Cosc363 Assignment 1

Note: This assignment was done using a Linux Mint VM and Geany as the development environment

Models:

- **Museum *(Figure 1)*:** This custom-made model is made out of GLUT cubes for the roof, back wall, left wall, right wall and 2 more separate GLUT cubes for the entrance. The museum floor is made up of a textured GLUT quad. This model was constructed using 9 GLUT objects. This model also has diffuse reflections.

- **Bird *(Figure 2)*:** This custom-made model is constructed out of 10 GLUT objects; GLUT spheres for its body, head and eyes, and GLUT cubes for its wings, legs and beak. Bird has a constant animation where it flaps its wings, moves its legs and opens and closes its beak. This model also has diffuse reflections.

- **Horse and Hay bale *(Figure 3)*:** This custom-made model is made out of GLUT cubes for the horse's legs, body, neck, head and tail, GLUT spheres for its eyes and textured GLUT quads to construct the hay bale. A total of 16 GLUT objects were used to construct the Horse and Hay bale. The horse has a constant animation where it moves his head up and down to eat the hay bale and also moves its tail up and down as well. This model also has diffuse reflections.

- **Snowman *(Figure 4)*:** This custom-made model is made out of GLUT spheres for its lower body, mid body, head, eyes and buttons and GLUT cubes where used to construct its arms and nose. A total of 13 GLUT objects were used to construct this snowman. The snowman has a constant animation where it moves its arms up and down. This model also has diffuse reflections.

- **Golden Chalice *(Figure 5)*:** This custom-made model is made up of custom-built sweep surfaces to construct its shape (explained further in the Extra Features section).

- **Cannon *(Figure 7, Figure 8)*:** This model is taken from the cosc363 Lab 2 with the addition that it now casts a planar shadow onto the museum floor from the outside light source and now has a constant animation where it fires a cannonball calculated by parabolic equation.
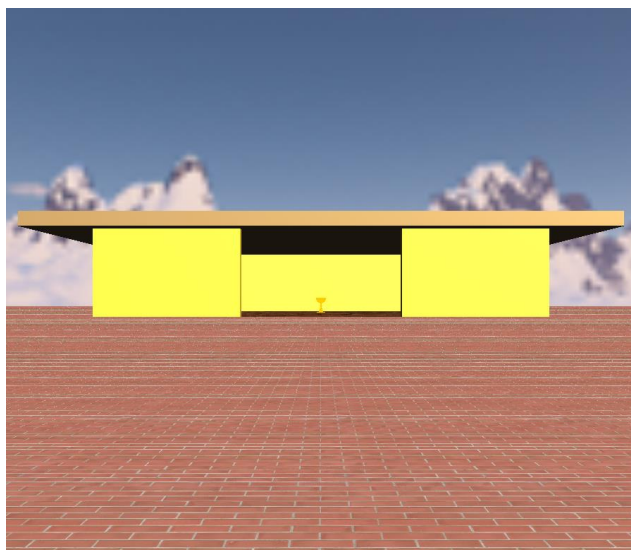
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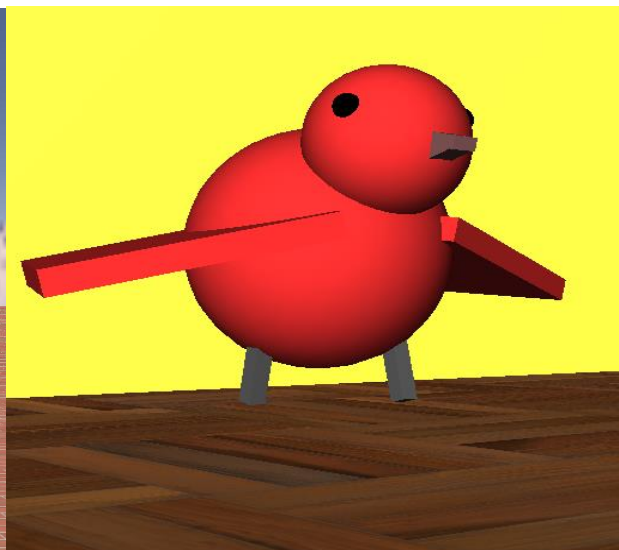*Figure 1: Museum building with outdoor brick flooring and skybox*
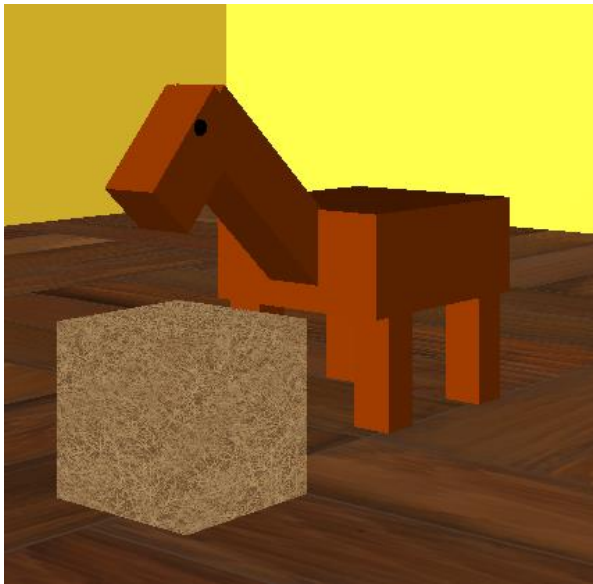
Figure 2: Bird Exhibit

