

Reflection on 1st semester coding Project

Cloud simulation using cellular automata

Summary

As my projects scope was too large for a first Semester Project the results are not covering my initial target. The elusiveness of shader programming did, although definitely facilitating learning about this topic, cost a lot of time just to be discarded. Meaning that the goal of computing the cellular automaton directly on the gpu was not achieved. The logic was rather implemented purely in C#, which was much more straightforward to write for me. But even on the cpu, if only the simulation logic (no visualisation) runs I achieved over 1200fps on a high end PC, which is much more then my target of 60 fps. However when the cpu visualisation is enabled the frame rate drops to below 1. But the logic works!!!

Going forward

The topic of this project was chosen to get more into shader programming and c#. While the c# side worked out quite nice the shader part did not. And there are the next steps to be found. The goal is to create a vert/frag shader that takes the simulation space as setup in c# as the bounds of a ray march logic to calculate the lighting to actually see the cloud. So major steps going forward are:

Create ray march shader that checks via sdf function if a step is whiten simulation space

If step in simulation space

- map step position to simulation space index
- sample density at step position
- raycast from step position to light source taking density into consideration
- output pixel color & alpha
- go to next step

Else return

A major problem here will be the communication between cpu & gpu. Probably the shader will only work efficiently when the simulation is 'finished'. Assuming this is the way to go forward it could look something like this:

If simulation is finished

- straighten 3d array into 1d buffer
- dispatch 1 d buffer to gpu as RWStructured buffer
- let the ray marching begin

Conclusion

Overall this project was fun and a good learning experience. I will definitely continue to work on it in the future. Especially on the shader side of things, I need a lot more time and effort to produce something functional. But I am looking forward to it!