ADAPTIVE RENDERING: USING EYE TRACKING TO BOOST SYSTEM PERFORMANCE OF HEAD MOUNTED DISPLAY DEVICES

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HINTERGRUND

Virtual reality (VR) head-mounted displays (HMD) are becoming popular in the consumer space. To increase the immersion further, higher temporal and spatial resolutions are demanded. Even with expected progress in future GPUs, it is challenging to render in real-time at a 16K retina resolution. For this reason, the workload of the rendering has to be reduced. Aiming at a reduction of the rendering workload, “foveated” rendering methods have been developed in recent years. Here, the rendering quality of the individual pixels/sections of the image is adapted to the users actual gaze direction and corresponding quality of perception which is – due to the physiology of the human's eye – inferior for objects located in the periphery of the visual field compared to those in its center.

LÖSUNG

Our inventive method uses the effective visual field of the user depending on their actual eye gaze to fully skip the rendering of peripheral pixels/areas of the screen which are not perceived. In doing so, we incorporate two effects that influence and define the pixels within the visual field that has to be rendered: First, lens defects lead to the observation, that depending on the distance of the eye gaze to the center of the optical system, certain parts of the screen towards the edges that were visible when looking through the center are not visible anymore. Second, when looking in the periphery, the user cannot see the opposite peripheral parts of the screen. For these invisible areas which can be calibrated dependent on the eye gaze, we propose to skip rendering and to reuse the pixel colors from the previous frame. When applying the consequently adapted visual field to a renderer, we can more than double the system performance.
Representative result of a calibration step: When gazing at a point in the upper right corner (blue marker), the yellow calibration points enclose the perceivable area. Thus, the outward area can be skipped for rendering.

**VORTEILE**

- massive speed-up of rendering compared to other state-of-the-art foveated rendering methods
- method can be combined with other foveated rendering methods to further reduce rendering workload
- easy to implement after one-time calibration

**ANWENDUNGSBEREICHE**

head-mounted display devices that use eye tracking