CIS 565 Final Project

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Overview

I want to implement IBL (Image Based Lighting) using Vulkan. IBL is a technique of lighting synthetic (or real) objects using real world photographs. In this project, I will focus on lighting synthetic objects using HDR light probes.

Initiative

During my internship in this summer, I was first exposed to the term – real time PBR. I was fascinated about the concept as I still am. So I will take advantage of this opportunity to kick start my own implementation of a real time PBR renderer. This will be a long term personal project and I am 100% sure I won't be able to finish everything in just about four weeks. But that is fine. I will do part of it (IBL in this case), do more if I have time, and continue working on it after this semester.

The following videos are the demo videos from IBLBaker. It is an environment map baking tool but as the author stated, it is meant to be a sample implementation of the real time PBR pipeline introduced by Epic Games at Siggraph 2013. They show what I want to achieve in the end (in the end of the project, not this semester). Video1: https://vimeo.com/100285383. Video2: https://vimeo.com/96235208. Here is the repo of IBLBaker (many images on his README): https://github.com/derkreature/IBLBaker.

Difficulties

There are several difficulties lie on the path. I am new to Vulkan and it is complicated. I will follow tutorials to build up my own Vulkan helper function library but I will not use others directly. So it takes time. I am new to HDRI, I have some basic understanding of HDR imagery and environment mapping but I don't have any practical experience on them. So there is a lot more to explore. For the diffuse term of BRDF, I want to try Spherical Harmonics and compare to pre-filtered cube map in terms of performance and quality. Rendering with SH is not hard but computing SH coefficients is not so easy. I will need to correctly project each cube map pixel onto a unit sphere so that I can compute the correct solid angle it subtends.

Goals

- Render a red triangle using Vulkan
- Modeling loading and basic shading (Blinn-Phong with textures)
- Learn and use cube map for environment mapping
- Render using pre-filtered environment maps
- HDR rendering and tone mapping (correctly display HDR values)
- Use Spherical Harmonics to reconstruct irradiance value used in diffuse term of BRDF

References

Siggraph 2003 IBL course

IBLBaker repo

Spherical Harmonics

Siggraph 2010 PBR course