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**University of Manouba**

**Higher Institution of Multimedia Arts**



**GRADUATION PROJECT DISSERTATION  
Code IC19**

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## **Dedication**

I dedicate this project to my family and friends. Am blessed to have supportive people around me who constantly motivates and inspire me.

I also dedicate this project to myself. Video-games and music played a major role in my life since childhood, alongside with my huge love for the Japanese culture. Combining all of them to create this project was dream that came true.

**Sarah Yacoub**

To my family and everyone that helped and supported me, thank you. Working on this project made one of my dreams come true.

**Sarah Khamassi**

## Acknowledgment

We would like to thank the entire administration staff members and professors of the Higher Institute of Multimedia Art of Mannouba for providing us with various knowledge during our study path that served us to create 'Kamen'.

With great delight we would like to express our entire appreciation and gratitude to our respected Supervisors Mr. Henidi Mohamed Ennaser, M. Mezhoud Rim, Mr. Abid Ahmed for their constant guidance, valuable suggestions and constructive criticism that made the execution of this report possible.

We would like to express our special thanks to our internship supervisor Mr. Boudriga Hichem and the entire team of Galactech who provided us with guidance and tools allowing us to carry out our internship project.

We express our deepest thanks to all who have been a part of making this game a reality. Finally, we would like to express our most sincere thanks to the members of the jury who have done us the honour to review and evaluate our work.

# Game Design Document



# Document Overview

## Overview

This is the game design document for our game "Kamen", it is divided into several sections describing in detail different aspects of the game.

For additional information about the creation and the development, we created the appendices section available at the end of this document.

### Game Design Document Version Control

This is a description of the game design document version control. Here are listed in the table below the most important changes is provided following each revision number. In addition, the list for the main topics is provided.

Version	Date	Change Description
1.0	February 12	Creation of GDD
1.1	February 26	Game inspiration and introduction to VR
1.2	March 11	Game overview + game conception
1.3	March 30	Gameplay and mechanisms
1.4	April 13	Levels
1.5	April 28	Story Setting and Characters
1.6	May 9	Technical + management
1.7	May 12	Interface
1.8	May 15	References + Appendices

*Table 1: Creation of GDD*

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# **Introduction**

We have always considered a video-game as an experience, a journey through a story with a unique atmosphere and a taste of challenge. As we tested a plenty of games since our childhood we wanted to come up with something new, thus our project 'Kamen'.

It was challenging to create a VR game due to how recent the technology is, the lack of documentations and software compatibilities issues. However we managed to develop our very own virtual reality videogame as part of graduation project for our bachelor degree in computer science and multimedia and bachelor degree in communication and multimedia at the Higher Institute of Multimedia Arts of Manouba ISAMM.

This Project is an opportunity to deploy our acquired knowledge, to go through a professional experience that will allow us to practice what we have been studying during the last couple of years at ISAMM and initialize ourselves to work on the video game industry within a company circumstances.

The main purpose of our project is to make and conceive a VR video game for people who want to be entertained, challenged but at the same time discover some aspects of the Japanese culture. It was therefore necessary to set a good story and a theme for it. We chose to orient the principle of 'Kamen' in the discovery of a Japanese folklore called "Yokai".

We had the opportunity to have an internship within Galactech and it was a great chance for both learning and professional development. Galactech is a Startup founded by Houssem Maiza in 2016, located in Tunisia. It is best known for 2D and 3D mobile applications and video-games, virtual visits and simulations on multiple platforms.

## **Discipline adopted:**

Throughout the years we spent at ISAMM learning, we received a strong education that made the creation of this project possible, during internship we used:

- Design and Graphic Conception: for the game interfaces.
- 3D art: in modelling, texturing and animating a game object.
- Object-Oriented Programming: for programming levels of the game.

# Introduction to Virtual Reality

## Virtual reality (VR):

VR is an interactive computer-generated experience taking place within a simulated environment. It incorporates mainly auditory and visual feedback. This immersive environment can be similar to the real world or it can be fantastical.<sup>1</sup>

## Types of virtual reality systems:

Virtual reality is an emerging new technology that is still yet into improvement. However, we can already take notice of wide choices available to experience it.

In this section we are going to list the most popular among them and choose which one suits better our need for "Kamen".

## Tethered VR headsets:

Involves headset physically connected to a computer in order to work. Those are the most immersive ones due to high end quality gaming experience they can offer such as the HTC Vive headset made by the Taiwanese company HTC .



Figure 1 : HTC vive headset

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<sup>1</sup> Source : [https://en.wikipedia.org/wiki/Virtual\\_reality](https://en.wikipedia.org/wiki/Virtual_reality)

Headset highlights	Headset drawbacks
<ul style="list-style-type: none"> <li>• Offers the highest quality graphics.</li> <li>• Very well equipped, it includes: intuitive controllers, base stations for area tracking and ear buds for audio.</li> <li>• Extremely immersive.</li> </ul>	<ul style="list-style-type: none"> <li>• Constantly connected to a PC which makes the movement limited.</li> <li>• Needs really powerful gaming PC to work.</li> <li>• Expensive.</li> </ul>

*Table 2: highlights and drawbacks of HTC Vive*

### **Standalone VR headset:**

No physical connection to a computer or mobile phone is needed with this kind of headset apart from charging their battery, they are considered as wireless: they're including everything needed to run a VR game offers however low quality graphics.

We can see as an example for this category right below: the Oculus Go from the American technology company Oculus.



*Figure 2: Oculus Go headset*

Headset highlights	Headset drawbacks
<ul style="list-style-type: none"> <li>• Easy to use and can be carried around in a bag.</li> <li>• Free movement.</li> <li>• Equipped with controller.</li> </ul>	<ul style="list-style-type: none"> <li>• Limited graphics.</li> <li>• Needs to be recharged frequently.</li> <li>• Moderately immersive.</li> </ul>

*Table 3 : highlights and drawbacks of Oculus Go*

### **Smartphone VR headsets and handheld VR viewers:**

In order to enjoy a virtual reality experience the headset must be equipped with enough powerful smartphone to run the game .Indeed the graphics quality depends highly on the smartphone used, the headset only offers lenses that create a sense of depth and sometimes, depending on the model, it's provided with a strap too to hold into place. Here's below the famous Google cardboard, leader of this category.



*Figure 3 : Google Cardboard*

Headset highlights	Headset drawbacks
<ul style="list-style-type: none"> <li>• Extremely affordable.</li> <li>• Very easy to set up.</li> <li>• Widely spread.</li> </ul>	<ul style="list-style-type: none"> <li>• Very limited graphics.</li> <li>• Not that much immersive.</li> <li>• Often made with low cost materials that doesn't last long.</li> </ul>

*Table 4 : highlights and drawbacks of Google Cardboard*

### Conclusion:

In conclusion, every category of headset suits a specific need. As for the development of our game, we opted for the tethered VR headset HTC Vive to take full advantage of its capacities and offer the most immersive result possible.

# 1 Game Overview

The game overview allows us to clearly see what to aim for and basically what the game is all about.

## 1.1 Concept

'Kamen' is an action game in virtual reality, where players see the world through the eyes of a Samurai<sup>2</sup> in the Edo era, a particularly rich history period of Japan with remarkably developed folktales and myths.

Immerse into authentic Japanese environments to experience special powers of Yōtō, the cursed katana and wipe out the toughest Yokai; evil spirits starving for power, who doesn't hesitate to use magical spells and fighting skills to make Japan falls into their hands.

## 1.2 Genre

'Kamen' is a 3D action video game in virtual reality.

## 1.3 Target Audience

The game is designed for anyone 16 years old and up due its exposure can be harmful for children still growing and can also give motion sickness.

We aim to give a chance to anyone who's curious and interested to know more about Japanese culture and folklore.

## 1.4 Device

Kamen is set to run on a personal computer (PC) VR ready equipped with a HTC vive headset.

## 1.5 Project Scope Summary

### ❖ Number of locations

There are 3 locations in this game:

- The training room
- The mask room
- The fighting room

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<sup>2</sup> A member of a powerful military caste in feudal Japan.

❖ **Number of Levels**

There are three levels, an introductory level that gives a chance for the player to get familiar with the controls and the environment, a second level where the player needs to make a choice and a main level that basically represent the game core.

❖ **Number of NPC**

The game have in total 2 NPCs<sup>3</sup>, they are all enemies.

❖ **Number of Weapons**

There's only one available weapon for the player to use for defence, enemies uses magic powers to attack rather than weapons.

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<sup>3</sup> Nonplaying characters

## 2 Inspiration

Before developing the game, we researched, analysed, and studied some games that are similar to 'Kamen', in order to release a successful videogame that can satisfy the players in both technical and graphical range.

### 2.1 The Legend of Zelda: Twilight Princess

Twilight Princess is an action-adventure game developed and published by Nintendo for the Wii and GameCube home video game consoles .

The story focuses on series protagonist Link, who tries to prevent the kingdom of Hyrule from being engulfed by a corrupted parallel dimension known as the Twilight Realm. To do so, he takes the form of both a 'Hylian' and a wolf.

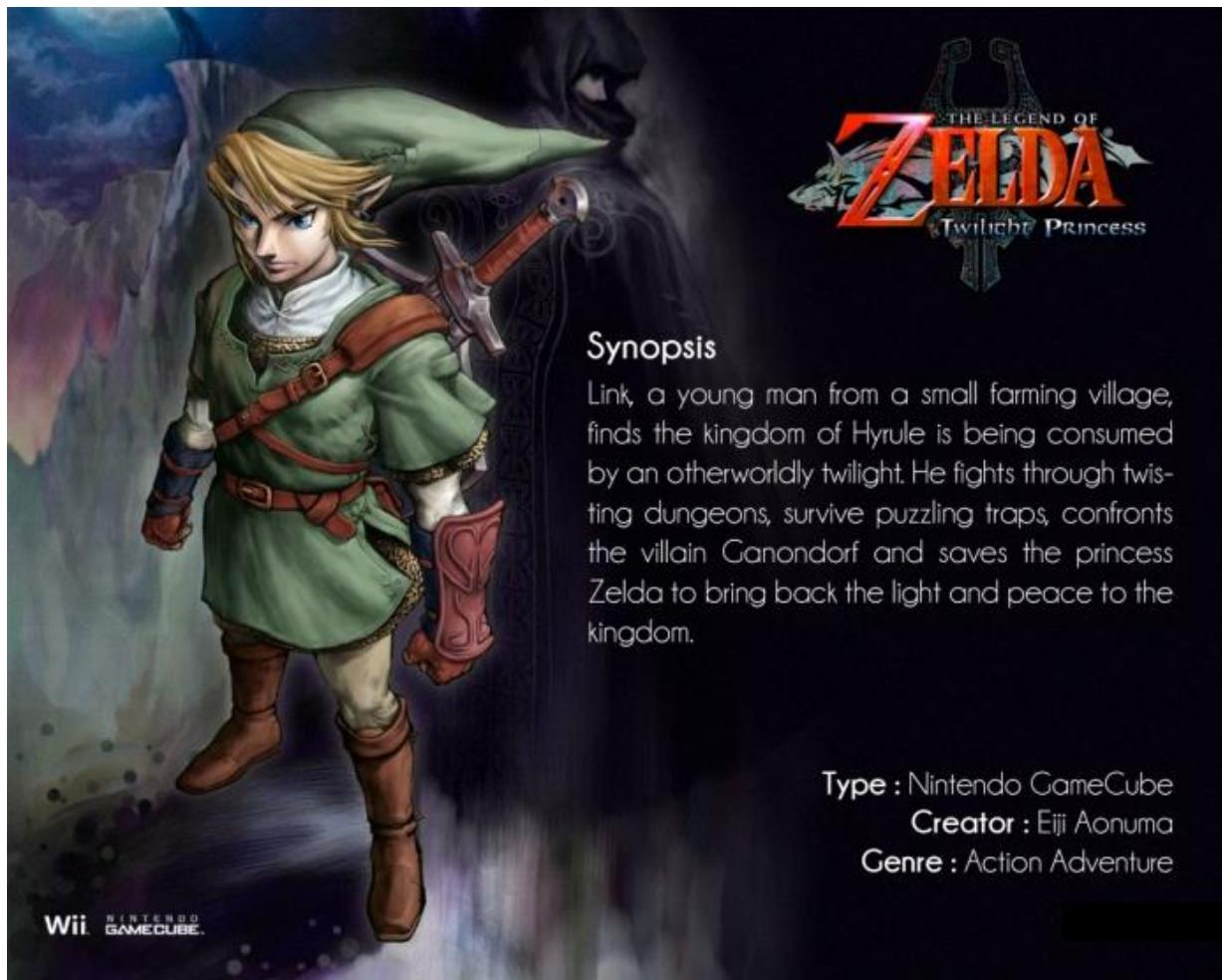


Figure 4 : The Legend of Zelda Twilight Princess: Overview

## 2.1.1 Character Design

### ➤ Link

Link is the main protagonist of Nintendo's video game series The Legend of Zelda. He appears in several incarnations over the course of the games, He is one of Nintendo's main icons and one of the most well-known and popular characters in video game history.

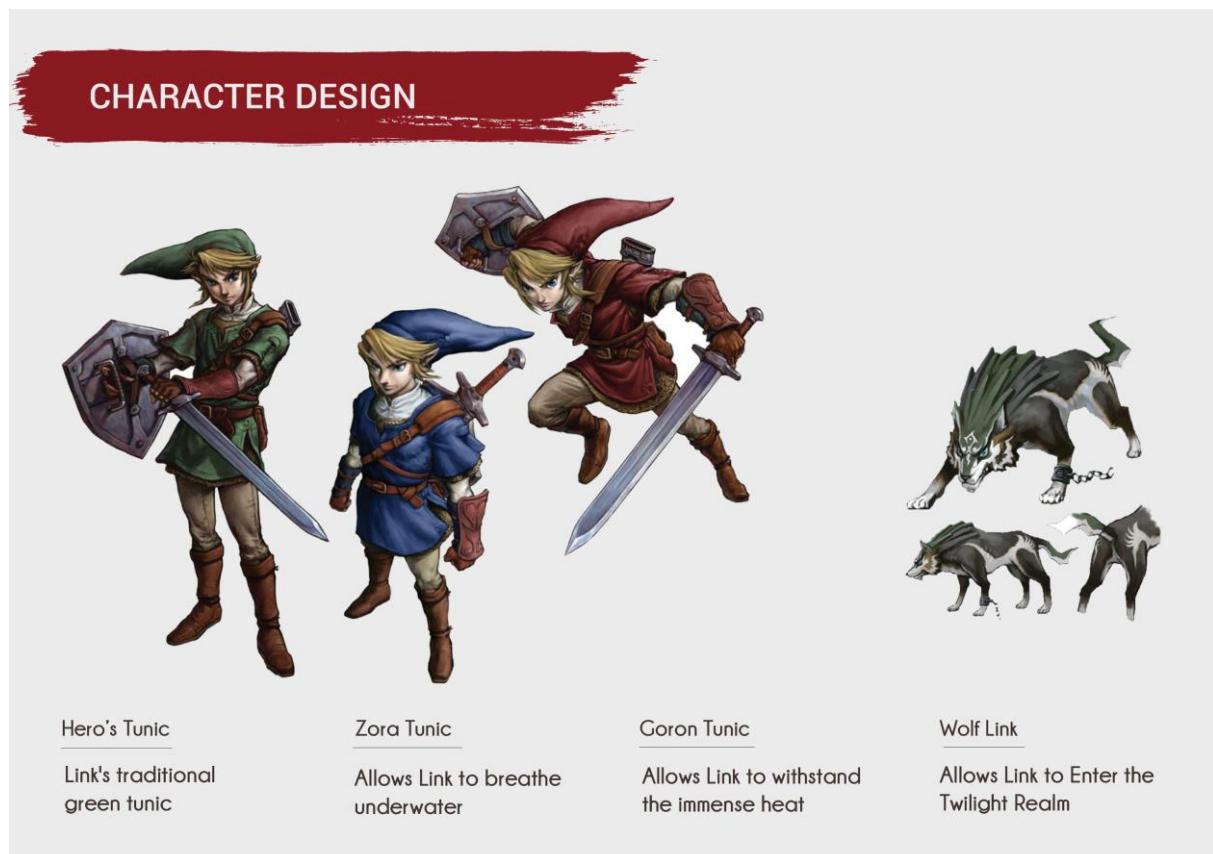


Figure 5 : Link's forms

Link often travels through Hyrule, defeating creatures, evil forces, and the series' primary antagonist, Ganon, while attempting to save Princess Zelda and Hyrule. To defeat Ganon, Link usually requires the mystic Master Sword and Light Arrows, or a similar legendary weapon, obtained after many trials and battles.

## CHARACTER DESIGN



Hylian Shield



Textures and colors



Master sword



Figure 6: Link's Character Design

The creator of The Legend of Zelda wanted Link to seem familiar to the audiences, so he asked designer Takashi Tezuka to craft Link's appearance based on popular Disney characters. Tezuka looked to Peter Pan for inspiration, giving Link a green tunic, a long floppy hat, and pointy ears similar to an elf.

## ➤ Ganondorf

Ganondorf in his humanoid form, is a fictional character and the main antagonist of Nintendo's The Legend of Zelda video game series. Ganon is the final boss in many Zelda titles, in Twilight Princess he possess the soulless Princess Zelda and attack Link before leaving her body and transforming into a feral version of Ganon.

