CSCI 8980: Immersive User Interfaces

Fall 2018

Instructor: Evan Suma Rosenberg
E-mail: suma@umn.edu
Office: Keller 6-201

Class Hours: T/Th 4:00-5:15pm
Office Hours: to be determined
Web: www.sumarosenberg.com

Note: preliminary syllabus, course policies are subject to change.

Course Description

The goal of this course to provide a comprehensive overview of the state-of-the-art and current research trends in virtual, mixed, and augmented reality, with a focus on 3D user interfaces and interaction techniques. Classroom topics will encompass both theory and practice, including immersive displays, motion tracking, navigation, selection, manipulation, system control, design guidelines, and evaluation methods. Course activities will also include presentations, critical discussion, and implementation of interaction techniques from notable research papers in the field. For the final project, students will identify and propose a novel immersive user interface concept that will be further developed into a functional prototype.

Learning Objectives

Students will gain a deep understanding of the theoretical foundations, design principles, and research areas in virtual and augmented reality. Major learning objectives include:

- Understanding immersive input and output devices
- Learning how to design and implement 3D interaction techniques, including:
  - Navigation
  - Selection
  - Manipulation
  - System control
- Understanding design guidelines and evaluation methodologies for immersive user interfaces
- Becoming familiar with foundational literature and current research challenges in virtual and augmented reality
- Gaining experience in proposing, designing, and developing a novel immersive user interface to solve a specific problem

Eligibility

This course is primarily intended for graduate students that wish to learn more about immersive user interfaces from a scientific research perspective. Advanced undergraduates may also be considered with permission from the instructor.

Prerequisites

Solid programming skills; familiarity with basic principles of computer graphics and 3D coordinate systems. Prior experience developing applications in Unity is beneficial, but not required.

Textbook

3D User Interfaces: Theory and Practice (Second Edition)
LaViola, Kruijff, McMahan, Bowman, and Poupyrev. ISBN: 978-0134034324
`https://www.amazon.com/3D-User-Interfaces-Practice-Usability/dp/0134034325`

Assignments

Lectures. This course will follow a format that rotates between classroom lecture, student presentations, and demonstration of immersive interaction techniques from the research literature. For each topic covered in class, the instructor will first present a lecture to provide an overview of the conceptual background. Students will be expected read the corresponding textbook chapters or research papers outside of class. There will be a midterm exam on the conceptual material covered in lectures during the first two thirds of the course.

Paper Presentations. The instructor will also select a collection of research papers for a more in-depth investigation of each topic. Throughout the semester, each student will periodically be assigned to read one of these papers, present it to the class, and then lead a discussion. Students will be expected to read and think deeply about these papers. The goal of these presentations is to deepen the knowledge of the topics presented in class, and to practice thinking critically and constructively about virtual and augmented reality user interfaces. Grading on the presentations will be based on mastery of the technical material (how well you understood the paper and communicated the key concepts) and thoughtful discussion of its novelty, strengths, weaknesses, and open questions for future work.

Discussions. After presenting the paper, each student will lead a brief discussion in class. Although these conversations can develop organically, preparing several discussion questions in advance is recommended in order to get the things started. Students in the audience will be expected to participate by listening to the presentations and asking thoughtful questions. Class attendance is therefore required and excessive absences will be factored into the participation grade unless the student is excused the instructor.

Interface Prototypes. Each student will also develop a functional prototype of an interaction technique that was presented in class. Students will not be expected to implement an entire research paper, but rather a specific component of the user interface selected by the instructor. These prototypes will be demonstrated in class at least one week after a student's paper presentation.

Final Project. For the course project, students will propose, design, and develop a prototype user interface that addresses one of the topic areas covered in the class. This project can either be completed individually or with a small group of 2-3 students; group projects will have higher expectations for functionality and complexity. Students will present their project proposals in class for early feedback, and then will also another presentation on the development accomplishments and challenges during the last week of class. Final project code and a live demonstration will be due during the final exam period.

Grading

Category	% of grade
Paper Presentations	15
Interface Prototypes	15
Midterm Exam	30
Final Project	30
Class Participation	10

Academic Integrity

Academic integrity is essential to a positive teaching and learning environment. All students enrolled in university courses are expected to complete coursework responsibilities with fairness and honesty. Failure to do so by seeking unfair advantage over others or misrepresenting someone else's work as your own, can result in disciplinary action. The University Student Conduct Code defines scholastic dishonesty as follows: Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using course materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. Within this course, a student responsible for scholastic dishonesty can be assigned a penalty up to and including an F or N for the course. If you have any questions regarding the expectations for a specific assignment or exam, ask.

For assignments and projects involving programming, it may be acceptable to use third party software libraries, art assets, or code only if the following conditions are met: (1) the assignment explicitly states that third party content is permitted, (2) the third party content is not utilized to solve the portion of the assignment that is required to be implemented solely by the student, and (3) all third party content is disclosed, including its source (e.g. link to website, github repository, or asset store), in the documentation submitted with the assignment. All other uses of third party content will be treated as a form of scholastic dishonesty. Again, if you have any questions about the usage of third party content in a programming assignment or project, ask.

Additional Policies

Late submissions will be accepted up to 24 hours after the announced deadline, with a penalty of 20%. Submissions received more than 24 hours late will not be accepted without prior permission from the instructor.

Tentative Schedule

	Topics	Reading
Week 1 9/4 - 9/6	Introduction to Immersive User Interfaces	Ch. 1-2
Week 2 9/11 - 9/13	Human Sensation and Immersive Displays	Ch. 5
Week 3 9/18 - 9/20	Motion Tracking and Spatial Input	Ch. 6
Week 4 9/25 - 9/27	Selection and Manipulation 1	Ch. 7
Week 5 10/2 - 10/4	Selection and Manipulation 2	TBA
Week 6 10/9 - 10/11	Navigation 1	Ch. 8
Week 7 10/16 - 10/18	Navigation 2	TBA
Week 8 10/23 - 10/25	System Control 1	Ch. 9
Week 9 10/30 - 11/1	System Control 2	TBA
Week 10 11/6 - 11/8	Midterm / Project Proposals	-
Week 11 11/13 - 11/15	Immersive Perception	Ch. 3.1 - 3.3
Week 12 11/20	Spatial Cognition	Ch. 3.4 - 3.7
Week 13 11/27 - 11/29	Presence and Plausibility	TBA
Week 14 12/4 - 12/6	Haptic Interaction	TBA
Week 15 12/11	Project Presentations	-
FINAL	Final Project Demonstrations (no exam)	-