

USC Iovine and Young Academy

*Arts, Technology and the Business
of Innovation*

ACAD230 - Intro to Physical Computing

Fall 2024 | 4 Units

Mon 12p-1:50p IYH 110

Wed 12p-1:50p IYH 111

John Bruneau

Office Hours: Fri 12-1pm

bruneau@usc.edu

IT Help

Hours: M-F 8:30am - 6:30pm

Contact Info: iyahelp@usc.edu

Course Description

Interactive physical computing exists at the intersection of electronics, computing, and design. This course explores the domain of interactivity within the fields of consumer electronics and product design. This hands-on course will examine keynote examples of physical computing in our everyday lives and create prototype devices that leverage design and interactive principles using electronics.

Learning Objectives and Outcomes

Students in this course will gain the mindset and complementary hard skills to create physical prototypes that host features enabled by electronics, coding and digital fabrication.

Students will be introduced to the following:

- Interactive design principles for physical products
- Basic Electronics
- Sensors and Actuators
- Microcontrollers
- Arduino C++ Programming
- Design Artifacts
- Digital Fabrication

Course Notes

This course will make use of Brightspace for content and assignments. Any supplemental course content will be posted to Brightspace for use by all students. Any and all announcements for the course will be posted to Brightspace. Please familiarize yourself with Brightspace before the course begins.

Required Hardware

Elegoo Super Starter Kit UNO R3

Each student is to have the Elegoo Super Starter Kit UNO R3 Project prior to the second week of classes. It is available for purchase here:

<https://www.elegoo.com/products/elegoo-uno-r3-super-starter-kit>

<https://www.amazon.com/ELEGOO-Project-Tutorial-Controller-Projects/dp/B01D8KOZF4>

Required Software

Arduino IDE

Students must become familiar with the Arduino IDE. We will be using the most recent version Arduino IDE 2.3.2 in class. It is available for download or cloud version here

<https://www.arduino.cc/en/software>

Required Text

Elegoo Starter Kit Lessons

Many of the assignments will be based on tutorials from the kit itself. Download the PDF here:

https://download.elegoo.com/?t=UNO_R3_Project_Super_Starter_Kit

Highly Recommended Text

Getting Started with Arduino (4th edition)

Get this book is available as a free E-book through the USC library or you can purchase it on Amazon. While there will not be readings directly assigned, the information in this book will be incredibly helpful.

<https://www.amazon.com/Getting-Started-Arduino-Electronics-Prototyping-dp-1680456938/dp/1680456938>

Also available as an E-Book. (Use your USC email for access)

<https://learning.oreilly.com/library/view/getting-started-with/9781680456929/>

Supplementary Text

Arduino: A Technical Reference

A Handbook for Technicians, Engineers, and Makers.

O'Reilly press, ISBN: 978-1-491-92176-0

<https://www.amazon.com/Arduino-Technical-Reference-Technicians-Engineers/dp/1491921765>

Description and Assessment of Assignments

For the first 6 weeks of the course, students will be assigned two weekly exercises that will focus on a variety of fundamental skills. For the following 4 weeks, students will work on two large group assignments where they will demonstrate their creativity with the skills learned from the exercises. During the last five weeks of the course, students will be working on a final project of their choosing. This will be a group project with weekly milestones. Requirements for the projects will be provided by the course faculty. Students will present their final project during the final exam period for the course. All work is due one hour before class on the due date.

Extra Credit

Any outside but related project can be eligible for extra credit. Attending external talks and lectures may earn extra credit as well. The amount of extra credit is based solely on what is deemed appropriate by the instructor.

Grading Scale

Course final grades will be determined using the following scale:

A	94-100	C	73-76
A-	90-93	C-	70-72
B+	87-89	D+	67-69
B	83-86	D	63-66
B-	80-82	D-	60-62
C+	77-79	F	59 and below

Grading Breakdown

Assignment	Grade %
Class Participation	10%
Excecises	30%
Assignments	20%
Final	40%
TOTAL	100%

Weekly Class Schedule (Subject to Change)

