MASTER ELECTRONIC DESIGN

Aspect, Set Perspective

Homework6

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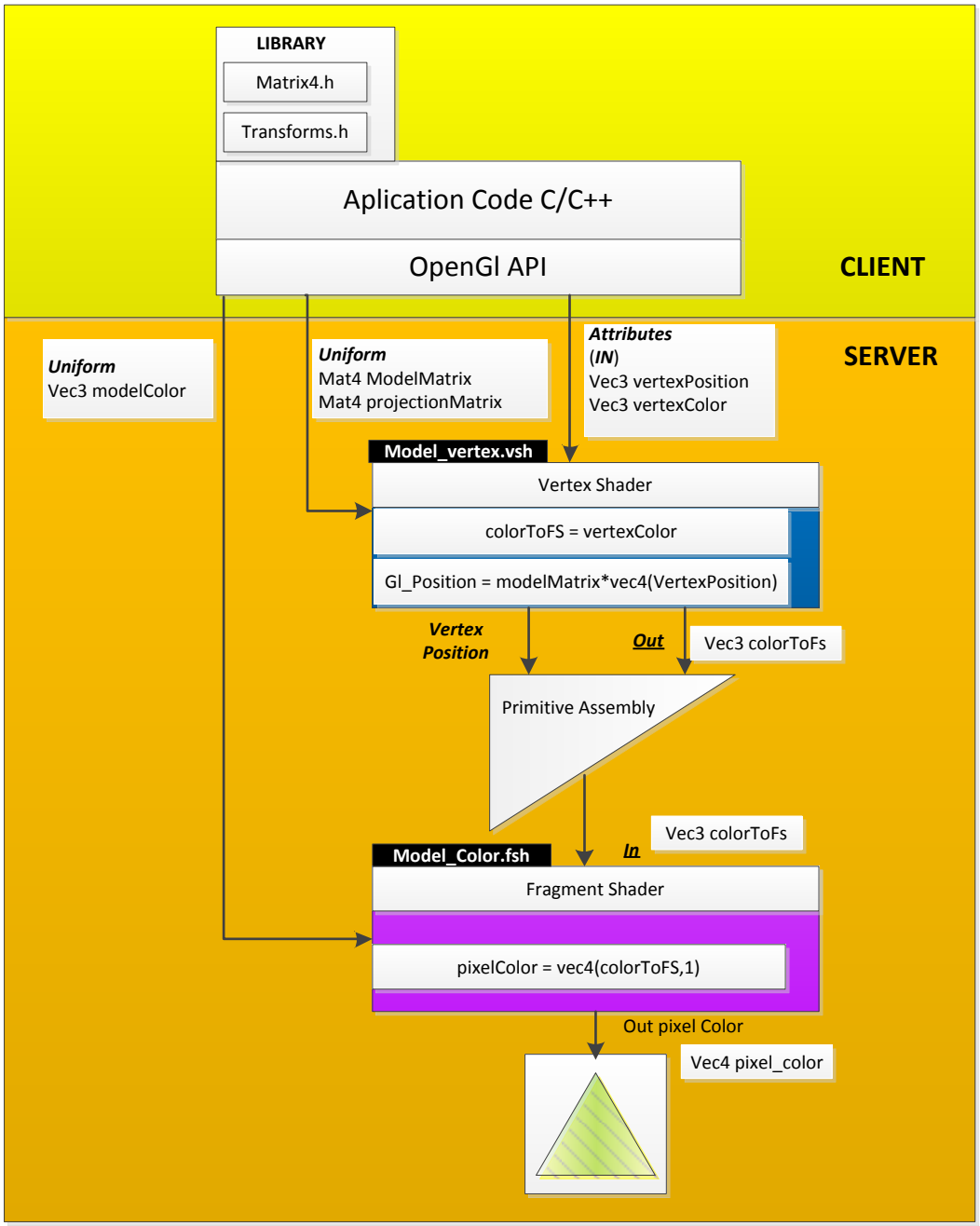
This document describes the system architecture and design about the body controller module, it's have block diagram and flowchart to describe software and hardware architecture.

Revision History

Date	Revision Number	Author/Editor	Modifications
January 2014	0.1	Miguel Tlapa	Created file

