Marble Run Documentation

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Implementation

Camera & Controller

Implemented a first person camera[1] and attached it to our PhysX Controller (Player)[2].

Raycast on Controller

Implemented PhysX Raycasting[3] from the controller to detect what player is looking at (e.g. button).

Collision Detection

Using PhysX we implemented collision detection[4] for all necessary actors in the scene. Furthermore advanced detection[5] was also implemented through hit callbacks for pressure plates.

Movement

Key callbacks are in place to update controllers movement. Additionally `deltaTime` is being calculated every frame to ensure frame-independence on player movement.

Object Loader

Using assimp[6] we implemented an object loader. We used the tutorial on https://learnopengl.com/[7]. An obj. File is loaded with assimp and a Mesh and Model are generated. Mesh data was modified to give PhysX cooking the correct data. We are able to load obj. files with textures or use our own textures.

Triangle Mesh Cooking

With PhysX we implemented cooking[8] to add imported objects to the scene and make them collide with other actors.

Lights & Shadows

The level and marble can throw shadows, the light source is the directional light in the “sky”. Shadow can move with the marble. We used the tutorial on https://learnopengl.com/[14].

Moving Platforms & Walls

With PhysX we added kinematic actors that can get triggered by certain events (button, pressure plates) and will start moving.

HUD

For the HUD we used the tutorial on https://learnopengl.com/[15]. The HUD displays the controls for the player, it shows if you win or lose, the current FPS and left time to finish the game in seconds.

Features

Movement

Player can walk in every direction and jump by using WASD and space.

Free Camera

After pressing ‘F1’ the camera is free to move without gravity or collision.

Interactions

Player can interact with buttons by looking at the object and pressing ‘E’. Furthermore the player can send an impulse onto the marbe by pressing ‘F’.

Special interactions with the Engine

‘F2’ the Engine shows the depth map shader from the view of the light source.
‘F3’ the Engine shows the wireframe, but it shows only the 2D texture for the Bloom/Glow effect.
With ‘F4’ the Engine changes scenes and shows the “Debug Mode” where we tested new features and effects.
With ‘F5’ the Engine activates/deactivates face culling.

Effects

Shadow Map with PCF

Directional light is throwing shadows on the world [14]. The Level and the marble have shadows and can move with the marble.

CPU Particle System

The marble leaves traces of small particles[10] after moving. These were implemented through multiple classes that handle the creation part, the updating part and the shader[11]. We also attached textures to the particles to make them look better.

Procedural Texture

Marble Pattern[9] on Marble, the texture is created on runtime. It changes the pattern with movement. First the shader draws straight lines (veins) then turbulence is added to the veins with a 3D noise function (Classic Perlin 3D Noise by Stefan Gustavson)[13].

Bloom/Glow

We use the Glow[12] effect to show the player the object she or he can press (buttons). First the shader extracts the bright colors and stores it in a separate image. Then blur is added on this image. Then both textures are combined together.

How to win

First Level:

- Push the marble onto the platform using ‘F’ and make sure the marble stays on the platform
- Upon reaching the platform, your platform should start moving up and down
- Use it to get to the next level and push the glowing button by looking at it and pressing ‘E’
- Now your marble should also get up with you and you successfully reached Level 2

Second Level:

- Behind the stairs is a pressure plate for you to stand on. It should move the wall that’s blocking the marble out of the way
- Now use ‘F’ again to push the marble onto the platform, don’t forget to make sure it stays on it!
- This should open up the stairway for you, so you can get to the next level
- Now press the button again to get your marble to the next level too and now you successfully reached Level 3

Third Level:

- Solely push the marble using ‘F’ to the next platform (so much that it gets over the ramp)
- This should trigger your platform again, but this time it’s a little short, so to get to the next level you have to jump from the platform
- After that press the glowing button again to get your marble up
- If you did all that in time, you won! :)

Libraries & References

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