Izabela Wenda
Inżynieria Obliczeniowa
Gr nr 3

# SPRAWOZDANIE

Lab nr 5

Celem ćwiczenia było zapoznanie się z programowaniem grafiki przy użyciu shader'ów, zastosowanie swobodnego poruszania kamery oraz kontroli szybkości działania pętli głownej.

1. Ustalenie przechwytywania kursora myszy.

```
window.setMouseCursorGrabbed(true);
window.setMouseCursorVisible(false);
```

2. Dodanie funkcji przechwytu do eventu MouseMoved.

```
void setMouse(GLint uniView, float time, sf::Window& window) {
    localPosition = sf::Mouse::getPosition(window);
    double xoffset = localPosition.x - lastX;
    double yoffset = localPosition.y - lastY;
    lastX = localPosition.x;
    lastY = localPosition.y;
    xoffset *= sensitivity;
    yoffset *= sensitivity;
    yaw += xoffset;
    pitch -= yoffset;
    if (pitch > 89.0f)
        pitch = 89.0f;
    if (pitch < -89.0f)
        pitch = -89.0f;
    front.x = cos(glm::radians(yaw)) * cos(glm::radians(pitch));
    front.y = sin(glm::radians(pitch));
    front.z = sin(glm::radians(yaw)) * cos(glm::radians(pitch));
    cameraFront = glm::normalize(front);
}
```

3. Utworzenie macierzy widoku.

```
glm::mat4 view;
view = glm::lookAt(cameraPos, cameraPos + cameraFront, cameraUp);
GLint uniView = glGetUniformLocation(shaderProgram, "view");
glUniformMatrix4fv(uniView, 1, GL_FALSE, glm::value_ptr(view));
```

