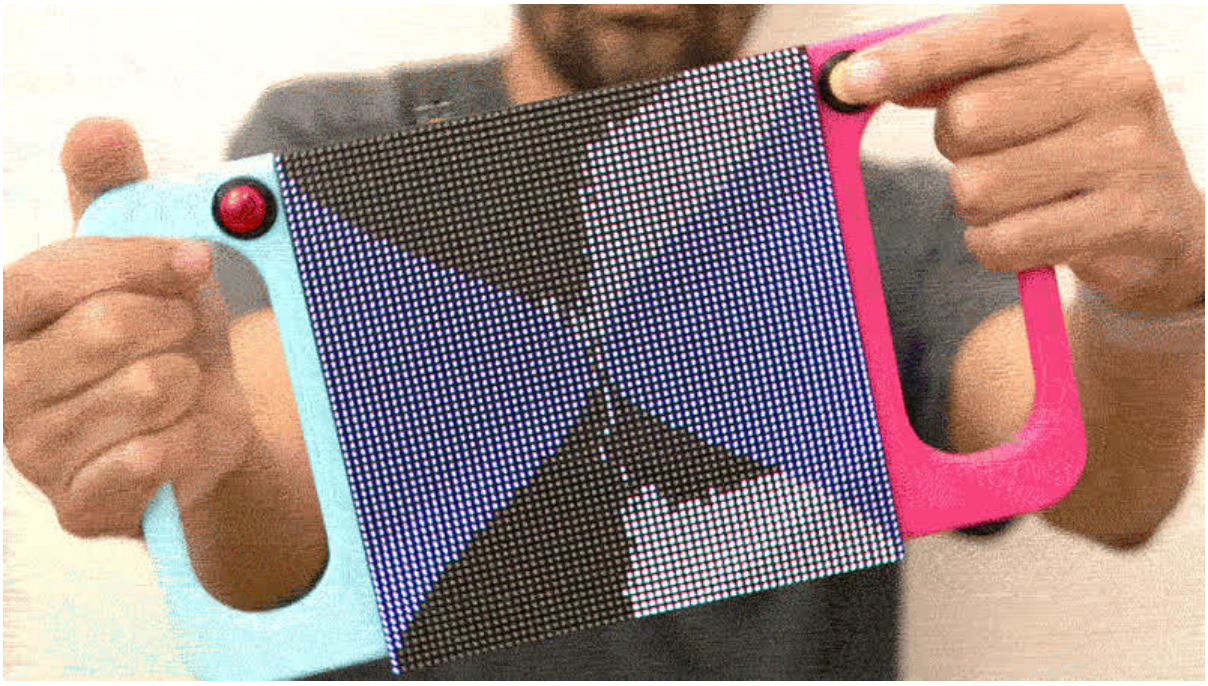
Raspberry Pi LED Matrix Sand Toy

Created by Ruiz Brothers



https://learn.adafruit.com/matrix-led-sand

Last updated on 2024-03-08 02:57:39 PM EST

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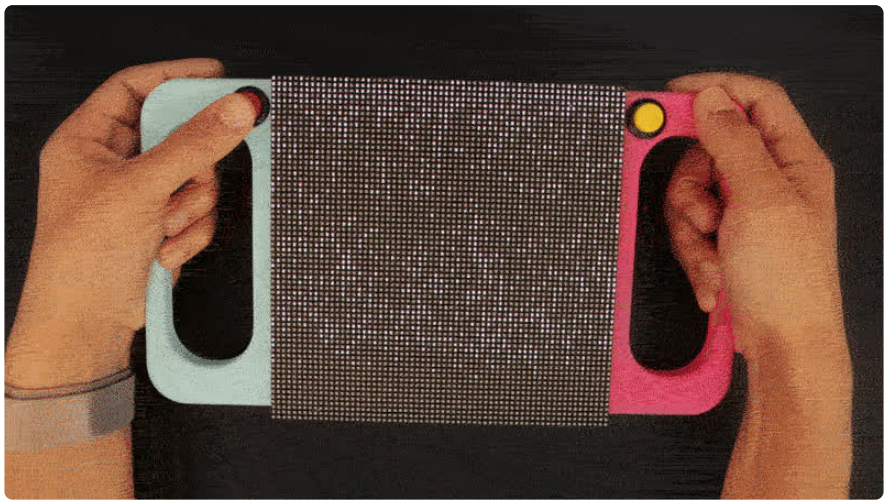
Overview

