Practicing 2D Objects and Application of W-to-V Mapping Adding Text and Image

Open GL Lab03

BSCS-514 Computer Graphics
Instructor Dr. Humera

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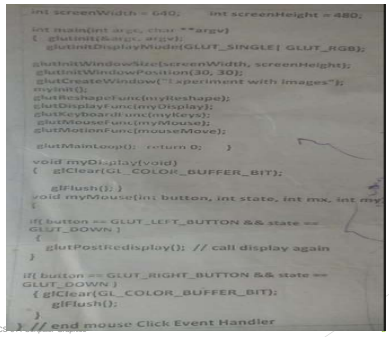
Step1: Add Reshape, Mouse and Keyboard Handler routine to **Lab 01**



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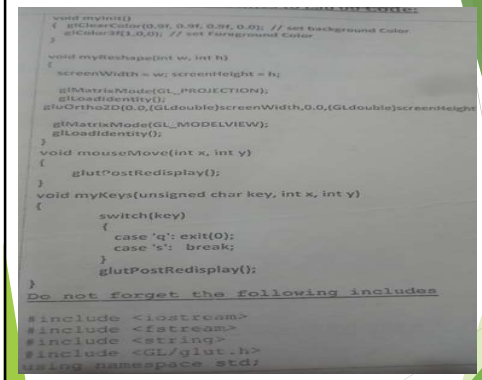

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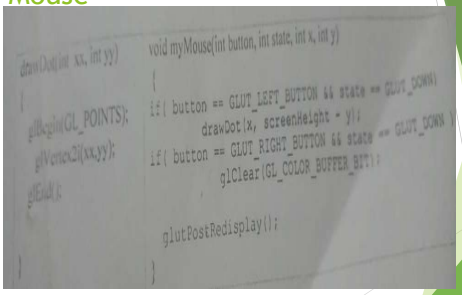
STEP 2: Placing Dots with Mouse



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Step 03: Free Hand Drawing with Fat Brush

Step 04: Using both ViewPort and World Window

Note: Now a mouse operation doesn't work why and what is the solution?

```
float minX = -10, minY=-10,
      maxX =10,maxY =10;
int   VP_bottom = 0,VP_left =0 ,
      VPWidth = 640, VPHeight = 480;

void drawAxis()
{
   glBegin(GL_LINES);
         glVertex2f(minX,0);
           glVertex2f(maxX,0);
   glEnd();

   glBegin(GL_LINES);
           glVertex2f(0,minY);
           glVertex2f(0,maxY);
glEnd();
```

```
void myDisplay(void)
{
glClear(GL_COLOR_BUFFER_BIT);

glViewport(VP_bottom,VP_left,VPWidth,
VPHeight);

      glMatrixMode(GL_PROJECTION);
   glLoadIdentity();
   gluOrtho2D(minX,maxX,minY,maxY);

     drawAxis();

      glFlush();
}
```


Step 5: Adding Keyboard Interaction

'f' : change foreground color
'm': drawMountain ranges from -10 to 10 using GL_TRIANGLES
'c': clear screen

Step 6: Adding Sound to your Program

```
#include <windows.h>
#include "wav.h"
```

Use multibyte character set from project properties if got error.

- PlayBackgroundSound("backmusic.wav"); // call it in myInit()
- case 'p':
  - PlayForegroundSound("ouch.wav"); break;

STEP 7: Writing Text to the Screen

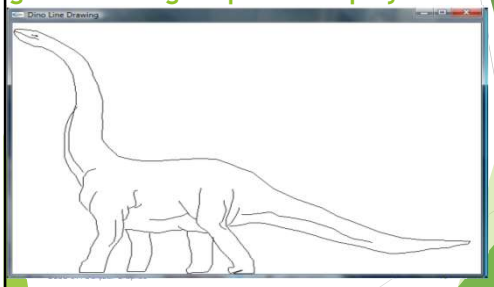
```
Void bitmap_output(int x, int y, string s, void *font)
{
int len, i;

glRasterPos2f(x, y);
len = s.length();
for (i = 0; i < len; i++) {
 glutBitmapCharacter(font, s[i]);
}
```

```
glColor3f(1, 0, 0);
bitmap_output(40, 230, "This is written in a GLUT bitmap font.",
                        GLUT_BITMAP_TIMES_ROMAN_24);

glColor3f(1, 0, 0);
bitmap_output(30, 210, "More bitmap text is a fixed 9 by 15
                        font.", GLUT_BITMAP_9_BY_15);

glColor3f(0, 1, 0);
 bitmap_output(70, 35, " Helvetica is yet another bitmap font.",
GLUT_BITMAP_HELVETICA_18);
```

