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# Development of a Virtual Bluetooth Escape Room For Android Devices

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Design and Development of Video Games Degree

VJ1241 - Bachelor's Thesis

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# SUMMARY

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This document presents the Final Degree Project in Video Game Design and Development. The work to be developed consists of the creation of a videogame for mobile devices in Escape Room format using Bluetooth beacons. The player will have to solve the puzzles that are distributed in the different rooms of the videogame by interacting in different ways with the screen and the environment, changing the room when approaching the beacon associated with it.

**Keywords:** Android, Mobile Application, Bluetooth Beacon, Escape Room, Unity.

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# 1. PROJECT MOTIVATION

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This section aims to illustrate the main motivations of the project and the related subjects.

## 1.1 Introduction and Project Motivation

In order to create an application that complies with this approach to the Escape Room genre<sup>1</sup>, it is necessary to know in a remarkable way those elements that allow the development of an attractive theme for the players, trying to achieve a total or partial immersion in the videogame, as well as tests and enigmas with enough difficulty to make it a challenge, but without becoming frustrating.

Most of them are based on a system of solving puzzles, generally point and click and guided without leaving space for the user to think, think and try to find and solve the puzzles. It should be added that taking into account the fact that there is no connection with the physical world, but that they can be played in a static way detracts from the value of the experience and of course immersion<sup>2</sup>.

Therefore, this final degree project aims to implement an experience as close as possible to the Escape Room format through the different interactions with the screen, from dragging to turning and pressing, leaving subtle clues for the player to continue completing the puzzles, but always leaving room for logical thinking and creativity. By implementing Bluetooth technology, a greater immersion is achieved by making the player walk from one beacon to another as if they were in a real physical Escape Room and being able to turn any space into a game.

## 1.2 Related Subjects

- VJ1222 Conceptual Design of Video Games: The techniques implemented by this subject allow to design a video game that makes sense, what elements should be, how and why, being determinant when designing the puzzles and the estimated duration of the same, as well as the Escape Room in general.
- VJ1223 Art of the video game: This subject teaches different artistic techniques and programmes, which allow the cohesion and elaboration of the different elements of a video game. It has had great relevance when designing and drawing each of the scenarios, elements belonging both to the user interface and those belonging to the different tests, as well as the choice of the type of art.
- VJ1227 Videogame engines: Subject in which different graphic engines are taught, especially Unity3D and above all exercises for programming different components such as the user interface, artificial intelligence, among others. Totally decisive when it comes to choosing the game engine used, due to the previous experience provided by the subject.

## 2. PLANNING

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This section shows the objective to be achieved in carrying out the project, the estimated time and the expected results once the project has been completed.

### 2.1 Objectives

The objectives to be achieved with the realisation of this project are:

- To use the capabilities of mobile devices to virtualise increasingly popular experiences to a portable format such as the Escape Room.
- Integrate BLE-based positioning into the developed Escape Room application.
- Create an optimised and intuitive programme for any mobile device.
- Explore the feasibility of augmented reality for the creation and design of videogames and games on mobile devices.

### 2.2 Planning Schedule

This section details the estimated time spent on each of the parts that make up this project.

The project is divided into three parts according to the design of the mechanics and levels, the art and the programming of the aforementioned elements, as well as the logic of the application:

Creation of each of the rooms, puzzles and user interface design, as well as the main mechanics of the videogame:

LEVEL DESIGN	Time (hours)
Challenge Design	12
Rooms Design	10
Interface	5
Mechanics	8
TOTAL	35



This refers to the creation and implementation of the assets and animations that make up the visual section of the project.

<b>ART</b>	<b>Time (hours)</b>
Menu Interface	5
Scenarios	46
Items	17
Light & Particles	4
<b>TOTAL</b>	<b>72</b>

Time invested in programming each of the mechanics and logic of the project.

