CSE 168 Final Project Proposal

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1 Introduction

My main goal for the final project will be to generate a extremely realistic image, based off of a scene that I have handcrafted. In order to do this, I will be extending my path tracer using several modern algorithms. In this sense, the project is four-fold:

1. Identify the extensions to be made to the path tracer.
2. Find or generate a suitable reference image.
3. Recreate the reference image as an exportable scene.
4. Rewrite my path tracer from homework 4 to be able to read the new scene file and to implement the necessary extensions.

My hope is that my final render will be suitable for entry into a final competition, if there were one to be held.

2 Proposal

2.1 Extension List

The following extensions will be implemented.

1. **Depth of Field**: The pinhole camera model used in the previous assignments will be scrapped in favor of a camera with an aperture. This will allow us to achieve a depth-of-field effect, where the objects in front are sharp but those in the back are more blurry.

2. **Texture Mapping**: Some objects in the scene will have textures associated with them that need to be properly mapped on to their surfaces.

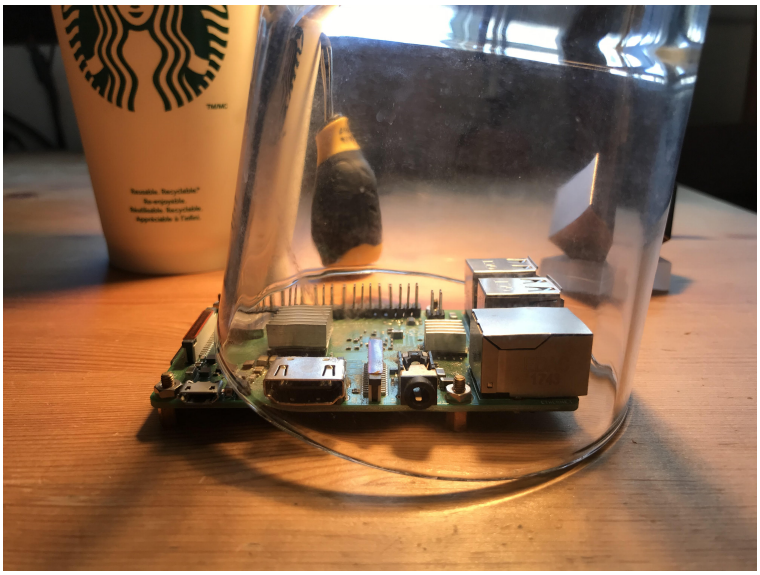
3. **Realistic Glass BTDF**: There will be at least one transculent, refractive object that is made out of Flint glass. The current microfacet BRDF in use will be extended to include a BTDF component, thus making it a BSDF. This will be accomplished through techniques described in the popular paper 'Microfacet Models for Refraction through Rough Surfaces' [1].

4. **Realistic Wood BRDF**: The table that my objects will rest on is a wood desk with a finish applied to it. As specified in the paper, 'Measuring and Modeling the Appearance of Finished Wood' [2], I will augment the microfacet BRDF currently used to model the wood with an additional BRDF that takes into account the fibers of the wood.

5. **Smoke**: Volumetric path tracing will be used in order to generate the visual effect of smoke emanating from an object.

2.2 Reference Image

I selected the following reference image as a guide for helping me design an appropriate scene.



I choose this reference image because it showcases well all of the extensions I would like to make.

- The scene is structured such that not all objects are equidistant from the camera. In this case, the computer and glass cup are intended to be in focus, and the objects further away in the scene will be blurred. This is a result of **depth of field**.
- There are items with **mappable textures**. Notably, the Raspberry Pi computer, the Starbucks cup, and the wooden desk will need textures in order appear correctly.
- These items also have lots of **variation in terms of material**. The screwdriver has a rubber handle, the Starbucks cup and breadboard are made out of plastic, the cube is made out of tungsten, and the rod of the screwdriver and tungsten cube are made out of metal.
- The overturned **glass cup** is a focal point of the scene. You can see how the tungsten cube and screwdriver are distorted through the cup. Additionally, around the rim of the cube, you can see an envelope of light, the caustics of the glass.
- The **wood desk** will be modeled using the supplemental BRDF described above.
- There is no **smoke** currently visible in the image. However, in the final render, smoke will appear as if it is coming out of the portion of the breadboard sticking outside of the glass cup, resulting in partial obstruction and distortion of the Starbucks cup.

This concludes my proposal. Please see my website for additional details regarding the implementation process.

References

[1] Bruce Walter, Stephen R Marschner, Hongsong Li, and Kenneth E Torrance. Microfacet models for refraction through rough surfaces. *Rendering techniques*, 2007:18th, 2007.

[2] Stephen R Marschner, Stephen H Westin, Adam Arbree, and Jonathan T Moon. Measuring and modeling the appearance of finished wood. In *ACM SIGGRAPH 2005 Papers*, pages 727–734. 2005.