Wearable LED Matrix Face Mask

by **NLED-Projects** on October 7, 2015

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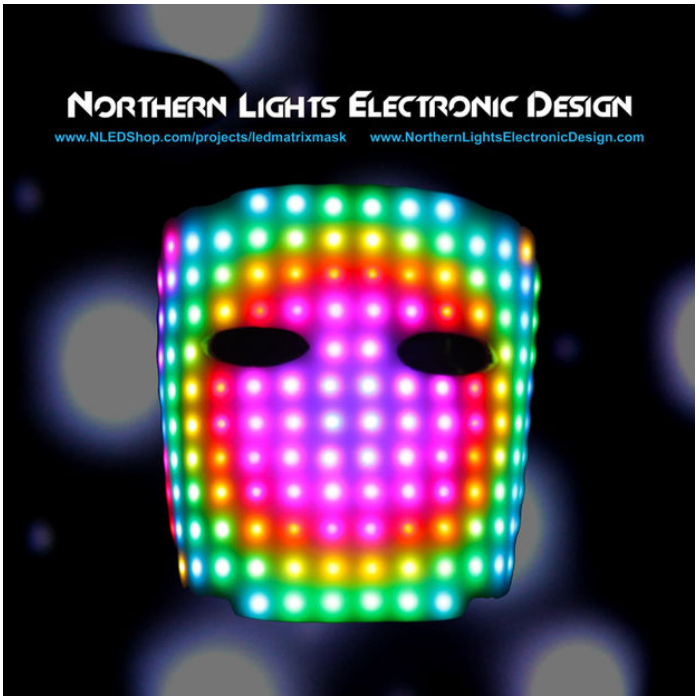
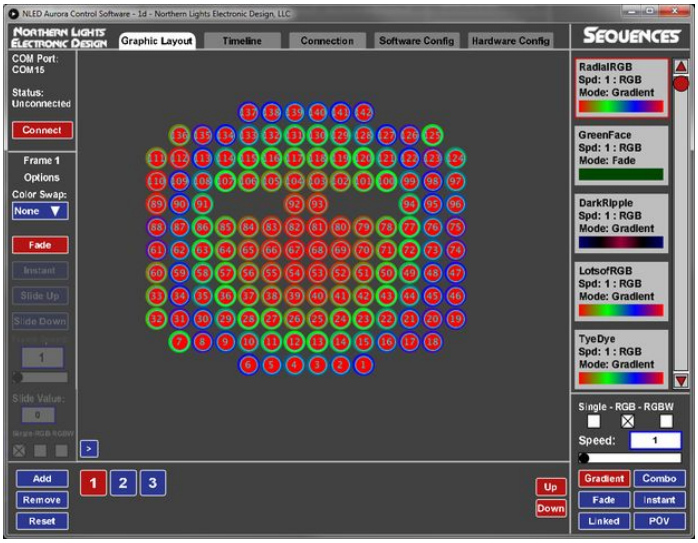
Located in Minneapolis, Minnesota in the USA. Designing high quality LED controllers for personal and commercial use. All devices are designed and fabricated in the USA to high standards. With a competent support team available to help you design and select the correct components to assist in completion of your projects. Specializing in LED controllers of all sorts, with versatile hardware designs that allow control of many configurations of LEDs and data controlled from many sources, such as DMX-512, USB, Serial(such as Arduinos and other MCUs). Most devices are compatible with the in-house software, NLED Control, for dynamic color sequences that run stand-alone, no computer connection required once the sequences are uploaded, in additional to Live USB Control, DMX or serial control.

Intro: Wearable LED Matrix Face Mask

Basically just a 12 x 16 pixel LED matrix made into a wearable mask. A high impact polystyrene plastic base plate with 142 pixels of WS2812B 60 LEDs per meter strip attached. Each pixel is independently controllable from a single tiny Pixel Controller Ion. The controller allows customized patterns and color sequences to be created on a computer using the software, NLED Aurora Control, then uploaded/saved to the controller for it to run independently. The color sequence creation software NLED Aurora Control is used to design the color patterns, it features several ways to create a visual representation of the project which makes it quite easy to create the custom color sequences most projects require.





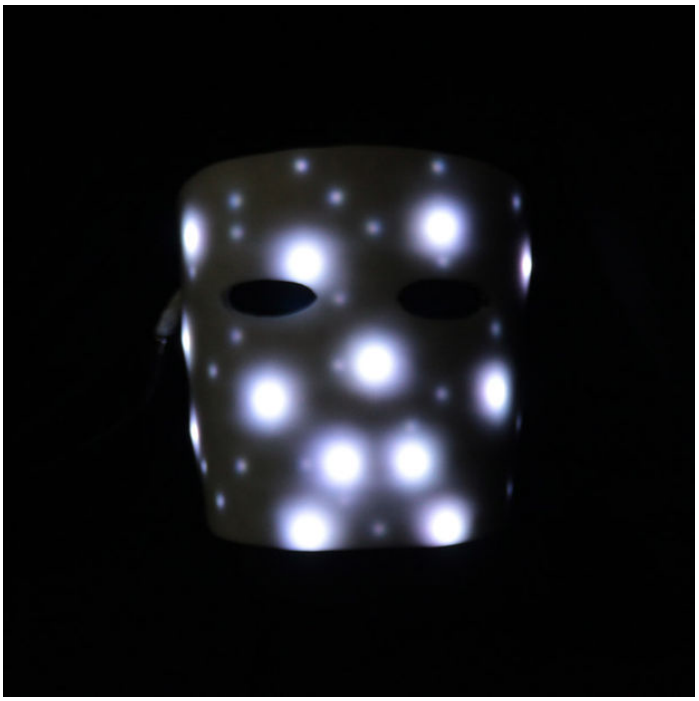
Step 1: Parts and Supplies

Parts:

- Pixel Controller Ion
- WS2812B LED Strip, 60 LEDs Per Meter, used 142 pixels worth
- Momentary Push Button, PCB Mount - Included with Pixel Controller Ion
- 18650 Lithium Battery
- 18650 Battery Holder - Digikey: BK-18650-PC2 - Or make one.
- 2.1mm x 5.5mm panel mount barrel jack
- Wire with 2.1mm x 5.5mm barrel plug - scavenged from wall-wart PSU
- Aluminum Tape
- High Impact Polystyrene sheet or Acrylic - 8.5" x 11" piece used for this project
- 50 Mil HDPE plastic sheet, or other type of plastic for diffusing
- Sheet of White Packing Foam - The flat kind used for wrapping things
- Paintball mask strap - scavenged
- Scrap medium density foam blocks

Tools:

- Solder Iron
- Electronics Tools - Pliers, strippers, electrical tape, etc
- Pop Rivet Gun
- Pop Rivets - used 1/16" white ones



Step 2: The Face Plate

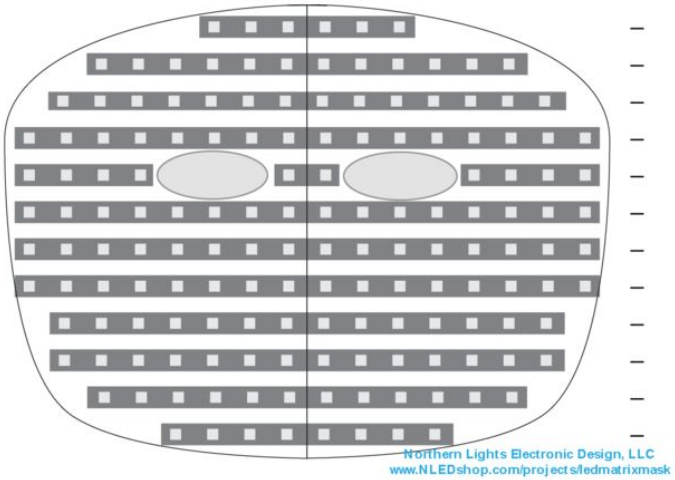
The main structure of the mask is a 1/8" high impact polystyrene plate bent to form around a face. The easiest way to make a LED matrix is to use a flat surface. Ideally the mask would have a lot more to it, but being completely flat makes the LED strip go down easier and lay flatter. A mask pattern was created through trial and error in Illustrator. And was mocked up in cardboard to get the right shape and eye hole spacing. Missed some pictures in the early stages.

Cut Out The Plastic Plate:

- The cut pattern was printed onto paper and taped it to a the piece of HIPS, about 8.5" x 11"
- Cut out the pattern using a band saw.
- Drilled a pilot hole and used a jigsaw to cut out the eye holes.
- Sanded the edges and eye holes til it was symmetrical and smooth.

Bending:

- Tried to place it in a solder reflow oven(since that was the most convenient and had precise temperature control) at about 120F, and brought the temperature up slow. It quickly went from soft but not yet moldable, to nearly completely melted real quick. Let it cool for a sec and then was able to reshape it and mold it.
- A heat gun was used to reheat areas to make them playable to be able to shape it. A small plaster bucket happened to be the right size and did just the trick to form the plastic plate into the approx shape required.
- The shape of the mask tapers, wider at the top, narrower at the bottom, with the ends bent in. Repeatedly tried it on and made adjustments til it fit correct.



File Downloads

nled-mask-plate-cut.pdf (285 KB)
[NOTE: When saving, if you see .tmp as the file ext, rename it to 'nled-mask-plate-cut.pdf']

Step 3: LED Placement and Wiring

LED Strip Placement:

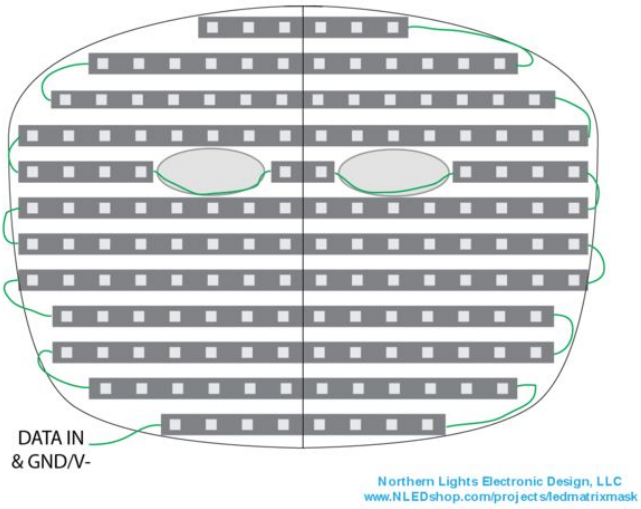
- Cleaned the face plate off thoroughly with rubbing alcohol to get any dirt or oil off.
- Used the pattern to mark the rows on the face plate using a pencil.
- Plan what row/pixel will be #1 and start from there.
- Applied the LED strip in straight lines and straight columns. Leaving some space on the outer edge to hide any wires.
- Applied all the LED strip, keeping it straight and orderly. The strip is controlled uni-directionaly, so make sure that the ends(In and out sides) are positioned properly.

