Lighted Robot and Helicopter

Report for Project C on Computer Graphics.

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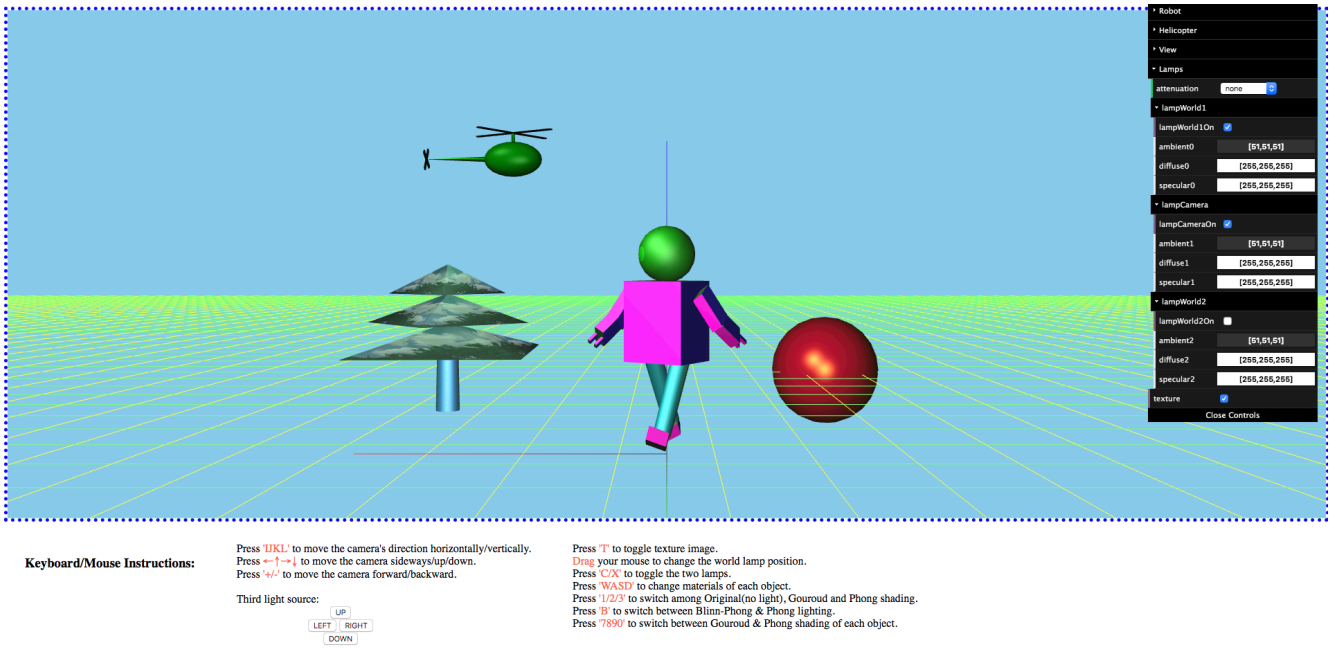

Figure 1. A screenshot of the user interface.

Introduction

In project C, I built a 3D interactive scene that contains a dancing robot, a swing tree, a flying helicopter, and a spinning sphere to better observe lighting results.

There are three light sources in in the scene: One headlight from the camera position, and two other movable light sources, all of which have R, G, B values that can be adjusted for ambient, diffuse and specular light amounts, and can be switched on and off. And we can select from attenuation functions in the control bar.

The lighting and shading are implemented in four methods: Gouraud / Phong shading, with Phong or Blinn-Phong lighting. The four methods can be smoothly switched using keyboard events, which are detailedly described in the following user guide section.

The tree can be texture mapped. And the material and shading method of each object can be switched independently and separately through keyboard events.

As in the previous project B, we can navigate our camera throughout the scene to view the light effects. And we can pause / start the robot and helicopter. Users can also switch between frustum and perspective view. In addition, the window can be resized with undistorted image and no slider bars.

User Guide

This user guide consists of three parts: Control light effects, control material effects, and control camera.

❖ Press 'H' or 'Close Controls' to hide the control bar.

Notes: Make sure you switched to your local chrome page or localhost server to see texture mapping.

Control light effects:

❖ Switch **shading** methods: Press '1''2' or '3' to change shading method of the whole scene from original (no light), Gouraud shading and Phong shading. Press '7''8''9' or '0' to switch between two shading methods of each object. For example, '7' changes shading of helicopter, '8' changes that of tree, '9' changes that of robot, and '0' changes that of sphere. See Figure 2.