Figure 3: Horse and Hay bale Exhibit

Figure 4: Snowman Exhibit

Figure 5: Golden Chalice Exibit
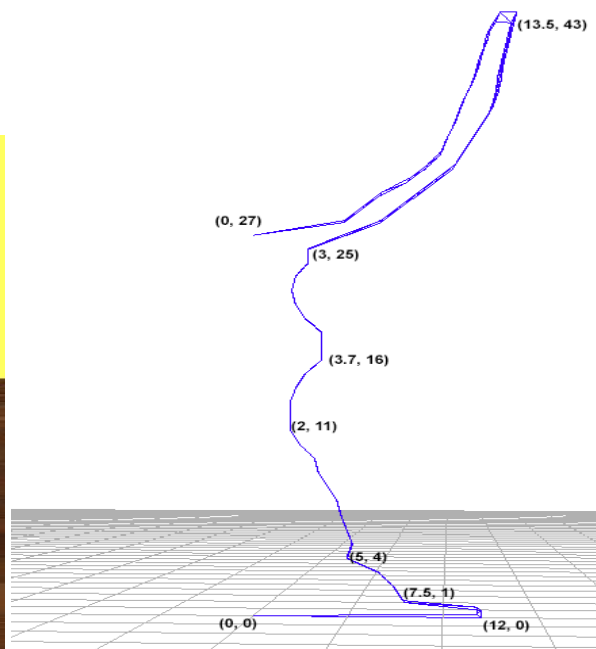

Figure 6: Chalice Base curve
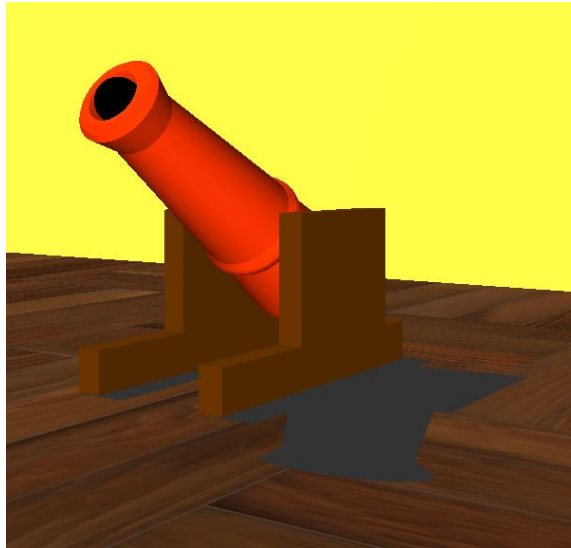
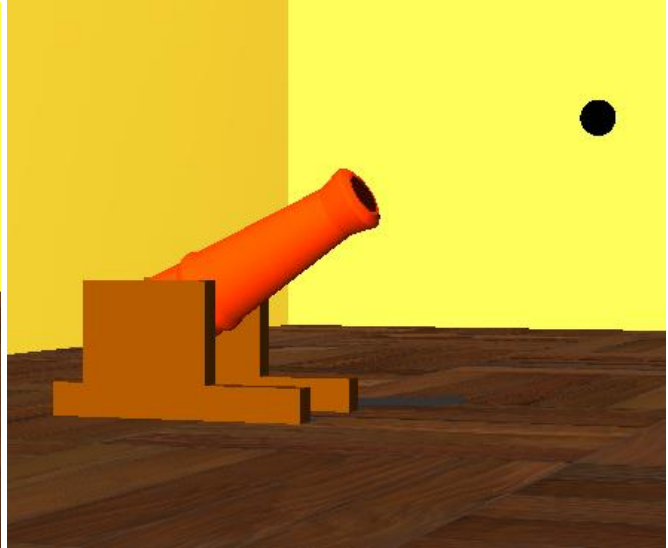Figure 7: Cannon   Figure 8: Cannon firing the cannonball

