MGAIA Assignment 1: Procedural Content Generation

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Abstract

My aim was to create a farmhouse that Seemlessley integrated with the natural beauty around it. In the end, I aimed to create a space that functions as a residence while fostering a connection to the natural environment. I envisioned the roof and walls featuring reflective surfaces that serve as mirrors. In this manner, residents can admire the stars and moon at night, while appreciating the sun's reflection in the morning. This would act as an incentive for them to go outside. Additionally, the layout featured a well-equipped bathroom with a calming shower beneath a transparent ceiling, an automated door system, and an L-shaped hallway that links the bathroom to the main residence. The beginning of the corridor was also designed using glass. This document details all steps from assessing the land and selecting a construction location to constructing the different components of the house. The creativity and tactics used in procedural content generation are remarkable.

My Aims and Design Vision

I aimed to build a nature farmhouse that not only provides shelter but also keeps the occupants closely connected with nature. My design features:

- **Transparent Mirror Surfaces:** Mirrors on the walls and roof allow residents to see the night sky, including the moon and stars, and enjoy the natural reflections in the morning.
- **Integrated Washroom:** An attached washroom with a transparent roof and automated doors, connected via an L-shaped path, ensures functional and aesthetic harmony.
- **Interior Comfort:** Besides basic furnishings, I also installed a heater to ensure the house remains warm during cold nights.

This design ensures the structure is seamlessly integrated with its environment while offering a unique, nature-inspired living space.

Methods

Terrain Analysis

I started by evaluating the build area (typically 100x100 blocks) using the GDPC package's `MOTION_BLOCKING_NO_LEAVES` heightmap. The algorithm examines candidate regions large enough to accommodate the farmhouse. For each region, it calculates the height difference (max minus min) and the average height, ensuring the area is flat enough for construction. It also checks that the surface consists of natural blocks (such as `grass_block`, `dirt`, or `stone`). If no ideal candidate is found, a default location is chosen.

Randomization and Variation

To ensure each run produces a unique farmhouse, several aspects are randomized:

- **Dimensions:** The width, depth, and wall height are randomly selected within preset ranges (e.g., width between 10 and 20 blocks, depth between 8 and 16 blocks, wall height between 4 and 8 blocks).
- **Material Selection:** The foundation and wall materials are chosen at random from predefined lists, while the roof is consistently built with transparent glass (`minecraft:glass`) for a mirror-like effect.
- **Washroom and Decoration:** The washroom is randomly attached to either the left or right side, and extra mirror surfaces are added to enhance views of nature.

Integration and Believability

Instead of removing all the blocks in the build area, I only clear those necessary for construction. This careful clearing maintains a large portion of the natural landscape, ensuring the farmhouse blends smoothly with its surroundings. Additionally, I included a feature to fill any spaces beneath the house and the bathroom with natural (grass) blocks. This ensures that the structure is securely established. The design features interior decor (furniture, a functioning TV, and a heater) as well as exterior decor (a flower garden, torches, and a pathway) to establish a lifelike living space.

Results

Each run of the program produces a unique farmhouse that adapts naturally to the terrain. The randomized dimensions and material selections ensure that no two houses are the same. The final output includes:

- A strong foundation, walls, and a transparent roof.
- Mirror surfaces on the roof and walls for clear views of the night sky and natural reflections.
- An attached washroom with automated doors and a transparent roof.
- A connecting L-shaped path between the main house and the washroom.
- Interior furnishings including two red beds, a crafting table, chest, bookshelves, lighting, an active TV, and a heater.
- Exterior elements such as a flower garden in back yard and torches.

