CSE 190: Virtual Reality Technologies

LECTURE #10: VR DISPLAYS

VR Content Presentation

Ryan Tjio: Angel Falls, Venezuela

- https://www.youtube.com/watch?v=8rUwdtERUOM&index=94&list=PLU8wpH_LfhmsSVRA8bSknO4-2wXvYXS4C

Announcements

Homework project 2

- Due tomorrow May 5 at 2pm
  - To be demonstrated in VR lab B210
    - Even hour teams start at 2pm
    - Odd hour teams start at 3pm
  - Upload code to Ted by 2pm

3D Displays

Introduction To Displays

Display: device which presents perceptual information

Often term “display” is used for “visual display”

Goal: display devices which accurately represent visual perception in a simulated world

Visual Display Characteristics

Field of View (FOV) and Field of Regard (FOR)

- FOR – amount of physical space surrounding viewer in which visual images appear
- FOV – maximum visual angle seen instantaneously

Spatial Resolution

- number of pixels and screen size

Screen Geometry

- rectangular, hemispherical, etc…

Light Transfer Mechanism

- front projection, rear projection, laser light, etc…

Refresh Rate

- not the same as frame rate

Ergonomics

Display Types

Stereo Monitor

Active or passive stereo

“Fishtank VR”

Stereo Monitor – Advantages

Inexpensive

Crisp image at HD or more

Keyboard and mouse work as usual

Can be used with most 3D input devices

Stereo Monitor – Disadvantages

Not very immersive

User seated, cannot move around

Does not take advantage of peripheral vision

Stereo can be problematic

- Active: user's 3D glasses need to face emitter
- Passive: blank pixel lines can be perceptible

Occlusion from physical objects can be problematic

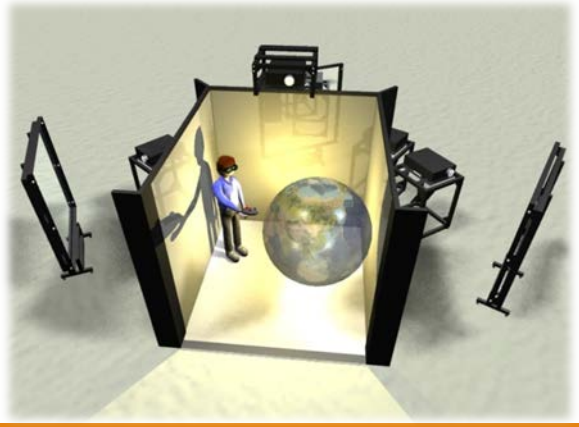
Surround Screen VE

Has 3 to 6 large screens

Puts user in a room for visual immersion

Usually driven by a single or group of powerful graphics engines

Requires elaborate head/wand tracking



StarCAVE

18 graphics workstations

Dual graphics cards per node

CentOS Linux

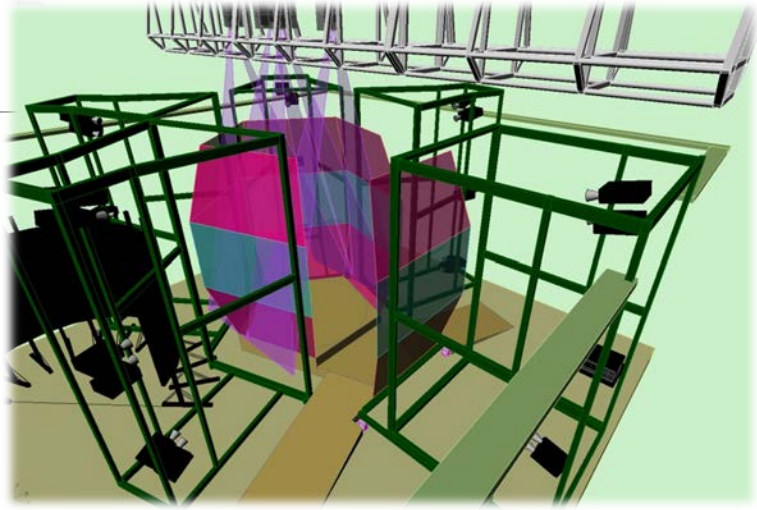
34 HD projectors:
~34 megapixels per eye

