Syllabus

CSCI11 2018: Electronic Textiles

4-week Winter Term Course for students with [any] previous computer science background.

Overview

Digital data is being infused throughout the entire physical world, escaping the computer monitor and spreading to other devices and appliances, including the human body. Electronic textiles, or eTextiles, is one of the next steps toward making everything interactive and this course aims to introduce learners to the first steps of developing their own wearable technology devices.

After completing a series of introductory eTextiles projects to gain practice in necessary skills, students will propose and design their own eTextiles projects, eventually implementing them with Lilypad Arduino components, and other found electronic components as needed. The scope of the project will depend on the individual's prior background, but can include everything from a sweatshirt with light-up turn signals for bicycling, to a wall banner that displays the current air quality of the room, to a stuffed animal that plays a tune when the lights go on, to whatever project you can conceivably accomplish with Lilypad Arduino inputs, outputs, and development board in a two-week time period.

People with little computer programming experience will learn to edit snippets of Arduino code for their purposes. People with considerable computer programming background will learn some of the idiosyncrasies of programming for Lilypad Arduino which should be transferable to other Arduino platforms.

Learning Objectives

By the end of this course, students will be able to:

1. Select appropriate stitch styles and sew two sewable items to each other with that stitch, and secure with knots.
2. Diagram, via paper prototypes, a variety of functioning circuits for physical computing.
3. Implement electric circuit diagrams using electronic components designed for textiles, using a variety of inputs and outputs.
4. Program an Arduino to use a variety of inputs and output components, both analog and digital.
5. Design and create a creative eTextiles product that uses appropriate sewing techniques, simple & complex inputs & outputs, as well as novel Arduino code to transform those inputs & outputs.
6. Apply appropriate debugging techniques that include incremental testing and help seeking from peers, the Internet, the instructor, as well as other resources.

Textbook

The course will rely heavily on online materials that will be provided as needed. The SparkFun Tutorials on Lilypad will be of particular relevance: learn.sparkfun.com/tutorials/tags/lilypad

Students may opt to purchase *Make: Wearable Electronics: Design, prototype, and wear your own interactive garments* by Hartman or *Sew Electric* by Buechley & Qiu for a more introductory book focusing on the Lilypad Arduino. Neither of these references are necessary for success in the course. The professor will have these books (and some sewing tutorial books) available for reference during class meetings.

Materials

To start, all students will need (provided by instructor, unless otherwise noted):

Available from SparkFun.com

1. 1x *ProtoSnap - LilyPad Development Board* with LilyPad Simple Board, LilyPad Button, LilyPad Slide Switch, LilyPad White LEDs, LilyPad RGB tri-color LED, LilyPad Light Sensor, LilyPad Temp Sensor, LilyPad Buzzer, LilyPad Vibe board, FTDI basic, 60 ft conductive thread, needle set, and 110mAh LiPo Battery (DEV-11262)
2. 2x *CR2032 Coin Cell Battery (20mm)* (PRT-00338)
3. 1x *LilyPad Coin Cell Battery Holder - Switched - 20mm* (DEV-13883)
4. 1x *Coin Cell Battery Holder – Unswitched – 20mm (*DEV-08822)
5. 1x *LilyPad Rainbow LED (6 Colors)* (DEV-13903)
6. 1x *Alligator Test Leads* (PRT-12978)
7. 1x *USB Mini-B Cable* (CAB-11301)
8. *Conductive fabric* (COM-14110)
9. Depending on your proposed project, there are other components you may need but are not supplied. Using just the above listed supplies you should be able to implement a variety of interesting projects.

Other

1. Storage box
2. Some fabric to sew on (i.e., craft felt, cotton calico, an old T-shirt, other textiles)
3. Non-conductive sewing thread, embroidery floss
4. Fabric Scissors (Do not use to cut anything other than fabric!!)
5. 2-3x Needle threaders
6. Depending on your proposed project, you may require specific textile objects that will not be supplied (i.e., Velcro, ribbons, more fabric, a shirt, a stuffed animal, a pennant, painted canvas, etc.). There is a small budget for these supplies, about $5/student.

You may want to download the Arduino Desktop IDE prior to week 2: https://www.arduino.cc/en/Main/Software

Evaluation

There will be [0, check-minus, check, check-plus] graded assignments to provide summative feedback on your progress on these skills. You should complete these assignments individually, without assistance from other students. Assignments are generally to be completed by the next class session. Class sessions will often include some time to work on these assignments, to provide students timely assistance on their efforts. See assignment hand-outs for specific details.

Participation and Citizenship

In order to learn the most from our in-person meetings, it is necessary to attend each session and to complete the daily assignments. Peer feedback will be given on assignments the following class session, and so if you have not done the assignment, it will be difficult to discuss your efforts with classmates. This category also includes cleaning up your workspace at the end of class and providing respectful feedback to your peers.

Grade Breakdown

Assignments 35%

Class Activities /Citizenship 15% (for reasonable effort)

Final Project 50% (proposal, prototypes, final project)

Students Who Need Accommodations

If formal accommodations need to be made to meet your specific learning or physical abilities, please contact me as soon as possible to discuss appropriate accommodations. Please also contact the Director of Accessible Education, Dr. G. L. Wallace (413-597-4672) or the Dean's office (413-597-4171). We will work together to ensure this class is as accessible and inclusive as possible. Also, students experiencing mental or physical health challenges that are significantly affecting their academic work are encouraged to contact me or to speak with a dean. The deans can be reached at 413-597-4171.