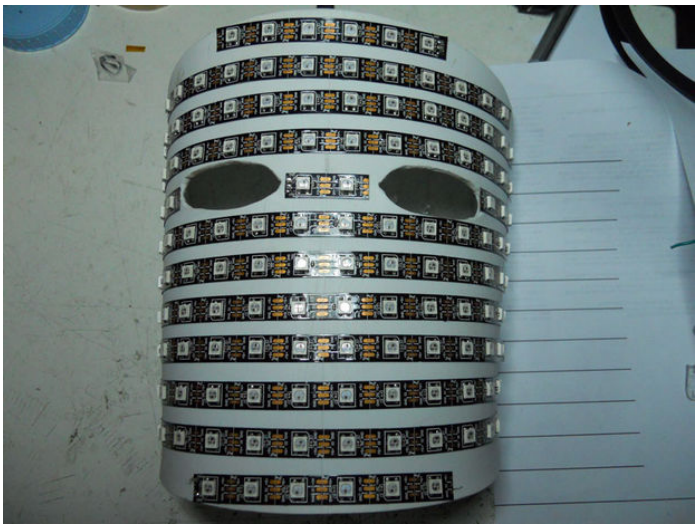
LED Strip Data Wiring: The theory is to connect all the LED strip rows into one long string. For WS2812B only the DAT pads have to be connected in order. Ground/V- and +5v can be connected anywhere on the strip, it doesn't have to be on the ends.

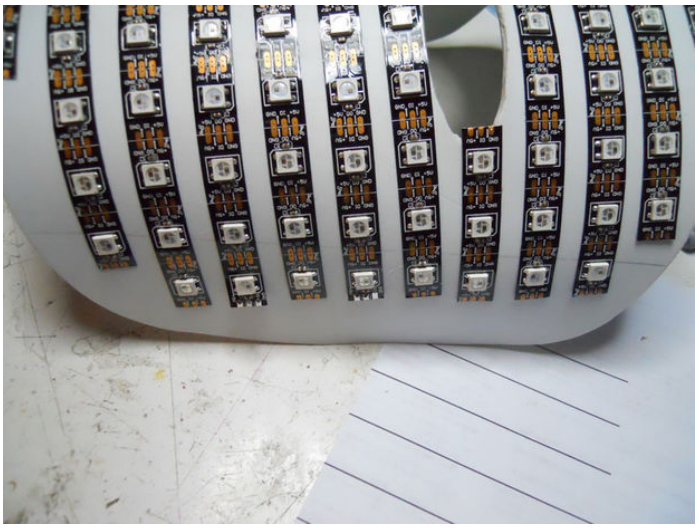
- The IN for row #1/Pixel #1 had a 3-pin JST-SM connector attached. The wire leads were shortened first.
- Connect DAT out of row #1 to DAT In of row #2 using a piece of stranded wire, trimmed to minimum length
- Continue connecting the DAT out of one row to the DAT in of the next row. Until every row has their DAT(data) pad connected OUT to IN.

LED Strip Power Wiring: Ground/V- and +5v can be connected anywhere on the strip, every row needs a connection to them. Pictures of power wiring were lost. But simple enough.

- Connect every divided section of LED strip to +5v and GND/V-
- Used red wire for +5v and green wire for GND. Should have used white instead of green since it shows through a bit.
- Connected pads mostly in the middle of the strips, snaking from vertically. Left the end of the strips just for DAT connection.







Step 4: Diffusing and Straps

Some steps did not have pictures taken during assembly.

Diffuser:

- Before starting the diffuser mounting, drill any holes for power and controller connections.
- Placed a sheet of cellular packing foam over the entire mask, over the edges and held temporarily with tape.
- Placed a sheet of 50mil HDPE sheet over that, which also went over the edge.
- Clamped both sheets to the face plate using small clamps.
- Re-positioned both sheets so they fit correctly.
- Marked and drilled 3x evenly spaced 1/16" holes down one side of the mask through the HDPE, cell foam, and face plate.
- Using 1/16" pop rivets, the 3 holes were riveted. Securing all 3 pieces together.
- Removed the clamps and smoothed out the diffusing sheets.
- Repeated on the other side, with 3 more holes and pop rivets.
- Flipped it over, and used a sharp razor blade and the face plate as a guide. Then trimmed the HDPE and cell foam flush to the edges of the face plate.

