

Mapping Urban Recyclable Waste via a Scalable, Low-Cost, High-Fidelity Sensor Array and Dynamic Recycling Resource Allocation

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Objective:

- Revolutionize urban sustainability by developing a remote sensing framework for monitoring urban recyclable waste at the city neighborhood level.
- Transform every municipal recycling bin in the City of Saint Louis into a low-cost geospatial waste sensor to aid the city in increasing recycling efficiency by creating a geospatial nervous system of waste.
- Develop a graph-based spatial optimization algorithm that will use reinforcement learning to design feasible and profitable recyclable collection routes for the City.
- Make broad impacts in capacity building for geospatial sensing infrastructure, filling a geographic scale gap in the recycling logistics chain, capacity building for inherently spatial IoT designs for urban sensing, and capacity building for spatial reinforcement learning for sustainable geodesign and decision-making



Sensors capture the inside of a waste bin. The sensors are built in the AI-CHESS (Artificial Intelligence for Coupled Human Environment System Analysis for Sustainability) Lab at SLU.

Approach:

- Develop an urban sensor network that consists of interconnected sensors arrays to characterize the type, composition, and recyclability of incoming residential waste
- Design and field test sensor array for retrofitted to existing waste collection infrastructure, such as recycling bins, for continuous waste data collection
- Develop a spatiotemporal resource allocation framework for allocating waste management resources given incoming waste amount, composition, and quality
- Build a GIS dashboard by collaborating with the City of St. Louis to make data on solid waste generation and recycling effectiveness available at the block level
- Engage community stakeholders in the City of St. Louis for action plans related to optimizing the recycling logistics chain and community education for recycling

Key Milestones:

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| • Award start | 05/23 |
| • Initial Sensor Prototype | 07/23 |
| • lot System Prototype | 08/23 |
| • Submitted major funding proposal | 08/23 |
| • Award end & submission of final report | 06/24 |