CS 5610/6610 - Spring 2022 - Interactive Computer Graphics

Final Project - Image Based Lighting

Name: Santhosh Natarajappa

Project Screenshots:

Figure 1: Teapot rendered using Blin shading

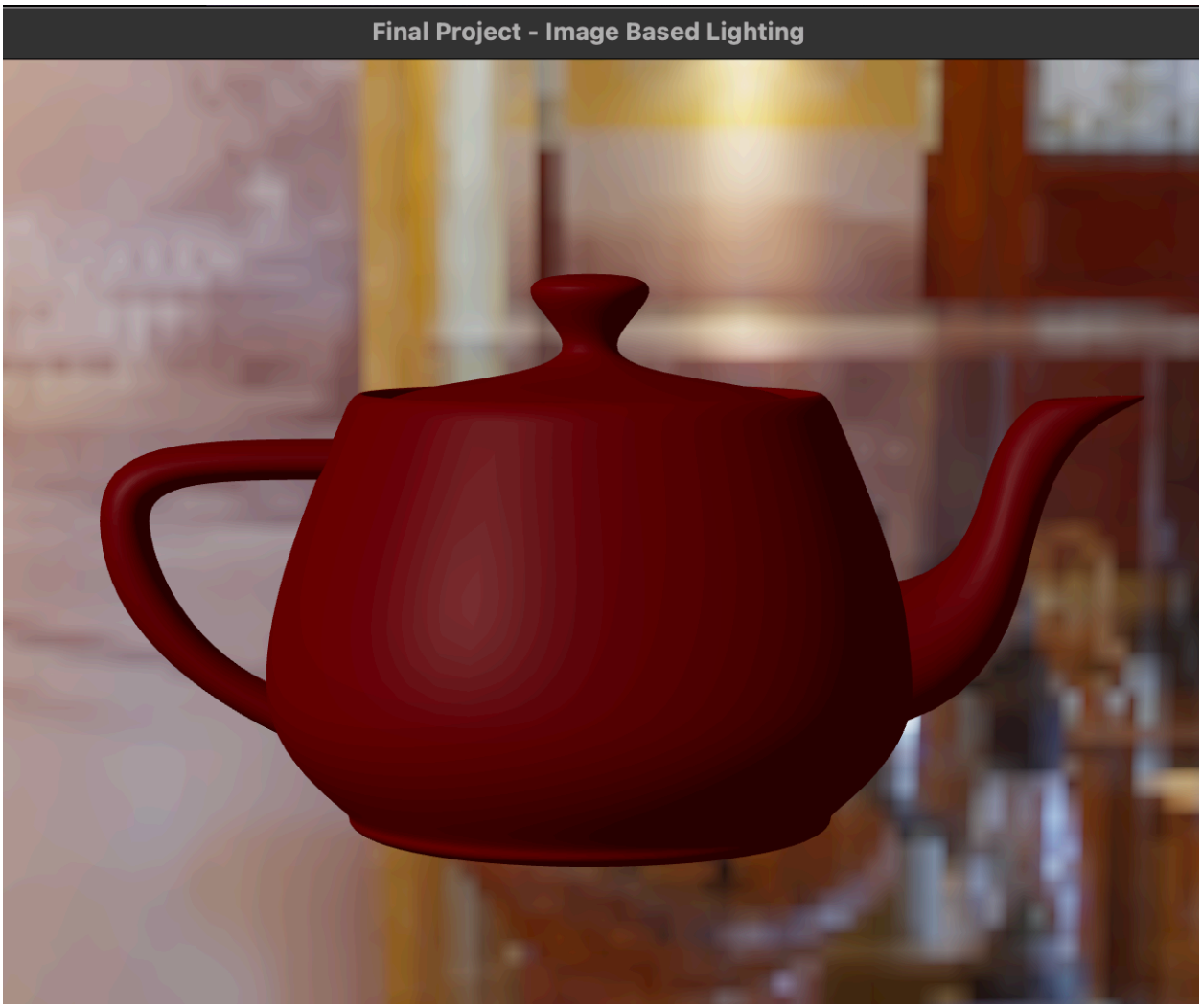

Figure 2: Teapot rendered using physically based rendering and metallic and roughness material properties.

