Project Log

Alexander Arvidsson

April 9, 2020

Contents

Introduction

This page will consist of the collaborative log from each group member and eventual problems and challenges that the group encounters during the development process of the project.

Usually, the group will write their own individual efforts at the end of the week and then compose it into one shared log which will be written here.

Week 1

This week marks the start of the project, and thus a lot of research and administrative tasks was required, such as decisions regarding tools and a schedule.

Every decision that we make during meetings should be documented, so we decided to create a group contract and a log book. Initially, the log book were only the individual's own weekly logs, but we later realized we needed a shared log that summarized the overall progress of the project, which is the log that you are reading right now.

Here are some decisions that were made during this week:

- The secretary during the meetings should be rotated according to this order:
    1. Marcus Ansamaa
    2. Alexander Arvidsson
    3. Anton Håkansson
    4. Viktor Truvé
- The report should be written in LaTeX

We decided to use Google Calendar for scheduled meetings, and that we should have two lunch meetings as well as 3 workshops every week. The lunch meetings usually were an hour long, over lunch, while the workshops were all 4 hours, placed during Thursday afternoon, Friday morning and Friday afternoon. The purpose of the workshops is to meet up with the group to sit down and get work done, while also being able to get help from eachother if need be.

For communication, we decided to use Slack as it is the easier platform which everyone was familiar with, which also gave us a more organized form of communication than other platforms would offer (for example, Messenger).

File sharing and development ended up being Google Drive and Github. All our documents and resources we collect during the projects lifetime would be placed in drive for ease of access, while the project code and report is in two separate Github repositories for version control.

We got to meet our supervisor during this week which guided us to get a good start with the project, and we were also able to ask any questions we had before getting started.

Most of us who were available also attended the introductory seminars during this week.

The rest of the time was spent invididually, researching different aspects of the project to get a deeper understanding of what requirements and specifications our project would need.

Week 2

This week also had a few lectures, and Alexander also came back from his vacation so we made sure to get him up to date.

Lots of subjects were brought up during the workshops this week, such as what method we wanted to use for different parts in the world generator. We quickly came up with two methods of generating roads, and because we could not all agree on one method we decided it was best to create two separate demos that would demonstrate the method and its pros / cons.

The first demo made use of road building Agents that were deployed onto a 2D-plane, and placed down roads while interacting with the road network. This was initially a very basic system that simply had Agents walk in straight lines and sometimes branching off into more Agents.

The second demo used a recursive approach where it split the world into small cells, and each cell could further be subdivided. The idea was to place down a lot of points, split the cell into two by creating a line between each point, and then recursively applying that algorithm into more detail.

We decided to postpone selecting which tools to use for our project until next week, because

we wanted to research which tool would suit us best and needed more time.

In this week we attended a few lectures. We had our first 3 work meetings, started on the project plan, developed 2 demos for the road generation, and further discussed the specifications of the project. The first road demo made use of road building agents that were deployed onto a 2D-plane, and built outwards. The second demo used a recursive approach were it split the world into small cells. We made a lot of admin related decisions. We also researched a bit.

Week 3

In this week we have put a lot of effort into the project plan. We have finished a first draft for feedback from the supervisor. We have also decided which tools (Unity/C#) we will

use to develop the end product. Furthermore we have also defined common terminology for referencing the different sections of the road subdivisioning. We have also expanded the prototypes of road generation with road strategies for different types of city types (Paris, Washington) and more natural streets. We have defined a pipeline for the program which essentially means that we have finalized a design for the algorithm.

Week 4

In this week we had a very constructive meeting with Staffan who gave us tips on how to improve our current project plan. Jacob also set up a Unity-base project. Although specific sections were originally assigned to be written by project members eventually all parts of the plan was to some degree rewritten or modified by someone else. Everyone made an effort to make sure that each of the chapters were well-written and together made up one coherent text.

Week 5

"In this week we started programming the different generators. Theodor worked with the BuildingGenerator and the PlotGenerator, Viktor worked with the ParkGenerator, Anton and Alexander with the RoadGenerator, Marcus with the TerrainGenerator. Jacob has worked with FBX export to work in runtime, and had to try a lot of options to get something to work. One of major problems has been to make the FbxExporter in Unity to not depend on Editor code. Jacob also made a basic UI that resembles the mock. Anton worked on generating a road mesh following a (poly)bezier spline for the Road Generation."

