

# Serious Game for Patients with Severe Burns Treatment

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First of all, I would like to thank my Final Degree Work supervisor, Ignacio Miralles Tena, for sharing with me his proposal of doing a game that not only shows the knowledge I have gained during this degree, but also goes beyond and is able to help people who are having a tough time. And, of course, for helping me throughout this project.

To Jon and Diana for giving me ideas to improve my game.

To my mother and friends for always supporting me.

I also would like to thank Sergio Barrachina Mir and José Vte. Martí Avilés for their inspiring LaTeX template for writing the Final Degree Work report, which I have used as a starting point in writing this report.



# ABSTRACT

This document presents the project report of the Video Games Design and Development Degree Final project by Jaime Sánchez Alba.

There are many people who suffer from severe burns that need to be cured, which causes a lot of pain. This can be lessened by distracting the person by doing another activity. This is the main objective of this work, to create a virtual reality environment capable of evading the person from the pain caused by these cures. In this 3D environment the player advances along a pre-established path in an automatic way, constantly moving forward. This is because people in this situation are not in a position to have much control over the game, so the interactions they may have are simplified to facilitate the gaming experience.

In addition, this game is created so that it can be played on an Android mobile with a VR headset and a game pad that connects to the mobile. This game pad allows the player to have more control over the game, since having the mobile placed inside the VR headset does not allow the player to touch the screen. Although, as I said before, you don't have to have much control over the game either, so the functions that can be performed with the game pad are quite reduced.





# CONTENTS

<b>Contents</b>	<b>v</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Work Motivation . . . . .	1
1.2 Objectives . . . . .	2
1.3 Environment and Initial State . . . . .	2
<b>2 Planning and resources evaluation</b>	<b>5</b>
2.1 Planning . . . . .	5
2.2 Resource Evaluation . . . . .	8
<b>3 System Analysis and Design</b>	<b>9</b>
3.1 Requirement Analysis . . . . .	9
3.2 System Design . . . . .	13
3.3 System Architecture . . . . .	15
3.4 Interface Design . . . . .	16
<b>4 Work Development and Results</b>	<b>17</b>
4.1 Work Development . . . . .	17
4.2 Results . . . . .	23
<b>5 Conclusions and Future Work</b>	<b>27</b>
5.1 Conclusions . . . . .	27
5.2 Future work . . . . .	28
<b>Bibliography</b>	<b>29</b>
<b>A Other considerations</b>	<b>31</b>
A.1 Bibliography . . . . .	31
A.2 Appendices . . . . .	31
<b>B Source code</b>	<b>33</b>



# INTRODUCTION

## Contents

---

1.1	Work Motivation . . . . .	<b>1</b>
1.2	Objectives . . . . .	<b>2</b>
1.3	Environment and Initial State . . . . .	<b>2</b>

---

This chapter describes the main objectives of the work done along with the motivation that was necessary to achieve the main purpose and what led me to develop the game.

## 1.1 Work Motivation

The main objective of this project, besides demonstrating what I have learned in my career, is to try to solve a problem that some people suffer from or at least reduce it. This problem is about the pain suffered by people who are being treated for a severe burn. [6]

Previous studies have shown that it is possible to mitigate part of this pain by keeping the patient focused on other activities, such as a video game. However, the mobility of their arms or hands, as well as the characteristics of the treatments, often do not allow them to use conventional video games to generate this distraction.

This project is not the first solution to this problem that has been implemented. There are serious video games that want to help these patients to reduce their pain, but they need powerful computers that are able to run these games without performance problems, as they present environments with a high level of detail. This entails a great economic cost for the places that want to make use of these tools, which makes it very difficult for these games to reach the patients to make use of them. In addition, these

high-performance PCs require a large number of cables to connect the computer to the VR headset. This obviously makes the doctors' work much more complicated because they have to be careful with these cables as they move around the room. It is also uncomfortable for patients because they can become entangled in these cables if they move around too much.

The idea behind this work is to create a 3D virtual environment capable of immersing patients in the same way as current solutions do, but with much more affordable devices. The game itself consists of a guided walk through the environment in which the player must interact with the different objects that appear, this way the patients get distracted and their pain gets reduced.

The 3D models found in this game are all low poly, so they do not require a device with a high performance capacity. Therefore, it can be played on almost any cell phone with Android operating system with a VR headset using Google Cardboard [5] and a small gamepad. This gamepad is used to give some interaction to the user since she can not touch the phone's screen. Although these interactions are very limited because the target of this game are not people used to playing video games, but any kind of person. Therefore, the controls are simple enough so that it can be played by all kinds of people, but without being boring.

