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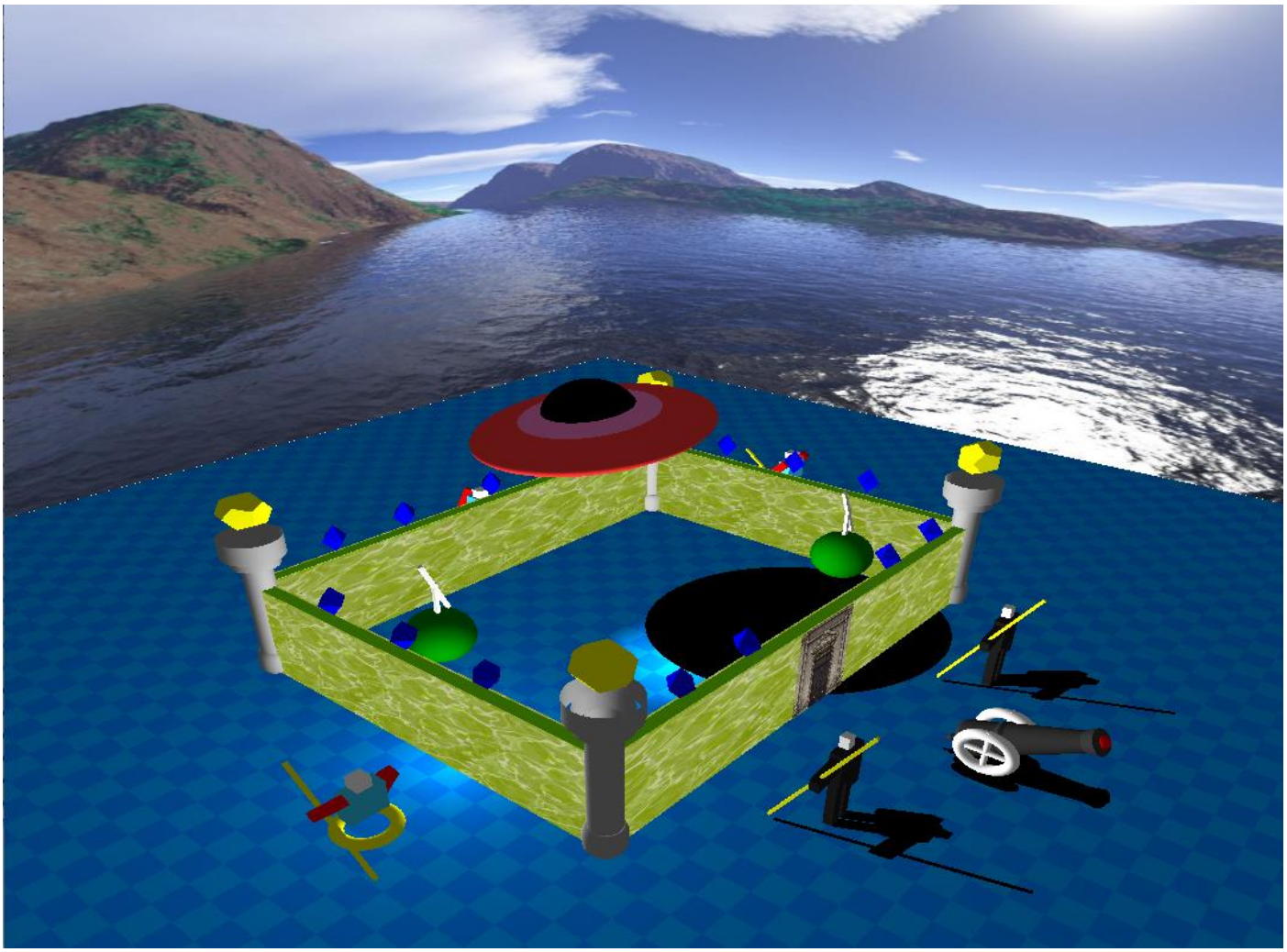

Introduce the whole scene:

It is a ground are built upon a sea, the sea was surrounded in hills. From the initially visual angel. It is the top and left corner of the fortress, there are four walls constructed the fortress, and there is a grey and gothic pillar between every two walls. The main door is set on the front wall; it is the way in and out of the fortress, so there must be two armed guardian aliens to protect it. There is yellow energy diamond in on the top of each pillar, which is four energy diamonds; overall, it provides the whole amount of nuclear energy the fortress required. There are a couple of blue light cannons against the attack of humans, it could launch a ray, the ray power is provided by energy diamonds. There is also a huge cannon is placed in front of the main door. Robots keep flying three patrol along with the left, right and behind walls of the fortress. Inside the fortress, there is a rotating spaceship is parking, the bottom of the spaceship contains a spot light, the spot light's direction is directly below the spaceship. Two flying spies keeps inspecting what happening inside the fortress.

