♻️ Project Brief: Trashure

1. Title & Team

- **Project Name:** Trashure (Trash + Treasure)
- **Tagline:** "Gamifying the Circular Economy: Turn Your Waste into Rewards."
- **Mission:** To decentralize waste management by making recycling fun, verifiable, and instantly rewarding through accessible Edge AI technology.
- **Core Philosophy:** "Thick Client, Lean Server." We leverage the user's device power to keep infrastructure costs at zero while maximizing scalability.

2. The Problem

The global recycling system is failing due to three friction points:

1. **Low Participation:** Despite high awareness, the global plastic recycling rate remains stagnant at ~9%.
2. **Contamination:** "Wish-cycling" (throwing non-recyclables in the bin) ruins entire batches of waste because users lack real-time guidance.
3. **Delayed Gratification:** Recycling feels like a chore with no immediate feedback loop or tangible reward.

Waste pollution in the Philippines continues to rise due to improper disposal habits, limited llack of motivation, awareness, and incentives to practice consistent recycling, leading to accumulating waste in households, communities, and public spaces. This growing issue contributes to environmental degradation, public health risks, and long-term sustainability challenges.

3. The Solution: A Dual-Mode Ecosystem

Trashure is a split-interface ecosystem designed to run on the **Firebase Spark (Free) Plan** by offloading AI processing to the edge.

Mode A: The Trashure Kiosk (The Edge Node)

- **Hardware:** Runs on any standard laptop, tablet, or old smartphone with a webcam.
- **Technology:** Uses **TensorFlow.js (MobileNet)** to identify waste items (PET Bottles, Aluminum Cans) locally in the browser. No video is sent to the server, ensuring privacy and zero API costs.
- **Guest Flow:** Users do not need to log in. The Kiosk generates a cryptographically signed **QR Code Receipt** containing their earned points, allowing for rapid, anonymous usage.

Mode B: The Mobile App (The User Hub)

- **Technology:** A React Progressive Web App (PWA).
- **Core Loop:** Users scan the Kiosk's QR receipt to "claim" points into their secure wallet.
- **Gamification:** Features monthly challenges (e.g., "The Aluminum Assassin"), global leaderboards, and a "Streak" system to drive retention.
- **Rewards:** A marketplace to exchange "Trashure Coins" for real-world value (coupons/vouchers).

4. Market Opportunity

The convergence of waste management and digital engagement presents a massive opening:

- **Waste Management Market:** Valued at **$1.3 Trillion** (2025), driven by Smart City initiatives.
- **Gamification Market:** Projected to reach **$29 Billion** by 2025, with "Green Gamification" being a top trending sector.
- **Target Audience:** Universities, Corporate Offices, and Smart Cities looking for low-cost ESG (Environmental, Social, and Governance) solutions.

5. Business Model

- **B2B SaaS Licensing:** We sell the Kiosk software and "Impact Dashboard" to universities and offices who want to track their sustainability metrics.
- **Sponsored Challenges:** Brands (e.g., Coke, Starbucks) pay to host "Branded Challenges" (e.g., "Recycle 5 Starbucks Cups for 10% off").
- **Data Monetization:** Aggregating anonymized data on consumption habits (e.g., "What time of day are most energy drinks consumed?") for market research.

6. MVP Feature List (The "Must-Haves")

We are building a Minimum Viable Product focused on the core "Scan-Reward" loop.

Component	Feature	Description
Kiosk	**Edge AI Scanner**	Real-time detection of bottles/cans using client-side TensorFlow.js.
Kiosk	**Guest Receipt**	Generates an encrypted QR code holding session points (JSON payload).
Kiosk	**Anti-Idle**	Uses Wake Lock API & Idle Timer to reset the screen automatically.
App	**Secure Wallet**	Scanning a receipt verifies the hash and adds points to Firestore.
App	**Leaderboard**	Real-time ranking of top recyclers (read-optimized for scale).
App	**Kiosk Locator**	Map interface using OpenStreetMap to find nearby bins.

7. Traction & Validation

- **Technical Feasibility:** We have successfully proved that **MobileNet** can run on a standard laptop webcam with >85% accuracy for distinct trash items, validating our "Zero-Server-Cost" AI approach.
- **Infrastructure:** The architecture is designed to handle 50,000 daily reads on the Firebase Free Tier by using aggressive client-side caching and batching.

8. Roadmap

- **Phase 1 (Current):** Web-based MVP deployment on laptops acting as kiosks.
- **Phase 2:** Integration of **Google Gemini API** for "Advanced Analysis" (e.g., detecting if a pizza box is greasy/contaminated).
- **Phase 3:** Hardware prototype integration (Arduino/ESP32) to physically unlock bin lids only when recyclable items are detected.

9. Call to Action

"Help us turn trash into treasure."
We are looking for:

- **Beta Testers:** Try the app and attempt to "trick" the AI scanner to help us improve accuracy.
- **University Partners:** Student organizations willing to host a Trashure Kiosk for a 1-week pilot.
- **Developers:** Contributors to help optimize our Offline-First synchronization logic.

🛠️ Technical Stack (For Devs)

- **Frontend:** React (Vite), Tailwind CSS, Framer Motion.
- **AI Engine:** TensorFlow.js (MobileNet), Teachable Machine.
- **Backend:** Firebase (Auth, Firestore, Hosting).
- **Security:** Crypto-js (HMAC signing for QR codes), Firestore Security Rules.
- **APIs:** Wake Lock API, Geolocation API.

Project Source Code LINKS

About		
Github Org	https://github.com/Trashure-PH	
Trashure-PH-Landing-Page	https://github.com/Trashure-PH/Trashure-PH-Landing-Page	https://trashure-ph-landing-page.vercel.app
trashure-kiosk	https://github.com/Trashure-PH/trashure-kiosk	https://trashure-ph-kiosk.vercel.app
Trashure-mobile view	https://github.com/Trashure-PH/trashure	https://trashure-ph.vercel.app
Dev Research Docs	Trashure: Dev Research	