

Visual Displays

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Overview

- Head mounted displays
- Stereoscopic monitors
- Environmental displays
- Retinal displays

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Head Mounted Displays

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Head Mounted Displays

- See-through head mounted displays (HMD)
 - Users see 3-D computer-generated objects superimposed on their real-world view
 - Augmented reality
- Two categories
 - Optical
 - Video
- Tracking required
- Reference: Rolland & Fuchs 2000

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UNC Ultrasound/Medical Augmented Reality Research

- Goal: ultrasound based augmented reality for minimally invasive procedures
- Components
 - HMD: modified custom
 - Tracking device: hybrid electro-optic
 - Computer: SGI Reality Monster



<http://www.cs.unc.edu/~us/>

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Optical HMDs

- Real world seen through half-transparent mirrors
- Mirrors also reflect computer generated images
- Example
 - Kaiser Electro-Optics Sim Eye XL100A
 - XGA video
 - Cost: \$90,000



<http://www.keo.com/SIMEYE100A.htm>

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Video HMDs

- Real world view obtained through video cameras
- Superimposed with computer generated images
- Example
 - University of North Carolina prototype system



Rolland & Fuchs, *Presence* 2000

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Tracking of HMDs

- Tracking system: position and orientation (pose) of user's head
- Computer updates displayed image to reflect current head pose
- Augmented reality requires highly accurate trackers for good registration of real and virtual objects
- Source: <http://www.es.unc.edu/~tracker/#Anchor-Overview-26424>

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Tracking Systems

- Inertial
- Acoustic
- Magnetic
- Optical
- Mechanical
- Radio (GPS)
- Source: SIGGRAPH 2001 Course H: Tracking (<http://www.es.unc.edu/~tracker/refs2001/tracker/index.html>)

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Wide Area Tracking: HiBall

- Can cover room size areas
- Sensor shown at right
 - Mount on a head mounted display or hand held device
- Infrared LEDs (beacons) mounted in ceiling



<http://www.3dtech.com/HiBall.htm>

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Optical Tracking: Polaris

- Standard for image-guided surgery systems
- Optical camera shown at right
- Can track active or passive tools
- Accuracy 0.35 mm



<http://www.ndigital.com/polaris.html>

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Magnetic Tracking: Aurora

- Sensors as small as 0.9 mm in diameter
- No line of sight requirement
- Field generator shown at right
- Available late 2001
- Accuracy 1-2 mm



<http://www.ndigital.com/aurora.html>

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Prototype Surgical Training Tool

- Goal: portable medical training tool for space missions
- Components
 - HMD: Sony Glasstron (CrystalEyes shown here)
 - Tracking device (Ascension pcBird)
 - Computer: PC based
 - Voice input (Dragon Systems)
 - Speech synthesis (Microsoft speech)



Courtesy of Kevin Montgomery, PhD, Stanford-NASA National Biocomputation Center

http://biocomp.stanford.edu/presentation/MMVR01-iop_files/frame.htm
http://biocomp.stanford.edu/papers/mimvr/MMVR01-iop_paper.htm

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Stereoscopic Monitors

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Stereoscopic Displays

- Requirements
 - Software
 - » Compute alternate fields of left and right projection
 - Hardware
 - » Graphics card
 - » Monitor
 - » Eyewear
- Example: CrystalEyes
 - Cost: \$1000



<http://www.stereographics.com/html/products.html>

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DTI 3D Flat Panel Display

- Real 3D display without glasses (autostereoscopic imaging)
- Up to 1024 x 768 resolution
- Cost: \$1699 for 15 inch model
- Supports most graphics card using nVidia chipset



<http://www.dti3d.com/2015.asp>

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Virtual Workbench

- Reach-in 3D environment
 - Display system (frame with mirror & computer monitor)
- Hardware required
 - Silicon Graphics computer
 - 21 inch monitor
 - Polhemus 6 DOF tracker
 - CrystalEyes stereo glasses
- Singapore: Kent Ridge Digital Labs



<http://www.krdl.org.sg/RND/biomed/virtual/>

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Reachin Display

- Components
 - PHANTOM force feedback
 - Stereo monitor
 - Semi-transparent mirror
- Swiss company: Reachin Technologies



<http://www.reachin.se/products/reachin2display/>

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i.e.Med Reality Sculptor

- Components
 - Input device (such as PHANTOM or tracking system)
 - Windows PC with OpenGL graphics card
 - Mirror and stand
 - TDI software development kit



<http://www.icmed.com/products/products/reality/index.htm>

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Environmental Displays

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CAVE: Automatic Virtual Environment

- Room-sized
 - Stereoscopic projection
 - 3D computer graphics
- 3 by 3 by 3 meters
- Developed at Univ. of Illinois at Chicago
- Sold by Fakespace Systems



Medical Readiness Trainer at University of Michigan

<http://www-vrl.umich.edu/mrt/>

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Elumens VisionStation 800

- Immersive 3D space
- Low cost: \$10,000
- Elumens Corporation: hemispherical 3D visualization systems
- Other products: VisionDome
- Potential applications
 - Triage simulation



<http://www.elumens.com/>

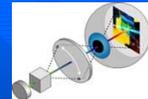
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Retinal Display

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Retinal Scanning Display

- Scans the image directly onto the retina



<http://www.mvis.com/retscandisplay.htm>



<http://www.mvis.com/facts.htm>

- Nomad visualization system available 2001
- VGA / SVGA resolution
- Company: Microvision

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Resources

- Head mounted displays
 - <http://www.vrnnews.com/issnarchive/vrn1001/vrn1001tech.html>
 - <http://www.cs.unc.edu/~sus/vch/headmounts.htm>
- Tracking
 - <http://www.cs.unc.edu/~tracker/ref/biblist/index.html>
- Stereoscopic displays
 - <http://www.stereographics.com/html/hp-paper.htm>

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