SCHOOL OF COMPUTER SCIENCES

UNIVERSITI SAINS MALAYSIA

CPC354 - COMPUTER GRAPHICS AND VISUALISATION

SEMESTER 1 SESSION 2023/2024

ASSIGNMENT 1

GROUP 13

LECTURER: PROFESOR MADYA DR. AHMAD SUFRIL AZLAN BIN MOHAMED

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1. DETAILED WORKS ON TEAM MEMBERS

Based on the assignment given we divided the task equally among the members of the group we divided the task into 2 parts which are coding and report. We assigned 2 individuals to work on the animation of the TV ident. An individual in charge of designing a dialogue with a good user interface. The last member is appointed to write a structured program and extend functionality of the program.

For the report we appointed one member to write the detailed works on team members and also the conclusion. Introduction, literature review, proposed methods are done by an individual each. The detailed work of each team member will be explained below.

<u>Sofea binti Taufik</u>

This team member is tasked to write the Introduction for the report. For the coding task she writes the structured program and extended functionality of the program.

<u>Huda Nabilah binti Zulkarnain</u>

This team member is tasked to write a detailed description of our technique/functions. For the coding task she work on the animation of the TV ident.

<u>Adam Amirin bin Md Rasul</u>

This team member is tasked to write Detailed Works On Team Member and Conclusion. For the coding task he works on the animation of the TV ident.

<u>Siti Adibah binti Zaini</u>

This team member is tasked to write the literature review where she is required to provide several reviews on the progress of TV ident since the beginning of the advent of computer graphics. The coding task for her is to design a dialogue with good user interface to input multiple parameters.

2. INTRODUCTION

Explain what is tv ident in terms of computer graphics and and visualisation

Generally, tv ident is a short video showcasing the channel's logo. It will be used to identify the channel. Most of the time it is shown during the commercials to establish brand recognition.

In terms of computer graphics and visualisation, tv ident can be broken down into several parts. There are 3D animation, motion graphics, compositing, and special effects.

Motion graphics are used in TV ident by combining the text and moving design elements. The motion graphics in this context are not like the animated Disney films, instead they are short animation that is entertaining or informative. Advertisements used to be in a flat 2D, however since the rise of social media, companies started using motion graphics to engage more with the audience. As well as the 3D design has started to make the advertisement more appealing.

In 3D animation, meshes are first created before being built into the system. This model then can be modified and animated to the animator's liking. The animation is then rendered, usually at a frame rate of 30 frames per second, as a sequence of images. Sequential playback of the animation produces the impression of motion and a three-dimensional virtual environment. Next, the animation will be done by generating keyframes in which they are the same object but at different key times. So, these keyframes are at least made of 2 frames to show the movements. Nowadays, there are many rates of frames per second (fps). The higher the fps then the smoother. The process of transitioning from one keyframe to another is called tweening. This will generate the animated object.

Compositing is a process of blending multiple images as overlapping layers in one image. The 3 techniques that are the basics in compositing are layer blending — layering one image on another to combine, masking — conceal certain parts of the image, and blending modes — switch how colours interact when they are layered.

Image 1: Before masking

Image 2: After masking

Image 3: After blending models

Keying is the most often used technique for this kind of work. It involves taking out any colour information that isn't on a transparent background in order to display the footage that was shot behind it. Now, in tv ident, compositing is one of the crucial parts because there will be transitions. So, to make the transition even smoother then compositing is needed.

Lastly, the special effects (SFX) are artificial visuals you do on camera to add realism. For example, using a big hose to sprinkle water to shoot a raining scene. This special effect is used in tv ident by manipulating objects and characters. SFX can be used to modify how characters and things in an identity appear and move. This covers things like morphing — one shape or items smoothly change into another, scaling — changing the size of objects, adjusting speed, and applying digital makeup to scenes to increase their impact. In morphing there are 3 common techniques which are direct morphing, morphing at maximum speed and 3D morphing. Morphing at maximum speed is usually used in films where the objects are morphed while moving. Meanwhile, direct morphing can be used for simpler animations like changing a basic line-drawn shape into another. 3D morphing makes it possible to switch between several movements using this kind of morphing animation. A morph target defines every pose or movement. It's applied to animate things without a skeleton.

3. LITERATURE REVIEW

The evolution of TV idents (short for "identifications") has been closely tied to the progress in computer graphics and the broadcasting industry. TV idents are the brief animations or graphics that identify a TV station or network, typically shown during program breaks.

