

# CSCI 39545: VR, AR and Mixed Reality

3 hrs, 3 credits. Department of Computer Science, Hunter College, City University of New York.

**Instructor:** [Prof. Wole Oyekoya](#)  
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**Office hours:** Wednesdays, 3:00pm-5:00pm <https://huntercollege.zoom.us/j/3356454291>  
**Semester:** Fall 2020  
**Section:** CSCI 39545  
**Class Sessions:** Mondays and Thursdays, 11:10am-12:25pm  
**Classroom:** Online (Blackboard)

## Course Description

This course introduces students to the development of 3D simulations in virtual, augmented and mixed reality (VR/AR/MR) environments. Students will be introduced to various topics which include immersion, presence, immersive visual displays, remote telepresence, motion tracking, interactive 3D graphics and immersive audio.

## Learning Outcomes

Students completing this course will be able to:

- Understand fundamental concepts of virtual, augmented and mixed reality;
- Use Unity3D game engine to develop VR, AR and MR projects;
- Choose the most effective VR/AR/MR display for showcasing your projects.

## Outline and Schedule of Course Topics

Please note that this schedule is tentative and is meant to serve only as a guide:

- Introduction to VR, AR and MR
- Hardware and Software
- Immersive Visual and Interactive Displays
- Immersion, Presence and Reality
- 3D Tracking, Scanning and Animation
- Interaction and Input Devices
- Interactive 3D Graphics
- 3D Geometry
- Immersive Audio

- Perception
- VR Sickness and Latency
- Immersive Telepresence

## Prerequisites

- CSCI 23500: Software Analysis and Design II or equivalent.
- MATH 15500: Calculus with Analytic Geometry II or equivalent.

## Textbooks and Materials

- Jason Jerald. 2015. The VR Book: Human-Centered Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool Publishers. ISBN 9781970001129.
- LaValle, Steven M. Virtual Reality. (Self-published), 2016, <http://msl.cs.uiuc.edu/vr/>.

## Grading

Category	Percentage
Attendance/Participation	10%
Seminar	20%
VR/AR/MR Project	50%
Exam	20%

## Key Dates

Event	Date
One-page Project Proposals due	September 11th @ 5pm
Project Updates	Bi-Weekly
Seminar	Weekly (Assigned)
Project Submission	November 23rd @ 5pm
Exam	December 14th, 11:30 am - 1:30 pm

## Project

The course will include one group project. Students will be randomly split into 10 groups of four students. Each group of four will implement a VR/AR/MR application. Each student is expected to contribute to the group project, and this will be monitored through weekly presentations and anonymous peer review. A one-page project proposal needs to be submitted that includes the names of individuals within each group, project idea and an outline of weekly milestones. The proposal will be maintained as a group web page showing weekly progress. The VR application

must be an interactive 3D application utilizing an input device, displays on Google Cardboard VR (or any VR headset), and include features that we learn in class. Every weekly presentation update should demonstrate how you've incorporated what you've learnt in class up to that week. The final deliverable will include a short research paper (~3-5 pages) written in latex format and an application demo.

## Notes

- Usually, students would develop VR experiences in Unity3D and display it on more expensive headsets like [Oculus Rift](#), [HTC Vive](#) and [Hololens](#), which we have in the lab and can be shared. Due to covid-19 restrictions, students will use the [inexpensive Google Cardboard VR](#) to create Virtual Reality (VR) experiences instead. Students will use the Cardboard SDK to turn a smartphone into a VR platform. A smartphone can display 3D scenes with stereoscopic rendering, track and react to head movements, and interact with apps by detecting when the user presses the viewer button. Visit <https://developers.google.com/cardboard> for more information on setting up Google Cardboard.
- **Late project submission will be penalized.**
- No extensions will be given.

## Other Resources Required

- Download Unity - <https://unity3d.com/get-unity/download>
- Download Adobe Fuse and optionally, Adobe Photoshop - [www.adobe.com](http://www.adobe.com).
- You may want to create Adobe personal account on [www.mixamo.com](http://www.mixamo.com).

## Seminar

Each group of four will also review an assigned VR/AR/MR paper that will be presented during class session.

## Exam

December 14, 11:30am -1:30pm

## Attendance

Attendance is expected for *each and every class* meeting.

## Academic Violations

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The college is committed to enforcing the

CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures. Special attention is given to CONTRACT CHEATING (this is where students have work completed on their behalf which is then submitted for academic credit).

## **Discussion and Q&A**

We will be using Blackboard for class discussion. The system is highly catered to getting you help fast and efficiently from classmates and myself. Rather than emailing questions to me, I encourage you to post your questions on Blackboard forum.

## **Email**

Emails to the instructor must be via a CUNY email addresses for FERPA reasons. Please post all class-related discussion on Blackboard. Also, please ensure that your *correct* email address is entered into the CUNY Blackboard.

## **Bulletin Board**

You should check the [Blackboard](#) site regularly, since all class material will be posted there. Please make sure you have configured Bb to use your *CUNY email address*. You are responsible for any email the instructors might send there.

## **Computer Science Facilities & Labs**

All computer science students can use any of the general-purpose labs throughout Hunter College. In addition, computer science majors and students enrolled in CSCI courses can obtain an account on the Computer Science Department Network. More information can be found on the [Computer Science Department's website](#).