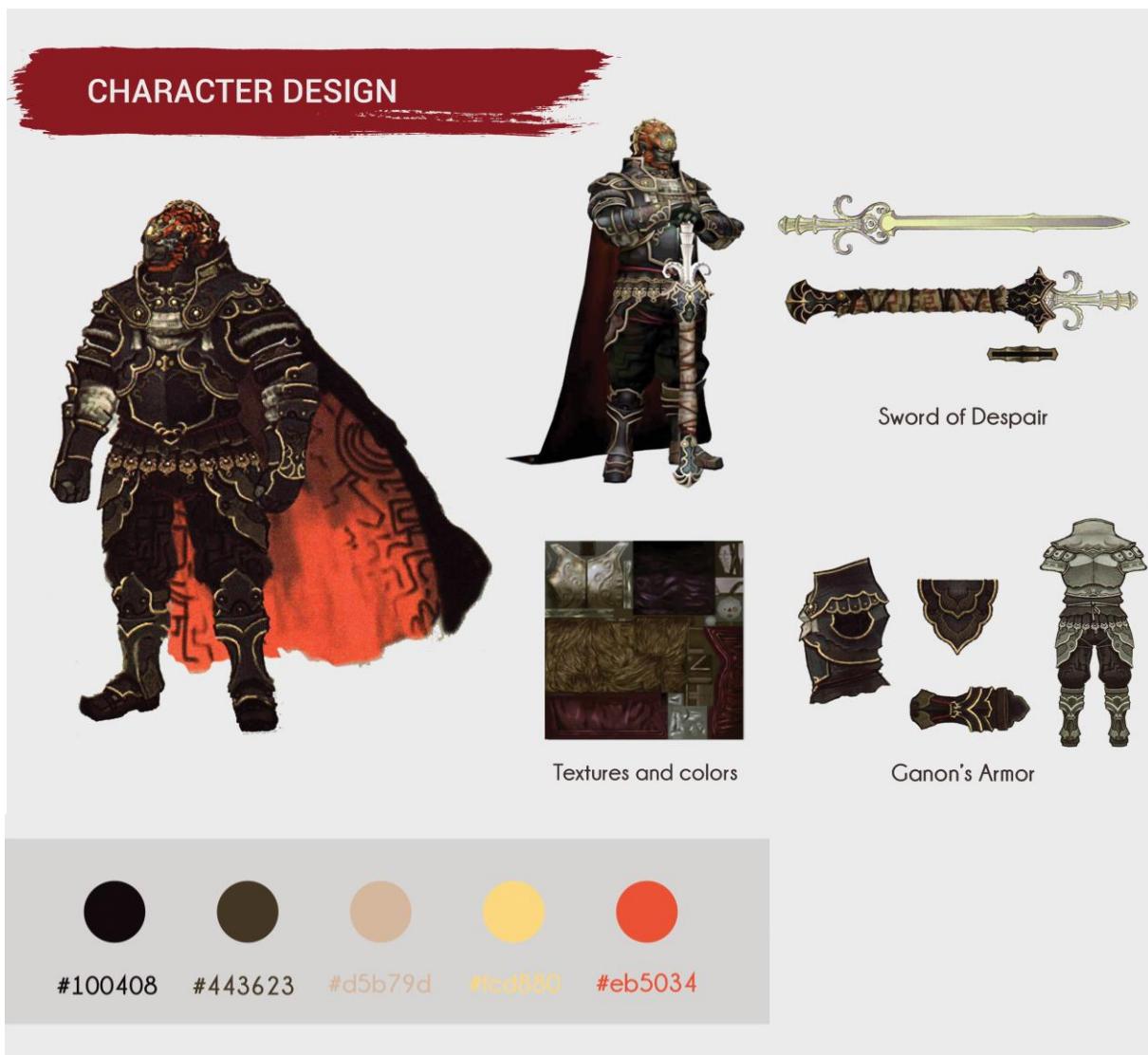


Figure 7: Ganon's Character Design

Ganon was originally known as "Hakkai" during development of the original The Legend of Zelda, in reference to a humanoid pig character known from the 16th century Chinese novel "Journey to the West". In Twilight Princess he appears with a cloak, a thick armor, a glowing white wound in his chest that originated from his failed execution, and the same sword that was used during the execution attempt.

## ➤ Princess Zelda

Princess Zelda is the titular character in Nintendo's The Legend of Zelda video game series. She appears in several incarnations throughout the series, generally as a member of Hyrule's royal family and an associate of the protagonist Link. Ganon's Puppet Zelda is one of the final bosses from Twilight Princess. Ganondorf possesses Princess Zelda to fight Link when the two meet at Hyrule Castle.

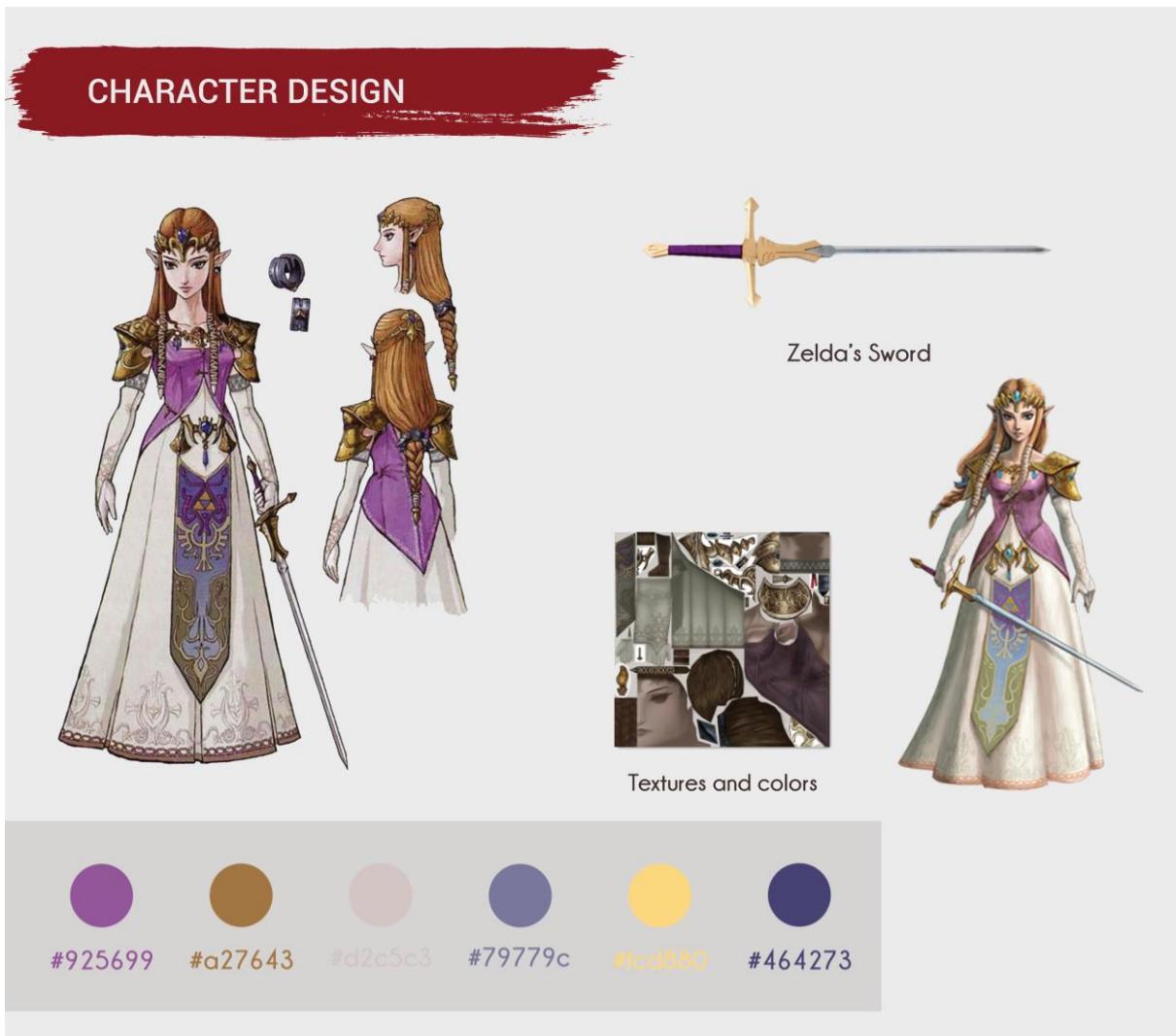


Figure 8 : Zelda's Character Design

Zelda is often shown as beautiful and elegant princess; she could easily be compared to the description of a fair maiden. Her hair colour is depicted as dirty blonde in Twilight Princess, her hairstyle tends to be long with braids, her eyes are blue, and her ears are pointy, since she's an Elf. The dresses that she always uses are long with determinate colours, such as different tones of pink, white and blue. She also have a tiara with either a red or blue crystal in it.

## 2.1.2 Gameplay

### ➤ Basic Controls

#### **Human Form:**

Link's most versatile form is his normal, everyday self. In human form, Link can wield a sword and defend himself with a shield. He also has access to all of the different items and tools he has acquired during his travels, which are often used to overcome a variety of obstacles. Most importantly, Link can talk to people he meets while in human form.

- Walking and Running :

Link can walk in any desired direction in an open world. He can also run which is the most quick and efficient method to traverse the game world.

- Targeting :

Targeting hostile creatures is absolutely vital to succeeding in combat. Link's attention then becomes focused on the enemy, keeping it in his view at all times.

- Sword combos :

Continuously pressing the B allows Link to draw his sword and begin hacking and slicing. This is the most common way clear out fields full of tall grass or to soften up groups of enemies before making a more calculated assault.

#### **Wolf Form:**

As a wolf, Link has access to a whole new range of talents and abilities, but he loses many of the skills he possesses in human form. While he can still walk and run about as normal, Link cannot wield a sword or shield or use any items; wolf paws weren't designed for such work. It's also impossible for wolf Link to speak with humans he meets.

- Dashing :

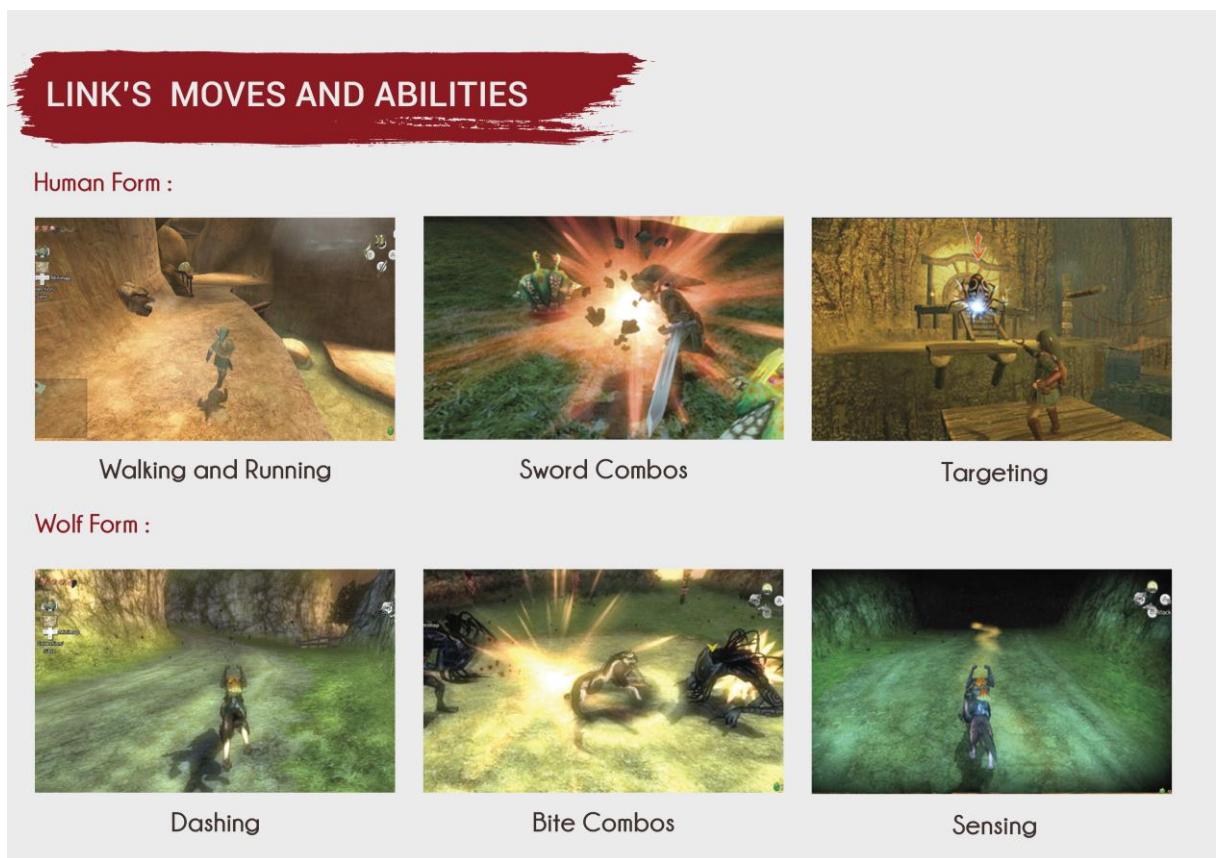
Walking, running, and jumping remain exactly the same between Link's wolf and human forms, but his bipedal roll ability becomes replaced by a short dash that works in much the same way.

- Biting Combos :

Link's standard sword barrage is replaced by a series of vicious bites when in wolf form. These quick nips have a shorter range than the human form sword strikes, but they're a bit faster to execute.

- Sensing :

In wolf form, Link has access to heightened senses, which he can turn on and off at will



*Figure 9: Link's moves and abilities*

## ➤ Boss Battle

### Ganon's Puppet Zelda:

Her main attack consists of an energy ball which she will fire at Link. This attack is the only way Link can harm her. Link must rebound the energy ball back to her by swinging his sword or empty bottle when it is near. Zelda will hit the ball back at him, and Link must continue to volley it back until it finally hits her.



Figure 10 : Screenshots from Puppet Zelda's boss fight

### 2.1.3 Level Design

#### ➤ Tutorial:

The game begins with Link in Ordon Village. Like all games in the series, it opens with the player partaking in a tutorial of sorts, a good introduction to the rest of the game. It feels less like a forced tutorial and more like a beginning to the adventure of a lifetime.

Link obtains a wooden sword to use during the tutorial, allowing the player to learn how to target, run, jump, and perform the other mechanics that are staples of the Zelda series. Further in the game, Link acquires the Master sword; his main weapon, after finishing a specific quest.

#### ➤ Levels:

The colours were very diversified and conferred a truly poetic atmosphere to the game, while remaining relatively realistic, the colours of Twilight Princess are confined to dark colours (ocher, grey, dark green ...). This was a deliberate choice of the developers to give a darker atmosphere to the game.

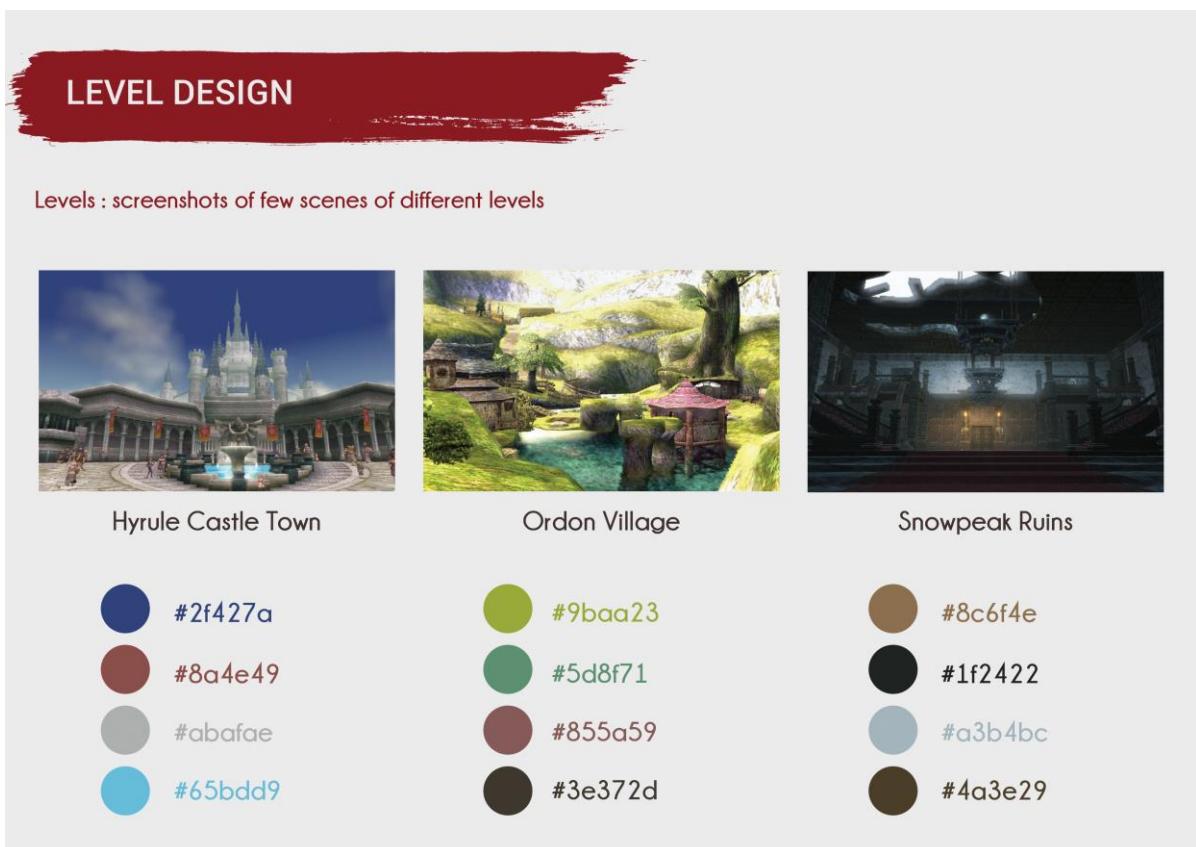


Figure 11: Screenshot of Level designs in Zelda

## ➤ The Dungeons:

The main mechanic of a Zelda dungeon is "Keys and Doors"; a door is blocking the player's progress and he needs to find a key to open it. This often forces the player to take alternative paths in order to find the key.

All the dungeons in this game can be finished using the exact same path, as the player moves in the same directions in the same order. Due to the varied visuals and gimmicks, the dungeons feel so similar to play, even if they look very different.

