

Merry'Go Round Recycling System

By Alberto Ibarra

Description of the product:

I am an avid recycler who believes in finding ways to help reduce our carbon footprint. Every six months, I aim to collect about 310 aluminum cans (or roughly 10 pounds) around my city, neighborhood, and simply at home. Due to the enormous quantity of cans that I collect, I store them in large trash bags, without even crushing them. I usually don't crush the cans because it is a tedious process of doing one by one. Thus, it isn't easy to carry so many bags at once to the recycling center. To combat these issues, I came up with the design of the Merry'Go Round Recycling System. This product easily crushes the cans in an automatic circular assembly line, stores them in a convenient recycling bin, and counts the number of cans that enters the bin (it has an LCD screen to show your count). You add all the cans in the elevated storage container and let the product do the rest of your work. This product will crush the cans in a compact size to fit as many cans in the storage container. Also, I believe this design project would be a great opportunity to learn more about motors, motion sensors, gears, and linkages. Due to time and limited resources, I have provided a detailed computer-aided design of the whole assembly process:

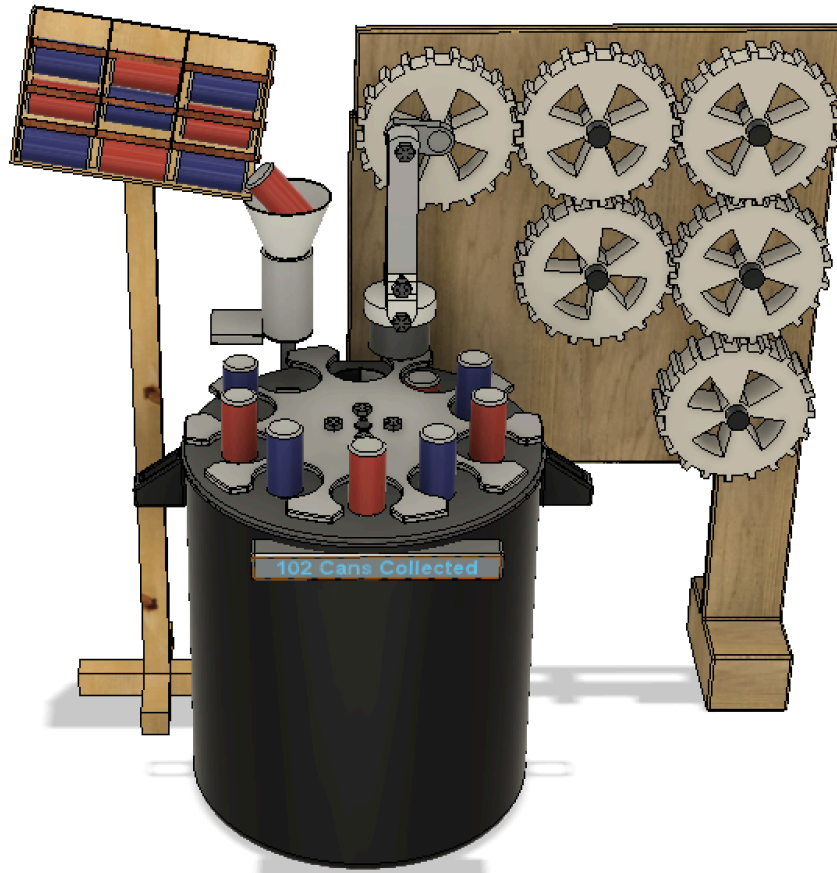



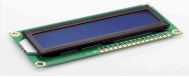
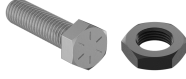
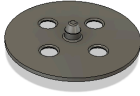


