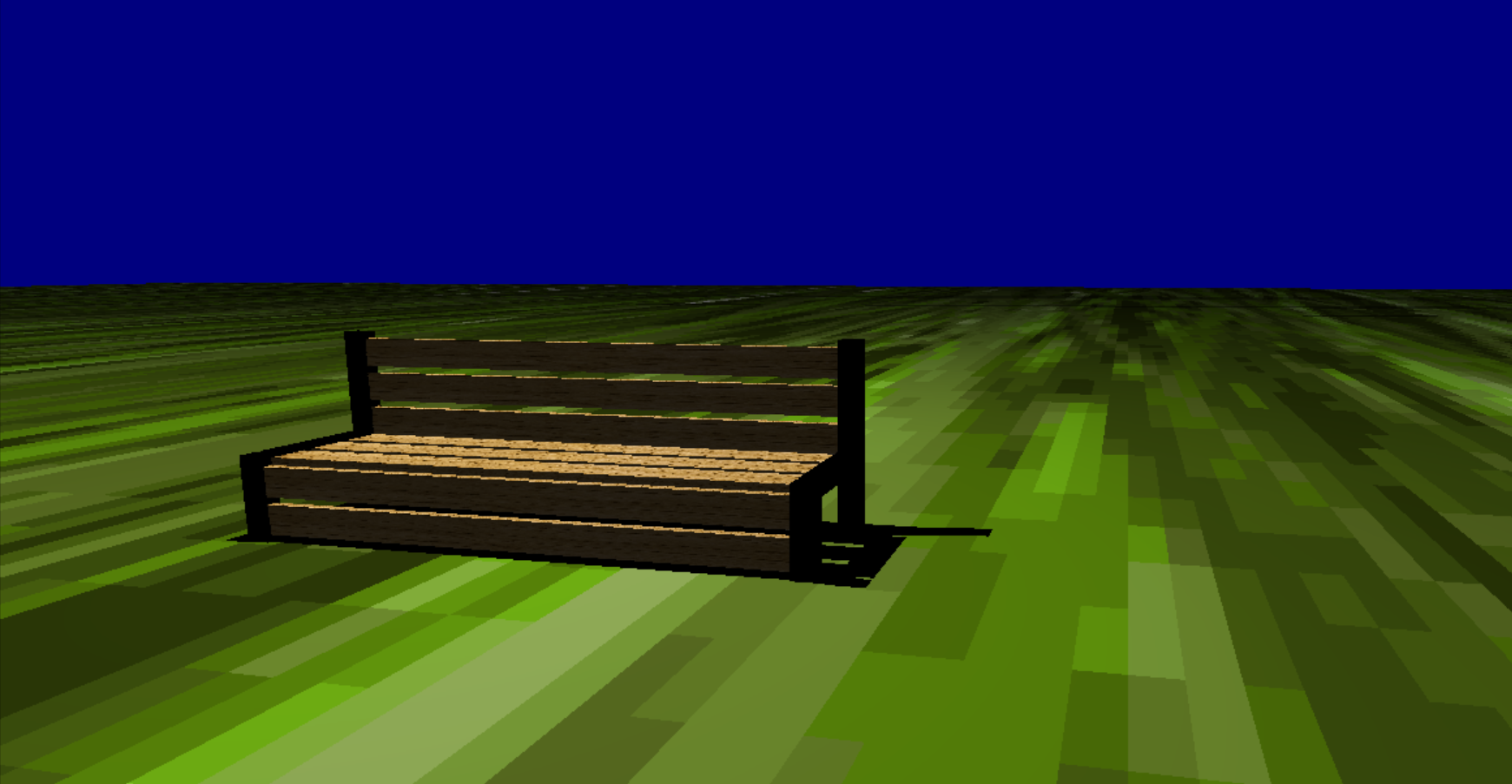
**PROIECT 2**

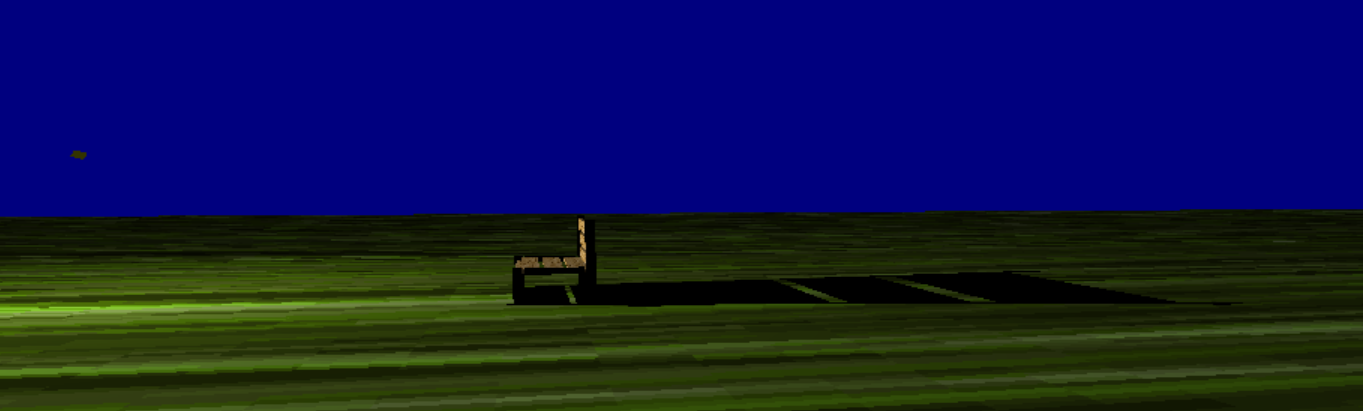
**ECHIPA : ADAM ADRIAN CLAUDIU, grupa 342**

