

ID 4071 Syllabus

Invention Studio – Designing Robotic Environments, Section 1, 4 Credits

Fall 2026

Instructor Information

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General Course Information

Description

This course is a senior Interaction Design studio with a focus on designing “Robotic Environments,” which is an interdisciplinary topic discussed in various academic communities, including Interactive Architecture (IA), Architectural Robotics, Human-Robot Interaction (HRI), Socially Interactive Robotic Environment (SIRE), and Human-Building Interaction (HBI). “Robotic Environments” are built environments embedded with robotic components. They are physical, reconfigurable, interactive, and can be augmented through extended or mixed realities. We will explore the Design of Robotic Environments through various design methods and paradigms (e.g., movement-centric design, scenario-based design, design patterns, etc.) but under the paradigm of Human-Centered Design (HCD) and Research through Design (RtD). The goal is to design and develop innovative robotic environments or robots with environmental impacts through a rigorous design research process. We hope the outcome of this studio will significantly contribute to students’ design and research portfolios, no matter which career path they pursue, either in academia or industry, after they graduate.

Course Highlights

- We only have **one** group project in one semester.
- We are aiming for **publishable** design and research outcomes from the group projects.
- All group projects will be **submitted** to premier HCI conferences’ student design competitions (e.g., ACM HRI, ACM TEI, ACM CHI, etc.).
- Student groups will **self-define** group project topics and milestones under the instructor’s guidance.

- We will introduce various design research paradigms, methods, and tools with case studies **tailored** for each group project.
- We emphasize **“Learning to Learn”**: Students are expected to develop the ability to effectively acquire, process, and apply knowledge and skills independently.

Course Pre-requisites

No Prerequisite

However, I do expect students to have at least entry-level skills for prototyping cyber-physical artifacts. If you do not have such a skill, you should buy an electronics starter kit and pick it up quickly from online tutorials before the new semester begins.

Course Learning Outcomes

- Development and demo of partially functional robotic environment prototypes and a high-fi prototype (functional enough to serve the purpose of the proposed group project) to tell the story of how the design project addresses your design goal.
- Development and delivery of a final report in publishable quality to tell the story of how the design project addresses your design goal: logically sound, contently convincing, structurally clear, and well-written (examples and templates will be given in the class).
- Development and delivery of a design diary that details the design process, research process, and decision-making process (examples and templates will be given in the class) of the robotic environmental components.
- Development and delivery of a project video that clearly and vividly describes the project, especially how the Human- “Robotic Environment” Interactions may unfold (examples will be given in the class), and how such interactions may promote your design goal.

Course Delivery

Each student group should submit the following deliverables:

- **A Final Report** of your design-research process **in publishable quality**. It could be submitted to DIS or TEI pictorials (or other design research conferences) if you do it well enough.
- **A Design Diary** recording the design and research activities your group has gone through in a Research through Design (RtD) style.
- **Project Video**. The **project video** tells the story of your project with a focus on how people may interact with your robotic environment prototype.

- **Presentation PPTs with high-quality images.** There will be three presentations for the three design iterations. High-quality images of diagrams, renderings, and project photos should be presented in the PPT documents.
- **Design Topic Poster and Pitch Scripts.** Design topic posters are for ideating group project topics, and your poster pitch (an informal presentation)'s scripts are supposed to be well-crafted and logically sound.
- **Design Portfolio.** Based on the materials, both graphical and textual, you have generated for your group project, a design portfolio can be generated (for the group with more people only).

Required Course Materials

All learning resources will be provided through online materials and the course website.

