Procedural cloud shader

Requirement specification

Project 2
The goal of this project is to research and implement a procedural, volumetric cloud shader. The following document reveals the process of creating such a shader from both a technical and mathematical perspective, considering different algorithms for techniques like noise generation and raymarching.

Field of Studies:	BSc in Computer Science
Specialization:	Computer perception and virtual reality
Author:	Matthias Thomann
Supervisor:	Prof. Urs Künzler
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Berner Fachhochschule — Haute école spécialisée bernoise — Bern University of Applied Sciences

Contents

1 General

1.1 Purpose

This document serves the purpose of defining and clarifying the goals, which the project 'Procedural cloud shader' is supposed to achieve. Furthermore, the requirement specification allows for a more accurate evaluation of the achievement of objectives and of the result itself.

1.2 Revision History

Version	Date	Name	Comment
0.1	February 29, 2020	Matthias Thomann	Initial draft

2 Scope of Work

2.1 Initial Situation

With shaders making up a large part of visual effects in games and in game development generally, they have become more and more important throughout the years. Due to their high flexibility, it is possible to create a wide variation of implementations as well as cheap alternatives to otherwise highly complex and computationally demanding simulations, such as simulating water, fire or clouds.
This project specifically focuses on clouds. But to achieve a realistic look and feel of the clouds, certain methods and knowledge are required. The motivation for this project is to implement such a shader based on information gathered during the given period.

2.2 Goals

The primary goal of the project is to research and document rendering techniques for real-time procedural cloud shaders. Additionally, a prototype is to be implemented based on the newly discovered knowledge.

2.2.1 Mandatory Goals

The following tasks must be accomplished during the project:

- Understanding of the basic nature of clouds
- Understanding of what makes good clouds in games
- Research common methods and algorithms involved in rendering procedural clouds, including...
  - volumetric rendering
  - procedural noise generation algorithms
  - the concept of ray-marching

2.2.2 Optional Goals

For further optional research, these tasks can be looked into:

- Light scattering illumination and sub-surface scattering
- Performance optimization
- Simulation of gas

2.3 Educational Objectives

Educational objectives include shader programming, rendering techniques, common algorithms used in computer graphics, a general understanding about the role of clouds in games and other topics.

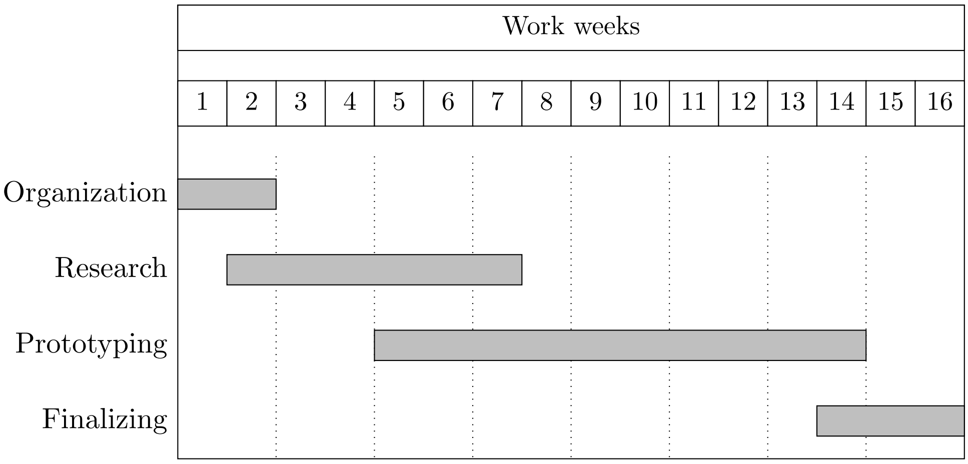
2.4 Used software

All documentation will be made in Visual Studio Code. The shader will be implemented in Unity. The chosen language is HLSL.

3 Planning

3.1 Schedule

The project will be split into four primary task groups, namely organization, research, prototyping and finalization. Put into relation with the duration of the project, an estimated schedule looks like this:



4 Results

4.1 Documentation

The following documents must be submitted for grading:

- Requirement specification
- Project documentation indcluding:
  - Conceptual formulation
  - Comparison and details fo methods and algorithms
  - Details of implementation
  - Result report

4.2 Implementation of the Shader

The Unity project, including the implemented shader code, will be managed and stored in the given Gitlab repository[1]. This will also serve as a form of submission for grading.

4.3 Submission terms

The project must be submitted in digital form before the XXth of June 2020, 12pm.

Glossary

HLSL High Level Shading Language. 3

References

[1] *Gitlab: Cloud shader repository.* [Online]. Available: `https://gitlab.ti.bfh.ch/cpvr-students/cloud-shader`.