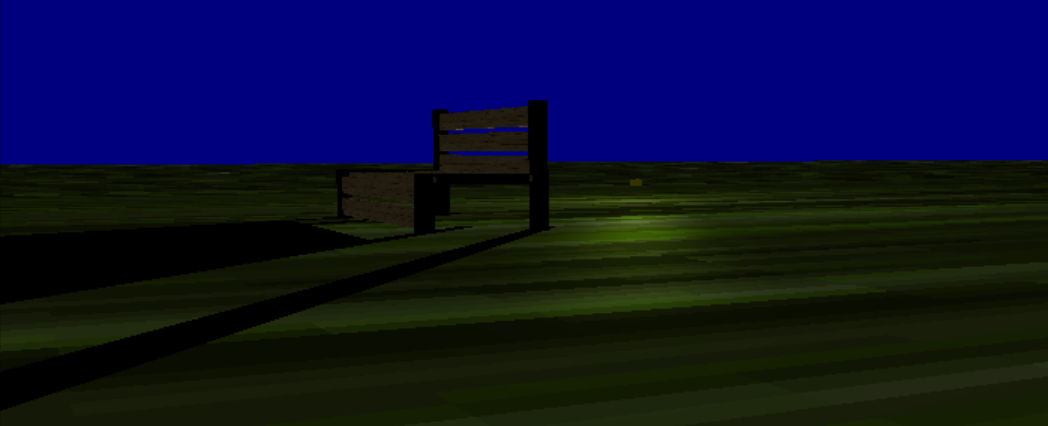
**POINARITA ANDREEA DIANA, grupa 343**

1. **CONCEPTUL PROIECTULUI**

Proiectul reprezinta o animatie 3D pentru a simula iluminarea si umbra unei banci atunci cand lumina provine atat de la o sursa fixa, dar si de la o sursa aflata in miscare (e.x. soarele pe parcursul unei zile).

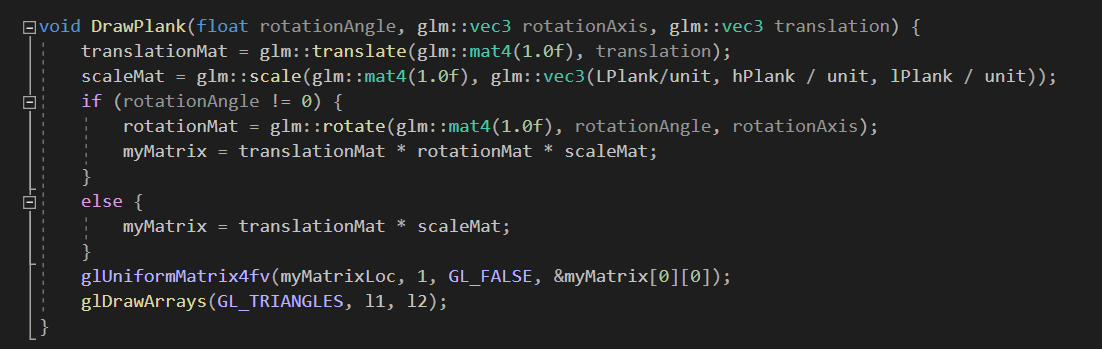




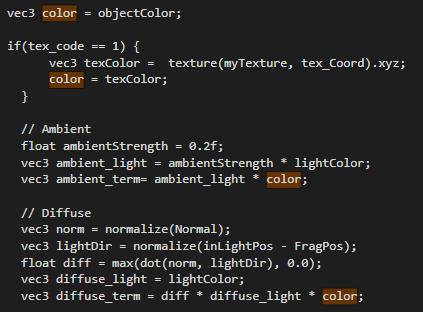


1. **ELEMENTE INCLUSE:**

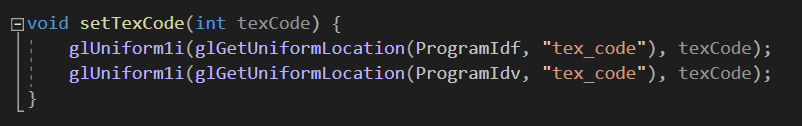
* *Obiectele 3D* (podeaua, sursa de lumina, banca) - reprezentate prin scalarea, translatarea si rotatia unui paralelipiped.

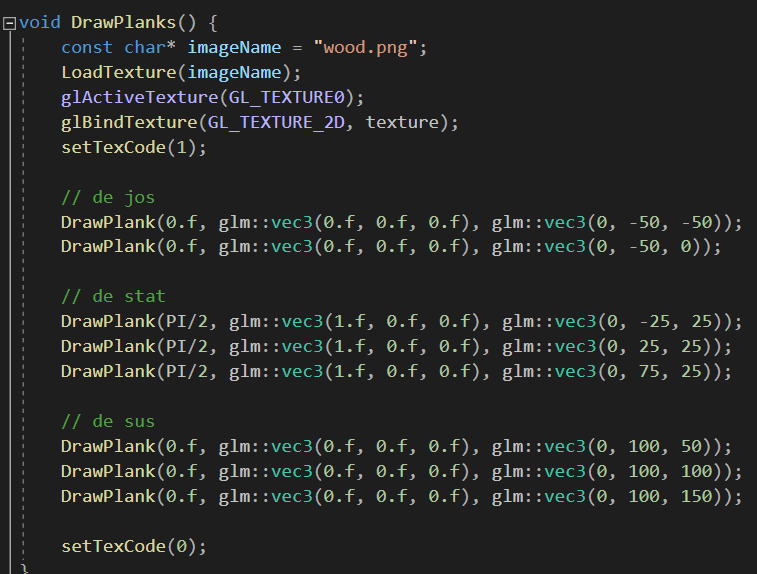


* *Textura -* bancii si podelei le-a fost aplicata texturarea, prin inlocuirea variabilei corespunzatoare culorii obiectului cu coordonatele pentru texturare, incluse in continuare in formula pentru iluminare:

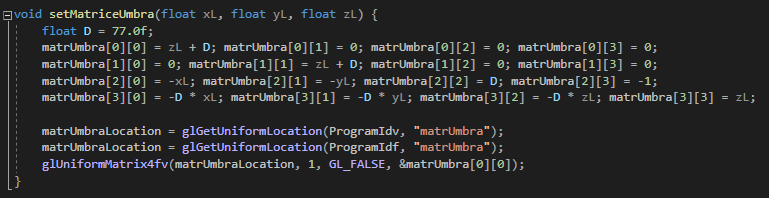
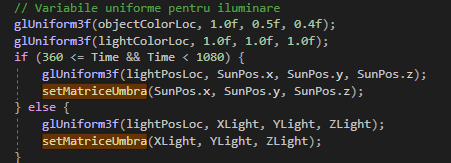


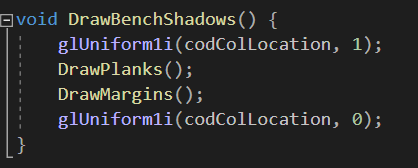
Deoarece obiectele au fost reprezentate folosind acelasi obiect initial (aplicandu-i transformari), am introdus variabila tex\_code pentru a informa in shadere ca se vrea a fi folosita textura sau nu, ci culoarea simpla a obiectului.



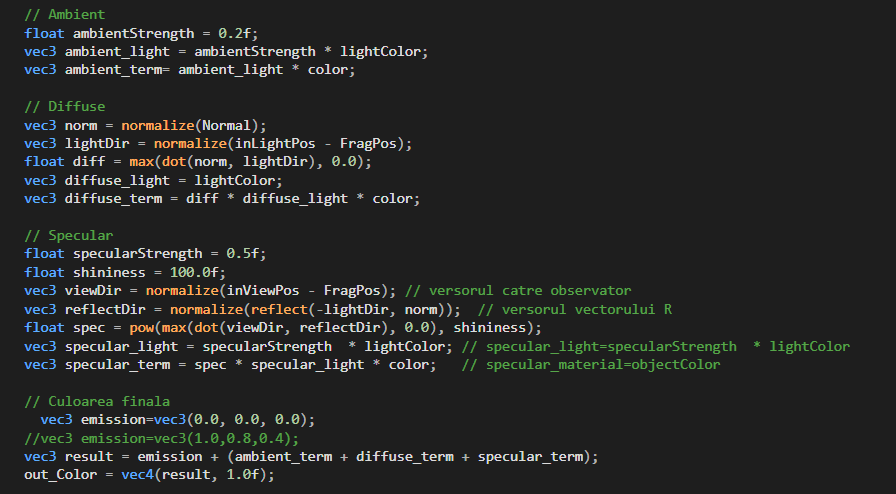


* *Umbra -* umbra bancii a fost desenata folosind aceleasi coordonate initiale, insa prin setarea culorii negre (fara a folosi texturarea sau a aplica iluminarea) si prin adaugarea matricei - umbra, care este actualizata la fiecare modificare a pozitiei sursei de lumina:

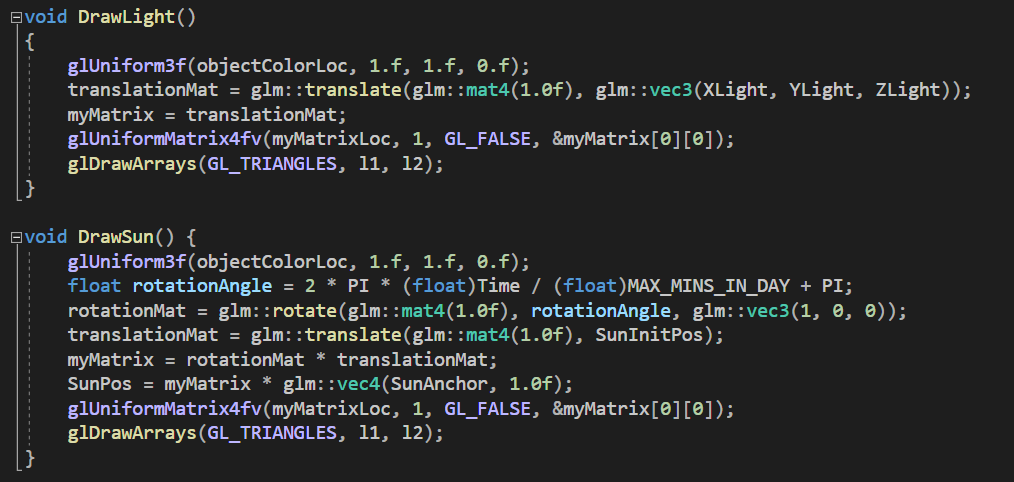
 

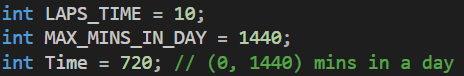


* *Lumina* – pentru simularea luminii am folosit formulele clasice prezentate in cadrul laboratorului.