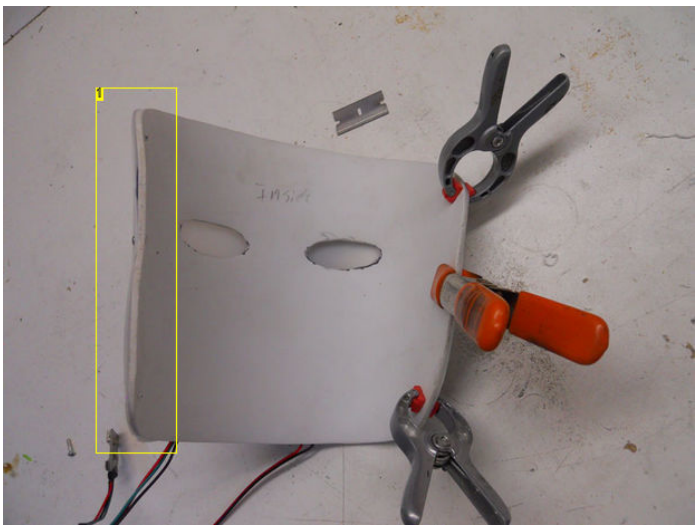
Straps and Mounting: Seemingly the hardest part was to get it to fit right. A head strap from an old paintball mask was used for holding the mask on and some foam blocks were added for comfort and for positioning. It was found that adding a chunk of foam to the forehead area made it more comfortable, as the strap tension would make the mask pivot off the forehead which kept it from rubbing on the face/chin. Overall its fairly comfortable, all things considered.

Power and Battery:

- A 2.1mm x 5.5mm barrel jack was connected to the power wires. Note there are 2 runs of power, one from the bottom rows and one from the top. Although they are connected together on the strips, it helps to have multiple 'home runs' of power to provide the required current when its needed. 142 pixels could draw up to 8.52 amps.
- The battery holder shown is made from a piece of thin aluminum square tube, that was formed into a holder for a 18650 using some shapelock plastic and wire.
- A scavenged cord(from a wall wart PSU) with a 2.1mm x 5.5mm barrel plug was added to the battery holder. It mates with the panel mount barrel jack that hangs off the mask. There is no switch the mask is turned on and off by unplugging it for now.

Controller and Wires:

- Use any kind of permanent tape to secure the controller and wires. Aluminum duct tape, gaff tape, or other type.



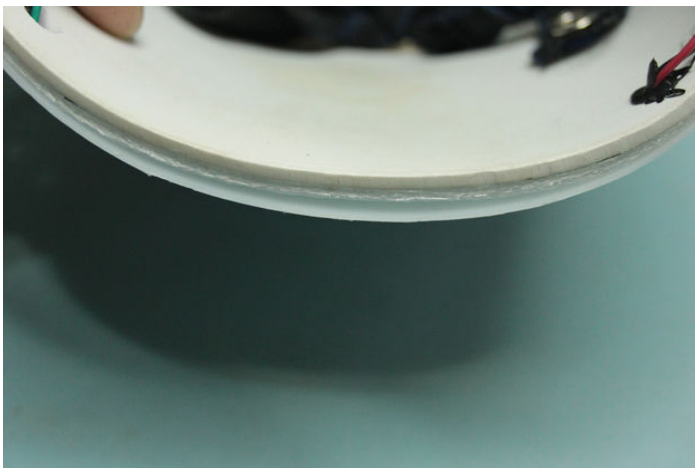
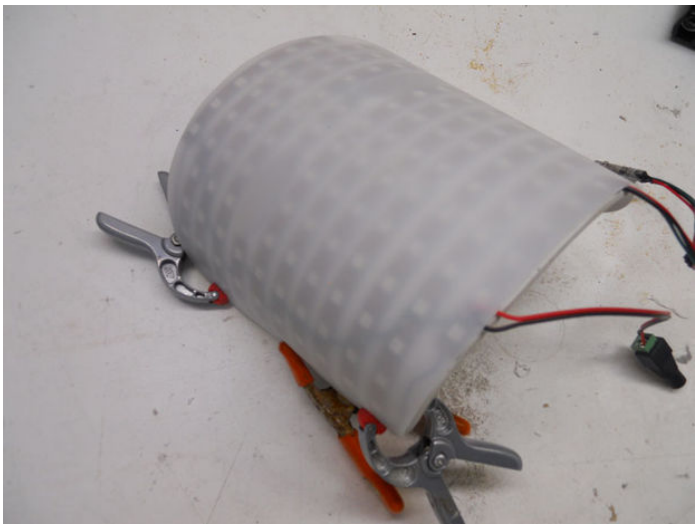
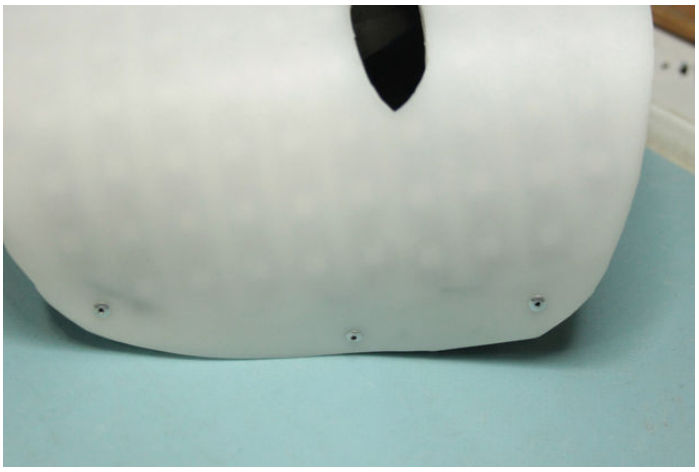
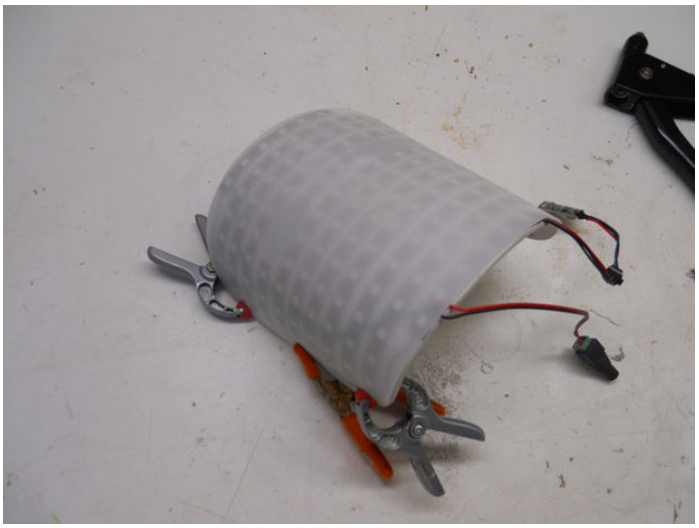