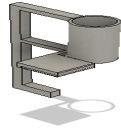




Figure 1: Computer Aided-Design of Merry'Go Round Recycling System

Table 1: Item List

Name	Vendor (Link Provided)	Brief Description	Picture
Trash can with Lid	Amazon can purchase Amazon lid purchase	Storage and Component Housing Support	
Slider	3D Print, UCB	Slides crushed cans into the bin, also is the housing for the motion sensor	
TRCT5000 Infrared Red	SunFounder Part	Checks the presence of an object (1.used for the detecting cans into the bin for count and 2. for can stopper can detect can at the pvc pipe)	
LCD Display	Vetco Part	Displays the value of the amount of count of cans	
Bolts and Nuts	McMaster Nut McMaster Bolt	Fastens and tights the components together	
Motor housing for revolving circular disk	3D Print, UCB	Housing Support to pair the circular disk and motor	
Revolving Circular disk	WaterJet Cutting, UCB	Rotates and holds the cans along the way	
Funnel	3D Print, UCB	Can enters through funnel to pvc pipe	
PVC Pipe with Supports	Home Depot, Parts	Can entrance zone, and supports attached to recycling bin	
Can Disk Limiter	3D Print, UCB	Stops Can from passing through until given a signal	
Can Disk Limiter housing	3D Print, UCB	Housing for Can disk when can is allowed to go through	

Can Storage Housing	Home Depot, Wood Assembly	Storage for Cans before being crushed	
Metal Arm for Crusher	Home Depot, Assembly Link	Attaches to crusher and provides movement	
Cylindrical Crusher	McMaster, Part	Crushes the Cans	
Cylinder crusher housing	3D Print, UCB	Cylindrical Crusher housing assembly	
Gear support parts	3D Print, UCB	Mounts Gears to Walls	
Gears	WaterJet Cutting, UCB	Rotates and moves crusher	
Gear Board Support	Home Depot, Wood Assembly	Supports Gears	
Motor for Gears	Transmotec, Parts	Moves Gears	
Motor for Revolving Disk	Transmotec, Parts	Moves the Circular Disk	
Motor for Can Disk Limiter	Pololu, Parts	Moves the Disk Limiter to open the door for the can	

Assembly Process and Fabrication:

In this design projects, most of the fabrication process will be through 3D printing, water jet cutting, or simply cutting existing purchases materials from different vendors. In the case of all the gears on the wooden board and the cylindrical rotating disk (on the lid of the recycling bin), these parts will be made from water jet cutting to have a clean cut of

the 2D figure with couple of inches of thickness. For all the support parts, funnel components, and the two metal linkage of the gear below, it will be prepared by physically cutting/building the parts with screws. Lastly, for all the housing parts of the components, for instance, the metal linkage grasping on the metal crusher or the can stopper housing), these will be made through 3D printing processes. Most of the components will be tightened with nuts and bolts.