- Hoffman, Guy, and Wendy Ju. "Designing robots with movement in mind." *Journal of Human-Robot Interaction* 3, no. 1 (2014): 91-122.
- Schafer, G, Green, K. E., Walker, I. D., Fullerton, S. K. In Press. *Words Become Worlds: The LIT ROOM, a Literacy Support Tool at Room-Scale. In Proceedings of the 2018 Designing Interactive Systems Conference (DIS '18). ACM, New York, NY, USA, 511-522.*
- Wang, Yixiao, and Keith Evan Green. "Designing Socially Interactive, Robotic Environments through Pattern Languages." *In Proceedings of Fourteenth IEEE International Conference on Intelligent Environment (IE), 2022.*
- Kerlinger, F. & Lee, H. (2000). *Foundations of behavioral research, 4th ed. New York: Harcourt. Chapter 1, 2, and 3.*

Learning Modes: Readings, Seminars, Cohort Learning, Lectures, Workshops, Consultation, Work Sessions, and Group Projects

- **Lectures & cohort learning:** Our discussions are designed to clarify concepts and share inspirations. lectures are designed to introduce innovative ideas, interesting topics, and important design-research methods for Robotic Environments. Find what's exciting to you and dive into it through design-research iterations. Be excited about your project first, so that others can share your excitement ($\geq \cup \leq$).
- **Workshops and consultations:** We have several workshops and consultation sessions since doing is the most effective way of learning design. Our consultation sessions are designed to give feedback on your group projects.
- **Presentations and Pin-ups:** We have a total of three presentations and one project topic pitching during the semester. The goal is to provide feedback on the project development and make sure your project moves forward as planned.

- **Work Sessions and Group projects:** We strongly encourage interdisciplinary learning for group projects. Work sessions are in-class sessions where group members can work on their group projects. We also have peer evaluation as part of the grading process.

Grading Policy:

Scores for individual submissions, assignments, the final grades, or any other components will be given based on the general guidelines below. Any additional grading criteria in the assignment sheet need to conform to the guidelines below:

- **A:** 90.00-100% *Excels in quality and understanding beyond requirements*
- **B:** 80.00-89.99% *Meets all requirements and has no outstanding lack in quality*
- **C:** 70.00-79.99% *Minor lack in quality or some requirements missing*
- **D:** 60.00-69.99% *A small part of the requirements is delivered, but effort is evident*
- **F:** 0-59.99% *Low effort or major lack in quality or no submission*

Description of Graded Components

For students, the course grade is composed of the following key elements: (1) **Acquiring IRB Approval**, (2) **Design Topic Poster and Presentation**, (3) **Design Diary** (relatively large group only), (4) **Final Report**, (5) **Phase I, II, III Presentation + Demo** (6) **Project Video** (7) **Extra Credits: Case Study**. **Given this is a studio course, you are required to attend Launch-Pad.** The points of each element and submission weeks are outlined in the table below for 3-person and 4-person groups:

For a 3-person group:

Acquiring IRB Approval	Design Topic Poster and Presentation	Phase I, II, III Presentation + Demo	Design Research Report	Design Diary	Project Video	Case Study	* Peer Evaluation
5 pts	10 pts	30 pts	20 pts	10 pts	10 pts	2 pts	10 pts

For a 4-person group:

Acquiring IRB Approval	Design Topic Poster and Presentation	Phase I, II, III Presentation + Demo	Design Research Report	Design Diary	Project Video	Case Study	Final Portfolio	* Peer Evaluation
5 pts	10 pts	30 pts	20 pts	10 pts	10 pts	2 pts	5 pts	10 pts

“Case Study” offers 2 points of extra credit.

* Peer Evaluation Form will be distributed on Canvas and should be submitted as **an individual assignment**. **If you do not submit your peer evaluation form for your teammates on time, you will also lose points in this category.**

“Attending Launchpad” is required. The group project should have a poster and a table of robotic prototypes well set up according to the Launchpad Requirement. At least one student in each group should attend Launchpad physically. **Failure to do the above will result in a maximum of 2 points deducted from the total grade.**

The total points will be specified to the second digit after the decimal point. Students’ final grades do not need to fit into a normal distribution curve: if everyone is doing excellent, then everyone could get an A. **Finally, the final grade is based on percentage, not the absolute grade points.** Below is the grading scale:

A	B	C	D	F
90-100%	80-89.99%	70-79.99%	60-69.99%	<= 59.99%

Course Schedule

WEEK (MW)	COURSE TOPIC
Background & Paradigms	
Week 01 (Aug. 24, Aug. 26)	Week1 Class1 (Wk1-C1): Course Introduction. Syllabus Go Through + Course Background Introduction + Design Paradigm Introduction (<i>Big Lecture</i>) Week1 Class2 (Wk1-C2): Design Paradigm. Design Paradigm Introduction (<i>Big Lecture</i>) + Design Theme Introduction and Brainstorm Specific Topics with Temporary Groups
Week 02 (Aug. 31, Sept. 2)	Wk2-C1: Defining Problems. Work Session: Working on Design Topic Posters, Pitch Drafts, and CITI Training. Wk2-C2: Defining Problems. Work Session: Working on Design Topic Posters, Pitch Drafts, and CITI Training.
Week 03 (Sept. 7, Sept. 9)	Wk3-C1 (Sept. 7): Official institute holiday -- Labor Day Wk3-C2: Informal Topic Pitch. Project Topic Pitching and Project Topic Consultation
Methods & Tools	
Week 04 (Sept. 14, Sept. 16)	Wk4-C1: Design Ideation. Introducing “Design Diary” and “Design Iteration I Presentation” Requirement, Introducing "Paper Mechatronics" and "Mechanical Mechanisms" (<i>#Lecture Component</i>) + Project Topic and Design Ideation Consultations + Customizing Iteration I Presentation content for each group + Design Ideation Session Wk4-C2: Design Research. Research Design Lecture (<i>#Lecture Component</i>), Project Topic and Design Ideation Consultations + Design Ideation Session + IRB Application Initial Info.

Week 05 (Sept. 21, Sept. 23)	Wk5-C1: IRB Workshop (<i>Carolyn Sims is coming</i>); Lectures for IRB History and Application (<i>#Lecture Component</i>) + Group by Group IRB Consultation. Wk5-C2: Design Materials . “Designing Robot with Movement in Mind” Lecture (<i>#Lecture Component</i>) + Further define “Iteration I Presentations + Demos” Milestones for Each Group + IRB Application Q&A + Work Sessions.
Week 06 (Sept. 28, Sept. 30)	Wk6-C1: Design Ideation & Research Design . Works Sessions + Consultations for Design Ideation, User Studies, and Research Design (IRB Application). Wk6-C2: Design Ideation & Research Design . Works Sessions + Consultations for Design Ideation, User Studies, and Research Design (IRB Application).
Week 07 (Oct. 5, Oct. 7)	Wk7-C1 (Oct. 5): Fall break. No Classes. Campus open. Wk7-C2: Presentation Preparation . Work Sessions with Consultations on "Iteration I Presentations + Demos."
Case Studies	
Week 08 (Oct. 12, Oct. 14)	Wk8-C1: “Iteration I Presentation + Demos” + Consultation/Discussions on next steps and design directions. Wk8-C2: Design Reflection . Introducing “Iteration II Presentation” assignment and “Extra Credit Case Study Presentation” assignment. Work Sessions to discuss "Iteration II Presentations + Demos" deliverables. Consultation session to customize Iteration II content for each group.
Week 09 (Oct. 19, Oct. 21)	Wk9-C1 (Oct. 19): Guest Lecture (<i>pending further confirmation</i>) Wk9-C2: Design Development . Introduce the SDC paper writing template (<i>#Lecture Component</i>). Work Session: Working on User Studies, Skeleton/Robotic Prototype, Paper Writing, and more.
Week 10 (Oct. 26, Oct. 28)	Wk10-C1: Design Development . Work Session: Working on User Studies, Skeleton/Robotic Prototype, Paper Writing, and more. Wk10-C2: Design Development . <i>*Optional Case Study (within 25 mins for each group)</i> + Work Session: Working on User Studies, Skeleton/Robotic Prototype, Paper Writing, and more. “Quantitative Data Analysis Workshop” can be provided to groups whose projects require statistical analysis.
Week 11 (Nov. 2, Nov. 4)	Wk11-C1: Presentation Preparation . Work Sessions with Consultations for "Iteration II Presentation + Demo." Wk12-C2: “Iteration II Presentation + Demos” + Consultation/Discussions on next steps and design directions.
Communications	
Week 12 (Nov. 9, Nov. 11)	Wk12-C1: Paper & Video and Design Reflection . Introducing “Final Presentation” assignment; Introducing the “Course-submission Paper Templates” and “Project Video Templates and Examples” (<i>#Lecture Component</i>). Reflections on Iteration II Presentation and Work Session with Consultation on Next Steps Design Directions and SDC Submissions.

