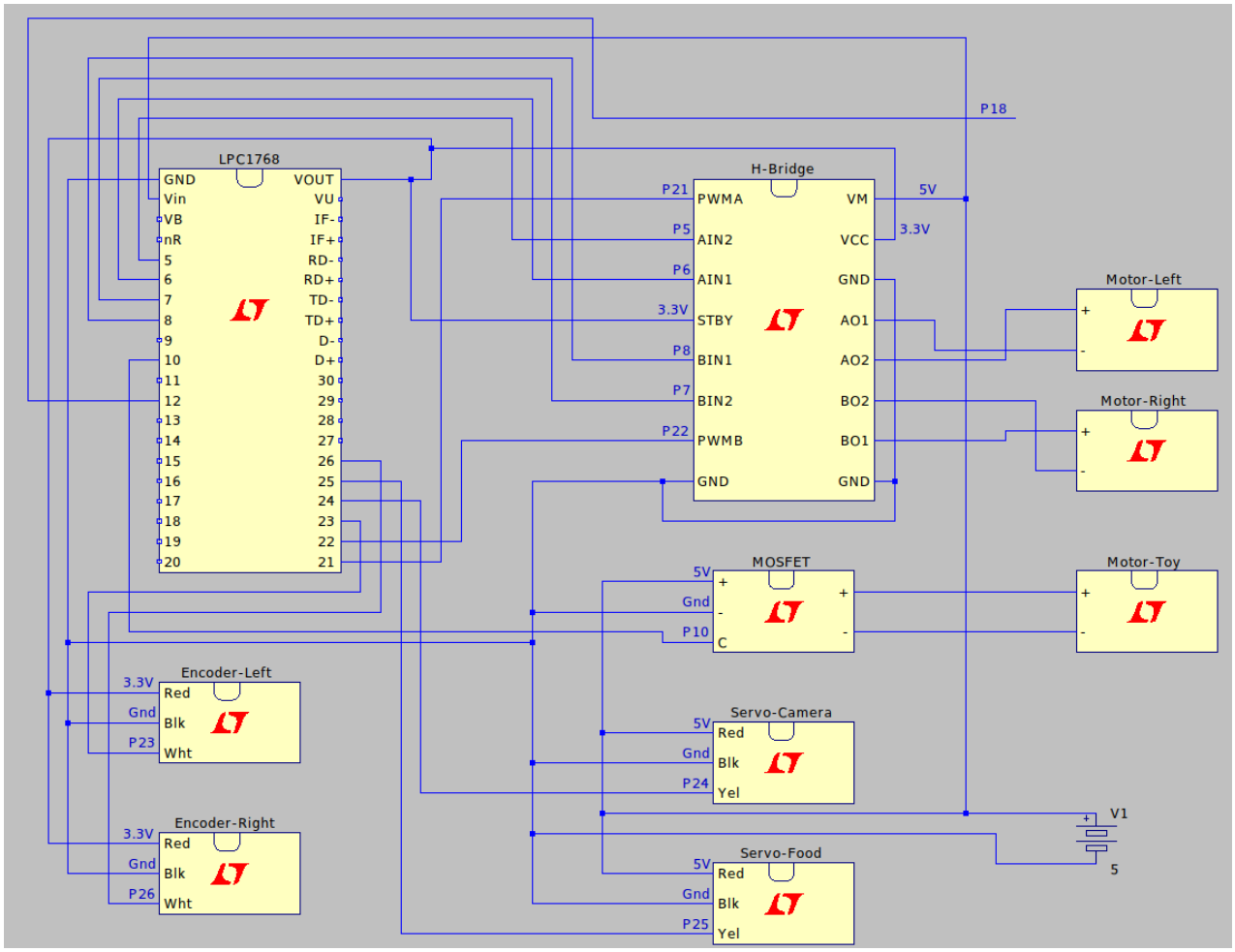
CatBot

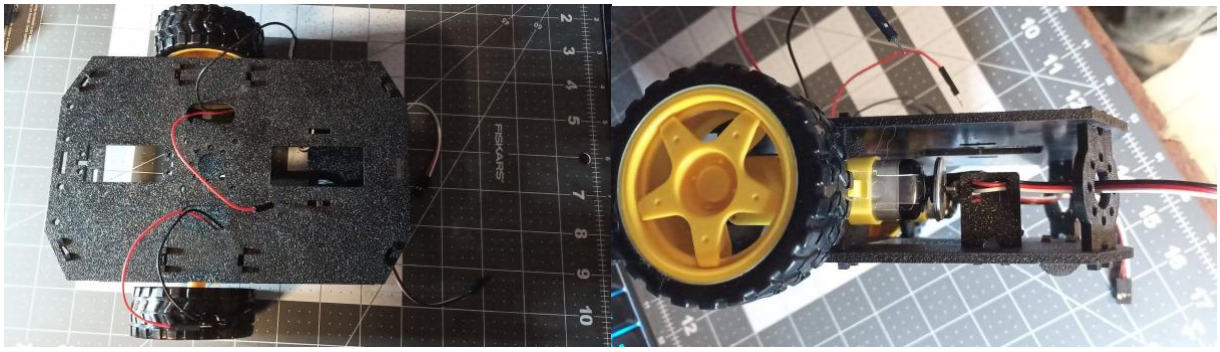
	Parts	**Quantity**
1.	Mbed - LPC1768	1
2.	Servo - Hitec HS-422	2
3.	SparkFun Motor Driver - Dual TB6612FNG (with headers)	1
4.	DC Barrel Jack Adapter - Breadboard Compatible	1
5.	Hobby Gearmotor - 140 RPM (Pair)	1
6.	Sparkfun Shadow Chassis	1
7.	Wheel - 65mm (Rubber Tire, Pair)	1
8.	Portable Pillow Speaker with 3.5mm Aux Plug	1
9.	Gikfun 1.5V-6V Type 130 DC Motor	1
10.	SparkFun MOSFET Power Control Kit	1
11.	Raspberry Pi 4, 4GB	1
12.	8 - 16G SD card	1
13.	5V DC Power Supply	1
14.	Battery Holder - 4xAA to Barrel Jack	1
15.	Plastic Coffee can	1
16.	Plastic peanuts container	2
17.	Raspberry Pi Camera	1
18.	Raspberry Pi Camera 9inch ribbon cable	1
19.	Animal food bowl	1
20.	USB Audio Speaker	1