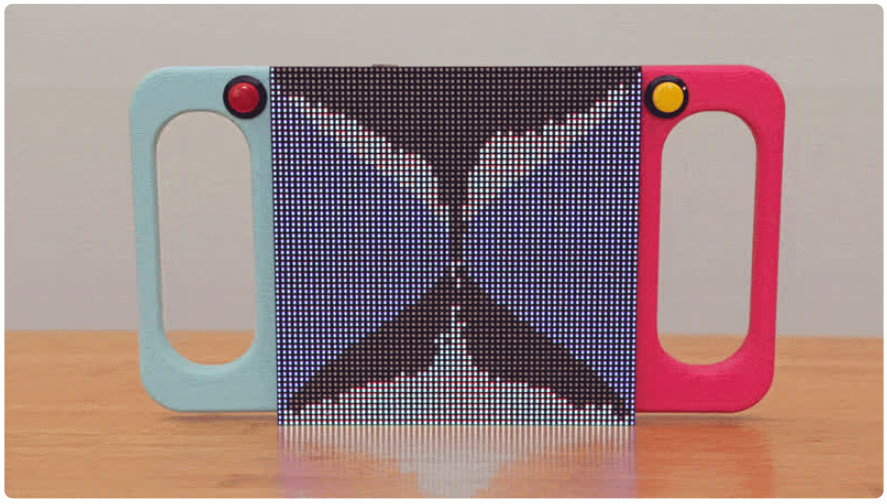


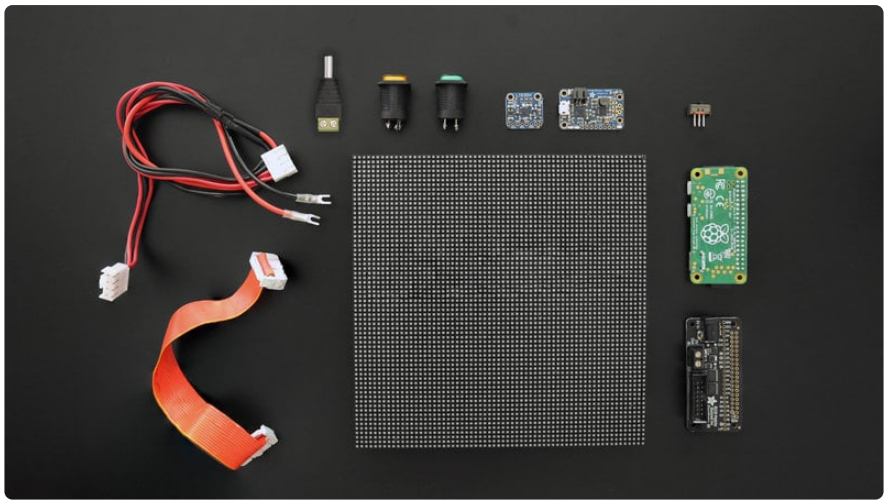
Simulated LED Sand Physics!

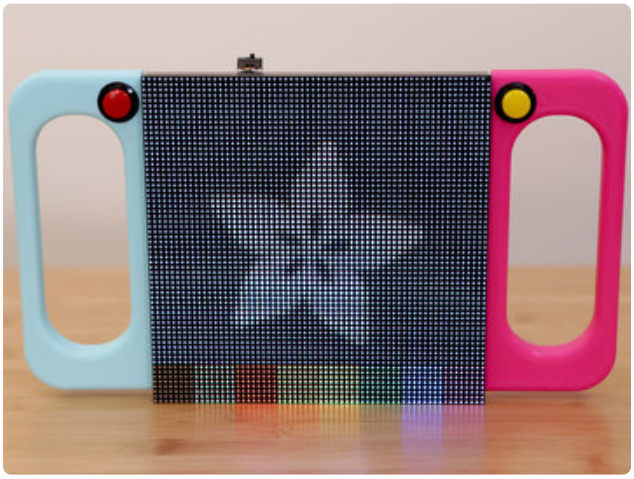
These LEDs interact with motion and looks like they're affect by gravity. An Adafruit LED matrix displays the LEDs as little grains of sand which are driven by sampling an accelerometer with Raspberry Pi Zero!

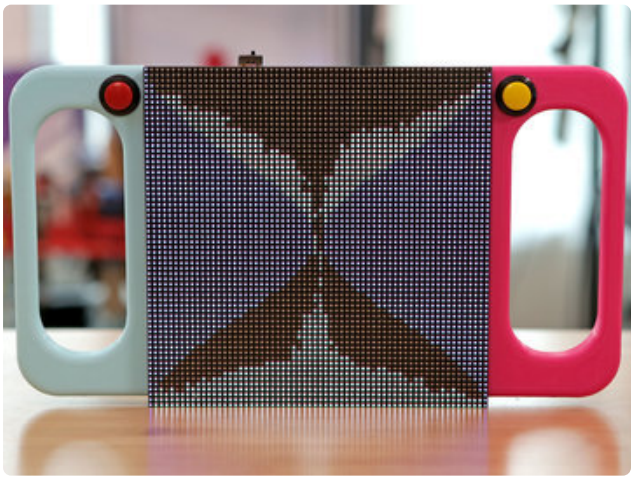
The 3D Printed handles make it easy to hold the 64x64 LED Matrix and the two buttons make it easy to switch modes or reset simulations!

The code, written by Phillip Burgess (https://adafru.it/iPc), simulates physics by calculating collisions and terminal velocity.









Prerequisite Guides

I suggest walking through the following guides to get a better understanding of the electronics.

Adafruit LIS3DH Triple-Axis Accelerometer (https://adafru.it/AJo)

RGB Matrix Bonnet for RaspberryPi (https://adafru.it/AJp)

14 x M2.5x5mm Screws

M2.5x5mm Screws

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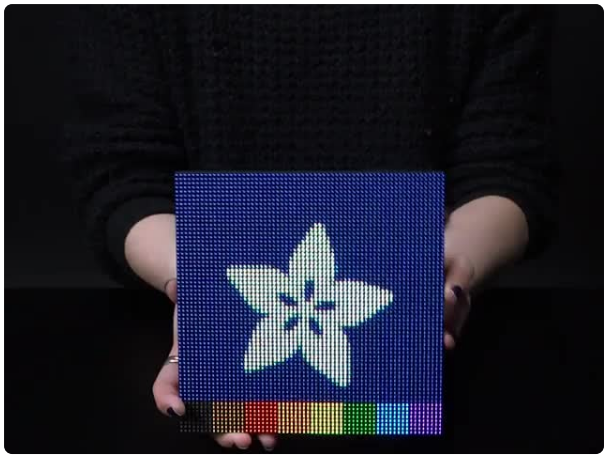
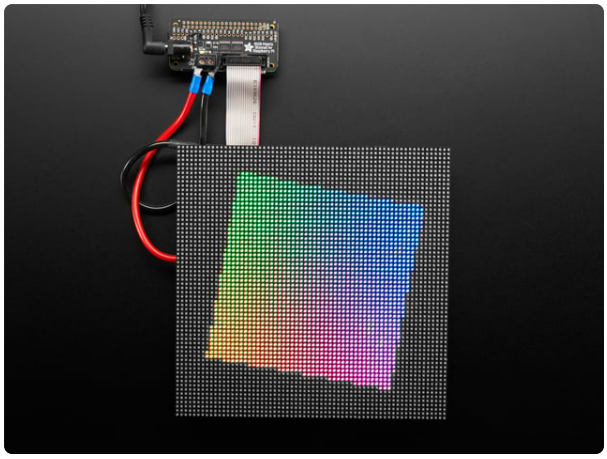
4 x M3x5mm Screws