Extra Features

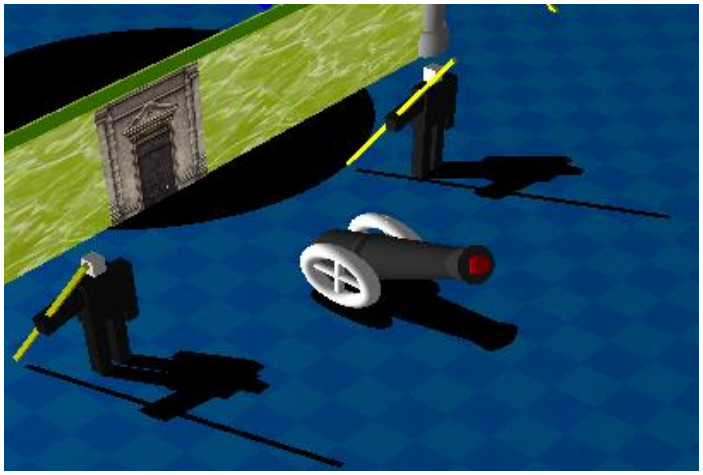

Fig1

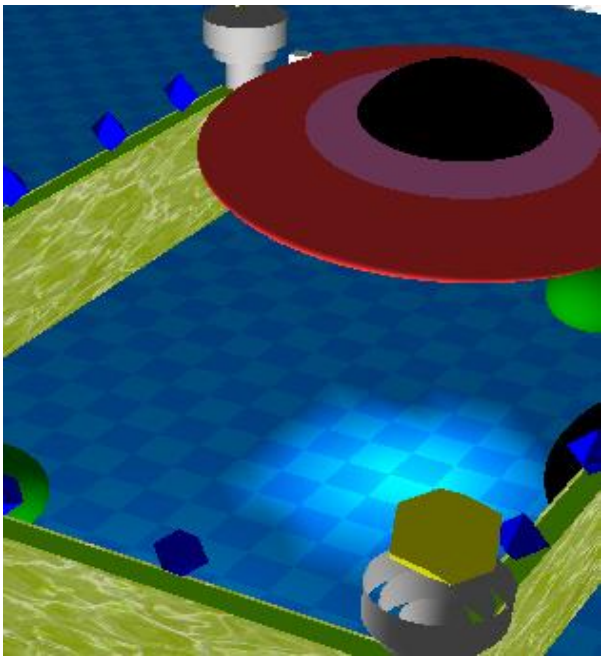

Fig 2

The planar shadows cast by the cannon, guardians and spaceship, even the projectile got shadows as well, and the light position is set on (100,500,100), specially the spaceship's shadows keeping rotating followed by the frequency of spaceship's rotation. *(Fig1)*

A spotlight on the bottom of rotating spaceship, the spotlight's height rises when the spaceship is lifting off; there is a clearly visible light reflected on the floor. I set the cut off is 30.0 and exponent is 10. *(Fig2)*

Inside the fortress, two additional flying spies' looks like a helicopter; they keep inspecting everything from left wall to right wall repeatedly.