Week 6

In this week everyone kept working on the generators from last week and improving them. Viktor and Anton also spent time on preparing the half-time presentation. The progress in output from the generators will be provided as images, and more detailed descriptions of how the work progress looked like will be given in the individual week-logs. Although a very rough draft of it the road generation logic from Anton and Alexander has started to be merged together. The park generator is currently in hiatus as Viktor and Theodor work together on implementing a polygon divider. We have working CI builds and linters now. We have proper terrain, population, road, park, building (only 1 building type though). We lack plot and block generator. We also lack a parking generator, but that wasn't included in the scope of this iteration. Next week we will start a new iteration. The current FBX exporter only works in editor runtime which is a major concern.

Week 7

In this week Anton and Viktor held the halftime presentation. Viktor spent most of the rest of the week after that working on the PathGenerator for the parks, he was also assisted by Anton. Anton worked on coupling the generated road network with the spline and road mesh logic(Heavily Assisted by Alexander). Furthermore, he also has spent some time on generating a more complex shape for the road mesh (WIP). Jacob wrote on the polygon extractor part of the block generator. Alex and Jacob merged road generation functionalilty and block gen inset stuff. Alex implemented the block gen inset stuff. Jacob got a .GLTF and .GLB exporter to work in runtime. There seems to be some limis to the new exporter, but it works better than the last one. Marcus worked on adding water feature to the terrain and tweak the textures.

Week 8

This week Anton worked on creating intersections between roads. At the moment the outline of the intersection looks reasonable - however, no actual complete mesh is generated except for the arc “”corners“” between two roads entering the intersection. Alexander has worked on a general noise generator component that can be used in many parts of the application, and also implemented the noise in the road generation to create highways outside cities that are guided towards high populated areas. Jacob worked on FBX -> glTF for terrain since FBX didn't work without depending on UnityEditor. Since Unity's terrain is dynamic it doesn't work well in exporting as model, you can convert it to a mesh but that also requires UnityEditor. Thus, Jacob worked a lot on converting this terrain into a mesh-based one, integrating it with noise module, and supporting multiple textures and such. Marcus has been working slightly on camera movement so that the user can look around the city.

Week 9

<Exam week>

Week 10

In this week, Marcus has worked on the UI for the terrain generator, adding sea level, x offset and z offset as modifiable options. A lot of PRs were reviewed/merged such as Mesh Terrain, Noise module, plots and buildings. We aso started on the final report and wrote about noise in the Theory chapter. Viktor spent this week adding the Park Generator to the World Generator and doing a little bit of report writing. We started doing daily meetings online. Alexander worked on the road generation so that it now adjusts based on terrain slopes and sea level in

such a way that it doesn't enter seas or tries to ascend to steep hills. This week Anton spent on reworking the generated road meshes (simplifying by removing crosssection, only road width and sidewalk now) and tweaking the intersections to a way that more similarily resembled CityEngine's intersections(WIP).

Week 11

Jacob added a skyscraper generator, 5 pages were written on the Theory chapter (Noise, L-systems, Search-based PCG and Voronoi Diagrams). Marcus has finished the terrain options: terrain offset and sea level sliders. Using the sliders, sea level can be adjusted and the user can move along the terrain by entering a speed given to the sliders. Alexander worked with improving generation in the UI, like separating the road and street generation and also implemented block and plot types so that different things can be generated like parks or skyscrapers. Anton has also been making improvements on the generated road network mesh. This includes resolving bugs for specific intersections cases that caused the intersections and roads to stretch and occupy the whole world. Furthermore, the same problem was solved for a bug where duplicate identical roads were being instantiated. The roads also try to project onto the terrain. The projection on to the terrain is still a work in progress as some segements of the roads appear underneath the terrain which needs to be resolved next week. Work has been started with creating what will be the final structure of BuildingGenerator. The ability of generating any type of building with different kinds of strategy. Viktor has made sure to get his paths and parks working with the terrain. He also added a collision-check for the paths and worked on different algorithms for the paths.“ a