Zelda: Breath of the Wild – 3D Printed Bladesaw

Created by Ruiz Brothers

https://learn.adafruit.com/bladesaw

Last updated on 2023-08-29 03:51:31 PM EDT
# Table of Contents

## Overview
- Make Link’s Bladesaw!
- Parts
- 3D Parts
- Prerequisite Guides
- Parts

## Circuit Diagram
- Connections:

## MakeCode
- MakeCode for CRICKIT and Circuit Playground Express
- Setup Circuit Playground Express for MakeCode
- Install CRICKIT Extension for MakeCode
- Upload and Test Code
- WebUSB

## 3D Printing
- What If I Don’t Have A 3D Printer?
- Edit Design
- Slice Settings
- Blade
- Handle
- Pommel
- Design Source Files
- Supports
- Tapping Standoffs
- Chain

## Assemble
- Assemble Right Blade
- Battery Slide Switch
- Crickit + CPX + Speaker
- Slide Switch Mount
- Measure UV NeoPixel Strip
- Drive Wheel Strip
- Tin Strip
- Female Jumpers
- Connect to Crickit
- Solder Wheel Strip
- Side NeoPixel Strip
- Two Sided Strip
- Side Light Strip Jumpers
- Prepare Handle Side Light NeoPixels
- Single NeoPixel
- Attach to Crickit
- Handle Strip Mount
- Motor Prep
- Jumpers
- Mount Motor
- Attach Gear
- Motor Cover
• Left Blade Assembly
• Wheel Assembly
• Button Assembly
• Button mount
• Button jumpers
• USB mount
• Connect buttons and USB
• Bearings
• Teeth
•
• Wheel Attachment
• Left Cover
• Closing Halves
• Fit teeth over Wheel
•
• Fasten
• Motor Nuts
• Greeblies
• Circuit Playground Reset button
• Handle Assembly
• Dowel
• Pommel Assembly
Overview

Make Link's Bladesaw!

In this project we built the ancient bladesaw from Zelda, Breath of the Wild.

This fully 3d printed prop has a moving chainsaw with tons of NeoPixel LEDs.

It has lots of detail making this one of our most intricate builds. It's pretty massive – over 40 inches in length with over 200 neopixels.
It is a pretty fun weapon that can take down guardians by just swinging it around.

So we wanted to make this bladesaw look and feel like it’s straight out of game.

We designed the bladesaw in Fusion 360 using reference images from the game.

All of the parts are printed individually and secured together with hardware.

Parts

The Adafruit Cricket and Circuit Playground Express is a fully loaded robotics platform that will drive all of the components.

The PCB is secured to the built-in standoffs near the center of the bladesaw.

There’s so many things the Adafruit CRICKIT can do. We could take this much further with servos and sensors like the accelerometer or even capacitive touch.
3D Parts

The main parts were 3D printed using an Ultimaker S5.

Parts are dual extruded to make built-in light diffusion so details printed in translucent filament will illuminate.

We used Ninjaflex to create a flexible sleeve for the handle.

The design files are free to download and the source file is open for remixing.

We used glitter infused filament to give the parts a bit of texture.

Prerequisite Guides

There's resources in these guides that go beyond what's covered in this tutorial. MakeCode guide is all about setting up your Circuit Playground Express board. The Circuit Playground Express introduction guide walks you through all of the pinouts, sensors and everything you need to know.

- [MakeCode for Circuit Playground Express](#)
- [Introducing Circuit Playground Express](#)
- [Introducing CRICKIT](#)

Parts

You can find the list of all parts used to make this project linked below!
Adafruit CRICKIT for Circuit Playground Express
Sometimes we wonder if robotics engineers ever watch movies. If they did, they'd know that making robots into servants always ends up in a robot rebellion. Why even go down that...
https://www.adafruit.com/product/3093

Circuit Playground Express
Circuit Playground Express is the next step towards a perfect introduction to electronics and programming. We've taken the original Circuit Playground Classic and...
https://www.adafruit.com/product/3333

TT Motor All-Metal Gearbox - 1:90 Gear Ratio
These durable (but affordable!) gearbox motors (also known as 'TT' motors) are an easy, low-cost way to get your projects moving. This is a TT DC All-Metal Gearbox...
https://www.adafruit.com/product/3802

Adafruit NeoPixel UV LED Strip with 32 LED/m
What new iteration of NeoPixel strip is this? Roll out the black light and disco ball! It's an Adafruit...
https://www.adafruit.com/product/3851
Adafruit NeoPixel LED Side Light Strip - Black 60 LED
Fancy new side light LED strips are a great alternative for folks who have loved and used Adafruit LED strips for a few years but want gorgeous, glowy light emitting at...
https://www.adafruit.com/product/3636