Wiring Diagram

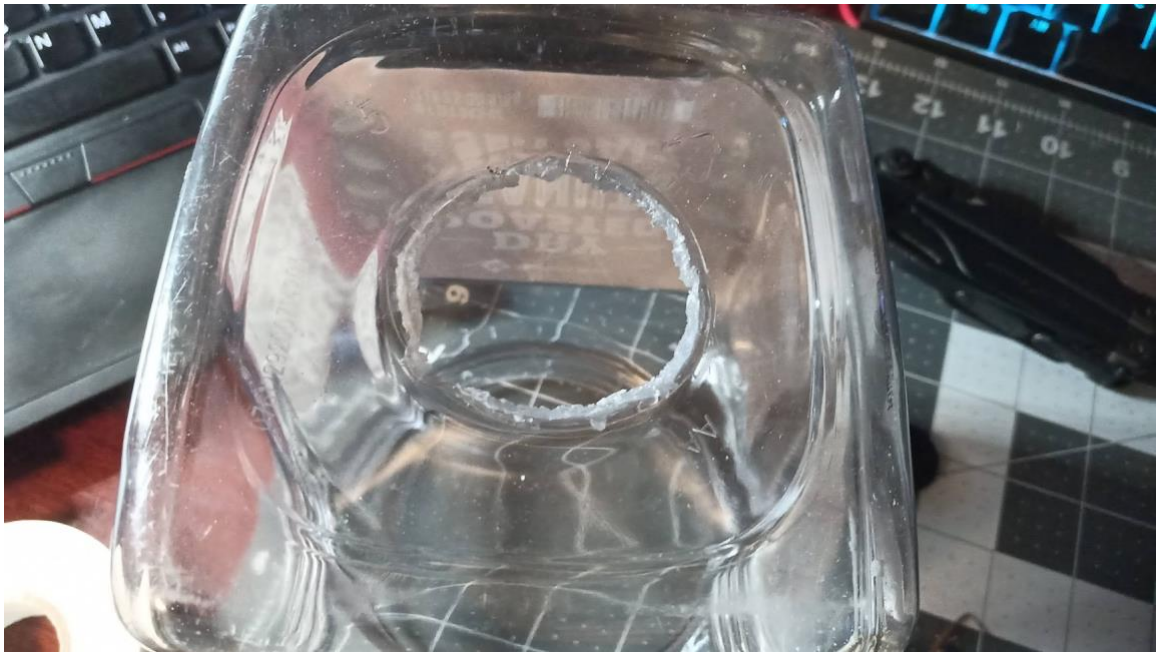


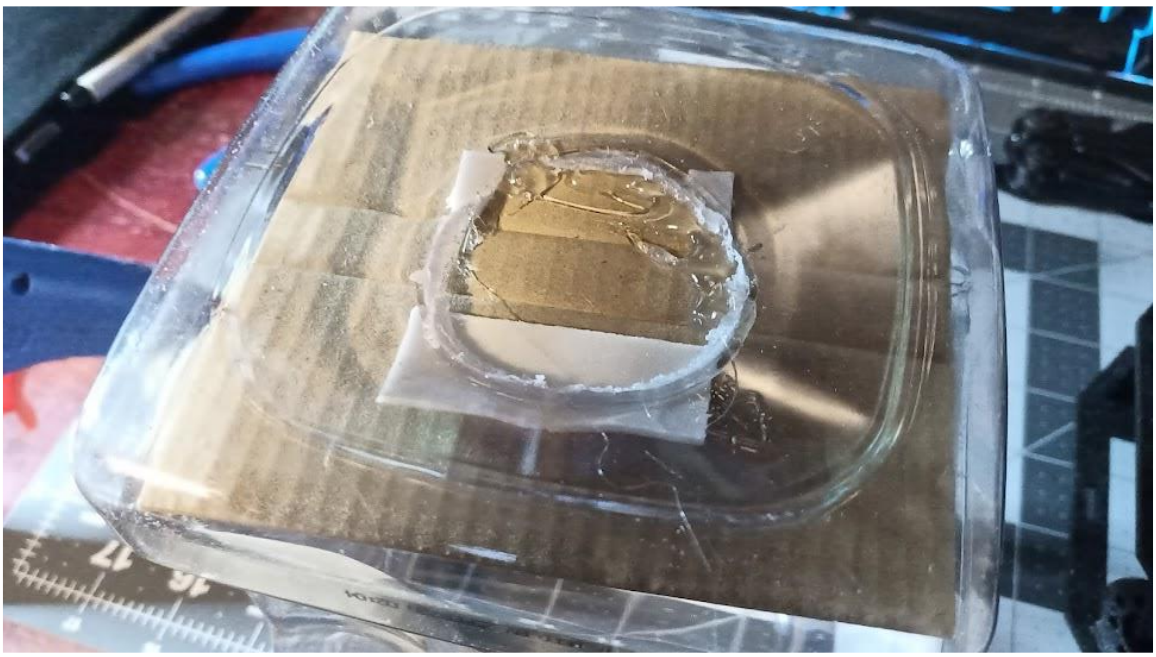
Build Instructions

Sparkfun has made a great video on how to build the Shadow chassis, which can be viewed here. https://youtu.be/aJRYTqZu5OE Because we are not building the bot completely, you only need to follow along till the two minute mark, at which point you can go ahead and put the top on and you should have a bot similar to the images below.



Now it's time to focus on the Peanuts can, which will be our main housing for the electronics of this build. All of this will depend on your container you are using, so follow along as required. The container I found had a large indent in the bottom, preventing the Mbed from sitting flat along the bottom. I first cut out a hole in the container, to remove the majority of the raised section. I then used a piece of cardboard and super glue to create a flat base to hook the mbed onto. The Mbed is attached to a breadboard, with the barrel jack in the back and another hole is cut in the container to give access to the barrel jack from outside of the housing.



