“WAITING FOR YOUR RETURN”: A STUDY OF LIGHTING SETUP AND FAST RENDERING IN 3D ANIMATION

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This report is submitted in partial fulfillment of the requirements for the Bachelor of Computer Science (Interactive Media) with Honours.

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DECLARATION

I hereby declare that this project report entitled

"WAITING FOR YOUR RETURN": A STUDY OF LIGHTING SETUP AND FAST RENDERING IN 3D ANIMATION

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT : _____ Date : 7 SEPT 2021

(KHOO PEI HAOW)

I hereby declare that I have read this project report and found this project report is sufficient in term of the scope and quality for the award of Bachelor of [Computer Science (Software Development)] with Honours.

SUPERVISOR : _____ Date : 12 SEPT 2021

(DR. MOHD ADILI NORASIKIN)

DEDICATION

Dedicated to my beloved family and friends who are always give me the support in education.

ACKNOWLEDGEMENTS

I would like to thank my FYP supervisor, Dr Mohd Adili Norasikin who is giving me a lot of guidance and motivation to complete this project. The project can be complete on time because of the Dr's assistant. Furthermore, I would like to thank the other lecturers of Faculty Information Technology for providing some helpful information regarding the project. Other than that, I would also like to thank my family members who have been giving me full support and encouragement throughout my project.

ABSTRACT

"Waiting For Your Return" is a 3D-based animation that enables audience to see how the effect of lighting represent different emotion or feel in animation. Lighting can create different moods in our daily life, for example light affects our moods during gloomy days of fall. The color of light also can determine different moods, for example, blue can represent moody, yellow represent caution, red represent angry and others. However, some of the animators did not know how to implement the technique to perform the effect of lighting among animation. Therefore, the purpose to develop this 3D-based animation is to help audience to learn the usage of lighting. In this project, open-source software like Blender will be used to develop the 3D animation and advanced lighting technique will be develop in the animation.

ABSTRAK

"Waiting For Your Return" merupakan satu animasi berasaskan 3D yang membolehkan penonton melihat bagaimana kesan pencahayaan mewakili emosi atau perasaan yang berbeza dalam animasi. Pencahayaan dapat mewujudkan suasana yang berbeza dalam kehidupan seharian kita, contohnya cahaya mempengaruhi mood kita semasa hari-hari musim gugur yang suram. Warna cahaya juga dapat menentukan mood yang berbeza, contohnya biru dapat mewakili murung, kuning mewakili berhati-hati, merah mewakili marah dan lain-lain. Walau bagaimanapun, sebahagian animator tidak tahu bagaimana menerapkan teknik untuk melaksanakan kesan pencahayaan dalam animasi. Oleh itu, tujuan untuk mengembangkan animasi berasaskan 3D ini adalah untuk membantu penonton mempelajari penggunaan pencahayaan. Dalam projek ini, perisian sumber terbuka seperti Blender akan digunakan untuk mengembangkan animasi 3D dan teknik pencahayaan canggih akan digunakan dalam animasi ini.

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LIST OF ABBREVIATIONS

FYP	**-**	**Final Year Project**
3D	**-**	**Three-dimensional**
GPU	**-**	**Graphics Processing Unit**
NLM	**-**	**Non-local means**

LIST OF ATTACHMENTS

CHAPTER 1: INTRODUCTION

1.1 Introduction

As the three final stages of the 3D animation production state, 3D visual effects, lighting, and rendering are closely tied together. Cinematic lighting has substantial impact, and it is one of the most important elements of any visual representation. The lighting artist sets up different combination of light sources to draw attention to a specific part of the setting, set the overall mood of the scene or character, or represent the natural properties of the scene such as day or night. The lighting can significantly bring out various details of the objects, everything without the assistant of proper lighting may look boring and unappealing.

Cinematic lighting is the collection of tools and techniques used to simulate light in computer-generated 3D environment. Cinematic lighting gives a realistic look to a scene with huge amount of flexibility regarding the implementation of detail, complexity, and functionality of lighting. Variety of light source, effects, tools, and techniques can be chosen to suit the 3D environment needs. The lighting stage in the 3D animation production is all about making 3D scene looks better in a specific way by setting up different sources of light. Birn (2013) and Calahan (1996) stated that the most significant roles of cinematic lighting are enhancing the audience's emotional experience and supporting visual storytelling. This means that lighting is important in a 3D animation because it must support the story, convey the mood of a shot, and depict the time of day and the change of weather.

1.2 Problem Statement

In video production, everyone knows lighting a live-action scene is essential, but people forget to do the same in animation. As a lighting artist, people should do a lot of research, it is important to use real world examples to study how these virtual renderings are achieved in 3D environment to make the animation looks realistic. Many people think that all the lighting artists must do in a 3D scene is simply put a light source at certain coordinate, or just turn on the lights that are in the shot and their works are finished, but there is a lot of techniques need to be involved.

A lighting artist need to understand deeply how real-world light interacts and reacts in different situations. There is a lot of knowledges of lighting that needs to be learn such as how light interact with different materials, what qualities the light takes in different situations, how the color of the light affects the scene, and others. Without this knowledge, any 3D animation would look unrealistic with bad lighting. There is an issue that most of the people who work as lighting artists faced.

1.3 Objective

1. To investigate how cinematic lighting designs affect 3D animated scenes
2. To apply cinematic lighting in animated 3D scenes
3. To evaluate the suitable render settings that can reduce rendering time

1.4 Scope

The target audience of this project is localized to anybody that is interested to watch the animation and study how the lighting setup is done to make the animation more realistic. This animation does not contain any subtitles since the animation will not have any conversation such as talking with each other so that this animation is also suitable for children to learn some moral values.

1.5 Project Significance

The project gives significance to the targeted audience watching the 3D animation to learn some knowledge about lighting setup and cinematic lighting. They also can understand the human-robot interaction included in the animation.

1.6 Conclusion

In conclusion, Chapter 1 covers the project topic ““Waiting For Your Return”: A Study to Lighting Setup and Fast Rendering in 3D Animation” with the objective and goal of the project. The project will follow the activities schedule which is listed in the Gantt Chart and milestone that proposed in the proposal to ensure the project can be carried out on time within the period. In the next chapter, the literature review and project methodology will be conducted.

CHAPTER 2: LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

This chapter will discuss the research of the related topic about the use of different lighting with 3D animation. Besides that, this chapter also recovers the project methodology to show the procedure or process of the project development and the requirement such as software and hardware.

2.2 Literature Review

2.2.1 Cinematic lighting

Cinematic lighting exists since the advent of film and photography, but certain varieties remain despite the several changes and improvements of technology of lighting. Most of the lighting techniques for compelling, emotive image-making are timeless and constant (Schaefer & Salvato, 1984). J. M. Garcia (2005) states that lighting can transform an environment or 3D animated scene and create the mood to influence the audience's emotions, this can achieve a great understanding of the story.

Although the lighting in the animated film plays the same role as the lighting in live-action movies, the approaches are different between the two of them. S. Calahan (1996) states that the staging and framing of each scene are done together at the same time and require more effort in collaboration in live-action lighting design, because the director, cinematographer, and actors are affecting each other when filming activity. Lighting setup in 3D animation will be implemented after a character or object design such as modeling, texturing, and animation. It does not influence other factors such as actors, weather, and other physical factors.

S. Rangaswamy (2000) broadly classified the role of lighting into several categories which are lighting directing the audience's attention, conveying a mood, creating a sense of depth, and maintaining visual continuity. S. Rangaswamy (2000) also mentioned that color can be used to set a different tone in the scene. For example, red lights can excite the viewer's mood while green indicates a calmer environment. A sense of peacefulness can be given to the viewer if the scene is well lit. In contrast, dark and low-key lighting is commonly used to represent a dangerous situation. The shadows formed by the lighting also apply the same purpose, the crisp or clear shadows indicate a cold, sterile environment while soft lights are used to create a sense of faint, barely noticeable shadows in warm settings.

All the above studies have reviewed literature on cinematic lighting in 3D animation. There are varied goals when setting up lightings but creating moods to enhance the audience's emotional watching experience seems to be the most important.

2.2.2 Moods

J. Birn (2013) stated that most of the audience never focuses on the lighting of the movie or animation when they are watching the story, but they will feel it instead. It is a key visual goal of 3D lighting design, and it plays an important role to create a mood that enhances the audience's watching experience.

Many properties provide advantages when establishing mood through lighting, but the main properties will be the lighting style. The lighting style can give a feeling for a scene before or at the beginning of the story point. The mood and character of the scene can be affected by manipulating the values of tone from light to dark. For example, the happy and comedy scenes are often lit with high-key lighting style. S. Rangaswamy (2000) defines that high-key lighting is the lighting that well-lit the scene with few shadows and little contrast, and finally give the audience a sense of peace and happiness. Figure 1 shows an example of high-key lighting in a 3D animated scene.

Figure 2.1 : **High-key lighting scene**

(Digital Cinematography – Three-point lighting. Arts Col 752. https://www.asc.ohio-state.edu/price.566/courses/752/3pnt_lighting.html)

In contrast, low-key lighting is the overall dark environment with only a few areas of light lit to the audience's attention. S. Calahan (1996) states that the darkness is intended to stimulate the audience's imagination. The audience can guess what will happen to the next scene, low-key lighting is commonly used in a horror movie. Figure 2 shows an example of low-key lighting in a scene.

Figure 2.2: Low-key lighting scene

(Digital Cinematography – Three-point lighting. Arts Col 752. https://www.asc.ohio-state.edu/price.566/courses/752/3pnt_lighting.html)

2.2.3 Light colors

The color of light is one of the most important elements to establish the audience's emotions. J. Birn (2013) states that the right color can affect the performance of the scene or change the meaning of the scene.

S. Calahan (1996) also mentions that colors can evoke physiological, psychological, and emotional responses. Two people can have different reactions to the same color they see. A person can also have a different reaction to the same color based on its use. However, there are enough shared life experiences and backgrounds to make some generalizations about how color affects our emotions.

Light colors can be categorized as warm, cool, or neutral. J. Birn (2013) has defined the meanings of colors in his book as below:

Red, orange, and yellow are often described as warm colors. Red can represent alarm because it is like the color of fire and blood. The hazard sign or other warning sign often uses red.