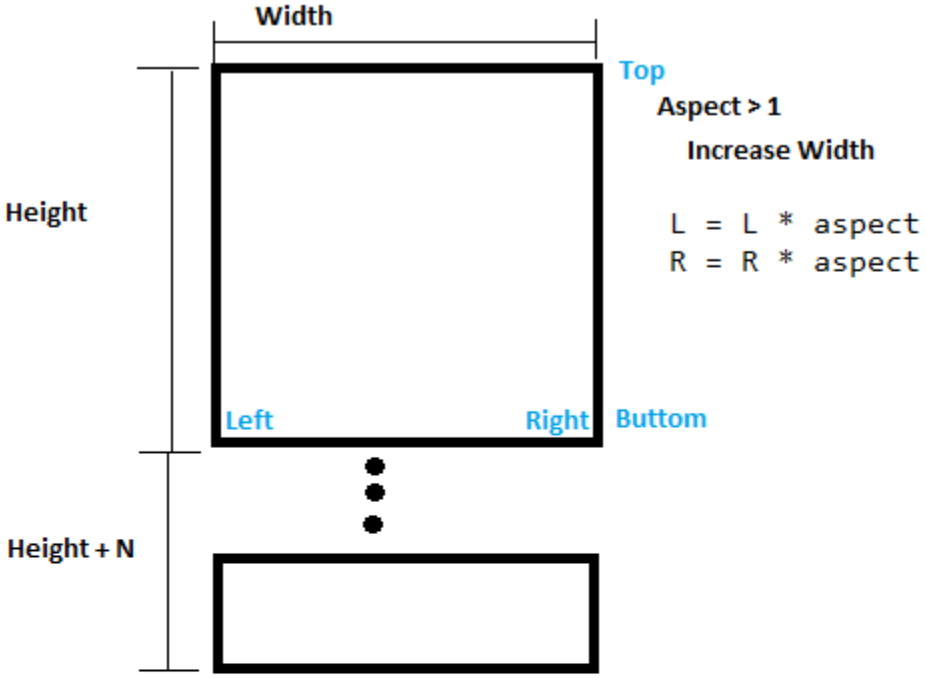
Disclaimers

1. Explanation/*

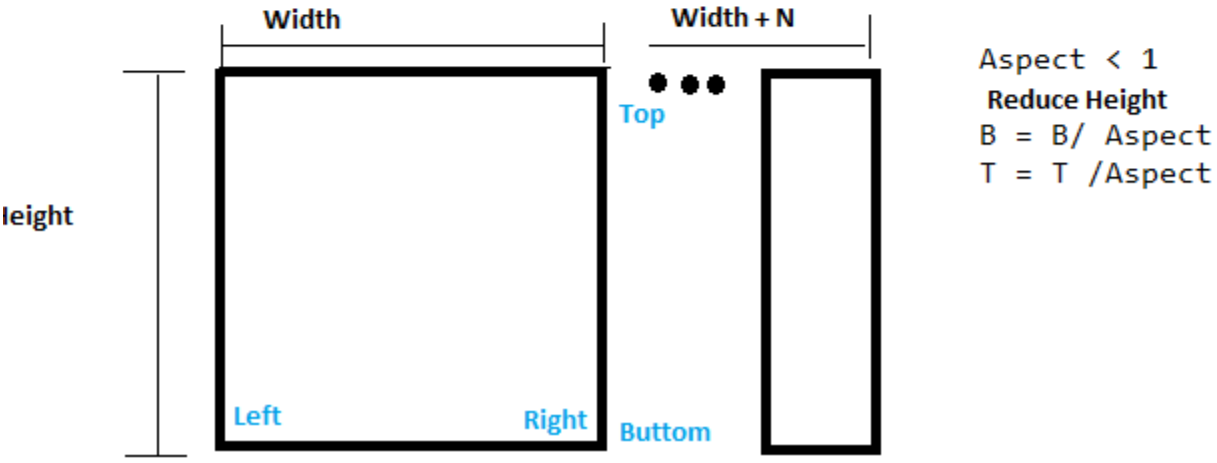


********** ASPECT**********

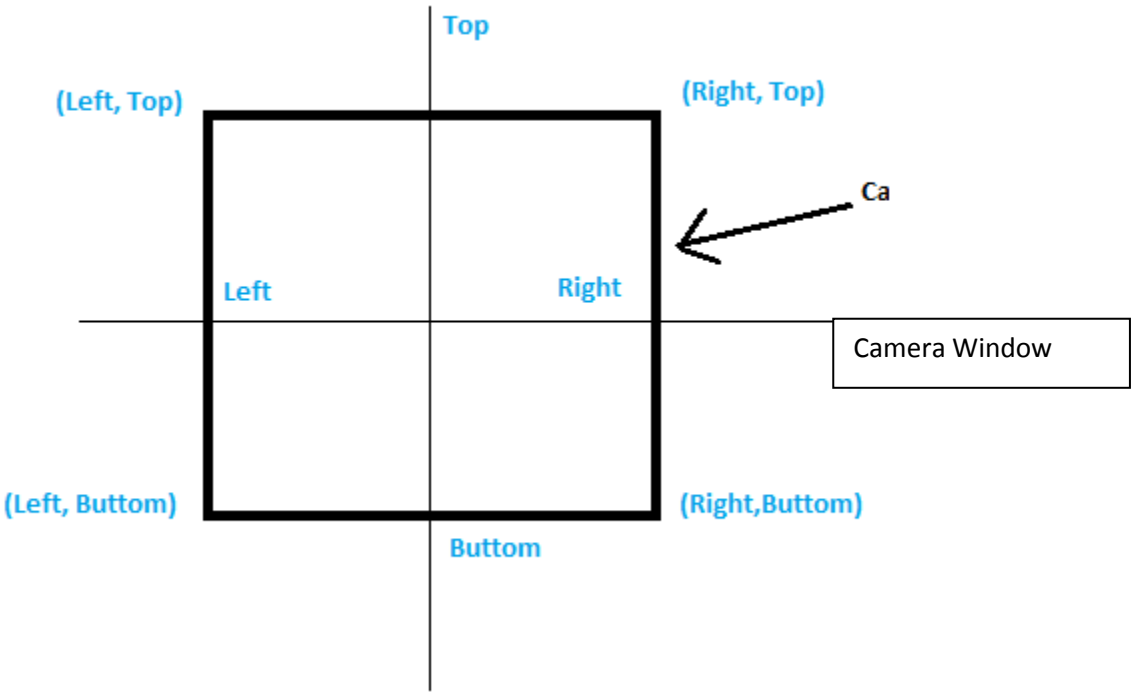
Case A) Height > Width

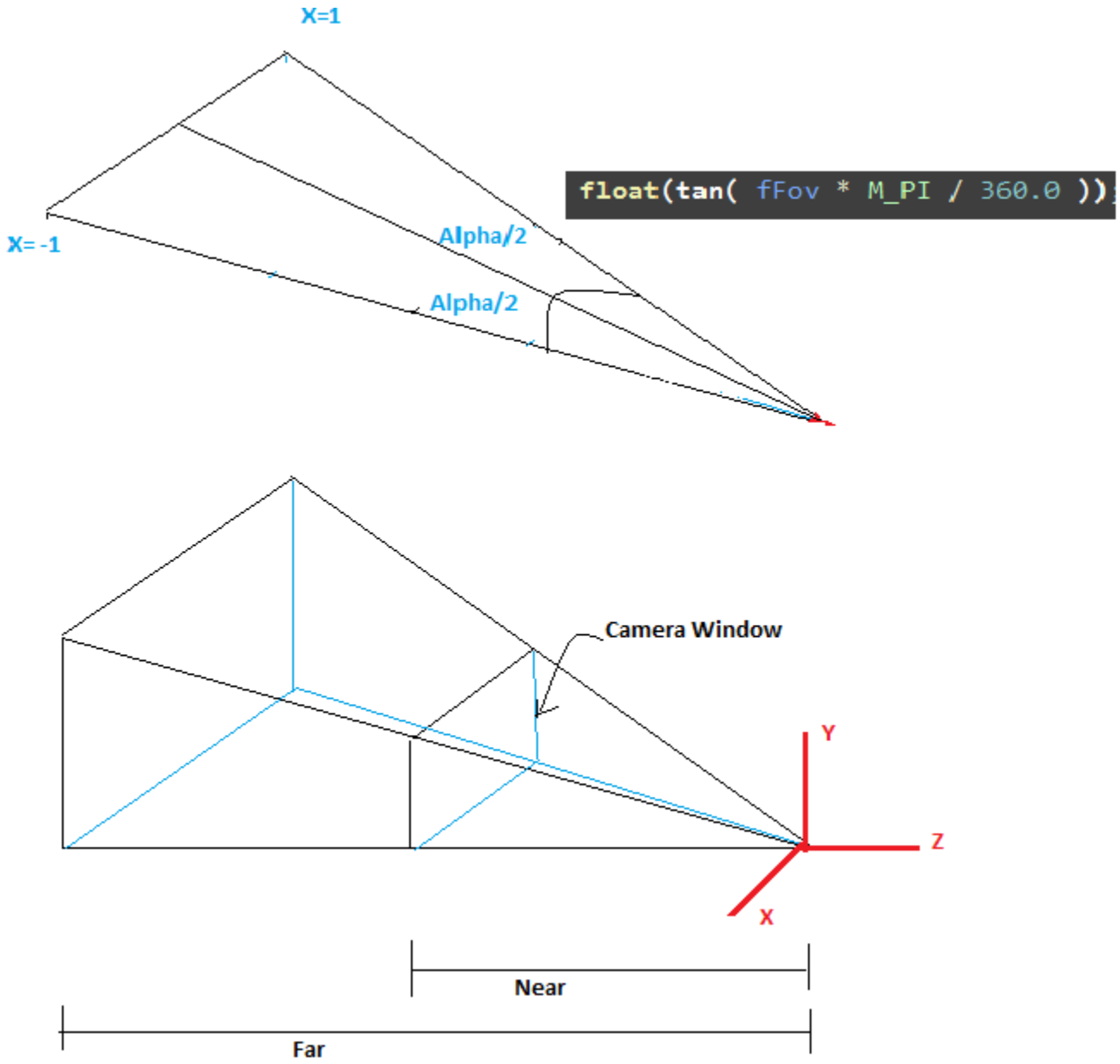


Case B) Widht > Height



**********SET Perspective **********





Perspective Matrix

