase Hosting + Cloud Functions
Version Control	Git + GitHub

6. System Architecture

The application follows a three-tier architecture: a React Native client layer, a RESTful Node.js API layer, and a Firebase data persistence layer. All emission calculations are performed server-side to ensure consistency and auditability.

Architecture Flow

```
React Native App  (User Interface + Local State)
      ↓  HTTPS REST Calls
Node.js + Express API  (Business Logic + Calculations)
      ↓  Read / Write
Firebase Firestore   (Users, Activities, Rewards, Budgets)
      ↓  External API Calls
Carbon Interface API  |  Google Maps API  |  OpenAI API
```

7. Database Schema

GreenPass uses Firebase Firestore, a NoSQL document database. Below are the primary collections and their fields.

7.1 users

Field	Description
uid	string — unique user ID (Firebase Auth UID)
name	string — display name
email	string — email address
city	string — used to localise emission factors
vehicle_type	string — petrol / diesel / ev / none
daily_budget_kg	number — assigned CO_2 budget in kg
green_coins	number — total accumulated reward points
streak_days	number — consecutive days within budget
created_at	timestamp

7.2 activities

Field	Description

activity_id	string — auto-generated document ID
uid	string — foreign key to users collection
type	string — driving / electricity / food / flight
sub_type	string — e.g. petrol_car, plant_based, short_haul
quantity	number — km, kWh, kg, or route distance
co2_kg	number — calculated emission in kg CO_2
timestamp	timestamp — date and time of activity
source	string — manual / gps / api

7.3 daily_summaries

Field	Description
summary_id	string — uid_YYYY-MM-DD
uid	string — user reference
date	string — YYYY-MM-DD
total_co2_kg	number — total emissions for the day
budget_kg	number — budget for that day
within_budget	boolean — true if total <= budget
coins_earned	number — GreenCoins earned that day
activities_count	number — number of logged activities

7.4 rewards

Field	Description
reward_id	string — auto ID
partner_name	string — e.g. Whole Foods, Metro Transit
title	string — short reward description
coin_cost	number — GreenCoins required to redeem
discount_pct	number — percentage discount offered
valid_until	timestamp — expiry date
category	string — food / transport / lifestyle

8. Emission Factor Reference

All emission calculations use verified factors from Our World in Data, the IPCC, and the India Central Electricity Authority.

Activity	Emission Factor	Source
Petrol car	0.21 kg CO_2 / km	IPCC 2023
Diesel car	0.17 kg CO_2 / km	IPCC 2023
Electric vehicle	0.05 kg CO_2 / km	India grid mix
Electricity (India)	0.82 kg CO_2 / kWh	CEA 2023
Short-haul flight	0.255 kg CO_2 / km	ICAO
Long-haul flight	0.195 kg CO_2 / km	ICAO
Beef (per kg)	27.0 kg CO_2	Our World in Data
Chicken (per kg)	6.9 kg CO_2	Our World in Data
Plant-based meal	2.0 kg CO_2	Our World in Data

9. Project Timeline

Phase	Milestone	Deliverable
Week 1–2	Project Setup	Initialise React Native + Expo project, Firebase setup, folder structure, Git repository.
Week 3–4	Authentication	Firebase Auth integration, login/signup screens, user profile creation.
Week 5–6	Activity Tracking	Manual input forms for all four activity types, emission calculation engine.
Week 7–8	GPS & APIs	expo-location integration, Google Maps Distance API, carbon-interface API.
Week 9–10	Dashboard & Charts	Home screen, budget ring, Victory Native charts, daily summaries.
Week 11–12	Rewards System	GreenCoins logic, rewards catalogue, redemption flow.
Week 13–14	AI Tips Engine	OpenAI integration, personalised daily suggestions, notification system.

Week 15–16	Testing & Polish	Unit tests, UI refinement, performance optimisation, bug fixes.
Week 17–18	Deployment & Demo	App build, final documentation, presentation preparation.

10. Business Model & Revenue

Stream	Description
Brand Partnerships	Brands pay to feature rewards/discounts in the GreenCoins marketplace (main revenue stream).
Premium Subscription	Rs. 99/month for advanced analytics, export reports, and unlimited history.
Carbon Credits	Users can sell excess carbon credits through a partner marketplace (5% commission).
B2B Licensing	White-label version for corporates needing ESG employee engagement tools.
Data Insights	Anonymised aggregate trend data sold to urban planning and sustainability researchers.

11. Expected Outcomes

- A fully functional cross-platform mobile app deployable on both iOS and Android.
- A working emission calculator covering driving, electricity, food, and flights.
- Real-time carbon budget tracking with visual feedback and streak system.
- A GreenCoins reward engine with a simulated partner rewards catalogue.
- An AI-powered daily suggestion system integrated with OpenAI.
- A clean Firebase backend with structured data models and API layer.
- A project report and presentation demonstrating end-to-end functionality.

12. Conclusion

GreenPass is more than a college project — it addresses a genuine gap in the market for consumer-facing carbon accountability tools. By combining proven technologies (React Native, Firebase, GPS, AI) with a compelling gamification layer, the project demonstrates real-world engineering skills across mobile development, API integration, database design, and product thinking.

The app is designed to scale from a working prototype to a production-ready product, with a business model that is viable beyond the academic context. Every small eco-friendly choice adds up — and GreenPass makes sure users know exactly how much difference they're making.

"Every small eco-friendly choice you make adds up to a big impact. Let's make a difference together — one step at a time."