<b>PROGRAMMING</b>	<b>Time (hours)</b>
Inventory	20
Puzzles	60
Menu & HUD logic	15
Narrative System	9
Interaction System	50
Animations	10
Event System	40
<b>TOTAL</b>	<b>204</b>

Total time invested in hours:

TASKS	Time (hours)
Level Design	35
Art	72
Programming	204
Report & presentation	60
TOTAL	371

## 2.3 Expected Results

The expected results of the project are to obtain an application that emulates the Escape Room experience by successfully implementing Bluetooth technology.

To increase knowledge in the application of Bluetooth beacons to mobile videogames.

Improve the immersive experience that a mobile videogame can offer.

Optimal programming to reduce the space of the videogame without reducing or worsening the game experience.

## 3 ANALYSIS

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This section deals with the elements analysed prior to the realisation of the project, the elaboration of the theme and the detailed description of the parts divided into design, art and programming.

### 3.1 Previous Research

#### 3.1.1 About Escape Room genre

Every day the Escape Room genre is growing exponentially as they are interactive physical games that consist of solving puzzles individually or in teams, usually in different rooms trying to solve a mystery in a given time, resulting in a rewarding and immersive experience in equal parts<sup>3</sup>. There are many examples of Escape Rooms, each with different themes, from the purest detective style to themes related to fantasy or science fiction<sup>4 5</sup>. Being the theme one of the most important elements of the Escape Room itself and a showcase to the outside that will attract the majority of users, in this way must be an original theme, if possible innovative and trying to arouse the curiosity of the public inviting them to participate in solving the puzzles and the mystery posed by the Escape Room. The number of puzzles, their difficulty and the number of people who can participate in solving them should also be emphasised, trying to achieve a balance between player satisfaction and frustration, being a challenge without being overwhelming or stressful. All these elements must be brought together according to the proposed theme in order to immerse users in a narrative, in which they must try to strive to complete the puzzles and advance in order to reach the outcome of the game.

#### 3.1.2 Mobile Device Videogames

These are just a few small touches to take into account because the application itself is a video game designed for mobiles and therefore has the characteristics of these.

In the industry of mobile video games<sup>6</sup>, most of them are designed to be of a short exposure by the user, they try to be as attractive and addictive as possible in the shortest amount of time without being long or tedious, in order that the user accesses them at specific times, usually short journeys or short periods of rest<sup>7</sup>. For this reason, many of them follow the arcade format, levels with certain objectives to achieve and of very short duration, each one presenting a greater challenge as one progresses. Games such as "Angry Birds"<sup>8</sup>, "Fruit Ninja"<sup>9</sup>.

There is also the aspect of competitive multiplayer games such as moba, cardgame, shooter and mmo, all designed for quick games of less than 20 minutes, in contrast to their pc and console versions<sup>10</sup>.



Figure 1, Riot Games™, Legends of Runeterra, 2020.

For games that feature a series of puzzles or storytelling type games, they are also adapted to this rapid format, the former being adapted to a level-based arcade format, Candy Crush<sup>11</sup>, and the latter to a format in which the player's progress is continuously saved, SIMULACRA 2<sup>12</sup>.



Figure 2, King™, Candy Crush, 2012

Taking the aforementioned as a reference, especially the last two genres, the videogame has had to be adapted to a short format in which the game lasts no more than 15 minutes with intuitive puzzles that are easy to recognise and relate to each other in order to try to create the most enjoyable, interesting and satisfying experience possible adapted to a mobile format.

## 3.2 Game Design Document

This section aims to analyse the project before going deeper into its implementation. The main idea of the videogame is explained, as well as its main characteristics through the Game Design Document (GDD)<sup>13</sup>.

The GDD is the design document of a videogame. It is used as a guide describing and explaining each of the elements that make up the video game, from its mechanics to its art and narrative.

### 3.2.1 Narrative and Thematic

#### Narrative

Blue Mountains, England, 1860, a quiet village if ever there was one, with the occasional disappearance or murder, albeit in strange circumstances, isolated incidents. We play the role of local detective Catherine Poe or Ms. Poe as she is known, a detective who after many years of experience in London moves to this village for a quiet retirement, or so she thought. But one day a case changes her whole perception of the town and even of reality itself. The owner of the Conway estate, Mr. Marple, has disappeared. We must solve the mystery surrounding his sudden disappearance by thoroughly investigating the estate, discovering clues, solving puzzles from the simplest to the most macabre and irrational. Police, enigmas, rituals and cosmic horrors surround this disappearance. Will they manage to solve the mystery?

