COMP3421/9415 Computer Graphics 2023 T3

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Introduction

In the ever-evolving domain of 3D gaming, where immersive worlds and complex gameplay narratives come to life, we find a unique opportunity to explore and redefine user engagement. Our project, Farming Fantasy, harnesses this potential to offer an experience that blends strategy with simulation in a vibrant 3D agricultural setting.

Farming Fantasy invites players to immerse themselves in the art of farming, presenting a world where they can cultivate land, rear a variety of animals, and manage resources against the backdrop of dynamic environmental changes. This game is more than just a farming simulator; it is a journey into the heart of rural life, encouraging players to build, expand, and thrive within their virtual farming empire.

As players delve deeper into the game, they will discover the intricacies of farm management, from nurturing animals and harvesting crops to engaging in trade and showcasing achievements. Each element of the game has been thoughtfully crafted to provide an authentic and engaging farming experience, making Farming Fantasy not just a game but a portal to a pastoral world.

This final report aims to capture the essence of our journey in developing Farming Fantasy. It details the technicalities that went into creating this interactive 3D environment, the challenges faced, the innovations introduced, and how each aspect of the game contributes to an engaging and strategic player experience. We will also explore how the game has evolved from its initial concept to its current form, highlighting the key features that make Farming Fantasy a unique addition to the 3D gaming landscape.

By merging strategy, simulation, and the beauty of agricultural life, Farming Fantasy stands as a testament to the capabilities of modern 3D gaming and its ability to create worlds that are not only visually stunning but also rich in content and gameplay depth.

Purpose of the System

1. System Overview

Farming Fantasy emerges as a distinctive entrant in the realm of 3D interactive gaming, offering an enriching blend of farming simulation and adventure. Set within a vividly crafted island environment, players embark on a journey with Amy, a character determined to cultivate a thriving farm from a barren land. This game is a harmonious fusion of strategy, simulation, and immersive storytelling, set in a three-dimensional space that promises depth and engagement.

Genre and Story

At its core, Farming Fantasy is anchored in the simulation and adventure genres. The narrative is centred around Amy's quest to build a flourishing farm, involving intricate farming practices and wildlife management. Players engage in various activities such as planting and harvesting crops, and interacting with the island's wildlife, including trapping rabbits and attracting livestock like cows, sheep, and pigs. These elements are woven into a storyline that encourages exploration and personal connection to the virtual world.

Visual and Auditory Immersion

Diverging from the traditional 2D or block-style graphics of conventional farming games, Farming Fantasy leverages state-of-the-art 3D graphics to create an environment that is both visually appealing and lifelike. The detailed landscapes, and realistic character models contribute to an immersive audio-visual experience that draws players deeper into the game's world.

Balanced Gameplay for All

Recognizing the complexity often associated with simulation games, Farming Fantasy is designed to be accessible and enjoyable for a wide audience. It caters to both experienced gamers and novices, balancing intricate farming mechanics with an approachable gameplay structure. The game's learning curve is crafted to be engaging, ensuring a rewarding experience that keeps players of all skill levels invested.

Interactivity and Exploration

The game's open world invites players to explore and interact with their surroundings. Beyond the bounds of traditional farming, players can discover hidden areas, partake in various activities, and immerse themselves in an interactive world. The level of care and attention required for crops and animals adds depth to the gameplay, enhancing the overall experience.

Dynamic Ecosystem

A standout feature of Farming Fantasy is its dynamic and responsive ecosystem. The AI-driven behaviours of animals and the responsiveness of the environment to players' actions create a living, breathing game world. This aspect adds a layer of realism and depth to the farming experience, as each decision made by the player has tangible effects on the game's ecosystem.

Farming Fantasy thus stands as a pioneering project in the farming simulation genre, offering a rich and immersive experience. It combines realistic graphics, balanced gameplay, and a dynamic ecosystem to create a world that is both engaging to explore and rewarding to cultivate.

2. Key Demographics of Target Audience

Age Range and Accessibility

Farming Fantasy is crafted to engage a diverse audience, with a particular focus on players aged 8 and above. This wide age bracket ensures that the game is accessible and enjoyable for both younger audiences and older players. Younger players are drawn to the vibrant, interactive environment and the simple joy of farming and animal care. At the same time, older players, including teenagers and adults, find appeal in the strategic aspects of managing a farm and exploring an open world. The game strikes a balance between ease of play for the younger demographic and depth for those seeking a more involved experience.

Interests and Genre Appeal

The game's primary audience includes individuals with a fondness for simulation and adventure genres. Those who enjoy games like Minecraft and Stardew Valley are particularly drawn to Farming Fantasy, owing to its immersive 3D environment and dynamic gameplay mechanics. The focus on nature, wildlife, and environmental stewardship also appeals to players interested in these themes. Moreover, Farming Fantasy's design transcends gender boundaries, offering an inclusive experience that resonates with both male and female players. The character of Amy, serving as a relatable protagonist, and the non-violent, nurturing aspects of the gameplay make it broadly appealing.

3. Game System Style

Farming Fantasy is crafted primarily as a game system, emphasising an engaging and interactive farming experience. This immersive simulation allows players to delve into the intricacies of farm management, animal cultivation, and ecosystem balance. Designed for a diverse gaming audience, it provides a platform for both casual and serious gamers to explore their farming aspirations in a virtual world.

For casual gamers, the game is a relaxing retreat into a serene farming environment. Here, players can casually engage in activities like crop cultivation, animal care, and resource collection without the pressures of intense gameplay. The intuitive mechanics and user-friendly interface ensure that even those new to the genre can easily navigate and enjoy the game. On the other hand, serious gamers are drawn to the deeper aspects of the game, such as strategic farm management and resource optimization. The game challenges these players to devise and execute complex strategies for farm expansion and efficiency, offering a more intense and engaging experience. This blend of simplicity for casual players and complexity for serious gamers ensures that Farming Fantasy appeals to a broad spectrum of players, each finding their own unique way to enjoy and engage with the game.

In its essence, Farming Fantasy is a testament to the versatility and appeal of modern gaming, providing an all-encompassing farming adventure that caters to various gaming preferences and styles.

4. Unique Aspects and Innovations

Farming Fantasy sets itself apart from other games in its genre through a blend of unique features and innovative mechanics. The game's design focuses on providing a realistic, immersive 3D farming and animal-catching experience, striking a balance that caters to both new gamers and seasoned players.

Innovative Animal Interaction Mechanics

Unlike many existing farming games, Farming Fantasy introduces unique ways of interacting with animals. Players engage in activities such as setting traps for rabbits and using specific crops to attract and collect different animals. This system of animal interaction is more dynamic compared to the static animal management seen in other titles.

Simplified Complexity

The game addresses the challenge of complexity prevalent in similar games. By simplifying complex farming mechanics, Farming Fantasy makes the gameplay accessible and enjoyable for gamers of all skill levels, ensuring that the learning curve does not deter new players.

Immersive 3D World

In contrast to the blocky graphics of Minecraft or the 2D world of Stardew Valley, Farming Fantasy offers an immersive 3D environment. This enhances the player's experience, providing a more realistic and engaging world to explore and interact with.

Day and Night Cycle

Incorporating a day and night cycle adds a dynamic element to the game, influencing various aspects like animal behaviour and crop growth. This feature enriches the gameplay, offering a more lifelike farming experience.

Customization and Personalization

Players have the option to customise and personalise their tools and equipment with special skins that come with visual effects. This feature not only adds to the game's aesthetics but also allows players to express their individuality.

Friendship Bar

The introduction of a friendship bar for each animal in the barn is a novel concept. This feature provides players with a visual representation of their relationship with each animal, adding depth to the animal management aspect of the game.

Dynamic Museum Feature

The museum in Farming Fantasy is not just a static display but a dynamic feature that updates with each animal caught and resource collected. This gives players a tangible sense of progression and achievement as they build their farm.

Adapted Features

While certain aspects like weather changes and a full range of animals could not be implemented, the game compensates with other engaging features. The inclusion of a currency system for purchasing unique tool skins and the focus on essential farm animals like sheep, cows, pigs, and rabbits ensures a comprehensive farming experience.

5. Engagement Strategies for Target Audience

Simplified Learning Curve with Progressive Challenges

- Recognizing the game's appeal to players over the age of 8, including those new to gaming, the system introduces a gentle learning curve. Starting with straightforward farming and animal care tasks, the game progressively introduces more complex elements. This ensures that new players are not overwhelmed while experienced gamers remain engaged.
- Interactive tutorials and gradual unlocking of more complex features will guide players, making the game accessible and enjoyable for a wide age range.

Immersive 3D World with Realistic Graphics

- To address the lack of immersion often cited in similar games, the game boasts a realistic 3D world. This immersive environment, coupled with high-quality graphics, enhances player engagement by creating a more lifelike and engaging farming and animal care experience.
- The visual aesthetics cater to both younger audiences who enjoy vibrant, lively environments, and older players who appreciate a more realistic approach.

Dynamic Animal Interaction and Caretaking

- A unique feature of the game is the dynamic interaction with animals. Players can attract, catch, and take care of various animals, each with specific needs and preferences. This aspect not only adds a layer of strategy but also fosters a sense of responsibility and attachment to the animals, encouraging longer play sessions.
- The friendship and mood systems for animals add depth to the gameplay, as players must balance resource collection with the well-being of their animals.

AI-Controlled Animal Movements for Dynamic Interaction

- To add a layer of unpredictability and liveliness to the game, the animals exhibit AI-controlled movements, wandering and interacting within the environment in a dynamic and natural manner. This feature ensures that each gaming session is unique, as players encounter animals in different locations and scenarios.
- The random movements of animals not only contribute to a more realistic and immersive experience but also present varied challenges and opportunities for the players. For instance, tracking and catching a roaming animal can be more engaging than interacting with static, predictable NPCs (Non-Player Characters).
- This dynamic behaviour can also influence the player's strategy and decision-making. For example, the location and activities of animals could affect where players choose to plant crops or set traps, adding depth to the gameplay.

Customization and Creative Freedom

- Allowing players to customise their farms and choose their own paths offers a sense of ownership and personalization. This level of creative freedom is particularly engaging for a younger audience, fostering creativity and strategic planning.
- The game's open-world nature and lack of a restrictive storyline mean players can explore at their own pace, experiment with different farming strategies, and create a unique experience tailored to their preferences.

By implementing these strategies, the game aims to captivate its target audience, balancing ease of play with depth and variety, and creating an engaging, immersive world that appeals to both casual and seasoned gamers.

Features of Farming Fantasy

1. Phase One Features

- Landscape: Diverse environments such as woods, forests, cliffs, rivers, and a lake, offering varied exploration opportunities.
- General Farm Area: Includes fences, paths, and decor, creating a visually appealing and functional farm space.
- Crop Area: Soil and pots for planting, providing the basic infrastructure for farming activities.
- Plants: Different stages of Wheat, Potato, and Carrot (seed, seedling, fully grown) to offer a variety of farming experiences.
- Rabbit Pit: A dedicated area to catch rabbits, enhancing the diversity of animal interaction.
- House and Barn: Fully designed interiors and exteriors, serving as central locations for player activities.
- Animals with Animations: Cows, pigs, sheep, and rabbits, each with unique animations to bring the farm to life.
- AI Animal Roaming: Dynamic AI-driven movement for animals, allowing them to roam freely around the island.
- Inventory and Equipment: Implementation of an inventory system and equipment like nets, hoes, watering cans, and sickles.
- Animal Resources: Collection of resources like milk, truffle, fur, and wool from farm animals.
- Day/Night Cycle: A dynamic time system affecting gameplay and environment.
- Wild Animal Generation: Randomly spawning wild animals in the open world.
- Pet Animal Friendship Levels: An innovative feature that allows players to build relationships with their animals, influencing gameplay.
- Minimap: An essential navigational tool that provides players with a quick reference to their surroundings, objectives, and points of interest on the farm.
- Museum and Store Popups: Interactive features for additional gameplay depth, including updates based on player progress.

2. Phase Two Features

- Game Completion and Tutorial Screens: Essential UI elements to guide and inform players.
- Museum Features: Enhancing the museum experience by reflecting player achievements in animal collection.
- Store Features: Implementing a functional store for buying, selling, and managing resources.
- Main Menu: The Main Menu serves as the gateway to our farming adventure, offering a simple and direct choice - embark on a new journey with the "New Game" option, or gracefully exit the gaming experience with the "Quit" feature.
- Option Menu: Accessible with a press of the 'O' key, the Option Menu in FarmingFantasy offers a seamless transition between gameplay and breaks. Players can choose to quickly dive back into their farm's activities with "Back to Game" or navigate to the Main Menu to pause their adventure.

Explanation of Implementation

1. Key Features Implementation

a. Graphics

i. Customising the Player's House

The 'FANTASTIC - Village Pack' was used for a majority of the decorative and building assets. The pack includes buildings but with no interior, windows or doors. Hence, tools such as the 'Extrude' and 'Plane' tool in the Modelling mode were used to create a custom house for the player. Additionally, the material of the roof was tinted to suit the aesthetic of our game more. This is shown below in Figure 1.

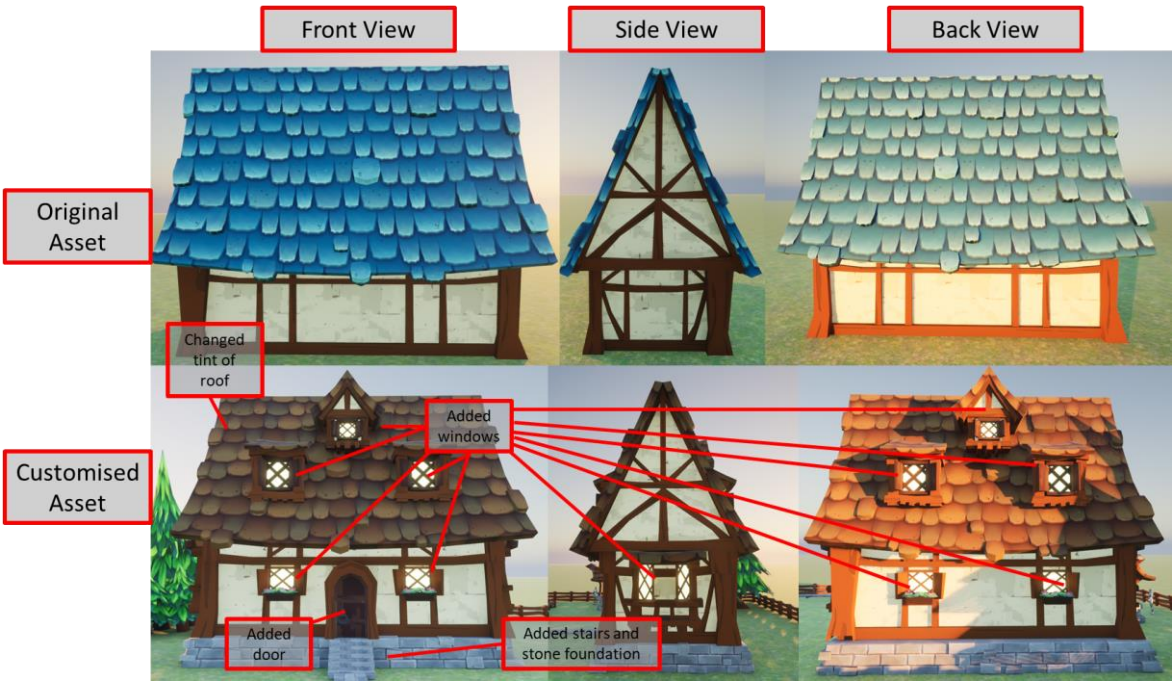


Figure 1: Original Asset (top) and Customised Version (bottom)

ii. Player's House Door

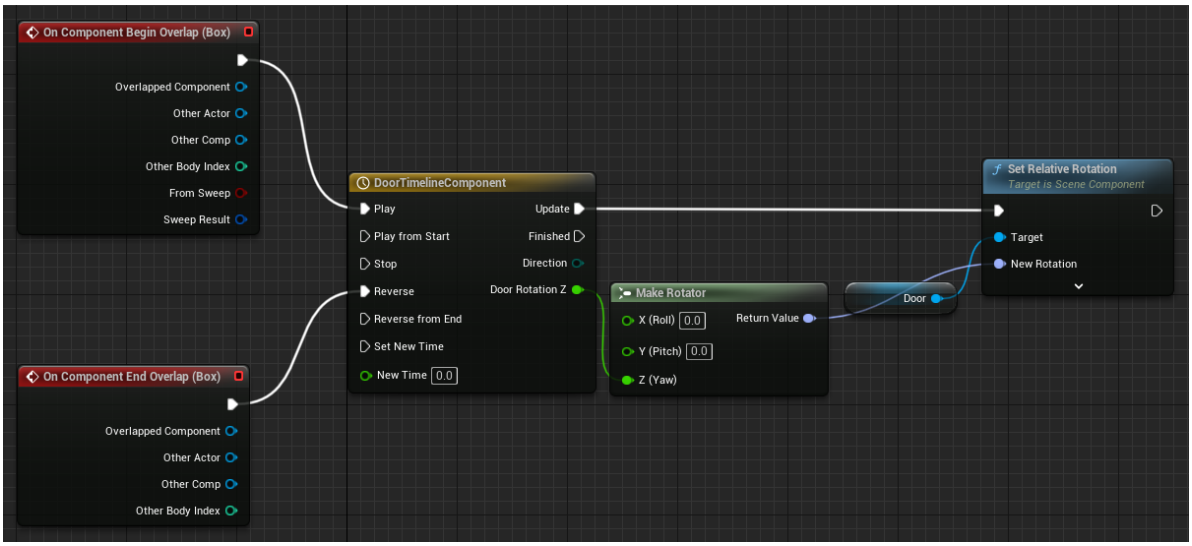


Figure 2: BP_HouseDoorActor Blueprint

In our proposal, we simply had it so that going up to the house's door would let the player interact with the museum. But this was too uninteractive so the interior was designed and a book was used to show the player's museum. This brought a new mechanic of having a door. When the player is within the door's collision box, it rotates along the z-axis to mimic doors swinging open. Once the player has left the collision box, it rotates in the opposite direction. This is all contained within the 'BP_HouseDoorActor' blueprint class as shown in Figure 2.

iii. Customising the Barn

The barn on the left in Figure 3 was built from the combination of assets shown on the right side of Figure 3 from the 'FANTASTIC - Village Pack' collection on Unreal Marketplace. A combination of the 'Extrude' tool with resizing and grouping formed the two-tiered look.

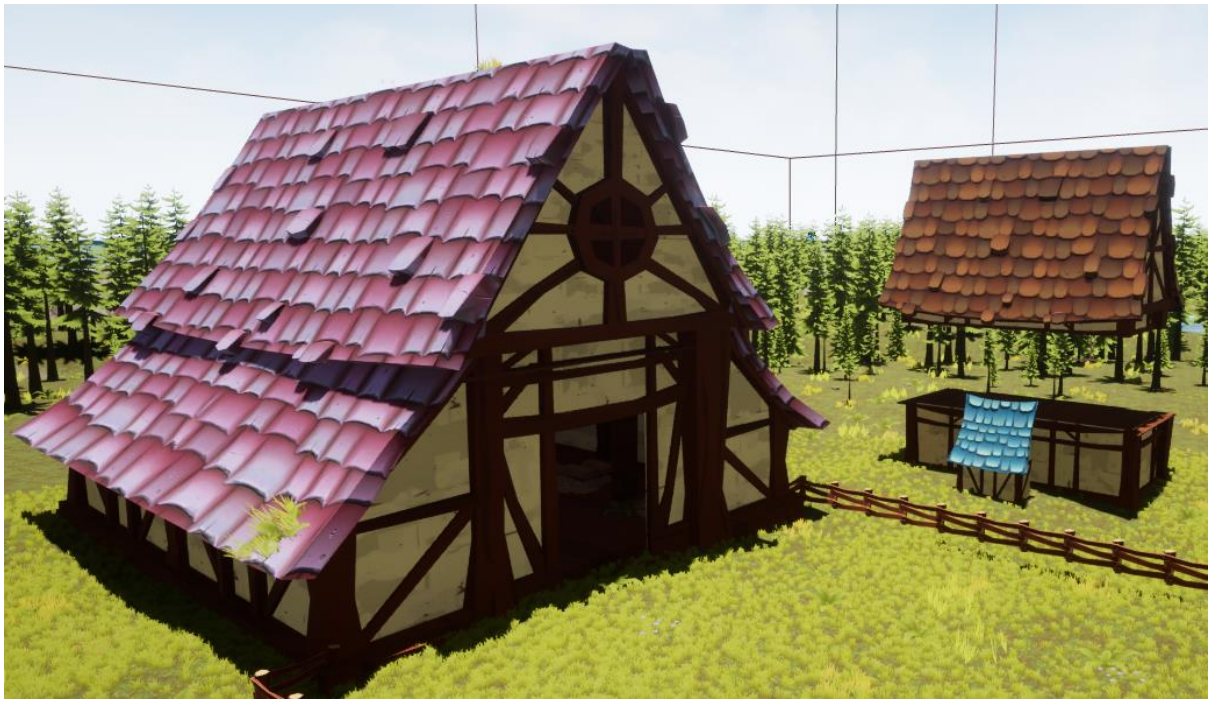


Figure 3: Barn (left), Assets Used (right)

iv. Cow, Pig and Sheep Skeleton Mesh and Animation

Since our aesthetic was more cartoon-esque, there were no free assets which had a skeleton and animations attached to a cow, pig and sheep mesh. Hence, the software Blender was used to attach a skeleton to a free cow [1], pig [2] and sheep [3] mesh. The mesh and skeleton for each animal are shown in Figure 4, 5 and 6.