Yellow is considered a bright, happy color. Most of the happy stories often used a bright yellow scene that can let the audience expect that the storyline will be happy.

Blue and green are categorized as cool colors and they give a sense of relaxation. Blue lighting can take on sad feelings or create cold weather such as rain and winter.

Green is often used in the natural environment since it is the color of plants or trees. However, green lighting can show a sickness of character, a character's body turning green can look very sick.

S. Calahan (1996) mentioned that neutral colors are almost grey-looking colors. This color can let the scene look cold and the loneliness that the characters are experiencing.

Figure 2.3: Warm color animation scene

(Baianat (2000). *The power of color in animation*. https://www.baianat.com/articles/the-power-of-color-in-animation)

Figure 2.4: **Neutral color animation scene**

(Baianat (2000). *The power of color in animation*. https://www.baianat.com/articles/the-power-of-color-in-animation)

Figure 2.5: Cool color animation scene

(anim8_bot (2020mNarcg 10). *Choosing an animation color palette*. Anim8 Blog. https://blog.anim8.io/choosing-an-animation-color-palette/)

Characters can have their own coloring schemes and styles, which can be used in their current environment, appearance, or skin colors in 3D animated films. This

concept appeared in Disney/Pixar's Inside Out (2015) where the main characters are five personifications of a young girl's basic emotions. For example, the character Joy has yellow skin, Sadness's skin is blue, Fear's skin is a purple color, Disgust's skin is green color, and Anger's skin is red color.

Figure 2.6: Inside Out, a computer-animated comedy film

(Guardian News and Media. (2015, July 23). *Inside Out: which is the most on-trend emotion?* The Guardian. https://www.theguardian.com/fashion/2015/jul/23/inside-out-most-on-trend-emotion.)

In Kaya and Epps's study (2004), the college students were asked to give their emotional response to each color that was shown on a computer screen. The results show that green and yellow which are bright colors had gained the most positive responses. Green color is able to give the feelings of relaxation, calmness, comfort, peacefulness, and happiness. The yellow color represents energy and lively. They mentioned that blue and red colors indicated both positive and negative emotions such as blue indicate calmness(positive) and sadness(negative), and then red indicates romance(positive) and evil(negative). Finally, the purple color gave the feelings of relaxation and calmness.

2.2.4 Approach of lighting

In Birns's book (2013) and John Kahrs's(1996) work, they have mentioned three-point lighting is one of the basic approaches in 3D animation. The three-point lighting consists of 3 lights which are the key light, fill light, and rim light, each of the lights has a different role. Kahrs (1996) states that key light is the main and primary source of illumination. It is brighter than other lights and usually casts the most visible shadows in the scene. A key light commonly illuminates the main subject about ¾ illumination.

Fill light is often used to fill the shadows created by the key light and make the subject more visible. There are two different kind of fill light which is natural ambient and added fill. But added fill represents fill light in three-point lighting, added fill is a light that is added by the lighting artist to fill the shadows and make the subject softer.

Rim light also called back light which provides highlights and created a defining edge to separate the subject from the background. Rim light can bring a stylized quality to the subject. The rim light was placed opposite from the key light.

Figure 2.7: Key light, fill light, and rim light approach

(Jaygubs, /. (2016, June 22). *Lighting Rendering and Compositing*. Gubble Art. https://jaygubs.wordpress.com/2016/06/20/lighting-rendering-and-compositing/)

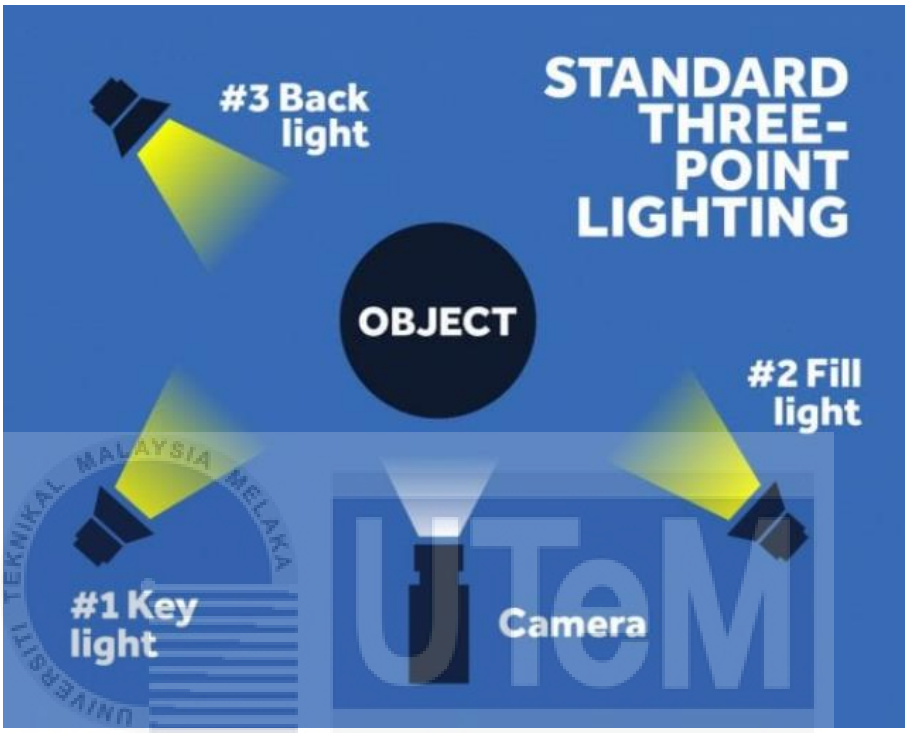


Figure 2.8: Three-point lighting setup and placement

(Academy of Animated Art. (2021, May 8). *What is 3-Point Lighting? Understand the Basics.* https://academyofanimatedart.com/understanding-the-basics-of-3-point-lighting/)

2.3 Project Methodology

To develop the 3D animation, the process will be separated into five phases that contain several steps in each part with the ADDLE methodology. The respective phases are:

i. Literature Review

In this phase, the research literature review is done before the project start. The literature review phase contains the information of the concept and knowledge about the proposed title. The information needs to be gathered and compile to understand what is the concept that should include in the project.

ii. Requirement Analysis

The activities involved in this phase are requirement analysis. The analysis contains three categories which are project requirement analysis, software requirement analysis, and hardware requirement analysis. The requirement analysis needs to be done to understand who the target audience is, what are the needs in the project, and the suitable software and hardware used in the project.

iii. Design

In the design phase, the activities involved are designing conceptual models and a flowchart of the animation. The developer needs to design the conceptual model to identify how the character or model looks like in the animation.

iv. Development

In the production phase, the production process of the animation will be conducted. The production process includes modeling, texturing, rigging, animation, lighting, and rendering. In this phase, the characters and objects will be produced, and the shooting of the animation will begin.

v. Testing

Testing of the project will be conducted in the final phase to determine whether which render settings are suitable to reduce the render time without losing the quality of animation.