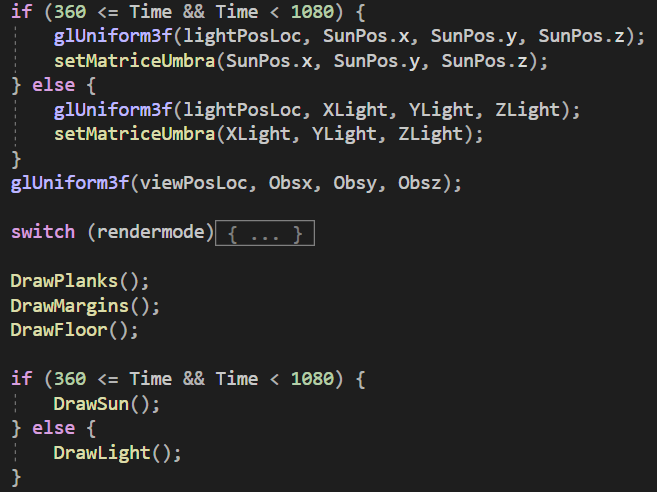


Soarele si licuriciul de noapte au coordonate diferite, fiecare fiind reprezentat in momente diferite ale zilei, niciodata simultan. Pentru desenarea acestora am creeat cate o functie.



* *Timpul* - Luand in considerare tematica trecerii timpului, am incercat sa simulam acest fenomen printr-o reprezentare grafica. Am impartit ziua in 1440 minute, iar la fiecare apasare a tastei **SPACE** incrementam **Time** cu **LAPS\_TIME** minute.

Cu ajutorul acestei referinte putem decide cand reprezentam soarele si cand reprezentam licuriciul.



Cum 720 am considerat ora 12:00, 360 este ora 6:00, iar 1080 este 18:00. Soarele rasare astfel la 6:00 AM is apune la 6:00 PM. Acesta are o singura libertate de miscare, depinzand doar de timp.

Pe de alta parte, licuriciul are 3 libertati de miscare, putand fi controlat dealungul celor 3 axe de miscare (A(<), D(>), S(v), W(^), Q(O), E(o)).

1. **ORIGINALITATE**

In scena 3D sursa de lumina este folosita sub 2 forme, astfel incat se poate urmari secvential modul in care obiectul este iluminat si cum se formeaza umbra acestuia.

1. **COD SURSA**

// Iluminare: aplicarea mecanismului la nivel de varf / de fragment

#include <windows.h> // biblioteci care urmeaza sa fie incluse

#include <stdlib.h> // necesare pentru citirea shader-elor

#include <stdio.h>

#include <math.h>

#include <iostream>

#include <GL/glew.h> // glew apare inainte de freeglut

#include <GL/freeglut.h> // nu trebuie uitat freeglut.h

#include "loadShaders.h"

#include "glm/glm/glm.hpp"

#include "glm/glm/gtc/matrix\_transform.hpp"

#include "glm/glm/gtx/transform.hpp"

#include "glm/glm/gtc/type\_ptr.hpp"

#include "SOIL.h"

using namespace std;

// identificatori

GLuint

VaoId,

VboId,

ColorBufferId,

ProgramIdv,

ProgramIdf,

viewLocation,

projLocation,

codColLocation,

depthLocation,

matrUmbraLocation,

rendermode,

TextureId,

l1, l2,

codCol,

texture;

GLint objectColorLoc, lightColorLoc, lightPosLoc, viewPosLoc, myMatrixLoc;

// matricea umbrei

float matrUmbra[4][4];

// variabile pentru matricea de vizualizare

float Obsx = 0.0, Obsy = -600.0, Obsz = 0.f;

float Refx = 0.0f, Refy = 1000.0f, Refz = 0.0f;

float Vx = 0.0, Vy = 0.0, Vz = 1.0;

// variabile pentru matricea de proiectie

float width = 800, height = 600, znear = 0.1, fov = 45;

float PI = 3.141592;

// matrice utilizate

glm::mat4 view, projection, myMatrix, rotationMat, translationMat, scaleMat;

float unit = 10;

float spacing = 10;

float LPlank = 250, lPlank = 20, hPlank = 5;

float XLight = -400, YLight = 0, ZLight = 400;

int LAPS\_TIME = 10;

int MAX\_MINS\_IN\_DAY = 1440;

int Time = 720; // (0, 1440) mins in a day

glm::vec3 SunInitPos = glm::vec3(-100.0f, 0.0f, 1000.0f);

glm::vec3 SunAnchor = glm::vec3(0.0f, 0.0f, 0.0f);

glm::vec3 SunPos = SunInitPos;

enum {

Il\_Frag, Il\_Frag\_Av, Il\_Vert, Il\_Vert\_Av

};

void menu(int selection)

{

rendermode = selection;

glutPostRedisplay();

}

void processNormalKeys(unsigned char key, int x, int y)

{

switch (key) {

case 'l':

Vx -= 0.1;

break;

case 'r':

Vx += 0.1;

break;

case '+':

Obsy += 10;

break;

case '-':

Obsy -= 10;

break;

case 'w':

ZLight += 10;

break;

case 's':

ZLight -= 10;

break;

case 'a':

XLight -= 10;

break;

case 'd':

XLight += 10;

break;

case 'q':

YLight -= 10;

break;

case 'e':

YLight += 10;

break;

case ' ':

Time += LAPS\_TIME;

Time = Time % MAX\_MINS\_IN\_DAY;

break;

case '`':

Time -= LAPS\_TIME;

if (Time < 0) {

Time = MAX\_MINS\_IN\_DAY - 1;

}

cout << Time <<endl;

break;

}

if (key == 27)

exit(0);

}

void processSpecialKeys(int key, int xx, int yy)

{

switch (key) {

case GLUT\_KEY\_LEFT:

Obsx -= 20;

break;

case GLUT\_KEY\_RIGHT:

Obsx += 20;

break;

case GLUT\_KEY\_UP:

Obsz += 20;

break;

case GLUT\_KEY\_DOWN:

Obsz -= 20;

break;

}

}

void CreateVBO(void)

{

GLfloat Vertices[] =

{

// FRAGMENT

// inspre Oz'

(-1)\* unit, (-1)\* unit, (-1)\* unit, 0.0f, 0.0f, -1.0f,

unit, (-1)\* unit, (-1)\* unit, 0.0f, 0.0f, -1.0f,

unit, unit, (-1)\* unit, 0.0f, 0.0f, -1.0f,

unit, unit, (-1)\* unit, 0.0f, 0.0f, -1.0f,

(-1)\* unit, unit, (-1)\* unit, 0.0f, 0.0f, -1.0f,

(-1)\* unit, (-1)\* unit, (-1)\* unit, 0.0f, 0.0f, -1.0f,

// inspre Oz

(-1)\* unit, (-1)\* unit, unit, 0.0f, 0.0f, 1.0f,

unit, (-1)\* unit, unit, 0.0f, 0.0f, 1.0f,

unit, unit, unit, 0.0f, 0.0f, 1.0f,

unit, unit, unit, 0.0f, 0.0f, 1.0f,

(-1)\* unit, unit, unit, 0.0f, 0.0f, 1.0f,

(-1)\* unit, (-1)\* unit, unit, 0.0f, 0.0f, 1.0f,

// inspre Ox'

(-1)\* unit, unit, unit, -1.0f, 0.0f, 0.0f,

(-1)\* unit, unit, (-1)\* unit, -1.0f, 0.0f, 0.0f,

(-1)\* unit, (-1)\* unit, (-1)\* unit, -1.0f, 0.0f, 0.0f,

(-1)\* unit, (-1)\* unit, (-1)\* unit, -1.0f, 0.0f, 0.0f,

(-1)\* unit, (-1)\* unit, unit, -1.0f, 0.0f, 0.0f,

(-1)\* unit, unit, unit, -1.0f, 0.0f, 0.0f,

// inspre Ox

unit, unit, unit, 1.0f, 0.0f, 0.0f,

unit, unit, (-1)\* unit, 1.0f, 0.0f, 0.0f,

unit, (-1)\* unit, (-1)\* unit, 1.0f, 0.0f, 0.0f,

unit, (-1)\* unit, (-1)\* unit, 1.0f, 0.0f, 0.0f,

unit, (-1)\* unit, unit, 1.0f, 0.0f, 0.0f,

unit, unit, unit, 1.0f, 0.0f, 0.0f,

// inspre Oy'

(-1)\* unit, (-1)\* unit, (-1)\* unit, 0.0f, -1.0f, 0.0f,

unit, (-1)\* unit, (-1)\* unit, 0.0f, -1.0f, 0.0f,

unit, (-1)\* unit, unit, 0.0f, -1.0f, 0.0f,

unit, (-1)\* unit, unit, 0.0f, -1.0f, 0.0f,

(-1)\* unit, (-1)\* unit, unit, 0.0f, -1.0f, 0.0f,

(-1)\* unit, (-1)\* unit, (-1)\* unit, 0.0f, -1.0f, 0.0f,

// inspre Oy

(-1)\* unit, unit, (-1)\* unit, 0.0f, 1.0f, 0.0f,

unit, unit, (-1)\* unit, 0.0f, 1.0f, 0.0f,

unit, unit, unit, 0.0f, 1.0f, 0.0f,

unit, unit, unit, 0.0f, 1.0f, 0.0f,

(-1)\* unit, unit, unit, 0.0f, 1.0f, 0.0f,

(-1)\* unit, unit, (-1)\* unit, 0.0f, 1.0f, 0.0f,

/////////////////////////////////////////////////////

// Vertex

// inspre Oz'

(-1)\*unit, (-1)\*unit, (-1)\*unit, -1.0f, -1.0f, -1.0f,

unit, (-1)\*unit, (-1)\*unit, 1.0f, -1.0f, -1.0f,

unit, unit, (-1)\*unit, 1.0f, 1.0f, -1.0f,

unit, unit, (-1)\*unit, 1.0f, 1.0f, -1.0f,

(-1)\*unit, unit, (-1)\*unit, -1.0f, 1.0f, -1.0f,

(-1)\*unit, (-1)\*unit, (-1)\*unit, -1.0f, -1.0f, -1.0f,

// inspre Oz

(-1)\*unit, (-1)\*unit, unit, -1.0f, -1.0f, 1.0f,

unit, (-1)\*unit, unit, 1.0f, -1.0f, 1.0f,

unit, unit, unit, 1.0f, 1.0f, 1.0f,

unit, unit, unit, 1.0f, 1.0f, 1.0f,

(-1)\*unit, unit, unit, -1.0f, 1.0f, 1.0f,

(-1)\*unit, (-1)\*unit, unit, -1.0f, -1.0f, 1.0f,

// inspre Ox'

(-1)\*unit, unit, unit, -1.0f, 1.0f, 1.0f,

(-1)\*unit, unit, (-1)\*unit, -1.0f, 1.0f, -1.0f,

(-1)\*unit, (-1)\*unit, (-1)\*unit, -1.0f, -1.0f, -1.0f,

(-1)\*unit, (-1)\*unit, (-1)\*unit, -1.0f, -1.0f, -1.0f,

(-1)\*unit, (-1)\*unit, unit, -1.0f, -1.0f, 1.0f,

(-1)\*unit, unit, unit, -1.0f, 1.0f, 1.0f,

// inspre Ox

unit, unit, unit, 1.0f, 1.0f, 1.0f,

unit, unit, (-1)\*unit, 1.0f, 1.0f, -1.0f,

unit, (-1)\*unit, (-1)\*unit, 1.0f, -1.0f, -1.0f,

unit, (-1)\*unit, (-1)\*unit, 1.0f, -1.0f, -1.0f,

unit, (-1)\*unit, unit, 1.0f, -1.0f, 1.0f,

unit, unit, unit, 1.0f, 1.0f, 1.0f,

// inspre Oy'