4. Dodanie nagłówka, utworzenie obiektów clock i time (czas trwania pętli głownej).

5. Ustalenie prędkości kamery na podstawie tego czasu.

```
cameraSpeed = 0.000099f * time.asMicroseconds();
```

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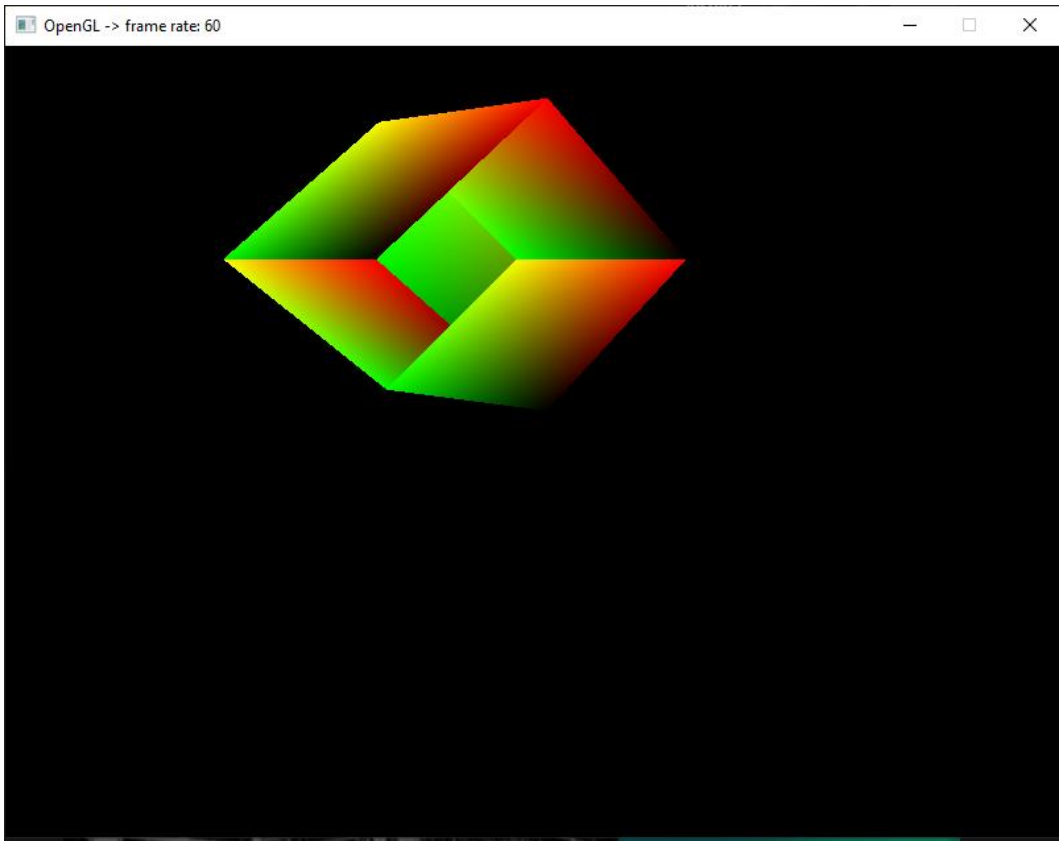
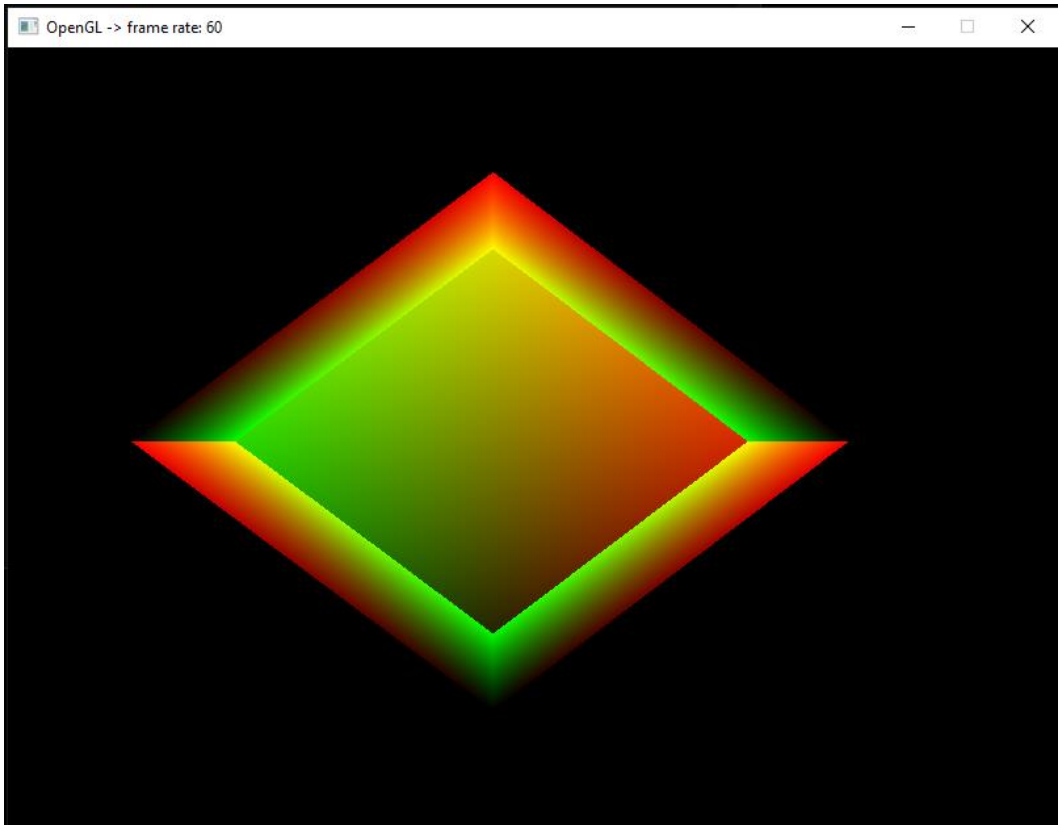
Wyniki programu:



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Kod:

```
// Naglowki
#define _USE_MATH_DEFINES
#include "stdafx.h"
#include <GL/glew.h>
#include <SFML/Window.hpp>4
#include <iostream>
#include <math.h>
#include <random>
#include <Windows.h>
#include <glm/glm.hpp>
#include <glm/gtc/matrix_transform.hpp>
#include <glm/gtc/type_ptr.hpp>
#include <SFML/System/Time.hpp>
const GLchar* vertexSource = R"glsl(
#version 150 core
in vec3 position;
in vec3 color;
out vec3 Color;
uniform mat4 model;
uniform mat4 view;
uniform mat4 proj;
void main(){
Color = color;
gl_Position = proj * view * model * vec4(position, 1.0);
}
)glsl";
const GLchar* fragmentSource = R"glsl(
#version 150 core
in vec3 Color;
out vec4 outColor;
void main()
{
outColor = vec4(Color, 1.0);
}
)glsl";
// Zmienne opisujące kamerę
glm::vec3 cameraPos = glm::vec3(0.0f, 0.0f, 3.0f);
glm::vec3 cameraFront = glm::vec3(0.0f, 0.0f, -1.0f);
glm::vec3 cameraUp = glm::vec3(0.0f, 1.0f, 0.0f);
void Camera3D(GLint uniView) {
	glm::mat4 view = glm::lookAt(cameraPos, cameraPos + cameraFront,
		cameraUp);
```

```
	glUniformMatrix4fv(uniView, 1, GL_FALSE, glm::value_ptr(view));
}
double yaw = -90;
double pitch = 0;
double lastX = 0, lastY = 0;
double sensitivity = 0.1;
glm::vec3 front;
sf::Vector2i localPosition;
void setMouse(GLint uniView, float time, sf::Window& window) {
	localPosition = sf::Mouse::getPosition(window);
	double xoffset = localPosition.x - lastX;
	double yoffset = localPosition.y - lastY;
	lastX = localPosition.x;
	lastY = localPosition.y;
	xoffset *= sensitivity;
	yoffset *= sensitivity;
	yaw += xoffset;
	pitch -= yoffset;
	if (pitch > 89.0f)
		pitch = 89.0f;
	if (pitch < -89.0f)
		pitch = -89.0f;
	front.x = cos(glm::radians(yaw)) * cos(glm::radians(pitch));
	front.y = sin(glm::radians(pitch));
	front.z = sin(glm::radians(yaw)) * cos(glm::radians(pitch));
	cameraFront = glm::normalize(front);
}
GLfloat* toCartesian(float p, float z, int num) {
	GLfloat* arr = new GLfloat[6 * num];
	float change = 360.0f / static_cast <GLfloat>(num);
	float degree = 0;
	srand(time(NULL));
	for (int i = 0; i < num; i++) {
		arr[0 + i * 6] = p * static_cast <GLfloat> (cos(degree *
			M_PI / 180));
		arr[1 + i * 6] = p * static_cast <GLfloat> (sin(degree *
			M_PI / 180));
		arr[2 + i * 6] = z;
		arr[3 + i * 6] = rand() % 11 / 10.0;
		arr[4 + i * 6] = rand() % 11 / 10.0;
		arr[5 + i * 6] = rand() % 11 / 10.0;
		degree += change;
	}
	return arr;
```

```
}
using namespace std;
int main()
{
	sf::ContextSettings settings;
	settings.depthBits = 24;
	settings.stencilBits = 8;
	// Okno renderingu
	sf::Window window(sf::VideoMode(800, 600, 32), "OpenGL",
		sf::Style::Titlebar | sf::Style::Close, settings);
	int frames = 60;
	//window.setFramerateLimit(frames);
	window.setTitle("OpenGL -> frame rate: " + to_string(frames));
	// Inicjalizacja GLEW
	glewExperimental = GL_TRUE;
	glewInit();
	// Utworzenie VAO (Vertex Array Object)
	GLuint vao;
	glGenVertexArrays(1, &vao);
	glBindVertexArray(vao);
	// Utworzenie VBO (Vertex Buffer Object)
	// i skopiowanie do niego danych wierzchoĹkowych
	GLuint vbo;
	glGenBuffers(1, &vbo);
	GLfloat vertices[] = {
	-0.5f, -0.5f, -0.5f, 0.0f, 0.0f, 0.0f,
	0.5f, -0.5f, -0.5f, 1.0f, 0.0f, 0.0f,
	0.5f, 0.5f, -0.5f, 1.0f, 1.0f, 0.0f,
	0.5f, 0.5f, -0.5f, 1.0f, 1.0f, 0.0f,
	-0.5f, 0.5f, -0.5f, 0.0f, 1.0f, 0.0f,
	-0.5f, -0.5f, -0.5f, 0.0f, 0.0f, 0.0f,
	-0.5f, -0.5f, 0.5f, 0.0f, 0.0f, 0.0f,
	0.5f, -0.5f, 0.5f, 1.0f, 0.0f, 0.0f,
	0.5f, 0.5f, 0.5f, 1.0f, 1.0f, 0.0f,
	0.5f, 0.5f, 0.5f, 1.0f, 1.0f, 0.0f,
	-0.5f, 0.5f, 0.5f, 0.0f, 1.0f, 0.0f,
	-0.5f, -0.5f, 0.5f, 0.0f, 0.0f, 0.0f,