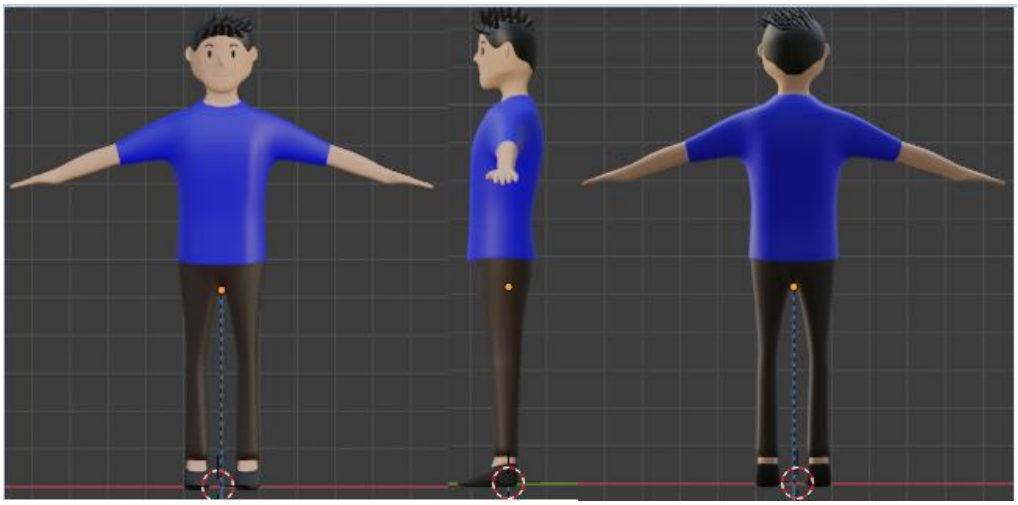


Figure 2.9: **Conceptual model of character 1**

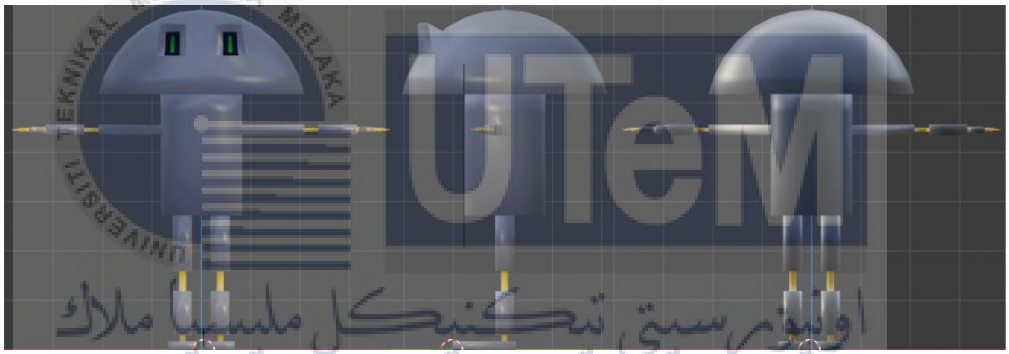


Figure 2.10: **Conceptual model of character 2**

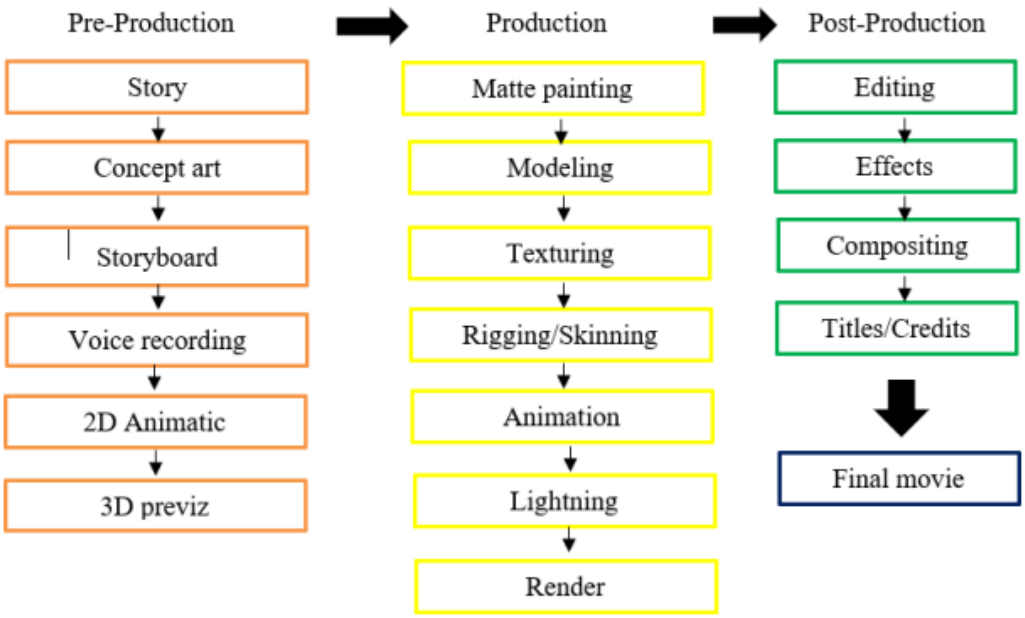


Figure 2.11: Flowchart

2.4 Project Requirement

2.4.1 Software requirement

1. Blender

2.4.2 Hardware requirement

1. Laptop

2.5 Conclusion

The different lighting approaches have been used in 3D animation to enhance the audience's emotional experience while enjoying the story. In the literature, it is noted that color, depth, and the placement of light are the important elements to create different moods or emotions of the scene, and it can change the meaning of the scene too.

CHAPTER 3: ANALYSIS

3.1 Introduction

This chapter will provide the requirement analysis to identify the needs to produce an animation. The information collected is based on the testing with hardware such as a laptop to get some statistics. The software requirement and hardware requirements for this project will list down to give the best assistance throughout the development phase.

3.2 Requirement Analysis

3.2.1 Project Requirement Analysis

I. User Analysis

As mentioned in Chapter 1, the target audience of the animation is anybody that wanted to watch and learn how the cinematic and 3D lighting affects the overall performance of the scene in animation. The literature review showed that the lighting can influence the audience's emotional experience because the different intensities of color such as warm or cool color established different situations of the scene that may be sad or happy moment.

II. Technical Analysis

This project will use software such as Blender to produce the 3D animation. The less information about solutions and techniques for 3D animation production can affect the information gathering. Hence, Google search, Youtube, and other useful resources about animation will be used for the project research to act as an assistant to

give functionality. Those resources cannot be regarded as scientific, but they provide a starting point in research. Besides, there is a lot of time needed to produce a good animation because of the rendering process. To render a frame that used a lot of lighting effects or other complex 3D models, it might take 1 to 2 minutes to complete the rendered image. That means to completely render out the full animation with thousands of frames, it will take many days to finish. To counter this issue, the method of reducing render time with a nice look of animation must be done by looking for the techniques through the internet such as Youtube.

III. Resource Analysis

There are many sources and references that were search during the analysis for the design and development project such as the internet. This is important as the technique of 3D modeling, texturing, rigging, lighting, and others must be studied to produce a good animation. Before beginning the animation production, I had to search for some teaching videos about the techniques and start to learn the skills to produce a good animation.

3.2.2 Software Requirement Analysis

There is various software available in the market. The selection of software is important because it can affect the process of development. The chosen software is based on suitableness and effectiveness. There are two types of software for the project which are software for development purposes, and software for documentation purposes.

I. Software Development Requirement

i. Blender

In this project, Blender was the main and the most important software to produce the animation. Most of the development of the animation is done in the Blender which is modeling, texturing, rigging, animating, lighting, rendering, and compositing process.

II. Software Documentation Requirement

i. Microsoft Word

A program developed by Microsoft. Microsoft Word used in documentation of proposal and final report.

ii. Microsoft PowerPoint

Application software that is used to present the information or data by using text, diagram, chart, and so on in .ppt format.

3.2.3 Hardware Requirement Analysis

I. PC Requirement

At least have 64-bit dual-core 2Ghz CPU with SSE2 support, 4GB RAM of memory, NVIDIA GeForce 400/ AMD GCN 1st gen/ Intel Haswell as the graphic cards , and the screen resolution 1280x768.

II. Mobile Devices

The mobile device is used to record the audio that needs to place in the animation.

3.3 Project Schedule and Milestones

The project schedule and milestones are important documents to draft before the project started. The project schedule and milestones are described in Table 3.1 and Figure 3.1.

Table 1: Project Milestone

Activity	Duration (Day)	Start Date	End Date

1.0 Define			
Brainstorming idea about project	4	01 Mac 2021	04 Mac 2021
Meeting with supervisor and determine title of project	1	05 Mac 2021	05 Mac 2021
2.0 Planning			
Analysis of project and define problem statement	2	05 Mac 2021	06 Mac 2021
Preparation of proposal	3	06 Mac 2021	08 Mac 2021
3.0 Implementation			
Installation of required software	2	09 Mac 2021	11 Mac 2021
4.0 Construction			
Development of project and report preparation	94	12 Mac 2021	13 June 2021
5.0 Evaluation			
Testing and publishing	6	14 June 2021	19 June 2021

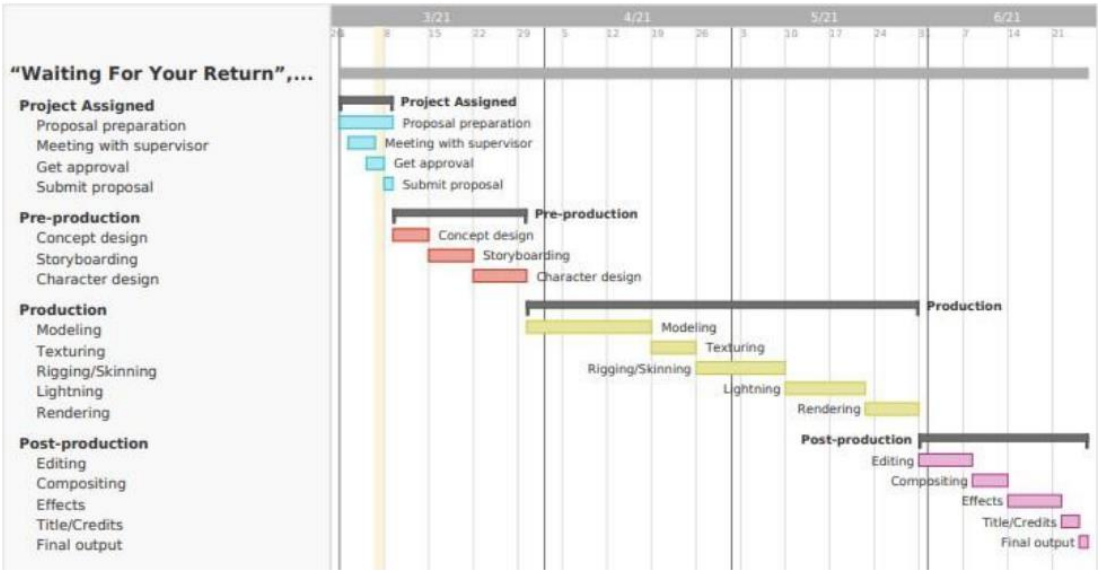


Figure 3.1: Gantt chart of the project

3.4 Conclusion

In conclusion, requirement analysis is important for the project before beginning production. The analysis shows the overall view of the hardware requirement of this project which is concerned throughout this project. The hardware and software requirements need to be analyzed to prepare the materials to conduct the project. The project schedule and milestones are also analyzed from the initial idea to the whole development process in PSM 1. In the next chapter, the project will proceed to the design.

CHAPTER 4: DESIGN

4.1 Introduction

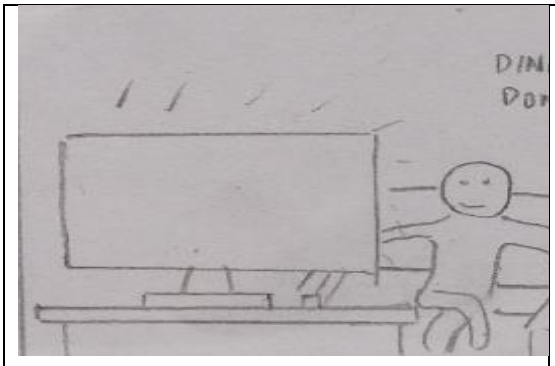
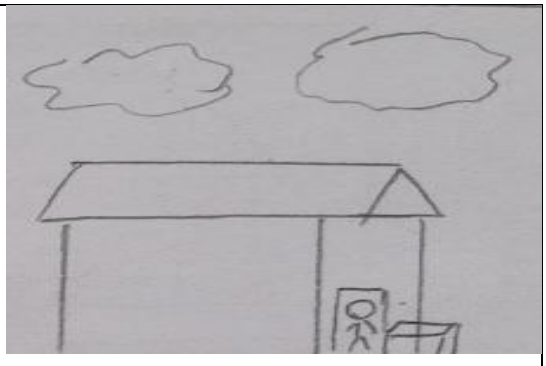
In this chapter, the three preliminary designs will be provided which are storyboard, 3D model, and the lighting setup.