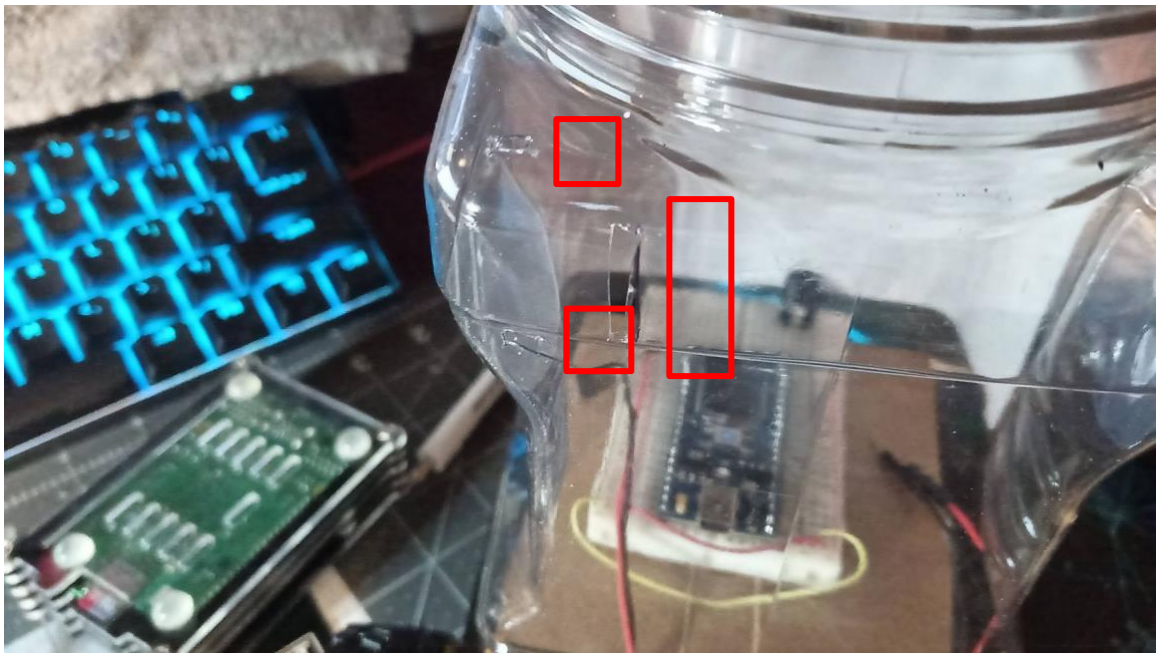



ROASTED
PEANUTS
WITH
SEA SALT
NET WT 34.5 OZ
(2 LB 2.5 OZ) 978 g

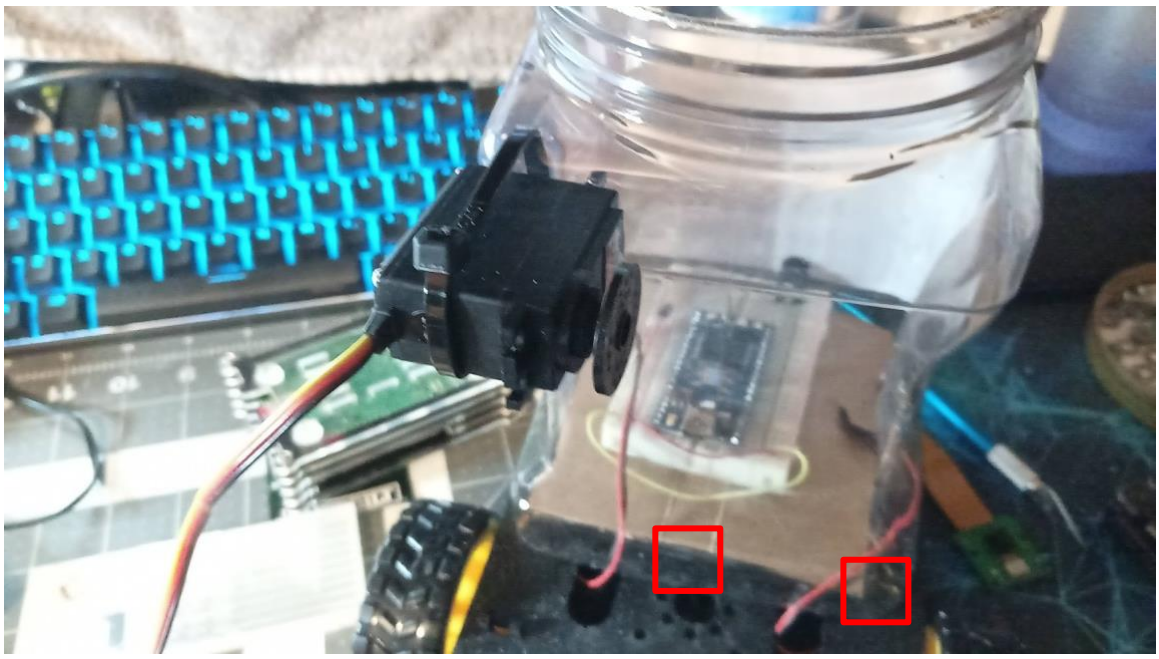
With the Mbed now in place, we can secure the container to the top of the shadow robot. Measure out the location where the holes on the container will go first, and mark them accordingly.

Mark the holes on the top of the shadow robot, and drill through both the container and the robot upper bracket to make holes large enough to fit a screw threw. I was going to secure them with a locking nut on the other side, but if you keep the holes small enough then the screws might hold securely without the use of a nut as was the case for me. Attach the container to the base and you then mount it back to the shadow bot.

With the container now mounted, it's time to start adding on the other devices. I started with the forward mounted camera. Because of the design of the Servo, I figured the brackets on the side could be used to stabilize while on the container. I measure and cut a single slot for the bracket to fit through, and another two holes to fit a zip tie through. Also, cut two small holes in the bottom front of the container to allow for the DC motor wires to feed through.

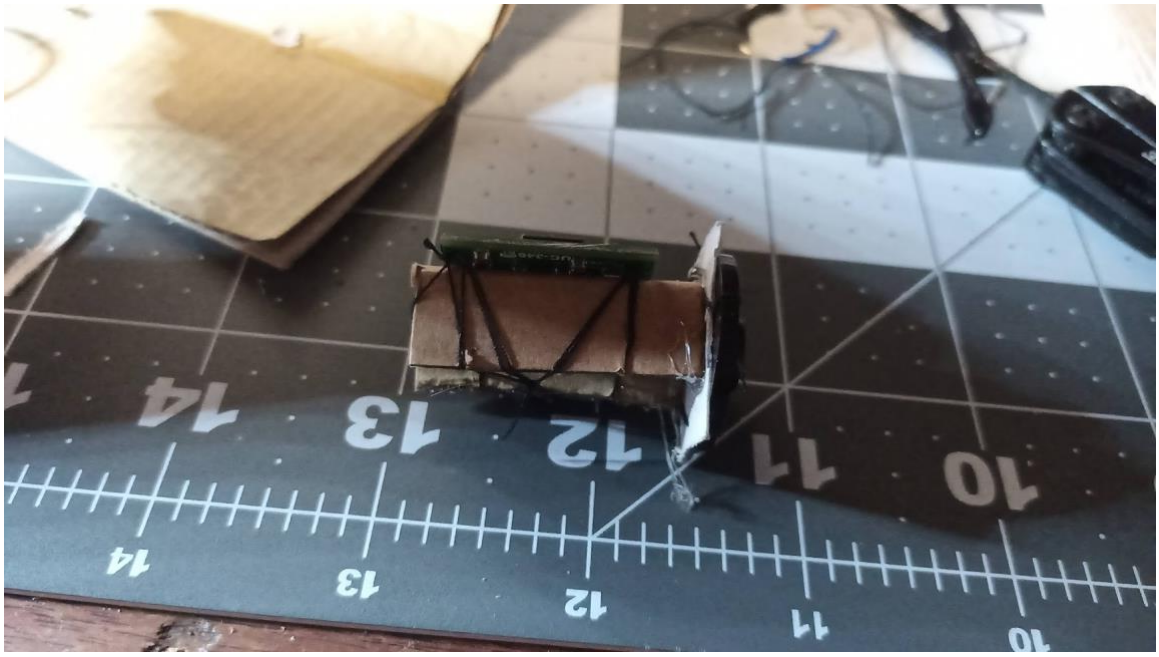


After, we can mount the servo with the rotating portion towards the middle. The camera will be fastened to the servo mount so it can look up and down, as such, you should offset the serve mount enough so the camera will be somewhat in the center of the device.



