Final Project

Technical Guide

Computer Graphics and Human-Computer Interaction Lab

School of Engineering
National Autonomous University of Mexico

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Group: 12

Class Code: 6590

Contents

1 Objective

The student must apply and demonstrate the knowledge acquired throughout the course for the Computer Graphics and Human-Computer Interaction class at UNAM's School of Engineering

2 Project's scope

- OpenGL for modeling and animation of graphic elements
- 3D modeling using modeling software (Maya)
- Basic transformations in OpenGL
- Modeling of a three-dimensional space in OpenGL (facade and room)
- Recreation, through 3D modeling, of at least 7 objects
- 5 animations (3 simple and 2 complex)

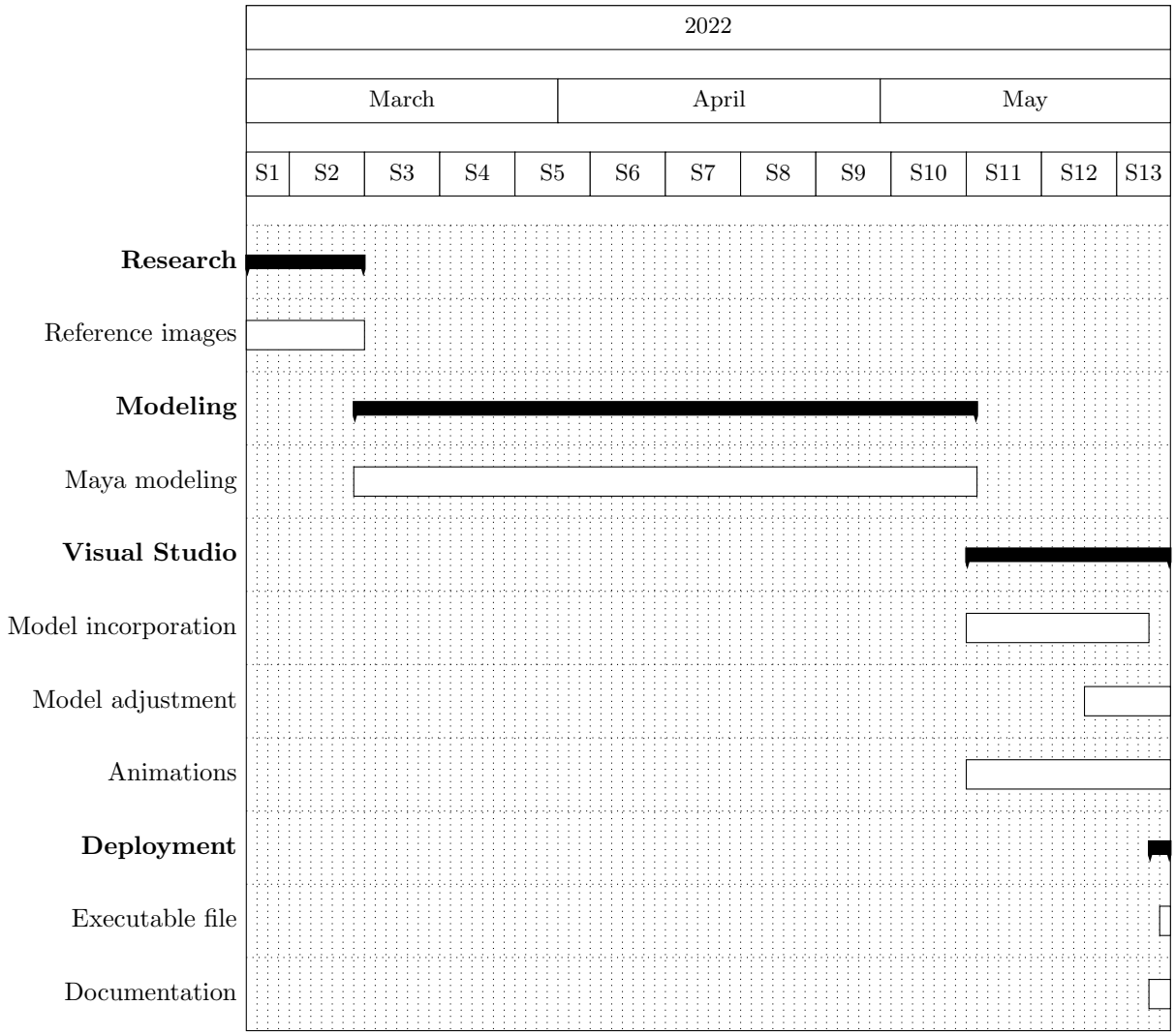
2.1 Limitations

To carry out the project I used a computer with 16GB of RAM and an Intel i7 processor. However, the main limitation that I noticed was with Maya when I tried to modify the houses model according to the needs of the project. The house model in Maya weighs 83MB but it took a lot of computer power to continue modeling and making transformations on it which delayed the time frame of the project

