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EI17: BUILD YOUR OWN VR DISPLAY: AN INTRODUCTION TO VR DISPLAY SYSTEMS FOR HOBBYISTS AND EDUCATORS

Instructors: Hayato Ikoma, Robert Konrad, and Nitish Padmanaban, Stanford University, and Keenan Molner, Playground Global (US)**Wednesday January 31, 8:30 AM – 12:45 PM | Course Level:** Introductory | **Fee:** Member: \$275/ Non-member: \$300 / Student: \$95

(*prices for all increase by \$50 after January 8, 2018)

Wearable computing is widely anticipated to be the next computing platform for consumer electronics and beyond. In many wearable computing applications, most notably virtual and augmented reality (VR/AR), the primary interface between a wearable computer and a user is a near-eye display. A near-eye display in turn is only a small part of a much more complex system that delivers these emerging VR/AR experiences. Other key components of VR/AR systems include low-latency tracking of the user's head position and orientation, magnifying optics, sound synthesis, and also content creation. It can be challenging to understand all of these technologies in detail as only limited and fragmented educational material on the technical aspects of VR/AR exist today.

This course serves as a comprehensive introduction to VR/AR technology. Attendees learn how to build a head-mounted display (HMD) from scratch using low-cost, off-the-shelf components. Throughout the course, different components of the VR system are taught and implemented, including the graphics pipeline, stereo rendering, lens distortion with fragment shaders, head orientation tracking with inertial measurement units, positional tracking, spatial sound, and cinematic VR content creation. For maximum accessibility, all software is implemented in WebGL and using the Arduino platform and a provided source code.

Benefits:

- Understand and be able to implement the various systems comprising today's VR display systems with low-cost DIY components, hardware, and software.
- Understand the basic computer graphics pipeline.
- Learn basic OpenGL, WebGL, and GLSL and how to implement via Javascript with Three.js to run in a browser.
- Understand stereoscopic perception and rendering.
- Evaluate head mounted display optics and how to correct for lens distortion.
- Explore orientation tracking and how to perform sensor fusion on IMU data.
- Use positional tracking via a DIY system that reverse engineers the Vive Lighthouse.
- Learn omnidirectional stereo (ODS) VR video format and current methods of capturing VR content.
- Explore spatial Audio representations for 3D sound reproduction.

Intended Audience: For this introductory-level course, some familiarity with programming, basic computer graphics, OpenGL, and the Arduino platform would be helpful. However, all required software and hardware concepts will be introduced in the course.

Instructors: **Hayato Ikoma** is a PhD student at Stanford University, working with Prof. Gordon Wetzstein. **Robert Konrad** is a 3rd year PhD candidate at Stanford University, advised by Wetzstein. **Keenan Molner**, is a recent graduate of Stanford; he currently works at Playground Global on optoelectric sensing systems. **Nitish Padmanaban** is a second year PhD student at Stanford in the computational imaging lab on optical and computational techniques for VR/AR.

SYMPOSIUM PLENARY TALKS

Monday: Overview of Modern Machine Learning and Deep Neural Networks – Impact on Imaging and the Field of Computer Vision, **Greg Corrado, co-founder of Google Brain and Principal Scientist at Google**

Tuesday: Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, **Avideh Zakhor, Qualcomm Chair & Professor at UC Berkeley**

Wednesday: Ubiquitous, Consumer AR Systems to Supplant Smartphones, **Ronald T. Azuma, Intel Labs Researcher and Augmented Reality Pioneer**

SYMPOSIUM HIGHLIGHTS

- 18 conferences featuring 30 keynote talks by world renowned experts
- 3D Theatre
- Tours of Stanford University Labs
- Industry Exhibition
- Meet the Future: Showcase of Student and Young Professional Research
- Demonstration Session
- Poster Session
- Welcome Reception
- Women in Electronic Imaging Breakfast
- Human Vision in Electronic Imaging 30th Year Banquet

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