# KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

## KUET

## SESSIONAL REPORT

Department Of CSE Course No. CSE 4908

Experiment No. 0

Name of the Experiment Project Report on Rail station design

*Remarks*

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## Objectives:

→ To implimen design a scene based on a Real life Rail station

→ To implimnt texture, curved surface other then project.

→ To make the scene dynamic

## Introduction:

OpenGl 3.3 has become a modern tool for designing complex and real life scene. It has a long pipeline. Among the pipeline we can work on fragment shader and vertex shader to make the scene realistic or animated.

In this project we have used phong shading ~~con~~ vertex technique for fragment shader.

Scene description:

The Rail way station is divided into some part. At first in the outside it has parking lot. There are road and grass.

Then comes to ticket counter. there are 4 ticket counters and there are fare chart. There is a door for booking counter. In the front glass gate there is a scrolling text for welcoming the participants.

Then there is entrance to main plat form in the main ~~platform~~ ticket counter. There is a gate. Now when the gate is opened there HDI the plat form.

In the platform there is cylindered pillers in one platform and there is some fans. in the other platform there is a brick wall and square pillers.

In middle of two platforms there are two rail tracks. then the rail tracks have steel tracks and concrit middle piller. In the other platform there is a train standing. The train moves when key pressed.

Requirement B

Cube drawing:

The first thing we need in this project is a cube. To draw a cube at first we take the vertices of the cube. Then it is placed in VBO. The indices are placed in EBO. Then we ~~const~~ concatenate all information in VAO. This VAO would be used to draw cubes in further direction.

Drawsphere:

Sphere is a basic ~~std~~ structure in scene drawing

To draw a sphere we need the Radious of center and the ~~Earth~~ radious will gradually decrease while going up and going down. So we have to build vertices like this and then we use triangle fan to draw the whole sphere.

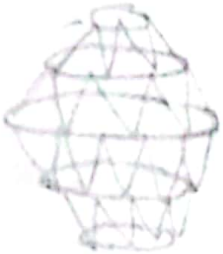

Fig: To draw a sphere using triangle fan.

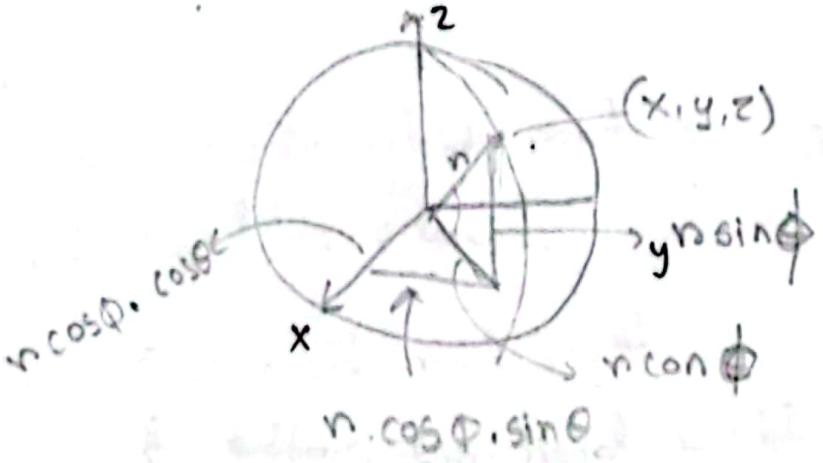


Fig: Math behind the sphere.

At each step,

$$x = r \cos\phi \cos\theta \qquad y = r \cos\phi \sin\theta \qquad z = r \sin\theta$$

Draw Cylinder:

In the circle we have to calculate the new Radius by using cosθ and sinθ. Here in cylinder there is no such calculation, we just have to take one axis and Rotate the point along the axis and thus we get cylinder.

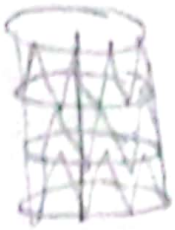

Fig: Cylinder

Lighting:

One off the most imporatent pant is lighting. Here 3type of light is present.

