Assignment 4 (Mini-Project)

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***Abstract*—This report explains how 3D rendering with animation, camera setup, and textures is implemented. Features of threejs are used.**

I. Introduction

This project is a simplified VR application. There is 3D rendering done with cameras and lighting and animation and textures. Also other functionalities like handling collisions are also implemented.

II. Scene Graph Organization

In default the scenegraph is as given in Fig. 1. Player denotes the player itself, Moving Objects represent the dynamic objects of the VR application, Lights denote the lighting of the system and the respective light sources and lastly static objects denote the objects upon which we do texture operations.

There are two nodes for light and camera in the scenegraph. One is that they both are child nodes of the root node, i.e., the scene node. And other is they are the child nodes of the 3D Object node. The child nodes of 3D object, light and camera nodes, are used for the functionality of taking a light source along with the player and watching the scene through the player's perspective respectively. It accurately depicts the motion of the object combined with the moving object.

But when the player grabs the moving object, player's mesh becomes the child node of the moving object mesh as we see in Fig. 2. The major reason behind this is that once the child of the moving object mesh, the player truly acts like it has grabbed the moving object as it moves wherever the moving object does.

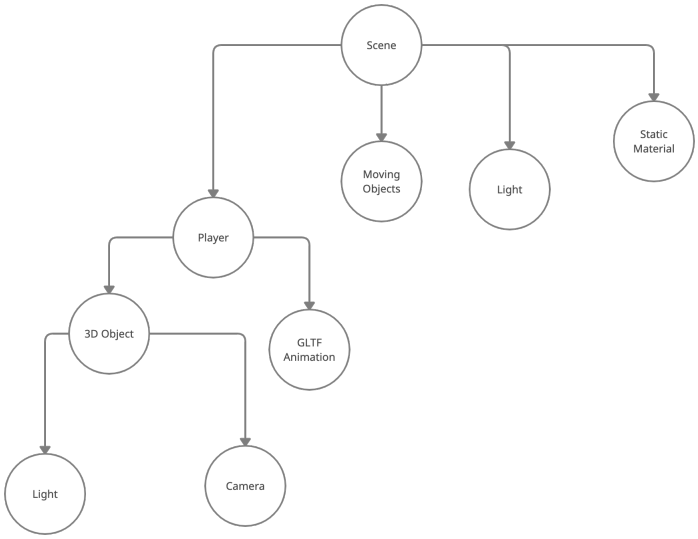

Fig. 1. Default Scenegraph

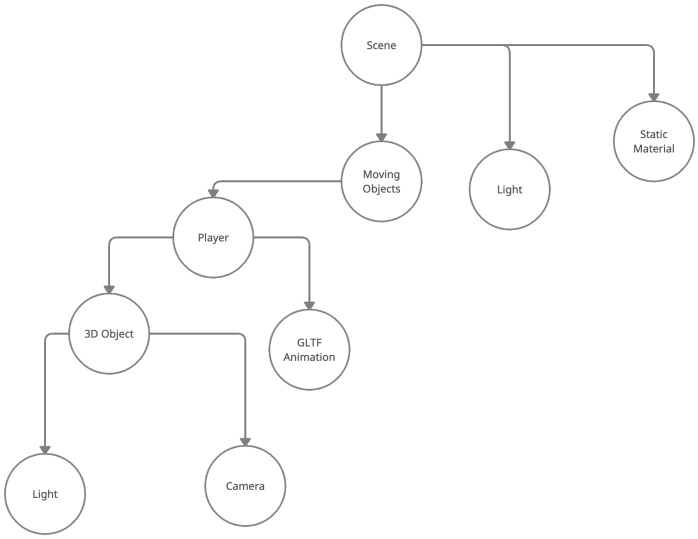

Fig. 2. Scenegraph when the player grabs the moving figure.

III. Calculation of Position and Orientation

A. Lights

For implementing part A, i.e.,

One set of lights is fixed to the ground, and each light illuminates a small region around it (e.g. streetlights).

We added 4 point light sources at the corners of the ground mesh. They act like the floodlights for the ground. The 4 instances of pointLight were added to the root node

of the scene graph. Each of them are depicted using a semi-transparent cuboid, placed at the top of 3 tall cylinders, acting as a tower.

Second part,

Another light is at a fixed location, but tracks one of the moving objects (e.g. a searchlight).

The searchlight is placed just besides the centre of the field. It uses the instance of spotLight lighting and the target location of the spotLight has to be updated regularly based on the position of the model. Therefore a different class is implemented for spotLight and the target postion if aligned with one of the moving objects in the scene

Lastly,

Another light third is attached to one of the moving objects (e.g. a car headlight or a flashlight in a person's hand).

A point light source acts like a glowtorch and the original position of the light source is the same as the model character. The light source is depicted by a cube. This instance is then added to the node corresponding to the object in the scenegraph.

B. Camera

The default view of the camera is set at an appropriate position for clear picture of the canvas as a whole.

For the view of the canvas from the user's perspective, the camera is added to the node in the scenegraph corresponding to the user.

C. Collision Detection

For collision detection, I used a simple bounding box mechanism, with a sphere of radius equivalent to half of the length of the object. Each model had an estimated size and we used that as the diameter of our sphere. If the any two spheres were intersecting, it would detect it as collision.

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REFERENCES

[1] https://threejs.org/docs/index.html#manual/en/introduction/Creating-a-scene
[2] https://threejsfundamentals.org/
[3] https://www.youtube.com/watch?v=pUgWfqWZWmM&t=3061s
[4] https://github.com/designcourse/threejs-webpack-starter