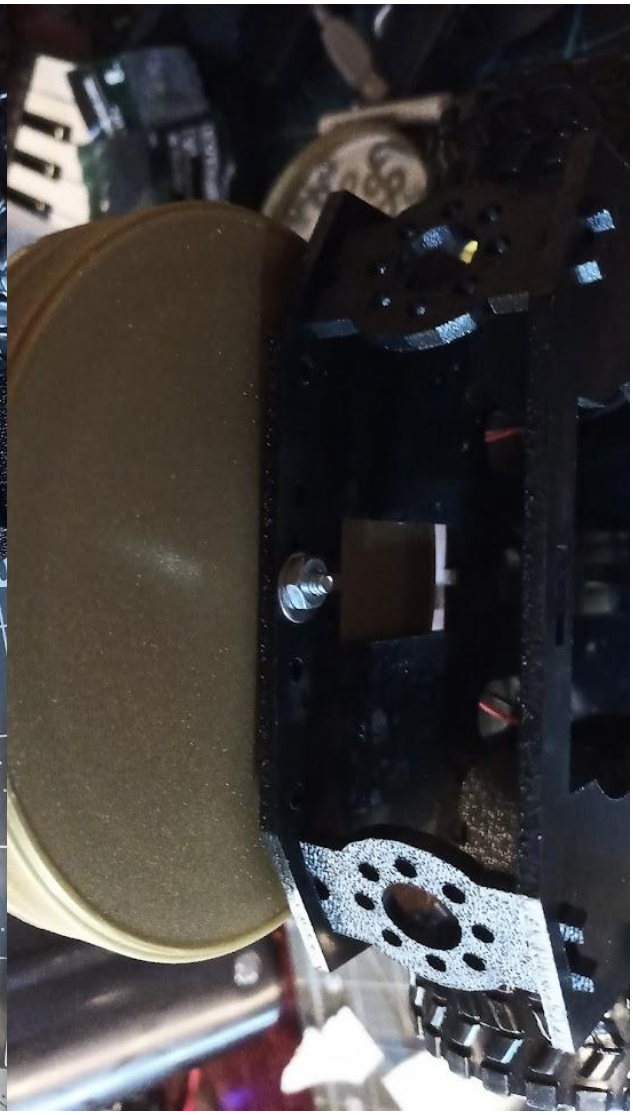
To mount the camera, we made a mounting bracket out of a few pieces of cardboard. One flat piece will be mounted to the servo, and another longer rectangular piece will hold the camera. We measured the rectangular piece out so it would be long enough to fit the camera, then used super glue to fasten the two pieces together.

We then mounted the bases together by putting holes in the cardboard base and using string to tie them to each other. In a similar fashion, the pi camera has holes on the breadboard that can be used for mounting. By cutting a few slots in the rectangular cardboard piece, we can mount the camera to the piece using some string. If you make it tight enough, it should not move much.



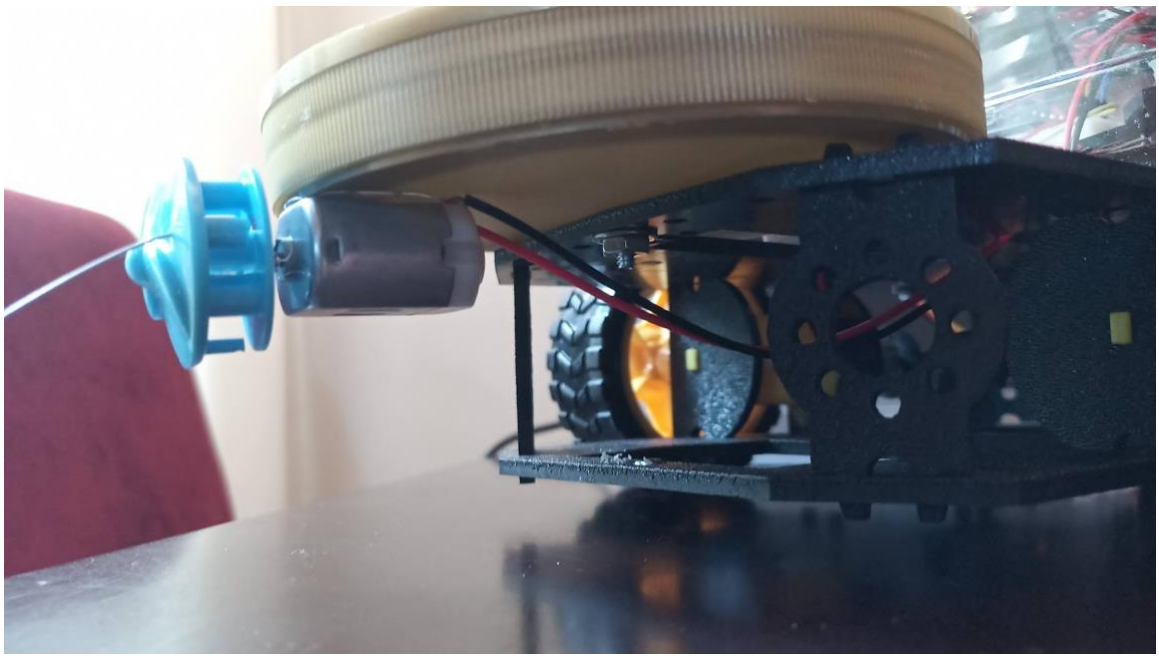
You can then mount that back onto the servo, but make sure you mount it so half way through the motion it should be facing directly forward. This will allow it to look straight up and down while operating.

