# ROBOTIC TRASH CART (RTC)

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## Project Background

The Robotic Trash Cart (RTC) will hold and carry both waste containers from the home base to the curb for pick up using a controller. The RTC design is focused on senior citizens, the disabled community, and people with limited mobility and strength in their extremities.

## Markets

PRIMARY MARKETS:
- Waste Management Companies
- Senior Citizens
- Disabled Community

SECONDARY MARKETS:
- Amusement Parks
- Malls and outdoor shopping plazas
- Local, state, and national parks
- Locales with dense foot traffic, such as city centers and plazas

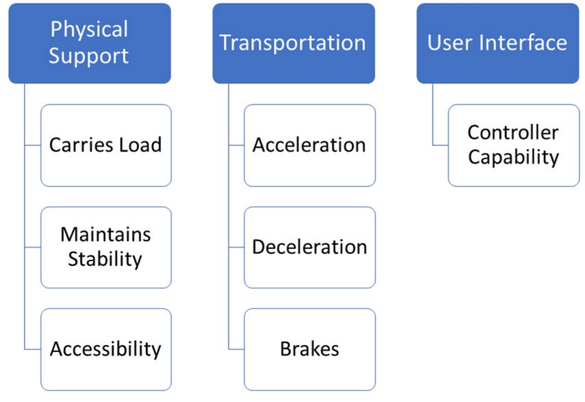
## Assumptions

- Largest gradient that will be traversed is 5 degrees of incline (ADA)
- South Florida weather: rain, wind, humidity
- Pathway is paved
- RTC will be stored outside of the house
- Waste engineers will return the bins to the RTC after dispensing the waste

## Targets

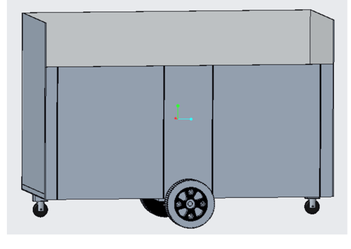
| Need | Metric | Units | Marginal Value | Ideal Value |
|---|---|---|---|---|
| Transport | Within Destination Target Area | m | 1 | 0.5 |
| Battery Life | Capacity V.S. Runtime | mAh | 3000 | 4500 |
| Transit Stability | Speed V.S. Stability | m/s | 0.10 | 0.10 |
| Drive over Obstacles | Obstruction Height | cm | 1 | 2 |

## Functional Decomposition




## Design

- Rectangular shape
- Gate allowing easy access to containers
- Mid-Wheel Drive
- Caster wheels on the front and back corners
- Wireless control



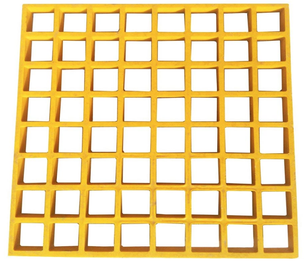
## Frame

Aluminum Angle Bar:
- ⅛” thick - bottom sides of the frame
- 1/20” thick - middle of the frame

Aluminum Flat Bar:
- ⅛” thick - top of the frame

Natural HDPE Sheet:
- ¼” thick - base

Ideal Base Material:
Fiberglass square grating is more durable and prevents any issues with pooling water, but it is more costly than the HDPE plastic sheets.



## Wheels

Drive Wheels:
Primo Powertrax Foam Filled Scooter Tires
- Holds their shape well
- Puncture resistant
- No maintenance needed

Caster Wheels:
6-¼” PowerTec Swivel Heavy Duty Industrial Caster
- Durable
- Easily replaced

## Drive System

Torque needed for 5° incline:

$$\tau = r * Fcos(\theta) = 0.127m(93kg)(9.8\frac{m}{s^2})\cos(5°)$$

$$\tau = 115.3\ Nm$$

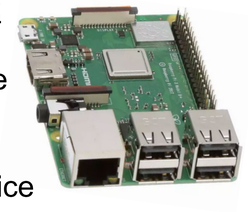
## Power Supply

$$P = \tau\omega = (115.3\ Nm) \cdot \frac{2\pi\left(7.51\ \frac{rev}{min}\right)}{60} = 90.68\ W$$

$$P = \frac{90.68\ Watts}{745.7} = 0.12\ Hp$$

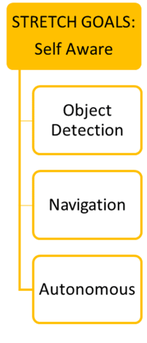
## Control System

Raspberry Pi 3B+ Model:
- Large community of users and open source resources
- Meets our processing needs with the best price point.



XBox 360 Controller:
- Dual joysticks for separate control of left and right wheels
- Simple retrofitting with a Raspberry Pi SBC

## Looking Ahead




- Find motors and batteries that meet our torque and power needs
- Purchase parts and begin prototyping
- Prepare for InNOLEvation Challenge Competition
- Work on our Stretch Goals of autonomous functionalities