360 degrees immersion

Passive stereo, circular polarization

15 screens on 5 walls, ~8 x 4 foot each, plus floor projection

4-camera optical tracking system



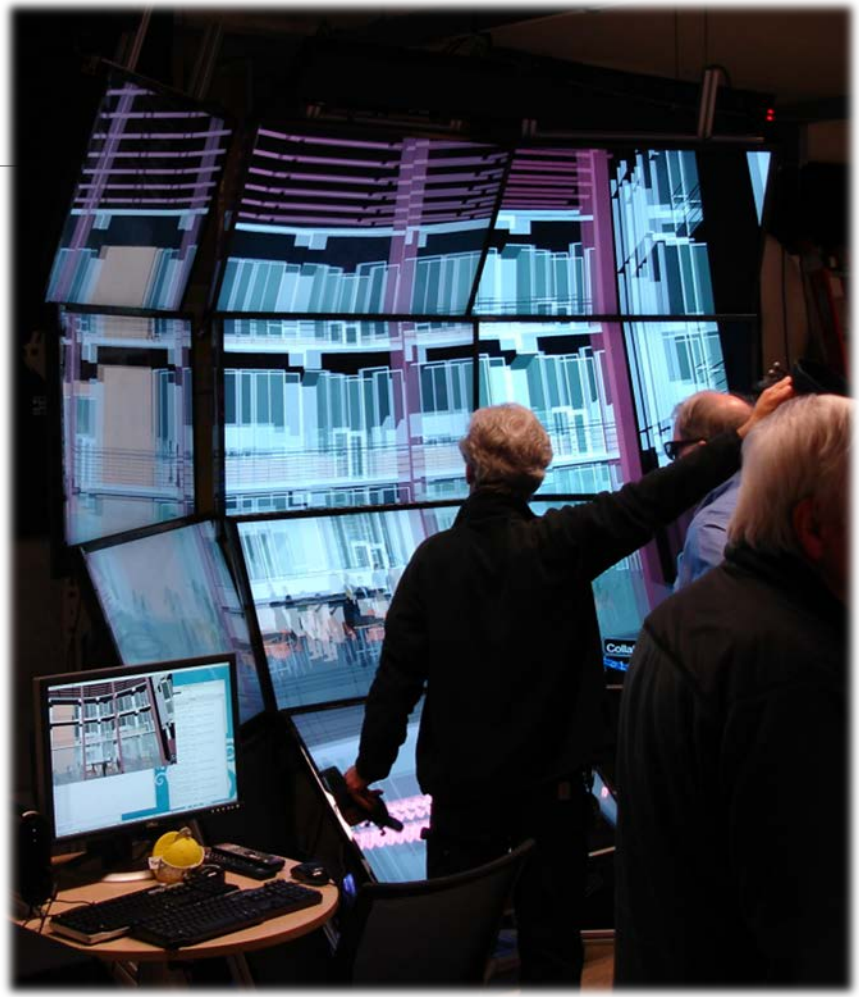
NexCAVE

First LCD-based CAVE

14 42” HD passive stereo displays

8 rendering PCs

2-camera optical tracking system



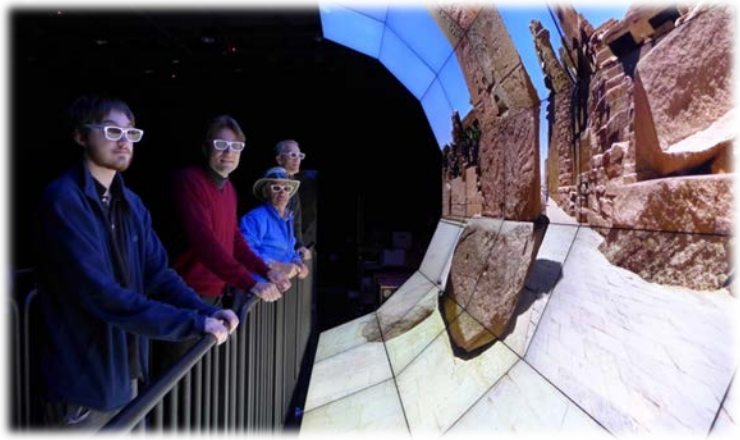
WAVE

35 55” HD monitors with narrow bezels

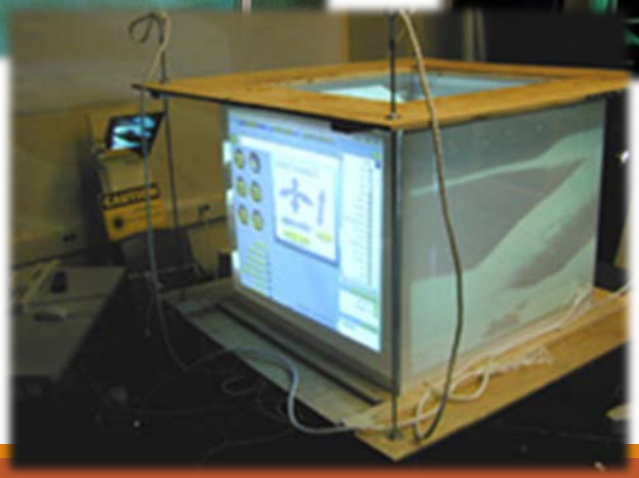
18 rendering PCs

Passive stereo

9600x7560 pixels combined



Other CAVEs



Surround Screen Virtual Environments – Advantages

Provide high resolution and large FOV

Passive stereo: user only needs a pair of light weight glasses for stereo viewing

User has room to move around

Real and virtual objects can be mixed

A group of people can use the space simultaneously

Disadvantages

Expensive (typically >$100k)

Require a large amount of physical space

Projector calibration must be maintained

Normally only one user head tracked

Stereo viewing can be problematic (ghosting, focal plane far away)

Physical objects can get in the way of 3D image

CAVE Interface Design

Do not need to represent physical objects (i.e. hands) as graphical objects

Can take advantage of the user's peripheral vision

Do not want the user to get too close to the screens

Developer can take advantage of the space for using physical props (i.e. car seat, treadmill)

VR Workbenches etc.

Similar to CAVEs but only one or two displays

Can be a desk or a large single display (e.g., PowerWall)

Traditionally a table top metaphor

VR Workbenches etc.

VR Workbenches etc.

zSpace

3D display with built-in head and stylus tracking

Full screen passive circular polarization

Full HD for each eye

Polarization switching full screen LC layer

Workbenches – Advantages

High resolution

For certain applications, makes for an intuitive display

Can be shared by several users

Workbenches – Disadvantages

Limited movement

Typically only one user head-tracked

No surrounding screens

Physical objects can get in the way of graphical objects

Stereo can be problematic

Workbenches – Interface Design

Ergonomics are important especially when designing interfaces for table displays

User can take advantage of direct pen-based input if display surface permits

No need to create graphical representations of physical objects