INTRODUCTION

Description of the project

This project is a simple game as described above using openGL.The game involves shooting of arrows one after the other in order to hit the balls which are moving at a constant speed in the right end.

User has to shoot the balls by pressing the key 'f' on the keyboard.

How to play

This game has two levels

1st level-The main aim is to strike the balls thrice within the given number of arrows which is 30.Upon winning this the user moves to the next level.If the user is unable to accomplish this he loses the game.

The user can directly jump to the second level without playing the first level.

2nd level-The main aim is to strike the balls thrice within the given number of arrows which is 20.If the user is unable to accomplish this he loses the game.

INTRODUCTION TO OPENGL

Most of our application will be designed to access OpenGL directly through functions in three libraries. Functions in the main GL (or OpenGL in windows) library have names that begin with the letters gl and are stored in a library usually referred to as GL (or OpenGL in windows).

The second is the **OpenGL Utility Library** (GLU). This library uses only GL functions but contains code for creating common objects and simplifying viewing. All functions in GLU can be created from the core GL library but application programmers prefer not to write the code repeatedly. The GLU library is available in all OpenGL implementations; functions in the GLU library begin with letters glu.

To interface with the window system and to get input from external devices into our programs, we need at least one more system-specific library that provides the "glue" between the window system and OpenGL. For the X window system, this library is functionality that should be expected in any modern windowing system.

Fig 2.1 shows the organization of the libraries for an X Window System environment. For this window system, GLUT will use GLX and the X libraries. The application program, however, can use only GLUT functions and thus can be recompiled with the GLUT library for other window systems.

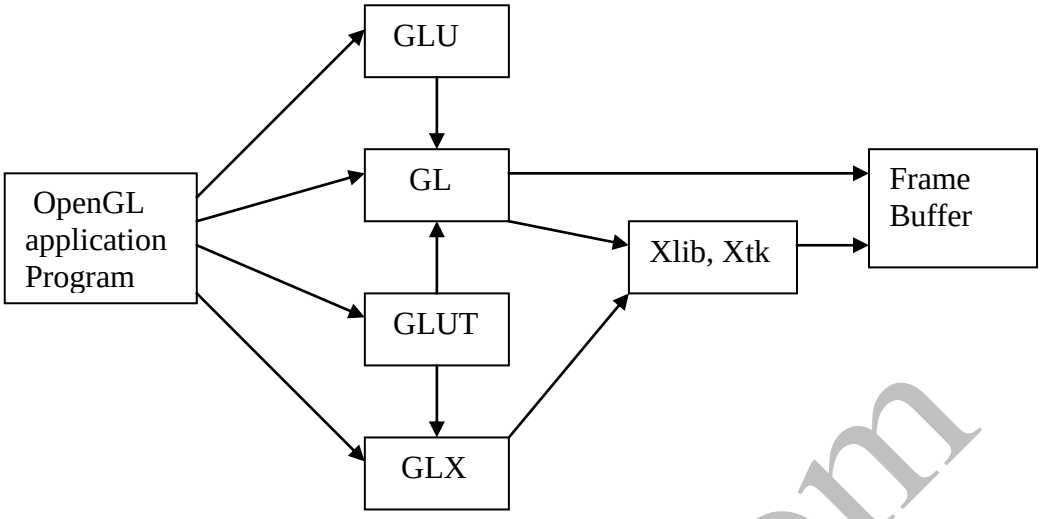


Fig 1.2 Library organization

1.2.1:OpenGL Command Syntax:

OpenGL commands use the prefix **gl** and initial capital letters for each word making up the command name. Similarly, OpenGL defined constants begin with GL_, use all capital letters and use underscores to separate words (like GL_COLOR_BUFFER_BIT).

LITERATURE SURVEY

The OpenGL Programming Guide - The Redbook

The OpenGL Programming Guide 5th Edition The Official Guide to Learning OpenGL Version 2.1

The OpenGL Programming Guide, Fifth Edition, provides definitive and comprehensive information on OpenGL and the OpenGL Utility Library. The previous edition covered OpenGL through Version 1.3 and 1.4. This fifth edition of the best-selling "red book" describes the latest features of OpenGL Versions 1.5 and 2.0, including the introduction of the OpenGL Shading Language. You will find clear explanations of OpenGL functionality and many basic computer graphics techniques, such as building and rendering 3D models; interactively viewing objects from different perspective points; and using shading, lighting, and texturing effects for greater realism. In addition, this book provides in-depth coverage of advanced techniques, including texture mapping, antialiasing, fog and atmospheric effects, NURBS, image processing, and more. The text also explores other key topics such as enhancing performance, OpenGL extensions, and cross-platform techniques. This fifth edition has been extensively updated to include the newest features of OpenGL, versions 1.5 and 2.0.

www.opengl.org for OpenGL tutorials

Pervisim offers consulting and software development for visualization leveraging OpenGL

Pervisim is a new consulting and software development firm located in Cary, NC that specializes in 3D visualization applications. Recently completed and revived projects include mashup visualizations that create terrain visualizations in 3D pdf and molecular modeling using OpenGL.