2.2 Project deliveries

1. Technical guide
2. User guide
3. Project executble file
4. Models
5. Reference images

3 Gantt Diagram



4 Environment to recreate

The scenario to recreate consists of the following elements:

- Facade
- Room
- At least 7 objects (excluding windows and doors)

4.1 Facade

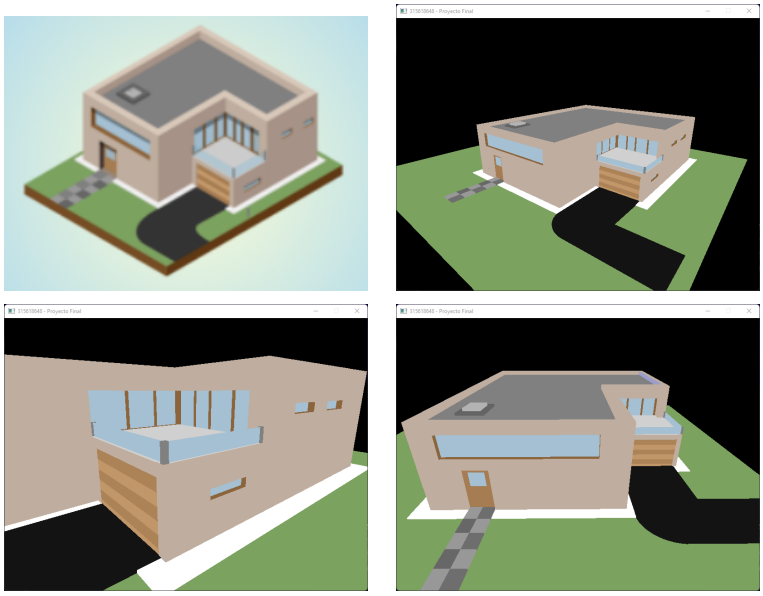


Figure 1: Facade to recreate (top left) vs. Facade recreated in OpenGL

4.2 First Room

Figure 2: Room to recreate (top left) vs. Recreated Room in OpenGL

4.3 Second Room

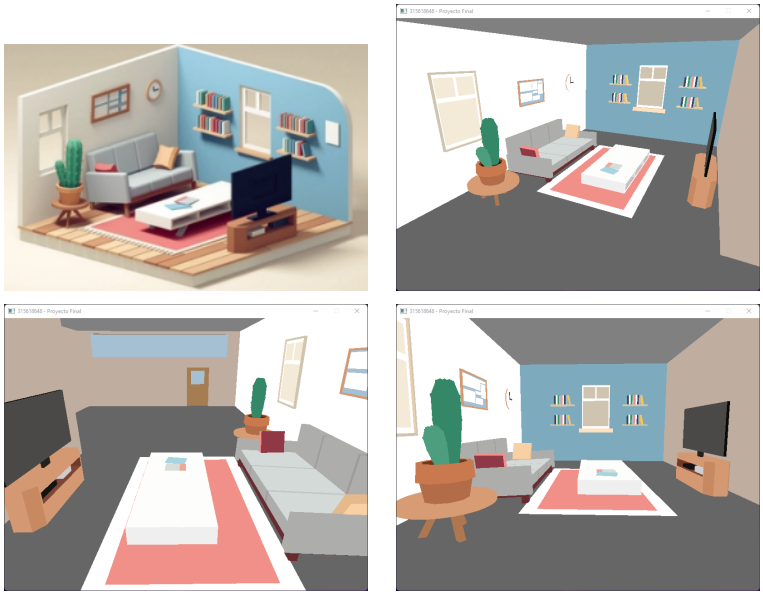
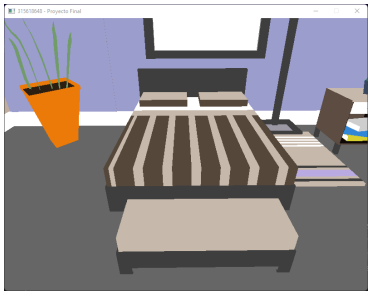


