



1. Abstract

This project aims to develop a first-person shooter (FPS) game that leverages procedural generation techniques to create dynamic and unpredictable gaming environments. Procedural generation will be employed to produce varied landscapes, levels, and in-game assets, enhancing replayability and providing players with a unique experience each time they play.

2. Overview of procedural generation



Procedural generation is a method of creating data algorithmically rather than manually, typically through the use of mathematical models and algorithms. In the context of video game development, procedural generation is used to automatically generate game content such as levels, terrain textures, characters, and items. This technique allows developers to create vast, complex, and diverse environments with relatively minimal manual effort, enhancing the variety and replayability of games.

3. Methodology

Perlin Noise

Creates smooth, natural terrains using gradient noise, ideal for generating organic landscapes in games.

$$\text{Perlin}(x, y) = \sum_{i=0}^{n-1} (\text{gradient}(x_i, y_i) \cdot (x - x_i, y - y_i)) \cdot \text{fade}(t)$$

$$\text{new_point} = \frac{\text{point}_1 + \text{point}_2}{2} + \text{random_displacement}$$

Generates fractal landscapes through recursive subdivision, producing realistic and detailed terrains.

MPD

Ridge Noise

Enhances terrain features with sharper ridges, adding definition to mountains and valleys.

$$\text{Ridge}(x, y) = 1.0 - |\text{Perlin}(x, y)|$$

1. Create a function for the given method in Custom Terrain Script.
2. Create a GUI Element in Custom Terrain Editor Script.
3. Creating some specific parameters to have greater command over what is being created.
4. Integrating the parameters in our Unity GUI Inspector to help us control the terrain while inspecting the terrain and make a list of working values to be further used

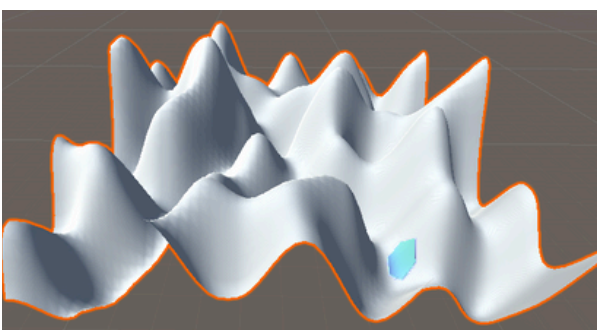
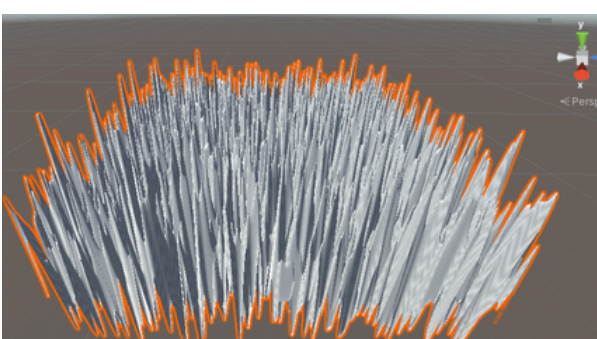
$$\text{Voronoi}(x, y) = \arg \min_i d((x, y), p_i)$$

Partitions the plane into regions based on proximity to seed points, creating organic and natural patterns in terrain.

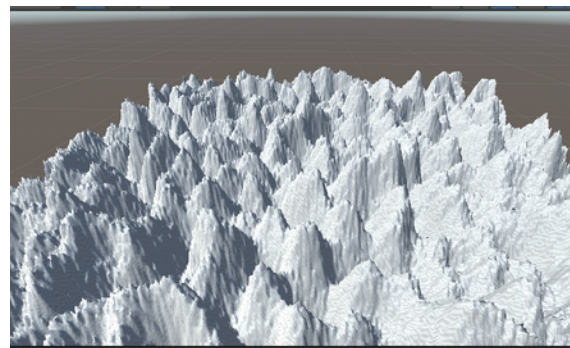
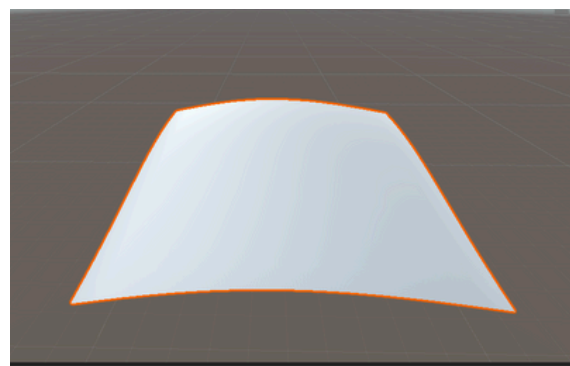
Voronoi

