VHS Pixel Goggle Kit Guide v1.29.2021

This guide was written to help people assemble the SteamPunk style Pixel Goggle kit that I made for members of my local maker space (**Vancouver Hack Space or VHS**). The kit and these instructions are completely based on the Adafruit Kaleidoscope Eyes build guide which you can find here:
https://learn.adafruit.com/kaleidoscope-eyes-neopixel-led-goggles-trinket-gemma
Please refer to it in addition to using this guide for more information…

In place of the LiPo battery pack this kit uses 3 AAA batteries in a holder. This is too large to fit in the goggles themselves so it will have to be attached to the head band or possibly in the hat you may have the goggles placed on.

You will need the following tools and equipment:
- Soldering Iron & Solder
- Diagonal Cutters
- Wire Strippers
- Electrical Tape or Heat Shrink Tubing
- 3x AAA batteries
- Micro USB Cable
- Hot Glue Gun
- PC with Arduino IDE application installed

While I think this is a pretty easy to build project, VHS (and myself) take no responsibility for any damage (physical/medical or psychological) that you may incur while assembling and using this kit!!

Step #1 - Referring to the picture below, check the list to ensure you have all the parts in your VHS kit. The ATTiny85 controller module and the WS2811 led rings will be in protective antistatic bags, ensure you take precautions with these parts as they are static sensitive.

- ❏ 1x DigiSpark Attiny85 module clone (included header strip will not be used)
- ❏ 2x 16 LED WS2812 Pixel Ring
- ❏ 1x AAA Battery Holder (with switch)
- ❏ 1x Pair Of Goggles
- ❏ 4x Translucent Lenses
- ❏ 1x 6 Inch Length 3 Conductor wire
- ❏ 1x 3 Inch Length 3 Conductor wire
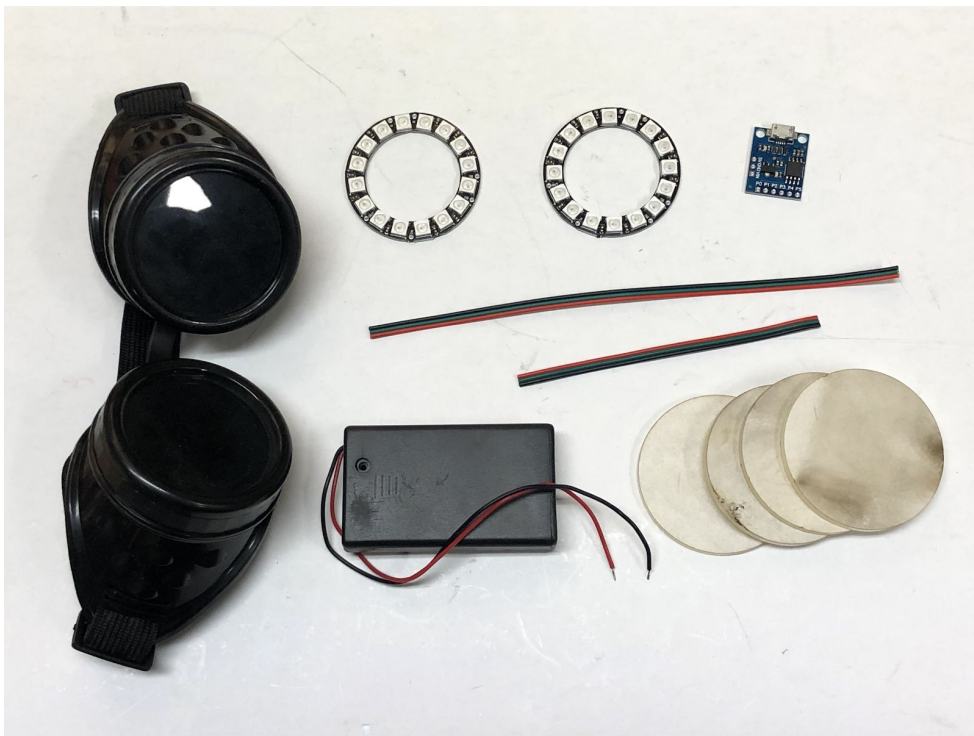
Step #2 - Attach ribbon wire to first Pixel Ring

