DRAFT

USC Iovine and Young Academy
Arts, Technology and the Business of Innovation

ACAD431 - Devices and Systems for Body Computing

4 Units | Spring 2025
Thu 2pm - 4:50pm
Room IYH 212

Instructors

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Office Hours by appointment
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IT Help

Hours of Service: 8:30 a.m. – 6:30 p.m.
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Course Description

The course will introduce students to a new model of digitally enabled health and human performance care that we term Lifecare. Bodxy computing liberates accurate and continuous mind and body data from the recipient of this care. This enables more continuous insights, fills in important gaps in knowledge related to the t ransition from a health to disease states and engages the user in their own care. Devices that support Lifecare come from both consumer technology and medically regulated device manufacturers. These devices may have either diagnostic or therapeutic capability or both. The course will review the rich ecosystem of care and insights that can be created by devices and enabling software. The course will provide exposure to how 'big data', machine learning and AI can be applied to Lifecare data. Models for the ethical use of health and human performance data will be discussed as well as how to best protect and secure data. The course will cover current regulatory and legislative initiatives designed to evaluate digital health products for FDA approval and that will govern care that is capable of delivery across geographies. Novel business models are needed to capitalize Lifecare that will challenge both traditional medical care reimbursement and consumer technology payment models. Students will gain understanding as to how digital health models of care may impact underserved and under resourced populations As a result of this course students will be well positioned to design and help envision how to best enable and scale Lifecare.

Learning Objectives and Outcomes

- Describe how traditional medical care interacts with the medical consumer
- Analyze how consumer facing and digitally enabled diagnostic devices challenge traditional care models
- Develop criteria for assessing and rating the accuracy of consumer diagnostic devices
- Provide examples of digitally enabled, consumer facing diagnostics that can drive the consumer toward early medical care
- Describe and provide examples of how commonly collected digital data, like geolocation can be leveraged to enrich and improve digital healthcare diagnosis and access
- Provide examples of digital therapeutics for mind or body health optimization
- Develop an idea for a digitally enabled de-centralized clinical trial that could earn FDA approval
- List legislative initiatives needed to enable Lifecare care delivery and payment
- Give four examples of how novel collaborations could occur between medically regulated companies and technology companies working in health and human performance care
- Describe methods to educate user of digital health and human performance products that is engaged, understandable and on-demand
- Analyze digital health and human performance payment models and provide examples of how they can be improved and scaled to larger populations
- Describe how digital health and human performance care models impact diverse populations, including underserved and under resourced populations
- Provide a 'moonshot' idea of how digitally enabled care can solve an important health or human performance problem (examples, obesity, musculoskeletal injury in professional athletics)
- Explore how design can influence the behavior of how people interact with their health data
- Create artifacts that best represent students' 'moonshot' ideas visually or physically
- Assess the attributes that make for an effective, meaningful or novel health device and service
- Leverage trend analysis to make educated and informed ideas regarding the future of healthcare and devices.

Prerequisites - One or more of the following:
ACAD 230 Intro to Physical Computing
ACAD 245 Fundamentals of Product Design
ACAD 260 / MEDS 250 Introduction to Healthcare Innovations
ACAD 415 Dev III
ACAD 422 Cybersecurity
ACAD 432 Collaborative Prototyping in Health Innovation
IDSN 536 Designing Networked Objects
IDSN 539 Extended Reality Development

Course Notes

The course is for a letter grade and will be conducted online. All assignments, and additional Course materials will be posted to Brightspace. Email and Brightspace will be the main means of course announcement and communications.

Technological Proficiency and Hardware/Software Required
Students must provide their own laptop. The laptop specifications take into consideration that students will be creating and storing large multimedia files and the laptop must be capable of running Unity well.