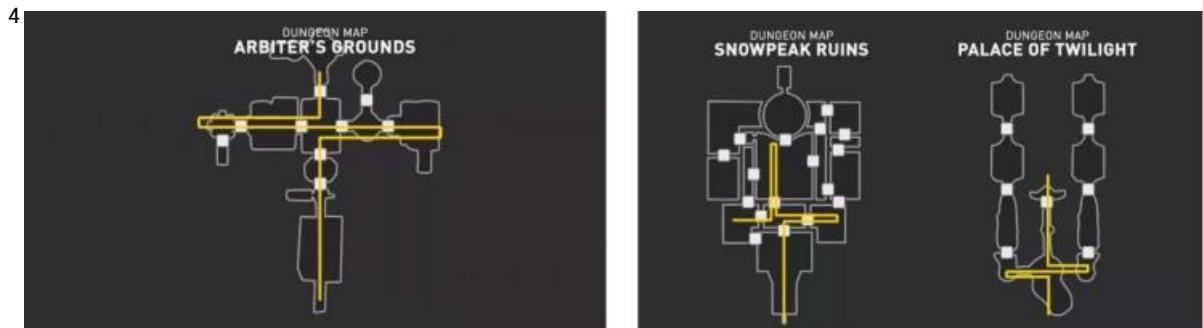
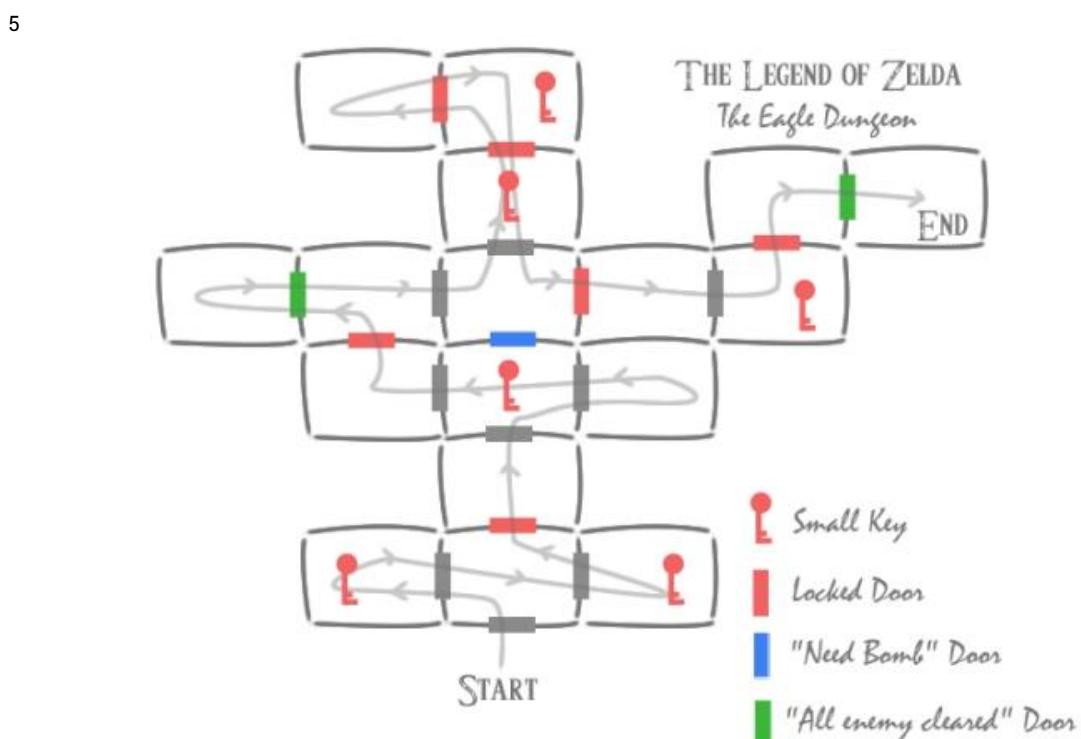


Figure 12: Map Design in The Legend of Zelda



<sup>4</sup> Source : <https://www.polygon.com>

<sup>5</sup> Source: <https://gameatelierstories.wordpress.com>

### ➤ **Textures:**

Twilight princess was the only realistic and mature Zelda game it features a stylized, naturalistic art style. Example: The water design appears more realistic when compared to other Zelda games such as The Wind Waker.



Figure 15: Water Texture in The Legend of Zelda wind waker



Figure 14: Water Texture in The Legend of Zelda twilight princess

## LEVEL DESIGN

Textures : Example of few textures in different levels

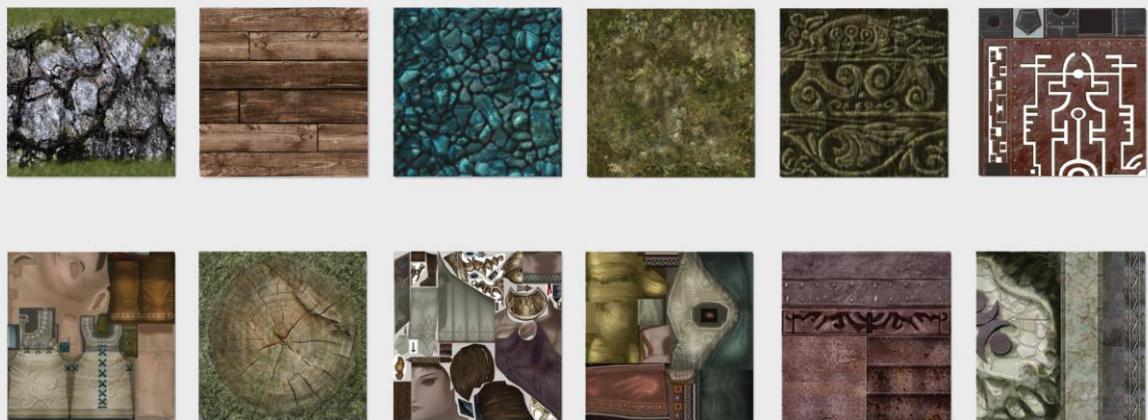


Figure 16: Texture in the Legend

### • Conclusion :

The legend of Zelda twilight princess is a very inspiring game, especially with its dark and dim environment and various character design.

## 2.2 Vanishing Realms

Vanishing realms is an immersive RPG adventure game exclusively available on HTC Vive and is one of the most highly rated and well sold VR games on steam VR, it is developed by Indimo labs in 2016.

The game has the classical heroic fantasy scenario where the player mainly sword fight with animated skeleton monsters in original medieval magical world.



Figure 17: Vanishing Realms: Rite of Steel Overview

### 2.2.1 Enemies

During the adventure, we can encounter two kinds of enemies.

#### Enemy with the Sword

The character is pretty tall and well equipped with a big sword, helmet with horns and big shield. In fact, he's very impressive and hard to kill, however, the undead don't really lunge at the player, rather wait around for the player to make the first move than to attack.



Figure 18: Enemy with sword

### **Enemy with the Bow:**

The second character is a lot shorter, with a different helmet and a bow, despite being far, this enemy attack as soon as the player enter his area and melee combat once the player gets nearer. The enemy is more aggressive than the first one but tend to die faster.



*Figure 19: Enemy with bow*

### **2.2.2 Gameplay**

The gameplay of Vanishing Realms is halfway between a first-person role-playing game like 'Skyrim'<sup>6</sup>, and an adventure game like The Legend of Zelda.

In order to progress in the adventure, the player must solve puzzles to collect keys, find new weapons and other pieces of equipment, and fight the monsters that stand in his way.



*Figure 20: Enemy with sword attacking*

---

<sup>6</sup> Action role-playing video game

### 2.2.3 Level Design

Most of the levels in vanishing realms are a mix of open and closed areas where's the player moves by pointing where he want to be and teleport there. The design is built in a cartoonish-fantasy low poly style and include only two chapters in total which represents 2-3 hours of game play.

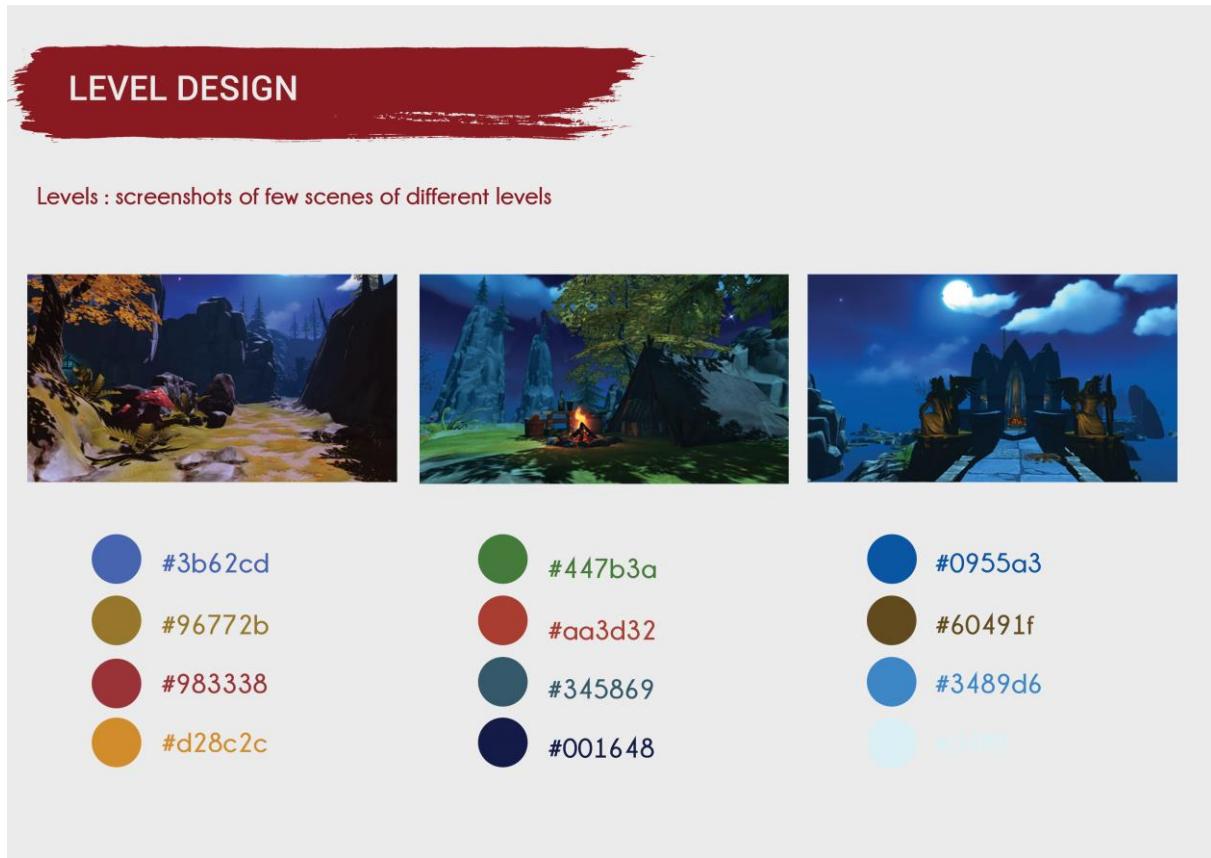


Figure 21: Level design of Vanishing Realms

### 2.2.4 Controls

The game takes full advantage of the HTC VIVE controllers, they are used as real weapons.

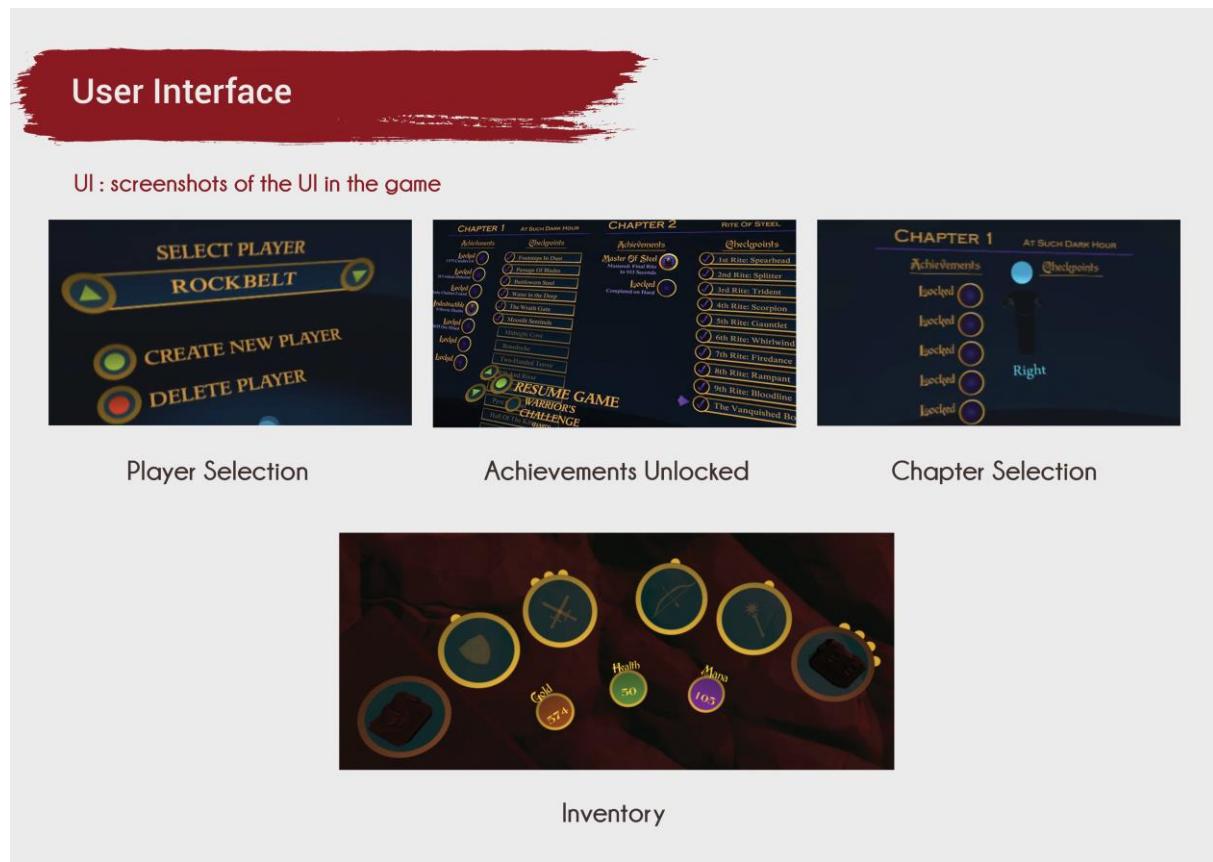
At the beginning, there's a very brief tutorial about how to move in the game, picks things and store them, which makes the intuitive controls fast to get.

The player equips a sword and a shield, he will have to wield the controller he holds in his right hand like a blade, and lift the left controller like a shield protecting him from enemy assaults.

If he equips a bow, his right hand will be used to orient his weapon, while the left hand will control the bow string.

## 2.2.5 User Interface

As soon as we start the game, the player faces a wide user interface in 3 parts: the first one allows the player to select, create or delete a player. The second part allows to see which achievement unlocked so far and available checkpoints and last the part does the same thing for the second chapter. In game, the player can get access to the inventory where there's enough place for the weapons and the collectibles, as well as the gold, Mana and health are displayed.



*Figure 22: User Interfaces of Vanishing Realms*

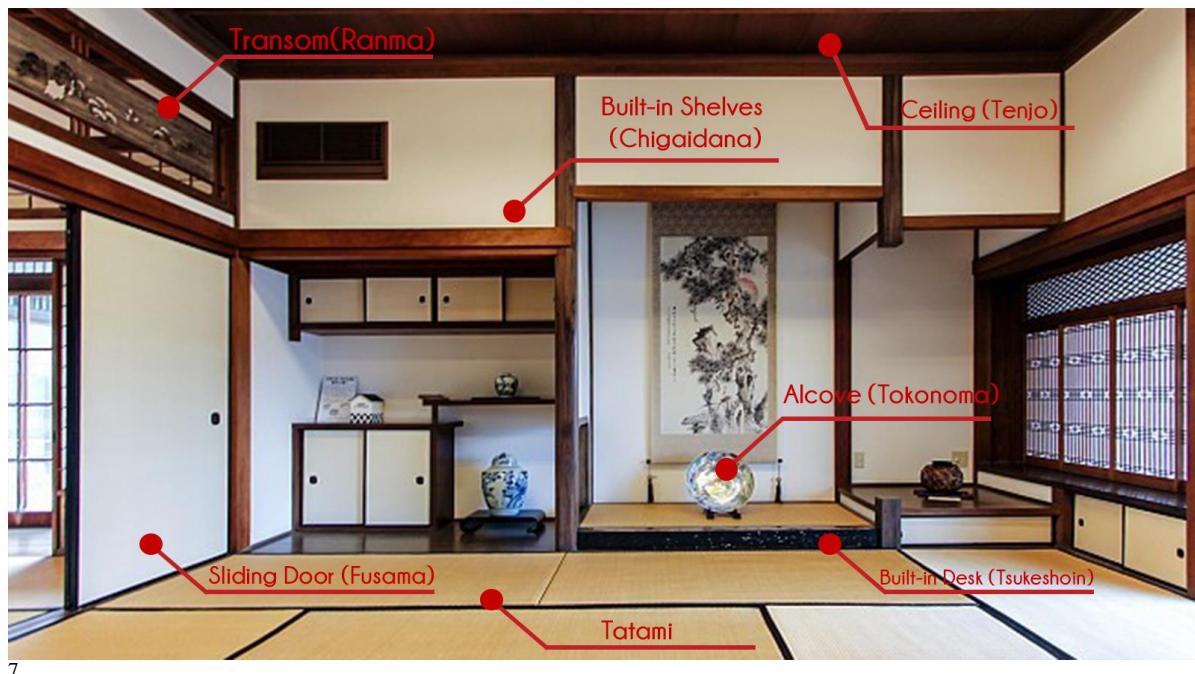
- Conclusion :

We were inspired by how far vanishing realms took the gameplay experience, offering a real adventure through a magical world and challenging enemies. Even though the game concept is deep compared to other virtual reality game, we really felt a lack of story to drive the game and make it a little bit more thrilling.

## 2.3 Japanese Inspiration

### 2.3.1 Interior Design Inspiration

The traditional Japanese rooms that can be seen today mostly come in two basic styles: shoin and sukiya. Shoin style rooms originally served as study rooms in temples and typically incorporated a built-in desk, an alcove and built-in shelves. Shoin style rooms became popular in Muromachi Period residences where their function was extended to receiving and entertaining guests. Additional characteristics that developed in Shoin rooms of the time included floors covered entirely with tatami mats, Fusuma sliding doors and shoji doors.



7

Figure 23: Shoin Style Room elements

The sukiya style is a variation of the Shoin style with subtle artistic differences. The Sukiya style was heavily influenced by the tea ceremony and is commonly seen in tea rooms. Characteristics elements include unadorned clay walls, woven straw or bamboo ceilings, undecorated Fusuma and unfinished wood.

<sup>7</sup> Source : <https://www.japan-guide.com>

### 2.3.2 Japanese Traditional Cloth

Traditional Japanese clothing changes based upon season, events, age, and sometimes even gender. The changes in clothing are usually matched with the weather (for example, thinner fabrics in the summer) or by the formality of the event (more elaborate clothing for a child's first visit to the temple or a wedding). All these different choice can get a bit confusing, so let's take a look at the different types of traditional Japanese wear.

- **Japanese Clothing and Marital Status:**

Particularly for women, traditional Japanese clothing are worn based on seasons, events, but also marital status. Young unmarried women wear kimono with long sleeves with vibrant colors and rich with patterns. Married women or older women generally wear simpler more subdued kimonos.