M3x5mm Screws

WARNING - The hole spacing on the 64x64 2.5mm pitch matrix (PID 3649) has changed. Currently, the 3D parts DO NOT match this new spacing.

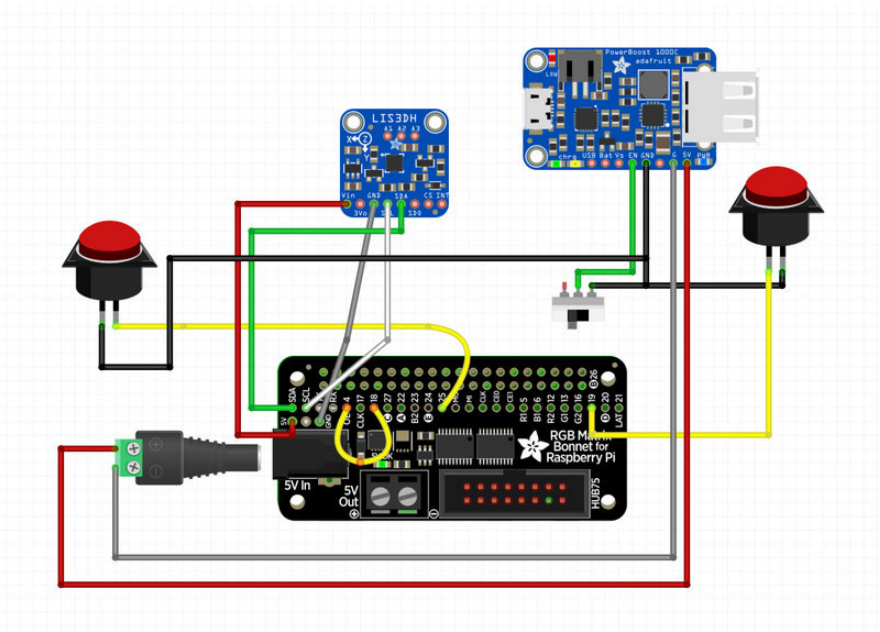


64x64 RGB LED Matrix - 2.5mm Pitch
Winter time can be rough in the city. The sky is gray. The weather is unpredictable. So slough off those seasonal blues with some Times Square razzle dazzle from this...
https://www.adafruit.com/product/3649



Adafruit RGB Matrix Bonnet for Raspberry Pi
You can now create a dazzling display with your Raspberry Pi with the Adafruit RGB Matrix Bonnet. These boards plug into your Pi and make it...
https://www.adafruit.com/product/3211

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.

The **Slide switch** will connect to the **PowerBoost1000C** board on the **GND** and the **EN** pin

PowerBoost **5v** and **G** connects to the Bonnet via the 2.1mm Male DC adapter and will both need to be 150mm long.

RGB Matrix Bonnet connects to the **Raspberry Pi Zero**.

LIS3DH connects to the Bonnet and will need to be 80mm long for **3V, GND, SDA and SCL** connections.

The **Reset Button** connects to **pin 19** and will need to be **110mm** long. **Ground** will need to be **95mm** long.

Mode Button connects to **pin 25** on the Bonnet and will need to be **130mm** long. **Ground** will need to be **160mm** long.

Code

PixelDust Demos

https://adafru.it/AJq

First make sure you've loaded the latest Raspbian Lite operating system on your Raspberry Pi. You can find the OS image download here (https://adafru.it/dpb), instructions for burning to an SD card image here (https://adafru.it/evK), and a convenient guide here (https://adafru.it/jd1) that explains how to load an operating system.

Make sure your Raspberry Pi is connected to the internet, either with a wired connection to its ethernet port, or by setting up wireless access to a WiFi network. Check out the guide on network setup (https://adafru.it/jd2) for more details on using wireless and WiFi networks with the Pi.

Once your Raspberry Pi is powered up and connected to a network you can follow the steps below to install the video looper software.

If you're familiar with connecting to the Raspberry Pi over SSH (https://adafru.it/jsE) you can use an SSH terminal application to connect and skip down to the install commands section below (https://adafru.it/uRC). If you aren't familiar with SSH you can use the Adafruit Pi Finder tool (https://adafru.it/enj) to find your Raspberry Pi and

open a terminal to run the installation. I'll show installation steps using the Pi Finder tool below.

Note with the latest versions of Raspbian (Jessie full & lite since ~February 2017) they disable SSH by default! Read below to see how to enable SSH so you can access the Pi with tools like Pi Finder.

