2022

ICTGAM433 Project Plan

ASSESSMENT 1

XIHAO CHEN | 30053752

IMMERSIVE STUDIOS

Table of Contents

Rendering In 3D Modelling/Animation/Game Development

Rendering refers to the concept of creating life-like images on a screen through the use of 3D software, achieved by computing the lighting/shadows, textures and camera angles of a 3D asset/scene. The end result is a two-dimensional image with the applied effects.

The rendering methods are split into either real-time rendering or pre-rendering:

- Real-time rendering is capable of creating life-like images from a 3D model/scene in ~33 milliseconds or less, providing instant feedback to the user.
- Pre-rendering involves generating a life-like image of a model/scene ahead of time, producing higher-fidelity results.

Rendering is essential for the above applications as through the rendering process, 3D models are given textures, brightness and surfaces for a life-like appearance. In the case of animation, rendering provides animators with the means to adjust the properties of the 3D models for advanced motion techniques, fluid simulations, etc. In the context of game development, real-time rendering allows for making minor adjustments to 3D assets without wasting time/processing power.

Design Brief Requirements/Summary

The requirements of the project are summarised below according to the design brief:

- A blender scene is supplied for rendering purposes, being used as a target for the future implementation of the assets into a game.
    - Materials may be changed as needed.
    - Compositing and any adjustments of assets are permitted.
- The rendering of three images each at a resolution of **1920 x 1080.**
    - The render times are expected to be less than **two (2) minutes**.
    - The result of the render is the main priority.
- Each image must have a different camera angle:
    - The camera angle must hide all 3D geometry artifacts.
    - No visible noise should be seen in each image render.
- Each image render result is saved as a **TARGA** file format, with a maximum file size of **800MB** for each file.

Rendering Software Used for Project

The rendering software to be used for the project is **Blender**.

Blender is a free/open-source 3D software that includes core functionality for modelling, sculpting, UV mapping, texturing, lighting, animation and rendering. The potential capability of Blender allows users to produce high-quality projects, assets and renders that are applicable for many purposes. Users are able to switch between the Eevee, Workbench and Cycles rendering engines at any point in the workflow:

- Eevee is a physically based real-time renderer.
- Cycles is a physically based path tracer.
- Workbench is designed for layout, modelling and previews.

Of the three rendering engines available by default, Cycles produces the most accurate results for renders with ray tracing at the cost of hardware resources, while Eevee provides real-time feedback with viewport navigation and minimal quality loss for renders. Workbench is primarily used for fast rendering during modelling/animation previews, with the other engines used for rendering purposes.

System Requirements for Rendering Software

Minimum Specifications

- 64-bit Quad-Core CPU with SSE2 support
- 8 GB RAM
- Full HD display (1920x1080)
- Mouse, trackpad or pen/tablet combination
- Graphics card with 2 GB RAM, supporting OpenGL 4.3
- System age less than 10 years old

Recommended Specifications

- 64-bit Eight-Core CPU
- 32 GB RAM
- 2560×1440 Display (1440p)
- Three-button mouse or pen/tablet combination
- Graphics card with 8 GB RAM

The Windows 10 desktops in the SMTAFE computer lab are sufficient for running Blender and working on the project. For at-home work, the personal desktop device is also sufficient, with potentially faster rendering times compared to the SMTAFE desktops.

Suitability of Rendering Software

3D Animation

Blender is well suited for creating 2D and 3D animations, providing users with the necessary tools out of the box within Blender. The grease pencil tool allows for drawing into scenes within 2D space, presenting creative opportunities to blend 2D drawings and 3D objects together for animation purposes. Blender also provides native rigging support, allowing for complex animations with objects that have multiple moving parts, such as humanoid and vehicular objects.

3D Modelling

The quintessential application of Blender is capable of rivalling other specialist modelling software. Blender's 3D modelling tools allow for actions such as bevelling, extruding and cutting through geometry for creating 3D models for any purpose. Blender comes with mesh and curve modelling options by default, with the 3D viewport tools allowing for efficient navigation and modelling workflow.

