

VALID ENVIRONMENT GENERATION TOOL USING PROCEDURAL GENERATION

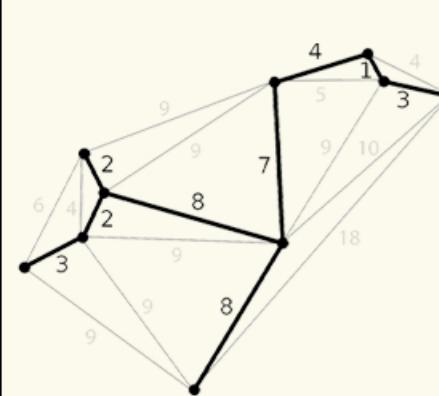
PROBLEM DEFINITION:

Manually creating interesting and varied game environments is a time-consuming and resource-intensive task in game development. Additionally, environments and landscapes created using traditional methods are often monotonous and lack dynamic elements.

PROBLEM SOLUTION:

We created a tool that uses procedural algorithms to automate terrain generation and is integrated with the Unity game engine. The tool produces realistic terrains, biomes, vegetation, structures, pathways, and animal behaviors. Our tool makes environment creation more efficient, allowing developers to concentrate on game design and narrative.

PATH GENERATION WITH MST:



The MST algorithm avoids obstacles like water bodies and uses the shortest path network to connect all buildings. The first step in the process is to locate the black nodes on the building map. These points are measured for Euclidean distance, and the edges are sorted by length in a priority queue. Beginning at an arbitrary point, the MST is constructed by connecting new nodes with edges, and this process continues until all nodes are connected. Buildings are connected logically and efficiently thanks to this technique.

ANIMAL AI:



To improve realism, different behaviors for predators and prey are included in the animal AI system. Lone predators, such as bears, prowl their surroundings, finding and pursuing prey when they become hungry. When one of the pack predators spots prey, the rest of the pack follows to pursue the meal. There are two basic ways that prey behave: lone prey roam freely, dodging predators when needed, and group prey remain together and run when a predator approaches.

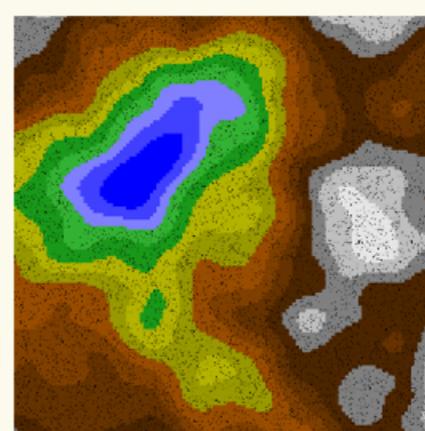
Our procedural generation process and results are illustrated in following visuals.



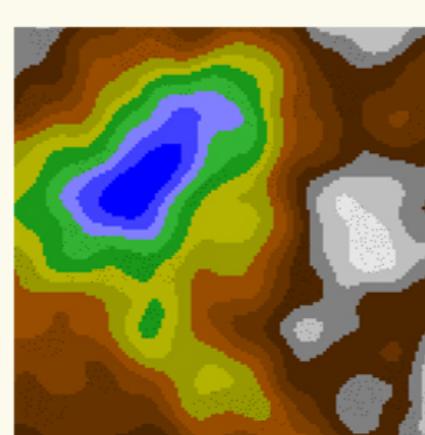
By capturing a variety of topographical features, the heightmap establishes the terrain foundation using fractal noise and Perlin algorithms.



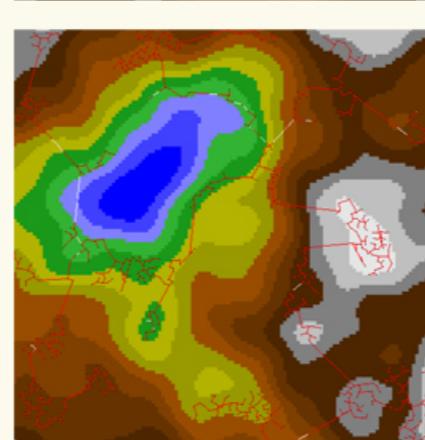
The biome map divides a region into areas covered in snow forests and deserts. Within these areas, the biome subsection map provides more information.



The foliage map arranges the flora logically to produce a colorful landscape.