Software:
- Unity (latest LTS version) (https://unity.com/pricing#plans-student-and-hobbyist)
- Visual Studio Code (https://code.visualstudio.com)
- VS Code Unity extension (https://code.visualstudio.com/docs/other/unity)
- Unity Remote (https://apps.apple.com/us/app/unity-remote-5/id871767552) or
- (https://play.google.com/store/apps/details?id=com.unity3d.mobileremote)
- Xcode (Apple + iphone only) (https://developer.apple.com/xcode)
- Android File Transfer (Apple + Android only) (https://www.android.com/filetransfer)

HOW TO PURCHASE SOFTWARE AT THE DISCOUNTED ACADEMY RATE
For classes that require them, the following software are available for purchase **online** through the USC Iovine and Young software catalog at the Academy discounted rate:

Software	**IYA Short-Term License at USC Bookstore**
Adobe Creative Cloud	$75 2024–2025 annual license (active through July 2025)
Apple Final Cut Pro	$35 semester license

To purchase:
- Visit: https://commerce.cashnet.com/IOVINE
- Select the software license(s) you would like to purchase by clicking “View Details” or the software title, and make your purchase
- You will receive an order confirmation receipt at the email address you provided
- You will be notified by email when the software license has been activated

If you have any questions about this process, please do not hesitate to contact Academy IT Support at iyahelp@usc.edu.

Description and Assessment of Assignments

Writing Responses

Following class lectures students will compose thoughtful written responses to the material presented in the lecture. In some cases specific prompts will be given out, in other cases students will be asked for their overall thoughts and takeaways from the material. These written responses will be posted on Brightspace.

Assignments

Assignments are large scale projects, accomplished in multi-week sprints. The focus is on rapid development, iterative design and a polished end product. All projects begin with proposals that are presented, reviewed and critiqued in class. Once a proposal is approved, it will move quickly from concept to interactive demo, then tested, polished, and refined into a release candidate. Each assignment will be submitted via an Itch.io or github page and will be accompanied by a documentation.

The accompanying documentation will consist of an overview of the project, screenshots or video of the finished product, a link to the presentation slides, the git repo, and the Figma mockups. Mobile projects should be available for download for either Android or iPhone. Assignments must be submitted as a URL on Brightspace one hour before class on the day they are due.

Assignment 1 - Health Product Analysis (Individual)

Evaluate a wearable health device from the list below and track your experience for approximately one month of use. Create a deck and present your findings to the class.

- Apple Watch
- Polar Fit
- Oura Ring
- Lingo Biosensor
- Stelo Glucose Biosensor

Evaluate the device based on the following criteria:

1) Identify the Most Compelling Use Cases. Determine the primary purpose of the device that you find most valuable (e.g., sleep tracking, activity tracking, weight loss, focus). You may select more than one use case and rank them in order of importance.
2) Analyze Strengths and Weaknesses. Evaluate the hardware and software, including factors such as:
   - Battery life
   - Wearability
   - User Interface (UI) and User Experience (UX)
   - Data usage policies
   - Cost
3) Suggest Potential Enhancements. Propose improvements to the hardware and/or software of the device.

4) Explore Use Cases in Health Settings. Provide a use case for the device in:
   - The management of chronic diseases (e.g., Apple Watch for arrhythmia detection).
   - Health maintenance (e.g., sleep monitoring).

Assignment 2 - Health App (Partners)
Design an app for mobile devices that has a health focus which meets a specific need. Consider what is actually useful to your audience. Think about what data can be tracked internally like geolocation or externally like heart rate. Pay close attention to UI/UX. Your finished app should have a cohesive visual design and a polished look and feel.

Assignment 3 - Clinical VR (Partners)
Create a therapeutic clinical VR application. This experience can be focused on physical therapy, psychological therapy, pain reduction, or whichever therapeutic focus you propose. Consider what technological affordances are offered by VR and what various VR devices allow you to track ie, eye tracking, hand tracking, foot tracking, etc. Are there other datapoints that require an external add-on or peripheral you would like to incorporate?

