



CS 475 Computer Graphics

Assignment 3

Siddharth Mahesh Patil
21D070071

Deepasha
210070025

Indian Institute of Technology, Bombay
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1 Lighting

We have completely revamped the shader from the previous assignment.

Now, the shader is a per-pixel shader which supports multiple lights with direction and spread and an "illumination radius", i.e. a circle which is always lit up by the light, irrespective of its direction, and intensity. And, since there are multiple lights, it is possible that the illumination may cross 1, so we have clamped the values of illumination to be between 0 and 1.

Even the surface parameters can be different, but for this assignment, we have kept the same surface parameters for most of the objects, except a few, like the trees, the ground and the sky-box.

We have implemented a total of 7 lights in this assignment. 4 global light sources which are omni-directional and stationary (Only 2 of the are on by default), 1 light for Vector prime which is located on his chest and is directed towards the ground in front of him and has a limited spread, and 2 lights for Optimus Prime's headlights which are also directed with a limited spread.

Note: Although our code supports variable intensities, we have only set the values of intensity to 0 or 1, to indicate whether the light is on/off.

2 Sky-box

For the sky-box, we have used 6 images and textured them on the faces of a large cube to give the appearance of a sky. Therefore, as long as the camera is near the center of the cube, the sky-box will give a good enough approximation of an actual sky.

We have set the diffuse and the specular component of the sky-box to 0 because we don't want it to interact with the light sources. So, only the diffuse component is present which is set to 1 when there is at least one global light turned on, i.e. day time, and it is set to a very low value otherwise, i.e. night time.

3 Ground

For the ground, we have used a seamless lawn/turf texture with the texture wrap set to GL_REPEAT, because the lawn texture has to be repeated on the ground. We didn't use GL_MIRRORED_REPEAT because our texture was already seamless. We also used Mip-maps for this texture to reduce the computational loss and to avoid graininess of the ground surface which is far away from the camera.

We have also populated the ground with trees which are placed and oriented randomly (but the random number generator is seeded so as to give consistent output).

4 Cameras

We have implemented 3 cameras, 1 global camera, i.e. the camera that we control, and 2 fixed action cameras, 1 for Optimus Prime and one for Vector Prime, which follow them around and are fixed to them, i.e. any change in orientation of the transformer will lead to a change in the orientation of the camera.

5 Keyframes

The current state of the scene can be saved using 'S' and the user is also required to enter the frame number which corresponds to that scene. This is stored in keyframes_temp.txt and the user can add these keyframes to his keyframes.txt or rename this to keyframes.txt and add the number of frames in the first line to use this file for loading the animation.



The first line in keyframes.txt should be the total number of frames in the animation. This can be more than or equal to the actual total number of frames in the animation, but cannot be less than that.// To load the frames, the user can press the 'L' key which will read keyframes.txt and load the scenes/frames present in it and also generate the intermediate frames via linear interpolation (of float type variables). Then ,by pressing 'P', the loaded animation will be displayed and by pressing 'R', the window will reshape to 1280x720 (720p) and start rendering and saving the loaded animation.

6 Usage

To toggle keyframe control, press K, then:

- S - Saves the current parameters in keyframe_temp.txt
- L - Loads the parameters from keyframe.txt
- P - Plays the animation
- S - Plays and saves the frames of the anumation in the folder named "frames"

To toggle Camera and Lights control, press M, then:

- 1 - To switch to the camera
- 2 - To switch to the action camera of Vector Prime
- 3 - To switch to the action camera of Optimus Prime
- 4 - To toggle the global_light_1 on/off
- 5 - To toggle the global_light_2 on/off
- 6 - To toggle the global_light_3 on/off
- 7 - To toggle the global_light_4 on/off
- 8 - To toggle the headlights of Vector Prime
- 9 - To toggle the headlights of Optimus Prime
- W,S - To rotate the camera along the x axis
- A,D - To rotate the camera along the y axis
- Q,E - To rotate the camera along the z axis
- Num-pad Keys:
 - 4,6 - To translate the camera along the x axis
 - 8,5 - To translate the camera along the y axis
 - 7,9 - To translate the camera along the z axis



7 Animation

7.1 Script of Story

In the Cybertronian battleground, Optimus Prime faced Vector Prime in a fierce clash. Initially overpowered, Optimus discovered Vector's hidden core at sunset. With this knowledge, Optimus struck at the heart, sending Vector Prime fleeing in fear through the night sky. The once-mighty Vector Prime now soared in panic, while Optimus stood triumphant on the battlefield.

In short, at the start of the animation, Vector Prime and Optimus Prime start "fighting" and at the midpoint of the animation, we showcase the 4 global lights and then we show the transformers' headlights and their action cameras.

7.2 Youtube Link

No audio

Audio

8 Bibliography

The following references were used for understanding the topic of the assignment better and for aiding the design and implementation of transformers.

1. Tutorial 8 - Computer Graphics
2. Skybox Texture
3. Ground Texture