

КАФЕДРА №

ОТЧЕТ  
ЗАЩИЩЕН С ОЦЕНКОЙ  
ПРЕПОДАВАТЕЛЬ

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должность, уч. степень, звание

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подпись, дата

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инициалы, фамилия

## ОТЧЕТ О ЛАБОРАТОРНОЙ РАБОТЕ

### **Работа с источником света и свойствами источников и материалов**

по курсу: Компьютерная графика

РАБОТУ ВЫПОЛНИЛ

СТУДЕНТ ГР. №

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подпись, дата

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инициалы, фамилия

Санкт-Петербург 2022

1) Листинг программы:

Main.cpp

```
#include <iostream>
#include <cmath>

#include <GL/freeglut.h>

#define W_WIDTH 1280
#define W_HEIGHT 720

/* параметры материала шара */

// угол поворота камеры
double angle_x=0.0;
double angle_y=-5000.0;
// координаты вектора направления движения камеры
float lx=0.0f, ly=0.0f, lz=-1.0f;
// XZ позиция камеры
float x=0.0f, y=0.0f, z=5.0f;

int refreshMills = 60;

float fraction = -0.5f;
float fraction_angle = 0.1f;

float light_fraction = -0.5f;

bool use_mouse = true;

bool forward = false;
bool back = false;
bool left = false;
bool right = false;

bool light_up = false;
bool light_down = false;
bool light_forward = false;
bool light_back = false;
bool light_left = false;
bool light_right = false;

float mat_dif_Teapot[] = {0.2f, 0.2f, 0.2f, 1.0f};
float mat_spec_Teapot[] = {0.0f, 0.0f, 0.0f};
float mat_amb_Teapot[] = {0.4f, 4.0f, 4.0f};
float mat_shininess_Teapot = 0.1f * 128;

float mat_dif_Cube[] = {0.0f, 0.0f, 0.0f, 1.0f};
float mat_spec_Cube[] = {0.9f, 0.9f, 0.9f};
float mat_amb_Cube[] = {0.0f, 0.0f, 0.0f};
float mat_shininess_Cube = 0.1f * 128;
```

```
float mat_dif_Sphere[] = {0.0f, 0.0f, 0.0f, 1.0f};  
float mat_spec_Sphere[] = {0.9f, 0.9f, 0.9f};  
float mat_amb_Sphere[] = {0.0f, 0.0f, 0.0f};  
float mat_shininess_Sphere = 0.1f * 128;
```

```
float mat_dif_Icosahedron[] = {0.9f, 0.9f, 9.9f, 1.0f};  
float mat_spec_Icosahedron[] = {0.9f, 0.9f, 0.9f};  
float mat_amb_Icosahedron[] = {0.9f, 0.9f, 0.9f};  
float mat_shininess_Icosahedron = 0.1f * 128;
```

```
float mat_dif_center[] = {0.9f, 0.9f, 9.9f, 0.5};  
float mat_spec_center[] = {0.9f, 0.9f, 0.9f};  
float mat_amb_center[] = {0.9f, 0.9f, 0.9f};  
float mat_shininess_center = 0.1f * 128;
```

```
float mat_dif_light[] = {0.0f, 0.0f, 0.0f, 1.0};
```

```
/* параметры источника света */
```

```
int index_light = 0;  
GLfloat light_position[3][4] = {  
    {0.0, 0.0, 0.0, 1.0},  
    {0.0, 0.0, 0.0, 1.0},  
    {0.0, 0.0, 0.0, 1.0}  
};
```

```
GLfloat ambientColor1[] = { 0.2, 0.2, 0.2, 1.0 };  
GLfloat diffuseColor1[] = { 0, 1, 0, 0.6 };  
GLfloat emis1[] = { 0.1, 0.1, 0.1, 0.1 };
```

```
GLfloat ambientColor2[] = { 0.4, 0.2, 0.4, 1.0 };  
GLfloat diffuseColor2[] = { 1, 1, 0, 0.6 };  
GLfloat emis2[] = { 0.1, 0.1, 0.1, 0.1 };
```

```
GLfloat ambientColor3[] = { 0.6, 0.2, 0.6, 2.0 };  
GLfloat diffuseColor3[] = { 1, 0, 0, 0.6 };  
GLfloat emis3[] = { 0.1, 0.1, 0.1, 0.1 };
```

```
GLfloat Teapot_rotation = 0.0f;
```

```
void drawText2f(float x, float y, std::string text) {  
    glColor3d(1.0, 0.0, 0.0);  
    glRasterPos2f(x, y);  
    glutBitmapString(GLUT_BITMAP_8_BY_13, (const unsigned char*)text.c_str());  
}
```

```
void drawText3f(float x, float y, float z, std::string text) {  
    glColor3d(1.0, 0.0, 0.0);  
    glRasterPos3f(x, y, z);  
    glutBitmapString(GLUT_BITMAP_8_BY_13, (const unsigned char*)text.c_str());  
}  
//прорисовка, для не искажения окна
```

```

void Reshape(int w, int h) {
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();
    gluPerspective(40.0, (GLfloat) w / h, 1, 100.0);
    glMatrixMode(GL_MODELVIEW);
    glLoadIdentity();
    glViewport(0, 0, (GLsizei) w, (GLsizei) h);
}

void move() {
    // camera
    if (forward) {
        z -= lz * fraction;
        x -= lx * fraction;
        y -= ly * fraction;
    }

    if (back) {
        z += lz * fraction;
        x += lx * fraction;
        y += ly * fraction;
    }

    if (left) {
        z += lx * fraction;
        x -= lz * fraction;
    }

    if (right) {
        z -= lx * fraction;
        x += lz * fraction;
    }

    // light
    if (light_forward) {
        light_position[index_light][0] += light_fraction;
    }

    if (light_back) {
        light_position[index_light][0] -= light_fraction;
    }

    if (light_left) {
        light_position[index_light][2] -= light_fraction;
    }

    if (light_right) {
        light_position[index_light][2] += light_fraction;
    }

    if (light_up) {