VSFL – Very Simple Font Library

Text rendering is very useful to display information on top of a 3D world. VSFL aims at providing users with the ability to render bitmapped text in an OpenGL application using the core profile. With immediate mode gone in core OpenGL versions, so are the vast majority of font libs that worked with OpenGL. Immediate mode was terribly slow, and code wise very extensive. Vertex Buffers are clearly the way to go. This lib uses VAOs and vertex buffers to render text.

RenderStream 21.6 Teraflop Servers and Workstations for OpenCL - OpenGL

RenderStream announced its AMD Radeon based 21.6 teraflop servers and workstations for OpenCL / OpenGL / Brooks based applications and product development. The workstations offer 1,536 stream processors and eight GPUs per system, which provide access to 12,288 cores and 21.6 TFLOPS of aggregate compute power. As an example from information security, the HD 6970 and HD 6990 based VDACTr8 evaluated over 45 billion solutions per second versus 18 billion for the GTX 580 based systems, depending on the implementation.

Third part of an in-depth tutorial to OpenGL

The last part of this series about OpenGL and OpenGL ES on DB-Interactively blog. The other tutorials came with a sample project to iPhone/iPad and covered the most important concepts of OpenGL. This last tutorial comes with a lot of informations about how to make 2D applications using OpenGL. As well, this tutorial brings:

- Multisampling
- PVRTC and textures
- Optimizations

.

REQUIREMENTS SPECIFICATION

The requirements can be broken down into 2 major categories namely hardware and software requirements. The former specifies the minimal hardware facilities expected in a system in which the project has to be run. The latter specifies the essential software needed to build and run the project.

Hardware Requirements:

The hardware requirement is minimal and the software can run with minimal requirements. The basic requirements are as enlisted below:

1. Processor: Intel 486/ Pentium processor or a processor with higher specifications
2. Processor speed: 500MHz or above.
3. RAM : 64MB or above
4. Storage space : 2MB or above
5. Monitor resolution: A color monitor with a minimum resolution of 640 * 480.

Software Requirements:

1. An MS-DOS based operating system like Windows 98, Windows 2000 or Windows XP is the platform required to develop the 3D simulation.
2. A C/C++ (integrated with OPEN GL) compiler like Eclipse is required for compiling the source code to make the executable file which can then be directly executed.
3. A built in graphics library; glut.h is required for drawing the layout of the game.
4. glut32.dll for running the application.

SOFTWARE DESIGN

This project has been created using the OpenGL interface along with the GLUT(OpenGL Library Toolkit), using the platform Eclipse as the compiling tool. This game has been designed in a simple and lucid manner so that further developments can be made, and run on many platforms with a few changes in the code.

We begin our game by providing a simple menu option upon right click of the mouse to display 2 levels of the game which the user can choose, and a third option to exit the game.

Upon selecting the first level, a red ball is continuously produced and moves upwards at the right side of the screen. Hitting the ‘f’ key on the keyboard produces an arrow, which the user must aim to hit the balls with. On successful contact with the ball, the game registers it as a ‘HIT’ and increments a counter variable. A count of 3 (i.e 3 hits) takes the player to the next level of the game.

Level 2 increases the difficulty level by producing2 colours of balls- a blue one and a red one. While the red is as before produced continuously and moves from bottom to top, the blue one moves from top to bottom at irregular intervals to confuse the player. The player needs to aim correctly and target only the red ones. Player needs to again score a minimum of 3 ‘hits’ to be a Winner.

Level 2 can be directly entered in the beginning itself (without playing level 1). We provide this option so that the player can choose his difficulty level.

The underlying logic of the game is Collision detection. The bounds of the ball are detected with the bounds, or the continuously changing position of the arrow head. 2 variables ‘pos’ (for the arrowhead) and ‘up’ (for the ball) are kept tab of, and are updated with their changing values.

If the given position vector does intersect with the current value of the ‘up’, we infer that a collision has been detected and register it as a hit, and increment ‘counter’. Other wise the function returns a NULL.

Once a ‘hit’ takes place, we call a Sleep() timer (as buffers are too fast to see the collision in our game), show the ball burst (without particle effect or engines) and reset the ball to its initial position and the cycle starts all over again.
Careful observation of these values have been made while developing the game.

To model the objects as 3D entities we also use the effects of lighting in our game via 4 different mechanisms:

AMBIENT - light that comes from all directions equally and is scattered in all directions equally by the polygon.

DIFFUSE - light that comes from a point source and hits surfaces with an intensity that depends on whether they face towards the light or away from it. SPECULAR - light is reflected more in the manner of a mirror where most of the light bounces off in a particular direction defined by the surface shape.

