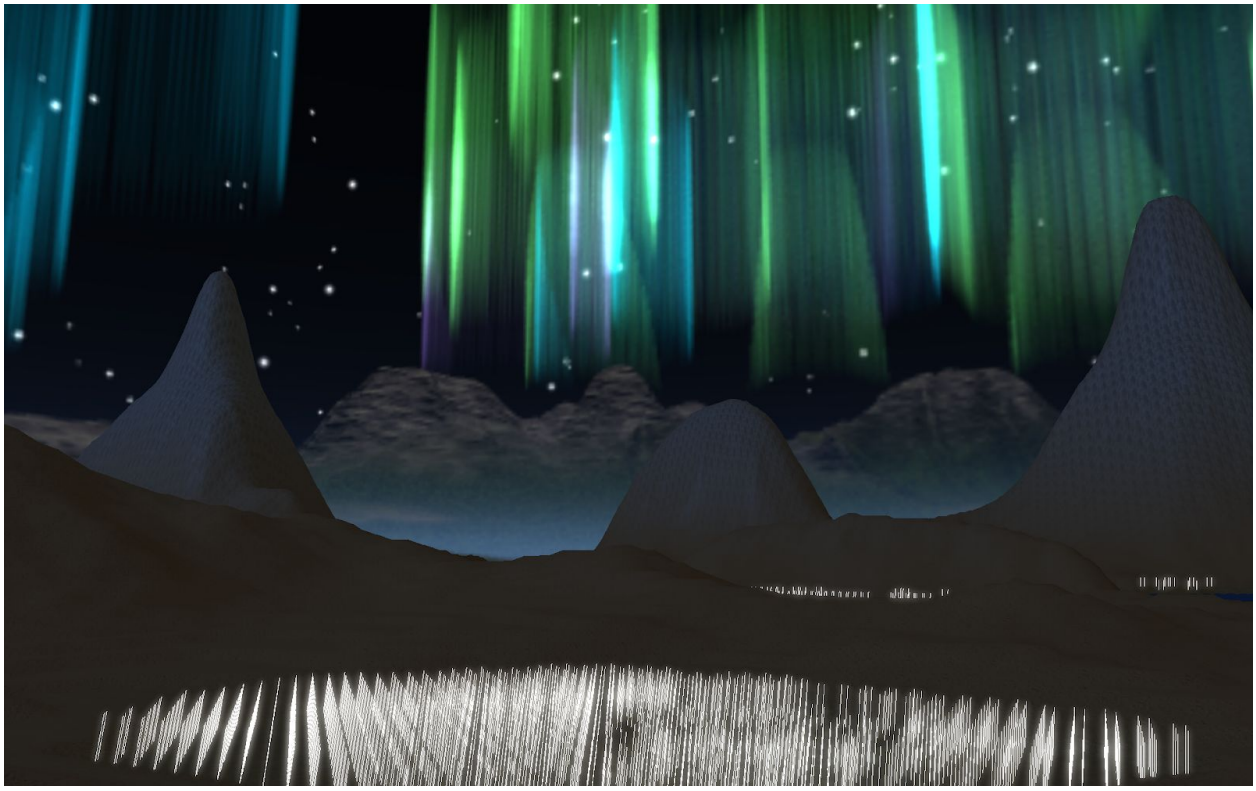
CSC8502 Advance Graphics Coursework



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Introduction

My objective with this coursework was to have a working engine that I could later reuse and add new features. I started with what I thought of being the core features: scene management, lightning and shadows. This took most of the time but after that the development speed increased and now it's very easy to add or remove features and also toggle them on and off between scenes. I liked programming shaders and that influenced me choosing some extra effects other than the recommended ones.

A video demonstrating this project is available here:

Scene Management and Keys

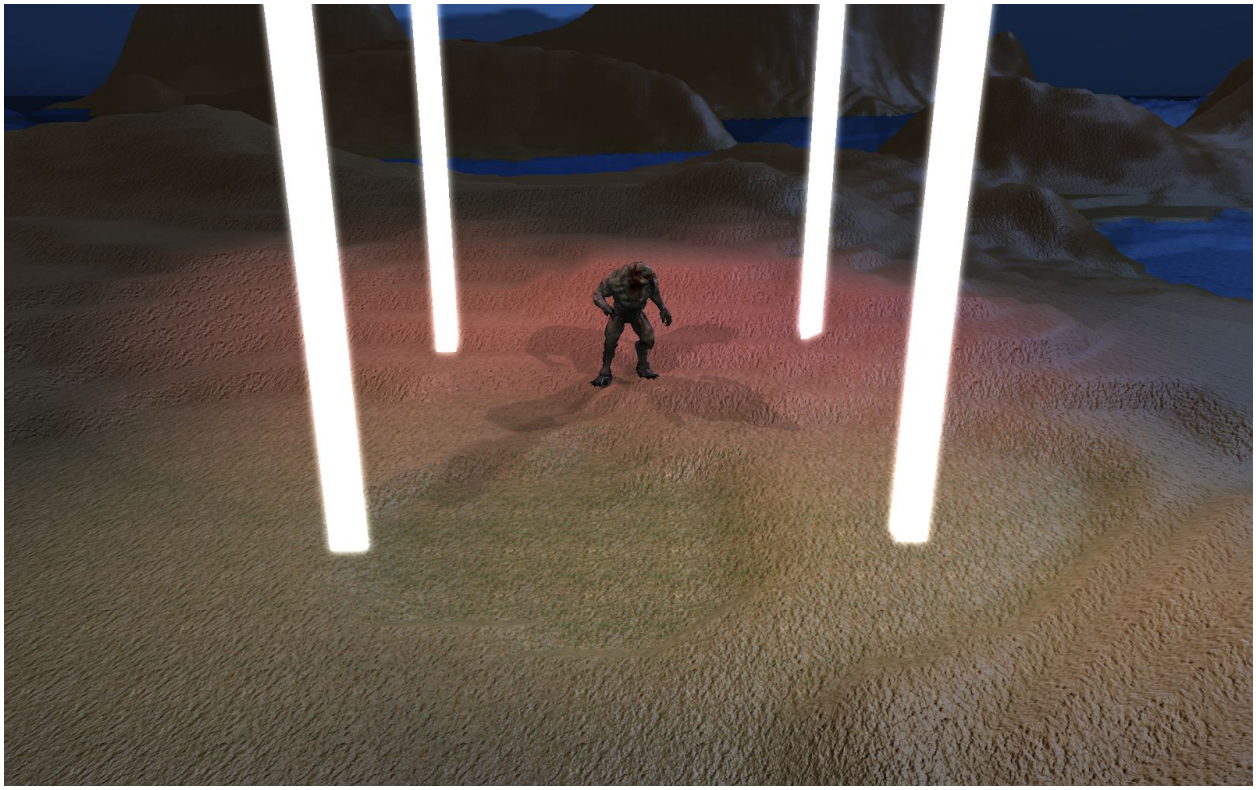
The objects in the scene are structured with a Scene Graph. Like the tutorials, the scene graph groups the objects in two lists (opaque and transparent) and then draws them according to that and also the distance from the camera. I added an "isActive" variable to enable/disable objects in different scenes and also made possible to rotate objects.

The **arrow keys** change the current scene back and forth and the **number keys (1-3)** select the specific scene. **Tab** also places the camera in the position of each light.

Lightning and Shadows

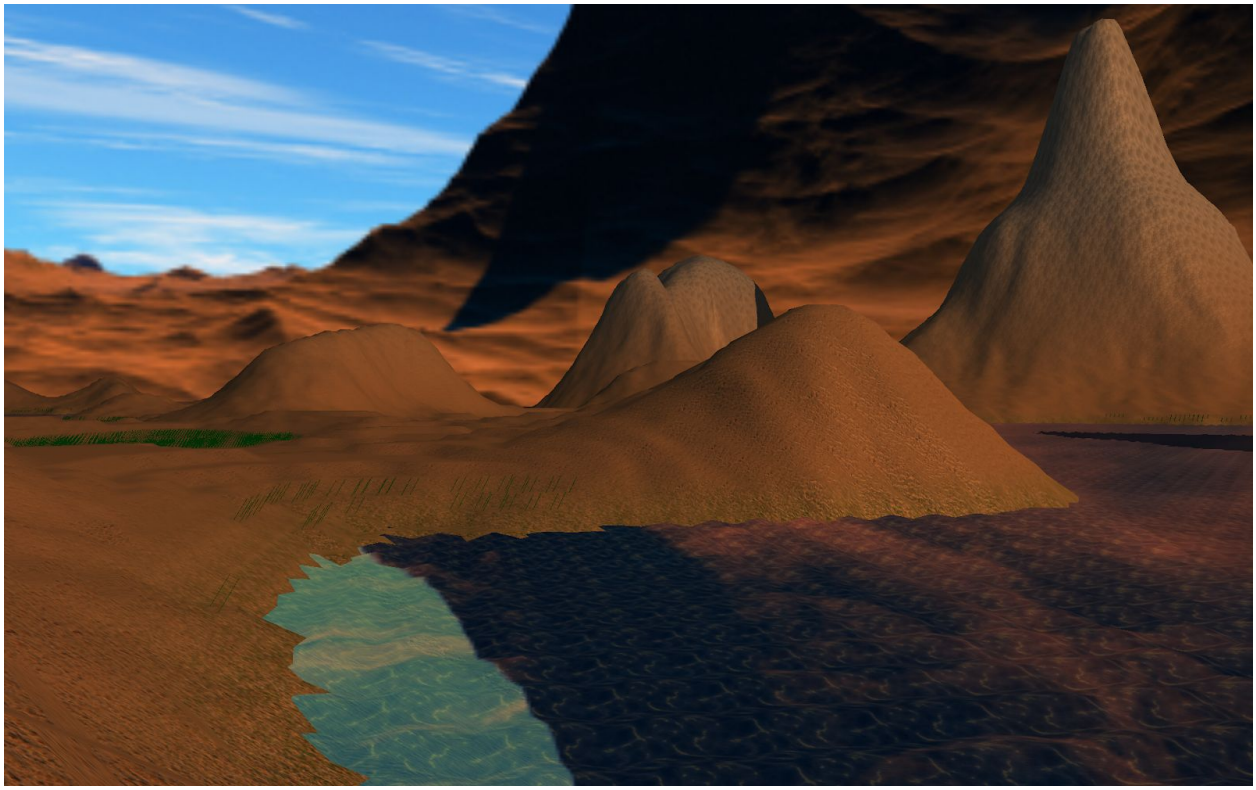
Every scene features the same lightning and shadowing system. It's using deferred shading and each light has the ability of casting shadows. There's a list of lights and a list of activeLights and all the lights in this last list will be used to cast the shadows (up to a maximum of MAX_SHADOWS defined). This also allows to turn on and off lights between each scene.

