ASSIGNMENT1 REPORT

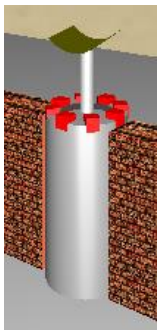
Name: Enyang Zhang ID:72004622

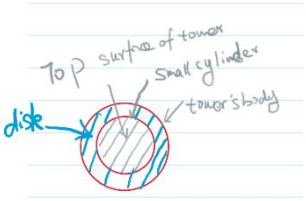
SCENE DESCRIPTION

Aliens landed on area of desert on earth, they found an abandoned fortress and built their base. Alien landed their UFO in the middle of the fortress. A solar system has been built around fortress, each tower has one solar panel for collecting power. Aliens stay inside the UFO but sent out two robots, one robot patrolling around fortress for security and another one gathering something that they need for next set off, it puts things inside the cargo that it is pushing. A cannon has been deployed in front of fortress. An eternal tower has been built which represent the highest technology of aliens.

MINIMUM REQUIREMENTS

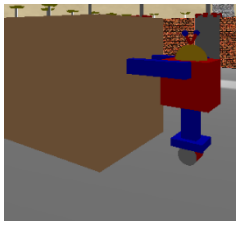
2.1 A model of fortress is created. The walls are created using GL_QUAD, and are textured with brick wall image. The body of the tower created as a cylinder (baseRadius = topRadius), the top of the tower is using small cubes, translated and rotated to get part of edge. But next to a cube we need a half height brick to complete the edge. To achieve this(challenge), one small disk to cover the top of the half height brick, and small cylinder for inside surface. See pictures below.



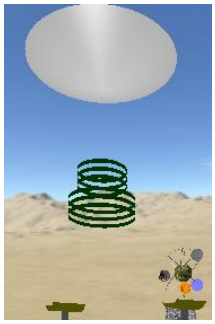


2.2 The cannon is placed in front of the fortress, press 'c' to fire. Model of cannon is using lab2's.

2.3 Two robots are deployed outside fortress. Robots have hemi-spherical head with red eyes, a pair of antennas which spinning all the time, and one wheel for movement. One robot patrol before front gate swing arms. Another one pushes cargo walking along the walls of fortress with its arm rotated toward front to push cargo (cargo will always at the front of robot). Apply 'switch' to make robot be able to walk along walls instead of walking along circle. See pictures below.

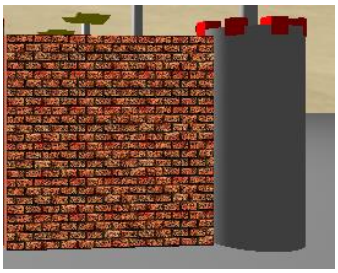
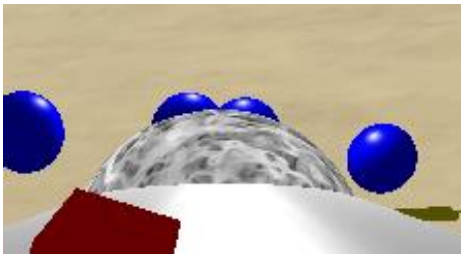


2.4 A model of spaceship in UFO shape. By pressing 's' to lift-off the spaceship. The dock of UFO is spinning all the time. After lift-off, spaceship will emission transport circle to floor. Transport circle consist of two group of circles, for each group of circles, its size will get larger and smaller turn by turn. See pictures below.



2.5 Up and down arrow can move camera in camera mode 1. Left and right arrow will turn 5 degree to corresponding side.

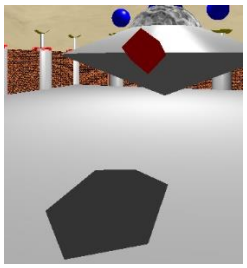
2.6 There are in total 8 texture in the scene. See pictures below.

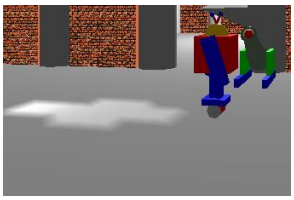
Atomic nucleus, electrons and eternal tower include 6 textures.

EXTRA FEATURES

1 Planar shadow is created referring to Lab3. The shadow and object are in front of UFO. Create light at (-240, 300, -540), and two object at(-200, 100, -300), using glMultMatrixf(shadowMat) provided in slide to convert one of object onto the floor. See picture below.



2 A spot light are always towards floor in front of the robot which patrolling at front gate. Referring to Lab3. Create a new light set direction of the light, and set it always follow the robot, in my case when robot turn around the light will be translated to opposite of robot, so that it will always at the front of robot. See picture below.