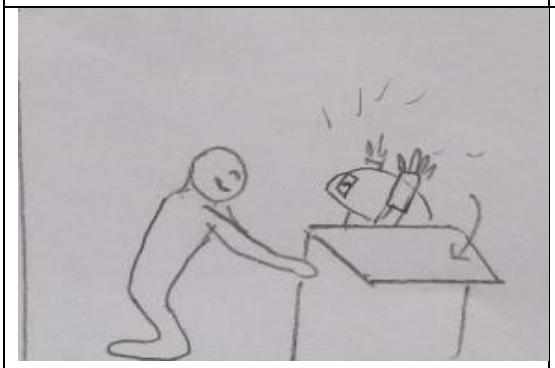
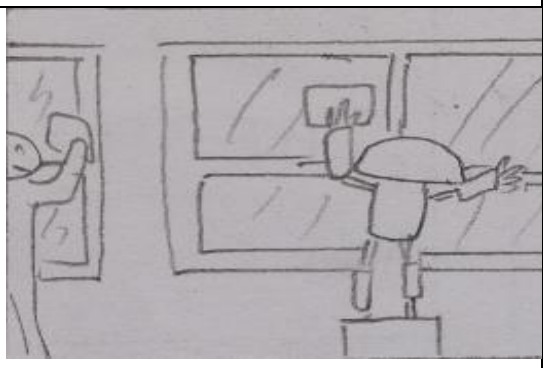
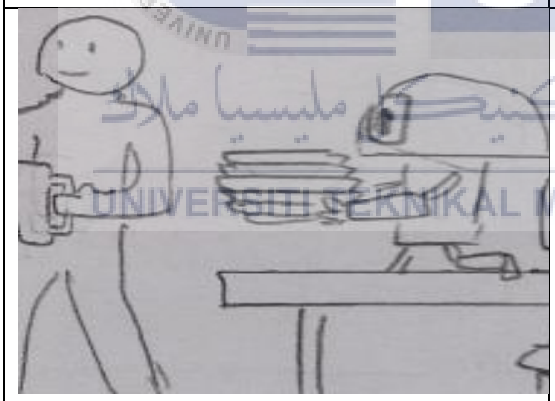
4.2 Preliminary Design

4.2.1 Storyboard design

The storyboard is designed by hand-drawing and there are contain 12 scenes in the animation. Figure 4.1 below shows the storyboard.

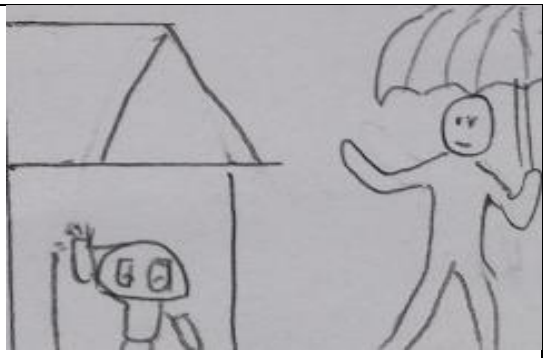
Table 2: Storyboard

	
scene 1 In the beginning, a man is sitting on the sofa and watching television as usual.	scene 2

Suddenly, there is a someone knocks his house door since his parcel is delivered to him	He opens the door and takes his parcel into his house.
 scene 3 When he unboxes the parcel, a robot jumps out and greeting with its host.	 scene 4 They do housework together (Mop the window).
 scene 5 They do housework together (Cleaning table).	 scene 6 Playing together outside the house.

scene 7

Watching television together at nighttime.

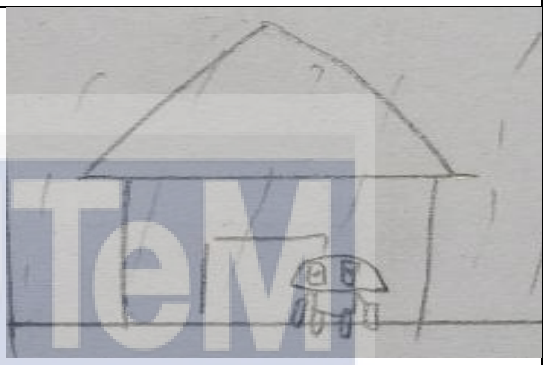


scene 8

He goes from his house to buy some stuff on a rainy day.

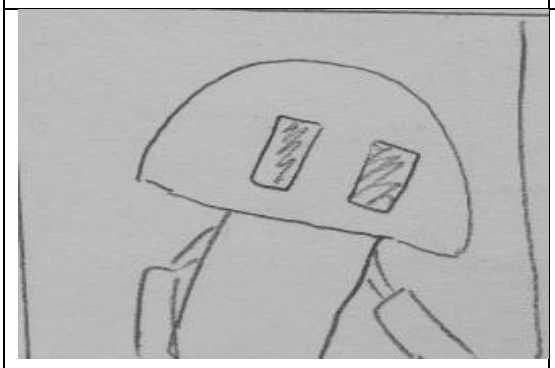
scene 9

He had a car accident on the way to the shop.



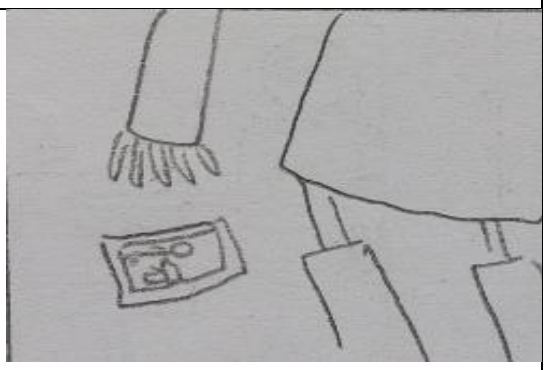
scene 10

The robot keeps waiting for the man to come back home day by day.



scene 11

The robot's power supply is empty and starts to shut down because of waiting for its host to return.



scene 12

The robot accidentally drops down the photo.

4.2.2 Three-dimensional Model Design

There is a lot of 3D models designed for this animation. Except for the house model in the animation, the remaining 3D models are modeled nicely by using Blender. The figures below are the completed models.

Figure 4.1: Character in the animation

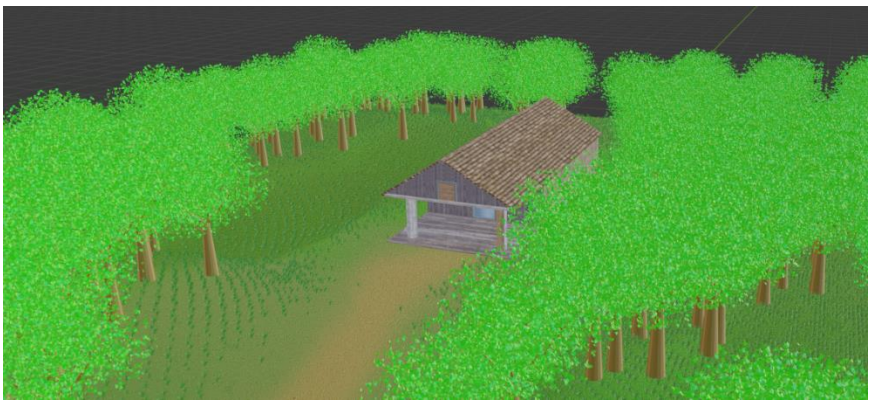


Figure 4.2: Environment of the scene

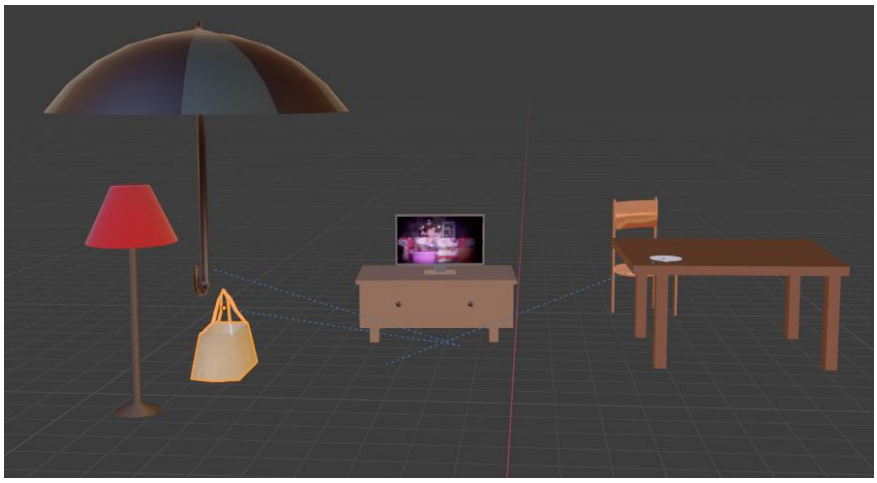


Figure 4.3: Furniture in the animation

The figures above are the 3D models that texture by the material which is the base color provided inside the software.

Figure 4.4: Sofa

The 3D model above is texture by the material which is using image texture as the base color.

4.2.3 Lighting setup

This project is more focused on the lighting techniques, so the lighting setup is done by implement standard three-point lighting and cinematic lighting.

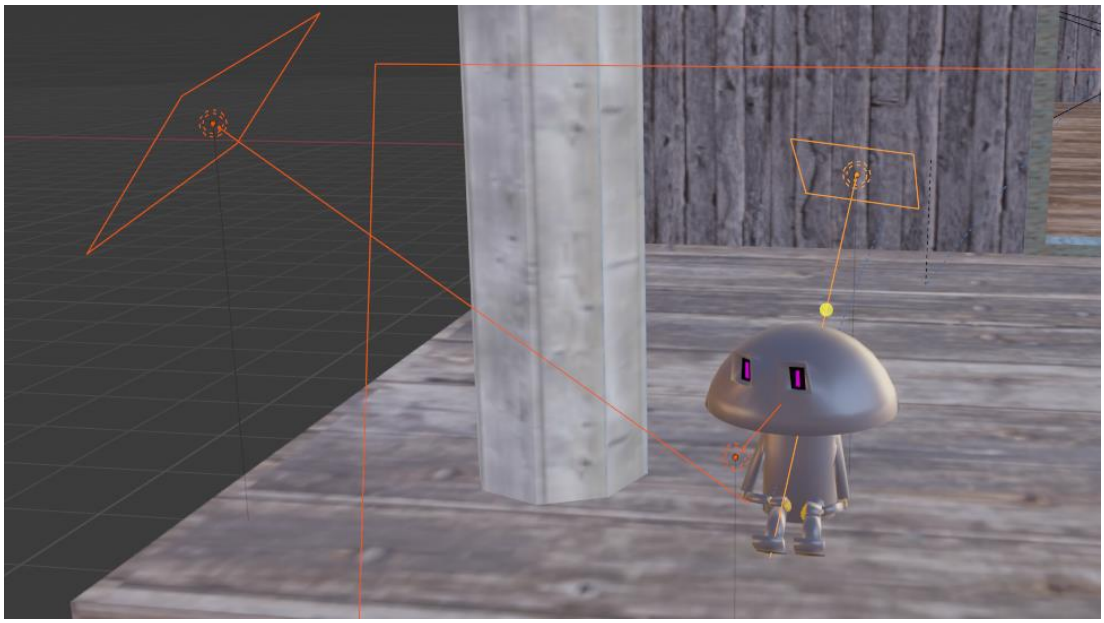


Figure 4.5: Three-point Lighting

Figure 4.5 shows the standard three-point lighting which is used as the area light to represent rim light, key light, and fill light.

