In this digital mock-up Breath and Taking were to be separated and hung one above the other. Each letter with a minimum of 9 LEDs, this would be hanging on the wall with all electronics hidden.

Abstract

"Breathtaking" is an open source hardware installation built into a wall at New Mexico Museum of Art in Santa Fe NM, which uses RGB LED strips inside custom cut/translucent acrylic letters that are designed to "inhale" and "exhale" at the rate of an average breath. Its purpose was to welcome visitors into an exhibit with multiple New Mexico based artist's installations.

https://vimeo.com/799324356
https://vimeo.com/799335121

The museum used a local vendor in Santa Fe to cut the acrylic letters to spell out BREATHTAKING and technology fabricator Becca Sharp was hired to solder and test the electronics used in the title wall. Technology fabricator Rianne Trujillo was also hired to help with the installation and creative coding for the LEDs. They used a single Arduino Uno and just over two meters of LED strips from Adafruit. This project was developed and created in two months, however, due to the Covid19 Pandemic this project was shelved and not installed until the following year - almost nine months after prototyping /began.

Project Development

Initial Proposal

Professors Lauren Addario and Miriam Langer have been successfully running a paid summer internship program in Media Arts & Technology for over ten years. Through this internship program they create opportunities for students to use their skills and interests to work with a museum or historic site for an entire summer from concept to install in most cases. They introduced Becca Sharp to Matt, Monica, and Kate from the New Mexico Museum of Art for an interview to take on this project. The install as originally planned would greet visitors as they made their way to an exhibit that would only be available to the public for a short time. The lights illuminated and would slowly dim at the rate in which someone would breathe in and out at an average pace.

Becca Sharp worked closely with Matt, Monica and Kate to determine the budget of the project and at the time, pre-shutdown, the date of install for a Summer 2020 opening. Becca Sharp worked with Miriam Langer and Rianne Trujillo to develop a parts list and custom circuit using a single Arduino Uno R3 and two power supplies to operate the LEDs and microcontroller. The LEDs would also be daisy-chained together with JST connectors on every letter with an input and output to ensure easy replacement if necessary.
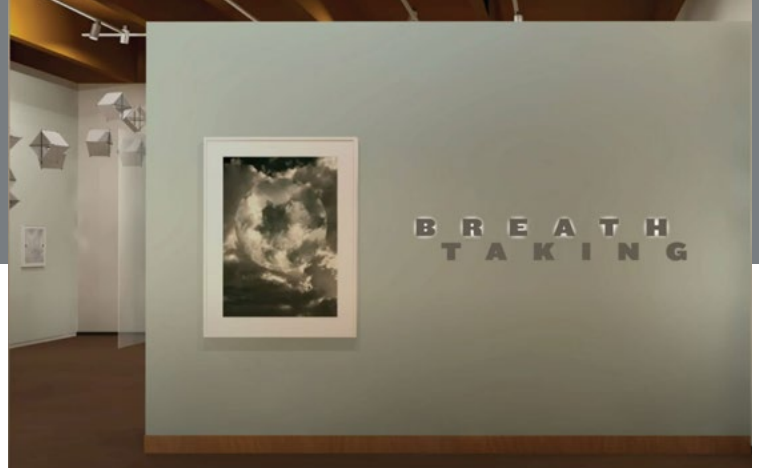
Early Prototyping

Becca started by creating a custom circuit with the help of Rianne Trujillo to test the LEDs and determine how much power will be needed based on how many LEDs would be used in the install. Becca cut and soldered LED strips to use for testing colors and brightness with a simple strand test using Arduino CC. We decided on using a 5V LED strand from Adafruit (Product ID: 1138). Two power sources were used, one was for the Arduino Uno R3 to power this was a 9V1Amp and the other was to power the LEDs. Due to the amount of LEDs used (2.5 meters at 60LEDs per meter) a 5V10Amp was needed for power.

The requirements were that the top word would illuminate and as it was dimming the bottom word would illuminate seamlessly. This would need to operate from open to close at the museum for (at the time) an undetermined number of months.

