Making Textile Sensors from Scratch

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Abstract
This workshop will explore the use of low-cost materials and tools to build textile-based interfaces. We will introduce a range of methods for handcrafting textile sensors and circuitry. Participants will learn techniques developed by the workshop leaders and will also be encouraged to use our material library to design their own custom sensors. The goal of the workshop is to familiarize participants with available electronic textile materials and introduce them to a variety of sensor and circuitry construction techniques.

Keywords
DIY, sensors, soft circuitry, craft, handmade, conductive materials, electronic textiles, e-textiles

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design

Introduction
We will begin the workshop by introducing participants to a range of low-cost and widely available textile materials that have interesting electrical characteristics. We will demonstrate how these materials can be employed to build an assortment of textile circuits and sensors [cf 1].

Participants will then have the option of using one of our designs to construct an interface or experimenting with the materials we have collected to build their own sensors and circuits. Figures 1-5 show examples of some of the sensors and materials we will introduce.

Figure 1: Tilt sensor made from conductive fabric, conductive thread and a metal bead

Figure 2: Neoprene bend sensor made from neoprene, conductive fabric, conductive thread, and Velostat

Figure 3: Stroke sensor made from neoprene and conductive thread

Figure 4. Series of crochet tilt potentiometers made from resistive and traditional yarn

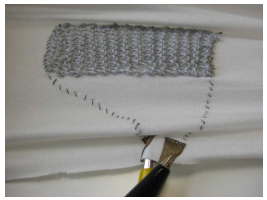

Figure 5. Stretch sensor made by knitting resistive yarn

We expect that participants will explore the physical and electrical properties of many of the materials and experiment with how these properties can be leveraged in a variety of sensing and interaction contexts. Collaboration between participants is encouraged, as is the inclusion of participants' professional or hobbyist skills. Participants are also welcome to bring materials and tools that they would like to share, demonstrate or use.

The materials for this workshop were sourced and selected because of their availability and price and include conductive and resistive fabrics and yarns, metal fasteners, beads, fusible glues, fabric glues and neoprene. The LilyPad Arduino will be introduced as a computing platform designed to be integrated in textile circuitry [2]. Techniques such

as knitting, crochet, sewing, and laminating will be demonstrated.

Studio Topics and Learning Goals

Sensors that will be introduced in the workshop include pressure and bend sensors, knitted stretch sensors that can also detect pressure, crocheted tilt potentiometers, embroidered and fused tilt sensors and stitched stroke sensors. Peculiarities about the materials and tools used to construct these sensors will be shared with the participants. For example, conductive thread frays when knotted and cut, and anti-fray and fabric glues can be used to prevent this; neoprene, a material between a fabric and a rubber, has great isolating properties; cross-disciplinary use of tools comes in handy when combining materials. The workshop will focus on exploring the materials at hand and inspiring human-computer interaction scenarios that can be supported by textile interfaces.

Participants will learn how to build textile-based sensors and circuitry from textile materials that are readily available. They will also learn where and how to obtain these materials and should leave the workshop with the skills and knowledge necessary to start building textile-based interfaces.

Studio Supporting Web Documents

>> http://www.kobakant.at/DIY/
>> http://www.instructables.com/member/Plusea/
>> http://hlt.media.mit.edu/
>> http://web.media.mit.edu/~leah/LilyPad/
>> http://processing.org/
>> http://arduino.cc/
>> http://lessemf.com/fabric.html

References

[1] Buechley, L. and Eisenberg, M. (2009) Fabric PCBs, Electronic Sequins, and Socket Buttons: Techniques for E-textile Craft. Journal of Personal and Ubiquitous Computing, 13(2), pp 133-150.

[2] Buechley, L., Eisenberg, M., Catchen, J. and Crockett, A. [2008]. The LilyPad Arduino: Using Computational Textiles to Investigate Engagement, Aesthetics, and Diversity in Computer Science Education. In *Proceedings of the SIGCHI conference on Human factors in computing systems (CHI)*, pp. 423-432.