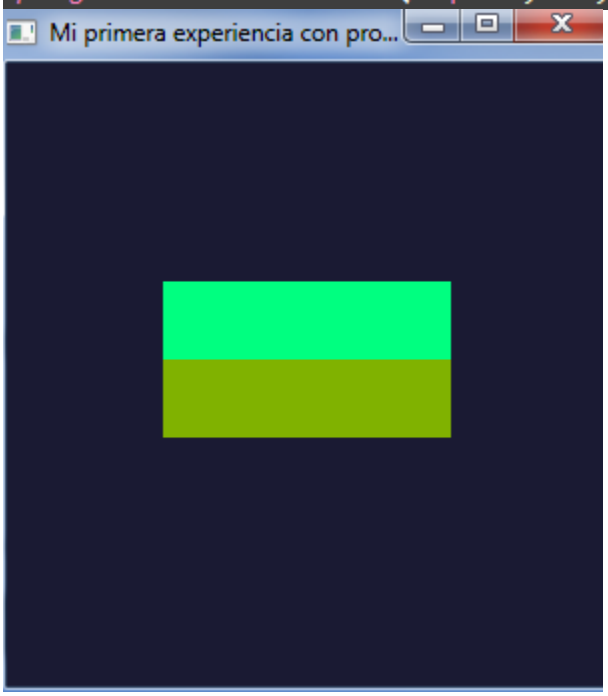
values[0] = 1.0/(fAspect * tan(fFov * M_PI / 360.0)	0	0	0
0	values[5] = 1.0/(tan(fFov * M_PI / 360.0))	0	0
0	0	values[10] = -((fFar + fNear)/(fFar - fNear))	values[11] = -((2*fFar*fNear)/(fFar - fNear))
0	0	values[14] = -1.0f;	values[15] = 0.0f;

