UTM
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SCSV2213

FUNDAMENTAL OF COMPUTER GRAPHICS

ALTERNATIVE ASSESSMENT

AQILAH HANIM BINTI MOHD TAUFIK

B 19EC0006

FACULTY OF ENGINEERING, SCHOOL OF COMPUTING

DR NORHAIDA BINTI MOHD SUAIB

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Introduction

In today life, the use of Computer Graphics is very widespread. With just one computer, Computer Graphics can generate many benefits. Among the uses of Computer Graphics are user interface, photography, film, video games, video display, and more. Technology is needed in order to access Computer Graphics.

In Computer Graphics, 2 Dimensional (2D) and 3 Dimensional (3D) images can be created. It also involves the processes of rendering, lighting, texturing, and displaying models. Most of them are used for Mathematics and Engineering.

Phenomena such as reflections, transparencies, or diffuse lighting may be modelled utilizing a number of different algorithms, some programmed to be mechanically precise, others, based on specific requirements, to be computationally efficient. In a matter of milliseconds, virtual reality imagery must be produced, whereas thorough architectural rendering can require hours of computation time.

Assignment 1A

Sample of Computer Graphics Application

For this assignment, my partner and I was instructed to choose a sample of an application that uses Computer Graphics and we chose the topic Animations in Films & Entertainment, with the animation 'Shrek' as the main reference. By finishing this assignment, I now understand that Computer Graphics is used in creating motion pictures and cartoons in the entertainment industry.

In the animation 'Shrek', Computer Graphics was used to bring the animation to life. Emotions and power are injected into the inanimate objects, making them look life-like. There are two different types of animation. Computer-assisted animation and computer-generated animation. Computer Graphics can be produced by film or by video.

Besides that, I also learnt a lot of new Computer Graphics in Animation terms such as Animation Sequence which is a single animation asset that can be played on a skeletal mesh, and also Skeletal Mesh, which is a set of polygons composed to make up the surface of a class of mesh that can be animated. There are many other terms that I learnt such as Facial Animation, Static Modelling and last but not least, Photorealism.

Assignment 1B

OpenGL Aidilfitri Card

For our second assignment, we were asked to create an Aidilfitri E-Card using OpenGL. This was when I was first introduced to creating different shapes using coding. At first, it was a little hard for me, as we were trying to explore different shapes to use for our card. We wanted to make a simple 'Ketupat' with a few Eid wishes on it but after seeing our classmates card, we pushed ourselves to do more.

I learned how to find the right coordinates for all the shapes. I did so by sketching the whole card on a piece of graph paper before keying in the coordinates into the code. For the 'Ketupat', we used a compination of `GL_QUADS` and `GL_LINES` for the string. Besides that, I also learned to use `glColor3f` for the colours of the 'Ketupat'.

Next, we combined a square and four triangles to form the star shape on the card. We labelled each coordinate to make it easier to spot which polygon we were working on. Last but not least, we added a small message on the bottom of the card which says "Eid Mubarak! Maaf Zahir dan Batin. Best Wishes from Aimi Binti Rusdi and Aqilah Hanim Binti Mohd Taufik" using the coding `GLUT_BITMAP_TIMES_ROMAN_24.`

As a result the card turned out better than what we had expected. It was only a 2D assignment, but we were glad we got to finish it on time, and we were proud of our outcome. The both of us worked hard to find different references on the internet so our card would look different from the others. It was a great first time experience getting to run the different shapes. Our card was pretty.

Assignment 2

Output Primitive OpenGL (Paint Program)

For the Paint Program assignment, we had to include three different lines, which were DDA Lines, Midpoint of Circle and also Midpoint of Ellipse. We had a little trouble combining the three different lines at first, but we later got the hang of it after a friend taught us. We learned about output primitives, which basically are the basic elements of creating a graphic.

We used the DDA algorithm as it was far easier to understand compared to the Brasenham's line algorithm. We added the colour red for the line, and set the thickness of the line to 5.0f. The coding for Midpoint of Circle was a little bit complicated and it took some time for me to understand the full coding. It took me a while to understand why there needed to be eight octants on the xy plane.We set the colour purple for the circle. Midpoint of Ellipse was a little bit easier compared to the Midpoint of Circle as the coding was more or less the same. An ellipse is shaped like an oval, which is an elongated circle. We set the colour of the ellipse to blue. We just had to understand the properties of the Ellipse.

A menu button and mouse function was added into the coding, to let the user choose which line he or she wants to use for the program. Six different menus were included in the menu entry. DDA Line, Circle, Ellipse, Quit, Clear and Draw. Draw id the sub menu entry. For the mouse function, `void mouse(int button, int state, int mousex, int mousey)` was used.

As a result, all three lines were able to be displayed as our program was a success. Although it took a few days for me to fully understand the program, I'm thankful Aimi was with me as she did the most in helping me figure out the coding.