❖ Switch **lighting** methods: Press 'B' to switch between Phong and Blinn-Phong lighting of the whole scene at any time. See Figure 2.

❖ Switch **on/off** lamps: Press 'C' or the checkbox 'lampCameraOn' in the control bar to toggle camera headlight. Press 'X' or the checkbox 'lampWorld1On' in the control bar to toggle 2nd light source. Click the checkbox 'lampWorld2On' in the control bar to toggle 3rd light source. See Figure 3.

❖ **Move** lamps: Drag your mouse to move the second lamp. Click the button group 'up', 'down', 'left', and 'right' on the bottom of the web page to move the third lamp.

❖ Adjust **color** of lamps: Set RGB values of ambient, diffuse and specular amount for each light in the control bar. See Figure 3.

❖ Select **distance dependencies** for light sources: Select from the tree attenuation functions in the control bar to set distance dependent light sources.

Control material effects:

❖ Change **materials** for single object: Press 'W''A''S' or 'D' to change material of each object. For example, 'W' changes material of helicopter, 'A' changes that of tree, 'S' changes that of robot, and 'D' changes that of sphere. See Figure 4.

❖ Toggle **texture** mapping: Press 'T' or the 'texture' checkbox in the control bar to show / hide texture of the tree. See Figure 5.

Control camera:

- **Turn** the camera: Press 'I''J''K''L' to turn or tilt the camera's aiming direction up/left/ down/ right without moving the camera.
- **Move** the camera: Press ←↑→↓ to move the camera horizontally/vertically without changing the aiming direction of camera. Press +/- to move the camera forward/backward in gaze direction.
- **Frustum** view: Click on the 'frustum' checkbox in the control bar to switch to frustum view on the left side. And enter numbers in the edit-boxes below the checkbox to adjust parameters of frustum view.

