I Basic information

Module Code: CPT205

Assessment 2 – 3D Modelling Project

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Degree Programme: ICS

II Design overview and features

I mainly used OpenGL's freeglut library to create this 3D Project. I drew a living room connected to a bedroom, including a sofa, dining table, chairs, ceiling lamp, floor lamp, TV and murals in the living room, as well as a complete computer desk, wardrobe, another ceiling lamp, bed, pendulum clock and three other murals in the bedroom. Here is a list of the features and the technologies used to implement them:

1.Room wall design: I would like to talk about my overall room structure first, I had two ideas, one is to divide the living room and the bedroom into two Spaces, draw the living room and then open the door automatically transmitted to the bedroom, but the difficulty is too high to achieve. I chose the present one, making a large room and adding a partition wall in the middle to create the appearance of two rooms, so I made the two rooms share the floor and ceiling, and the left and right walls were painted separately to distinguish them. Not only that, when I first started painting the walls of the room, I used a basic material that made the lighting and appearance not very good, so I used texture mapping to both improve the lighting and provide a realistic interior environment.

2.Lighting system:Then my lighting system, I made three light sources and additional ambient light, the chandelier in the living room was the point light source, while the chandelier in the bedroom and the floor lamp in the living room were spotlights that could be turned on and off with the keyboard, I adjusted the attenuation index several times, the ambient light and the material of each object to make it look good. The lights are controlled via OpenGL functions such as glLightf() for individual parameters and glLightfv() for vector parameters. I also added additional ambient light to each lamp and distinguished the ambient light intensity in different states, as well as its own material color. At first I set all the lights to point light, but the whole room would be bright and wouldn't show much difference, and the switches wouldn't show much difference, so I replaced the other two with spotlights. After I reduce the floor lamp, reduce the irradiation Angle, improve the attenuation index, and better reflect the feeling of the floor lamp, the bedroom chandelier is still selected the spotlight, because I want to distinguish from the chandelier in the living room.

3.Texture mapping: Talking about texture mapping, as mentioned above, I added BMP texture loading to the walls, floor and ceiling, I also made several settings, includes:Texture loading and parameters setting, Proper texture coordinate mapping, Multiple texture support for different surfaces. and made some of my favorite murals on the room. I first read the texture of the original picture, and then drew a special square for the mapping of the picture, and moved the square to the appropriate position to show the appearance of the murals. I processed all the images, making each one the right size, then converting it to bmp format, and finally mapping it in as high definition as possible.

4.Furniture: Fourth, the production of all types of furniture is essentially a combination of basic graphics using a hierarchical transformation structure. For example, components of furniture like computer desks are constructed from multiple parts, with transformations managed through matrix stack operations. Flower pots, chandeliers, and other furniture are similarly created by stitching together pre-written cylinder-drawing functions. I do not reuse textures, but instead, continuously adjust them, modify individual reflection parameters, and tweak hierarchical levels.

5.Animation: Then the animation and interaction system, my door and pendulum clock have added animation effects, I use rotation to represent the door switch, use timer function to control the animation speed and frame rate, creates realistic pendulum motion using trigonometric functions and also use HUD system to add the effect that there will be prompt text near the door, only near the door can be switched on. The pendulum clock dynamically updates the Angle of the pendulum, and the pendulum needle and the pendulum swing together around the Z axis according to the fulcrum. It's worth mentioning that this color is already the most suitable for me

6. Collision detection: The last thing I want to talk about is my collision detection. For the collision detection of the whole room, I specified the movement space of the camera, which can only move in the whole space, and at the same time, I lifted the camera to a suitable height to simulate the walking system. Then, I conducted coordinate detection for the partition wall and door in the middle, and if I reached the coordinate, I could only march in place. At the same time, I checked the door switch, only open to enter and exit through the door. As for furniture collision detection, I didn't think it was necessary to add meaningless work, so I didn't make it.

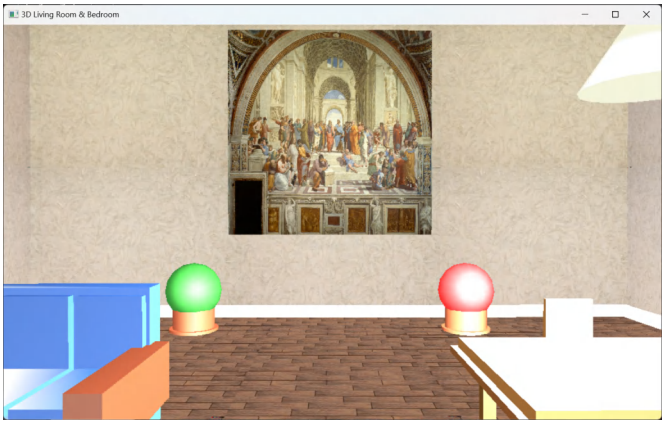
III Instructions for running the program

Open the project in Microsoft Visual Studio and make sure the freeglut library is properly linked or click on the ”.exe” file to open it.