Fig.Farm House night view

Construction Photos

Front View Images

*Front View Images

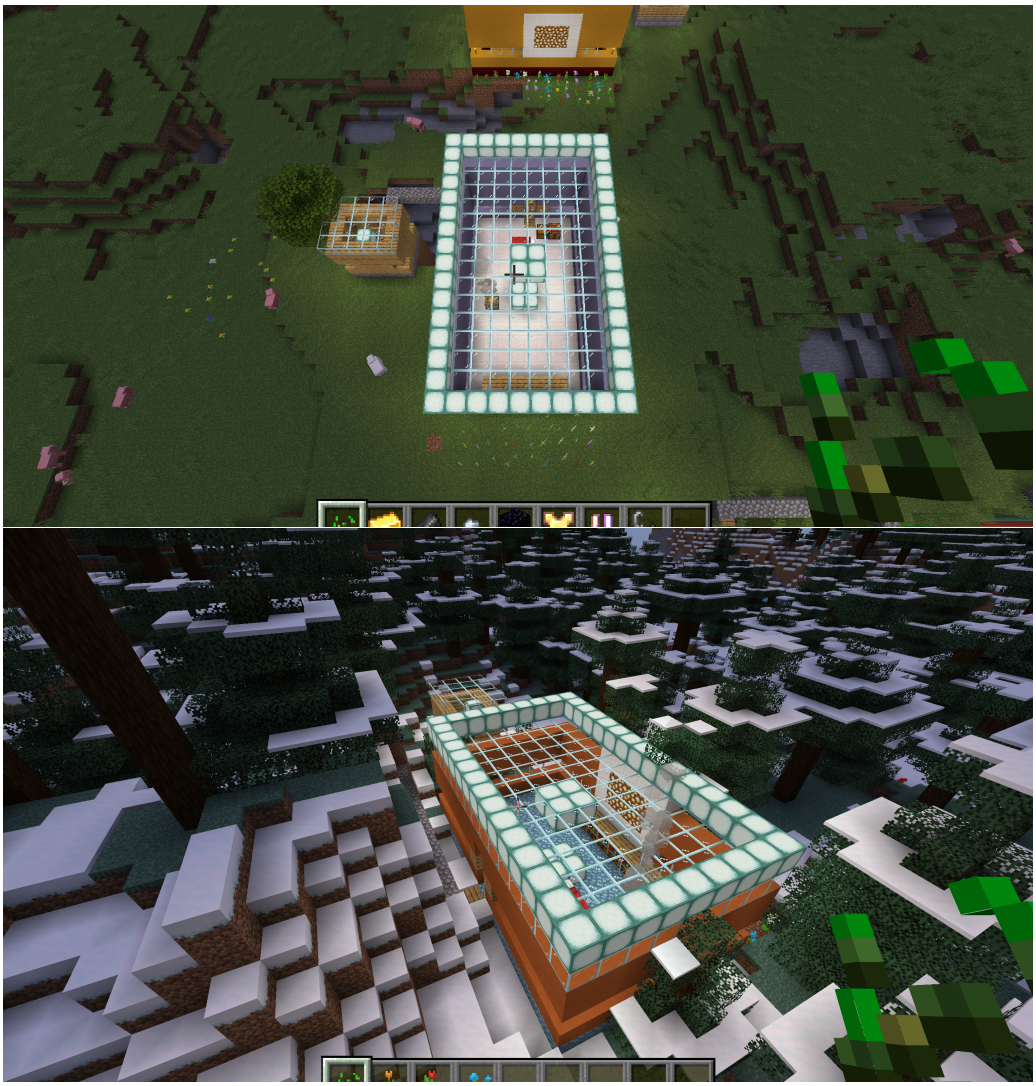
Inside View Images

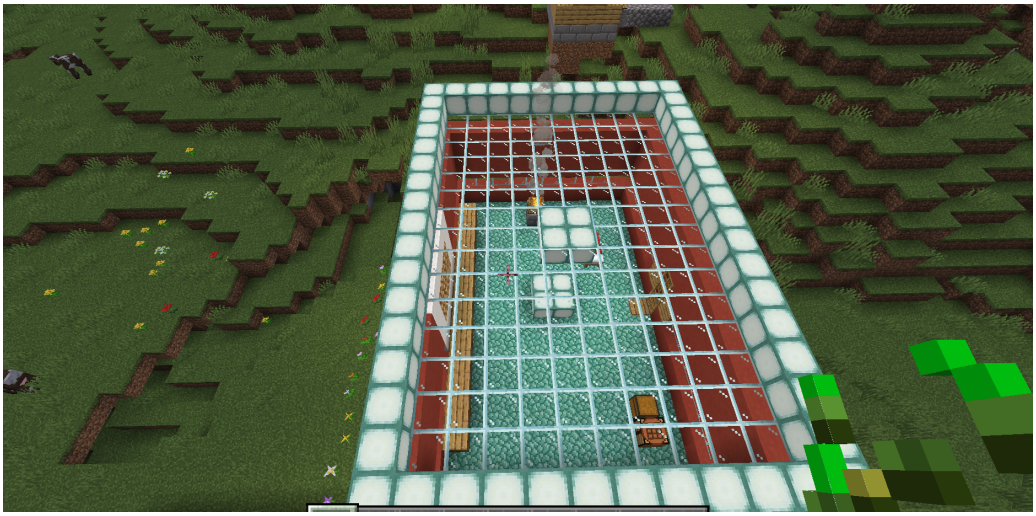
*Inside View Images

Back Side Images

*Back Side Images

Top View Images





*Top View Images

Conclusion

In this assignment, I developed a procedural system to generate a nature farmhouse in Minecraft using the GDPC Python package. The system evaluates the terrain to select a suitable build area and uses randomization to vary the house dimensions and material selections. Notable features include:

- Transparent mirror surfaces on the roof and walls, which allow residents to enjoy the night sky and natural reflections.
- An attached washroom with automated door systems and a transparent roof.
- A connecting L-shaped path that integrates the house with the washroom.
- Interior furnishings that include a bed, crafting table, chest, bookshelves, lighting, an active TV, and a heater to provide warmth.

These design choices ensure that the farmhouse is both functional and aesthetically pleasing while integrating seamlessly with the natural environment.