Becca was provided with a single acrylic letter 'B' to use for prototyping and testing this letter would be the same size and painted with the same top coat of gray paint. The letter was solid and needed to have an area for the LED strip, Becca used a dremel to create an inlay for the LED strip to rest in facing the wall. This would allow for no bright LEDs to be seen through the acrylic letters
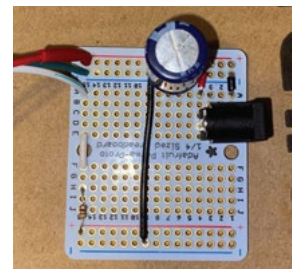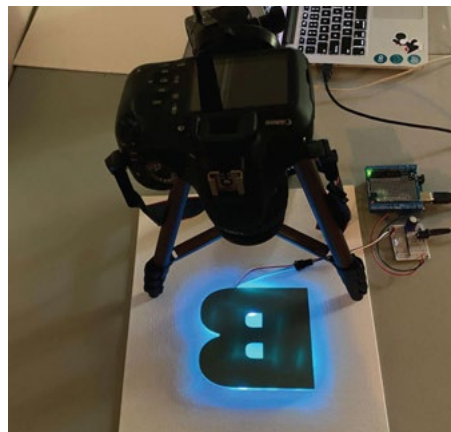
During testing, it was decided to flip the LEDs due to the sharpness of the lights.

The letters were then all soldered and daisy chained together to further test.

While communicating with the museum staff and giving updates all LEDs were plugged in and tested. This led to the decision to split the two words up by adding on another JST connection to the circuit and allowing the B and T to be the two letters plugged directly into the circuit starting each letter. The number of LEDs per Letter in each word were as follows:

B-13 (0-13)	**T**-11 (78-88)
R-14 (14-27)	**A**-12 (89-100)
E-12 (28-39)	**K**-14 (101-114)
A-12 (40-51)	**I** -6 (115-120)
T-11 (52-62)	**N**-15 (121-135)
H-15 (63-77)	**G**-9 (136-144)
=77 pixels (0-77)	=71 pixels (78-144)

Fritzing Schematic

After this time, when both words were performing as wanted, the project was packed carefully into a box with handwritten notes regarding the project and how it was created.
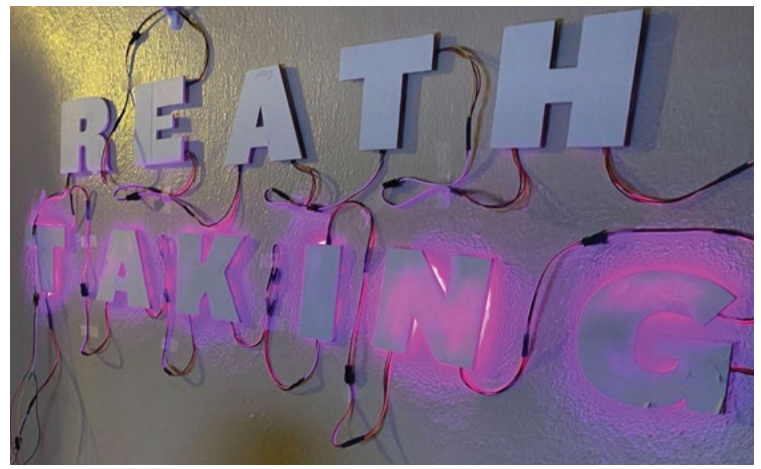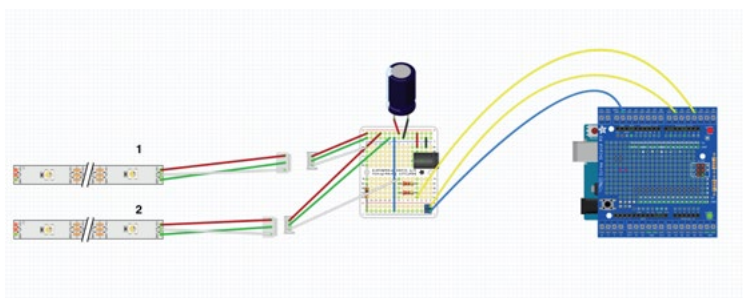
Installation

On Site at NMMoA

In February of 2021 the museum had contacted Becca Sharp, Lauren Addario and Miriam Langer and said that they were ready for installation. The electronics had been packed up in bubble wrap in a taped box since July of the prior year and needed testing.

The lights were tested and worked as planned seven months earlier. An installation team with Becca, Rianne, and Daniel Vaughn-Sharp worked at the museum for two days in a one week period. The museum had provided a large moving wall that had an opening on one end for the team to be able to get on the inside of the wall without being exposed in any way.

There was only one thing to still determine with the museum which was the color of the LEDs. The museum was still debating between two colors but ultimately decided on a turquoise (RGB: 10, 210, 180).

The install team worked with the museum curator Kate and (I need to remember his name but he was incharge of doing things like drilling into the walls) to drill holes into the wall to allow the JST connectors to go through and plug in on the inside of the wall.