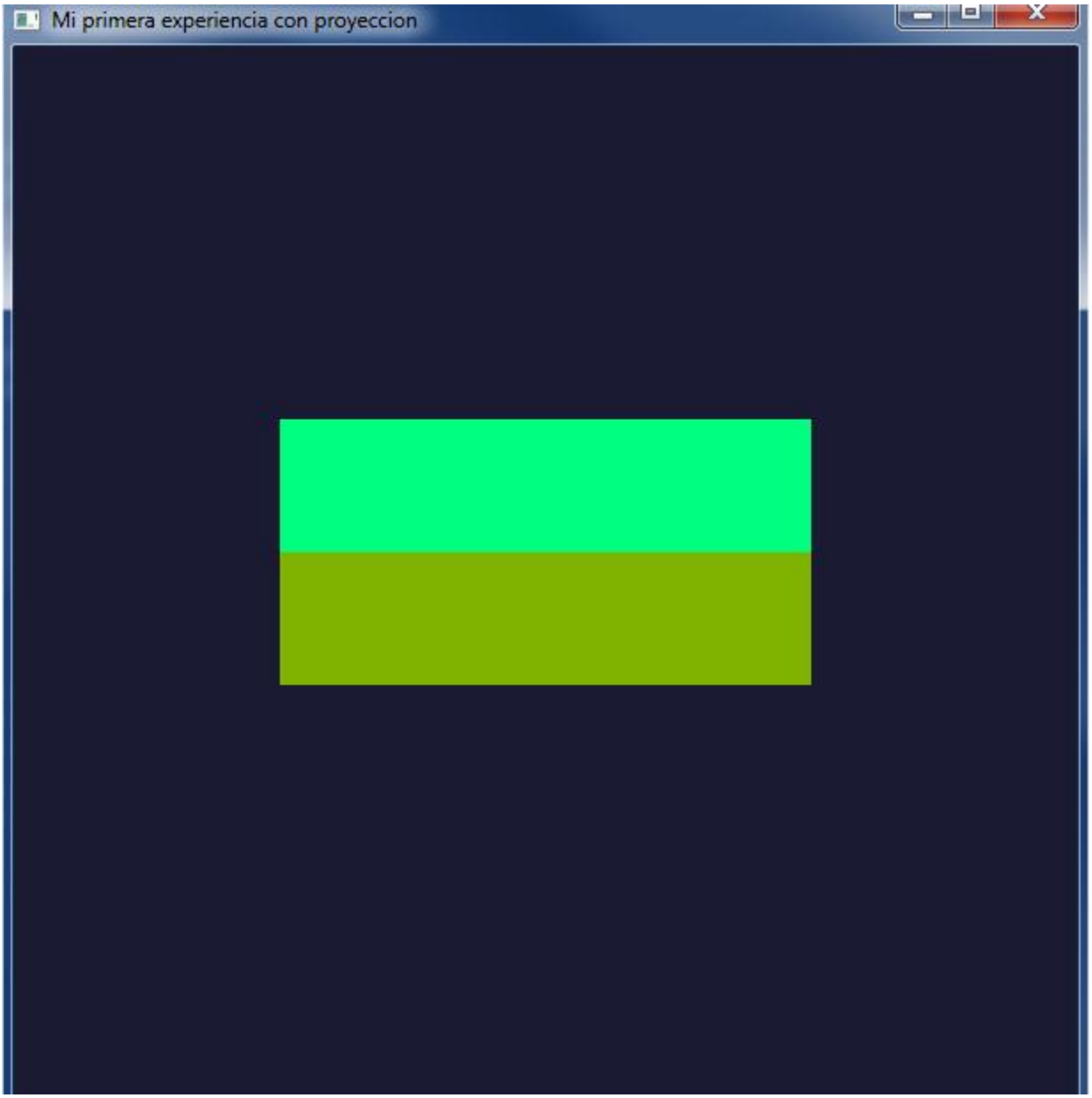
RUNNING PROGRAM
Testing ASPECT

INPUT

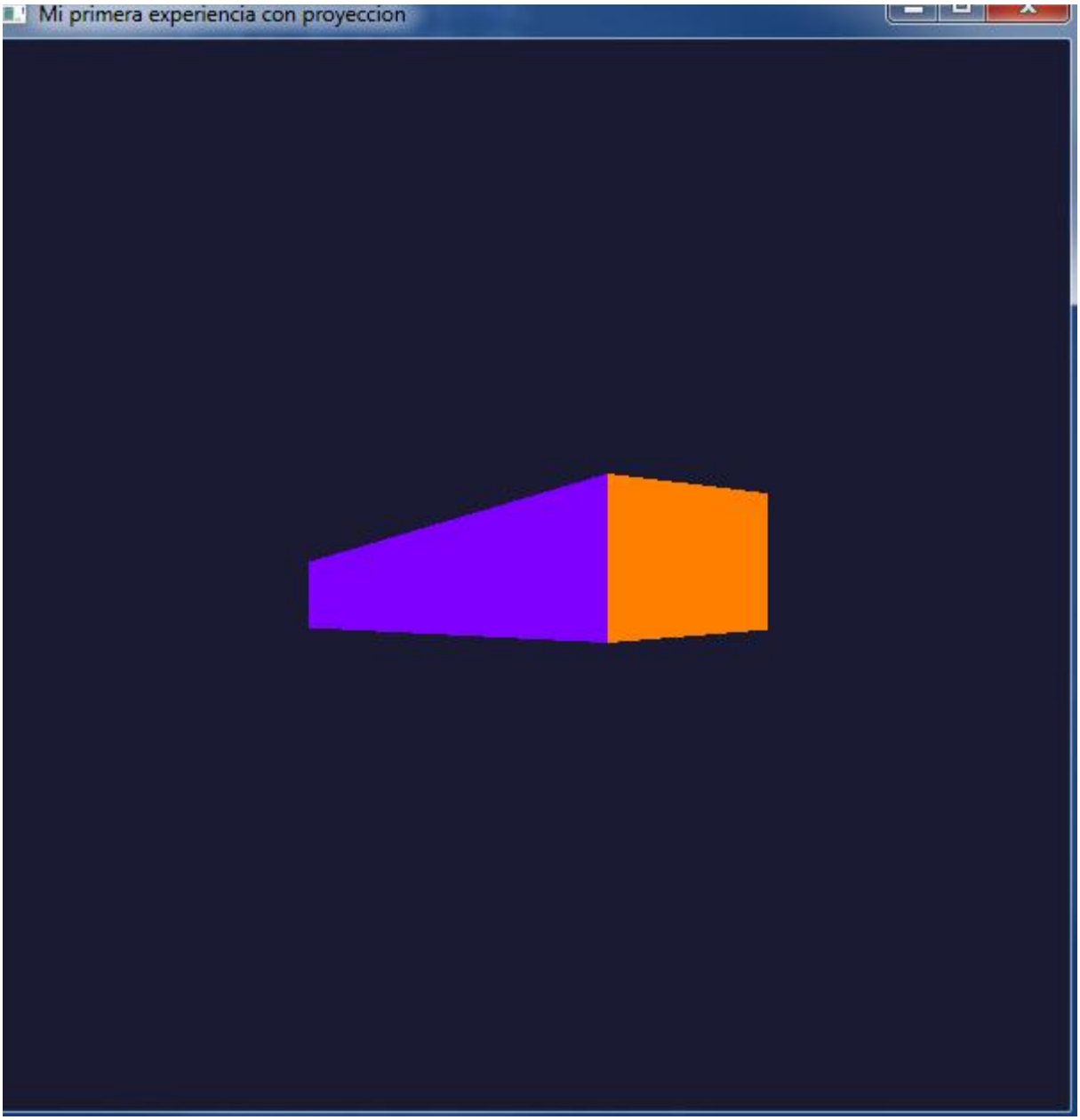
```
glutInitWindowSize(600, 600);
glutInitWindowPosition(100, 100);
glutTimerFunc(50, timerFunc11, 1);
```

```
projection11.setOrtho(aspect,-10, 10,-10, 10, 10, -10);
```