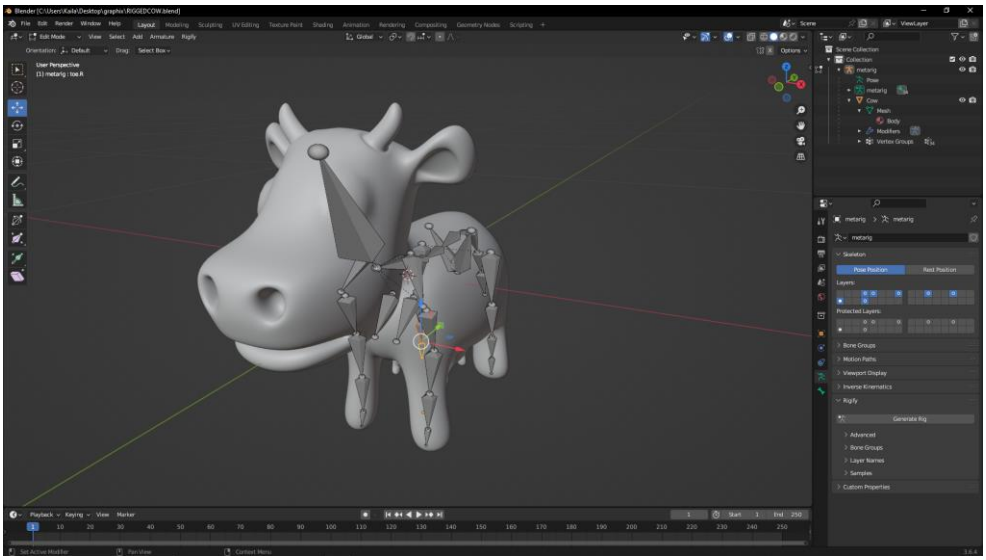


Figure 4: Cow in Blender

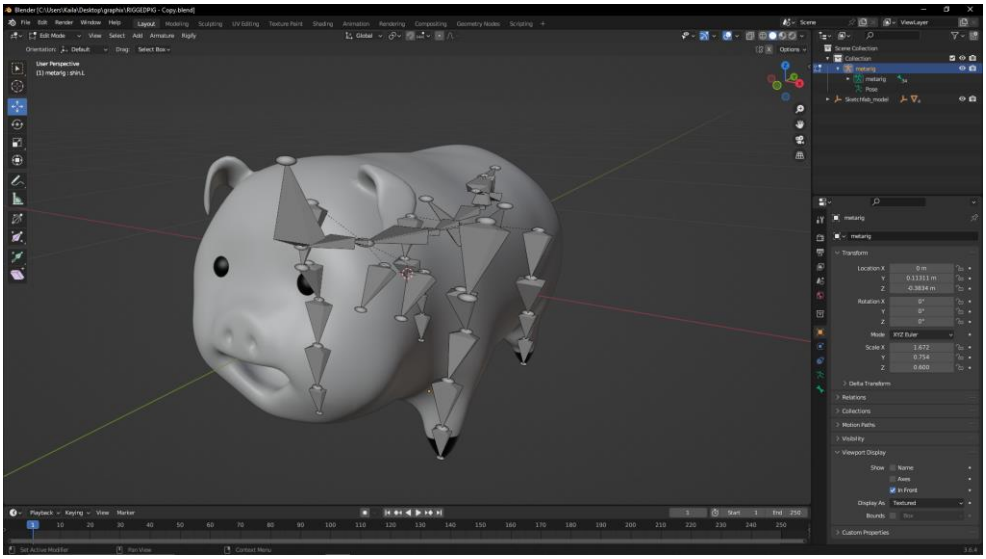


Figure 5: Pig in Blender

Figure 6: Sheep in Blender

Since these animals all had similar movements, the animations for a common quadruped were

acquired. The bones for a quadruped as shown in Figure 7 were then retargeted using the UE5 IK Retargeter.

Figure 7: Quadruped Bones to be Retargeted

v. Rabbit Skeleton Mesh and Animation

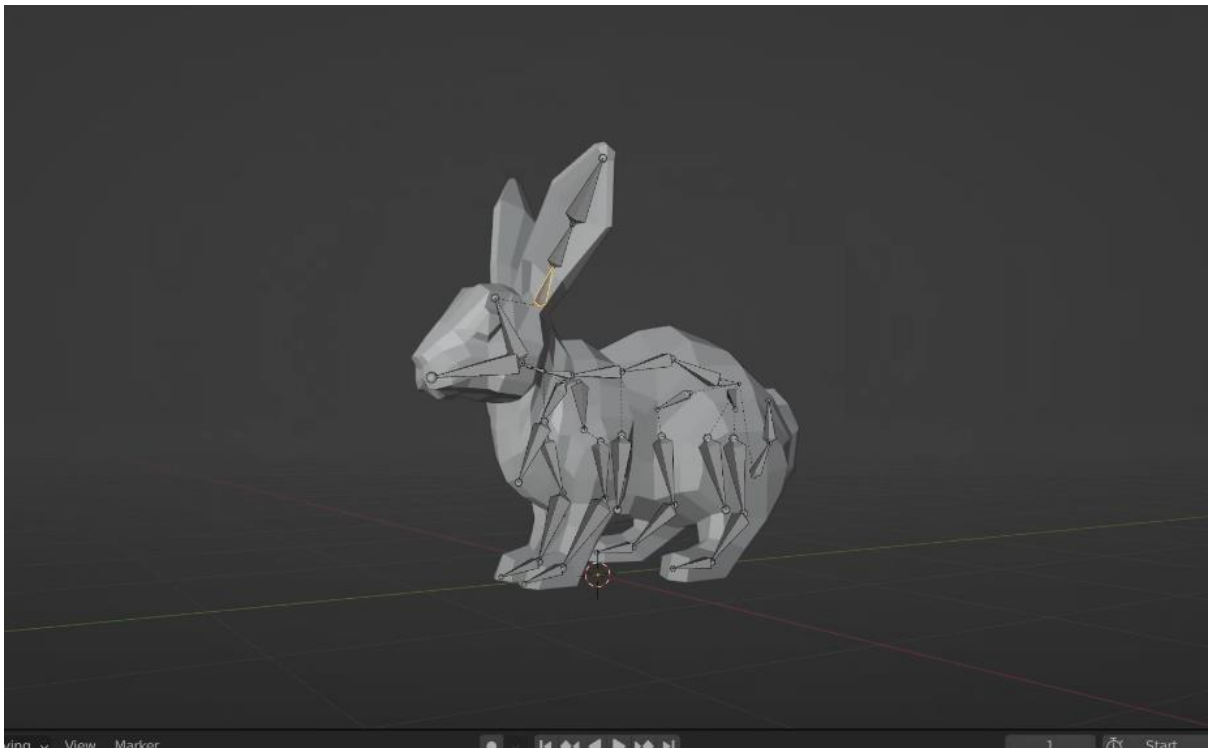


Figure 8: Bunny on Blender with skeletal rigs

In FarmingFantasy, the creation of the bunny asset and its animation involved a detailed and meticulous process in Blender. The bunny, designed to align with the game's cartoon-esque aesthetic, required a custom approach to bring it to life within the Unreal Engine environment. The bunny model was carefully sculpted in Blender, paying close attention to its proportions and features to ensure it fit seamlessly into the game's world. A crucial step in the animation process was the rigging stage. Here, a skeleton was created for the bunny model, involving the placement of joints and bones that define how the model moves. The rig acted as the framework, enabling the bunny to have realistic and fluid motion. Once rigged, the bunny was animated to simulate walking motion. This involved creating a sequence of movements where each frame captured a different position of the bunny, mimicking the natural gait of these animals.

vi. Day and Night Lighting

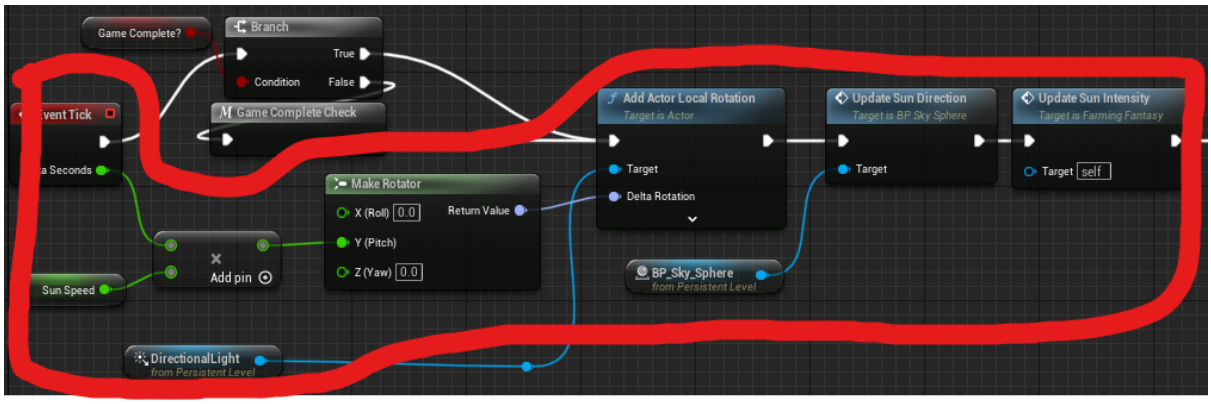


Figure 9: FarmingFantasy Level Blueprint

To indicate the passing of days, the island has a day and night cycle. Using the ‘Sun Position Calculator’ plugin, the lighting of the sky is able to change according to the current position of the sun. This was used in the level blueprint for the ‘FarmingFantasy’ Level and is shown in figure 9. A float variable ‘Sun Speed’ was added which sets how fast the sun will cycle. The length of the day and night is around 2 minutes when the variable of ‘Sun Speed’ is set to 3.4. Since there was unusual lighting coming from underneath the landscape during night time, an ‘UpdateSunIntensity’ custom event was made to change the brightness of the sun to 0 when the sun has set. This is shown in Figure 10.

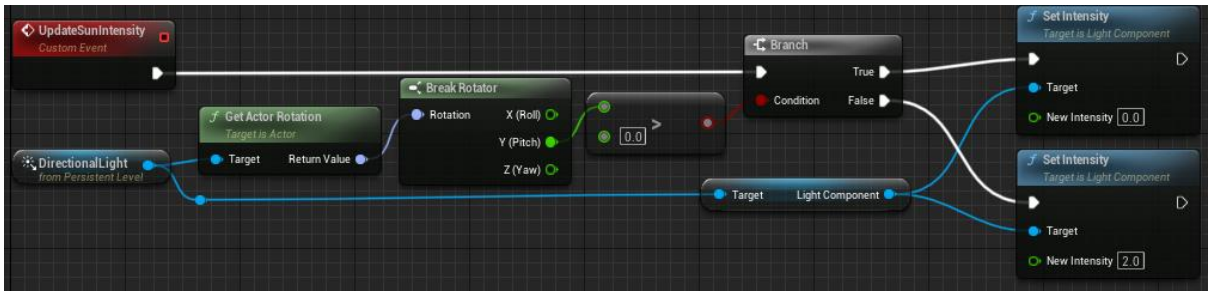


Figure 10: Custom Blueprint for Updating Sun Intensity

vii. Island Graphics

1. Landscape/Terrain

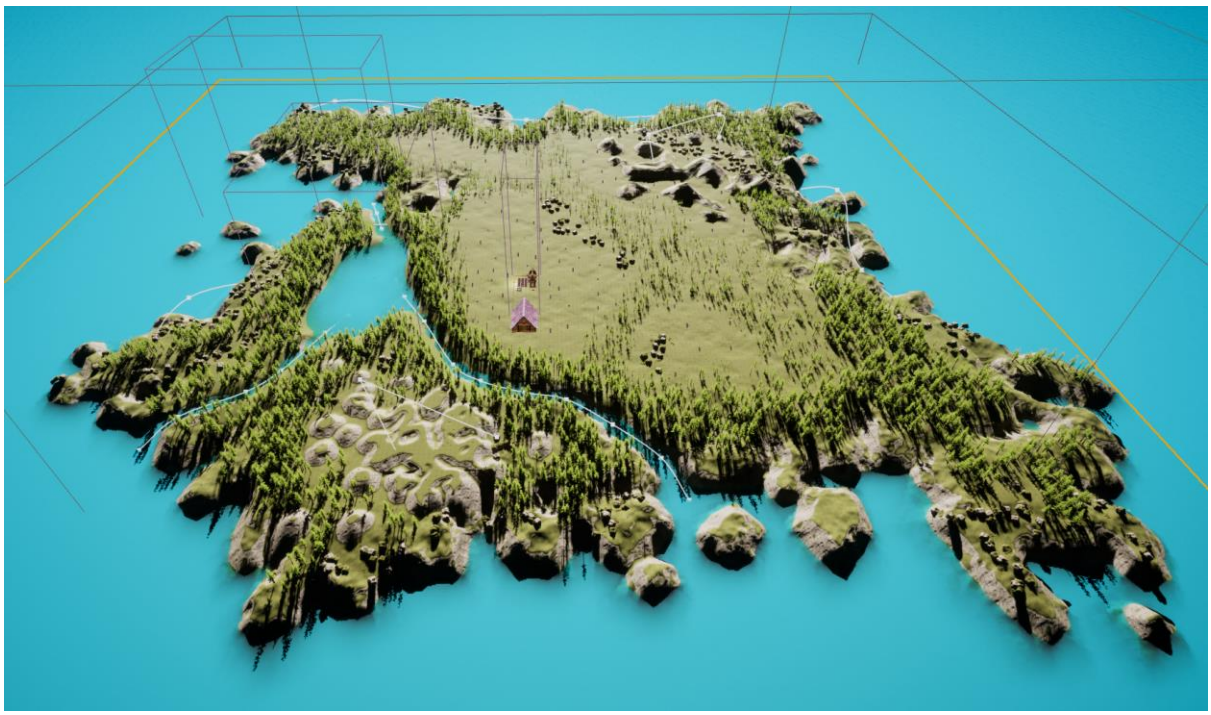


Figure 11: The grassland terrain of the island

The terrain of FarmingFantasy's island is an essential component of the game's environment, setting the stage for the player's agricultural adventures.

Creation of the Island's Terrain:

- The landscape of the island was initially shaped using Unreal Engine's landscape custom brush landmass tool. This feature allowed for the manipulation of the island's basic contours

and the creation of its general topography.

- Specific features like cliffs and shoreline were refined using a combination of curl noise, strength adjustments, terracing, displacement, and fallout details. These techniques contributed to the realistic appearance of the terrain, particularly in shaping rugged cliffs and the nuanced edges of the island.

Application of Textures and Materials:

- To enhance the visual appeal of the terrain, the "Easy Building System v10" from the Unreal Engine Marketplace was integrated into the project. This provided a set of stylized landscape materials, including variations for terrain, grassland, dirt, and wet dirt [5].

- These materials were strategically applied across the landscape to create a realistic and varied terrain surface, which not only added to the aesthetic quality but also enriched the in-game experience by providing a more immersive environment for farming and exploration.

2. Ocean, Lakes and Rivers

Figure 12: Rivers and Lakes that channel and connect to the surrounding Ocean.

In FarmingFantasy, the integration of water bodies such as oceans, lakes, and rivers plays a pivotal role in creating an immersive and realistic game environment.

Integration of Water Bodies:

- The incorporation of the water body ocean, water body lake, and multiple water body rivers was achieved through the use of Unreal Engine's water plugin. These elements were carefully adjusted and customised to fit seamlessly within the island's landscape.

Customization for Realism:

- A significant aspect of the customization process involved fine-tuning the physics of the water, particularly focusing on wave attenuation in the ocean and lake. This adjustment was

crucial in achieving a more realistic representation of water movement and behaviour.

- Additional parameters like the direction of flow and speed of flow were also modified for each water body. These adjustments ensured that the rivers, lakes, and ocean not only looked authentic but also interacted realistically with the surrounding environment and the game's mechanics.

3. Rocky Cliffs and Hills

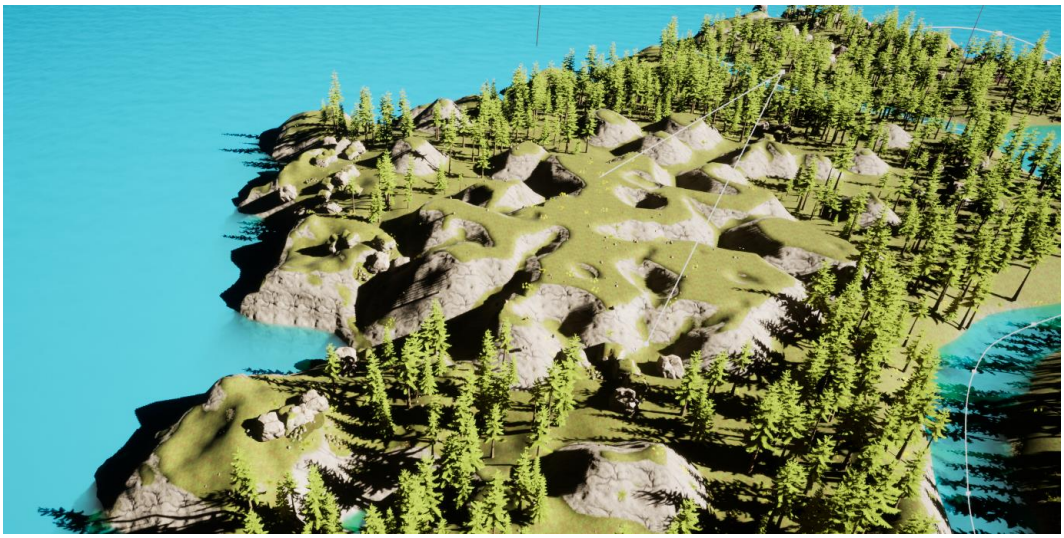


Figure 13: Custom Landmass layer that formed the structure of Cliffs and Hills.

The creation of rocky cliffs and hills in FarmingFantasy is a testament to the detailed and meticulous design approach used to craft the game's terrain, contributing significantly to the game's dynamic and engaging environment.

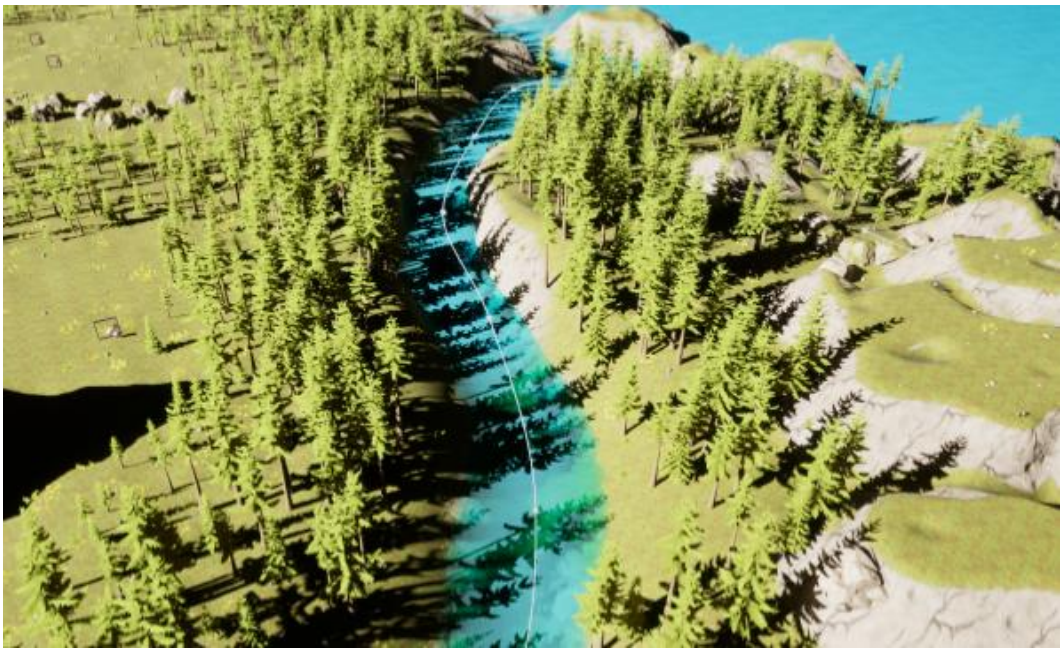


Figure 14: River running through the island

- The landscape sculpting tool played a crucial role in shaping the hills and mountains of the island. By strategically placing multiple landscape custom brush landmasses atop the existing terrain, a foundation for the hills and cliffs was established.

