University of Southern California
ITP 348: Introduction To Physical Computing
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Final Project Documentation

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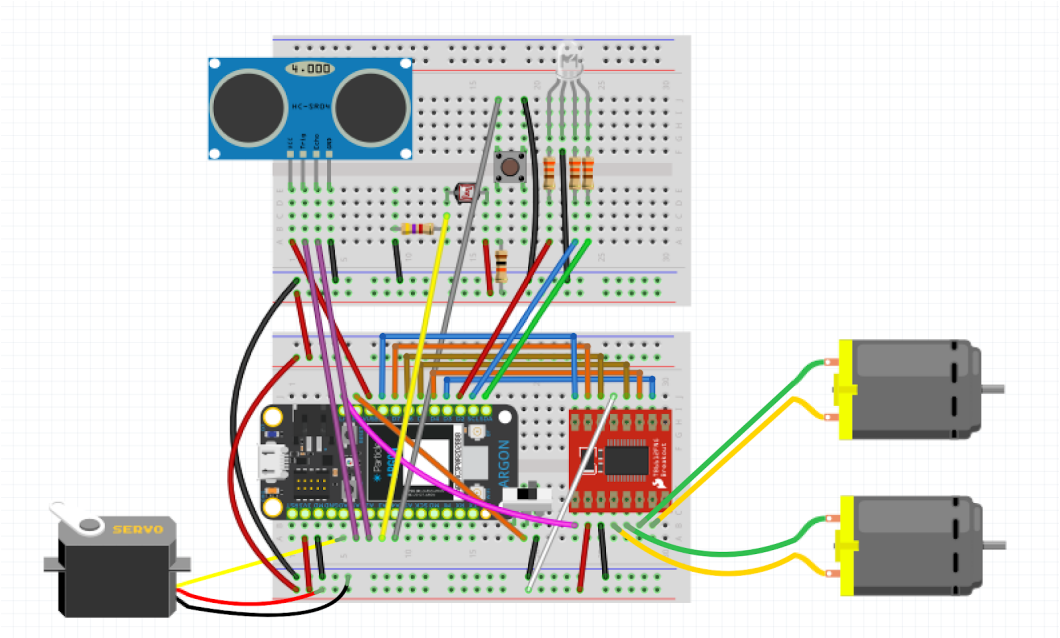
Overview

The Touchless Trash Can is a device that detects the distance of an object from its front and opens the lid if something is close enough to it. A light sensor detects if the trash level has reached the Can capacity. In addition, it can be switched to Bluetooth Mode in which the Can can be moved around and controlled from the Bluefruit app.

Wiring Diagram and Components



Sensors

The sensors for this project to achieve the desired product functions are described in the following table.

Sensor	Location	Purpose
Light Sensor	Near top of can	Detect if trash level is full
Ultrasonic Sensor	Outside facing outside of can	Detect if a motion is made

Actuators

The actuators for the project are:

Actuator	Location	Purpose

Push Button	Outside of can	Change mode/state
Switch	Outside of can	Turn off device

Additional Components

Additional components and their purposes are the following:

Component	Location	Purpose
RGB LED	Outside of can	Indicate state and status
Servo	Inside of can	Open device lid
Two hobby motors	Underneath can	Move device in Bluetooth Mode

The RBG glows purple for near object, green for opening lid for very close objects, and blue for Bluetooth mode.

Cloud Functions and Variables

The Cloud function is the function **changeState** which will switch between Bluetooth and Sensing Mode. This function changes the value of the variable **enableState** to 1 for Sensing Mode and 0 for Bluetooth Mode. The function can be triggered by either the physical button or the Dashboard's virtual button.

The Cloud variables that are published and read into the Dashboard are the following:

Variable	Meaning
status	Lid has been opened or closed
state	Trash Can is in Sending Mode or Bluetooth Mode
light	Can is full or not full

These messages are displayed on the Dashboard. To save Cloud space, the **status** is published only when there is a change in **status**, and the **state** is published only when there is a change in **state**. Similarly, the **light** to detect fullness is only read and published immediately before the lid closes after an opening (because trash can only be added after opening the Can).

The device is not continuously publishing data when there is no activity.

Special Things to Note

Array is **distanceArr** will hold the previous 10 data points for distances detected. The value reported is the average of the array. This value determines if the Can will open, and the threshold is currently 12 cm for “near” object and 5 cm for a lid-triggering object.

When debugging, if the Argon is stuck in a while loop, the Particle Argon must be put in Safe Mode or it will not flash.