- ❏ Separate the wires by about 1 inch at both ends of the 3 inch length of ribbon cable
- ❏ Strip about 1/4 inch of insulation off the end of each wire (do both ends)
- ❏ Insert each wire through the front of the Pixel Ring PCB in the appropriate hole and solder in place. You may find it easier to do one at a time. Ensure you connect as follows:
    - ❏ Red Wire = **Power 5V DC**
    - ❏ Green Wire = **Data Input**
    - ❏ Black Wire = **Power Signal Ground**
- ❏ Dress the wires to fit between the led modules and bring wire through center hole to back of LED Ring
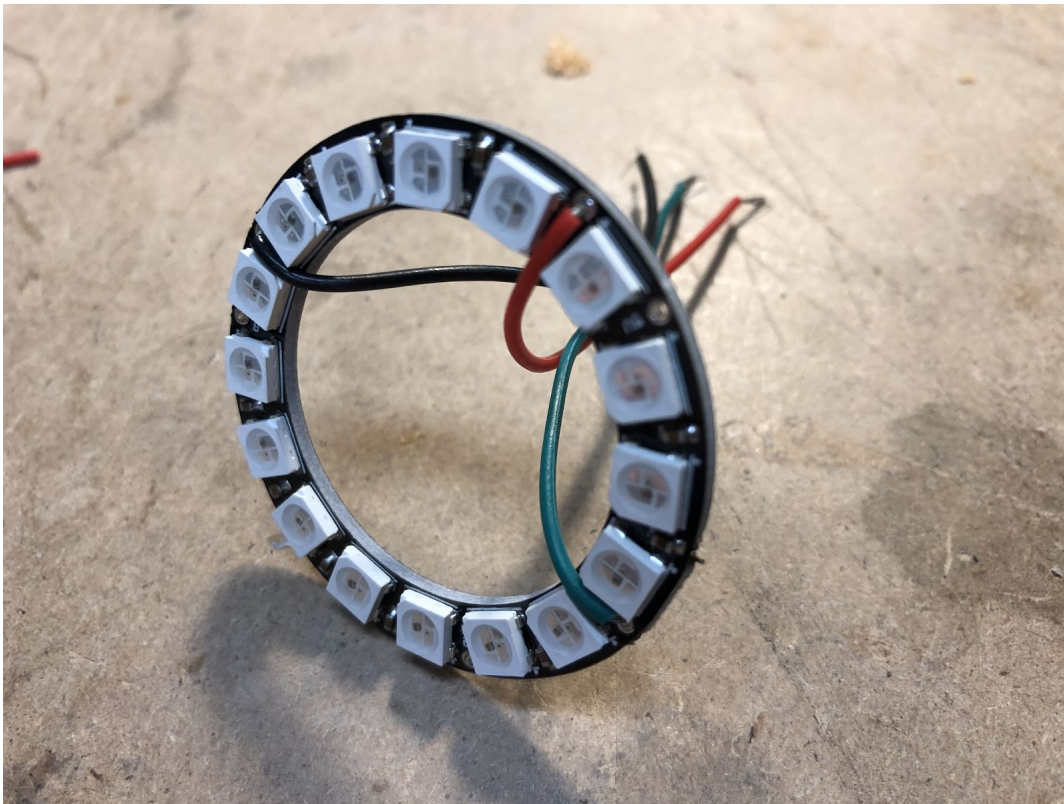
**Step #3** - Attach ribbon wire to second Pixel Ring

