

Programming Assignment 2

Date of announcement: 31st Jan 2019
Submission deadline: 21st Feb 2019

Description

In this assignment you will learn how to implement the Gouraud and Phong shading, and Phong lighting model in OpenGL using programmable shaders.

Implementation Specifications - Grading Criteria

Develop an OpenGL application with the following functionality and features:

- The minimum version of OpenGL should be 3.1 and up.
- OpenGL must be used in *retained mode*.
- Include comments throughout the source code to explain each command/block of commands.
- Load the OBJ files from assignment #1 and render them with triangles
- Prepare all necessary OpenGL data structures (EBO, VBO, VAO). **You should use an element buffer object to implement the vertex list.**
- Create a GLFW window of size 800×800 with double buffering support.
- Render the object on display.
- The application should use a perspective view to display the object and use the depth buffer for hidden surface removal.
- The application must handle the following input (same as assignment #1):
 - the user can move the camera using the mouse i.e. moving forward/backward while left button is pressed → move into/out of the scene
 - the user can move the camera using the keyboard i.e. W moves forward, S moves backwards, A moves left, D moves right, left arrow rotates the camera left about the up vector → R_{upL} , right arrow rotates the camera right about the up vector → R_{upR} , up arrow rotates the camera upwards about the right vector → R_{rightU} , down arrow rotates the camera downwards about the right vector → R_{rightD}
 - the user can rotate the object using keyboard input i.e. B rotates the object about the X axis, N rotates the object about the Y axis, E rotates the object about the Z axis
 - the user can move the object using keyboard input i.e. J moves the object along the +X axis, L moves the object along the -X, I moves the object along the +Y axis, K moves the object along the -Y, PgUp moves the object along the +Z axis, PgDown moves the object along the -Z axis
 - the user can uniformly scale the object using keyboard input i.e. O scales up the object by a factor of 10%, P scales up the object by a factor of -10%
- In addition to the above, the application must handle the following input:
 - pressing key '1' should toggle the red channel on/off
 - pressing key '2' should toggle the green channel on/off
 - pressing key '3' should toggle the blue channel on/off
 - pressing key '4' should turn on all channels
 - pressing key '5' should toggle between Gouraud and Phong shading

- pressing key '6' should toggle the light on/off
- pressing key 'M' should toggle on/off rendering each vertex with its normal as the color
- pressing key 'G' should render the scene in grayscale. Note: If the RGB color is r, g, b then the corresponding grayscale is $g = 0.2989 \times r + 0.5870 \times g + 0.1140 \times b$
- the scene should have a point light with color $(0.8, 0.8, 0.8)$ at location $(0.0, 20.0, 5.0)$
- the ambient, diffuse, and specular coefficients should be $k_a = 0.25, k_d = 0.75, k_s = 1.0$ respectively.

Submission (electronic submission through Moodle only)

Please create a zip file containing your C/C++ code, vertex shader, fragment shader, a readme text file (.txt). In the readme file document the features and functionality of the application, and anything else you want the grader to know i.e. control keys, keyboard/mouse shortcuts, etc.

Additional Information

- You can use the skeleton code provided during the lab sessions to get started.
- A video demonstrating the functionality is posted on YouTube: https://youtu.be/0y7_E2LMG4w

Evaluation Procedure

You MUST demonstrate your solution program to the lab instructor during lab hours. You will be asked to download and run your submitted code, demonstrate its full functionality and answer questions about the OpenGL programming aspects of your solution. Major marking is done on the spot during demonstration. Your code will be further checked for structure, non-plagiarism, etc. However, ONLY demonstrated submissions will receive marks. Other submissions will not be marked.