OpenGL Museum Report

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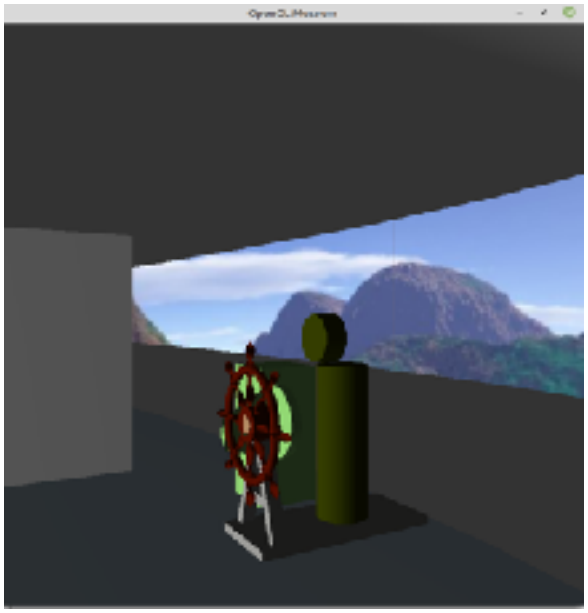
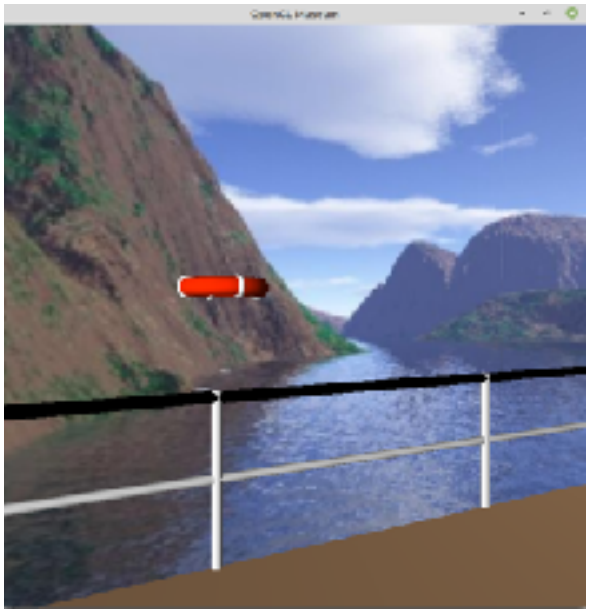
Descriptions of Models

1. The museum was modelled after a ship called Hikawamaru. There are two buildings that can be accessed from the initial position. The deck was drew using GL_POLIGON in drawDeck().
2. The initial view is facing to the main building of the ship. It consists of 8 cubes scaled and translated.
3. The wheelhouse building is at the back of the initial view. There are three floors and roof on the top. The wall of the wheelhouse building has a curve which was drew using GL_QUAD_STRIP.
4. Stairs were produced by allocateStairs(). The steps are made of scaled cube, and the sides are made of cylinder. drawStairs(float stairsHeight, float stairsDist, float stairsWidth) takes three augments so that the angle and the length of the stairs can be changed each time.
5. Fences were produced by allocateFence(). They are made of cylinders and the height and the width can be adjusted by passing the values into drawFence(float fenceHeight, float fenceWidth).
6. In the main building, chairs, tables and ceiling fan are displayed as exhibits. The chair consist of cubes with texture on the backrest. The table consists of cylinders.
7. The ceiling fan consists of simple solid cylinders, a cylinder with different size of base and top, sphere for light bubble, and fans made by GL_POLIGON. It rotates along the y axis constantly.
8. Going down the stairs of the back end of the social hall (the room with chairs and tables), there is an engine room. There is a model of piston-crankshaft engine in the room as another exhibit. The object consists of three parts, piston, connecting rod, and crankshaft. The animation is produced due to complex equation.
9. On the deck (turn right from the initial position), there is a vermilion life buoy. It is constantly projected from the deck and make the parabola curve. It uses the equations of displacement due to gravitational acceleration.
10. On the third floor of the wheelhouse building, there is a control room. There is a helm consists of torus, cylinder, and handles created by sweep surface. The back wall of the room has a texture of gauges.

Screenshots





Top-left: The wheelhouse on the third floor. The wall is bended and the handles of the helm are drown using sweep surface.
Top-right: Projected lifebuoy from the deck. The animation is constant motion and do not require key event.
Bottom-left: Engine model. The top silver part is a piston that oscillates up and down. The connection rod (light green) has mixed motion of rotation and translation. The crankshaft rotates at constant angular speed.
Bottom-right: There is a stairs that leads to downstairs if you turn right in the corner. Walking toward the stairs make the viewer to move instantly to the bottom of the stairs. Turn right again to find the engine model.

Extra feature

1. Physics base animation is done by the life buoy projected and falls toward the sea. The equation of displacement due to projection with gravity effect was used. Letting the global “totalTime” incremented once in 50 milliseconds, the time value to put into the equation was obtained using modulus. x and y coordinate are function of time shown as below.

```
totalTime++;
t = (totalTime % 100) / 20.0;
buoy_x = v0 * t * cos(theta);
buoy_y = -0.5*G*pow(t, 2.0) - v0*t*sin(theta);
```

2. Collision detection is implemented in this museum. The algorithm used for the collision detection is the same as that in Yard.cpp lab materials but it has more complex shape of borders. It uses nested if and else if statement written in detectCollision(). Also, in the certain area such as near the stairs, the event teleporting to another floor occurs. If a viewer walks towards the stairs, the viewer will instantly moved to a certain coordinate which is also implemented in detectCollision().

3. Motion of engine model uses a complicated function. The variables used here are crank angle, connecting rod length, crank radius, angular speed of crankshaft omega. Those variables define the angle and position of connecting rod.

```
crankAngle += (delta * 180/PI);
crankAngleRad = crankAngle * PI/180;
rodAngle = (crankRadius*omega/rodLength) * sin(crankAngleRad) * 180.0/PI;
rodPosition = crankRadius*cos(crankAngleRad) + sqrt(pow(rodLength, 2.0) - pow(crankRadius, 2.0)*pow(sin(crankAngleRad), 2.0));
pistonHeight = rodPosition + 6.0;
```

4. Sweep surface modelling was used to draw handles of helm in the wheelhouse. The algorithm and codes are almost the same that provided in the lecture material.

5. Skybox is used in this museum. It is skybox4 which was downloaded from this course LEARN page.

Control functions

Up arrow key ⋯ Move forward
Down arrow key ⋯ Move backward
Left arrow key ⋯ Turn the view angle to left
Right arrow key ⋯ Turn the view angle to right

Reference

Algorithms and codes taken from the lectures and lab materials are abbreviated.

Texture

“controlPanel.tga” Control panel in the wheelhouse. From https://www.textures.com/download/gauges0002/7212?q=gauges

“chairTexture.tga” Texture on the backrest of chairs in social hall. From https://www.textures.com/download/fabricpatterns0055/12421

Equations

Equation of displacement of projectile motion⋯ From https://en.wikipedia.org/wiki/Projectile_motion

Equation of displacement of piston-crankshaft motion⋯ From https://en.wikipedia.org/wiki/Piston_motion_equations