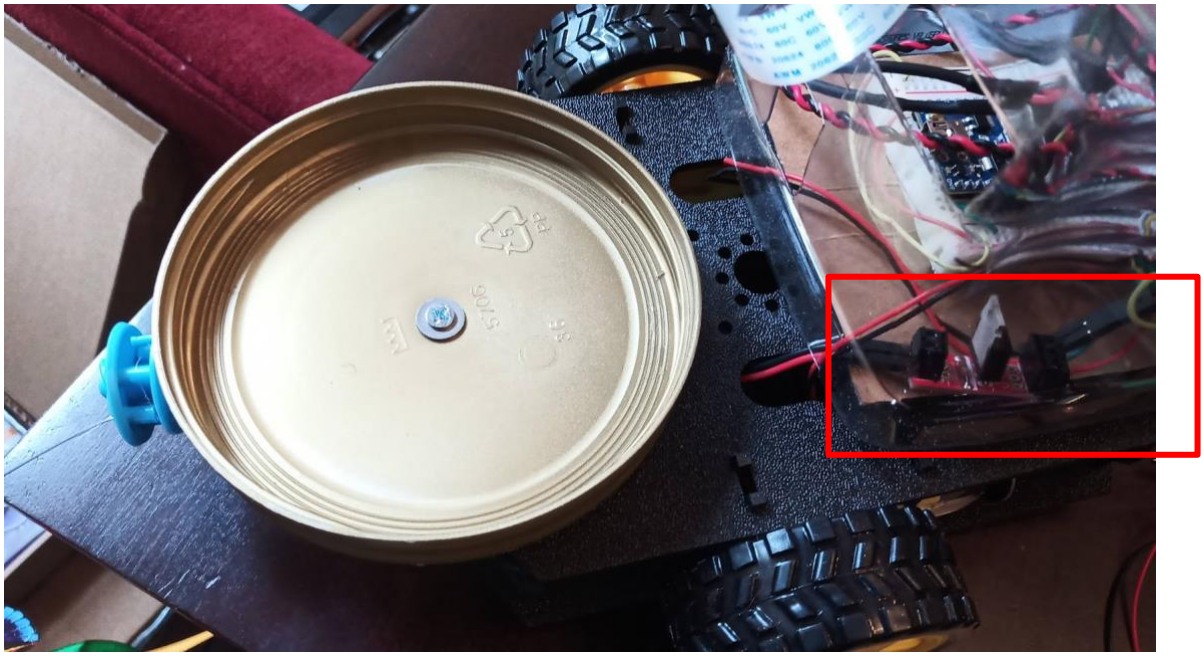
The next piece to attach is the holder for the food bowl. I used a lid that was the exact same as the peanut cans, which is why you need two cans of peanuts for this build. Simply drill a hole in the middle of the lid, and attach it to the shadow bot using the holes already made. It will require a nut on the other side to fasten tightly.



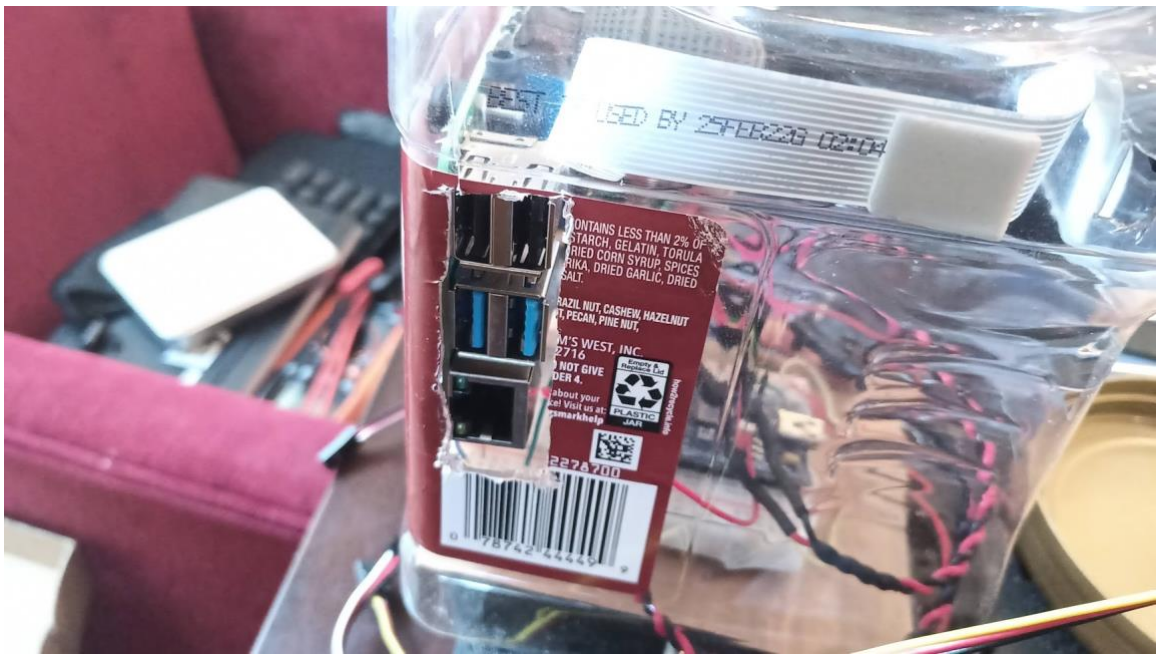
This lid is only there to hold the bowl, of which you can find any bowl that fits, but this bowl measures around 3.5” at the base and fits nicely into the lid allowing for little movement.

Attach the other DC motor to the bottom of the bowl holder using some super glue. I attached a cat toy that spins around to the motor as well using some super glue. For the motor wires, you can feed them through the same holes used for the other DC motors. This motor will be using the MOSFET so now is a good time to go ahead and hook that up we don't get confused later.

