COSC363 Assignment 2 Report

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1. Introduction

This assignment implemented a ray tracer that handles different types of geometric objects such as a sphere, cone, cylinder, and plane. It also has global illumination features such as multiple light sources, shadows, reflection, and fog. Figure 1 shows the final output of the ray tracer.

Figure1

2. Features list

It successfully implemented the basic features as well as some extra features in the assignment specification.

It also has some failures such as a black edge around the refractive sphere and a lighter shadow area when the shadow of a refractive object and the shadow of a non-refractive object overlap.

Extra features include:

1). A cone. (File Cone.cpp & Cone.h)

2). A cylinder. (File Cylinder.cpp & Cylinder.h)

3). A refractive sphere. (File RayTracer.cpp line 158)

4). Multiple light sources including multiple shadows generated by them. (File RayTracer.cpp line 107)

5). Anti-aliasing: supersampling is used to compute the average of the colour values of each square pixel to avoid distortion artefacts along edges of polygons and shadows. (File RayTracer.cpp line 239)

Figure 1 shows the output result using anti-aliasing. Figure 2 shows the output result without anti-aliasing.
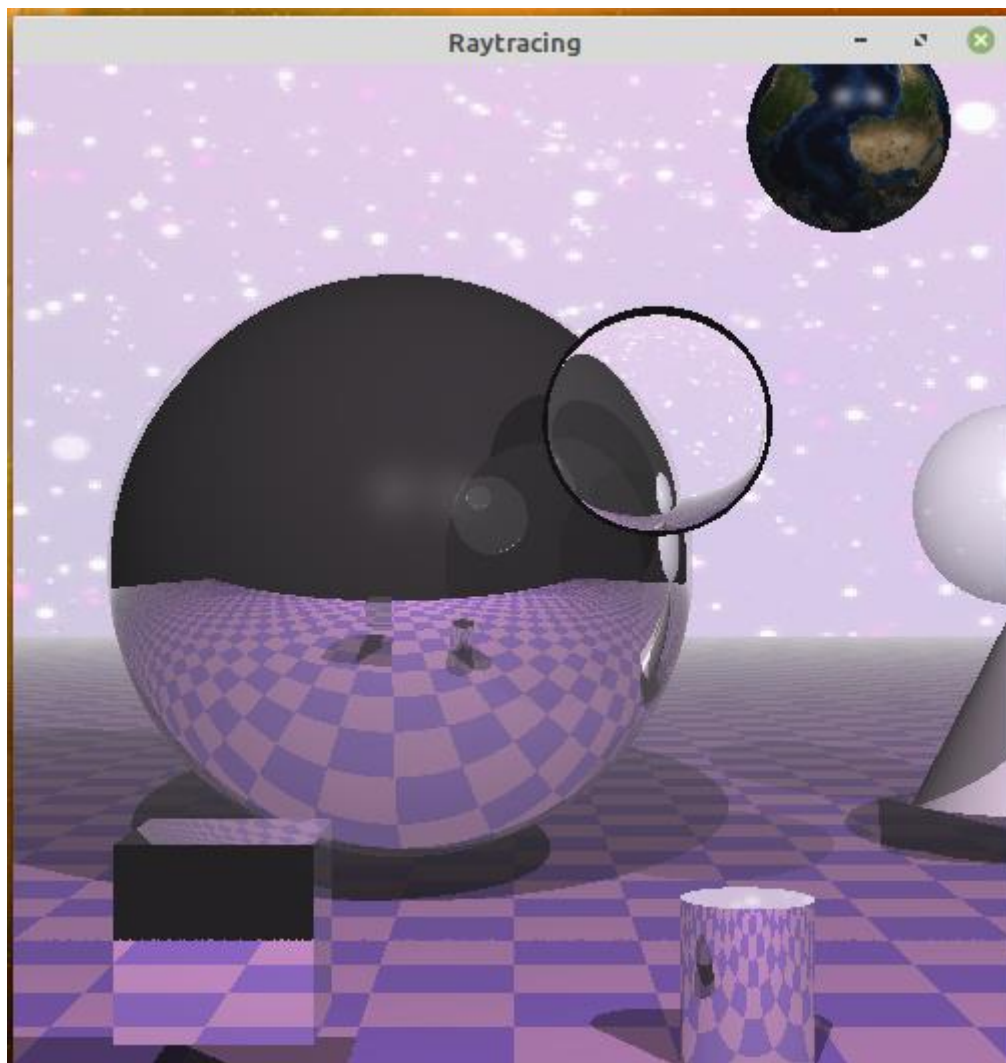
Figure2

6). A sphere textured using an image. (File RayTracer.cpp line 59)

The mathematical equations used for mapping coordinates is:

Denote the normal vector of a point p0 on the surface of the sphere as n.

Denote the texture coordinates as (s , t)

s = arctan(n.x, n.z) / (2 * PI) + 0.5

t = −arcsin(n.y) / PI + 0.5

7). Fog (File RayTracer.cpp line 198): Use a fog factor to linearly blend the colour values. The fog range is [−30, −550], and the floor range is [−20, −420] in z−axis. Figure 1 shows the output result with fog. Figure 3 shows the output result without fog.

