

COL781, Computer Graphics

Assignment 2

Final Report

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1 Introduction

In this assignment, we implemented a model of a quad-copter with the following features:

1. The drone is in an environment with a fixed camera and the drone also has a camera in front of it
2. The rendering of both the scenes is done using lighting and shading in OpenGL
3. The views of both the cameras are visible in two separate windows
4. The model of the quad-copter is represented as a hierarchical model(Directed Acyclic Graph)
5. The model of the quad-copter(all the parts) and the objects in the environment are made using OpenGL primitives
6. The drone can be manipulated(translation and rotation) using the keys of the keyboard
7. The drone can also follow a pre-defined trajectory

2 Model of the Drone

The drone is represented as a Directed Acyclic Graph with parts of the drone as nodes. Root of this graph is the cuboidal centre. The children of this cuboid are the cylindrical arms. Each arm has a torus as its child that serves the purpose of outer cover of the fan. Finally, each fan cover has a three-blade fan as the child. The green bump on the central cuboid marks the front of the drone.

The fans of the drone rotate according to the motion of the drone, i.e. the speed and direction of rotation of the fans change according to the motion.

The initial position of drone is the origin and its viewing direction is towards negative z-axis.

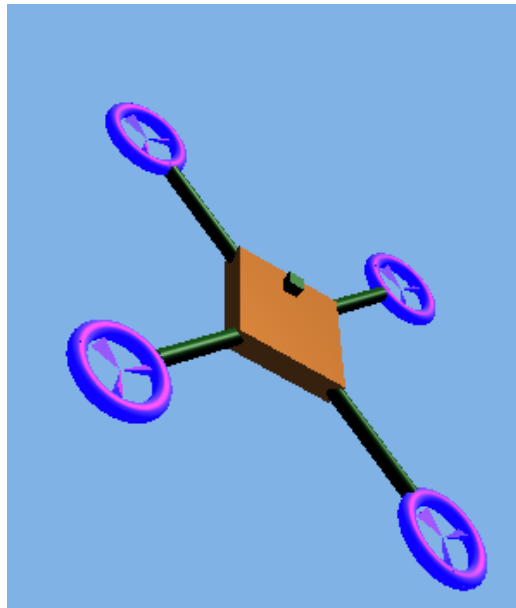


Figure 1: Drone

3 Navigating the Drone

The drone can be controlled using the keys of the keyboard as shown in the following table:

Key	Function
Up Arrow key	Forwards
Down Arrow key	Backwards
Left Arrow key	Leftwards
Right Arrow key	Rightwards
O	Upwards
P	Downwards
W	Pitch (towards back)
S	Pitch (towards front)
A	Roll (towards left)
D	Roll (towards right)
Q	Yaw (anticlockwise)
E	Yaw (clockwise)

Table 1: Keyboard controls for the drone

4 Environment

The objects in the environment are made using OpenGL primitives. The shapes of buildings include cuboid, trapezoid, torus and cylinder.