Detailing and Refinement:

- The detailing process involved the use of parameters like curl noise and curves, which were instrumental in defining the level and overall roughness of the hills. This step ensured that each hill and cliff had a unique and realistic appearance.

- Adjustments to falloff details were also made to fine-tune the transitions between different elevations, creating a more natural and seamless landscape.

4. Trees, Plants, Rocks, Boulders

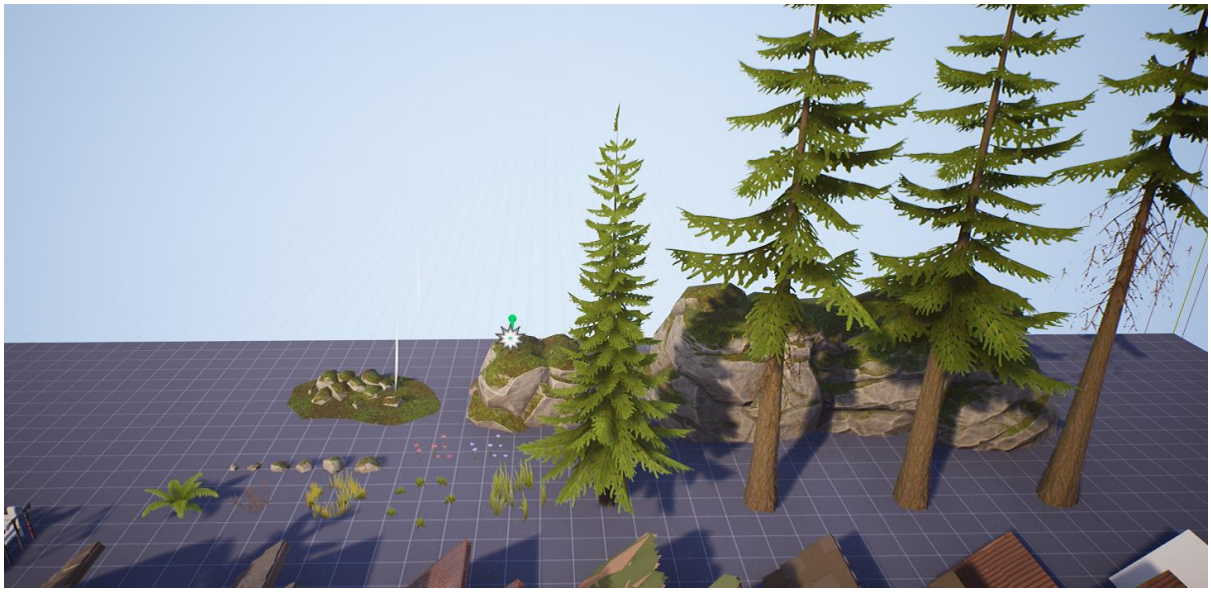


Figure 15: Assets from EasyBuildingSystem project.

In FarmingFantasy, the integration of Trees, Plants, Rocks, and Boulders plays a pivotal role in bringing the island to life, offering a rich and immersive environment for players. The assets for these natural elements were carefully selected and integrated to enhance the game's aesthetic and functional aspects.

Asset Selection:

- The meshes and materials for these foliage components were sourced from the EasyBuildingSystem v10 project set downloaded from Unreal marketplace. This choice provided a diverse range of high-quality assets that perfectly aligned with the game's artistic vision and thematic setting.

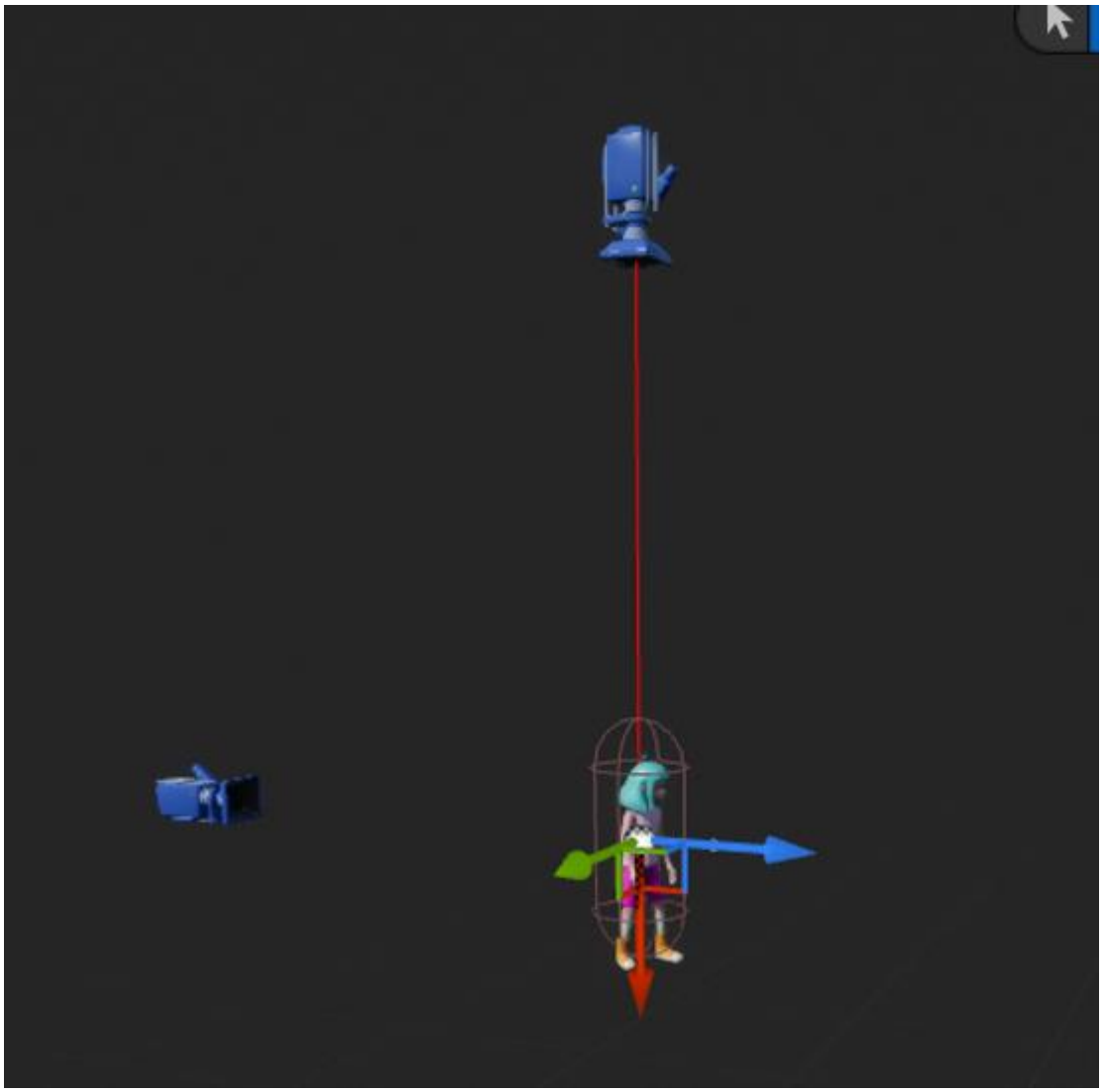
Customization and Integration:

- Utilising the foliage paint tool, these elements were meticulously placed across the island. Adjustments to the density and scale were made to ensure that the distribution of trees, plants, rocks, and boulders appeared natural and harmonious with the terrain.

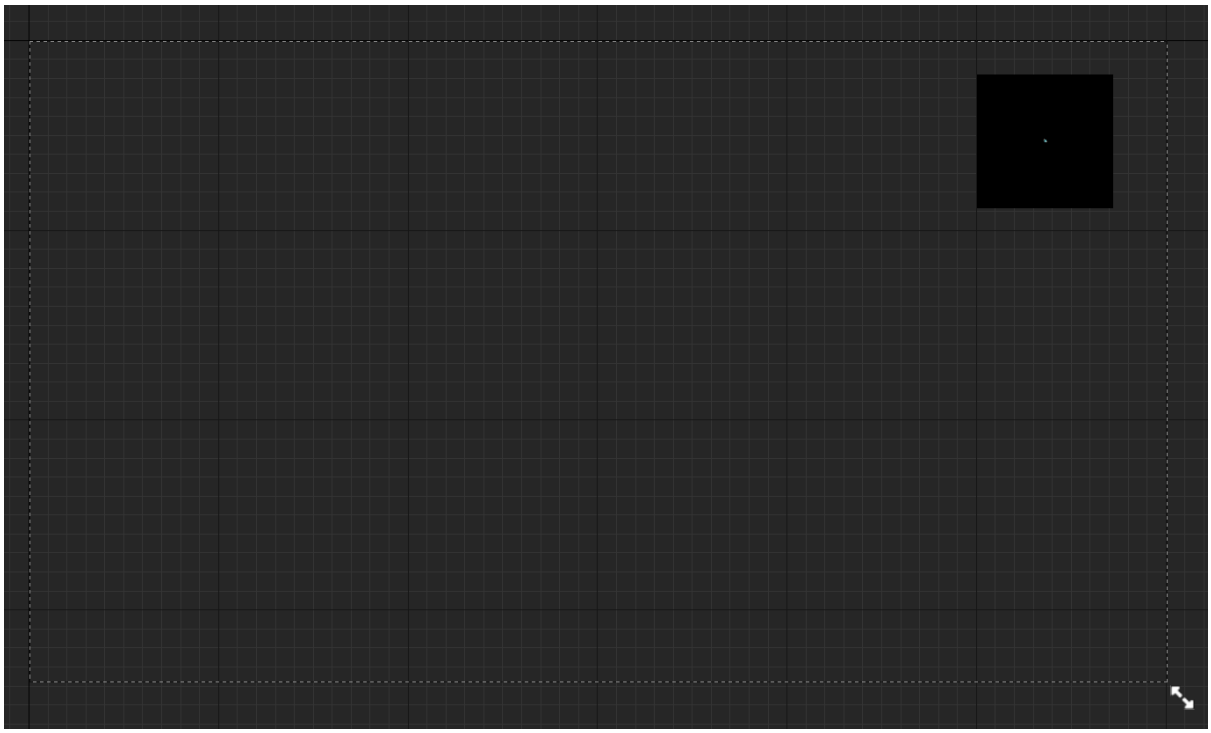
- The placement of these elements was not just aesthetic but also considered gameplay dynamics, creating natural barriers, hiding spots, and points of interest that add depth to the exploration experience.

viii. Minimap

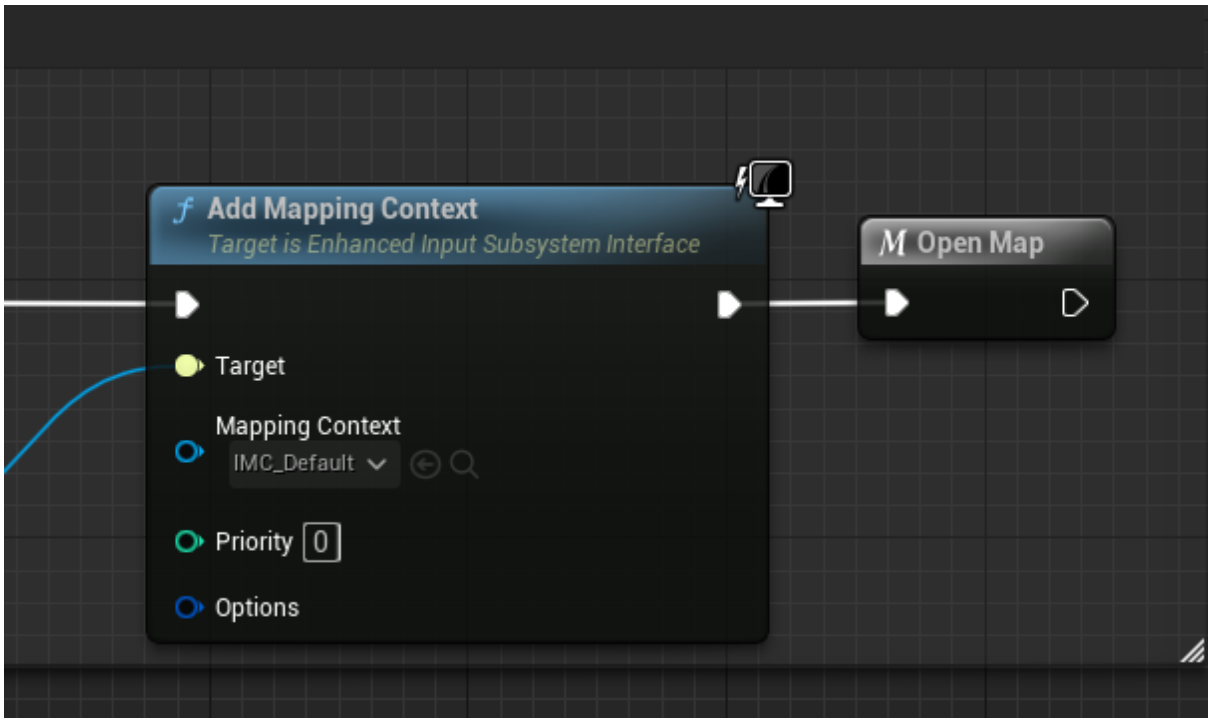
The minimap is created by using a spring arm. In the third person character blueprint a spring arm is added, then a SceneCaptuerComponent2D is added as a child of the spring arm.

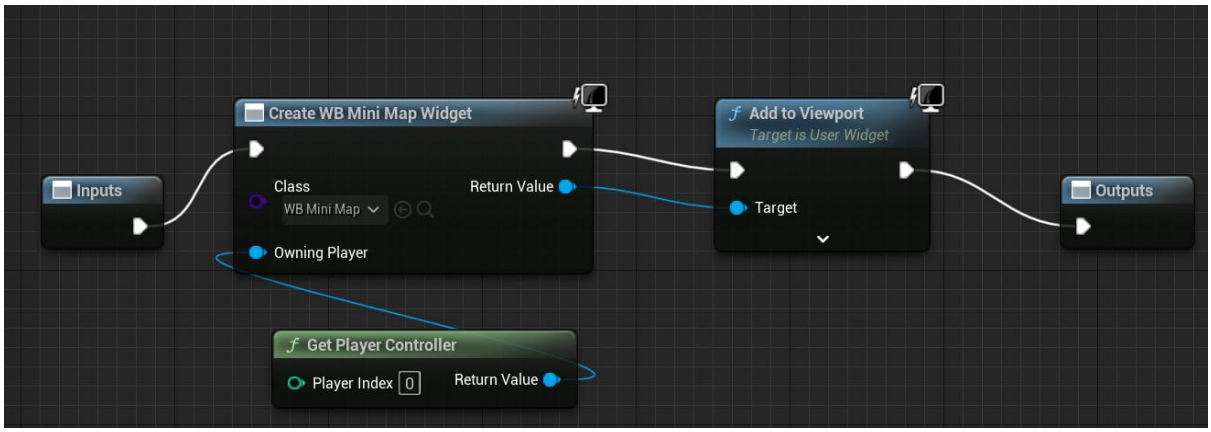


What it sees i.e. the viewport is saved into a texture. Then a material is created so that it can be displayed in a widget. A canvas panel with an image.



Then the map is added.




Inputs
Create WB Mini Map Widget
Class
WB Mini Map
Return Value
Owning Player
Add to Viewport
Target is User Widget
Target
Outputs
Get Player Controller
Player Index
0
Return Value

b. Animal Mechanics

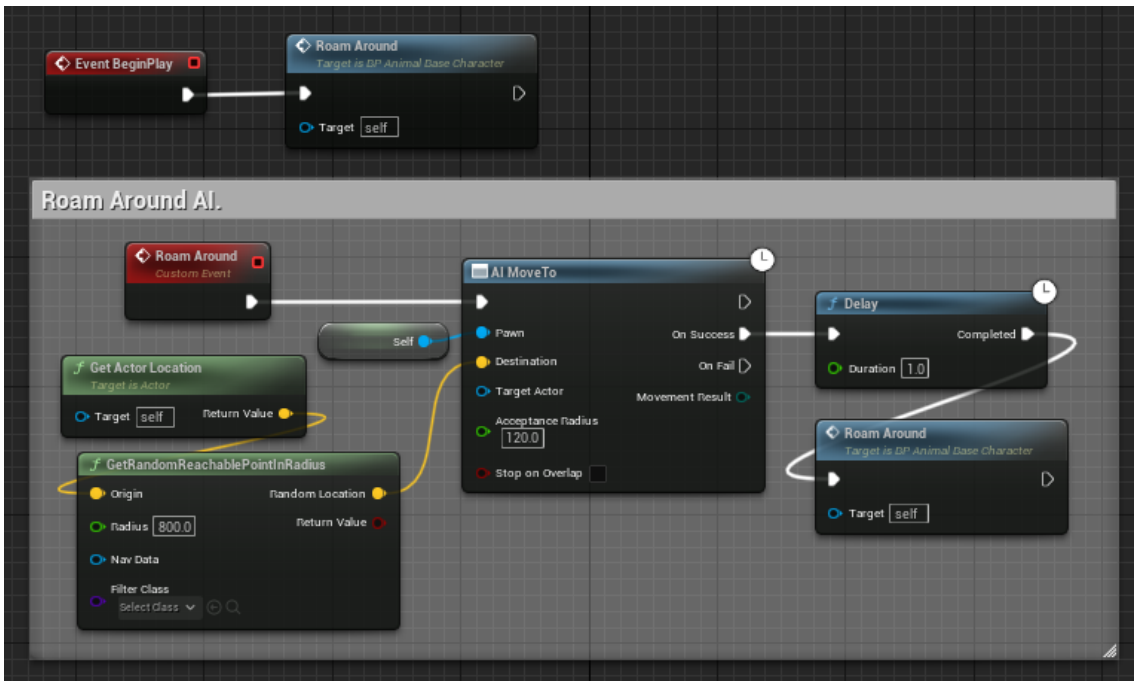


Figure 16: Random movement generator.

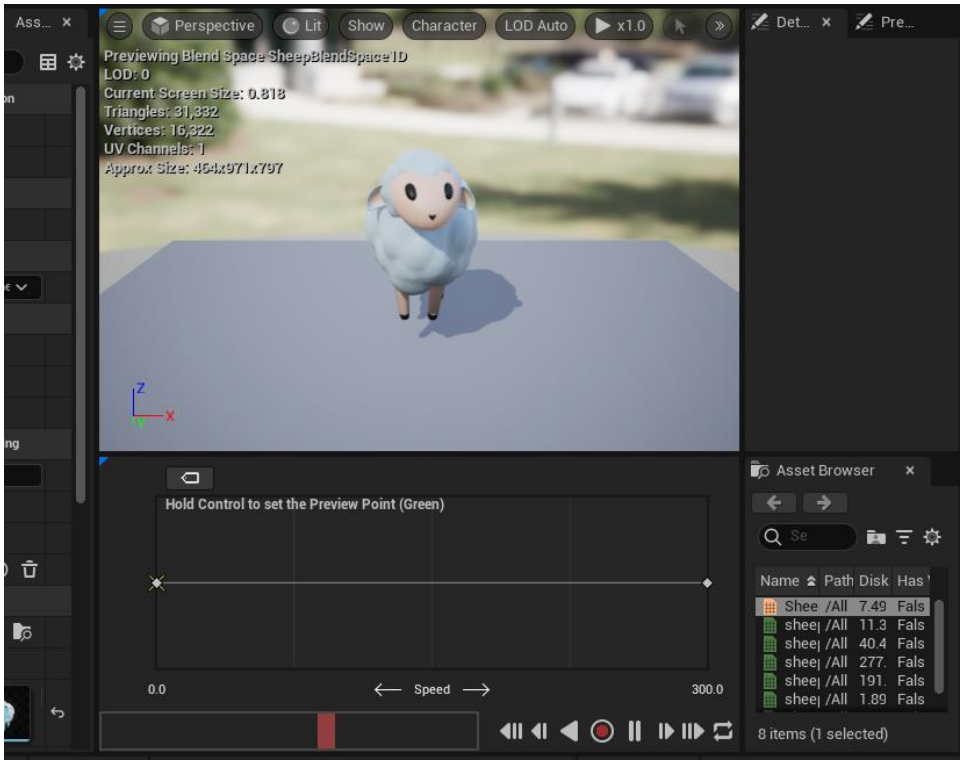


Figure 17: Combination of Sheep walking and idle animation.

