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Real-Time Interactive Ray tracing in Distributed Environments for Virtual Reality Systems

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Abstract

The broader goal of this paper is to increase the efficiency and realism of rendered images in virtual reality systems while preserving a relatively high frame rate. Ray tracing has a high degree of realism but is very costly in terms of computational expenses. For this reason it is not recommended for use when real time interactions are required in graphics such as in virtual reality environments. This investigation looks at developing an algorithm which works alongside the ray-tracing algorithm and interweaves estimations based on the temporal coherence inherent in certain types of scenes with actual ray traced frames thereby increasing the frame rate while preserving the visual quality of the environment. This algorithm applies to environments, which allow for only one degree of freedom in the users motion i.e. the motion is along the direction of the camera (so the user can only walk looking ahead on a linear path consistent with our experimental treadmill environment). It is also possible to add a rotational component thus allowing this algorithm to be applied to rotational motion as well as linear motion. The algorithm is developed in a way that it is distributable allowing it to be combined with parallel processing power to increase the speed even further. The system will increase the quality, speed and efficiency of interactive ray tracing required to generate the graphical environment for our immersive locomotive virtual environment.

This paper will first explain some of the background of ray tracing in distributed environments such as the Beowulf system. Then it will talk about how my algorithm uses geometric constraints in the environment and the constraints on the motion of the user as indicators of the optic flow patterns in the scene. This optic flow will be used to determine how the images change from frame to frame in a computationally less expensive approach, which intends to be qualitatively as effective as actual ray tracing.