	-0.5f, 0.5f, 0.5f, 1.0f, 0.0f, 0.0f,
	-0.5f, 0.5f, -0.5f, 1.0f, 1.0f, 0.0f,
	-0.5f, -0.5f, -0.5f, 0.0f, 1.0f, 0.0f,
	-0.5f, -0.5f, -0.5f, 0.0f, 1.0f, 0.0f,
	-0.5f, -0.5f, 0.5f, 0.0f, 0.0f, 0.0f,
	-0.5f, 0.5f, 0.5f, 1.0f, 0.0f, 0.0f,
	0.5f, 0.5f, 0.5f, 1.0f, 0.0f, 0.0f,
```

```
0.5f, 0.5f, -0.5f, 1.0f, 1.0f, 0.0f,
0.5f, -0.5f, -0.5f, 0.0f, 1.0f, 0.0f,
0.5f, -0.5f, -0.5f, 0.0f, 1.0f, 0.0f,
0.5f, -0.5f, 0.5f, 0.0f, 0.0f, 0.0f,
0.5f, 0.5f, 0.5f, 1.0f, 0.0f, 0.0f,
-0.5f, -0.5f, -0.5f, 0.0f, 1.0f, 0.0f,
0.5f, -0.5f, -0.5f, 1.0f, 1.0f, 0.0f,
0.5f, -0.5f, 0.5f, 1.0f, 0.0f, 0.0f,
0.5f, -0.5f, 0.5f, 1.0f, 0.0f, 0.0f,
-0.5f, -0.5f, 0.5f, 0.0f, 0.0f, 0.0f,
-0.5f, -0.5f, -0.5f, 0.0f, 1.0f, 0.0f,
-0.5f, 0.5f, -0.5f, 0.0f, 1.0f, 0.0f,
0.5f, 0.5f, -0.5f, 1.0f, 1.0f, 0.0f,
0.5f, 0.5f, 0.5f, 1.0f, 0.0f, 0.0f,
0.5f, 0.5f, 0.5f, 1.0f, 0.0f, 0.0f,
-0.5f, 0.5f, 0.5f, 0.0f, 0.0f, 0.0f,
-0.5f, 0.5f, -0.5f, 0.0f, 1.0f, 0.0f
};

glBindBuffer(GL_ARRAY_BUFFER, vbo);
glBufferData(GL_ARRAY_BUFFER, sizeof(vertices), vertices,
        GL_STATIC_DRAW);
// Utworzenie i skompilowanie shadera wierzcholkow
GLuint vertexShader =
        glCreateShader(GL_VERTEX_SHADER);
glShaderSource(vertexShader, 1, &vertexSource, NULL);
glCompileShader(vertexShader);
// Utworzenie i skompilowanie shadera fragmentow
GLuint fragmentShader =
        glCreateShader(GL_FRAGMENT_SHADER);
glShaderSource(fragmentShader, 1, &fragmentSource, NULL);
glCompileShader(fragmentShader);
// Sprawdzanie czy shadery sie dobrze zaladowaly
GLint check1;
GLint check2;
glGetShaderiv(vertexShader, GL_COMPILE_STATUS, &check1);
glGetShaderiv(fragmentShader, GL_COMPILE_STATUS, &check2);
cout << "Compilation vertexShader: ";
if (check1 == GL_TRUE)
        cout << "works" << endl;
else {
        cout << "error" << endl;
        GLint infoLength;
        glGetShaderiv(vertexShader, GL_INFO_LOG_LENGTH,
```

```
		&infoLength);
	GLchar* buffer = new GLchar[infoLength];
	GLsizei bufferSize;
	glGetShaderInfoLog(vertexShader, infoLength, &bufferSize,
		buffer);
	cout << buffer << endl;
	delete[] buffer;
}
cout << "Compilation fragmentShader: ";
if (check2 == GL_TRUE)
	cout << "works" << endl;
else {
	cout << "error" << endl;
	GLint infoLength2;
	glGetShaderiv(fragmentShader, GL_INFO_LOG_LENGTH,
		&infoLength2);
	GLchar* buffer2 = new GLchar[infoLength2];
	GLsizei bufferSize2;
	glGetShaderInfoLog(fragmentShader, infoLength2,
		&bufferSize2, buffer2);
	cout << buffer2 << endl;
	delete[] buffer2;
}
// Zlinkowanie obu shaderow w jeden wspolny program
GLuint shaderProgram = glCreateProgram();
glAttachShader(shaderProgram, vertexShader);
glAttachShader(shaderProgram, fragmentShader);
glBindFragDataLocation(shaderProgram, 0, "outColor");
glLinkProgram(shaderProgram);
glUseProgram(shaderProgram);
// Specifikacja formatu danych wierzcholkowych
GLint posAttrib = glGetAttribLocation(shaderProgram, "position");
glEnableVertexAttribArray(posAttrib);
glVertexAttribPointer(posAttrib, 3, GL_FLOAT, GL_FALSE, 6 *
	sizeof(GLfloat), 0);
GLint colAttrib = glGetAttribLocation(shaderProgram, "color");
glEnableVertexAttribArray(colAttrib);
glVertexAttribPointer(colAttrib, 3, GL_FLOAT, GL_FALSE, 6 *
	sizeof(GLfloat), (void*)(3 * sizeof(GLfloat)));
GLenum primitive = GL_TRIANGLES;
// Utworzenie macierzy modelu
glm::mat4 model = glm::mat4(1.0f);
model = glm::rotate(model, glm::radians(45.0f), glm::vec3(0.0f,
	0.0f, 1.0f));
```

```
	GLint uniTrans = glGetUniformLocation(shaderProgram, "model");
	glUniformMatrix4fv(uniTrans, 1, GL_FALSE, glm::value_ptr(model));
	glm::mat4 view;
	view = glm::lookAt(cameraPos, cameraPos + cameraFront, cameraUp);
