COSC363

Computer Graphics
Assignment 2

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Ray Tracing

Taking the result of Lab7 as a starting point, I have added the following features to the ray tracer program.

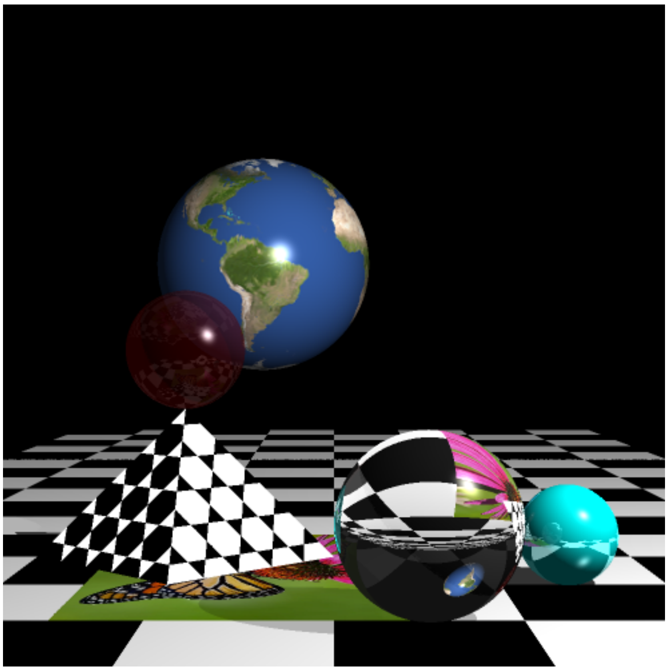

Figure 1 - Scene

For the minimum requirements:

- A red transparent sphere. Rendered by the ray tracer as a hollow sphere which blends the color of the sphere whit whatever is in the background.
- Shadows to transparent and refractive elements are lighter than shadows produced by solid objects. I have tried to implement a solution that would render a shadow in function of the refraction index or the transparency coefficient, but it failed in extreme cases where the coefficients get limit values such as 1 or 0.
- A pyramid constructed using a set of planes. A function to construct a pyramid in the desired position and size has been developed for this.
- The floor has now a checkered pattern.

For extensions:

- Refraction of light through an object. A method for sphere refractions have been implemented. It assumes that the refraction index outside the sphere is 1.0 (air), and the refraction index for the sphere can be chosen (In figure 1, I have chosen an index of 1.33 simulating a sphere filled with water).

-Anti Aliasing. The original (no AA) method was extended to a super sampling AA method. The AA can be switch on or off by choosing the appropriated value for the Boolean ANTIALIASING defined at the beginning of the RayTracer.cpp file.

In my computer, the program takes about 10s to render with this setting ON, and about 4s with the setting OFF. It fixes a lot of spots in edges and pixelation as per shown in Figure 2 below. It Also introduced some new defects. Maybe an adaptative sampling method could be more appropriate as the color values drastically change all the time in the image. Great improvement in quality overall.

