



# HalloWing Flapping Bat

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<https://learn.adafruit.com/hallowing-flapping-bat>

Last updated on 2024-06-03 03:14:56 PM EDT

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# Overview

Twinkle, twinkle, little bat! How I wonder what you're at!  
Up above the world you fly, Like a teatray in the sky.

The Mad Hatter  
Alice in Wonderland by Lewis Carrol

Make a spooky bat out of chipboard and decorate it with your best Halloween colors, sparkles, and ribbons. A little hot glue and crafting, and you're ready to hang it above your door, where unwary passers-by will brush past and trigger your bats wings to flap up and down, scaring them out of their pants!

You don't need a fancy motion sensor to trigger this halloween effect. The bat wings are triggered by a strand of conductive thread tied to the Hallowing's onboard capacitive touch sensor. Anyone who comes in contact with the secret dangling thread will cause the bat to leap into motion.

The Hallowing board is the spookiest, creepiest, scariest microcontroller around. Its skull face and winking OLED eye are sure to frighten even the bravest of makers when you program it to go Bump in the Night.



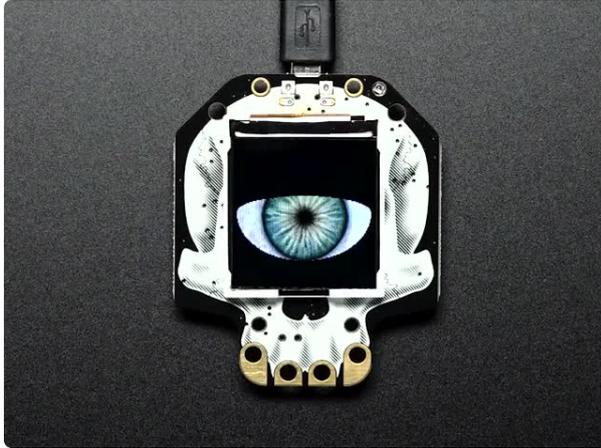
## Difficulty Level

This is a very easy beginner project. There is no soldering required - all the parts just plug in or tie onto one another.

The bat shape is made from light chipboard, and can be cut out with a Cricut or Silhouette cutting machine or with scissors or a utility knife and a little patience. Final assembly makes use of a hot glue gun.

The software for this project is also very easy to install - just drag and drop the file onto the Hallowing and you're ready to go.

## Parts



### [Adafruit HalloWing MO Express](https://www.adafruit.com/product/3900)

This is Hallowing..this is Hallowing...  
Hallowing! Hallowing! Are you the kind of person who doesn't...

<https://www.adafruit.com/product/3900>



### [Micro Servo with 3-pin JST PH 2mm Cable - TowerPro SG92R](https://www.adafruit.com/product/4326)

This tiny little servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds you're used to but smaller. You can use any...

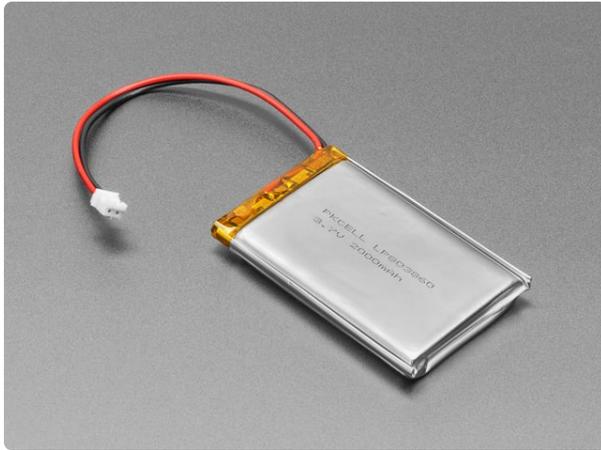
<https://www.adafruit.com/product/4326>



### [Stainless Thin Conductive Thread - 2 ply - 23 meter/76 ft](https://www.adafruit.com/product/640)

After months of searching, we finally have what we consider to be the ultimate conductive thread. It's thin, strong, smooth, and made completely of 316L stainless steel. Once you...

