Advice document

Introduction

“Not everything is as it seems”

In this document, you can read all of the advice I gave during my internship at Dutch Rose Media. I dove into the world of hybrid festivals, where I experimented with three different projects. The last two projects were postponed and therefore I could not give my full advice on those two projects.
This document will primarily focus on the **body projection mapping** project. I divided the advice in three different subjects: **System, Interaction, and Documentation**.

System

Body projection mapping is a system that should project animation that is precisely mapped on the body. This could possibly enhance a concert or festival experience, by enhancing the entire performance with a captivating animation that can extend the vision of the artists.
During this internship, I experimented with body projection mapping, but unfortunately, the system I used was incapable of precisely mapping out the projections on the body. These projections that were displayed were either too slow or not aligned properly with the performers. This resulted in the project being scaled back in terms of the actual mapping of the projections. The projections will then have to be displayed on a projector screen that is usually placed behind the performers.
I will be talking about the hardware of the system which includes the **Realsense senso**r and the **projector**. Next to that, I will also explain how the software works, this includes **Nuitrack** and the implementation in **Unity**. Last but not least I will also show how the entire system should be set up at the small stage of the Effenaar.

The hardware

Realsense Sensor

The **Realsense D455**, is a rather capable depth-sensing camera, equipped with an RGB sensor and depth sensor. This sensor is capable of creating a depth image and this depth image can then be used to detect objects with object detection software.
The range of the Realsense sensor is quite small when compared to the area that performers need to perform. Therefore, it is important to remember that the depth range is up to 6 meters, it can do up to 10 meters, but the results may vary. You will need to inform the artists about these limitations to prevent any issues during the live performances. For an artist that does not move around all too much on the stage, or only wants to do a simple intro sequence with minimal movements, this sensor would be the best for that.

The software

Nuitrack

Nuitrack Key features

- Interpret a depth map as 3D Point Cloud
- Perform scene analysis, detect key elements like Floor Plane and B ackground Objects
- Detect/track persons in the scene and provide Pixel-perfect Masks for each of them
- Perform a highly sophisticated Full Body Skeletal Tracking (19 Joints) for each person.
- Perform a basic Facial Analysis like age and emotion detection
- Provide a Hand Tracker and Gesture Recognition higher-level APIs for the development of gesture-based user interfaces

I used **Nuitrack**, object detection software, to track a human body in the video on the right. This video shows how I am able to track a person and place a skeleton on top of them. The small cubes represent the outer points of each body part.
The NuiTrack SDK contains examples of projects that show the capabilities of Depth Sensing. This SDK can then be imported into Unity. This shows that the combination of the **Realsense D455** and **Nuitrack,** is capable of tracking a person and placing objects on top of them.

