COMPUTER GRAPHICS

ASSIGNMENT NO:- 6

Vanishing Point

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0.1 Introduction

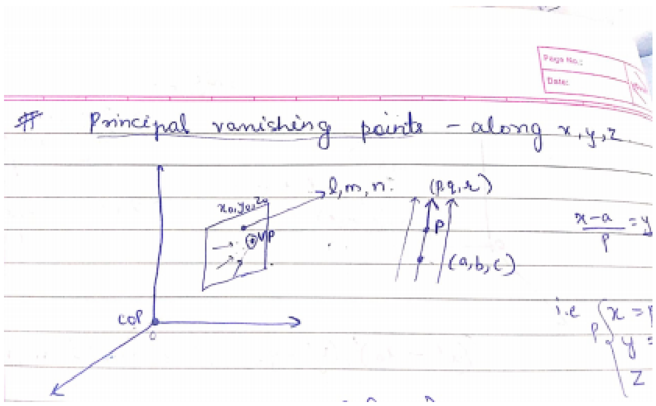

Figure 1: principal vanishing point

- Any set of parallel lines that are not parallel to the projection plane will converge to a vanishing point.If the set of lines is parallel to one of the three principal axis then it is called a principal vanishing point.

- Vanishing points corresponding to the three principle directions are referred to as "Principle Vanishing Points (PVPs)". We can thus have at most three PVPs. If one or more of these are at infinity (that is parallel lines in that direction continue to appear parallel on the projection plane), we get 1 or 2 PVP perspective projection.

- P0(a,b,c) is a point on line.

- Point D(p,q,r) is the direction vector

- Let T be the Transformation matrix:Any Point P(x,y,z) at infinity on parallel lines can be written as:
  P(x, y, z) = lim(t→∞) P0(a, b, c) + D(p, q, r)∗ t

- Let T be the Transformation matrix:

$$T = \begin{bmatrix} d & 0 & 0 & 0 \\ 0 & d & 0 & 0 \\ 0 & 0 & d & 0 \\ l & m & n & 0 \end{bmatrix}$$

- P'(x0, y0, z0) be the transformed point on screen.

  P' = T $*$ P(x, y, z)

  i.e

  $$\text{P'(x0, y0, z0)} = \begin{bmatrix} d & 0 & 0 & 0 \\ 0 & d & 0 & 0 \\ 0 & 0 & d & 0 \\ l & m & n & 0 \end{bmatrix} * \text{P(x, y, z)}$$

  i.e

  $$\text{P'(x0, y0, z0)} = \begin{bmatrix} d & 0 & 0 & 0 \\ 0 & d & 0 & 0 \\ 0 & 0 & d & 0 \\ l & m & n & 0 \end{bmatrix} * \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

  i.e

  $$\text{P'(x0, y0, z0)} = \begin{bmatrix} d & 0 & 0 & 0 \\ 0 & d & 0 & 0 \\ 0 & 0 & d & 0 \\ l & m & n & 0 \end{bmatrix} * \begin{bmatrix} a+pt \\ b+qt \\ c+rt \end{bmatrix}$$

- Solving this equation and applying the limit to t gives us value of P'(x0,y0, z0) as follows:

  $$\text{P'(x0, y0, z0)} = \left(\frac{d*p}{lp+mq+nr}, \frac{d*q}{lp+mq+nr}, \frac{d*r}{lp+mq+nr} \right)$$

0.2 Results

For principal vanishing point in:

- x - direction will have D(p,q,r) = (1,0,0) and so,
  P'(x0, y0, z0) = ($\frac{d}{l}, 0, 0)$
- y - direction will have D(p,q,r) = (0,1,0) and so,
  P'(x0, y0, z0) = (0, $\frac{d}{m}, 0)$
- z - direction will have D(p,q,r) = (0,0,1) and so,
  P'(x0, y0, z0) = (0,0, $\frac{d}{n})$

0.3 References

- Class notes