<https://www.adafruit.com/product/640>



### Lithium Ion Battery - 3.7V 2000mAh

Lithium-ion polymer (also known as 'lipo' or 'lipoly') batteries are thin, light, and powerful. The output ranges from 4.2V when completely charged to 3.7V. This...  
<https://www.adafruit.com/product/2011>



### USB cable - USB A to Micro-B

This here is your standard A to micro-B USB cable, for USB 1.1 or 2.0. Perfect for connecting a PC to your Metro, Feather, Raspberry Pi or other dev-board or...  
<https://www.adafruit.com/product/592>

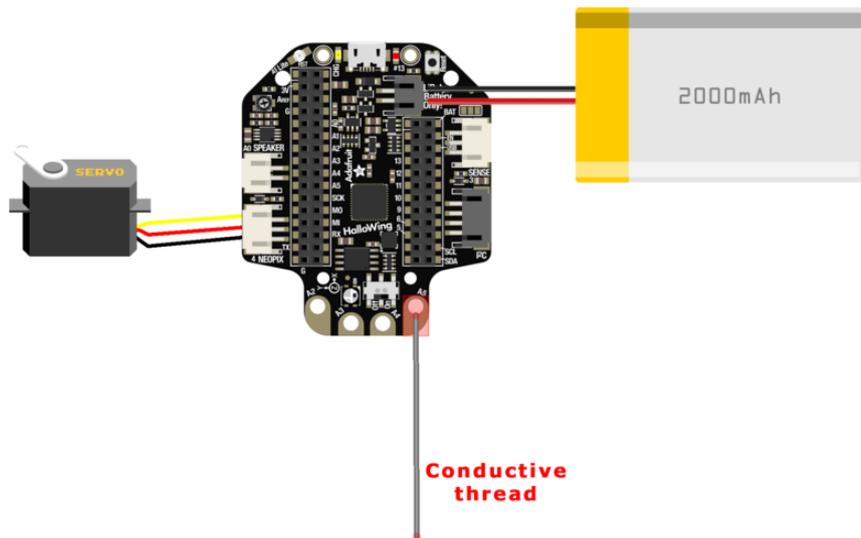
## Additional Materials Needed

- 12"x24" sheet of light chipboard - I'm using [store bought \(https://adafru.it/Ofk\)](https://adafru.it/Ofk), but you can also use a cereal box that's been sliced at the corner and unfolded so it's flat
- About 18" of thin, stiff wire - I'm using 22g steel wire
- Hot glue gun
- Glitter, paint, and sparkles for decorating
- Fishing line or string for hanging your bat
- Utility knife or vinyl cutting machine
- Small Rubber bands
- A small screwdriver to assemble the servo

If you're using a Cricut or Silhouette to cut your bat shape, you'll need a 12x24 firm grip cutting mat and some blue painter's tape.

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# Wiring Diagram



Plug your servo into **D4**, the 3-pin port on the left as you're looking at the back of the board. Plug the battery in to the 2-pin connector on the upper right.

Tie your conductive thread securely to the pin on the far right as you're looking at the back of the board - this is capacitive touch pad #1.

This uses a good sized battery, so your bat will run for a long while. However, you'll also need to keep a USB cable plugged into the HalloWing, or the trigger won't work. The other end of the cable doesn't need to be plugged in, since there is an onboard battery, but you can of course plug it in if you'd like, and your bat will run indefinitely! If you are planning to hang it while plugged in, you don't necessarily need to have the battery too - it will run fine from USB power alone.

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## Software

Download the UF2 file linked below. Turn on Hallowing and connect a USB cable to your computer. Double-click Hallowing's reset button, wait for the **HALLOWBOOT** drive to appear, then drag the UF2 file to this drive. After a few seconds, the code should be finished transferring and will run.

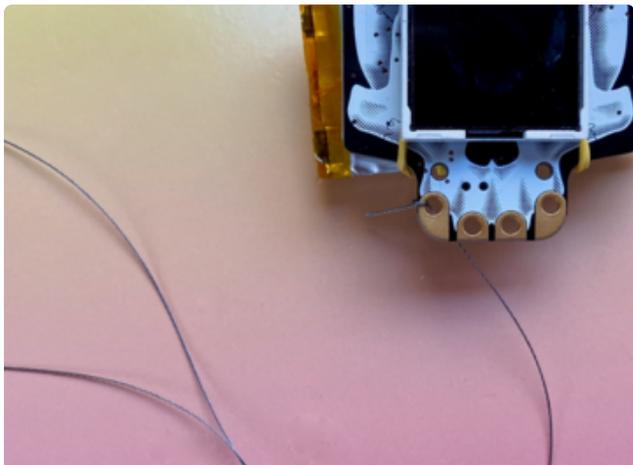
**This will overwrite CircuitPython if it's currently installed on your board** (but your CircuitPython code and any libraries are safe).

