

BURSA ULUDAĞ ÜNİVERSİTESİ

BİLGİSAYAR MÜHENDİSLİĞİ

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BİLGİSAYAR GRAFİKLERİ RAPORU

MURAT BERK YETİŞTİRİR

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**SORU:** 3-B silindirik bir tel çerçeve temsilini belirlenen hassasiyet katsayısıyla çizdiren etkileşimli bir uygulama geliştiriniz. Tel çerçeveye Y klavye tuşuyla yeşil mermer, G klavye tuşuyla gri metalik doku giydiriniz. Ok yönleriyle modelin sağ-sol ve yukarı-aşağı hareketini sağlayınız. R klavye tuşuyla modelin y ekseni etrafında dönmesini sağlayınız. T klavye tuşuyla tel çerçeve moduna geçiniz. Bu modda, Gösterim ekranında gerçekleşen bir fare tıklaması için sahne sınırlarına göre farenin tıklandığı P0 konumundan –z eksenine doğru sahneye dik (ortogonal) bir ışın gönderildiğini varsayınız. Işının tel çerçeveyi kestiği silindirik poligonu son basılan klavye tuşuna göre yeşil mermer veya gri metalik dokuyla görselleyiniz. Işının tel çerçeveyi kestiği herhangi bir poligon yoksa tel çerçevenin tel rengini rasgele güncelleyiniz. Tam yorumlu kodunuzu ve OpenGL çıktısını içeren bir rapor hazırlayınız. Raporun içine ve dosya ismine adınızı, soyadınızı ve öğrenci numaranızı yazınız. Dosyayı pdf olarak kaydedip son teslim tarihinden önce UKEY’deki Lab4 ödevi arayüzüne yükleyiniz. Işın poligon kesişimi için ışın-normal yönelimi, ışın-düzlem kesişimi ve içinde-dışında testlerinden yararlanınız. shader ve stb\_image kütüphanelerini ekleyiniz.

**CEVAP KODUM:**

#include <glad/glad.h>

#include <GLFW/glfw3.h>

#include <stb\_image.h>

#include <glm/glm.hpp>

#include <glm/gtc/matrix\_transform.hpp>

#include <glm/gtc/type\_ptr.hpp>

#include <learnopengl/filesystem.h>

#include <learnopengl/shader\_m.h>,

#include <iostream>

#include <vector>

void framebuffer\_size\_callback(GLFWwindow\* window, int width, int height);

void mouse\_callback(GLFWwindow\* window, double xpos, double ypos);

void scroll\_callback(GLFWwindow\* window, double xoffset, double yoffset);

void processInput(GLFWwindow \*window);

// settings

const unsigned int SCR\_WIDTH = 800;

const unsigned int SCR\_HEIGHT = 600;

// camera

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);

bool firstMouse = true;

float yaw = -90.0f; // yaw is initialized to -90.0 degrees since a yaw of 0.0 results in a direction vector pointing to the right so we initially rotate a bit to the left.

float pitch = 0.0f;

float lastX = 800.0f / 2.0;

float lastY = 600.0 / 2.0;

float fov = 45.0f;

// timing

float deltaTime = 0.0f; // time between current frame and last frame

float lastFrame = 0.0f;

bool useFirstTexture = true;

float rotationAngle = 0.0f;

bool rotateModel = false;

bool wireframeMode = false;

void generatePrismVertices(std::vector<float>& vertices) {

const int SIDES = 10;

const float PI = 3.1415926f;

const float RADIUS = 0.5f;

const float HEIGHT = 1.0f;

vertices.clear();

float centerBottom[] = { 0.0f, -HEIGHT / 2.0f, 0.0f, 0.5f, 0.5f };

float centerTop[] = { 0.0f, HEIGHT / 2.0f, 0.0f, 0.5f, 0.5f };

for (int i = 0; i < SIDES; ++i) {

float angle1 = (2.0f \* PI / SIDES) \* i;