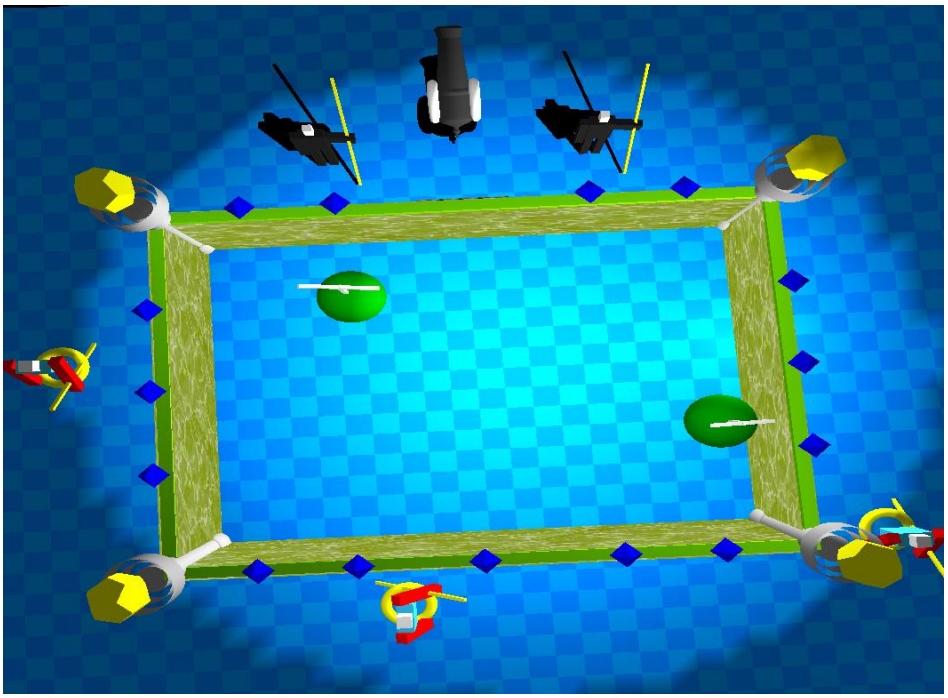

Fig3

There are two camera modes, it could toggle to another one by pressing HOME button controls. One is the initially visual angel that is introduced above; another view angel is from the spaceship's inside. It is able to see the fortress and all aspects from the highest height. *(Fig3)*

The projectile's movement is followed a free-faller, it does not just increase 'sphere_x' and 'sphere_y', then the projectile keeps going until out of our sight. The movement of the projectile is an upward arc, once it arrives the vertex it changes to an upward arc to the floor, which is the same as the reality.

The collision detection is set when the projectile fall to the ground; it will not stop moving immediately, it keeps jumping and falling, but the upward speed and forward speed are decreasing. It will stop on the ground when one of the two speeds is zero or it arrives the appointed 'sphere_x'. The reason I set the appointed 'sphere_x' is that the floor limit is finite; if we set, the upward speed and forward speed are great, and it will go very far away, we could not see the trend at all.

The sky box is set on the front, left, right, back and top sides.

Challenges

Challenge 1:

When I set up the shadows, I did not expect the shadow's color was not following the color I setup before which is black; it is exactly the same color as the object. It is not supposed to happen. Then I kept trying to change the configurations, finally, I found the reason is that I set color to each aspect of the object when I was designing it, and I am not allowed to change each aspect's color to what I want inside the display() function. Because I design the whole object from another function, after that, I translate it to the expected position by display() function. The way to solve that is adding a parameter 'i' in the design function to check if I want to it to be colored, for example "void cannon (i)", I add an if statement before every glColor3f(), if 'i' is zero, glColor3f() is not working. When I create the shadow, I call "void cannon (0)" which means object entirely have no color, but i call "void cannon (1)" when I really build it. The object has its given color, and the shadow is black.

Challenge 2:

When I was doing the conversion of two camera modes. I was in trouble of detection which mode is on. In the beginning, I tried to change last two parameters of glRotatef() from display() which one is deciding the angle of whole scene, then adjust all glLookAt() parameter. If the second parameter is 1.0 and third parameter is 0.0, it is in initially visual angel, conversely, it is in spaceship visual angel. But the system does not check the parameters accurately, sometimes it cannot detect the change of two parameters, even though it changed to another mode, the view was not like what I expected to see. By the support of Dr.R.Mukundan, I know it is not a best idea to check float number in if statement, I added a new global integer to record which mode is on and leave the glRotatef() parameter is (0,1,0), just to update glLookAt() parameter. It works well finally.

Control Functions:

Keys	Scene Interacting
Home	Toggle camera modes
Page Up	Increase camera height in initial camera mode
Page Down	Decrease camera height in initial camera mode
Up	Move camera forward
Down	Move camera backward
Right	Turn right by 5 degs
Left	Turn left by 5 degs
S	Spaceship lifts off
A	Spaceship lands
C	Cannon fire

Resource and references:

1. All Skybox pictures were taken from COSC363 Lab material (2019)
2. Walls textures were taken from http://www.arcgis.com/apps/View/index.html?appid=ef8f4b2dc6074d80abaec379b46126b6
3. Door textures were taken from http://gg-deco.rlcgeek.com/darkrockcastle/