Extra Features:

- **Skybox:** The scene is enclosed in 6 textured quads to create a skybox around the scene *(shown in figure 1)*

- **Planar Shadows:** The Cannon casts a planar shadow onto the museum floor (shown in *figure 7*)

- **Physics based animation:** The cannon has a constant animation where it fires the cannon ball *(shown in figure 8)*. The position of the cannon ball is calculated using the following parabolic equation:

$$y = -0.2x^2 + 1.5x + 1$$

- **Collision Detection:** The museum walls have been implemented with collision detection preventing your camera from going through the walls.

- **Custom Built Sweep Surfaces (*Figure 5 and figure 6*):**

   The base curve is plotted with the following set of 36 vertices:

float vx[N] = { 0.0, 12.0, 12, 8, 7.5, 6.7, 5, 5.3, 5, 4.7, 4.5, 4.0, 3.5, 3.3, 2.5, 2.0, 2.0,
          2.0, 2.3, 2.8, 3.7, 3.7, 3.7, 2.8, 2.3, 2.1, 2.3, 3, 3, 5, 7, 8, 9, 10, 11, 11.5, 12, 12.5, 13,
          13.3, 13.5, 13.6, 13.8, 14.0, 14.2, 14.4, 13.5, 13.0, 12.8, 12.5, 12.3, 12.0, 11.6, 11.3, 11.0,
          10.6, 10.3, 9.5, 8.5, 7, 6, 5, 0 };

float vy[N] = { 0.0, 0.0, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
          19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
          39, 40, 41, 42, 43, 43, 42, 41, 40, 39, 38, 37, 36, 35, 34, 33, 32, 31, 30, 29, 28, 27 };

float vz[N] = {0};

Controls:
Up Arrow Key: Move camera forward
Down Arrow Key: Move camera backwards
Left Arrow Key: Look Left
Right Arrow Key: Look Right

Build Commands:

1. Download and install VirtualBox
2. Download Linux Mint
3. Once inside your Linux Mint virtual machine, run the following commands one at a time from the terminal to install OpenGL, CMake and the build tools:
   sudo apt-get update
   sudo apt-get install build-essential
   sudo apt-get install freegult3-dev
   sudo apt-get install cmake
   sudo apt-get install libglm-dev
4. Install the open source version of Geany using the following command from terminal:
   sudo apt-get install geany
5. Open Geany and access the build settings using the "Set Build Commands" window under the "Build tab.
6. Set up your Geany build commands so the fields "Compile", "Build" and "Lint" match the image below:

7. In geany, open "Assignment-1.cpp", compile, build and run the program. Now you can navigate the museum as you please.

References:

- Hay, brick floor and museum floor textures were sourced from textures.com
- Mountain skybox texture was sourced from lecture notes 4: Skybox texture file
- Cosc363 Lab Material
- Cosc363 Lecture Material
- TIFF to TGA image converter: https://image.online-convert.com/convert-to-tga
- Desmos.com – used to calculate the parabolic curve