Mi primera experiencia con proyeccion

Testing Perspective



INPUT

```
 glutInitWindowSize(600, 600);
 glutInitWindowPosition(100, 100);
 glutTimerFunc(50, timerFunc11, 1);
```

```
projection11.setPerspective(53,aspect,10,100);
```

```
void display11() {
    glClear(GL_COLOR_BUFFER_BIT);
    glUseProgram(programId11);
    glBindVertexArray(va11[0]);
    model11 = loadIdentity();
    translate(model11,0.0,0.0,-40);
    rotateY(model11,yAngle+=0.5);
    glUniformMatrix4fv(modelMatrixLoc11, 1, GL_TRUE, model11.values);
    glUniformMatrix4fv(projectionMatrixLoc11, 1, GL_TRUE, projection11.values);
    glBindBuffer(GL_ELEMENT_ARRAY_BUFFER, 3);
    glDrawElements(GL_TRIANGLE_STRIP,29,GL_UNSIGNED_SHORT,0);
    glutSwapBuffers();
}
```

```
#include <GL/glew.h>
#include <GL/freeglut.h>
#include "Utils.h"
#include "Transforms.h"

using namespace mat4;
GLuint programId11, va11[1], vertexPosLoc11, vertexColorLoc11, modelColorLoc11,
modelMatrixLoc11, projectionMatrixLoc11;
Matrix4 model11, projection11;
float yAngle = 0;

void initShaders11() {
	GLuint vShader = Utils::compileShader("Shaders/proj_model_col_pos.vsh",
GL_VERTEX_SHADER);
	if (!Utils::shaderCompiled(vShader)) return;
	cout << "compilo el vertex shader" << endl;
	GLuint fShader = Utils::compileShader("Shaders/color.fsh",
GL_FRAGMENT_SHADER);
	if (!Utils::shaderCompiled(fShader)) return;

	programId11 = glCreateProgram();
	glAttachShader(programId11, vShader);
	glAttachShader(programId11, fShader);
	glLinkProgram(programId11);
	vertexPosLoc11        = glGetAttribLocation(programId11,
"vertexPosition");
	vertexColorLoc11      = glGetAttribLocation(programId11, "vertexColor");
	modelMatrixLoc11      = glGetUniformLocation(programId11, "modelMatrix");
	projectionMatrixLoc11 = glGetUniformLocation(programId11,
"projectionMatrix");
}

void myReshapeFunc(int width , int hight )
{
	cout << "valor width "<< width << endl;
	cout << "valor hight "<< hight << endl;
  /* void glViewport( GLint x,GLint y,GLsizei width,GLsizei height)
	x, y Specify the lower left corner of the viewport rectangle, in pixels.
The initial value is (0,0).

	width, height Specify the width and height of the viewport.
	When a GL context is first attached to a window, width and height are set
to the dimensions of that window.
```

```
  */
     glViewport( 0, 0, width, hight );
     float c = 1.0 * width; // Change width and hight in float
     float d = 1.0 * hight;
     float aspect;       // Define Aspect Variable
     if(width == 0){     // Code that avoids to divide by zero
          width = 1;
          }
     //aspect  =hight/width;
     aspect  =c/d;
     cout << "aspect: "<< aspect << endl;
     //projection11.setOrtho(aspect,-10, 10,-10, 10, 10, -10); //Send aspect
and
     projection11.setPerspective(53,aspect,10,100);
}

void createModel11() {
     float    modelPos[]   = { // Cara Frontal (verde obscuro)
                                   -5, -2.0, 7, 5,  -2.0, 7,  // 0 //1
                                   -5,  0.5, 7, 5, 0.5, 7,  //1  //2
                                   // Cara Superior (verde)
                                   -5,  0.5, 7,  5, 0.5, 7,
                                   -5,  3.0, -7, 5, 3.0, -7,

                                   // Cara posterior( naranja)
                                   -5,  3.0, -7,  5, 3.0, -7,
                                   -5,  -2.0, -7,  5, -2.0, -7,

                                   // Cara INFErior( AZUL)
                                   -5,  -2.0, -7,  5, -2.0, -7,
                                   -5,  -2.0, 7,  5, -2.0, 7,
                                   // cARA dERECHA (MORADO)
                                   5,-2.0, 7,  5, -2.0, -7,
                                   5, 0.5, 7, 5, 3.0, -7,

                                   // cARA iZQUIERDA (rOSA)
                                   -5,-2.0, -7,  -5, -2.0, 7,
                                   -5, 3, -7,    -5, 0.5, 7

     };


     float    modelColor[] = { 0.5, 0.7, 0,   0.5, 0.7, 0,
                               0.5, 0.7, 0,   0.5, 0.7, 0,

                               0.0, 1.0, 0.5, 0.0, 1.0, 0.5,
```

```
                                    0.0, 1.0, 0.5, 0.0, 1.0, 0.5,