EMISSION - the light is actually emitted by the polygon - equally in all directions.

Texture is yet another feature we have implemented to show the material properties of the object, in whichever small way we could.

IMPLEMENTATION

Choose():

This function gives a switch case to choose from the different menu options. Choosing case 2 (Level 1) calls the function Display1() and choosing case 3 (Level 2) calls Display2(). Choosing quit case 1 will exit from the game at any point in the game.

Display():

sets the background colour and clears the color buffer bit, and depth buffer bit (for hidden surface removal and Z buffer test), and it is called from the main().

Display1():

- It plays the Level 1 of the game. It initially sets the the red ball to a position given by 'up' variable, and using the Translatef() function it displaces only the y-coordinate of the ball upwards.
- glutSolidSphere() renders a 3D sphere with radius, slices and stack as parameters.
- While the 'f' key is pressed, the function creates an arrow head, and associates a variable 'pos' with it, to translate the arrow towards the right in a single direction. This variable is incremented continually everytime and called with the Translatef() to redraw the arrow at new positions.
- If the condition for bounds satisfy, that means collision has occurred, and counter1 is incremented to register a hit. The flag 'bang' is set to 1, so that when encountered during the next iteration the following changes can take place: position of sphere is reset to 0, bang is reset to 0 (to prepare for next hit), position of arrow is reset.
- 'up' variable is continually incremented to keep the ball moving upwards for a large number of iterations by calling glutPostRedisplay() everytime. It marks the normal plane of

current window as needing to be redisplayed with the same specifications.

- The counter1 value is checked for every iteration. Once it has reached a value of 3, Display2() is called to play Level 2 of the game.

Display2():

- It enters the Level 2 of the game. It initially sets the the red ball to a position given by 'up' variable, and using the Translatef() function it displaces only the y-coordinate of the ball upwards.
- Also, it sets the blue balls position and using the Translatef() function it displaces only the y-coordinate of the ball downwards.
- glutSolidSphere() renders a 3D sphere with radius, slices and stack as parameters.
- While the 'f' key is pressed, the function creates an arrow head, and associates a variable 'pos' with it, to translate the arrow towards the right in a single direction. This variable is incremented continually everytime and called with the Translatef() to redraw the arrow at new positions.
- If the condition for bounds satisfy, that means collision has occurred, and counter1 is incremented to register a hit. The flag 'bang' is set to 1, so that when encountered during the next iteration the following changes can take place: position of sphere is reset to 0, bang is reset to 0 (to prepare for next hit), position of arrow is reset.
- 'up' variable is continually incremented to keep the ball moving upwards for a large number of iterations by calling glutPostRedisplay() everytime. It marks the normal plane of current window as needing to be redisplayed with the same specifications.

The counter2 value is checked for every iteration. Once it has reached a value of 3, myHit() is called to display that the player is a winner.

MyHit():

This function is primarily to display text on screen. glBlendFunc defines the operation of blending when it is enabled. We also set the antialiasing for lines and set the line width to prepare to draw our text as Stroke Characters.

Drawhit():

It draws text in Stroke Character font. A stroke font is a 3D font. As opposed to bitmap fonts these can be rotated, scaled, and translated. The GLUT_STROKE_ROMAN font is used here. The text can be placed anywhere on the screen using Translatef() and scaled to any size as needed using Scalef().

Instructions():

It creates a separate instruction page where the instructions are displayed on another window using StrokeCharacter font, and translated to appropriate postions on the screen.

Draw_instruct():

It draws text in Stroke Character font. A stroke font is a 3D font. As opposed to bitmap fonts these can be rotated, scaled, and translated. The GLUT_STROKE_ROMAN font is used here. The text can be placed anywhere on the screen using Translatef() and scaled to any size as needed using Scalef().

Keyboard():

Keyboard is a keyboard callback function which is used to make our program interactive. It makes the shoot flag = 1 in our program everytime key ‘f’ is pressed, by recognizing it as an ASCII character.

Main():

The main function performs the required initializations and starts the event processing loop. All the functions in GLUT have the prefix *glut*, and those which perform some kind of initialization have the prefix *glutInit*.