Install Matrix Driver

OK now you are ready to install the drive for the LED matrix. We have a script that downloads the code and any prerequisite software. It works with the current **Raspbian "Stretch" operating system** (either the Lite or Desktop version). Walk through the options it presents and select the ones that pertain to your setup. If you get stuck, we have a more details in the Bonnet Matrix guide (https://adafru.it/Bma).

```
curl https://raw.githubusercontent.com/adafruit/Raspberry-Pi-Installer-Scripts/
master/rgb-matrix.sh &gt;rgb-matrix.sh
sudo bash rgb-matrix.sh
```

The script will **confirm your selections** and offer **one more chance to cancel** without changes.

There's a lot of software to update, download and install, so it may take up to **15 minutes** or so to complete. Afterward, you'll be asked whether you want to **reboot** the system.

Install Git and Clone

Once you have enabled SSH and connected to the Pi via a separate computer over WiFi, you can install the proper tools to install the software. First, let's get the git command so we can clone the library repo. Then, we'll install the library and copy code from the repo to the home directory of the Pi.

```
sudo apt-get install -y git
git clone https://github.com/adafruit/Adafruit_PixelDust.git
```

Enable I2C via raspi-config

In order to read the accelerometer, I2C must be enabled via the **raspi-config** interface. Follow the guide below for a step by step guide. If your familiar with this, use **sudo raspi-config** and enable I2C through the "Interfacing Options."

Raspberry Pi – Enable I2C

https://adafru.it/dEO

Make PixelDust

In order to compile the Adafruit PixelDust library to the Pi, we'll need to execute a make command.

```
cd Adafruit_PixelDust/raspberry_pi
make
```

Running the Code

OK now it's time to run the demo! Execute the command below and use the two buttons to change demos and reset the simulation. You'll need to be in the right directory to run the python script.

```
cd Adafruit_PixelDust/raspberry_pi/
sudo python buttons.py
```

Press Control+C to stop the program and get back to the command line.

Adjusting Brightness

By default the LED brightness is set to 100%...this might be a bit much both on the eyes and the battery. We can tone it down by editing the Python script...

```
nano buttons.py
```

Look for this line near the top of the code (around line 15):

```
FLAGS        = ["--led-rgb-sequence=rbg", "--led-brightness=100"]
```

That “100” is the brightness, expressed as a percentage from 1 to 100. Quite often running around 1/3 brightness (33) looks perfectly good. For photography and video you may want even less, perhaps 10 percent. Save changes to the file, exit and try running again with “sudo python buttons.py”

Automatic Startup

We can configure the system to start the demo automatically after booting, so you don't need a keyboard and screen to get it started every time...

```
sudo nano /etc/rc.local
```

Just BEFORE the final "exit 0" line, insert the following two lines:

```
cd /home/pi/Adafruit_PixelDust/raspberry_pi
python buttons.py &amp;
```

(If you've installed the code in a different location, adjust the "cd" command to match.)

Save changes to the file, exit and reboot.

It may take 30 second to a minute before the software starts. This is normal...booting a Linux system is a lot of work and our code is the last thing to run.

Safely Shutdown setup

Turning the switch off before properly shutting down the Pi can cause the SD card to corrupt so we suggest safely shutting down the Pi before turning off the PowerBoost. We have a dedicate guide for enabling **Read-Only** mode which will allow you to quickly turn off the Pi without risking corrupting the SD card. Check it out here: https://learn.adafruit.com/read-only-raspberry-pi (https://adafru.it/AJr)

Read-Only Pi Guide

https://adafru.it/AJr

Customization Options

The Python script (Adafruit_PixelDust/raspberry_pi/buttons.py) uses two buttons (currently on GPIO 19 and 25) to cycle between demos or reset the current one. Near the top of that file you'll see settings for the GPIO pin numbers and LED brightness. You can edit and save the script using **nano buttons.py** so you won't not have to type changes every single time.

3D Printing

The 3D printed parts are fairly easy to make with most common home desktop 3D printers that are on the market.

And if you don't have access a 3D printer, you can order our parts by visiting our Thingiverse page and have someone local 3D print the parts and ship them to you.

Our LED Matrix hole spacing has been updated causing the original STL files not work. An updated set of STLs are available thanks to @KDLaun.