In FarmingFantasy, the animal mechanics are a core aspect of the gameplay, adding a vibrant and dynamic element to the game world. The movement and behaviour of the animals are governed by an AI system, designed to simulate natural and realistic animal activities. This section delves into the intricacies of how these mechanics were implemented to create an

engaging and immersive experience for the player.

AI Movement and Roaming:

- Base Animal Blueprint: All animals in FarmingFantasy derive from a parent class, `BP_AnimalBaseCharacter`. This class includes essential components and behaviours common to all animals, ensuring consistency and efficiency in the development process.
- Roaming AI: A key feature of the animal mechanics is the 'Roam Around' AI blueprint. This blueprint controls the random movement of the animals within the game. The roaming behaviour is initiated with a custom event `Roam Around`, which uses the `AI Move To` node, followed by a brief delay and a subsequent call to `Roam Around` again. This cycle creates a natural and continuous roaming pattern.
- Random Destination Selection: The roaming destinations are randomly selected using the `GetRandomReachablePointInRadius` node with an 800-radius setting. This randomness in movement paths adds to the unpredictability and natural behaviour of the animals.
- Navigation Mesh Bounds: To regulate the roaming area of the animals and prevent them from wandering into undesirable locations, like barns or lakes, navigation mesh bounds volumes are strategically placed around the island. These bounds ensure that animals only roam within designated zones, enhancing the game's realism.

Animation and Movement:

- Use of BlendSpaces: Each animal features a BlendSpace1D, effectively blending idle and walking animations to create seamless transitions. The BlendSpace is configured to vary between idle and walking states based on the animal's speed, ranging from 300 to 800 milliseconds. This approach results in more lifelike and fluid animal movements.
- Animation Blueprints: The animals are animated using individual Animation Blueprints (ABP) like `ABP_Sheep`. The AnimGraph within these blueprints plays a crucial role in mapping the animal's speed to the appropriate animation state in the BlendSpace. The Event Graph updates the speed parameter based on the velocity of the animal, ensuring that the animation state accurately reflects the animal's movement.
- Orientation and Rotation: The animal blueprints are configured with 'Use Controller Rotation Yaw' and 'Use Controller Desired Rotation' settings, allowing the animals to naturally orient themselves in the direction of their movement. This feature adds to the authenticity of their behaviour, as they visually turn and adjust before changing direction.

The animal mechanics in FarmingFantasy represent a sophisticated blend of AI programming, animation techniques, and strategic environmental design. The roaming AI, combined with carefully crafted animations and controlled movement areas, creates a lively and engaging wildlife experience within the game. These mechanics not only enhance the game's visual appeal but also contribute to a more immersive and interactive environment for the players.

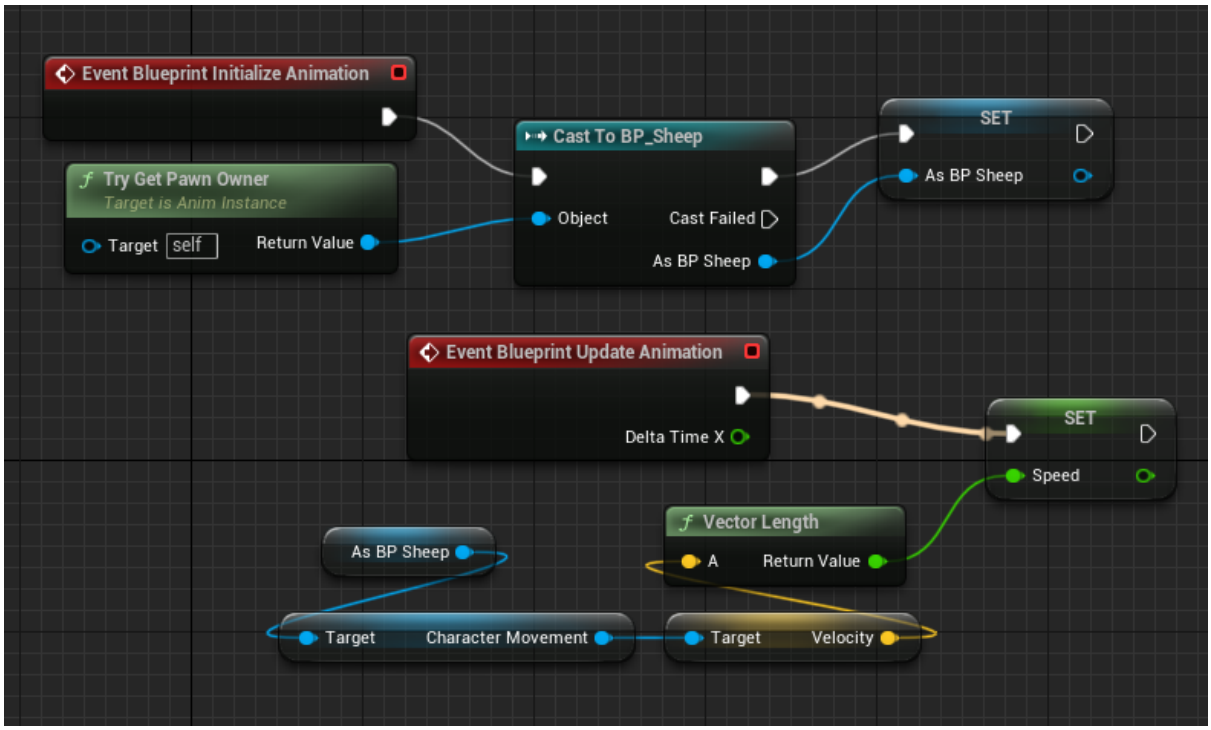


Figure 18: Playing animation while the animal moves.

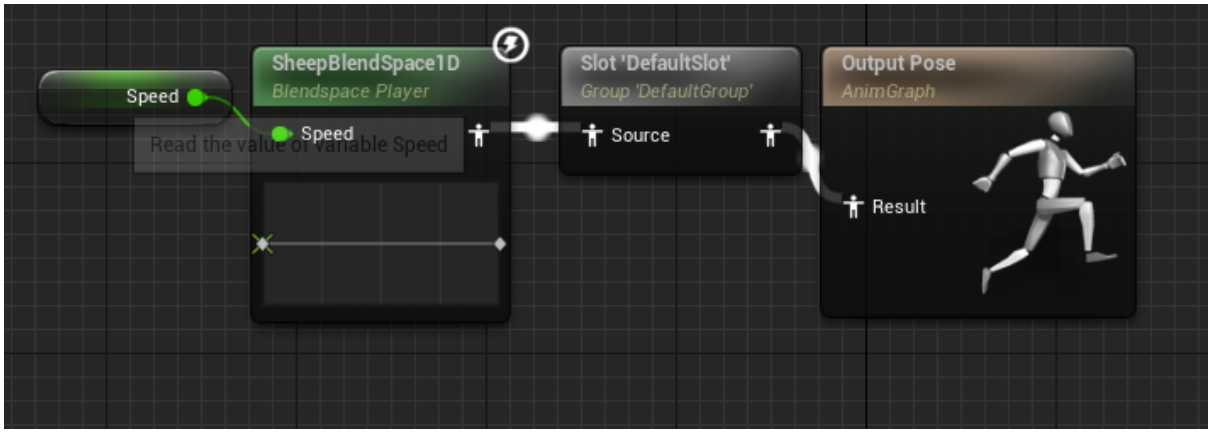


Figure 19: Setting timer for animation speed.

There are specific spawners for each animal and they all work in the same way. At the beginning of the game a timer starts looping to start spawning animals, it chooses a random location around the spawner and then spawns every X time. Then it is cast to whatever animal is supposed to be spawned so that the roaming AI works.

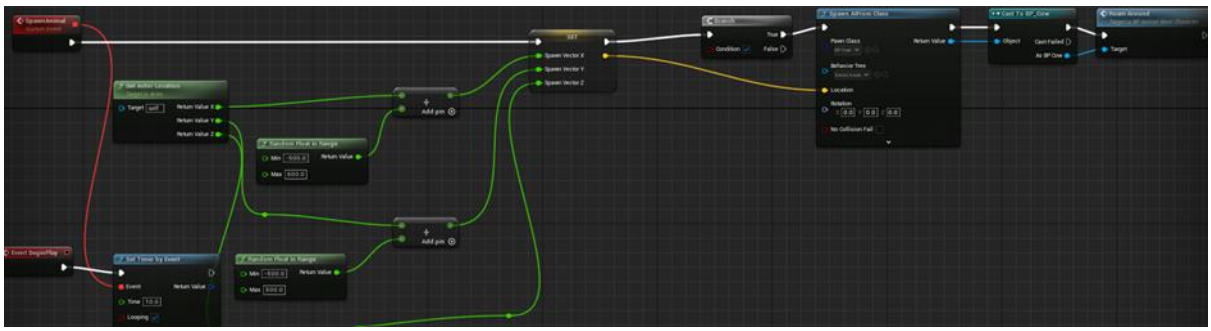


Figure 20: Custom Event for Spawning Animals

c. Farming Mechanics

A majority of the farming mechanics are located in the 'BP_Soil' blueprint class.

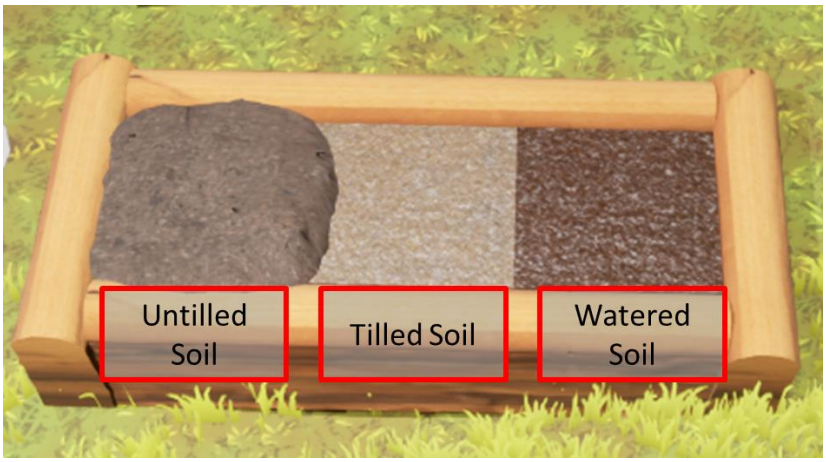


Figure 21: Visual Graphics of Different Soil Statuses

i. Tilling the Soil

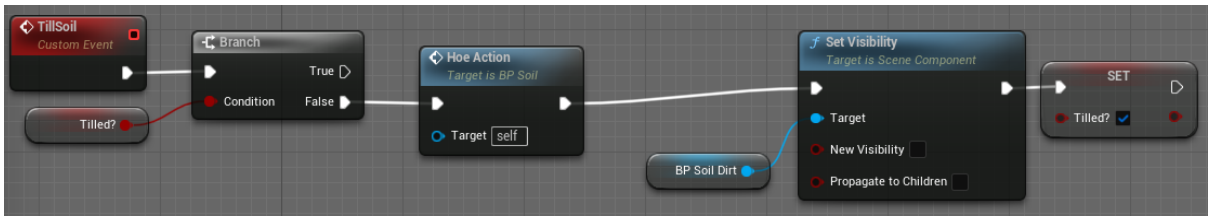


Figure 22: Custom Event for Tilling the Soil

The code in Figure 22 above shows the blueprint for tilling the soil. To be able to plant, there is a check for if the tool equipped is a hoe and if the soil has not been tilled yet. If both of these conditions are true, then the character tills the soil. This sets the soil's tilled variable to true for other mechanics to use. To represent this as a visual update, the untilled and tilled soil are shown in Figure 21.

ii. Planting the Seed

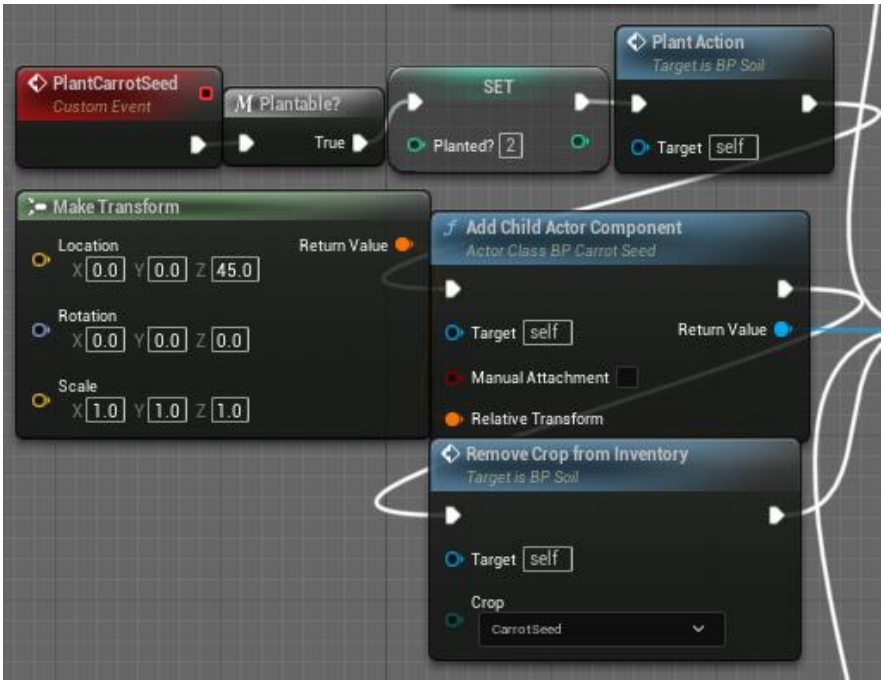


Figure 23: Custom Event for Planting Seeds

The code in Figure 23 shows the blueprint for planting the seed. To plant a seed, there is a check for if the soil is tilled and if there is no crop currently planted in it. Additionally, the player also has to have a seed equipped. If all of these conditions are true, the character plants the seed into the soil and there is a visual update for each stage of the crop's growth (seed, seedling and full grown stage) as shown in Figure 24. The visual update is done by adding a child actor component to the soil.

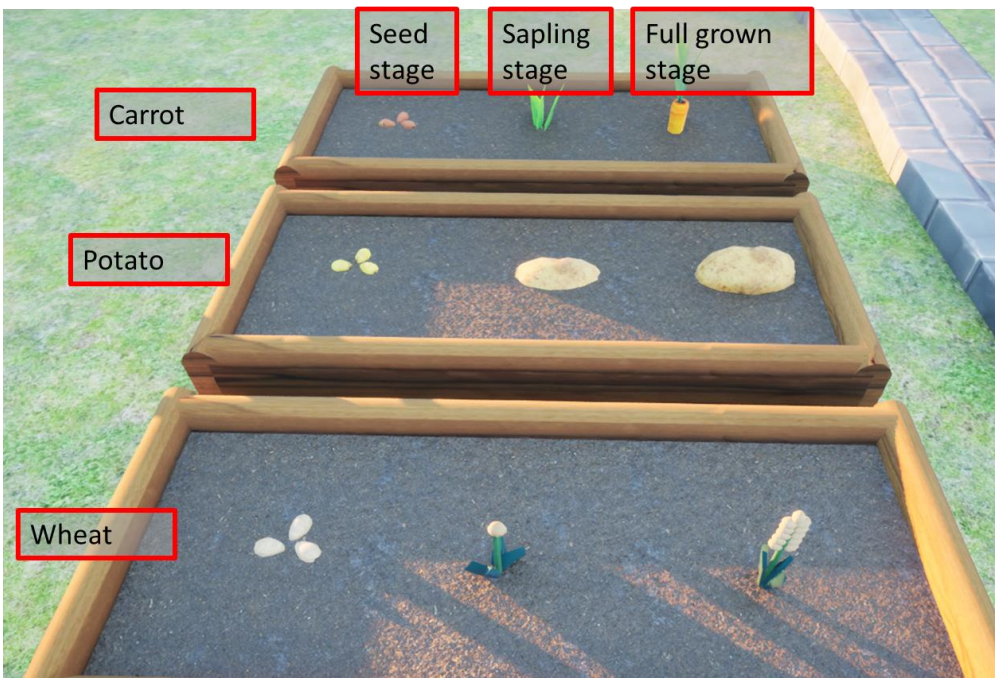


Figure 24: Graphics of Crops at Each Stage of Growth

iii. Watering the Crop

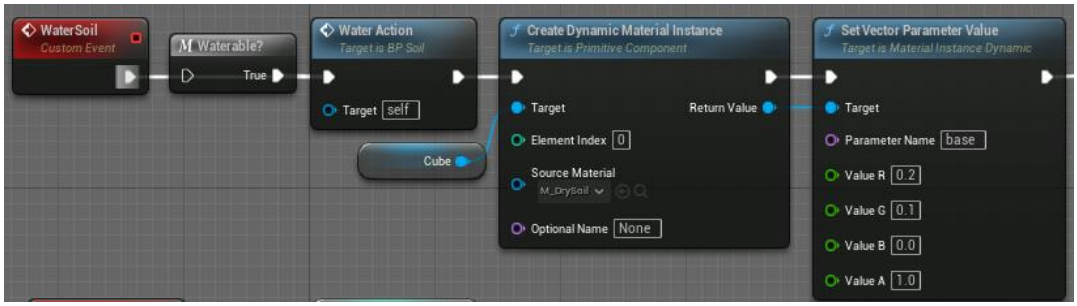


Figure 25: Custom Event for Watering Crop

The code in Figure 25 shows the blueprint for watering the crop. To water a crop, there is a check for if there is a crop planted in the soil. If this condition is true, the soil is watered and stays watered for the rest of the day as shown in the continuation of the code in Figure 26. Since there are 2 stages for crop growth, a Boolean for whether the crop is in seedling stage is ticked. There is also a visual update for this as described in Figure 24 earlier which is done through changing the tint of the soil's material.