- glutInit(int *argc, char **argv) - parameters are pointers to the *unmodified* argc and argv variables from the main function.
- We establish the window's position by using the function *glutInitWindowPosition*.
- We choose the window size using the function *glutInitWindowSize*.
- We define the display mode using the function *glutInitDisplayMode*. GLUT_RGB - selects a RGBA window. This is the default color mode. GLUT_SINGLE – selects a single buffer window.
- Each window can be created with *glutCreateWindow*. The return value of *glutCreateWindow* is the window identifier.
- glutDisplayFunc() passes the name of the function to be called when the window needs to be redrawn.
- glutKeyboardFunc- is notify the windows system which function(s) will perform the required processing when a key is pressed. This function is to register a callback for keyboard events that occur when you press a key.
- Creating a menu: glutCreateMenu creates a menu table on a default right click of mouse. glutAddMenuEntry adds a menu entry to this menu created.
- When we are ready to get in the application event processing loop we enter glutMainLoop. It gets the application in a never ending loop, always waiting for the next event to process

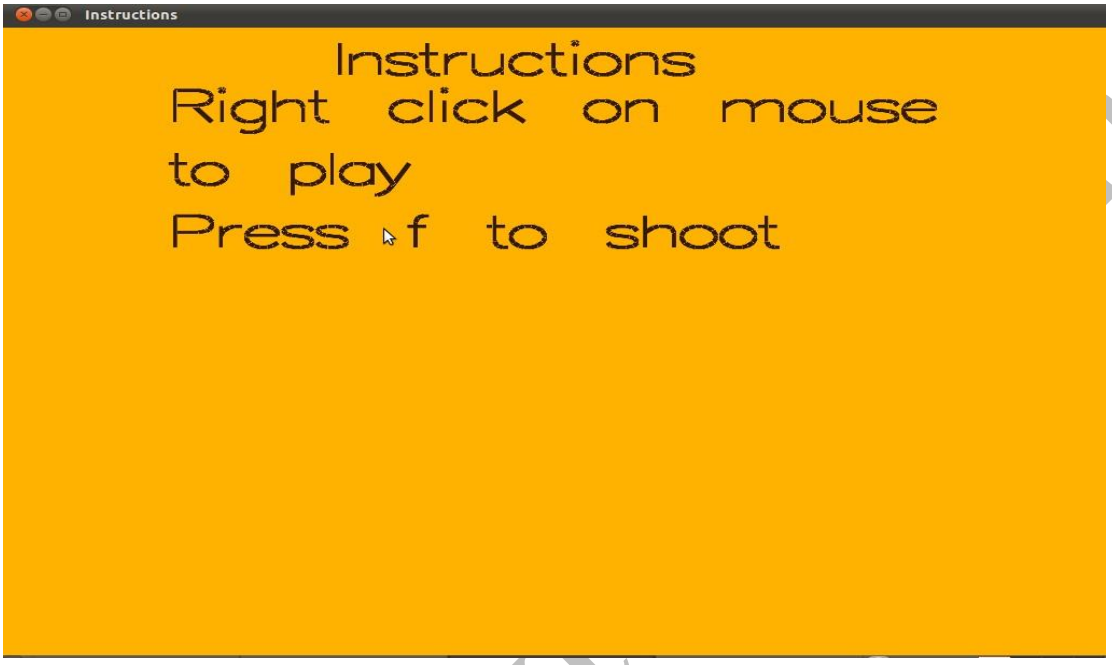
Init():

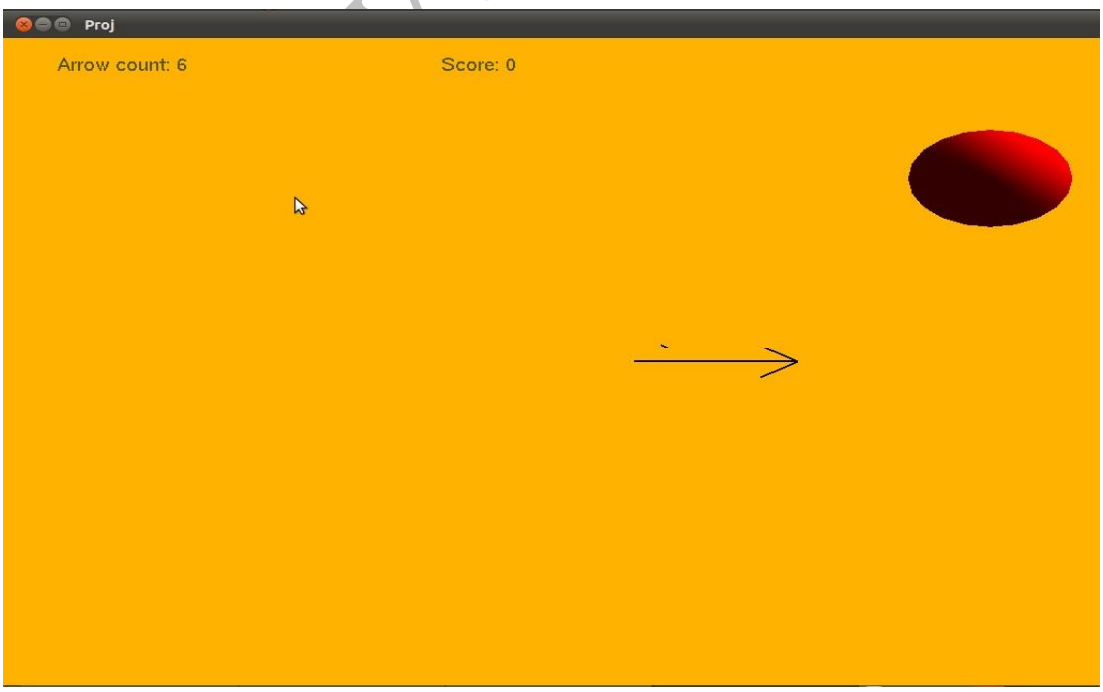
Sets the background color for the game and enables light source to provide the following lighting effects:

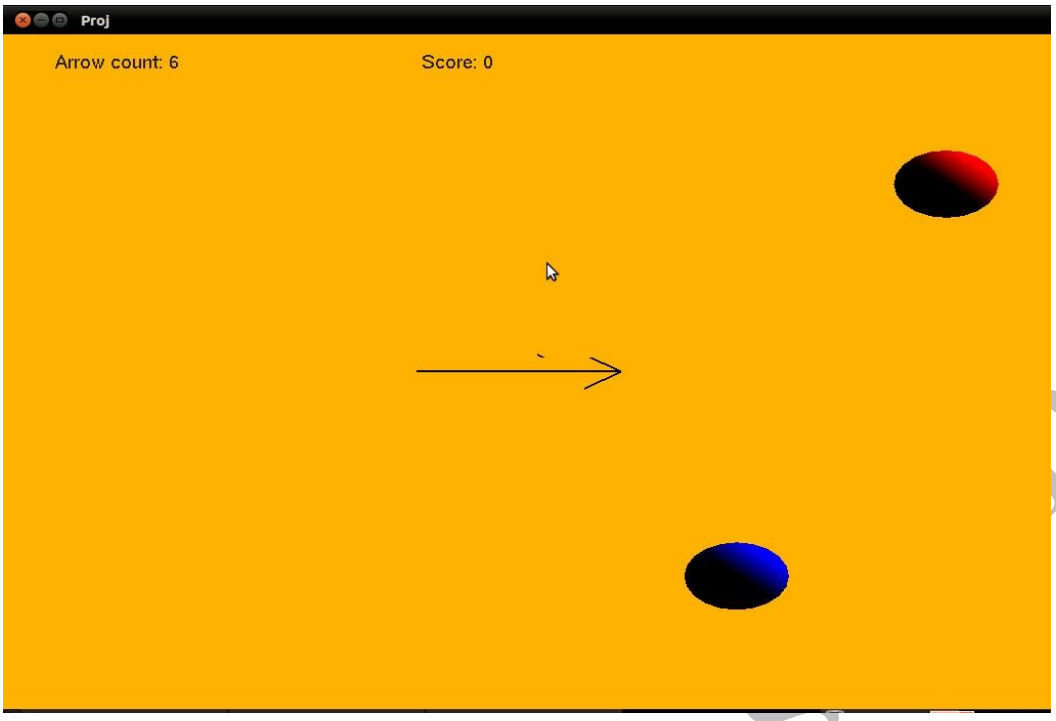
- AMBIENT - light that comes from all directions equally and is scattered in all directions equally by the polygon.
- DIFFUSE - light that comes from a point source and hits surfaces with an intensity that depends on whether they face towards the light or away from it.
- SPECULAR - light is reflected more in the manner of a mirror where most of the light bounces off in a particular direction defined by the surface shape.
- EMISSION - the light is actually emitted by the polygon - equally in all directions