Once the investigation has begun, the player advances through the different rooms of the hacienda in which each of the puzzles is unique and has a somewhat peculiar narrative to which the game contributes with dialogue boxes that help to understand and give meaning to each element on the screen. Once all the puzzles have been completed, the final scene is triggered in the last room in which Mr. Marple lies dead in a somewhat unnatural position, triggering a ritual in which the characters are forced to flee and burn the mansion to leave no trace of what killed Mr. Marple.

#### Thematic

The main theme of the video game is a mixture of the detective novels of writers such as Agatha Christie<sup>14</sup>, Edgar Allan Poe<sup>15</sup> and Sir Arthur Conan Doyle<sup>16</sup>, in which police investigations have a dark touch and deal recurrently with death, terror and drama. Added to this is the cosmic horror of the American writer HP. Lovecraft<sup>17</sup> to give it a more mysterious atmosphere that tries to arouse the user's curiosity in order to reach the conclusion of the story.

### 3.2.2 References

H.P. Lovecraft: American writer known for his characteristic macabre style and psychological terror in all his stories, in which he creates a whole imaginary of gods, creatures, rituals, cults and changes the perception of all kinds of reality through the cosmic horrors he narrates. Terror on which the main plot of the videogame is based.

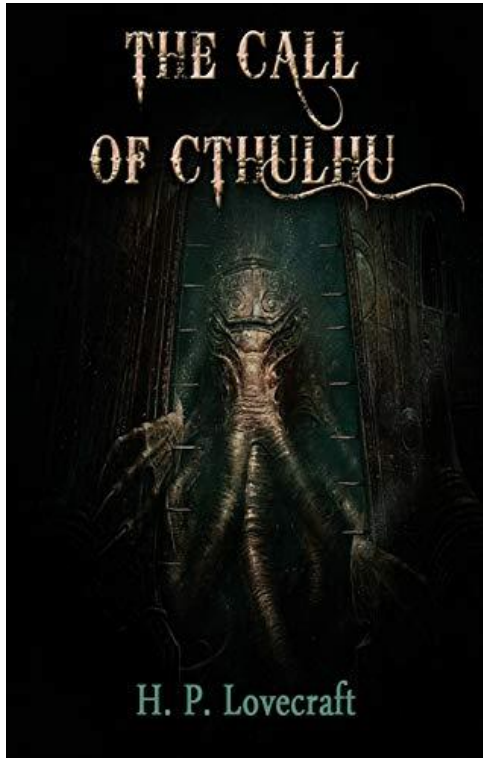


Figure 3, H. P. Lovecraft, *The Call of Cthulhu*, 1926



Figure 4, H. P. Lovecraft, *The Color out of Space*, 1927

Agatha Christie, Sir Arthur Conan Doyle: Great references of the detective and crime novel genre, in which their protagonists solve the most original and sometimes even macabre cases and mysteries, creating a unique atmosphere that has been implemented in this videogame.

