Queen Mary
University of London

EBU5405: 3D Graphics Programming Tools
Coursework Part 2: Labs 6 to 8

1. Introduction to Coursework part 2

In the second part of the coursework, you will add lighting to your object and create an animation.

2. Lab 6

2.1. Aim

The aim of Lab 6 is to understand and practice lighting using OpenGL and to start adding lighting to the articulated object.

2.2. Lighting exercises

You should download and open the Week3Code.doc file.

Copy and paste the two code samples in their own .c files and name each .c file as shown in the Week3Code.doc file. Compile and run each program.

Now try answering the questions or exercises below.

a) spheres.c

i. Using the Colour Converter Flash application (which can be found on Blackboard), observe all the colours declared in the various light and material properties.

ii. Given the light and material properties you observed above, can you explain the aspect of each of the spheres?

iii. Modify the colour declarations as you like, observe and try to explain the changes you can see on the spheres.

iv. Modify the position of the light and try to explain what you observe as a result.

b) cube.c

i. Repeat questions i, ii and iii above for the cube.

ii. Re-calculate all the normal vectors and verify that they are correct.

iii. Modify the code so the light source is fixed relative to the cube, i.e. you want the light to rotate with the cube. A single face (always the same) should appear illuminated.

iv. Modify the code so the cube is fixed (rotated only once by 45 degrees on each axis), but the light source continuously rotates around the fixed cube. For a better result, you may want to use a greater increment for the angles theta[axis].

Here is useful information for the exercises iii and iv above:
http://www.opengl.org/resources/faq/technical/lights.htm#ligh0050

2.3. Lighting the object

2.3.1. Light source

Set up a fixed light source similar to the one used in the cube.c program. Insure that your code is complete (e.g. declaration of normals (if needed), lighting and light source enabled, etc.).

2.3.2. Materials

Declare different types of material (as you like) for the different parts of the object.

2.4. Animation of the object

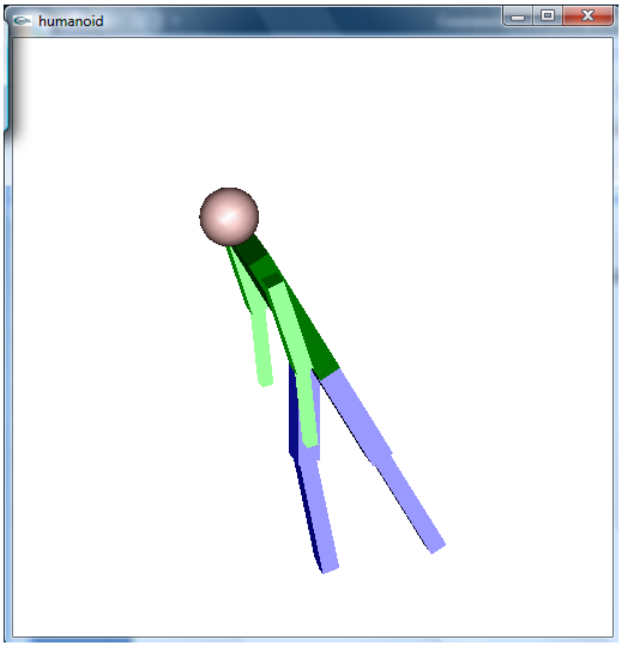
You should remove the interactive menus you implemented in Lab5 and add the following behaviour to your object: a click anywhere inside the window with the left button of the mouse should start and stop the animation of the object.

The object will animate in two ways:

- The object should rotate on itself along the Y axis (similarly to the Rotating menu option of the previous lab).
- The object should continosly change the position of its various parts (similarly to the Bending option of the previous lab).

2.5. Outcome of Lab 6

The outcome of this lab should be an animated object that is shaded using OpenGL lighting calculations (see an example showing the humanoid below).



Save your work in a folder named Lab6, include all your code, makefile and .exe application. Do not forget to comment your code.

3. Lab 7

3.1. Aim

The aim of Lab 7 is to experiment with various types of light sources.