- ❏ Separate the wires by about 1 inch at both ends of the 6 inch length of ribbon cable
- ❏ Strip about 1/4 inch of insulation off the end of each wire (do both ends)
- ❏ Insert each wire through the front of the Pixel Ring PCB in the appropriate hole and solder in place. You may find it easier to do one at a time. Ensure you connect as follows:
    - ❏ Red Wire = **Power 5V DC**
    - ❏ Green Wire = **Data Input**
    - ❏ Black Wire = **Power Signal Ground**
- ❏ Dress the wires to fit between the led modules and bring wire through center hole to back of LED Ring
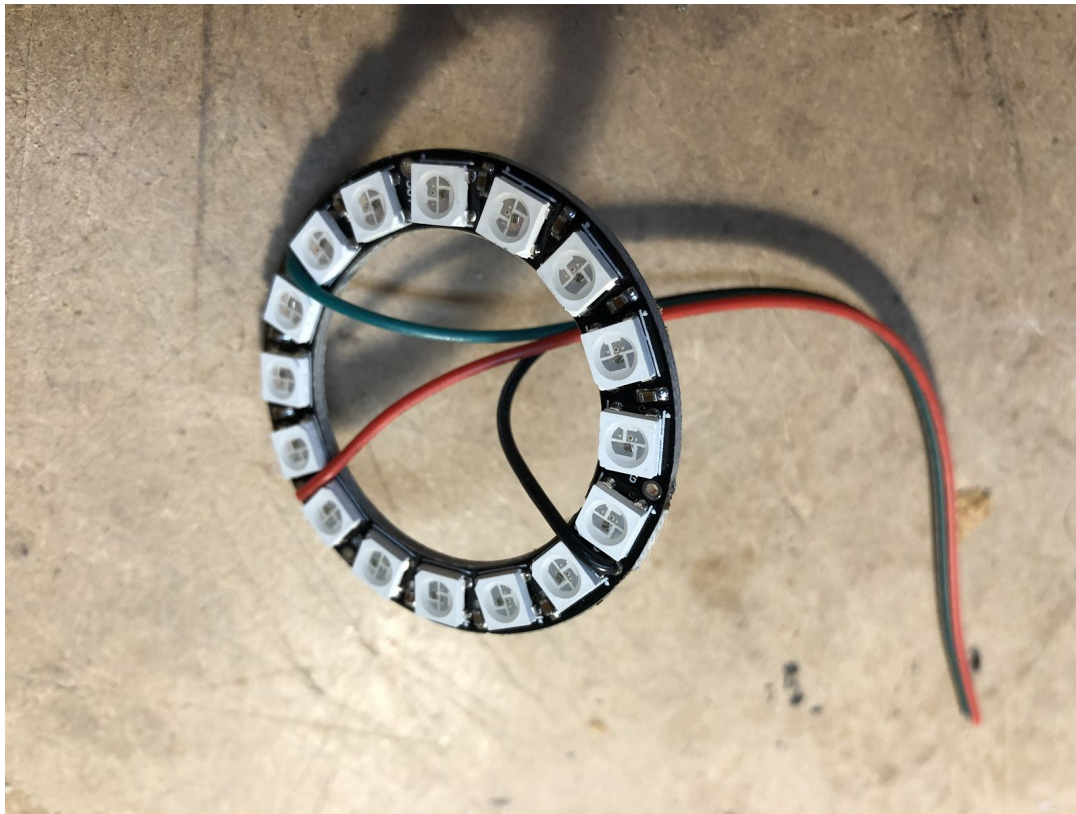
Step #4 - Connect Pixel Rings together