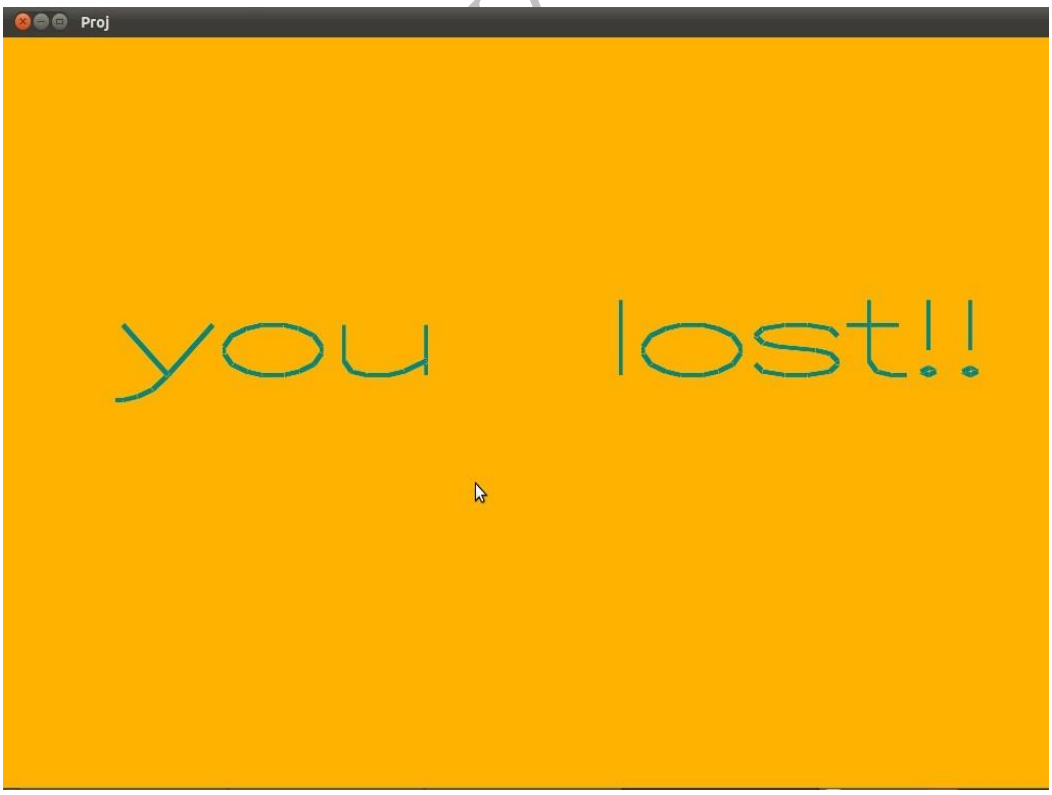
It also sets the Material for the object and enables this option to provide different surface textures to our objects.

SNAPSHOTS


Instructions
Instructions
Right click on mouse
to play
Press f to shoot


Proj
Arrow count: 6
Score: 0


Proj
Arrow count: 6
Score: 0


Proj
you lost!!

CONCLUSION

The development of computer graphics has made computers easier to interact with and better for understanding and interpreting many types of data. Developments in computer graphics have had a profound impact on many types of media and have revolutionized the animation and video game industry.

We started with modest aim with no prior experience in any programming projects as this, but ended up in learning many things, fine tuning the programming skills and getting into the real world of software development with an exposure to corporate environment. During the development of any software of significant utility, we are faced with the trade-off between speed of execution and amount of memory consumed. This is simple interactive application application. It is extremely user friendly and has the features, which makes simple graphics project. It has an open source code and no security features has been included. The user is free to alter the code for feature enhancement. Checking and verification of all possible types of the functions are taken care. Care was taken to avoid bugs. Bugs may be reported to creator as the need may be .So, we conclude on note that we are looking forward to develop more such projects with an appetite to learn more in computer graphics.

