上海电力学院

虚拟现实技术

课程设计报告

题目 3D 人脸渲染

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一、目的

（1）熟悉 Opengl 工具

（2）学会在 Ubuntu 中运行 OpenGL 示例

（3）了解 OpenGL 并用自己的图片渲染 3D 人脸模型

二、环境

VMware Workstation Pro—Ubuntu

Win10 VS2013

三、实现主要代码

```
#define WindowWidth   800
#define WindowHeight 800
#define WindowTitle   "OpenGL 纹理测试"

#include <GL/glut.h>
#include <stdio.h>
#include <stdlib.h>

//定义两个纹理对象编号
//GLuint texGround;
GLuint texWall;

#define BMP_Header_Length 54   //图像数据在内存块中的偏移量
//static GLfloat angle = 0.0f;     //旋转角度
//GLfloat diffuseMaterial[4] = { 0.5, 0.5, 0.5, 1.0 };

int s1=0,s2=0;
//  函数 power_of_two 用于判断一个整数是不是 2 的整数次幂
int power_of_two(int n)
{
     if( n <= 0 )
          return 0;
     return (n & (n-1)) == 0;
}

/*  函数 load_texture
*  读取一个 BMP 文件作为纹理
*  如果失败，返回 0，如果成功，返回纹理编号
*/
GLuint load_texture(const char* file_name)
{
     GLint width, height, total_bytes;
     GLubyte* pixels = 0;
     GLuint last_texture_ID=0, texture_ID = 0;
```