float angle2 = (2.0f \* PI / SIDES) \* (i + 1);

float x1 = cos(angle1) \* RADIUS;

float z1 = sin(angle1) \* RADIUS;

float x2 = cos(angle2) \* RADIUS;

float z2 = sin(angle2) \* RADIUS;

vertices.insert(vertices.end(), {

centerBottom[0], centerBottom[1], centerBottom[2], centerBottom[3], centerBottom[4],

x2, -HEIGHT / 2.0f, z2, 0.0f, 0.0f,

x1, -HEIGHT / 2.0f, z1, 1.0f, 0.0f

});

vertices.insert(vertices.end(), {

centerTop[0], centerTop[1], centerTop[2], centerTop[3], centerTop[4],

x1, HEIGHT / 2.0f, z1, 1.0f, 1.0f,

x2, HEIGHT / 2.0f, z2, 0.0f, 1.0f

});

vertices.insert(vertices.end(), {

x1, HEIGHT / 2.0f, z1, 0.0f, 1.0f,

x2, HEIGHT / 2.0f, z2, 1.0f, 1.0f,

x1, -HEIGHT / 2.0f, z1, 0.0f, 0.0f

});

vertices.insert(vertices.end(), {

x2, HEIGHT / 2.0f, z2, 1.0f, 1.0f,

x2, -HEIGHT / 2.0f, z2, 1.0f, 0.0f,

x1, -HEIGHT / 2.0f, z1, 0.0f, 0.0f

});

}

}

int main()

{

glfwInit();

glfwWindowHint(GLFW\_CONTEXT\_VERSION\_MAJOR, 3);

glfwWindowHint(GLFW\_CONTEXT\_VERSION\_MINOR, 3);

glfwWindowHint(GLFW\_OPENGL\_PROFILE, GLFW\_OPENGL\_CORE\_PROFILE);

#ifdef \_\_APPLE\_\_

glfwWindowHint(GLFW\_OPENGL\_FORWARD\_COMPAT, GL\_TRUE);

#endif

// glfw window creation

// --------------------

GLFWwindow\* window = glfwCreateWindow(SCR\_WIDTH, SCR\_HEIGHT, "Prisma", NULL, NULL);

if (window == NULL)

{

std::cout << "Failed to create GLFW window" << std::endl;

glfwTerminate();

return -1;

}

glfwMakeContextCurrent(window);

glfwSetFramebufferSizeCallback(window, framebuffer\_size\_callback);

glfwSetCursorPosCallback(window, mouse\_callback);

glfwSetScrollCallback(window, scroll\_callback);

// tell GLFW to capture our mouse

glfwSetInputMode(window, GLFW\_CURSOR, GLFW\_CURSOR\_DISABLED);

// glad: load all OpenGL function pointers

// ---------------------------------------

if (!gladLoadGLLoader((GLADloadproc)glfwGetProcAddress))

{

std::cout << "Failed to initialize GLAD" << std::endl;

return -1;

}

glEnable(GL\_DEPTH\_TEST);

Shader ourShader("7.3.camera.vs", "7.3.camera.fs");

std::vector<float> prismVertices;

generatePrismVertices(prismVertices);

// world space positions of our cubes

glm::vec3 prismPosition[] = {glm::vec3(0.0f, 0.0f, 0.0f)};

unsigned int VBO, VAO;

glGenVertexArrays(1, &VAO);

glGenBuffers(1, &VBO);

glBindVertexArray(VAO);

glBindBuffer(GL\_ARRAY\_BUFFER, VBO);

glBufferData(GL\_ARRAY\_BUFFER, prismVertices.size() \* sizeof(float), prismVertices.data(), GL\_STATIC\_DRAW);

// position attribute

glVertexAttribPointer(0, 3, GL\_FLOAT, GL\_FALSE, 5 \* sizeof(float), (void\*)0);

glEnableVertexAttribArray(0);

