COSC 363: Computer Graphics
Assighment 1 – Headquarters of Iron Man

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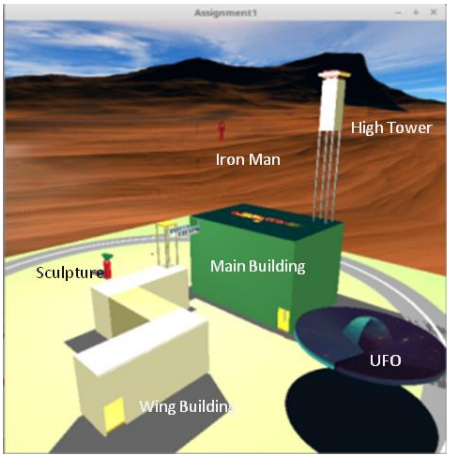
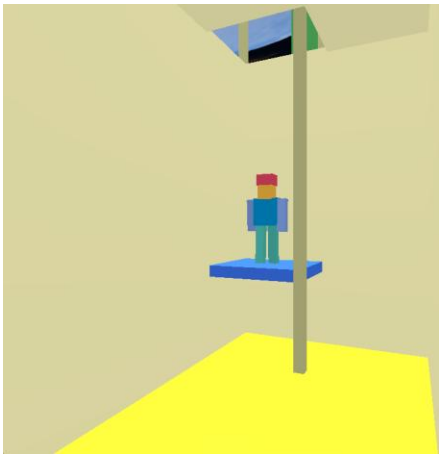
1. Description of Scene

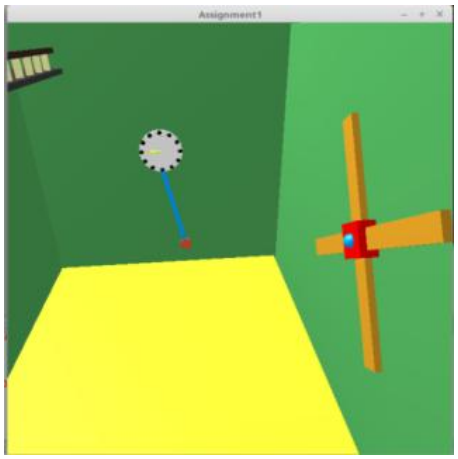
The scene I want to display is a UFO came to investigate the headquarters of Iron Man. Iron Man tried to chase the UFO but the unstable contral system made him hit the high tower. This scene contains a wing-building in shape of character "Z" and a main building with a high tower on the lower right conner of the roof. These two buildings are connected by a connecting bridge and two elevators makes a visitor can walk around between them. In the scene, a clock and windmill in the main building and a shooting ball sculpture are gitfs from the citizens, commending him protect their city. A brief view as picture 1.1, 1.2, 1.3 and 1.4 shown below.



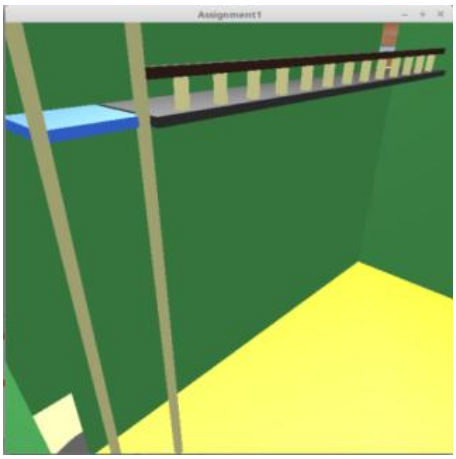
1.1 exterior view of scene



1.2 interior view of wing building



1.3 interior view of main building



1.4 interior view of main building

2. Features of Minimum Requiremsnt (including decription of models)

2.1 The opening scene contains buildings, roads, trees, and a car goes along the road.
2.2 Wing buildng has 10 faces and main has 6 faces, both of them are combine GLUT objects.

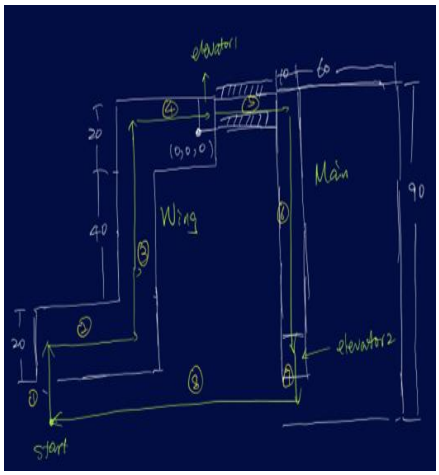
2.3 Opening scene contains a sky box.

2.4 Camera moving control meets the requirements, details of operation will be mentioned later.

2.5 animated models:

1) interior of buildings:

- **elevator in the wing building**: it stays in the bottom when there is no visitor. When visitor stand up, the elevator will rise to the bridge and return to the grould.
- **elevator in the main building**: it has the opposite operation from elevator in wing.
- **windmill**: it contains GLUT cube and sphere, keeps rotating clockwise.
- **clock**: every 2-time swing of pendulum, the minute hand moves a scale, after a rotating of a circle of minute hand, the hour hand moves a scale.
- **Visitor**: it is combined by GLUT cubes and shperes(for eyes) and keep going through between two buildings with walking gesture. it has 8 go_straight phases with go_straigh function, 6 rotate phases with turn function and 2 moving with elevator phases. The model and paths as picturrs 2.1and 2.2 below.