You can restore CircuitPython easily by [following the directions here \(https://adafruit.it/CmJ\)](https://adafruit.it/CmJ).

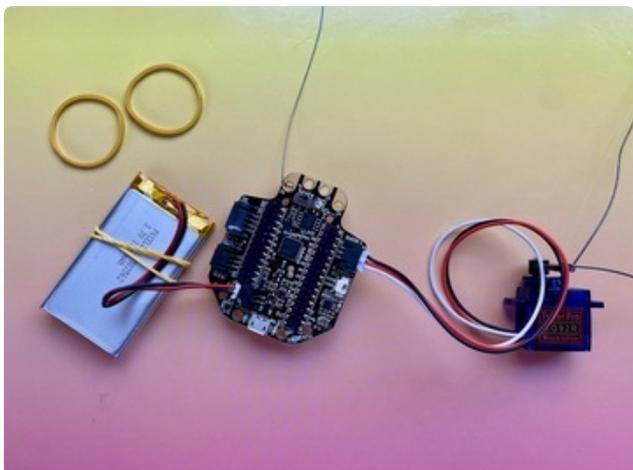
## Electronics Assembly



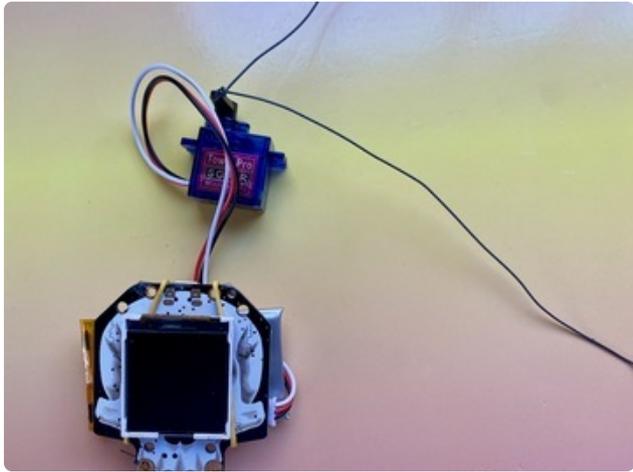
Put a rubber band around your battery wires as shown. This will keep the wires from pulling on the delicate connections at the top of the battery. This is good practice whenever you're using one of these lipoly batteries - it will save you a lot of heartache to cultivate this habit!



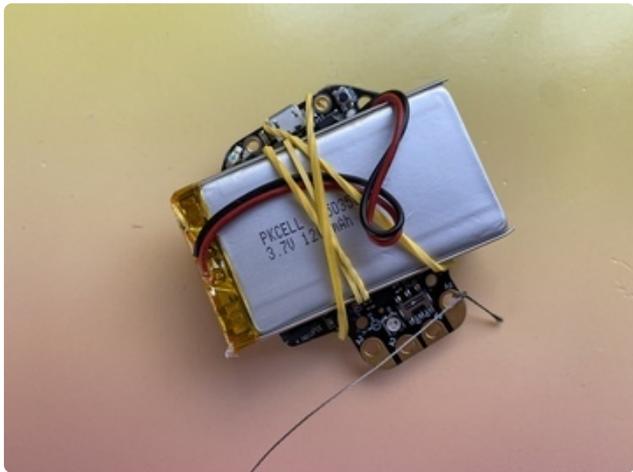
Cut a long piece of conductive thread and tie it securely to capacitive touch pad 1. This is the tooth on the left as you're looking at the face of the board.



Plug your battery into the JST port on the back of the Hallowing and the servo into port D4. If you've already uploaded your code, touch the conductive thread to make the servo react.



Screw the single-sided servo horn loosely onto the top of the servo with the included screw. Thread your thin, stiff wire through the outermost hole in the servo horn and give it a twist so it stays put.



Unplug your servo for now - we'll plug it back in through the chipboard later on.

Use a couple small rubber bands to secure your battery to the back of the HalloWing. Be sure not to block the on/off switch on the back of the board or the USB port at the top. I found it worked best to secure it perpendicular to the HalloWing.