Figure 4.6: Scene lighting

Figure 4.6 shows the lighting setup that will make the environment more realistic.

4.3 Conclusion

In conclusion, this chapter is discussing the preliminary designs and the design of the 3D models in detail. The importance of these elements is to enhance the overall performance of the final animation. The project implementation will be discussed in the next chapter.

CHAPTER 5: IMPLEMENTATION

5.1 Introduction

This chapter will describe the production of texts, models, and audio. The media integration will explain the process of integrating all creation of components and elements in software. Besides, the product configuration management will describe the way of render setup and the animation implementation process. In this phase, the project will continue to develop and reach the objective of the project.

5.2 Media Creation

5.2.1 Production of Texts

Media creation for this project is a composition of texts production, 3D model production, and audio production. The tables and figures below are the detailed specifications for each media creation.

Table 3: Specification of production of text

Type of text	Fonts	Format	Size	Color
Animation Title	Typo Formal Demo	Regular	86 pt	White
Animation Credit	Typo Formal Demo	Regular	65 pt	White
Name of Producer and Supervisor	Typo Formal Demo	Bold	65 pt	White

Contents	Tall Films Expanded	Regular	65 pt	White

5.2.2 Production of Modeling

Production of modeling in this section is including the modeling, texturing, and rigging of the 3D model. After the models have done, the models will be appended to the main blend file which is used for animation production.

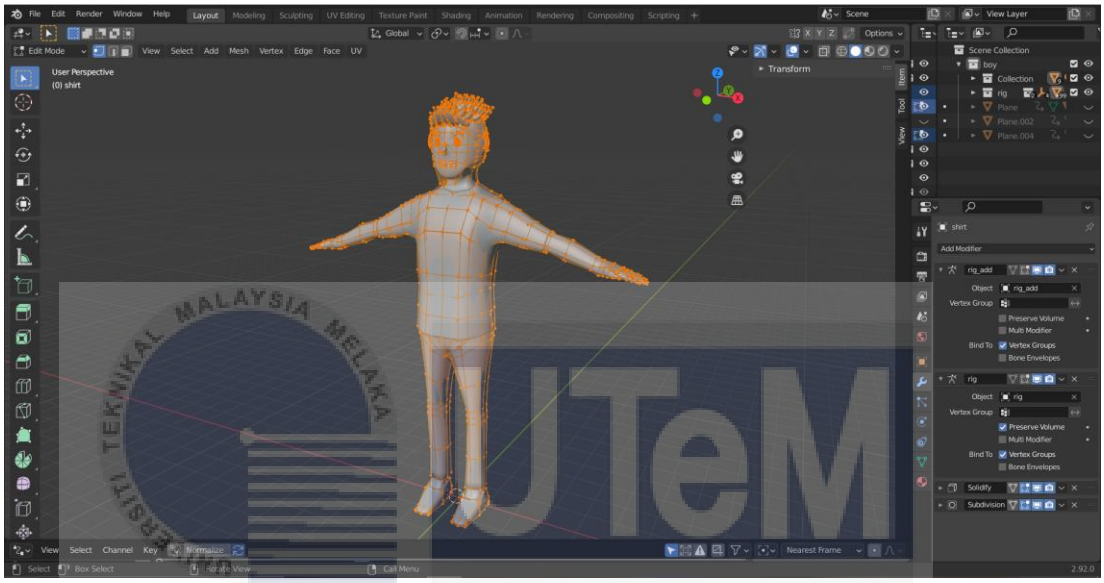


Figure 5.1: Modeling of the main character

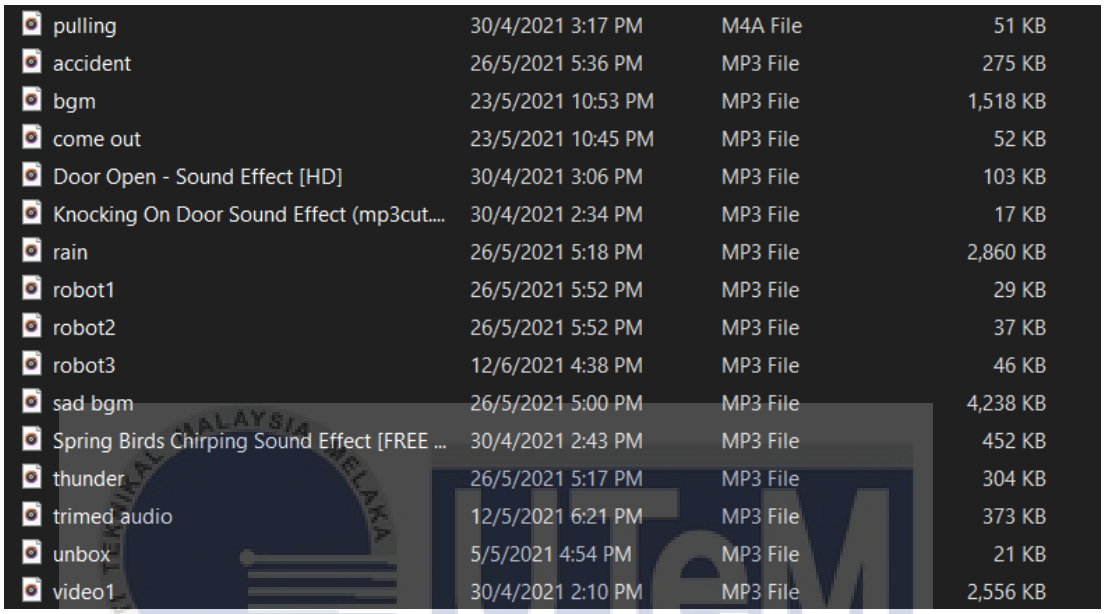
Figure 5.2: Texturing process of the main character

Figure 5.3: Rigging with Auto-Rig Pro

Figure 5.3 shows the model is rigged by using Auto-Rig Pro which is need to install from the internet.

5.2.3 Production of Audio

The audios are downloaded from the internet, the audios are trimmed using Audio Trimmer which can be searched in the browser. The audios are saved as mp3 after completed trimmed.



pulling	30/4/2021 3:17 PM	M4A File	51 KB
accident	26/5/2021 5:36 PM	MP3 File	275 KB
bgm	23/5/2021 10:53 PM	MP3 File	1,518 KB
come out	23/5/2021 10:45 PM	MP3 File	52 KB
Door Open - Sound Effect [HD]	30/4/2021 3:06 PM	MP3 File	103 KB
Knocking On Door Sound Effect (mp3cut....	30/4/2021 2:34 PM	MP3 File	17 KB
rain	26/5/2021 5:18 PM	MP3 File	2,860 KB
robot1	26/5/2021 5:52 PM	MP3 File	29 KB
robot2	26/5/2021 5:52 PM	MP3 File	37 KB
robot3	12/6/2021 4:38 PM	MP3 File	46 KB
sad bgm	26/5/2021 5:00 PM	MP3 File	4,238 KB
Spring Birds Chirping Sound Effect [FREE ...	30/4/2021 2:43 PM	MP3 File	452 KB
thunder	26/5/2021 5:17 PM	MP3 File	304 KB
trimed audio	12/5/2021 6:21 PM	MP3 File	373 KB
unbox	5/5/2021 4:54 PM	MP3 File	21 KB
video1	30/4/2021 2:10 PM	MP3 File	2,556 KB

Figure 5.4: Downloaded MP3 files

5.3 Media Integration

With all the preparation of texts, 3D models, and audio done, the project can be started to develop by creating a new blend file in Blender.

Firstly, all of the models are appended to the Blender, and the location of each model is set up in the first frame before the start to animate them. After placed the models, the characters are animated frame by frame by changing the mode “Object Mode” to “Pose Mode”. Other than that, the position of the camera needs to be set up because the animation’s look will follow the camera angle.