	Class	Assignments
Week 1	Introduction to Class Introduction to Arduino C++ and the Arduino IDE	Ex1a Starter Kit Ex1b Safety Training (lab)
Week 2 <i>no class</i> <i>Monday</i>	Setting up the Arduino. Intro to Circuits Controlling LEDs, Digital output, Resistors	Ex2a Blink (lab) Ex2b Creative LEDs
Week 3	Creative LED presentations Introduction to C++ Variables, Operations, Conditionals, Loops, Functions	Ex3a C++ Basics (lab) Ex3b Conditionals and more
Week 4	Soldering techniques and best practices Digital Inputs, Analog outputs	Ex4a Soldering (lab) EX4b Color Picker
Week 5	Electronics and Circuits Timers, Capacitors, Potentiometers, Speakers Analog Inputs and Photo Cells	Ex5a Atari Punk Audio (lab) Ex5b Light and Sound
Week 6	More C++ Sensors Introduction to Motor Types	Ex6a Analog Sensors EX6b Intro to Motors (lab)
Week 7	Motors and Movement	Assignment 1 - Prototype

Week 8	Motors and Movement Continued Assignment 1 Presentations	Assignment 1 - Production
Week 9	Passing data to and from a PC	Assignment 2 - Prototype
Week 10	Passing data to and from a PC Continued Assignment 2 Presentations	Assignment 2 - Production
Week 11	Final Project Idea Pitches	Final pt1: Pitch
Week 12 <i>no class Monday</i>	Group Brainstorming, Develop working prototype	Final pt2: Prototype
Week 13	Beta development work	Final pt3: Design Docs
Week 14 <i>no class Wed</i>	Beta Presentations and Playtesting	Final pt4: Beta
Week 15	Final polish work and revisions	Final pt5: Release
Final	Present Final Presentations Refer to final exam schedule at Schedule of Classes	Final pt6: Presentation

Assignment Rubrics

Student work will be assessed based on:

- Level of understanding and execution of software skills on assignments.
- Degree of complexity of the assignment goal both creatively and technically.
- Innovative application of tools and concepts covered in class.

Assignment Submission Policy

Combine all your submission materials and assets into a single zip file and upload it to Brightspace. All assignments and labs must be delivered, per instructor guidelines, one hour before that section's live session, on the date that deliverable is due. No exceptions. (Early submissions are, of course, encouraged!)

Late Work and Resubmissions

Due dates and requirements for all assignments will be posted on Brightspace. It is the student's responsibility to submit work by the due date following the defined class procedures, even if they miss class. To receive credit, all projects must run and documentation must be complete.

Work turned in up to 1 week late will receive a 10% deduction. Work turned in up to 2 weeks late will receive a 20% reduction. **Work will not be accepted after two weeks past its due date.** To receive credit for late work you MUST email the professor that you posted a lab or

assignment after the due date or you will not receive credit. Work may be resubmitted, but the same grading penalties apply. Work may not be resubmitted after 2 weeks.

Grading Timeline

Milestones and assignments will be reviewed, graded, and provided with feedback within two weeks of submission.

Correcting a Grading Error or Disputing a Grade

If you don't inform the instructor of missing or incorrect grades within two weeks of those grades being posted, the grades will be assumed correct. Do not wait until the semester's end to check or appeal any grades. If you feel a grade merits re-evaluation, you are encouraged, within one week of the instructor providing a grade and initial feedback, to send the instructor a memo in which you request reconsideration. The memo should include a thoughtful and professional explanation of your concerns. Be aware that the re-evaluation process can result in three types of grade adjustments: positive, none, or negative. (Note: Complaints on the date of a graded assignment's return to you will not be addressed; it is essential to wait one full day prior to raising a concern.)

Academy Attendance Policy

The Academy maintains rigorous academic standards for its students and on-time attendance at all class meetings is expected. Each student will be allowed **three** absences over the course of the semester for which no explanation is required. Students are admonished to not waste excused absences on non-critical issues, and to use them carefully for illness or other issues that may arise unexpectedly. Except in the case of prolonged illness or other serious issue (see below), no additional absences will be excused. Each unexcused absence will result in the lowering of the final grade by $\frac{1}{3}$ of a grade (e.g., an A- will be lowered to B+, etc.). In addition, being tardy to class will count as one-third of an absence. Three tardies will equal a full course absence. Missing more than 15 minutes of class will be counted as a full absence. Students must be in class before attendance starts to be counted as present. If a student arrives after attendance is taken, it is up to them to inform the teacher.

Students remain responsible for any missed work from excused or unexcused absences. Immediately following an absence, students should contact the instructor to obtain missed assignments or lecture notes and to confirm new deadlines or due dates. Extensions or other accommodations are at the discretion of the instructor.

Automatically excused absences normally may not be used for quiz, exam or presentation days. Using an excused absence for a quiz, exam or presentation, such as in the case of sudden illness or other emergency, is at the discretion of the instructor.