// texture coord attribute

glVertexAttribPointer(1, 2, GL\_FLOAT, GL\_FALSE, 5 \* sizeof(float), (void\*)(3 \* sizeof(float)));

glEnableVertexAttribArray(1);

unsigned int texture1, texture2;

// texture 1

// ---------

glGenTextures(1, &texture1);

glBindTexture(GL\_TEXTURE\_2D, texture1);

// set the texture wrapping parameters

glTexParameteri(GL\_TEXTURE\_2D, GL\_TEXTURE\_WRAP\_S, GL\_REPEAT);

glTexParameteri(GL\_TEXTURE\_2D, GL\_TEXTURE\_WRAP\_T, GL\_REPEAT);

// set texture filtering parameters

glTexParameteri(GL\_TEXTURE\_2D, GL\_TEXTURE\_MIN\_FILTER, GL\_LINEAR);

glTexParameteri(GL\_TEXTURE\_2D, GL\_TEXTURE\_MAG\_FILTER, GL\_LINEAR);

// load image, create texture and generate mipmaps

int width, height, nrChannels;

unsigned char\* data = stbi\_load(FileSystem::getPath("resources/textures/marble.png").c\_str(), &width, &height, &nrChannels, 0);

if (data) {

GLenum format = (nrChannels == 4) ? GL\_RGBA : GL\_RGB;

glTexImage2D(GL\_TEXTURE\_2D, 0, format, width, height, 0, format, GL\_UNSIGNED\_BYTE, data);

glGenerateMipmap(GL\_TEXTURE\_2D);

}

// texture 2

// ---------

glGenTextures(1, &texture2);

glBindTexture(GL\_TEXTURE\_2D, texture2);

// set the texture wrapping parameters

glTexParameteri(GL\_TEXTURE\_2D, GL\_TEXTURE\_WRAP\_S, GL\_REPEAT);

glTexParameteri(GL\_TEXTURE\_2D, GL\_TEXTURE\_WRAP\_T, GL\_REPEAT);

// set texture filtering parameters

glTexParameteri(GL\_TEXTURE\_2D, GL\_TEXTURE\_MIN\_FILTER, GL\_LINEAR);

glTexParameteri(GL\_TEXTURE\_2D, GL\_TEXTURE\_MAG\_FILTER, GL\_LINEAR);

// load image, create texture and generate mipmaps

int width1, height1, nrChannels1;

unsigned char\* data1 = stbi\_load(FileSystem::getPath("resources/textures/metal.png").c\_str(), &width1, &height1, &nrChannels1, 0);

if (data1) {

GLenum format1 = (nrChannels1 == 4) ? GL\_RGBA : GL\_RGB;

glTexImage2D(GL\_TEXTURE\_2D, 0, format1, width1, height1, 0, format1, GL\_UNSIGNED\_BYTE, data1);

glGenerateMipmap(GL\_TEXTURE\_2D);

}

stbi\_image\_free(data1);

ourShader.use();

ourShader.setInt("texture1", 0);

ourShader.setInt("texture2", 1);

GLuint currentTexture = texture1;

while (!glfwWindowShouldClose(window))

{

float currentFrame = static\_cast<float>(glfwGetTime());

deltaTime = currentFrame - lastFrame;

lastFrame = currentFrame;

processInput(window);

glClearColor(0.2f, 0.3f, 0.3f, 1.0f);

glClear(GL\_COLOR\_BUFFER\_BIT | GL\_DEPTH\_BUFFER\_BIT);

// bind textures on corresponding texture units

glActiveTexture(GL\_TEXTURE0);

glBindTexture(GL\_TEXTURE\_2D, texture1);

glActiveTexture(GL\_TEXTURE1);

glBindTexture(GL\_TEXTURE\_2D, texture2);

// activate shader

ourShader.use();

ourShader.setBool("useFirstTexture", useFirstTexture);

