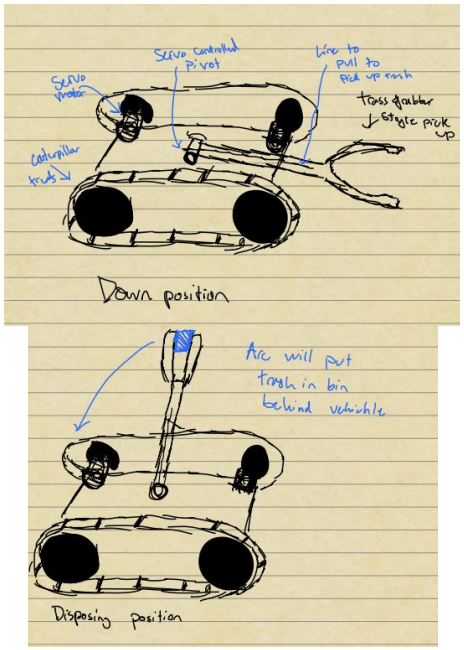
Our customer: Dr. Jackson Potter

Our project: ASME SDC 2025 Waste Collection Robot, designed to traverse a mini-city and collect the residents' garbage receptacles to be deposited in a central dumpster.



Design concept:
Hinged Wall-E

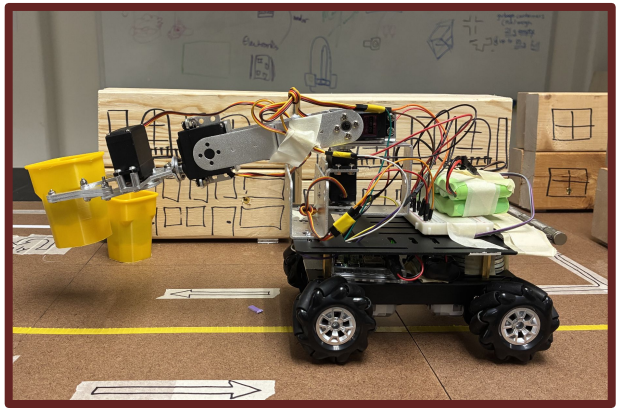
Customer Needs

1. Robot successfully collects and deposits waste.
2. Robot successfully navigates the mini-city and obeys traffic.
3. Robot is remote-controlled by one student in the group.

Link to the ASME SDC Overview and Rules:

Link to our Final Prototype Performance Video:

TRASH-E (Tracked Robotic Acquisition Sanitation Handler)



Team J2

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MEMS 4110

Mechanical Engineering Senior Design Project

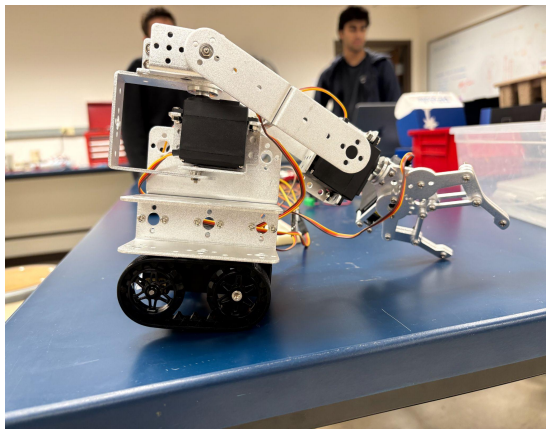
Fall 2025

Design Analysis

- Torque/Moment Arm
- Electrical Circuits

Performance Goals

1. Deliver 6 garbage bins in <5mins
2. Deliver 4 garbage bins without violating traffic laws in <5mins
3. Dump contents of bin into receptacle 5x without spilling



Initial prototype: Chassis could not support the weight of the robotic arm.

Initial prototype performance

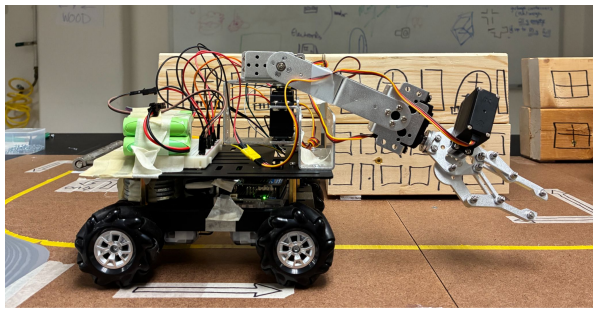
Goal 1: No, could not move and pickup trash bins.

Goal 2: No, same as goal 1.

Goal 3: No, was not able to repeat without spilling.

Design Refinements

- Rerouted power and signal circuitry.
- Added weight on the back of the vehicle to support moment created by trash bins.
- Simplified arm from 6-DOF to 4-DOF. Allowing for better movement of car while not compromising on trash collection.
- Switched from Caterpillar-track to mecanum wheels. Preserving tank drive, but increasing maneuverability.



Final prototype performance

Goal 1: Yes, we delivered 6 bins in <5 minutes.

Goal 2: Yes, we delivered 4 bins but had a few minor violations

Goal 3: Yes, we dumped 5 receptacles in a row w/o spill.

Future Improvements

- Cleaner wire management for robotic arm
- Large bin mounted on vehicle that can make one delivery to receptacle
- Wheels with larger friction coefficient to navigate the hill with ease
- Lower center of gravity to avoid tipping when scaling the hill with a trash bin on the end of the arm.
- Using fewer batteries. The current design has 3 separate power sources
- Simplifying the circuitry so that there is not a breadboard on board the vehicle

Acknowledgements

Thank you to Drs. Potter and Okamoto.

Additional thanks to Reddit and Arduino/Pololu Forums.