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## Bat Body

### Using a Cutting Machine

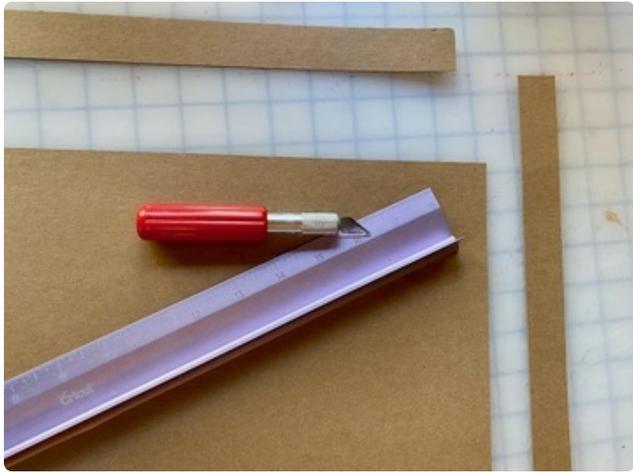
If you want to use your Cricut or Silhouette cutting machine, download the file below. It has all three pieces sized correctly to be cut on a piece of 12x24 light chipboard.

[cricut\\_bat2.png.zip](#)

<https://adafru.it/Oe2>

Upload the file and double check to be sure it's sized correctly in your cutting machine's design software. It should be about 9" wide and 22" high.

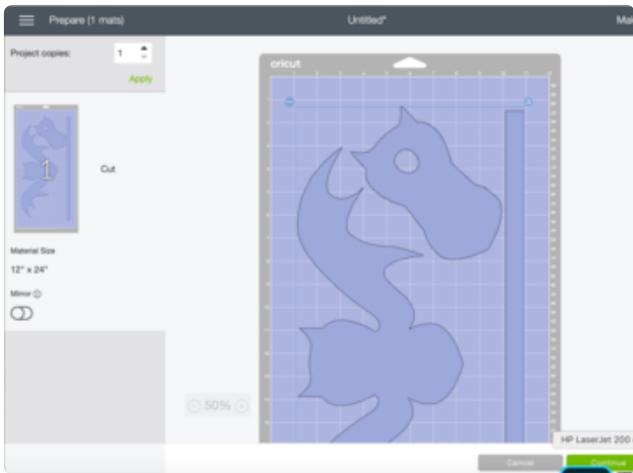
On my Cricut, I selected "Light Chipboard" as the material.



Heavy materials like chipboard can be tricky to cut since they don't like to stay stuck to your cutting mat. A couple tips for greater success:



Cut about 1" off both edges of your chipboard so it's 11x23. Press it down into the center of your mat so there's about 1/2 of space on all sides. Put a piece of blue painter's tape along the edges of the chipboard and into that 1/2" gutter you just made. This will really help keep it from moving.



Since you trimmed the chipboard, be sure to center the design in the software or you may end up misaligned and cut off part of your design.

## Cutting By Hand

Download the patterns below. These are sized to print on letter-sized paper. Print two copies of part 1 to get a complete pattern.

Cut the patterns out with scissors or a utility knife and trace around them onto your chipboard. Cut the chipboard on the cut lines.

bat\_print.zip

<https://adafru.it/Oe3>



With either method, you should end up with three pieces -- the bat body with wings, the front body without wings, and a rectangle spacer.

Now it's time to decorate your bat! Use spray paint, glitter, sequins, pipe cleaners, candy corn, or any other spooky Halloweeny craft materials to make your bat unique.

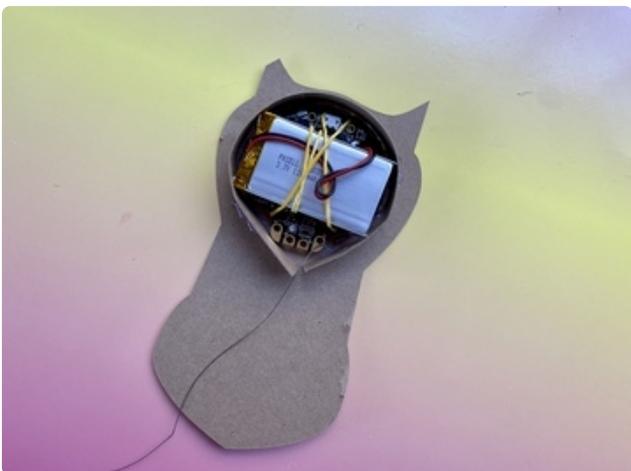
## Final Assembly

### Assemble the Body



With your servo unplugged, place your HalloWing and battery face down on the front body (the one without wings) and center it so the screen shows through the hole. Draw a line around the electronics with a sharpie.