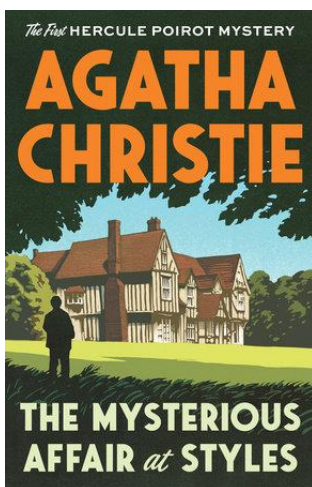


Figure 5 Agatha Christie, *The Mysterious Affair at Styles*, 1920

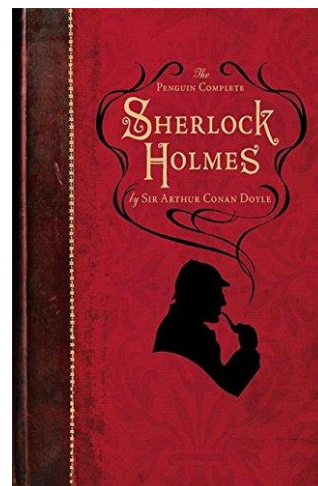


Figure 6 Arthur Conan Doyle, *The Adventures of Sherlock Holmes*, 1891

### 3.2.3 Gameplay

The videogame consists of an Escape Room in which the player must investigate a disappearance by interacting with the different elements on the screen and in each of the rooms, finding and solving the puzzles. There is a progression between the puzzles, the main objective being to complete all the puzzles until the eye of the main statue in the hall is obtained, which unlocks the door to the final corridor and the outcome of the story.

### 3.2.4 Mechanics

The main mechanics of the videogame are as follows

**Interactive objects:** Elements on the screen that, when touched, trigger events: a more detailed view of a room element, moving, dragging certain elements, etc.

**Storable objects:** Objects with a glowing outline that when selected will be stored in the player's inventory.

**Use object:** This mechanic is essential in the Escape Room, and the completion of the puzzles and the game depends on it. When an item remains in the inventory it can be used by selecting it at the touch of a finger, as long as the player is in the room or in the correct area of the room.

**Inventory system**<sup>18</sup>: The inventory system is a database that the player can quickly access in the form of a submenu, which is accessed by clicking on the corresponding button and shows the items that the player has managed to store.

**Room Change:** Moving from one room, resulting in a satisfactory experience to another in Bluetooth mode occurs when approaching the bluetooth beacon corresponding to that room. In offline mode you can switch rooms by pressing the arrow buttons at the bottom of the screen.

**Dialog box**<sup>19</sup>: Frames that appear at certain times, narrate the story while guiding the player through the rooms and puzzles.

### 3.2.5 User Interface (UI)

The user interface consists of the set of buttons, menus and submenus that are accessible to the player at all times.

Buttons:

Inventory opened and closed



Change Room (Left Room, Right Room)



Inventory:



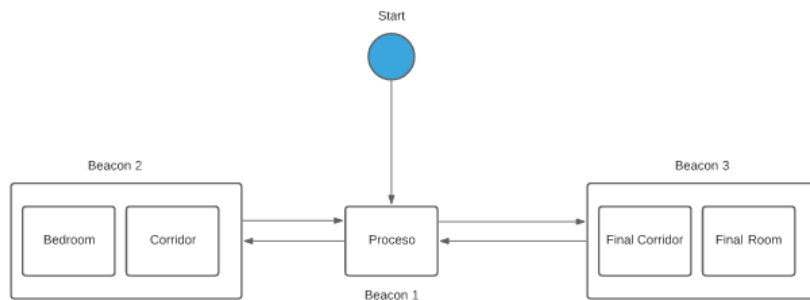
Menu:





### 3.2.6 Level Design

The video game consists of a single level divided into several rooms which have interconnected puzzles, i.e. some of them depend on the previous completion of another puzzle, creating a single puzzle that encompasses the main objective of the game, but generating multiple paths that the user can take. The game consists of 5 rooms, each of them with its own mechanics and key elements. They are designed to be able to change from one room to another using the technology of the bluetooth beacons following the following scheme:



Figure, Beacon-Room Connection

#### Room Scheme:

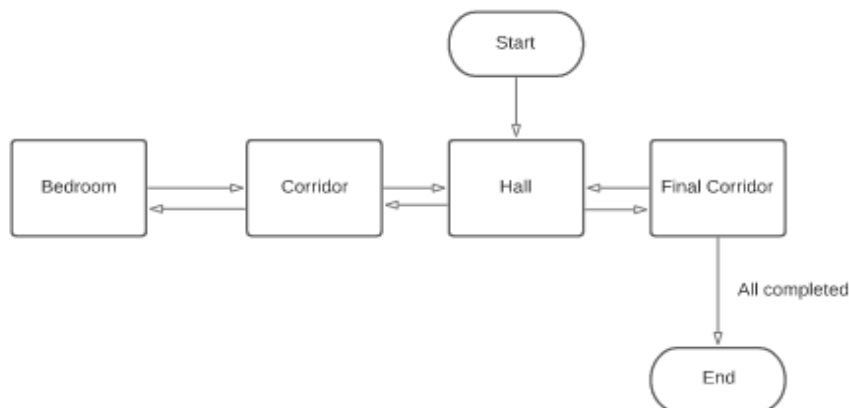


Figure 7, Room Connection

**Hall:** Initial room of the game. There are 3 puzzles at it.

**Puzzles:** Clock, we will have to put it in time, unlocks a part of the mechanism of Mr. Marple's room.

**Scroll:** Incomplete object, the player will have to find the note in the cupboard and use it to complete it.

**Statue:** The bust is the object around which all the puzzles revolve as the recovery of the missing eye is the final resolution of the game, triggering the final cinematic when accessing the final corridor..

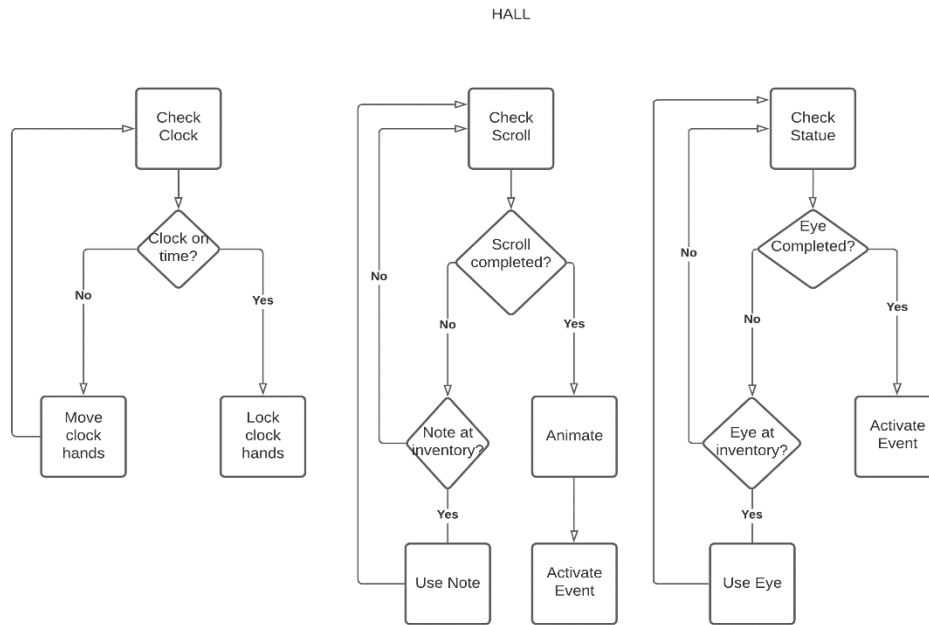


Figure 8, Hall puzzle Dialog Flow

**Corridor:** Intermediate area between the lobby and Mr. Marple's room.

**Painting:** Element to be activated once.

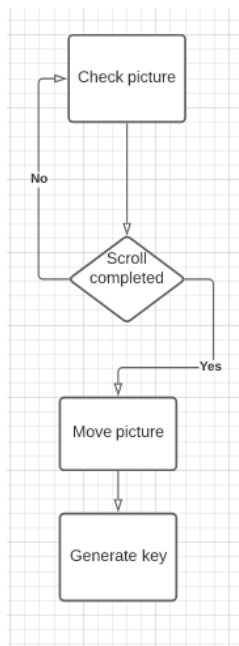


Figure 9, Corridor Dialog Flow

**Mr. Marple's Room:** Room consisting of a large puzzle in the form of a mechanism that is derived from three other conditions: Set the clock in the hall on time, move the eye along the wall following the circuit, use the light bulb in the chest after using the key in the corridor.

**Mechanism:** If all three conditions are met, the eye can be placed on the statue.

**Chest:** If the key is used, it is opened by giving the player the light bulb.

**Eye in the wall:** Controlled by the yellow valves in the room, each one controls a direction (up, down, right and left).

