CSC4140 Assignment 2

Computer Graphics

February 23, 2022

Transformation

This assignment is 10% of the total mark.

Strict Due Date: 11:59PM, Feb 25^{th}th , 2022

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This assignment represents my own work in accordance with University regulations.

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1 Transformations

1.1 Definition of parameters

The parameters for this assignment are defined in **config.ini**, as shown in figure 1. Here are explanations of each parameter:

tx, ty, tz: The offsets of x, y, z for translation in the model translation matrix **T**, respectively.

sx, sy, sz: The multiples of x, y, z for scaling in the model scaling matrix **S**, respectively.

p0x, p0y, p0z, p1x, p1y, p1z, angle: Denote rotational endpoints to be P_0, P_1. **p0x**, **p0y**, **p0z** represent the coordinates of point P_0 under the model coordinate system. **p1x**, **p1y**, **p1z** represent the coordinates of point P_1 under the model coordinate system. $P_1 - P_0$ specifies the rotational axis for the model rotation. **angle** specifies the rotational angle.

eyePosx, eyePosy, eyePosz: Coordinate x, y, z components of the eye position for viewing transform, respectively.

eyeFov: Field-of-view for perspective projection.

aspectRatio: The ratio between the length and the width of the near projection plane.

zNear: The z-coordinate value of the near projection plane.

zFar: The z-coordinate value of the far projection plane.

pt, ind: **pt** refers to the positions of three points (with their respective x, y, z coordinates) for a triangle under model coordinate. **ind** specifies their order of drawing.

config.ini

```
; translation params
[translate]
tx=2
ty=0
tz=0
; scaling params
[scale]
sx=0.5
sy=0.5
sz=1
; rotational params
[rotation]
angle=0
p0x=0
p0y=0
p0z=0
p1x=0
p1y=0
p1z=1
; viewing eye position params
[view]
eye_posx=0
eye_posy=0
eye_posz=0
; projection parameters
[projection]
eye_fov=120
aspect_ratio=1
zNear=0.5
zFar=3
; specicfy 3 pts of the triangle
[three_d_pts_and_inds]
pt=0,0,2
pt=1,1,1
pt=-1,1,1
ind=0,1,2
```

Figure 1: Parameters' definitions

1.2 Running commands and results

1.2.1 Image output mode

Do compilation and linking first. Then run the executable object file in Linux terminal with command:

```
./main -o output.png
```

This takes in the parameters (rotaional angle, etc) specified in **config.ini** as mentioned, and output the rasterized triangle image saved as file **result.png**. Sample resulting output figure is shown in figure 2 (with parameters corresponding to figure 1).

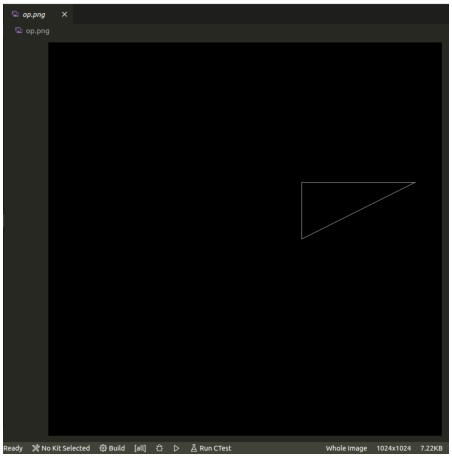


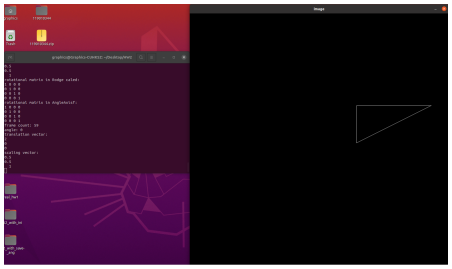
Figure 2: **result.png** with **config.ini** as setting

