Exploring a Novel Method of Foveated Rendering in Virtual Reality with an Object Based Approach

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Rendering virtual environments for simulated reality applications often proves to be a challenge due to the high demands of simulations capable of imparting enough detail to appease the human eye. Traditional simulated environments typically waste processing power rendering entire scenes in high detail, limiting simulations to high end computers. This reduces the viability of virtual and augmented reality as a technology that can be used to benefit average consumers. Most of this detail is wasted, as human eyes are only capable of perceiving detailed information in a small central field of view. This research attempts to create a rendering system that reduces level of detail of objects in the peripheral region to reduce graphical processing requirements, a method called foveated rendering. The rendering system, designed for the Unity3D platform using JavaScript, loads objects into an adaptive level of detail reduction tool on startup, and creates copies of each model reduces down to a predetermined minimum level of detail. These secondary models are stored in memory, and are retrieved to replace full-detail primary models by the rendering system. In each frame, the renderer tracks the current center of the field of view and the acceleration of the head mounted display to determine a cone of foveation and calls primary and secondary models based on object location relative to the cone. In initial testing, frame rates of simulations run with foveated rendering are on average 13% higher than the corresponding control simulations, with an average increase in memory use of 17%.

Awards Won:
Association for Computing Machinery: Fourth Award of $500