Hardware Design Basics Workshop
EXP 250
Wednesday 1:30PM - 3:00PM
Location: Daley 503 (14 E. Jackson Blvd.)

Office Hours: W 5:00PM-6:00PM
Location: The IRL

Instructors
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Course Description
This hands-on course introduces hardware design and programming to designers and artists. Students will cover the knowledge needed to craft interactive experiences using microcontrollers, electronics, and programming. Students will experiment with circuitry, soldering, and designing for the Arduino while developing small-sized simple circuits and group projects. No prior hardware experience is required.

Learning Goals
- Be familiar with the basic concepts behind hardware design and development.
- Know and understand how to design, program, and implement a small hardware project on readily available technology such as Arduino, Raspberry Pi, and Makey Makey to design experiences that leverage the unique affordances of specific hardware components such as sensors and inputs.
- Effectively solve problems when programming and constructing physical experiences by using the appropriate resources and communities.

Required Materials
- *The Arduino Starter Kit - https://amzn.com/B009UKZV0A*

Also recommended (but <u>not</u> required)
- *Designing for Emerging Technologies*, Jonathan Follett

Assignment due dates/rubric
- Weekly exercises will be due, when assigned, the following **Monday in class**.
    - Criteria will be laid out in each weekly assignment section.
- The final project (group work) is due **Week 11**.

Week 1. Simple Circuits
Explore electronic components and electrical concepts covering current and flow, batteries, LEDs, buttons, and resistors. Build a simple battery-powered parallel circuit.

Assignment: Build a series circuit.

Reading: Read Setting Up and Chapter 1 in the Arduino Projects Book (chapters on D2L.)

Week 2. Schematics and Circuits

Assignment. Write a schematic based on a breadboarded example of a series circuit. Build a circuit based off of a schematic of a parallel circuit. Build a parallel and series circuit and draw a schematic for it.
Reading: None.

Week 3. Introduction to Prototyping Platforms

Review of tinkering platforms, their general taxonomy, and how to apply breadboarding skills to them.

Assignment. Create a Makey Makey toy with at least four inputs, using tinfoil only, that modify a pre-existing game or digital experience.
Reading: Read "Prototyping Platforms" (D2L)

Week 4. The Arduino as Prototyping Platform

Modify sample Arduino code. Breadboard and modify Arduino circuit schematics.

Assignment. Build the circuit that corresponds with the Arduino Blink example. Modify it to include two additional (different) outputs. Build the circuit that corresponds with the Arduino Button example. Modify it to include three additional (different) inputs. Replicate the variable LED project from Chapter 4 of the Arduino Projects Book.
Reading: Read Chapter 4 in the *Arduino Projects Book*.

Week 5. Complex Arduino

Review of digital physical toys. Sample Arduino code to construct a toy.

Assignment. Sample a project from Chapters 5-7, modifying it to include at least two new inputs and two new outputs.
Reading: Read Chapters 5-7 in the *Arduino Projects Book*.

Week 6. Soldering

Learn what solder is and how it works, how to use a soldering iron, how a PCB is built, and how to solder a circuit, de-solder a circuit, and test to make sure a circuit is working using a multimeter.

Assignment. Solder a circuit created in week 5.

Reading: None.

Week 7. Digital Fabrication

Cover different forms of digital fabrication and their advantages and disadvantages.

Assignment. Design an object incorporating at least three different drawing tools in Autodesk123D and 3D print it.
Reading: Read "Getting it Right by Getting it Wrong: RepRap and the Evolution of 3D Printing" (D2L.)

Week 8. Group Project Preparation

Discuss third party sensors and outputs and the challenges of rapidly prototyping an object.

Assignment. Write three one sentence pitches for next week describing a project idea for teams to work on in weeks 9 and 10. The project idea can be a toy, a game, or a product idea, but must be designed to solve a clearly articulated problem or evoke a clearly articulated feeling. The project must draw on the skills you have learned in weeks 1-7.
Reading: Read "Prototyping Interactive Objects" by Scott Sullivan.

Week 9. Project Pitches and Group Project Work

Building off the previous week, just because you can do things to get more money from your customers for the same product doesn't mean you should. We'll go over how to recognize and avoid obnoxious monetization methods. We'll also talk about how to find and maintain contracting work with outside vendors.

Assignment. One sentence pitches and team formation. Begin working on group projects.
Reading: None.

Week 10. Group Project Work

Putting it all into perspective. The concepts we discussed and the projects you've been working on aren't just university assignments -- they're tools you can use to better attack your career. We'll address students' individual questions about anything that hasn't come up yet.