(-1)\*unit, (-1)\*unit, (-1)\*unit, -1.0f, -1.0f, -1.0f,

unit, (-1)\*unit, (-1)\*unit, 1.0f, -1.0f, -1.0f,

unit, (-1)\*unit, unit, 1.0f, -1.0f, 1.0f,

unit, (-1)\*unit, unit, 1.0f, -1.0f, 1.0f,

(-1)\*unit, (-1)\*unit, unit, -1.0f, -1.0f, 1.0f,

(-1)\*unit, (-1)\*unit, (-1)\*unit, -1.0f, -1.0f, -1.0f,

// inspre Oy

(-1)\*unit, unit, (-1)\*unit, -1.0f, 1.0f, -1.0f,

unit, unit, (-1)\*unit, 1.0f, 1.0f, -1.0f,

unit, unit, unit, 1.0f, 1.0f, 1.0f,

unit, unit, unit, 1.0f, 1.0f, 1.0f,

(-1)\*unit, unit, unit, -1.0f, 1.0f, 1.0f,

(-1)\*unit, unit, (-1)\*unit, -1.0f, 1.0f, -1.0f

};

static const GLfloat Textures[] =

{

0.0f, 0.0f,

1.0f, 0.0f,

1.0f, 1.0f,

1.0f, 1.0f,

0.0f, 1.0f,

0.0f, 0.0f,

0.0f, 0.0f,

1.0f, 0.0f,

1.0f, 1.0f,

1.0f, 1.0f,

0.0f, 1.0f,

0.0f, 0.0f,

0.0f, 0.0f,

1.0f, 0.0f,

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0.0f, 1.0f,

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0.0f, 1.0f,

0.0f, 0.0f,

0.0f, 0.0f,

1.0f, 0.0f,

1.0f, 1.0f,

1.0f, 1.0f,

0.0f, 1.0f,

0.0f, 0.0f,

0.0f, 0.0f,

1.0f, 0.0f,

1.0f, 1.0f,

1.0f, 1.0f,

0.0f, 1.0f,

0.0f, 0.0f

};

glGenVertexArrays(1, &VaoId);

glGenBuffers(1, &VboId);

glBindVertexArray(VaoId);

glBindBuffer(GL\_ARRAY\_BUFFER, VboId);

glBufferData(GL\_ARRAY\_BUFFER, sizeof(Vertices), Vertices, GL\_STATIC\_DRAW);

glEnableVertexAttribArray(0); // atributul 0 = pozitie

glVertexAttribPointer(0, 3, GL\_FLOAT, GL\_FALSE, 6 \* sizeof(GLfloat), (GLvoid\*)0);

glEnableVertexAttribArray(1); // atributul 1 = normale

glVertexAttribPointer(1, 3, GL\_FLOAT, GL\_FALSE, 6 \* sizeof(GLfloat), (GLvoid\*)(3 \* sizeof(GLfloat)));

glGenBuffers(1, &TextureId);

glBindBuffer(GL\_ARRAY\_BUFFER, TextureId);

glBufferData(GL\_ARRAY\_BUFFER, sizeof(Textures), Textures, GL\_STATIC\_DRAW);

glVertexAttribPointer(2, 2, GL\_FLOAT, GL\_FALSE, 0, 0);

glEnableVertexAttribArray(2);

}

void DestroyVBO(void)

{

glDisableVertexAttribArray(2);

glDisableVertexAttribArray(1);

glDisableVertexAttribArray(0);

glBindBuffer(GL\_ARRAY\_BUFFER, 0);

glDeleteBuffers(1, &TextureId);

glDeleteBuffers(1, &VboId);

glBindVertexArray(0);

glDeleteVertexArrays(1, &VaoId);

}

void LoadTexture(const char\* imageName)

{

glGenTextures(1, &texture);

glBindTexture(GL\_TEXTURE\_2D, texture);

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

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

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

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

int width, height;

unsigned char\* image = SOIL\_load\_image(imageName, &width, &height, 0, SOIL\_LOAD\_RGB);

glTexImage2D(GL\_TEXTURE\_2D, 0, GL\_RGB, width, height, 0, GL\_RGB, GL\_UNSIGNED\_BYTE, image);

glGenerateMipmap(GL\_TEXTURE\_2D);

SOIL\_free\_image\_data(image);

glBindTexture(GL\_TEXTURE\_2D, 0);

}

void setTexCode(int texCode) {

glUniform1i(glGetUniformLocation(ProgramIdf, "tex\_code"), texCode);

glUniform1i(glGetUniformLocation(ProgramIdv, "tex\_code"), texCode);

}

void setMatriceUmbra(float xL, float yL, float zL) {

float D = 77.0f;

matrUmbra[0][0] = zL + D; matrUmbra[0][1] = 0; matrUmbra[0][2] = 0; matrUmbra[0][3] = 0;

matrUmbra[1][0] = 0; matrUmbra[1][1] = zL + D; matrUmbra[1][2] = 0; matrUmbra[1][3] = 0;

matrUmbra[2][0] = -xL; matrUmbra[2][1] = -yL; matrUmbra[2][2] = D; matrUmbra[2][3] = -1;

matrUmbra[3][0] = -D \* xL; matrUmbra[3][1] = -D \* yL; matrUmbra[3][2] = -D \* zL; matrUmbra[3][3] = zL;

matrUmbraLocation = glGetUniformLocation(ProgramIdv, "matrUmbra");

matrUmbraLocation = glGetUniformLocation(ProgramIdf, "matrUmbra");

glUniformMatrix4fv(matrUmbraLocation, 1, GL\_FALSE, &matrUmbra[0][0]);