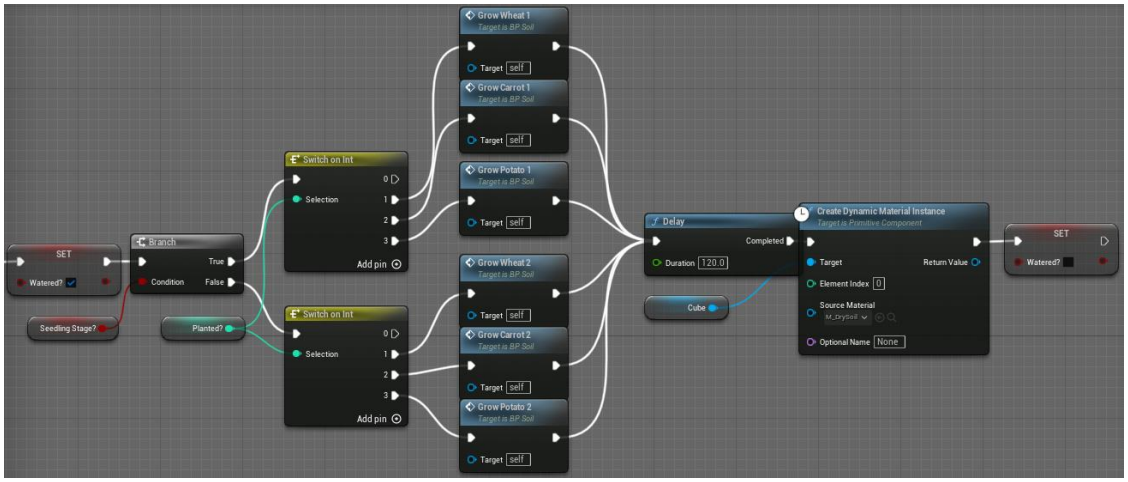


Figure 26: Setting the Crop as Watered Depending on Seed and Stage

iv. Crop Growth

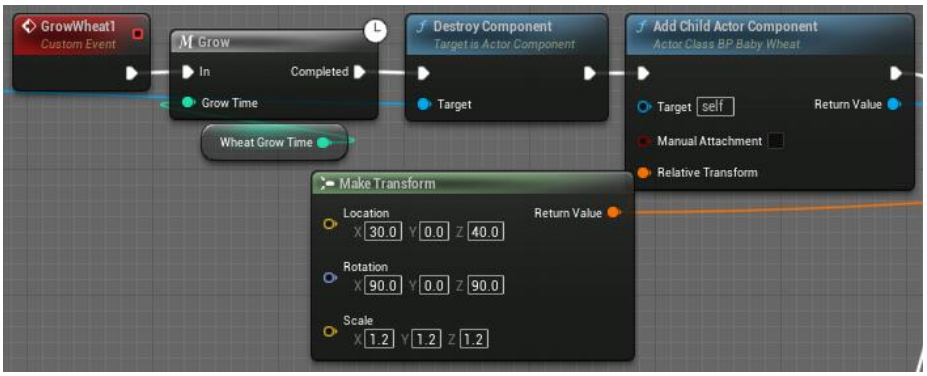


Figure 27: Custom Event for Crop Growth

Each crop grows to either the seedling or fully grown stage after a day of being watered. If the plant is watered, there is a delay which is the length of a day. After the delay, the old mesh of the crop is destroyed to show the next stage of the crop's growth and the new mesh is spawned. This code for this is shown in Figure 27.

v. Harvesting the Crop

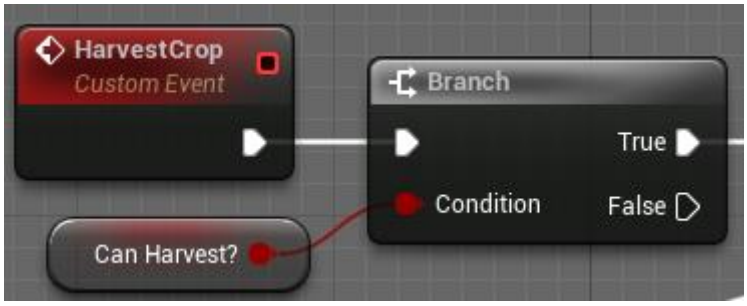


Figure 28: Checking if a Crop is Harvestable

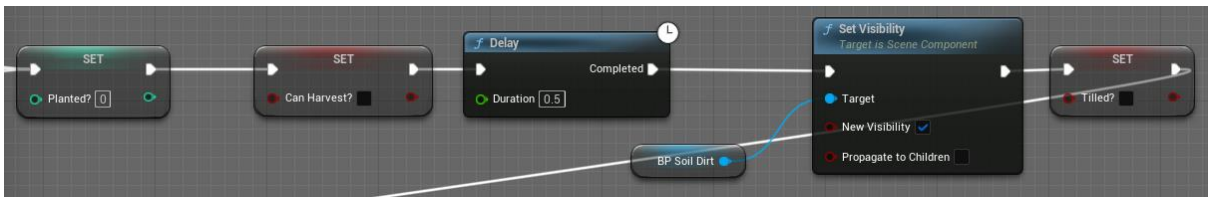


Figure 29: Blueprint for Harvesting Crop and Resets Soil Graphics to Untilled

In a previous blueprint, it is checked if the player has equipped a sickle. Then, to harvest a crop, there is a check for if the crop is in the fully grown stage as shown in Figure 28. If these conditions are true, the character harvests the crop and the soil resets back to being untilled and unplanted and the visual of an untilled soil is back as shown in Figure 29.

d. Animal Interaction Mechanics

One of the most engaging aspects of FarmingFantasy is the ability for players to interact with animals, both wild and those captured in the barn. A critical component of this interaction system is the menu popup mechanism, which is meticulously designed to facilitate various interactions such as feeding, petting, collecting, or attracting animals. This section outlines the underlying blueprint mechanism that enables this interactive feature.

i. Interaction Menu Popup Mechanism

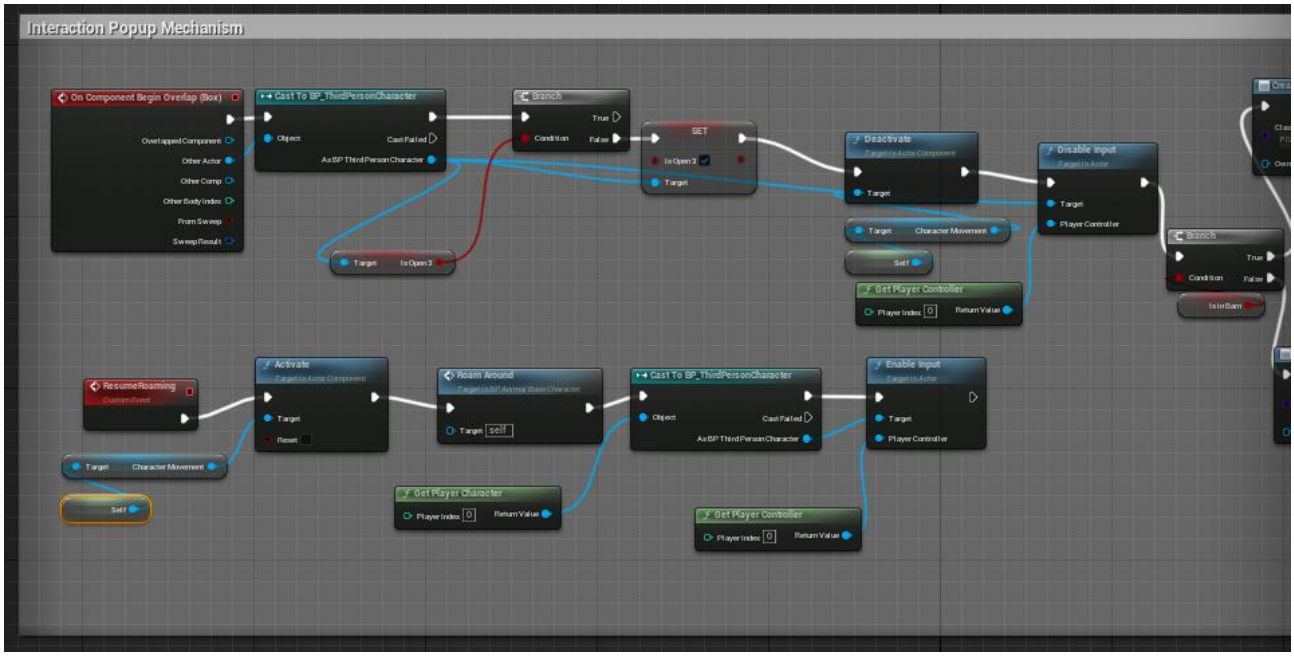


Figure 30: On overlap event when player hits the box collider of animals.

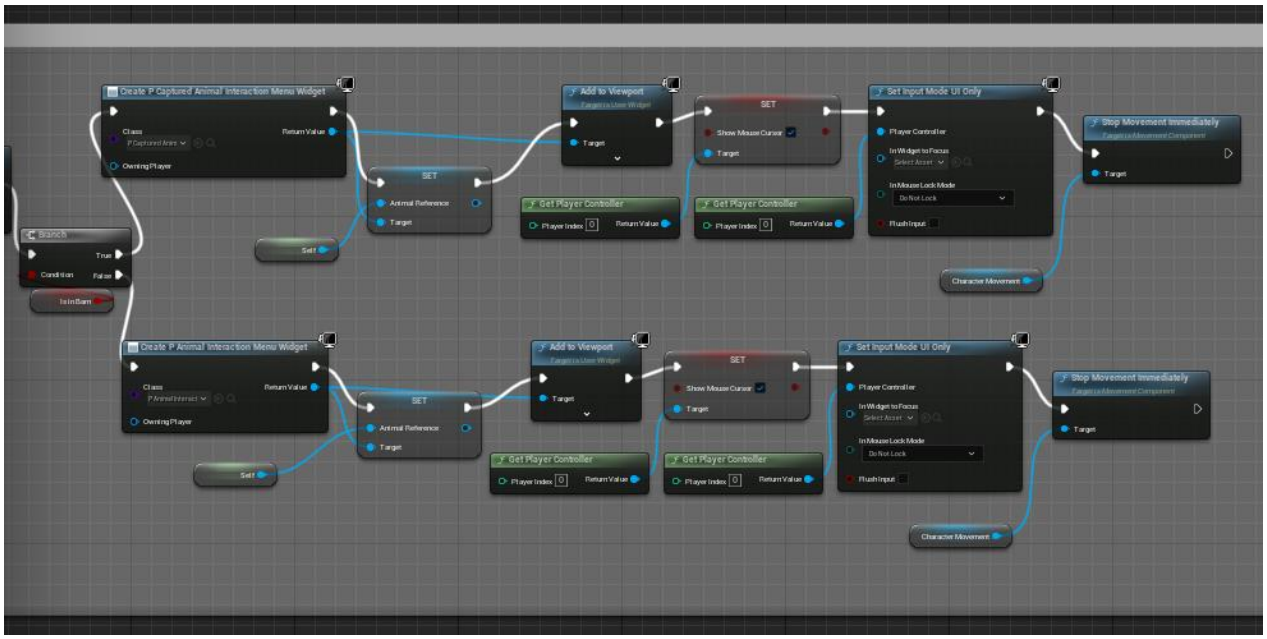


Figure 31: Continuation of an overlap event of animal base character.

Triggering Interaction: The interaction with animals is initiated when the player's character comes into proximity with an animal, specifically when the player's character overlaps with the animal's box collider. This overlap event is handled within `BP_AnimalBaseCharacter` blueprint.

Blueprint Workflow

- Overlap Event: The sequence begins with the `On Component Begin Overlap (box)`

node, which is triggered as soon as the player's character intersects with the animal's collider.

- Character Check: A cast to `BP_ThirdPersonCharacter` is performed to ensure that the overlapping entity is indeed the player character.
- Interaction Availability Check: A branch node checks the condition `IsOpen`, determining if an interaction menu is already active. If not, the sequence proceeds.
- Player Movement Deactivation: Upon a successful overlap without any active interaction menu, the player's movement is disabled using `Disable Input`. This prevents the player from moving while interacting with the menu.
- Menu Creation and Display:
    - For Captured Animals: If the `IsInBarn` condition is true, indicating the animal is captured and in the barn, the `P_CapturedAnimalInteractionMenu` widget is created and added to the viewport. This menu includes options like feed, pet, and collect.
    - For Wild Animals: Conversely, if the animal is not in the barn, the `P_AnimalInteractionMenu` widget is created, featuring options like attract for wild animals.
- UI and Cursor Settings: For both scenarios, the cursor is made visible, and the input mode is set to UI only, focusing player interaction on the menu.
- Halting Animal Movement: The `Stop Movement Immediately` node is used to halt the animal's movement, ensuring that the interaction occurs without interruption.

This interaction mechanism in FarmingFantasy demonstrates a sophisticated integration of player and AI elements, providing a seamless and intuitive interaction experience. Whether it's feeding a captured sheep in the barn or attracting a wild rabbit in the forest, these interactions are made possible through a well-orchestrated series of blueprint nodes and conditions. The attention to detail in the interaction mechanism significantly enhances the game's immersive quality, allowing players to feel genuinely connected to the world and its inhabitants.

ii. Close Button Mechanism

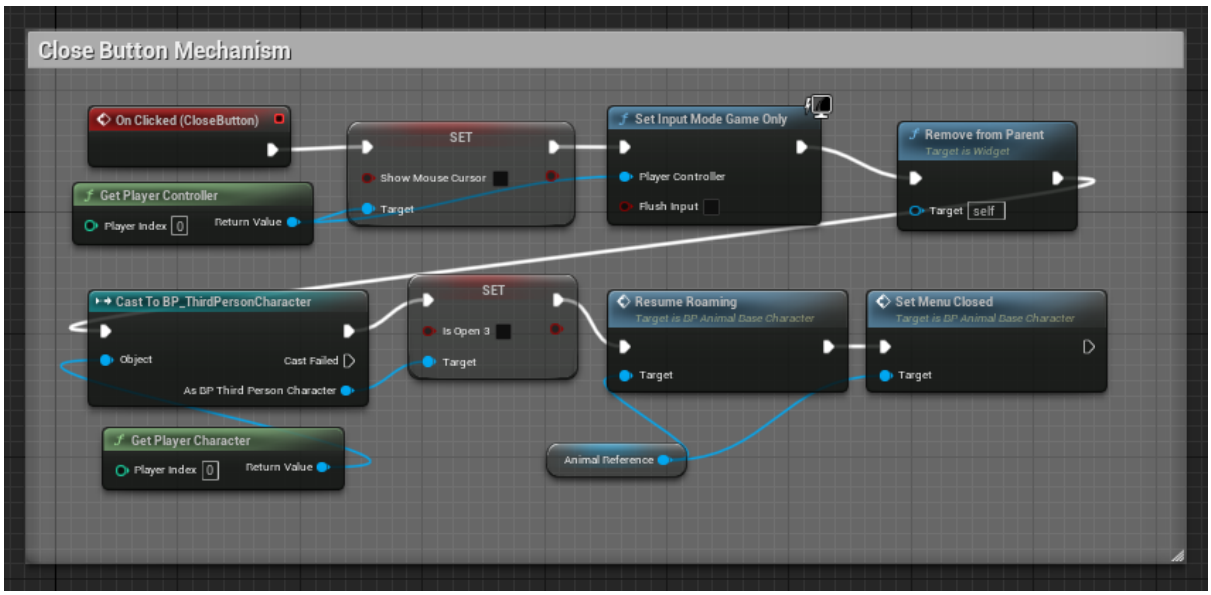


Figure 33: On clicked event for close button.

FarmingFantasy incorporates a well-designed close button mechanism in its interaction menus, ensuring a smooth and user-friendly experience when players choose to exit these menus. Both the `P_AnimalInteractionMenu` and `P_CapturedInteractionMenu` widgets feature this mechanism. The process is outlined below, focusing on how the game transitions back to normal gameplay after a player interacts with an animal.

Blueprint Workflow for Close Button:

- Triggering the Close Event: The sequence is initiated when the player clicks the close button in either of the interaction menus.
- UI and Cursor Adjustments:
    - Cursor Visibility: The first action is to set `Show Mouse Cursor` to false. This change reverts the cursor back to its non-interactive state, aligning with gameplay mode.
    - Input Mode Reset: The input mode for the player controller is then set to `Game Only`. This step is crucial as it shifts control back from the UI to the game, allowing player movement and interaction with the game world.
- Menu Dismissal:
    - Remove Menu: The `Remove from Parent` node is used to effectively close and remove the interaction menu from the viewport.
    - Player Status Update: A cast to `BP_ThirdPersonCharacter` is performed, followed by setting the `IsOpen` boolean to false. This action signifies that no interaction menu is currently active, enabling the possibility of future interactions.
- Resuming Animal Movement:
    - Custom Event Call: The `Resume Roaming` custom event in the animal's blueprint is called. This event is a key aspect of reactivating the AI movement and roaming behaviour of the animal.
    - Menu Closure Acknowledgment: The `Set Menu Closed` step confirms the completion of the interaction and the closure of the menu.

iii. Attract Button Mechanism

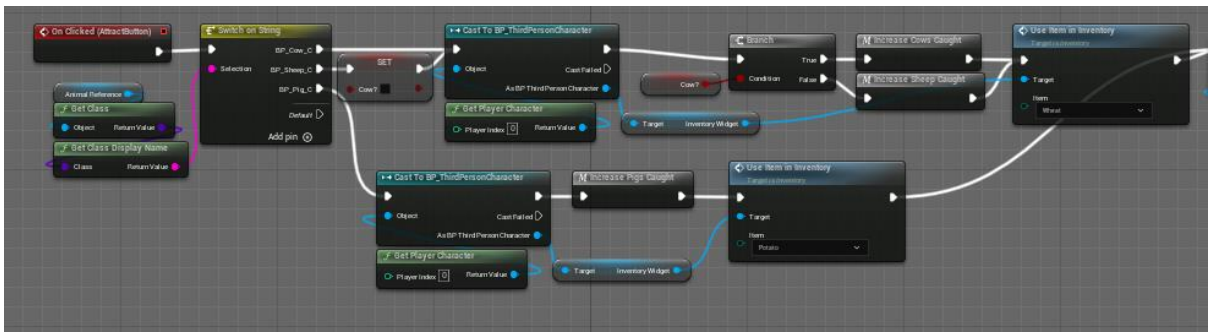


Figure 34: On click event on attract button.

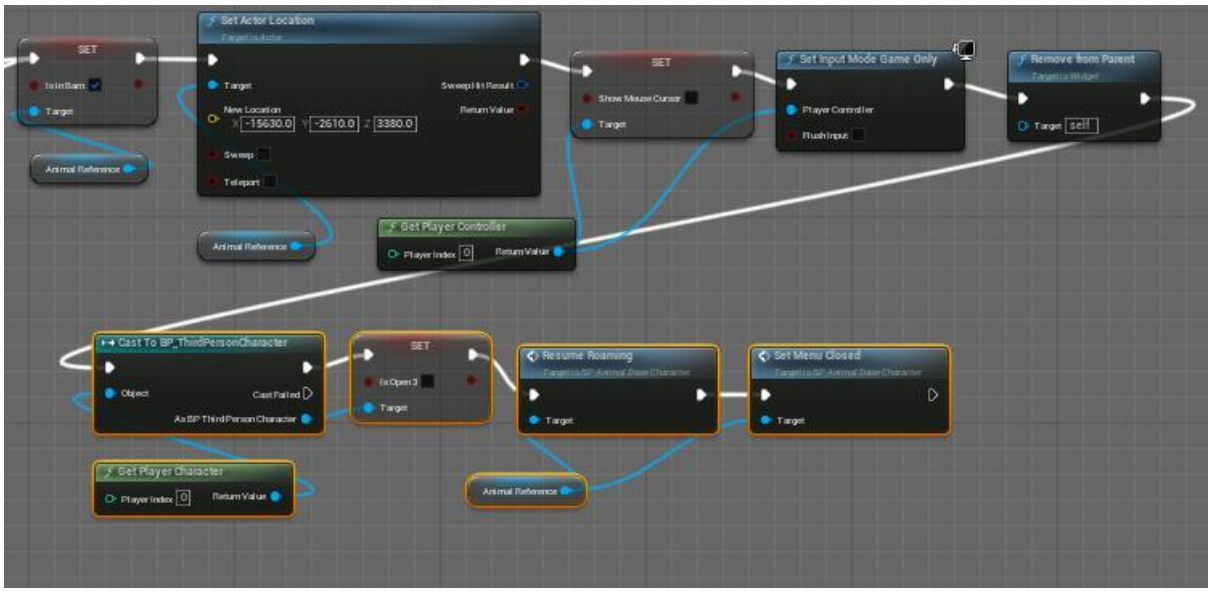


Figure 35: Teleporting the animal when attracted with the correct crop.

FarmingFantasy integrates an "Attract" feature into its gameplay, allowing players to interact with and capture farm animals. This mechanism, primarily accessible through the Attract button in the animal interaction menu, is a crucial part of the animal interaction mechanics. Below is a description of how this feature functions, focusing on its intuitive and engaging design.

Initiating Attraction: The process begins when a player clicks the Attract button. This action is the gateway to initiating interaction with the animal.

Animal Type Determination: The game then identifies the type of animal the player is interacting with. This step is crucial for determining the appropriate action and resource requirement (e.g., wheat for cows and sheep, potato for pigs).

Resource Consumption and Animal Capture:

- Inventory Check and Use: Depending on the animal type, the game checks for the required item in the player's inventory (like wheat or potato). If the item is available, it's used to attract the animal.
- Updating Animal Status: The animal's status is updated to reflect its capture, with relevant counters like 'Cows Caught' being incremented. This update is a key part of the game's tracking and progression system.
- Relocation to Barn: Once attracted, the animal is teleported to a specific location inside the barn, symbolising its capture and new home. This relocation is both a visual and functional change, reflecting the successful interaction.

Reverting to Gameplay Mode:

- Cursor and UI Adjustments: Post-interaction, the game swiftly transitions back to the regular gameplay mode. The cursor is hidden, and the input mode is reset to focus solely on the game.
- Menu Closure: The interaction menu is closed, and the 'IsOpen' status is updated to false in the player character's blueprint, indicating the end of the interaction phase.

Resuming Normal Game Flow:

- Animal AI Behaviour: The animal's roaming AI is resumed, allowing it to return to its natural behaviour within the game environment.
- Finalising Interaction: The 'Menu Closed' status is set, marking the completion of the interaction and the smooth transition back to the main game.

iv. Rabbit Pit

Figure 36: Rabbit Pit

A special way to catch rabbits is through the rabbit pit located in the player's farm. If the player is close by, a prompt will show as shown in Figure 36 to let the player be able to interact with it.