3 x AA Battery Holder with 2.1mm Plug
Here's another addition to our growing family of AA battery holders. A holder for three (3) AA batteries!...
https://www.adafruit.com/product/3842

Metal Ball Tactile Button (6mm) x 10 pack
Add some steely elegance to your project with these Metal Ball Tactile Buttons. They've got a nice industrial shine to them along with a light blue...
https://www.adafruit.com/product/3347

Breadboard-friendly SPDT Slide Switch
These nice switches are perfect for use with breadboard and perfboard projects. They have 0.1” spacing and snap in nicely into a solderless breadboard. They're easy to switch...
https://www.adafruit.com/product/805
Panel Mount Extension USB Cable - Micro B Male to Micro B Female
Check out this handy MicroUSB extension cable, which will make it easy for you to enclose a device that has a B type (micro USB host) port. Great if you need to extend the USB...
https://www.adafruit.com/product/3258

Thin Plastic Speaker w/Wires - 8 ohm 0.25W
Listen up! This 1.5" diameter speaker cone is the perfect addition to any audio project where you need an $8\Omega$ impedance and are using 0.25W of power. The speakers are rated...
https://www.adafruit.com/product/1891

12mm Coin Cell Breakout w/ On-Off Switch
Simple but effective - this breakout board has a CR1220 coin cell battery holder soldered on, an on/off switch and 0.1" pitch breakout pins for easy connecting. Great for powering...
https://www.adafruit.com/product/1867

Diffused Red 10mm LED (25 pack)
Need some big indicators? We are big fans of these huge diffused red LEDs. They are fairly bright so they can be seen in daytime, and from any angle. They go easily into a breadboard...
https://www.adafruit.com/product/845
CR1220 12mm Diameter - 3V Lithium Coin Cell Battery
These are the highest quality & capacity batteries, the same as shipped with the iCufflinks, iNecklace, Datalogging and GPS Shields, GPS HAT, etc. One battery per order...
https://www.adafruit.com/product/380

Breadboard-friendly RGB Smart NeoPixel - Pack of 4
This is the easiest way possible to add small, bright RGB pixels to your project. We took the same technology from our Flora NeoPixels and made them breadboard friendly, with two rows...
https://www.adafruit.com/product/1312

Premium Male/Male Jumper Wires - 40 x 6" (150mm)
Handy for making wire harnesses or jumpering between headers on PCB's. These premium jumper wires are 6" (150mm) long and come in a 'strip' of 40 (4 pieces of each of...
https://www.adafruit.com/product/758

Premium Female/Female Jumper Wires - 20 x 3" (75mm)
These female-female premium jumper wires are handy for making wire harnesses or jumpering between headers on PCB's. They're 3" (75mm) long and come in a...
https://www.adafruit.com/product/1951
<table>
<thead>
<tr>
<th>Blade parts</th>
<th><a href="http://www.albanycountyfasteners.com/2-5-MM-x-45-Phillips-Flat-Head-Machine-Screw-p/1011-1002.htm">www.albanycountyfasteners.com/2-5-MM-x-45-Phillips-Flat-Head-Machine-Screw-p/1011-1002.htm</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x <strong>M3x25mm</strong> TT Motor</td>
<td><a href="https://www.albanycountyfasteners.com/3-MM-x-5-Phillips-Flat-Head-Machine-Screw-p/1011-1006.htm">https://www.albanycountyfasteners.com/3-MM-x-5-Phillips-Flat-Head-Machine-Screw-p/1011-1006.htm</a></td>
</tr>
<tr>
<td>5 x <strong>M2.5x5mm</strong> Crickit and Wheel</td>
<td><a href="https://www.albanycountyfasteners.com/2-5-MM-x-45-Phillips-Flat-Head-Machine-Screw-p/1011-1002.htm">https://www.albanycountyfasteners.com/2-5-MM-x-45-Phillips-Flat-Head-Machine-Screw-p/1011-1002.htm</a></td>
</tr>
<tr>
<td>7 x <strong>10x15x4mm Bearings</strong></td>
<td><a href="https://www.amazon.com/gp/product/B00RWGXNVI/">https://www.amazon.com/gp/product/B00RWGXNVI/</a></td>
</tr>
<tr>
<td>10pcs. 10x15x4mm Precision Ball Bearings Steel ABEC 1 Rubber Seals</td>
<td></td>
</tr>
<tr>
<td>1 x <strong>48-in L x 0.875-in (7/8 x 48 in)</strong></td>
<td><a href="https://www.lowes.com/pd/Madison-Mill-Round-Wood-Poplar-Dowel-Actual-48-in-L-x-0-875-in-dia/3040773">https://www.lowes.com/pd/Madison-Mill-Round-Wood-Poplar-Dowel-Actual-48-in-L-x-0-875-in-dia/3040773</a></td>
</tr>
<tr>
<td>48-in L x 0.875-in (7/8 x 48 in) (we'll need 347mm)</td>
<td></td>
</tr>
</tbody>
</table>

