INTRODUCTION

To build the project I used different tools like WebGL and Three.js. WebGL is a Javascript API library based on WebGL. Three.js is used because allows to work with: scene; camera; lights use to add also shadows; different materials; different objects like bones; geometry primitives and gItl loader used to load the model and textures.

The game is composed by cubes, planes and 3D models. All the 3D models are downloaded from Sketchfab that allows to directly upload them in the project. To cube and plane also the textures are added in order to better represents the environment.

In Figure 1, there is the representation of the total map of the environment.

***Figure 1**: Total environment*

MODELS

All the models used to compose the environment are taken from sketchfab. In particular, all the models like trees, flowers etc… are not animated and I don't add the animation.

The 3D models that I animated are only two:

- **Leonard**: is the main character;
- **Warrior**: is the enemy.

LEONARD

Figure 2: *Leonard*

It is a hierarchical model and using the bones of the model, I have implemented the animations. In particular, this is the main character, and it performs five different actions:

1. Idle;
2. Walk forward;
3. Walk backward;
4. Turn right;
5. Turn left.

The animations are implemented using JavaScript.

WARRIORS

The enemies are the warriors. The enemies have a hierarchical model. The animations are implemented using JavaScript and they perform only the run actions.

Figure 3*: Warrior*

POSSIBLE SETTINGS

When the game starts, there are some settings that can be changed by the player, like:

- Difficulty;
- Light;
- Volume;
- Camera position.

In Figure 4, we can see the starting page of the game, in which the black part is the one that the user can modify, instead the yellow one is those selected by the user.

***Figure 4**: Starting page*

DIFFICULTY

For what concern the difficulty, I have implemented three levels:

1. Easy;
2. Medium;
3. Hard.

There are different settings regarding the difficulty that we choose. The settings are specified in Table [1].

Level	Enemies	Diamonds	Teleportation
Easy	6 slow velocities	6	Every 7.5 seconds
Medium	6 medium velocities	4	Every 7.5 seconds
Hard	6 fast velocities	2	Every 5.0 seconds For each iteration of the render cycle, it has 1 possibility over 1000 to teleportation.

Table 1: Different settings depending on the level.

LIGHT

For what concern the light we can changed the time of the day, and this affects:

- the position of the light;
- the intensity of the light;
- the color of the light.

For example, if the player chooses the morning time, the sun is placed on the left side with a yellow light as in Figure 5; if the player chooses the midday time, the sun is central and the light is white with a very high intensity like in Figure 1; if the player chooses the night, the light comes from the right-side and the light color is blue with a very low intensity as illustrated in Figure 5.

***Figure 6**: Morning time*

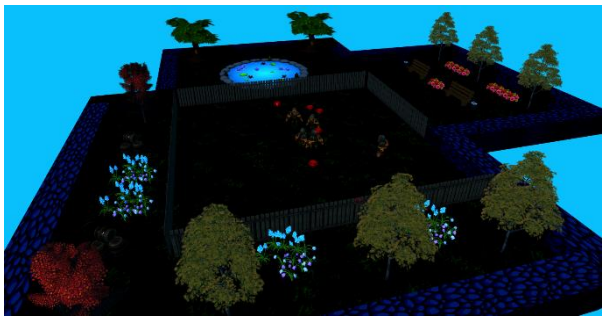

***Figure 5**: Night time*

VOLUME

For what concern the volume, the player can vary it. So, he can use a high volume or small ones. In particular for the music are used different sounds for the starting game, the collection of the diamonds, the life lost and the game over.

CAMERA POSITION

For what concern the camera position there are two types of settings:

- *First person*: the camera is close to the character, and it follows the movements. It is always placed behind him as illustrated in Figure 7;
- *Third person*: the camera can be moved by the mouse. So, the player can get closer or far away to the character. The camera does not change depending to the character's movements.

***Figure 7**: First person camera*

***Figure 8**: Third person camera*

TEXTURES

The textures are loaded when the game starts.
I assign different coordinates to the texture base on the length and on the width of the cube/rectangle to which it has to be attached in order to end up with a better effect.

The textures are taken on the web and they are loaded to the project. To have a more realist effect I used also the normal maps.

GAME COMMANDS

The **goal** of the game is to collect all the possible diamonds without losing all the life. The life is lost whenever a warrior hits Leonard.

The commands to use are:

- **W A S D**: direction movements;
- **Arrows**: has the same functioning of W A S D;
- **ESC**: pause or exit the pause.