In the early days, spanning from the 1950s to the 1970s, TV idents were primarily mechanical or filmed, crafted without the aid of computer technology. These idents often involved the use of physical models and simple animations, creating an iconic presence in the minds of viewers. For instance, the BBC's early idents were notable for their use of mechanical devices to produce their classic globe and bat's wings logos (Airey, 2008). This era was marked by creativity within constraints, as broadcasters were limited to the technology available, yet they still managed to create memorable and distinctive idents (*The Television Symbol*, 2021).

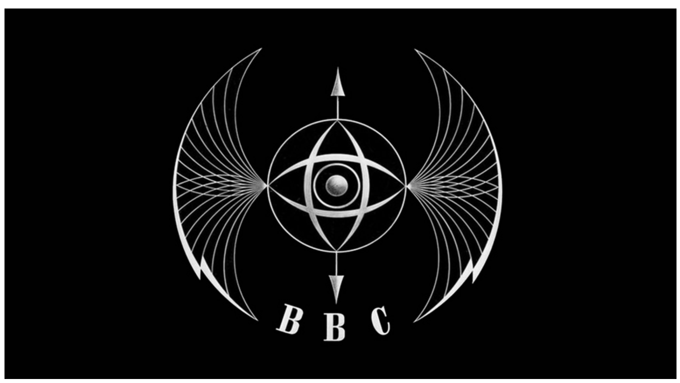


Image 4: BBC bat wings logo by Abram Games

As we moved into the late 1970s and 1980s, the advent of computer graphics brought a significant transformation. This new technology allowed for dynamic and more visually captivating sequences. Early computer-generated idents, though basic by today's standards, were groundbreaking at the time, offering new possibilities in animation and design. The 1980s saw the introduction of computer-generated imagery (CGI) in TV idents (McKenna, 2017). This allowed for more complex and dynamic logos. However, these early digital creations were constrained by the technological limitations of the time, resulting in graphics that were often simple and blocky.

Image 5: 1985 "Channel 4" ident in the UK

The 1990s witnessed a leap in technology, leading to more sophisticated computer graphics. This era saw idents evolve into a form of branding and artistic expression. Broadcasters began using them not just as station identifiers but as a way to convey their brand identity and values. This period was significant for viewer engagement, as the improved quality and creativity of idents played a crucial role in channel branding (*Wikiwand - BBC Two 1991–2001 Idents*, 2014). Idents became more elaborate, featuring 3D animations and complex visual effects such as BBC 2's idents.

Image 6: Paint, first of the BBC 2 series to be broadcast

With the advent of high-definition broadcasting in the 2000s, TV idents reached new heights of quality and detail. This era was characterized by a shift towards realism, with idents showcasing almost lifelike complex animations (Angelos, 2021). This period also reflected a globalized media landscape, with diverse styles and themes becoming prevalent in idents worldwide. With the advent of the internet, there was a blending of global styles in TV idents. The 2000s saw the use of more abstract and conceptual designs (Angelos, 2021). MTV's idents of this era were particularly innovative, often reflecting contemporary digital art trends known as one of the most notable examples.

Image 7: One of MTV idents during 2000s

The 2010s marked the introduction of 3D graphics in TV idents, adding a new level of depth and realism (Morton, 2022). Idents during this era were not just identifiers but were akin to short stories or artistic pieces, often conveying messages or themes in line with the channel’s ethos. This period exemplified a perfect blend of advanced technology and creative artistry, pushing the boundaries of animation. The advent of HD broadcasting and further advances in CGI led to even more visually stunning idents.

Currently, in the 2020s, the integration of AI and machine learning is beginning to revolutionize TV idents. There is also a growing trend of incorporating virtual reality (VR) and augmented reality (AR) elements into TV idents (Morton, 2022). These technologies are enabling the creation of more personalized and dynamic idents. There is a growing trend towards hyper-realistic graphics, sometimes indistinguishable from real footage. The potential for interactive idents, which can change based on various factors like time of day or viewer preferences, is also being explored.

Image 8 & 9: Bubbles ident from ITV1 HD

TV idents have evolved from simple mechanical designs to complex CGI animations, reflecting the advances in computer graphics and broadcasting technology. They are not just brand identifiers but also creative expressions of the channels' identities. The journey of TV idents, from mechanical and filmed designs to the integration of advanced computer graphics and AI, reflects the broader evolution of technology and its impact on broadcasting and viewer engagement. As this evolution continues, the future of TV idents promises even more groundbreaking innovations and creative possibilities.

