Project B
Virtual Room : Optical Markerless Gesture Interface

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Background

Vroom (Virtual Room) is a next-generation remote collaboration environment in development at UCSD's Calit2 research institute. Vroom enables freely scalable digital collaboratories, connecting distributed, high-resolution visualization resources for collaborative work in the sciences, engineering and the arts. Vroom can transform a space into a completely immersive mixed media environment with interactive display surfaces and spatialized audio.

The system utilizes narrow bezel display walls, directional audio and advanced interaction devices to share ultra high resolution data. Vroom builds on previous research from the NSF funded OptiPuter project by integrating modular OptiPortables (portable tiled display systems) with open-source middleware for local and remote collaboration.

Vroom enables group collaboration for local and remote participants to share knowledge and experiences. Possible applications include:

- Remote learning
- Brainstorming / Storyboarding
- Post-production review and collaboration
- High resolution video playback
- Tele-immersive 3D interaction
- Easy-to-use screencasting
- Image, video, text media sharing

Vroom features include:

- Support for multiple user interfaces (3D mouse, smartphone, laptop, optical tracking, touch UI, etc.)
- Support for directional and spatialized audio
- Giga-Pixel image interactivity
- 4K video streaming
- 3D visualization
- Tele-matic production

The installation of Vroom in the Calit2 Theater can have approximately 100 displays, both 2D and 3D in a reconfigurable arrangement. Open-source software developed at UCSD and the Electronic Visualization Lab at UIC will enable the graphics (SAGE, CGLX and CalVR) and audio (SAM, Audio Renderer, SoundBender and VMAP) middleware to share data across the local Vroom system as well as with remote nodes. Vroom uses 10Gbps networking to all the display nodes with 60Gbps uplinks to remote servers. Using both research systems and commercial platforms, we have integrated HD and 4K video tele-conferencing with remote nodes. We employ spatialized and directional audio with distributed Meyer speakers along with multiple wave field synthesis speaker arrays to dynamically provide advanced listening configurations.

Project

I am the lead UI researcher for markerless and marker-based head and hand tracking for Vroom. I would like to work with ECE 191 students to design and develop an optical markerless gesture interface to control the tiled display wall. Using an Asus Xtion Pro Live, we are looking to manipulate large data collections of media assets with simple and intuitive hand movements. Students will explore how gestural interfaces have been articulated in science-fiction genres such as the Minority Report as well as how common touch user interface strategies such as flick, pinch, rotate can translate to full body gestures. Students should define the hardware, software and networking challenges as well as consider human factors at the onset of the design and development period. For example, what is an acceptable learning curve for a basic gesture library? Once the project plan has been appropriately specified, students will work collaboratively to develop, deploy and iteratively test their solutions. At least two of the students in this group should be familiar with C++. Previous experience with cameras (such as a Kinnect) is desirable, but not required. Previous experience with network socket communication is also desirable, but not required.