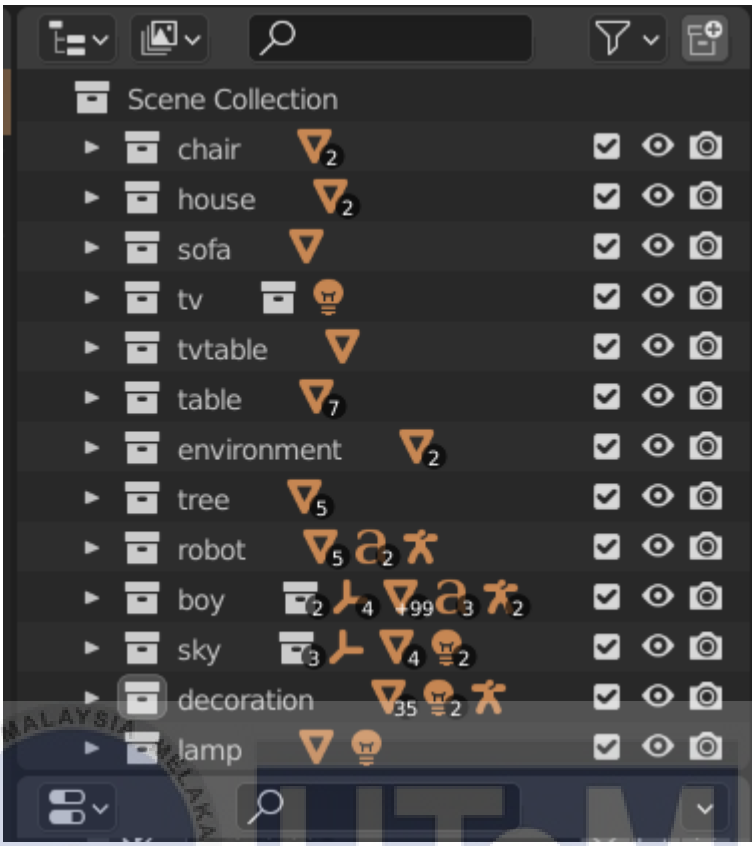


Figure 5.5: Appended blend file of all models

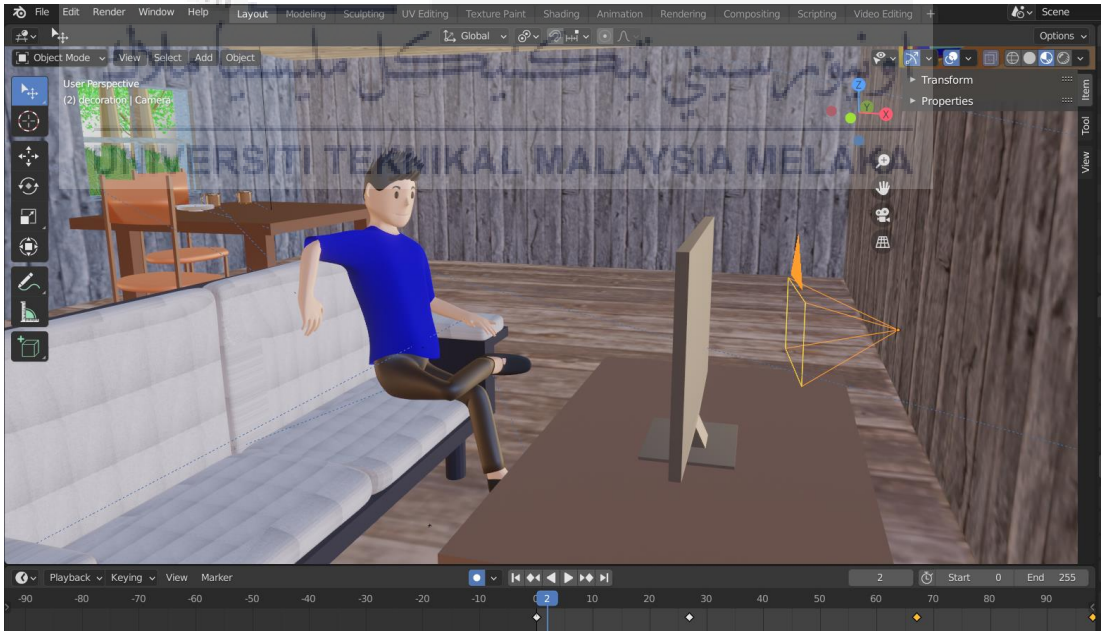


Figure 5.6: Camera angle adjustment in the scene

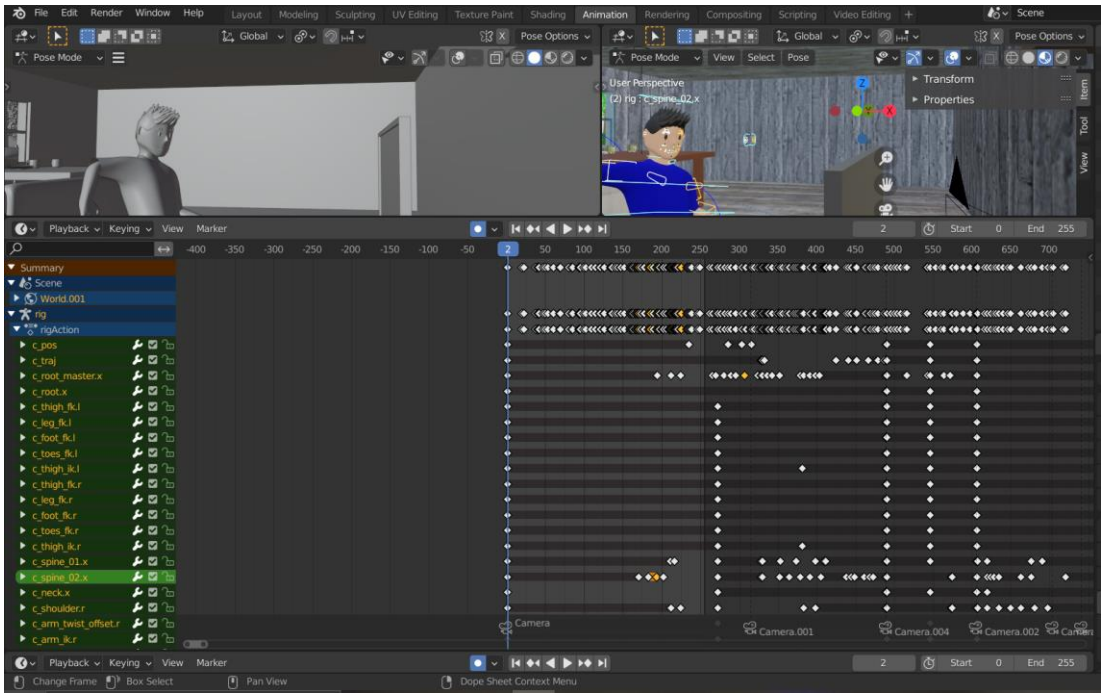


Figure 5.7: Animating the model in the scene

When the frame shooting of animation is done, the process of video editing is proceeding. In this process, the thousands of rendered frames are added to the "Sequencer" and then render as video files. After that, the audio and the texts are inserted into "Sequencer" to begin the editing process.

Figure 5.8: The video editing process

5.4 Product Configuration Management

This section discussed the method in setting up configuration management for Blender.

5.4.1 Render Setting Configuration

To render thousands of frames in the animation, it is compulsory to configure the render setting in the “Render Properties” and “Output Properties” to get a nice look at the animation. Below are the figures of the configuration of render settings in Blender.

I. Render Animation as PNG Format

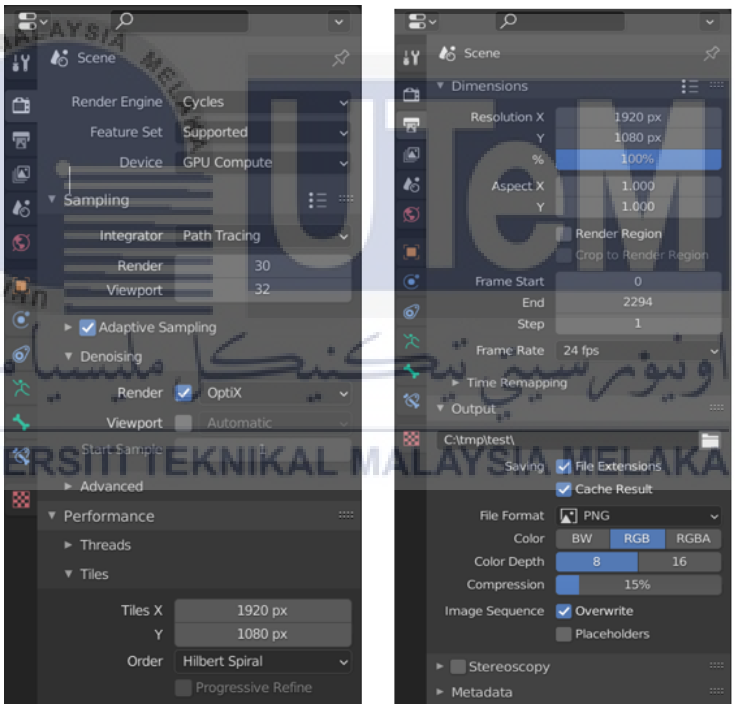


Figure 5.9: Render setting for PNG format

II. Render Animation as MP4 Format

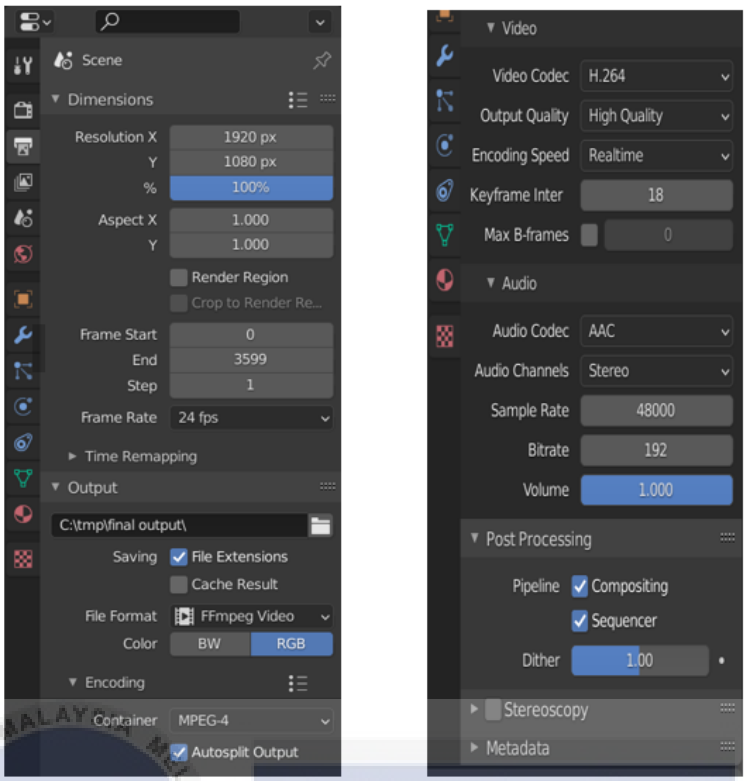


Figure 5.10: Render setting for MP4 format

5.5 Implementation Status

The implementation status of this project will be briefly explained based on the activities stated in Gantt Chart.

Table 4: Implementation status

No.	Task Name	Duration (Day)	Date completed	Status
1.	Project preparation	10	8 March 2021	On-time
2.	Pre-production	20	28 March 2021	On-time
	Concept design	7	15 March 2021	On-time
	Storyboarding	7	22 March 2021	On-time
	Character design	6	28 March 2021	On-time

3.	Production	63	30 May 2021	On-time
	Modelling	22	19 April 2021	On-time
	Texturing	7	26 April 2021	On-time
	Rigging	14	10 May 2021	On-time
	Lighting	10	20 May 2021	On-time
	Rendering	10	30 May 2021	On-time
4.	Post-production	18	18 Jun 2021	On-time
	Editing	12	12 Jun 2021	On-time
	Compositing (Final output)	6	18 Jun 2021	On-time

5.6 Conclusion

In conclusion, this chapter explained all the implementation in media production and described the process of animation production in detail. The configuration management is briefly explained, and also the implementation status of the project production.