1.2.2 Interactive mode

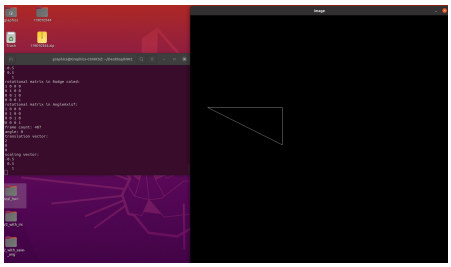
To allow the user to adjust parameters more conveniently, the following command can be used for the executable object file:

```
./main
```

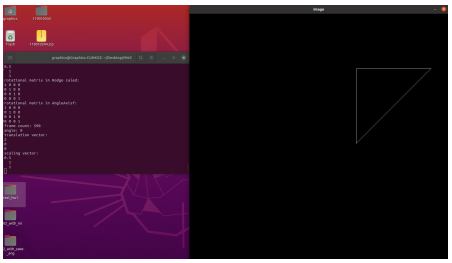
The results for original image and pressing keys for scaling are shown in figure 3, where 3(a) shows the unchanged image and 3(b), 3(c), 3(d) show results for scaling along x, y, z axises by pressing keys, respectively.



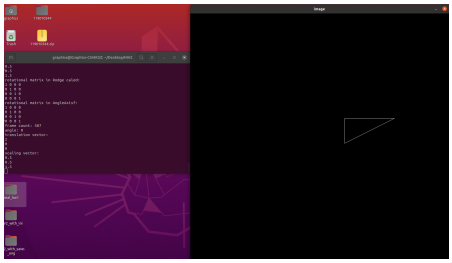
(a) Original image



(b) Pressing 'f' or 'c' for x-axis scaling



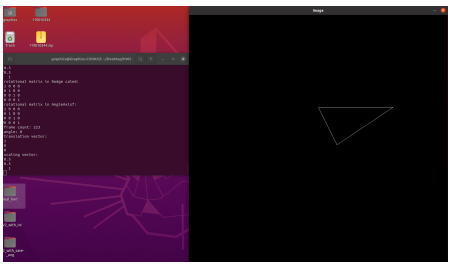
(c) Pressing 'g' or 'v' for y-axis scaling



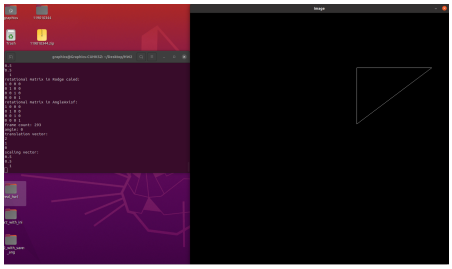
(d) Pressing 'h' or 'b' for z-axis scaling

Figure 3: Results for original and scaling cases under interactive mode

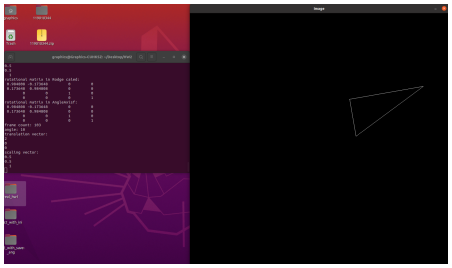
The results for interactive translation and rotation are shown in figure 4, where 4(a), 4(b) show results after translations along x, y axises, respectively, and 4(c), 4(d) show results after rotation counterclockwise and clockwise, respectively.



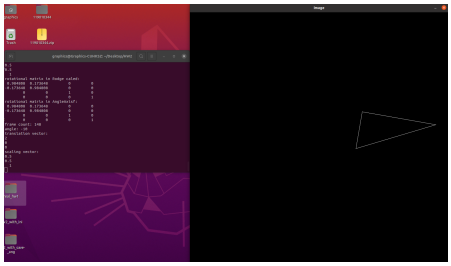
(a) Pressing 'j' or 'l' for x-axis translation



(b) Pressing 'k' or 'i' for y-axis translation



(c) Pressing 'a' for positive-angle rotation



(d) Pressing 'd' for negative-angle rotation

Figure 4: Results for translational and rotational cases under interactive mode