

WP 4 Project Deliverable D4.3

Report on hardware HMD specification



Project Number	IST-2000-29266
Project Title	Virtual Real Time Fire Emergency Simulator
Deliverable Type	Report
Deliverable Class	Restricted

Deliverable Number	D4.3
Title of Deliverable	Specification of hardware requirements for HMD system [WP 4.1]
Nature of the Deliverable	Report
Contributing WPs	WP 2, WP 3
Contractual Date of Delivery	30. March 2002
Actual Date of Delivery	30. Sept 2002
URL	www.virtualfires.org
Authors	Gunther Lenz (SiTu), Thomas Reichl (SiTu)
Contact Details	Institute for Structural Analysis / SiTu Research Univ. Prof. Dipl.-Ing. Dr. techn. Gernot Beer Lessingstrasse 25/II 8010 Graz / Austria Tel.: +43 316 8736180 Fax: +43 316 8736185 Email: gernot.beer@ifb.tu-graz.ac.at

Abstract	The objective of WP4 Task 1 is to specify the hardware requirements for the HMD installation. This also includes the selection of a tracking system for the user's head movement.
Keywords	Specification, HMD, Tracking system

Contents

1	Overview	3
2	Requirements	4
2.1	Functional Requirements.....	4
2.1.1	HMD	4
2.1.2	Tracker	4
2.2	Nonfunctional Requirements.....	4
3	Available HMD devices	5
4	Selection of HMD device.....	6
4.1	Testing of the HMD	6
4.2	Description of the selected HMD	7
4.2.1	User adjustment	8
4.2.2	Connections	8
4.2.3	Supported video modes:	9
5	Literature/Links.....	9

1 Overview

This document describes the criteria used for selecting the HMD for the VIRTUALFIRES project. It also gives a short overview of available HMDs on the market and the results of the testing of the finally selected HMD model.

2 Requirements

2.1 *Functional Requirements*

2.1.1 HMD

The HMD must support 3D viewing. That means it must be able to display different images to the left and right eye.

The HMD must support the videosignal generated by the OpenGL Stereomode. This is by default a framesequential signal on most current graphics adapters.

The HMD should support linesequential 3D. (aka interlaced 3D)

The HMD should be able to work with 2 different input signals for the left and right eye.

The HMD must be equipped with a tracking sensor with at least 3DOF. Alternatively it must be easy to mount such a tracker.

2.1.2 Tracker

The tracker must provide at least 3 DOF.

The tracker must be supported under Windows2000 and Linux.

The tracker should be already mounted on the HMD. Alternatively it should be easy to fix it on the selected HMD model.

The trackers position values should show high accuracy and low jitter.

The tracker should not be influenced by neighboring objects.

2.2 *Nonfunctional Requirements*

The HMD should be rugged.

The HMD should be lightweight.

The HMD should be easy to adjust for different persons using it.

3 Available HMD devices

At the time of selecting the HMD a market survey found the following models available.

Manufacturer	Model	Resolution	FOV	Binocular overlap	Transmission	Eye Relief mm	Weight kg	Video inputs	Price
Kaiser Electro Optics	Sim Eye XL 100A [1]	1024 x 768	112° diag	30°	see through > 20%	30	2.7	2 1024 x 768, non interlaced, 60 Hz, sync on: sep. h/v sync	\$ 87,500
	ProView XL35 [2]	1024 x 768	35° diag	100%	no	25	1.0	1 or 2 1024 x 768, non interlaced, 60 Hz, sync on: video, composite sync or sep. h/v sync (autodetect)	\$ 19,500
	ProView XL50 [3]	1024 x 768	50° diag	100%	no	25	1.0	1 or 2 1024 x 768, non interlaced, 60 Hz, sync on: video, composite sync or sep. h/v sync (autodetect)	\$ 19,500
Cybermind	HiRes-900St [4]	800 x 600	31.2° diag	adjustable	no	25	0.65 0.7 w. tracker	1 or 2 800 x 600, non interlaced, 60 Hz, sync on: video, composite sync or sep. h/v sync	€ 3,995 € 4,950 w. InterTrax ²
iReality.com, Inc.	CyberEye CE-500S [5]	800 x 600	30° diag		no	35	0.4	1 800 x 600, non interlaced, 60 Hz, sync on: video, composite sync	\$ 2,750
i-O Display Systems, LLC	i-glasses SVGA 3D A501206 [6]	800 x 600	26° diag	100%	no	25	0.2	1 800 x 600, sync on compiste sync	\$ 1,600
DAEYANG E&C	I-Visor DH-4400VP-3D [7]	800 x 600	31.2° diag		no	25	0.3	1 or 2 800 x 600, non interlaced, 60 Hz, sync on: video, composite sync or sep. h/v sync	\$ 2,000

