

KV6003: Individual Project

Project Terms Of Reference

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Design and Implement a Rendering Engine

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1 Background

Computer graphics is a topic that has always greatly interested me, especially when it comes to real-time rendering. I have always wanted to know how software such as game engines, 3D modelers, and other similar computer graphics software work. As an aspiring computer scientist, I strive to learn how such software is not only created, but also designed. I want to learn just how a rendering engine is developed in a software engineering perspective, and to also learn the core components of real time rendering. A real-time engine display three-dimensional data as images on the computer at an interactive display rate. The display rate is measured in frames per second(fps), however for a real-time renderer the fps should be higher than 15fps for it to be considered smooth. Real-time renderers are very important for visualizing 3D scenes and environment, it takes a great deal of knowledge, and patience to run these computationally complex software to run consumer grade hardware. It also has you learn how to work with a Graphical Processing Unit(GPU), as well as the Central Processing Unit(CPU). I will be exposed to new concepts such as how lighting, and shadows are implemented in a renderer.

2 Proposed Work

I will be using C++ as my programming language of choice, and OpenGL which is a graphics API that will allow me to create graphics programs. The goal for creating a rendering engine is to manage graphical effects, such as lighting, shadows, texture mapping, and to apply them to a 3D scene and have them interact with other 3D objects. A rendering engine should not be confused with a game engine which would have me implement a physics system, and an animation system as well.

I wish to build an engine with a 3D scene that will showcase various graphics effects. I want to be able to move around the 3D space using a camera, so I can be able to look at the scene at different perspectives. I want to be able to turn toggle of, and on certain features to be able to show what the scene will look like without them, for example toggling off shadows to show how they may impact the scene visually.

3 Aims and Objectives

Aims

- To Build a Rendering Engine
- To design a maintainable piece of software using modern design principles

Objectives

1. Use software engineering design principles to implement the renderer.
2. Learn the required theory that will be needed to further understand my project.
3. Implement lighting in scene.
4. Implement Shadows in scene.
5. Implement Shaders in scene.
6. Implement Skybox in scene.
7. Implement Reflections in scene.
8. Implement Texturing in scene.
9. Implement a 3D scene environment to showcase the implemented features.
10. Implement Model Loading into scene.
11. Test and debug the system using tools specific for graphics programming.

4 Skills

1. Programming in C/C++ (from module KF4006)
2. Software Engineering (from module KF5012)
3. Algorithms (from module KF5008)
4. OpenGL API (Learnt enough to build a 3D scene)
5. Computer Graphics Theory (Currently Learning in Module KF6018)

5 Resources

Hardware

- Computer

Software

- Visual Studio
- GPU debugger

6 Structure and Contents of Project Report

Planned Chapters

1. Designing the Renderer
2. Rendering Engine Theory
3. Implementing the Rendering Engine
4. Creating the Scene environment
5. Testing and Debugging using bespoke Software
6. Evaluating the Rendering Engine

7 Marking Scheme

Project Type Software Engineering projects

Project Report Analysis

1. Designing the Renderer
2. Analysing Rendering Techniques

Synthesis

1. Implementing the Rendering Engine
2. Creating the Scene environment
3. Testing and Debugging using bespoke Software

Evaluation

1. Evaluating the Rendering Engine

Product Deliverables list

1. Class Diagram
2. Use Case Diagram
3. Rendering Engine Source Code
4. Test Plans

8 List of Appendices

Will Add soon

9 Project Type

This will be a Software engineering project

10 Project Plan