Therefore, this video game has the purpose of developing an environment that is easy to install and configure, without a high degree of complexity, which allows the integration of the distraction tool in a hospital context, offering the opportunity to distract the patient without being an impediment to perform the cures correctly.

## 1.2 Objectives

The main objectives that this project had can be found in the following list:

- Create a virtual environment that immerses the player.
- Develop game dynamics that are both entertaining and simple.
- Design the virtual environment so that it can be used on low-cost mobile devices to facilitate accessibility.
- Make in-game movement conform to people lying on hospital gurneys.

## 1.3 Environment and Initial State

The idea that was originally proposed was one that did not have much elaboration, but in the first meeting with the project supervisor he raised an idea that seemed much better. Later that day it was decided that the original idea was not clear enough and it was better to work around the supervisor's idea. It was also kept in mind that this project could be used to help other people and would not remain as a simple end-of-degree project, but could be further developed in the future to be refined and adapted to different situations to help even more people.

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The project has been made individually, although to ensure that the game could reach its goal, the help of the LABPSITEC was necessary, a team of psychologists, specifically Diana's, who has reviewed the work done a couple of times and has given the necessary feedback to adapt it to the needs of the patients.

The technical support offered by INIT, specifically Jon's and Nacho's, the supervisor, has also been of great help in solving more technical problems and improving some parts of the game.

Although all the development part of the work has been done by me.



## PLANNING AND RESOURCES EVALUATION

### Contents

---

2.1	Planning . . . . .	5
2.2	Resource Evaluation . . . . .	8

---

This chapter contains the planning that has been followed to accomplish the final game and the resources that were used to do so.

### 2.1 Planning

In this section it is explained the different tasks that were followed to develop the project. For this, the next lines explain these tasks one by one and then a Gantt Chart (see Figure 2.1) is attached to be able to see the workflow in a more visual way.

- **Write technical proposal (5 hours)**
- **Collect information (20 hours):** since this game has a very specific target, it was necessary to do some research on how to adapt the game to their needs. Therefore, there was a process of collecting information about the most important points that the game should have.
- **Design of environment (20 hours):** design a proper environment in which the player could feel comfortable and immersed as much as possible.
- **Write analysis and design document (5 hours)**
- **Create environment (30 hours):** transforming a design idea into an actual environment.

- **Adjust game with the VR headset (40 hours):** once the game had its basics done, it was necessary to adapt them to make it work with a VR headset attached to an Android phone.
- **Create 3D models (20 hours):** apart from the assets downloaded from the Unity Store some more models were made.
- **Define agents' behavior (20 hours):** design how the different agents would act in the game (movement, spawning, interactions...).
- **Implement agents' behavior (40 hours):** put into work the idea of how the agents would act.
- **Create options screen (10 hours):** make an options screen that gave the player the capacity of changing the type of interaction with the different objects, change the difficulty, choose which stage to play and turn on and off the sound.
- **Create results screen (10 hours):** make a results screen to show the player the final score he or she got.
- **Add different game themes (10 hours):** some sources indicate that a stage that transmits cold works better with the patients that will play the game. In order to prove that the game features two types of main stage: summer and winter.
- **Adjust the game to the psychologist notes (30 hours):** since this game needed to be tested by a psychologist in order to adapt it as well as possible to the needs of the target, some changes were necessary.
- **Write the report (30 hours)**
- **Prepare the final presentation (10 hours)**



