University of Wollongong

SCSSE

School of Computer Science & Software Engineering

CSCI336 – Computer Graphics
SIM Session 1, 2013

Lab Assessment 3

Aim: to understand how to setup 3D projections, and to use modelling transformations and lighting in OpenGL

You may use code from the lectures as a basis for your own code.

Main Task (6 marks)

Write a program that implements perspective projection.

Draw a scene of a room with at least a table and two chairs. On top of the table there should be a number of ornaments. The ornaments should be specular objects, each object must be set up with different material properties. Each ornament should also be displayed in a different colour when colour tracking is used. You will have to use the OpenGL 3D modelling transformation functions to place the ornaments appropriately. For the ornaments, use all of the following:

- glutSolidTeapot
- glutSolidSphere
- glutSolidCone
- glutSolidTorus
- glutSolidDodecahedron
- glutSolidOctahedron
- glutSolidTetrahedron
- glutSolidIcosahedron

Other than the ornaments, you must put together the other objects (e.g. room walls, table, chairs, etc.) yourself using OpenGL primitives. You will also have to specify the normals for these in order for them to be lit appropriately.

The room must be lit by two light sources on opposite sides of the room. Also implement a swinging spotlight that is attached to the room's ceiling. The user should be able to adjust the spotlight's swinging speed. These light sources must have different colour properties. Use spheres with an emission component to mark the locations of the light sources.

The user should be able to use keyboard input to:

- Toggle
  - Wireframe and solid mode
  - Smooth and flat shading

  - Enable and disable colour tracking

- Turn the help display on/off
- Turn individual lights on/off
- To quit the program

Also setup a menu system to allow the user to adjust the global ambient lighting levels in the scene.

Your program must also implement a movable camera, controlled using keyboard input. The camera should focus on a point at the centre of the scene. The user should be able to rotate the camera in all directions around this point, be able to zoom in and out, and be able to roll the camera by +/- 45 degrees. Also provide an option for the user to reset the camera's position.

Use text to implement a help display on the upper left of screen. This display should show the number of frames per second, along with a description of keyboard controls, etc.

Advanced Task (2 marks)

Using spotlights, implement moving 'disco' lights attached to the room's ceiling. The user should be able to adjust the movement speed of the lights and be able to switch them on/off. Allow your ornaments to dance ☺ (just make them rotate) when these lights are on.

Combine orthographic and perspective projection displays in a single program. Use two sub-windows within a main window and display the same scene within the two separate sub-windows. The program should implement 2D projection for the main window, orthographic projection for the left sub-window and perspective projection for the right sub-window. The user must be able to manipulate the camera in the respective sub-window separately.

Label the type of projection that the respective sub-window implements using text.

Assessment

Submit an electronic copy of your work to your tutor at the start of the lab in which this assessment task is due. Do not try to fix your code during this lab, otherwise late penalties may apply. The code that you submit must be your own work. You must be ready to demonstrate and explain your code at any time during that lab session. Your program must work on the lab computers.

Marks will be awarded based on the quality of your code and the implemented features. Note that marks may be deducted for other reasons, e.g. if your code is too messy or inefficient, is not well commented, if you cannot correctly explain what you did, etc. For code that does not compile, does not work or for programs that crash, the most you can get is half the assessment marks or less.