The Honor Code

Homework and assignments are to be the sole work of each student unless the assignment explicitly states otherwise. Students may discuss issues related to an assignment, provided that such discussions are cited in the material turned in. However, students may not collaborate on designing or writing code. Uncredited collaborations will be considered a violation of the honor code and will be handled appropriately. For a full description of the Computer Science Honor Code, please see https://csci.williams.edu/the-cs-honor-code-and-computer-usage-policy If in doubt of what is appropriate, do not hesitate to ask.

Schedule

CSCI11 2018: eTextiles

The following schedule is a suggestion and may change as the class body encounters difficulties with course content.

Class generally meets Mondays, Tuesdays, and Thursdays, 10-11:50am in TCL217.

Demo Day is Thursday 1/25/18 at 10am in Bronfman 105.

CSCI11 2018:: Schedule : Schedule

Week	Monday	Tuesday	Thursday	Deliverables
1			**Jan 4:** Sewing by Hand	Assignment 1.1, due 1/8
2	**Jan 8:** Circuits & Paper Prototyping *Assignment 1.1 due.*	**Jan 9:** Simple Inputs & Outputs *Assignment 2.1 due.*	**Jan 11:** Arduino Programming *Assignment 2.2 due.*	Assignment 2.1, due 1/9; Assignment 2.2, due 1/11; Assignment 2.3, due 1/16; Project Proposal, due 1/17
3	**Jan 15: MLK Day, No Class**	**Jan 16:** Inputs & Outputs *Assignment 2.3 due.*	**Jan 18:** Project Proposal Presentations + Connecting components to Arduino *Assignment 3.1 due. Project Proposals due (**Wednesday**).*	Assignment 3.1, due 1/18; Project Prototypes (3.2) due 1/22; Project, due 1/25
4	**Jan 22:** Project Workshop Day *Project Prototypes & Programming (3.2) due.*	**Jan 23:** Project Workshop Day	**Jan 25: Project Demo Day** Bronfman 105 10am-12p *Projects due at Open House Write-up due* **Wednesday** *at midnight.*	*PROJECT - demo/presentation, poster, write-up*

Thursday, January 25.

- Project Demo Day! We're in Bronfman 105!
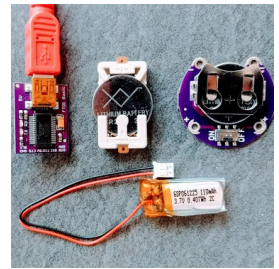- [Final Project Slides](#).

Tuesday, January 2 3.

- Project Tips. [Lecture Slides](#).

- [Project Write-Up](#) due **Wednesday** January 24, midnight.
- [Project Demo](#) due Thursday January 25, 10am in Bronfman 105.

Monday, January 22.

- Power & Projects. [Lecture Slides](#).
- [Sample Project Write-Up](#).

- [Project Write-Up](#) assigned. Due January 24, midnight.
- [Project Demo](#) assigned. Due January 25, 10am in Bronfman 105.

Thursday, January 18.

- Connecting Components. [Lecture Slides](#).
- [Sample Code for Assignment 3.1 (I/O).](#)
- [Project Proposal Slides](#).

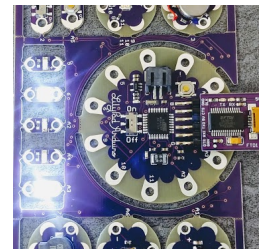- [Assignment 3.2 (Project Prototypes)](#) assigned. Due January 22, 10am.
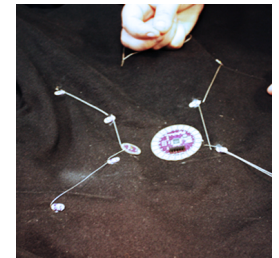
Tuesday, January 16.

- Input/Output Components. [Lecture Slides](#).

- [Assignment 3.1 (I/O)](#) assigned. Due January 18, 10am.
- [Project Proposal](#) assigned. Due January 17, midnight.
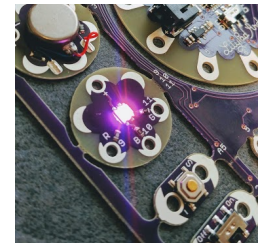
Thursday, January 11.

- Arduino. [Lecture Slides](#).
- [Assignment 2.3 (Sparkly)](#) assigned. Due January 16, 10am.
  - *Takes about 3 hours, with wide variability.*

Tuesday, January 9.

- Series Circuits, eTextiles Tips, Conductive Fabric. [Lecture Slides](#).
- [Assignment 2.2 (Homemade Switches)](#) assigned. Due January 11.
  - *Takes about 1.5 hours.*
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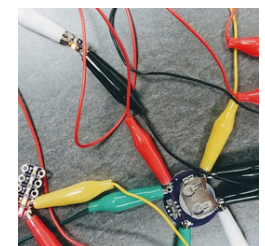
Monday, January 8.

- Simple Circuits. [Lecture Slides].
- [Assignment 2.1 (Simple Circuits + Plushy)] assigned. Due January 9am.
  - *Takes about 3 hours.*

Thursday, January 4.

- Hand Sewing. [Lecture Slides].
- [Assignment 1.1 (Embroidery Sampler)] assigned. Due January 8.
  - *Takes about 5 hours.*