Final - Moonshot Project (Individual)
What is the digitally supported healthcare experience of the future? Develop a well-researched proposal for a software or hardware project that will be the killer healthcare app of the future. This is a Moonshot proposal. It can be anything you can envision, AR, VR, Wearable, Implant, etc. The technology does not have to exist today. The main deliverable is your final presentation. Include a page with all the documentation as you would for your past assignments but also include your final presentation slides, a supporting video documentation, and as much of the product as you can reasonably prototype.

Participation
Students are expected to be engaged and familiarize themselves with class reading and reference materials to actively participate in class discussions. Students must be present to support collaborative learning and projects.

Grading Breakdown
Grading rubrics will be provided upon each project/assignment introduction.

Assignment	**Grade %**
Class Participation	10%
Writing Responses	10%
Assignment 1 - Health Product Analysis	10%
Assignment 2 - Health App	15%

Assignment 3 - Clinical VR	15%
Moonshot Project Proposal	10%
Moonshot Final Presentation	10%
Moonshot Project Final Deliverable	20%
TOTAL	100%

Grading Scale

Course final grades will be determined using the following scale

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

Assignment Submission Policy

Combine all your submission materials and assets into a single zip file and upload it to Brightspace. All assignments 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 executables must run, all writing 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
Grades will be communicated following a maximum of 2 weeks after submission.

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 two excused 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 ⅓ of a grade (e.g., an A will be lowered to A-, and A- will be lowered to a B+, etc.). In addition, being tardy to class will count as one-third of an absence. Three tardies will equal a full course absence.

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.

Fall 2022 addendum
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. Either classroom recordings or live remote access to the class via Zoom will be provided.

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.

In the event that you find yourself experiencing COVID-19 related symptoms, in keeping with university recommendations, you should Stay home! This is the best way to prevent spreading COVID-19 as supported by scientific evidence; Please do not come to an in-person class if you are feeling ill, particularly if you are experiencing symptoms of COVID-19.

Iovine 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 Iovine and Young Hall will be discarded two days after final exams end. No exceptions.**

Course Schedule Weekly Breakdown

	Class	Assignments Due
Week 1 1/16	Introduction to Class Traditional HealthCare Models Digital Health and Human Performance Care Model Lecture: Doctor Saxon	
Week 2 1/23	Implications of a Consumer Facing Continuous Care Model Guest Speaker: Steve McLelland Assignment 1 Proposals Begin Health Product Analysis	As1 Proposal
Week 3 1/30	Setting up your development environment Introduction to Unity and C# Lecture: Professor Brueau	
Week 4 2/6	Software, Services and Devices Supporting LifeCare Assignment 1 Beta Demos Layout, Canvas, Scenes, Input, and Interface Lecture: Professor Bruneau	As1 Beta
Week 5 2/13	Healthcare and Lifecare-filling in gaps in knowledge iOS App Development Guest Speaker: Joe Perez Publishing an App: Unity, Xcode, and the App Store Lecture: Professor Bruneau	
Week 6 2/20	Ethics, privacy and cybersecurity in the new healthcare Lecture: Doctor Saxon Assignment 1 Presentations	As1 Release

Week 7 2/27	Digital diagnostic and therapeutics Decentralized clinical trials-new discovery Lecture: Doctor Saxon Introduction to Medical VR Lecture: Professor Bruneau	
Week 8 3/6	Health Product Analysis Presentations Creating 3D interactions in Unity Beginning VR Lecture: Professor Bruneau	Health Product Analysis
Week 9 3/13	Medical VR Guest Speaker: Skip Rizzo Developing Medical VR in Unity Lecture: Professor Bruneau Assignment 2 Proposals	As2 Proposal
3/20	Spring Break	
Week 10 3/27	Guest Speaker: Medical VR Samuel Rodriguez Assignment 2 Beta Demos Developing Medical VR in Unity Continued	As2 Beta
Week 11 4/3	On-demand, digital healthcare and lifecare education products. Disruptors in technology, retail, payor	
Week 12 4/10	Big data, machine learning and AI Novel collaborations in healthcare-lifecare Guest Lecture: Arnab Ray, Director of Product Cybersecurity and Manufacturing at Abbott, Artificial Intelligence in HealthCare	As2 Release
Week 13 4/17	Lifecare-Implications for underserved under resourced populations Lecture: Doctor Saxon Moonshot Proposal Presentations	Moonshot Proposal
Week 14 4/24	Moonshot Proposal Prototype Demos Moonshot Studio Time	Moonshot Prototype
Week 15 5/1	Moonshot Proposal Beta Demos Moonshot Studio Time	Moonshot Beta
Final 5/8	Moonshot Final Deliverable Presentations	Moonshot Final

