LMC 8803 Prototyping

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Mo 12-3 + Fri 12:30-2:30 (Prototyping Lab ID/ College of Architecture)
Office hours: Nitsche: Mo 3:30-4:30 (TSRB 320B)

Description

The course provides a hands on introduction to hardware prototyping. It covers the use of tools, work with various components, as well as the integration and programming of microcontrollers. It is not a software class and some coding knowledge is beneficial but the course itself does not require prior programming experience.
Assignments will range from basic circuit-building to the use of more advanced components (sensors, motors), to a combination of the electronic prototype with traditional materials. The final projects will be inspired by an external artist's work and will be developed in collaboration with that designer but the projects ultimately will be designed and implemented by the students .
There will be a number of critical readings to situate our work and clarify key components of prototyping in emerging critical practices and the academic discourse.
On the practical level, the course will have multiple critique sessions where students present individually and in groups, discuss their concepts, receive and provide feedback, and re-iterate on their original ideas.

The course should be interesting for MS and PhD candidates with an interest in physical computing who want to build media artifacts and discuss how they relate to our surrounding world through those objects and the creation process.

Schedule

(changes are bound to happen)

Week	Date	Topic	Reading	Deliverable
1	1/11	Intro to course **Basics** Building a circuit (copper tape, LEDs, batteries, Multimeter) Build a first circuit		order your Arduino kit
	1/15	Lab (building a puppet circuit)		
2	1/18	**MLK Day**		
	1/22	Lab **Basics** Building a circuit (documentation and components, schematics, Ohm's Law, resistors, potentiometers)	"making is critical" Ratto	Sort out access to group blog;
3	1/25	**Arduino I** (set up; Blinky to RGB Blinky; one sensor (photo), one output (LED))	"what is context?" Dourish	**DUE**: "First circuit" presentation
	1/29	Lab (add a new sensor, add output)		
4	2/1	**Arduino II** (serial; servo motor) individual review session in class	"what are projects?" Hertz	
	2/5	Lab (TBC)		
5	2/8	**Arduino III** Catch up session for "film prop"		
	2/12	Lab (presentations)		**DUE**: Arduino basics "film prop"
6	2/15	**Complexity I** (controlling high currency, wireless connections)		**DUE**: presentation of existing project (part of participation grade)
	2/19	Lab (strange materials TBC)		
7	2/22	**Complexity II** (complex input, libraries)		**DUE**: your concept for "wearable" (not graded)
	2/26	Lab (use of shields, soldering)		
8	2/29	**Complexity III** (work on mid term project) Catch up session for "wearable" project		
	3/4	Lab		
9	3/7	**Complexity presentations**		**DUE**: mid term

		“wearable” project presentations + creation of groups + meet the client		project “wearable”
	3/11	Design discussion		
10	3/14	Design presentation for client		**DUE**: client design presentation
	3/18	Review of feedback and design iteration		
11	3/21	**Spring Break**		
	3/25			
12	3/28	Work on final project		
	4/1	Lab		
13	4/4	Work on final project		**DUE**: technical prototype in class
	4/8	Work on final project		**DUE**: technical prototype in class
14	4/11	Work on final project		**Due**: documentation v .1
	4/13	**DM Demo Day**		
	4/15	Work on final project		
15	4/18	catch up session for final project		
	4/22	Work on final project		
16	4/25	Work on final project		
	4/29	In-class final presentations		**Due**: final project presentations

Outline and Goals

We will use Arduinos for most of the course and students are required to purchase this introductory kit:
http://www.adafruit.com/products/170

Learning Objectives MS

- Demonstrate the ability to devise, design, create, and assess prototypical digital media artifacts, services, or environments and to contextualize them within recognized traditions of practice.

- Demonstrate use of digital media to create prototypes
- Can develop interactive media artifacts
- Can summarize their work orally and in written form using formal terminology
- Can justify the design choices in their works

Learning Objectives PhD

same as MS plus the following:

- Students can formulate original interpretations and design original prototypes that reflect an understanding of the humanistic context of digital media.
- Students can formulate and explore the answers to critical questions in the domains of Arts & Entertainment, Public & Civic Media, and Knowledge & Creativity as related to new media.