Figure 37: Rabbit Pit Interaction Screen

Upon pressing 'E', the camera focuses on the rabbit pit and swaps to a camera placed above it as seen in Figure 37.

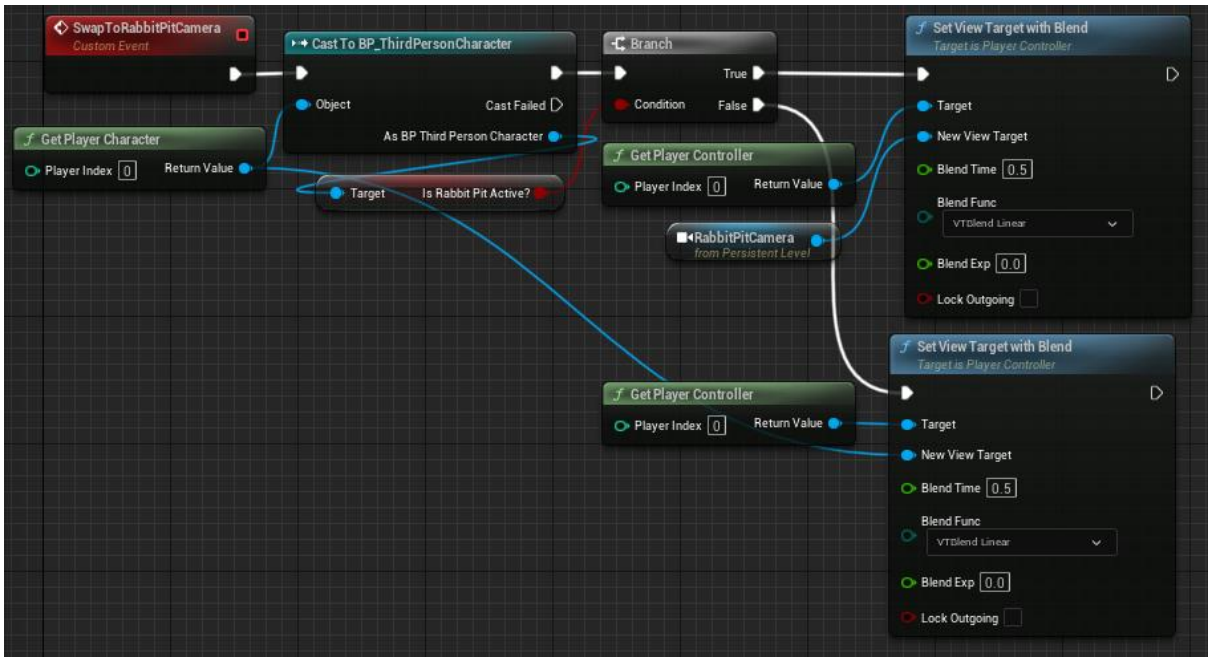


Figure 38: Rabbit Pit Camera View Blueprint

The code for swapping to the rabbit camera is shown in Figure 38. The available interactions with the rabbit pit are also shown.

Figure 39: Rabbit Pit Fill Interaction

If the player has carrots in their inventory, they are able to fill the rabbit pit with it as shown in Figure 39.

Figure 40: Rabbit Pit Catch Interaction

After some time, a rabbit will come and be attracted to the carrot. Once there is a rabbit, players can equip their net and catch the rabbit.

v. Pet Animals

For petting animals it just sets the Boolean and increases friendship.

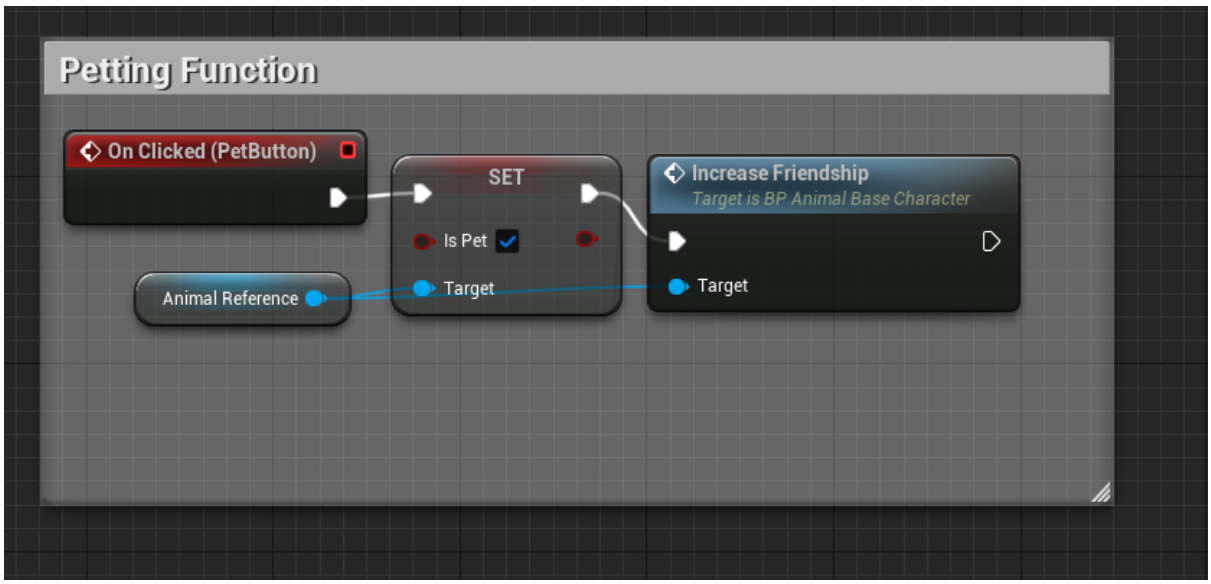


Figure 41: Petting Function Blueprint

For feeding it checks which animal it is first and then checks the inventory for the proper crop, if it's present it feeds the animal and increases friendship.

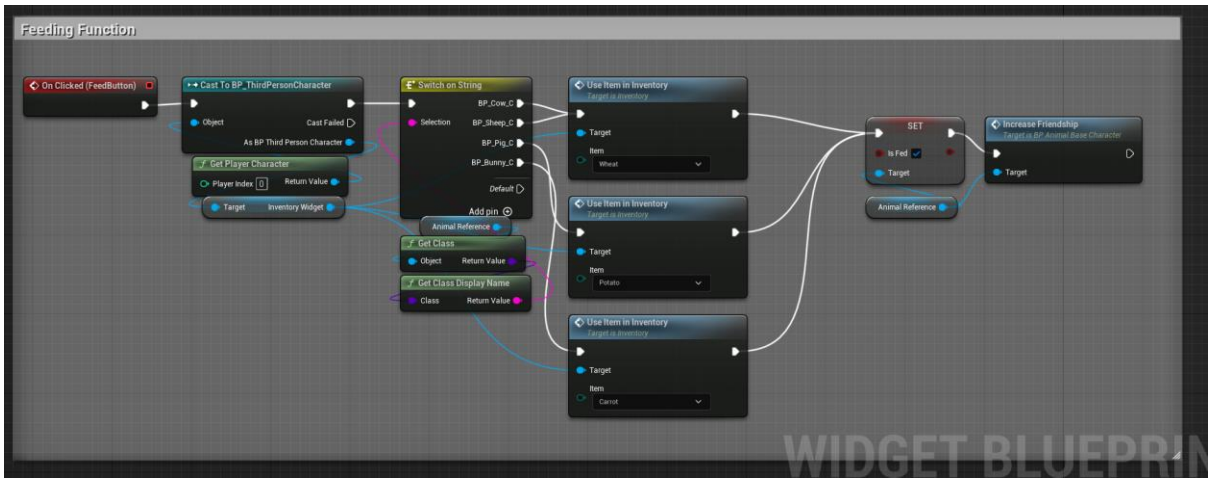


Figure 42: Feeding Function Blueprint

vi. Collecting Animal Resource

For collecting, it sets has collected to true in order to prevent infinite collecting.

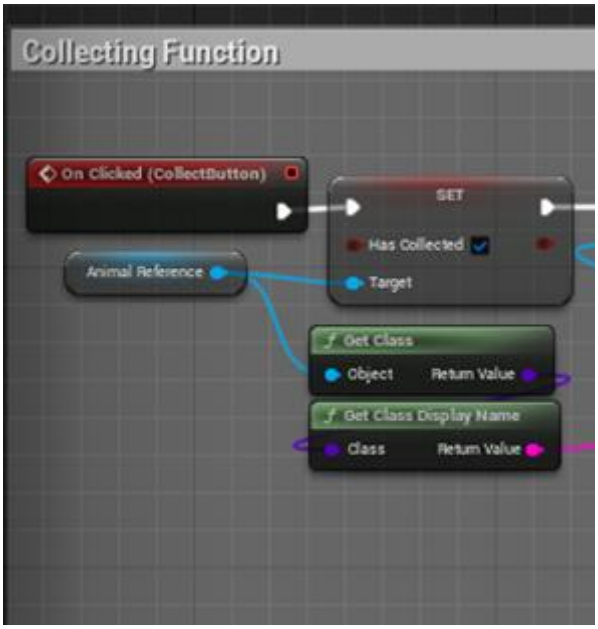


Figure 43: Collection Function Blueprint

It checks the animal type then it will call a macro to increase the player's resource.

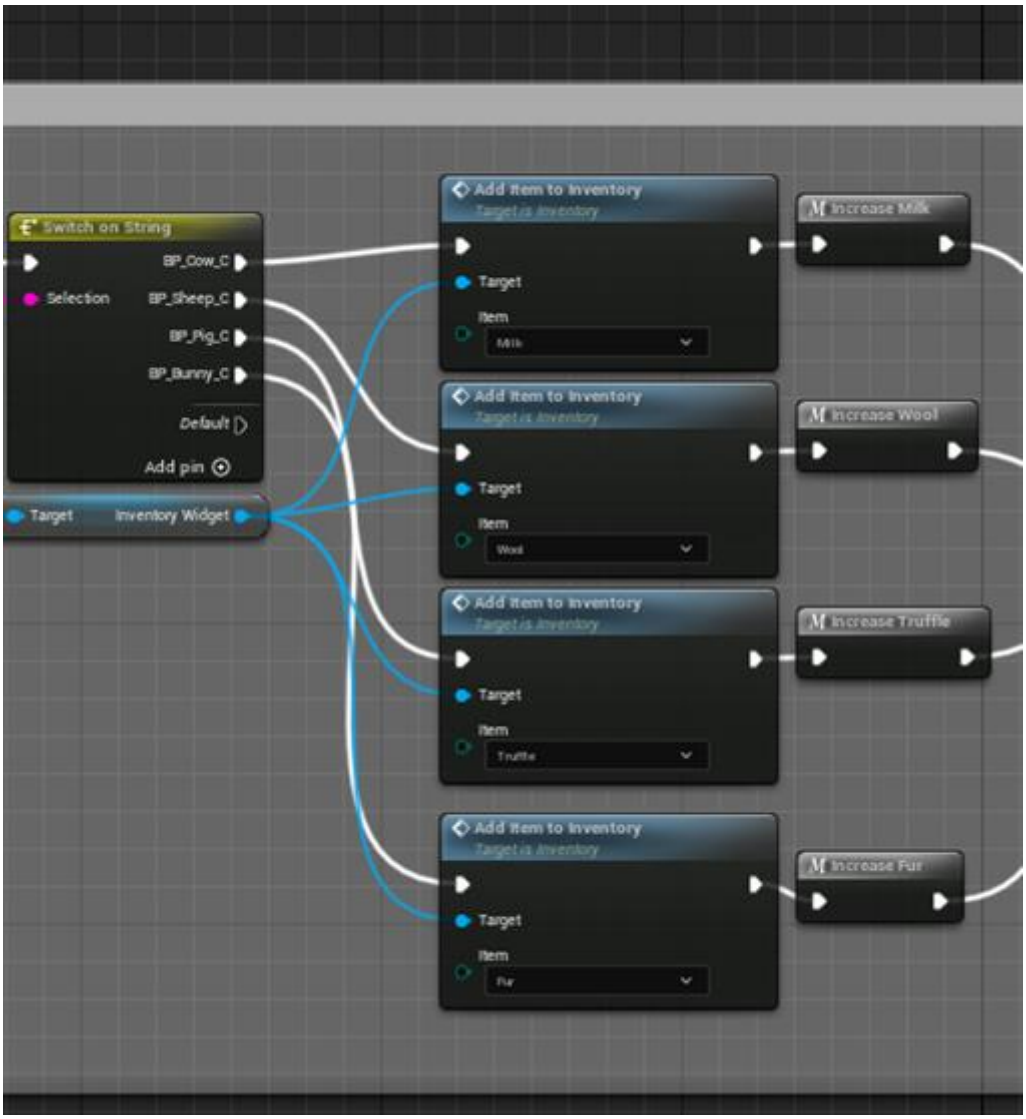


Figure 44: Add To Inventory Blueprint

e. Resource Collection and Management

i. Item Inventory

Items including the seeds, crops and animal resources are stored in an inventory hotbar at the bottom of the screen. Any item can be accessed by pressing on the corresponding number (1-0) given in the top left corner of that item. This will highlight the item to show that it is currently equipped. On button press, the corresponding item slot was found through the character's inventory widget based on its index to set a border colour around the correct slot. To prevent multiple highlights of different boxes, all slots are reset to unhighlighted first.

The inventory consists of an array of 'item slots' which display the item's image and stack size to visually match the character's stored inventory.

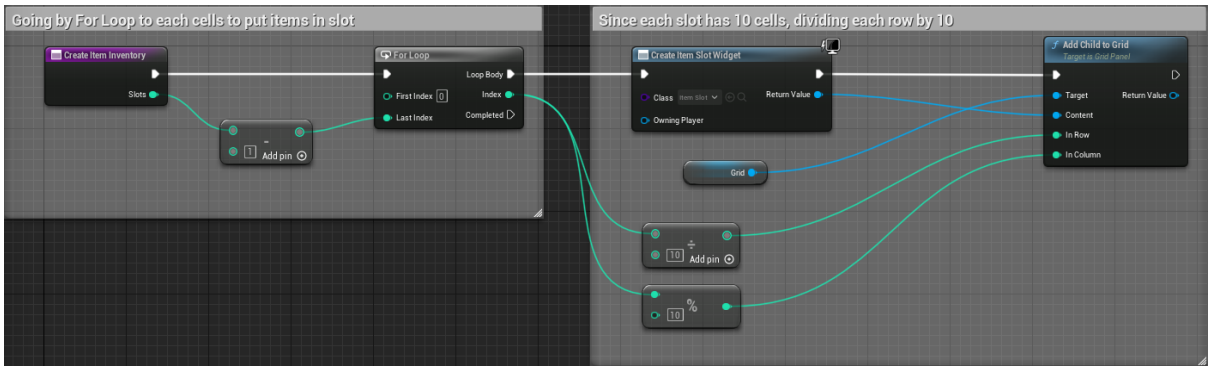


Figure 45: Creating Inventory Blueprint

Anytime an item is added, removed or the quantity of an item has changed from the character's stored inventory, the changes must be reflected in the inventory widget. This is done in the 'update inventory' function displayed in Figure UPDATE INVENTORY.

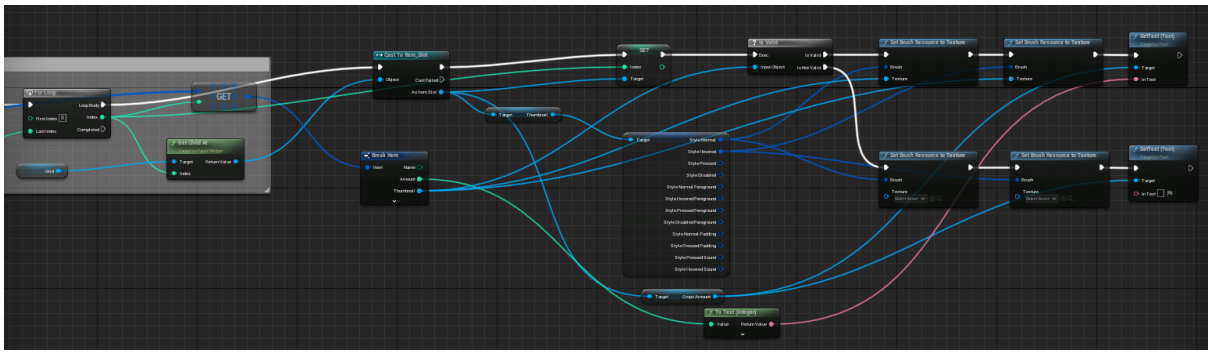


Figure 46: Update Inventory Blueprint

f. Character Progression and Friendship Levels

i. Friendship Levels

Each animal has their own friendship level that is stored as an integer. The level goes up and down based on actions the player takes, this is shown as a bar of hearts where each half heart equals 1 friendship level. When the player pets or feeds the animal, the level goes up. If the player forgets to do these things the level goes down. The player is not allowed to infinitely feed or pet the animal and this is achieved by having these tracked as a Boolean in the animal.

Figure 47: Friendship Level Flowchart

At the start of the day, it loops through all of the pet animals and checks whether they have either been pet or fed. For each of these that have not been set then it will decrease the friendship level. This is shown in Figure 48

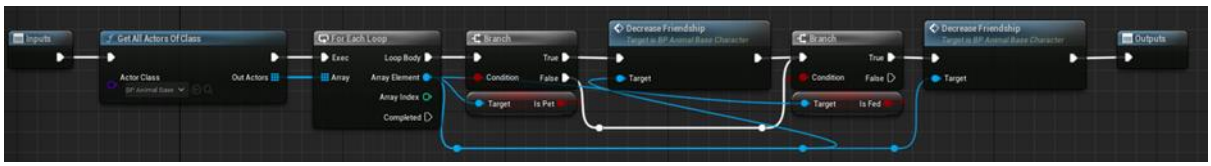


Figure 48: Friendship Checking Blueprint

Afterwards it then resets all of a pet animal's Booleans (fed, pet and collected) to false as shown in Figure 49. This is so the player can feed and pet the animal each day simulating real life.

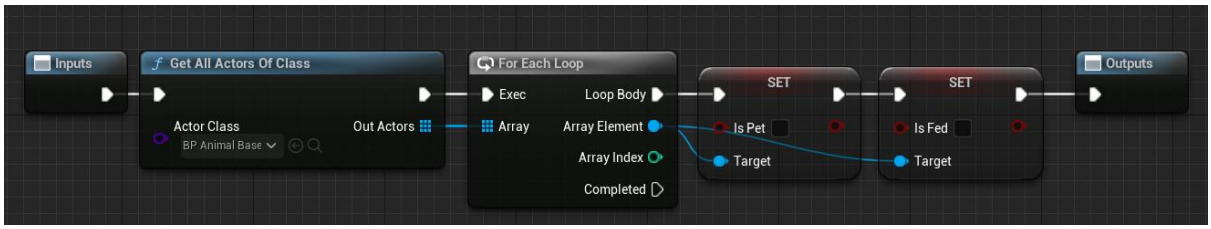


Figure 49: Daily Interaction Reset Blueprint

ii. Museum

Figure 50: Museum Interaction Prompt

Inside the player's house, the player can go up to the book placed on the chair and a prompt will appear for them to interact with the museum. The museum shows the photo of the animal, the number of times the player has caught them and the number of resources the player has collected from that animal. A counter for each type of animal along with their resource is stored in the character's blueprint.

