

SI 559 Fall 2020

Intro to AR/VR Application Design

Professor Michael Nebeling

Instructional Team

- Professor: Dr. [Michael Nebeling](mailto:nebeling@umich.edu) (nebeling@umich.edu) -- <https://mi2lab.com>
- GSIs: Toshi Gupta (toshig@umich.edu), Alan Wu (wuliwei@umich.edu)

Classes

- Fridays 9-11.50pm **FULLY REMOTE*** [SI 659 am Zoom Meeting](#)
- Fridays 1-3.50pm **FULLY REMOTE*** [SI 659 pm Zoom Meeting](#)
- [Lecture recordings are available here](#)
- **Slack channel:** si559fall2020.slack.com ([Invite link](#))

*** The course was previously categorized as *hybrid* but in order to provide both a safe and supportive environment for learning about these technologies which are like our phones typically treated as personal devices (I mean we are talking about headsets for the most part) I was able to convert the course to *fully remote*. The implications of this are that we will have to reduce the amount of in-class group work, but allowing you to work asynchronously on things and in your own time will also allow you to focus on the aspects of design that you most care about. I believe that the tradeoffs we will need to make will overall provide a safer and in some ways better learning experience. Nobody should feel like they will need to have access to high-end equipment to succeed in this course. An AR/VR device is not required. However, you will need access to a computer with a webcam or phone (ideally no older than 2017) for the technical portions of this course, and there will be ways to work with us around this as well.**

Office Hours

- Michael: tentatively Tuesday/Wednesday morning (starting after September 17), may also stream on some agreed-on video streaming platform like YouTube or Twitch
- Toshi: **Wednesday 3pm-4pm**
(<https://us04web.zoom.us/j/71799208949?pwd=U21QdDB3M0xuS1U4S0p4Q1E2S3l5Zz09>, pw: 559pm)
- Alan: **Tuesday 4pm-5pm** (<https://umich.zoom.us/j/93337362361>, pw: 559am)

Course Summary

This course will introduce you to the world of Augmented, Mixed, and Virtual Reality interfaces. These interfaces enable new kinds of user experiences by superimposing digital content onto the user's real world view or creating fully immersive virtual world experiences. You will learn about the differences between AR/VR, about the technical and design requirements for creating

such user experiences, and how to prototype and develop your first AR/VR interfaces. You will also receive an overview of new and evolving interaction design principles and methods, current AR/VR interface development approaches, and how to assess the usability of AR/VR interfaces.

Learning goals for this course

- Understand the differences in AR/VR concepts and technologies
- Evaluate usability of AR/VR applications and critique their use of AR/VR capabilities
- Have an overview of AR/VR development approaches
- Design and prototype effective AR/VR applications using state-of-the-art tools
- Compare AR/VR to other approaches; match technology to needs and use cases
- Articulate trends and trajectories in current and future AR/VR systems

How learning goals are addressed

The course starts with an introduction to key concepts such as the virtuality-reality continuum and its mediality extensions as well as levels of immersion. There will be hands-on tech demos of various devices in class (and via online video recordings) and you will be given access to devices as much as possible (we ordered Google Cardboard adapters compatible with many phones and will use them for the VR and AR prototyping portions whenever possible). Issues and trends surrounding AR/VR technologies will be discussed and there will be a special topics theme on privacy, social, and ethical implications throughout the course. We want to be good at both designing for the technologies and thinking critically about them and our designs.

The course focuses on design and prototyping activities with and for state-of-the-art technologies and tools, with a focus on prototyping techniques, but also including a short introduction to programming tools such as A-frame, Unity, and Unreal. There are three bigger assignments: two mini-projects throughout the course, one on AR, and the other on VR, and a final design jam task. Human interface guidelines for AR/VR as far as they exist will be covered, as will be the fact that these are still evolving and rather preliminary. Usability evaluation techniques will be reviewed and applied in peer evaluations of the mini-projects and design jam results. Throughout the course, every student will prepare and present a design critique of an existing AR/VR app. These will be used as a basis for discussion around the technical, design, and social issues, to help you make better choices in your own assignments and projects.