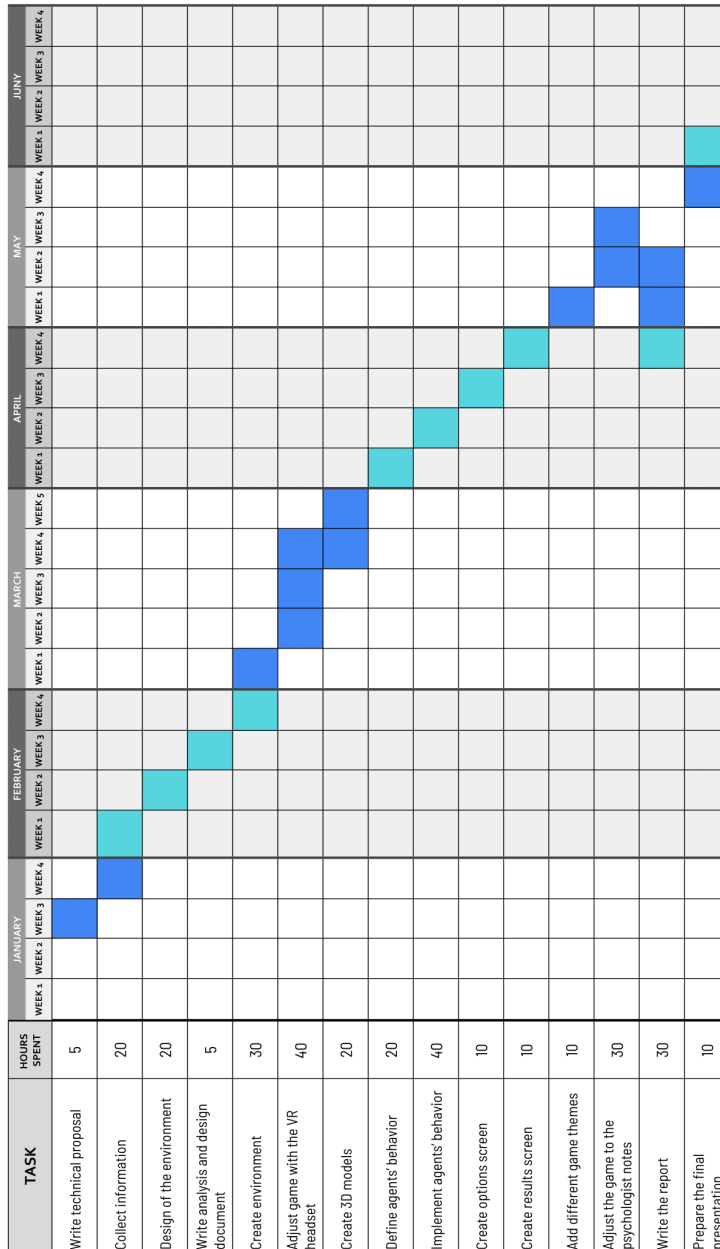


Figure 2.1: Gantt Chart that has been followed

## 2.2 Resource Evaluation

The resources used for this project were:

- Acer Aspire A515-56, i7, 8GB RAM, 500GB Hard disk.
- Samsung Galaxy A70.
- VR headset for smartphone.
- Android gamepad.
- Unity 2021.3.21: used to develop the project.[12]
- Unity Asset Store: used to obtain useful resources.[11]
- Visual Studio 2019: used to create the code.[9]
- Blender 3.5.1.0: used to model and animate some objects.[10]
- GitHub and GitHub Desktop: used to keep the project updated on the Internet.[8]
- Krita: used to create some 2D images.[4]
- Flaticon: used to obtain some 2D images.[1]
- Freesound: used to get sound clips.[2]
- Audacity: used to modify some sound clips.[7]

## SYSTEM ANALYSIS AND DESIGN

### Contents

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3.1	Requirement Analysis . . . . .	<b>9</b>
3.2	System Design . . . . .	<b>13</b>
3.3	System Architecture . . . . .	<b>15</b>
3.4	Interface Design . . . . .	<b>16</b>

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This chapter shows the requirements analysis, design and architecture of the work, as well as, its interface design.

### 3.1 Requirement Analysis

First of all, it is necessary to clarify the main objectives of this project. The first one was to create a virtual environment that immersed the player. This would be one of the most important objectives, since it seeks the purpose of moving away from reality as much as possible to the person who is playing it because this reality involves a situation in which the player is feeling a strong pain.

The second objective was to develop game dynamics that were both entertaining and simple. Once again, the target's situation must be taken into account. These people are in a state in which they can not practically move, at most they can make small movements with their hands like pressing a button and little else. Therefore, the controls of this game are not complicated at all, on the contrary, they are quite simple so that players are not overwhelmed with the things he can do.

The third one was to design the virtual environment so that it could be used on low-cost mobile devices to facilitate accessibility. As previously mentioned, there is already

a solution to this problem that uses virtual reality, but it involves great economic costs and it is not easy to use in the space where the player is. This work offers a solution that only needs a cell phone with Android as its OS, a VR headset to place the phone inside and a Bluetooth controller with some buttons. This makes the wiring reduced to 0 in addition to being something much more affordable.

The last objective was to make in-game movement conform to people lying on hospital gurneys. When playing in virtual reality while lying on a gurney, it is difficult for the camera to be focused forward, and if there are many fast movements, the person playing can become dizzy. To avoid this, the game has a camera centering system that resets the camera position to look forward when the player presses a button. And to control motion sickness, the speed at which the player moves is very low and constant.

And now the more technical part of the analysis is shown in the following part.

When the player opens the game, the first thing he encounters is an initial screen (see figure 3.1) with one button: play. This one takes the player to the options screen (see figure 3.2), that allows him to make some changes. These are: Turn the sound on and off, change the difficulty, choose between playing in a winter or summer setting, and interact with objects using a button or the time. Once the player has selected his preferences, he must press the button on the right with an arrow to start the game. In both of these locations the player can look to the left wall to see the instructions of the game (see figure 3.3).