Assignment 3

2D Hierarchical Modelling

For our last assignment, we were asked to design a structure of a 2D hierarchical model. We also had to generate the 2D hierarchical model using OpenGL functions. We designed a paper plane which consisted of three levels. Level 0 is the paper plane itself. Level 1 is the Left Wing and Right Wing, Level 2 is the Bottom Left Wing and Bottom Right Wing and Level 3 are the starts on the background.

We studied a lot about transformation to complete this assignment. `glTranslatef` for translation and `glRotatef` for rotation. We designed the paper plane exactly like how we designed our Aidilfitri Card. We plotted down each coordinate and used triangles to construct the paper plane.

We included specific keyboard buttons to rotate each node of the planes. For instance, 'W' is used to move the root of the diagram upwards, while 'S' moves the root of the diagram downwards. 'A' rotates the root of the diagram anti-clockwise, while 'D' rotates the root of the diagram in a clockwise direction. 'Q' rotates the nodes of the diagram anti-clockwise, while 'E' rotates the nodes of the diagram in a clockwise direction. Last but not least, 'Z' rotates the subnodes of the diagram anti-clockwise, while 'X' rotates the subnodes of the diagram in a clockwise direction.

Even though we were lacking the creativity to design other shapes for this assignment, it was a great pleasure to be able to control the transformations in the diagram.

Project

3D Hierarchical Modelling

For our final project, we decided to work on a 3D ice cream as we were asked to design a 3D hierarchical model. The first thing we did was graph a hierarchical table to get the gist of what we were designing. There were three levels in our model. Level 0, the root, is the whole ice cream itself, On Level 2 are the Cone, Node 1, and the Icosahedron, Node 2. The Bottom Scoop, Subnode 1, and Top Scoop, Subnode 2, are on Level 2. Cherry, Subnode 3, and Sprinkles, Subnode 4, are on Level 3.

Translation and rotation were included in this program. Only one light source was enabled using `(GL_LIGHT0).` Besides that, shade was needed. We included `glShadeModel(GL_SMOOTH)` to show the smoothness of Gouraud shading which looks more presentable and better than a simple flat shading.

For camera, view and projection, the whole program was set using glOrtho() as we chose to manually control the view. Projection was used by declaring glMatrixMode(GL_PROJECTION) and to avoid sudden deletions, we used glLoadIdentity(). We use gluLookAt(xkey, ykey, z, 0.0, ycentre, xcentre, 0.0, 1.0, 0.0) for the camera position and change the settings at xkey, ykey, z, ycentre and xcentre to manipulate the camera angle. Xkey, ykey and z represent the camera 's position while the ca mera's direction is by reflecting the ycentre and xcenter.

I took me a while to understand all the concepts for the final project but after consulting a few friends, we managed to finish our project. The output was good, but we did not get to finish our report on time as we were taking such a long time understanding the concept.

Summary

TOPICS \ ASSIGNMENTS	1A	1B	2	3	PROJECT
Computer Graphics Applications	✓				
Graphics Systems Overview		✓	✓	✓	
Output Primitives		✓	✓	✓	✓
2D Transformation				✓	
2D Line Clipping				✓	
Hierarchical Modelling				✓	✓
Introduction To 3D Graphics					✓
3D Transformations					✓
Viewing And Projection & Visible Surface Detection					✓
Lighting And Illumination					✓
Surface-rendering Techniques					✓
Texture Mapping					✓

ASSIGNMENTS	COVERAGE
1A	— Understanding the use of Computer Graphics in Animation in the Entertainment industry.
1B	— Understanding OpenGL. — Explaining how to use OpenGL simple shapes. — Show how the shapes display.
2	— Define Digital Differential Algorithms (DDA). — Figuring out the use of DDA Lines. — Show how the Lines display.
3	— Understanding 2D hierarchical modelling. — Explaining how to use transformation in OpenGL. — Show how the shapes display.
PROJECT	— Understanding 3D hierarchical modelling. — Explaining how to use 3D transformations, camera, viewing and projection and lighting in OpenGL. — Show how the shapes display.

Reflection

Alhamdulillah, even though I went through a few challenges, I managed to finish all the assignments and projects on time. Computer Graphics is a little overwhelming for me, as it is my first time introduced to OpenGL. Even though I've been studying Computer Science for almost 4 years, it took me the most time to understand OpenGL compared to other languages. One book wasn't enough for me to understand all the terms and regulations of using OpenGL.

Despite all that, having our weekly classes online, made me feel more comfortable compared to our face-to-face classes, as our class is very big and it was rather uncomfortable to squeeze about 50 students into the computer lab.

I would like to thank you Dr Norhaida, for always helping us out, when we are in need, and for understanding our current situation. I would also like to thank my partner Aimi Binti Rusdi, for always helping me figure out what I have to understand. For guiding me every step of the way.

Last but not least, thank you for helping us out in any way possible, for us to get the most marks we can for this semester Dr. Learning Computer Graphics is an exciting subject and I will be sure to continue exploring deeper into the world of Computer Graphics, as a Computer Graphic student.