Lighting

Blender includes support for local and global lighting with its default render engines, with each having its respective options for controlling light in a scene. Local lighting options for scenes include point, spot, area and sun lights, while the global lighting options control the surface, volume and viewport lighting of the scene.

Rendering

Blender's three native render engines have their own unique approach to the rendering of 3D objects, materials and lighting, with users being able to switch the render engine used at any point in the workflow. The main rendering engines for producing renders are Cycles and Eevee: Cycles is the render engine which uses path tracing to create accurate lighting for environments, with Eevee being used for computational speed at a small expense of realism.

Texturing

Blender's integrated texture panel for the Cycles and Eevee rendering engines allows the user to change the image/procedural textures, environment maps and bump/normal maps of assets in a scene. The mapping of textures can be done in Blender via UV or coordinate mapping with additional controls for texture projection.

Shading

Blender includes support for many shader types for PBR textures, such as BSDF, emission, volume, background shaders, etc. With the node wrangler add-on installed, adding and mixing different types of shaders can be done via "drag and drop" on adjacent nodes, allowing for unlimited combinations of shader effects.

Technical/Resource Limitations

- Resolution – **1920x1080**
- Render time - **≤ 2 minutes**
- File format/size – **TARGA**, **≤ 800MB** per file (x3 files)

A software limitation for Blender in terms of rendering time is the vertex count and lighting/shading effects for the assets and scene. A software technical limitation that impacts the rendering quality is the type of rendering engine used. In Blender, three render engines are provided by default – Eevee, Workbench and Cycles. For this project, Cycles will be used to produce the rendered images. With Cycles, an additional consideration for hardware resources is required to ensure each rendered image is of high quality and can render in under 2 minutes.

Hardware limitations are determined by the device that Blender runs on, impacting the rendering times of each image render. It will limit the number of lighting/shader effects used in the scene and may prevent multi-tasking in the Blender viewport during the rendering process.

Resource limitations involve the available textures for asset modification, specifically the resolution and variants of textures. With the primary source of textures sourced from textures.com, the free tier limits users to 15 credits per day. Although sufficient for a handful of free textures, the lack of high-resolution textures may reduce the visual appeal of the rendered images.

File Format/Size Requirements

The design brief specifies the rendered images must be saved in the TARGA file format, with a maximum file size of 800MB for each rendered image. Each rendered image must be rendered at a resolution of 1920x1080, which can be configured within Blender. The .blend file for the project scene is pre-configured with some settings requiring manual input.

The free offerings from textures.com are around 0.5MB per texture file, averaging 2.5MB with the included bump, normal and specular maps. While there are no size limits for textures, the limitations described in the technical/resource section above must be considered to ensure the textures can render in a reasonable timeframe and quality.