}

void CreateShadersFragment(void)

{

ProgramIdf = LoadShaders("10\_02f\_Shader.vert", "10\_02f\_Shader.frag");

glUseProgram(ProgramIdf);

}

void CreateShadersVertex(void)

{

ProgramIdv = LoadShaders("10\_02v\_Shader.vert", "10\_02v\_Shader.frag");

glUseProgram(ProgramIdv);

}

void DestroyShaders(void)

{

glDeleteProgram(ProgramIdv);

glDeleteProgram(ProgramIdf);

}

void Initialize(void)

{

glClearColor(0.0f, 0.0f, 0.5f, 0.1f);

CreateVBO();

CreateShadersFragment();

objectColorLoc = glGetUniformLocation(ProgramIdf, "objectColor");

lightColorLoc = glGetUniformLocation(ProgramIdf, "lightColor");

lightPosLoc = glGetUniformLocation(ProgramIdf, "lightPos");

viewPosLoc = glGetUniformLocation(ProgramIdf, "viewPos");

viewLocation = glGetUniformLocation(ProgramIdf, "view");

projLocation = glGetUniformLocation(ProgramIdf, "projection");

myMatrixLoc = glGetUniformLocation(ProgramIdf, "myMatrix");

codColLocation = glGetUniformLocation(ProgramIdf, "codCol");

CreateShadersVertex();

objectColorLoc = glGetUniformLocation(ProgramIdv, "objectColor");

lightColorLoc = glGetUniformLocation(ProgramIdv, "lightColor");

lightPosLoc = glGetUniformLocation(ProgramIdv, "lightPos");

viewPosLoc = glGetUniformLocation(ProgramIdv, "viewPos");

viewLocation = glGetUniformLocation(ProgramIdv, "view");

projLocation = glGetUniformLocation(ProgramIdv, "projection");

myMatrixLoc = glGetUniformLocation(ProgramIdv, "myMatrix");

codColLocation = glGetUniformLocation(ProgramIdv, "codCol");

}

void DrawPlank(float rotationAngle, glm::vec3 rotationAxis, glm::vec3 translation) {

translationMat = glm::translate(glm::mat4(1.0f), translation);

scaleMat = glm::scale(glm::mat4(1.0f), glm::vec3(LPlank/unit, hPlank / unit, lPlank / unit));

if (rotationAngle != 0) {

rotationMat = glm::rotate(glm::mat4(1.0f), rotationAngle, rotationAxis);

myMatrix = translationMat \* rotationMat \* scaleMat;

}

else {

myMatrix = translationMat \* scaleMat;

}

glUniformMatrix4fv(myMatrixLoc, 1, GL\_FALSE, &myMatrix[0][0]);

glDrawArrays(GL\_TRIANGLES, l1, l2);

}

void DrawPlanks() {

const char\* imageName = "wood.png";

LoadTexture(imageName);

glActiveTexture(GL\_TEXTURE0);

glBindTexture(GL\_TEXTURE\_2D, texture);

setTexCode(1);

// de jos

DrawPlank(0.f, glm::vec3(0.f, 0.f, 0.f), glm::vec3(0, -50, -50));

DrawPlank(0.f, glm::vec3(0.f, 0.f, 0.f), glm::vec3(0, -50, 0));

// de stat

DrawPlank(PI/2, glm::vec3(1.f, 0.f, 0.f), glm::vec3(0, -25, 25));

DrawPlank(PI/2, glm::vec3(1.f, 0.f, 0.f), glm::vec3(0, 25, 25));

DrawPlank(PI/2, glm::vec3(1.f, 0.f, 0.f), glm::vec3(0, 75, 25));

// de sus

DrawPlank(0.f, glm::vec3(0.f, 0.f, 0.f), glm::vec3(0, 100, 50));

DrawPlank(0.f, glm::vec3(0.f, 0.f, 0.f), glm::vec3(0, 100, 100));

DrawPlank(0.f, glm::vec3(0.f, 0.f, 0.f), glm::vec3(0, 100, 150));

setTexCode(0);

}

void DrawMargin(glm::vec3 translation, glm::vec3 scale) {

translationMat = glm::translate(glm::mat4(1.0f), translation);

scaleMat = glm::scale(glm::mat4(1.0f), scale);

myMatrix = translationMat \* scaleMat;

glUniformMatrix4fv(myMatrixLoc, 1, GL\_FALSE, &myMatrix[0][0]);

glDrawArrays(GL\_TRIANGLES, l1, l2);

}

void DrawMargins() {

glUniform3f(objectColorLoc, 0.f, 0.f, 0.f);

DrawMargin(glm::vec3(LPlank, 100, 50), glm::vec3(1.0f, 1.0f, 13.0f));

DrawMargin(glm::vec3(-LPlank, 100, 50), glm::vec3(1.0f,1.0f,13.0f));

DrawMargin(glm::vec3(LPlank, 25, 25), glm::vec3(1.0f, 6.0f, 1.0f));

DrawMargin(glm::vec3(-LPlank,25, 25), glm::vec3(1.0f, 6.0f, 1.0f));