❏ Bring the undersolderd end of the 6 inch wire (already connected to the 2nd Pixel Ring) through the middle of the 1st Pixel Ring and insert each wire through the front of the Pixel Ring PCB in the appropriate hole and solder in place. You may find it easier to do one at a time. Ensure you connect as follows:
  ❏ Red Wire = **Power 5V DC**
  ❏ Green Wire = **Data Output**
  ❏ Black Wire = **Power Signal Ground**
❏ Dress the wires to fit between the led modules
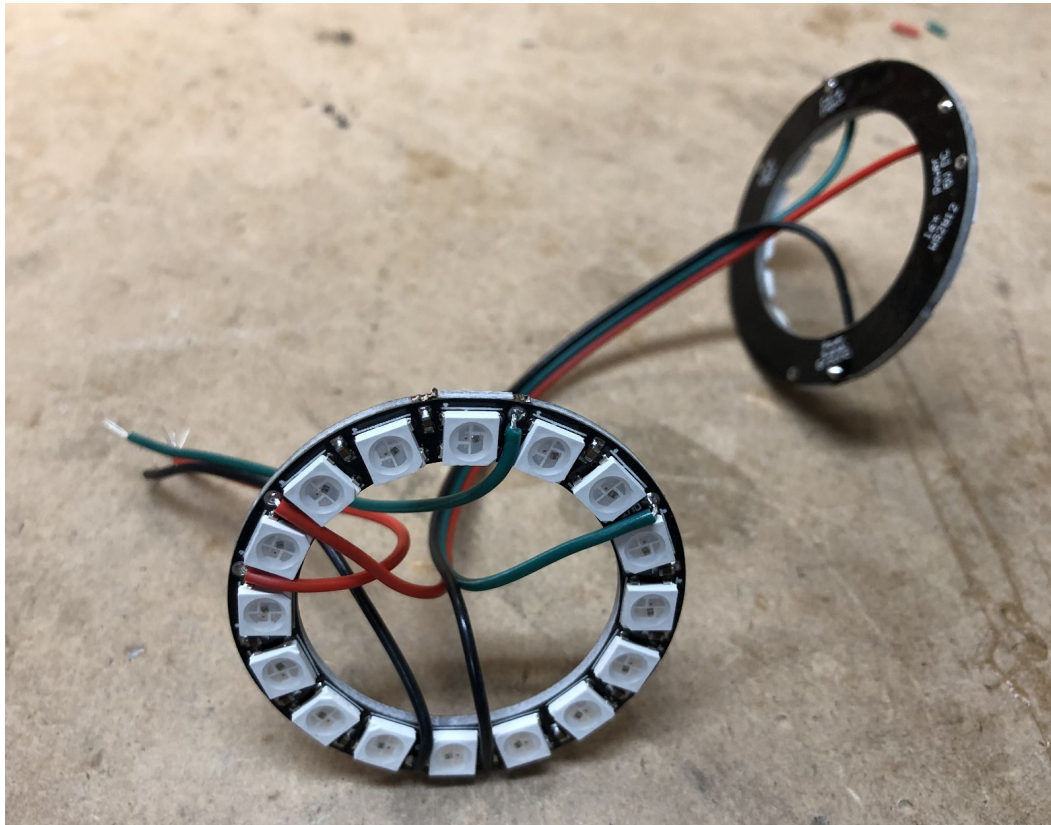
Step #5 - Connect it all together
