Project Smart Trash

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We’ve got a problem

Client Statement: Reverse engineer a device to solve to design a recycled, cost effective, useful, durable, environmentally friendly, and intuitive device that helps achieve one of NAEs grand challenges (restore and improve urban infrastructure).

Our Problem: Trash overflow in dorm buildings (ie. bathrooms and lounges) leads to inefficient waste management and an unsanitary environment.

Here’s a solution

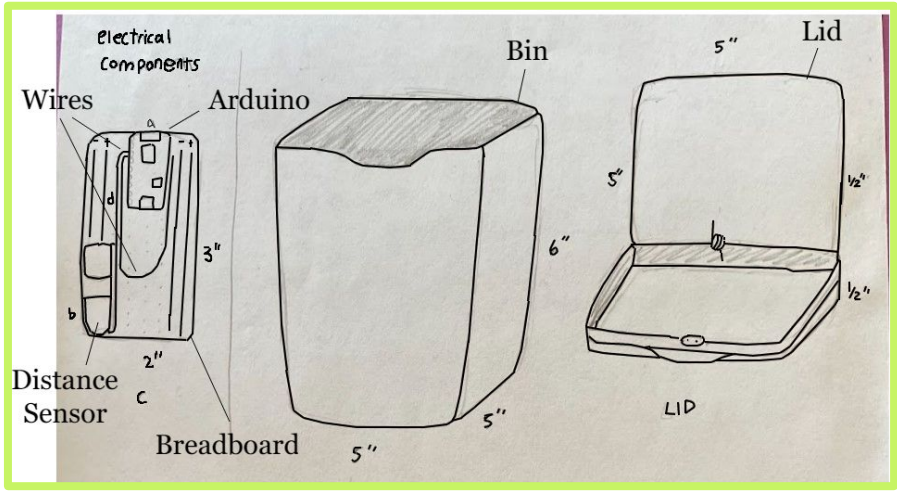
Objective: To create a system that helps users manage waste.

- Restore and improve urban infrastructure.

How it works:

- Trash is thrown away.
- Arduino records how full the bin is.
- App alerts users when full and helps them manage waste.

Conceptual Design



Questions:

- Lid or no lid?
- MF-Wires or plain?
- How to connect the sensor to the arduino?
- Mount the sensor on the top or the side?

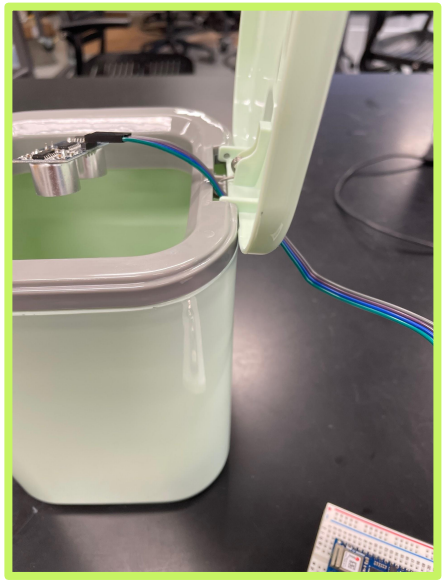
Our Metrics

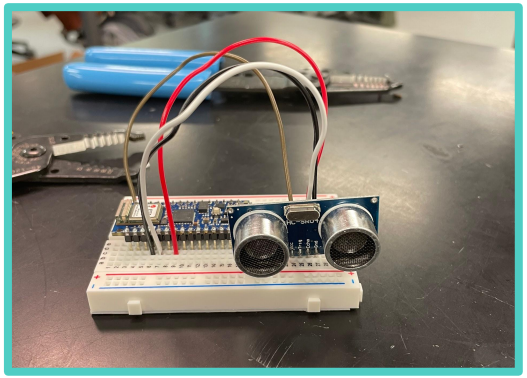
Objective	Metric	Sustainability Area
Accessible/Versatile	Mountable to all types of trash cans	Society
Impactful/Useful	Reduce incidence of waste overflow by at least 10%	Environmental
Intuitive	Takes less than 15 minutes to mount to trash can	Society
Recycled	At least 50% recycled materials	Environmental
Compact	< 1 ft^3	Society
Environmentally Friendly	Helps inform users about the harms of wastefulness.	Environmental
Durable	Bin can be shaken without the system breaking.	Economic
Efficient	Produces an accurate result within 10 seconds of the bin being full.	Economic
Inexpensive	Costs less than $50	Economic

Preliminary Design:

Decision:

- Kept the lid
- Decided to use MF-wires
- Established connection between Arduino and distance sensor
- **Main focus: where to attach the sensor and breadboard to the trash can?**