                                    1.0,0.5,0.0, 1.0,0.5,0.0,
                                    1.0,0.5,0.0, 1.0,0.5,0.0,

                                    0.0,0.5, 1.0, 0.0, 0.5, 1.0,
                                    0.0,0.5, 1.0, 0.0, 0.5, 1.0,

                                    0.5, 0.0, 1.0, 0.5, 0.0, 1.0,
                                    0.5, 0.0, 1.0, 0.5, 0.0, 1.0,

                                    1.0, 0.0, 0.5, 1.0, 0.0, 0.5,
                                    1.0, 0.0, 0.5, 1.0, 0.0, 0.5
    };

    GLushort modelIndex[] = { 0, 1, 2,3, 0xFFFF,
                                     4,5,6,7,0xFFFF,
                                     8,9,10,11,0xFFFF,
                                    12,13,14,15,0xFFFF,
                                    16,17,18,19,0xFFFF,
                                    20,21,22,23};

    glGenVertexArrays(1, va11);
    glBindVertexArray(va11[0]);
    glBindBuffer(GL_ARRAY_BUFFER, 1);
    glBufferData(GL_ARRAY_BUFFER, sizeof(modelPos), modelPos, GL_STATIC_DRAW);
    glEnableVertexAttribArray(vertexPosLoc11);
    glVertexAttribPointer(vertexPosLoc11, 3, GL_FLOAT, 0, 0, 0);

    glBindBuffer(GL_ARRAY_BUFFER, 2);
    glBufferData(GL_ARRAY_BUFFER, sizeof(modelColor), modelColor,
GL_STATIC_DRAW);
    glEnableVertexAttribArray(vertexColorLoc11);
    glVertexAttribPointer(vertexColorLoc11, 3, GL_FLOAT, 0, 0, 0);

    glBindBuffer(GL_ELEMENT_ARRAY_BUFFER, 3);
    glBufferData(GL_ELEMENT_ARRAY_BUFFER, sizeof(modelIndex), modelIndex,
GL_STATIC_DRAW);
    glEnable(GL_PRIMITIVE_RESTART);
    glPrimitiveRestartIndex(0xFFFF);
    glEnable(GL_CULL_FACE);
//  glFrontFace(GL_CCW);

}

void display11() {
```

```
      glClear(GL_COLOR_BUFFER_BIT);
      glUseProgram(programId11);
      glBindVertexArray(va11[0]);
      model11 = loadIdentity();
      translate(model11,0.0,0.0,-40);
      rotateY(model11,yAngle+=0.5);
      glUniformMatrix4fv(modelMatrixLoc11, 1, GL_TRUE, model11.values);
      glUniformMatrix4fv(projectionMatrixLoc11, 1, GL_TRUE,
projection11.values);
      glBindBuffer(GL_ELEMENT_ARRAY_BUFFER, 3);
      glDrawElements(GL_TRIANGLE_STRIP,29,GL_UNSIGNED_SHORT,0);
      glutSwapBuffers();
}

void exitFunc11(unsigned char key, int x, int y) {
    if (key == 27) {
        glDeleteVertexArrays(1, va11);
        exit(0);
    }
}

void timerFunc11(int id) {
      glutTimerFunc(10, timerFunc11, id);
      glutPostRedisplay();
}

int main(int argc, char **argv) {
      glutInit(&argc, argv);
      glutInitDisplayMode(GLUT_DOUBLE);
    glutInitWindowSize(600, 600);
    glutInitWindowPosition(100, 100);
    glutTimerFunc(50, timerFunc11, 1);

    glutCreateWindow("Mi primera experiencia con proyeccion");
    glutDisplayFunc(display11);
    glutReshapeFunc(myReshapeFunc);// It is a callback that send width and
height to myReshapeFunc
    glutKeyboardFunc(exitFunc11);
    glewInit();
    initShaders11();
    createModel11();
      //projection11.setOrtho(-10, 10,-10, 10, 10, -10);
    glClearColor(0.1, 0.1, 0.2, 1.0);
    glutMainLoop();
      return 0;
}
```

```
***************MATRIX4.CPP *****************
/*
 * Matrix3.cpp
 *
 *  Created on: 14/01/2014
 *      Author: Iván
 */

#include "Matrix4.h"
#include <cmath>

using namespace std;

namespace mat4 {

     Matrix4::Matrix4() {
          setIdentity();
     }

     Matrix4::~Matrix4() {
     }

     void Matrix4::setIdentity() {
          for(int i = 1; i < 16; i ++) values[i] = 0;
          values[0]  = 1;
          values[5]  = 1;
          values[10] = 1;
          values[15] = 1;
     }

     void Matrix4::setOrtho(float aspect,float l, float r, float b, float t,
float n, float f)
     {

          if(aspect >= 1)
              {
                l = l*aspect;
              r = r*aspect;


              /*   Widht
               *    ____________________
               *    |                   |
               * H  |                   |
               * e  |                   |
               * i  |                   |
```

```
             * g  |                |
             * h  |                |
             * t  |                |
             *    |________________|
             *

             */