- ❏ Cut the ends of the battery case leads to the same length and strip off 1/4 inch of insulation off both the red and black wires
- ❏ Twist the red battery case wire together with the red Pixel ring wire and insert into the 5V hole on the Digispark controller. Solder in place.
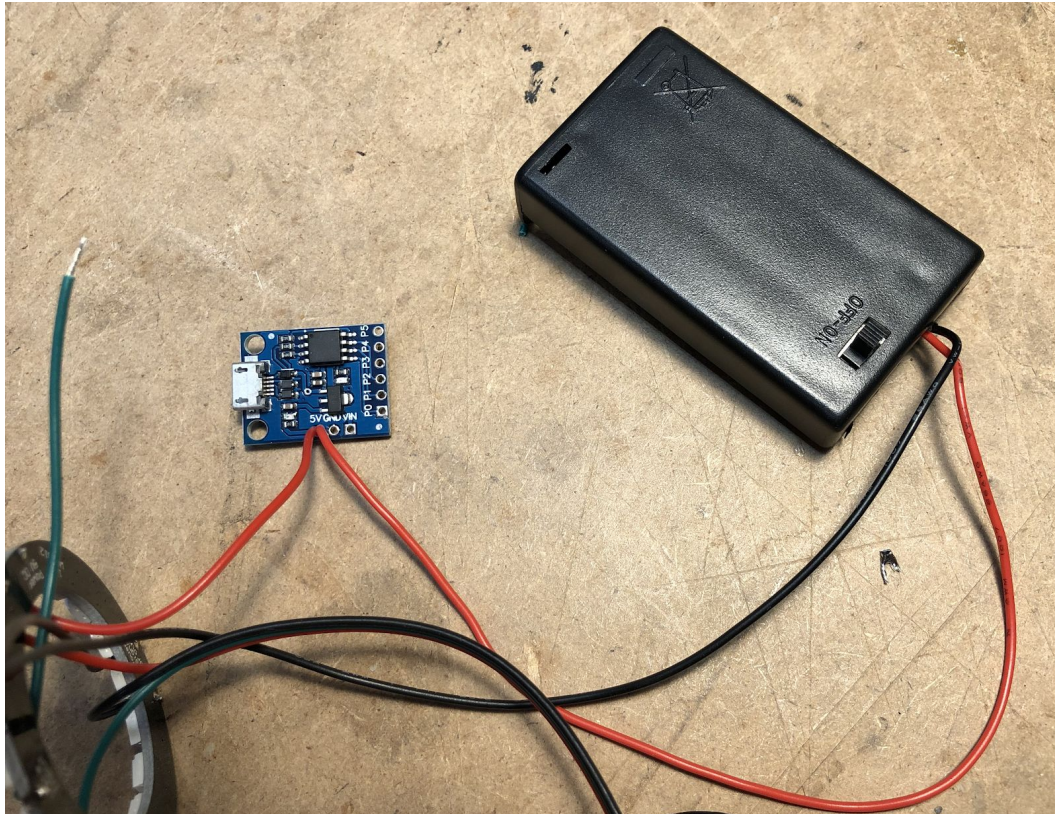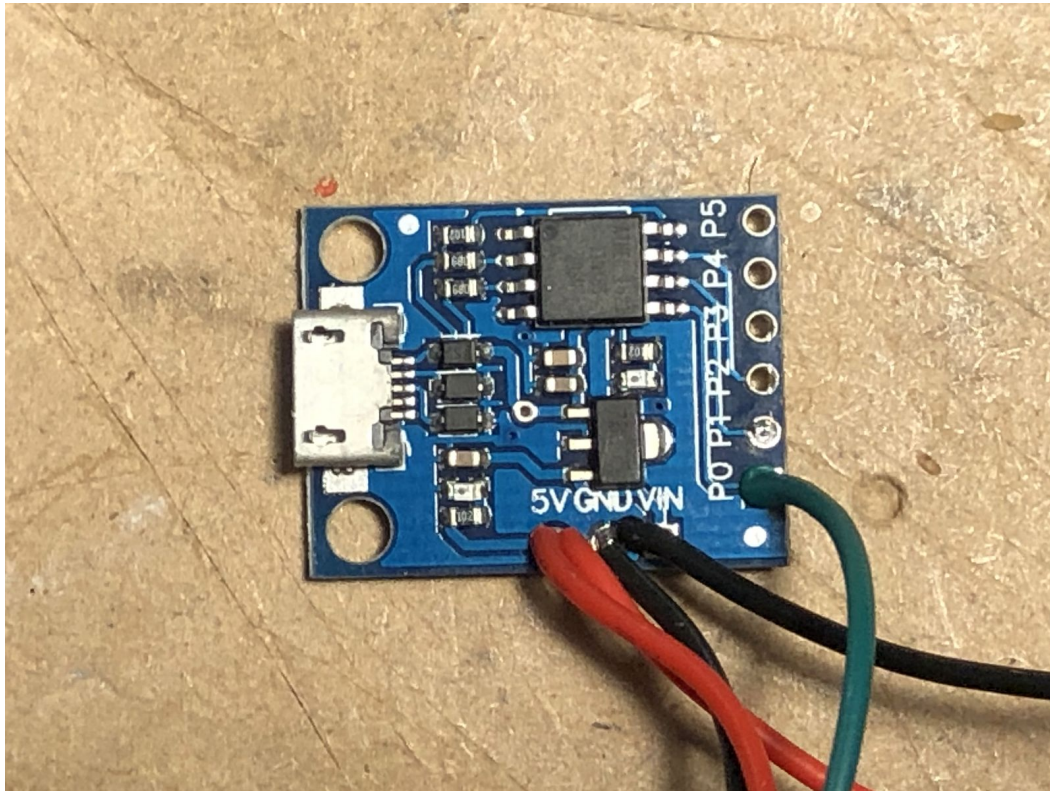
❏ Twist the black battery case wire together with the black Pixel ring wire and insert into the GND hole on the Digispark controller. Solder in place.
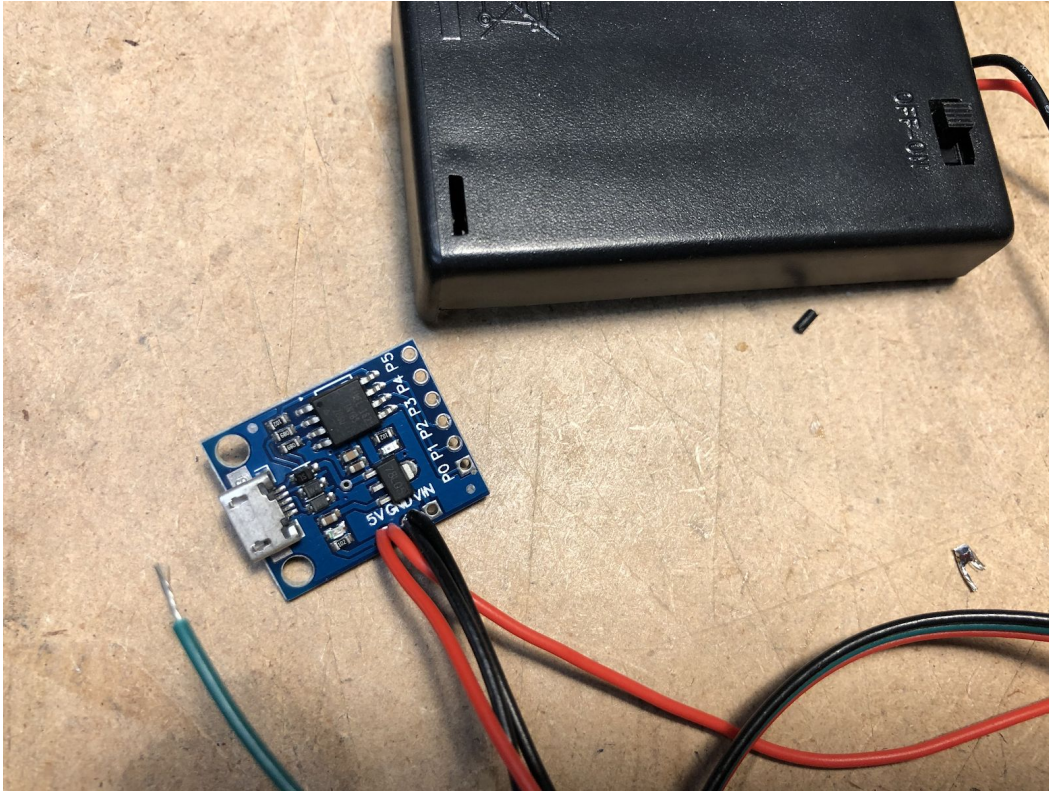
❏ Insert the green wire from the 1st Pixel Ring into the P1 hole on the Digispark controller. Solder in place.

