3D Renderer Using Linear Algebra operations

Mahmoud Fathy Mohamed

20230375

How it works

Each cube is a mesh and meches are composted of triangles which are then used to project (flatten) the image into the 2d screen.

Each triangle is composed of 3 vertices going in clockwise order, the operations themselves are applied to the vertices which are just a position in 3D space

The vertices are in always defined in clockwise order so that the sueface normal is always pointing in the same direction relative to the surface which is used in determining how aligned the surface is with the camera, its useful for simple lightning and not rendering triangles facing away from the camera.

There are three main functions:

- Translate
- Rotate(3 functions for rotation about the X, Y, Z Axises)
- Scale

Each triangle has its own scale, rotation and translation.

First of all the the triangles get translated relative to the original mesh (cube for example), then the mesh itself applies all the operations to each triangle in relation to the origin point

Note: its important for the operations to always be applied in scale > rotation > translation order

Then finally the program gets the camera data and moves everything in the opposite direction to give the illusion of moving the camera itself, for example if the camera moves 2 units in the positive z direction everything moves 2 units in the negative z direction.