	Wk12-C2: Qualitative Data Analysis and Design Development. “Reflexive Thematic Analysis” lecture (#Lecture Component) + Work Session with Consultation on Final Deliverables.
Week 13 (Nov. 16, Nov. 18)	Wk13-C1: Deliverable and Design Development. Work Session with Consultation on Final Deliverables Wk13-C2: Preparing the HRI SDC Paper and Highly-Recommended Video Submissions (Due Nov. 20th). Work Session with Consultations.
Week 14 (Nov. 23, Nov. 25)	Wk14-C1: Summative Evaluation and Design Development. Work Session with Consultations on Final Deliverables Wk14-C2 (Nov. 25): Student recess. No classes. Campus open.
Week 15 (Nov. 30, Dec. 2)	Wk15-C1: Presentation Preparation and Consultation for Final Course Submissions. In-class Consultation and Work Session for Videos, Papers, and More. Wk15-C2: Presentation Preparation and Consultation for Final Course Submissions. In-class Consultation and Work Session for Videos, Papers, and More.
Week 16 (Dec. 7)	Wk16-C1: “Final Presentation + Demos.” After the presentation, Remember to do CIOS Survey.

Course Policies

Attendance and/or Participation

*You are expected to attend each class from week 1 to week 15, and attendance will be taken by the TA (if any) or the instructor during the class periodically, particularly during lectures, guest speaker sessions, presentations, and workshops. If there is something urgent happens (e.g., family emergency, illness, job interviews, etc.), you should email BOTH the instructor and the TA (if any) about the situation the day BEFORE the class. Arriving more than 15 minutes late will be recorded as a late arrival. Two late arrivals will be counted as one absence. Arriving more than 30 minutes late will be recorded as an absence. **Any UNEXCUSED** absence will result in a final grade deduction:*

<i>Number of Unexcused Absence:</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>>= 5</i>
<i>Point deduction from the final grade:</i>	<i>0</i>	<i>1</i>	<i>2</i>	<i>5</i>	<i>10</i>

Office Hours

Please be aware that the maximum office hours the instructor can provide weekly are 2 hours outside regular class time. **So, please do not wait until the very last week to seek consultations for your deliverables.** Office hours are appointment-based. **Please book my office hours at least 24 hours ahead of the meeting time.** Here is the link you can book my office hours:

<https://docs.google.com/spreadsheets/d/1QICJiWHJ--TNrprcMtOgW8BLB3u908YAIPHuLTXOxbY/edit?usp=sharing>

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review [Georgia Tech's Honor Code](#) and the student [Code of Conduct](#).

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Core IMPACTS

Not Applicable.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, [contact the Office of Disability Services](#) (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also email me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. [The Student-Faculty Expectations](#) articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Extra Credit Opportunities and Grade Dispute Policies and Procedures

Presenting a "Case Study" offers 2 points of extra credit (see "Description of Graded Components"). The grade of each assignment on Canvas will be released on Canvas. Students should email the instructor within 4 days of the grades being posted (including holidays) if they have any questions about the grade. After 4 days, no grade disputes will be accepted.

