CS-AD-216: Foundations of Computer Graphics

Assignment 6, Due: November 3

Instructions:

- Assignments can be submitted in groups of at most three. The purpose of groups is to learn from each other, not to divide work. Each member should participate in solving the problems and have a complete understanding of the solutions submitted.
- Submit your assignments as a zip file (one per group).

Problem 1 (10 points)**.**
Add code to `Camera.js` (in `Common` folder) so that we are able to move the camera using the keyboard as follows:

1. Up and Down arrow keys should tilt the camera up and down respectively. These should be rotations by angles θ and $-\theta$ respectively about the x-axis of the camera coordinate frame.
2. Left and Right arrow keys should tilt the camera left and right respectively. These should be rotations by angles θ and $-\theta$ respectively with respect to the y-axis of the camera coordinate frame.
3. `Ctrl + Up` should move the camera origin up (along the y axis in the camera coordinate frame) by a distance δ. The actions for `Ctrl+Down`, `Ctrl+Left` and `Ctrl+Right` are define analogously.
4. The keys '`a`' and '`z`' should move the camera origin forward and backward respectively i.e., '`a`' should move the camera origin by a distance δ along the negative z direction of the camera coordinate frame and '`z`' should move the camera origin by a distance δ along the positive z direction of the camera coordinate frame.

Rather than hardcoding values of θ and δ, define them as variables so that the values may be easily modified. Test your code with code in the directory "`VirtualTrackball and Camera`".

Problem 2 (10 points)**.**
Consider an axis parallel square of side length 2 with center at $(0, 0, 0)$ on the xy-plane. Construct a mesh as follows: subdivide the square into an $n \times n$ grid of smaller squares and then split each of those squares into two triangles using a diagonal. Modify the coordinates of a vertex with coordinates $(a, b, 0)$ in the mesh to $(a, b, f(a, b))$ where $f(a, b)$ is some function. The mesh then represents a portion of the surface $z = f(x, y)$. Display the mesh using index buffers.

Try the following function: $f(a, b) = 0$ if $a = b = 0$ and otherwise $f(a, b) = \frac{sin(\pi r)}{\pi r}$ where $r = \sqrt{a^2 + b^2}$.

You can also replace the function $f(a, b)$ by a function $f(a, b, t)$ which depends on the time t. Try the following function: $f(a, b, t) = cos(a + b + t)$.

Your code should have the virtual trackball enabled so that the user can move things around.