Figure 3.1: Title Screen



Figure 3.2: Options Screen

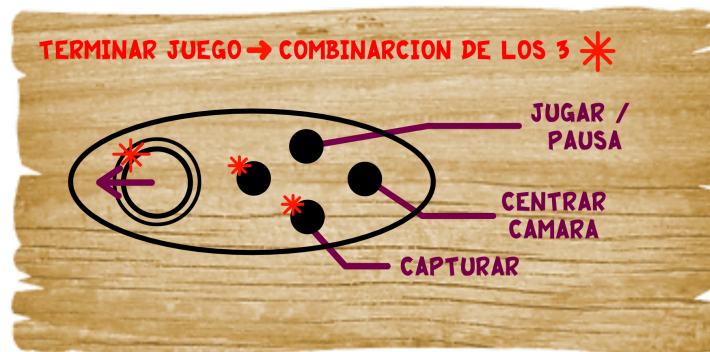


Figure 3.3: Game Instructions

Then, if the player presses play the game will start. Now, the player will move forwards and the only thing he or she has to do is look for the objects he or she can interact with. If the player chose to interact with them using a button he must center the object inside the circle that appears in the center of the screen and press the down button of the gamepad. On the other hand, if the player chose the option to interact using time he should do the same, but this time he will not need to press any button, the circle will be filled (see figure 3.4) in approximately 3 seconds having the same effect as when he presses the button. Using this second option makes the circle bigger, making it easier to interact with the object.



Figure 3.4: Time interaction enabled

These interactive objects are animals and pumpkins. There are 6 different types of animals: pigs, dogs, cats, ducks, cows and sheep. Each one gives the player a certain amount of points. Pigs are worth 200 points, dogs 400, cats 500, cows 100, and ducks and sheep 300. These points have been assigned according to how difficult it is to capture each animal, either by size or speed. Pumpkins are separate from the animals. These are like a special object that the player must find along the map. There are a total of 7 hidden pumpkins.

Since the players are patients who receive cures of different time durations, the game is a sort of infinite run. It does not end until the player decides. For this, he must press a combination of buttons on the gamepad: left button + down button + move the joystick to the left. Once the player has ended the game, a results screen will appear showing the total of animals and pumpkins he was able to obtain. There will be a button that takes the player to the initial screen.

Taking into account, once again, the situation of the players, the ability of centering the camera is very important because there are some of them that will be moved during the cure and there must be an option that lets them see the game correctly in any position.

### 3.1.1 Functional Requirements

The functional requirements are the following:

- R1.** The player can start the game.
- R2.** The player can change the interaction type.
- R3.** The player can change the difficulty.
- R4.** The player can change the stage season (summer or winter).
- R5.** The player can turn sound on and off.
- R6.** The player can center the camera.
- R7.** The player can obtain points using time.
- R8.** The player can obtain points using the down button.
- R9.** The player can end the game.

**R10.** The animals can move avoiding obstacles.

**R11.** The system can generate new animals.

### 3.1.2 Non-functional Requirements

The non-functional requirements are the following:

**R12.** The 3D models are low poly to ensure that the game runs perfectly on an Android phone.

**R13.** The game will be playable on an Android phone with a VR headset.

**R14.** The environment must immerse the player as much as possible.

**R15.** The controls must be very simple to make the game accessible to people who are not used to play video games.

**R15.** The buttons have been adapted to press the just by looking at them.

## 3.2 System Design

Input:	Press play button
Output:	Scene changes from title screen to main game
When the player presses the play button, she is taken to the scene where the game takes place.	

Table 3.1: Functional requirement «CRED1. Start the game»

Input:	Press time or button checkbox
Output:	Changes interaction type on main game
When the player starts the game she will be using her preferred interaction type (time or button).	

Table 3.2: Functional requirement «CRED2. Change interaction type»

Input:	Press easy, normal or hard checkbox
Output:	Changes difficulty on main game
When the player starts the game the animals will move slowed or faster depending on the difficulty she chose.	

Table 3.3: Functional requirement «CRED3. Change difficulty»

---

Input:	Press winter or summer checkbox
Output:	Changes the season on main game
The environment will be snowing and with snow on the floor or with green grass and a lot more sun	

---

Table 3.4: Functional requirement «CRED4. Change season»

---

Input:	Press Sound On or Sound off checkbox
Output:	Mutes the game / Adds sound to the game
The player can choose whether to play the game with sound of activated or on mute if deactivated.	

---

Table 3.5: Functional requirement «CRED5. Sound On/Off»

---

Input:	Press right button on gamepad
Output:	The camera will focus straight ahead
It does not matter where the player is looking, the camera will be reset to look forwards.	

---

Table 3.6: Functional requirement «CRED6. Center the camera»

---

Input:	Center object in the circle
Output:	Total points go up
The player must center an interactive object inside the circle for approximately 3 seconds.	