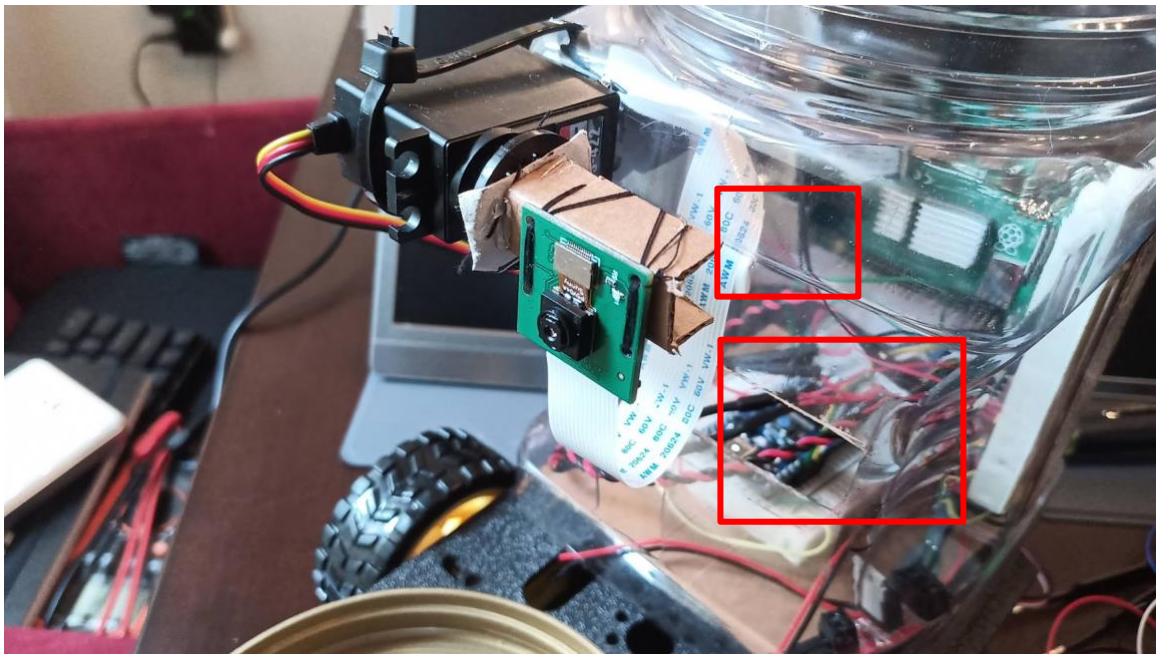




It is time to start mounting the raspberry pi. It might be possible to run this on a Pi Zero or Pi Zero W 2, in which case you would want mount it to allow routing of the cables you want to use. We decided for ease of use and testing to allow access to the USB ports. We also mounted the pi low enough to allow some room for the top ports to be used as well. After figuring out where you want to mount the pi, you can mark the holes you will need to make on the outside and drill them. Mounting the pi required smaller hardware, and utilizing the rubber mounts from the servo kit to give it some space between it and the plastic container. Cut a hole in the side of the container for the USB ports and IO to stick out of, and then mount the pi.

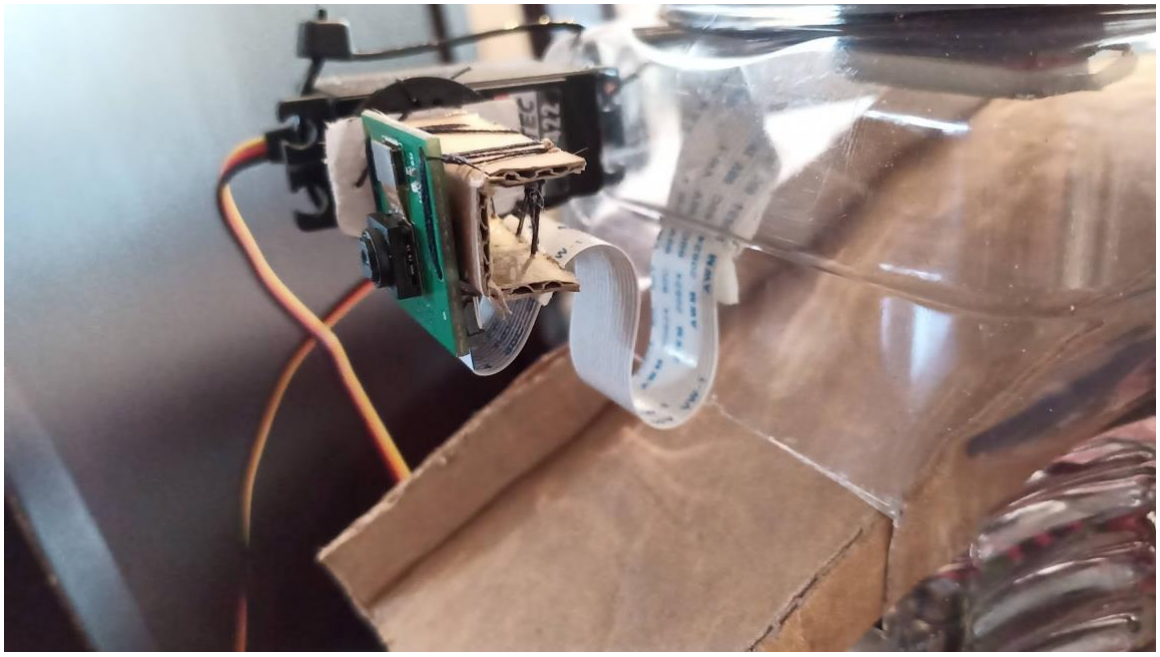


For the camera ribbon cable to fit well, we cut a small slot higher on the container and fed the cable through. Make sure you have enough slack outside of the container so the cable does not have much tension on it when the camera is rotating. Also, we cut another large hole, almost 3/4” tall and 3” long, that will be used to slide food down from the dispenser to the bowl. The location of the slot is roughly in the middle of the housing, but you will want to see with the lid on, from the outside, at what angle you would want that allows the food to slide into the bowl.



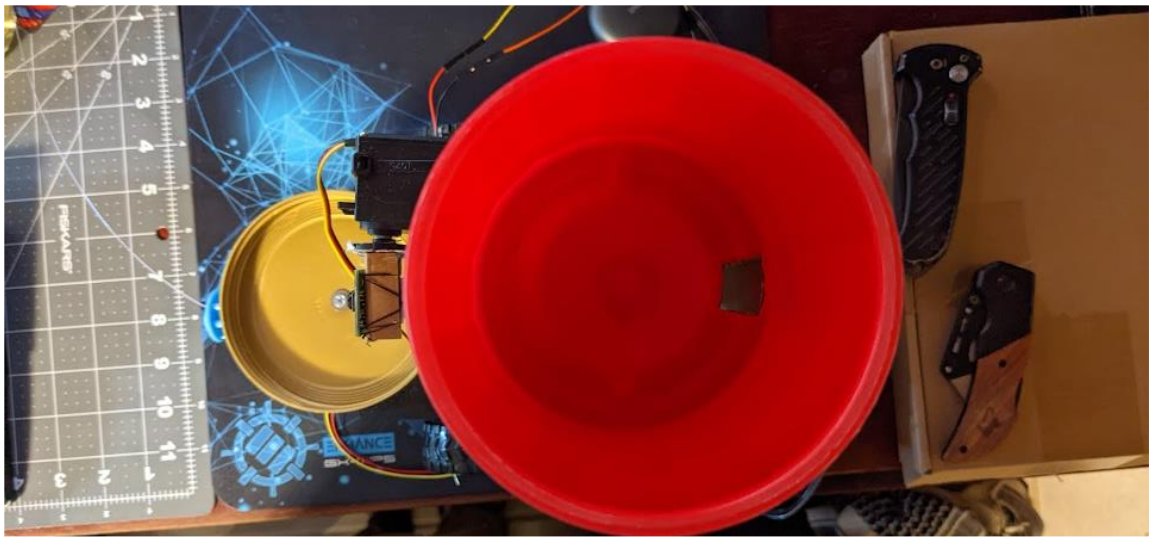
Using another roughly 7” piece of cardboard, fold up the sides like a rail, and make it long enough so it goes all the way to the back of the container, and will feed into the bowl.

Use a small piece of double sided tape to fasten the ribbon cable to the rectangular piece, so that the cable will not block the food as it’s dispensing.

