CPSC 490 Proposal: Rendering Exploration in Unity

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Introduction

I wanted to explore more techniques and theory within the computer graphics domain while strengthening my foundational knowledge in the context of gaining applicable skills in industry. With that in mind, I decided to create a game in Unity with an emphasis on rendering and shaders.

Rendering is the process of generating 2D or 3D images from models by means of a computer program. The graphics pipeline describes the necessary steps a graphic system needs to go through in order to actually render an image. The photo below is a high level overlook on the graphics pipeline.

3D Graphics for Game Programming (J. Han)

I am concerned with the vertex and fragment processing steps, which utilizes shaders to describe the traits of either a vertex or fragment (a pixel in the screen space) accordingly. A shader is a program that runs in the graphics pipeline to inform the computer on how to render each pixel based on information provided in the model and are used to control color, lighting, shadows, and other properties. It can also be used for effects such as bump mapping, volumetric lighting, etc.

Project

The initial aim was to create a fully functioning game in Unity; however, my group mate and I realized the scope might be too large for our timeline, so we decided to focus on creating the scripts, tools, and shaders necessary to develop a game we would want to make. The goal is
collect different animals by growing trees that can attract them, but both the weather and other trees that are growing in close proximity to it affect the way trees can grow—which then affects the type of animal it attracts. It is a collectible game we came up with after taking into account different topics in graphics we wanted to explore.

These are the following aspects of the game creation of which I am in charge:

- Pulling in real-time weather data to accurately represent the same weather in game
- Texture/image mapping on the trees and animals based on weather
- Making a toon/cel-shading shader to mimic the look of a game
- Adding volumetric lighting

Additional components to add if time allowed

- Figuring out object management in Unity to store information about the animals and trees the players collect and grow
- Adding other weather components to add to the ambiance of the scene
  - Particle systems for precipitation
  - Shaders for fog
  - Puddles and ripples
  - Other types of lighting

Implementation Details

This will require me to become very familiar with Unity’s interface and rendering pipeline. I will make use of Unity’s Scriptable render pipeline in order to add customization, and the script portion will be completed in C#. I will utilize HLSL to make the appropriate shaders. I might explore Unity’s post-processing options and see what is involved to use that. Different rendering techniques will involve me researching the math and theory behind it to accurately conceptualize and implement the feature. I will also have to learn how to integrate real-time weather into Unity by using some sort of API or script.

It is unclear whether more technology will be involved due to my limited knowledge on Unity, so the implementation details will become clearer as the project progresses.

Schedule

Write & submit proposal
  Week 1 (9/15-9/21)
Gain familiarity with Unity’s interface and functionality
Learn C# and HLSL
   Week 2 (9/22-9/28)
   Week 3 (9/29-10/5)
   Week 4 (10/6-10/12)
Write texture/image shaders for tress & animals
   Week 5 (10/13-10/19)
   Week 6 (10/20-10/26)
Write toon/cel-shading shader
   Week 7 (10/27-11/2)
   Week 8 (11/3-11/9)
Add volumetric lighting
   Week 9 (11/10-11/16)
Pull in real-time weather data
   Week 10 (11/17-11/23)
Accommodation for delays or Opportunity for enhancement
   Week 11 (11/24-11/30)
   Week 12 (12/1-12/7)

Deliverables

At a bare minimum:

   • Scripts
   • Shaders
   • A gallery of images & videos
   • Final report

If time permits, a basic game that runs in Unity that utilizes both the work of my group mate and mine.

Sources

There are many online tutorials and documentation on Unity, scripting, and shaders to reference as I proceed through my project. As techniques and topics within computer graphics appear, appropriate research will be conducted through online resources and textbooks.