Assignment 4 Report

GROUP 4
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Question 1: Texture difficulties

Problems

The sphere we used for the football was a UV sphere and hence, we faced issues in applying the texture using the Three js library. We hence proceeded to use the inbuilt sphere shape given by the aforementioned library. We successfully rendered the texture onto the sphere, but, we observed that since it was an image being mapped, there were discontinuities.

We used the checkerboard image for the football. We observed that at some places on the ball, the squares on the checkerboard overlapped and the pattern was not consistent.

Approach

Instead of using an image for imparting the texture, we thought that we could implement the design itself on the sphere by forming longitudinal and latitudinal lines on the sphere. These lines result in the formation of squares. Each square can then be alternately given the colour black or white as needed. This would help us maintain the shape of the squares on the football and the texture does not look inconsistent anymore.

Question2: Design Notes

Scene Graph Organisation

We have added all the objects and their attached cameras and lights in addition to the fixed lights to the scene graph. Every aforementioned object is a node in this graph. One of the players has a camera attached to it. This relationship is modelled by making the camera node adjacent to the player node in the scene graph. Also a light is attached to the sphere i.e. the football. This relationship is also modelled in the same way as suggested above. The image below shows the exact structure of the graph:

We have used a total of 10 lights: 8 lights fixed to the ground, 1 spot light which functions as a search light for the player and one light which is attached to the football. In the above diagram; l1, l2, l3, l4, l5, l6, l7, l8 are fixed lights while l9 is the light moving along with the sphere. The way this is designed is that when the sphere coordinates are changed, the light coordinates also change by the same amount. Hence, the light moves with the football.

'c2' is the camera attached to the player 'p2'. The 'spotL' is the spotlight on the player which is yellow in colour. We also have 4 obstacles placed in the similar manner as the lights on the ground
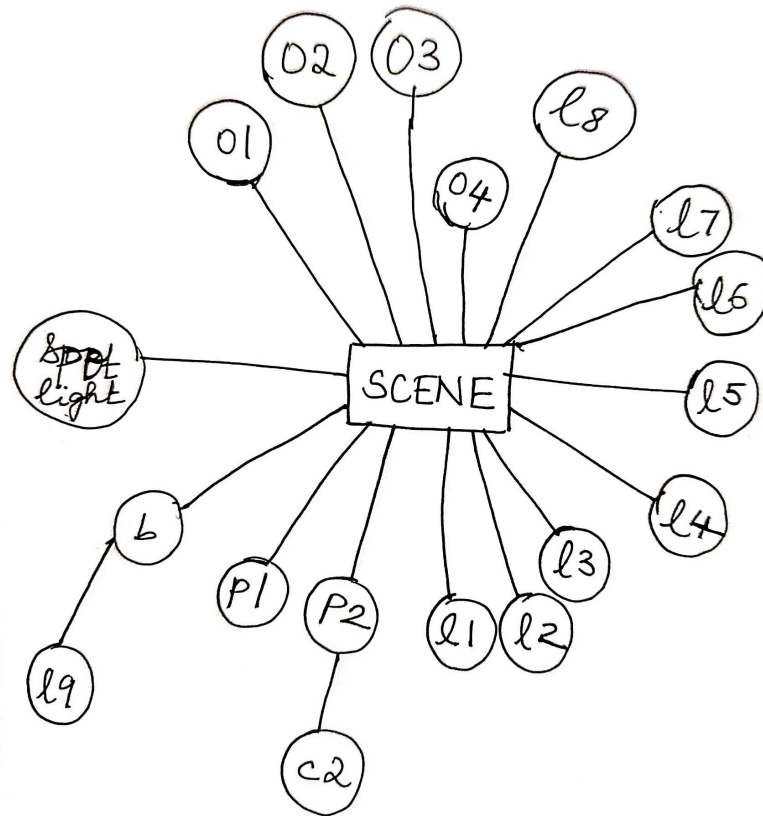
Position and Orientation of lights

The lights have been spread out evenly along the sides of the ground. Along the length there are 3 lights and are separated by 40 units horizontally. Along the breadth there are three lights, each separated vertically by about a distance of 20 units. The lights being planted here are point lights and are depicted as small spheres on the screen. The top-left most light starts from the x and y coordinate value of -30 and -2 respectively. The bottom-right most light has the x and y coordinate value of 50 and -40 respectively. There are 8 such lights in total.