3.2. Content of Lab 7

3.2.1. Light position

Test two different behaviours for the light source. The first behaviour is for the light to always remain at a fixed position, independently of the object rotation (“fixed”). The second behaviour is to make the light rotate with the object, i.e. the light should be fixed relative to the object (“relative”).

Hint: In the last question of this lab, you are required to write a menu which allows us to interactively change the behaviour of the light source, from “fixed” to “relative” and vice versa. Write your code in a way that will make this menu interaction easy for you to implement.

3.2.2. Light type

Test two different types of light source: ambient light source (“ambient”) and distant (i.e. parallel) point light source (“distant”). The ambient light source should be implemented using the glLightModelfv OpenGL function. When the ambient light source is activated, the point light source should be disabled.

Hint: In the last question of this lab, you are required to write another menu which allows us to interactively change the type of the light source. Write your code in a way that will make this menu interaction easy for you to implement.

3.2.3. Light properties

Test different light properties for the ambient, diffuse and specular components. Retain two sets of properties you like. One set should correspond to a white light, the second set should correspond to a coloured light.

3.2.4. Interaction

Implement an interactive menu that can be used to modify the light set-up.

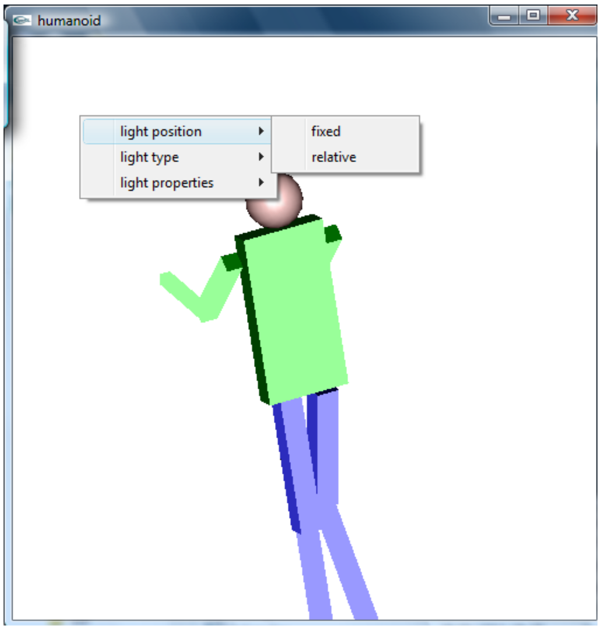
The menu should be attached to the right button of the mouse and show the following three options: “light position”, “light type” and “light properties” (see illustrations below).

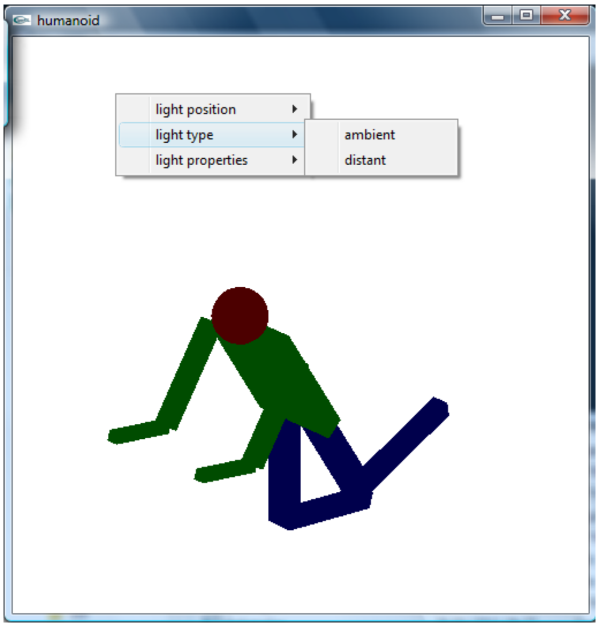
The “light position” menu should include a submenu with the following two options: “fixed” and “relative”.