Result

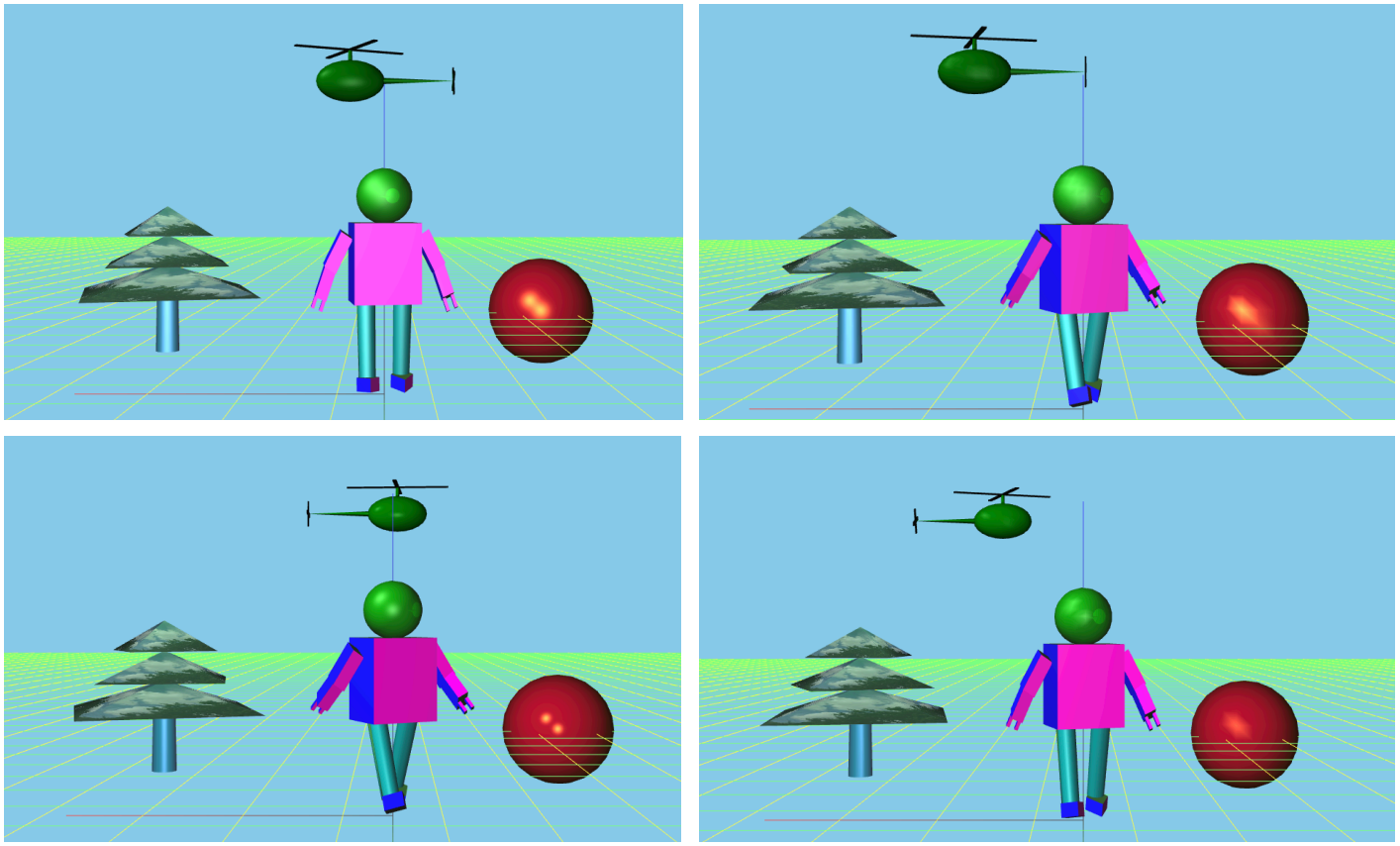

Figure 2. (top left) Phong shading with Blinn-Phong lighting. (top right) Gouraud shading with Blinn-Phong lighting. (bottom left) Phong shading with Phong lighting. (bottom right) Gouraud shading with Phong lighting.