https://www.thingiverse.com/thing:4805155

Download Fusion 360 files

https://adafru.it/AJs

Download from Thingiverse

https://adafru.it/AJt

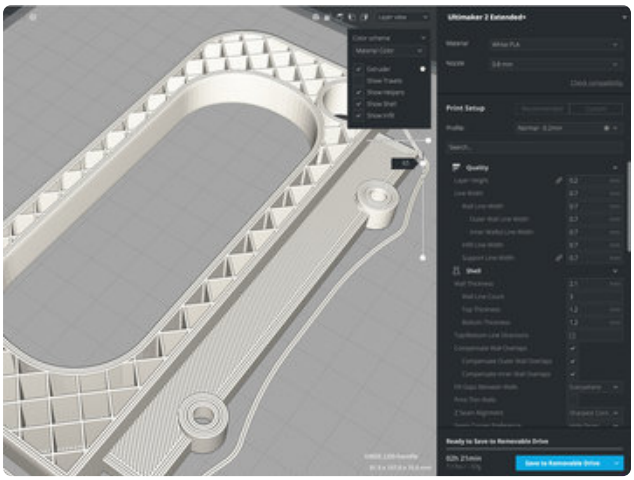
Download from Youmagine

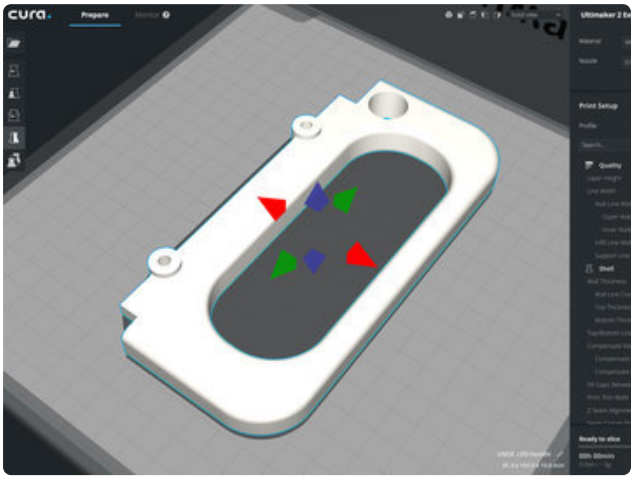
https://adafru.it/AJu

Download from Pinshape

https://adafru.it/AJy

Slice Settings





Download the STL file and import it into your 3D printing slicing software. You'll need to adjust your settings accordingly if you're using material different than PLA.

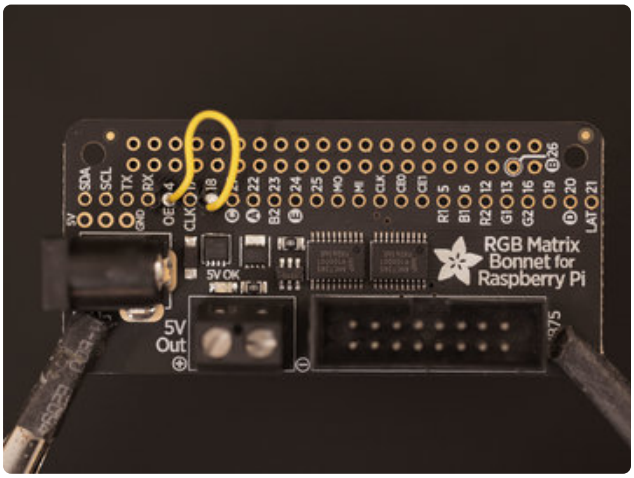
230C Extruder Temp
No heated bed (65C for heated)
1.0 Extrusion Multiplier
.8mm Nozzle
0.7 Extrusion Width
.2mm Layer Height
30% infill
30% Supports
skirt
60mm/s | 120mm travel speed

Mirror

Use the mirror function inside your slicing software to print the opposite handle

Assemble

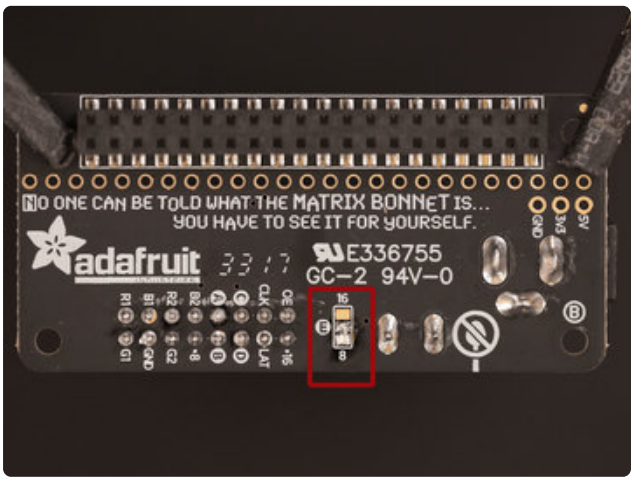
Prep Bonnet



First we'll need to add a jumper to connect two pins and then bridge two pads to enable the RGB Matrix Bonnet to work with the 64x64 LED Matrix.

Jumper

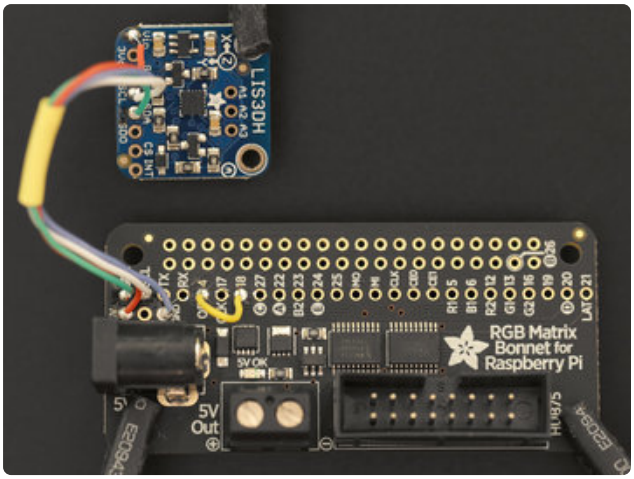
We'll start by measuring a wire 30mm long. Tin and solder pin 4 to pin 18. Carefully bend the wire and move it away from the headers on the Bonnet.



Bridge Pad

Next we need to turn the Matrix Bonnet over and locate the three solder pads. Tin the middle pad "**E**" and the "**8**" pad. Now heat up one of the pads and drag solder over to the next pad to bridge the two connections.

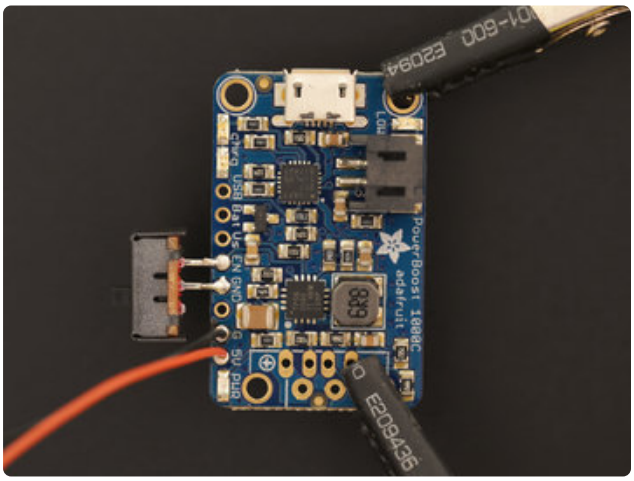
Solder LIS3DH



The accelerometer is solder to the Bonnet. Measure four wires **80mm** long to connect **5v**, **GND**, **SDA**, and **SLC** on the **Bonnet** and **LIS3DH** .