Download the Nuitrack SDk by clicking the link below

Nuitrack

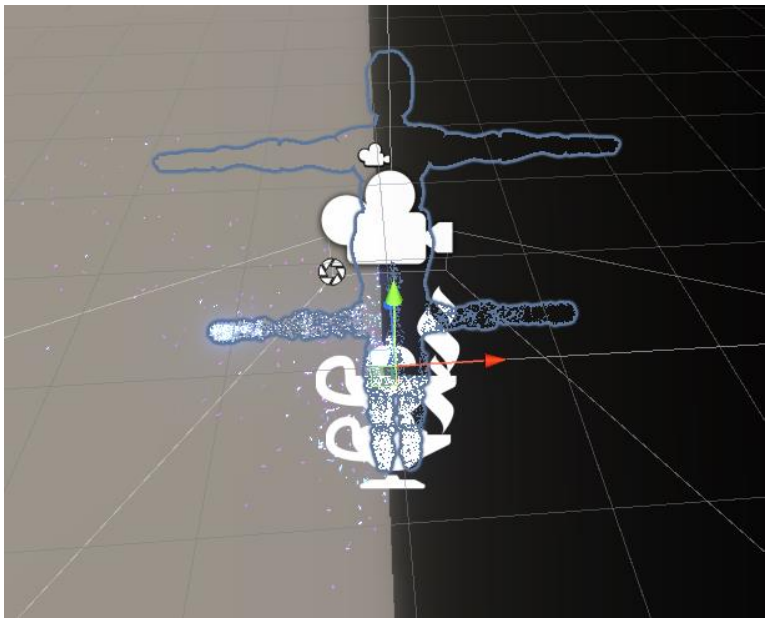
The software

Unity

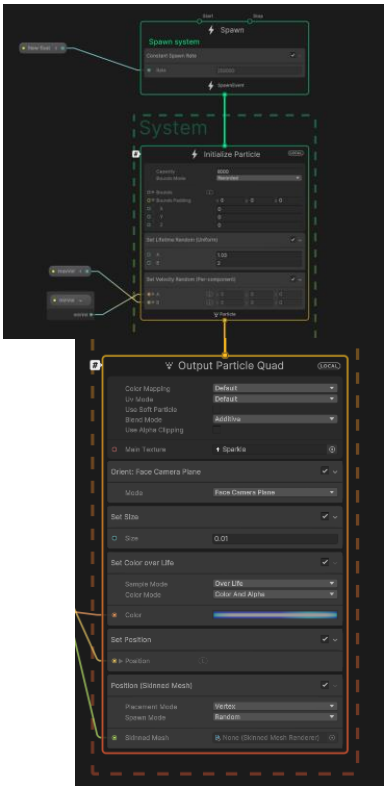
Nuitrack has a simple SDk that you can download. This SDK includes all sort of examples that you can experiment with and test out the capabilities/limitations of the object detection software.
The trial version has a time limit of three minutes, this limits you with certain projects. The full version of the software is €100,- and this removes the three-minute time limit.

Body tracking

A The Nuitrack SDK allowed me to import the skeleton depth data from the **Realsense depth sensor.** Once the data is imported, I also need to rig it on a object or avatar. I used a Mixamo avatar for this project and turned the point-to-point cloud into the particle system.



Body Particles



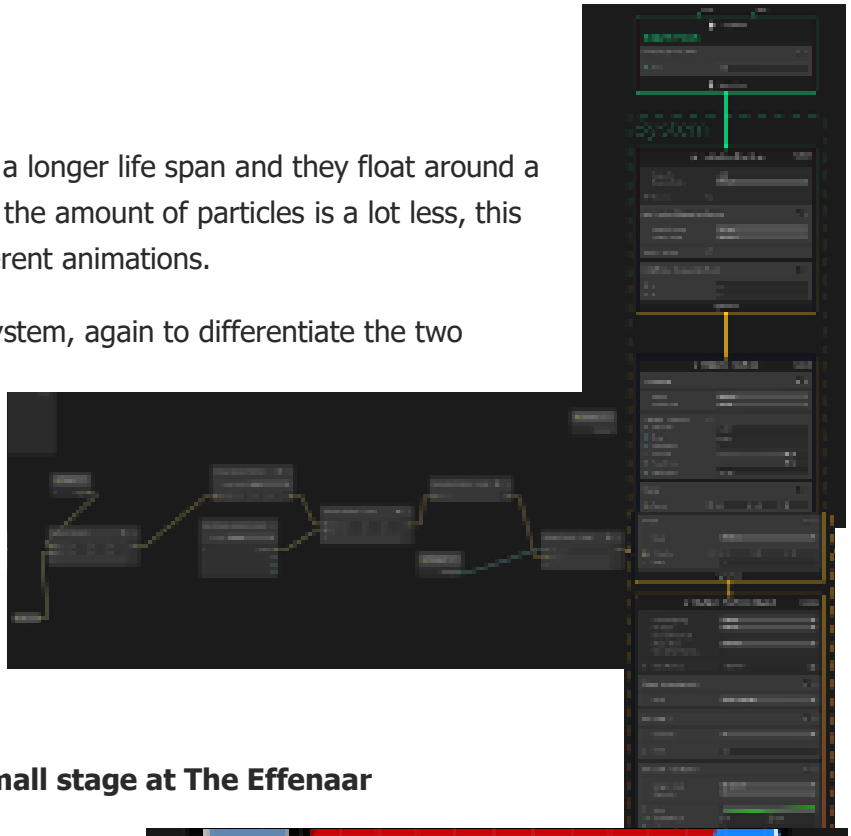
For the body particles, I have a fixed Spawn Rate. This is due to the triggers that are implemented in the system. The idea is to project this animation in a sequence and this sequence I will be manually setting these sequences off by pre-programmed triggers.
Once the body particles have been triggered, the amount of particles is defined by Capacity. This can be tweaked throughout, but I left it at 8000, because it shows the outline of the "avatar", but it is not too distracting.
Next to that, the particles float around and each particle only appears briefly before it disappears again. This life-time cycle is defined in the module on the bottom.

Body projection mapping, also known as "performance mapping," is a technique that involves projecting images and videos onto the human body, creating the illusion of clothing or accessories that are not there. This technology can be used to enhance the festival experience in several ways.

