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Real World Blocker for Augmented Reality Devices

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References cited:

- PATENT DOCUMENTS
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OTHER PUBLICATIONS

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ABSTRACT

A Liquid Cristal Display (henceforth called LCD) that partially blocks areas of the incoming image from a live real world scene towards the eye, on places where artificially generated images should take its place in augmented reality eye-glasses and head-sets. The regions that are blocked by the LCD can be determined (1) indirectly, by comparison of depth values of the real and virtual world or (2) directly, by tracking markers in the real environment. The information required for this can be obtained from images taken by a camera mounted on the headset.

The image behind the aforementioned LCD is merged with an artifical image from a device displaying the virtual objects (henceforth called VR display), using (possibly coated) prisms or mirrors. The VR display device can be any conventional display type, such as a Liquid Cristal display, a Cathode Ray Tube display, a Micro-Mirror display, a Retinal Scanning or a display device based on any other technology.

Additional optic elements may be required to place the LCD and the VR displaying device at an optically more convenient distance, in order to allow the human eye to focus on them and to match the optical distance between the eye and the LCD, between the VR display and the eye, and between the real objects and the eye. This matching may be done in real-time, as a function of the distance to the object in the real world where the observer using the system is looking at.

The image on the blocking LCD device may have a lower resolution than the image of the VR display device. The edges between blocked and nonblocked regions may be smoothed by (1) optically placing the blocker slightly out of focus, or (2) by means of blocking the incoming image partially instead of completely at the positions of such edges.

The images from the camera that is mounted on the headset can be used to obtain the required areas for the LCD directly (e.g., a marking colour on those places where the real world should be filtered out or by markers indicating the edges of such areas), or indirectly (e.g., by reconstruction of depth from motion). The camera may also provide an image containing an image of the live real world from two different viewpoints at a single moment, thus allowing a reconstruction of depth from two images.The image processing algorithms to track those regions of interest may be based on any set of algorithms, e.g. using motion estimation or region labelling.

4 Claims, 1 Drawing Figure

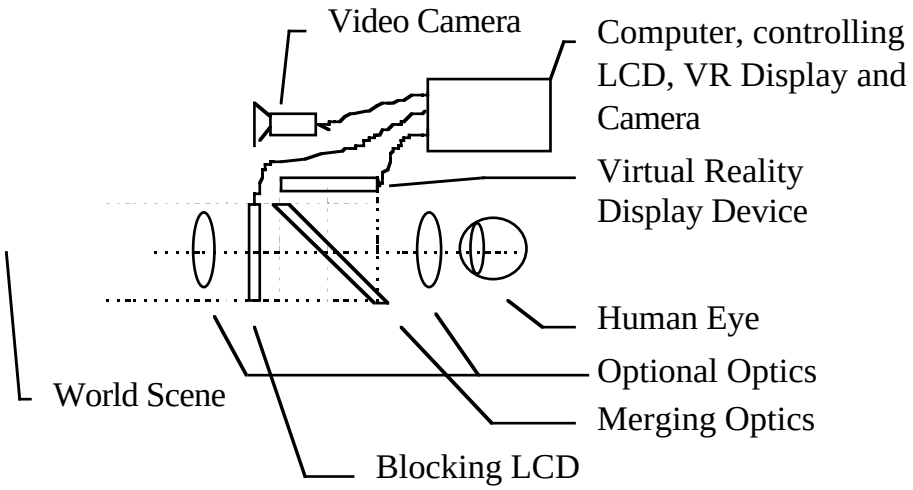

Figure 1: Overview of the system.

Real World Blocker for Augmented Reality Devices

The invention relates to the projection of artificial images in the human eye optically merged with certain parts of the view of the real world using a device that partly blocks the light from the real world.

Occlusion of objects by other objects that are closer to the observer is a very strong cue to the human visual system that the occluded object is further away from his eyes than the occluding object. Conventional see-through displays superimpose the two images. Therefore the occlusion cues in these displays may be incorrect and therefore the observer may be misinformed about the layout of the real and virtual world. The invention is a solution to display such occlusion cues correctly in a situation where real-world and synthetic images are being merged.
An offspin from this system is that it allows dynamic matching of the brightness of the environment with the brightness of the VR display and with the brightness that the user prefers. This could be done by partial blocking (and complete blocking where appropriate) of the entire image from the real world.

Figure 1 describes the invention:
A Liquid Cristal Display (henceforth called LCD) partially blocks the incoming image from a live real world scene towards the eye, on places where artificially generated images should take its place, to be used in augmented reality eye-glasses and head-sets. The regions that are blocked by the LCD are obtained by a video camera positioned on the eye-glasses or head-set and are processed with segmentation image processing algorithms to segment the image in parts that indicate that the LCD should block the incoming light and in parts that the LCD should pass the incoming light. Alternatively, the camera image may be used to reconstruct the depth to the visible real objects, in order to decide what parts of the real world should be blocked. The image behind the aforementioned LCD is optically merged with an artifical image from a Virtual Reality (henceforth called VR) display device, using (possibly coated) prisms or mirrors. LCD, VR display device and merging optics may be combined in a single device. The VR display device can be any Liquid Cristal, Cathode Ray Tube, Micro-Mirror, Retinal Scanning based display device or display device based on any other technology. The image on the blocking LCD device may have a lower resolution than the image of the VR display device and the blocked region may be smoothed in order to get smooth transitions of augmented and real parts of the augmented reality image that is projected in the human eye as a result of the merging of the image through the LCD and the image from the VR Display. The image of the head-set video camera that is used to generate the image for the blocking LCD, is used to track the regions that need to be blocked on the blocking LCD. The image processing algorithms on the computer system of the head-set or eye-glasses, that are tracking the regions of interest, may be based on any set of algorithms, e.g. using motion estimation or region labelling. The image processing algorithms take care of the correct view point translation for the LCD image, from the camera image viewpoint to the eye view point.

We claim:

(1) A Liquid Cristal Display to be used in Augmented Reality head-sets or eye-glasses, to block light from the real-world scene at regions of interest which position, size, form, intensity and colour distribution is based on a processed image of the same scene taken by a video camera.
(2) The optically merging of the view of which partly light is blocked by the device of claim (1) by an artificial image displayed by some image display device.
(3) The realisation of the blocking Liquid Cristal Display of claim 1 and the optical device to merge the partly blocked image and the artificial image of claim 2 into a single electro-optical device.
(4) The realisation of the blocking Liquid Cristal Display of claim 1 and the optical device to merge the partly blocked image and the artificial image of claim 2, and the display device of the artificial image into a single electro-optical device.