COSC363: Computer Graphics

Assignment 1

**Brief description**

This is a scene of robots discovering a new planet. The scene contains these objects: a rainbow, a TV, a teapot on a stand, a space rover and a custom space décor. The textures used in this scene is on the walking robot, the skybox and the TV. One robot has boosters and is doing a flip around a rainbow while another robot is walking around the scene. The space rover is also moving around the scene with a spotlight. There is continuous animation going on with the robot, space rover and the space décor.

**Important aspects of the scene**

Figures 1.1 and 1.2 shows the important aspects of the scene. The rover body has a floating rectangle is intended for futuristic effect and it has a spotlight. The rover moves around the scene and so does its light. The other important aspect of the scene is the custom space décor object that was designed to use sweep and extrusion techniques.

**Extra implemented features**

A formula is used for the rainbow it is a half a circular ring. The ring is then displayed in seven strips with different radii and colours.

The ring uses GL\_QUADS and draws three quads, one facing inwards, outwards and facing up. For every angle between 0 and 180 degrees in 5 degree intervals, the angle is converted to radians and then two angles are stored: the initial angle (angle1) and the initial angle added with the interval gap (angle2). Each angle, t, is then substituted into the parametric equations for a circle so that the coordinates of the points on the x and z planes can be found. The radius of the circle is represented as r and r will change depending on which section of the quads are being calculated. For each quad, there will be four vertices. Given a width, height and radius, each 5-degree quad slice of the ring can be calculated using this equation:

For the quad facing up, the first coordinate calculation use angle1 as t and the difference between the given radius and width as r. The second calculation also uses angle1 but r is used as the value of the radius plus the width. The third and fourth calculation are similar but uses angle2 as t. The normal and y values are fixed as the given height because the quad needs to be fixed to the highest part of the ring to be facing upwards. This step is repeated for all quads but with different normal so that the quad is facing the correct direction. The y coordinate value is specified as height if the quad will be touching the edge that will be facing up.

A skybox is implemented … This was very difficult for me because I had a bug in my code where one corner of the skybox would turn partially turn white when moving away from the centre of the scene.

Collision detection is implemented when the camera reaches the edge of the skybox therefore the camera cannot move outside the skybox.

**Model descriptions**

Custom model of a space décor is built by a sweep surface, extrusions and surfaces of revolution. The main part of this model is the curved structure. It was aimed to be an hourglass-like shape. Using the lab material [1] as guidance and designing the shape by sketching on paper, the shape was generated. For futuristic effect a dodecahedron object is rotating above it and it is also animated with a sphere orbiting around it attached to a ring.

The robot design is based from a humanoid. It has shoulder joints and leg joints as solid spheres. The leg joint is underneath the robot’s skirt. The robot’s eyes are also spheres and the mouth is created using GL\_TRIANGLES. The rest of the robot’s body is made from solid cubes that have been translated and scaled.

**Challenges faced**

This assignment was very difficult for me because it took a long time to design the models before I started coding. Since my code was all in one big file it was hard to maintain and I ran into many problems such as bugs but also hard to navigate through my code during implementation. I had a bug in my code where one corner of the skybox would turn partially turn white when moving away from the centre of the scene which I spent a lot of time fixing. I solved this by… I also had a problem where my animation was not smooth enough I solved this by…

**Control functions**

The control functions for interacting with the scene is simply the UP, DOWN, LEFT and RIGHT buttons to control the camera movement.

**References:**

1. Dr. R. Mukundan. (2017). *COSC363 Lab material*. Retrieved from http://www.learn.canterbury.ac.nz/