Environment particles

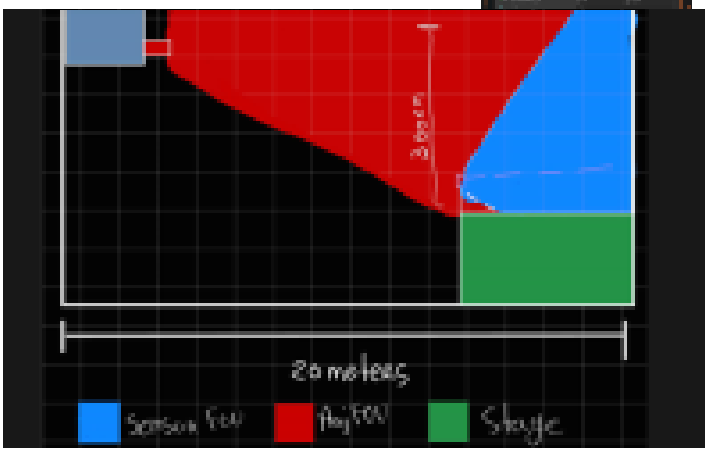
The particle for the environment have a longer life span and they float around a lot more than the body particles. And the amount of particles is a lot less, this was done to differentiate the two different animations.

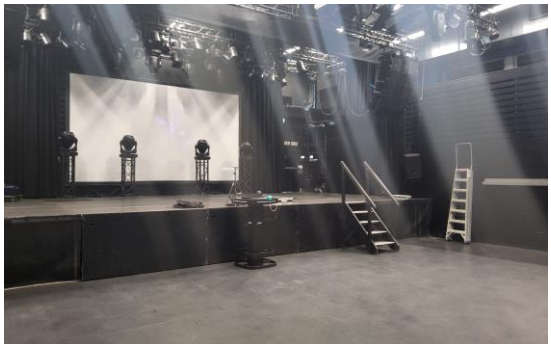
The capacity is also a lot less in this system, again to differentiate the two animations. The particles in this system is a lot more float and fits in line with what the artists want during their live performance.



The entire system set up at the small stage at The Effenaar

This was the set up for the body projection mapping, but due to the mapping not being completely accurate, we decided to just use the body tracking to manipulate an animation on the projection. The same setup can be used with the final changes to the prototype.





Projectors

In my **possible technologies** analysis, I compared multiple projector and sensor set-up that could be capable of body projection mapping. From this analysis I concluded that it is important to have a projector with a high refresh rate. This is because a higher refresh rate ensures that the animation are synchronized with the performers. Next to high refresh rate, it can also be more immersive if the projector would be a laser projector, this results in a higher quality projection and can also help improve the refresh rate. This is due to the laser projector only projecting what is displayed, there is no need to project empty space.

Realsense Setup

The Kinect is more for small-scale venues or a bar/café event, that is where the Realsense sensor comes in. This setup can be used for larger venues and is faster and more accurate in every aspect.

Technical Requirements:

- Realsense D455 (Sensor)
- Panasonic 120hz 4K Laser projector
- PC with the latest graphics cards and processor
- Tripod for the Realsense Sensor

Total expenses:

- Realsense D455 499,-
- Laserprojector 1999,-/4999,-

Pros	Cons
Very accurate sensor	Expensive sensor
Can project up to 5 performers	Requires moderate programming skills
Easy to use and program in Unity	Can be obstructed by fog and lighting

Interactions

In my previous semester, I experimented with the same body projection mapping project and it was primarily focused on the interaction part. With my internship, I also tried to find different ways of allowing the audience and artist to interact by using body projection mapping. I came up with different interactions to pitch to the artists, in order to make sure they understand the different capabilities of these projections. During the interviews, I pitched these ideas to them

Poll System

A system that allows festival visitors to participate in an online voting poll via a link that they received when ordering their ticket. The results from the polls will be counted and each results will change the look of the body projections that will be seen throughout the festival performance. The incentive here is for the festival visitors to allow them to have an influence on the live performance that they are going to see. Making them feel connected to a larger crowd.

Cup System

A system that does the same thing as the Poll System and shares the same incentive. But instead of an online voting poll, this system uses a special garbage bin that can count all of the cups and uses for the input.

Real-time System

This uses a system that can directly influence the projections during a live show or concert. Stickers or animations can be added through an online application.

Conclusion

Both of the artists did not want any real-time interactions with the body projections. By real-time interactions, I mean allowing the audience to change or manipulate the projections in real-time. This could possibly change to show too drastically that it would mess with their visual performance. During the third meeting with Whiff and the Wet Socks, we concluded that creating any interactions would not be feasible with the time constraints. Therefore we dropped all of the interactions and focused on the interaction with the sensor and artists.

Documentation

Read all my documentation on my portfolio!

https://zonar1994.github.io/