Halloween LED Mask – A Sustainable Alternative Arduino with Adafruit Gemma

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Introduction

The fashion industry is an evolving industry and humans adapt to it by following trends and using various cosmetic products. Though this led to a thriving cosmetics industry, it has resulted in large amounts of chemical wastage. This demands for a sustainable alternatives – LEDs. LEDs are considered to be a sustainable option as they facilitate the idea of re-use. They are facilitated with microcontrollers, which are small computers that enable self-programming of brightness and colors of the LEDs [1] and this way, one can change their appearance without large costs of pollution [2]. This presentation builds on this idea to propose a design for a sustainable, innovative and an adaptable Halloween mask.

Methods

This product was built using Arduino IDE with Adafruit Gemma microcontroller and a Neo Pixel ring. The design for the Halloween masks involved 2 main aspects: circuit arrangement and programming of the microcontroller.

Circuit Arrangement and Exterior Appearance

The circuit arrangement involves three main connections which have been carried out through conductive thread and sewing kit. The D1 pin-out, GND pin-out and Vout pin-out of the Adafruit Gemma microcontroller have been connected to the Data Input pin-out, GND pin-out and PWR (5V) pin-out on the Neo Pixel ring respectively. In addition to connections, appearance of the product to users is essential for any sort of marketing and thus some other features like double layering the sewed part and aesthetic touch-ups were made to the Halloween mask.

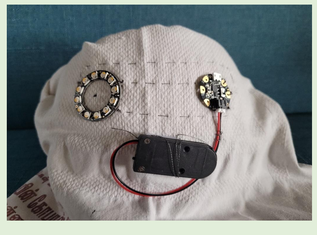

Figure 1: the circuit arrangement on the mask

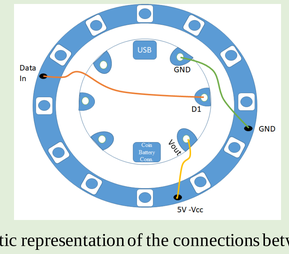

Figure 2: The schematic representation of the connections between the pin-outs

Programming of Patterns

The programming employed the Adafruit Neo Pixel library to import 4 unique patterning programmed through 4 different modes. These mode were accessed using a switch case block and each mode runs every 8 seconds. The first mode is a spinning wheel of changing brightness where the color of the entire wheel is reset every spin. The second mode is a fade effect where the lights pulse periodically. The third mode is a blinking pattern where the lights turn on and off all at once periodically. The fourth mode is an alternating pattern where the lights switch on in an alternating pattern and color.

Figure 3: The programming behind the switching of modes and timings

Results

The design of the mask depends on flashing of the LEDs and one essential factor to be considered while designing is the frequency of the flashing. The frequency of the LEDs depends on the capacitors and their capacitance values. Thus, the relation between the frequency and the capacitance values are analyzed. The Table 1 tabulates the calculated frequency values for a range of capacitance values and has been graphed in Figure 4. From Figure 4, shown on the right, it could be established that the relationship between the investigated values are an inverse exponential relationship. In other words, as the capacitance increases, the frequency of the flashing LEDs decrease exponentially.

Table 1: The calculated values of Frequency in hertz for a given range of capacitance values in farads

Capacitance [farad]	Frequency [hertz]
2.20E-07	3.55
1.00E-07	7.81
5.00E-08	15.62
2.20E-08	35.50
1.80E-08	43.38
1.00E-08	78.09

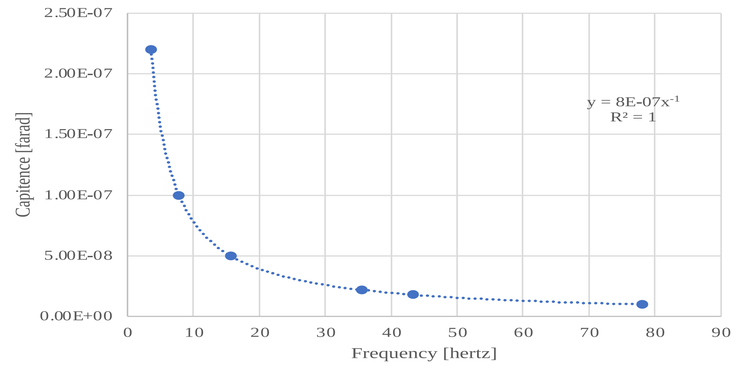

Figure 4: Graph of the Capacitance values [F] versus the Frequency of the flashing LEDs [Hz]

Conclusion

This design aims to minimize environmental pollution and provides a safe alternative to fashion wearable. The design uses the Arduino Adafruit Gemma microcontroller with a NeoPixel ring to create colorful patterns on LEDs that can be used as decorations or wearable. The device is very light weight making it portable and easy to be stitched onto costumes. It is also very safe as it designed without complicated wiring or high voltage electricity which can pose a risk to the wearer. This eco-friendly fashion device hopes to encourage others to design products that minimize the impact on the environment which prolongs the earth as a suitable place for organisms to live.

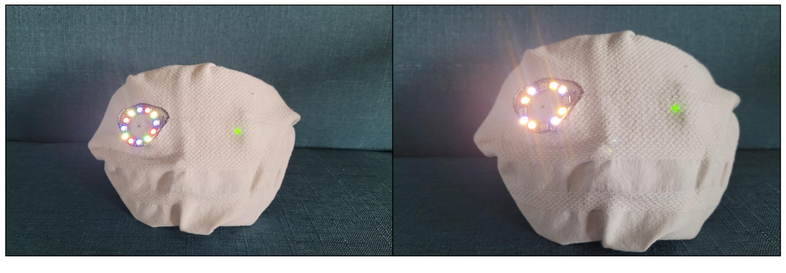

Figure 5: The final design of the Halloween LED mask after import of the code

References

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[2] G. Biwa, A. Aoyagi, M. Doi, K. Tomoda, A. Yasuda and H. Kadota, “Technologies for the Crystal LED display system” Journal of the Society for Information Display, vol. 29, no. 6, pp. 435-445, June 2021.