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ABSTRACT

In this workshop, Professors Nick Bontrager and Taylor Hokanson introduce the tools and services required to fabricate printed circuit boards, or PCBs. The process is more accessible than ever before, and is cheap enough to allow individuals to obtain functional prototypes, in small quantities, that are indistinguishable from similar PCBs that might be produced in the hundreds of thousands for industry or commercial applications. Using an "unpopulated" demonstration board designed by the workshop co-chairs, participants walk through all the steps needed to assemble and solder surface-mount components, finishing the event with a battery-operated, wearable, LED light display.

INTRODUCTION

Though not an art event by any means, DEFCON should be familiar to anyone working in the technology sphere; it's oldest and largest computer hacker conference in the world. While the conference is most famous for its presentations and papers on hardware and software security, it also encompasses a fantastically inventive subcommunity known as Badgelife.

Badgelifers create functional circuit boards that are worn in place of conventional conference name tags. These badges have a myriad of high-tech features, including animated light displays, wireless badge-to-badge communication, playable video games, and even flyable drone technology. In addition to these fun and flashy functions, badges can also make socio-political commentary; at Queercon 2017, the badges featured an electrical connector that "mates to itself," allowing participants to link multiple badges into complex geometric structures while making a playful reference to sexual identity[1].

The Badgelife scene has produced some amazing work to date, though its authors are engineers first and artists second. Now that projects like the Arduino and Raspberry Pi have democratized wearable computing for the rest of us, we see an exciting opportunity for artists and designers to expand into this new medium. We (Bontrager and Hokanson) embraced this opportunity by creating a badge that non-engineers can assemble and program in the context of a single, simple workshop.

INTRODUCTION

The badge for our workshop is based on a simple computer chip: the Attiny85. Once installed on the demo board, this chip can receive inputs, like the signals from buttons and sensors, and generate outputs, in the form of animated light display. The Attiny can also be programmed with inexpensive hardware and free software on a standard laptop, and costs about one dollar each. Price and accessibility were two major factors that led us to design around this chip.

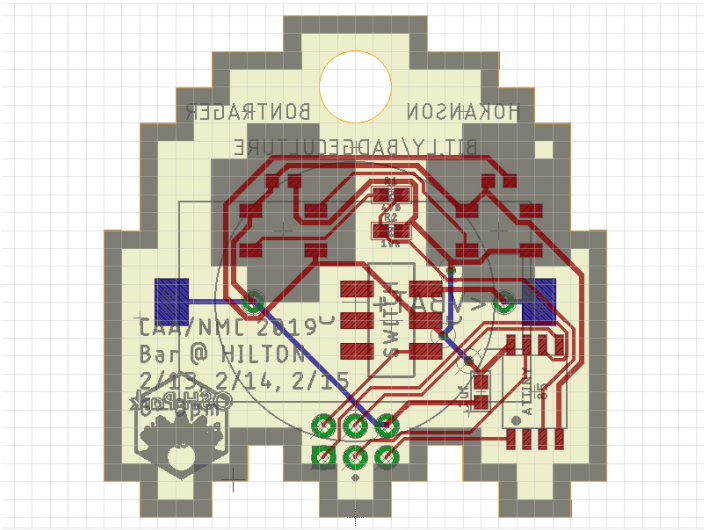

Figure 1. *EAGLE design preview for "ghost" badge variant.*

Though similar to the Arduino, a popular and well-established physical computing platform, our purpose-built hardware features some important differences. Compared to the Arduino, our development board has a drastically reduced part count. This decision also limits the device's function, though we argue that a simpler design makes the project less intimidating for and more applicable to a wider audience. Further, Arduino users usually purchase their devices prebuilt, whereas workshop participants built their devices by hand, first applying solder paste, then placing each component on the PCB with a pair of tweezers. Populated boards are then "baked" on a hot plate, toaster oven, or similar device, until the solder melts and fixes all the parts in place.

The New Media Caucus workshop at the College Art Association conference in February 2019 was a big hit. Almost all of our 25-30 participants got to make their own badge, program it, and take it home for further experimentation. Future events could include more people if we streamline the design, perhaps by partially populating the board ahead of time. Working from a simple, but functional, device, attendees could instead focus on adding secondary parts, with a lecture/workshop describing how to interface the core board with various sensors and actuators.

Figure 2. ***Fabrication is simple enough to perform in a conference hotel room.***

All of the design files for this project are available for free on Github[2], an online content distribution platform. As the project moves forward, we hope to inspire a movement similar to DEFCON's Badgelife, ultimately taking a back seat as principal authors when the community becomes self-sufficient. In a bid towards generating that energy, we will disseminate further versions of the device in increasing scale, with plans to eventually release badges at events with hundreds, or even thousands, of attendees.

Figure 3. ***Workshop participants display a finished badge.***

ACKNOWLEDGEMENTS

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ENDNOTES

1. https://blinkylights.ninja/blinky-lights/queercon-14-defcon-25-2017/ Retrieved March 1, 2019.
2. http://bit.ly/badgeculture Retrieved March 1, 2019.

AUTHOR BIO

Nick Bontrager is an interdisciplinary artist whose work and research explores the physical and conceptual nature of the moving image, game-based interactions and exchanges, and the idea of replicas or facsimiles as tools of preservation or understanding.

Nick received his MFA from The Ohio State University for studies in Art & Technology and his BFA at the University of Houston in Photography & Digital Media. His artwork has been exhibited internationally in film festivals, museums, and galleries with a recent focus on interactive electronics workshops for underrepresented and underserved groups.

Nick is currently an Associate Professor of New Media Art at Texas Christian University in Fort Worth, Texas where he resides with partner, Jessica, and their two cats, five chickens, and one turtle.

Taylor Hokanson is an artist, academic, podcast producer, open hardware advocate, and noted tall person. As a longtime participant in the “maker" movement, Hokanson investigates the impact of technology consumption in the post-digital landscape. Examples include human-computer interaction, computer-aided fabrication, and new models for collaborative authorship and content distribution. Though technical in origin, these research avenues demonstrate how omnipresent computing is rapidly eroding traditional notions of value, creativity, and craftsmanship. Hokanson directs our attention to this cultural inflection point with multimedia artworks that blend technology with absurdity, producing social commentary that is intriguing, accessible, and fun.