```

```

    light_position[index_light][1] -= light_fraction;
}

if (light_down) {
    light_position[index_light][1] += light_fraction;
}

}

void keyUp(unsigned char key, int xx, int yy) {
    switch (key) {
        // camera
        case ('w'):
            forward = false;
            break;

        case ('s'):
            back = false;
            break;

        case ('a'):
            left = false;
            break;

        case ('d'):
            right = false;
            break;

        // light
        case ('u'):
            light_forward = false;
            break;

        case ('j'):
            light_back = false;
            break;

        case ('h'):
            light_left = false;
            break;

        case ('k'):
            light_right = false;
            break;

        case ('y'):
            light_up = false;
            break;

        case ('i'):
            light_down = false;
            break;
    }
}

```

```

        // switch move light
case ('t'):
    index_light += 1;
    if (index_light >= 3)
        index_light = 0;
    break;

    // включить (выключить курсор)
case ('g'):
    use_mouse = !use_mouse;
    break;

    // выход
case 27:
    //glutDestroyWindow ( Win.id );
    exit (0);
    break;
    }
}

void keyDown(unsigned char key, int xx, int yy) {
    switch (key) {

        // camera
case ('w'):
        forward = true;
        break;

case ('s'):
        back = true;
        break;

case ('a'):
        left = true;
        break;

case ('d'):
        right = true;
        break;

        // light
case ('u'):
        light_forward = true;
        break;

case ('j'):
        light_back = true;
        break;
    }
}

```

```

    case ('h'):
        light_left = true;
        break;

    case ('k'):
        light_right = true;
        break;

    case ('y'):
        light_up = true;
        break;

    case ('i'):
        light_down = true;
        break;

}
}

double sensitivity = 0.001;

void mouseMove(int xx, int yy) {
    if (use_mouse) {
        angle_x -= (W_WIDTH/2 - xx) * sensitivity;
        if ((angle_y + (W_HEIGHT/2 - yy) * sensitivity < -4998.3) && (angle_y +
(W_HEIGHT/2 - yy) * sensitivity > -5001.3)) {
            angle_y += (W_HEIGHT/2 - yy) * sensitivity;
        }

        // lx = sin(angle_x);
        // lz = -cos(angle_x);
        // ly = sin(angle_y);
        lx = sin(angle_y) * sin(angle_x);
        ly = -cos(angle_y);
        lz = -sin(angle_y) * cos(angle_x);
        glutWarpPointer(
            W_WIDTH / 2,
            W_HEIGHT / 2
        );
    }
}

//вывод на экран, созд сцены
void Display(void) {

    move();

    glLoadIdentity();

    gluLookAt(x, y, z,
        x+lx, y+ly, z+lz,
        0.0f, 1.0f, 0.0f );
}