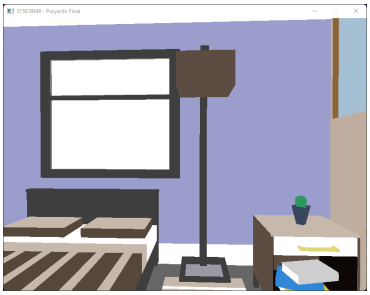
Figure 3: Room to recreate (top left) vs. Recreated Room in OpenGL

5 OpenGL models

5.1 First Room



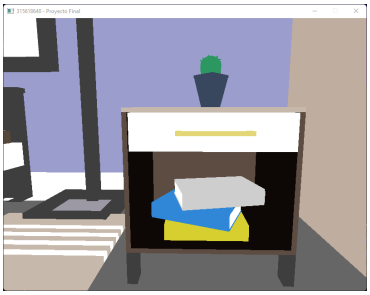
(a) Bed



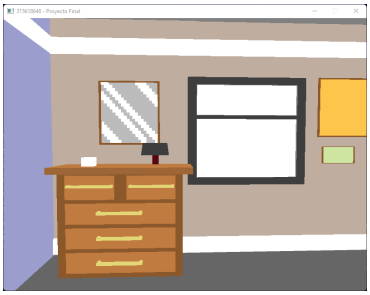
(b) Lamp

(c) Plant

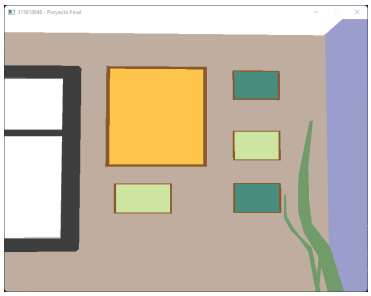
(d) Armchair



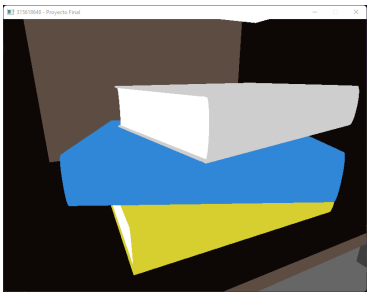
(e) Bedside furniture



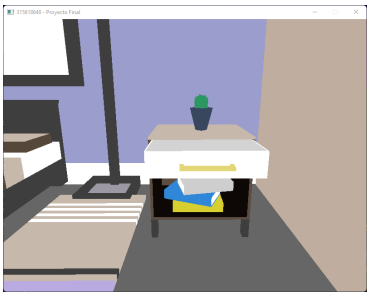
(f) Wardrobe



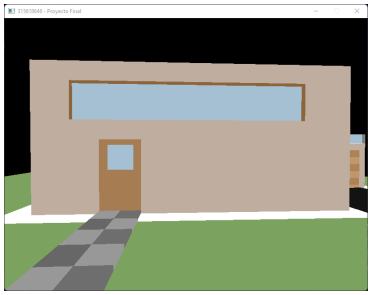
(g) Paintings



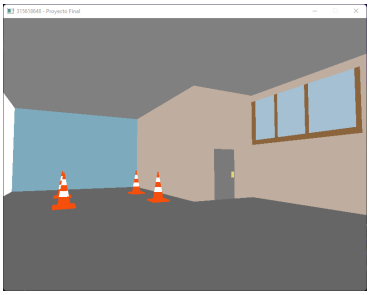
(h) Books



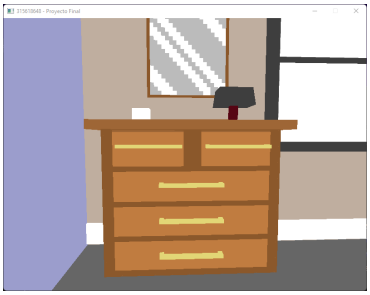
(i) Bedside furniture's drawer



(j) Exterior door



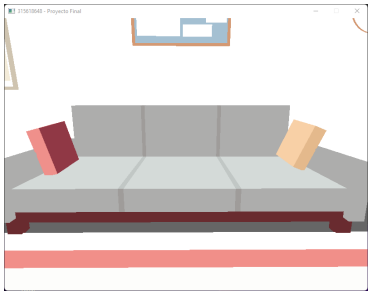
(k) Interior door



(l) Wardrobe's lamp

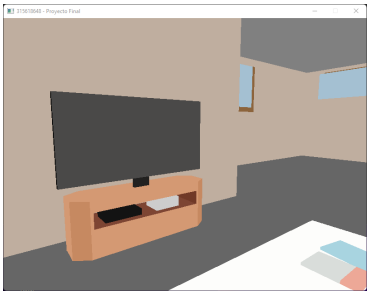
Figure 4: OpenGL models

5.2 Second Room

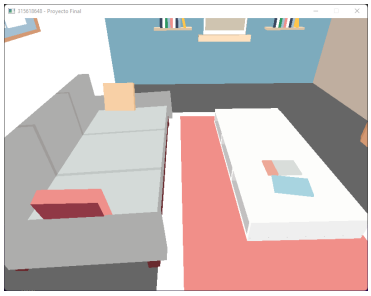


(a) White armchair

(b) White furniture

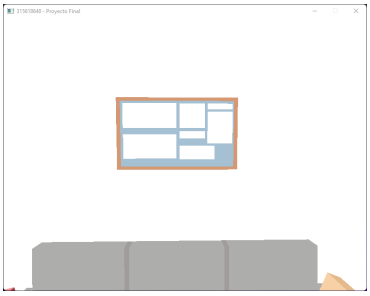


(c) Base furniture + TV

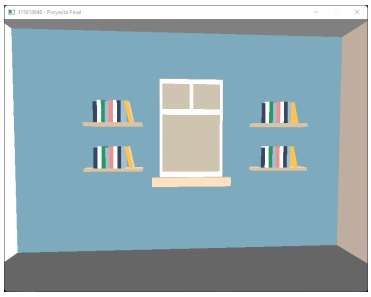


(d) Pillows + Tapestry

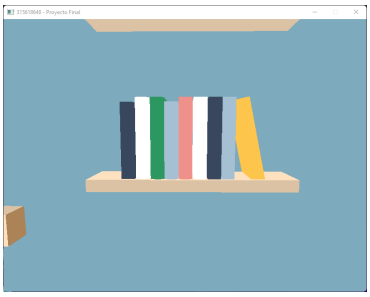
(e) Pot + Cactus



(f) Blue painting



(g) Window + book shelves



(h) Books

6 Code architecture

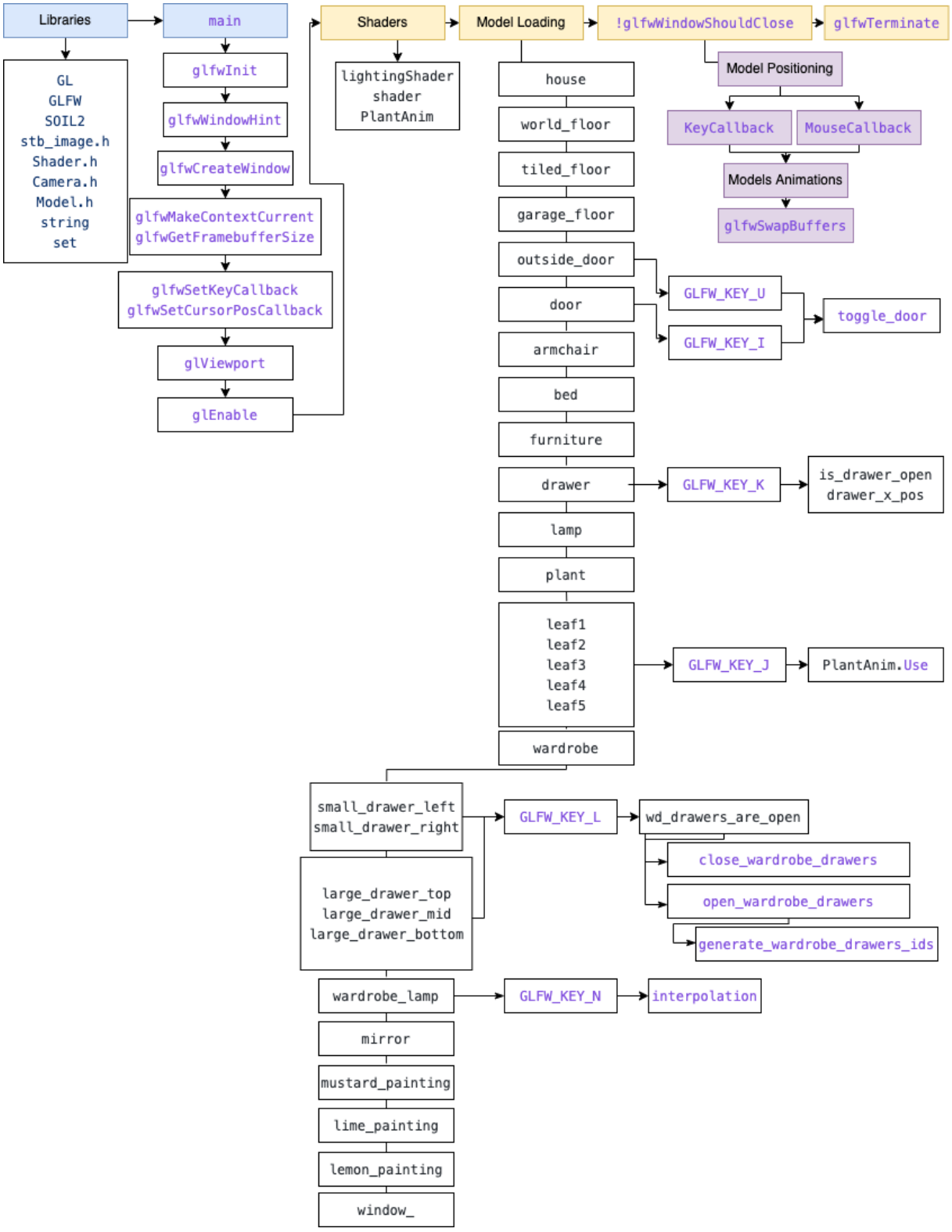


Figure 6: Project architecture

As exemplified on figure 6, the code architecture is composed of the following elements:

- **Libraries loading**