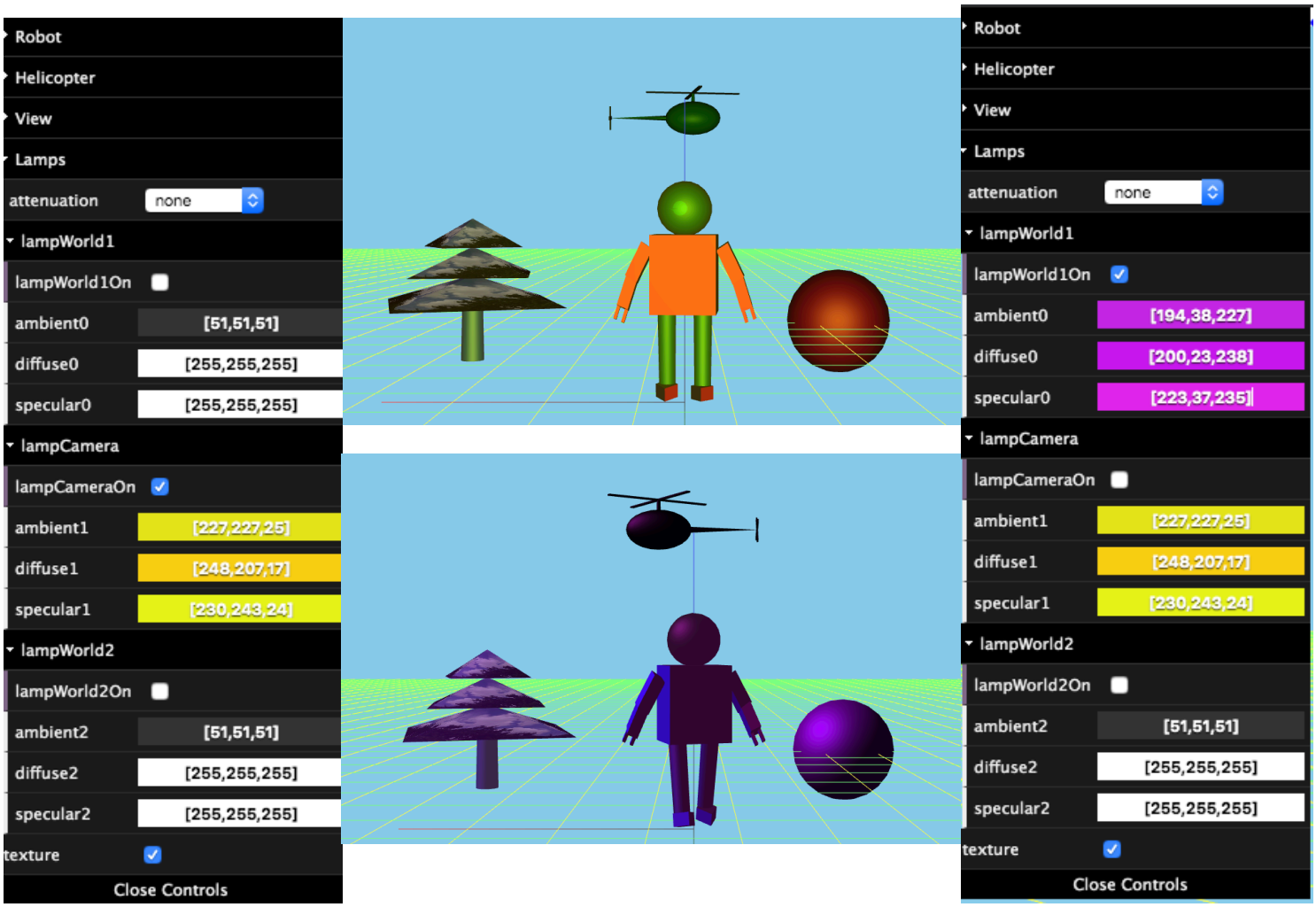

Figure 3. (left and middle top) Only switched on camera headlight. And then set light color to yellow, providing middle top view. (right and middle bottom) Only switched on world lamp 1 and changed light colors to purple, providing middle bottom scene.

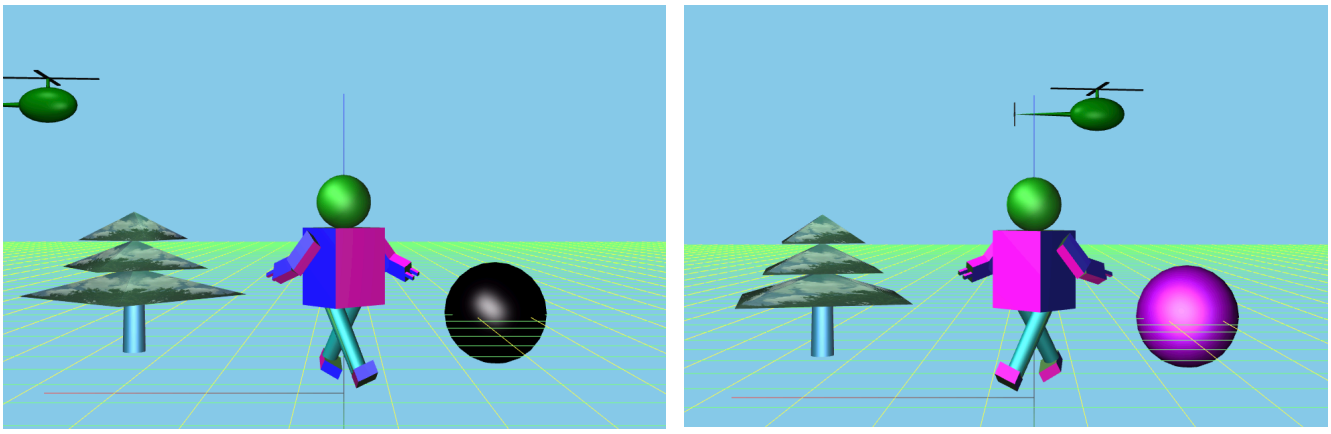

Figure 4. Change material of the sphere only.

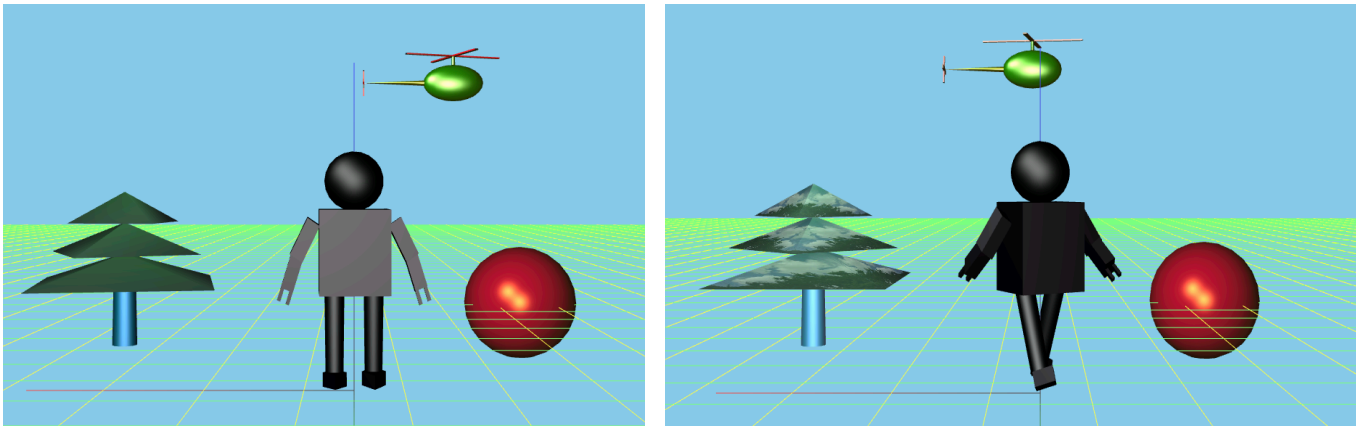

Figure 5. Toggle texture mapping. Switched materials for helicopter and robot.

