Project 2 Interactively Manipulate Lighting and Materials of A Teapot

Due: 23:59:59, Monday, November 7

In this project, you need to manipulate the lighting and material properties of a teapot using shader-based OpenGL.

Set the initial lighting and material as:

light_position($0.0, 0.0, 1.0, 0.0$);
light_ambient($0.1, 0.1, 0.1, 1.0$);
light_diffuse($1.0, 1.0, 1.0, 1.0$);
light_specular($1.0, 1.0, 1.0, 1.0$);
material_ambient($0.5, 0.0, 0.0, 1.0$);
material_diffuse($0.5, 0.0, 0.0, 1.0$);
material_specular($0.5, 0.0, 0.0, 1.0$);
material_shininess = $100.0$;

Tasks:

1. Use LookAt and Perspective/glFrustum functions to display and illuminate the teapot appropriately. You need to set up the vectors of eye, at, and up and choose the parameters for the frustum such that the teapot should not be cropped out. You may also need to adjust the light position according to your view volume.

2. You need to register a callback function for the mouse to select which set of properties you want to modify: lighting or material. Specifically, press
   a. the left button to modify the lighting properties,
   b. the right button to modify the material properties.

   You also need to register a callback function for the keyboard to change the lighting and material properties. Specifically, press
   c. “Q/q” to exit,
   d. “a” to change the ambient,
   e. “d” to change the diffuse,
   f. “s” to change the specular,
   g. “R/r” to increase/reduce the red component by 0.1,
   h. “G/g” to increase/reduce the green component by 0.1,
   i. “B/b” to increase/reduce the blue component by 0.1.

   Note: all the values should be in the range of [0,1]. You need to set the upper/lower bound when you modify those values.

3. (Graduate Students only) You need to move the position of the light by mouse. Specifically, click the middle button of the mouse and
   a. Move the light with $tx = \pm \frac{1}{num\text{\_clicking}}$ by moving the mouse to the left/right of the window
   b. Move the light with $ty = \pm \frac{1}{num\text{\_clicking}}$ by moving the mouse to the top/bottom of the window
**Bonus credits** (10 pts):
Add an additional blue spotlight with the cutoff angle of 5 degree. Make sure at least part of the teapot is within the focus range of the spotlight. Use “+/—” on the keyboard to increase/decrease \( \alpha \), i.e., the power coefficient of the attenuation function.

**Requirements:**
In turning in your homework, you need to submit a zipped file (named as LastName_project2) through dropbox including your code. Please make sure your codes can be compiled, linked, and run successfully on the department linux machine.