Project Trash Bandicoot

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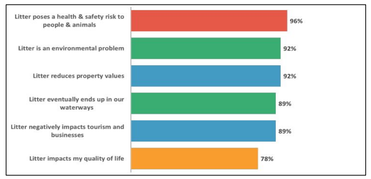
Overview

Waste management is an issue affecting both residential and commercial areas. Despite widespread recognition of negative impacts of litter, the amount of waste being produced continues to increase as shown in figure 2. Traditional trash cans are too small and infrequently collected [1]. As a result, excess trash is often blown or washed into the environment, leading to health problems and other serious issues.



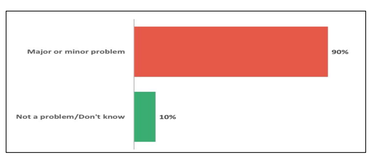


Figure 1: Opinion on Litter [3]

	Change in Waste Disposal per capita from 2012 to 2016/2017	*2012 Pounds per Person per Day disposal*	*2016/2017 Pounds per Person per Day disposal*
State of California	**+13%**	**5.3**	**6**
Sacramento	0%	5.9	5.9
Bakersfield	+5%	4.3	4.5
Long Beach	+5%	3.7	3.9
Chula Vista	+6%	3.5	3.7
Santa Ana	+8%	4.8	5.2
San Jose	+10%	3	3.3
San Diego	+11%	5.4	6
Oakland	+13%	3.9	4.4
Anaheim	+18%	5.6	6.6
Riverside	+23%	5.6	6.9
Los Angeles	+23%	4.3	5.3
Irvine	**+24%**	**5.5**	**6.8**
San Francisco	+28%	2.9	3.7
Fresno	+31%	3.6	4.7
Stockton	+32%	4.1	5.4
Provided by CalRecycle			

Figure 2: 2012 -2017 Waste Audit Comparison [2]

Background

- Rivers provide two-thirds of our drinking water. Consumption of contaminated water due to litter is a risk to public health [4].
- The current mode of trash collection is insufficient to address the growing scale of waste disposal [2].
- Existing solutions such as the Smart Can are limited in their ability to handle the problem at its source.

References

[1] A. Kroker and M. A. Weinstein. Data trash: The theory of the virtual class. New World Perspectives, 1994.
[2] CALPIRG, "The state of waste in California," CALPIRG Education Fund, 06-Aug-2022. [Online]. Available: https://pirg.org/california/edfund/resources/the-state-of-waste-in-california/. [Accessed: 20-Oct-2022].
[3] Scott, David, et al. 2020 National Litter Study. vol. 2020, Keep America Beautiful Inc., 2020, p. 47. 1 vols.
[4] "Trash Fact Sheet." State Water Resources Control Board. [Online]. Available: https://www.waterboards.ca.gov/water_issues/programs/swamp/docs/cwt/guidance/431.pdf. [Accessed on: Oct. 1, 2022].

Achievements

Figure 3: Load Cell Sensor

Figure 4: Large Scale Implementation

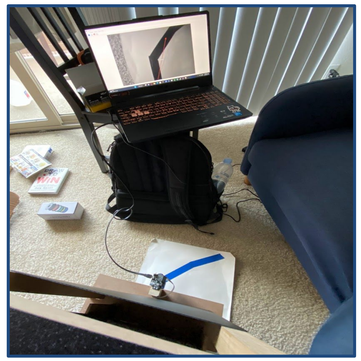


Figure 5: Pixy2 Camera Navigation

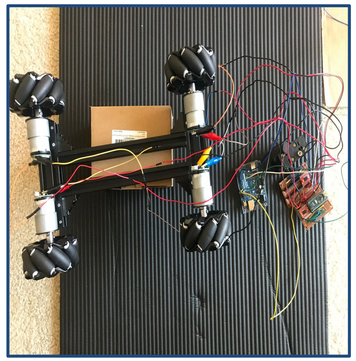


Figure 6: Motor Driver Circuit

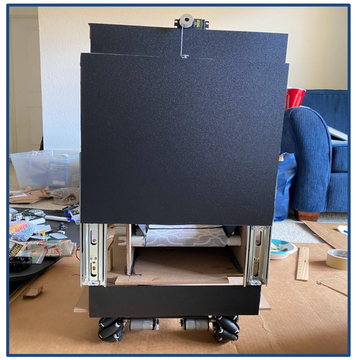


Figure 7: Pulley Hatch System

Figure 8: Conveyor Belt Structure

Methodology

GOAL: Construct a self-emptying trash can to alleviate excess trash overflow.

EQUATIONS:

$$d_r = \sum_{n=1}^{10} \frac{t_j}{10 \cdot v_s}$$ Ultrasonic Module Distance Calculation: t is the time for the echo to return divided by the speed of sound v_s

$$N_f = m_t \cdot g \cdot \cos(a)$$ Force Applied to Hatch: mass of trash multiplied by acceleration due to gravity and the cosine of the angle

$$t = r \cdot w$$ Torque Required to Lift Hatch: Radius of pulley r multiplied by weight of door W.

FINITE STATE MACHINE: As trash accumulates, an ultrasonic ranging module and a load sensor will determine capacity. Once full, the wheels will be able to navigate to a dumpster with the help of a lidar scanner and a camera. When it arrives, the trash can will open a hatch through a motor pulley system to remove its contents with an internal conveyor belt. The trash can will move back to its original station to continue the cycle.

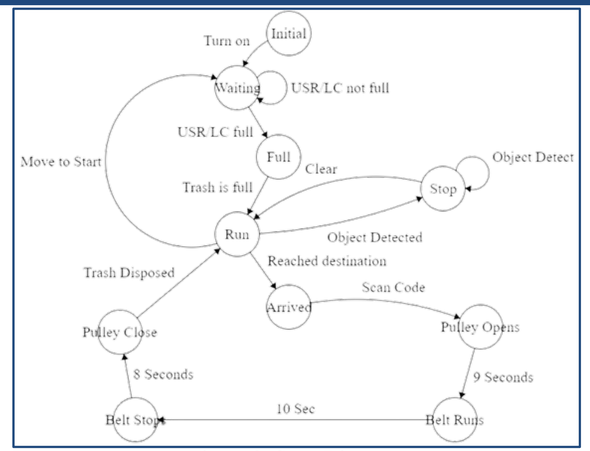


Figure 9: State Diagram

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