8

Figure 24: Example of Japanese clothing

<sup>8</sup> Source : <https://www.japanesestyle.com>

### 3 Game Conception

#### 3.1 Use Case Diagram

Use case diagrams are used to gather the requirements of a system including internal and external influences. These requirements are mostly design requirements. Hence, when a system is analyzed to gather its functionalities, use cases are prepared and **actors** are identified.<sup>9</sup>

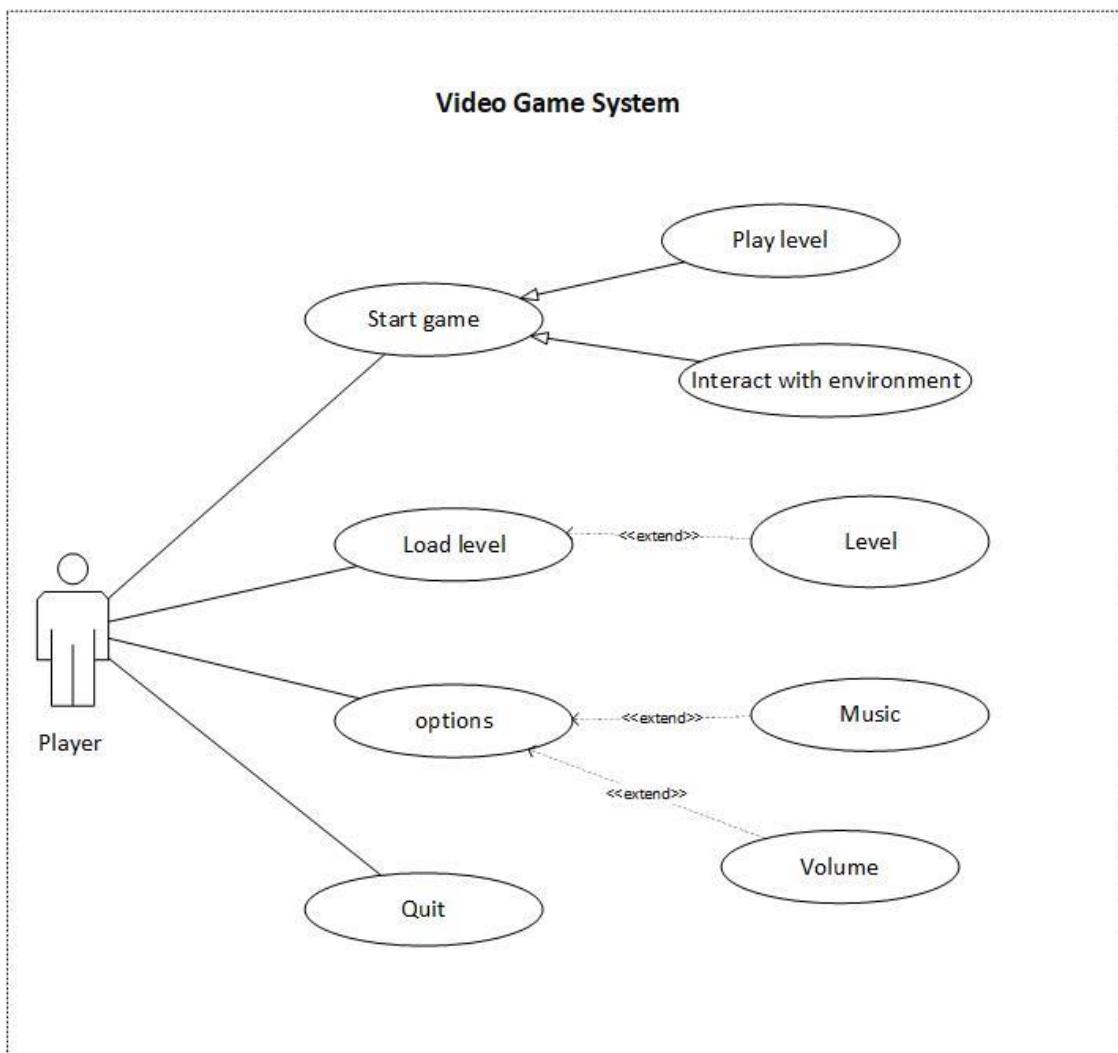


Figure 25: Use Case diagram

Use case: < Use case of the game>

Actor: <Player>

Objective: show the general interactions players can do in the game.

Precondition: a working HTC Vive headset well and fully connected to machine.

Game launched

Postcondition: Game application closed.

<sup>9</sup> Source : [https://www.tutorialspoint.com/uml/uml\\_use\\_case\\_diagram.htm](https://www.tutorialspoint.com/uml/uml_use_case_diagram.htm)

## 3.2 Sequence Diagrams

Sequence Diagram <> move weapon>>

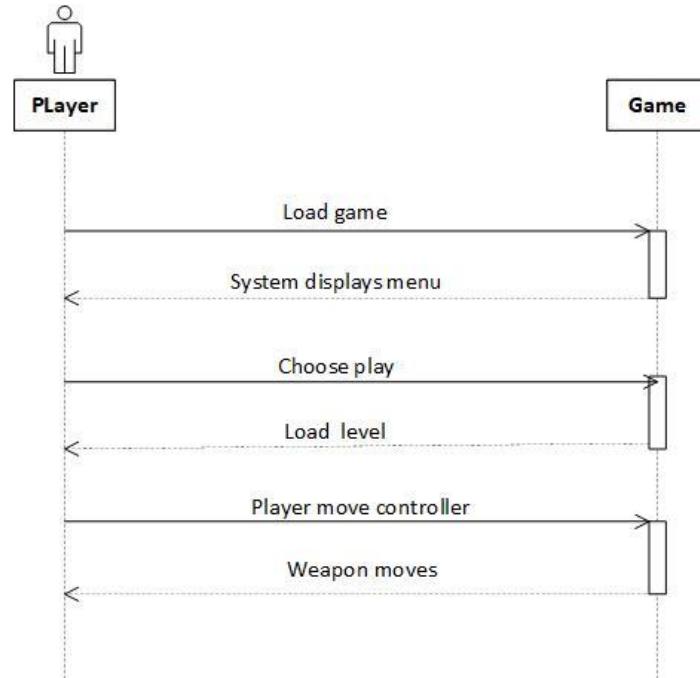


Figure 26: Sequence diagram <move weapon>

Sequence Diagram <>walk>>

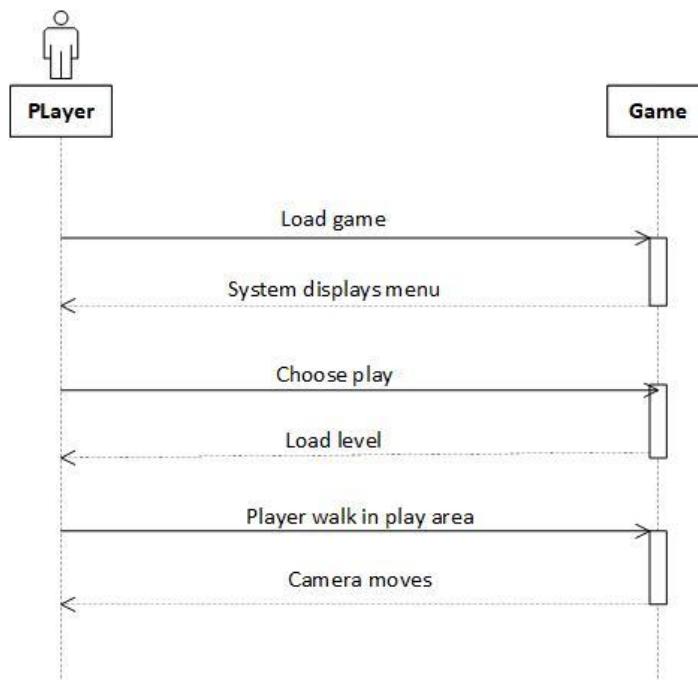


Figure 27: Sequence diagram <walk>

### 3.3 Activity Diagrams

The Kabuki Spirits and Kitsune are the main enemies in our game, below are their activity diagrams explaining their Attack System:

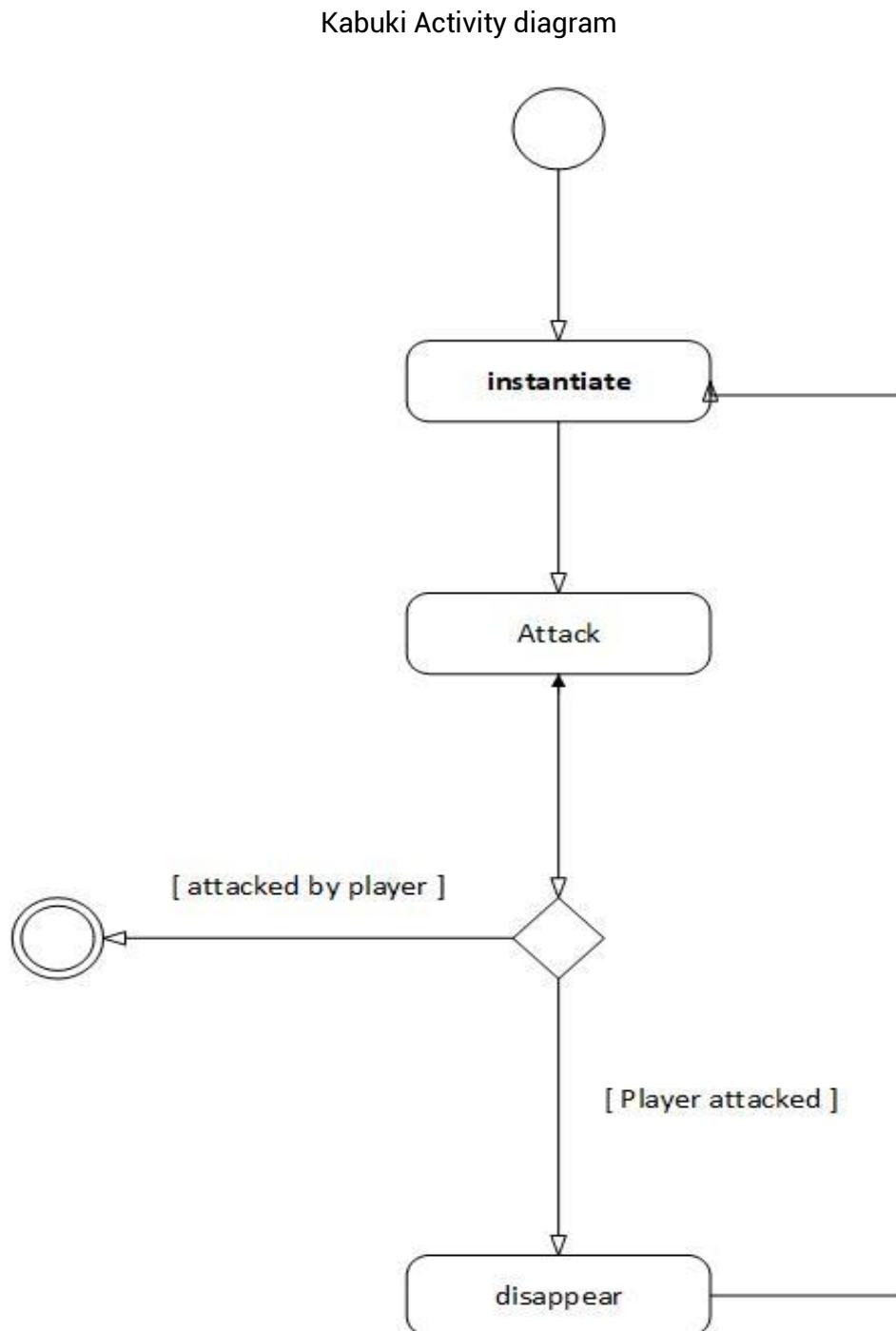


Figure 28: Kabuki Activity diagram

### Kitsune Activity diagram

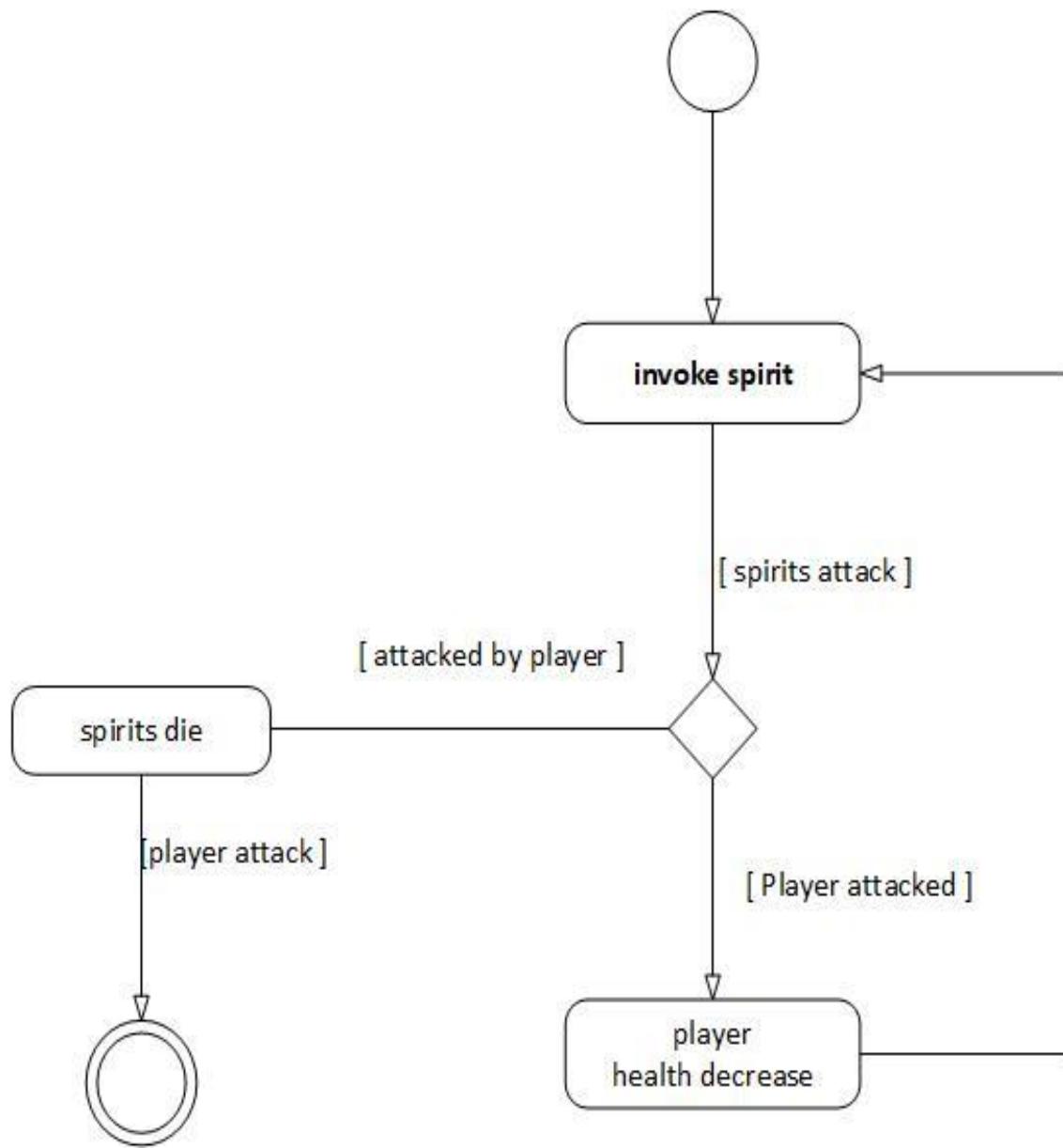


Figure 29: Kitsune Activity diagram

## 4 Game Play and Mechanics

### 4.1 Gameplay

#### 4.1.1 Game progression

Players will progress through different rooms within the game.  
Primarily within training room:

- Training room:

Kamen begins in the training room; players can take all the time needed to look around and check what they can interact with.

In the beginning we're aiming to push them to discover the environment and not immediately get into combat mode.

Eventually when the player will grab the katana and learn how to skilfully use it, enemies will show up and attack.

Players needs to eliminate them all in order to proceed to the next room.

- Masks room:

In this room the player doesn't have to fight, but they need to make a choice. They will face three masks representing Yokais.

In order to choose which Yokai to fight, its representing mask must be sliced with the katana, however the skills learned in the previous room are limited and can only counter-attacks one Yokai, therefore there's only one beatable Yokai who will be available for the fight at first.

- Fighting room:

After choosing which Yokai to face and fight, players proceeds to the final room where the combat will take place.

The main idea is to let them observe and try to guess how to reach the enemy, no indications will be given to help.

Players can take damage, dodge or run from the Yokai attack and have only the katana to face it.

### **4.1.2 Objectives**

In order to clear the game, those objectives must be completed:

- Grab the katana.
- Clear the first room.
- Make the Yokai mask choice.
- Fight the chosen Yokai.

### **4.1.3 Play flow**

The game starts with a logo screen and then acceding to the main menu scene where's players can essentially choose to load a level or to start game.

The first level starts in a private Shoin room where's the main weapon of the game is available.

However, picking up this special katana leads to enemies attacking players to stop them from using its powers, they quickly find themselves involved in the first fight of Kamen that also helps them to get used to the kind of enemies they can encounter in-game.

After defeating all the kabuki spirits rushing in the room, they can now use the door leading to the next room: The Mask room; a space where precious Yokai masks are being exposed.

Players can then discover that breaking in half one the Yokai's mask can lead to their spirit to awaken and have to face a combat with one of these powerful spirits in the next room: The Combat Room.

Once in there, they can notice how special this room is compared to the others: bigger space, almost no decorations, no instructions given, but an angry Yokai standing there, the second fight is then engaged.

## 4.2 Mechanics

### 4.2.1 Physics

Physics in Kamen work as such:

- Players can move in a 3D world.
- The final Boss character (Yokai) is very strong and not easy to reach and damage, except when a weakness is established.
- Gravity is present in this game.

### 4.2.2 Movement in the game

We're using the room scale tracking incorporated in The HTC Vive Virtual reality system: thanks to tracking stations players can walk in a defined play area in order to move in the game.

They can move and look anywhere and anytime during all the gameplay; they perceive the game in a first-person perspective and can walk in any desired direction for a full immersion during gameplay and overcome the biggest issue in VR: motion sickness.

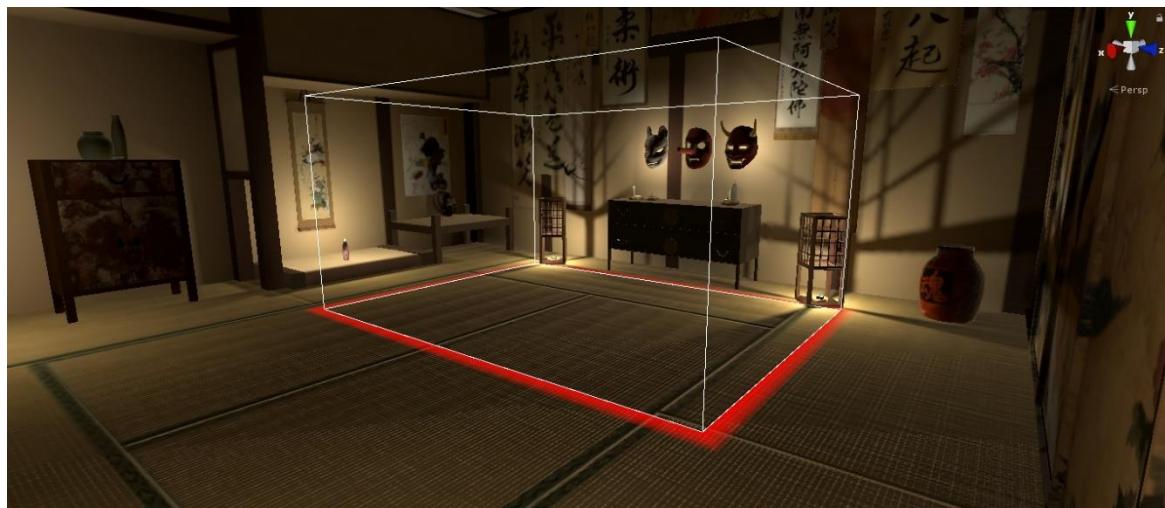


Figure 30: Room Scale

#### 4.2.3 Objects

The only object players are going to directly interact with using the controllers is Yōtō the katana: all they need to do to pick it up is to hover one of the controllers over Katana's handle to actually hold it.