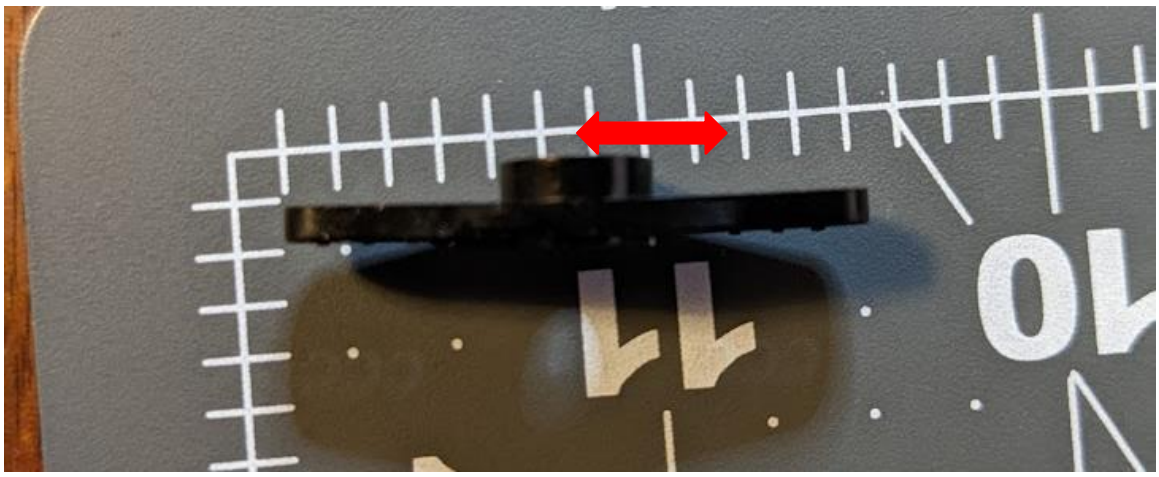


The final part to build is the dispenser itself. This is using the coffee can and the final servo motor. Cut a hole in the base of the coffee can that is large enough for the treats you want to dispense.

Now, depending on your peanut can lid, and in the case of mine, it tightens down to the same location every time, but it's easier to attach the peanut lid first, then mark the location of the hole you want to cut by aligning the coffee can hole at the very back of the peanut container. It should look like the image below. Once you have it centered, take a marker and outline the hole in the lower peanut lid. You can then cut a hole in that location in the peanut lid.



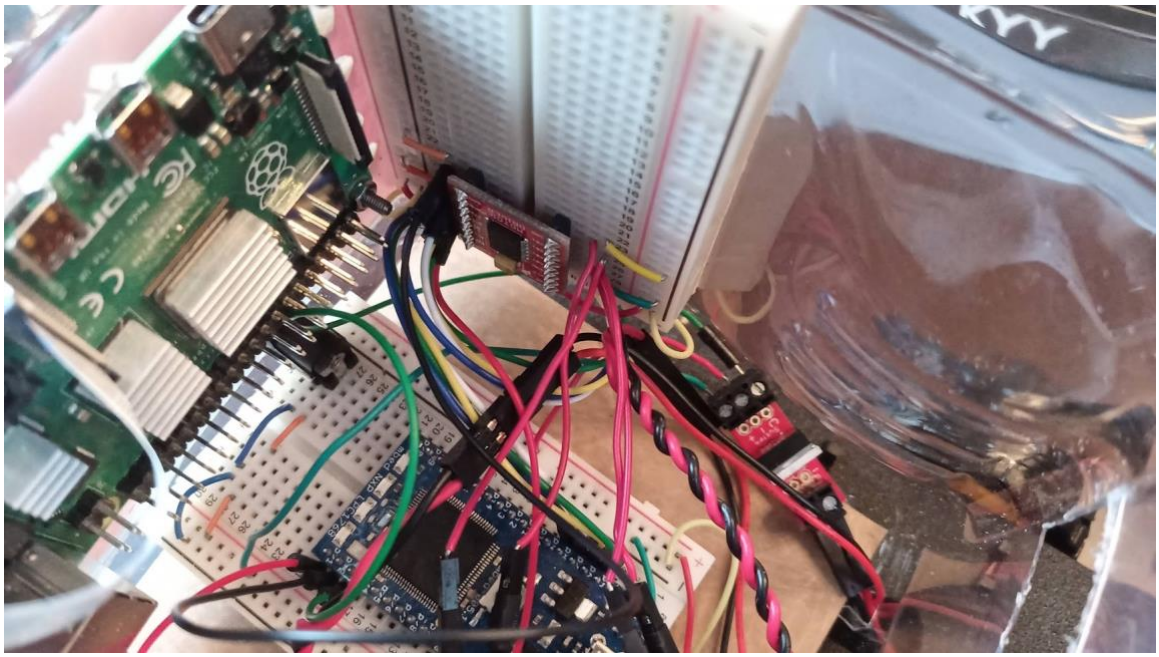
Now cut another hole through the center of the peanut can lid, similar to the food bowl lid, but large enough so the servo motor can fit through. It's best to take off the servo motor rotating attachment first. Something over 1/4 inch radius should be sufficient, but something larger than the arrow shown below. This will allow enough room so the servo can move freely through the peanut can lid, which will turn the coffee can.



Once you have that hole cut, attach the servo to the peanut can lid using super glue. Attach the rotating portion of the servo motor back again. Before attaching the servo to the coffee can, make sure you know where in the cycle the servo is. I moved the servo to the half way location, so it would be mid cycle when the holes lined up, then put a decent amount of super glue on the rotating portion and lined up the holes holding it steady till it fastened.