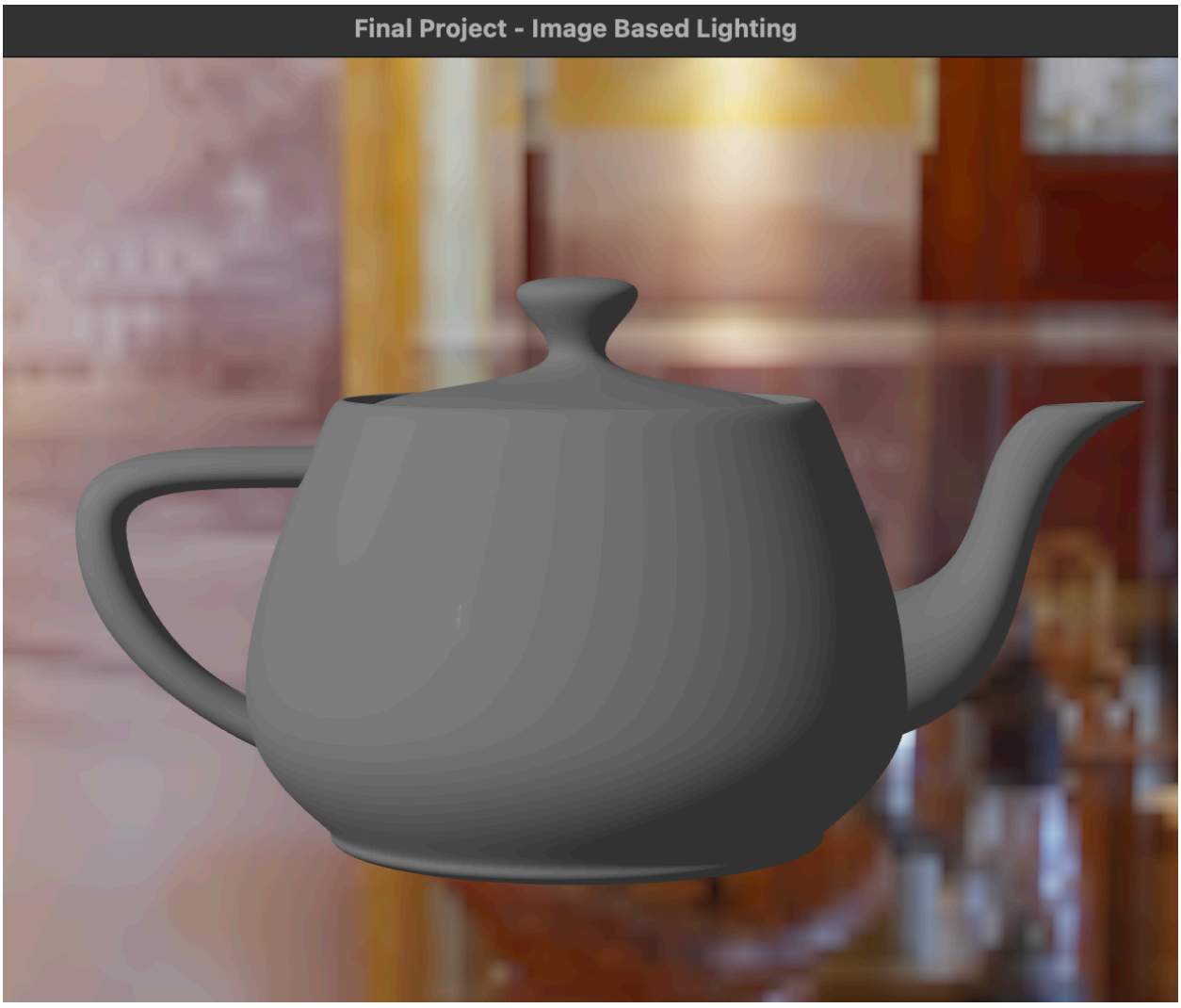

Figure 3: Teapot rendered using material (porcelain) properties as textures

Figure 4: After enabling the diffusion component of the image based lighting

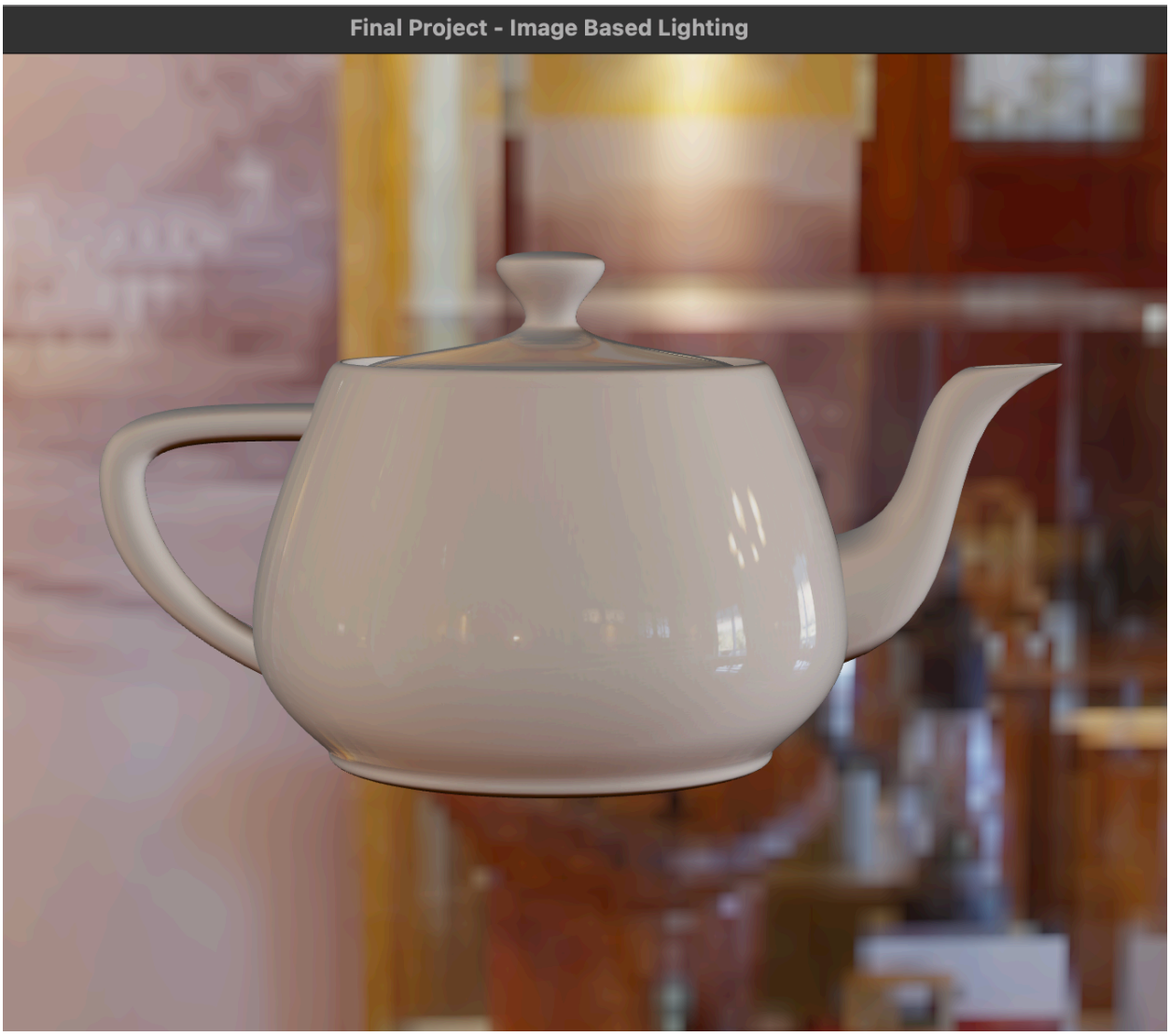

Figure 5: After enabling the specular component of the image based lighting

Video:

Implemented Features:

- The HDR spherical images are converted to cube map to use as environment mapping.
- The physically based rendering is enabled by using material properties such as metallic, roughness and ambient occlusion along with the albedo material property.
- The material properties are computed using the images and rendering them as textures.
- The irradiance map is computed by using the environment map to calculate the diffusion component of the image based lighting.
- The pre filtered map is computed in order to account for light from all the direction to compute the specular component of the image based lighting.
- The BRDF texture is calculated to compute the diffusion component of the image based lighting.
- By combining the pre filtered map and BRDF texture, final specular component is computed.

How to use:

- Compile and run the project using the below commands
- Enter ‘P’ key to enable physically based rendering.
- Use Right and Left arrow keys to increase and decrease the roughness of the material.
- Use Up and Down arrow keys to increase and decrease the metallic properties of the material.
- Use ’T’ key to render the material properties based on the textures.
