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Term Project Proposal – 3D Renderer / Editor

The long term goal for my project is to create a 3D editor that would take in a 3D .obj file, display it, edit the vertices and save changes to the file. For this I will not be using any modules other than Tkinter, therefore I will be writing my own 3D interpreter.

My 3D interpreter will take use of 3 dimensional vectors. I will be creating a Vector3 class that will be represented by x, y, z coordinates and will include common vector operations such as the dot and cross product. To translate the 3D positions of every vertex of an object I will be using an imaginary camera that will be defined by two orthogonal unit vectors. These vectors will be representing the x and y coordinates of the display and will allow me to determine the rotation of the camera. The 3D position of the vertices will be converted into x, y coordinates using the dot product operation in my Vector3 class. For each vertex, I will find the difference vector of the camera’s position vector and the vertex’ position vector. I will than take the dot product of this difference vector with the x and y vectors of the camera and the results will represent the x and y coordinates of the vertex on the display window. I will inversely scale the results according to the distance of the vertex from the camera in order to create an illusion of perspective.

After finding what all vertices translate to in terms of x and y coordinates, I will make a list of all the faces of the object that are going to be rendered. The faces are defined inside the .obj file by the vertices that they connect. So every face inside the render list will be a list of vertex indices. I will order the render list according to the average distance of the vertices of a face. In the redrawAll function, I will go through every face, find the corresponding positions of all its vertices and draw a polygon in between these vertices in order to display the face.

In order to receive all the information about the vertices and faces of an object I will have to parse through a .obj file. The .obj file has a very simple structure, in which every line that starts with a ‘v’ defines a vertex and the position of the vertex is simply defined by the following number on the same line. Every face of an object is defined in a similar way, the only difference being that the line starts with an ‘f’. My code will loop through every line in the .obj file and append it to a vertex list if it is a vertex line and to a face list if it is a face line. This way, every separate 3D object inside the .obj file will be defined by a list of vertices and faces inside my code.

The ‘editing’ part of my program will be handled by an array of textboxes to the right of the window. Every object will have 3 textboxes for all of its vertices and these textboxes will represent the x, y, z coordinates of the vertex. Changing the values inside these textboxes will change the respective values inside the vertex list of the object in real time and render the changes.