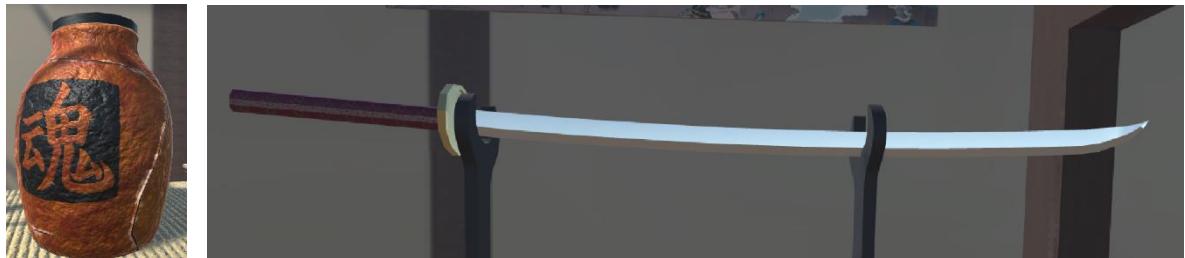


Figure 31: Vase and Katana sword

#### 4.2.4 Actions

While playing Kamen, players can attack enemies, walk and look. They can also interact with some objects in the game: they can read instructions, piece of story, break vase, interact with a door, etc..

#### 4.2.5 Combat

There are two combats in Kamen:

- The combat with the Kabuki spirits.
- The combat with the chosen Yokai.

In the first combat enemies are easy to get rid of, only one successful attack is enough to kill them otherwise they will disappear and respawn again, however to defeat the Yokai, thinking of a real strategy is needed.

## 4.3 Screen Flow

### 4.3.1 Screen Flow Chart

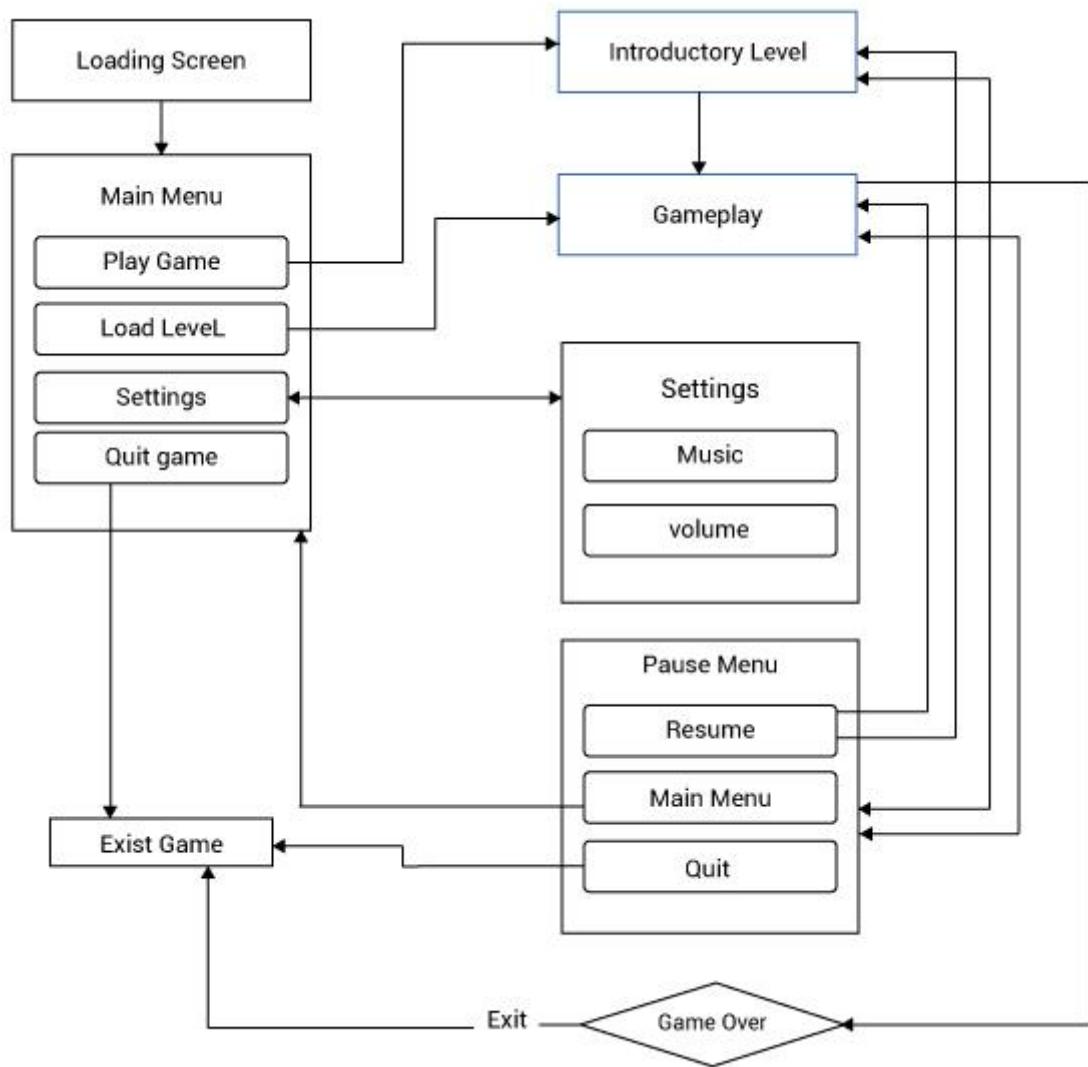


Figure 32: Screen Flow Chart

### 4.3.2 Screen Descriptions

- **Loading Screen**

The loading screen allows the game to load. When the game finish loading, a players proceed to the main menu or the next scene.

- **Main Menu Screen:**

The main menu screen, allows the player to start a game, load a level, configure settings or exit the game.

When the player start a new game, they proceed to the introductory level. If the player chose 'Quit Game', they leave the game.

- **Game Play / Introductory level Screen :**

The game play and introductory screens are where the gameplay happens. From this screen, the player can pause the game. if the player loses his health points, they proceed to the game over screen.

- **Game Over Screen :**

The game over screen is made to let the player know that they have lost the game. In this screen, the message of "game over" is shown. The player can either restart or exit the game.

- **Pause Screen :**

We chose to make a pause screen to give the player the ability to stop the game and resume it whenever they want, move back to the main menu or quit the game.

The pause screen is only visible when the game is paused.

- **Settings Screen**

The settings screen is just a way to let the player control and set the game's sound volume and music as they wish.

### **4.3.3 Easter Eggs**

There is one Easter egg in the game. We placed a sacred urn that imprisons a spirit. If the player breaks that specific urn they will be able to see it.

## 5 Story Setting and Characters

### 5.1 Story and Narrative

#### 5.1.1 Back Story

The game starts in traditional Japanese room, as the player starts to investigate it, they notice a certain weapon glowing. The weapon informs the player that if they hold it, they will be possessed by an infinite urge to kill and gain greater powers. In order to proceed in the game, the player is obliged to carry the weapon thus fight the first enemy he faces, the spirits of the Kabuki. When the player murders them he then moves to the second room where he has to decide which enemy he wants to face. The enemies are represented as masks, each mask represents a supernatural spirit from the Japanese folklore and has its own powers and abilities that the player gains by beating each one gradually.

#### 5.1.2 Characters

Yōkais are supernatural monsters, spirits, and demons in Japanese folklore. The Yokai masks are often used in theatres to symbolize the spirit's ability and character. In various myths the masks are known for possessing their holder and turning them into a Yokai themselves. We decided to present some of the most popular Yōkais in the folklores; the Kitsune, the Tengu and the Oni. We also introduced two important characters in the Japanese culture known as Yōtō and Kabuki.

### Main Character:

#### 5.1.3 Yōtō

- **Back Story :**

The name Yōtō in Japanese, signifies "the cursed Katana". In popular culture Yōtō is known for being a cursed sword with demonic powers that Poses its holder and forces them to commit genocide.

- **Special ability :**

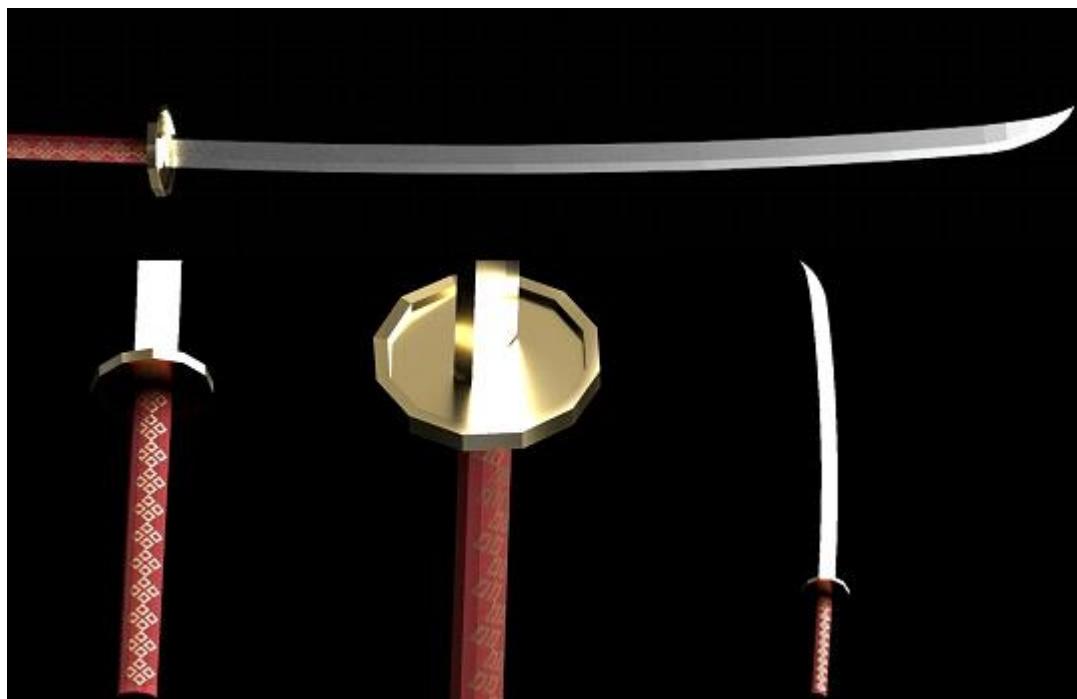
Yōtō allows the player to slice through the enemies and certain objects in the game due to its sharpness and easy manoeuvrability.

- **Character design :**

We found various designs for the Yōtō sword, so we preferred to create our own using the colours of gold and dark red which signifies blood and wealth as a symbol for its users : the Samurais ; military nobility that spilled bloodshed.

- ❖ **Katana Creation :**

We modelled a basic katana then painted it on Substance painter using various materials and brushes.



*Figure 33: Katana*

- **NPCS:**

#### **5.1.4 Kabuki Spirit**

- **Back Story :**

The word Kabuki is derived from the verb kabuku, meaning "to be out of the ordinary".

Kabuki is usually interpreted as "bizarre" or "avant-garde" theatre. The kabuki masks represents the spirits of specific types of performers known as "Kesho".

- **Special ability :**

The Kabuki Spirits attacks the player in different speeds and patterns, all at the same time in order to distract him to easily damage him.

- **Character design :**

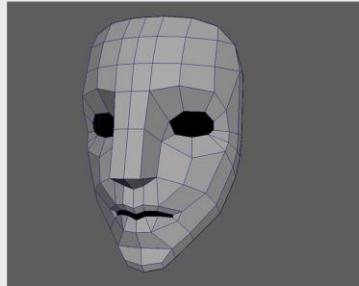
We designed the Kabuki spirit mask based on the kabuki make up that is easily recognizable even by those unfamiliar with this form of art. We used the white base to create the characteristic stage make up, and the Kumadori to exaggerate the facial lines. The kumadori make up is often used to produce dramatic animal or super natural masks. The colour of Kumadori expresses the character's nature: the red lines indicates passion and heroism, the black ones represents villainy and jealousy.



*Figure 34: Kabuki mask*

## CHARACTER DESIGN PROCESS

NPC : Kabuki Spirit



Modeling a basic face  
in Maya



Applying Texture according  
to the UV map



Applying wood material in  
Substance Painter

Figure 35: Character Design progress of Kabuki

- **Yokai Masks:**

- **5.1.5 Kitsune**

- **Back Story :**

Kitsune is the Japanese word for fox. Kitsune is a fox spirit that has the ability to take a human form, she usually tends to be mischievous and malicious in the Japanese folklore.

- **Special ability :**

Kitsune possess superior intelligence, long life, and magical powers such as manipulating other objects and spirits and duplicating the appearance of a specific person. Kitsune is the first and only fightable boss in the game.

- **Character design :**

Foxes spirit are particularly renowned for impersonating beautiful women. In medieval Japan, there was a common belief that any woman encountered alone, especially at dusk or night, is a Kitsune, which inspired us to design our character based on a normal Japanese women wearing the Kitsune mask that symbolizes her identity as a fox.

## CHARACTER DESIGN PROCESS

Boss Character : Kitsune

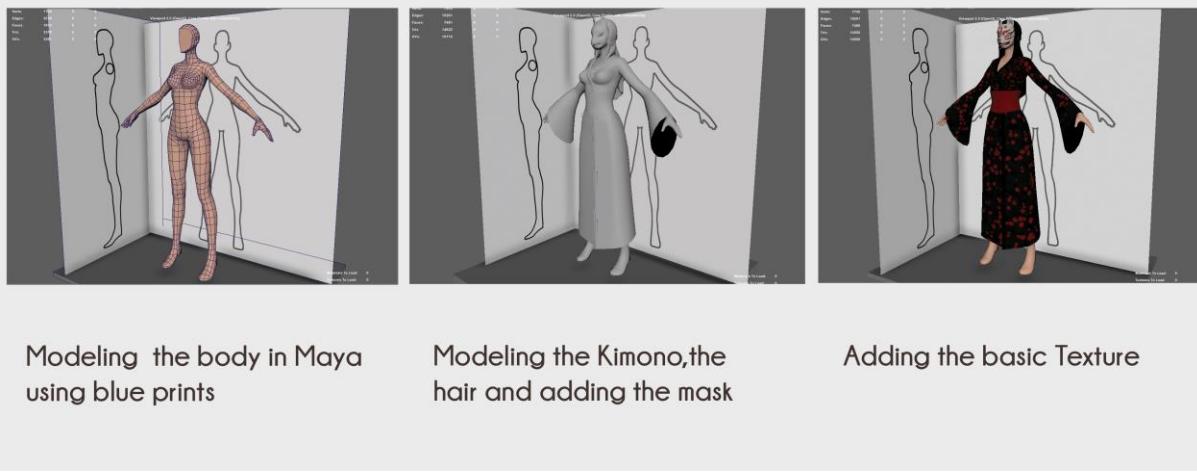


Figure 36: Character Design Process kitsune

### ❖ Mask Creation :

We modelled the Kitsune mask using Maya, we started from a basic face shape and turned it into a fox figure using blue prints. Unlike the other masks the Kitsune has a very detailed facial paintings so we used Adobe illustrator to create them then added the wood material on Substance painter.

## CHARACTER DESIGN PROCESS

Boss Character : Kitsune Mask



Modeling the mask in Maya using blue prints

Adding the textures using Adobe Illustrator

Adding wood material in Substance Pinter

Figure 37: Character Design Process Kitsune Mask



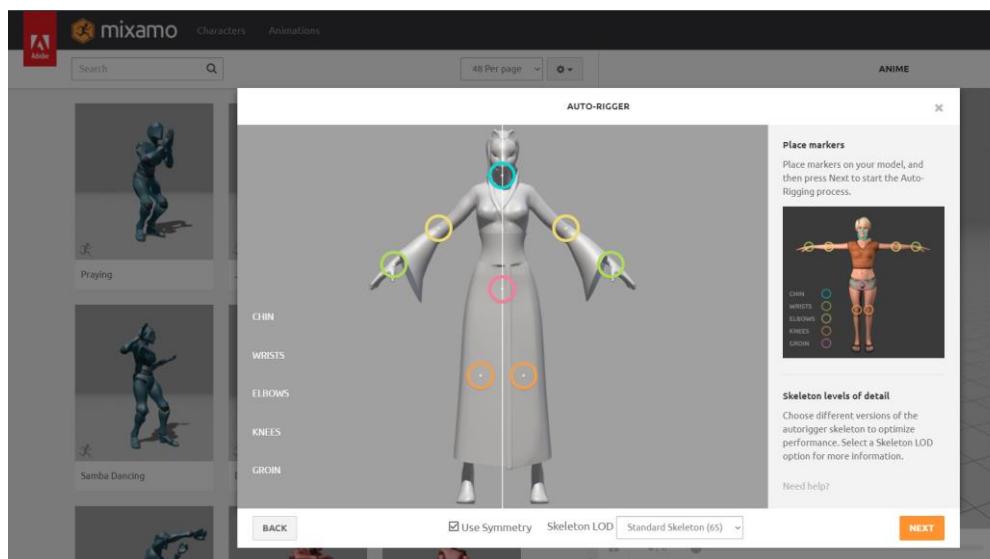
*Figure 38: Kitsune Mask*



*Figure 39: Kitsune Character*

#### ❖ Character animation :

In order to animate Kitsune, we used a software called Mixamo. Its technologies is based on machine learning methods that automates the steps of the character animation process ,such as 3D modelling, rigging and 3D animating.



*Figure 40: Rigging with Mixamo*

To create the animations, we need to define the location of chin, wrist, elbow, knees and groin for auto rigging process [See Figure 40].