CHAPTER 6: TESTING

6.1 Introduction

This chapter will discuss the test plan and test strategy. The test implementation will also be discussed in this chapter. After that, the result of the test will be shown and stated at below.

6.2 Test plan

6.2.1 Test environment

The location will be in the office or room. The testing will be implemented inside the laptop with the software Blender which is currently used to start the animation project. The laptop must require this software to begin the testing.

6.2.2 Test schedule

The duration of the testing phase will be about 6 hours. The testing cycle consists of a test run with Blender which renders 10 frames of animation repeatedly by modifying different render settings of the software.

6.3 Test Strategy

First, the animation files which is blend file will be sent to my laptop and the test run will be done. Since one of the objectives in this project is to evaluate the best render settings that can reduce rendering time and produce nice look animation, so the

test run will be the rendering process of animation. The main purpose of the test is to analyze the suitable render setting requirement to render the sequence of images in a short time with better quality. After evaluating the objective of the project, the finalized animation video will be produced.

6.4 Test Implementation

First, the test will be done with the Blender software. After the animation is done, it will be undergoing a rendering process. In this testing, only 10 frames of the animation video will be rendered to find out the suitable way to render the remaining frames. The different ways will be implemented while rendering the sequence of images, the render settings that will be manipulated are the Graphics Processing Unit (GPU), denoising support, render sample, tile size, and light bounces. With the manipulation of the render settings, the average render duration will be recorded and come out with a better solution to reduce the render time. After that, 1 of 10 of the frames will be taken and compare with online tools to determine which frame has the better quality.

6.5 Test Data

Below is the checklist of the test in Blender software. The test will be conducted targeting the render settings shown in the checklist.

Table 5: Checklist of Test

No.	Render Settings
1.	GPU Usage
	- With GPU
	- Without GPU
2.	Denoising Support

	- OptiX
	- OpenImageDenoise
	- NLM (Non-local Means)
3.	Render Sample
	- 8
	- 30
	- 128
4.	Tile Size
	- 64x64 pixels
	- 128x128 pixels
	- 240x216 pixels (Auto tile size)
5.	Number of Light Bounces
	- 4
	- 8
	- 12

The test data are then used for the analysis to get the result. The data will be shown with a form of a table and line chart.

6.6 Test Results and Analysis

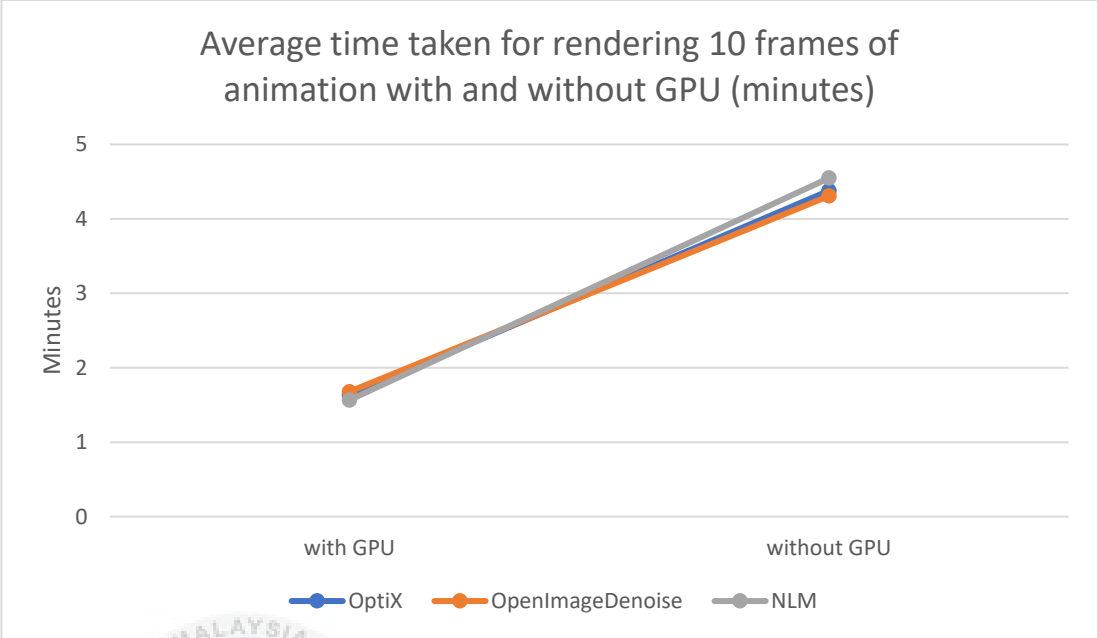
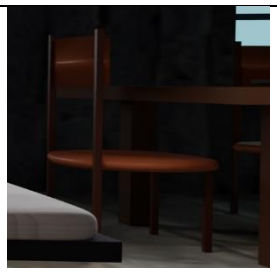
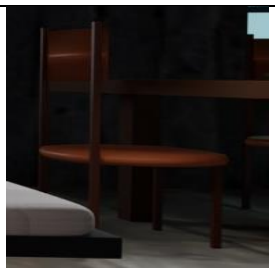
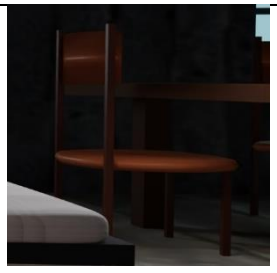
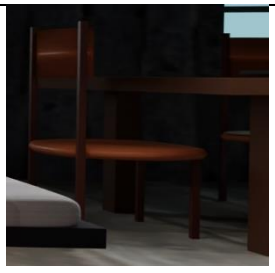


Figure 6.1: Average time taken for rendering 10 frames of animation with and without CPU

Table 6: Rendered image comparison with and without GPU

Denoiser	With GPU	Without GPU
OptiX		
OpenImageDenoise		

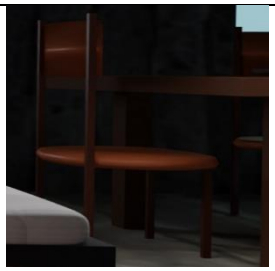
NLM		

Figure 6.1 shows the average time taken for rendering 10 frames of animation with and without GPU. From the result from the graph, using GPU to render frames has the best advantage of reducing rendering time compared without GPU, but the render duration is almost the same with different denoiser. Table 6 shows the image comparison, the table shows that the quality of each image is the same. This can be concluded that with the manipulation of GPU usage, the quality of the animation will not be influenced.

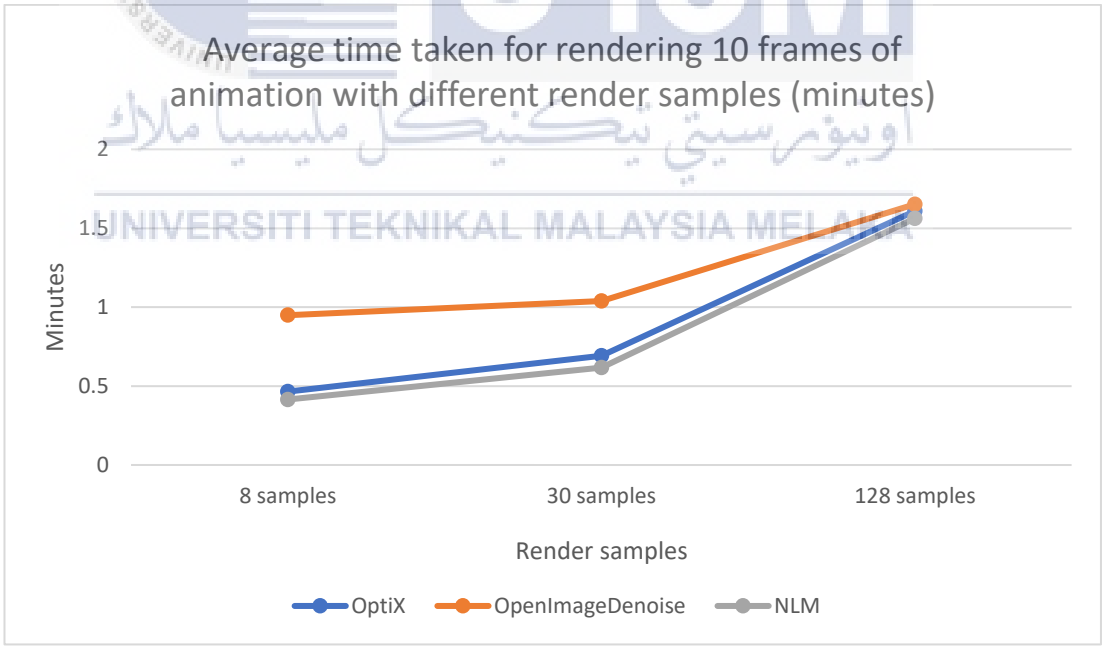


Figure 6.2: Average time taken for rendering 10 frames of animation with different render samples

Table 7: Rendered image comparison (render samples)

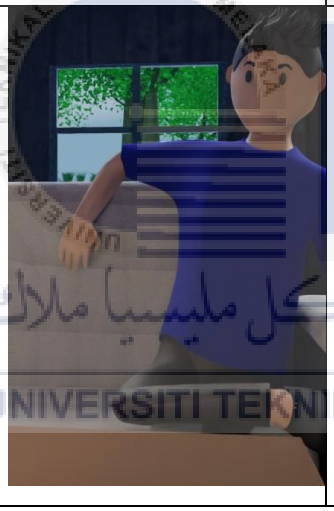
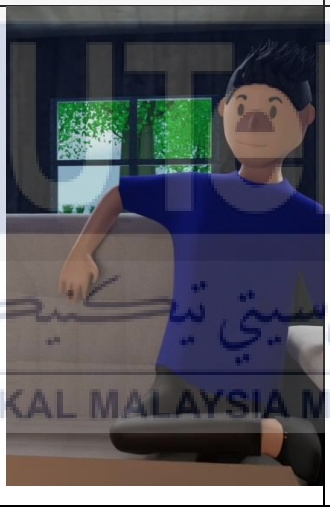
	8 samples	30 samples	128 samples
NLM			
OptiX			

Figure 6.2 shows the average time taken for rendering 10 frames of animation with different render samples. From the graph, the duration of rendering with only 8 samples is shorter than 30 and 128 samples. Table 7 shows the rendered image comparison with different render samples. From the comparison with 8 samples and different denoiser, it shows that the quality of the image render with OptiX denoiser is greater than the image render with NLM denoiser. The images that render with 128 samples almost have the same quality compared with 30 samples. This can be concluded that render the frames with OptiX denoiser and 30 samples are the suitable settings to reduce the render duration for the project.

