Assignment 2

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***Abstract*—Rendering and manipulation of 3D models.**
Learning Objectives:
Creating 3D models (using a modeling tool)
Importing 3D mesh models
Transformations of 3D objects
View transformations
Picking model objects and their constituent parts in 3D

I. Introduction

In this assignment, I am using the models created in Blender and rendering it using WebGL. I am having certain operations like scaling, translating, moving camera which I am performing on the models.

II. Related Work

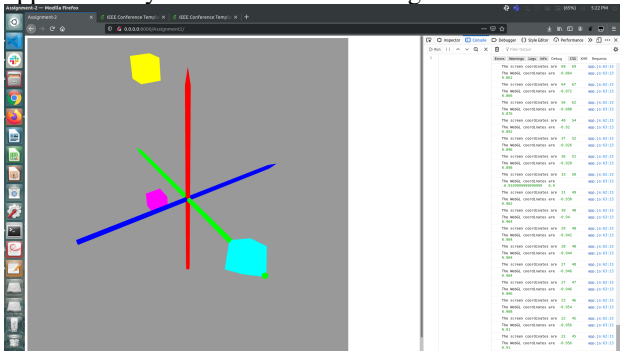
A. Brief Intro of the Assignment

I am using Blender to create 3 models.One of them is Cube, another is octahedral and I am using cylinder with cones for creating the 3 coordinate axes.

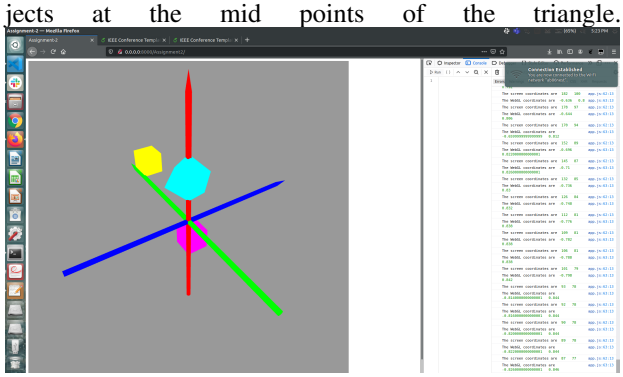
I am importing the 3d mesh models as .OBJ files.

The assignment has steps A,B,C,D,E,F,G,H,I.Also steps D to I can be performed in any order.

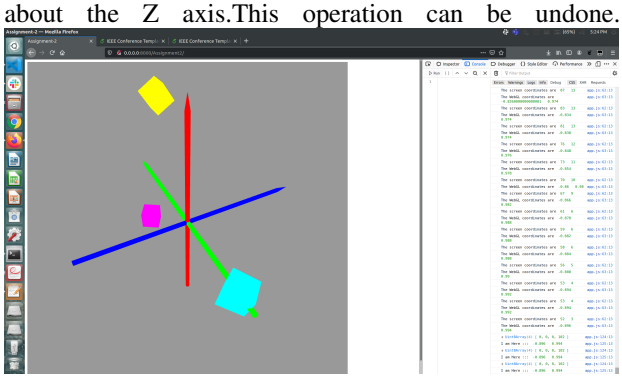
- In step A, we are drawing the axes of the scene.
- In step B,I am importing the 3d models.I am using .obj format.
- In step C,I am rendering the model objects positioned at the origin.Each model object is assigned a different colour.
- In step D,I am positioning the objects at the corners of a triangle in X-Y plane.This triangle is approximately centered at the origin of the scene.



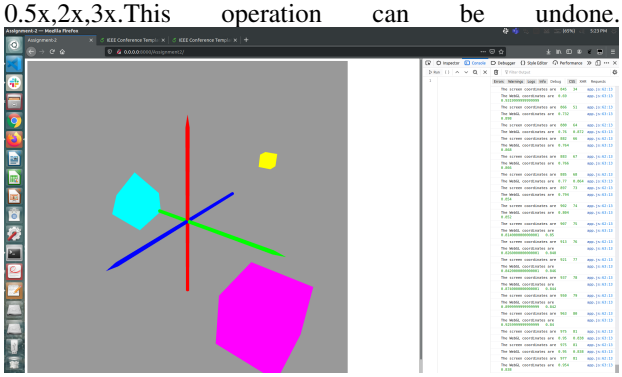
- In step E, I am re-positioning the objects at the mid points of the triangle.



- In step F, I am rotating each object by 45 degrees about a point.One object is rotated around X axis,one about Y axis and the third about the Z axis.This operation can be undone.



- In step G, I am scaling the objects by 0.5x,2x,3x.This operation can be undone.



- In step H, I have implemented object and face picking.I used readPixels() function to get the pixel values at a particular point and using fragment shader, I turned it

into black colour.

- In step I, I am changing the camera coordinates based on mouse coordinates for good visualization.