Usually there's a main light (sun/moon) that gets a specific projection view and every other light uses the same projection view that allows better shadows at close distance.



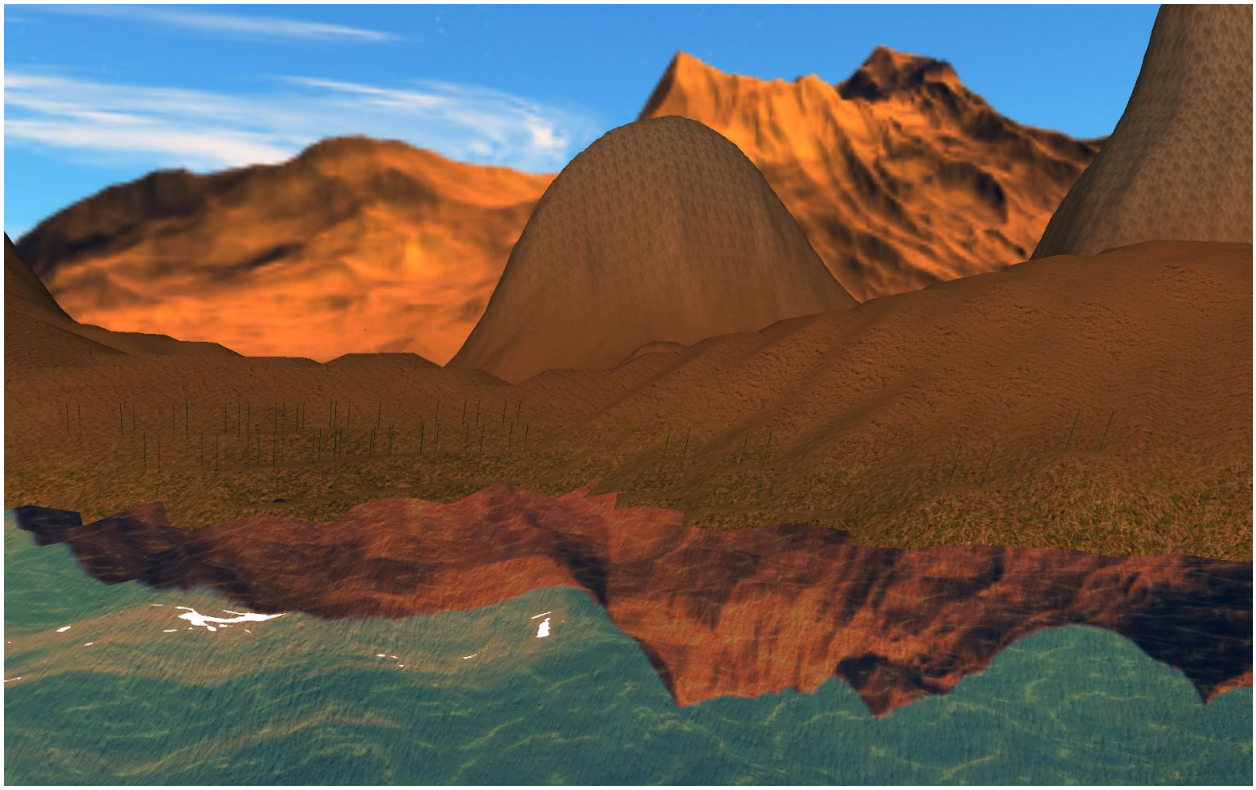
Texturing

Textures are used in the hellknight and in the water but the most interesting application is with the heightmap. Here I pass the shader a list of textures and depending on the height it chooses which texture or combinations of textures to use. The final product has mostly sand with whiter montains, darker bottom of the lakes and a mossy coast.



