Exercise 3

Kevin Serrano, Gianni Scarnera

24 October 2012

Part 3.2 Transformation and Translation

First we have to calculate the dimension of the near plane. Given the angle in y-axis from the camera to the near plane and the distance of the near plan, we can calculate the distance of the $top, bottom, left, right$ from the center of the near plane. Then the half-height is given by trigonometric rule

Figure 1: Camera, near plane and far plane

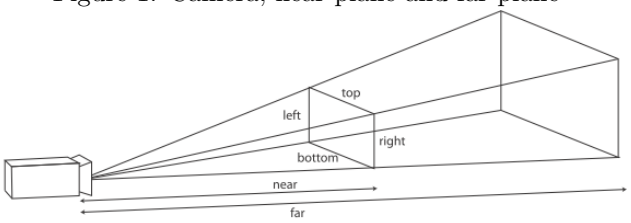
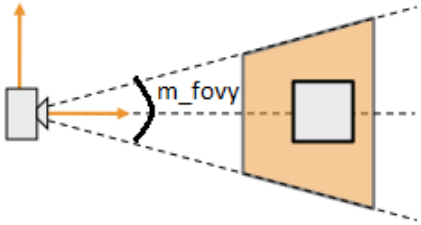


Figure 2: angle



$$halfheight = nearPlane \cdot tan(m_{fovy}/2)$$

where m_fovy is in degree. Then we can do a ration to figure out the half-width and then

$$halfwidth = halfheight \cdot Height/Width$$

where Height and Width are from the camera. Then we can juste compute the $top, bottom, left, right$ as $bottom = -halfeight; top = halfheight; left = -halfwidth; right = halfwidth;$
Then the projection matrix is given in the course and is

$$\begin{pmatrix} (2 \cdot n)/(r-l) & 0 & (r+l)/(r-l) & 0 \\ 0 & (2 \cdot n)/(t-b) & (t+b)/(t-b) & 0 \\ 0 & 0 & -(f+n)/(f-n) & -(2nf)/(f-n) \\ 0 & 0 & -1 & 0 \end{pmatrix}$$

Then in the cube.vs file, we applied the transformation in this order to get the gl_position :

$$gl_{Position} = (ProjectionMatrix * WorldCameraTransform * ModelWorldTransform) * gl_{Vertex};$$

The translation matrix is given in the course:

$$\begin{pmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1 & t_z \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

so we can return this matrix in $getTranslationMatrix()$

Now the difficulty to implement the $translateWorld()$ and $translateObject()$ functions is that we have to do the multiplication in correct order, because matrices multiplication isn't ever commutative as we've seen in lecture. For $translateWorld()$, the translation must be applied after all previous matrices and it's the inverse for $translateObject()$, i.e : for $translateWorld()$

$m\_transformationMatrix = getTranslationMatrix(\_trans) \cdot m\_transformationMatrix;$

and for $translateObject()$

$m\_transformationMatrix = m\_transformationMatrix \cdot getTranslationMatrix(\_trans);$

where $m\_transformationMatrix$ is the current transformation matrix.