Final Project Proposal

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Overview

Real-time raytracing has spurred the development of faster rendering techniques to achieve high-quality graphics without dramatically affecting game performance. One topic of study includes real-time global illumination. A recent paper by Majercik, et. al (2019) details a method of approximating indirect lighting, with information updated at every frame based on dynamic lighting and moving scene geometry. Other global illumination approximation algorithms tend to cause “light leaking”, but light leaking solutions generally only work with static geometry. We will implement this paper for our final project to show how this method can be used to globally illuminate dynamic in-game worlds with sufficiently fast performance.

Goal

Using Vulkan APIs, this project aims to generate a dynamic Minecraft-inspired scene illuminated by Dynamic Diffuse Global Illumination (DDGI) Probes as described in this paper.

Due Dates	Person 1	Person 2	Person 3
11/9	Project pitch; do more research on the background and implementations of paper		
11/13 (mini milestone)	Familiarize ourselves with Vulkan API, and decide on a starting base code to build path tracer off of a single repo		
11/18 (Milestone 1)	Have a basic deferred lighting path tracer running with direct lighting and single-bounce indirect lighting; Generate simple custom scene		
11/30 (Milestone 2)	Generate rays from singular probe and save info to a texture	Disperse and visualize probes in the scene; implement an algorithm to find surrounding probes for every pixel	Scene generation: darkly lit cave with sparse internal lights as well as external lights (holes in ceiling)
12/07 (Milestone 3)	Read from probe texture and interpret data for shading	Dynamically update probe information from frame to frame and understand the visibility test to prevent light leak	Support Person 1; implement WASD camera controls and include dynamic lighting in scene
12/13 (Final)	Stretch Goals: Glossy GI, textures, procedural sky, better procedurally generated world, optimization data structures, interactive scene, player physics, documentation		

References

- Main paper: http://jcgt.org/published/0008/02/01/paper-lowres.pdf
- Supplementary paper: http://casual-effects.com/research/McGuire2017LightField/McGuire2017LightField.pdf
- Video presentation by the author: https://youtu.be/LRWWa4SwKuw