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Overview

In this project we'll show you how to bring creatures to life using magnetic filament and magnets, powered by a Circuit Playground Express and Crickit, Adafruit's robotics platform!

The enclosure houses the electronics and the models are printed in Magnetic PLA.

Adafruit's Crickit and Circuit Playground Express have everything you need to build a project with lights, sounds, and motor control.

These magnetic creatures come to life when placed close to the platform. Here a motor and magnet move the creatures around the platform. NeoPixel UV LED help illuminate the dual translucent material!

The print in place hinges bring these 3d printed creatures to life!
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 (https://adafru.it/wWd)
- Introducing Circuit Playground Express (https://adafru.it/adafruit-cpx)
- Introducing CRICKIT (https://adafru.it/BD7)

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 slaves 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
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

DC Motor in Micro Servo Body
This tiny DC Motor in Micro Servo Body is an interesting motor - it's the same size and shape as our micro servo but it isn't a servo. It's...
https://www.adafruit.com/product/2941

High-strength 'rare earth' magnet
Yow! These things are super powerful. 1/2" diameter, 3/16" thick discs, south side is marked with a red line. Great for use with your SpokePOV Kit. If you have an aluminium...
https://www.adafruit.com/product/9

Proto-pasta - 2.85mm Diameter - Magnetic Rustable Iron Filament
Pici up this filament today! It'd be Fusilli not to buy...
https://www.adafruit.com/product/3753
Proto-Pasta - 1.75mm Magnetic Iron Filament
Pici up this filament today! It'd be Fusilli not to buy this...
https://www.adafruit.com/product/2797

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<td>CIRCUIT PLAYGROUND BOLT-ON KIT</td>
<td><a href="https://www.adafruit.com/product/3816">https://www.adafruit.com/product/3816</a></td>
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## Circuit Diagram

This provides a visual reference for wiring of the components. They aren't true to scale, just meant to be used as reference. This diagrams was created using [Fritzing software](https://adafru.it/oEP).

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.
Connections:

DC in Servo Brody:

Connect your two motor wires to the Motor 1 connectors. For now it does not matter which color wire goes in which Motor 1 slot. We used Male to Male jumper wires (http://adafru.it/rf4) to connect to the Motor terminal on the Crickit, these were then connected to the Female connector on the DC motor in Servo Body.

UV NeoPixel Strip:

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

Code

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 a 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 (https://adafru.it/CLO).

Code

The code for this project only takes ten blocks! You can download the code by clicking the green button below.
Setup Circuit Playground Express for MakeCode

To get started, we'll need to head over to the Adafruit MakeCode (https://adafru.it/Bct) website and follow the steps below.

1. Plug in your Circuit Playground Express with a known good data+power 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.
4. If you see a flash drive named CIRCUITPY, press reset twice to get to the CPLA YBOOT drive.

Install CRICKIT Extension for MakeCode

On the MakeCode Adafruit (https://adafru.it/wmd) 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 (https://adafru.it/BKC).

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 green button above to open up the program in MakeCode. Click on the pink edit icon near the top of the title to open the code in the full editor. 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 (https://adafru.it/CLO).

Open the project: https://makecode.com/_4MAgJY56mgTx (https://adafru.it/Exy)

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

There are several pieces in this project which can be made with a 3D printer.

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

Not to worry! You can use a 3D printing service, such as a local 3D printer operator, to 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.

![Image of 3D printed parts]

**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 CPX + Motor Mounts**
https://adafruit.it/Exz

**Edit Case**
https://adafruit.it/ExA

**Slice Settings**

Depending on your 3D printer, you may need to adjust the slice settings. We printed all of the parts on an [Inventor II 3D Printer](https://adafruit.it/CF5). These parts were sliced with FlashPrint.

- Nozzle: 0.4mm
- Extrusion Width: 0.4mm
- Layer Height: 0.2mm
- Infill: 20%
- Nozzle Temperature: 210c
- Print Speed: 60mm/s
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 (https://adafru.it/AW8).