```

```

glClearColor(0, 0.3, 0.3, 1);
glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);

drawText3f(0, 0, 0, "Teapot");
drawText3f(-10, 0, 10, "Dodecahedron");
drawText3f(10, 1, 10, "Cylinder");
drawText3f(0, 1, 20, "Sphere");

glEnable(GL_DEPTH_TEST);

glEnable(GL_BLEND);
glBlendFunc(GL_SRC_ALPHA, GL_ONE_MINUS_SRC_ALPHA);

glLightfv(GL_LIGHT0, GL_DIFFUSE, diffuseColor1);
glLightfv(GL_LIGHT0, GL_AMBIENT, ambientColor1);
glLightfv(GL_LIGHT0, GL_EMISSION, emis1);

glLightfv(GL_LIGHT0, GL_POSITION, light_position[0]);
glTranslatef(light_position[0][0], light_position[0][1], light_position[0][2]);
glMaterialfv(GL_FRONT, GL_DIFFUSE, mat_dif_light);
glutSolidSphere(0.2, 32, 32);
glTranslatef(-light_position[0][0], -light_position[0][1], -light_position[0][2]);

glLightfv(GL_LIGHT1, GL_DIFFUSE, diffuseColor2);
glLightfv(GL_LIGHT1, GL_AMBIENT, ambientColor2);
glLightfv(GL_LIGHT0, GL_EMISSION, emis1);

glLightfv(GL_LIGHT1, GL_POSITION, light_position[1]);
glTranslatef(light_position[1][0], light_position[1][1], light_position[1][2]);
glMaterialfv(GL_FRONT, GL_DIFFUSE, mat_dif_light);
glutSolidSphere(0.2, 32, 32);
glTranslatef(-light_position[1][0], -light_position[1][1], -light_position[1][2]);

glLightfv(GL_LIGHT2, GL_DIFFUSE, diffuseColor3);
glLightfv(GL_LIGHT2, GL_AMBIENT, ambientColor3);
glLightfv(GL_LIGHT0, GL_EMISSION, emis1);

glLightfv(GL_LIGHT2, GL_POSITION, light_position[2]);
glTranslatef(light_position[2][0], light_position[2][1], light_position[2][2]);
glMaterialfv(GL_FRONT, GL_DIFFUSE, mat_dif_light);
glutSolidSphere(0.2, 32, 32);
glTranslatef(-light_position[2][0], -light_position[2][1], -light_position[2][2]);

/* включаем освещение и источник света */
glEnable(GL_LIGHTING);
glEnable(GL_LIGHT0);
glEnable(GL_LIGHT1);
glEnable(GL_LIGHT2);

Teapot_rotation += 0.5f;
glMaterialfv(GL_FRONT, GL_AMBIENT, mat_amb_Teapot);
glMaterialfv(GL_FRONT, GL_DIFFUSE, mat_dif_Teapot);

```



```

glMaterialfv(GL_FRONT, GL_SPECULAR, mat_spec_Teapot);
glMaterialf(GL_FRONT, GL_SHININESS, mat_shininess_Teapot);
glRotatef(Teapot_rotation, 0.0f, 1.0f, 0.0f);
glTranslatef(0.0f, -2.0f, 0.0f);
glutSolidTeapot(2);

glMaterialfv(GL_FRONT, GL_AMBIENT, mat_amb_Cube);
glMaterialfv(GL_FRONT, GL_DIFFUSE, mat_dif_Cube);
glMaterialfv(GL_FRONT, GL_SPECULAR, mat_spec_Cube);
glMaterialf(GL_FRONT, GL_SHININESS, mat_shininess_Cube);
glRotatef(-Teapot_rotation, 0.0f, 1.0f, 0.0f);
glTranslatef(-10.0f, 0.0f, 10.0f);
//glutSolidCube(2.0);
glutSolidDodecahedron();

glMaterialfv(GL_FRONT, GL_AMBIENT, mat_amb_Sphere);
glMaterialfv(GL_FRONT, GL_DIFFUSE, mat_dif_Sphere);
glMaterialfv(GL_FRONT, GL_SPECULAR, mat_spec_Sphere);
glMaterialf(GL_FRONT, GL_SHININESS, mat_shininess_Sphere);
glTranslatef(10.0f, 0.0f, 10.0f);
glutSolidSphere(2.0, 32, 32);

glMaterialfv(GL_FRONT, GL_AMBIENT, mat_amb_Icosahedron);
glMaterialfv(GL_FRONT, GL_DIFFUSE, mat_dif_Icosahedron);
glMaterialfv(GL_FRONT, GL_SPECULAR, mat_spec_Icosahedron);
glMaterialf(GL_FRONT, GL_SHININESS, mat_shininess_Icosahedron);
glTranslatef(10.0f, 0.0f, -10.0f);
glutSolidCylinder(2.0, 4, 32, 32);

glMaterialfv(GL_FRONT, GL_AMBIENT, mat_amb_center);
glMaterialfv(GL_FRONT, GL_DIFFUSE, mat_dif_center);
glMaterialfv(GL_FRONT, GL_SPECULAR, mat_spec_center);
glMaterialf(GL_FRONT, GL_SHININESS, mat_shininess_center);
glTranslatef(-10.0f, 0.0f, 0.0f);
glutSolidDodecahedron();

glFlush();

}

void timer(int value) {
    glutPostRedisplay();
    glutTimerFunc(1000/refreshMills, timer, 0);
}

int main(int argc, char ** argv) {
    glutInit( &argc, argv);
    glutInitDisplayMode(GLUT_RGBA | GLUT_DEPTH);
    glutInitWindowPosition(150, 50);
    glutInitWindowSize(W_WIDTH, W_HEIGHT);
    glutCreateWindow("light");
    glutReshapeFunc(Reshape);

```

```
glutDisplayFunc(Display);  
  
glutSetKeyRepeat(GLUT_KEY_REPEAT_OFF);  
  
glutKeyboardFunc(keyDown);  
glutKeyboardUpFunc(keyUp);  
  
glutPassiveMotionFunc(mouseMove);  
  
glutTimerFunc(0, timer, 0);  
  
glutMainLoop();  
  
}
```

- 2) Вывод: были изучены принципы работы с источником света и свойствами источников и материалов.