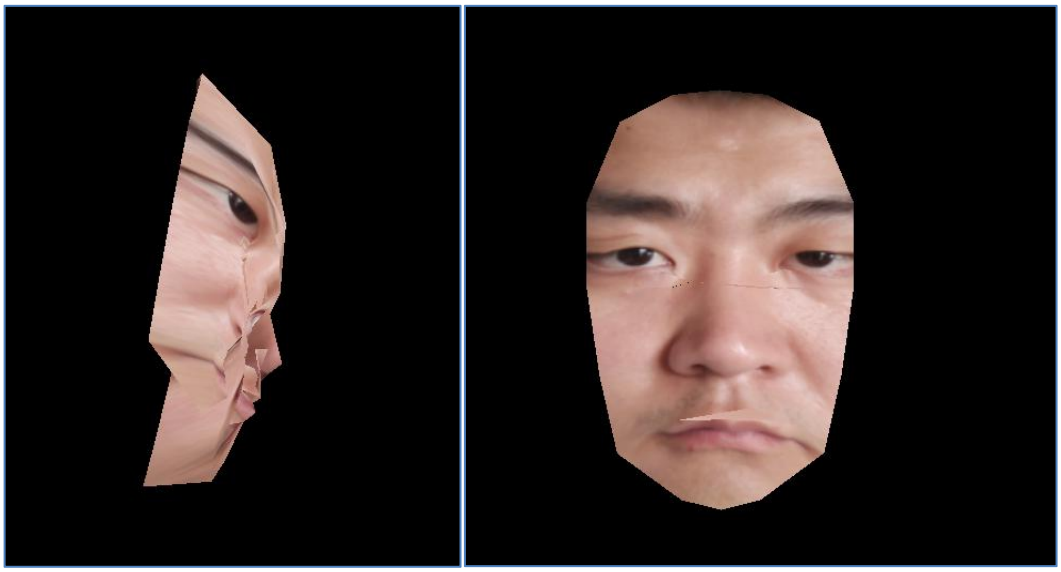
```
// 打开文件，如果失败，返回
FILE* pFile = fopen(file_name, "rb");
if( pFile == 0 )
    return 0;

// 读取文件中图象的宽度和高度
fseek(pFile, 0x0012, SEEK_SET);
fread(&width, 4, 1, pFile);
fread(&height, 4, 1, pFile);
fseek(pFile, BMP_Header_Length, SEEK_SET);

// 计算每行像素所占字节数，并根据此数据计算总像素字节数
{
    GLint line_bytes = width * 3;
    while( line_bytes % 4 != 0 )
        ++line_bytes;
    total_bytes = line_bytes * height;
}

// 根据总像素字节数分配内存
pixels = (GLubyte*)malloc(total_bytes);
if( pixels == 0 )
{
    fclose(pFile);
    return 0;
}

// 读取像素数据
if( fread(pixels, total_bytes, 1, pFile) <= 0 )
{
    free(pixels);
    fclose(pFile);
    return 0;
}

// 对就旧版本的兼容，如果图象的宽度和高度不是的整数次方，则需要进行缩放
// 若图像宽高超过了 OpenGL 规定的最大值，也缩放
{
    GLint max;
    glGetIntegerv(GL_MAX_TEXTURE_SIZE, &max);
    if( !power_of_two(width)
        || !power_of_two(height)
        || width > max
        || height > max )
    {
        const GLint new_width = 256;
        const GLint new_height = 256; // 规定缩放后新的大小为边长的正方
形
        GLint new_line_bytes, new_total_bytes;
        GLubyte* new_pixels = 0;

        // 计算每行需要的字节数和总字节数
        new_line_bytes = new_width * 3;
        while( new_line_bytes % 4 != 0 )
```

```
                ++new_line_bytes;
            new_total_bytes = new_line_bytes * new_height;

            // 分配内存
            new_pixels = (GLubyte*)malloc(new_total_bytes);
            if( new_pixels == 0 )
            {
                free(pixels);
                fclose(pFile);
                return 0;
            }

            // 进行像素缩放
            gluScaleImage(GL_RGB,
                width, height, GL_UNSIGNED_BYTE, pixels,
                new_width, new_height, GL_UNSIGNED_BYTE, new_pixels);

            // 释放原来的像素数据，把 pixels 指向新的像素数据，并重新设置 width
和 height
            free(pixels);
            pixels = new_pixels;
            width = new_width;
            height = new_height;
        }
    }

    // 分配一个新的纹理编号
    glGenTextures(1, &texture_ID);
    if( texture_ID == 0 )
    {
        free(pixels);
        fclose(pFile);
        return 0;
    }

    // 绑定新的纹理，载入纹理并设置纹理参数
    // 在绑定前，先获得原来绑定的纹理编号，以便在最后进行恢复
    GLint lastTextureID=last_texture_ID;
    glGetIntegerv(GL_TEXTURE_BINDING_2D, &lastTextureID);
    glBindTexture(GL_TEXTURE_2D, texture_ID);
    glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_MIN_FILTER,
GL_LINEAR);
    glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_MAG_FILTER,
GL_LINEAR);
    glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_WRAP_S, GL_REPEAT);
    glTexParameteri(GL_TEXTURE_2D, GL_TEXTURE_WRAP_T, GL_REPEAT);
    glTexEnvf(GL_TEXTURE_ENV, GL_TEXTURE_ENV_MODE, GL_REPLACE);
    glTexImage2D(GL_TEXTURE_2D, 0, GL_RGB, width, height, 0,
        GL_BGR_EXT, GL_UNSIGNED_BYTE, pixels);
    glBindTexture(GL_TEXTURE_2D, lastTextureID);  //恢复之前的纹理绑定
    free(pixels);
    return texture_ID;
}
void keyboard (unsigned char key, int x, int y)
```

```
{
switch (key) {
case 's':
s1 = (s1 + 5) % 360;
glutPostRedisplay();
break;
case 'S':
s1 = (s1 - 5) % 360;
glutPostRedisplay();
break;
case 'e':
s2 = (s2 + 5) % 360;
glutPostRedisplay();
break;
case 'E':
s2 = (s2 - 5) % 360;
glutPostRedisplay();
break;
case 27:
exit(0);
break;
default:
break;
}
}
static GLfloat spin = 0.0;
void init(void)
{
glClearColor(0.0,0.0,0.0,0.0);
glShadeModel(GL_FLAT);
}
void display(void)
{
    // 清除屏幕
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);
    // 设置视角
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();
        //gluPerspective(75, 1, 1, 21);
       gluPerspective(20, 1, 3, 21);
    glMatrixMode(GL_MODELVIEW);
    glLoadIdentity();
    gluLookAt(-4, 7,7, 0, 0, 0, 0, 0, 1);
    //glRotatef(angle, 0.0f, 0.0f, 1.0f); //旋转
        //glRotatef(spin,0.0,0.0,0.0);
        glRotatef(s1,0.0,0.0,1.0);
        glRotatef(s2,1.0,0.0,0.0);
        glBindTexture(GL_TEXTURE_2D, texWall);
       //glBegin(GL_QUADS);
      glBegin(GL_TRIANGLES);

/*glClear(GL_COLOR_BUFFER_BIT);
glPushMatrix();glRotatef(spin,0.0,1.0,0.0);
glColor3f(0.5,0.0,1.0);
glPolygonMode(GL_FRONT_AND_BACK,GL_FRONT);
glBindTexture(GL_TEXTURE_2D, texWall);
```

```
    glBegin(GL_TRIANGLES);*/
        // 绘制底面以及纹理
    glTexCoord2d(0.501041,0.005000);glVertex3f(0.000000f,1.061000f,-0.371000f);
    glTexCoord2d(0.587917,0.079375);glVertex3f(0.174000f,0.800000f,-0.024000f);
    glTexCoord2d(0.600208,0.014375);glVertex3f(0.217000f,1.039000f,-0.371000f);
    glTexCoord2d(0.501041,0.005000);glVertex3f(0.000000f,1.061000f,-0.371000f);
    glTexCoord2d(0.587917,0.079375);glVertex3f(0.174000f,0.800000f,-0.024000f);


    int main(int argc, char* argv[])
    {
        // GLUT 初始化
        glutInit(&argc, argv);
        glutInitDisplayMode(GLUT_DOUBLE | GLUT_RGBA);
        glutInitWindowPosition(20, 20);
        glutInitWindowSize(WindowWidth, WindowHeight);
        glutCreateWindow(WindowTitle);
        glEnable(GL_DEPTH_TEST);

        glEnable(GL_TEXTURE_2D);      // 启用纹理
        //texGround = load_texture("2.bmp");   //加载纹理
        //texWall = load_texture("lby.bmp");
            texWall = load_texture("zhengmian.bmp");
        glutDisplayFunc(&display);    //注册函数
            glutReshapeFunc(reshape);
            glutMouseFunc(mouse);
            glutKeyboardFunc(keyboard);
        //glutIdleFunc(&myIdle);
        glutMainLoop(); //循环调用
        return 0;
    }
```

四、效果



五、总结

本次课程设计，入门和了解 OpenGL 工具并使用 OpenGL 完成一些简单到复杂的图像设计和处理。这学期最大的收获是，感谢仝老师给了很多方面的指导和指引，以及对学习和未来职业规划上思维的扩展，更好地利用 github 上面丰富的开源资源，在工作学习中做更深入的研究。