APPENDIX

```
#include<stdlib.h>
#include<stdio.h>
#include<string.h>
#include<GL/glut.h>
#include<time.h>
#include<math.h>
//#include<windows.h>

static GLfloat up=-0.2;
static GLfloat pos=-0.2;
int shoot=0,bang=0;
int counter1=0,counter2=0,count=0;
int game,instruct;
char tmp_str[40];

void display2();
void displost();

void init(void)
{


   GLfloat mat_specular[] = { 1.0, 1.0, 1.0, 1.0 };
   GLfloat mat_shininess[] = { 50.0 };
   GLfloat mat_diffuse[]={ 1.0,1.0,1.0,1.0};
   GLfloat mat_ambient[]={0.0,0.0,0.0,1.0};
   GLfloat light_position[] = { 1.0, 1.0, 0.0, 0.0 };

   glClearColor (0.0, 0.0, 0.0, 0.0);
   glShadeModel (GL_SMOOTH);

   glMaterialfv(GL_FRONT, GL_SPECULAR, mat_specular);
   glMaterialfv(GL_FRONT, GL_SHININESS, mat_shininess);
   glMaterialfv(GL_FRONT, GL_DIFFUSE, mat_diffuse);
   glMaterialfv(GL_FRONT, GL_AMBIENT, mat_ambient);


   glLightfv(GL_LIGHT0, GL_POSITION, light_position);
   glColorMaterial(GL_FRONT_AND_BACK,
GL_AMBIENT_AND_DIFFUSE);

   glEnable(GL_LIGHTING);
   glEnable(GL_LIGHT0);
   glEnable(GL_DEPTH_TEST);
   glEnable(GL_COLOR_MATERIAL);
}


void drawhit(const char * message, int x, int y)
{
   glPushMatrix();

   glScalef(0.3,0.2,0.15);
    glTranslatef(x,y,0);
```

```
   while (*message)
   {
         glutStrokeCharacter(GLUT_STROKE_ROMAN,*message++);

   }

   glPopMatrix();
}

void myHit()
{
   glClear(GL_COLOR_BUFFER_BIT);
    glMatrixMode(GL_PROJECTION);
   glLoadIdentity();
   gluOrtho2D(0,200,0,200);
   glMatrixMode(GL_MODELVIEW);
   glClearColor(1.0,0.0,0.5,1.0);
   glColor3f(0.0,0.8,0.80);

   glBlendFunc(GL_SRC_ALPHA, GL_ONE_MINUS_SRC_ALPHA);
   glEnable(GL_BLEND);
   glEnable(GL_LINE_SMOOTH);
   glLineWidth(4.0);

    drawhit("WINNER!!",70,550);


}

void draw_instruct(const char *message, int x, int y)
{
   int j;

   glPushMatrix();

   glScalef(0.1,0.1,0.0);
      glTranslatef(x,y,0);
   while (*message)
   {
         glutStrokeCharacter(GLUT_STROKE_ROMAN,*message++);

   }
      for(j=0;j<10000;j++);
   glPopMatrix();
}

void instructions()
{
   glClear(GL_COLOR_BUFFER_BIT);
      glMatrixMode(GL_PROJECTION);
   glLoadIdentity();
   gluOrtho2D(0,200,0,200);
   glMatrixMode(GL_MODELVIEW);
   glClearColor(1.0,0.7,0.0,1.0);
   glColor3f(1.0,0.5,0.1);

   glBlendFunc(GL_SRC_ALPHA, GL_ONE_MINUS_SRC_ALPHA);
   glEnable(GL_BLEND);
   glEnable(GL_LINE_SMOOTH);
   glLineWidth(4.0);
```

```
            draw_instruct("Instructions",600,1850); // change1
      draw_instruct("Right click on mouse",300,1700);
      draw_instruct("to play",300,1500);
            draw_instruct("Press f to shoot",300,1300);
      glFlush();


}

void Write(char *string)
{
   glScalef(0.02,0.02,0.0);
       while(*string)
       glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18,
*string++);
}

void display1()
{

   int i;

   if(counter1==3)
   {
      display2();
      glFlush();
   }
   else
   {     int j;
         for(j=0;j<10000;j++);

         glClearColor(1.0,0.7,0.0,1.0);
         glClear(GL_COLOR_BUFFER_BIT|GL_DEPTH_BUFFER_BIT);
         glPushMatrix();
         glColor3f(1, 1, 0);
         glRasterPos2f(-0.9, 0.9);
         sprintf(tmp_str, "Arrow count: %d", count);
         Write(tmp_str);
         glPopMatrix();
         if(count>=30)

                                    glutDisplayFunc(displost);
                              glPushMatrix();
         glColor3f(1, 1, 0);
         glRasterPos2f(-0.2, 0.9);
         sprintf(tmp_str, "Score: %d", counter1);
         Write(tmp_str);
         glPopMatrix();
         glPushMatrix();
         glColor3f(1.0,0.0,0.0);
         glLoadIdentity();
         glTranslatef(0.8,-0.869+up,0.0);
         glutSolidSphere(0.15,20,16);

         if(shoot==1)
         {

               glPushMatrix();
               glLoadIdentity();
               glTranslatef(-0.8+pos,0.0,0.0);
               glColor3f(0.0,0.0,0.0);
```

```
                glLineWidth(2.0);
                glBegin(GL_LINES);
                glVertex3f(-0.2,0.0,0.0);
                glVertex3f(0.1,0.0,0.0);
                glVertex3f(0.1,0.0,0.0);
                glVertex3f(0.03,0.05,0.0);
                glVertex3f(0.1,0.0,0.0);
                glVertex3f(0.03,-0.05,0.0);
                glEnd();
                glPopMatrix();
        }
        if(bang==1)
        {

                bang=0;pos=-0.2;

                glPushMatrix();
                glLoadIdentity();
                up=0;
                glColor3f(1.0,0.0,0.0);
                glutSolidSphere(1,20,16);
                glPopMatrix();
        }
        glPopMatrix();