We used heat shrink to keep the wires organized.

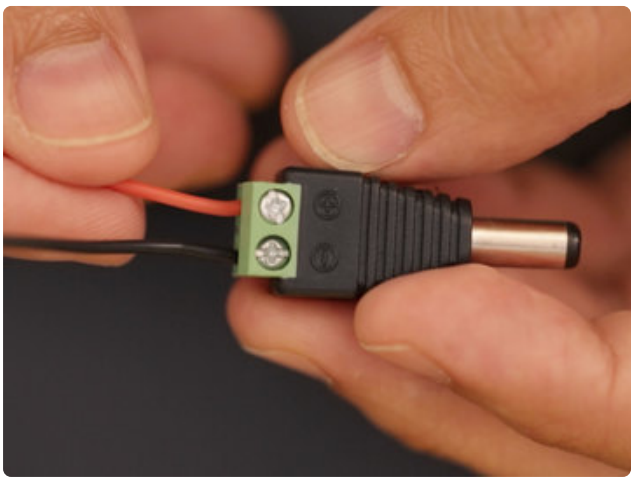
PowerBoost



Now we'll need to measure wires for power and ground to connect the Pi and Bonnet. Cut wires **150mm** long so it can reach the barrel on the Bonnet.

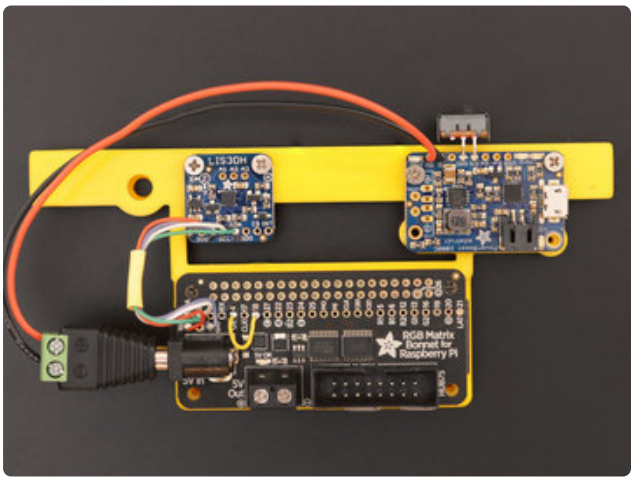
Slide Switch

To power the circuit on and off, we'll add a slide switch on the GND and EN pin on the PowerBoost.



DC Plug

Power and ground connect to the DC plug by tightening the terminal screws.



Board Frame

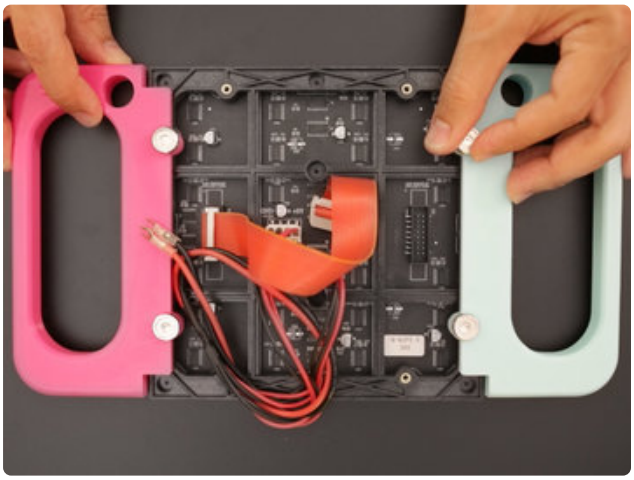
With all of the boards soldered we can move on to mounting them to the **LED-boards** part.

Use M2.5mmx5mm long screws to mount the boards to each standoff on the part.

Matrix Cables

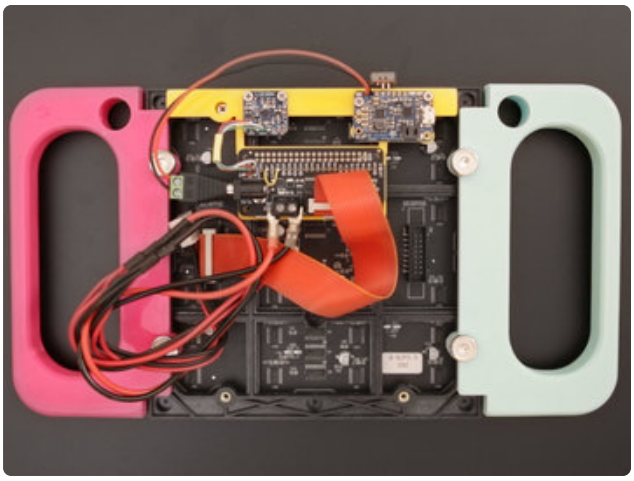
Now we can move on to the LED Matrix! Connect the red ribbon cable and the power and ground wire plug as shown on the picture.

Matrix Handles



To attach the handles, we'll use the M3 thumb screws included with the LED Matrix. Align the handles so the button holes both align with the Matrix.