3 An additional animated system inside fortress. At the top of eternal tower inside fortress, there is an atom model, the atomic nucleus with electrons. all of balls are spinning themselves, and electrons are flying around atomic nucleus on 4 different visible tracks. Basically, referring to Lab4, each electron translated to 40 unit away from atomic nucleus, and rotated by 4 different pivots. See picture above in 2.6 tower part.

4 Two camera modes have been made. Mode 1 is the same as 2.5. And mode 2 is at top of UFO, can not move forward and backward but can still turn left and right by pressing left and right arrow. But after UFO lift off, mode 2 will only show the view of whole castle cannot turn left and right. I use switch to implement this feature. Press 'home' for toggle between the two modes.

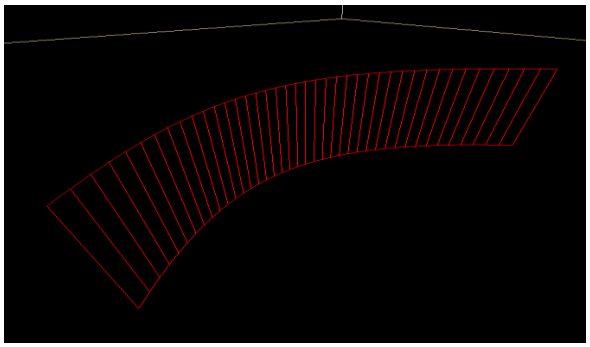
5 Physics model, gravity been calculated for the trajectory of the projectile so that it perform a parabolic trajectory. The equation is x = 5*cos(30deg)*t, y = (5*sin(30deg) + gravity*t)*t. The initial speed is 5, I evaluate it in x and y aspects.

6 Custom-built extruded surfaces are the body of eternal tower. 9 vertices for the tower, implemented referring to Lab5. Each level be twisted 10 degree and it has 9 level. The extruded surface is generated by doing: generates vertical two points per literation and each literation connect four points to create a surface until last surface close the object. And an

outer loop will increase y coordination and apply same method mentioned above for 9 times. As shown in the picture and tower are shown above in 2.6.

```
    const float CDR = 3.14159265/180.0;
    float vx[N] = {10,20,20,10,0,-10,-20,-20,-10,10};
    float vy[N] = {0};
    float vz[N] = {-20,-10,10,20,30,20,10,-10,-20,-20};
    float wx[N], wy[N], wz[N];
    float text[N] = {0,1,0,1,0,1,0,1,0,1};

    spanangle = -10*CDR;
    for(int a = 0; a <9; a++){//9 level
    for(int i =  0; i < N; i++){
    wx[i] = vx[i]*cos(spanangle) + vz[i]*sin(spanangle);
    wy[i] = vy[i] +20;
    wz[i] = -vx[i]*sin(spanangle) + vz[i]*cos(spanangle);
}
    glEnable(GL_TEXTURE_2D);
    glBindTexture(GL_TEXTURE_2D,txId[3]);
    glTexEnvi(GL_TEXTURE_ENV, GL_TEXTURE_ENV_MODE, GL_REPLACE);
   glBegin(GL_QUAD_STRIP);
   for(int i = 0; i < N; i++){
      glTexCoord2f(text[i], 0);  glVertex3f(vx[i],vy[i],vz[i]);
      glTexCoord2f(text[i], 1);  glVertex3f(wx[i], wy[i], wz[i]);

   }
   glEnd();

    for(int i =  0; i < N; i++){
        vx[i]=wx[i];
        vy[i]=wy[i];
        vz[i]=wz[i];
    }

}
```

7 a surface shape generated using a mathematical formula. The solar panel are generated via mathematical formula which is y = 0.025 * i^2 (-20<= i <=20). See picture below.



8 collision has been set up for skybox, that is when trying to move camera passing edge of skybox, camera will not go pass it. This collision applies for 4 edge of skybox.

9 skybox has been implemented.

10 No particle system.

List of control function

Function 'special' implements the collision and camera mode switching including camera mode 1 and camera mode 2.
Function 'keyboard' implements UFO lift-off using 's' and fire cannon using 'c'.

Challenge

When implement robot walking along castle's walls, to make it walk in a square route, use switch to change routes instead of just set edge of coordination.

Reference

Skybox:
https://www.kisspng.com/png-skybox-texture-mapping-cube-mapping-landscape-wate-980130/download-png.html

All texture:
www.textures.com

Some models from Lab1-5