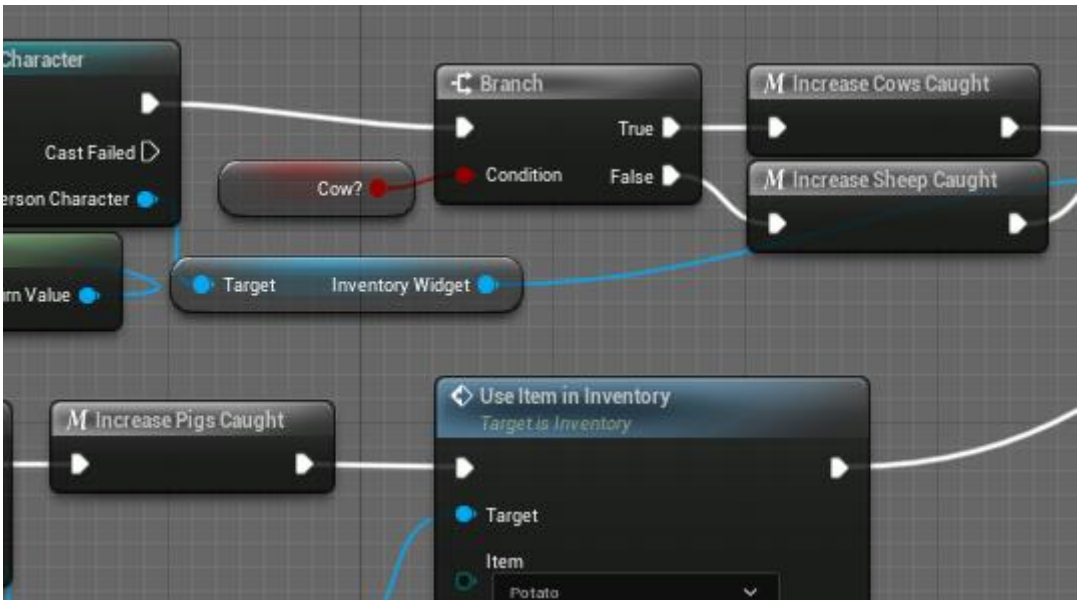


Figure 51: Blueprint Containing Macro for Increasing Specific Animal Caught

Every time an animal is caught, their counter is updated as shown in Figure 51.

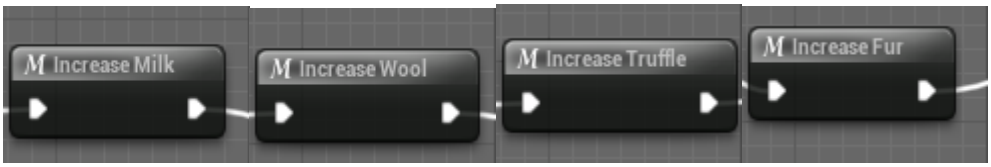


Figure 52: Macros for Increasing Resource Counter

This also happens for whenever a resource is collected from them as shown in Figure 52. The blueprint for the museum is located in 'BP_MuseumDisplay'. Essentially, as shown in Figure 53, the information shown depends on the page and sets the visibility for the needed page as visible and hides all other pages.

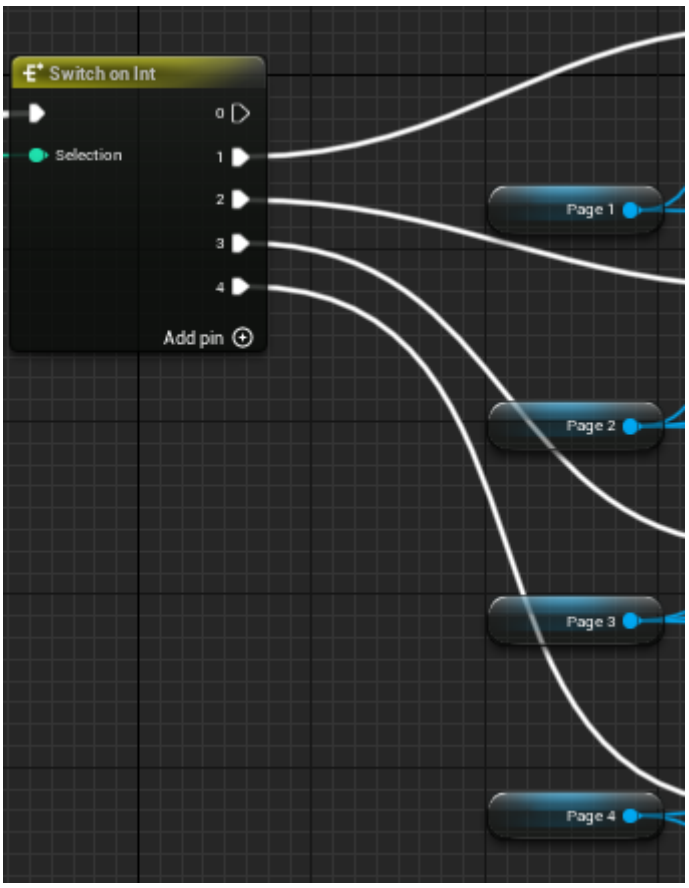


Figure 53: Blueprint for Selecting the Visible Page on the Museum

At each tick, the game checks if the player has completed the museum and upon completion Figure 54 is shown.

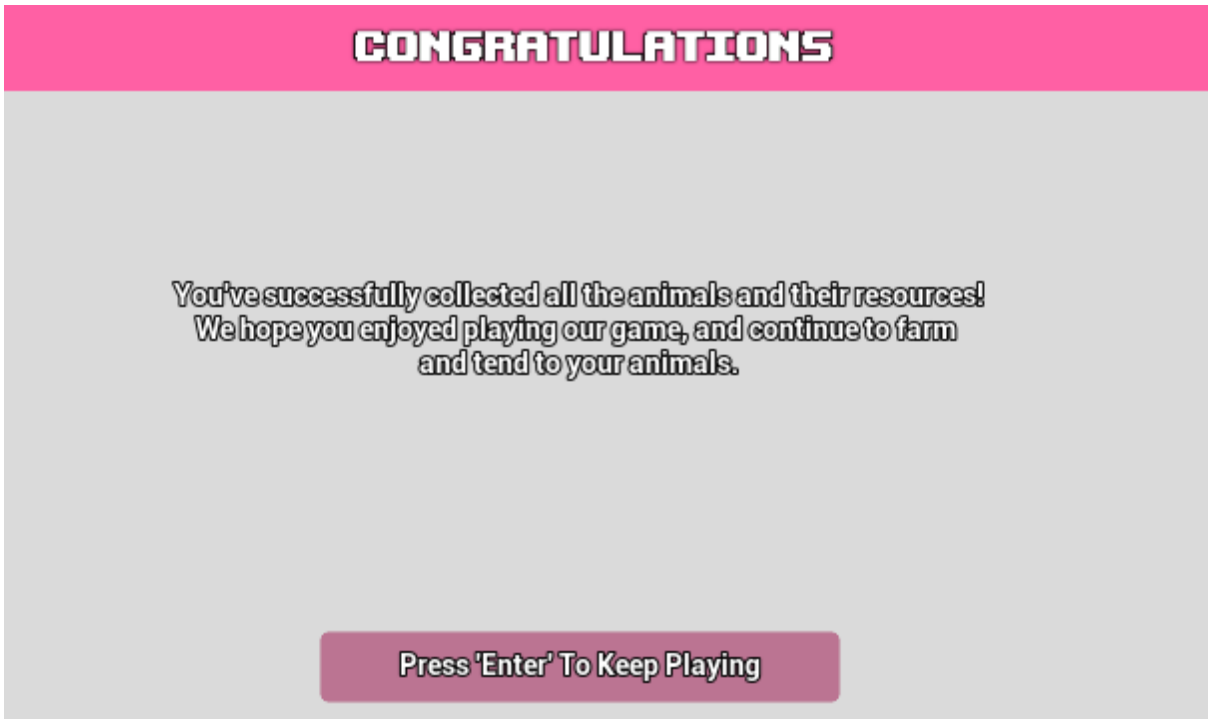


Figure 54: Game Completion Screen

g. Store

i. Tool Variations

Additional effects using the Niagara System fountain effect. A new diamond material was created for each sparkle [4].

In the blueprint for the soil, a pink or blue coloured glowing effect will appear after using any of the purchased variations in the store. It will activate for a few seconds before deactivating.

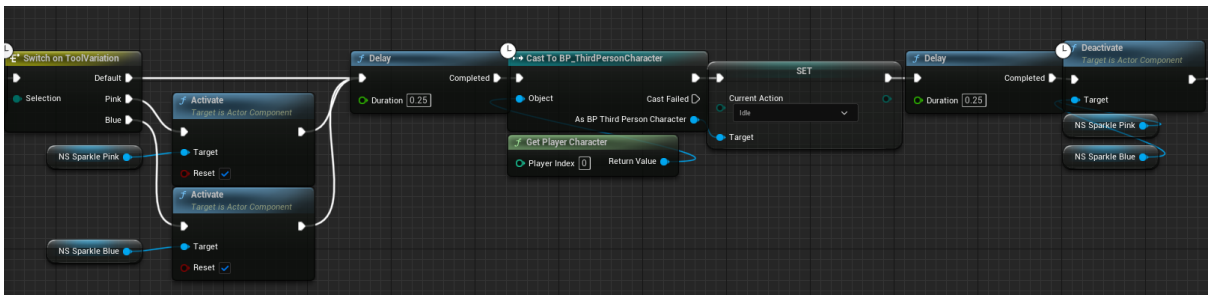


Figure 55: Niagara System Activation and Deactivation

ii. Buying and Selling Seeds, Crops and Resources

For purchasing seeds from the store, the player presses the ‘Q’ button as prompted by the button shown on the left-side of the screen. This is performed in BP_ThirdPersonCharacter where it checks if the store is already open and will toggle between the store being open with the mouse cursor, or the store button displayed. The ‘Disable No Items’ function is called to enable or disable the buttons depending on whether the character has the specified item to sell in their inventory.

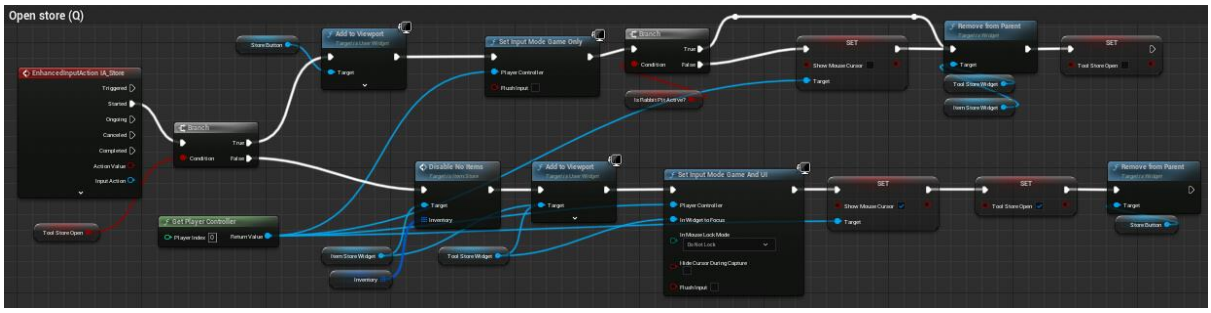


Figure 56: Open and Closing of Store Blueprint

The following screenshot shows the opened store. Only seeds can be bought from the store, but any item in the inventory can be sold so each instance is listed with their price.

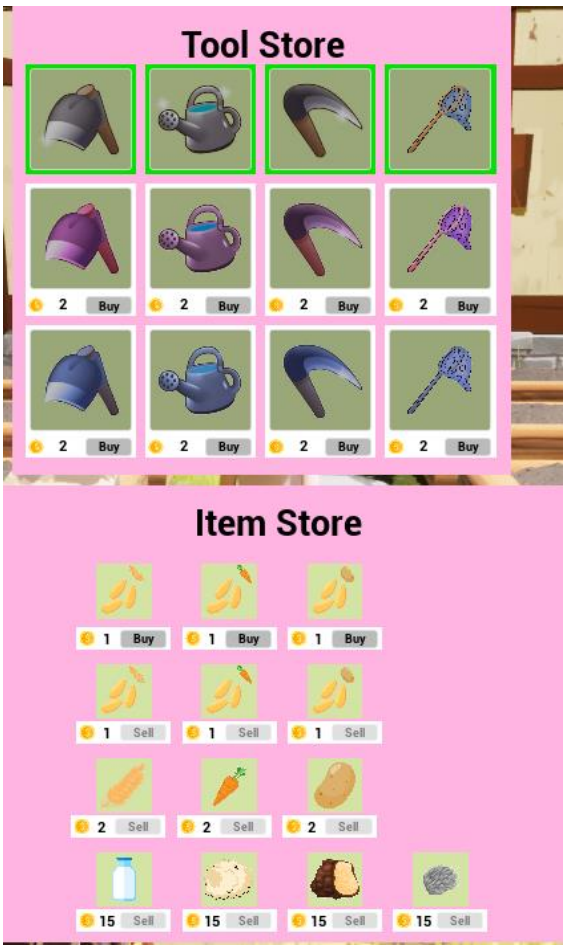


Figure 57: In-game Store

Each pressable sell button shows the following blueprint by first checking whether the character has enough money in the ‘Spend Money’ function before than sending the purchased item into the inventory. After buying and selling any items, ‘Disable No Items’ ensures that the player is unable to cheat the system by trying to sell items they do not have.

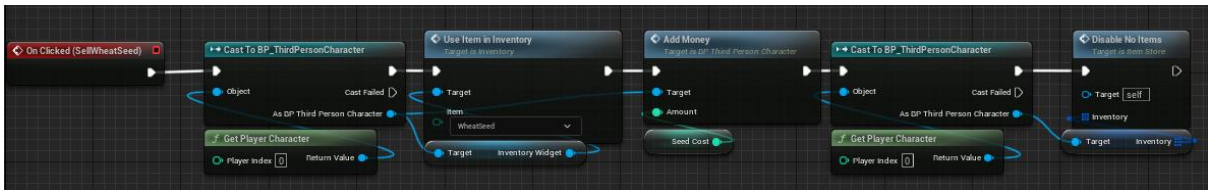


Figure 58: Selling Blueprint

2. Blueprint/Software Architecture

a. Tool Hotbar

To change between tools, the player must press a key ‘z’, ‘x’, ‘c’, or ‘v’ for the hoe, watering can, sickle or net. The functions ‘EquipHoe’, ‘EquipWateringCan’, etc.. check whether the character is currently holding the tool. If it is not holding a tool, the character will equip it. If the character is holding the wrong tool, it will swap to the correct tool and if the character is holding the correct tool, it will unequip the tool. There many conditions to consider, whether the character was already holding a tool, if the tool was already equipped and which variation the character was holding.

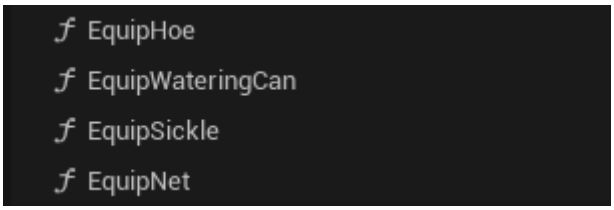


Figure 59: Equip Functions

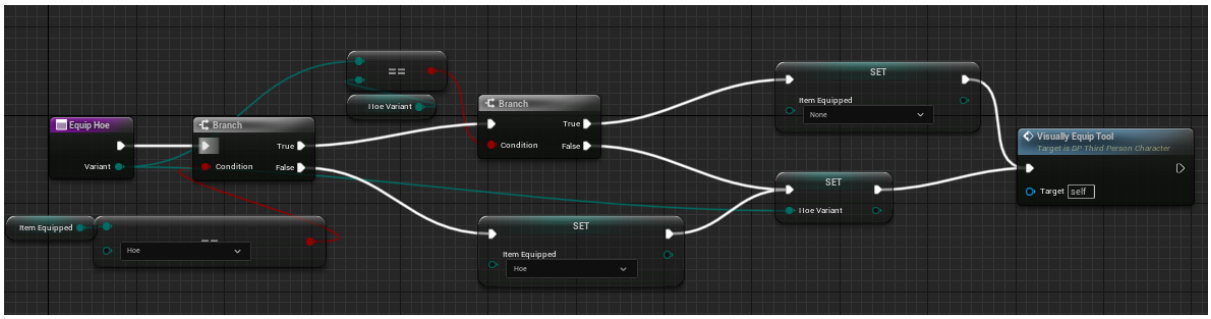


Figure 60: Equipping Function Blueprint

For visually equipping the tool, this is done by setting all tools to invisible except for the tool set to currently equipped in the character’s variable. Figure 61 is called and then performs Figure 62 after checking if the character equips or unequips the tool in Figure 60.

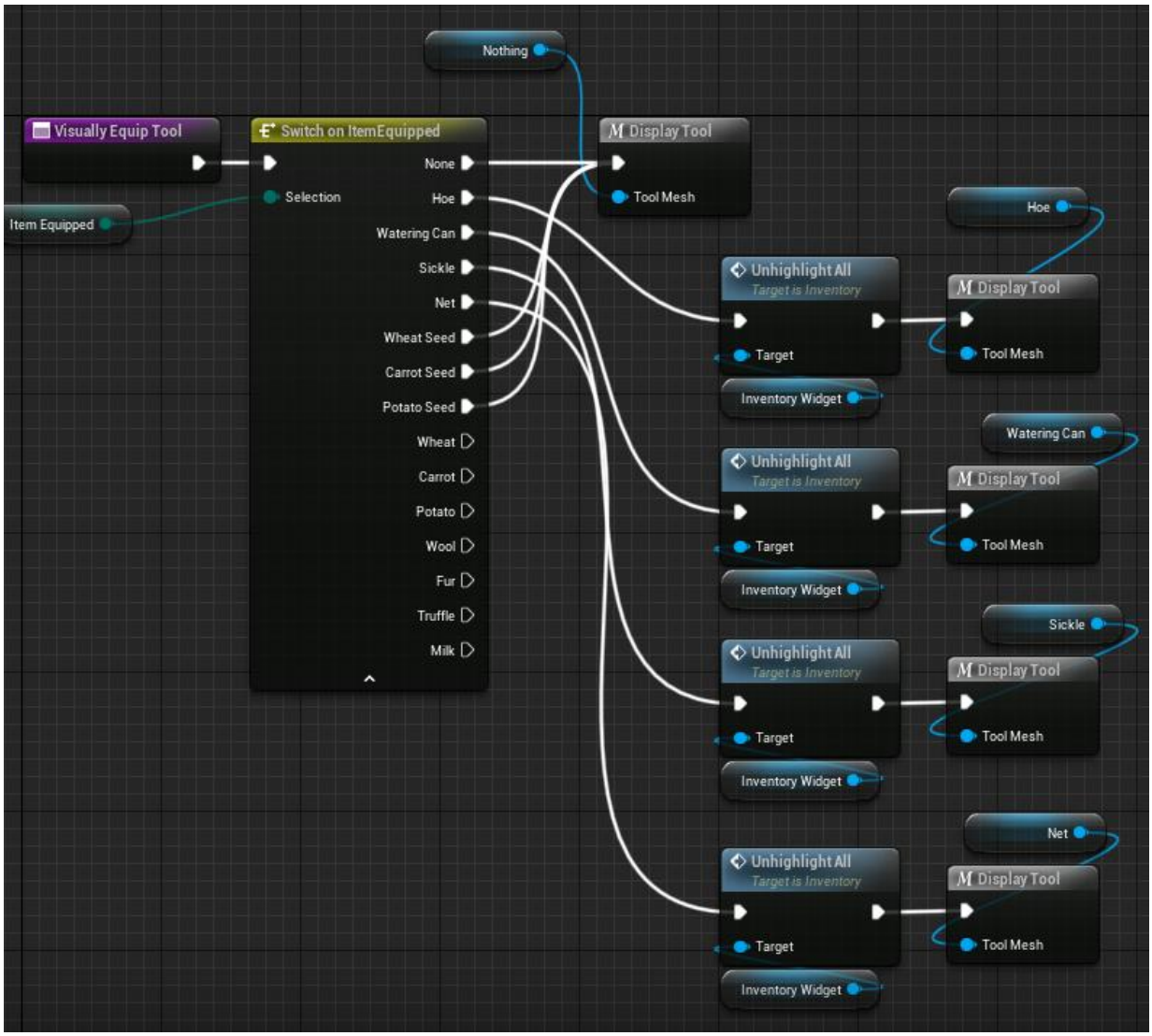


Figure 61: Setting Visibility of Tools Blueprint

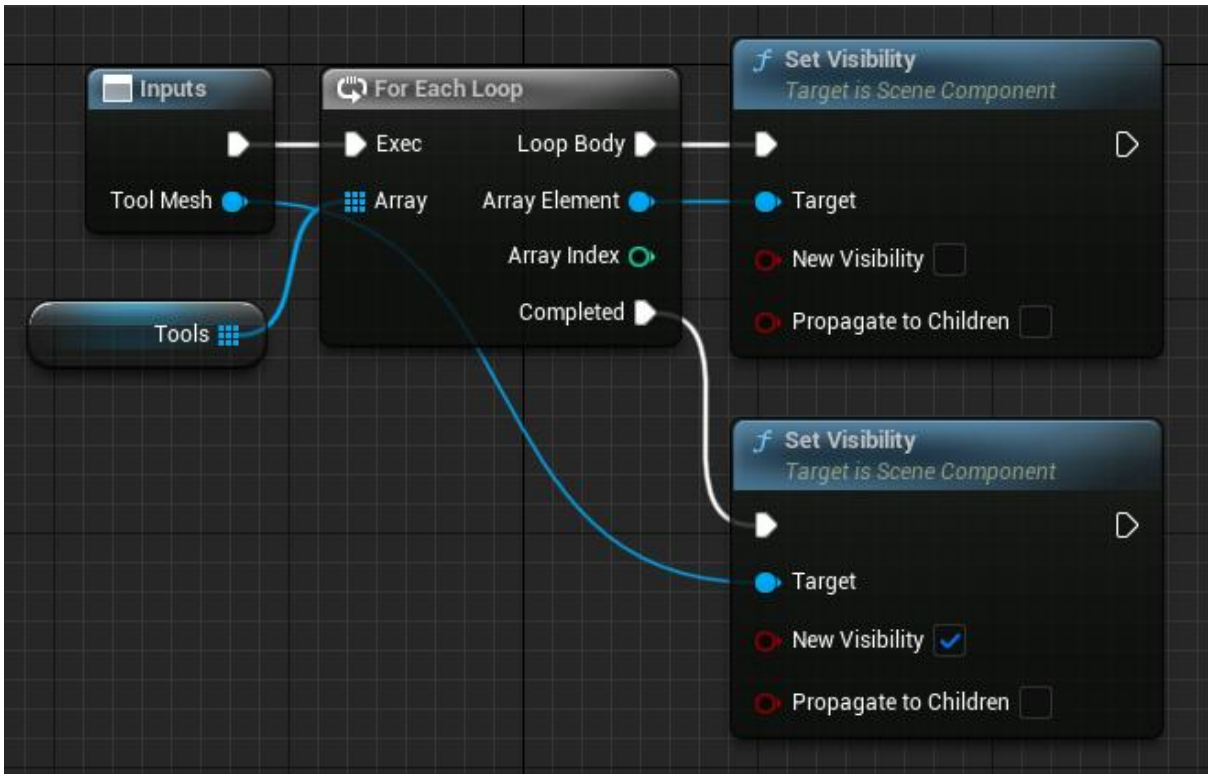


Figure 62: Display Tool Macro

b. UI/UX

To improve user experience, buttons which cannot be used will be disabled. For example, in Figure 63, the 'ATTRACT' button is disabled as the player does not have wheat in their inventory which is what is used to attract sheep.