4. Procedurally Generated LandScapes

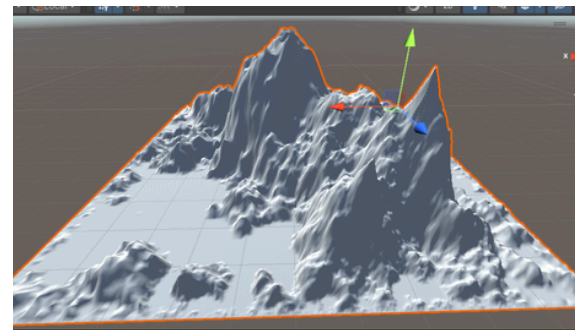
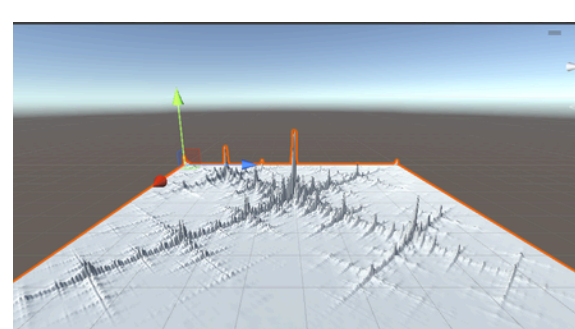
Perlin Noise



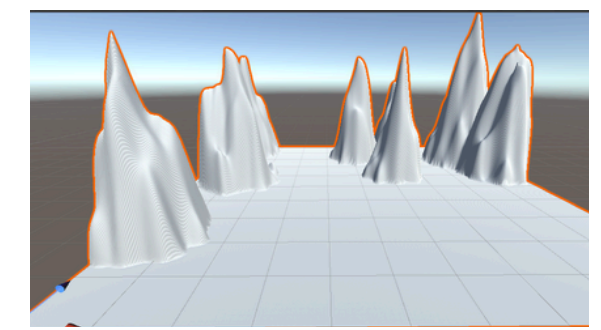
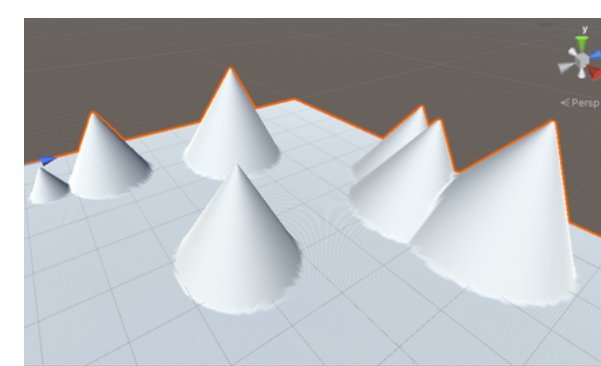
Ridge Noise



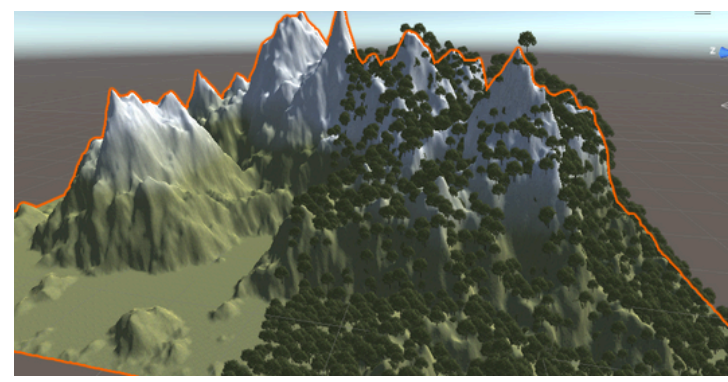
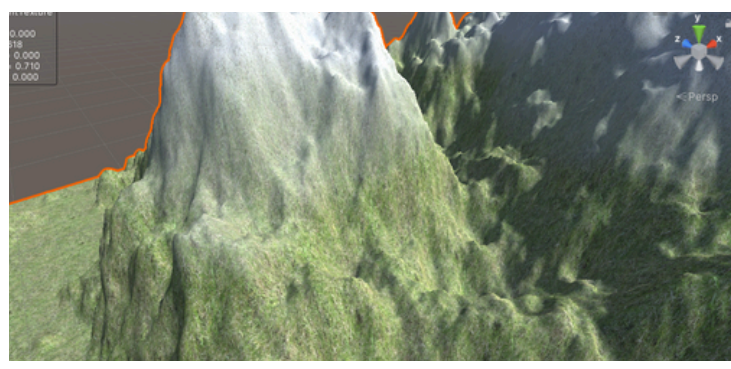
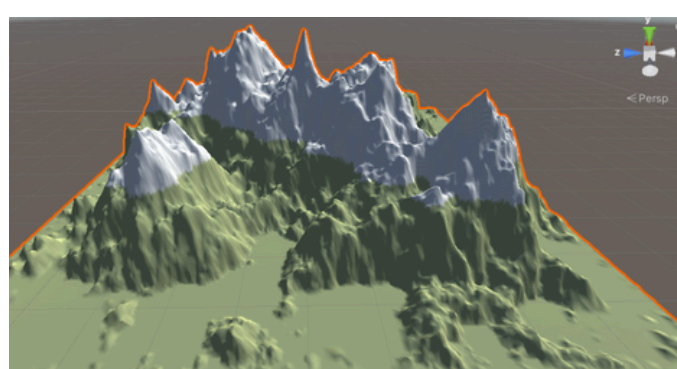
MPD



Voronoi



5. Adding Splat Maps, Vegetation and Details



6. References.



7. Result

The integration of procedural generation techniques (Perlin Noise, Ridge Noise, Midpoint Displacement, Voronoi Transformations) successfully created dynamic, immersive, and unique game environments, enhancing gameplay experience and replayability.

