SMART INDIA HACKATHON 2025

TITLE PAGE

- **Problem Statement ID - 25060**
- **Problem Statement Title- Real life solutions for Waste Management**
- **Theme- Clean & Green Technology**
- **PS Category- Software**
- **Team ID-**
- **Team Name- Nexagen**

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IDEA TITLE

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❖Proposed Solution(Describe your Idea/Solution/Prototype)

Idea:

- **AI Sorting**: Smart bins automatically identify waste type.
- **Earn Rewards**: Citizens get points for correct disposal.
- **Full Transparency**: Blockchain tracks waste from bin to facility.
- **Everyone Wins**: Incentives for both citizens and workers.
- **Proven Impact**: Verifiable data ensures accountability and results.

Innovation & Uniqueness:

- **GreenCoins Rewards:** Earn digital tokens for correct waste disposal, redeemable via UPI or government subsidy benefits.
- **AI Phone Scanner:** A low-cost tool using smartphone cameras to identify and classify waste types for users.
- **Blockchain Tracking:** An immutable ledger to ensure tamper-proof data on segregation quality and collection metrics.
- **Voice-Based Trainer:** An accessible, voice-guided tool in regional languages to train citizens and workers on proper waste handling.
- **Community Leaderboard:** A public "Cleanest Ward Award" to foster healthy competition and drive community-wide participation.

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TECHNICAL APPROACH

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Technologies to be used

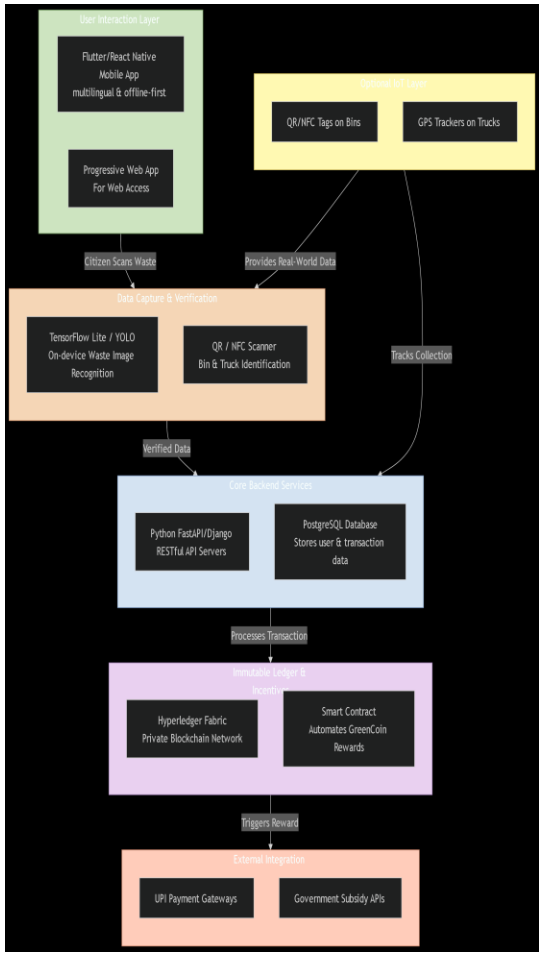
AI/ML
TensorFlow Lite / YOLO for waste image recognition

Blockchain
Hyperledger Fabric or Ethereum Private Chain for transparent tracking

Mobile App
Flutter/React Native (multilingual, offline-first)

Backend
Python (FastAPI/Django) + PostgreSQL

IoT Integration (optional)
QR/NFC tags on bins, GPS tracking of trucks



Methodology & Implementation Process

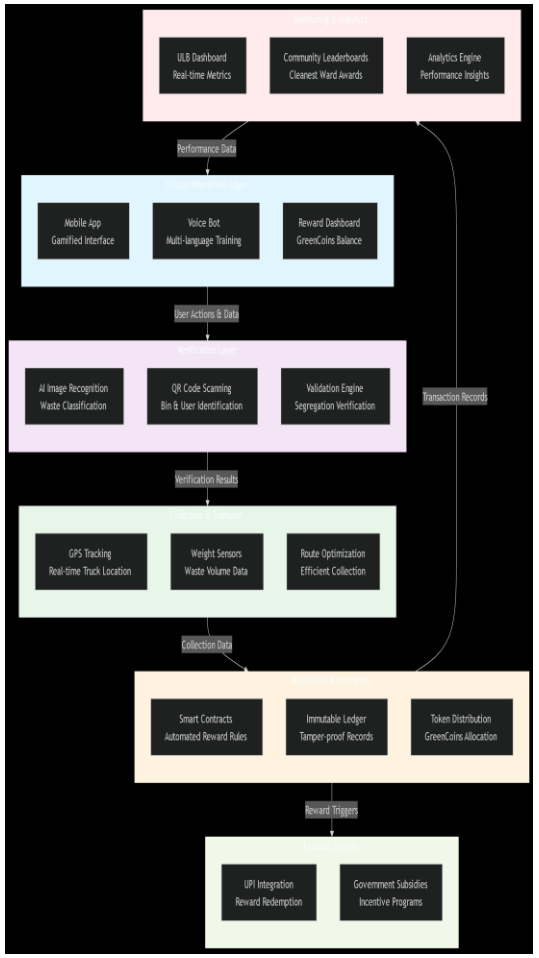
Cen Training & Gamification
Voice bot and app modules for education and engagement.

