EXERCISE
2D OPENGL

Yun Jang
jangy@sejong.edu

Disclaimer

- These slides can only be used as study material for the Computer Graphics at Sejong University
- The slides cannot be distributed or used for another purpose

How to Set up

- Copy dlls to
  - Project directory or
  - Windows system32
- Copy directory <GL>
  - /directory/to/Visual/Studio/VC/include
  - (C:\Program Files (x86)\Microsoft SDKs\Windows\v7.0A\Include)
- Copy library glut32.lib
  - Project directory or
  - /directory/to/Visual/Studio/VC/lib
  - (C:\Program Files (x86)\Microsoft SDKs\Windows\v7.0A\Lib)

main() Function


```
int main(int argc, char** argv)
{
  // glut init
        glutInit(&argc, argv);
        glutInitDisplayMode (GLUT_SINGLE | GLUT_RGB);
  // actual window size
        glutInitWindowSize(500,500);
  // initial window location, top-left corner
        glutInitWindowPosition(0,0);
  // create window with title “simple”
        glutCreateWindow("simple");
  // call mydisplay() function
        glutDisplayFunc(mydisplay);
  // call init() function
        init();
   // main event loop, do not use exit()
        glutMainLoop();
}
```

Init() Function


```
void init()
{
    glClearColor (0.0, 0.0, 0.0, 1.0);          // black clear color, opaque window

    glColor3f(1.0, 1.0, 1.0);                   // white

    glMatrixMode (GL_PROJECTION);
    glLoadIdentity ();

    glOrtho2D(-1.0, 1.0, -1.0, 1.0);            // screen size (-1.0,-1.0) to (1.0,1.0)
}
```

display() Function


```
void mydisplay()
{
    glClear(GL_COLOR_BUFFER_BIT);          // clear the window
    glBegin(GL_POLYGON);                   // fill connected polygon
        glVertex2f(-0.5, -0.5);            // vertices of the square
        glVertex2f(-0.5, 0.5);
        glVertex2f(0.5, 0.5);
        glVertex2f(0.5, -0.5);
    glEnd();
}
```

Drawing Exercise

- Draw 3 polygons in 2D
  - Any shapes are fine but all shapes should be different
  - Set the color as white for all polygons
  - No overlap between polygons
- Background color is yellow

Callbacks

- Callback functions refresh
  - *void (*func)(void)* – what is this thing?
- Virtually all interactive graphics programs are event driven
- Glut/freeglut uses callbacks to handle events
  - Windows system invokes a particular procedure when an event of particular type occurs.
  - MOST IMPORTANT: display event
    - Signaled when window first displays and whenever portions of the window reveals from blocking window
    - *glutDisplayFunc(void (*func)(void))* registers the display callback function

GLUT/freeglut Callbacks Overview

- *glutDisaplyFunc(void (*func)(void))*

  whenever GLUT/freeglut decides to redisplay the window, the registerd callback is executed.

- *glutReshapeFunc(void (*func)(int w, int h))*

  indicates what action should be taken when the window is resized.

- *glutKeyboardFunc(void (*func)(unsigned char key, int x, int y))*
  *glutMouseFunc(void (*func)(int button, int state, int x, int y))*
  *glutSpecialFunc(void (*func)(unsigned char key, int x, int y))*

  allow you to link a keyboard key or a mouse button with a routine that's invoked when the key or mouse button is pressed or released.

- *glutMotionFunc(void (*func)(int x, int y))*

  registers a routine to call back when the mouse is moved while a mouse button is also pressed.

- *glutIdleFunc(void (*func)(void))*

  registers a function that's to be executed if no other events are pending – use for animation or continuous update

Keyboard Callback Code Example


```
glutKeyboardFunc( keyboard );
void keyboard(unsigned char key, int x, int y )
{
  switch( key ) {
    case ‘q’ : case ‘Q’ :
      exit(0);                          // exit the program
      break;
    case ‘r’ : case ‘R’ :
        glColor3f(1.0, 0.0, 0.0);
        glutPostRedisplay();            // update the display
      break;

    case ‘g’ : case ‘G’ :
        glColor3f(0.0, 1.0, 0.0);
        glutPostRedisplay();            // update the display
      break;
    case ‘g’ : case ‘G’ :
        // draw blue objects …
  }
// glutPostRedisplay();
}
```

Special Key Callback Code Example


```
glutSpecialFunc( specialKeys );
void specialKeys(unsigned char key, int x, int y )
{
  switch( key ) {

    case GLUT_KEY_F1:                    // F1 function key
      red   = 1.0;
      green = 0.0;
      blue  = 0.0;
      break;

  case GLUT_KEY_F2:

      // green

  case GLUT_KEY_F3:

      // blue

}
 glutPostRedisplay();
}
```

Mouse Function Callbacks

glutMouseFunc(*mouseMovement*);

```
void mouseMovement(int button,int state,int x,int y)
{
// button: GLUT_LEFT_BUTTON, GLUT_MIDDLE_BUTTON,
          GLUT_RIGHT_BUTTON
// state:  GLUT_DOWN, GLUT_UP

  if (button == GLUT_LEFT_BUTTON &&
      state == GLUT_DOWN)
  {
     startMovement = GL_TRUE;
     // do something
  }

  mouseCurPositionX = x;   // record mouse position
  mouseCurPositionY = y;
  mouseCurButton    = button;
}
```

Do follows

- If you click the left half of the window with the left mouse button, make the object color blue, otherwise red.
- If you click the upper half of the window with the right mouse button, make the object color white, otherwise black.

Mouse Motion Callback

glutMotionFunc(mouseMotion);

```
void mouseMotion(int x, int y)
{
  if(mouseCurButton == GLUT_LEFT_BUTTON) {
    x_angle += 360.0*(x-mouseCurPositionX)/width;
    y_angle += 360.0*(y-mouseCurPositionY)/height;
   }
   if(mouseCurButton == GLUT_RIGHT_BUTTON)
     scale += (y-mouseCurPositionY)/100.0;
   mouseCurPositionX = x;
   mouseCurPositionY = y;

   glutPostReDisplay();
}
```

In display( ) we have …. ….. ….

```
      glScalef (scale, scale, scale);
      glRotatef (x_angle, 1.0f, 0.0f, 0.0f);
      glRotatef (y_angle, 0.0f, 1.0f, 0.0f);   … …. ….
```

Do follows

- If you push the left mouse button down and drag the mouse,
  - If you move from left to right, then make the object colors red
  - Otherwise green

Questions?

- Ask now or e-mail later
- Acknowledgements
  - Previous instructors at Purdue
    - David Ebert, ECE
    - Niklas Elmqvist, ECE
  - Previous instructors at Arizona state university
    - Ross Maciejewski
  - Textbook (Ed Angel)
  - Google Image Search
    - Copyright respective owners