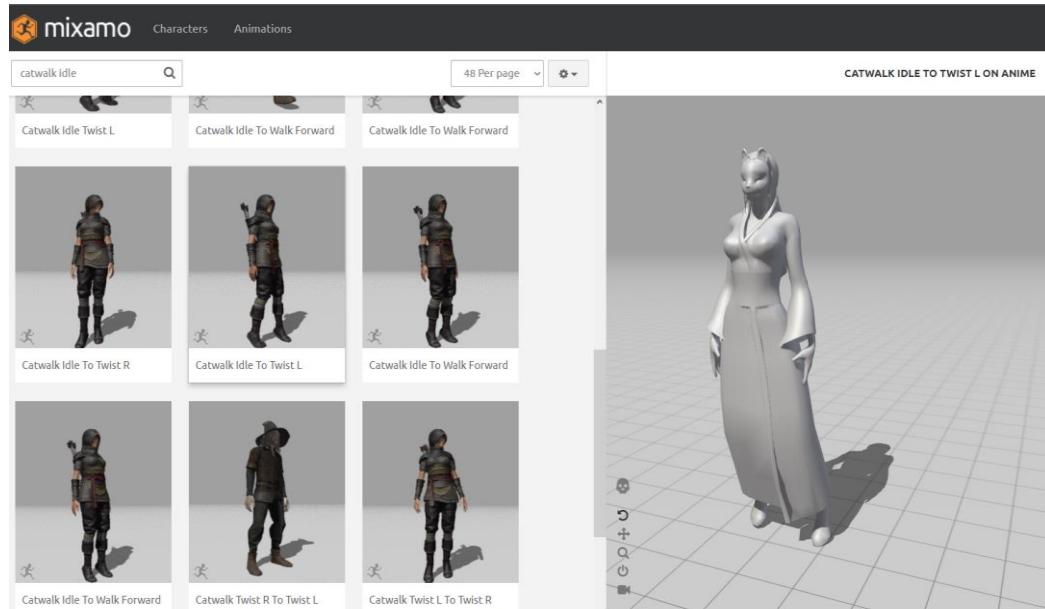


Figure 41: choosing animations in Mixamo

After auto rigging process, we can used few animation moves from Mixamo, such as charging, catwalk idle and dying animations [See Figure 41].

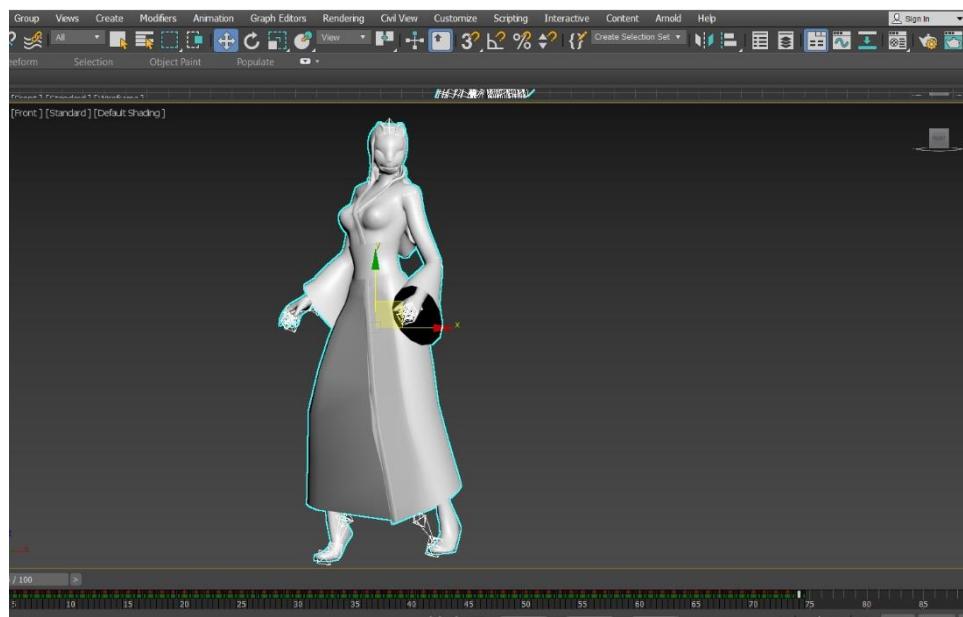


Figure 42: Customizing animations in 3DS MAX

After downloading the animations, we adjusted it and customized it using 3ds Max to avoid certain collusions. We also create more Key frames and removes others to adapt the animations to our specific needs.

### 5.1.6 Tengu

- **Back Story :**

Tengu signifies "heavenly dog" in Japanese. Tengus are known to be troublesome opponents, ghosts of angry, vain, or heretical priests.

- **Special ability :**

The Tengu came to be feared as the vigilant protectors of certain forests.

Legends eventually ascribed to them great knowledge in the art of skilled combat. Due to the limited schedule we have, Tengu appears only in its mask form thus he's not a fightable boss.

- **Character design :**

The Tengu often appears with a red face and an unusually long nose, exaggerated face details and golden eyes.

- ❖ **Mask Creation :**

We modelled the Tengu mask by modifying a basic face on Maya then painting it with Substance painter directly.



Figure 43: Tengu Mask

### 5.1.7 Oni

- **Back Story :**

Oni is an iconic supernatural demon in the Japanese Folklore. Oni were originally invisible spirits or gods which caused disasters, disease, and other unpleasant things

- **Special ability :**

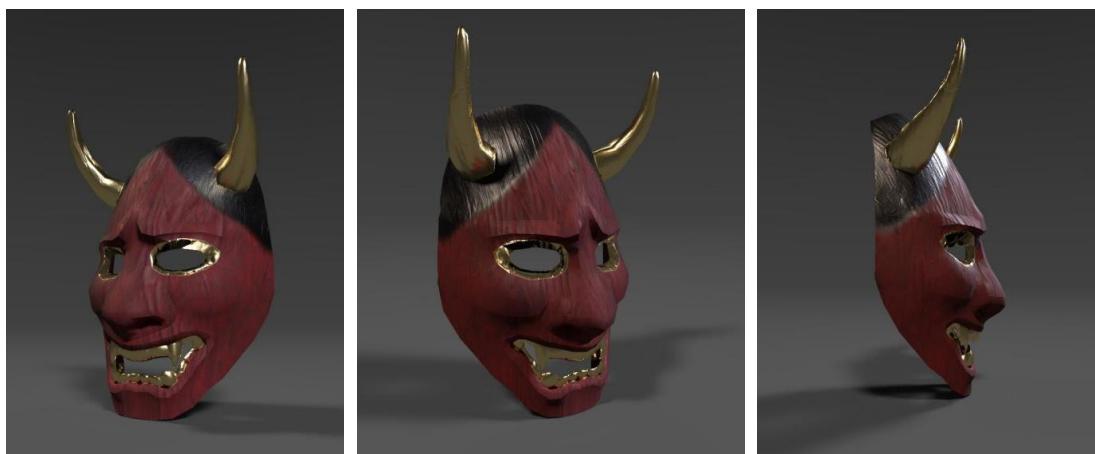
Onis are known for being the strongest Yokais, they possess a remarkable strength and the ability to manipulate weather, turn invisible, Telekinesis , shape shifting and spell casting. Oni is supposed to be the final and strongest boss, however 'Kamen' is a student project with a tight schedule thus he appears only in its mask form.

- **Character design :**

In the Japanese Folklore Onis are portrayed as ogres with golden horns growing out of their heads, dark hair, golden eyes and messy teeth.

❖ **Mask Creation :**

We modelled the Oni mask by modifying a basic face on Maya; adding horns and teeth then painting it with Substance painter directly.



*Figure 44: Oni*

## 5.2 Game world

### 5.2.1 General Look and Feel

The events of 'Kamen' will take place at sunset, it has a very dim yet beautiful environment giving the player the feeling of curiosity to explore it and the thrill to face its enemies.

### 5.2.2 Environment Creation

'Kamen' takes place in 3 different environments, each in a different level. In this part, we will be explaining the process of the conception of both environments from 3D modelling, to texturing. For modelling we have used Autodesk Maya 2018. As for the texturing, we used Substance Painter 2018, Photoshop CC 2015 and Unity 2018.2.8.

- **First Level environment**

- Tutorial Room 3D Modelling :

In the tutorial room, we opted for something closed where the player can adapt to the controls and moving in the game. We made the design similar to a Shoji style room [Figure 23] to come up with the result shown in the screenshots below [Figure 45].

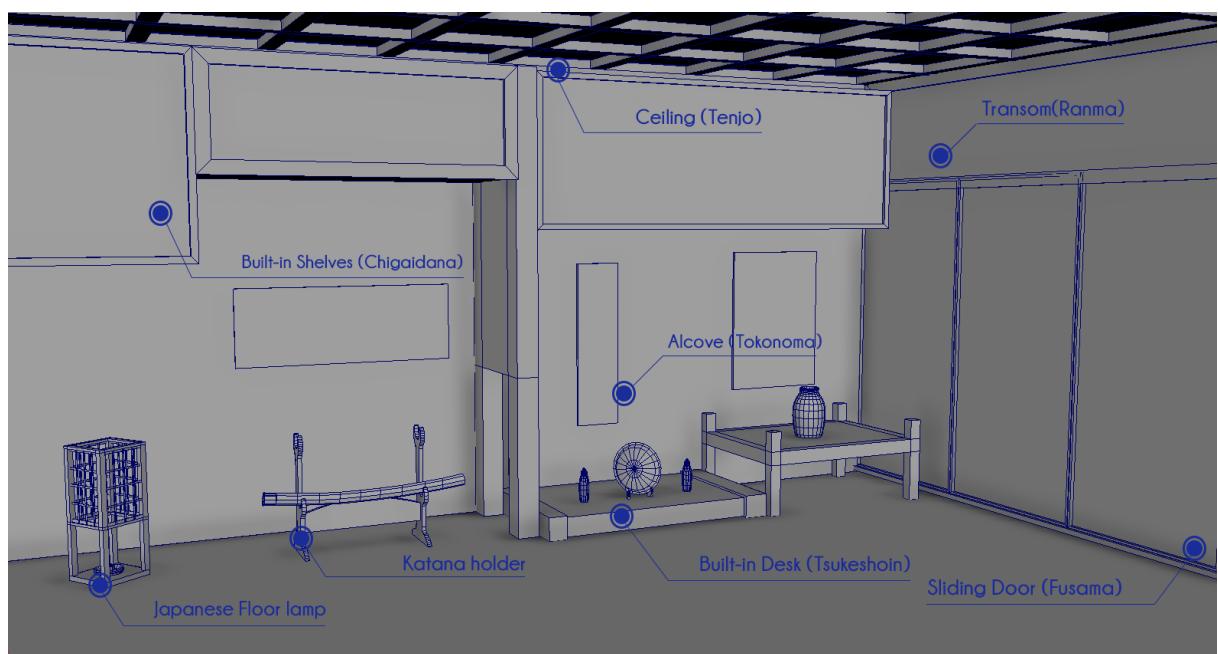
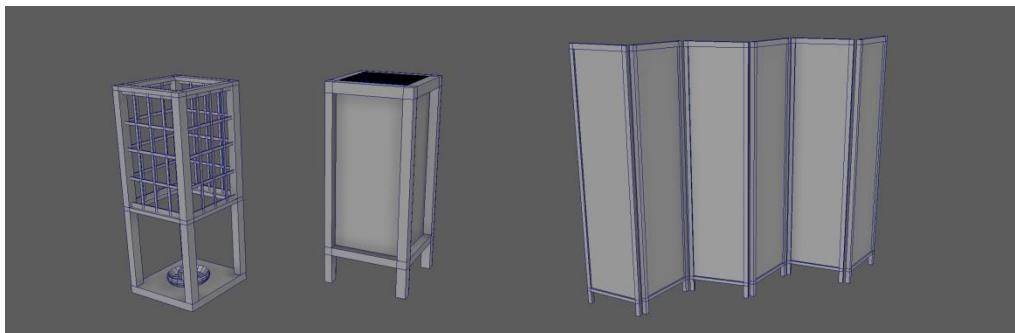


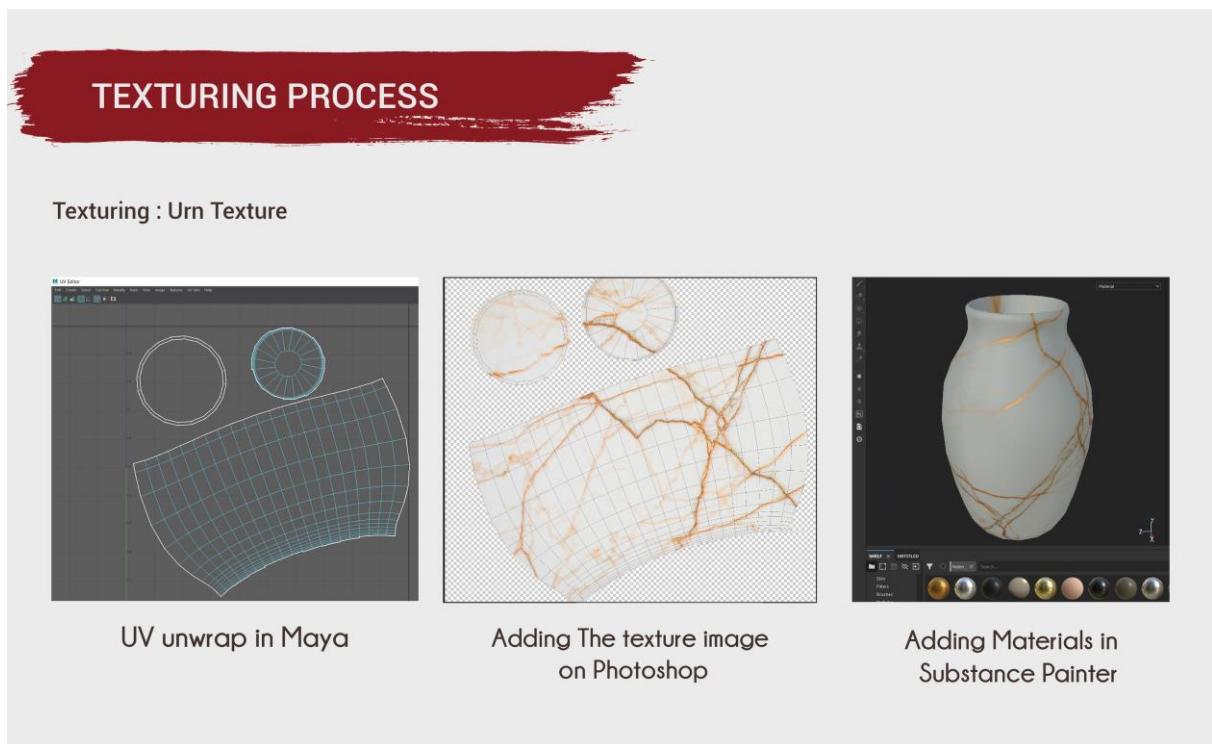
Figure 45: First Room elements following the Shoin style



*Figure 46: Elements in the Tutorial room*

- Tutorial Room 3D Texturing :

After modelling, we unwrapped our objects in Maya, exported the UV layouts to Photoshop for specific objects, and then painted them in Substance Painter using smart materials to finally export the maps for Unity.



*Figure 47: Texturing process of the elements in the tutorial room*

### Textures in Unity before adding light:



Figure 48: Tutorial Room Textured

### Textures in Unity with light:

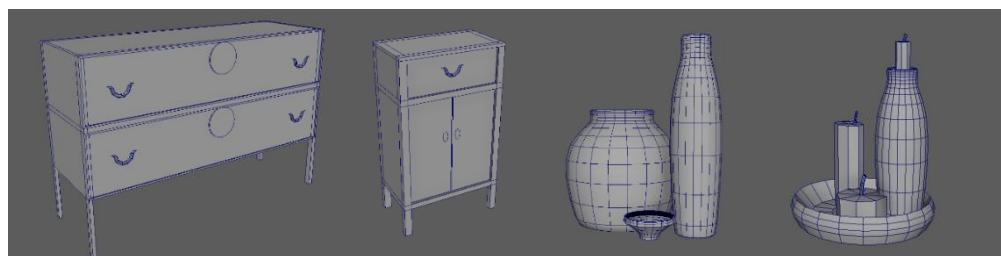


Figure 49: Tutorial room Textured with light

- **Second Level environment**

- Mask Room 3D Modelling :

The second room follows the Shoji style as well, we used objects from the first environment and added other elements inspired from the Japanese interior architecture.



*Figure 50: Modelled elements of Scene 2*

- Mask Room 3D Texturing :

We changed the textures of objects that we used in the first environment to avoid the visual redundancy.



*Figure 51: Scene 2 Modelling*

### Textures in Unity before adding light:



Figure 52 : Scene 2 Textured

## Textures in Unity with light:

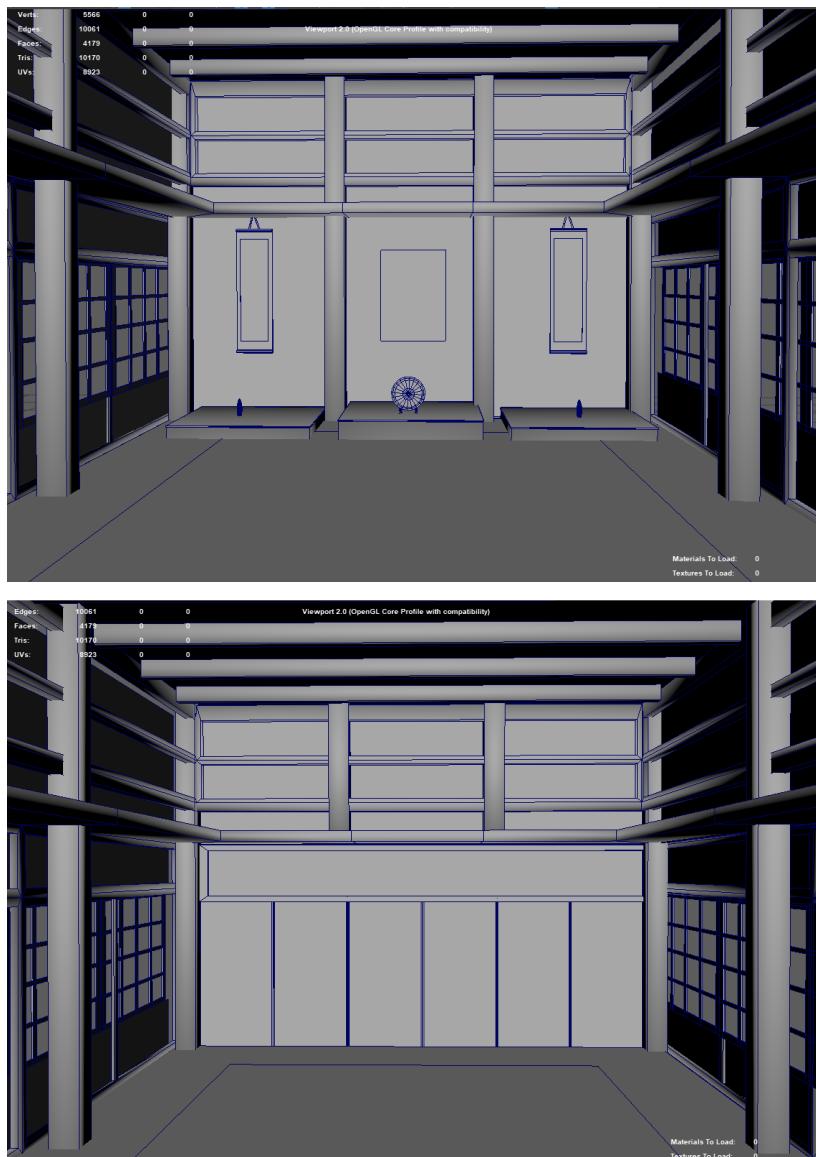


Figure 53 : Scene 2 Textured with light

- **Third Level environment**

- Boss fighting Room 3D Modelling :

The third room is a Dojo<sup>10</sup> where the boss fight takes place, we modelled the pillars and bases of it then used objects from the second environment that blends with the atmosphere.