Grading

First circuit	Create a simple circuit with some form of control and form of some output; Theme: hybrid puppet	**10**
Arduino basics	Create a first Arduino project; it has to include at least one input, one output – both should be "in context"; that means: implemented in such a way as to make sense of the surrounding world and material; your object is made of a certain material and performs in a certain condition/ setting – how do you incorporate that in your design? Theme: film prop	**15**
Arduino basics	Presentation + Documentation (video, images, post, schematics)	7
Arduino basics	Project itself; functionality; complexity; design; imagination; context-inclusion	8
Complexity	Create an Arduino controlled object that includes complex input (e.g. taking in data from a second source) and complex output (e.g. use high currency motors); the operation has to remain "in context" Theme: wearable	**20**
Complexity	Presentation (clarity of presentation (slides, images, talk); daring and clear idea; put the idea in context (Who? Why? What? Which question? What material and what conditions?)	6
Complexity	Documentation (video, images, post, schematics)	7
Complexity	Project itself; functionality; complexity; design; imagination; context-inclusion	7
Final Project	The instructors will form teams who will design, revise, and implement a response to the challenges presented by a visiting designer/ artist; all pieces have to function as proof-of-concept prototypes; in this assignment the "context" is set by the external collaborator (we will have at least 2 sessions together, but the project will ultimately be developed by the students alone) did your design address the key issue at hand?	**35**
Final Project	Design presentation (see above)	8
Final Project	Final presentation (see above) plus: effective demo!	9
Final Project	Documentation; blog posts and additional descriptions; technical and design details, clarity; video; images	9
Final Project	Project itself; functionality; complexity; design; imagination;	9

	context-inclusion	
Participation	Overall Teamwork; participation in discussions; active and prepared in critiques; external project presentation	**20**
Total		**100**

100-90% = A
89-81% = B
81-72% = C
73- = D

Grading of individual pieces will be in percentage.

Workload and Technicalities

The course is split in a taught session (Mo) and a lab session (Fri). Student participation in both is mandatory. We will use a range of components that will need to be purchased by the students.
This course will use a class blog to which students are expected to post project descriptions and other material. Be aware that this blog might become accessible to external viewers. We take your privacy serious and encourage all students to anonymize their contributions to avoid any breach of your privacy as student.

Main Assignments

Circuit: you will create a simple hybrid puppet; this object will consist of an operation puppet-like (or closely related) form that you can operate/ play; it has to include a simple circuit (no microcontroller) that utilizes conductive material different from wires, at least one output (e.g. LED) and at least one manipulation form (e.g. a form of a switch); the two components of physical operation and electronic functionality should seamlessly combine; you will create a short video (~ 100 sec) of your project (it has to include one single take that explains how it functions and was build); a blog post with a short description; and present the fully operational puppet in class; you submit: video and 10 images + blog post write up on T-Square

Arduino Basics: you will create a “film prop”; this object will include the use of the Arduino; at least one input (e.g. a light sensor) and one output (e.g. a motor); find a media object from a pre-digital age e.g. the Maltese Falcon, a book, a painting etc.; you transform it into a operational film prop for a science fiction movie (of any era); the Arduino must be invisible and you futuristic change to the object must be fully functional and seamlessly integrated into the physical function and form of the object; you will create a short video (~ 120 sec) of your project; a blog post with a short description + images + full schematics; and present the fully operational “film prop” in class; you submit: video + 10+ images + full schematics + blog post write up on T-Square

Complexity: you will create a “wearable”; this object will use at least one complex input (e.g. taking in data from an online source) and at least one complex output (e.g. multiple outputs); the object has to be wearable (but can use external power sources if needed); the Arduino must be invisible; you will create a short video (~ 120 sec) of your project; a blog post with a short description + images + full schematics; and present the fully

operational puppet in class; you submit: video + 10++ images + full schematics + blog post write up on T-Square

Final Project: the instructors will form small teams; we will have an external designer/ artist whose work will be a reference point for the course; she will present her own work and approaches to the class and the teams will present their ideas as reponses back to her; they will collect feedback and then implement their ideas in functional prototypes; only after both observation phases are completed you should start the design and implementation of the final project, which is a digital response to the craft; the development process is an important part of this project and the outcome should be understood as a successful trace and validation of that process; the development process will be in 3 stages: first you present your design in class, then you deliver a working prototype, then you present your final project in class

