Problem Statement and Team Details

Problem Statement: “Smart Waste Tagging and Decentralized Recycling Credit System”

Team Name: TECH-G

Team Leader Name: LIKHIL GOWDA K A

Institute Name: AMC ENGINNERING COLLEGE

Theme Name: "Digital Sustainability and Green Innovation"

Team Leader Email ID: likhilgowda89@gmail.com

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Problem and Solution

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Problem : The Urban Waste Crisis

Cities generate millions of tons of waste annually, with poor segregation and recycling rates.

Citizens lack motivation or incentives to sort waste properly.Informal workers (ragpickers) are unrecognized and underpaid.

No transparency or traceability in the waste disposal chain.

This leads to environmental pollution, health hazards, and missed recycling opportunities.

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Problem and Solution

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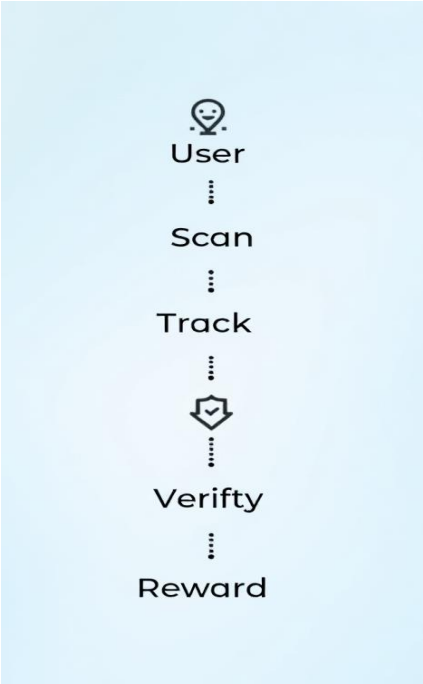
Solution : Smart Waste Tagging +
Decentralized Recycling Credit System Content

AI identifies and classifies waste at the source (mobile app).

Each waste item is QR-tagged and tracked on the blockchain.

Recyclers scan and verify tags during pickup or processing.

Users and workers earn Recycling Credits (RCs) as rewards.
A dashboard gives real-time insights to municipalities and businesses.



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Methodology & Implementation

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How Our System Works :

1. Waste Detection User captures waste image via mobile app. AI model classifies it into categories (e.g. plastic, metal, organic).

2. QR Code Generation A unique QR is generated for the waste item, containing metadata (type, user ID, timestamp).

3. Tagging & Collection The QR is printed or displayed for tagging the waste bag or bin. Waste is collected by authorized personnel or recyclers.

4. Blockchain Logging Each QR scan is logged on the blockchain as a verifiable transaction (proof of proper handling).

5. Reward System Users receive Recycling Credits (RCs) as incentives for correct segregation and tagging.

6. Admin Monitoring Realtime waste data is visualized on a dashboard for insights and auditing.

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Methodology & Implementation

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Technology Stack & Deployment :

Frontend (Mobile App):
- React Native for Android/iOS
- TensorFlow Lite / ONNX for AI waste detection

Backend APIs:
- Node.js with Express
- PostgreSQL for user/waste data
- QRCode and JWT for ID and security

AI Model:
- Trained on TACO/TrashNet datasets
- CNN model exported as ONNX for cross-platform deployment

Blockchain Layer:
- Smart contracts on Polygon or Hyperledger
- Tracks waste lifecycle and RC issuance

Dashboard (Admin Panel):
- Built with React and Chart.js Visualizes waste categories,
- credits earned, recycler activity

Deployment:
- Dockerized services
- GitHub Actions for CI/CD
- Firebase / AWS for hosting

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Flowchart & Supporting Images

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Flowchart Structure :

1. User scans waste (AI detects category)
↓
2. QR code is generated (Metadata embedded)
↓
3. QR tag is applied (Physically or digitally tagged on bin)
↓
4. Waste is collected and scanned (By recycler or smart bin)
↓
5. Blockchain logs transaction (Immutable waste trail)
↓
6. Credits issued to user (Recycling Credits + leaderboard)
↓
7. Dashboard shows analytics (Waste types, recycling score, RCs earned)

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Feasibility and Market Use

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Technical Feasibility:
AI model can be deployed on low-power mobile devices using TFLite or ONNX QR code systems are cheap, scalable, and easy to integrate Blockchain (Polygon, Hyperledger) supports lowcost, high-speed logging All components are open-source or low-cost for prototyping scaling

Operational Feasibility:
Works with existing waste management workflows Easily integrates with local municipal recycling systems Requires only smartphone access and low training for users/recyclers

Financial Feasibility:
Low development cost using open-source tech Can be monetized through B2G, CSR programs, ESG credits, or token-based platforms

Market Use :

Smart Cities & Urban Local Bodies:
Integrate into smart waste bins or Swachh Bharat programs Promote responsible waste behavior through gamification

Educational Institutions:
Deploy in universities or schools to create awareness and reward green behavior

Corporates & Campuses:
ESG compliance through waste tracking Employee engagement via green credits and gamified

Recyclers & NGOs:
Empower informal waste workers with digital identities and proof-of-work Partner with recyclers for verified collection

E-Commerce & Delivery Companies:
Trace packaging waste disposal Offer incentives to customers for returning recyclable materials