LMC 8803 Prototyping

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Mo 3-6 + Fri 12:30-1:30 (Prototyping Lab ID/ College of Architecture)
Office hours: Nitsche: Tue 1-2 (TSRB 320B)

Description

The course provides an introduction to hardware prototyping from simple circuits to sensors and Arduino programming. It is a class focused on making and hands on learning. This is not a software class and some coding knowledge is beneficial. However, the course itself does not require prior programming experience. Thematically, the course deals with interactive objects as media objects and the assignments will range from basic circuit-building to the use of more advanced components (sensors, motors). Throughout, it will encourage a combination of electronic prototyping with traditional materials.

The course is project-based and different assignments will be inspired by an external artist's work and should relate to the art, practice, and performance as a form of critical response.
Each Monday session will include a review of the current assignment and a discussion of the projects. It also will include introductions to prototyping skills and particular technologies. Labs are scheduled to provide in-depth assistance in project/ assignment support. Along the way, 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. Thus, the class is for students with an interest in making and experimenting as well as discussing and improving their efforts.

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

(expect changes as adjustments are bound to occur)

Week	Date	Topic	Reading	Deliverable
1	1/9	Intro to course **Basics** Building a circuit + Soldering **Meet** Katherine Fisher + introduction to her work		**order** your Arduino kit
	1/10	Katherine Fisher at Arts@Tech: CHARACTERS		
	1/13	Lab (building the jewelry + circuit)		
2	1/16	**MLK Day**		
100%	1/20	Lab **Basics** (Arduino set up + IDE)	"making is critical" Ratto	**DUE**: interactive jewelry; Sort out access to group blog
3	1/23	**Arduino I** (sensing + output)	"what is context?" Dourish	
	1/26 + 1/27	Ehren Tool visit to Tech		
	1/27	Lab (add a new sensor, add output)		
4	1/30	**Arduino II** (serial + advanced sensors/ accelerometers + intro to shields)		
	2/3	Lab (work on second project)		
5	2/6	**Arduino III** (alternative board/ Lilypad + using sound)		
	2/10	Lab		**DUE**: presentation of existing project (part of participation grade)
6	2/13	**Complexity I** (wireless connections) Visit to Innovation studio (TBC)		**DUE**: Arduino basics "performative object"
	2/17	Lab		
7	2/20	**Complexity II** (complex input + output/ multi-sensor)		**DUE**: present your concept for "dance object" in class
	2/24	Lab		
8	2/27	**Complexity III** (work on mid term project)		

	3/3	Lab		
9	3/6	**Complexity presentations** project presentations + creation of groups + meet the client Feedback session with Fisher + visit from Dance Atlanta choreographers + introduction to their work		**DUE**: mid term project "dance object"
	3/10	Design discussion		
10	3/13	Design presentation of final project ideas + critique session		**DUE**: design presentation
	3/17	Review of feedback and design iteration		
11	3/20	**Spring Break**		
	3/24			
12	3/27	Work on final project + technology intro (as needed)		
	3/31	Lab		
13	4/3	Work on final project		**DUE**: technical prototype in class
	4/7	Work on final project		**DUE**: technical prototype in class
14	4/10	Work on final project		**Due**: documentation v .1
	4/14	Work on final project		
	4/13	**DM Demo Day**		
15	4/17	catch up session for final project		
	4/21	Work on final project		
16	4/24	Work on final project		
	4/28	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/ **jewelry**	Create a simple circuit with some form of control and form of some output (e.g. a switch and a LED); material connections: use copper and solder to create the shape; Theme: jewelry	**10**
Arduino basics/ **performative object**	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 relate to the work of our collaborating artist; your object is made of a certain material and performs in a certain condition/ setting – how do you incorporate that in your design? Theme: performative objects	**15**
Arduino basics	Presentation + Documentation (video, images, post, schematics)	7
Arduino basics	Project itself; functionality; complexity; design; imagination; context-inclusion	8
Complexity/ **dance object**	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: dance object (based on the collaboration with our collaborating artist)	**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 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	**35**

	alone) did your design address the key issue at hand?	
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; context-inclusion	9
Participation	Overall Teamwork; participation in discussions; active and prepared in critiques; external project presentation	**20**
Participation	External project presentation	8
Participation	Teamwork; in class activity (in making and discussing)	12
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

Basic Circuit/ "jewelry": you will create a simple hybrid piece of jewelry that is inspired by the meeting with our first collaborating artist; it has to include a simple circuit as well as some casing construction that uses the material as part of the main design; it does not have a microcontroller; at least one output (e.g. LED) and at least one manipulation form (e.g. a form of a switch); but experiment with options (can you include the material? Can you use the way the user should wear it?) 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 jewelry object in class; you submit: video and 10 images + blog post write up on T-Square

Arduino Basics/ "performative object": you will continue the concept you explored in the first assignment but in a new object to create a "performative object"; 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); the object should relate to the work of our collaborating artist but should generally relate to performance situations; how would your object be used on a stage by dancers, actors, audiences? the object should be specialized for such a particular

performance/ expression! (make that focus clear in your video); the Arduino should be invisible in the casing; 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/ "dance object": this is the third level of technological complexity; your object will use at least one complex input (e.g. taking in data from an online source) and more elaborate and complex output mechanisms (e.g. multiple servos or neo pixels); the object has to relate to a performative situation (our collaborating artist will be encouraged to actually perform with it); if possible use an independent power source; the Arduino (or whatever board you use) 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 a second external artist whose work will be a reference point for the course; the art itself will remain in the domain of "dance" and choreography; and - as before - the artist(s) will present their own work and approaches to the class and the teams will present their ideas as responses 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 art/ practice; 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; you submit: video (~180 sec) + at least 20 images + full schematics + blog post (submit to blog as well as on T-Square)

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

We will use our own internal blog to keep track of projects and references:
http://blogs.iac.gatech.edu/prototyping/
This blog is currently only available for Georgia Tech students but it should be treated as an online publication that will become public in the future. Thus, participating students are welcome to use synonyms or - if they prefer - the TA or the instructor can post work anonymously for them there. If neither option is in the student's interest, let the instructor know and submissions to T-Square only will be accepted.

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.