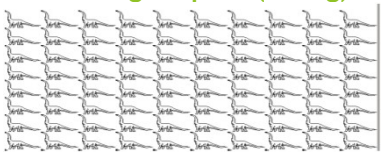
Add above method to your program and modify the display method as shown on right hand side.

Practicing 2D Objects and Application of W-to-V Mapping

Activity (1): Run the given skeleton code DinoPolyLines which should give following output on display.



Lab Activity (2): Modify myDisplay() and type and run the given Code1 to get the following output 1(Tiling)

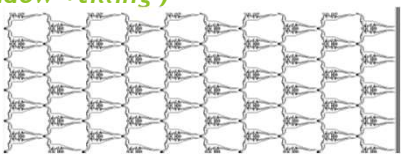


Tiling code

```
setWindow(0, 640.0, 0, 480.0);            // set a fixed window
for(int i = 0; i < 5; i++)                // for each column
   for(int j = 0; j < 5; j++)             // for each row
   {
      glViewport(i * 64, j * 44, 64, 44); // set the next viewport
      drawPolylineFile("dino.dat");       // draw it again
   }
```

Note: file "dino.dat" should be in your folder or you can use Your drawHouse( )

Lab Activity (3): Type and run the given Code2 to get the following output 2(*Flipping the World Window +tilling)*



Tiling and Flipping code

```
for(int i = 0; i < 5; i++)
   for(int j = 0; j < 5; j++)
   {
      if((i + j) % 2 == 0)                  // if (i + j) is even
         setWindow(0.0, 640.0, 0.0, 480.0); // right side up window
      else
         setWindow(0.0, 640.0, 480.0, 0.0); // upside down window
      glViewport(i * 64, j * 44, 64, 44);   // set the next viewport
      drawPolylineFile("dino.dat");         // draw it again
   }
```

Also implement setWindow(float left, float right, float bottom, float top);

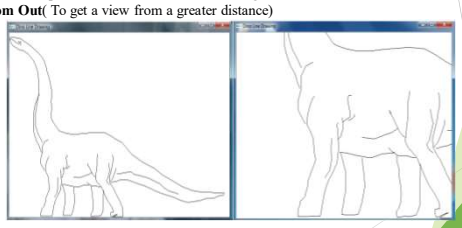
Lab Activity (4): Zooming in and Zooming out on a figure

As the window increases in size, the image in the viewport decreases in size and vice versa

Zoom in (To get a closer view)

Keep the Viewport fixed and make the window smaller. When the window is smaller, the portion inside becomes more enlarged.

Zoom Out(To get a view from a greater distance)



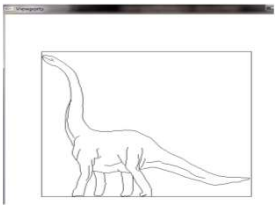
Modify main() function as follows:

```
int main(int argc, char** argv)
{

  ……..
  glutDisplayFunc(myDisplay);

  glutKeyboardFunc (keyboard);

  myInit();

   ********
}
```

```
void keyboard (unsigned char key, int x, int y)
{
   switch (key) {

      case '-':
       zooming in ?????
       break;

      case '+':
       zooming out ?????
      break;

      case 'q': exit (1);
   }

   glutPostRedisplay();
}
```

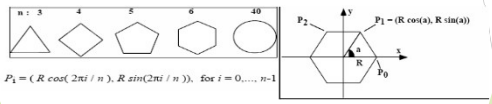

Lab Activity (5): Make a Viewport Dynamic.(Output is attached) i.e Roaming a.k.a Panning (To move the view in a specific direction