*Figure 54: modelling scene 3*

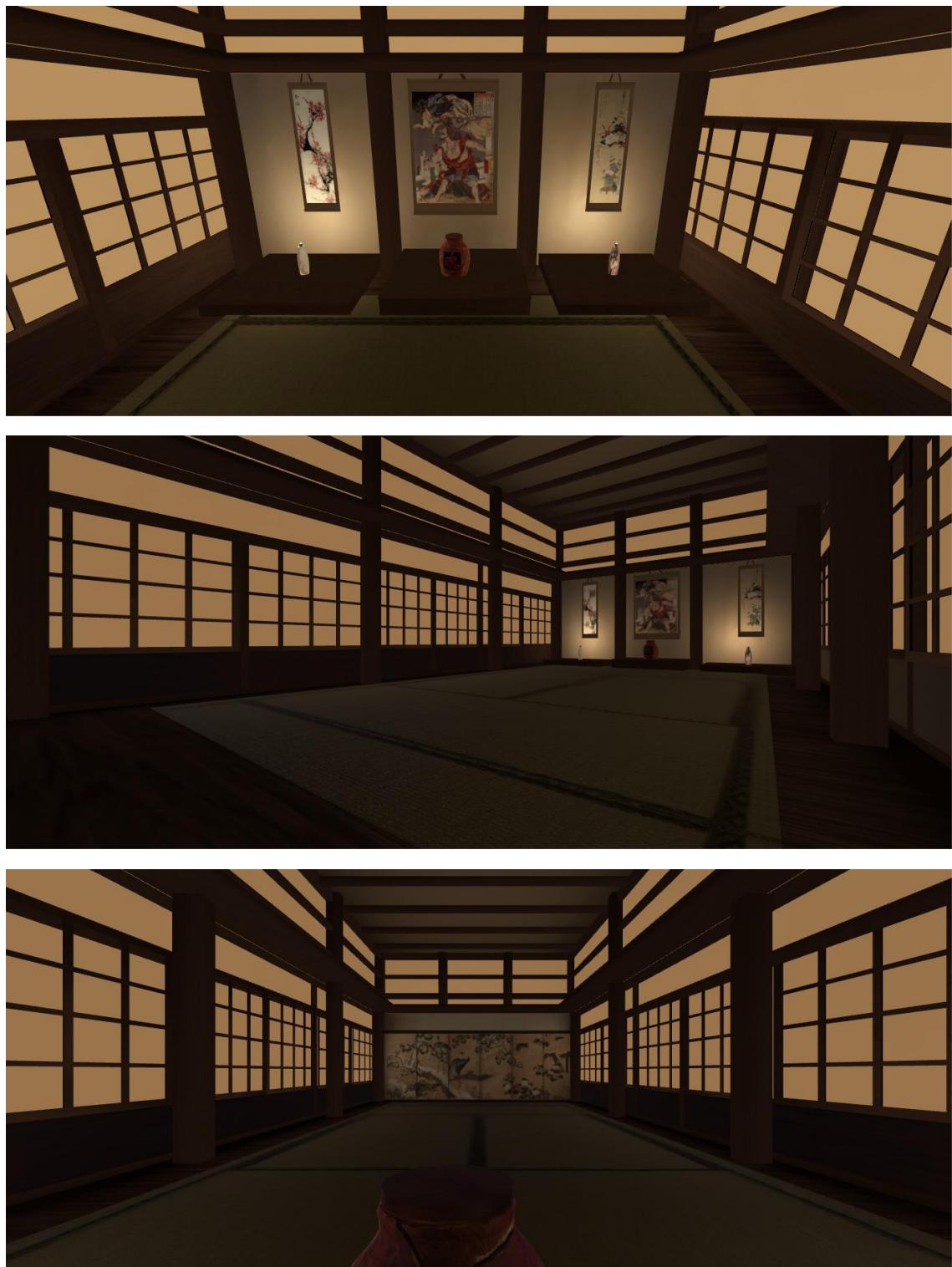
- Mask Room 3D Texturing :

We used a basic wood for the pillars and floor, a transparent material for the windows and we changed the textures of objects that we used from the second environment to avoid the visual redundancy.

---

<sup>10</sup> Dojo : a Dojo is a hall or space used by Japanese people for learning material arts and meditation.

**Final results of the Dojo room with light and textures in Unity:**



*Figure 55: Scene 3 Textured with light*

## **6 Levels**

'Kamen' features in total 3 levels.

### **6.1 First Level: Introduction**

#### **6.1.1 Synopsis**

The story begins when Yōtō a cursed sword, finds finally a hand to be in, a body to possess and Kabuki evil spirits to kill.

#### **6.1.2 Objective**

The most important objectives of this level are at first to help players smoothly immerse in the VR game and its atmosphere, discover the game environment and get used to it. Then, learn how to use the Katana against enemies.

#### **6.1.3 Encounters**

For this level, players encounter a wave of Kabuki Spirits attacking and must be defeated in order to access to the next room. Since it's an introductory level, we chose to make kabuki spirits harmless: in case players miss their hit, the spirits will only disappear and appear again until defeated.

#### **6.1.4 Closing Material**

This level is cleared when the waves of kabuki spirits have been successfully eliminated and the player choose the leave for next room.

### **6.2 Second Level: Transition**

#### **6.2.1 Synopsis**

After getting Yōtō, the cursed Katana, reaching the Masks Room is the next Step in the adventure.

#### **6.2.2 Objective**

In this level players faces different masks of Yokais and the main objective of this level is to choose which Yokai to fight as well as a break time between battles, but it's also a chance to learn about them and what makes each one of them unique.

## **6.3 Third Level: Main Battle**

### **6.3.1 Synopsis**

After getting Yōtō, the cursed Katana, final fight against the first Yokai is near. Speed and good timing are key words to clear this level.

### **6.3.2 Objectives**

The ultimate objective of this level is to eliminate the Yokai without being killed: by defending from Yokai's attack, avoid them by dodging and try to reach the sooner possible the Yokai and end his life with the cursed katana.

When the Yokai attacks, there are two choices for players: counter attack with the katana and get the chance to get closer to him, or dodge to avoid getting damage.

### **6.3.3 Encounters**

The ultimate encounter will be with a Yokai. Every Yokai have special power and making the combat dangerous and unpredictable.

### **6.3.4 Closing Material**

This level is over once the Yokai is dead, his spirits eliminated and all his powers are gone forever.

## 7 Interface

The user interface is a very important component of the game, it represents the space where interactions between the player and the game occur.

### 7.1 Visual System:

#### 7.1.1 HUD

The HUD <sup>11</sup>within 'Kamen' is designed to be fairly minimalist. It shows the player's health bar, the locked characters, dialogues and indications.



Figure 56: Lock used for locked characters in Scene 2

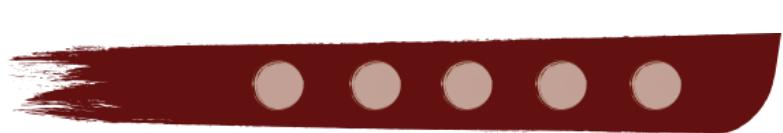


Figure 57: Health bar in Kamen

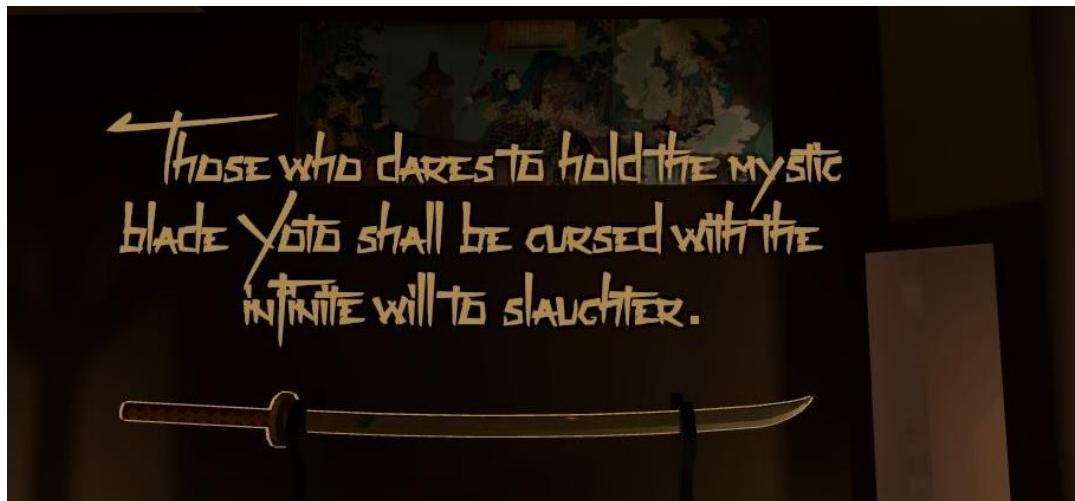


Figure 58 Text that appears before the player picks the Katana

---

<sup>11</sup> HUD : Head Up Display

## 7.2 Menus:

We created an interface that lasts few seconds welcoming the player with the logo [Figure 59] then the menu appears allowing the player to start the game:

- Main menu :



Figure 59: First interface in menu



Figure 60: Menu masks

- Pause menu:



Figure 61: Pause Menu

### **7.2.1 Rendering System:**

Unity offers multiple rendering techniques including appropriate ones for rendering VR applications. We used a technique called "Single Pass Stereo Rendering" for 'Kamen'. This rendering technique is exclusively used for PC and PlayStation 4-VR applications.

During normal VR (Multi-Pass) rendering, Unity renders the scene twice for both left and right eye, however when using Single Pass Stereo Rendering, both eyes share the work required.

### **7.2.2 Lighting models:**

Lighting plays a big role in the game development process; it adds depth to our environments, highly improves game's graphics and helps creating the perfect ambience we want for our game.

- **Light maps:**

In order to enhance our game's graphics without sacrificing precious frame rate, using baked light maps is a must for VR games as well as emissive materials instead of generating real-time lights, so we used essentially light-yellow point lights set to "baked".

However, light maps doesn't enlighten dynamic objects in the scene, to solve this issue we precisely placed light probe group and reflection probes to ensure realistic lighting wherever players are in our game.



*Figure 62: Point Lights, Light probes group and Reflection probes.*

### 7.2.3 Visual Effects:

To add the visual effects in the game, we used particles system and post processing:

- **Particles System:**

We added few particles systems to create simple visual effects and give a warmer and livelier look to our scenes and adds to its atmosphere.



Figure 63: Particle system for candles

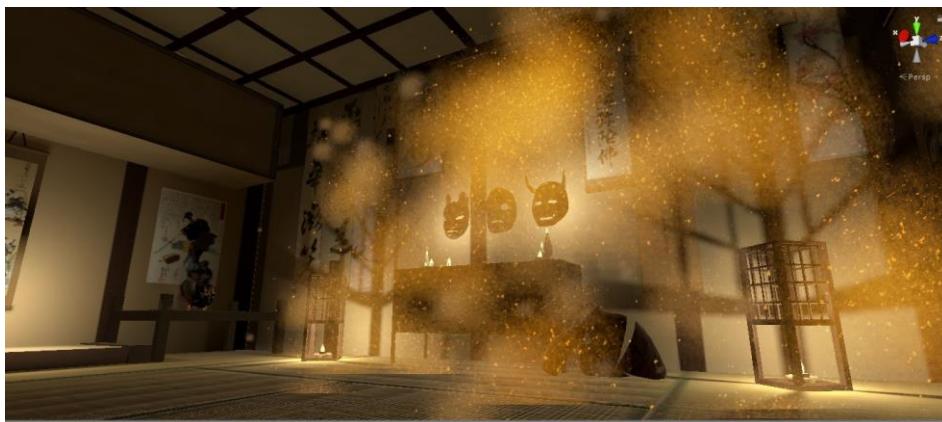


Figure 64: Particle System of the Easter eggs urn



Figure 65: Particle System of Kitsune hands

- **Post Processing:**

To increase even more our game's graphics, we opted for Post Processing Stack to add suitable effects to our environments and improve strongly the mood we want to create.



*Figure 66: Scene without post processing*



*Figure 67: Scene with post processing*

To achieve this effect, we used "Colour grading" and "Ambient Occlusion" features and we enabled for the Anti-aliasing mode the Fast-Approximate Anti-aliasing.

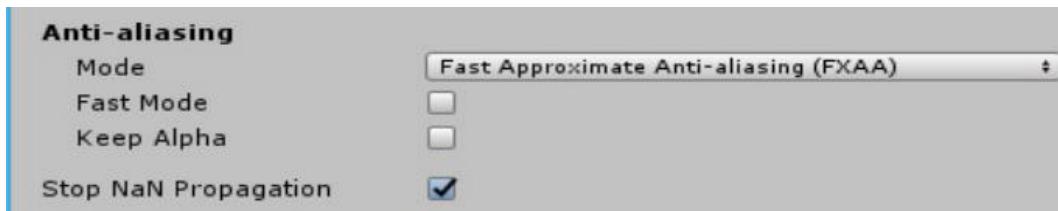


Figure 68: Anti-aliasing settings

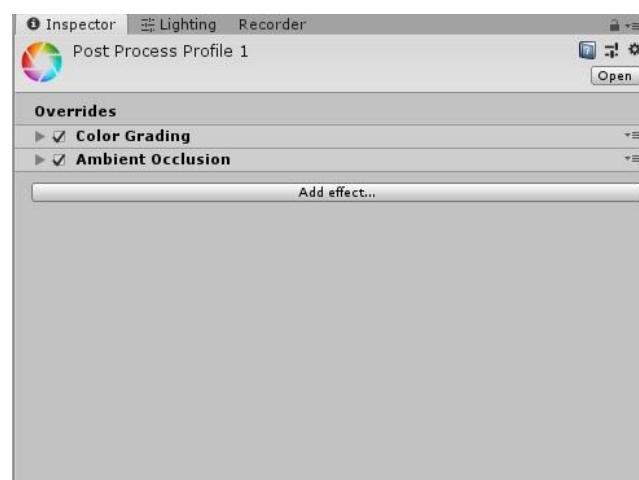


Figure 69: The Post Processing Profile

#### 7.2.4 Game Logo and name explanation:

'Kamen' means Mask in Japanese, as the emblematic symbol of Yokais are their iconic masks, which represents them the most and makes them so unique.



Figure 70: Kamen's Logo

The logo of Kamen represents a basic mask cut in a dynamic way that reflects the game play, we used the colour red and a white base to symbolise the kumadori; Japanese make up worn by the Kabukis.

## 7.3 Sound System:

We decided to create our own music to deliver a unique and original insight of our game. The vivid presence of sound is very important to the experience of narrative through virtual reality immersion.

### 7.3.1 Music

- Scene 1 and 2:

Using Fruity Loops, we composed basic melodies with bass inspired from the traditional Japanese music.

We added a dynamic rhythm to the first track used in the tutorial room to put the player in the atmosphere of fighting the enemies.

The second track sounds slow, calm, and mysterious, thus we used it for the second scene, where the player is supposed to explore the dim environment and choose the next level.

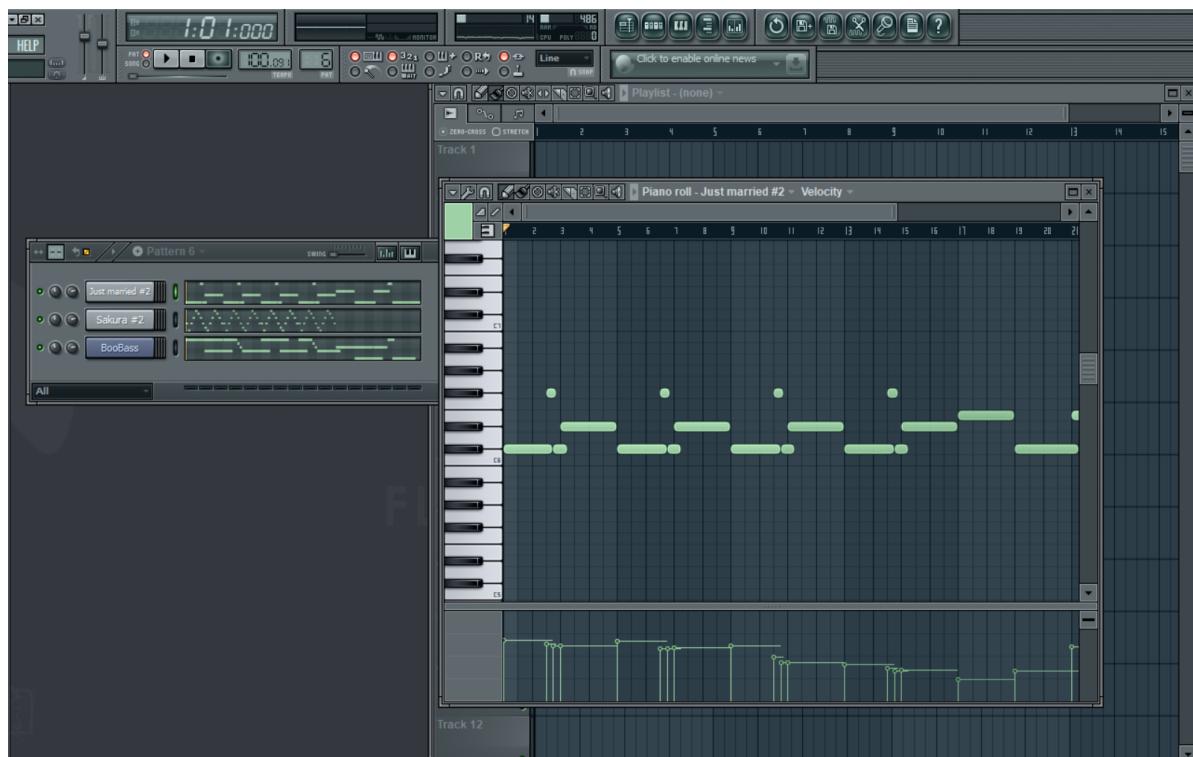


Figure 71: melody composition in Fruity loops

We also used generators to modify the instruments and make them sound Japanese [Figure 72].