Course Schedule

Topics	Dates
Week 1: AR/VR Concepts and Technologies Learn about the various AR/VR concepts, displays & tracking technologies	4 Sep
Week 2: AR/VR Mini-Design Jam #1 Conceptualize the design of an existing AR/VR app & add a new feature	11 Sep
Week 3: VR Design Overview Get an overview of guidelines, methods, tools & pick design problem	18 Sep
Week 4: Physical Prototyping for VR Physical prototype of potential solution	25 Sep
Week 5: Digital Prototyping for VR Learn about tool choices, digital prototype of (key aspects of) solution	2 Oct
Week 6: VR Mini-Project Presentations + VR Quiz Demo/pre-record video & get feedback from instructional team & peers	9 Oct
Week 7: AR/MR Design Overview Get an overview of guidelines, methods, tools & pick design problem	16 Oct
Week 8: Physical Prototyping for AR Physical prototype of potential solution	23 Oct
Week 9: Digital Prototyping for AR Learn about tool choices, digital prototype of (key aspects of) solution	30 Oct
Week 10: AR Mini-Project Presentations + AR/MR Quiz Demo/pre-record video & get feedback from instructional team & peers	6 Nov
Week 11: AR/VR Mini-Design Jam #2 Work through a design problem with peers, choose AR/VR & prototype	13 Nov
Week 12: Privacy, Ethical, and Social Implications, and the Future of AR/VR Establish main concerns with respect to your mini-design jam solution	20 Nov
<i>Thanksgiving break (21 Nov - 30 Nov)</i>	27 Nov
Week 14: AR/VR Mini-Design Jam Presentations Present mini-design jam solution & discuss privacy, ethical, social concerns	4 Dec

Assignments

Assignment	Dates
Week 1: Short Statement of Interest and Bio	4 Sep
Week 2: AR/VR Mini-Design Jam #1 Report	11 Sep
Week 3: VR Problem Statement and Competitive Analysis	18 Sep
Week 4: VR Physical Prototype	25 Sep
Week 5: VR Digital Prototype	2 Oct
Week 6: Final VR Prototype + VR Quiz	9 Oct
Week 7: AR Problem Statement and Competitive Analysis	16 Oct
Week 8: AR Physical Prototype	23 Oct
Week 9: AR Digital Prototype	30 Oct
Week 10: Final AR Prototype + AR Quiz	6 Nov
Week 11: AR/VR Mini-Design Jam #2 Report	13 Nov
Week 12: AR/VR Mini-Project Portfolios	20 Nov
Week 13: ---	27 Nov
Week 14: Final AR/VR Mini-Project Submissions	4 Dec

Grading

In this class, we will learn about AR/VR technologies together. You should do good work in this class because you care about the project you pick and because you want to learn how to design AR/VR interfaces. At any time throughout the course, please don't hesitate to reach out and discuss your performance in class and what to improve. My main goal is for us to know more about the opportunities and challenges of AR/VR technologies and how to design with and for them. This is an introductory class with no prerequisites and has traditionally been a productive and successful learning experience for both me and my students. That said, we must adhere to university policy and use grades, so here is how grades will work in this class:

- **Zipcrits (10%):**
 - Your design critique of an existing AR/VR app that you have inspected yourself.
- **Two quizzes (20%):**
 - The first around VR (10%)
 - The second around AR (10%)
- **Weekly reading responses (10%)**
 - A short reading reflection helping us to collect key questions for in-class debate
- **2 mini-projects (40%):**
 - The first around VR (20%).
 - The other around AR (20%)
 - You need to demonstrate your understanding of the methods and tools taught in the course.
 - Both will need to be presented and critiqued according to a schedule arranged with you.
- **Two design jams (20%):**
 - We will provide topics and instructions on how to prepare.
 - You will need to develop a design concept and prototype the main AR/VR interface components and interactions as proof of concept.
 - You will need to submit a video and/or slideshow as a record of your work.

Final Grades will be assigned per the following scale:

A+	99-100%
A	94-98%
A-	90-93%
B+	88-89%
B	84-87%
B-	80-83%
C+	77-79%
C	73-77%
C-	70-72%
D	60-69% (will be masked initially)
F	below 60% (will be masked as COVID-19 initially)

Late Assignments

- You need to contact us at least on the day the assignment is due (not past due) for an extension, **submit the work completed so far**, and include a written plan for completion.
- There is no need to provide a reason for requesting an extension for up to 3 days.
- Longer extensions can be worked out with the instructional team but need written confirmation.