1. Keep VP Parameters variable like VP_LEFT, VP_RIGHT ……
2. Refer to following code.




```
//-------------------------------------------------------------------
void myMouse(int button, int state, int x, int y)
{
  // Remember the location of the mouse when the button was pressed
  if (button == GLUT_LEFT_BUTTON && state == GLUT_DOWN)
  {
    ReferenceX = x;
    ReferenceY = y;
  }
}
//-------------------------------------------------------------------
void myMotion(int x, int y )
{
  // Translate the viewport according to the distance from the reference
  int  dx =    x - ReferenceX;
  int  dy = - (y - ReferenceY); // because the y axis is down

  ViewportXmin += dx;
  ViewportXmax += dx;
  ViewportYmin += dy;
  ViewportYmax += dy;
  SetViewport();

  ReferenceX = x;
  ReferenceY = y;

  glutPostRedisplay(); // puts a "redraw" event in the event queue
}
//-------------------------------------------------------------------
void myKey(unsigned char key, int x, int y )
{
  switch (key)
  {
    case 'u'    : ViewportYmin += 2; break;
```

Drawing a Parameterized Regular Polygon:



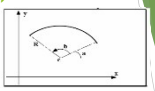
Lab Activity (6): Modify Display Function as follows

- myDisplay()
  {
  ……
  ngon(6, 20, 20, 10, 0);
  …… }

"If the no of sides of an n-gon is large, the n-gon approximates a CIRCLE in an appearance"

```
void ngon( int n, double cx, double cy, double radius, double rotAngle )
        {
                if( n < 3 )
                {
                        return;
                }
                double angle = rotAngle * PI / 180;
                double angleInc = 2 * PI / n;
                MoveTo( radius *Cos( angle ) + cx, radius *Sin( angle ) + cy );
                for( int k = 0 ; k < n ; k++ )
                {
                angle += angleInc;
                LineTo( radius * Cos( angle ) + cx, radius *Sin( angle ) + cy );
                }
        }
}
```


LabActivity(7) - Drawing Simple Arc (Chap 3, Page No. 134)



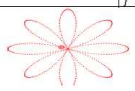
```
void drawArc(Point2 center, float radius, float startAngle, float sweep)
{
        const int n = 30; // number of intermediate segments in arc
        float angle = startAngle * 3.14159265 / 180; // initial angle in radians
        float angleInc = sweep * 3.14159265 /(180 * n); // angle increment
        float cx = center.getX(), cy = center.getY();
        moveTo(Point2(cx + radius * cos(angle), cy + radius * sin(angle)));
        for(int k = 1; k < n; k++, angle += angleInc)
                lineTo(Point2(cx + radius * cos(angle), cy + radius * sin(angle)));
}
```


Lab Activity(8) – Plotting Parametric form of curves (Chap 3, Page No.137 -144)

```
const int NUMPOINTS = 200; // the number of sample points to use for the parametric function

#define CIRCLE   1

#define ROSE     4

// Parametric equations for (x(t), y(t))
float x(float t)
                {       return 1;   }

float y(float t)
                {       return 1;   }

Void computeCurve()  { ……}

void plotCurve() {……}
```

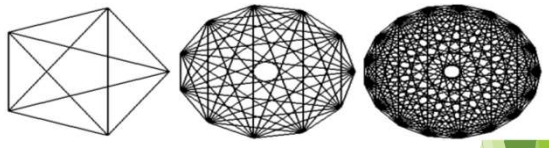
```
void display(void)
{
        setBackgroundColor(1,1,1);
        clearScreen();
        setColor(0,0,1);

// Initialize tmin and tmax
// Calculate the world window [xmin, xmax] x [ymin, ymax]

// Calculate and store points on curve in an array i.e. compute curve

//update xmin, ymin, xmax,ymax

//setWindow(xmin, xmax, ymin, ymax);

//  plotCurve  using lineTo and moveTo

glFlush();  // force drawing to the screen
}
```

$x = f(\theta) \cdot \cos(\theta)$
$y = f(\theta) \cdot \sin(\theta)$



- *Cardioid:* $f(\theta) = K(1 + \cos(\theta))$.
- *Rose curves:* $f(\theta) = K\cos(n\theta)$, where n shown
- *Archimedian spiral:* $f(\theta) = K\theta$.

Lab Activity(9): Implement The rosette, and the Golden 5-rosette(Example 3.4.1)



Lab Activity (10): Draw Circle With the help of EQ: x+r cos Φ, y+r sin Φ