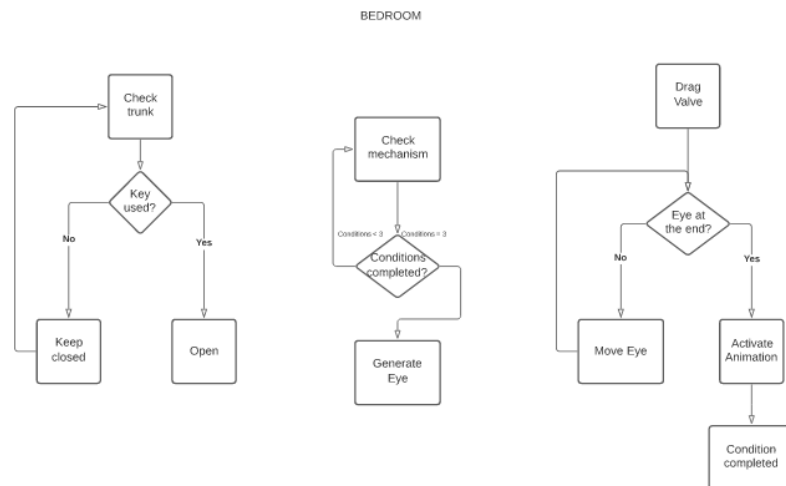


Figure 10, Bedroom Dialog Flow

**Final Corridor:** Access to the end of the game and its denouement. There is only one condition: if the eye has been placed on the statue, the door to the final cinematic opens.

### 3.2.7 Beat Chart

The beat chart<sup>20</sup> is a table that shows each of the game's challenges in a summarised and schematic way:

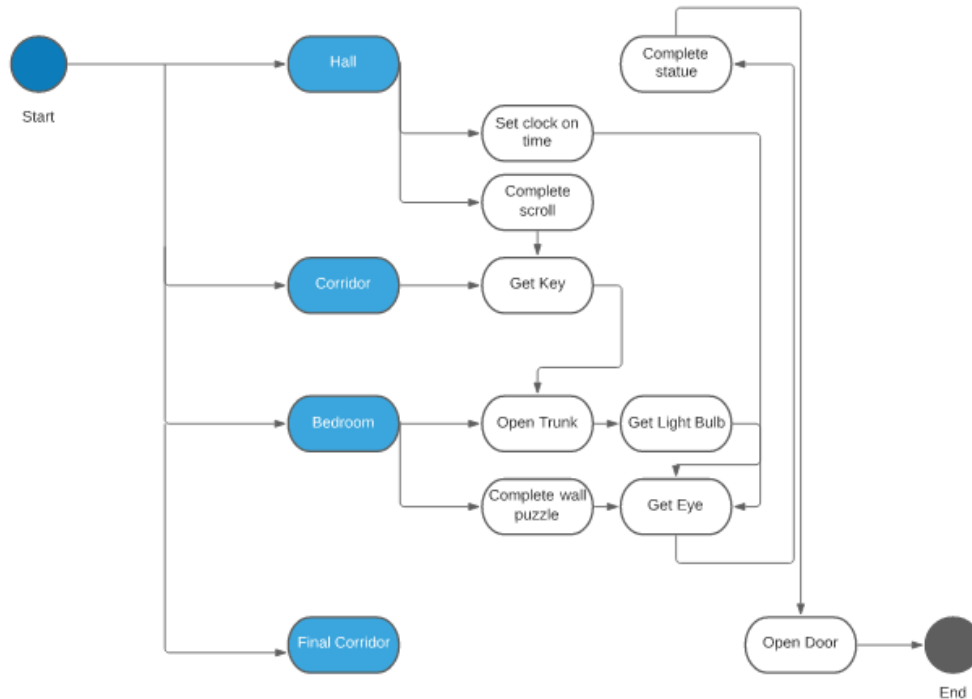


Figure 11, Game BeatChart

### 3.2.8 Artistic Design

This section details the artistic style used, the artistic references and shows all the assets drawn.