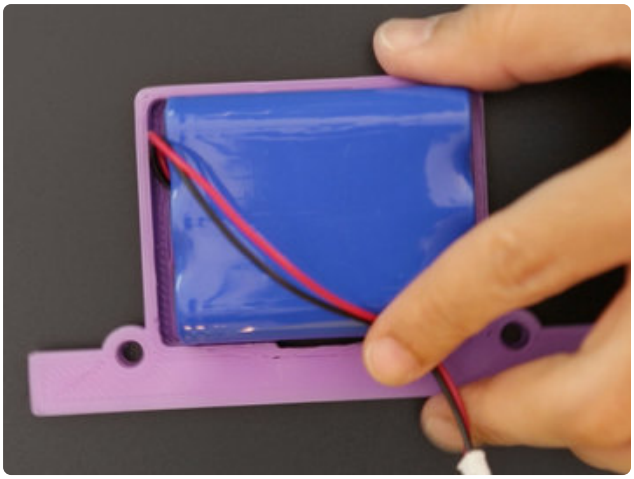
Secure by inserting the thumb screws into the counter sink holes and tighten. You can use pliers to ensure the handles are securely attached.



Attach boards frame

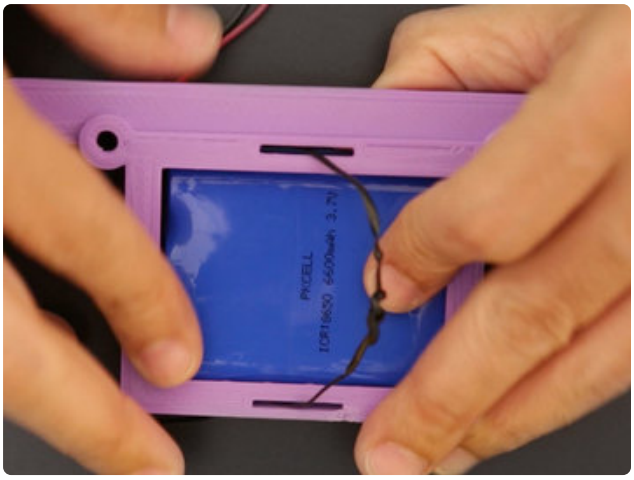
Position the boards to align with the mounting holes on the LED Matrix. Use M3x5mm long screws to secure the boards onto the LED Matrix.

Note that the PowerBoost will cover one of the mounting holes, so we'll need to secure that one screw on the Matrix frame and then fasten the PowerBoost back on.

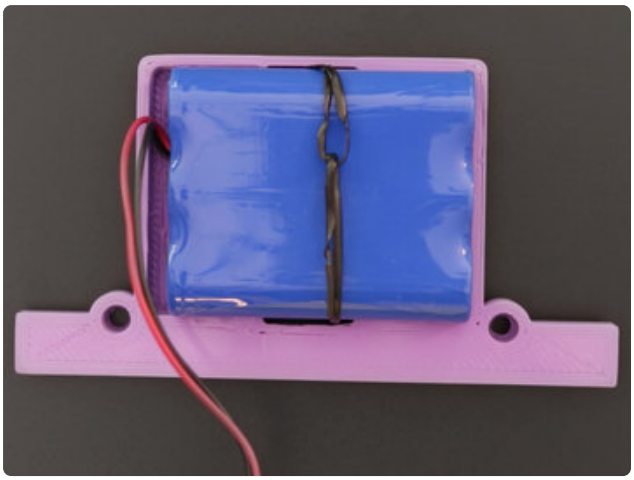


Battery frame

Mount the 6600mAh battery to the **LED-bat** part. Align it so the cable is positioned on the inside of the battery frame as shown in the picture.

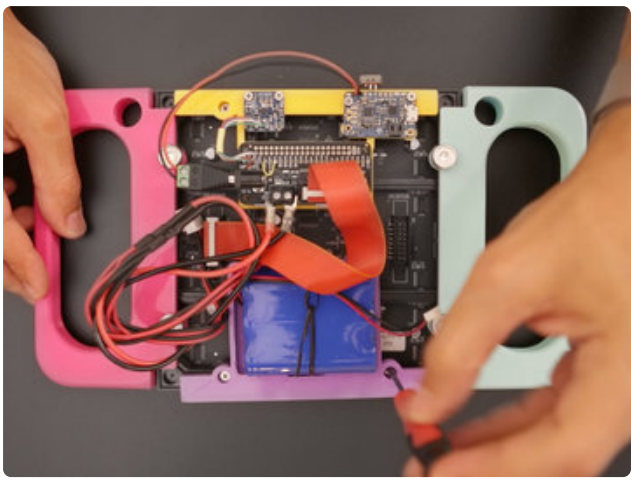


Turn the two over and use a zip tie or twisty ties to secure the battery to the frame. Pass the ties through the two slits on the battery frame to tightly secure the battery to the frame.

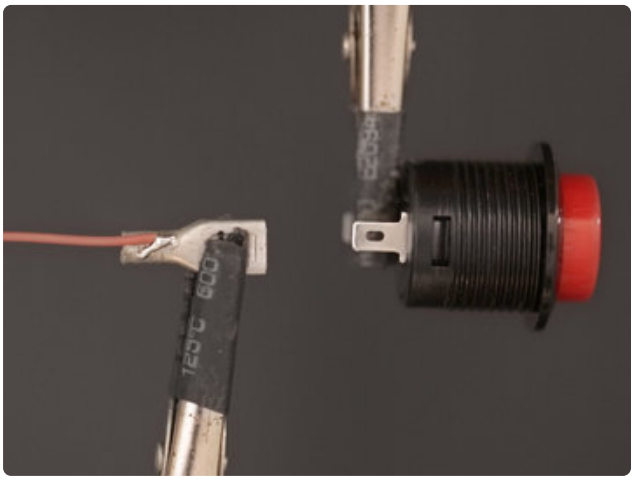


Mount Battery frame

Use M3x5mm long screws to secure the battery frame to the LED Matrix. Align the mount as shown and fasten each screw to attach the part to the matrix.