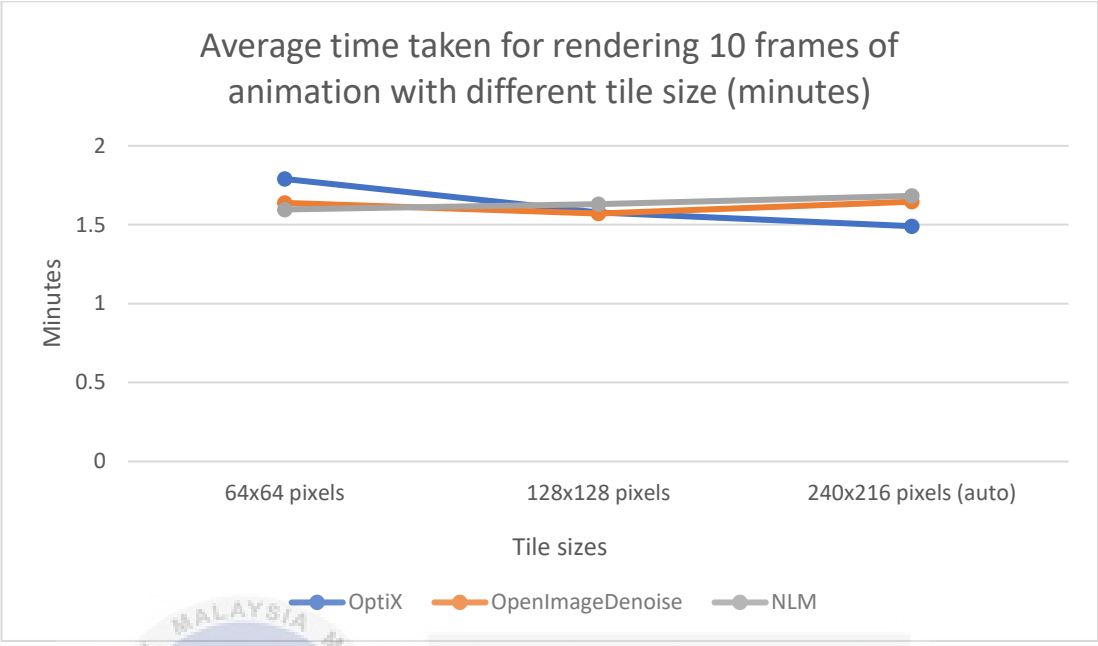


Figure 6.3: Average time taken for rendering 10 frames of animation with different tile size

Table 6.3 shows the average time for rendering 10 frames of animation with different tile sizes. From the graph above, it shows that with the auto tile size setting, which is 240x216 pixels, the render duration is the shortest when using OptiX denoiser compared to others. The manipulation of tile sizes will not influence the quality of images.

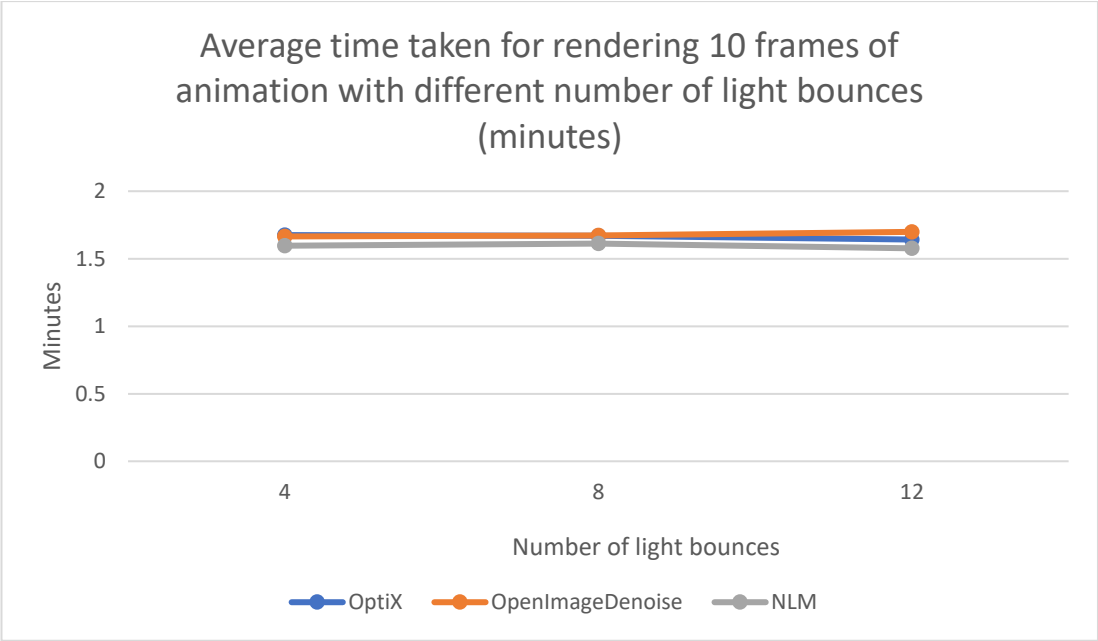


Figure 6.4: Average time taken for rendering 10 frames of animation with different number of light bounces

Table 8: Rendered image comparison with different numbers of light bounces

4	8	12
		

Table 6.4 shows the average time taken for rendering 10 frames of animation with the different number of light bounces. From the result, there is a slightly different render duration with a different number of light bounces. From Table 8, the quality of the images is the same because the current frames have no reflection between light and

object. This can be concluded that it is good to use fewer light paths if there is no glasses or other models that may cause the reflection to reduce the render time.

One of the articles from blenderguru.com stated that switching to GPU rendering is able to improve the rendering time by 12 times. After that, change the number of light bounces by experiment with the settings to find out which value can achieve better qualities without wasting render time. Based on the study, the optimal tile size for GPU is 256x256 which is automatically changed by Blender. Last but not least, there is not much difference when rendering the animation with 2000 samples and 5000 samples, so the author recommends the developer reduce the render samples because the audience will not notice the details of the animation.

In conclusion, all the results above had proved that the difference in render settings will influence the render time and the quality of animation. The suitable configuration of render settings that tested in the checklist are rendering the animation with GPU, OptiX for Cycles rendering denoiser, reducing render samples, auto tile size depends on hardware specifications, and fewer light bounces per frame without losing the quality of animation.

6.7 Conclusion

In this chapter, the test plan is discussed, and the test environment and test strategy are stated. The test plan including the test description and test data is discussed. Finally, the test results are done and discussed in this chapter.

CHAPTER 7: PROJECT CONCLUSION

7.1 Observation on Issues and Futures

Every animation has its weakness and strengths, so does “Waiting For Your Return” that produced just in few months. There are weaknesses and strengths identified in the testing phase.

7.1.1 Project Issues

i. Narration

Animation requires a lot of effort and time to create. With the limited knowledge of animation skills, the content of the animation does not develop as more as expected. Narration and conversation between the characters can be added to make the animation more interesting.

ii. Audio

The downloaded audio comes from different sources on the Internet, and part of the audio used is self-recorded audio. The pitch and volume of all audios are not well adjusted when inserting into the animation. Other than that, some of the audio is not synchronized with the scene when the character performs acts.

iii. Limited resources

Due to limited resources, the quality of the animation does not reach satisfaction. There are contain some noisy frames in the animation that have not been solved when developing the project. The hardware that was used to develop the project was consuming a lot of memory, so that some of the techniques to denoise the frames are not supported.

7.1.2 Project Futures

i. Valuable animation

This animation is suitable for all people, including children, because this animation is an educational video that allows children to learn some important things after watching it.

7.2 Future Improvement

i. Graphic quality

The graphic is one of the media in animation and the improvement of the graphic can enhance the audience watching experience. Also, the content of the animation can be expanded to make the storyline more interesting such as add some conversation with each other in the animation with subtitles.

ii. **Audio quality**

The volume of the downloaded audio can be adjusted using other software to improve the quality, the other audio can be recorded using a special microphone.

7.3 Project Contribution

This animation can become another educational animation for children and teenagers. The children are able to learn some moral values that the animation wants

to convey. For teenagers who want to learn more about lighting techniques, also can get benefit from this animation.

7.4 Conclusion

In conclusion, after reviewing the whole project, the main purpose has been achieved by the animation “Waiting For Your Return” based on every goal defined in each chapter. The nice animation can perform a storyline that never exists in real life and allows the audiences to visualize the animation scene. The project can allow the animation enthusiasts to act as a guide for them in the future to produce a high-quality animation with a shorter time consumed. However, improvements described in this chapter are still required to make it becomes a better-looking animation, such as adding narration and storylines in the animation and improving the graphics quality, the hardware specifications need to be considered to meet the requirement for making good animation. Hence, the project is successfully developed, and it is completed within the specified time thus meet all the objectives.

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APPENDIX

FYP2 report_KHOO PEI HAOW

ORIGINALITY REPORT

22%	18%	1%	15%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	oaktrust.library.tamu.edu Internet Source	7%
2	Submitted to Universiti Teknikal Malaysia Melaka Student Paper	6%
3	eprints.utem.edu.my Internet Source	2%
4	www.ecgprod.com Internet Source	1%
5	www.coursehero.com Internet Source	1%
6	Submitted to Universiti Malaysia Sabah Student Paper	<1%
7	Submitted to Lincoln College, Lincolnshire Student Paper	<1%
8	Submitted to AFDA Student Paper	<1%
9	Submitted to Bridgepoint Education Student Paper	<1%