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Procedural City Generator: Pattern Based Designs

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Introduction

Procedural content generation (PCG) is the creation of data through an algorithm with limited or no user interaction. This is an alternative to the manual creation of data by hand. PCG characterizes the data as a sequential instruction set, rather than a static block of information. PCG has many different techniques and subsequent applications. Some popular examples include generating fractals, textures, music or sound, virtual worlds, and 3D models.

This application uses a mixture of procedural content generation techniques and randomness to model and then in real time render an urban city environment.

The algorithm generates an initial set of streets representing a road network. Those streets as the simulation runs, will apply a selected/provided pattern and create child streets in order to expand the system.

The collection of road networks are subsequently passed into the rendering component which will output a 2D top down perspective in real time.

Objectives

Design and develop a software implementation that would generate a city street layout based on a provided pattern with the following goals in mind.

1) The algorithm should consist of simple rules that give rise to complex or seemingly complex results.

2) The user should be able to view the development in real time.

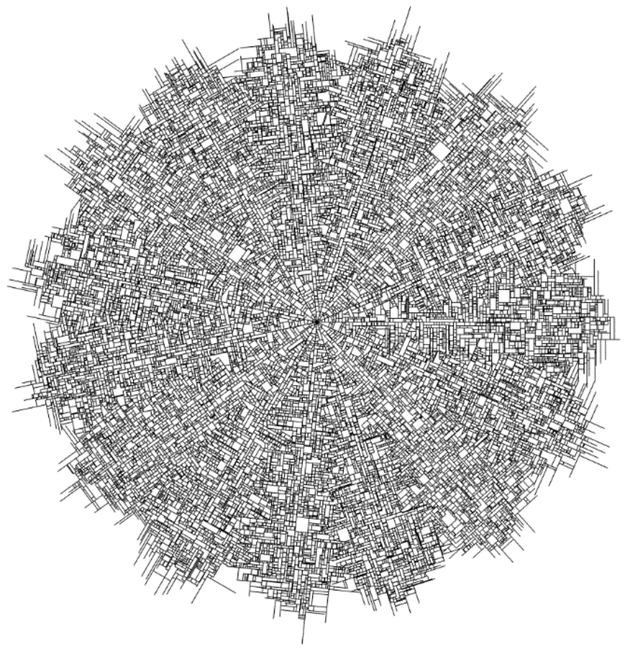
3) The end user should be able to modify the pattern in order to change the final output.

Methods & Materials

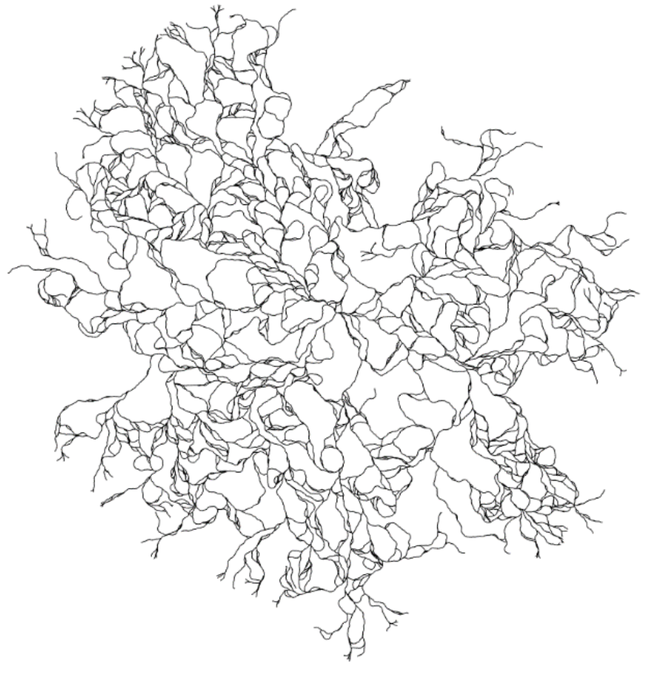
- Algorithm Development
- Software Development and Planning
- C++ Graphics Libraries

Results

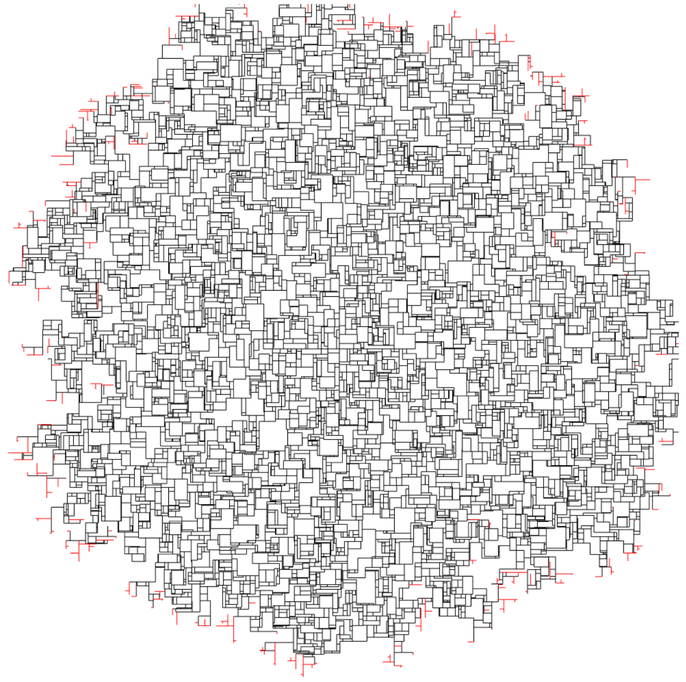
Radial Pattern - Streets radiating from single points or areas and expanding outwards.



Organic Pattern - Streets extend in every direction, seemingly at random. Varying degrees of curvature and direction signify this pattern.



Grid Pattern – Streets form 90 degree right angles which causes the repetitive fixed rectangular grids to appear.



Conclusion

Response to the program was positive, 100% of respondents indicated favorable or neutral reviews for the questions posed. The main issue that was raised was the speed of the program, this is because the algorithm requires more time to execute as the program runs resulting in a very noticeable slowdown.

The application is able to create a variety of self-similar yet different patterns on each use. Future improvements and additions would allow for a greater variety of results to emerge, as well as enhanced visuals and performance.

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