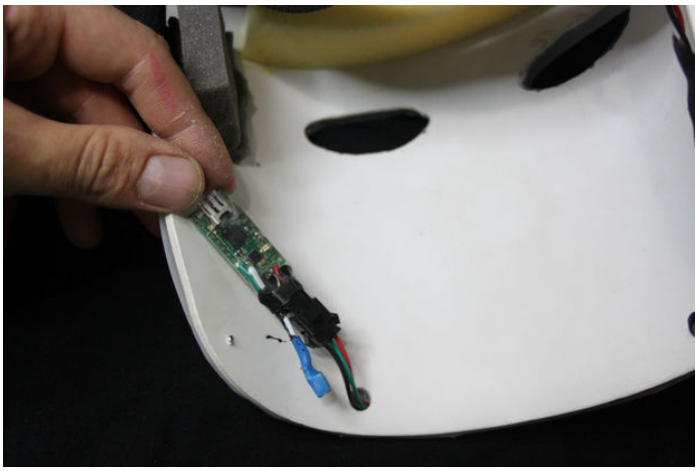
Image Notes

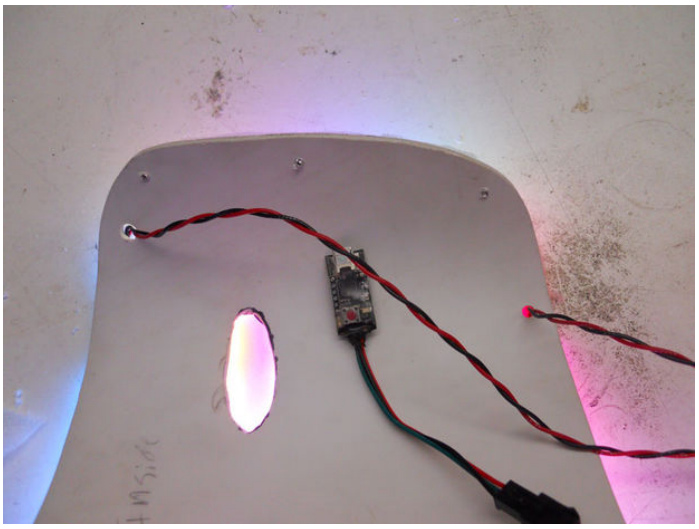
1. Did 3 pop rivets on one side, then the other.











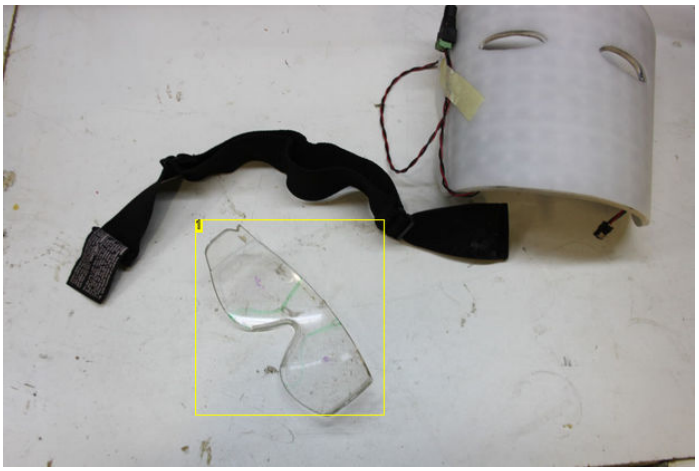
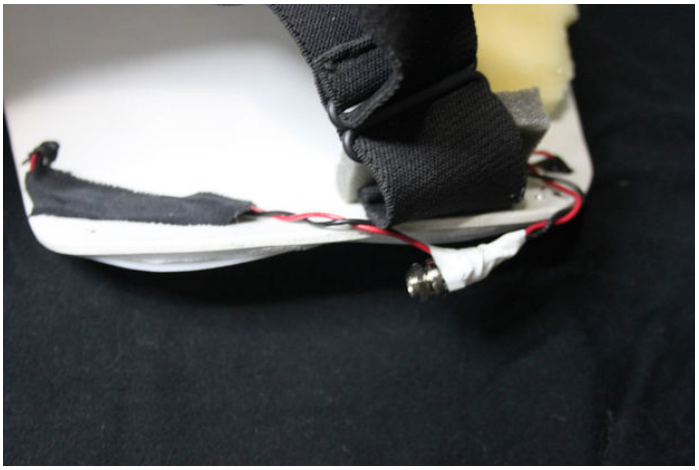