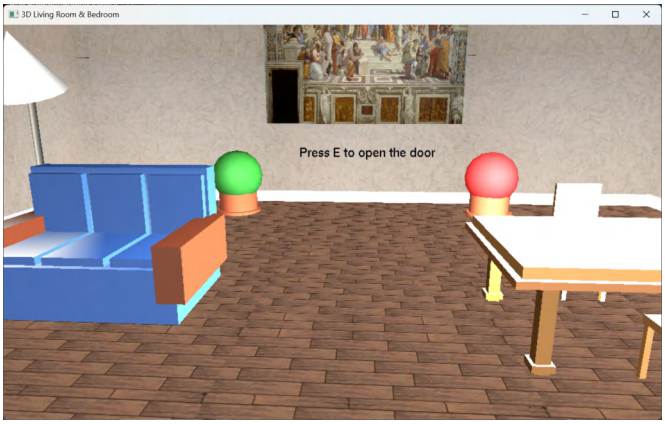
Keyboard Commands:
W: Move forward
S: Move backward
A: Move left
D: Move right
E: Interact with door (when close)
1: Toggle ceiling lamp
2: Toggle floor lamp
3: Toggle bedroom lamp
4: Turn off all lights
ESC: Exit program

Mouse Control:
Mouse movement controls view direction
Cursor is hidden during navigation

IV Screenshot of Program

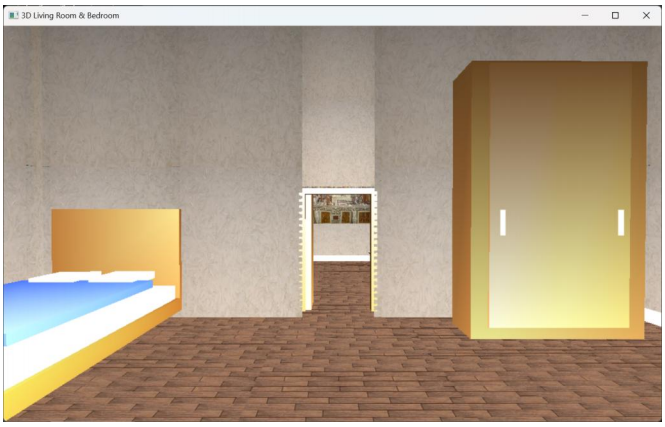


Screenshot 1: Initial scene, In the living room, display mural, flower pots, sofa, dining table and two lights.



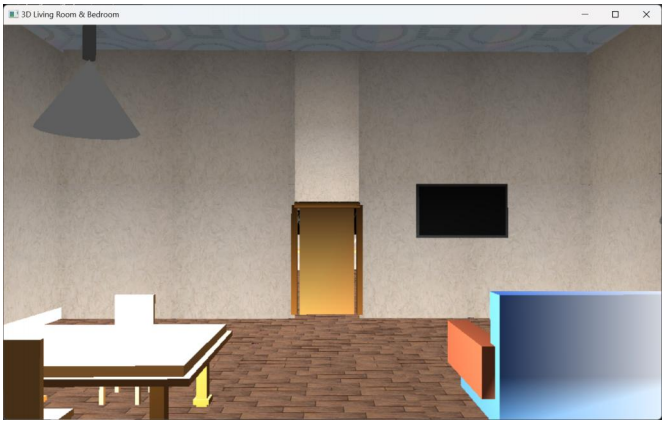
Screenshot 2: People near the door some, open the door prompt text appeared, closed the chandelier, only opened the floor lamp.

Screenshot 3: Enter the bedroom, showing three murals, computer desk and chandelier.



Screenshot 4: Look to the door from the computer desk and turn off the two living room lights, leaving only the bedroom light.

Screenshot 5: Show the pendulum clock and the side of the wardrobe.



Screenshot 6: Standing in front of the mural in the living room, look into the bedroom with the door closed and all the lights turned off.