4 Selection of HMD device

Kaiser and Cybermind were the only companies that could supply their models off the shelf. Due to the high price, which exceeds the budget within the project by far, the Kaiser HMDs were not considered in the selection process.

4.1 *Testing of the HMD*

To prove the specification of the manufacturer we tried to get a model of the Cybermind HiRes-900St, the CyberEye CE-500S and the I-glasses SVGA 3D. Unfortunately only Cybermind was able to supply his model for a testing, the other manufacturer rejected delivering their models without buying it.

The testing of the HMD was performed on a Dell Precision M40 Notebook equipped with a nVidia Quadro2go. The Quadro2go supports OpenGL stereo mode in the field-sequential format. The software used for testing was a simple OpenGL program switching between normal and stereo mode and was performed under Windows 2000 at a resolution of 800x600 at 60Hz.

The model HiRes900St supports this mode without problems. The only drawback is that the flicker filter for the 3D mode has to be adjusted again every time the HMD is disconnected from the mains.

The tracker software was tested under Windows 2000 with the supplied isdemo utility and under RedHat Linux 7.3 with the testprogram from the SDK 3.44. The tracker showed a good repeatability of the position estimation and virtually no drift over a period of 30 min. The tracker is very sensitive and capable of reliably tracking very small movements of the head. Only shocks of the HMD due to nudging against an obstacle yield to a constant deviation from the inertial position. This can only be corrected by powering off the tracker or by resampling the values of the rest-position.

During the testing the HiRes900St performed well and showed good reliability. Also the Intertrax² tracker fulfilled the requirements.

4.2 Description of the selected HMD

The HiRes900St is based on the Daeyang DH-4400VP-3D and wraps this model in a rugged plastic body, which can be seen in Figure 1 and was originally designed for arcade use. The body also houses the Intertrax² 3 DOF tracker [8].



Figure 1: HMD, control unit, RS-232 connector and powercord for InterTrax²-tracker and audio input plug (from left to right)

4.2.1 User adjustment

4.2.1.1 Head-diameter

The HMD can be adapted to the user's head size by turning the red knob at the rear side of HMD (see Figure 1). This allows a tight fixing on the users head.

4.2.1.2 Eye to eye distance

The 2 displays of the HMD can be shifted sideways to fit them to the users distance between the eyes. This is done via the knob on the frontside of HMD. Although the HMD is suitable for people wearing glasses, adjusting it is a bit tricky for them because a slight movement of the glasses results in a blurred image.



Figure 2: HMD displays



Figure 3: Frontside of HMD with adjustment wheel

4.2.2 Connections

4.2.2.1 HMD

The control unit of the HMD supplies the following connections:

- right video input
- left video input
- right VGA input
- left VGA input
- Audio in
- power supply DC 5V

In normal mode or single input stereo mode the signal for both displays is taken from the left input.



Figure 4: Frontside connections



Figur 5: Rearside connections

4.2.2.2 Tracker

- female 9-pin RS-232 connector
- power supply connector DC 6V

4.2.3 Supported video modes:

single VGA-input:

- normal (non-stereo)
- framesequential 3D
- linesequential 3D

dual VGA-input:

- separated video signal for left and right eye

5 Literature/Links

- [1] <http://www.keo.com/SIMEYE100A.htm>
- [2] <http://www.keo.com/proviewxl3550.htm>
- [3] <http://www.keo.com/proviewxl4050stm.htm>
- [4] <http://www.hi-res800.com>
- [5] <http://www.genreality.com/CE500.html>
- [6] <http://www.i-glasses.com>
- [7] http://www.personaldisplay.com/english/f_whatism.html
- [8] <http://www.intersense.com/products/pro/index.htm>