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are

equally unacceptable. See additional information in SCampus and university policies on Research and Scholarship Misconduct.

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.

Support Systems

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.
National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call

suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services
(RSVP) - (213) 740-9355(WELL), press "0" after hours - 24/7 on call
Studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
eeotix.usc.edu
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) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report

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.usc.edu
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) 821-4710
campussupport.usc.edu
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
diversity.usc.edu
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
dps.usc.edu, emergency.usc.edu
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) 442-120 - 24/7 on call
dps.usc.edu
Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
ombuds.usc.edu
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) 442-3340 or otfp@med.usc.edu
chan.usc.edu/otfp
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.

Reading List

Who Guidance

5. The WHO guidance on *Ethics & Governance of Artificial Intelligence for Health,* https://www.who.int/publications/i/item/9789240029200
6. WHO AI powered digital health worker, https://www.who.int/news/item/04-10-2022-who-and-partners-launch-world-s-most-extensive-freely-accessible-ai-health-worker

Saxon USC Center for Body Computing

1. Center for Body Computing 2018, 2020, 2021 Body Computing Conference, https://cbc.ict.usc.edu/
2. Health impacts of unlimited access to networked transportation in older adults
3. Retail healthcare update: Disrupting traditional care by focusing on patient needs
4. HIPAA Isn't Enough: All Our Data is Health Data
5. The democratization of diagnosis: bringing the power of medical diagnosis to the masses
6. Editorial commentary: re-inventing chronic disease management as a service-medication adherence solutions are ground zero
7. Consumer-facing Diagnostic Sensors in a Patient with Implantable Cardioverter-Defibrillator
8. Continuous measurement of reconnaissance marines in training with custom smartphone app and watch: observational cohort study
9. COVID-19 testing and infection surveillance: Is a combined digital contact-tracing and mass-testing solution feasible in the United States?
10. Player tracking technology and data for injury prevention in the National Football League
11. The democratization of diagnosis: bringing the power of medical diagnosis to the masses
12. Health impacts of unlimited access to networked transportation in older adults
13. Use of software applications to improve medication adherence and achieve more integrated disease management in heart failure
14. Why people stick with or abandon wearable devices
15. Digital technology to engage patients: ensuring access for all

Healthcare Disruptors

1. Apple Watch health features, https://www.apple.com/healthcare/apple-watch/
2. Amazon, CVS, Walgreens and Disrupting Healthcare, https://www.wsj.com/video/series/news-explainers/how-amazon-cvs-and-walgreens-are-tapping-into-the-4-trillion-healthcare-market/532F4DB7-CB0E-4A29-A494-0F0B607B507E
3. Amazon products in healthcare, https://www.huronconsultinggroup.com/insights/amazon-revolutionize-healthcare

Government and Digital Healthcare

1. Legislation to extend remote care beyond COVID-19, https://www.foley.com/en/insights/publications/2022/02/federal-telehealth-extension-evaluation-act
2. FDA Digital Health Guidance, https://www.fda.gov/medical-devices/digital-health-center-excellence/guidances-digital-health-content

3. How digital health challenges traditional health models, https://medcitynews.com/2022/04/how-digital-health-is-challenging-traditional-reimbursement-models