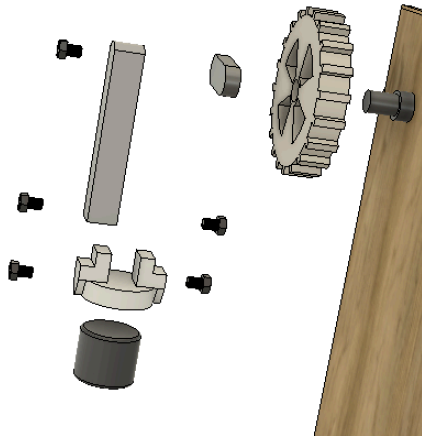


Figure 2: CAD Assembly Process for Can Crusher

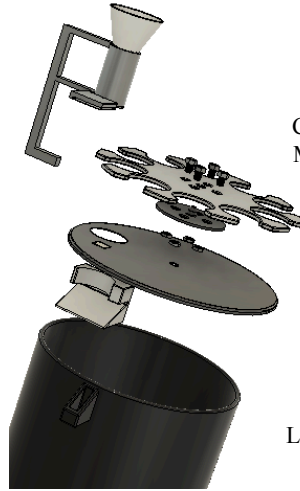


Figure 3: CAD Assembly of Recycling Bin

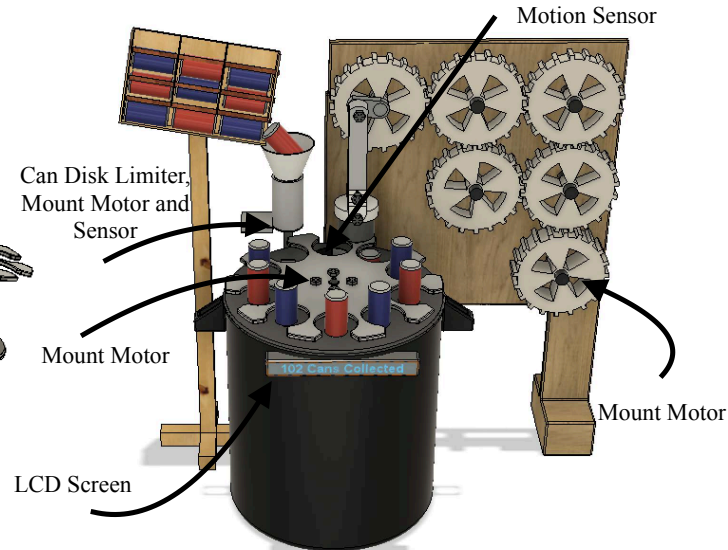


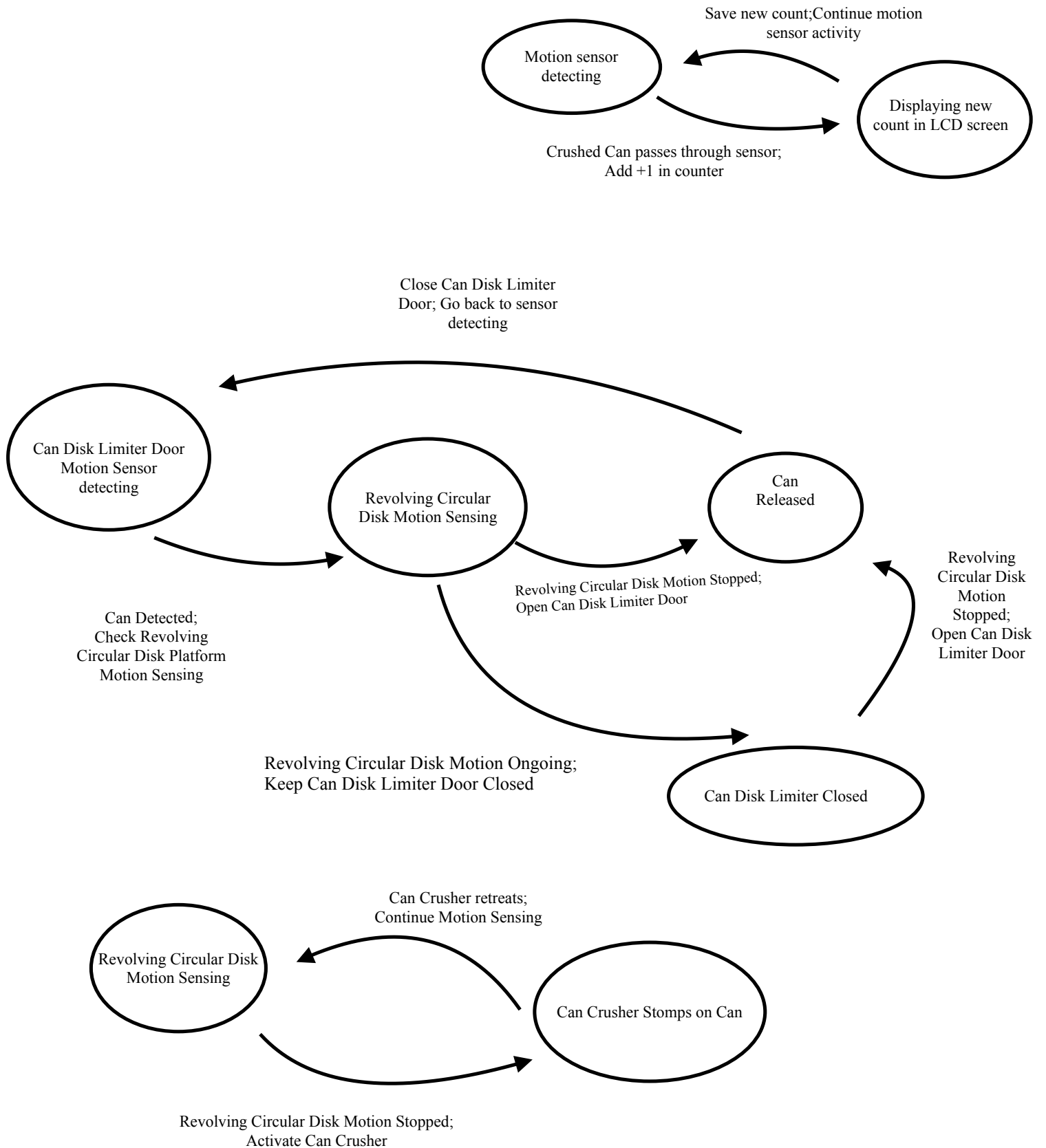
Figure 4: Diagram of Electronic Parts

Electronic Parts and its Function:

For this design project, there are three main electrical components: DC motors, motion sensors, and LCD display.

- (1) DC Motors: I will integrate 3 different types of motors for this design project. For the can-disk stopper, I will utilize the lab kit's DC gear motor due to its low voltage usage and for the low-intensive task of closing and opening the doorway of the PVC pipe. The next two motors will have to be much bigger due to the heavy load that it will have to exhibit. For instance, for the motor that will rotate the revolving circular disk that is place on the recycling bin's lid, it will need the requirements of Power=2.94 W, Torque= 3.12 Nm, and nominal rotational speed of 18.02 rpm (assuming 1kg of load). For the motor that will be used for the can crusher and withstand all the 6 gears, it will need the requirements of Power=44.15 W, Torque= 18.69 Nm, and nominal rotational speed of 22.5600 rpm (assuming 15kg of load).
- (2) TCRT5000 Infrared Reflective Sensor: We will utilize 2 components of this sensor. For this electronic part, I will place this at the entrance of the PVC pipe to notify when the can is ready to be released and set on the rotating disk platform. There will be another one located at the slider components when the crushed can falls in the bin. This will keep track the amount of cans that falls into the recycling bin.
