

COSC 4370 - Homework 3

Daniel Bonilla - 1768751

October 22, 2021

1 Problem

This problem for this assignment, is to shade a given cube with the usage of the OpenGL phong shading model.

2 Method

In order to achieve the phong shading model, three types of lighting must be first established to create the effect. These types of lighting are ambient lighting to give the object some color, diffuse lighting to give lighting directional impact, and specular lighting to give the object a bright spot, making it look shiny. Once these are established, combining them will give the phong shading model that is on the assignment.

3 Implementation

Before implementing the 3 types of lighting, a projection matrix, view matrix, and glposition must be established in order to view the cube given in the code. To add the projection matrix, we set projection equal to perspective(radians(45.0f), (float)WIDTH/(float)HEIGHT, 0.1f, 100.0f). To set the glposition, all we do is set it to projection * view * model * vec4(position, 1.0) within the phone.vs file. To establish the view matrix we return this line of code in the camera script, lookAt(Position, Position + Front, Up). Doing these steps will give us a view of the red cube already implemented in the assignment.

The first step to achieving phong shading is to make ambient lighting. To get the ambient values, we have a float value that represents ambient strength and this is multiplied by the light color of the object. To get just ambient, set the result to these values multiplied by object color and a dark cube will now appear.

Since the ambient values are established, the next step is add onto ambient with diffuse lighting. Diffuse lighting can be achieved by making a few additions within the phong.frag file. First addition is to normalize the normal vector3 and make a normalized vector3 that gets the direction from the light source to the fragment position. From here make a diffuse float variable that finds the max between the dot product of two normalized vectors and 0. Multiply this float value by the light color of the object and it will be ready to be added to ambient lighting. The result of adding diffuse to ambient and multiplying by object color will show a cube that is colored in the front and shaded towards the back. The only lighting missing, is the shiny texture from specular lighting.

Specular lighting is the last lighting that needs to be added to create a phong model. To get specular lighting, a few normalized vector3 variables are made. The first vector3 variable will hold the view direction from the view position to the fragment position. The second vector3 variables will hold the reflect direction result from doing reflect(-lightDir, normalized normal vector). From here a float variable will be made to hold the values from the max(dot(view direction, reflect direction), 0) to the power of 64. This power can be changed to obtain different levels of shine and in this case 64 is closest to the shine on the assignment. The values of this calculation are then multiplied with the light color of the object and desired specular strength to create specular values. This value is then added to ambient and diffuse then multiplied by object color to make the new result.

All three lighting values added together will make a phong model.

4 Results

The result of adding these different lighting values is a shiny shaded orange cube.