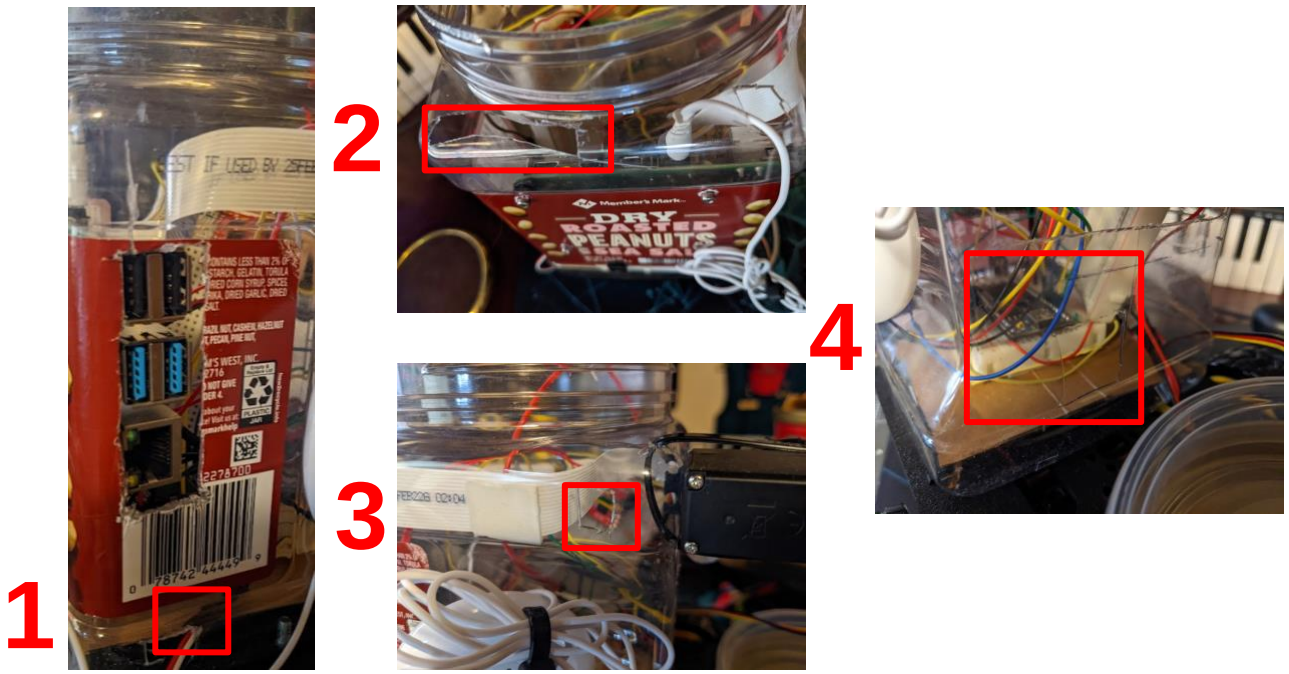
Now that you have a working food dispenser, you can add a funnel to the inside of the coffee can so the food will dispense easier and you won't have to put as much food in the housing. I hot glued some pieces of cardboard to the sides and made a funnel to the hole. It works very well with smaller sized treats. For larger treats that are almost the same size as the hole, they would often get stuck somewhere and not dispense. I think you want to make the hole about 2 to 4 times larger than the treat you wish to use to make it less likely they will get stuck.

For the H-Bridge driver, we put that on another breadboard which fits nicely along the side of the housing.



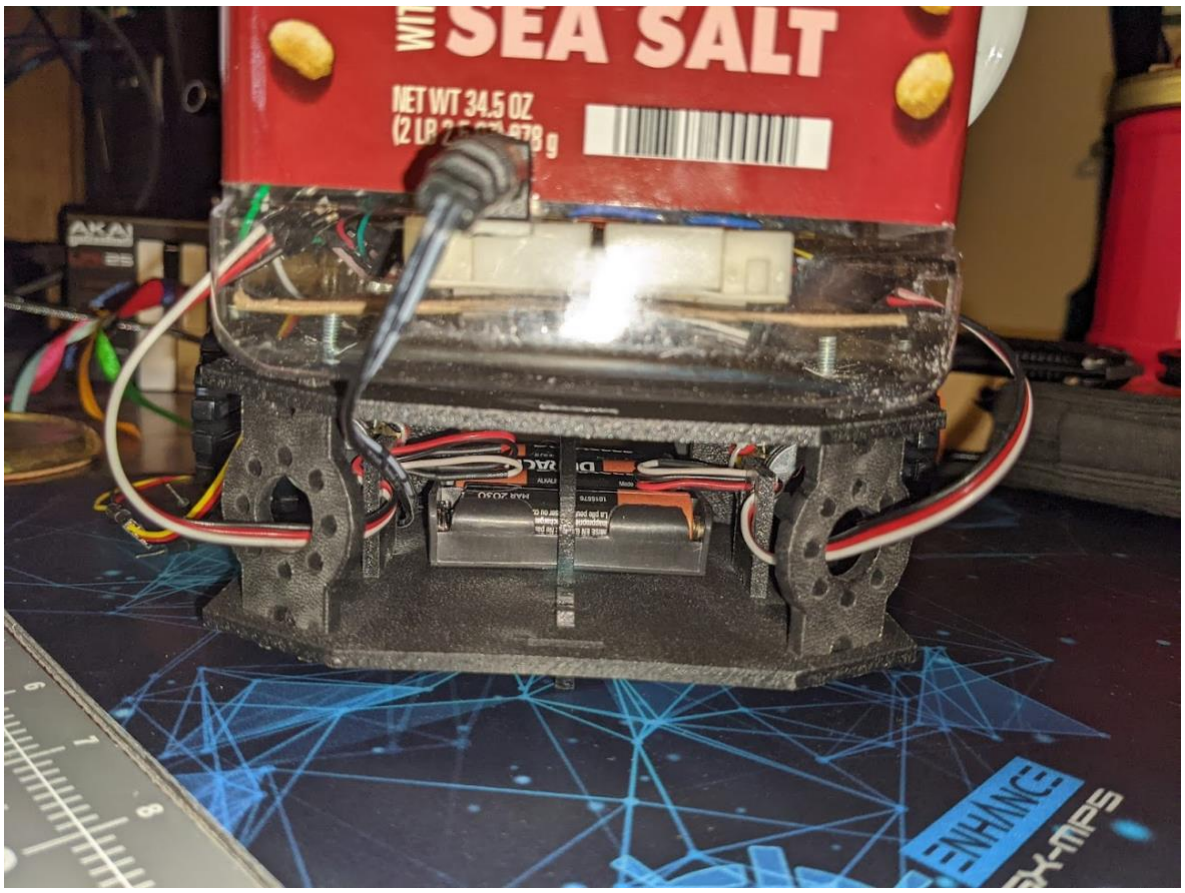
The speaker can be mounted to the breadboard just above the H-Bridge. Not all the parts can fit in the same row, so you will have to wire things to a different row to get them to fit. The diagram for how the speaker should be wired is below. The wire from the end of the resistor will go to the Mbed for the control signal.

Once the H-Bridge and speaker are wired up, you can put the breadboard inside the housing where it will sit. There are a few more holes to cut on the peanut housing container. 1) On the bottom of the peanut housing for the encoders to fit in for both sides. 2) One along the top of the pi on the other side to hook up power later. 3) One so the servo motor wires can fit through, as it will be easier to disconnect and reconnect it outside the housing later instead of trying to reach inside to connect it. 4) And another on the front so we can program the mbed.



The external 5V 4xAA battery pack can be attached to the bottom of the device. The shadow robot already has a spot made for this.

WARNING: During final operation the Mbed will be powered by the external 5V on pin VIN. If you connect the Mbed to a PC via USB while this is connected you could possible damage the Mbed. Recommend to leave VIN disconnected while programing the Mbed, or to ensure the external plug is disconnected.


SEA SALT
NET WT 34.5 OZ
AKAI