**Circuit Diagram**

Take a moment to review the components in the circuit diagram. This illustration is meant for referencing wired connections - The length of wire, position and size of components are not exact.

![Circuit Diagram](image)

**Connections:**

Motor Terminal:
Black and Red wires will connect to the number 2 labeled terminals.

The 3xAAA battery case connects to the Power input on the Crickit.

UV NeoPixel Strip:

The UV NeoPixel strip connects to the NeoPixel terminal. Din on the NeoPixel strip connects to the arrow icon on the terminal on the Crickit on the Crickit. GND connects to GND and 5V to 5V.

Side Light LED Strips

The Handle and End Side Light NeoPixel Strips connect to the A2 and A3 pads on the Circuit Playground Express. Both will share the 3v and GND pads. A single Breadboard NeoPixel will connect to the end of the Handle Strip.

Buttons

Two Buttons can connect to the A6 and A7 pads on the Circuit Playground Express. Both will share the second Ground pad.

MakeCode

MakeCode for CRICKIT and Circuit Playground Express

MakeCode is this programming editor that runs in the Google Chrome web browser. It’s has an intuitive interface that’s both block based and text editor.

It works with Adafruit's CRICKIT and Circuit Playground Express so you can make interactive projects with the on-board sensors and components. You can drag & drop blocks to make interactive programs using lights and sounds without having to solder or learning a new syntax.

You can alternatively upload code directly to the Circuit Playground Express with WebUSB, see the steps to do so here.
Open the Blade Saw code in MakeCode

Bladesaw_boot_files.zip

Setup Circuit Playground Express for MakeCode

To get started, we’ll need to head over to the Adafruit MakeCode website and follow the steps below.

1. Plug in your Circuit Playground Express with a USB Cable
2. Press the RESET button. Green light means you’re ready to MakeCode
3. Download the UF2 file and drop it onto CPLAYBOOT.
Install CRICKIT Extension for MakeCode

On the MakeCode.Adafruit.Com site, click on New Project. In the list of blocks, select ADVANCED and then EXTENSIONS. Click on the Crickit block that shows up and install Crickit support! You will now have a new CRICKIT bin of blocks you can use!

Continue on to learn how to use these blocks. Read the full guide here for more info.

Upload and Test Code

Once you have your CPX setup with the MakeCode UF2, try testing it out by uploading the code to the board. Click the link below to open up the program in MakeCode. Click on the pink edit icon near the top of the title to open the code. This will create a project in MakeCode and allow you to edit, modify and upload the code to the board.

WebUSB

Makecode can also pair with your Circuit Playground Express through a chrome web browser by following this page in our MakeCode guide.

Open the project here: https://makecode.com/_0xCWMphEz4F3

With WebUSB, the code edit will upload directly to the Circuit Playground Express without the need to drag and drop file onto it!
Follow the instruction to set up your board and you'll be able to quickly send code to Circuit Playground Express!

3D Printing

What If I Don't Have A 3D Printer?

Not to worry! You can use a 3D printing service such as [3DHubs](https://3dhubs.com) or [MakeXYZ](https://make.xyz) to have a local 3D printer operator 3D print and ship you parts to you. This is a great way to get your parts 3D printed by local makers. You could also try checking out your local Library or search for a Maker Space.

Download STLs from Thingiverse
Download STLs from Youmagine
Download STLs from Pinshape

Edit Design

The design is modeled in Autodesk Fusion 360 and available to edit. You can adjust the pieces to print by moving or adding construction planes to cut up the parts. You can modify the sketches or adjust features in the parametric timeline.

Edit Fusion 360 file

Slice Settings

Depending on your 3D printer, you may need to adjust the slice settings. We printed all of the parts on a Ultimaker S5. These parts were sliced with Ultimaker Cura.

- Nozzle: 0.8mm
- Extrusion Width: 0.77mm
- Layer Height: 0.3mm
- Infill: 20%
- Nozzle Temperature: 230c
- Heated Glass Bed: 60c
- Print Speed: 40mm/s
Blade

The blade is designed as a dual color print. This allows us to have built-in diffusion to minimize the amount of 3d parts required. We used Vertigo Galaxy () and Blue Translucent PLA (). The Vertigo Galaxy has a gold flakes that gives the sword a rustic look without the need to post process.