Take your chipboard rectangle and glue it along this line with hot glue as shown. Check to make sure your HalloWing assembly fits nicely inside and is aligned with the window. If you need to redo it, a little 99% alcohol will help get the glue off.



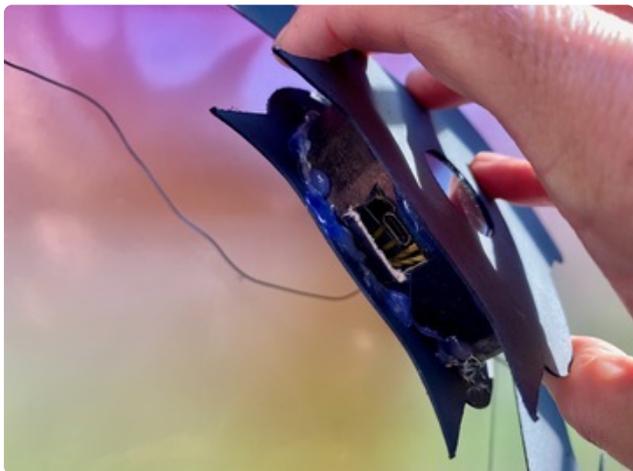
You can let the thread dangle through the opening like I have it here, or thread it through the front hole so it's dangling directly below the eye.



Thread your servo wire through the hole in the bat wing piece. Your servo will live on the outside of the bat on the back. Plug the servo into the HalloWing and push most of the wire inside the enclosure.

Line up the servo horn with the center of the bat. This means your servo will look like it's really off-center, but the part that matters is the bit that turns, so make sure that's as centered as you can get it.

Use a lot of hot glue to secure the servo to the outside of the wing piece. Align it "sideways" as shown, so the servo horn moves up and down.



Use more hot glue to secure the wing piece to the front piece along the edge of the cardboard rectangle. The HalloWing assembly should be facing front, with the screen inside the window, and the servo will be on the back of the bat (not between the pieces).

## Connect the Wings to the Servo



It helps to give a little crease where the wings connect to the body to allow lots of motion.

Thread the ends of the wires through the small holes in the wings. If you cut by hand, you may have missed these holes! That's ok, you can make them now. Exact placement isn't crucial. Use your knife or an awl to cut little holes in the wings and poke the wires through as shown.

You may need to loosen the screw and adjust the placement of the servo horn so it moves up and down like a light switch without hitting the bat body. Once you've got the alignment right, tighten the screw.



Adjust the wires until you're happy with the servo motion.

## Decorate & Hang Your Bat

Use a paint pen, glitter glue, jewels, pipe cleaners, or anything you fancy to decorate your bat.

Tie a piece of string or fishing line around the head piece. I found that poking one end through the on/off switch hole helped me adjust the angle of the hang to get it just right.

**Plug in a USB cable through your USB slot and thread it up along your string.** The conductive thread trigger will not work as well if you unplug the cable completely -- even if the other end isn't plugged into anything at all.

Why is this?

The capacitive touch pad on the HalloWing is looking for a difference in resistance. When you touch the thread, your body makes a slight electrical connection to the wire, which the HalloWing can read. The HalloWing compares this value to a non-touched value, and if there's enough of a difference, it knows to trigger the servo.

If the bat is hanging in mid-air, there is no physical connection to the ground, so the HalloWing can't get a good baseline reading. Keeping the USB cable plugged in adds about a meter of wire to act as a ground connection. So even if the cable is not plugged into an outlet, that extra meter of wire makes all the difference in getting the capacitive touch pad to work.

Capacitive touch works better when there's a little more ground wire involved in the project. The wires inside the USB cable will help ground the bat so there's more of a change when you touch the thread -- even if the other end of the cable is not plugged into anything at all.

Enjoy scaring all the trick-or-treaters this Halloween!