B. Step A

In step A,I am using 3 cylinders with cones on top as the coordinate axes.Initially the cylinder is aligned along Y-axis.

var shapeZAxis=new Mesh(canvas,Math.PI/2,[1,0,0]); I am rotating the cylinder 45 degrees anti-clockwise in x-direction.

var shapeYAxis=new Mesh(canvas,0,[1,0,0]); I am rotating the cylinder 0 degrees clockwise.This is correctly aligned.

var shapeXAxis=new Mesh(canvas,-Math.PI/2,[0,0,1]); I am rotating the cylinder 45 degrees clockwise in z-direction.

C. Step B

I am using WebGL OBJ loader to load the models.

Here this.objectStr is "object.obj". const mesh = new OBJ.Mesh(this.objectStr); this.object = mesh; OBJ.initMeshBuffers(gl, this.object);

Here this.object is my object which I am rendering.

D. Step C

Here I am rendering the objects at the origin.The translation is [0,0,0] for all the loaded models.

E. Step D

I am positioning the objects at the 3 corners of the triangle in the X-Y Plane in the world coordinates. The triangle coordinates are [4,4,0],[-4,0,0],[4,-4,0].I am translating them using the mat4.translate function.

F. Step E

Here I am re-positioning the models on the 3 sides of the triangle. The triangle coordinates are [4,0,0],[0,2,0],[0,-2,0].I am translating them using the mat4.translate function.

G. Step F

I am rotating each object by 45 degrees about a specific axis.I am not rotating the object by 90 degrees as the object is symmetric and rotating by 90 degrees won't show any changes.I am updating worldMatrix for each object here.

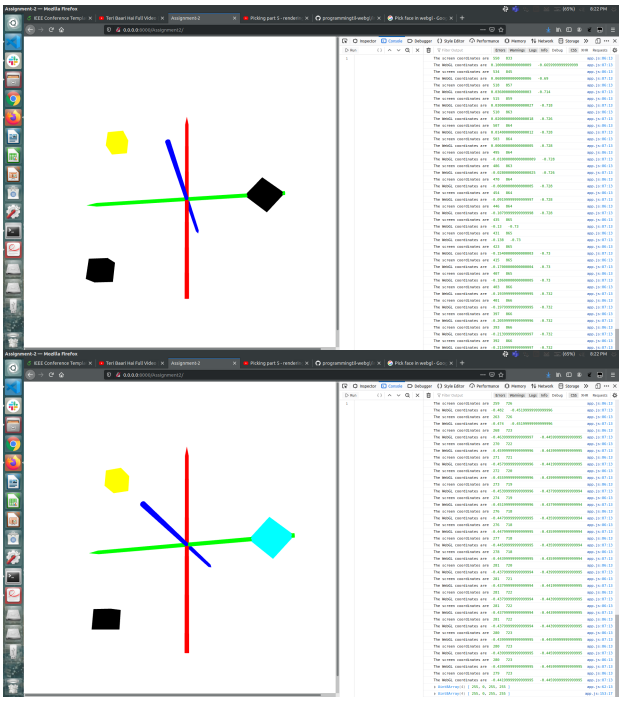
mat4.rotate(this.worldMatrix,this.worldMatrix,this.rotationAngle,this.rotationAxis);

H. Step G

Here I am scaling each of the objects.I am scaling them by 0.5x,2x and 3x.I am using mat4.scale function here.

I. Step H

I am using the readPixels() function to implement the Face and object picking.



J. Step I

Here I am using mouse coordinates to change the view matrix.In the mat4.lookAt() function I am passing the webgl coordinates of the mouse and moving the camera(which is simulated by mat4.lookAt() matrix). Here finalX and finalY are the converted webgl coordinates ranging from -1 to +1 which was then mapped to -9 to 9 for better view of lookAt() function.

mat4.lookAt(this.viewMatrix,[finalX,finalY,finalX+finalY-5],[0,0,0],[0,1,0]);

Conclusion

I have learnt a great deal of stuff using the assignment.I learnt about using blender and loading the models.I learnt coordinating various Javascript files and having coordination between them.I learnt a lot about how to debug javascript files and look through the internet for solutions.I also implemented vertex shader with model,view and projection matrices and did transformations using glMatrix.js .I also learnt picking objects in webgl using readPixels() function.

Acknowledgment

I would like to thank the professors for teaching me a great part of theory which I could implement in this assignment.Thanks to TA's for helping me with issues which I had during the assignment.

References

References

[1] https://learnopengl.com/Advanced-OpenGL/Depth-testing
[2] https://www.youtube.com/watch?v=2C6QAVc0list=PLPqKsyEGhUnaOdIFLKvdkXAQ
[3] https://webglfundamentals.org/webgl/lessons/webgl-load-obj.html
[4] https://www.youtube.com/watch?v=BW3D9WwalQE
[5] https://www.youtube.com/watch?v=dNVzqdYFbFMlist=PLPqKsyEGhUnaOdIFLKvdk
[6] https://www.youtube.com/watch?v=2C_6QAVc0list=PLPqKsyEGhUnaOdIFLKvdkXA

[7] https://github.com/frenchtoast747/webgl-obj-loader