

The Zookeeper

General

Welcome to the world of zookeeping! The goal of the game is to find and collect animals — two of them are the rarest... catch them and you will progress towards opening your dream zoo.

There will be hurdles along the way. Some animals are hidden from plain sights, others are a waste to catch and that might cost you precious time. As the Zookeeper, you must persevere and carry on with the mission you set out to accomplish.

You have a limited amount of in-game time ("12 days"), during which you must explore, track, and capture animals. The clock is ticking.

Game Overview

The game is built using Vulkan, combined with Bullet3 for physics. It features a procedurally generated terrain using tessellation from a heightmap, complete with dynamic lighting and textured environments.

Players can explore the world from a first-person perspective, interact with objects and, eventually, collect animals.

We structured the implementation with the following key systems:

- **Physics:** Bullet3 is used for both rigid and soft body dynamics. The player (POV camera) and the terrain are rigid bodies, while the imported animated models (e.g. the "cat/wolf/elephant/...") are treated as soft bodies.
- **Camera and Controls:** A first-person camera with WASD movement and cursor. Spacebar allows jumping, E allows collecting, Shift+W allows running. The controls are designed to feel familiar and responsive.
- **Terrain:** Tessellated terrain is procedurally generated from a grayscale image heightmap. The terrain also serves as a physics object, meaning players can walk on it naturally.
- **Scene Objects:** 3D models include animals, some of which are designed to move or interact with the player.
- **L-system Trees:** Trees are placed at random positions within the scene, and are generated through the L-system algorithm.

Game Features

- **First-Person Exploration:** Use WASD keys to move, Shift+W to run and cursor to look around. Press Space to jump and "E" to collect an animal, effectively adding it to your inventory and progressing in the game.
- **Textured Environment:** Assets are textured using **STB** image loading. A realistic terrain texture (e.g. green coloured "grass") is applied to the generated ground.
- **Tessellated Terrain:** A custom terrain generation system creates a walkable world with valleys derived from a PNG heightmap.
- **Physics Simulation:** **Bullet3** powers all physics interactions. Gravity affects the player and rigid and soft bodies, and collision detection ensures interaction between the camera, terrain, and scene objects.
- **Rigid Body Objects:** Complex models (cat, wolf, elephant, ...) are imported with **Assimp** library. They are placed within the scene in random places around the play area. Animals have rigid body physics, and thus can be interacted with and moved around the area. They are also illuminated by direct and point lights, and all have textures attached to them.
- **L-System Trees:** Procedural trees are generated using an L-System-based approach, these are also hierarchically animated with the trunk staying in place while the branches and leaves are moved "with the wind" (in reality, just a random number). The trees are also placed randomly in the scene around the player, giving the feeling of a slightly different game each run.
- **Culling:** Objects outside the view frustum are excluded from rendering, as implemented within the given framework.
- **Framerate Independence:** Frame time is calculated per frame, ensuring stable performance.
- **Adjustable Parameters:** From a config file the width, height, and fullscreen parameters can be tweaked.
- **Win/Lose:** If you fail to catch the animals whose total point value is 30 (randomly chosen each play time) within the allocated time (12 "days") you lose.
- **Collect Animals:** You can press "E" to collect an animal once you're touching it (camera collision).
- **Inventory:** Track your currently collected animals in your inventory (HUD).
- **Progress Bar:** Track your current game progress with the progress bar (HUD).
- **Adjustable Rendering Modes:** Polygon, Culling, Normal and Textures are keybinded to F1, F8, N and T and can be toggled back and forth.
- **Day Count:** Track the current day with the text on the screen (HUD).
- **Animal Exoticness:** The labels above the animals are colored differently depending on their level of exoticness.
- **Lens flare effect:** Realistic light artifacts that simulate camera lens glare from the sun.
- **Procedural texturing:** The sky is created with procedural texturing.

Dependencies

Libraries:

- **Bullet3 Physics SDK** - <https://github.com/bulletphysics/bullet3>: for rigid and soft body physics, gravity, and collisions.
- **Assimp importer** - <https://github.com/assimp/assimp>: for importing complex models as objects in the scene.
- **STB Image** - <https://github.com/nothings/stb>: to load PNG textures and heightmap images.

Assets:

- **Terrain texture and heightmap** - <https://ambientcg.com/view?id=Terrain004>: for generating the tessellated terrain and applying the grass texture to it.
- **Cat model** - <https://sketchfab.com/3d-models/maxwell-the-cat-dingus-2ca7f3c1957847d6a145fc35de9046b0>: the complex cat model in the scene.
- **Elephant model** - <https://www.cgtrader.com/free-3d-models/animals/mammal/elephant-57b2471c-c82c-4313-b539-1925bdf523a7>, the complex elephant
- **Wolf model** - <https://www.cgtrader.com/free-3d-models/animals/mammal/wolf-king-8a9a9e58-ea52-4928-b435-bd21bce75e9d>, the complex wolf
- **Armadillo model** - <https://www.cgtrader.com/free-3d-models/animals/mammal/armadillo-c42fbc02-1648-4c6b-a5c0-a302b56837ff>, the complex armadillo
- **Panda model** - <https://www.cgtrader.com/free-3d-models/animals/mammal/panda-4f3da7e7-d2ee-4dbb-9f9f-e2cfad7f0cbd>
- **Tiger model** - <https://www.cgtrader.com/free-3d-models/animals/mammal/tiger-5d0b554a-b873-4107-b162-4035dd4f7bb7>
- **Duck model** - <https://www.cgtrader.com/free-3d-models/animals/bird/duck-animal-71330e2b-341d-4b13-affa-1c63c585d009>
- **Koala model** - <https://www.cgtrader.com/free-3d-models/animals/mammal/koala-1bc964ae-8e2d-46ee-84c8-baf7448da9a1>
- **Gorilla model** - <https://www.cgtrader.com/free-3d-models/animals/mammal/gorilla-b0e344c3-2277-4a05-b3e2-be5a16910c49>
- **Rabbit model** - <https://www.cgtrader.com/free-3d-models/animals/mammal/rabbit-cfca5d4a-072a-42d0-b26b-bf30aad88ee5>

How to Play

1. Launch the game.
2. Explore the terrain using WASD and move cursor to look around.
3. Jump onto the terrain using Space.
4. Run using Shift+W
5. Observe the trees and their leaves blown by the wind, and the complex models in the scene — you can collide with them.
6. Once you get close to an animal, press E to collect it.
7. Collected animals get added to your inventory, if they're worth collecting!
8. Your inventory (HUD) holds the max. of 10 animals.
9. If you've successfully collected an exotic animal, the progress bar (HUD) gets more filled.

10. You have a total of 12 "days" to collect the exotic animals in order to win the game, failing to do so makes you lose the game.
11. Press F1 to toggle between polygon rendering modes, press F8 to toggle between culling modes, press N to toggle between drawing normals, and press T to toggle between drawing textures.