

ELSET™

Electronic Set for TV-Studios

General Description

Following the continuous expansion of the computer world, the combination of real and synthetic image processing becomes a key technology in a number of new application areas. Addressing the most powerful human sense, this technology can be considered as a new tool to put someone "in the picture", communicating to the observer, ambiances, ideas or concepts corresponding to the programme design.

Three dimensional, virtual, on line generated sets will dramatically reduce the day-to-day production and indeed the post production costs. This goes hand in hand with more creativity for designers because they are no longer restricted by material and locations.

The ELSET™ system is designed for TV production, to place actors in front of a blue background for separation, into any synthetic scene where set components might cover actors partially or in full. This requires the accurate measurement of real camera parameters and based on this information the corresponding view of the synthetic image to be mixed for the formation of the rendered final image.

Operative Steps:

- ◆ Data Acquisition
- ◆ Virtual Scene Construction
- ◆ Scene Preprocessing
- ◆ Sequence Generation

Data Acquisition

in the ELSET™ system is broken down into image acquisition and camera parameter acquisition. Image acquisition is performed by studio equipment (cameras, keyers) interfaced to the ELSET™ accelerator frame buffer via high performance I/O. Camera tracking is performed by the real-time analysis of the video signal.

For the Virtual Scene Construction step,

image analysis algorithms for the 3D reconstruction of single objects, indoor backgrounds and buildings were developed. The algorithm development, which involves complex image processing and 3D techniques, takes advantage of complementary features of natural sequences: image disparity, optical flow and perspective.

The virtual scene construction step involves the scene generation and interactive animation control activities which deal with the computer graphics model assembly and animation. Collision checking algorithms have been developed, to assist the user in this process and various texturing and light specification functions are available to the set designer.

For Scene Preprocessing,

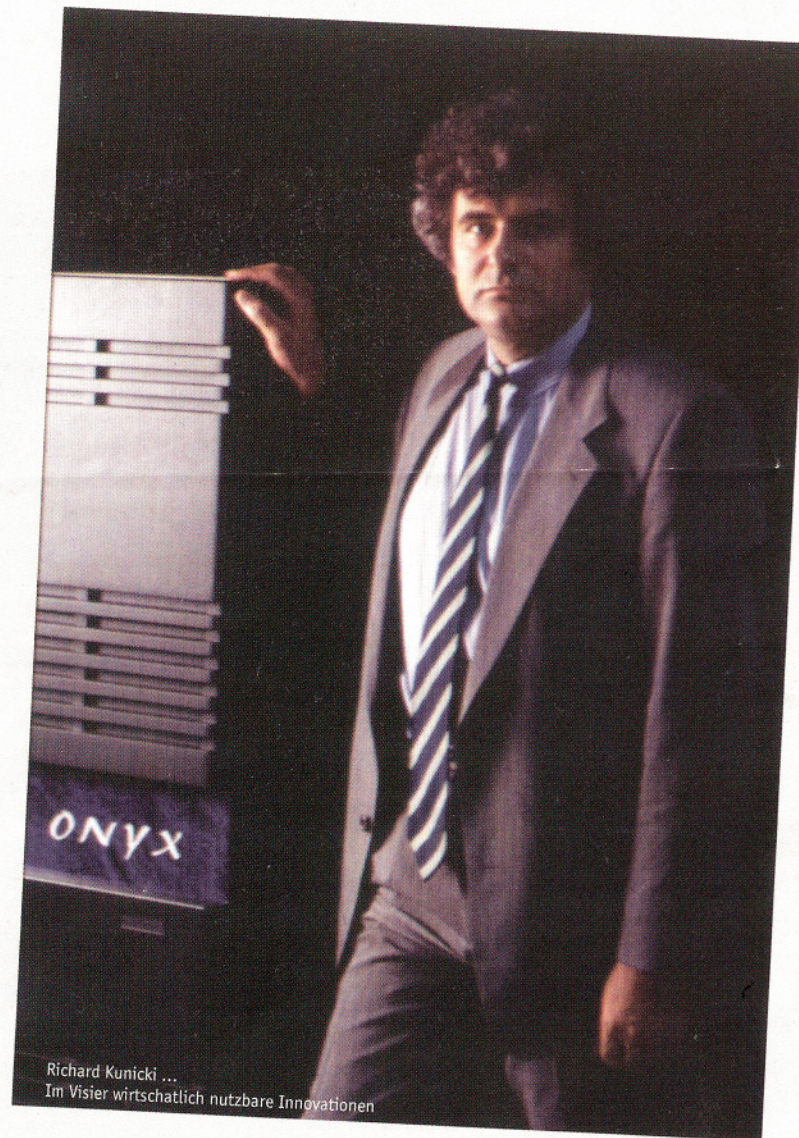
a preparatory step for rendering, software was developed for 3D frame coherence and illumination preprocessing.