Scene Graph

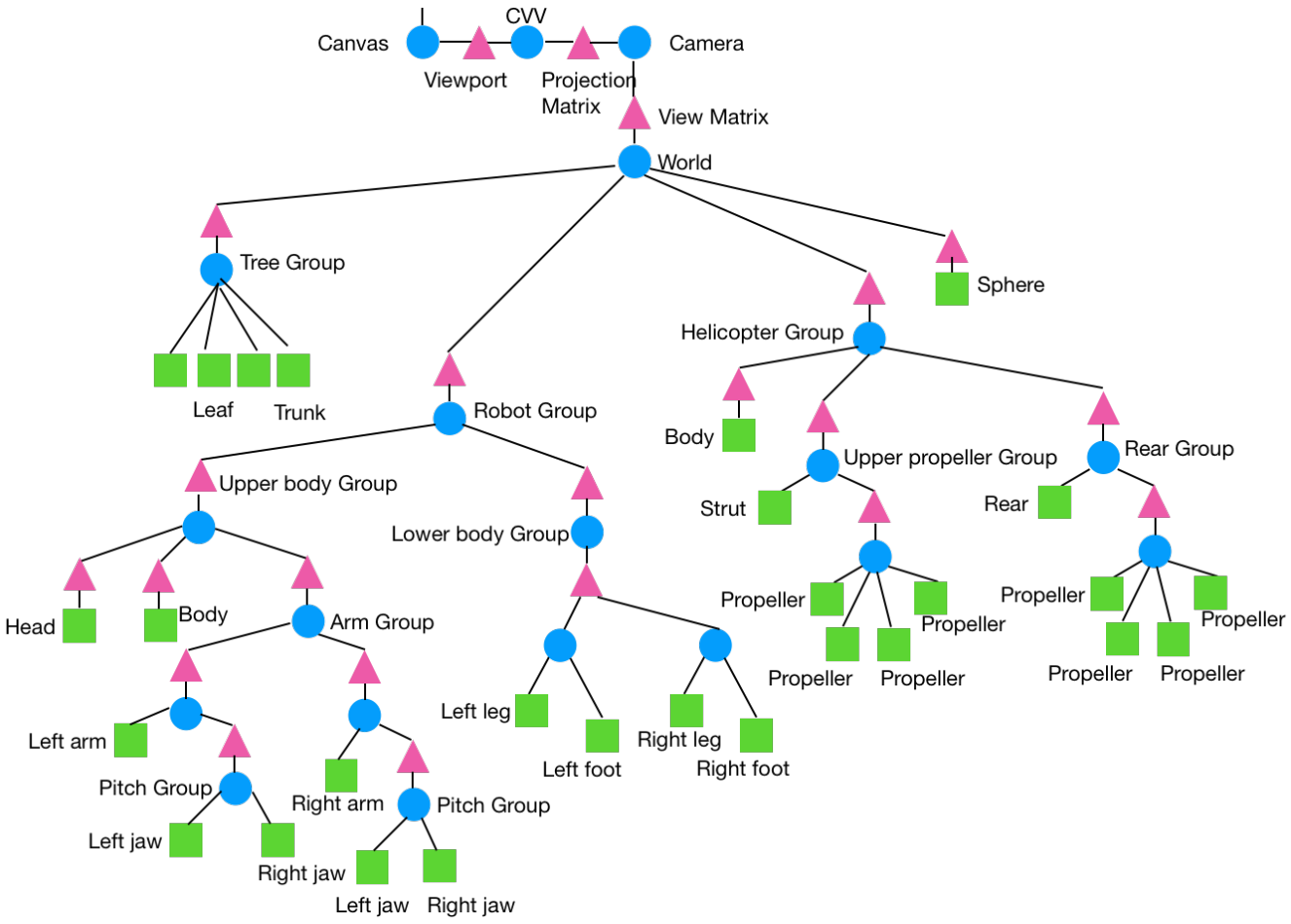

Figure 6. Scene Graph.