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COSC 363 Computer Graphics
Assignment 1
Alien Invasion!

Description

The scene shows a fortress occupied by aliens. Situated far away from civilization and surrounded by snowy mountains, it is hidden from humans. The highly intelligent aliens have made robots to patrol the area. For security, the aliens have reactivated an old abandoned cannon and modified it such that the cannonball bounces causing MASSIVE DAMAGE. The aliens, in their short stay on earth have developed an immense liking towards tea. Hence the golden teapot idol which serves earl gold tea imported from New Zealand. For extra safety measure, the aliens always remain inside their spaceship to be able to take off anytime if the humans come to attack.
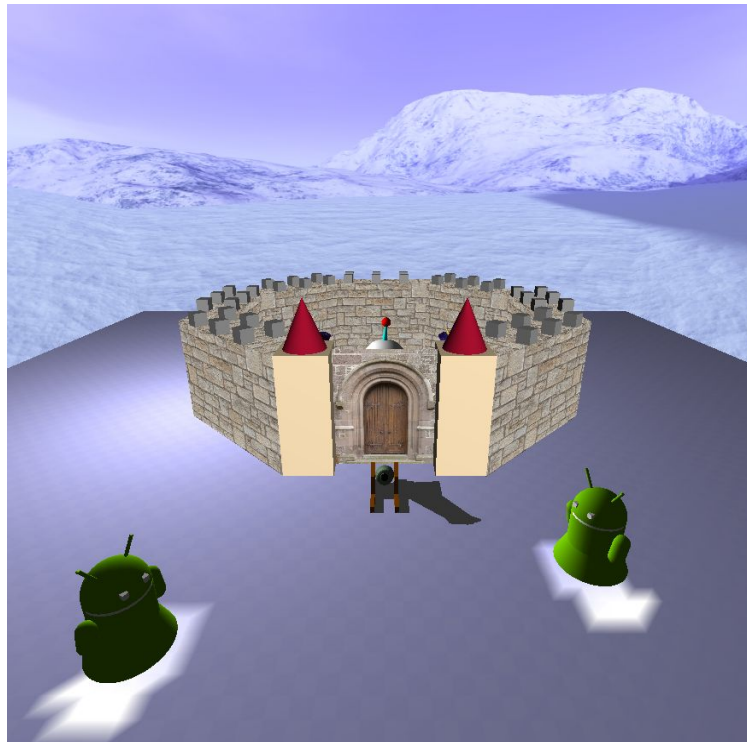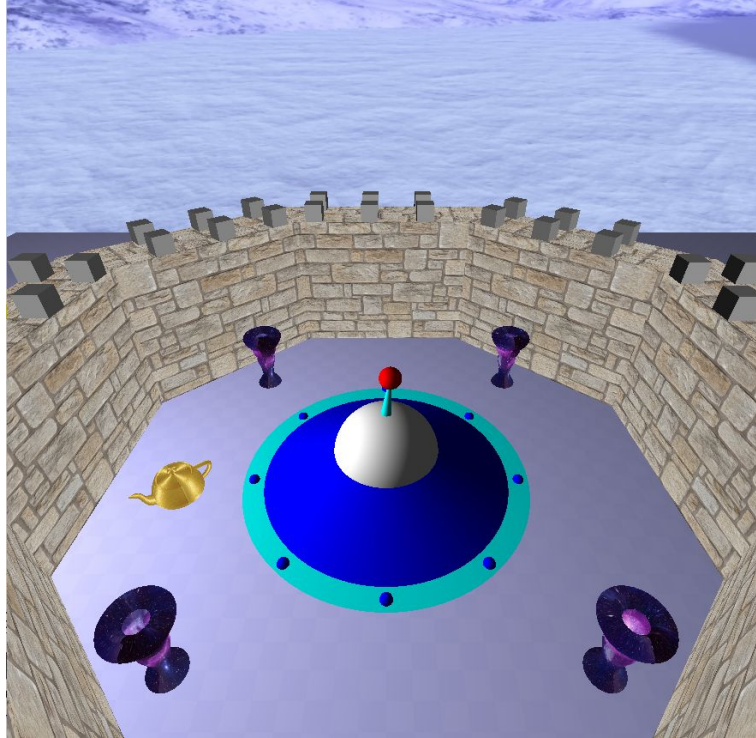

Figure 1 – Front view of the fortress

Figure 2 – View inside of the fortress

Features and models

- *Two robots* - One hovering in a clockwise direction and another in an anti-clockwise direction. The design of the robots is inspired by the android mascot, the 'Bugdroid'. They have moving arms, antennas and light on the bottom as they hover.
- *Spaceship* – The spaceship has multiple flashing lights on its base and a flashing light on its antenna.
- *Cannon* – The cannon is constructed using a mesh model. The cannon also reloads after it fires.
- *Fortress* – The fortress is made up of 8 walls forming an octagonal shape. 6 cubes represent the merlons (the top structures) of each wall. It has two posts with cones on top where the gate is situated between them.
- *Textures* – A total of 5 different textures are used for the scene, i.e. the fort walls, gate, vase, teapot and skybox.

Extra features

- *Shadow* – A planar shadow is cast by the cannon.
- *Spotlights* – Two spotlights are attached to each of the robots and follows the robots as they move around fortress.
- *Additional animated system* – In the fortress there is a rotating teapot which also moves in a square motion.