The spotlight is placed on about the center of the screen at a z-coordinate height of 20. This allows the player it searches to get light properly.

The light attached to the football, has the same position and movement as that of the football.

Collision Detection

Collisions of the ball with various parts of the scene are detected by using the distanceTo() method of the three js library. If the distance between the object (other than the operated player) and the ball is less than 5, then the ball translates 3 units behind and stops.
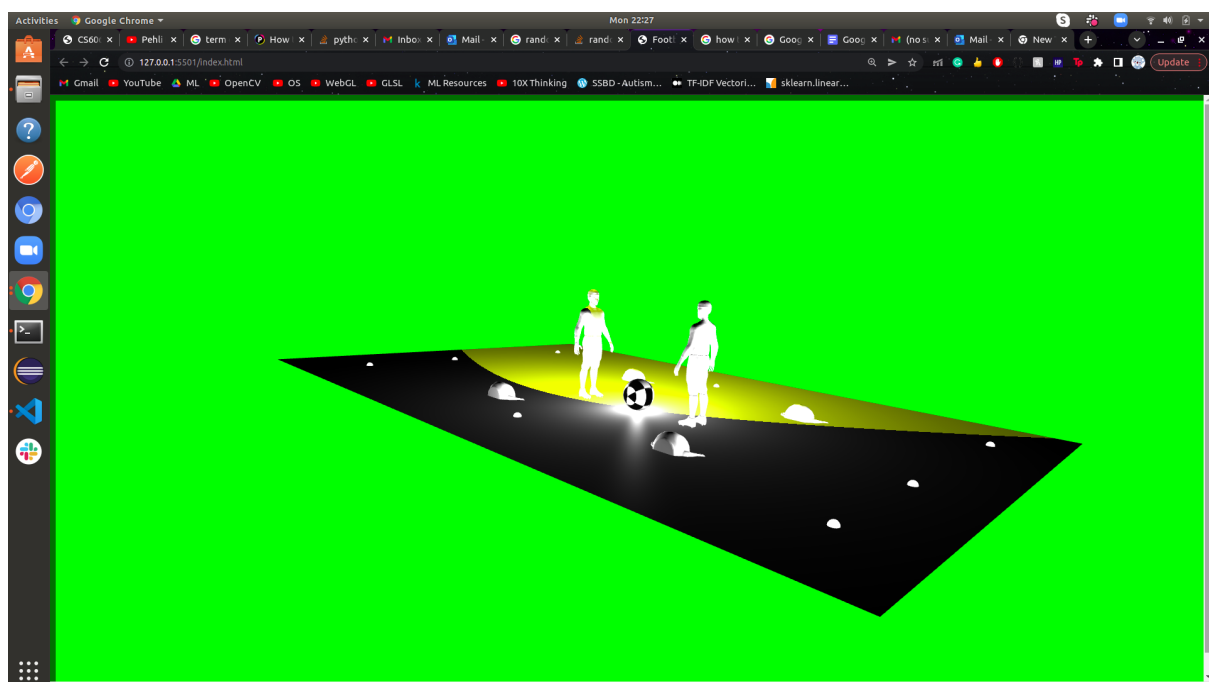
We have used a similar technique to determine the possibility of the dribbling, carrying and kicking as per the following rules:
- If the distance between the ball and the user's player is less than 5, then the ball can be 'carried' or 'kicked'.
- If the distance between the ball and the player is greater than 5 but less than 15, then 'dribbling' / 'kicking' can happen.

Key Bindings

- There are 10 objects. To toggle the spotlight for each object, select 'l' and then numbers between '0-9'
- To select the Players - 'p' followed by '1' for player 1 and '2' for player 2
- Carrying the ball - 'c'
- Dribbling - 'd'
- Kicking - 'k'
- Trackball - Click and hold left-click and drag to change the views
- Zoom in/out - Mouse scroll
- In addition to all of the above, each of the objects on the screen can be moved using the 'arrow keys'

The Scene

References

- https://threejs.org/docs/index.html#manual/en/introduction/Creating-a-scene (threejs docs)
- https://www.youtube.com/playlist?list=PLjcVFFANLS5zH_PeKC6I8p0Pt1hzph_rt
- https://webglfundamentals.org
- TA's repository on Github: https://github.com/Amit-Tomar/T2-21-CS-606