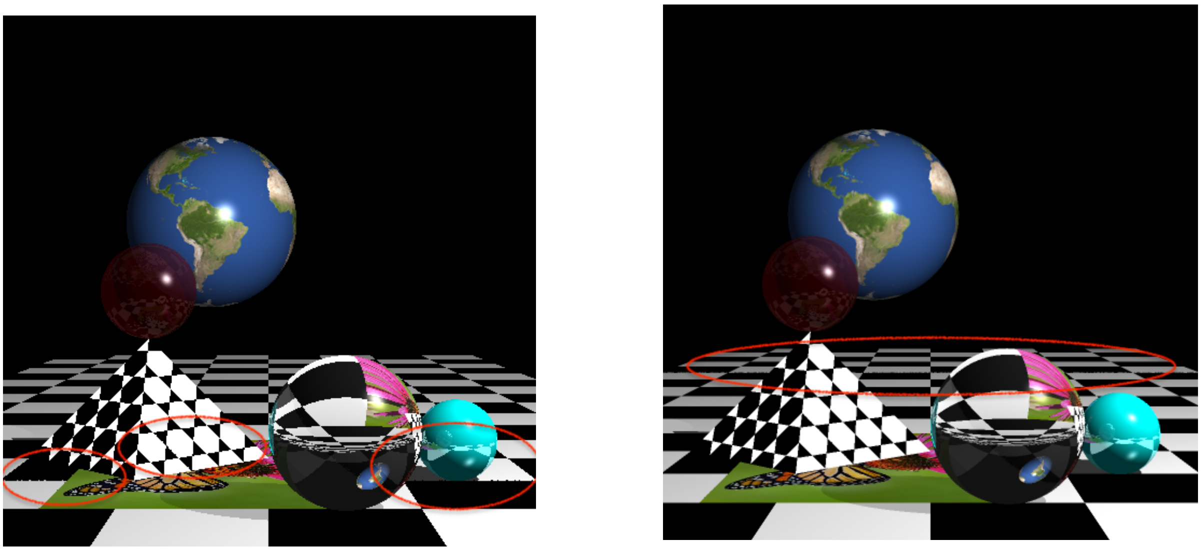

Figure 2 - AA off (left) VS. AA on (right)

- A non-planar object textured using an image. Using a website[*1], the code given in lab 7 for texture mapping, and some trial-error, the world map provided in previous labs have been used to texture-map a sphere.

- A procedural pattern has been generated for the pyramid. It uses the positions x, y, and z and a pattern type option (integer) to render different patterns in the pyramid.

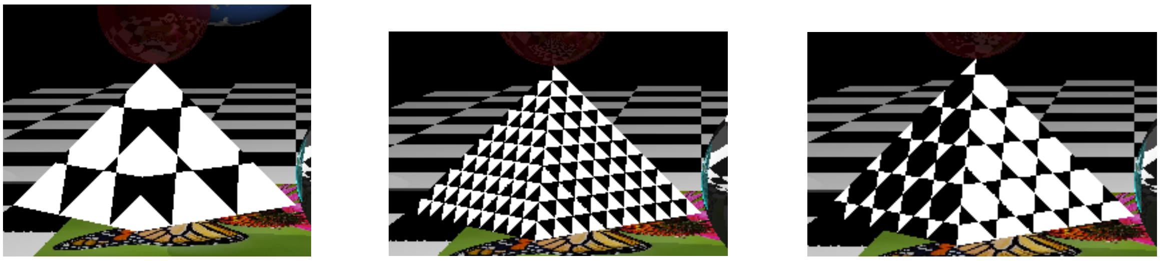

Figure 3 - Different patterns options

- Fog. Implemented using the formula provided in "Note 7 - Ray Tracing" to blend the color values with fog. This feature can also be enabled or disabled by setting the FOG Boolean constant to true or false at the beginning of the RayTracer.cpp file.

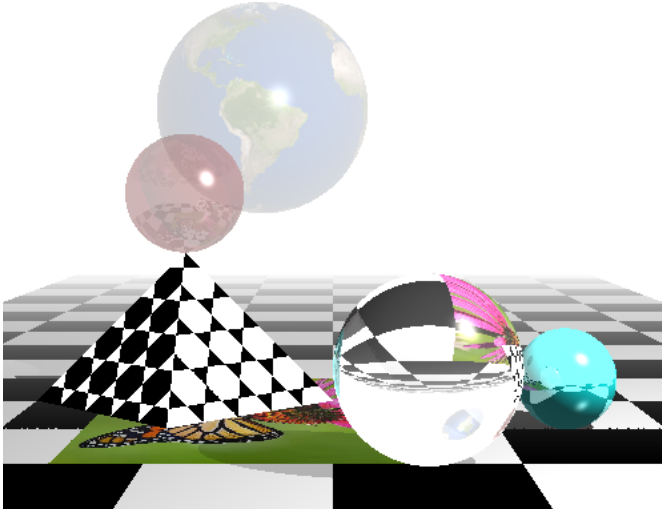

Figure 4 - Fog (AA off)

References:

(*1) https://stackoverflow.com/questions/22420778/texture-mapping-in-a-ray-tracing-for-sphere-in-c