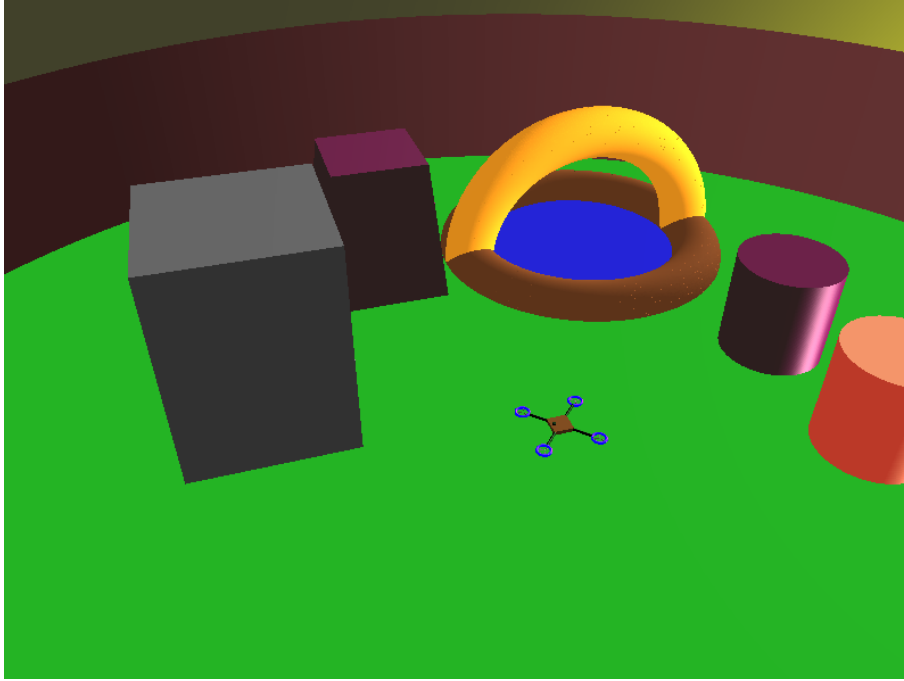


Figure 2: Environment

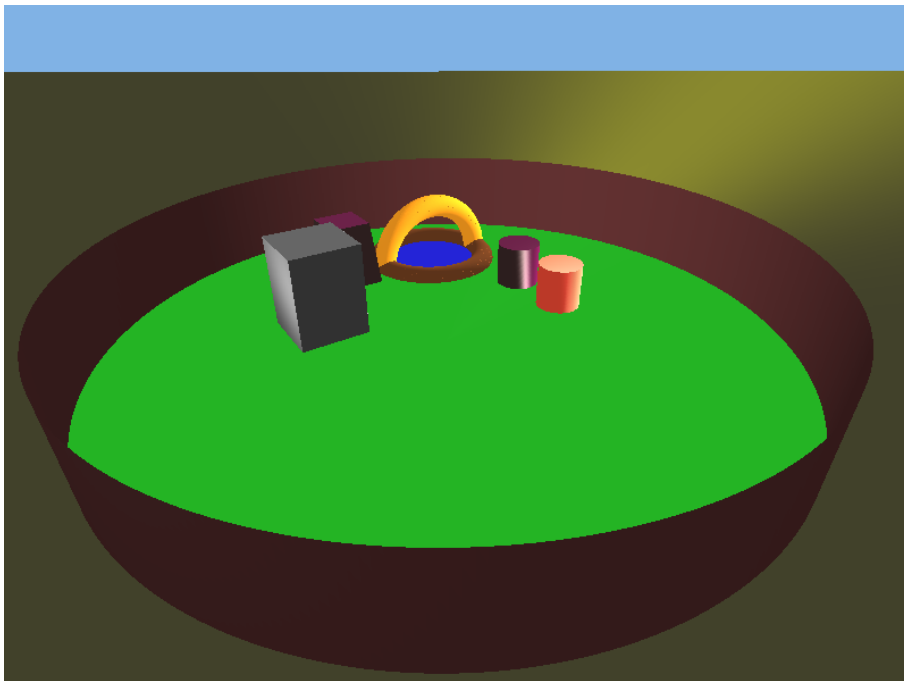


Figure 3: Environment through drone camera

5 Lights, Cameras and Action Windows

A directional light has been placed at the infinity pointing towards $(-1,-1,2)$.

There are two windows.

Window 1 shows the view from the fixed camera. The field of view of this camera is 45 degrees. The camera is situated at $(-40,50,-20)$ and is pointing towards the $(25,0,0)$.

Window 2 shows the view from the camera of drone. The field of view of this camera is 60 degrees.

6 Modes

There are two modes. First is the interactive mode where we can control the drone using the keys. The second one is the automatic mode where the drone follows the pre-defined trajectory.

7 Automatic Mode

The path of the drone is made using Bezier curves. The path contains both straight lines and curves. The path is **3-Dimensional**.

8 Compiling and Running

For compiling : Make compile

For running in interactive mode : Make run Mode=0

For running in automatic mode : Make run Mode=1

We can also specify the window size before running using : Make run WIDTH=w HEIGHT=h Mode=m where w and h are required width and height of the window and m is 0 or 1. The default width is 800 and height is 600.