Lab - 4
Lighting and Shading
October 3, 2022

1 Inroduction

In this lab we will look at how to perform lighing and shading. Primarily we have 2 different shading methods, **Gouraud** and **Phong**.

Gouraud or smooth shading shading performs per vertex computation

Phong shading performs per fragment computation.

There are differenrt types components in lighting and shading

Ambient Let L_a be the color of the ambient light. The ambient lighting is calculated as

$I_a = k_a L_a$

Diffuse Let L_d be the color of the diffuse light. The diffuse lighting is computed as

$I_d = k_d max((l.n)L_d, 0)$

where k_d is the fraction of diffused light that is reflected.

Specular Specular lighting is calculated as

$I_s = k_s L_s max((r.v)^\alpha, 0)$

where r is the reflected direction and v is the view vector, α is the shininess coefficient.

For the Phong lighting model we can avoid computing $r.v$ by computing $n.h$ where h is the $halfway$ vector. In the implementation we will be using the halfway vector which is given by

$$h = \frac{l + v}{||l + v||}$$

1.1 Instruction

In this lab we will use **Gouraud Shading** and **Phong Shading**

(a) In the vertex shader $L_a, L_d, L_s, k_a, k_d, k_s$ are provided. You have to calculate I_a, I_d, I_s, components and add them in the color.

(b) Since normals would be required, create a VBO for normals that will be used in Vertex shader.

(c) Compute the values for ambient, diffused and specular lighting in vertex shader.

(d) We will repeat the same thing in the fragment shader for Phong lighting.

2 Deliverables

The task for the lab is to refer to the lab code and comment line no. 7 and uncomment line no. 9. Generate results for Gouraud model of lighting. For ambient, specular and diffuse generate screenshots [a, d, s, (a+d), (a+d+s)] and submit them. Also create new shader file and calculate the same for the Phong model.

Submit the output along with code for evaluation. Upload the zip file with the format name roll_no_.zip.

3 Implementation Hints

For a cube centered at origin ands sides parallel to the primary axis, its easy to calculate all the normal. Calculate the normal direction for each points and normalize it and multiply with model matrix. This now becomes the surface normal(n). Calculate the direction vector using light position and normal and normalize it. Use these values to compute the ambient ,diffused and specular lighting for Gourad and Phong shading.