Figure 72: Sound generator in Fruity Loops

- **Game Event:**

We composed a short melody that indicates that an event happened such as opening the door and breaking the Easter urn.

- **Boss fight :**

As for the boss fight, we chose to compose a soundtrack filled with energy and dynamism, based on mixing few popular Japanese sound effects in Adobe audition and applying various modifications on them to create an original multitrack that puts the player in the climate of a battle [Figure 73].

The sound effects and loops were downloaded from YouTube.com:

- Japanese flute sound
- Kabuki YOOOO Sound Effect
- TAIKO 2 - High Impact Japanese Drum Library by Nine Volt Audio
- Shamisen Japanese Traditional Musical Instruments ( Sound Effect )

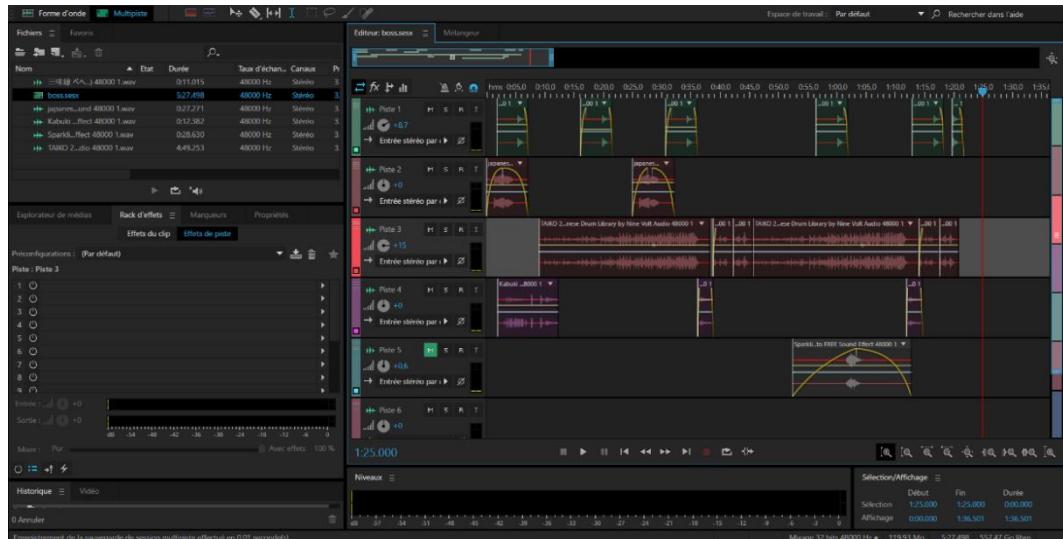


Figure 73: Multitrack in Adobe Audition

We then exported the multitrack to Fruity loops to create a melody in the background that adds tension to the gameplay [Figure 74].

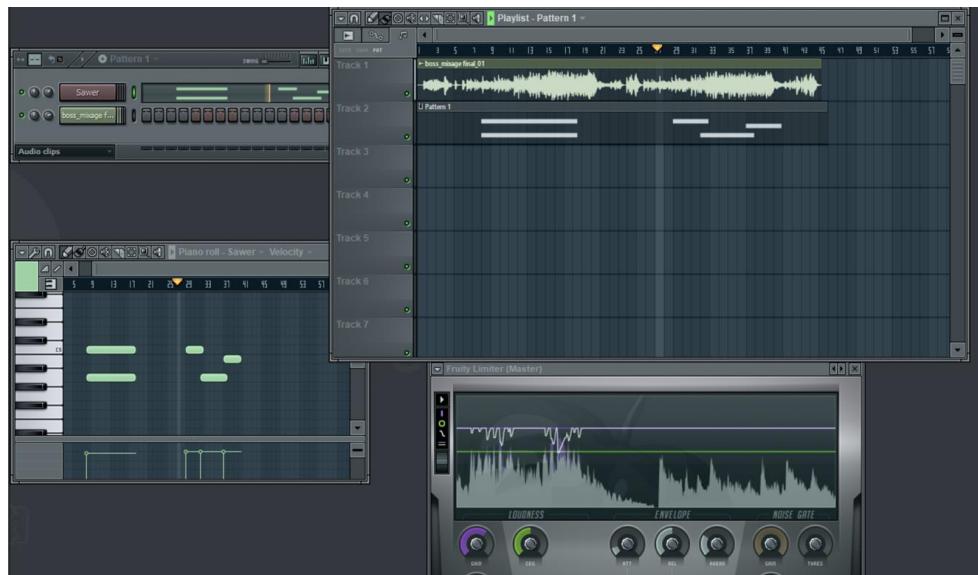


Figure 74: Mixing a multitrack from Adobe Audition in Fruity Loops

### 7.3.2 Sound Effects

The sound effects were downloaded from "freesound.org", a website that offers a large variety of soundtracks for free. We used the following ones:

- Chopping wood
- Katana sword
- Violently closing wooden door
- Poof sound
- break a vase-glass-Rode Microphone
- torch fire loop cut

## 8 Technical and Management

### 8.1 Technical

#### 8.1.1 Recommended Hardware

- CPU: Intel Core i7
- GPU: NVIDIA GEFORCE GTX 1060
- RAM: 16GB

This game mainly was developed on 2 machines with the following characteristics:

First machine	Second machine
<ul style="list-style-type: none"><li>○ I5 6400 2.7 GHz</li><li>○ 16 GB RAM</li><li>○ Windows 10</li><li>○ NVIDIA GEFORCE GTX 1060 6 GB</li></ul>	<ul style="list-style-type: none"><li>○ Intel® Core i7 2.8 GHz</li><li>○ 12 GB RAM</li><li>○ Windows 10</li><li>○ NVIDIA GEFORCE GTX 1050</li></ul>

Table 5: development hardware

We used as soft-wares:

- Adobe Photoshop: editing textures and pictures.
- Adobe Illustrator: logo, textures and UI.
- Autodesk Maya 2018: 3D modeling, 3D texturing.
- Unity 2018.3.7: game engine.
- Visual Studio 2017: C# scripting.
- Microsoft Visio 2016: game conception.
- Mixamo: character rigging and animating.
- Autodesk 3DS Max: animation.
- FL Studio: music composition.
- Adobe Audition: sound editing.
- Substance Painter: texturing and painting.
- Adobe Premiere: video editing.
- Adobe After Effect: video editing.

## 8.2 Management

### 8.2.1 Test Plan

Test	Success
Can the player move?	Yes
Can the player pick weapon?	Yes
Can the player attack?	Yes
Can enemy attack?	Yes
Can player interact with User Interface?	Yes
Can the player move to the next scene?	Yes
Can the player interact with objects?	Yes

Table 6: Kamen Test Plan

### 8.2.2 Detailed Schedule

First month milestones:

February 1 2019 - February 5 2019: the game core: establishing the story, game's scenario and the game overview.

February 6 2019 - February 11 2019: during this period, we worked on the analysis of existing games for inspiration and the conception of Kamen.

February 12 2019 - February 14 2019: we started writing the Game Design Document.

February 15 2019 – March 3 2019: we worked on the first level's modeling and texturing environment, as well as the mechanics involved in this level like example picking the weapon and the enemies attack mechanic.

Second month milestones:

March 4 2019 – March 10 2019: we have finished the first level design and starting the second level: integrating the first scene on Unity and adding appropriate lights particle systems.

March 11 2019 – March 24 2019: integrating the second scene, with finished 4 masks: adding the lights, reflection, particle systems and worked on the post process.

March 25 2019 – March 31 2019: we have finalized the 2 scenes.

Third month milestones:

April 1 2019 – April 14 2019: working on the third scene from coding to designing.

April 15 2019 – April 31 2019: Creating the character, the animation and particle system.

Fourth month milestones:

May 1st 2019 – May 20th 2019: Finalizing the game: establishing the UI and game logo.

May 21st 2019 – May 24th 2019: Final touch ups Trello To move the project forward, we used all the capabilities of an online task manager, Trello [See figure 71]. We had to visit this board every

- Trello :

We organized our project into boards using an online task manager; 'Trello', this tool was a key element in our communication and tasks pursuing.

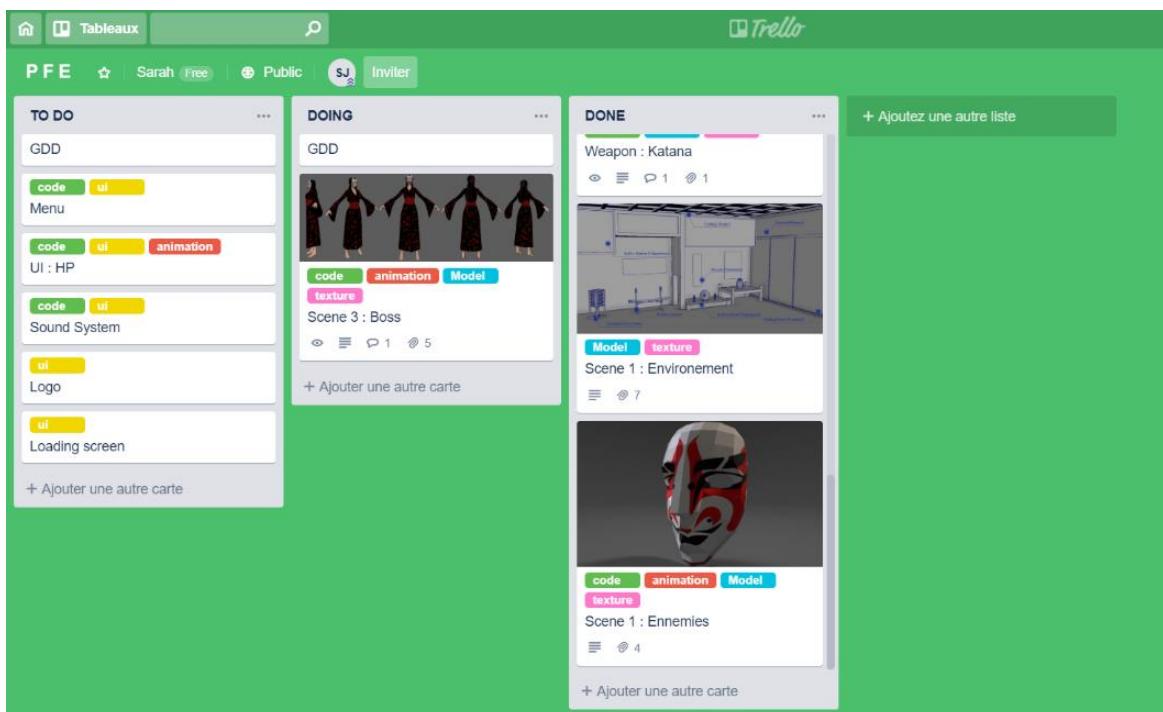


Figure 75: Trello Board with tasks

## Conclusion and Perspective

Working on 'Kamen' was by far the most productive, intense and challenging experience we went through. Despite all the hardships, we learned, experienced, adapted and enjoyed the process.

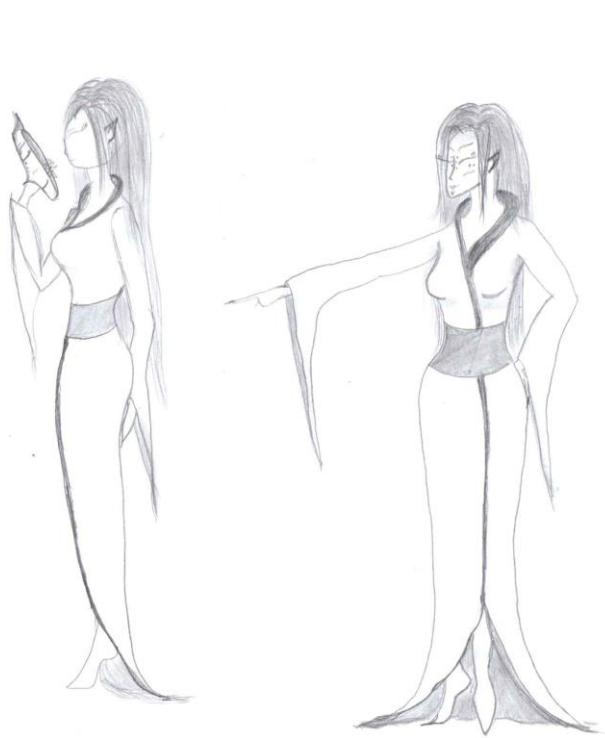
We learned a lot from time management to teamwork and allowed us to understand a little more the video game environment creation and the developing process. Thanks to this project, we acquired a lot of new skills and reinforced what we learned before, we realized how much time, patience, and love for this field is required to produce games.

We also are very thankful to Galactech Studio for giving us the opportunity to develop a video game in virtual reality, working with such a new thrilling technology was a whole new risky but yet exciting experience for us and in fact, made us want to dive even more into this field and create more original virtual experiences.

We intend to keep working on 'Kamen' and make a longer more diversified version of it as well as adding new features and the remaining enemies we already discover in our game that couldn't be added due to the time limit of the project.

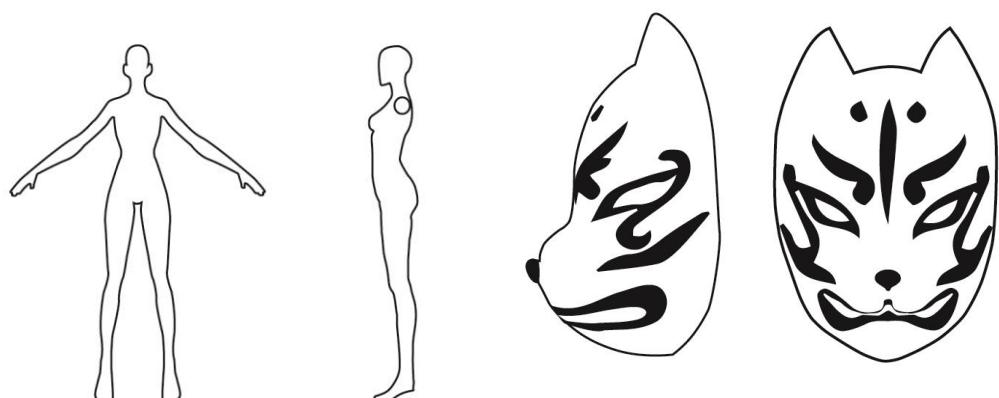
## Appendices

- Artworks



*Figure 76: early concept of Kitsune*

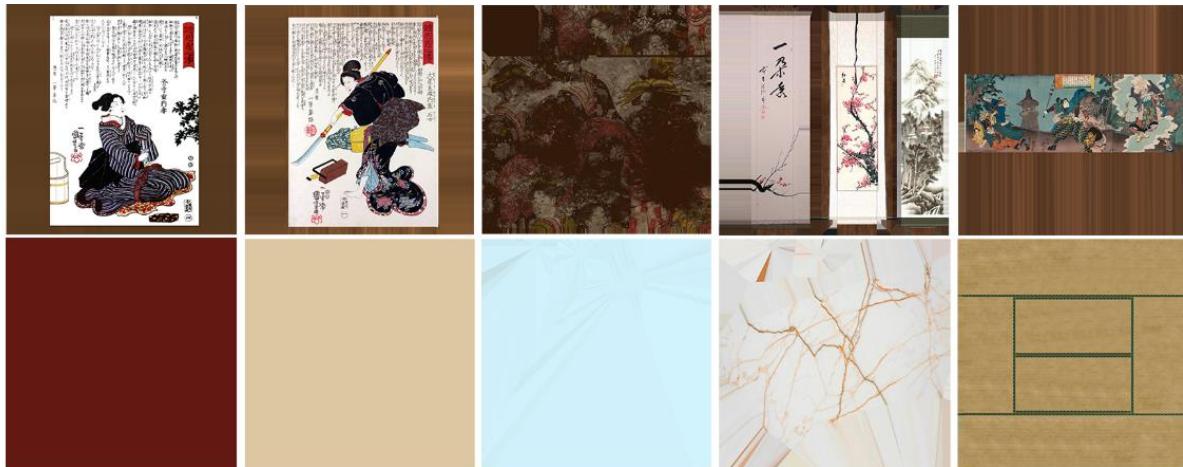
- Illustrations



*Figure 77: Illustration of Kitsune*

- Textures:

The following are few textures we used in 'Kamen':



*Figure 78 : environment textures*



*Figure 79: Character Texture*



*Figure 80: UI Masks texture*

- Logo

The image below shows the evolution of Kamen's logo [See Figure].



*Figure 81: Logo evolution*

- Example of a script

This script is made for enabling and disabling UI when players are near them:

```

5  public class ActivateUI : MonoBehaviour
6  {
7      private int NumberOfChildren;
8
9      void Start()
10     {
11         NumberOfChildren = this.transform.childCount;
12     }
13
14     void OnTriggerEnter(Collider other)
15     {
16         if (other.transform.tag == "HeadCollider")
17         {
18             for (int i = 0; i < NumberOfChildren ; i++)
19             {
20                 transform.GetChild(i).gameObject.SetActive(true);
21             }
22         }
23     }
24
25     void OnTriggerExit(Collider other)
26     {
27         if (other.transform.tag == "HeadCollider")
28         {
29             for (int i = 0; i < NumberOfChildren ; i++)
30             {
31                 transform.GetChild(i).gameObject.SetActive(false);
32             }
33         }
34     }
35 }
36

```

*Figure 82: example of a script in Kamen*

## References

### Ludography:

- The Legend of Zelda :  
Twilight Princess <https://www.zelda.com/twilight-princess-hd/>

Available

- Vanishing realms:

[https://store.steampowered.com/Vanishing\\_Realms/](https://store.steampowered.com/Vanishing_Realms/)

Available

### Bibliography:

- Graphical Style  
in Video Games : [https://www.theseus.fi/bitstream/handle/10024/133067/K eo\\_Mary.pdf?sequence=1&isAllowed=y](https://www.theseus.fi/bitstream/handle/10024/133067/K eo_Mary.pdf?sequence=1&isAllowed=y)

Available  
pdf format

### Websites

<https://www.youtube.com/>

<https://www.wikipedia.org/>

<https://trello.com/>

<https://unity3d.com/fr/>

<https://share.allegorithmic.com/>

<https://freesound.org/>

<https://www.polygon.com/>

<https://gameatelierstories.wordpress.com/>

<https://www.japan-guide.com/>

<https://www.japanesestyle.com/>

<https://kyotokimono-rental.com/>