CS 33400
Fall 2014
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Due: Monday September 22 at 6:00am

Assignment 3—Hello 3-D world

In a nutshell

Implement an interactive 3-D computer graphics application.

Details

1. Planar pinhole camera class
   - Constructor
   - Rotations (pan, tilt, roll)
   - Translations (left-right, up-down, front-back)
   - Zooming (in and out, a.k.a. changing the focal length)
   - Interpolation: given a second camera and a fractional number compute an intermediate camera by linear interpolation between the two cameras;
   - Save to text file, load from text file;
   - Visualization: draw the camera, given another camera and a framebuffer.
2. Triangle mesh class
   - Stores an array of triangle vertices, an array of vertex colors, and an array of triangle connectivity data;
   - Constructor: loading from file;
   - Constructor: axis aligned box;
   - Center: computes center of mass;
   - Position: translates the mesh to a new center of mass;
   - Scale: scales the mesh about its center of mass;
   - Rotate: rotates mesh about arbitrary axis theta degrees;
   - RenderWireFrame: given a camera and a framebuffer, draw the triangle mesh in wire frame mode, that is draw the edges of the triangles as line segments, with vertex color interpolation.
3. Example
   - Make a 3-D scene with the triangle meshes given; make sure that the application starts up with a meaningful view of the scene;
   - Allow the user to navigate the camera through the GUI;
   - Create a camera path that shows the scene you built; save the path to a text file; the path should have 3 or more key frames and 300 frames total; allow the user to render the path by pressing a Play button;
   - Path should show all aspects of planar pinhole camera control (i.e. 3 translations, 3 rotations, and zooming)

- Save the frames rendered by your path as consecutively numbered image files (e.g. in the tiff format); make a 10 second 30 frames per second movie from the stills; use compression; the movie file should be 10MB or less.
    - You can use any external video making utility you wish. Some free examples include VirtualDub, Windows Expression Encode, Windows Movie Maker, and Imagemagick.
- To generate an mpeg movie using Imagemagick from consecutively numbered tiffs, the command is "convert image*.tif movie.mpeg"

4. Extra credit
    - Non-linear camera interpolation (3%)
    - Morph triangle mesh to sphere (2%)
    - A cylinder constructor of the TriangleMesh class (2%)
    - A sphere constructor of the TriangleMesh class (2%)
    - Nice scene, i.e. complex geometry, animation (x%)

Turn in

- Submit your code
- A README.txt description of your GUI
- The path text file
- Movie file
- An image of your planar pinhole camera visualization
