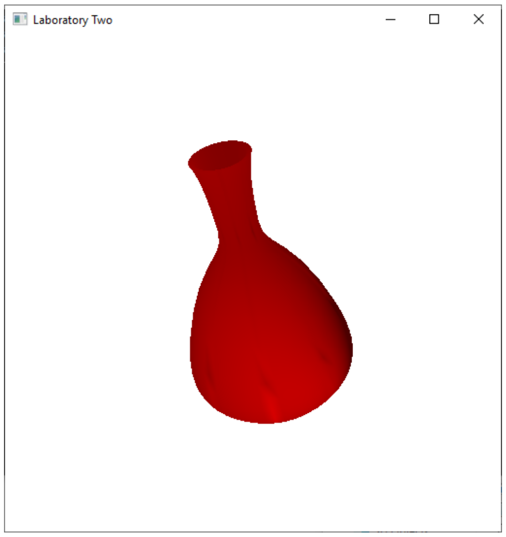
CSCI 3090 Laboratory Two

OBJ File Loader

Introduction

Entering vertex coordinates and normal vectors by hand quickly becomes tedious and time consuming. For any reasonable object this is not a practical approach. Instead, a geometrical modeller is used to construct the geometrical information. This is a program that supports the interactive editing of geometrical and quite often material properties of objects. A well-known open source geometrical modeller and animation program is Blender. These programs use various types of file formats for storing geometrical information and we will explore one of these file formats in this laboratory. The file format that we will use is called OBJ and it is an ASCII file format for geometrical information. This is a fairly sophisticated file format that can store far more information than we can use in OpenGL programs, but it is very widely used so it is worth investigating. You will find many free OBJ files on the web. We will use a simple library for loading OBJ files, called tiny OBJ loader. This library doesn't support all of the OBJ features, but it is very easy to add to our programs and is quite easy to use. There are only two source code files that you need to add to your project.

This laboratory builds on laboratory one, so you should start with the source code from that example. In addition, there is a lab2.zip file on Canvas that you must download for this laboratory. This zip file contains tiny_obj_loader.h and tiny_obj_loader.cc that you must add to the project for this laboratory. There is an init.cpp file that contains an init() procedure that replaces the init() procedure from laboratory one. You can copy and paste this into the main.cpp file from laboratory one (remember to delete the old init() procedure). The lab2.fs, lab2.vs and vase.obj file should be placed in the debug folder. You will need to make several modifications to the program, which are described below. When finished you will get the following output:



Modified Init() Procedure

The init() procedure will be examined before the remaining program changes are discussed. The heart of the tiny OBJ loader library is the tinyobj::loadObj procedure. This procedure is called close to the start of the init() procedure. This procedure has four parameters. The first parameter is the list of shapes in the model, and the second parameter is the list of materials. The third parameter is the OBJ file name, and the fourth parameter is the path to the folder where the material files are stored. I have chosen a particularly simple OBJ file that has only one shape and no materials to make this laboratory easier. As you can see from the program code the first parameter is a vector of tiny obj shape structures, where each shape has name and a mesh. Each mesh has positions (the vector coordinates), normal vectors and triangle indices. There is other information stored in the mesh, but we don't need them for this laboratory.

The first thing we do is extract the vertex coordinates from the mesh. This can be done with a simple for loop. Since we are loading the vertices from a file, we have no idea of the range of their coordinates, but we need this information to correctly display the object. The next for loop computes the minimum and maximum values of the x, y and z coordinates. This is then used to compute the center of the object's bounding box (the smallest box that contains the object), which is used to construct the viewing transformation in display ().

The normal vectors and triangle indices are extracted in essentially the same way. The rest of the init() procedure is similar to what we have seen before.

Other Program modifications

There are a few other changes that we need to make to the program starting with the include files and declarations at the start of the program. You should modify the start of the program to include the following two include files and the following global declarations:

```
#include "tiny_obj_loader.h"
#include <iostream>

GLuint program;                    // shader programs
GLuint objVAO;                     // the data to be displayed
int triangles;                     // number of triangles
```

Since this model is much larger than the one in the first laboratory, we need to modify our near and far clipping planes in the following way:

```
projection = glm::perspective(45.0f, ratio, 1.0f, 800.0f);
```

This is done in the `framebufferSizeCallback` () and the main() procedure. The display() procedure is basically the same as before with the major changes occurring in the call to glm::lookat and the call to glDrawElements. The code for the modified display() procedure is:

```
void display() {
	glm::mat4 view;
	glm::mat4 modelViewPerspective;
	int modelLoc;
	int normalLoc;

	view = glm::lookAt(glm::vec3(eyex, eyey, eyez),
					glm::vec3(cx,cy,cz),
					glm::vec3(0.0f, 0.0f, 1.0f));

	glm::mat3 normal = glm::transpose(glm::inverse(glm::mat3(view)));

	modelViewPerspective = projection * view;

	glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);
	glUseProgram(program);
	modelLoc = glGetUniformLocation(program,"model");
	glUniformMatrix4fv(modelLoc, 1, 0, glm::value_ptr(modelViewPerspective));
	normalLoc = glGetUniformLocation(program,"normalMat");
	glUniformMatrix3fv(normalLoc, 1, 0, glm::value_ptr(normal));

	glBindVertexArray(objVAO);
	glDrawElements(GL_TRIANGLES, 3*triangles, GL_UNSIGNED_SHORT, NULL);

}
```

Since the model is much larger, we need to change the initial values of eyex, eyey and eyez along with the parameters used in the navigation computations. The modified statements in the main() procedure are:

```
	eyex = 0.0;
	eyey = 500.0;
	eyez = 0.0;

	theta = 1.5;
	phi = 1.5;
	r = 500.0;
```

Laboratory Report

Make the modifications described above to the laboratory one program and show the results to the TA or submit it as a PDF file under Canvas.