

University of Science
FACULTY OF INFORMATION TECHNOLOGY

CS411 - Computer Graphics

Lab 03

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1 Draw any polygon

My drawing any polygon function is nearly similar to the polygon tool of MS Paint. First, you drag on the window to have a first line, then each time we click on the window, we will have a new line connected. At the end, we you right click, the shape will be connected by the first and the last point.

To implement this function, I have a class named "MyPolygon". The initial line of the polygon is created by dragging, so I continuously clear screen and clear the list of points of the polygon to update the points list and redraw. After the first edge having created, points clicked later are one by one added to the point list and the shape is continuously redrawn on the window.

2 Draw polygons chosen from the context menu

For other polygons chosen from the context menu such as triangle, rectangle,..., I implemented to draw them by dragging on the window. At first when the left button is clicked, I set the starting point for the polygon. Then, when the mouse is moved, I continuously clear the window, update points of polygon in the point list and redraw the polygon.

3 Affine transformation

3.1 Translation

I have a 1x2 matrix $\begin{bmatrix} trx & try \end{bmatrix}$ with trx and try is changed based on the orientation of motion of the user. For example $trx = 0$ and $try = -1$ when the user click up button. I traverse all the points in the point list, add each point with this transformation matrix then redraw the polygon with new translated point list.

3.2 Scaling

I have a 2x2 matrix $\begin{bmatrix} S_x & 0 \\ 0 & S_y \end{bmatrix}$ with $S_x = S_y = \sqrt{1.1}$ for scaling up the polygon 10% and $S_x = S_y = \sqrt{0.9}$ for scaling down the polygon 10%. To keep the polygon not moving when scaling, I choose the center as a fixed point in every polygon when transforming. I traverse all the points in the point list, update each point with the formula:

$$\begin{bmatrix} x' & y' \end{bmatrix} = \begin{bmatrix} x & y \end{bmatrix} \begin{bmatrix} S_x & 0 \\ 0 & S_y \end{bmatrix} + \begin{bmatrix} x_f & y_f \end{bmatrix} \begin{bmatrix} 1-S_x & 0 \\ 0 & 1-S_y \end{bmatrix}$$

3.3 Rotation

My pivot point is the center of the polygon. When rotating left $\alpha = -\frac{\pi}{180}$ and $\alpha = \frac{\pi}{180}$ when rotating right. I traverse all the point the the point list of polygon, update each point with the formula:

$$\begin{bmatrix} x' & y' \end{bmatrix} = \begin{bmatrix} x_r & y_r \end{bmatrix} + \begin{bmatrix} x-x_r & y-y_r \end{bmatrix} \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$$

4 Menu



This menu will appear when user clicks middle button. Functions such as “Triangle”, “Pentagon”, “Hexagon” gives choices to draw these shapes with additional characteristics such as equilateral or right equal for “Triangle”.

”Polygon” choice allows user to draw any polygon. This functions is quite similar to the one of MS Paint at the beginning. First, we drag to have one edge, then one by one left click to have next edges, and right click to connect the first and last points.

When choosing polygon such as “Triangle”, “Rectangle”, “Square”,... user will drag mouse to draw these polygon on the window.

5 Reference

- Slide 2D Transformation in the class.