Image Notes
1. Abandoned Idea - Not used



Step 5: Control and Software

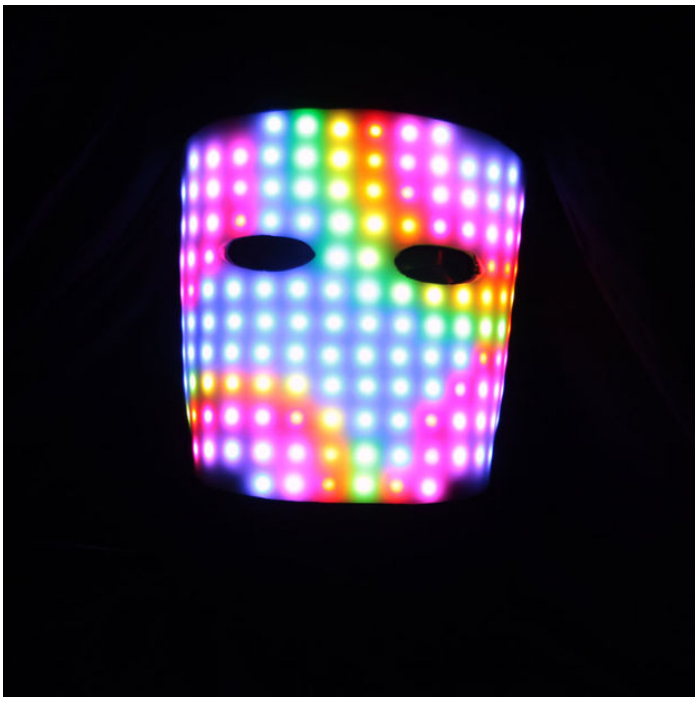
Controller: The controller chosen for this project was the Pixel Controller Ion. A very small(0.6"x1.25") controller with USB, onboard memory for storage of color sequences, single multi-use button, and compatibility with many pixel chipsets(WS2801, LPD8806, LPD6803, APA102, WS2811, etc with more to be added, request if you want one). It is compatible with NLED Aurora Control for creation of stand-alone color sequences. The controller comes in several different configurations, making it easy to implement with most any project.

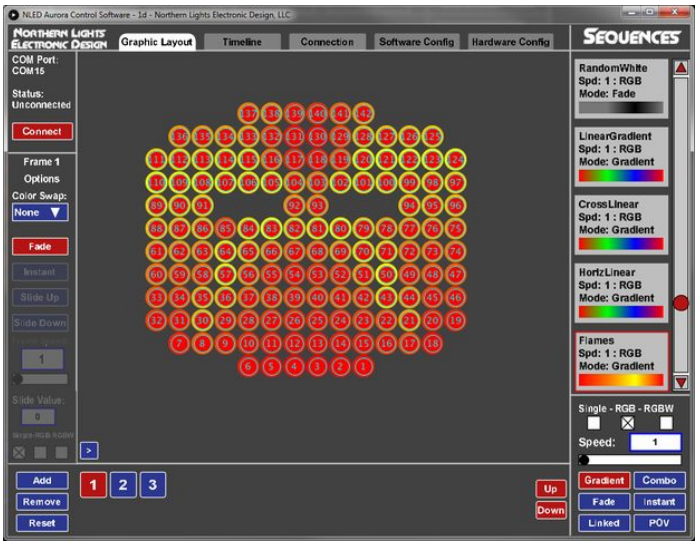
NLED Aurora Control - Stand-Alone Color Sequences: Used for the creation and upload of stand-alone color sequences to compatible NLED controllers. Once uploaded the controller can run the color sequences by itself, without a computer connection. Find all the information, downloads, and documentation on The NLED Aurora Control Webpage

Newest version allows a pixel map to be loaded and used to visualize the physical layout of the LED pixels. This makes it very easy to design color sequences for your custom project. The software NLED Matrix Patcher is a free, open source Processing application, originally for use with NLED Matrix.

NLED Matrix - Live Control with Video and Effects: Is an open-source Java based application used for mixing and controlling video content and to output it to a custom DIY LED Matrix or matrices, which can be of any shape and size. NLED Matrix supports pixel patching, which allows the user to create the order in which the software outputs the data to the LED Pixels. That means any shape of LED matrix, any layout, any color order, with any type of control scheme can be made to work with the software. It allows two feeds of video data, either from a file such as .MOV, from an image, from a external video feed, or from any of the numerous generated content. The mixed video feed can be sent over Serial(USB Adapter, or RS-485 adapter), TCP, or UDP.