We used Blue Translucent PLA for the Blade Teeth and sword details because of its UV reactive qualities. The UV NeoPixel help to illuminate the whole Blade Saw!

Handle

The handle is printed in a NinjaFlex. It prints hollow so we can slip it over our wooden dowel to provide the textured design while make it comfortable to hold.

Pommel

The Pommel is also designed as a dual color print to allows us to diffuse the eye and mouth details on the design. The coin cell breakout is mounted inside to help illuminate it!
Design Source Files

The enclosure assembly was designed in Fusion 360. This can be downloaded in different formats like STEP, SAT and more. Electronic components like the board, displays, connectors and more can be downloaded from our Fusion 360 CAD parts github repo.

Supports

To accommodate design details, the blade parts will require supports. We used the same Translucent material as the details for the supports with a .4mm support Z distance to make it easy to remove.

Support material was used for creating the recessed panels.

A palette knife or a Spudger can get in between the layers and Flush Diagonal Cutters break apart the supports.
Tapping Standoffs

A tapping tool creates threads in the built-in standoffs for fastening hardware.

Two halves of the blade are joined together using long machine screws.
Chain

The 23 blades are printed in Blue Translucent PLA and illuminated by the UV NeoPixels. The individual links of 1.75mm filament that hinge together to form the chain.

Assemble

Assemble Right Blade

Two halves of the blade are joined together using M2.5x12mm long machine screws. We recommend using a long drill bit to make to long the screws to fasten as straight as possible.
Battery Slide Switch

To power this project, a slide switch is wired to the double “A” battery pack.

To start, we'll first modify our 3xAA battery holder and wire up an slide switch inline with the power.

First, we'll carefully cut one of the wires and then extend each side with two 87mm long wires. Next, we'll connect these two wires to each pin on our slide switch as shown in the picture.

Remember to add heat shrink to each wire connection and the slide switch pins, before soldering!

Crickit + CPX + Speaker

The Circuit Playground Express mounts on top of Crickit PCB with the included screws and standoffs. The assembled circuit is then secured with four M2.5x6mm long screws into the built-in standoffs near the center of the Blade Saw. The speaker can be press fitted into the circular holder.
Slide Switch Mount

The slide switch fits into the little holder with the actuator on the outside.

Battery packs can be mounted next to the PCB with two M2.5x6mm long screws.

Measure UV NeoPixel Strip

The bladesaw is lined with NeoPixel strips and wedged in between the standoffs. Measure from the start of one side to the opposite side of the translucent wall. Cut away the excess strip to reuse on the circular wall around the drive wheel.
Drive Wheel Strip

Position the UV NeoPixel so they are facing the inside of the drive wheel. This will help illuminate the inside of the wheel and blade teeth.
Tin Strip

Next we'll need to tin both ends of the longer strip and then the start of the smaller strip.

Female Jumpers

Now we can make it easier to detach the strips by soldering on female jumper cable to the three pads on the start of the long strip.
Connect to Crickit

Male to male jumper cables can now connect the longer strip to the NeoPixel terminal on the Crickit.

Solder Wheel Strip

The end of the longer UV strip will now connect the smaller strip we cut off. We used 150mm long male to male jumper wires to the end of the longer strip.

Once solder, we'll want to align the wires against the walls so they don't block light or create shadows.
Side NeoPixel Strip

Side Light NeoPixel strips are cut in half and then the second half is resoldered in the opposite direction to illuminate the other side of the blade.

Locate the middle of the strip. You'll notice that its actually two strips soldered together.

Use a hobby knife to cut into the silicone sheathing and then pull both sides apart. We'll heat up our soldering iron and then apply heat to the middle of the pads until they both desolder.
Two Sided Strip

Next we'll remove the male wires from the end of the strip. We can then cut off wires to reconnect the strips with one half facing up and the second side facing down.

Now we'll go ahead to solder short female jumper wires to the start of the strip.

Make sure to add heat shrink to protect the connections.
Side Light Strip Jumpers

Three 150mm long male to male jumper wire will connect the strip to the A3, 3v and GND pads on the Circuit Playground Express.

We'll first tin the A3, 3v and GND pads on the Circuit Playground Express and then use tweezers to carefully solder each jumper wire to each pad.