            cout<<"modifica l y r" << endl;
             }
        else {
             b = b/aspect;
             t = t/aspect;
             cout<<"modifica b y t" << endl;

        }

        /*
         * |2/(r-l)  0         0        -(l + r)/(r-l) |
         * |0        2/(t-b)   0        -(b + t)/(t-b) |
         * |0        0         2/(n-f)  -(f + n)/(n-f) |
         * |0        0         0        1              |
         *
         */


        setIdentity();
        values[0]  = 2/(r-l);
        values[5]  = 2/(t-b);
        values[10] = 2/(n-f);

        values[3]  = -(l + r)/(r-l);
        values[7]  = -(b + t)/(t-b);
        values[11] = -(f + n)/(n-f);
    }



     void Matrix4::setPerspective(float fFov, float fAspect, float fNear, float
fFar)

   {

         cout << "fFov: " << fFov << " Aspect: " << fAspect << " fNear: " <<
fNear << " fFar: " << fFar << endl;

           setIdentity();
```

```
          // Construct the projection matrix
           values[0] = 1.0/(fAspect * tan(fFov * M_PI / 360.0));
           values[5] = 1.0/(tan(fFov * M_PI / 360.0));
           values[10] = -((fFar + fNear)/(fFar - fNear));
           values[11] = -((2*fFar*fNear)/(fFar - fNear));
           values[14] = -1.0f;
           values[15] = 0.0f;
//          cout << "ymax:" << ymax<< " ymin:"<< ymin << " xmin:" << xmin  << "
xmax:" << xmax << endl;
//          cout << "[0]  " << values[0] << endl;
//          cout << "[1]  " << values[1] << endl;
//          cout << "[2]  " << values[2] << endl;
//          cout << "[3]  " << values[3] << endl;
//          cout << "[4]  " << values[4] << endl;
//          cout << "[5]  " << values[5] << endl;
//          cout << "[6]  " << values[6] << endl;
//          cout << "[7]  " << values[7] << endl;
//          cout << "[8]  " << values[8] << endl;
//          cout << "[9]  " << values[9] << endl;
//          cout << "[10] " << values[10] << endl;
//          cout << "[11] " << values[11] << endl;
//          cout << "[12] " << values[12] << endl;
//          cout << "[13] " << values[13] << endl;
//          cout << "[14] " << values[14] << endl;
//          cout << "[15] " << values[15] << endl;


     }



     void Matrix4::set(int c, int r, float v) {
          if(c < 0 || r < 0 || c > 3 || r > 3) return;
          values[r * 4 + c] = v;
     }

     float Matrix4::get(int c, int r) const {
          if(c < 0 || r < 0 || c > 3 || r > 3)  return 0;
          return values[r * 4 + c];
     }

     Matrix4 Matrix4::operator *(const Matrix4& m) {
          Matrix4 res;
          for(int c = 0; c < 4; c ++) {
               for(int r = 0; r < 4; r ++) {
                    float sum = 0;
```

```
                    for(int k = 0; k < 4; k ++) {
                         sum += get(k, r) * m.get(c, k);
                    }
                    res.set(c, r, sum);
               }
          }
          return res;
     }

     ostream& operator<<(ostream& o, const Matrix4& m) {
          for(int r = 0; r < 4; r ++) {
               for(int c = 0; c < 4; c ++) {
                    o << m.get(c, r) << " ";
               }
               o << endl;
          }
          return o;
     }

} /* namespace CG */


**********MATRIX4.h**************************************************

#ifndef MATRIX4_H_
#define MATRIX4_H_

#include <iostream>
using namespace std;

namespace mat4 {

     class Matrix4 {
     public:
          float values[16];
          Matrix4();
          virtual ~Matrix4();
          void setIdentity();
          void setOrtho(float aspect, float l, float r, float b, float t, float
n, float f);
          void set(int c, int r, float v);
          float get(int c, int r) const;
          void setPerspective(float fov, float ratio, float nearZ, float farZ);
          void setView(float x, float y, float z);
          void setView(float x, float y, float z, float lookAtX, float lookAtY,
float lookAtZ, float upX, float upY, float upZ);
```

```
            void setTranslation(float tx, float ty, float tz);
            Matrix4 operator*(const Matrix4 &m1);
            friend ostream& operator<<(ostream& o, const Matrix4& m);
        };

} /* namespace CG */
#endif /* MATRIX4_H_ */
```