- **Shader's configuration**
- **Model loading**
- **Mouse y Key Callback**: once the models are loaded in OpenGL, both the mouse and key callback respond to user interactions (via (`GLFW_KEY_`)
- **Animations**: once the callbacks capture the user interactions, they call the following functions:
  - `toggle_door`: animates both interior and exterior door (figures 4j and 4k)
  - `is_drawer_open` y `drawer_x_pos`: these two variables control the bedside furniture's drawer animation (figure 4i)
  - `PlantAnim.Use()`: PlantAnim is a shader that controls the leaves' sinusoidal movement (figure 4c)
  - `wd_drawers_are_open`: this variable, based on its state, calls either `close_wardrobe_drawers` or `open_wardrobe_drawers` functions that conotrol both opening and closing of wardrobe's drawers (figure 4f)
  - `interpolation`: this function controls the wardrobe's lamp animation (figure 4l)

7 Cost Analysis

To carry out this project, I spent approximately 3 months working a total of 4 hours per week, which in total accounts for 48 hours. Knowing this, we can take an hourly price estimate. According to works in Glassdoor the average videogame developer salaries in Mexico goes from $15,000 to $22,000 Mexican pesos.

These monthly salaries are usually estimated for works of 40 hours per week, therefore if I worked in one of these companies, for this project, the salary I was to recieve would go from $4,500 to $6,600 Mexican pesos.

However, since this project can be considered as a freelance project, I have to consider the following expenses as well:

Expense	**Cost per hour (in Mexican pesos)**
Electrical energy	$700
Computer	$2250
Food expenses	$1000
Internet	$435
Total	$4,385

Table 1: Estimated additional expenses per hour (and not per monthly duration)

Considering the expenses in the previous table, in addition with the average salary that the industry is paying, I would charge this project at $15,000 Mexican pesos:

- General expenses (previous table): $5,000
- Monthly salary: $7,000
- Extra costs: $3,000

8 Closing Remarks

Throughout the project the main learnings I acquired were the following:

- 3D modeling using Maya
- Basic computer graphics knowledge implemented in OpenGL
- Rendering pipeline in OpenGL

Although the general concepts of the course were implemented in this project, the greatest learning that I acquired, given the essence of my project, was three-dimensional modeling in Maya. The staging of these models, together with basic transformations, was not a great challenge since the code was already given to us. However, much of the research for modeling in Maya I had to do it on my own and therefore, were the most learning I acquired.