Prepare Handle Side Light NeoPixels

The section closest to the handle will require the same modification the Side Light NeoPixel strip. We'll desolder the middle section of the strip and then reconnect with the second half facing the opposite direction.
Single NeoPixel

A single Breadboard NeoPixel can be wired to the end of the strip and used to fill the circular section underneath the Crickit.

Attach to Crickit

We used sticky tac on the bottom of the breadboard NeoPixel to attach it to the bottom of Crickit, right around "C" letter and the screw head as shown in the picture.

Handle Strip Mount

Next we'll place the strips side to side, making sure both sides are facing the opposite direction, and then fit them so the strips follow the contour of the various design elements as shown.
Motor Prep

The TT motor will require some preparation before mount. First we'll remove the small plastic nub next to the shaft with our flush diagonal cutters. this will allow our printed gear to fully fit into the shaft.

Jumpers

Next we'll carefully tin each metal connections on the motor. Two short female jumpers are soldered to each.

Mount Motor

Align the mounting holes on the motor body to the screws mounts on the blade. Insert and fasten two M3x25mm long screws until the motor is fully seated.

Take note the screws will protrude through to the outer side of the print. We'll add screw nuts to fully secure it near the end of the build or right now to prevent any scuffing on your work surface.
Attach Gear

The printed gear fits into the motors shaft and secured with a M3x5mm long screw.

Motor Cover

Panels are fitted inside to provide support for the chain while it’s in motion. Slightly squeeze both sides and press fit into place at an angle.
Left Blade Assembly

Okay, half way there! The left side of the blade attaches with the same M2.5x12mm screws.

Wheel Assembly

The Drive wheel spins with the help of a a barring. We can press fit the barring on to the center standoff and then add the barring washer and M2.5mmx5mm screw on top to prevent it from detaching.
Button Assembly

The buttons will mount on the opposite side of the Circuit, so will use long jumper wire to make it easy to reattach if we need to debug.

We used 220mm long female jumper wires. To make connections easier, we combined the ground connection into one wire by creating our own "Y" wire.

Button mount
We can inserted the button into the built-in holders on the inside. Insert at an angle as you press the button, to press fit into place.

Next, we'll need to bend the legs around the back wall to secure them in place.

Button jumpers

210mm long male jumper wires will connect to A6, A7 and GND on the Circuit Playground Express.
USB mount

The Panel Mount USB Cable includes screws to fasten to. We'll mount it to the port opening on the side of the print.

Connect buttons and USB

We can go ahead and connect the male and female jumpers on the buttons from here.
**Bearings**

Ball bearings reduce friction and provide the teeth with a smooth surface. The standoffs for each will be tight if the standoff print thicker near the top. We can use a hobby knife, sand paper or deburring tool to help carefully shave the top edge.

**Teeth**

23 teeth make up the chain. It's made up of linkages that are connected with rivets made from bits of 1.75mm filament.

**Wheel Attachment**

The assembled drive wheel tightly press fits onto the center mount on the end of the left blade part.

**Left Cover**

An additional panel is fitted inside to provide support for the chain while it's in motion. The left side is shorter, so will need to use an adhesive to attach it.
Closing Halves

We can finally start to combine both sides! Bring both sides together and then tuck the excess button wires into the motor cover.

Fit teeth over Wheel

Insert the end of the blade at an angle with the drive wheel first. Align the chain on to the drive wheel as to close both side together.

Fasten

Check around the sides of the walls to make sure no strips are protruding, this will prevent the sides from attaching.

Will need ten M2.5x12mm to fast all of the sides together.

Don't use an impact driver as the screws will strip.
Motor Nuts

Now we can fasten our motor nuts if you haven't already.

Greeblies

Various embellishments are glued to the outside. You can also sticky tac them on to test out the positioning of each.
Circuit Playground Reset button

The left circle greeblie has a port opening to allow our actuator to reach into the print to activate the rest button on the Circuit Playground Express.

The reset button is used for flashing new firmware or when entering or exiting MakeCode code mode.
Handle Assembly

The Ninjaflex hilt fits of the tang, up against the shoulder. It has a tight fit, so will need to twist as we fit it into place.

Dowel

We'll measure and cut a 7/8th diameter dowel down to 347mm long.

Fit the dowel into the shoulder.

Don't try to attach the dowel first as the it will become more difficult to align handle into the hilt.
Lastly, we can assemble the pommel circuit. We used a 12mm coin cell break with the on and off switch. Solder a 10mm LED to the SW and GND pins from the back on the breakout as shown.

Two rails inside the of the pommel allow the breakout board to fit in place. Position the on and off switch on the end for easy reach and then slide the circuit into the pommel.

Fit the pommel over the handle to complete the build!