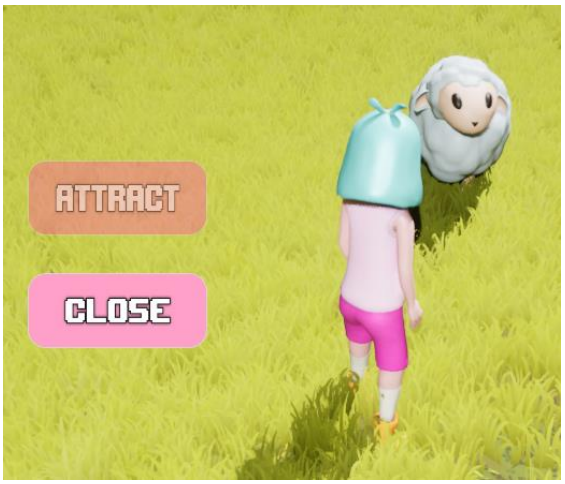


Figure 63: Disabled and Enabled Buttons

3. Challenges and Unimplemented Features

a. New character

Instead of using the default characters, Manny and Quinn, a mixamo character named Amy was used to replace the mannequin. However, the character comes in a T-pose so in order to make it move around like the default character, an IR Rig and retargetter was created from the animation blueprint of Quinn to Amy. Each bone in Amy was mapped in a bone chain to match Quinn's bone chain as much as possible. Unfortunately, on the first attempt, the rigs did not align properly and the character was not moving as intended despite the characters having the same pose in the retargetter. It took multiple attempts to figure out the problem before realising that the missing root bone caused the animations to not align properly. A root bone was added to the mixamo character in Blender and the addition of bone settings successfully allowed Amy to move just like Quinn.

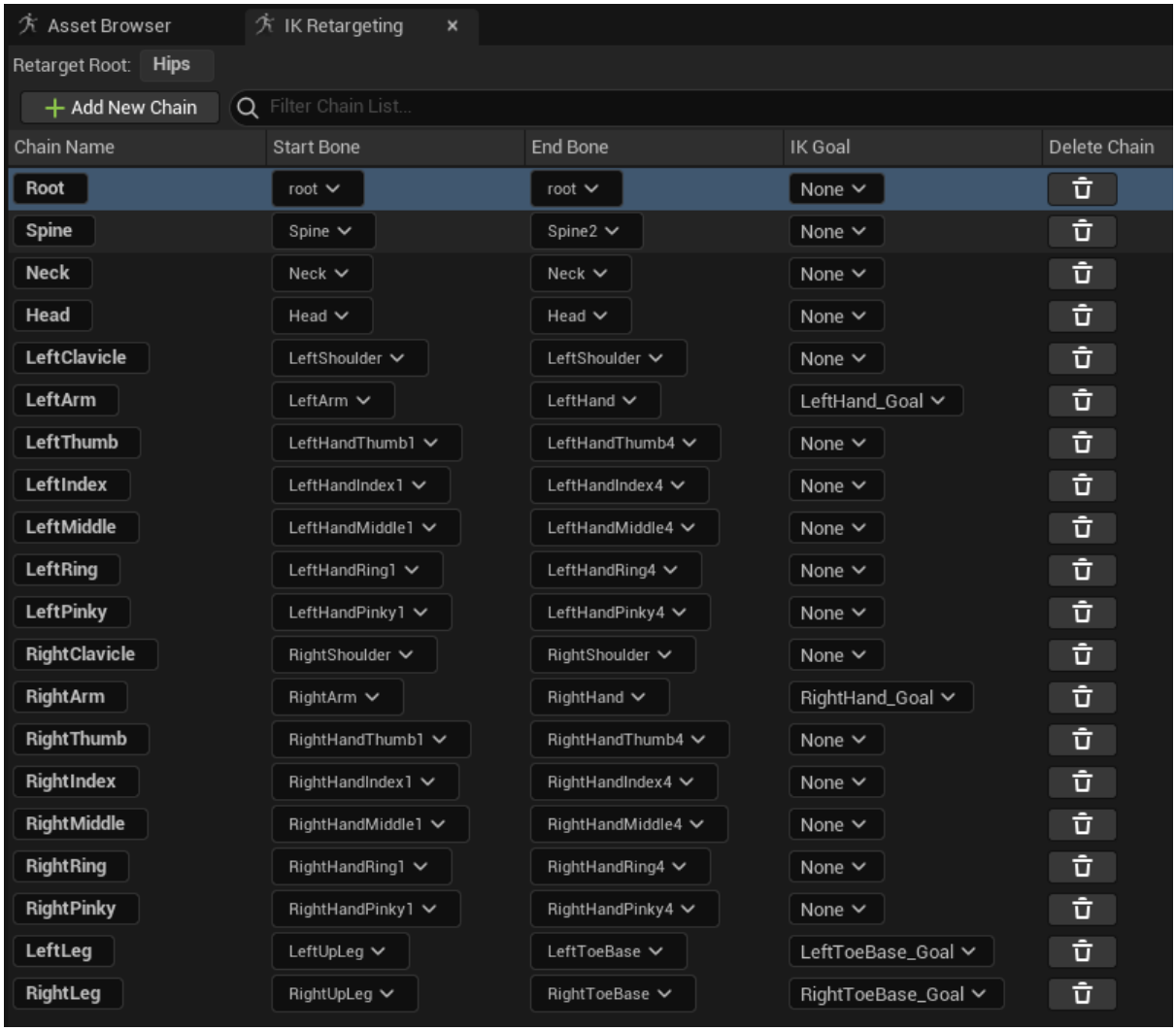


Figure 64: Bone Chain of Mixamo Character

b. Unimplemented Feature: Chicken

An essential farm animal that was unable to be implemented was the chicken and its resource which was eggs. The chicken would have been another animal to be caught in the wild and

can be fed any type of seed - making it the easiest animal to catch and level up its friendship. But due to some importing issues with the blender model and its animations not being recognised in UE5, it was thus dropped as an animal.

c. Unimplemented Feature: Animals Running Away

One unimplemented feature is the animals running away when the friendship level hits 0. So to add some challenge to managing the farm.

d. Unimplemented Feature: Weather

To add a more realistic feel to the farm, weather would have been implemented for phase 2. For rainy weather, crops would be automatically watered. Additionally, animals would need to be inside the barn in order to shield them from rainy weather. However, due to time constraints, it was decided to prioritise perfecting the phase 1 features and to minimise the features to be completed for phase 2.

e. Unimplemented Feature: Moving Animals Inside and Outside of the Barn

Another interaction with animals was moving them inside and outside of the barn. This was in relation to weather. If the weather was raining, the animals had to be moved inside the barn to preserve the friendship. If the animal was outside the barn while it was raining, they would lose 1 friendship point. However, since weather was unable to be implemented, this was also unimplemented.

User Manual

1. Getting started with Farming Fantasy

The user should launch the game in unreal then head to file and open level. They should click the main menu level. Then they should hit the green play button to start the game.

Upon first launching the game, users are greeted with a menu where they can start or quit the game. This is shown in Figure 65.

Figure 65: Main Menu Screen

Clicking on ‘NEW GAME’ leads the player to Figure 66 where the main gameplay level is. The user is presented with the tutorial which has an option to start a tutorial or skip it.

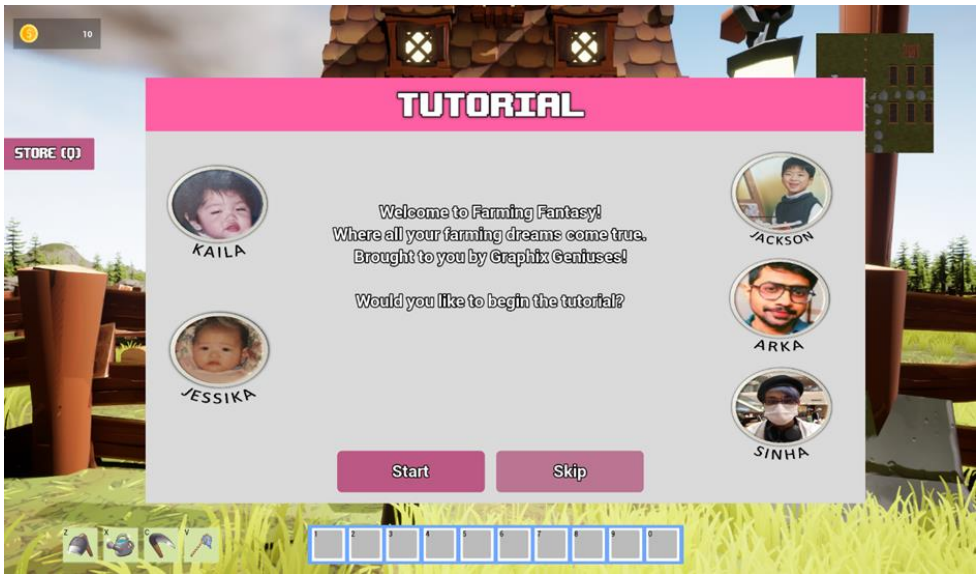


Figure 66: Tutorial Screen

The goal of the game is to collect all the animals and resources possible. Once the user has started the game, they are spawned into the world on their farm with 10 gold.

2. Gameplay Mechanics

a. Farming and crop management

The user must purchase seeds with this gold by heading into the store with the Q button. Then in the store the user should purchase 3 wheat, 3 potato and 3 carrot seeds.

Figure 67: Player with 3 wheat, potato and carrot seeds in their inventory

The user must then equip the hoe using the ‘Z’ button then go up to one of the crop boxes and

press the ‘E’ button (interact) to till the soil, this will enable a seed to be planted. The player must then plant the seeds by pressing the number correlating to the hot-bar slot to equip then pressing ‘E’ to plant.

Figure 68: Wheat seeds planted and watered in a crop box

The user must then equip the watering can to water the seeds so that they mature by pressing ‘X’ to equip the can then ‘E’ to water. The soil will turn dark to indicate it has been watered then it will turn light again to indicate it can be watered again. The user must do this two times in order to get the fully mature crop.

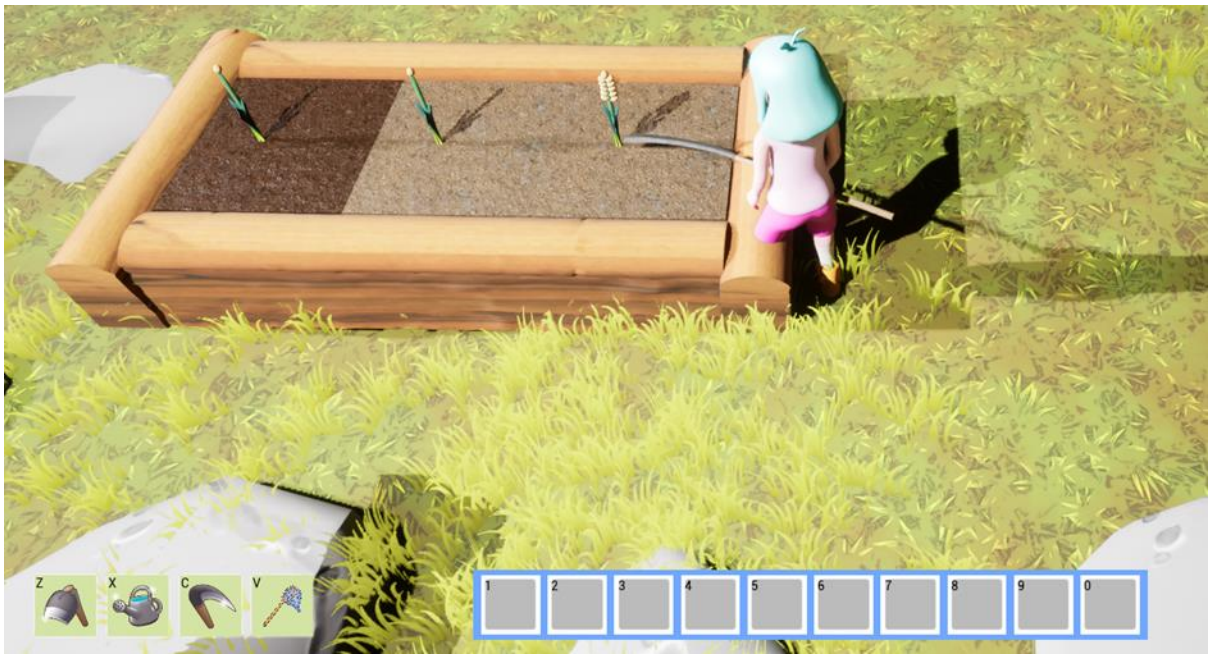


Figure 69: Watered wheat in seedling stage (left), unwatered wheat in seedling stage (middle) and full grown wheat (right)

The user must then equip the sickle using C in order to harvest the crop which will then

appear in the inventory.

b. Interacting with animals

The user must now venture into the world and capture animals, they do this by walking up to the animal and a menu will pop up with the buttons ‘ATTRACT’ and ‘CLOSE’. The user must have the correct crop in order to capture the animal wheat for cows and sheep, potato for pigs.

Figure 70: Player interacting with wild cow

After clicking ‘ATTRACT’, the appropriate crop will be used from the player’s inventory and the animal should teleport into the barn.

In order to catch rabbits the user must have carrots and head to the rabbit pit, when approached the user should press ‘E’ to interact. It will then bring up two buttons.

Figure 71: Player interacting with the rabbit pit

The user must first fill the rabbit pit with a carrot by pressing ‘F’, this will then attract a rabbit. Note that in Figure 71, the player is unable to fill the pit as they do not have carrots in their inventory.

After some time, a rabbit will appear at the pit and the user must then equip the net with ‘V’ then press ‘G’ to capture the rabbit.

Figure 72: A rabbit ready to be caught in the rabbit pit

c. Collecting Resources

The user must now take care of the animal by feeding and petting it, to do this the user must again approach the animal in the barn and a new menu will pop up with the buttons ‘FEED’, ‘PET’, ‘COLLECT’ and ‘CLOSE’. To feed the animal one must have the correct crop which is the same crop that was used to attract, the user can also pet the animal both of these actions are done by clicking on the corresponding button. Doing this will increase the friendship level, when the friendship level reaches higher than 6 e.g. 3 hearts the user can then collect the resource from the animal.

Figure 73: Interacting with a pet cow

The user must make sure that they are feeding and petting their animals each day otherwise the friendship level decreases leaving the player with no way of collecting resources and then no way of making more money. Thus becoming stuck in the game and losing.

The user can then sell the resource for more gold to buy more seeds. With the gold the user is also able to purchase different tool variations that have different effects when used.

Figure 74: Sparkle effect after using the pink hoe variant

After collecting one of each animal and one of each resource the user then ‘beats’ the game and is presented with the screen as shown in Figure 54 previously.

After pressing the enter key, the user is still able to play the game further infinitely.

3. Gameplay Strategies

The user must take care not to try and manage too many things at once, by spreading out their time and resources it is very easy to run out and lose.
The user should take care to immediately feed and pet any animal they capture in order to maintain friendship level. Users should capture during the day otherwise the friendship level could immediately decrease preventing the user from being able to successfully harvest resources.

Task Distribution and Team Contribution

1. Phase One Features

Task	Assigned
Graphics	
Creating the landscape for the island including forest, rivers, cliffs, lakes, grass, etc	Jackson
Create the house of the player (interior and exterior)	Kaila
Create the barn for the farm (interior and exterior)	Jessika
Create the player's farm area including fences, paths, lighting and other decor	Kaila
Change lighting for day and night cycle	Kaila
Farming Mechanics	
Till soil	Kaila
Water soil	Kaila
Planting seeds	Kaila
Plant growth	Kaila
Harvesting plants	Kaila
Animal Mechanics	
Create a mesh and skeleton for sheep, cow and pig	Kaila
Create a mesh and skeleton for rabbit	Jackson
Create idle and walking animation for sheep, cow and pig	Kaila
Create idle and walking animation for rabbit	Jackson
Generate random wild animals in open world	Jackson
Feeding wild animals in the open world	Jackson
Animal AI movement and roaming	Jackson
Rabbit pit	Kaila

Pet animal friendship levels	Sinha/Kaila
Pet animal interactions	Sinha
Museum Feature	
Viewing and interacting with museum	Kaila
Inventory Feature	
Create inventory widget	Arka
Visually equip tools on character	Jessika
Item icons	Jessika
Size stacking, collecting and using items	Jessika
Mini Store Feature	
Money	Jessika
Buying tool variations	Jessika
HUD and Other Interactions	
Interact prompts on interactable items (Museum and rabbit pit)	Kaila
Player house door opening and closing	Kaila
Mini map	Sinha
Title screen	Kaila/Jackson
Tutorial screen	Kaila/Jessika
Game completion screen	Kaila

2. Phase Two Features

Task	Assigned
Full Store Feature	
Buying seeds	Jessika
Selling seeds, crops and resources	Jessika

Character Skin	
Creating graphics for new skin	Jessika
Creating default animations (eg walking, jumping)	Jessika
Creating action animations (tilling, planting, watering, harvesting)	Jessika
Feedback Implementation	
Turning item inventory into hotbar	Jessika
Turning tool inventory into hotbar	Arka/Jessika
Beautifying animal interaction UI	Kaila/ Jackson/ Sinha
Visual animations for upgraded tools	Jessika

Reference

[1] KJFollow (1969) *Cow - download free 3D model by KJ (@kj3dx)*, *Sketchfab*. Available at: https://sketchfab.com/3d-models/cow-b2e1703c0d364b8b8c24bc68780565fd

[2] SnicksFollow (1965) *Mr waddles (gravity falls) *__* - download free 3D model by snicks*, *Sketchfab*. Available at: https://sketchfab.com/3d-models/mr-waddles-gravity-falls-03de8e908cbd4c138f210ddecc10555c

[3] KroliczekFollow, K. (1969) *Sheep - download free 3D model by Kinga Kroliczek (@kinga_kroliczek)*, *Sketchfab*. Available at: https://sketchfab.com/3d-models/sheep-fb30303a25dc4badad445217600206e5

[4] *Ue5 l sparkling particle L Niagara VFX tutorial L unreal engine 5* (2023) *YouTube*. Available at: https://www.youtube.com/watch?v=pLTqtM-D0ZU

[5] Unreal Engine (2021). *Easy Building System v10 in Blueprints by Easy Systems - UE Marketplace.* Available at: https://www.unrealengine.com/marketplace/en-US/product/easy-building-system