❏

Step #6 - Setup your Arduino IDE to work with the ATTINY85 Digispark and the Pixel rings

The Digispark ATTINY85 controller we are using is nice and small but can be a bit troublesome to program. You need to install a driver and support for the controller in your Arduino IDE for Windows

For Windows 10 users you can follow this link:
https://startingelectronics.org/tutorials/arduino/digispark/digispark-windows-setup/

For Linux users you can follow this link:
https://startingelectronics.org/tutorials/arduino/digispark/digispark-linux-setup/

For further info and Mac support check out:
http://digistump.com/wiki/digispark/tutorials/connecting

(Full disclosure I have only tried this on Windows 10)

- ❏ Install the Digispark support for your PC (as detailed above)
- ❏ You will also need the Adafruit NeoPixel library.Install the NeoPixel library per these instructions:
  https://learn.adafruit.com/adafruit-neopixel-uberguide/arduino-library-installation

Step #7 - Download and open the Pixel Google example code

- ❏ Download the Adafruit example code from here:
  https://learn.adafruit.com/pages/2246/elements/2977204/download?type=zip
- ❏ Or from here:
  https://zappedmyself.com/wp-content/uploads/2021/01/Kaleidoscope_Eyes_NeoPixel_LED_Goggles.zip

- ❏ Uncompress the downloaded zip file
- ❏ Open the **Kaleidoscope_Eyes_NeoPixel_LED_Goggles.ino** file in your Arduino IDE
- ❏ Select **Digispark (Default 16.5 Mhz)** as your Board Type under the **Tools** menu
- ❏ Select **Micronucleus** as your programmer under the **Tools** menu
- ❏ Use the **Verify** button on your Arduino IDE to confirm the code compiles. If it doesn't you need to determine what the issue is before going any further

Step #8 - Upload the code to the controller

The method of uploading the code to the Digispark is slightly different than you may be used. There are also issues with the bootloader USB driver and USB3.0 ports. Make sure you use a USB2.0 port. Let me know if you have issues and I can program the Digispark module for you.
- ❏ Ensure your Digispark controller is not connected to your PC
- ❏ Use the **Upload** button on your Arduino IDE to start the process.
- ❏ Watch the bottom section of the Arduino IDE window until you see the `**Plug in device now…** message
- ❏ Plug your Digispark controller into your PCs USB port and you should see the code get uploaded. Note that once the upload is completed you will not see the LEDs start to light
- ❏ Disconnect the USB cable from the Digispark controller