- *Two camera modes* – The first camera is the default camera. The second camera shows the view from a point of the spaceship. It also displays the view of the castle beneath it as the spaceship takes off.
- *Physics model* – Gravity. Once the cannon is fired the cannonball will curve downwards and bounce on the floor. The equation to form the parabolic curve is $-0.01x^2 + 2x$.
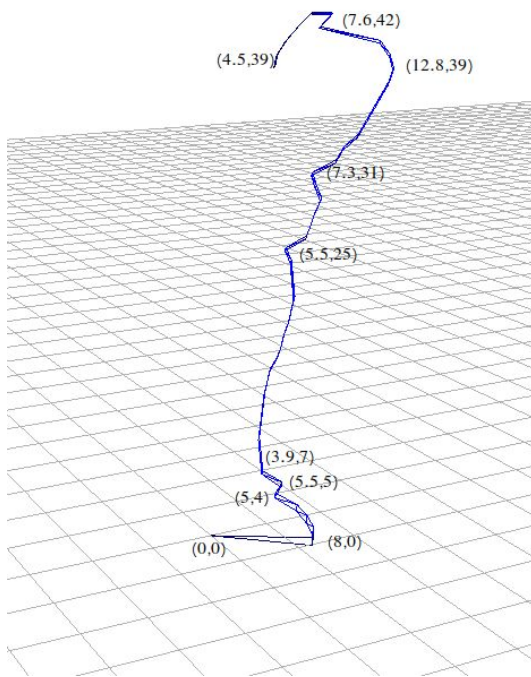- *Custom-built sweep surface* – Vases inside the fortress.
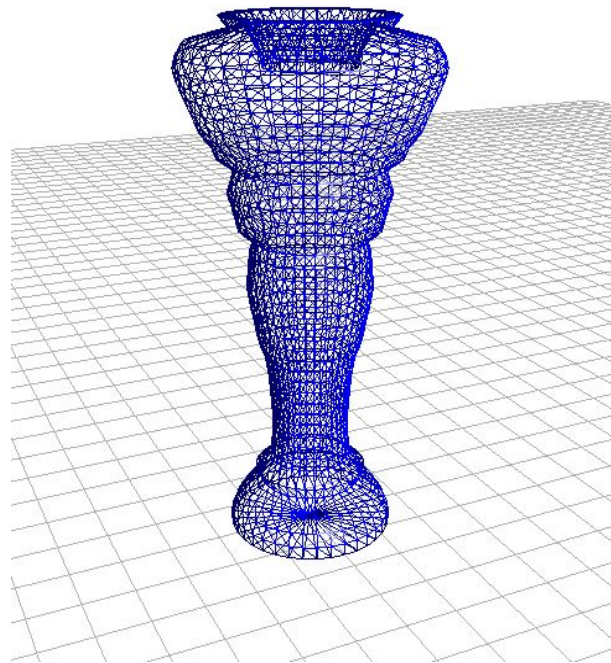

Figure 3 - Base curve for vase

Figure 4 - 360-degree revolution of the base curve

The base curve is plotted using the following set of 36 vertices:

float vx[N] = {0, 8, 8, 7.5, 6.7, 5, 5.5, 4, 3.9, 3.8, 3.7, 3.8, 3.9, 4, 4.1, 4.3, 4.5, 5, 5.3, 5.5, 5.8, 6.0, 6.2, 6.1, 6, 5.9, 5.5, 7.0, 7.3, 7.6, 8.0, 7.6, 7.3, 9.0, 9.5, 10.5,11, 11.5, 12, 12.5, 12.8, 12.5, 11.8, 7.6, 8.5, 7, 6.1, 5.3, 4.7, 4.5};

float vy[N] = {0, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 43, 42,41,40, 39};

float vz[N] = {0};

- *Collision detection* – The camera will always stay within the skybox.
- *Skybox* – A skybox of a snowy scene is used.

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Challenges

- I wanted to implement flashing lights but could not think of an idea to generate it. To solve my problem, I made a time interval to switch between white and a different color.
- I also had a problem with my cannon shadow, where it seems to intersect with the floor and would not produce a clear image. Therefore, I translated the shadow up by one pixel so it would no longer intersect with the floor.

List of keyboard controls

- Up arrow – Move camera forward
- Down arrow – Move camera backwards
- Left arrow – Turn left
- Right arrow – Turn right
- HOME key – Switch to spaceship camera. Press again to switch back to normal camera mode
- 'Z' or 'z' key – Toggle camera upwards
- 'X' or 'x' key – Toggle camera downwards
- 'C' or 'c' key – Fires the cannon
- 'S' or 's' key – Initiate lift-off for the spaceship

Reference and resources

- Lab 2, 3, 4, 5
- http://www.custommapmakers.org/skyboxes.php (for skybox)
- https://www.textures.com/ (texture for walls and gate)
- http://doc.instantreality.org/tools/color_calculator/ (RGB calculator)
- https://www.tug.org/pracjourn/2007-4/walden/color.pdf (RGB chart)
- https://www.desmos.com/calculator (calculate parabolic equation)
- https://image.online-convert.com/convert-to-tga (convert image to tga format)