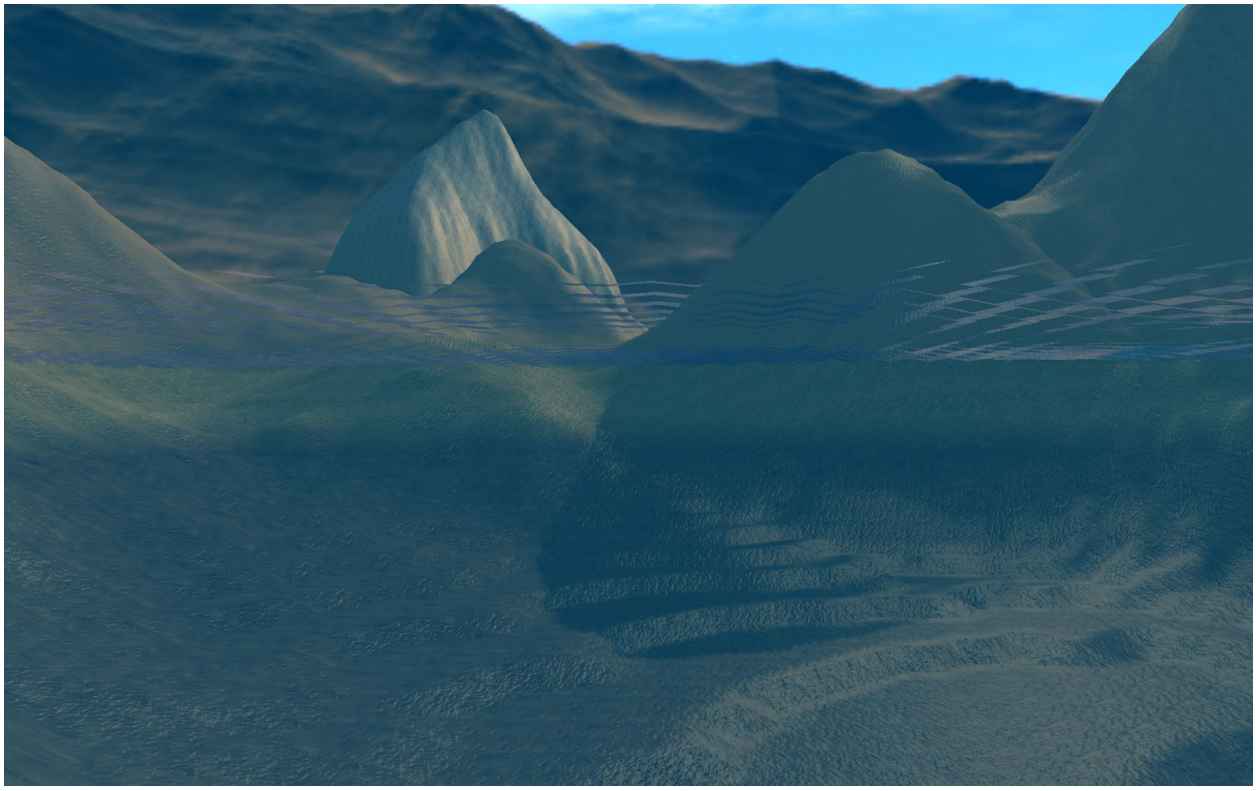
Skybox and Reflections

Each scene has its own skybox and the water reflection changes according to it. The water is also transparent and its possible to see the sky and bottom of the lakes at the same time. The skybox is rendered to the combined FBO only when the depth test is equal to 1 (which means nothing was drawn there).



Post Processing Effects

There are 3 post processing effects being used: blur, bloom and underwater effect. The blur is the same as the tutorial with some increased passes. Bloom is done in 3 steps, filter the image by brightness, blur this output and then merge it with the original. Underwater is done completely in the shader where it chooses the color accordingly to the current camera's vertical position.



Extra Effects

The grass in the scene is made using a geometry shader. It uses the center of the previous triangle and extends it with line_strips to make a very basic effect of grass. It also checks the world position and normal to decide if it should draw it or discard it.

I also used time to influence different aspects of the scene but i found that the best ones were making the water and the grass move slightly.

The project also contains skeletal animation but without much exploration on this subject.