Google Summer of Code 2019

Contributing for: **The Terasology Foundation**

Biome-centric Gameplay Template / Enhancements for Terasology!

1 About Me

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2 Biome-centric Gameplay Enhancements

2.1 Overview

This Idea has been chosen from Terasology's GSoC Ready Ideas board from Trello [1]. Currently biomes are used in a few game settings, but not with a huge impact to gameplay. This idea aims to support greater variety, meaning to biomes and to help make worlds more "alive" as said by Brylie on the forum.

2.2 Interest

My interest in this project comes from the fact that not many GSoC students are interested in it, so it definitely needs work as it is a very good idea for Terasology giving the game engine a unique feel to it. Also because I have worked very much with terrains, used World Machine, L3DT, Terresculptor terrain generators to generate climate based terrains. I am very interested as to how the world and life biomes could be improved in Terasology.

2.3 Project Functions

1. **Inspection tool:** When a player encounters a plant or animal, they might use an 'inspection' tool. It can show the details of the entity, we can use WordlyToolTip module to give such information. These details could include health, hunger, biome preferences, and genomic information for the inspected entity.
2. **Transplant/Transport:** Plants and animals can be transplanted between biomes. Animals could be transplanted using the GooKeeper module as a catch-and-release tool. Plants similarly could be sampled, either in seed form or sapling, and transplanted to new biomes where they may die off, flourish, or even transform the biome over time.

3. **Evolution:** When variants are introduced into an ecosystem, new evolutionary gradients are created governing the possible form and appearance of species within the biome. These gradients can also be triggered through player intervention, without the player needing to transport a species from biome to biome, by using the aforementioned inspection interface.
4. **Model Variation Integration:** Integrate game model variation project into this project to modify the biomes. This can help improve the biome features and evolutionary system.

2.4 Implementation Plan

2.4.1 Current Situation

As said by 'Cervator' on the forum [2]:

- Biome-per-block supports changing biomes over time, either via natural process or player intervention.
- Visually we can vary the appearance of biomes beyond what blocks they use. There's a tinting system although it is one of the oldest bits of rendering we have so I think it might need some dusting off.
- Genome system was overhauled some for GSoC 2018, there's an animal breeding system, and I think I also recall a seed mixing system came about in relation to it.
- GooKeeper also became a thing in GSoC 2018 and more or less has "pokeballs" and capture mechanics.
- The WorldlyTooltip module allows showing a detailed tooltip for a target, be it block or creature. This could be tweaked to allow more information if the player is equipped with a tool for better analysis.
- We could probably improve the 3D art pipeline to make it both easier to flow from model to in-game creature.
- This could be a good GSoC project for 2019.

2.4.2 Modification of Inspection Tool

Currently we have Inspection Tool which will be modified in this project.

Figure 1 – Inspection tool in Terasology

Inspection tool's mechanics exist in the 2 main scripts and few others are related.

- InspectionToolComponent.java
- InspectionScreen.java

I will modify these scripts and use the imported information from the biome module so we will have new features in the inspection module like being able to see the details about a specific object (which may include biome preferences and genomic information).

2.4.3 Entity Transplantation

I will make the module for transplantation mainly for biome-centric features. This will improve the overall gameplay mechanics and growth of the biomes with respect to the transplanted objects. We can take a look at Equilinox [3] as the game has very good mechanics of entity transplantation which effects the biome features as well.

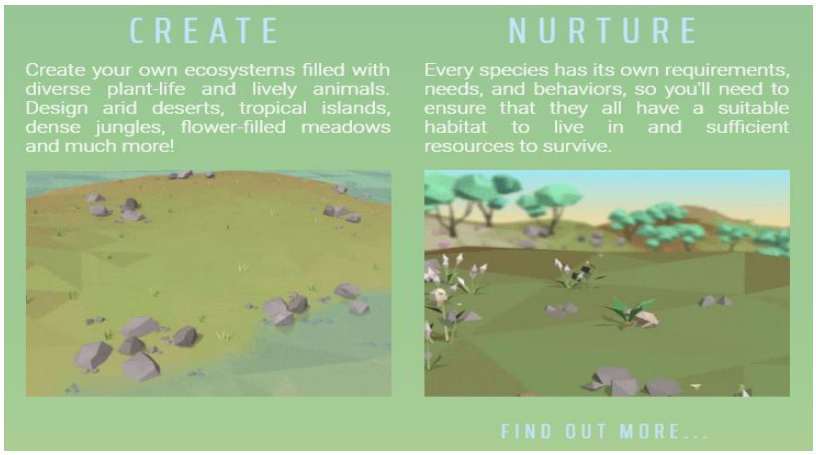

Figure 2 – Equilinox's Entity Transplantation

How to obtain this? Making new module for spawning of entities. I will create a script for plant transplantation with details relating to plant life, namely NatureTransplantation.java and similarly AnimalSpawning.java through GooKeeper module. And a TransplantManager module will use these scripts to make an actual impact in the game. These transplantations will later be used in Evolutionary system.

