

# CSE 191: Virtual Reality Technology

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LECTURE #1: INTRODUCTION

# Course Overview

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# Instructor

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Jürgen Schulze, Ph.D.

Adjunct Professor in CSE Department

XR Engineer at Qualcomm

Email: jschulze at ucsd.edu

Office hours:

- Mondays 7-8pm (except March 31 instead of April 4)
- On Zoom at <https://ucsd.zoom.us/j/93052169849>

# Course Goals

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Gain in-depth knowledge of virtual reality technologies.

Gain experience with the software pipeline for rendering in VR systems, with a focus on HMDs.

Get up-to-date overview of current VR and AR technology and research.

# Prerequisites

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No formal prerequisites but CSE 167 (Introduction to Computer Graphics) or equivalent recommended, especially:

- Linear algebra
- Coordinate system transformations

# Useful Experience

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Computer graphics programming

Software development with Unity

Programming in C#

# VR Headsets

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Oculus Quest 2 headsets can be borrowed from the VR lab for the duration of the quarter.



# Online Course Resources

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Course web site:

- <http://ivl.calit2.net/wiki/index.php/CSE191S2022>

Canvas:

- Grade management
- Submission of homework projects
- Scheduling of presentations
- Piazza discussion board



# Important Dates

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## Lectures:

- Tue 11:00-12:20pm in VR lab (room B210 in EBU-3B)
  - Exception: Tuesday, April 5: remotely on Zoom at <https://ucsd.zoom.us/j/99421404224>

## Office Hour:

- Mondays at 7pm on Zoom, starting April 11<sup>th</sup>
  - First office hour Thursday, March 31

VR app presentation scheduling due Sunday, April 17<sup>th</sup>

# Homework Assignment Submission

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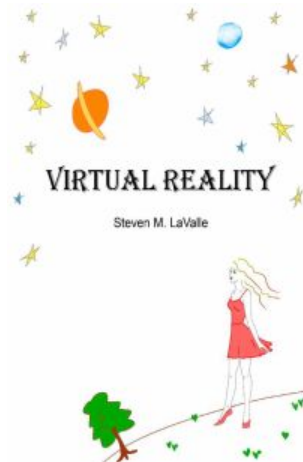
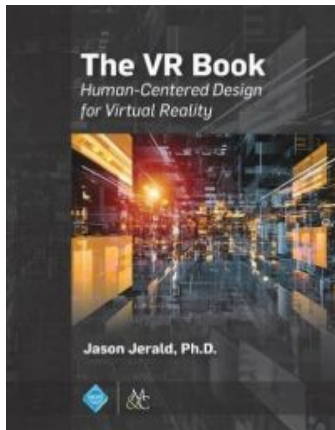
Submit video of VR recording on Canvas

# Books

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No required books.

Recommended books:



[The VR Book](#) by Jason Jerald, 550 pages, Morgan & Claypool Publishers, October 16, 2015, ISBN-10: 1970001127, ISBN-13: 978-1970001129

[Virtual Reality](#) by Steven M. LaValle. To be published by Cambridge University Press. Available as PDF free of charge.

# Class Structure

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- One lecture per week, each on specific topic
  - Reading assignments start in week 3
- Weekly office hour
- Programming assignment
- VR content presentation
- Technology presentation

# Grading

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Programming Project	30%
VR App Presentation	20%
Weekly reading	30%
Technology presentation	20%

# Cloud Storage

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Unless otherwise explicitly authorized, each student is completely responsible to keep their code, homework, design files and other coursework off publicly accessible internet sites.

Example: it is **not allowed** to put code in a **public** Github repository.

However, you are **encouraged** to put your code in a **private** Github repository.

These rules expire after finals week.

# Programming Environment

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All homework projects will be using Unity.

Download free student license from:

<https://store.unity.com/academic/unity-student>

# Programming Project

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To be implemented in Unity on Oculus Quest 2 or other VR headset available to the students.

Goal is to create a VR app by the end of the quarter. Specification will be given on course web site. Flexibility will allow for customization.



# VR App Presentation

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- Each student needs to present a **VR or AR app** in class
- It can be a game, entertainment or productivity app
- The app must be able to run on your VR device
- The app must be publicly accessible on the internet (e.g., Oculus Store, Steam, Viveport, Google Play, Apple Itunes, etc.)
- Enter your name, app title and app URL on scheduling page on Canvas for scheduling
- Presentation should be 10-15 minutes, followed by Q&A

# Technology Presentation

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Instructor selects topics for students to research

Students choose one topic to present during lecture

Examples:

- Research paper on light fields
- New product presentation of AR glasses
- New algorithm to reduce rendering delay

# Weekly Reading

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Every week everyone reads an article that can be found on the web.  
Each student needs to be ready to answer questions about this article.  
Requires presence in lectures.

The reading assignments start in week 3.

# Course Topics

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We can't do all of the below in depth. Priorities?

- Overview of the state-of-the-art VR technologies and research trends
- Human visual system: 3D depth cues, color perception
- How to generate stereographic 3D images for human consumption
- VR software development with Unity
- Fundamental physics of 3D displays
- 3D display types: LCD, OLED, volumetric, light field
- Immersive VR systems: Head Mounted Displays, CAVE, smart phone VR, etc.
- 3D tracking systems and controllers
- Rendering to Head Mounted Displays
- Counteracting motion sickness
- Augmented reality devices
- Capturing and displaying panoramic 3D images and video


# The HXI Lab Needs You

Project is run by Prof. Weibel  
Looking for Unity programmers

## Contact:

Weichen Liu: wel008@ucsd.edu


Menghe Zhang: mez071@ucsd.edu



**HXI LAB**  
<http://hxi.ucsd.edu>

Interested in eXtended reality and have a background computer graphics engineering?

In the HXI Lab, you will help develop and deploy **mixed reality application prototypes** that address specific healthcare challenges.



**WHAT'S REQUIRED**

**and**

- Major/Minor in CS **OR**
- Related field w/ project experience in Computer graphics
- Programming skills in C#
- Knowledge in C++ & Python

- Development experience in:
  - Unity3D & VR/AR
  - Background in Game & Software development
  - Basic Graphic shading

**Taking CSE 167 is a PLUS!**

**WHAT TO LOOK FORWARD TO:**

- Develop **innovative applications** on Unity3D and potential Graphics Shading Language.
- **Work closely w/ UX/UI Researchers** and frontline users for feature integration.

to apply, fill out the **Google Form** and its respective criteria!

Email questions to:  
Vish Ramesh @ [vramesh@eng.ucsd.edu](mailto:vramesh@eng.ucsd.edu) OR  
Danilo Gasques @ [dgasques@eng.ucsd.edu](mailto:dgasques@eng.ucsd.edu)