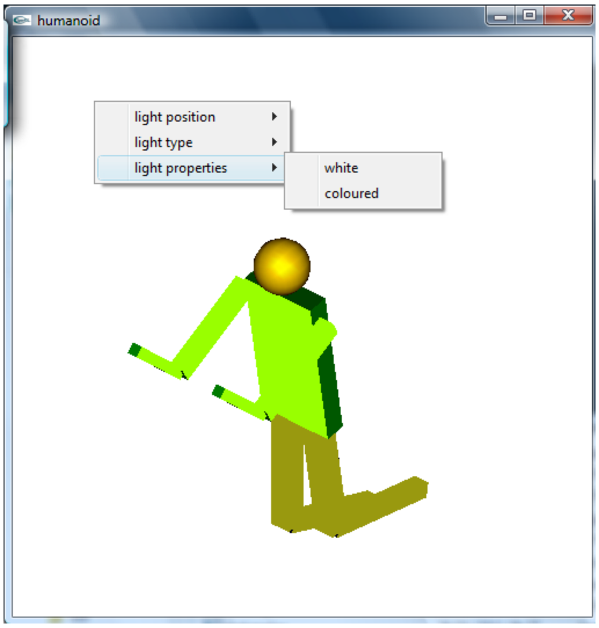
The “light type” menu should include a submenu with the following two options: “ambient” and “distant”.

The “light properties” menu should include a submenu with the following two options: “white” and “coloured”.

Note that when the light source if of type “ambient”, the light becomes unaffected by the position and properties menu selections.







3.3. Outcome of Lab 7

The outcome of this lab should be an animated 3D articulated object, which can be shaded using different lights. The default light source should be fixed, distant and white. The behaviour of the animated object is unchanged since Lab6. This behaviour is reminded here:

A click anywhere inside the window with the left button of the mouse should start and stop the animation of the object. The object will animate in two ways:

- *The object should rotate on itself along the Y axis.*
- *The object should continuously change the position of its different parts.*

Save your work in a folder named Lab7, include all your code, makefile and .exe application. Do not forget to comment your code.

4. Lab 8

4.1. Aim

The aim of Lab 8 is to experiment with various types of materials and to give the final touch to your object.

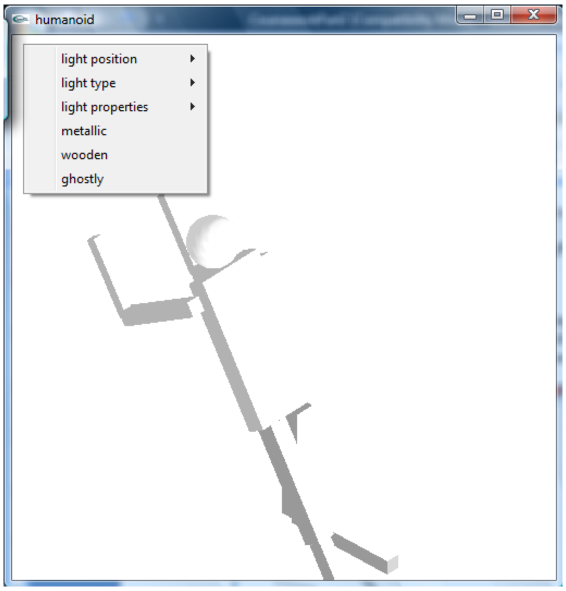
4.2. Content of Lab 8

4.2.1. Materials

Test different types of materials for the different parts of your object. Retain three sets of materials that you like. The three sets should give significantly different “looks” to your object. Find an appropriate name for each of the three sets (e.g. “metallic”, “wooden”, etc.). Remember that this is an individual coursework and that your object must be unique. Points will be given for originality.

4.2.2. Interaction

You will now add three options to the menu you implemented in Lab7. The three additional options should allow us to change the type of material used to render the object. Use the names you chose in the question above to display the new options in your menu (see an example below).



4.3. Outcome of Lab 8

The outcome of this lab should be an animated 3D articulated object, which can be shaded using different lights and materials.

Save your finished object in a folder named Lab8, include all your code, makefile and .exe application. Do not forget to comment your code.

Place the five folders: Lab4, Lab5, Lab6, Lab7 and Lab8 in a folder named **jp09xxxEBU5405** (replace jp09xxxx by your student number), and submit it as a zip archive on Blackboard before the coursework submission deadline.