The configuration files for this project can be found in the download, or with the new version of NLED Matrix. This project requires special pixel patching, as it is not a standard shape(square or rectangle). The image with the blue dots is the a screen shot of the pixel patch from the patching software, NLED Matrix Patcher(which is also compatible with NLED Aurora Control)

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Northern Lights Electronic Design
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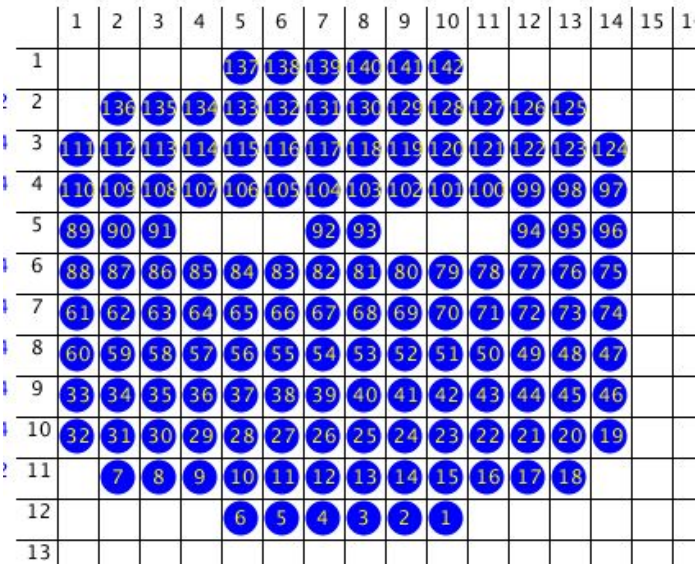
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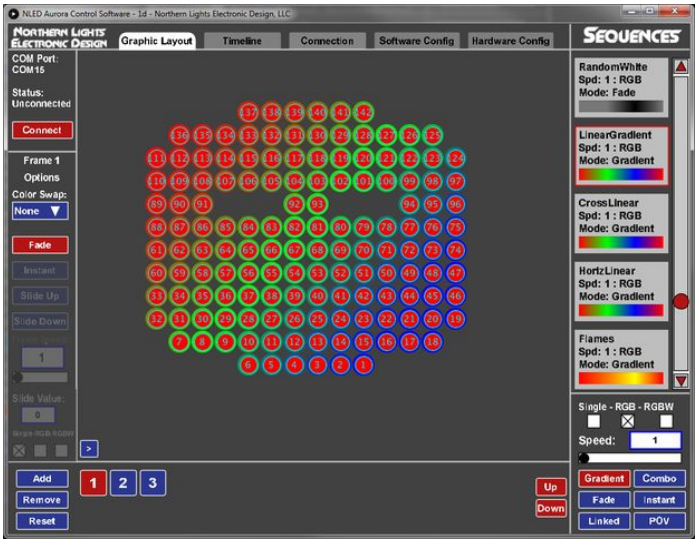
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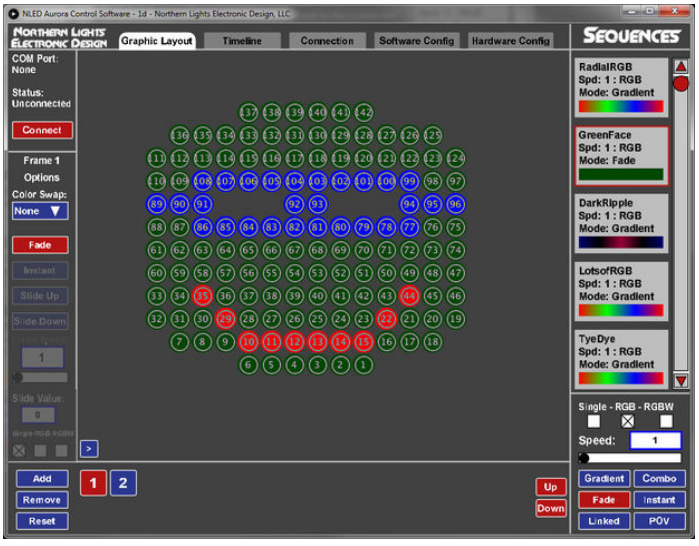
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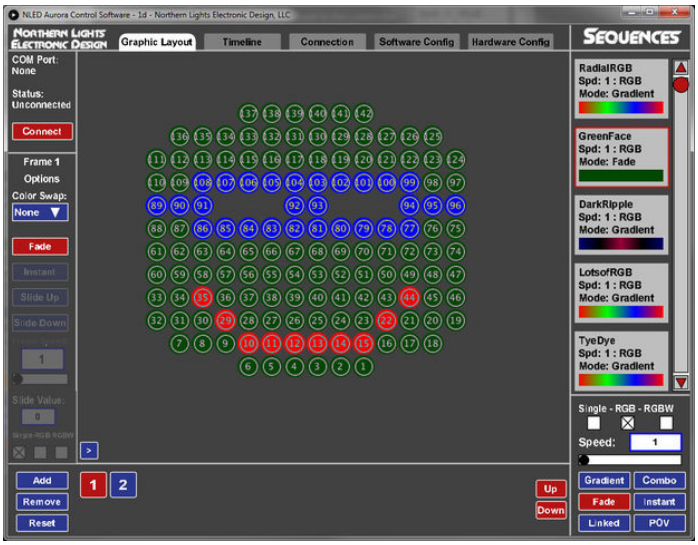
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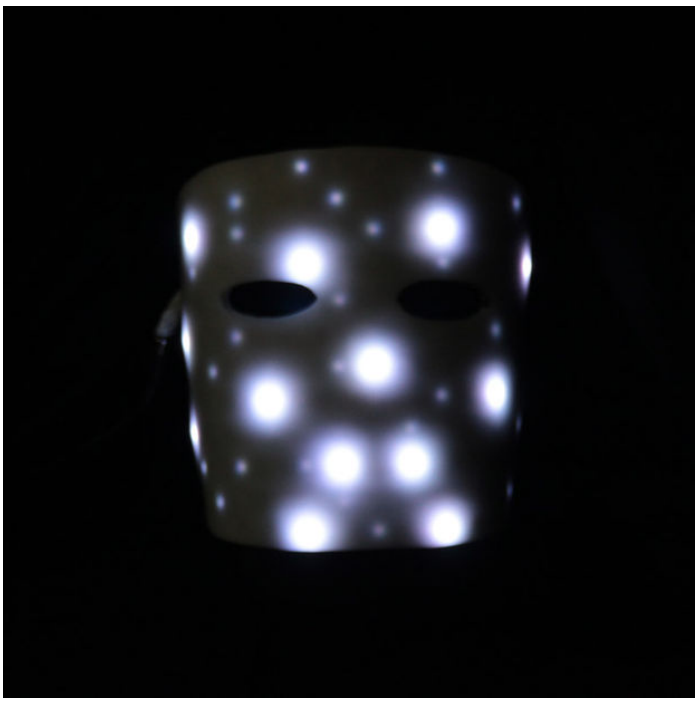