Participation: the overall course participation and "show and share" contributions in class; this grade includes the "external project presentation" (clarity of presentation, slides, identify key points of project)

Attendance Policy
Attendance will count towards the final grade. 2 unexcused absences will result in a 10 point reduction of the overall grade. 3 unexcused absences will result in 20 points reduction of overall grade, 4 unexcused absences mean failure of the course. All assignments must be submitted in order to achieve a passing grade. Excuses have to be granted ahead of each class session.

ADAPTS Information
Notify the instructor in the beginning of the course if you have any disabilities that might need special assistance or consideration. Georgia Tech offers accommodations to students with genuine and documented disabilities. If you need such accommodations, please make an appointment with the ADAPTS office. Verification of a disability may be obtained by contacting the ADAPTS-Disability Services Program, 404-894-2563.
http://www.adapts.gatech.edu

Honor Code:
Any material in a paper not composed by the author, or borrowed without attribution, will be considered plagiarized. Plagiarism is a serious offence and will be dealt with according to the GT Academic Honor Code. When in doubt, use quotation marks and cite sources. Sanctions for plagiarism can include receiving a failing grade in the course or, in serious cases, expulsion from the university.

Use of any previous semester course materials, such as tests, quizzes, homework, projects, and any other coursework, is prohibited in this course.

For any questions involving these or any other Academic Honor Code issues, please consult www.honor.gatech.edu.

Working References

The blog will feature a list of references that we will update over the course. A very good reference is the ITP physical computing class:
https://itp.nyu.edu/physcomp/itp/syllabus/

Technical readings:

Banzi, M. (2009). *Getting Started with Arduino*. Sebastopol, CA: O'Reilly.

Buechley, L. and Qiu, K. *Sew Electric*. HTL Press, Cambridge, MA, 2014.

Igoe, T. (2011 (2007)). *Making Things Talk. Second Edition*. Sebastopol, CA: O'Reilly.

Noble, J. (2009). *Programming Interactivity. A Designer's Guide to Processing, Arduino, and openFrameworks*. Sebastopol: O'Reilly.

O'Sullivan, D., & Igoe, T. (2004). *Physical Computing. Sensing and Controlling the Physical World with Computers*. Boston, MA: Thomson.

Peppler, K., Tekinbas, K. S., Gresalfi, M. and Santo, R. *Short Circuits. Crafting e-Puppets with DIY Electronics*. MIT Press, London, Cambridge, MA, 2014.

Platt, C. (2009). *Make: Electronics*. Sebastopol, CA: O'Reilly.

Context readings:

Dourish, P. What we talk about when we talk about context. *Personal Ubiquitous Computing*, 8, 1 (2004), 19-30.

Hertz, G. Critical Making. Telharmonium Press, Hollywood, CA, 2012.

Hertz, G. *Arduino Microcontrollers and The Queen's Hamlet. Utilitarian and hedonized DIY Practices in contemporary electronic Culture*. The Printing House, City, 2011.

Kuznetsov, S., Davis, G. N., Paulos, E., Gross, M. D. and Cheung, J. C. *Red Balloon, Green Balloon, Sensors in the Sky*. ACM, City, 2011.

Mellis, D. A., Jacoby, S., Buechley, L., Perner-Wilson, H. and Qi, J. Microcontrollers as material: crafting circuits with paper, conductive ink, electronic components, and an "untoolkit". In *Proceedings of the Proceedings of the 7th International Conference on Tangible, Embedded and Embodied Interaction* (Barcelona, Spain, 2013). ACM, New York, 2013, 83-90.

Ratto, M. Critical Making: conceptual and material studies in technology and social life. *The Information Society: An International Journal*, 27, 4, (2011) 252-260.

Zoran, A. and Buechley, L. Hybrid Reassemblage: An Exploration of Craft, Digital Fabrication and Artifact Uniqueness. *Leonardo*, 46, 1 (2010), 4-10.