2.4.4 Biome-Enhancements

As currently, the suggested project needs enhancements for biomes so I will add new features like biome-transformation over time, the life around it and evolution. I will modify the newly extracted Biome Module and BiomeManager.java which is a script responsible for biome IDs and registration. I will modify biome-related code and also have to add new features to the biomes. World generation will be modified in order to make it seed meaningful biomes in larger sensible areas. This will also make the game content vary based on the biome which would make the game more explore-able and enjoy-able. We can take some examples from Minecraft's engine.

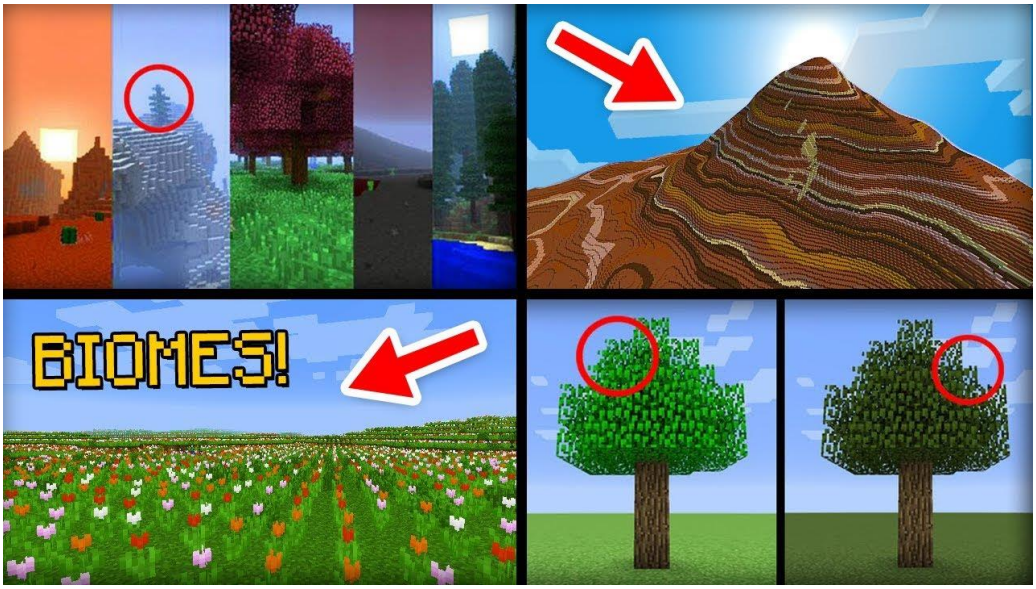

Figure 3 – Biomes in Minecraft

How to obtain this? This can be obtained by modifying biomes and their modules, BiomeManager and the new Biome module in the new World generation folder of Terasology. I will work on the new biome module first and then implement it in BiomeManager. I will add new features in the World generator scripts using the ClimateSimulator.java and CoreBiomes.java as these are the scripts containing core information of Biomes.

New scripts will also be added for meaningful biomes generation, which will spawn or generate the biomes related to the preferences surrounding it.

2.4.5 Evolution in the biomes

Currently, there's animal breeding system in Terasology but evolution needs more work. The actual impact in-game will be the new species and nature. As more the player engages with the biome, the more evolution will occur. For example, we can read specific stats of a plant like its height. When the evolution occurs on a specific time, the stats will change with that time, like the height may increase or decrease, growth rate, color, structure etc. might change. We can take examples from Equilinox's evolutionary system. I will make new species to be unlocked as evolution occurs in the particular biome. These species are dependent on the genetics' modification which can occur either naturally or player's intervention. Player can openly try to do what he wants, like comparing and testing different biomes environments to cause evolution.

Figure 4 – Equilinox's evolutionary system

How to obtain this? I will use the biome data and implement the effects on the species based on biome's characteristics. There will be new species but will be locked. These species will be unlocked by evolutionary system. As the player engages genetically with the nature, new species will be unlocked. To unlock the species, game will teach the player how he can unlock such species. The main scripts will be namely EvolutionData.java and EvolutionManager.java, these scripts will also use other scripts to extract biome data for example importing variables from BiomesManager.java to create a meaningful evolution in the biome.

2.4.6 Model Variation Integration

A new module for game model variation is under the works. As this module completes, I will use it in the Biome characteristics and Evolutionary system. This will create variations in the game models so the game does not seems to be repetitive.