4. PROPOSED METHOD

4.1. Rotate 180 Degrees

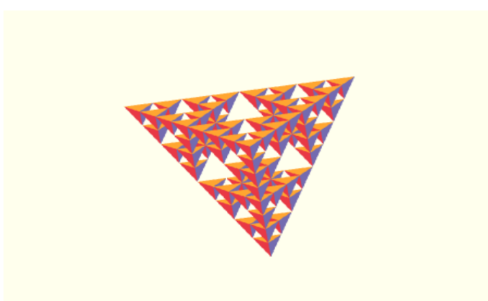


Image 10: Gasket is rotating clockwise

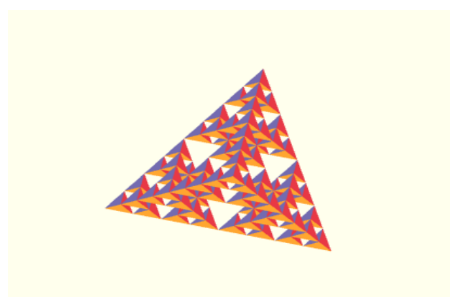


Image 11: Gasket is rotating anti-clockwise

In our triangle animation, we made our triangle rotate 180 degree and opposite 180 degree. In our **function rotate**, it has a mathematical function where its function is to rotate a 3D object around a specific axis although we do not specify the 180 degrees in our code.

We have incorporated two mathematical functions. Firstly, we made a conversion from degree to radian: Math.PI * degree / 180. This is because the mathematical operations in 3D rotations use radians for precise calculations. Secondly, we made the function to perform the rotation based on the axis parameter: if the axis === 0, it adds the converted radians to obj.theta[0], so the object will rotate in a specific angle along the X-axis. This applies the same for axis === 1 and axis === 2, the object will rotate to the Y-axis and Z-axis respectively. By this, it will update the corresponding component of the obj.theta vector. Therefore, the mathematical function can be expressed as: f(obj, degree, axis) = obj.theta[axis] + Math.PI * degree / 180.

However, the function does not specifically handle 180 degree rotation because we use a combination of conditional checks, gradual angle updates and animation sequences in order to achieve the effect we wanted on different axes. In order for the code to move 180 degree and -180 degree, we created a function **animationRegistry** where this function creates animation lists for our 3D gasket including the rotations around different axes. It will simulate a 180-degree turn followed by another 180 degree in the opposite direction.

4.2. Gradually enlarge gasket

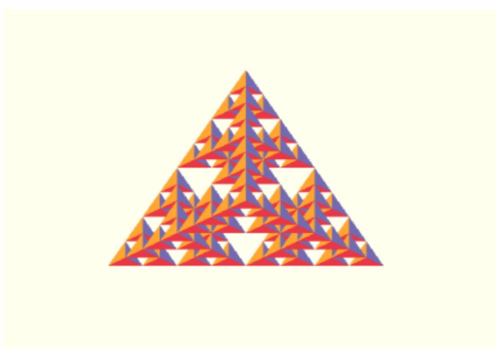


Image 12: Gasket in original scale

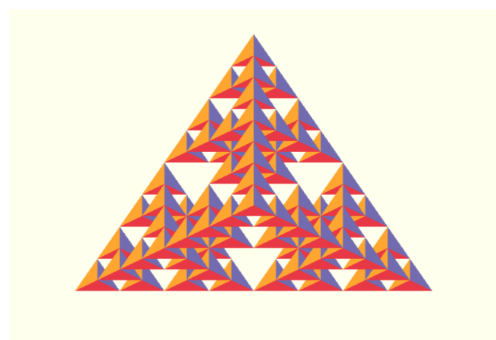
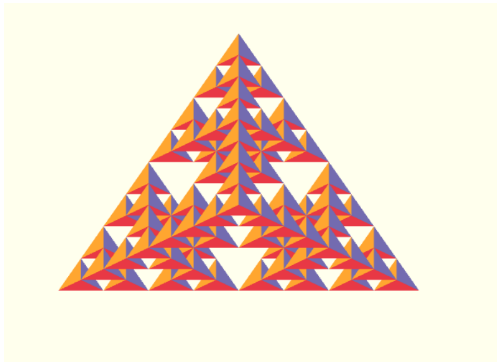


Image 13: Gasket enlarged

For gradually enlarging our 3D gasket, we have made several functions that contribute to this effect. Firstly, function scaling where it sets the obj.scale based on the input of the scale value. This scale value will affect the size of gasket vertices, hence enlarging it.

In order for our 3D gasket to gradually enlarge, we use function **animsRegistry** like how it was explained in 4.1 In this function, we include a call to the scaling function with different scale values. By shifting entries from said list and calling them during the animation, the gradual enlargement is effective by iteratively increasing the scale value in each step. When it has reached the maximum step, the enlarging will stop and it will start to move around.