Assignment. Class workshop. Continue group project work.
Reading: None.

Week 11. Group Project Presentation

Group showcase and pitches.

Grade Distribution

- 55% weekly work
    - Divided equally from weeks 1-7.
- 20% meaningful in-class participation
    - **Not** just attendance. You might have heard the phrase "90% of success is just showing up," but that isn't the case here. I want you to attack in-class discussions and projects with sincere enthusiasm, a spirit of collaboration, and insightful comments.
- 25% final project

Late Assignments

Late assignments will not be accepted without an appropriate, documented excuse. Assignments are due at the start of class unless otherwise stated.

Academic Integrity

This course will be subject to the academic integrity policy passed by faculty. More information can be found at http://academicintegrity.depaul.edu/.
The university and school policy on plagiarism can be summarized as follows: Students in this course should be aware of the strong sanctions that can be imposed against someone guilty of plagiarism. If proven, a charge of plagiarism could result in an automatic F in the course and possible expulsion. The strongest of sanctions will be imposed on anyone who submits as his/her own work any assignment which has been prepared by someone else. If you have any questions or doubts about what plagiarism entails or how to properly acknowledge source materials be sure to consult the instructor.

Using and citing electronic sources - In conducting research for this course, I encourage you to consult those standard reference tools, scholarly projects and information databases, and peer-reviewed academic journals that may be found on the Internet in addition to traditional print resources. Keep in mind, however, that those electronic sources must be acknowledged. Please see the Modern Language Academy Handbook, section 4.9, for information on the correct citation of these sources.

Withdrawal

Students who withdraw from the course do so by using the Campus Connection system (http://campusconnect.depaul.edu). Withdrawals processed via this system are effective the day on which they are made. Simply ceasing to attend, or notifying the instructor, or nonpayment of tuition, does not constitute an official withdrawal from class and will result in academic as well as financial penalty.

Retroactive Withdrawal

This policy exists to assist students for whom extenuating circumstances prevented them from meeting the withdrawal deadline. During their college career students may be allowed one medical/personal administrative withdrawal and one college office administrative withdrawal,

each for one or more courses in a single term. Repeated requests will not be considered. Submitting an appeal for retroactive withdrawal does not guarantee approval.☐☐College office appeals for CDM students must be submitted online via MyCDM.☐The deadlines for submitting appeals are as follows:☐☐

Autumn Quarter: Last day of the last final exam of the subsequent winter quarter☐
Winter Quarter: Last day of the last final exam of the subsequent spring quarter☐
Spring Quarter: Last day of the last final exam of the subsequent autumn quarter☐
Summer Terms: Last day of the last final exam of the subsequent autumn quarter

Excused Absence
In order to petition for an excused absence, students who miss class due to illness or significant personal circumstances should complete the Absence Notification process through the Dean of Students office. The form can be accessed at http://studentaffairs.depaul.edu/dos/forms.html. Students must submit supporting documentation alongside the form. The professor reserves the sole right whether to offer an excused absence and/or academic accommodations for an excused absence.

Incomplete
An incomplete grade is a special, temporary grade that may be assigned by an instructor when unforeseeable circumstances prevent a student from completing course requirements by the end of the term and when otherwise the student had a record of satisfactory progress in the course. CDM policy requires the student to initiate the request for incomplete grade before the end of the term in which the course is taken. Prior to submitting the incomplete request, the student must discuss the circumstances with the instructor. Students may initiate the incomplete request process in MyCDM.

- All incomplete requests must be approved by the instructor of the course and a CDM Associate Dean. Only exceptions cases will receive such approval.
- If approved, students are required to complete all remaining course requirement independently in consultation with the instructor by the deadline indicated on the incomplete request form.
- By default, an incomplete grade will automatically change to a grade of F after two quarters have elapsed (excluding summer) unless another grade is recorded by the instructor.
- An incomplete grade does NOT grant the student permission to attend the same course in a future quarter.

Students with Disabilities
Students who feel they may need an accommodation based on the impact of a disability should contact the instructor privately to discuss their specific needs. All discussions will remain confidential.☐To ensure that you receive the most appropriate accommodation based on your needs, contact the instructor as early as possible in the quarter (preferably within the first week

of class), and make sure that you have contacted the Center for Students with Disabilities (CSD) at:
☐Student Center, LPC, Suite #370
☐Phone number: (773)325.1677 ☐
Fax: (773)325.3720 ☐
TTY: (773)325.7296