The 3D frame coherence activity is implementing a Dynamic Object Based Method with the aim of reducing the computational cost of synthesis by detecting moving objects in the scene, allowing temporal coherence to be taken advantage of.

Radiosity based techniques have been developed and optimized in the illumination preprocessing activity for the creation of quality images allowing the computational load of real-time rendering to be reduced. Realistic lighting phenomena like surface light sources, diffused directional light sources (spotlights), soft shadows penumbra effects have been modelled. Innovative visibility determination and scene cut-out techniques have been developed to optimize the quality/cost ratio.

The Sequence Generation

step begins with the automatic animation control module which performs the real-time con-



Richard Kunicki ...
Im Visier wirtschaftlich nutzbare Innovationen

ELSET™ Overview

The benefits of using ELSET™ are the following:

- ◆ **Quicker and cheaper production process**
Low mechanical and in fact less manual set construction
Independent of locations
- ◆ **Increase in quality**
High resolution 3D sets with a high degree of detail
New keying method with more flexibility in lighting
- ◆ **Increase in creativity**
No restrictions of material, set coloring etc.
Creation of fantasy sets
- ◆ **Reduction of production time**
Off line construction design „at home“
Changes and/or adjustments during rehearsals

The features of ELSET™

- ◆ **New methods to create realistic looking sets**
- ◆ **Simulation of lighting conditions before installation of lamps**
- ◆ **Real-time signal processing employing Silicon Graphics' multiprocessor RISC technology**
- ◆ **Hardware acceleration DSP technology**
- ◆ **Camera movements related to virtual background and lighting**
- ◆ **New tools for 3D set design and modelling**
- ◆ **Z-mixing (distance key)**

The partners in the ELSET™ R&D project (Mona Lisa)

- ◆ BBC, British Broadcast Corporation
- ◆ Daimler Benz AG
- ◆ Siemens AG
- ◆ Thomson
- ◆ Queen Mary and Westfield College
- ◆ University of Balearic Island
- ◆ University of Hanover
- ◆ DVS Digitale Videosysteme GmbH
- ◆ VAP Video Art Production GmbH (representing the consortium MAC/EMO)

Cooperating Partners

- ◆ ARCONEX (Software)
- ◆ Silicon Graphics, Inc. (ONYX graphics workstations)
- ◆ Ultimatte Corp. (Memory Head & Ultimatte 7)

version of camera parameters from the real world to the virtual world. Driven by the real camera motion, this module transmits frame by frame scene information to the rendering module.

The rendering module exploits the scene pre-processing results to create in real-time the synthetic scene background. A complementary distance extraction feature has been developed to be exploited by the mixing module.

Implemented on powerful graphics workstation, these functions provide high quality images of the virtual background, matching the foreground camera position and motion.

The *Z-mixing* (distance key) system then combines the foreground action (shot by the real camera) and the rendered background.

In order to run real-time code (for example, for camera tracking) or to accelerate off-line pre-processing, the ELSET™ hardware platform combines a frame buffer with a DSP-based parallel processor pool. Application software (camera tracking, volume from silhouettes, illumination pre-processing) is being ported under the Remote Procedure Call based system software which has been developed. Studio I/Os and real-time video processing boards for foreground signal keying and for foreground/background Z-mixing have also been developed and integrated in the ELSET™ hardware platform.

ELSET™ is a trademark of VAP Video Art Production GmbH, Hamburg

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