4.3. Moving and loop button



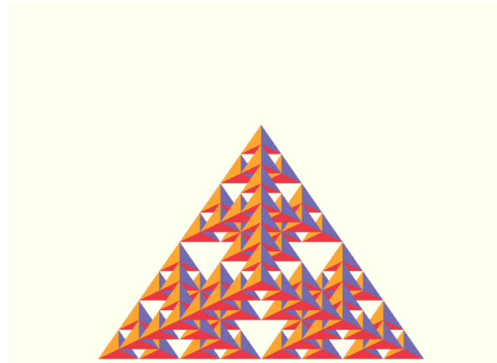
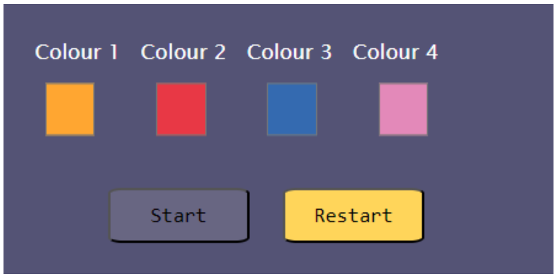


Image 14 & 15: Gasket moving around the canvas

After our 3D gasket has stopped enlarging, it will start to move around the canvas. For this functionality, we have used function translation where it handles the movement of the gasket. It takes the current object as input and updates its translation property based on: obj.transMode defines the movement of the gasket around, obj.speed controls the speed of movement, deltaX/Y define the direction of the gasket, and finally the collision detection checks if any vertex hits the edge of the canvas, it will reverses the corresponding delta value (X or Y) to prevent the gasket to go outside the bounds and suddenly disappear. Additionally, in scaling function will directly change the size of the gasket by modifying its obj.scale property.

In our looping movement, we implemented this in our function **animsRegistry** as per explained in 4.1 which includes the multiple calls to translation function with different values of deltaX/Y. This will define the sequence of animation movement within the loop. In our animate function, it iteratively went through the animation list in obj.anims, calling the current animation function such as translation(obj) on each frame. When the current animation is completed, it will go to the next animation in the list.



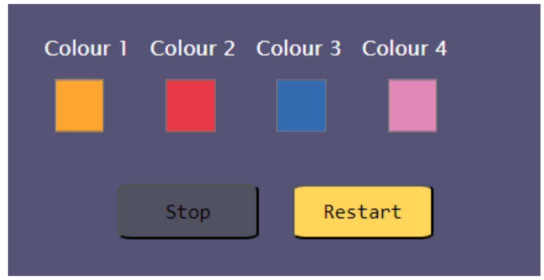


Image 16: Start button

Image 17: Start button turn into stop button

When the animation reaches the end of the list, the user has two options: stop the animation or restart the animation. If the user picks to stop the animation, it will freeze the frame and obj.trans stores the current movement of the gasket and if the user wants it to continue the current animation, it will continue to move from the movement it was paused to if they pressed the start button again. If the user picks the restart animation, the scaling will reset as it involves the obj.scale back to its initial value.

4.4. Colorpicker

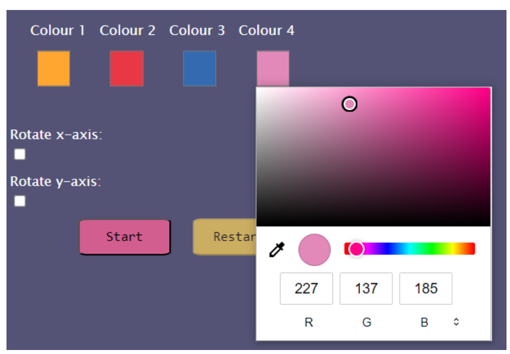


Image 18: Color picker

The color picker is created and managed by the JavaScript code in assignment.js. This functionality allows users to select and apply different colours to a 3D object rendered on a WebGL canvas. The script selects all elements with the class **.colorpicker** and attaches an event listener to each of them. Whenever a colour is picked or when the change event is triggered, the selected colour value is converted from a hex code to a vec4 format suitable for WebGL rendering using the hex2rgb function. This conversion is necessary because WebGL requires colours in a vector format (RGBA) where each component is a float between 0 and 1.

The design of the colour picker is intended to enhance user interactivity and customization for the 3D Gasket. By allowing users to select colours from a standard colour picker interface, the application makes it easy and intuitive to customise the appearance of the 3D object. This feature adds a layer of user engagement, as users can experiment with different colour combinations and see the immediate effect of their choices on the rendered object. The use of standard HTML input elements for colour picking ensures compatibility across different web browsers and devices, making the application more accessible and user-friendly. Additionally, the real-time application of selected colours to the 3D object provides immediate visual feedback, making the application more interactive and engaging.