Interaction Patterns

When the Can is opened, the system will remain in a while loop until the current time is greater than 3 seconds. The time to which the current time is compared is reset to the current time when an object is detected by the Ultrasonic Sensor. The while loop will automatically be exited after 30 seconds of being open regardless if an object is present.

The sensors will send data to the Cloud, and the results will display on the Losant dashboard interface application. The dashboard will show whether the container is open or closed via live indicator and if the Can is full.

The switch turns off the device completely.

Dashboard

The Dashboard comprises four primary components. First, a virtual button controller allows the user to virtually change the mode of the Can. Second, a message shows if the Can is opened or closed. Another indicator says if the Can is full (based on the light sensor). Finally, an indicator shows what mode the trash can is in (Sensing or Bluetooth).

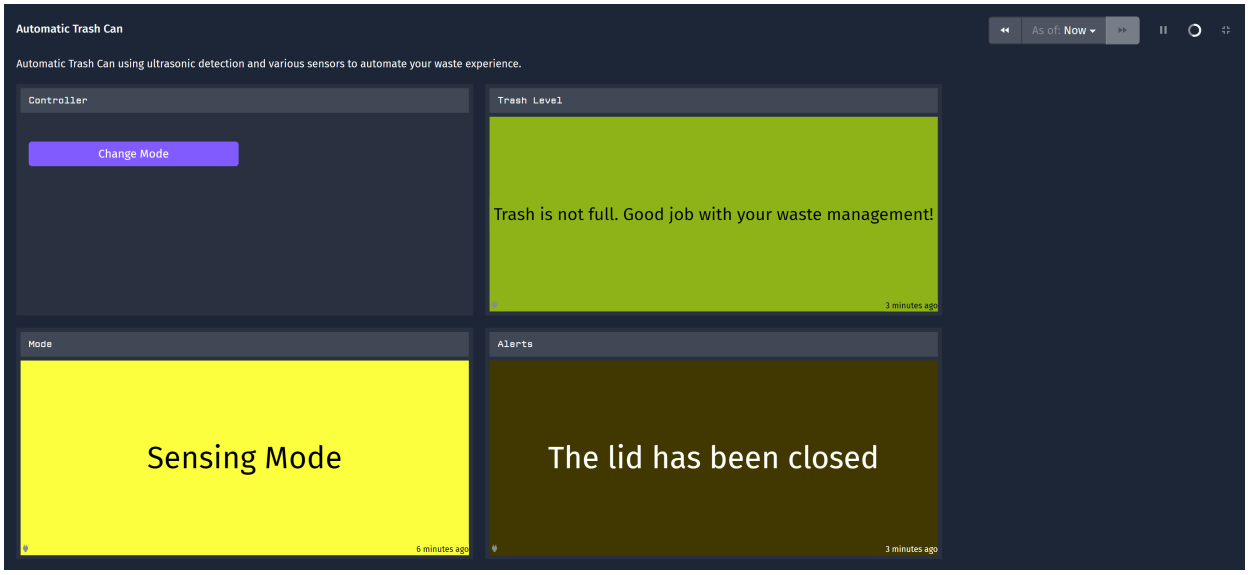
https://5df002e7829bcb0006626eca.onlosant.com/

https://5df002e7829bcb0006626eca.onlosant.com/trashcan

Log in with these credentials:

Email: test.user.c1juzyak9w@example.com

Password: c1juzyak9w



Bill of Materials

Including both kit items and non-kit items such as building supplies and other sensors, the budget is as follows. The only non-kit item is actually the 3D printed parts.

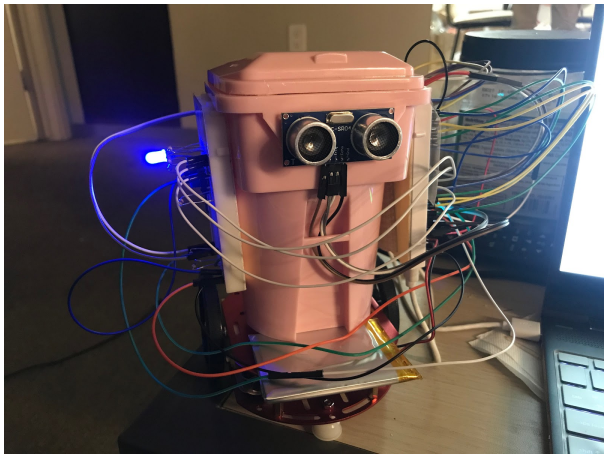
Name	Quantity	Price	Subtotal
Breadboard (Half)	1	$ 4.95	$ 4.95
Jumper Wires Standard 7” M/M - 30 AWG	1	$ 2.25	$ 2.25
Hobby Gearmotor - 140 RPM (Pair)	1	$ 4.95	$ 4.95
Ultrasonic Distance Sensor - HC-SR04	1	$ 3.95	$ 3.95
Optical Detector / Phototransistor - QRD1114	1	$ 0.95	$ 0.95
Resistor 330 Ω 1/4 Watt PTH - 20 pack	1	$ 0.95	$ 0.95
Resistor 10K Ω 1/4 Watt PTH - 20 pack	1	$ 1.20	$ 1.20
LED - RGB Diffused Common Cathode	1	$ 2.05	$ 2.05
3D print material (resin, PLA, or ABS)	-	Estimate	$20.00