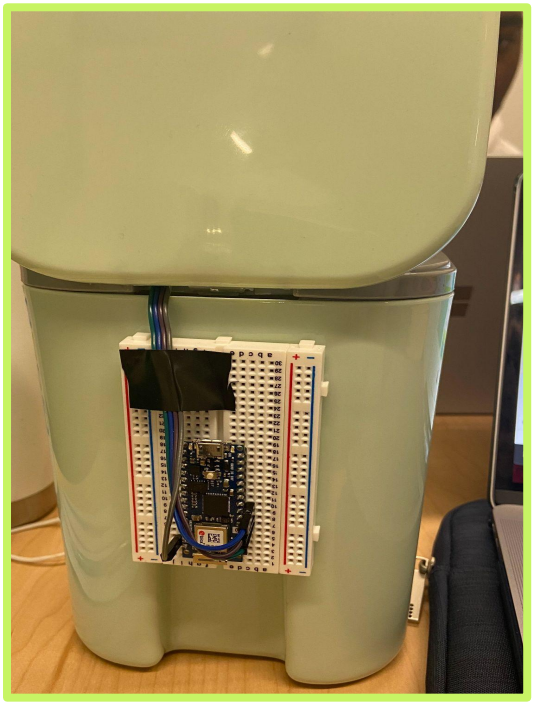


Preliminary Design: Cost

Material	Cost per Unit ($)	Dimensions	Mass (g)	Units Needed	Total Cost per Unit
Arduino Nano 33 IOT	20.00	0.39 x 0.71 x 1.77 inches	6.3	1	20.00
Hc-Sr04 Ultrasonic Sensor	1.50	4.5 x 3 x 1.5 cm	7.7	1	1.50
Male-Female Wire	0.08	11 cm .25 diameter	4.2	4	0.32
Breadboard	1.38	6.8 x 4.5 x 0.5 inches	37.5	1	1.38
Trashcan	11.55	5x5x6.5 inches	201.2	1	11.55
Total Cost ($)					34.75

Final Design

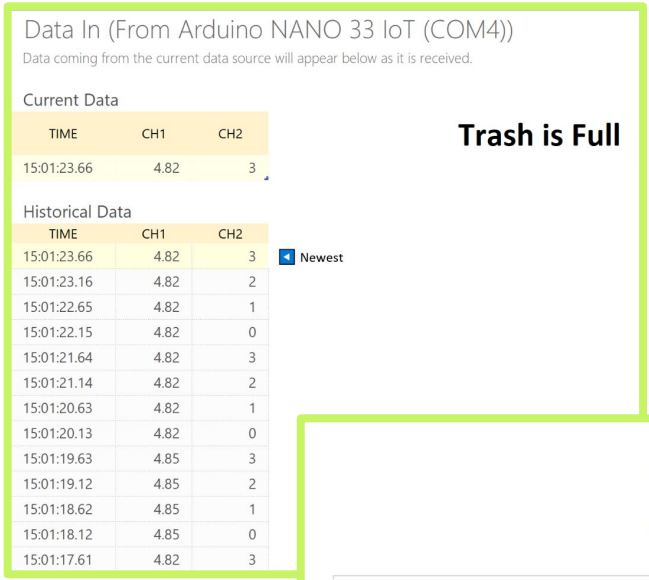
Arduino + breadboard attached to back

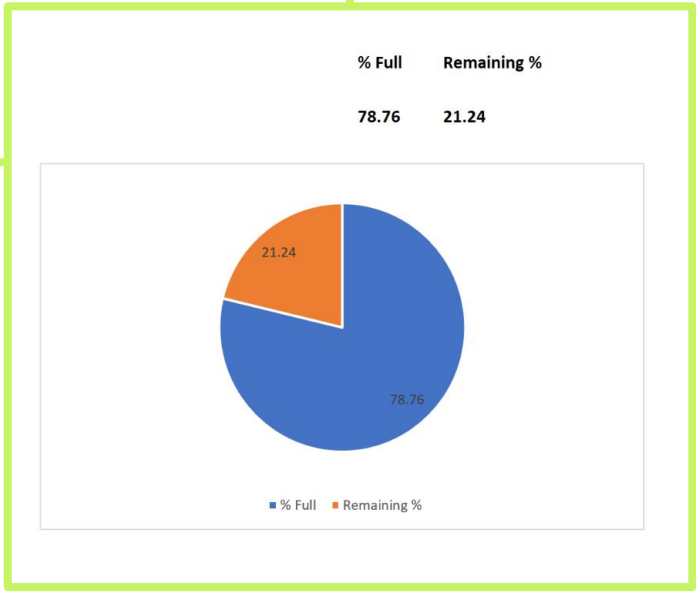


Distance Sensor records distance after lid is closed.

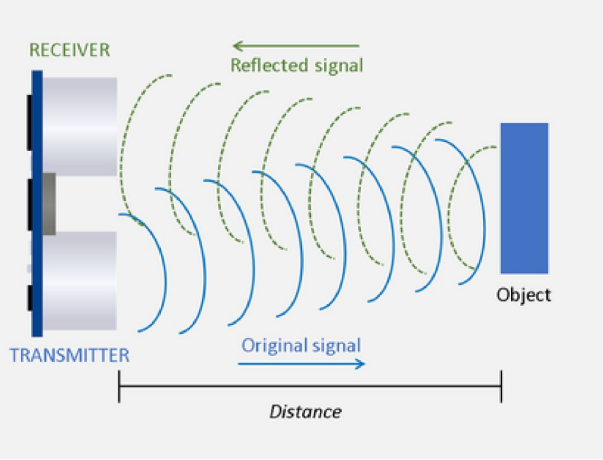
Final Design

- Testing different code parameters to ensure the sensor reading is accurate
- Real-time data displayed in excel.
- Visuals that would be included in the “app”





Code: Accurate Readings



Ultrasonic Sensors output the time it takes for a wave to travel to an object and back.

- Sound travels at 340 m/s = 0.034 cm/µs
  - We want cm and sensor pulse is in microseconds.
- ((0.034/2)cm/µs * sensor time) is the time from the sensor to an object.

Code: Cleaning the Data

Goal: Only take accurate readings when the trash can is closed.

Implementation:

- Consider multiple readings and delay output
  - Add readings sequentially to an array.
- Didn't want to output reading of an opened trash can
  - Reset sequential data collection (beginning of the array) when the reading was greater than the depth (15.2 cm).
- Accurate outputs
  - Outputted the mean of all the array values when the last value of the array is added.