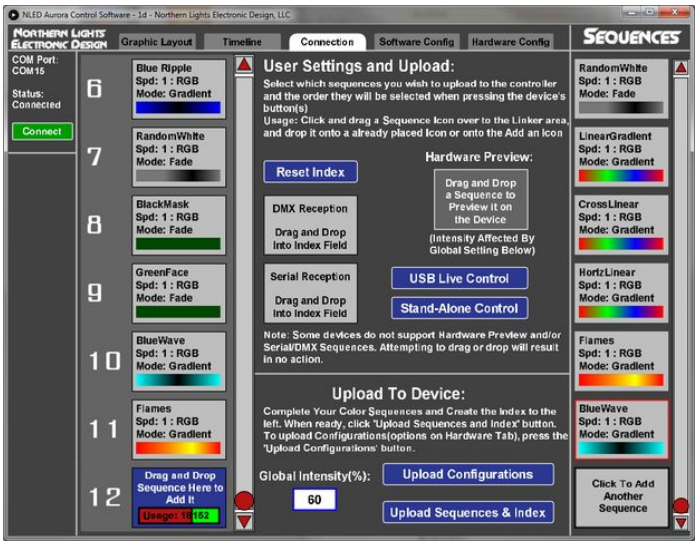

Step 6: Finished

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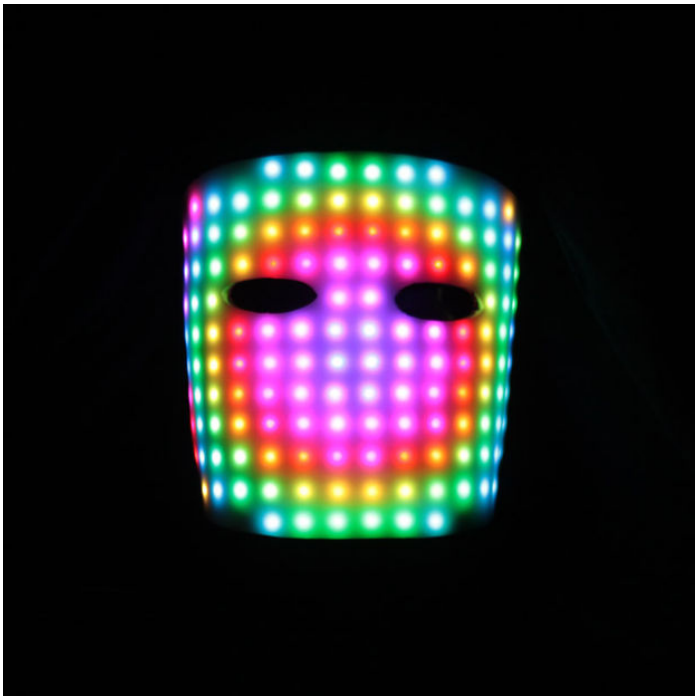
Please Contact Us with any questions, comments, or bug reports.

NLED is available for embedded programming, firmware design, hardware design, LED projects, product design, and consultation. Please Contact Us to discuss your project.

Updates and More Info Can Be Found On The Project Webpage: http://www.nledshop.com/projects/ledmatrixmask/