// pass projection matrix to shader (note that in this case it could change every frame)

glm::mat4 projection = glm::perspective(glm::radians(fov), (float)SCR\_WIDTH / (float)SCR\_HEIGHT, 0.1f, 100.0f);

ourShader.setMat4("projection", projection);

// camera/view transformation

glm::mat4 view = glm::lookAt(cameraPos, cameraPos + cameraFront, cameraUp);

ourShader.setMat4("view", view);

if (rotateModel)

rotationAngle += 0.01f;

// render boxes

glBindVertexArray(VAO);

for (unsigned int i = 0; i < 10; i++)

{

glm::mat4 model = glm::mat4(1.0f);

model = glm::translate(model, prismPosition[i]);

float staticAngle = 20.0f \* i;

model = glm::rotate(model, glm::radians(staticAngle), glm::vec3(1.0f, 0.3f, 0.5f));

// dinamik Y ekseni dönüşü (R tuşu ile kontrol edilir)

if (rotateModel)

model = glm::rotate(model, rotationAngle, glm::vec3(0.0f, 1.0f, 0.0f));

ourShader.setMat4("model", model);

glDrawArrays(GL\_TRIANGLES, 0, prismVertices.size() / 5); // 5 = position(3) + texcoord(2)

}

glfwSwapBuffers(window);

glfwPollEvents();

}

glDeleteVertexArrays(1, &VAO);

glDeleteBuffers(1, &VBO);

glfwTerminate();

return 0;

}

// cpp dosyası (örneğin geometry.cpp)

void processInput(GLFWwindow \*window)

{

if (glfwGetKey(window, GLFW\_KEY\_ESCAPE) == GLFW\_PRESS)

glfwSetWindowShouldClose(window, true);

float cameraSpeed = static\_cast<float>(2.5 \* deltaTime);

if (glfwGetKey(window, GLFW\_KEY\_W) == GLFW\_PRESS)

cameraPos += cameraSpeed \* cameraFront;

if (glfwGetKey(window, GLFW\_KEY\_S) == GLFW\_PRESS)

cameraPos -= cameraSpeed \* cameraFront;

if (glfwGetKey(window, GLFW\_KEY\_A) == GLFW\_PRESS)

cameraPos -= glm::normalize(glm::cross(cameraFront, cameraUp)) \* cameraSpeed;

if (glfwGetKey(window, GLFW\_KEY\_D) == GLFW\_PRESS)

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

if (glfwGetKey(window, GLFW\_KEY\_Y) == GLFW\_PRESS)

useFirstTexture = true;

if (glfwGetKey(window, GLFW\_KEY\_G) == GLFW\_PRESS)

useFirstTexture = false;

if (glfwGetKey(window, GLFW\_KEY\_R) == GLFW\_PRESS)

rotateModel = true;

if (glfwGetKey(window, GLFW\_KEY\_T) == GLFW\_PRESS)

{

wireframeMode = !wireframeMode;

glPolygonMode(GL\_FRONT\_AND\_BACK, wireframeMode ? GL\_LINE : GL\_FILL);

}

else

rotateModel = false;

}

void framebuffer\_size\_callback(GLFWwindow\* window, int width, int height)

{

glViewport(0, 0, width, height);

}

void mouse\_callback(GLFWwindow\* window, double xposIn, double yposIn)

{

float xpos = static\_cast<float>(xposIn);

float ypos = static\_cast<float>(yposIn);

if (firstMouse)

{

lastX = xpos;

lastY = ypos;

firstMouse = false;

}

float xoffset = xpos - lastX;

float yoffset = lastY - ypos; // reversed since y-coordinates go from bottom to top

lastX = xpos;

lastY = ypos;

float sensitivity = 0.1f; // change this value to your liking

xoffset \*= sensitivity;

yoffset \*= sensitivity;

yaw += xoffset;

pitch += yoffset;