---

Table 3.7: Functional requirement «CRED7. Obtain points using time»

---

Input:	Center object in the circle and press down on gamepad
Output:	Total points go up
The player must center an interactive object inside the circle and press the down button on the gamepad to obtain points.	

---

Table 3.8: Functional requirement «CRED8. Obtain points using button»



Input:	Press left button + down button + move the joystick to the left.
Output:	Change scene to results screen
The player must perform this combination of buttons to end the game when she pleases and see the results.	

Table 3.9: Functional requirement «CRED9. End game»

### 3.3 System Architecture

The minimum requirements to play this game in an Android phone are:

- Android 7.0 'Nougat' (API level 24).
- VR headset for a mobile phone.
- Android gamepad with Unity compatibility.

This diagram (see figure 3.5) shows the workflow of the project, with the main actions the game has. It uses a Model-View-Controller structure to make it much easier to manage and make changes to either side without them interfering with each other.

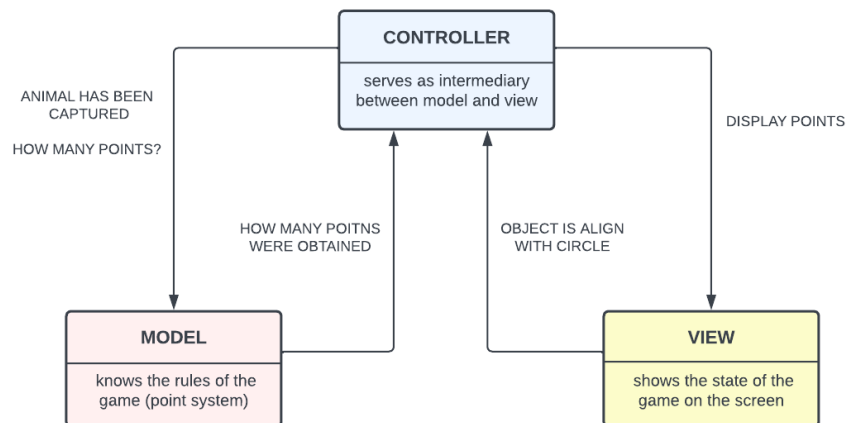


Figure 3.5: MVC diagram

### 3.4 Interface Design

The GUI has been design to be as simple and intuitive as possible, since the game is designed for people who may not have played almost any video game in their lives.

On the center of the screen will always be a circle that acts as a pointer. It is actually a slider that will fill as the player maintains it centered in a button or an interactive item and will perform an action once it it fully filled. If the player has chosen to interact with object by pressing a button this circle will be smaller to differentiate between the two possible types of interaction and the slider will not be filled as time passes (see figures 3.6 and 3.7). Although this only happens in the main game scene, the button will continue to be filled as time passes.

The points will be displayed fixed at the right of the screen to make sure the player can look at them at any time.



Figure 3.6: Button interaction enabled



Figure 3.7: Time interaction enabled

# WORK DEVELOPMENT AND RESULTS

## Contents

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4.1	Work Development . . . . .	<b>17</b>
4.2	Results . . . . .	<b>23</b>

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This chapter shows how the game has been developed during these months. It also includes ideas that were discarded, the difficulties found and the final result that is the final game.

## 4.1 Work Development

In this section it will be explained the development of the work following the different tasks that were set as goals to achieve.

The first one was designing the environment. In order to do this, it was necessary to meet certain requirements that had been discussed by the supervisor. These were that the environment should have a calm atmosphere to make the patients as comfortable as possible. To achieve this, the environment was expected to have trees, animals, rural houses and other elements reminiscent of a village in a forest. From here, the process of thinking about how could this environment be created started. Then some quick sketches (see figure 4.1) were made to devise how this village was going to look like. With the idea in mind, the next step was to look for assets in the Unity Assets Store that could be useful for what it was meant to be done, therefore, they had to be assets that were within the theme mentioned above and also were low poly to be sure that the performance would not be affected at any time.



Figure 4.1: Example of one the sketches

Then, the environment creation began on the basis of the idea. For this, Blender was used to create the base of the terrain, the mountains and a lake that appears in a part of the map. I hadn't used Blender for a long time, so at the beginning I had a hard time remembering some of its functions and I had to spend a lot of time on it. Materials and textures were added to the different parts of it and it was crucial to do something with the floor texture because the pattern of repeated images was very evident, so using the idea from a YouTube video[3] helped doing this. Thus, a texture was created in which the images had certain random values that made this obvious repetition dissipate (see figure 4.2). However, it was not possible to export it to Unity, so at the end the tiling was made in the Unity Editor and it turned out well.

