CSL7450: Computer Graphics
Assignment: 2

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Total Marks: 100

Create a 3D game titled "Space Heist" using OpenGL. Following is the brief description of the game:

- An interplanetary civilization often transports goods from a space station orbiting one planet, to a space station orbiting another, via a manned spaceship (let's call it the **Transporter**).
- During this transport journey, several rogue **Pirate** spaceships try to invade the Transporter in order to steal the goods.
- To protect itself from the Pirates, the Transporter is armed with a Laser blaster
- Create a game in which the user is a Transporter, with the mission to carry goods from the source space station to the destination space station.

Detailed discussion of each component

1. **3D World:**
   a. The 3D world consists of several randomly placed planets, and one space station orbiting each planet.
   b. The pirates and the transporter are not affected by the gravity of the planets.
   c. During each run of the game, the Transporter's mission is to travel from any one space station to another (randomly selected on every run)
   d. The planets are static objects (do not revolve).
   e. The design for the Transporter, Pirates, Space Station and Planets is up to you (importing downloaded/self-modelled 3D models is also allowed). Optional .obj files will be given along with the optional code template for the assignment.

2. **Playing as a Transporter:**
   a. The game starts with their spaceship on the source space station, their goal being to reach the destination space station (both randomly chosen on each run of the game).

b. A minimap in the bottom right corner of the screen points in the direction the player is supposed to go (just a 2D arrow is sufficient to denote the direction in XY plane, and colour of the arrow can denote the elevation: For example red means go higher, blue means go lower and white means correct elevation).

c. The transporter has a complete degree of freedom (yaw,pitch,roll) controlled by keys W,A,S,D,E,Q.
   i. W: pitch down
   ii. S: pitch up
   iii. A: Yaw to the left
   iv. D: Yaw to the right
   v. Q: Roll left
   vi. E: Roll right

d. The Spacebar key accelerates the transporter in the forward direction (Ensure a speed limit so it doesn't accelerate forever).

e. The player will have 2 view modes (The player can hold *Right Click* to enter view ii):
   i. <u>3rd person view</u>: In this mode the player can only maneuver the transporter, and not use the laser blaster.
   ii. <u>1st person view</u>: In this view the player cannot maneuver the spacecraft but can control the laser blaster with their mouse, and use *Left Click* to shoot the lasers. A crossheir must appear at the center of the screen in this view to denote the shooting direction.

f. Several Pirates spawn at random locations in the map at the start, and chase the player. These pirates are computer controlled, and head straight for the player (you are free to implement any logic for them). The pirates need not collide with each other or any planets/space stations. The transporter must dodge/destroy pirates while making its way to the destination. Should any pirate collide with the transporter, it will lead to a GAME OVER.

g. Each pirate takes a single laser hit to be destroyed.

h. The transporter must collide with the destination space station in order to win the game (Will just pass through any other space station or planet).

3. **Screens:**
   a. Main Menu:
      i. Should contain 2 options: "Start Game", and "Exit"
   b. Game screen:

    i. Shows the view from camera

    ii. Crosshair in case the player is in 1st person view.

    iii. Minimap at bottom right containing arrow (explained in section 2)

  c. GAME OVER and YOU WON screen

    i. Both will display the option to go back to the main menu.

Marks Distribution

- 3D World **(20 marks)**
  - Keep n_planets as a variable, and randomly place them in the world (10 marks)
  - Space stations orbiting the planets (10 marks)
- Transporter Logic **(40 marks)**
  - Maneuvering (10 marks)
  - 1st person view shooting (10 marks)
  - Collision logic with pirates and planets (10 marks)
  - Source, destination, GAME OVER, and YOU WON logic (10 marks)
- Pirate Logic **(20 marks)**
  - Computer controlled Maneuvering towards the transporter(15 marks)
  - Collision and spawn logic (5 marks)
- Screens **(20 marks)**
  - Start Menu, Game Over and You Won screen (5 marks)
  - Minimap with arrow logic (10 marks)
  - Crosshair for aiming (5 marks)

Submission Guidelines

1. Programming language: Python (PyOpenGL) / C++ (OpenGL)
2. OpenGL version: Legacy / Modern (recommended)
3. Submit the code as a single zip file titled *"RollNumber_A2.zip"* with all the code files and assets neatly organized. The zip file should also contain a readme file specifying in detail how to run the code.
4. An optional code template will be provided alongside the assignment.