CS 33400, Fall 2025

Due Saturday, September 20 at noon

Assignment 3—Hello 3-D world

In a nutshell

Implement an interactive 3-D computer graphics application.

Details

1. Planar pinhole camera class
   1. Constructor
   2. Rotations (pan, tilt, roll)
   3. Translations (left-right, up-down, front-back)
   4. Zooming (in and out, a.k.a. changing the focal length)
   5. Interpolation: given a second camera and a fractional number compute an intermediate camera by linear interpolation between the two cameras;
   6. Save to text file, load from text file;
   7. Visualization: draw the camera in wireframe, given another camera and a framebuffer.
2. Triangle mesh class
   1. Stores an array of triangle vertices, an array of vertex colors, and an array of triangle connectivity data;
   2. Loading from binary file;
   3. Set as axis aligned box;
   4. GetCenter: computes center of mass (centroid);
   5. Position: translates the mesh to a new center of mass;
   6. Scale: scales the mesh about its center of mass;
   7. Rotate: rotates mesh about arbitrary axis theta degrees;
   8. 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
   1. Make a 3-D scene with the triangle meshes given; make sure that the application starts up with a meaningful view of the scene;
   2. Allow the user to navigate the camera through the GUI; You can add a few buttons or use keyboard input, or mouse input.
   3. 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;
   4. Path should show all aspects of planar pinhole camera control (i.e. 3 translations, 3 rotations, and zooming)
   5. 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.
4. Extra credit
   1. Non-linear camera interpolation (3%)
   2. Morph triangle mesh to sphere (2%)
   3. A cylinder constructor (or Set method) of the TriangleMesh class (2%)
   4. A sphere constructor of the TriangleMesh class (2%)

Turn in (on Brightspace, don’t zip everything)

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

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