# 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 Presentation Scripts. Design topic posters are for ideating group project topics, and your poster 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 (≧◡≦).
- 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 + Attending 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 3 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): Syllabus Go Through + Course Background Introduction + Design Paradigm Introduction **(Big Lecture)**<br>Week1 Class2 (Wk1-C2): Design Paradigm Introduction **(Big Lecture)** + Broader Design Topics Introduction and Brainstorm Specific Topics |
| Week 02 (Aug. 31, Sept. 2) | Wk2-C1: Work Session: Working on Design/Research Topic Posters, Pitch Drafts, and CITI Training.<br>Wk2-C2: Work Session: Working on Design/Research Topic Posters, Pitch Drafts, and CITI Training. |
| Week 03 (Sept. 7, Sept. 9) | Wk3-C1 (Sept. 7): Official institute holiday -- Labor Day<br>Wk3-C2: Project Topic Pitching and Project Topic Consultation |
| | **Methods & Tools** |
| Week 04 (Sept. 14, Sept. 16) | Wk4-C1: Introducing "Design Diary" Requirement, Research Design Lecture, Project Topic Consultation, and IRB Application Walk-Through **(#Lecture Component)**<br>Wk4-C2 (Sept. 16, **Carolyn Sims coming, #Guest Lecture Component**): Each Group Crafting Project Timeline and Milestones with the Instructor focusing on Iteration I deliverables, and Work Session for IRB Application |
| Week 05 (Sept. 21, Sept. 23) | Wk5-C1**:** Introducing "Paper Mechatronics" and "Mechanical Mechanisms" + Design Ideation Workshop **(#Very Short Lecture Component).**<br>Wk5-C2: Further define "Iteration I Presentations + Demos" Milestones for Each Group + IRB Application Q&A + Work Sessions (on "Iteration I" slides) |

| | |
|---|---|
| Week 06 (Sept. 28, Sept. 30) | Wk6-C1: Introducing Movement Centric Design + Research Design Consultations (#Lecture Component).<br>Wk6-C2: Works Sessions + Design Research Consultations. |
| Week 07 (Oct. 5, Oct. 7) | Wk7-C1 (Oct. 5): Fall break. No Classes. Campus open.<br>Wk7-C2: Work Sessions with Consultations on "Iteration I Presentations + Demos." |
| **Case Studies** | |
| Week 08 (Oct. 12, Oct. 14) | Wk8-C1: **"Iteration I Presentation + Demos"** + Work Session: Improving Iteration I PPT slide and Skeleton Prototype<br>Wk8-C2: Work Sessions to discuss "Iteration II Presentations + Demos" deliverables. |
| Week 09 (Oct. 19, Oct. 21) | Wk9-C1 (Oct. 13): Guest Lecture **(#Guest Lecture Component)**<br>Wk9-C2: Discussing requirements for "Iteration II presentation and demos" for each group. |
| Week 10 (Oct. 26, Oct. 28) | Wk10-C1: *Optional Case Study 1 (within 0.5 hour for each group) + Work Session: Working on User Studies and Robotic Prototype.<br>Wk10-C2: *Optional Case Study 2 (within 0.5 hour for each group) + Work Sessions with Consultations. "Quantitative Data Analysis Workshop" can be provided to groups whose projects require statistical analysis. |
| Week 11 (Nov. 2, Nov. 4) | Wk11-C1: *Optional Case Study 3 (within 0.5 hour for each group) + Work Sessions with Consultations for "Iteration II Presentation + Demo"<br>Wk12-C2: **"Iteration II Presentation + Demos"** + Work Session: Improving Iteration II PPT slide and Skeleton Prototype |
| **Communications** | |
| Week 12 (Nov. 9, Nov. 11) | Wk12-C1: Introducing "Paper Templates and Examples" + "Project Video Templates and Examples" Work Session with Consultation on Final Deliverables **(#Lecture Component).**<br>Wk12-C2: "Reflexive Thematic Analysis" lecture + Work Session with Consultation on Final Deliverables **(#Lecture Component).** |
| Week 13 (Nov. 16, Nov. 18) | Wk13-C1: Work Session with Consultation on Final Deliverables<br>Wk13-C2: Work Session with Consultations on Final Deliverables |
| Week 14 (Nov. 23, Nov. 25) | Wk14-C1: Work Session with Consultations on Final Deliverables<br>Wk14-C2 (Nov. 25): Student recess. No classes. Campus open. |
| Week 15 (Nov. 30, Dec. 2) | Wk15-C1: Work Session with Consultations on "Final Presentation + Demos"<br>Wk15-C2: **"Final Presentation + Demos."** After the presentation, Do CIOS Evaluation. |
| Week 16 (Dec. 7) | Wk16-C1: (Dec. 7th) In-class Consultation for the Design Challenge submissions |

## 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 occasionally. 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. Any UNEXCUSED absence will result in a final grade deduction:*

| *Number of Unexcused Absence:* | *1* | *2* | *3* | *4* | *>= 5* |
|---|---|---|---|---|---|
| *Point deduction from the final grade:* | *0* | *1* | *2* | *5* | *10* |

**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 many different disciplines and 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