## **Counseling & Wellness Services**

Counseling & Wellness Services (CWS) provides mental health, health and wellness services aimed at enhancing students' quality of life and maximizing personal and academic growth and development. More information can be found on the [Counseling & Wellness Services website](#).

## **Special Needs**

Students with special needs should see me for accommodation.

## **ADA Compliance**

In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and / or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical and / or Learning) consult the Office of Accessibility located in Room E1124 to secure necessary academic accommodations. For further information and assistance please call (212-772-4857)/TTY (212-650-3230).

## **Family Educational Rights and Privacy Act (FERPA)**

The Family Educational Rights and Privacy Act (FERPA) (20 U.S.C. § 1232g; 34 CFR Part 99) is a Federal law that protects the privacy of student education records. The law applies to all schools that receive funds under an applicable program of the U.S. Department of Education.

FERPA gives parents certain rights with respect to their children's education records. These rights transfer to the student when he or she reaches the age of 18 or attends a school beyond the high school level. Students to whom the rights have transferred are "eligible students."

- Parents or eligible students have the right to inspect and review the student's education records maintained by the school. Schools are not required to provide copies of records unless, for reasons such as great distance, it is impossible for parents or eligible students to review the records. Schools may charge a fee for copies.
- Parents or eligible students have the right to request that a school correct records which they believe to be inaccurate or misleading. If the school decides not to amend the record, the parent or eligible student then has the right to a formal hearing. After the hearing, if the school still decides not to amend the record, the parent or eligible student has the right to place a statement with the record setting forth his or her view about the contested information.
- Generally, schools must have written permission from the parent or eligible student in order to release any information from a student's education record. However, FERPA allows schools to disclose those records, without consent, to the following parties or under the following conditions (34 CFR § 99.31):
  - School officials with legitimate educational interest;
  - Other schools to which a student is transferring;
  - Specified officials for audit or evaluation purposes;
  - Appropriate parties in connection with financial aid to a student;
  - Organizations conducting certain studies for or on behalf of the school;
  - Accrediting organizations;
  - To comply with a judicial order or lawfully issued subpoena;
  - Appropriate officials in cases of health and safety emergencies; and
  - State and local authorities, within a juvenile justice system, pursuant to specific State law.

Schools may disclose, without consent, "directory" information such as a student's name, address, telephone number, date and place of birth, honors and awards, and dates of attendance. However, schools must tell parents and eligible students about directory information and allow

parents and eligible students a reasonable amount of time to request that the school not disclose directory information about them. Schools must notify parents and eligible students annually of their rights under FERPA. The actual means of notification (special letter, inclusion in a PTA bulletin, student handbook, or newspaper article) is left to the discretion of each school.

For additional information, you may call 1-800-USA-LEARN (1-800-872-5327) (voice). Individuals who use TDD may use the Federal Relay Service.

Or you may contact us at the following address:

Family Policy Compliance Office U.S. Department of Education 400 Maryland Avenue, SW  
Washington, D.C. 20202-8520

## **Sexual Misconduct**

In compliance with the CUNY Policy on Sexual Misconduct, Hunter College reaffirms the prohibition of any sexual misconduct, which includes sexual violence, sexual harassment, and gender-based harassment retaliation against students, employees, or visitors, as well as certain intimate relationships. Students who have experienced any form of sexual violence on or off campus (including CUNY-sponsored trips and events) are entitled to the rights outlined in the Bill of Rights for Hunter College.

a. Sexual Violence: Students are strongly encouraged to immediately report the incident by calling 911, contacting NYPD Special Victims Division Hotline (646-610-7272) or their local police precinct, or contacting the College's Public Safety Office (212-772-4444).

b. All Other Forms of Sexual Misconduct: Students are also encouraged to contact the College's Title IX Campus Coordinator, Dean John Rose ([jtrose@hunter.cuny.edu](mailto:jtrose@hunter.cuny.edu) or 212-650-3262) or Colleen Barry ([colleen.barry@hunter.cuny.edu](mailto:colleen.barry@hunter.cuny.edu) or 212-772-4534) and seek complimentary services through the Counseling and Wellness Services Office, Hunter East 1123. CUNY Policy on Sexual Misconduct Link: <http://www.cuny.edu/about/administration/offices/la/Policy-on-Sexual-Misconduct-12-1-14-with-links.pdf>

## **Syllabus Change Policy**

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice. Students will find out about changes to the syllabus via class attendance.

## **Instructor Biography**

Prof. Wole Oyekoya is an Associate Professor in the Computer Science Department at Hunter College. He received his Ph.D. from University College London in 2007 for work on eye tracking for image search and retrieval. Prior to joining CUNY, he worked at Clemson University as the Director of Visualization from July 2015 to August 2019, where he was also an

Adjunct Assistant Professor with School of Computing. Prior to that, he worked for Advanced Research Computing (Visualization group), Virginia Tech as a Visualization and Virtual Reality Specialist from November 2013 to June 2015. He worked as a Research Associate at Middlesex University on medical image retrieval, followed by the Virtual Environments and Computer Graphics group at University College London. His research expertise includes visualization, virtual reality, eye tracking and visual perception.