        for( i=0;i<200;i=i+20)
        {
                if(pos>=1.74 && up>0.825 && up<0.975)
//collision detection
                {
                        counter1 ++;
                        for(j=0;j<10000;j++);

                        shoot=0;
                        pos=-0.2;
                        bang=1;
                }
                if(counter1==3)
                        count=0;
                up=(up+0.005);

                if(up>2)
                        up=0;
                if(shoot==1)
                {
                        pos=pos+0.009;
                        if(pos>2)
                        {
                                pos=-0.2;
                                shoot=0;
                        }

                }
                glutPostRedisplay();
        }

   glFlush();
   }
}
```

```
void display2()
{int i;

   if(counter2==3)
   { myHit();
     glFlush();
   }

   else
   {int j;
         for(j=0;j<10000;j++);
   glClearColor(1.0,0.7,0.0,1.0);
   glClear(GL_COLOR_BUFFER_BIT|GL_DEPTH_BUFFER_BIT);
   glLoadIdentity();

   glPushMatrix();
   glColor3f(1, 1, 0);
   glRasterPos2f(-0.9, 0.9);
   sprintf(tmp_str, "Arrow count: %d", count);
   Write(tmp_str);
   glPopMatrix();
   if(count>=20)
   glutDisplayFunc(displost);
   glPushMatrix();
   glColor3f(1, 1, 0);
   glRasterPos2f(-0.2, 0.9);
   sprintf(tmp_str, "Score: %d", counter2);
   Write(tmp_str);
   glPopMatrix();

   glPushMatrix();
   glColor3f(1.0,0.0,0.0);
   glLoadIdentity();
   glTranslatef(0.8,-0.769+up,0.0);
   glutSolidSphere(0.10,20,16);
   glColor3f(0.0,0.0,1.0);


   glPushMatrix();
   glColor3f(0.0,0.0,1.0);
   glLoadIdentity();
   glTranslatef(0.4,0.769-up,0.0);
   glutSolidSphere(0.10,20,16);
   glColor3f(0.0,0.0,1.0);

   if(shoot==1)
   {


   glPushMatrix();
   glLoadIdentity();
   glTranslatef(-0.8+pos,0.0,0.0);
   glColor3f(0.0,0.0,0.0);
   glLineWidth(2.0);
      glBegin(GL_LINES);
   glVertex3f(-0.2,0.0,0.0);
   glVertex3f(0.1,0.0,0.0);
   glVertex3f(0.1,0.0,0.0);
   glVertex3f(0.03,0.05,0.0);
      glVertex3f(0.1,0.0,0.0);
```

```
glVertex3f(0.03,-0.05,0.0);
glEnd();
glPopMatrix();
}
if(bang==1)
{


      bang=0;pos=-0.2;
      glPushMatrix();
         glLoadIdentity();

          up=0;
      glColor3f(1.0,0.0,0.0);
      glutSolidSphere(1,20,16);
         glPopMatrix();
}
glPopMatrix();


for( i=0;i<200;i=i+20)
{


if(pos>=1.75 && up>0.825 && up<0.975)
{

 counter2 ++;
 for(j=0;j<10000;j++);

shoot=0;
pos=-0.2;
bang=1;
}
up=(up+0.005);
if(up>2)
      up=0;
if(shoot==1)
{
      pos=pos+0.009;
if(pos>2)
{
      pos=-0.2;
   shoot=0;
 }

}
glutPostRedisplay();
}

}

glFlush();
}


void display()
{
      glClearColor(1.0,0.7,0.0,1.0);
glClear(GL_COLOR_BUFFER_BIT|GL_DEPTH_BUFFER_BIT);
glFlush();
```

```
}
void displost()
{
         glClear(GL_COLOR_BUFFER_BIT);
         glMatrixMode(GL_PROJECTION);
         glLoadIdentity();
         gluOrtho2D(0,200,0,200);
         glMatrixMode(GL_MODELVIEW);
         glClearColor(1.0,0.0,0.5,1.0);
         glColor3f(0.0,0.8,0.80);

         glBlendFunc(GL_SRC_ALPHA, GL_ONE_MINUS_SRC_ALPHA);
         glEnable(GL_BLEND);
         glEnable(GL_LINE_SMOOTH);
         glLineWidth(4.0);

       drawhit("you lost!!",70,550);
       glFlush();


}

void indisplay()
{
    glClearColor(1.0,0.7,0.0,1.0);
   glClear(GL_COLOR_BUFFER_BIT|GL_DEPTH_BUFFER_BIT);
   instructions();
   glFlush();
}




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

   if (key=='f')
   {
         shoot=1;

         count++;


   }


}



void choose(int i)
{
   switch(i)
   { case 1: exit(0);
     case 2: glutDisplayFunc(display1);
                break;
     case 3: glutDisplayFunc(display2);
               break;
     default:exit(0);
```

```
            }
}


int main(int argc,char **argv)
{
   glutInit(&argc,argv);

          glutInitDisplayMode(GLUT_DEPTH|GLUT_RGB);
   glutInitWindowSize(1500,1500);
   glutInitWindowPosition(0,0);
   instruct=glutCreateWindow("Instructions");
   init();
   glutDisplayFunc(indisplay);


   glutInitDisplayMode(GLUT_DEPTH|GLUT_RGB);
   glutInitWindowSize(1000,1000);
   glutInitWindowPosition(0,0);
   game=glutCreateWindow("Proj");
   init();
   glutDisplayFunc(display);
   glutKeyboardFunc(keyboard);
   glutCreateMenu(choose);
   glutAddMenuEntry("Quit",1);
   glutAddMenuEntry("PlayLevel1",2);
   glutAddMenuEntry("PlayLevel2",3);
   glutAttachMenu(GLUT_RIGHT_BUTTON);
   glutMainLoop();
   return 0;
}
```

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4. www.opengl.org for OpenGL tutorials