Print Creatures

We used Magnetic Iron Filament to print our creatures. Objects with print in place hinges that move side to side vertically, maneuver the best around the platform. You can find download links to the models we used in this project below.

Dual Extrusion

Dual extrusion is not required, but if you can, we recommend printing the "head" and "tail" parts of objects in Iron. Translucent material is UV reactive and makes an excellent second material choice.

Fish Fossilz by Murray Clark: https://www.thingiverse.com/thing:1276095 (https://adafru.it/Eyq)

Mini Octopus by Javi Rodríguez: https://www.thingiverse.com/thing:3495390 (https://adafru.it/Eyr)

Flexible Starfish by Yong Joo Kim : https://www.thingiverse.com/thing:3258092 (https://adafru.it/Eys)
Assembly

CPX mounts
First we'll assemble the included standoff kit to the Circuit Playground Express.

The 3D Printed Servo Mount attaches to the Circuit Playground Express. Align the cutaway over the JST port.

Use two M3 6mm long screws to secure the Servo mount to the Circuit Playground Express.
Mount to Crickit
Now we can go ahead and secure the Circuit Playground Express to the Crickit (https://adafru.it/CKF). Align the standoffs attached to the CPX to the six pads on the Crickit and secure with the included screws.

Connect wires
The UV NeoPixel strip connects to the labeled terminal on the Crickit. We removed the connector on the strip, tinned the wires with solder and fastened each connection on the NeoPixel terminal.

We can easily attach the DC Motor in Servo Body by connecting male jumper wires to the female connector on the motor.
Servo Holder
The printed Servo Holder will attach to the printed Servo Mount on the Circuit Playground via (4) M3 5mm standoffs.

Align the motor cable to the cutaway and press fit the motor into the holder. Now we can male jumper wires to the female connector on the motor.
Servo Horn
Press fit the horn onto the servos shaft. You can secure it further with one of the include servo horn screws.

Glue Magnets
Now we can attach magnets to each side of the horn. We used hot glue to adhere the magnets to each side of the horn attachment. Glue each one at a time.

Mount Crickit
Next we can move on to mounting the Crickit assembly into the printed case. Align the power barrel to the circular cutout on the case and secure with four M2x5mm or M3x5mm screws.

USB panel mount
We extended the USB port to the outside the case with a USB panel mount cable. Align the female connection to the screw holes on the inside of the case to secure. Use the included screws and fasten the connector to the case.

Mount NeoPixel Strip
Finally, we can wrap the UV NeoPixel strip inside the case with the LEDs facing the inside – This will create nice illumination.
Lid
The lid snap fits to the nubs along the inside of the case. Align the small nubs on the lid with the nubs on the case and press at an angle. Apply force to the opposite side to press fit into place.

Rubber feet
We used four of these rubber feet to prevent the case from sliding. Peel the backing off and press on to the corners of the case to help stabilize the case.

Adding Liquid and Effects

We found a nice glass jar at local arts/craft hobby store. Try to use a container with a flat bottom – This will keep the distance low between the magnets and the models.
Tonic water with quinine is UV fluorescent so it makes a real nice glow with the UV NeoPixel strip. Fill your container about half full. Perhaps experiment with different "add-ons" like glycerol, UV pigments and glitter to make swirling effects and add texture!

More Project Ideas

Check out the following tutorials for more ideas and inspiration. Make something cool you want to share with us? Please post, share and join our LIVE Show & Tell show (https://adafruit.it/ExB), every Wednesday @ 7:30PM ET.

- Made Science Test Tube Rack (https://adafruit.it/ExC)
- LED Glowing Slime (https://adafruit.it/ExD)
- HalloWing Magic 9 Ball (https://adafruit.it/ExE)
- Alohamora Bottle (https://adafruit.it/ExF)