IASF 2026 – Project Abstract

TrashTrack Bands

Project Title: **TrashTrack Bands,** for Smart Waste Management
Team Name: EcoInnovate
College Name: Anurag University
IUCEE Student Chapter: Anurag University Student Chapter
Submission Date: June 30, 2025

Chosen SDG Target

We're aiming to support SDG 11: Making Cities and Communities Sustainable.

By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

Problem Statement

Municipal solid waste management (MSWM) in urban areas, particularly in rapidly growing cities like those in India, faces significant challenges due to inefficient waste collection, illegal dumping, and poor infrastructure planning. Overflowing bins and unregulated dumps contribute to environmental pollution, public health risks, and increased greenhouse gas emissions. In India, cities generate ~160,000 tons of waste daily, with only 30% properly processed due to unsorted waste and inefficient collection routes. This inefficiency burdens sanitation workers, increases operational costs (70% of MSWM budgets spent on collection), and exacerbates environmental degradation, undermining sustainable urban development.

Detailed Description of the Problem

Digging Deeper into the Issue The root causes include a lack of real-time info on problem spots, inefficient routing for waste collection, and weak waste infrastructure. In

cities like Bangalore, waste generation shot up by an incredible 1750% from 1999 to 2016, overwhelming existing systems. Illegal dumping and overflowing bins cause groundwater contamination, emit methane which worsens air quality, and pose health risks to nearby residents and sanitation workers. These problems hit everyone—from municipal authorities to informal waste pickers, especially those living in marginalized neighborhoods where waste systems are least effective. Cities around the world, like Lahore and San Francisco, face similar obstacles—30% to 40% inefficiency in waste collection routes—mainly because they lack smart, data-driven solutions that prioritize workers' needs and scalability.

Case Studies

Indian Context:
India generates ~160,000 tons of municipal solid waste daily, with 95% collected but only 30% properly processed due to unsorted waste, informal sector inefficiencies, and inadequate infrastructure.
Challenges and opportunities associated with waste management in India | Royal Society Open Science

Global Context:
Example: Cities like San Francisco and Songdo (South Korea) have implemented smart waste solutions, such as Bigbelly smart bins and pneumatic waste systems, respectively. TrashTrack bands could enhance these systems by providing worker-driven data to complement bin-level sensors.
Smart Cities and IoT: The Future of Waste Management

Proposed Solution & Objectives

Our Solution & Goals We're proposing TrashTrack bands—wearable devices like smart rings or wristbands designed for sanitation workers. These gadgets help log locations where waste heaps are overflowing or illegal dumps are happening, generate heatmaps of waste hotspots, and suggest better collection routes using real-time location data. The system combines IoT tech, GPS, and cloud analytics to make waste management smarter and more efficient.
Our main objectives are:

- To create real-time maps of waste hotspots, so collection teams can focus on the most problematic areas.
- To optimize collection routes, aiming to cut fuel use and emissions by 20–30%.
- To help city planners figure out the best spots for new bins and waste facilities.

- To equip sanitation workers with tech that makes their jobs easier, safer, and more productive.
- To contribute to SDG 11.6 by lowering the environmental footprint of urban waste management. Together, these steps aim to make cities cleaner, healthier, and more sustainable.

Detailed Explanation of the Solution

How It Works – Technical Overview

TrashTrack bands are smart wearables worn by sanitation workers to log locations of overflowing bins and illegal dumps in real time.

- **Device Features**:
    - GPS to track locations.
    - Buttons to operate
    - Long battery life (12–24 hrs), water/dust resistant.
    - Connectivity via Bluetooth or LoRa/NB-IoT.
- **Mobile App**:
    - Collects data from the ring.
    - Works offline and syncs when the internet is available.
    - Shows alerts and optimized routes to workers.
- **Cloud Platform**:
    - Stores and processes all geolocation data.
    - Creates **heatmaps** of waste hotspots.
    - Suggests **best routes** to reduce fuel and time.
- **Dashboard (for Municipal Staff)**:
    - Visualizes city waste patterns.
    - Helps plan new bin locations and adjust waste collection schedules.

Simple Workflow

1. **Worker logs a waste event** using the band.

2. **Data syncs** to the app → cloud.
3. **System analyzes** and shows waste hotspots.
4. **Dashboard helps authorities** plan routes and infrastructure.
5. **Updated info sent back** to workers via the app.

Cross-Disciplinary Elements

- **Electronics** – Wearable design and sensors
- **Software** – App, cloud backend, dashboard
- **Geospatial Analysis** – Heatmaps and hotspot detection
- **Urban Planning** – Bin placement and route planning
- **Environment** – Reduces overflow, improves sanitation
- **User Experience** – Designed for ease of use by workers

Design Thinking Used

- **Empathize**: Talked to sanitation workers, understood pain points.
- **Define**: No easy way to log/report waste issues.
- **Ideate**: we choose wearables over bulky tech.
- **Prototype**: Built a simple, rugged band + app.
- **Test & Improve**: Piloted in one area, improved based on feedback.

Expected Outcomes

Short-Term:

- Real-time identification of 90% of waste hotspots, reducing illegal dumping incidents by 25%.
- 20–30% reduction in fuel use and emissions through optimized routes.
- Improved worker efficiency and safety via ergonomic tools and data-driven routes.

Long-Term:

- Data-driven placement of 100+ new bins in high-waste zones, reducing overflow by 40%.
- Scalable MSWM model adopted by 5+ Indian smart cities by 2030.
- Contribution to SDG 11.6 by lowering urban environmental impact.

Environmental, Social, Economic Effects:

- **Environmental**: Reduced methane emissions and groundwater contamination.

- **Social**: Empowered sanitation workers with tech skills and safer working conditions.
- **Economic**: Lowered MSWM costs by $50,000 annually per city ward through efficiency gains.

Resources Required

Materials, Equipment, and Technologies:

- Low-cost components to build basic wearable prototypes
- A few smartphones for testing and syncing data
- Free or open-source tools for app development and data mapping
- Basic cloud storage or even offline data handling for initial testing

Total estimated cost :
Basic working prototype (with GPS + BLE): ₹900
Simplified version without GPS (uses phone GPS): ₹300 – ₹600

TEAM MEMBERS:

Name	Branch	Year	Role
S F Cecilia (Team lead)	CSE	4th year	Concept, Design & Documentation
Yagneshwar DeviReddy	IT	3rd year	Hardware/IoT Development
Saketh Chittaluri	AIML	3rd year	App & Backend Development
K Kavya Sri	CSE	4th year	Data Analytics & Testing

Faculty Mentor:
Name: Dr. Narendhar Singh, Associate Professor, ECE
Email: narendarsinghece@anurag.edu.in

Thankyou