Segregation Proof
AI image scan or QR codes to verify waste type at the bin.

Collection & Transport
GPS and sensors on trucks to log route and waste volume.

Verification & Incentives
Blockchain-automated records trigger transparent reward payouts.

Monitoring Dashboard
Real-time tracking portal for urban bodies and community leaders.



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FEASIBILITY AND VIABILITY

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Feasibility

- **Mobile-First:** Leverages high smartphone penetration, ensuring pan-India accessibility.
- **Modular Tech Stack:** AI and IoT components can be scaled up or down based on a city's size and budget.
- **Phased Rollout:** Can be piloted in tech-savvy wards before a city-wide expansion.

Challenges

- **Low Digital Literacy:** Complex apps may alienate a significant portion of the population.
- **Adoption Resistance:** Changing deep-rooted waste disposal habits requires significant motivation.
- **Infrastructure Gaps:** Requires basic municipal cooperation and waste collection consistency.

Solutions

- **Voice-First & Multilingual:** Voice bots and UI in regional languages bypass literacy barriers.
- **Gamified Rewards:** Instant GreenCoins for positive actions provide tangible motivation for adoption.
- **Government Integration:** Linking GreenCoins to UPI payments, tax rebates, and subsidies drives utility and value.

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IMPACT AND BENEFITS

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Social Impact

- **Builds Citizen Awareness**: Voice and app-based training create an educated community on proper waste management.
- **Empowers Waste Workers:** Recognizes and incentivizes their crucial role, improving their social and economic standing.
- **Fosters Collective Responsibility:** Gamified leaderboards and community awards drive healthy competition and collective ownership.

Economic Benefits

- **Reduces Municipal Costs:** Higher recycling rates mean less waste going to expensive landfills.
- **Optimizes Operational Efficiency:** GPS-tracked routes and volume data reduce fuel costs and improve collection logistics.
- **Creates a Circular Economy:** Incentivizes the recovery of valuable materials, creating new revenue streams from waste.

Environmental Advantages

- **Increases Recycling Rates:** Accurate segregation at source ensures more clean, recyclable material.
- **Reduces Pollution:** Minimizes illegal dumping, landfill overflow, and harmful open burning of waste.
- **Conserves Resources:** Promotes the reuse of materials, reducing the need for virgin resource extraction.

Government & Transparency

- **Provides Tamper-Proof Accountability:** Blockchain creates an immutable audit trail from bin to processing, eliminating data manipulation.
- **Enables Data-Driven Decisions:** Real-time dashboards give ULBs actionable insights for better planning and policy-making.
- **Ensures Subsidy Effectiveness:** Directly links citizen benefits (subsidies/rebates) to verified, positive actions.

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RESEARCH AND REFERENCES

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Indian Context & Data

- **CPCB Annual Report 2021–22 (Municipal Solid Waste)**
  - **Note:** Provides official data on waste generation, collection, processing, and landfill statistics for Indian cities.
  - **Link:** https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2021-22.pdf
- **CEEW (Council on Energy, Environment and Water) Waste Management Report**
  - **Note:** A leading policy research institution; their reports offer critical analysis on the state of waste management in India.
  - **Link:** https://www.ceew.in/publications/towards-a-circular-economy-of-waste-management (Example report)
- **Karnataka's Yadgir "Photo Model"**
  - **Note:** A successful citizen-reporting model where residents send photos of uncollected waste to officials for immediate action.
  - **Link:** https://swachhindia.ndtv.com/yadgir-citizen-participation-model-garbage-60219/

International Case Studies

- **Estonia (Blockchain Governance)**
  - **Note:** A global leader in e-governance, using blockchain to ensure transparency and security in public services.
  - **Link:** https://e-estonia.com/solutions/security-and-safety/blockchain/
- **Seoul, South Korea (Waste Gamification)**
  - **Note:** Implemented the "Happy Points" system where citizens earn rewards for recycling and reducing waste.
  - **Link:** https://english.seoul.go.kr/policy/environment/waste-recycling/

Health & Safety Standards

- **WHO Waste Worker Safety Standards**
  - **Note:** Provides guidelines on protecting workers from health risks associated with waste handling, including chemical and biological exposures.
  - **Link:** https://www.who.int/publications/i/item/9789241512727