Production Schedule

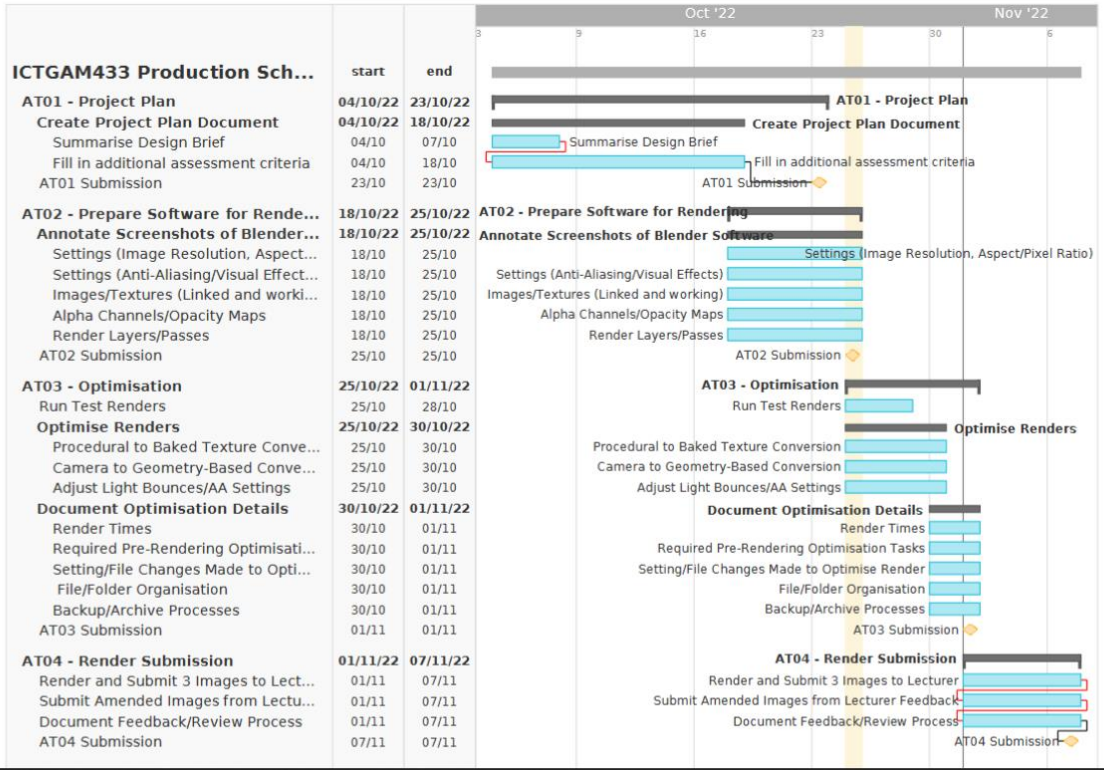

Figure 1 Gantt Chart outlining a proposed production schedule for the project.

The initial render scene supplied provides the 3D models of Samus Aran (Metroid) and Kermit (The Muppets), with the armatures posed to depict Samus shooting Kermit with the power beam. The background consists of a small section of rocky landscape (floor and rocks). As the Cycles render engine is used for the scene, production will require consideration of the quantity/quality of effects to ensure the rendered images fit within the design brief constraints.

Depending on the intended direction for the final render images, modifications may be made to the rock assets with textures and the number of rocks in the scene. The poses of the characters may be altered as well.

Photography techniques such as camera angles, rule of thirds, etc will influence the camera placement within the blender scene. An example of camera angles to use for the project are high/low angles with an emphasis on wide shots. Lighting changes can enhance the visual appeal of the rendered images by influencing the position of shadows on the assets.

References

Blender Foundation. (n.d.). *Free Software Never Looked This Awesome*. Retrieved from Blender: https://www.blender.org/features/

Kuska, A. (2021, June 07). *Top Reasons for Using Rendering in the 3D Animation Process*. Retrieved from cad crowd: https://www.cadcrowd.com/blog/top-reasons-for-using-rendering-in-the-3d-animation-process/

RealSpace. (2022). *WHAT IS 3D RENDERING - A STRAIGHTFORWARD GUIDE TO UNDERSTANDING THE 3D VISUALIZATION PROCESS*. Retrieved from RealSpace: https://www.realspace3d.com/resources/what-is-3d-rendering/#:~:text=3D%20rendering%20refers%20to%20adapting,the%20creation%20of%203D%20models.

Wharf Street Strategies. (2019, October 04). *Rendering: A new sunrise in the game design industry*. Retrieved from Medium: https://medium.com/wharf-street-studios/rendering-a-new-sunrise-in-the-game-design-industry-918455ee3f18#:~:text=By%20means%20of%20rendering%2C%20we,it%20a%20real%2Dlife%20appearance.&text=Those%20videos%20and%203D%20animations,to%20viewing%20the%20final%