Step #9 - Test the controller

- ❏ Ensure the switch on the battery case is in the OFF position
- ❏ Install the 3 AAA batteries in the case (ensuring you get the polarity correct, if you make a mistake you will toast the controller and the Pixel rings!!!)
- ❏ Ensure the controller and pixel rings are on a non-conductive surface
- ❏ Turn on the power switch and you should see the rings go through various sequences starting with Red, then green and then Blue. Note there is about a 5 second delay after turning on the power before the LEDs light up.
- ❏ If you have any issues you need to troubleshoot before going any further

Step #10 - Get the Pixel Rings into the googles

- ❏ Remove and discard the existing lenses on the goggles (there will be a clear and dark lens separated by a plastic spacer)
- ❏ Cut away the small tabs of plastic across the top of the google opening to allow for the wires

❏ Place the battery pack and 1st Pixel Ring in the left lens opening and place the 2nd Pixel ring in the right lens opening with the connecting wire placed in the slots at the bridge of the google.
❏ You may need to trim away some of the plastic so the wire will sit flat on the bridge of the goggles.

- ❏ Peel the protective paper covering off the 4 translucent plastic lenses
- ❏ Place 2 of the plastic lens into the lens holder
- ❏ Screw both the lens holders back onto the goggles ensuring you don't damage the wire connecting the two Pixel Rings

At this point you may want to test how the LEDs look and you can experiment with different ways of defusing the light. You may also want to cover the connecting wire with some black tape to hide it.

Step #12 - Mount the Pixel Rings

- ❏ Heat up your hot glue gun
- ❏ Turn the google over to work from the back side.
- ❏ Align the rings so that they are both oriented the same way. This is best for some of the animations.
- ❏ Ensure the wires are in between the leds on the front of the ring PCB and hold the ring against the lens.
- ❏ Use a few dabs of hot glue to hold it in place. Make sure you keep holding it till the glue sets and try not to burn your fingers. Do this for both Pixel Rings

Step #13 - Mount the Digispark controller

- ❏ Cover the Digispark controller with electrical tape or heat shrink tubing to make sure it doesn't short out on any of the wiring and to cover the red LEDs on the board (don`t want them to show through the lenses). Make sure you can still connect a USB cable to it if you intend to make any code changes.
- ❏ Mount the Digispark inside the goggle by gluing or taping it in place
- ❏ You may want to put some backing material behind the pixel rings to block light from coming through the back of the goggles.

Step #13 - Mount the battery pack.
- ❏ Mount the battery pack on the headband. I used a bit of hot melt glue to attach it to the band and then some electrical tape to secure it. Make sure you leave the side of the battery case with the switch exposed. You can use electrical tape to attach the battery wiring to the strap.

Step #13 - Now stick it on your hat and start steampunking!!!

Notes/Caveats/Comments

❏ Another power option is a rechargeable USB power pack. You can get an USB power cable like this:https://leeselectronic.com/en/product/16588.html Simply hack off the barrel connector and connect the wires in place of the battery pack. You should confirm the polarity of the USB cable power wires before you do this.
❏ You can use a 3.7V LiPo battery to power the goggles and you can find batteries small enough to fit inside the google.
❏ These goggles are not meant to go over the users eyes as the LEDs are very bright and could cause eye damage.
❏ The Digispark controller uses the Attiny85 processor and has limited FLASH (6K with the bootloader and 256 bytes of RAM. It will not typically run programs meant for larger processors like the UNO, etc.
❏ If you want more processing power (and have physical space) you can use any of the Arduino boards or any ESP8266 based controller (pretty much anything that will drive a WS2812 pixel).

- ❏ If space permits you could replace the Digispark controller with an ESPixelPOP controller (https://zappedmyself.com/espixelpops/). Then install WLED on the ESPixelPOP and you can control your google LEDs via the WLED app on your Wi-Fi connected cell phone (I have ESPixelPOP PCBS and kits available).
- ❏ Soldering the wires to the Pixel Rings through the front is easiest but the wires are a bit noticeable through the lenses. You can solder the wires through the back but be careful you don't damage the LEDs