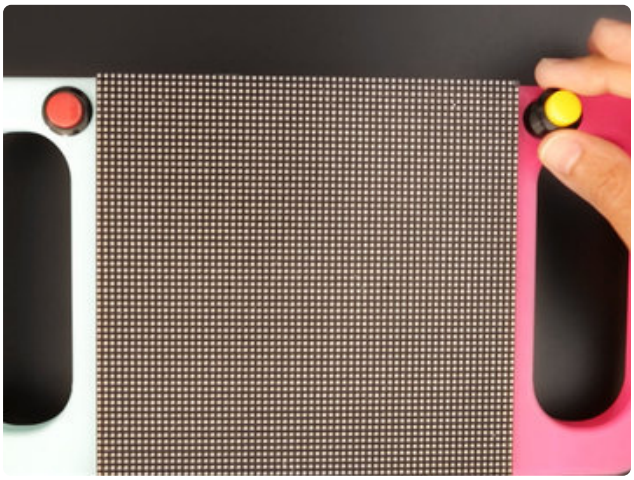


Buttons



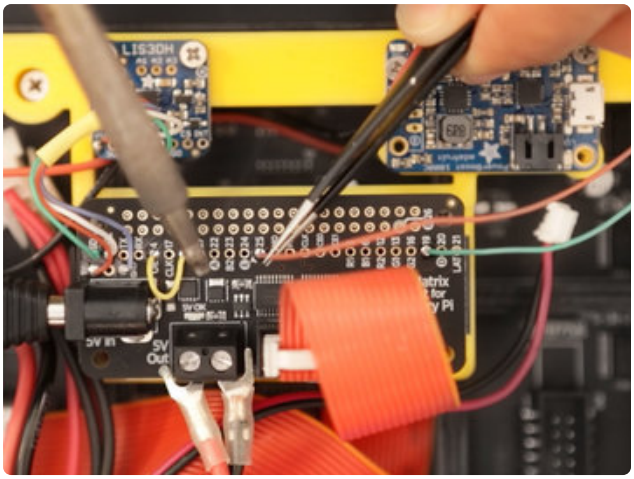
To easily connect and disconnect the buttons, we'll use quick connects. First start by measuring wires for the reset button. The **Reset Button** will connect to **Pin 19** on the Bonnet and will need to be **110mm** long. The **GND** wire will need to be **95mm** long.

The **Mode button** will connect to **Pin 25** on the Bonnet, and will need to **130mm** long. **GND** will need to be **160mm** long.



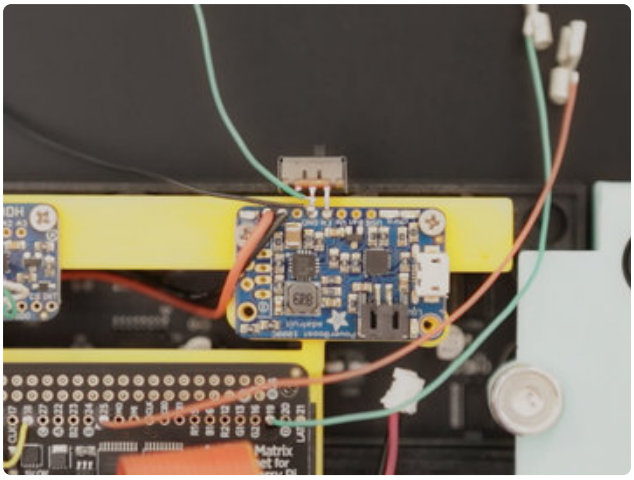
Mount buttons

The two buttons mount inside the cutouts on the handles. Push each button through to snap fit them on to the handles.



Solder Buttons

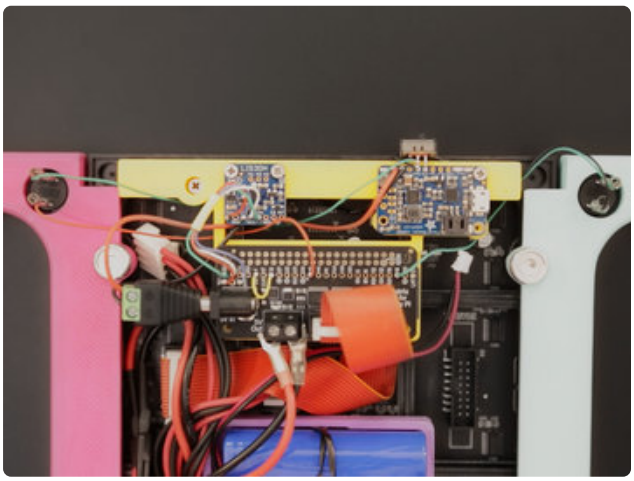
Next we'll solder the buttons to the GPIOs on the Bonnet. Tin and solder connects for **Pin 19** and **Pin 25.**



Ground

To make it easy, we'll solder the two ground connections to the slide switch leg connected to **GND** on the **PowerBoost**.

Thread Button wires



Finally we can thread our button wires through the LED frame and connect them to each button.

Connect Battery

All thats left is to plug the battery into the JST connection on the **PowerBoost** and flip on the switch!