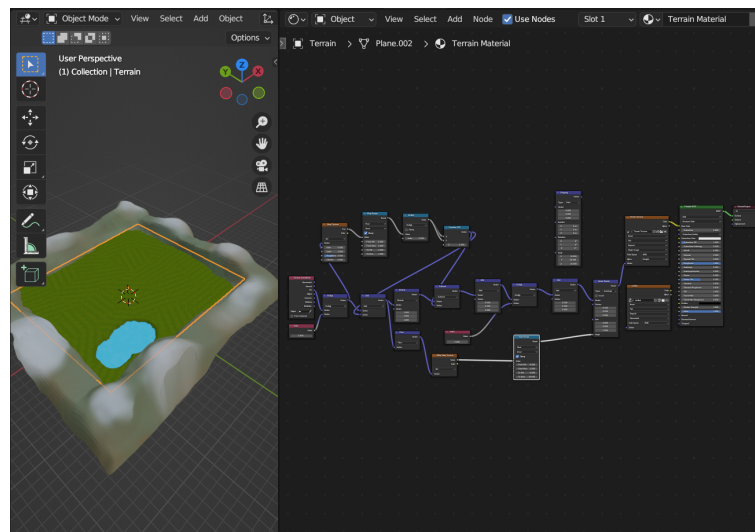


Figure 4.2: Example of one the sketches

Once the main idea of this project was clear, a necessary research about the target audience and the technology that needed to be used was done. This technology was a VR headset for cell phones along with the Google Cardboard library[5] that would make it possible for the game to be in virtual reality to make the player as immersed in the game as possible.

Since the game was going to be developed in Unity, what came next was to add the Google Cardboard plugin in the editor so the game could be built and work well with the VR headset. At first it seemed simple, but every time a build was trying to be made, an error that seemed to had no solution appeared. This persisted for quite some time, so a game mode that allowed to play the game using the mouse to move the camera was implemented, so other aspects could be developed until the bug was fixed. Once everything was in order it could be tested with the cell phone.

That being done, the need for pressing a button without touching the phone screen came. In order to do this a capsule collider that would move with the camera and could collider with the buttons was added. Once it collides, a ray will be cast to see if the button is being centered in the circle that the player can move by moving his head. Then, while the circle is pointing at a button that same circle will be filled over time (see figure 4.3) until it is fully filled and then the action of pressing the button will be performed.



Figure 4.3: Circle filling on button

As said before, Some assets from the Unity Assets Store[11] helped to create the environment, but despite that, there were some things that were missing and they were created by myself using Blender[10]. These were: a pumpkin, a flower, a barn, a pile of straw, a tulip, a duck (see figure 4.4) and the rocks that make up the path where the player advances. Each one of these has its own material and texture, except for the tulip, the duck and the rocks. These ones have more than one texture so they could have more variety.

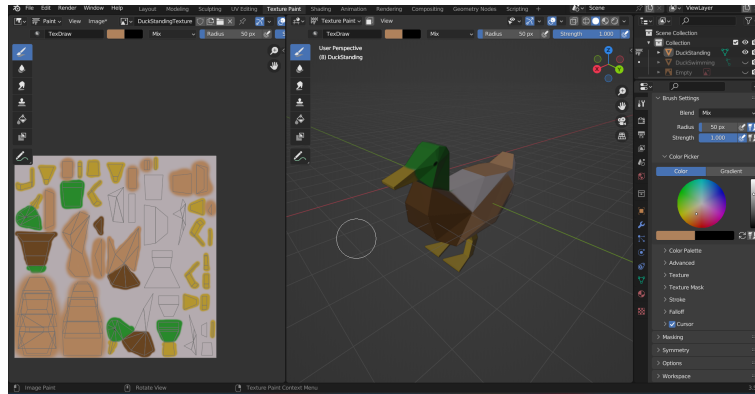


Figure 4.4: Duck created on Blender

The next step was to define the behavior of the game agents. Initially, the only agents that were going to appear were animals. These would have to move around the map in a random way, but within certain parameters that would make them not to move too far away from the route taken by the character. Then the best thing would be to make a kind of sphere in which they could move by choosing random points within it. Also, in order not to make the game too difficult, the animals would stop from time to time to make it easier for the player to capture them.

Then, the idea of having a small village with only animals seemed to be a little strange. So a good idea would be to have some people wander around the map just to make it like the player was not alone and to have a little bit more of variety over the different agents. These ones do not have any type of interaction with the player, their only duty is to move around in a certain path.

Once the idea was settled, those behaviours started to be implemented. Starting with the simplest agent, the people, they would follow a path that is being created via points that were located in the map, creating a path that makes them walk along it repeatedly.