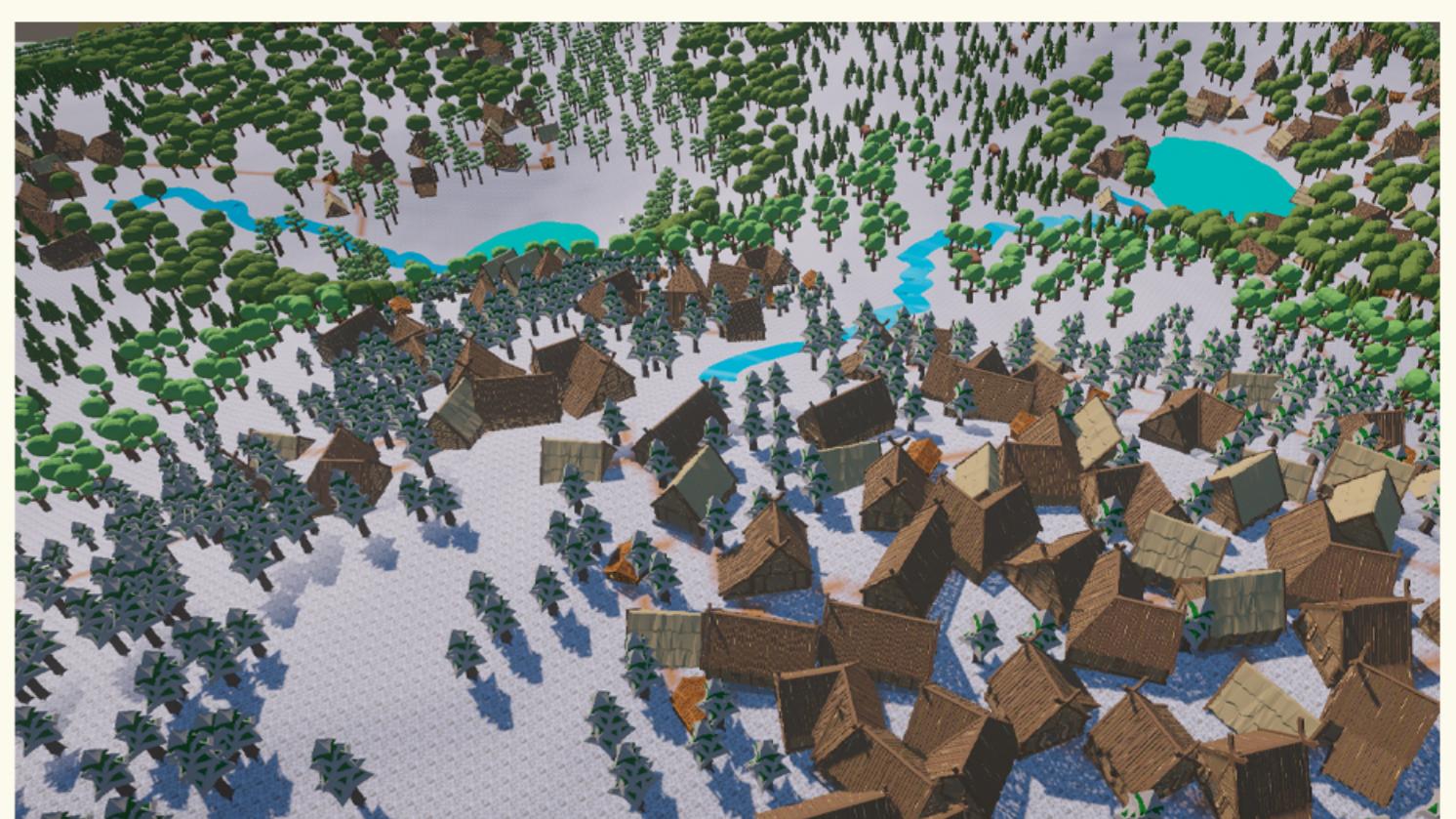


The building map stays away from bodies of water and groups buildings into structures resembling villages.



The path map uses the MST algorithm to display effective connections between points of interest.

Ultimately the 3D environment brings everything together presenting a unified and lifelike virtual world.



Project Outcome:

Our project was successful in creating a Unity procedural generation tool that automates the creation of realistic and varied game environments. Game development teams can now concentrate on gameplay and storytelling as this tool greatly reduces manual labor and time. Perlin and fractal noise algorithms are used to create natural terrains, biomes, foliage, and buildings. Utilizing performance optimizations like multithreading, the tool also incorporates dynamic animal behaviors. Valid Environment Generation Tool is a useful tool for game developers, improving efficiency, customization, and realism through the simplification of environment creation.

the link to the website of our project:

https://ibrahimelbir.github.io/Valid_Evironment_Generation_Tool_Using_Procedural_Generation/