4.5 Rotating on x-axis and y-axis

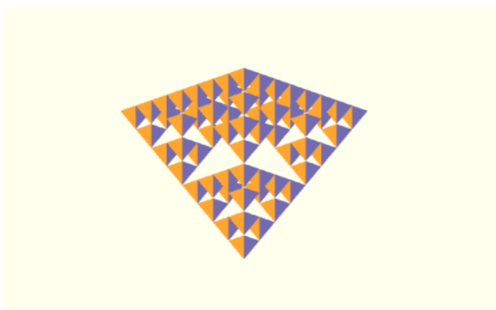


Image 19: Gasket rotating on x-axis

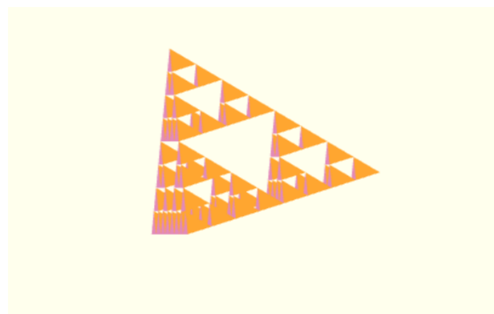
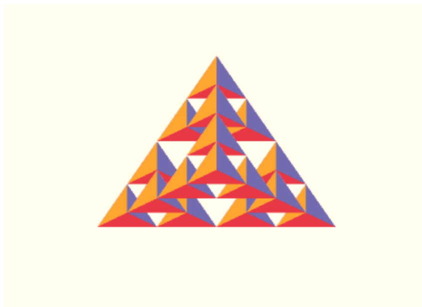


Image 20: Gasket rotating on y-axis

We extend our functionality where our gasket 3D can rotate X-axis and Y-axis if the user checked the box checker. In our function **rotateVertex**, it checks for theta to ensure whether it exists and if it does not exist, it will set it to a default array of all zeroes. It also extracts each angle for each axis from theta and it will make a copy of the original vertex for modification.

The function rotateVertex has conditional rotations where it rotates based on the corresponding element in rotateAxes. If the element is true, rotateX function is called for X-axis rotation and rotateY function is called for Y-axis rotation. Otherwise, the vertex remains unchanged for the said axis. Then, the updated theta values are returned along with the transformed vertex.

4.6 Subdivision



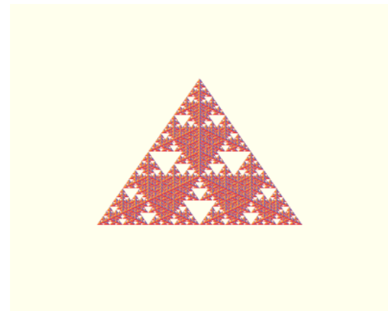


Image 21: Subdivision is set to 2

Image 22: Subdivision is set to 5

The subdivision of triangles in our gasket can be modified using the slider which is defined in **function divideTetra**. In this function, the triangles can be divided in range 1 to 5 triangles. This will modify the complexity and visual of the gasket. This is done by recursive division of the edges. The edges are divided into halves and the midpoints will then form a new triangle each.

5. CONCLUSION

In conclusion we were able to produce all of the features stated in the assignment successfully. We were able to display the shapes, colours and the animation of the 3D gasket of the TV ident. We were able to do this by learning how to implement the shape, colours and the animation of the 3D gasket using WebGL and html. We divided the task equally so all of the team members get to learn the process of making the 3D gasket. We use materials that were given during the lecture as our main references and some additional resources online. The lecture notes provided the information on getting the assignment started and it was very helpful. During the assignment we encountered errors, and it took quite some time to debug but our team worked on it until the error was fixed. Teamwork is one of the reasons we were able to carry out this assignment successfully.

The animation executes the specified rotation, scaling, and movements displaying that complies with TV ident design guidelines. Users can interact with the animation like subdivision, speed and colour attribute using buttons, menus, sliders and key events. This adds to the TV ident's customization and adaptability while improving user engagements. During the development of the design, the animation was twitching so we solved the problem by running through the source code to find the function that causes that particular animation and changing it.

The User Interface (UI) Design serves as evidence of the development process's user-centric methodology. The user experience can be personalised through the use of buttons, menus, sliders, and key events. There is a great deal of customization possible because parameters like the number of subdivisions, animation speed, and colour properties are readily available. We provide an UI that can be efficiently used by users where we prioritise utility over aesthetics.

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