ACG Project Midterm Report

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Abstract

We choose **Rendering** topic.

1 Project Goal

In this course project, we aim to implement the Disney BSDF along with multiple importance sampling, volumetric rendering, and advanced features such as texture mapping and skybox functionality, all while ensuring the implementation of all fundamental functionalities. Using this renderer, we will construct a scene.
Additionally, we plan to incorporate some aspects of wave optics, such as Young's double-slit interference and light diffraction. We have preliminarily established the theoretical foundation for this implementation through discussions on the Poynting vector. This part of the project is expected to be completed after achieving the required base score and individual goals outlined in the project announcement.

2 Technical Points Detail

We plan to implement (or have implemented):

- Base: Implement a path tracing algorithm that handles diffuse and specular materials. (basic, He Li implemented)
- Scene creation. (basic, 1pt, Waiting for register)
- Material:
  (1) Transmissive material (basic, He Li implemented)
  (2) Principled BSDF (2pts, He Li implemented)
- Texture:
  (1) Color texture (basic, He Li implemented)
  (2) Normal map (1pt, He Li implemented)
  (3) Height map (1pt, Chenglin Liu registered)
- Importance sampling with Russian Roulette and multiple importance sampling. (2pts, He Li implemented)
- Volumetric Rendering:
  (1) Homogeneous volume rendering (1pt, Chenglin Liu implemented)
  (2) Channel-independent subsurface scattering (1pt, Chenglin Liu registered)
  (3) Inhomogeneous volume rendering (1pt, Chenglin Liu registered)
  (4) Volumetric emission (1pt, Chenglin Liu implemented)
  (5) Volumetric alpha shadow (2pts, Chenglin Liu registered)
- Special Visual Effects:
  (1) Motion blur, depth of field (basic, Chenglin Liu registered)
  (2) Alpha shadow (basic, He Li implemented)
- Lighting:
  (1) Point light and area light (basic, He Li implemented)
  (2) Environment lighting with HDR (2pts, He Li implemented)
- Anti-aliasing. (basic, He Li has implemented this)

*Both authors contributed equally to this project.

3 Detailed Schedule

- **Week 12**: Inhomogeneous volume rendering, Wave optics.
- **Week 13**: Channel-independent subsurface scattering, Volumetric alpha shadow, Wave optics.
- **Week 14**: Height map, Scene creation.
- **Week 15**: Scene creation.
- **Week 16**: Preparing for Presentation (if we have an oral opportunity).

4 Rendering Results for Technical Points

We have the following figures for our current results:

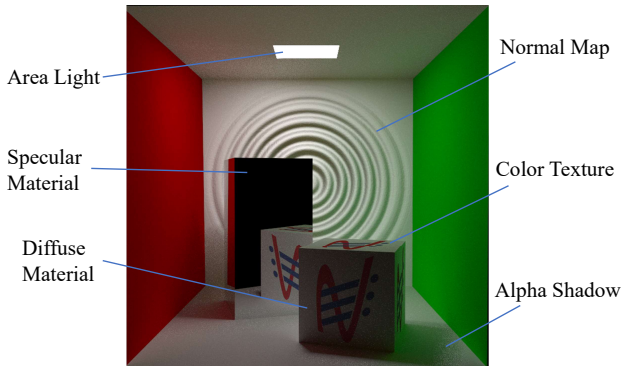

Figure 1: Basic Material, Light, Texture and Shadow

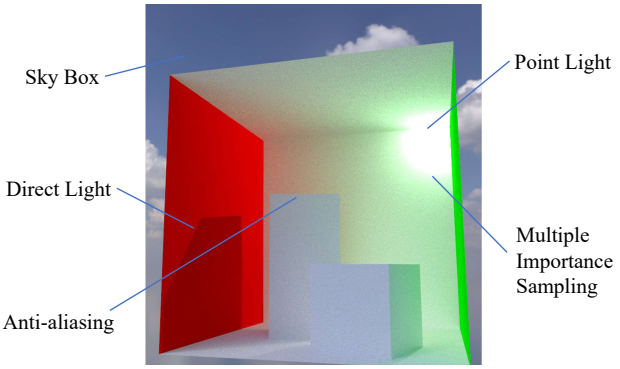

Figure 2: Sky Box, Anti-aliasing and Advanced Sampling

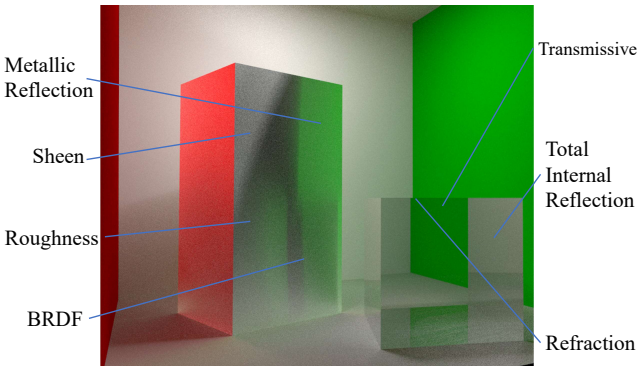

Figure 3: Selected Principle BSDF Stuff Property showcases

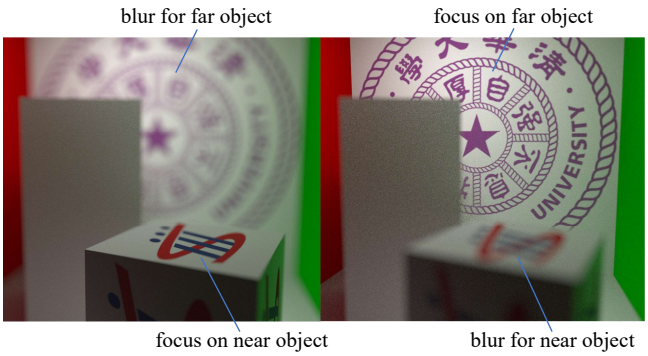

Figure 4: Depth of Field

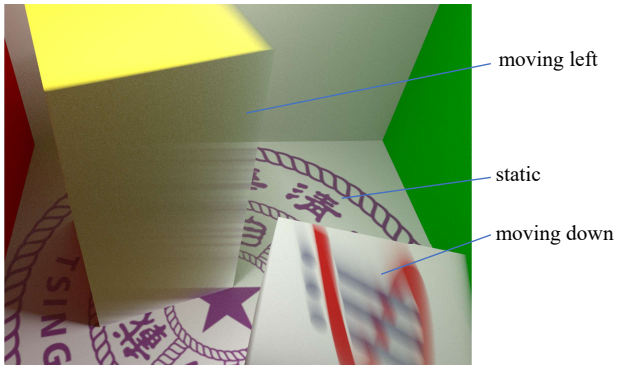

Figure 5: Motion Blur

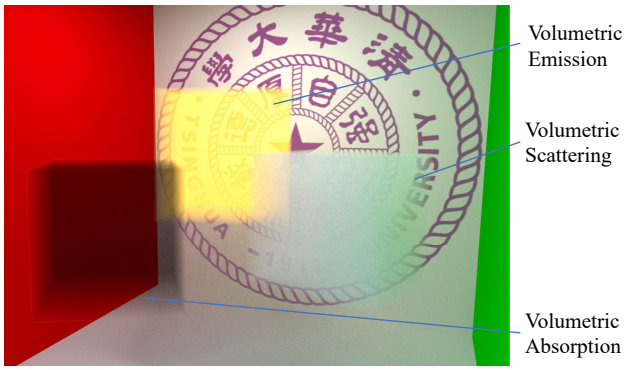

Figure 6: Volumetric Rendering showcases

5 Acknowledgement

We use the `Sparkium-v2` repository by `LazyJazz` as our codebase.