How to obtain this? As the model variation project is completed, I will import it in my project and start implementing model colors, size and growth variations. New scripts will be created to import the data from Model variation and will be fed into the new Biome modules and Evolutionary system. The BiomeManager will then use this data to generate enhanced Biomes. Similarly the EvolutionManager will also use this data to evolve species with different colors and sizes.

2.5 PROJECT TIMELINE AND MILESTONES

GSoC for Terasology contribution 2019 - timeline

May 1 - May 10
Community Bonding

This period is for making new relations for learning the Terasology Open Source Foundation. I will be doing contributions with them and learning the Engine. The more I learn, the easier it becomes for me to implement this project.

May 11 - May 15
Set-up!

Setting up the project environment and required plugins for Terasology.

May 16 - May 31 *Coding*	Testing BiomeManager.java and learning the new Biome module. Start practicing code with the Biomes in Terasology. Get ready
June 1 - June 15 *Coding and Game Design*	Inspection Tool Modification. Modifying and adding new features in InspectionScreen.java and InspectionToolComponent module.
June 16 - June 18 *Evaluation*	**First Evaluation**.
June 19 - June 22 *Corrections*	Correction of mistakes and reviewing of code.
June 23 - July 10 *Coding*	Entity transplantation. Creating new module for spawning species in the game biomes. Importing GooKeeper module to use it for animal transplantation.
July 11 - July 26 *World Generation*	Using the new Biome module and modify the BiomeManager.java to add new features to the climate and world generation.
July 27 - July 30 *Evaluation*	**Second Evaluation**.
July 31 - August 15 *Coding and Game Design*	Creating the Evolutionary system with model variations in the game engine. Making new species to be unlocked through Evolution and coding EvolutionManager to manage Evolutions in the biome.
Aug. 16 - Aug. 20 *Debugging*	Finally, the bug fixes and wrap up. Completing the project nice and well for the organization.
Aug. 21 – Aug. 30 *Code Submission and Final Evaluation*	**Final Evaluation**. Preparation for evaluation and Submission of the contributed project.

3 EXPERIENCE

I have been working in Game development for more than 5 years. I first started game development in 2013 on a game engine called “3D Rad. However with the time, I tried more game engines and started learning new programming languages. I loved to explore Unity, Unreal, LibGDX and a number of other small game engines. So my teenage has mostly been spent on game development, coding and game design.

3.1 SOLVED ISSUES

I am familiarizing myself with the Terasology Engine’s Github. I have been able to test the game with the forked project on my computer. And I have solved 1 issue so far and recognized a new issue (probably only on dedicated GPU laptops) with a proposed solution.

1. **#1942: Part of debug text originates from server?**
    a. **Issue:** https://github.com/MovingBlocks/Terasology/issues/1942

b. **Pull Request:** https://github.com/MovingBlocks/Terasology/pull/3655

2. **Recognized new issue #3652: Game build does not detect Dedicated GPU (even if you force it)**
    a. **Issue:** https://github.com/MovingBlocks/Terasology/issues/3652
    b. **Proposed Solution:** https://github.com/MovingBlocks/Terasology/issues/3652#issuecomment-479471613

3.2 Previous Projects

My projects are mostly about Game Development. I have used Unity and UE4 to produce my games. Some of them are available on Google play. Other projects include C++, java, python and Google's Flutter (dart).

Lead game developer at Harmonic Arts on Google Play:
https://play.google.com/store/apps/developer?id=Harmonic+Arts

Android and iOS game for Flush:
https://play.google.com/store/apps/details?id=com.flush.glyphand

https://itunes.apple.com/us/app/glyph-the-puzzle-game/id1331110161?mt=8

And a number of other projects including Weather System, Day-Night cycle, Google Play Games Plugins and more!

4 Open Source

I am new to the Open Source Community and honestly want to jump in for development. Google Summer of Code has finally started its campaign to help these organizations which is actually a great initiative for learning and development among students.

5 Background and Education

Apart from informal learning since teenage, I am a student at National University of Sciences and Technology, Pakistan. I am doing Bachelors (BS) Degree in Computer Engineering.

6 Plans for the Summer?

My only plans for this summer is Google Summer of Code. I will get 4 months free which is actually a great time to spend in the development for an Open Source organization. I will be fully available since I do not have to do any other job or study during this summer. And yep, I am pretty much active most of the time to be in contact with the community.

7 GSoC Experience

I am applying first time for Google Summer of Code as this is the first year I have got to know about it!

What kind of person am I?

Simply learned, well-mannered and hard-working person to keep the development environment up in the air!

8 References

1. https://trello.com/c/IAJ1ufSX/9-biome-centric-gameplay-template-enhancements-for-terasology
2. https://forum.terasology.org/threads/biome-hacking-and-natural-evolution.2192/
3. https://equilinox.com/

END OF PROPOSAL