In the case of prolonged illness, family emergencies, or other unforeseen serious issues, the student should contact the instructor to arrange for accommodation. Accommodation may also be made for essential professional or career-related events or opportunities. Additionally, students who need accommodations for religious observations should provide advanced notice to instructors and student athletes should provide Travel Request Letters. All accommodations remain at the discretion of the instructor, and appropriate documentation may be required.

Unless students provide an accommodation letter from USC's Office of Student Accessibility Services (OSAS) or a letter from IYA Student Services detailing visa or travel restrictions, attendance and active participation is expected in the classroom. Any student with such accommodations should submit their accommodation document to the instructor as soon as possible to discuss appropriate accommodations.

Students who are experiencing illness should not attend class in person. Please inform the instructor in advance of any class sessions that you can't attend for medical reasons, and accommodations will be arranged to view recorded lectures and submit alternatives to any missed class participation. Students will not be penalized for not attending class in person under these circumstances.

Irvine and Young Hall Cleanout

The Academy is unable to store student projects and materials beyond the end of the semester. Students must remove all projects and personal materials from the Creators Studio, lockers/locker room, and other classrooms by the end of each semester. **All projects and materials left in Irvine and Young Hall will be discarded the day after final exams end. No exceptions.**

General Classroom Policy

Students are expected to attend and participate in lecture discussions as well as attend and complete weekly labs and assignments. Students are expected to be seated in class **before the session begins** and treat learning as an opportunity. Students are to be respectful of each other and the space in which they inhabit. We are all here to have a positive learning experience, have fun, get to know each other, and grow as creative thinkers. Confront difficulties in your work in the spirit of learning, creative exploration and growth. Students being disruptive to the class who do not cease their activities will be asked to leave and if necessary will be escorted out.

Digital Storage & Data Loss

All work should be saved and backed up. Digital information does not exist unless it is saved in at least two locations. Back up everything in a git repo or external drive. Data loss for any reason is not an excuse. You have been warned.

Academic Integrity

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the [USC Student Handbook](#). All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

Academic dishonesty has a far-reaching impact and is considered a serious offense against the university. Violations will result in a grade penalty, such as a failing grade on the assignment or in the course, and disciplinary action from the university itself, such as suspension or even expulsion.

For more information about academic integrity see the [student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment or what information requires citation and/or attribution.

Policy for the use of AI Generators

Since creating, analytical, and critical thinking skills are part of the learning outcomes of this course, all assignments should be prepared by the student working individually or in groups. Students may not have another person or entity complete any substantive portion of the assignment. Developing strong competencies in these areas will prepare you for a competitive workplace. Therefore, in most cases, using AI-generated tools is prohibited in this course, will be identified as plagiarism, and will be reported to the Office of Academic Integrity. If there are questions or you think there is a special use case you would like an exemption for, ask your instructor.

Course Content Distribution and Synchronous Session Recordings Policies

USC has policies that prohibit recording and distribution of any synchronous and asynchronous

course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Student Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. ([Living our Unifying Values: The USC Student Handbook](#), p13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relation to the class, whether obtained in class, via email, on the internet, or via any other media. Distributing course material without the instructor's permission will be presumed to be an intentional act to facilitate or enable academic dishonesty and is strictly prohibited. ([Living our Unifying Values: The USC Student Handbook](#), p13).

Course Evaluations

Course evaluation occurs at the end of the semester university-wide. It is an important review of students' experience in the class. The process and intent of the end-of-semester evaluation should be provided. In addition, a mid-semester evaluation is recommended practice for early course correction. [Contact CET](#) for support in creating a mid-semester evaluation.

Students and Disability Accommodations

USC welcomes students with disabilities into all of the University's educational programs. [The Office of Student Accessibility Services](#) (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Student Financial Aid and Satisfactory Academic Progress

To be eligible for certain kinds of financial aid, students are required to maintain Satisfactory Academic Progress (SAP) toward their degree objectives. Visit the [Financial Aid Office webpage](#) for [undergraduate](#)- and [graduate](#)-level SAP eligibility requirements and the appeals process.

Support Systems

Counseling and Mental Health

(213) 740-9355 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline

988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP)

(213) 740-9355(WELL) – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX)

(213) 740-5086

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment

(213) 740-2500

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS)

(213) 740-0776

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention

(213) 740-0411

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

[Diversity, Equity and Inclusion](#)

(213) 740-2101

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

[USC Emergency](#)

UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

[USC Department of Public Safety](#)

UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call

Non-emergency assistance or information.

[Office of the Ombuds](#)

UPC: (213) 821-9556, HSC: (323) 442-0382

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#)

(323) 442-2850 or otfp@med.usc.edu

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.