DrawMargin(glm::vec3(LPlank, -50, -25), glm::vec3(1.0f, 1.0f, 6.0f));

DrawMargin(glm::vec3(-LPlank, -50, -25), glm::vec3(1.0f, 1.0f, 6.0f));

}

void DrawBenchShadows() {

glUniform1i(codColLocation, 1);

DrawPlanks();

DrawMargins();

glUniform1i(codColLocation, 0);

}

void DrawFloor()

{

const char\* imageName = "grass.png";

LoadTexture(imageName);

glActiveTexture(GL\_TEXTURE0);

glBindTexture(GL\_TEXTURE\_2D, texture);

glUniform1i(glGetUniformLocation(ProgramIdf, "myTexture"), 0);

glUniform1i(glGetUniformLocation(ProgramIdv, "myTexture"), 0);

translationMat = glm::translate(glm::mat4(1.0f), glm::vec3(0, 0, -8\*unit));

scaleMat = glm::scale(glm::mat4(1.0f), glm::vec3(1000.0f, 1000.0f, 0.1f));

myMatrix = translationMat \* scaleMat;

glUniformMatrix4fv(myMatrixLoc, 1, GL\_FALSE, &myMatrix[0][0]);

setTexCode(1);

glDrawArrays(GL\_TRIANGLES, 0, 36);

setTexCode(0);

}

void DrawLight()

{

glUniform3f(objectColorLoc, 1.f, 1.f, 0.f);

translationMat = glm::translate(glm::mat4(1.0f), glm::vec3(XLight, YLight, ZLight));

myMatrix = translationMat;

glUniformMatrix4fv(myMatrixLoc, 1, GL\_FALSE, &myMatrix[0][0]);

glDrawArrays(GL\_TRIANGLES, l1, l2);

}

void DrawSun() {

glUniform3f(objectColorLoc, 1.f, 1.f, 0.f);

float rotationAngle = 2 \* PI \* (float)Time / (float)MAX\_MINS\_IN\_DAY + PI;

rotationMat = glm::rotate(glm::mat4(1.0f), rotationAngle, glm::vec3(1, 0, 0));

translationMat = glm::translate(glm::mat4(1.0f), SunInitPos);

myMatrix = rotationMat \* translationMat;

SunPos = myMatrix \* glm::vec4(SunAnchor, 1.0f);

glUniformMatrix4fv(myMatrixLoc, 1, GL\_FALSE, &myMatrix[0][0]);

glDrawArrays(GL\_TRIANGLES, l1, l2);

}

void RenderFunction(void)

{

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

glEnable(GL\_DEPTH\_TEST);

glm::vec3 Obs = glm::vec3(Obsx, Obsy, Obsz);

glm::vec3 PctRef = glm::vec3(Refx, Refy, Refz);

glm::vec3 Vert = glm::vec3(Vx, Vy, Vz);

view = glm::lookAt(Obs, PctRef, Vert);

glUniformMatrix4fv(viewLocation, 1, GL\_FALSE, &view[0][0]);

projection = glm::infinitePerspective(fov, GLfloat(width) / GLfloat(height), znear);

glUniformMatrix4fv(projLocation, 1, GL\_FALSE, &projection[0][0]);

// Variabile uniforme pentru iluminare

glUniform3f(objectColorLoc, 1.0f, 0.5f, 0.4f);

glUniform3f(lightColorLoc, 1.0f, 1.0f, 1.0f);

if (360 <= Time && Time < 1080) {

glUniform3f(lightPosLoc, SunPos.x, SunPos.y, SunPos.z);

setMatriceUmbra(SunPos.x, SunPos.y, SunPos.z);

} else {

glUniform3f(lightPosLoc, XLight, YLight, ZLight);

setMatriceUmbra(XLight, YLight, ZLight);

}

glUniform3f(viewPosLoc, Obsx, Obsy, Obsz);

switch (rendermode)

{

case Il\_Frag:

glUseProgram(ProgramIdf);

l1 = 0; l2 = 36;

break;

case Il\_Frag\_Av:

glUseProgram(ProgramIdf);

l1 = 36; l2 = 36;

break;

case Il\_Vert:

glUseProgram(ProgramIdv);

l1 = 0; l2 = 36;

break;

case Il\_Vert\_Av:

glUseProgram(ProgramIdv);

l1 = 36; l2 = 36;

break;

};

DrawPlanks();

DrawMargins();

DrawFloor();

if (360 <= Time && Time < 1080) {

DrawSun();

} else {

DrawLight();

}

DrawBenchShadows();

glutSwapBuffers();

glFlush();

}

void Cleanup(void)

{

DestroyShaders();

DestroyVBO();

}

int main(int argc, char\* argv[])

{

glutInit(&argc, argv);

glutInitDisplayMode(GLUT\_RGB | GLUT\_DEPTH | GLUT\_DOUBLE);

glutInitWindowPosition(100, 100);

glutInitWindowSize(1200, 900);

glutCreateWindow("3D Luminosity");

glewInit();

Initialize();

glutIdleFunc(RenderFunction);

glutDisplayFunc(RenderFunction);

glutKeyboardFunc(processNormalKeys);

glutSpecialFunc(processSpecialKeys);

glutCreateMenu(menu);

glutAddMenuEntry("Fragment", Il\_Frag);

glutAddMenuEntry("Fragment+Mediere\_Normale", Il\_Frag\_Av);

glutAddMenuEntry("Varfuri", Il\_Vert);

glutAddMenuEntry("Varfuri+Mediere\_Normale", Il\_Vert\_Av);

glutAttachMenu(GLUT\_RIGHT\_BUTTON);

glutCloseFunc(Cleanup);

glutMainLoop();

}