Then, the animals are the most complex agent. They walk inside a sphere of a certain radius to make them stay in a certain region of the map. Inside it they choose a random point and move to it from time to time and once they arrive, they stop for a little while. Since it was a requirement that this game was a kind of infinite run some points were added and were located in the map in a way that there will be one point in each region of it. Then, when an animal is captured a random animal spawns in the furthest point to that captured animal. This way the map will be equally filled with animals in each part of the map and the player will never see an animal appearing in front of her.

They can be capture when the player centers one of the animals inside the circle that appears in the center of the screen and either presses a button on the gamepad or waits until the circle has been fully filled. This slider had an first version (see figure 4.5) that hindered the view, so it was changed in order to improve the player's vision to a new one (see figure 4.6).

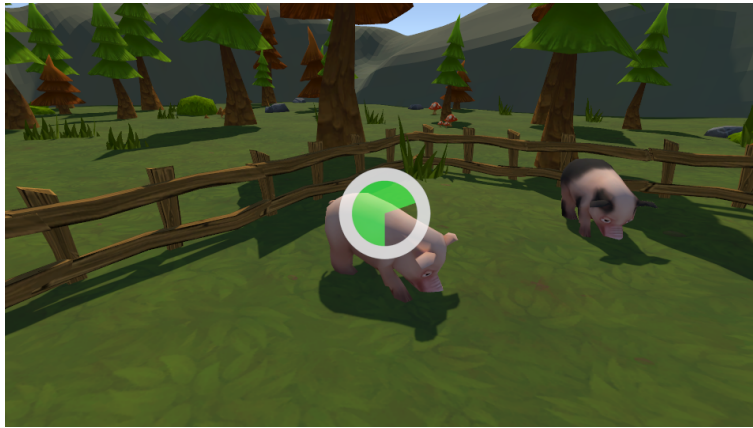


Figure 4.5: First Slider Version



Figure 4.6: Updated Slider

For the player to be able to interact with the animals it was reused the same method that was used with the buttons. Each animal has a box that collides with the player's capsule that moves with the camera. Once they have been captured heart particles will come out of their heads (see figure 4.7) to let the player know that the animal has been captured. Then, the animal destination changes and it goes directly to the player.



Figure 4.7: Heart Particles

When all of this was implemented, the game was left too simple, so the idea of creating a new object that the player should look for while looking at the animals came to mind. Then, a pumpkin that could be obtained the same way as the animals was created, but this one does not move. There are a total of 7 pumpkins hidden all over the map. Once the player has "captured" the pumpkin, it disappears leaving a cloud of dust.

After all of this, the options and results screen development started. The second one was the easiest, since it only displays the total number of each animal the player has captured along with the pumpkins he has obtained. It has a button that takes the player to the title screen.

The options screen, on the other hand, was mainly designed by Diana, the psychologist. This was because, after a meeting me and my supervisor had with her, she asked me to make some changes to the game that would help customize the game experience to each player profile. In order to do that, she told me that the best way was to implement two different stages: one that takes place in the summer and other in the winters. This was because some studies have shown that patients with severe burns take their treatment more easily when they are immersed in a cold-like environment. So, to prove that, the option of changing the season in which the game takes place was implemented. Another change was to make an option to enable and disable the sound. She told me that it was also convenient to make the player choose the difficulty she wants to play. Initially the difficulty was going to be regulated by changing the size of the circle used by the player to capture animals, but then a better way to change the difficulty came to mind and it would be to modify the behavior of the animals. On easy difficulty so they barely move, making them much easier to capture. On normal difficulty they move at a standard speed. And on the hard difficulty they rarely stand still as well as moving faster. Last we have the option of changing the type of interaction with objects. The player can choose between centering an animal inside the circle and pressing a button to capture it or centering it until the slider is fully filled.



## 4.2 Results

In the next pictures it is shows the different parts of the game that has been accomplished: title screen (see figure 4.8), options screen (see figure 4.9), summer themed game (see figure 4.10), winter themed game (see figure 4.11) and results screen (see figure 4.12).



Figure 4.8: Title Screen



Figure 4.9: Options Screen



Figure 4.10: Summer Themed Game



Figure 4.11: Winter Themed Game

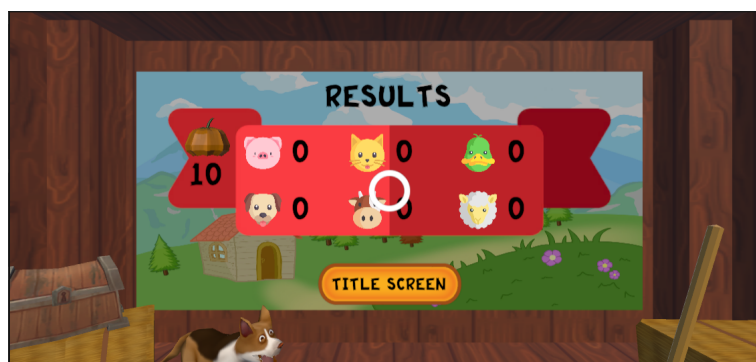


Figure 4.12: Results Screen

Taking into account the objectives that were set at the beginning of the project, it can be said that all of them have been achieved.