2.1 visitor 2.2 path of visitor 2.3 front side 2.4 back side

2) exterior of buildings:

- **Iron Man**: he has textures of face and body, also he has one blue spot light in the chest. He flys up along a one-fourth circle, turns around and flys straigt, after hitting the high tower he fall as a free-fall motion and light turns off, before hitting the bottom he flys again and light turns on. Models as 2.3 and 2.4 shown.
- **UFO**: it is generated by a surface of revolution similar as the vase of lab 4. I choose vertexs as a half of circle on upper , disc in the middle, a triangle underneath. It has texture , goes around the buildings moving up and down with first-person view camera.
- **sculpture**: A pipe shoots balls all the time. The balls flys as a Curvilinear motion.
- **car**: it goes along the circle road and has two spot lights as headlights.

2.6 It contains 4 light sources: GL_LIGHT0 for outside light, GL_LIGHT 1&2 for headlights of car, GL_LIGHT3 for light of Iron Men's chest. Car, sculpture and buildings has specular reflections.

2.7 Iron Man, roof of main building and UFO has texture.

3. Extra Features

3.1 Planar shadows on buildings, UFO, car and sculpture.

3.2 3 spotlight: two for headlights of cars, one for iron man.

3.3 First-penson view camera on UFO use 'F1' to switch between UFO view and normal modes.

3.4 Physics models:

1) Free-fall motion of Iron Man

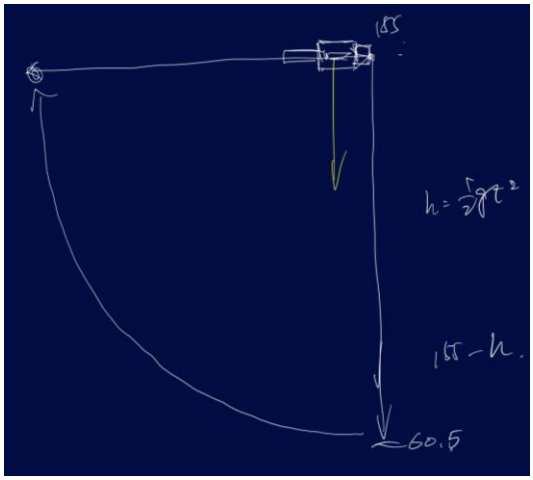
As the free-fall motion is on the YZ plane, the only changed translocation is on the Y axis. I set up variables as fall_t the falling time, fall_hgt value of Y, and gravity. I chose gravity as 1 to display the physical motion oberviously.

- Value of Y: fall_hgt = original height of hitting – distance of free-fall motion;
- Distance of free-fall motion formula: h = 1/2*gravity*time^2;

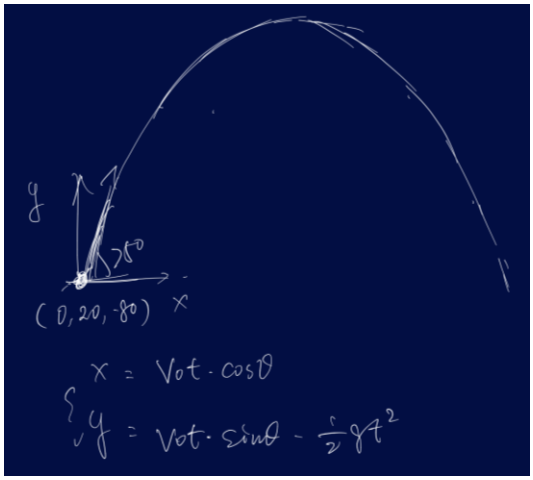
2) Curvilinear motion of sculpture

The shooting balls flys as Curvilinear motion with a original speed v0 as 10, the angle theta_ball between throw track and xz plane is 75 degree. the motion is on the XY plane. I set up bx, by as the value of X and Y, ball_t as the time of motion.

- Value of X: bx = original value of X + distance on horizontal direction of motion
- Value of Y: by = original value of X + distance on horizontal vertical of motion
- Distance on Horizontal Direction formula: h = v0*time*cos(theta);
- Distance on Vertical Direction formula: h = v0*time*cos(theta)-1/2*gravity*time^2;



3.1 original work on free-fall motion



3.2 original work on curvilinear motion

4. Control function

- Arrow Key Up: move camera forward;
- Arrow Key Down: move camera backward;
- Arrow Key Left: move camera towards left;
- Arrow Key Right: move camera towards right;
- W: move camera towards up;
- S: move camera towards down;
- Q: move camera height up;
- E: move camera height down;
- F1: change camera between UFO view mode and normal view mode;
- Space: change scene between Pause and Start

5.Recources and references

https://www.youtube.com/watch?v=imCNAWMC1Xs
https://sidvind.com/wiki/Skybox_tutorial
https://www.cnblogs.com/jukan/p/6088356.html
https://zh.wikipedia.org/wiki/曲线运动
LAB 1 – LAB 4