// make sure that when pitch is out of bounds, screen doesn't get flipped

if (pitch > 89.0f)

pitch = 89.0f;

if (pitch < -89.0f)

pitch = -89.0f;

glm::vec3 front;

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);

}

void scroll\_callback(GLFWwindow\* window, double xoffset, double yoffset)

{

fov -= (float)yoffset;

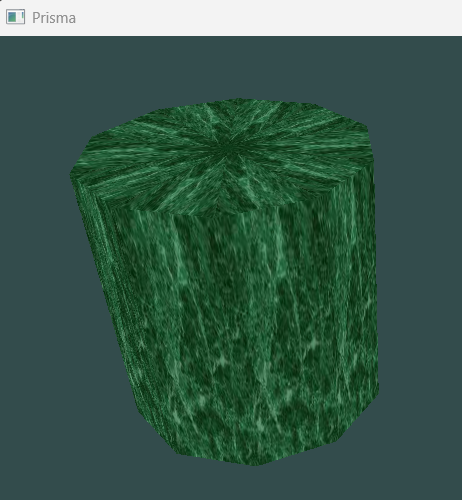
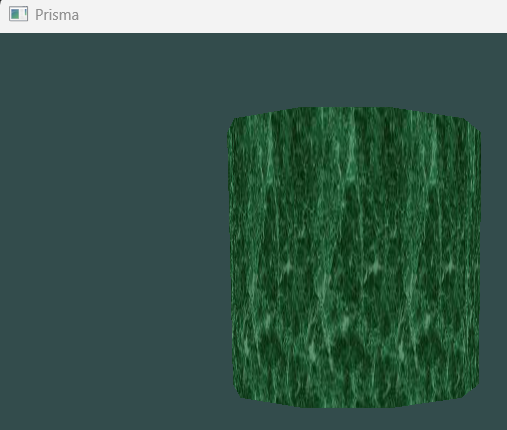
if (fov < 1.0f)

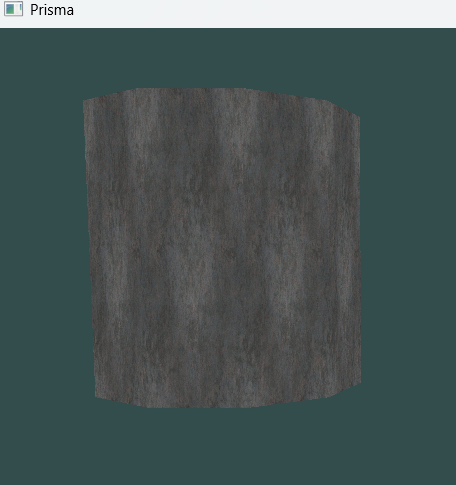
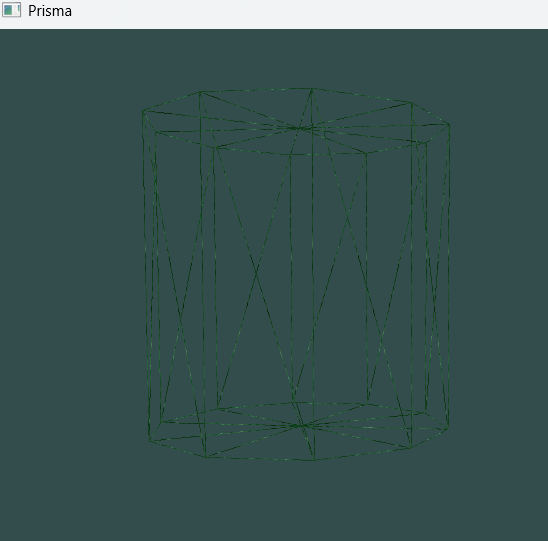
fov = 1.0f;

if (fov > 45.0f)

fov = 45.0f;

}

**CEVAP EKRAN ÇIKTISI  
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