Regrading Policy

- For any graded portions of the course, you may resubmit your work within a 3-day period after grades were released.
- You need to provide a summary of changes and an explanation for how you addressed the feedback.
- Unless there are special circumstances, you can only ask to regrade twice (two times in the semester).

Attendance

- Synchronous attendance via Zoom is highly encouraged but not required. We will make every effort to provide lecture recordings.
- You don't need to excuse yourself if you cannot make it to class. However, it is on you to find out what you missed by referring to the shared materials or asking your classmates.
- We will incorporate lots of opportunities for discussion as well as breaks. We will also ask for your feedback to help us make this an enjoyable and productive learning experience.
- Please understand that due to the design oriented nature of the class, there is no common structure between lecture blocks that would make it easy to attend only select portions of the class.
- We will use the U-M supported service Zoom for our meetings. One benefit of Zoom is virtual backgrounds which can help you feel more comfortable as you share your video.
- I will always encourage your participation via video and/or audio but this will be at your discretion. We will use the chat function as the primary mechanism to ask questions.

Accommodation for Students with Disabilities

If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way we teach may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Office of Services for Students with Disabilities (SSD) to help us determine appropriate accommodations. SSD (734-763-3000; ssd.umich.edu) typically recommends accommodations through a Verified Individualized Services and

Accommodations (VISA) form. I will treat any information that you provide in as confidential a manner as possible.

Student Mental Health and Wellbeing

The University of Michigan is committed to advancing the mental health and wellbeing of its students, while acknowledging that a variety of issues, such as strained relationships, increased anxiety, alcohol/drug problems, and depression, directly impacts students' academic performance.

If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, contact Counseling and Psychological Services (CAPS) at (734) 764-8312 and <https://caps.umich.edu/> during and after hours, on weekends and holidays. You may also consult University Health Service (UHS) at (732) 764-8320 and <https://www.uhs.umich.edu/mentalhealthsvcs>, or for alcohol or drug concerns, see www.uhs.umich.edu/aodresources.

Since many students are remote during fall 2020, [CAPS COVID-19 Support](#) features [SilverCloud](#), an online, self-guided, interactive mental health resource that provides cognitive behavioral interventions.

For a more comprehensive listing of the broad range of mental health services available on campus, please visit: <http://umich.edu/~mhealth/>

Academic Integrity

Abridged version: Unless otherwise specified in an assignment all submitted work must be your own, original work. Any excerpts, statements, or phrases from the work of others must be clearly identified as a quotation, and a proper citation provided. Any violation of the School's policy on Academic and Professional Integrity (stated in the Master's and Doctoral Student Handbooks) will result in serious penalties, which might range from failing an assignment, to failing a course, to being expelled from the program. Violations of academic and professional integrity will be reported to UMSI Student Affairs. Consequences impacting assignment or course grades are determined by the faculty instructor; additional sanctions may be imposed by the assistant dean for academic and student affairs.

Collaboration: UMSI strongly encourages collaboration while working on some assignments, such as homework problems and interpreting reading assignments as a general practice. Active learning is effective. Collaboration with other students in the course will be especially valuable in summarizing the reading materials and picking out the key concepts. You must, however, write your homework submission on your own, in your own words, before turning it in. If you worked with someone on the homework before writing it, you must list any and all collaborators

on your written submission. Each course and each instructor may place restrictions on collaboration for any or all assignments. Read the instructions carefully and request clarification about collaboration when in doubt. Collaboration is almost always forbidden for take-home and in class exams.

Plagiarism: All written submissions must be your own, original work. Original work for narrative questions is not mere paraphrasing of someone else's completed answer: you must not share written answers with each other at all. At most, you should be working from notes you took while participating in a study session. Largely duplicate copies of the same assignment will receive an equal division of the total point score from the one piece of work.

You may incorporate selected excerpts, statements or phrases from publications by other authors, but they must be clearly marked as quotations and must be attributed. If you build on the ideas of prior authors, you must cite their work. You may obtain copy editing assistance, and you may discuss your ideas with others, but all substantive writing and ideas must be your own, or be explicitly attributed to another. See the (Doctoral, MSI, BSI) student handbooks available on the UMSI intranet for the definition of plagiarism, resources to help you avoid it, and the consequences for intentional or unintentional plagiarism.