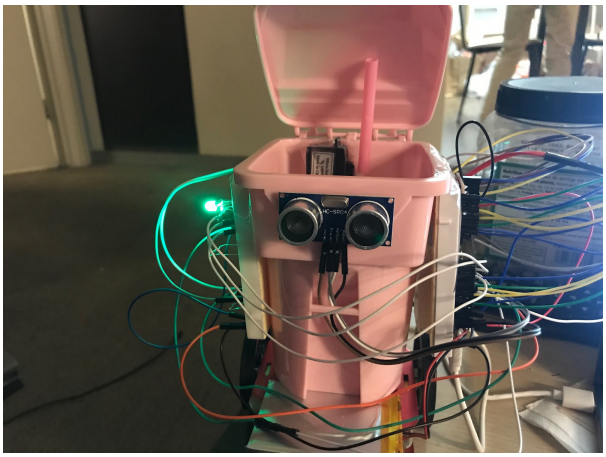
Total: $41.25

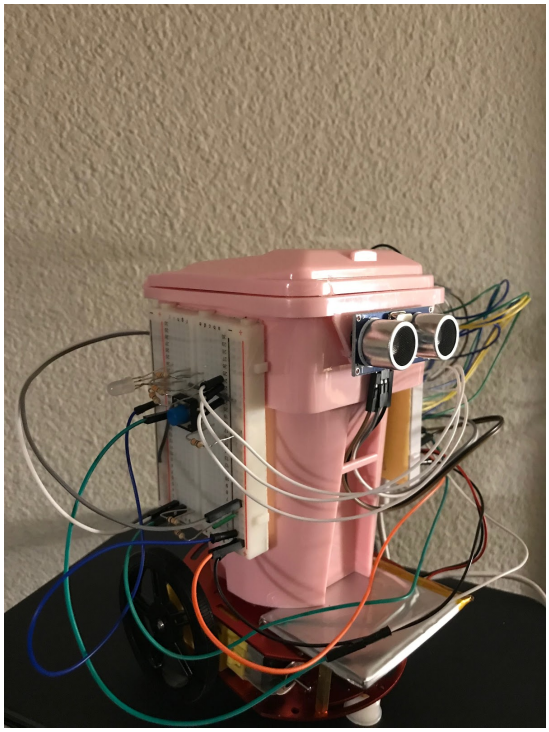
Total from kit: $21.25

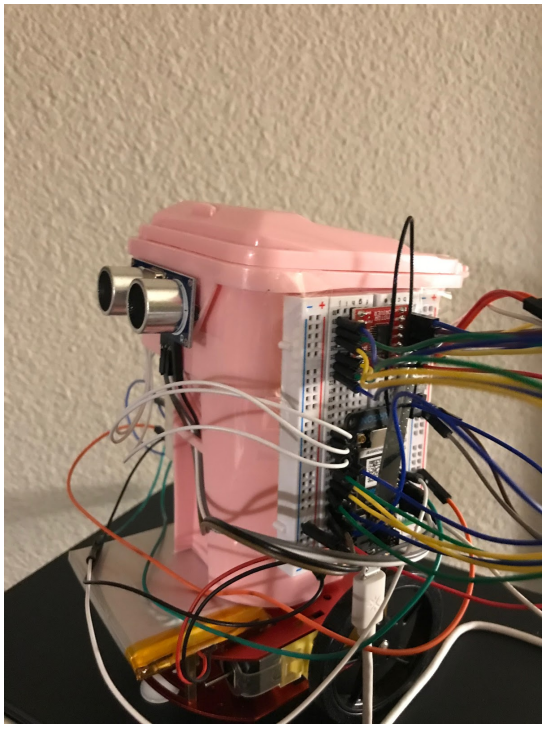
Total not from kit: $20.00

Product Images









Future Work

Future features include a detection of how long between Trash Can readings to develop a graph of trash production over time. Additionally, another potential feature to explore is autonomous calling - including integration with Google Home to ask Google to bring the garbage can to you.