Fraunhofer
Heinrich Hertz Institute

The Controller System for Autostereoscopic 3D Displays

The flexible controller system for autostereoscopic 3D displays enables processing of 3D video data in real-time. A stereo camera with two camera lenses records video from two slightly different perspectives. The video data are fed into an integrated 3D display controller which extracts information from the stereoscopic data and uses it to generate three dimensional images with supplementary data from the two cameras mounted on the display that track the position of the viewer's eyes. In this way the controller system for autostereoscopic 3D displays enables a three dimensional viewing experience in real-time from any position without the need for 3D eyewear.

Benefits

- 3D signal conditioning and processing for autostereoscopic (glasses-free) 3D displays in real-time
- Tracking of the viewer's position allows for freedom of movement
- Complex signal processing stages are integrated in a slimline system design
- Ultra-low latency offers excellent response rates in time-critical applications
- Reduced hardware complexity and power consumption
- Allows for customer-specific tailoring of the form factor and 3D depth impression
- Standards-compliant interfaces for displays and cameras
- Can process HDMI 1.4a compliant content

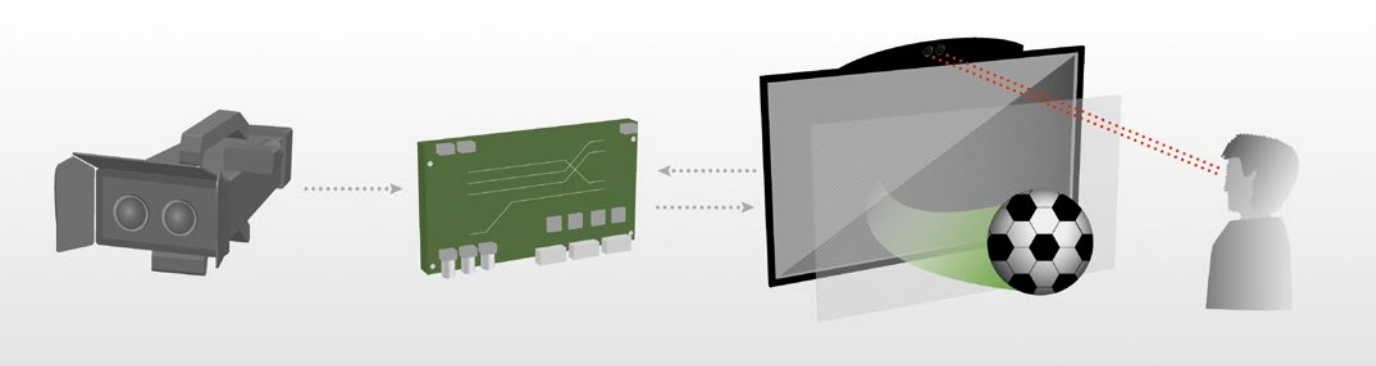
Areas of Application

- Visualization of construction plans in mechanical engineering
- 3D views of inaccessible places
- 3D microscopy, material analysis
- Virtual production
- Product presentation displays
- 3D monitors for film production

The integrated 3D display controller

Fields of Competence

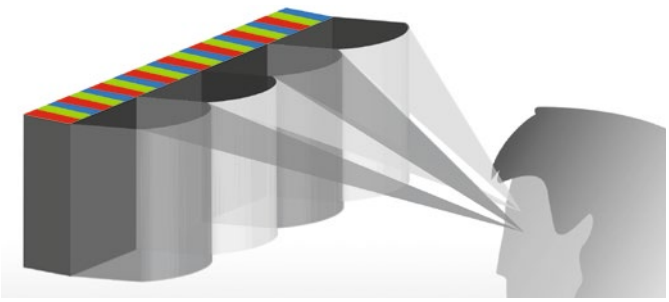
- Development of application-specific hardware architecture
- IP core development for video and data transmission
- From specifications to the complete system
- Optimization of high-speed systems
- System-on-Chip, System-on-Board technology consulting



The controller system for autostereoscopic 3D displays

Challenges

For 3D rendering the system uses a lenticular lens technique that sends a different image to each eye which gives the viewer a 3D depth impression without any need for glasses. For the rendering of 3d content a standard off-the-shelf display is overlaid with a lenticular lens system which directs light beams from the display in different directions. Conditioning of individual pixels enables picture information to be specifically targeted at the left or right eye. To ensure that a 3D depth impression is created in multiple positions before the display, the position of the pixels must be varied to correspond to the distance of the viewer from the screen and his or her individual position. A camera integrated in the display tracks the position of the viewer's eyes, and a separate image evaluation device notifies the 3D display controller of the viewer's position and their distance from the screen. For generation of three dimensional images, the images of the input signal (e.g. the signal from a 3D camera) must be processed to correspond to the viewer's position and the lenticular lens and rendered on the display. This involves fresh computation of each individual pixel on the display. A Full-HD 3D signal with a 60 Hz display refresh rate gives a data rate of up to 10 Gigabits per second. Such high data rates cannot be computed by traditional PC systems in real-time which lead to delays that real-time systems would not tolerate. This is why image computation is done by the controller system using a powerful FPGA-based hardware platform. The system can be used both as an integrated display controller and as a set-top box.



Standard off-the-shelf display is overlaid with a lenticular lens system

The opportunities offered by autostereoscopic displays and 3D processing with real-time capability make simplified visualizations possible that can be used in the fields of gaming and production as well as in automation and automotive technology. Multiple interfaces and supported 3D formats mean that the platform can be used in a variety of configurations as it can be fed with input signals from both computers and cameras. Novel FPGA-based hardware platforms in conjunction with optimized logic implementations (IP cores) meet the high requirements of Full-HD 3D video processing and open the way for a whole new generation of multimedia applications. Fraunhofer HHI uses cutting edge technology for the development of high rate data streams and systems optimized for data throughput and latency.

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