① ~~Ambient~~ Point Light
② ~~diffuse~~ Directional Light
③ Or Spot Light.

Each of the light has 3 properties.

① Ambient
② Diffuse
③ Specular

Ambient light is where the lights come from other sources. Diffuse Lights are the main light of the Light. The specular Light is shiny light.

In the object we calculate the normal at each vertex'. Then we calculate the light and attenuation at that vertex. we calculate the color of the vertex by using multiplying the object color property an Light color property. Then we get color.

Texture:

The texture is attaching an image over a shape.

~~The texturing is done~~ — we have an image in world co-ordinate and in object co-ordinate the co-ordinate is (S,T) we map the world co-ordinate (x, y) to (S,T) and get the texture

Linear texture mapping: Here texture is directly mapped into cube shape keeping the aspect ratio fixed.

Here is an effect called alising effect in which creats distorted imges to sblve this problem we use mipmapping technigue where we store magnified and minified image. For example 128×128, 64×64

To bind the texture we use
glBindtexture() function

then for image we use
gltextimage2D() function

it has some parameter

level: Mitmap level

component: How many channel are there (RGB, RGBA)

width, height: of image

Bonder format: it says in which format we are storing the image

Here we don't have to give the property of ~~of~~ object. It is directly taken from the curve image it self

Bézier curve: Here there would be some control points. Then we draw curve and take points ~~taken~~ considering an axis. Thus. just like the cylinder we can draw curvy shape throught Bézier curve control points.

Methodology:

1. At first there is a road. we have used Road texture to generate the road.
2. There are lamp post oven the road. Each lamp post holds a spot light. We know the attenuation of spot Light is $\cos\alpha$

where cos α is dot product of Light direction and vector of the light position and fragment position.

L = light position − fragposition

cos α = L · light direction.

if the fragment is greater than cos α then there would be no light. ~~And if there is somethin~~ otherwise intensity will be cos α.

Then there footpath texture is drawn.

4. Then there is a door. The door opens like rotating To impliment this we had to translate the axis of Rotation to (0,0,0) point and then we Rotate it then we translate back to its orginal position.

5. then there is a sliding texture. It is a continuous translation of one cube which comes one after another. Door canbe opened using P key and closed using O key

After that there is a quantinuous ticket counters There are force chants on the wall. There is a gate to platform.

6. In the platform there are fans. The fans are rotated using its middle centent of mass as an axis. The axis is translated and then rotated and again translated back.

7. Finally there is the train with its engine. we can press L to start the train and it moves slowly.

8. The platform and roof has their texture of their own.

9. Roll, Pitch and Yaw is also implimented. for front, we have to calculate the sine angle of pitch.

~~front.y = sin(pitch)~~

→ when we move along keeping the Z axis on axis it is called Yaw

→ when we move keeping the y-axis on axin of Rotation its called yaw pitch

→ finally Rotation along x axis is called Pitch Roll.

Discussion:

All of the discusses topic has been implemented in the project. At first there are 3 type of light. Then there has been rotation and translation and continuous translation (scrolling text) The dynamic object has also been designed (train, fan) a The texture is used to draw the engine, roof, road, farm chair, counter not. Etc

Finally curved surface like semi cylinder, full cylinder, wheel has also been drawn with this project.

While doing project the texture was sometimes black and white. The black and white texture was rather solved with png format image. Moreoverre the texture use needs heavy gpu computation. Still all the problem was overcomed and ~~we have slow~~ so the project was completed.

## Conclusion:

This was a difficult project. Every mathematical calculation has to be precise and the concept of topic has to be very clear. In the project we have implimented a Rail station model. Lighing and texture was also added. So we ~~th~~ apart from difficulties, we have succesfully completed the project

## Reference:

1. Learnopengl.com
2. wikipedia.com.