- Use ‘D’ key to enable diffusion component of the image based lighting.
- Use ’S’ key to enable specular component of the image based lighting.
- Use ‘1’, ‘2’ and ‘3’ keys to change the material properties.
- Use ‘8’, ‘9’ and ‘0’ keys to change the environment mapping.

Development Environment:

OS: OS X 12.01
IDE: XCode 13.2.1
Compiler: clang++

External Libraries and Dependencies:

- C++
- OpenGL
- glfw
- GLEW
- glm
- cyCodeBase
- stb_image

All the libraries and dependencies can be found in the include and lib folder inside the project directory.

Steps to Compile and Run the Project:

- Run the below command in the project directory (inside the FinalProject folder).

```
clang++  -std=c++11 -stdlib=libc++ -arch x86_64 -o run
finalproject/main.cpp finalproject/lodepng.cpp lib/
libGLEW.2.2.0.dylib lib/libglfw.3.3.dylib -framework OpenGL -I
include -L lib
```

- Run the below command to run the executable.

```
./run teapot.obj
```

- Alternatively, the project can be open in X Code and running on Rosetta.

References:

1. Ravi Ramamoorthi and Pat Hanrahan. 2001. An efficient representation for irradiance environment maps. In Proceedings of the 28th annual conference on Computer graphics and interactive techniques (SIGGRAPH '01). Association for Computing Machinery, New York, NY, USA, 497–500. DOI:https://doi.org/10.1145/383259.383317
2. Image-based lighting by Joey De Vries, https://learnopengl.com/PBR/IBL/Diffuse-irradiance
3. Chapter 19: Image Based Lighting by NVIDIA https://developer.nvidia.com/gpugems/gpugems/part-iii-materials/chapter-19-image-based-lighting