CalVR: An Advanced Open Source Virtual Reality Software Framework

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Overview

- CalVR is a virtual reality software framework/middleware
- CalVR has been developed at Calit2 since May 2010

- What is new and different?
Related Work

- Commercial VR middleware:
  - For example: WorldViz, EON Studio, COVISE, AVANGO
  - Closed source, limited programmability (only what API exposes)

- VR display and tracking abstraction software
  - Examples: CAVElib, VR Juggler
  - Limited to abstracting from display configurations, tracking systems, distributed graphics cluster
Related Work

- OpenSceneGraph
  - CalVR builds on it but adds many features (cluster support, tracking, user interface, modular programming interface, etc.)
Standard Features

- Operating system support:
  - Primarily CentOS Linux
  - Unofficially compiles for Mac OS
  - Compiles under Windows, but no cluster support
- Implemented in object-oriented C++
- Uses Cmake build system
- Graphics cluster support
- Built on top of OpenSceneGraph
Standard Features

- All OSG stereo modes supported, plus custom ones
- Modular plug-in system for independent application development
- Configured via XML file
- Includes customizable menu system
- Support for VRPN and trackd tracking libraries
- Default navigation modes: fly, drive, scale
Standard Features

- Collaboration mode supports multiple sites and viewpoint sharing
- OpenAL-based audio server allows sound effects
Software Components
Unique Features of CalVR

- Multi-user and device support
  - Configuration file allows multiple hand and head devices

- Additional rendering modes to what OSG provides:
  - 8-view autostereo
  - anti-aliasing for interlaced passive stereo
  - omnistereo
Layered Menu System

- Layered menu system
  - Separates menu hierarchy and functionality from GUI widget implementation
Scene Objects

- SceneObject class manages navigation, interactions and context menu for a 3D object
Tiled Display Wall Support

- TiledWallSceneObject
- Pointer class interactor
Terrain Rendering

- Built-in support for geo-science applications by integration of osgEarth
- Solves z-buffer problem with vastly different scales of earth vs. menus
Unique Features of CalVR

- Asynchronous tracking
  - Separate tracking thread
  - Runs at constant 60Hz
  - Allows recognition of double clicks and gestures

- Custom cull visitor
  - Helps load large data sets into cluster system
Conclusions

- Calit2 uses CalVR on all its clustered graphics systems (StarCAVE, NexCAVE, TourCAVE, Vroom)
- Software is fairly stable
- Available for download on GitHub at:
  - [https://github.com/CalVR](https://github.com/CalVR)
  - License: free for non-commercial use