Documentation Photos for museum
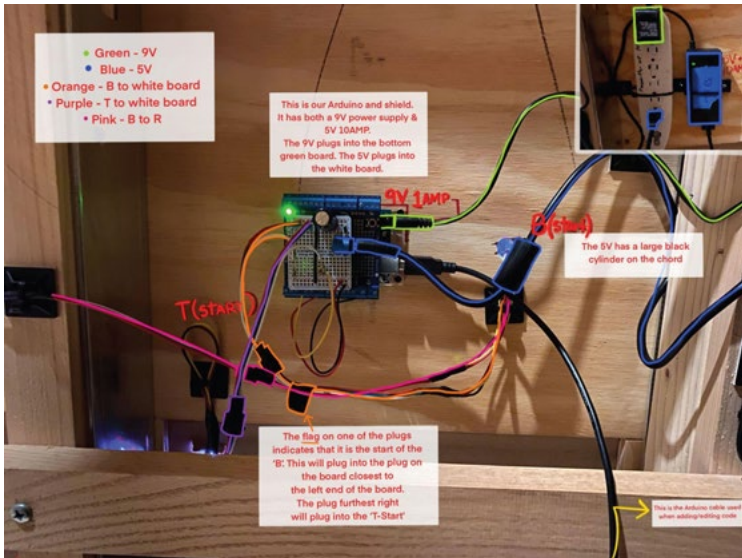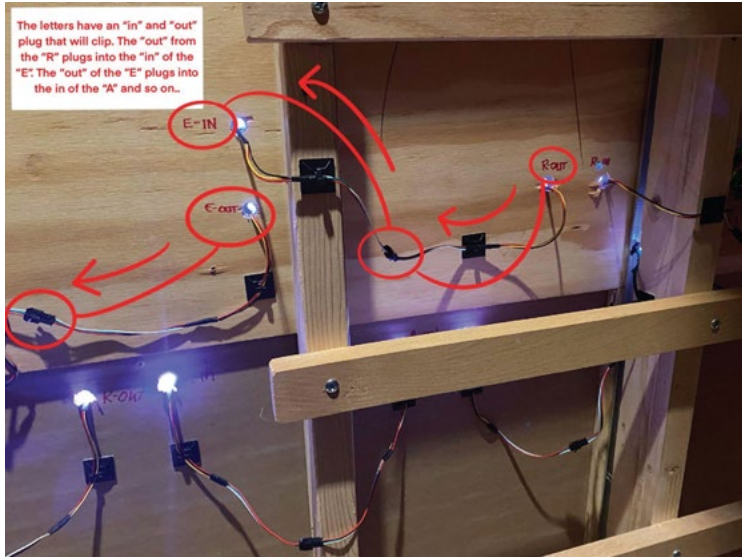
The above photos were left with the museum in case anything needed to be plugged back in. This however was not needed because the cables were managed and secured using zip ties and adhesive squares.

Parts List

- All parts are from Adafruit & SparkFun Electronics:
- 5V10Amp external power supply | Quantity: 1
- 9V1Amp external power supply | Quantity: 1
- 2.5 Meters 60 LEDs perMeter - LED Strip RGB | Quantity: 3 Meters
- JST Connectors: 3PIN | Quantity: 30pcs
- Arduino Uno R3 | Quantity: 1
- Arduino Uno Terminal Screw Shield | Quantity: 1
- Protoboard ¼ Size | Quantity: 1
- 2.1mm DC Barrel Jack | Quantity: 1
- Capacitor 1000uF | Quantity: 1
- 470 Ohm Resistors | Quantity: 2
- 1K Resistor | Quantity: 1
- Zip Ties
- Adhesive Squares

Troubleshooting and Lessons Learned

When troubleshooting to prepare to install one of the connection cables was far too long and was causing issues. While working with the letters we used BHV tape (linked here) to hang the letters and also adhere the LEDs to the inside of each letter. This was a one shot kind of thing and we learned that this BHV was great and held up multiple acrylic letters.

While installing the letter G the LEDs were accidentally bent and needed fixing. Thankfully we had more LED strands as well as JST connectors and were able to clip off the ripped LEDs and replace them on site. This did not slow down our installation but we did notice that when working with small channels for LEDs less is best rather than to try to fit as many as you can.

Conclusion

Overall, this was a very successful install from concept to installation. The electronics were reliable and from sources that have been used in other projects from the Media Arts & Technology department at NMHU.

This project was put on hold because of the Covid19 Pandemic and the LEDs were packed away for months, because of the software and hardware used the project was able to pick up right where it was left off when the time came.

By using open source hardware it was affordable and efficient especially when replacing LEDs during install. For this reason, we were also able to reuse these LEDs and letters to spell out "Night Break" for a student project the following Fall Semester.