Welcome to CSCI: eTextiles.

Course Overview

Lecturer: Prof. Iris Howley (email)
Class Time: TODO
Office: TODO
Office Hours: TODO (I am also available by appointment)
Website: TODO
Prerequisites: Computer Science 134 is encouraged.

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. Sew two sewable items to each other with a running stitch, overcast stitch, and secure with knots.
2. Diagram, via paper prototypes, a variety of functioning circuits for physical computing.
3. Implement an electric circuit diagram using electronic components designed for textiles, using a variety of inputs and outputs.
4. Apply appropriate debugging techniques that may 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.

Materials

To start, all students will need:
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) $60
2. 2x *CR2032 Coin Cell Battery (20mm)* (PRT-00338) $2x2
3. 2x *LilyPad Coin Cell Battery Holder - Switched - 20mm* (DEV-13883) $4x2
4. 1x *LilyPad Rainbow LED (6 Colors)* (DEV-13903) $5
5. 1x *Alligator Test Leads* (PRT-12978) $3
6. Depending on your proposed project, there are other components you may need. Using just the above listed supplies you should be able to implement a variety of interesting projects.

Other

1. Some fabric to sew on (i.e., an old T-shirt, craft felt, other textiles) $5
2. Non-conductive sewing thread $1
3. Scissors $7
4. Needle threaders (if unfamiliar with threading a needle) $2
5. Depending on your proposed project, you may require specific textile objects (i.e., Velcro, ribbons, a shirt, a stuffed animal, a pennant, painted canvas, etc.)

You will want to download the Arduino Desktop IDE prior to week 2:
https://www.arduino.cc/en/Guide/ArduinoLilyPad

Evaluation

There will be **weekly graded assignments** to provide summative feedback on your progress on these skills. You should complete these assignments individually, without assistance from other students.

Weekly assignments are broken down into **daily sub-assignments** which students will receive participation credit for if completed by the next class session. Class sessions will often include some time to work on these sub-assignments, to provide students timely assistance on their efforts.

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 sub-assignments. Peer feedback will be given on sub-assignments the following class session, and so if you have not done the sub-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)

Schedule

The following schedule is a suggestion and may change as the class body encounters unexpected difficulties with particular topics.

Date	Topic	Assignment (Due next class)	Project DUE
Week 1 - New Learning Objectives: 1. *Sew two sewable items to each other with a running stitch, overcast stitch, and secure with knots.* 2. *Diagram, via paper prototypes, a variety of functioning circuits for physical computing.*			
1.1	Electric Circuits Part 1	Problem set on: identifying functioning & shorting circuits; Predicting which LED will have more/less amperes; Open & closed circuits.	
1.2	Electric Circuits Part 2	Given system requirements, diagram new circuits (i.e., 3 LEDs that turn on when the lights turn-on in a room, etc.). Leverages use of simple/parallel/sequential circuits and knowledge of open/closed circuits, shorting, etc.	
1.3	Sewing by Hand	Sewing sampler that includes running stitch, overcast stitch, and securing end of thread. **Assignments 1.1, 1.2 & 1.3 are due by 2.1**	

Week 2 - New Learning Objectives: *3. Implement an electric circuit diagram using electronic components designed for textiles, using a variety of inputs and outputs [simple].* 4. *Apply appropriate debugging techniques that may include incremental testing and help seeking from peers, the Internet, the instructor, as well as other resources.*			
2.1	Simple Outputs with the Lilypad Components	Using battery holder, conductive thread, and 1-2 LEDs, sew a simple circuit that is then turned into a parallel circuit. A second task incorporates the battery, two LEDs, and the Lilypad board.	
2.2	Simple Inputs with the Lilypad Components	Sew light sensor to previous battery-2 LED-Lilypad project.	
2.3	Programming with the Lilypad Arduino	Program the Lilypad from previous two assignments in such a way that one LED lights up when it's dark, and the other LED lights up when it's bright. When lights-switch off and on in quick succession, both LEDs should turn on for 5 seconds. **Assignments 2.1, 2.2 & 2.3 are due by 3.1**	
Week 3 - New Learning Objectives: *3. Implement an electric circuit diagram using electronic components designed for textiles, using a variety of inputs and outputs [complex].* *4. Apply appropriate debugging techniques that may include incremental testing and help seeking from peers, the Internet, the instructor, as well as other resources [programming].*			
3.1	Programming with the Lilypad Arduino Redux (Anticipating difficulties) & Firehose Presentation of Project Proposals	Fix the code from previous assignment.	**Project Proposals (idea concept, requirements, necessary materials).**
3.2	Complex Inputs & Outputs with the Lilypad Components Part 1 (and feedback on project prototypes)	Sew battery, Lilypad board, Lilypad temperature sensor, and Lilypad Tri-color LED Board to each other.	**Paper prototypes/diagram of electric circuits for project.**
3.3	Complex Inputs & Outputs with the	Program the previous assignment with a behavior that uses at least three levels of inputs from the	**Sew components for your project. (Incremental test!!)**

	Lilypad Components Part 2	temperature sensor and three levels of outputs from the pixel board (i.e., not just off and on). **Assignments 3.1, 3.2 & 3.3 are due by 4.1**	
Week 4 – Learning Objectives: *Synthesis of Learning Objectives 1-4.*			
4.1	Complex Inputs & Outputs with the Lilypad Components Redux (Anticipating difficulties)	Fix previous assignment's programming.	
4.2	Project Workshop Day		**Program behavior for your project.**
4.3	Project Demo Day		**9-slide poster for your 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 and 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.