Collaboration, Group Work, and Use of Generative AI

Collaboration and teamwork are a core part of this class. By its nature, this class brings together people of different backgrounds and provides an opportunity for them to learn

from each other and work together. It is expected that members of this class will support each other, provide constructive criticism and feedback, and work to help each other complete assignments. Teams are expected to work together towards a common goal, and to resolve any differences amicably and with respect. Failure to do so may result in a penalty assessed to the semester participation grade.

Regarding the recent rise of LLM tools such as Chat GPT, this course allows the use of LLMs for the purpose of programming (e.g., writing an Arduino code to control the robot). However, students must clearly specify which parts of the code are generated by the LLMs, and which parts are written by themselves. This course does not allow students to use LLMs for paper writing or document drafting.

Regarding the recent rise of AI graphic tools such as Midjourney and DALL·E, this course allows the use of these tools for complementary elements of your work, such as the background picture of a PPT presentation, a layer of your Photoshop file, etc. For such pictures, students should acknowledge the use of such tools in the footnote of the pictures. Students should NOT use a completely AI-generated image as a page of their deliverables.

Dissemination of Course Outcomes

Upon completion of the course, some of the course outcomes, including papers, photos, and videos of the group projects, will be made available on the course website (if there is one). The students who produced the work will be credited. This is to inform and inspire future students. Perhaps some students want to embargo their project outcomes for certain reasons. In this case, consult the instructor or the teaching assistant and let them know the decision in advance. Non-participation will not affect the student's end grade.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

All assignments must be turned in on time, or alternative arrangements must be made with the instructors prior to the due date. Failure to hand in assignments on time may result in a late penalty assessment for that assignment. Extensions may be assessed in consultation with the instructors. Institute-mandated exceptions will be honored, as explained in this document: catalog.gatech.edu/rules/4/

Inclement Weather and Digital Learning Days

With developments and improvements to digital instruction over the past few years, the Institute has developed policies to leverage digital learning as much as reasonably possible. The policy sets forth requirements, procedures, and responsibilities related to the scheduling of digital instruction and/or make-up classes due to the modification of

campus operations, closing of campus, or the necessary closing of instructional spaces for any reason (including but not limited to emergencies, such as inclement weather, power outages, or other infrastructure failures). Students should await communications from their instructors regarding delivery of their classes during that period based upon the Digital Learning Days for Modified Campus Operations Policy. Students should follow guidance and/or directions provided by the Office of the Vice President for Student Engagement and Well-Being regarding student activities, events, programs and services.

Student Use of Mobile Devices in the Classroom

Mobile devices are permitted in the classroom during open work sessions and lab hours to facilitate coursework. However, mobile devices should not be used during lectures, class discussions, guest presentations, critiques, or any other situation where a speaker has the focus of the class. Repeated usage of mobile devices during these periods in the class will result in a penalty assessed to the semester participation grade.

Campus Resources for Students

Undergraduate Student Academic Success Resources:

Academic Support: Academic Success and Advising (a unit in the Office of Undergraduate Education & Student Success) provides free support for your courses. Students can attend scheduled supplemental review (PLUS) sessions, stop by Drop-In Tutoring, or schedule a one-on-one appointment through Knack. To explore what options work best for you, please visit us online at success.gatech.edu/tutoring, email us at tutoring@gatech.edu, or come see us at Clough Undergraduate Learning Commons, Suite 283.

Graduate Student Academic and Professional Success Resources:

A list of resources for graduate students is given on the [Office of Graduate and Postdoctoral Education](#) website. Specific information for [current graduate students](#) includes

- [Academic Resources](#) such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance;
- [Student Resources](#) such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide; and
- [Professional Development](#) such as the programming from the Career Center and other professional development resources and events”

Student Well-Being:

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A [comprehensive list](#) of wellness-related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being ([student-resource-guide \(gatech.edu\)](#)). More resources on supporting student well-being on the syllabus and beyond are available through the [Learning Well Initiative](#).

Safety Policies:

Please refer to the links here for safety and security-related policies:

<https://www.policylibrary.gatech.edu/employment/safety-security>