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

ACAD431 - Devices and Systems for Body Computing
4 Units | Spring 2024
Monday / Wednesday 4pm - 5:50pm
Room IYH 212

Instructors

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IT Help

https://uscedu.sharepoint.com/sites/IYAStudent/SitePages/IT-Resources.aspx
Hours of Service: Monday - Friday 9am - 6pm
iyahelp@usc.edu

USC Technology Support Links

Zoom information for students
Blackboard help for students
Software available to USC Campus

Course Description

The course will introduce students to a new model of digitally enabled health and human performance care that we term Lifecare. Body 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 transition 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.

Prerequisite(s) ACAD230: Intro to Interactive Physical Computing

Communication
Email and the LMS will be the main means of course announcement and communications.

Additional Materials
Additional Course materials will be found on the LMS and may vary on a semester basis.

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	$70 2019–2020 annual license
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
This course is primarily project and practiced based. Each project will have accompanying assignments that compose the total project grade.

Assignments
Assignments are large scale projects, accomplished in multi-week sprints. They build on each other both in concept and technical expectations. 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 Appstore 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. Desktop projects should be available for both Windows and Mac. Assignments must be submitted as a URL to the LMS one hour before class on the day they are due.

Assignment 1 - Health App
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 2 - Immersive Walkthrough
Working in groups, create an immersive XR or 360 video experience that is designed to pre-expose a patient to an invasive and possibly scary medical procedure. Create a scenario where the potential patient can do a walkthrough of the process and be put at ease with any fears or concerns they might have. Proposals for this assignment will be individual and project groups will be created based on those proposals.

Assignment 3 - Clinical VR
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
What is the digitally supported healthcare experience of the future? Working in groups, 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. Like Assignment 2, proposals for this assignment will be individual and project groups will be created based on those proposals. Make sure you include individual group roles in your proposal. 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 trailer, and as much of the product as you can reasonably prototype.

Participation

Students are expected to be engaged and familiar with class reading/reference materials to actively participate in class discussions. It is encouraged that student are present to support collaborative learning and projects.

Grading Breakdown

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

Assignment	Grade %
Class Participation	10%
Health Product Analysis	10%
Assignment 1 - Health App	10%
Assignment 2 - Immersive Walkthrough	10%
Assignment 3 - Clinical VR	10%
Moonshot Project Proposal	10%
Moonshot Final Presentation	10%
Moonshot Project Final Deliverable	30%
TOTAL	100%

Grading Scale

Course final grades will be determined using the following scale

A	95-100
A-	90-94
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

Assignment submission will be completed via posting in the LMS. Specific due dates will be introduced with each project.

Late Submissions

Due dates and requirements for all assignments will be posted on the course site. Students will "post" their work to their USC web space as defined on the course site. It is the student's responsibility to post work by the due date following the defined class procedures, even if you miss class. Assignments will be accepted after the deadline with the following grade penalties. Do not ask for extensions.

- Submission in the 24 hours after the deadline   10% deduction
- Submission more than 24 hours after the deadline   25% deduction
- Submission more than 1 week after the deadline   100% deduction

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

	Monday Lecture	**Wednesday Lab**
Week 1 1/8 S&B 1/10 B	Traditional HealthCare Models Digital Health and Human Performance Care Model	Introduction to Unity and C#
Week 2 1/17 S	Holiday - Martin Luther King Day	Implications of a Consumer Facing Continuous Care Model

Week 3 1/22 S&B 1/24 B	*Assignment 1 Proposals* Software, Services and Devices Supporting LifeCare	Layout, Canvas, Scenes, Input, and Interface Begin Assignment 1 Development External Data Input Tracking Geolocation Saving and Loading Data
Week 4 1/29 S 1/31 B	Healthcare and Lifecare-filling in gaps in knowledge Guest Speaker: iOS App Developer	Building a mobile app Assignment 1 Beta Testing
Week 5 2/5 S 2/7 S&B	Ethics, privacy and cybersecurity in the new healthcare	*Assignment 1 Presentations* Working with Git and repositories
Week 6 2/12 S&B 2/14 B	*Assignment 2 Proposals* Digital diagnostic and therapeutics	Working with AR Begin Assignment 2 Development
Week 7 2/21 B	Holiday - Presidents' Day	Eye and Face tracking
Week 8 2/26 S 2/28 B	Disruptors in technology, retail, payor Big data, machine learning and AI Guest Speaker: Health and Human Performance in the Military	Textures, Materials, and Lighting Assignment 2 Beta Testing
Week 9 3/4 S 3/6 S&B	Decentralized clinical trials-new discovery Guest Speaker: Medical VR	*Assignment 2 Presentations* Sound Effects and Music
Week 10 3/18 S&B 3/20 B	*Assignment 3 Proposals* Novel collaborations in healthcare-lifecare	Setting up and building to a VR headset Begin Assignment 3 Development
Week 11 3/25 S 3/27 B	On-demand, digital healthcare and lifecare education products, Student Moonshot Proposal Introduction Guest Speaker: Digital Health	Head and hand tracking in VR Open XR input
Week 12 4/1 S 4/3 S&B	Lifecare-Implications for underserved under resourced populations Guest Speaker: Healthcare Narrative	Physics in 3D, Colliders, Triggers, Rigidbodies, Recasting Assignment 3 Beta Testing
Week 13 4/8 S&B 4/10 B	*Moonshot Proposal Presentations*	*Assignment 3 Presentations* Student led-Moonshot Studio Time
Week 14 4/15 S 4/17 B	Student led-Moonshot Studio Time	Student led-Moonshot Studio Time Unity and AR

Week 15 4/22 S 4/24 B	Student led-Moonshot Presentations	Student led-Moonshot Presentations
FINAL 6/5 S&B	Moonshot Final Deliverable	

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](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](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

1. The WHO guidance on *Ethics & Governance of Artificial Intelligence for Health,* https://www.who.int/publications/i/item/9789240029200
2. 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