- (3) For the LCD display, this electronic part will work with the infrared reflective sensor to display the amount of cans that have been crushed in the recycling bin.

Appendix I: Finite State Machine



Appendix II: Website Links

Can Storage Housing:

https://www.amazon.com/gp/product/B00002N600/ref=ox_sc_act_title_3?smid=ATVPDKIKX0DER&psc=1

https://www.amazon.com/gp/product/B005KD0V4C/ref=ox_sc_act_title_2?smid=ATVPDKIKX0DER&psc=1

TRCT5000 Infrared Red:

https://www.sunfounder.com/products/tcrt5000-line-tracking-sensor?variant=36141649199265&utm_medium=cpc&utm_source=google&utm_campaign=Google

Shopping&gclid=EAIaIQobChMI1O7Yy8C97QIVpxmtBh2KUw5QEAQYASABEgJyePD_BwE

LCD Display: https://vetco.net/products/16x2-character-lcd-display?gclid=EAIaIQobChMI47uRsK697QIViT2tBh0KFgf6EAQYBCABEgIptvD_BwE

Bolts and Nuts:

<https://www.mcmaster.com/90475A036/>

<https://www.mcmaster.com/92620A868/>

PVC Pipe with Supports:

<https://www.homedepot.com/p/Charlotte-Pipe-3-in-x-2-ft-PVC-DWV-Sch-40-Pipe-PVC-07300-0200/100533056#product-overview>

Can Storage Housing:

<https://www.homedepot.com/p/2-in-x-4-in-x-96-in-Prime-Whitewood-Stud-058449/312528776>

Metal Arm for Crusher:

<https://www.homedepot.com/p/Everbilt-1-2-in-x-36-in-Aluminum-Flat-Bar-800217/204604762>

Cylindrical Crusher:

<https://www.mcmaster.com/1610T39/>

Gear Board Support:

<https://www.homedepot.com/p/2-in-x-4-in-x-96-in-Prime-Whitewood-Stud-058449/312528776>

Motor for Gears:

<https://www.transmotec.com/product/PD71125-24-75-BF/>

Motor for Revolving Disk:

<https://www.transmotec.com/product/PD3237-24-264-BF/>

Motor for Can Disk Limiter:

<https://www.pololu.com/product/2215>