Whoa Board: Interactive Lighting for Wearables and Beyond

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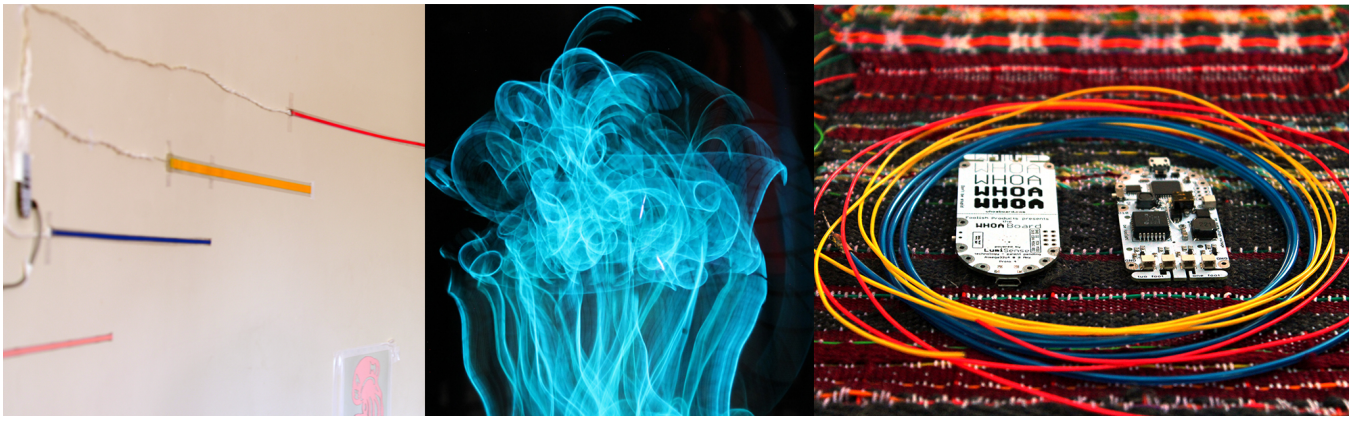

(left) An installation that uses the Whoa Board to enable interactive architectural lighting. (center) Visualizing capoeira by controlling wearable lighting in response to acceleration. Captured as a long exposure photo. By Xin Wen and Allen Costa. (right) Two Whoa Boards on a fabric woven with 1.3 mm EL wire.

ABSTRACT

We present a custom PCB which integrates a novel, fast, high-voltage tolerant, capacitive sensing circuit. This board makes it possible to turn Electro-Luminescient (EL) materials into interface elements with no modification. This sensing works at a distance (and through materials like fabric). It is the first device that makes it possible to make commodity EL materials interactive, without requiring additional modification to the EL elements.

EL materials come in a number of forms, including wires, panels, and paint. They are light, flexible, low-power, and can produce even illumination over large areas without needing a diffuser. This makes them well suited for integrating lighting into everything from wearables to complex architectural installations.

CCS CONCEPTS

•**Computing methodologies** →**Mixed / augmented reality;** Graphics input devices; •**Human-centered computing** →**Touch screens;** •**Hardware** →*Emerging interfaces;*

KEYWORDS

HCI, Wearables, Smart Clothes, Capacitive Sensing

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1 FEATURE NOTES

This board was designed to serve as a convenient general purpose prototyping platform (targeted at wearables). In addition to novel EL control circuitry, it is Arduino IDE compatible, and can be extended to communicate wirelessly through the unencumbered (and low cost) NRF24L01 radio. It can be powered off of commodity 5V supplies (for recharging cellphones), and is small enough to unobtrusively integrate into garments.

The board is capable of performing capacitive measurements on EL materials powered by either an onboard high voltage power supply or an external one (which enables application in large installations like painted architectural surfaces). These measurements can be done with an off time of the material of $< 5ms$, which is not noticeable during operation.

2 DEMOS

This board has been used to power a diversity of demos, including:

- A motorcycle jacket with integrated turn signals - triggerable through a shoulder shrug (without a dedicated sensor).
- Leggings that also respond to dance.
- A mixed material fabric woven with EL wire that responds to touch.

- An airbrushed painting which responds to touch.
- A dress with a mixture of LEDs and EL panels - touching the EL controls the LEDs.
- An installation with several large EL panels that can be triggered at a distance, and where the interaction controls sound.

3 CONCLUSION

This project presents a novel material interaction, enabled by an innovation in circuit design which is tightly coupled with specialized (and open source)[1] firmware. We believe that this technology is well suited for integrating interactive lighting/controls into a diversity of applications with complex geometry.

[1] https://github.com/foolish-products/whoaboard_getstarted