EXPERIMENT NO. 06

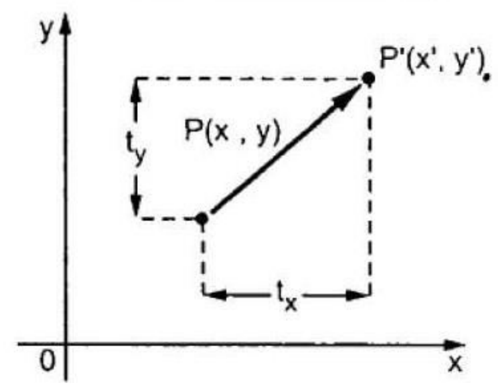
AIM: To apply the basic 2D transformations such as translation, Scaling, Rotation for a given 2D object.

SOFTWARE AND HARDWARE REQUIRED: TurboC and Pentium IV and above.

THEORY:

TRANSLATION: -

It is a process of changing the position of an object in a straight line path from one co-ordinate location to another. We can translate a two dimensional points by adding translation distance tx,ty to original co-ordinate position (x,y) to move point to new position (x,y) to (x',y') as shown in figure.



$$x' = x + tx$$
$$y' = y + ty$$

The translation distance vector point (tx,ty) is called a translation vector or shift vector. It is possible to express translation equation in a single matrix equation as a column vector to represent co-ordinate positions and translation vector or shift vector.

It is possible to express translation equation as a single matrix using column vector to represent co-ordinate position and translation vector.

$$P = \begin{bmatrix} x \\ y \end{bmatrix} \quad P' = \begin{bmatrix} x' \\ y' \end{bmatrix} \quad T = \begin{bmatrix} tx \\ ty \end{bmatrix}$$

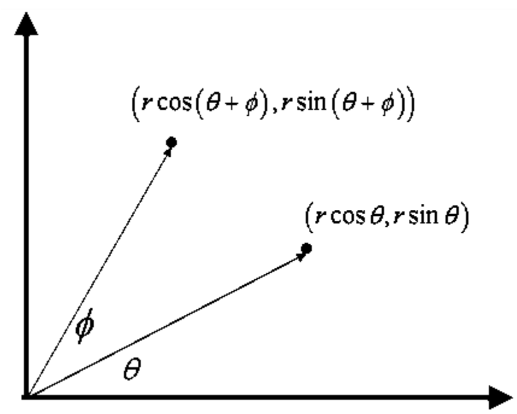
This allows us to write two dimensional translation equations to matrix form.

$P' = P + T$

ROTATION:-

A two dimensional rotation is applied to an object by repositioning it along a circular path in x-y plane.

To generate a rotation we specify rotation angle _ and position of rotation.



$$x' = r\cos(\Phi+\Theta)$$

$$y' = r\sin(\Phi+\Theta)$$

The equation for rotation is

$$x' = r\cos(\Phi+\Theta) \quad + r\sin(\Phi+\Theta)$$

$$y' = - r\sin(\Phi+\Theta) \quad + r\cos(\Phi+\Theta)$$

The rotation matrix can be given as

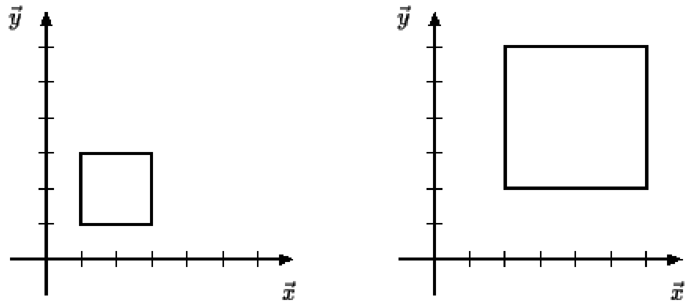
$$R = \begin{vmatrix} \cos\Theta & \sin\Theta \\ -\sin\Theta & \cos\Theta \end{vmatrix}$$

Homogeneous co-ordinate for rotation $R = \begin{vmatrix} \cos\Theta & \sin\Theta & 0 \\ -\sin\Theta & \cos\Theta & 0 \\ 0 & 0 & 1 \end{vmatrix}$

SCALING:-

A scaling transformation changes size of an object scaling factor Sx scale object in x-direction Sy in y-direction.

$$x' = x.Sx \qquad y' = y.Sy$$



The equation can be written as

$$\begin{bmatrix} x' & y' \end{bmatrix} = \begin{bmatrix} x & y \end{bmatrix} \begin{bmatrix} sx & 0 \\ 0 & sy \end{bmatrix}$$

Homogeneous co-ordinate for scaling.S =

$$\begin{bmatrix} Sx & 0 & 0 \\ 0 & Sy & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} x' & y' & 1 \end{bmatrix} = \begin{bmatrix} x & y & 1 \end{bmatrix} * \begin{bmatrix} s \end{bmatrix}$$

ALGORITHM:

TRANSLATION: -

1. Read vertices of polygon.
2. Read translation vector tx and ty.
3. For i = 0 to vertex * 2

   Add tx and ty to each polygon vertex.
4. End for.
5. Draw polygon.
6. Stop.

ROTATION: -

1. Read vertices of polygon.
2. Read angle of rotation.
3. For i = to vertex * 2

   Poly[i] = Poly[i]cosΘ - Poly[i+1]sinΘ

   Poly[i] = Poly[i]sinΘ - Poly[i+1]cos.Θ
4. Draw polygon.
5. Stop.

SCALING :

1. Read vertices of polygon.
2. Read scaling factor Sx and Sy.
3. For (i =0 to vertex*2)
   Poly[i] = Poly[i] * Sx
   Poly [i+1] = Poly [i+1] * Sy.
4. Draw polygon.
5. Stop.

CONCLUSION: Successfully Implemented basic 2D transformations such as translation, Scaling, Rotation for a given 2D object.

SIGN **GRADE**

DATE