Figure3
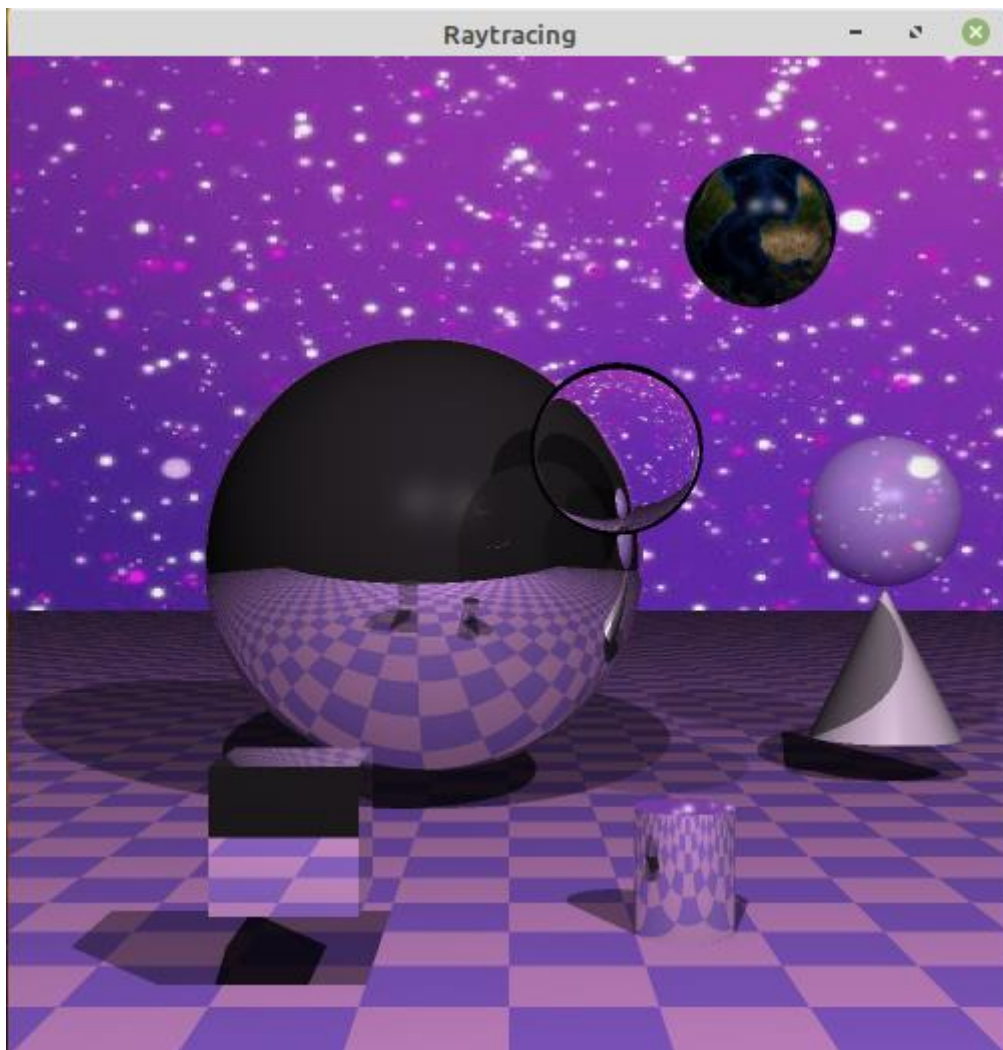
3. Command line to build the program

Unzip the file
cd lli180_assignment_2
cmake
make
./RayTracer.out
The time taken by the program to generate the output on the lab computer is about 12 seconds with 500 * 500 pixels.

References:

image sky.bmp

https://www.google.com/search?q=texture+purple&tbm=isch&hl=zh-CN&chips=q:texture+purple,online_chips:purple+glitter+texture:XJjhCPvOjQw%3D,online_chips:vector+image:R7cXQHSfm0E%3D&sa=X&ved=2ahUKEwie_M7R1_PwAhXgxTgGHR70AuQQ4lYoA3oECAEQIg&biw=1905&bih=936#imgrc=J1jAgkFZ5N1DXM&imgdii=Ud3ora6XertsXM

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https://www.google.com/search?q=earth+texture+bitmap&tbm=isch&ved=2ahUKEwj63MuK2PPwAhWXBisKHaEmDLoQ2-cCegQIABAA&oq=earth+&gs_lcp=CgNpbWcQARgAMgQIIxAnMgQIIxAnMgIIADICCAAyAggAMgIIADICCAAyAggAMgIIADICCAA6BAgAEBM6BwgjEOoCECdQoswFWOLnBWCGhgZoAXAAeASAAYACiAGiEZIBBTAuNy40mAEAoAEBqgELZ3dzLXdpei1pbWewAQrAAQE&sclient=img&ei=Qre0YPqzlJeNrAGhzbDQCw&bih=936&biw=1905&hl=zh-CN#imgrc=-wmfepbN3aouFM