The first one was to create a virtual environment that immersed the player. This has been achieved by creating the virtual environment with all those objects that appear in the game and making it work in virtual reality using the cell phone and the VR headset.

The second one was to develop game dynamics that were both entertaining and simple. This has been achieved by implementing game mechanics that were limited to the necessary requirements to adapt the game to its target, but also taking into account aspects that would make the game more entertaining such as making each object give a different amount of points to the player.

The third one was to design a virtual environment so that it could be used on low-cost mobile devices to facilitate accessibility. This has been achieved by created the whole project for Android cell phones, in addition to use 3D models that are low-poly, making it possible to run in almost every Android cell phone.

The last one was to make in-game movement conform to people lying on hospital gurneys. This has been achieved by creating the option to center the camera at the touch of a button, so that if the player has to change his position he can center the camera at any time to always be able to see forward.

Although every main objective has been accomplished, here are still some changes that could improve the game, but for that it is necessary to have more time to do more meetings with specialists like Diana.



## CONCLUSIONS AND FUTURE WORK

### Contents

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5.1	Conclusions . . . . .	<b>27</b>
5.2	Future work . . . . .	<b>28</b>

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This chapter presents the conclusions of the work, as well as its future extensions.

### 5.1 Conclusions

During all the time I have been doing my degree I have always thought of the final degree project as something far away and that I would worry about it until it came, so at no time did it cross my mind to ask myself what would I do for this work. When the time came I proposed an idea that could have ended up in a good game, but it was not something that was important to me. So when my tutor proposed his idea to me, it seemed to me that it was what I had to go for. Thanks to this, my work will not only remain as just a game, it will be able to help people who are going through painful moments. I have also been able to put into practice many of the things I have learned during my studies, such as 3D modeling, 2D drawing and programming the game itself. And I have not only stayed there, I decided to bet on doing something more than what I had been taught and I dared to do it in virtual reality. This meant having to learn in a short time how it worked and how to adapt the ideas that I had been taught to this type of game, since I had never done anything that had anything to do with virtual reality. So I feel proud of myself to have done something that has been a challenge for me and can also be taken to people who need to escape from reality.

This work has achieved something that not all final degree works can achieve. First of all, it is a game that has a target that is not the usual when it comes to creating video games, these being people who are in a medical center while they are undergoing painful cures. Secondly, it is a work that has immersive virtual reality, which means that it helps players to evade reality to a certain extent. It has also been developed so that it can be played on almost any cell phone with Android as its OS, which gives it a very important accessibility feature as well as being a very affordable resource, since all it is needed is a cell phone with Android as its OS, as mentioned above, a VR headset where to place the device and a controller that connects via Bluetooth.

## 5.2 Future work

It would be ideal if this project continued to evolve in the future, since, as said on several occasions, it is a way for people who know how to work with video games and virtual reality to do something for others. the best case scenario would be that the game could be more polished so that more people can play it. This could be done by creating new game modes, new themes, etc. Also, while the game was being developed the psychologist Diana gave a lot of useful feedback, but with much more time she could give even more indications so that it could be improved a lot more. Then this project could be much bigger and reach more hospitals and health centers so that people can use it.

That being said, this game needs to be tested with real patients in order to get even more accurate feedback on what could be improved or integrated it. Therefore, in the future it would be ideal to do this in order to define more specific requirements that the project should meet.

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## OTHER CONSIDERATIONS

This appendix is included to comment some aspects not considered in the rest of the template and as an example of the format of an appendix.

### A.1 Bibliography

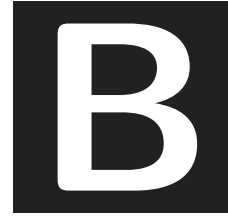
All the references to the external documentation used for writing the report (and, therefore, for the realization of the work) should appear in the bibliography. All the bibliography entries should be conveniently referenced on the text.

### A.2 Appendices

Technical information of the work must be presented in the Appendices. Technical information refers to: the source code (see Appendix B), the screenshots, the photos of the implemented system, the manuals developed, etc. As a general rule, each of the above kind of materials will result in a separate appendix.



A P P E N D I X



## SOURCE CODE

Because of the large amount of scripts contained in the project I leave here the link to the GitHub repository where you can find the complete work.

<https://github.com/jaime134/TFG-JaimeSanchezAlba>