	GLint uniView = glGetUniformLocation(shaderProgram, "view");
	glUniformMatrix4fv(uniView, 1, GL_FALSE, glm::value_ptr(view));

	glm::mat4 proj = glm::perspective(glm::radians(45.0f), 800.0f /
		800.0f, 0.06f, 100.0f);
	GLint uniProj = glGetUniformLocation(shaderProgram, "proj");
	glUniformMatrix4fv(uniProj, 1, GL_FALSE, glm::value_ptr(proj));
	float cameraSpeed = 0.05;

	int pos;
	window.setMouseCursorGrabbed(true);
	window.setMouseCursorVisible(false);
	sf::Clock clock;
	sf::Time time;
	bool running = true;
	while (running) {
		time = clock.getElapsedTime();
		clock.restart();
		sf::Event windowEvent;
		while (window.pollEvent(windowEvent)) {
			switch (windowEvent.type) {
			case sf::Event::Closed:
				running = false;
				break;
			case sf::Event::KeyPressed:
				switch (windowEvent.key.code)
				{
				case sf::Keyboard::Up:
					cameraPos += cameraSpeed * cameraFront;
					break;
				case sf::Keyboard::Down:
					cameraPos -= cameraSpeed * cameraFront;
					break;
				case sf::Keyboard::Left:
					cameraPos -=
						glm::normalize(glm::cross(cameraFront, cameraUp))
* cameraSpeed;

					break;
				case sf::Keyboard::Right:
```

```
                        cameraPos +=
                                glm::normalize(glm::cross(cameraFront, cameraUp))
* cameraSpeed;

                        break;
                case sf::Keyboard::Escape: // close application
                        window.close();
                        break;
                case sf::Keyboard::Num1:
                        primitive = GL_POINTS;
                        break;
                case sf::Keyboard::Num2:
                        primitive = GL_LINES;
                        break;
                case sf::Keyboard::Num3:
                        primitive = GL_LINE_STRIP;
                        break;
                case sf::Keyboard::Num4:
                        primitive = GL_LINE_LOOP;
                        break;
                case sf::Keyboard::Num5:
                        primitive = GL_TRIANGLES;
                        break;
                case sf::Keyboard::Num6:
                        primitive = GL_TRIANGLE_STRIP;
                        break;
                case sf::Keyboard::Num7:
                        primitive = GL_TRIANGLE_FAN;
                        break;
                case sf::Keyboard::Num8:
                        primitive = GL_QUADS;
                        break;
                case sf::Keyboard::Num9:
                        primitive = GL_QUAD_STRIP;
                        break;
                case sf::Keyboard::Num0:
                        primitive = GL_POLYGON;
                        break;
                }
        case sf::Event::MouseMoved:
                setMouse(uniView, time.asMicroseconds(),
                        window);

                break;
```

```
                }
            }
            Camera3D(uniView);
            // Nadanie scenie koloru czarnego
            glClearColor(0.0f, 0.0f, 0.0f, 1.0f);
            glClear(GL_COLOR_BUFFER_BIT);
            // Narysowanie trojkata

            glDrawArrays(primitive, 0, 36);
            // Wymiana buforow tylni/przedni
            window.display();
            //Sleep(100);
            cameraSpeed = 0.000099f * time.asMicroseconds();
        }
        // Kasowanie programu i czyszczenie buforoww
        glDeleteProgram(shaderProgram);
        glDeleteShader(fragmentShader);
        glDeleteShader(vertexShader);
        glDeleteBuffers(1, &vbo);
        glDeleteVertexArrays(1, &vao);
        // Zamkniecie okna renderingu
        window.close();
        return 0;
}
```