#### Artistic Style

The style chosen for the creation of the video game's artwork consists of a type of Pixel Art<sup>20</sup> style drawing, mixing colours and shapes that try to provide the video game with the most mysterious and enigmatic atmosphere while maintaining detail and an aesthetic that is pleasing to the user's eye.

Pixel Art aesthetics is a form of digital art in which the use of the most basic unit of the screen, the pixel, stands out above all. Within the videogame, each of the assets are designed for screen resolutions of 320x180<sup>21</sup>, so that each of the pixels that make up the image displayed on the screen can be seen perfectly, giving it a retro atmosphere, but with certain elements that make them stand out. The colours used are based on the recreation of Victorian mansions with the use of warm colours such as brown, red and orange and playing continuously with colours such as fuchsia pink or purple to give an unnatural atmosphere to certain areas and scenes of the game.

Within the game certain lights and shadows are used to highlight objects or give atmosphere. Those objects that can be stored in the inventory have a white light and

some particles or colour changes to make them stand out, drawing the player's attention, with the intention of helping them in the course of the Escape Room.

## Artistic references

**Stardew Valley**<sup>22</sup>: Resource management videogame with a very detailed Pixel Art aesthetic.



Figure 12, Concerned Ape™, Stardew Valley, 2016

**Call of Cthulhu**<sup>23</sup>: Videogame based on H. P. Lovecraft's story of the same name.

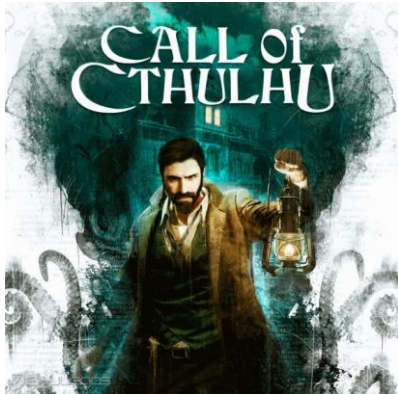


Figure 13, Focus Home Interactive™, Call of Cthulhu, 2018

**Enola Holmes**<sup>24</sup>: Victorian-set film, centred on the adventures of Sherlock Holmes' sister.

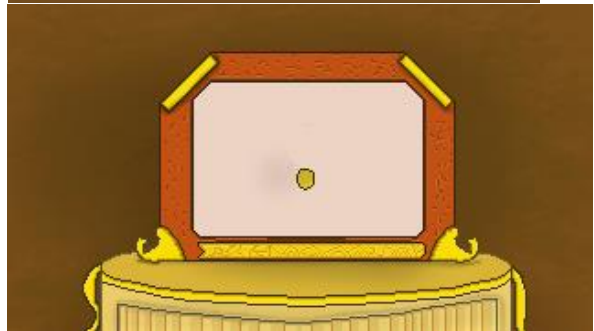


Figure 14, Netflix Enola Holmes, 2020

## Project Assets

The assets have a low resolution generated from, but with a lot of detail in such a way that they are perfectly adapted to the mobile format due to the low memory footprint of each of them.

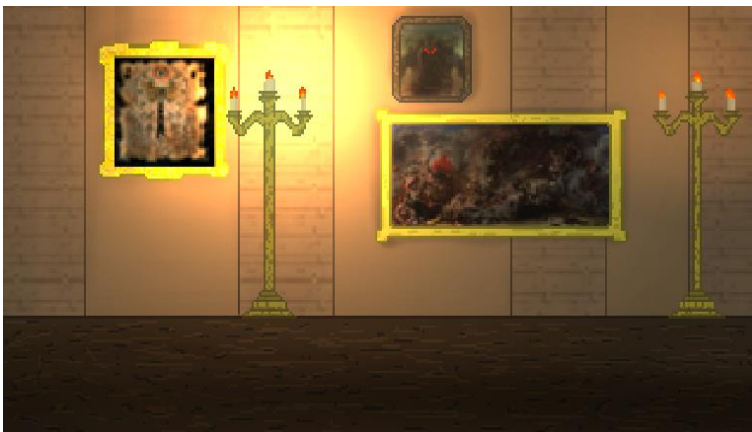
### Elements:



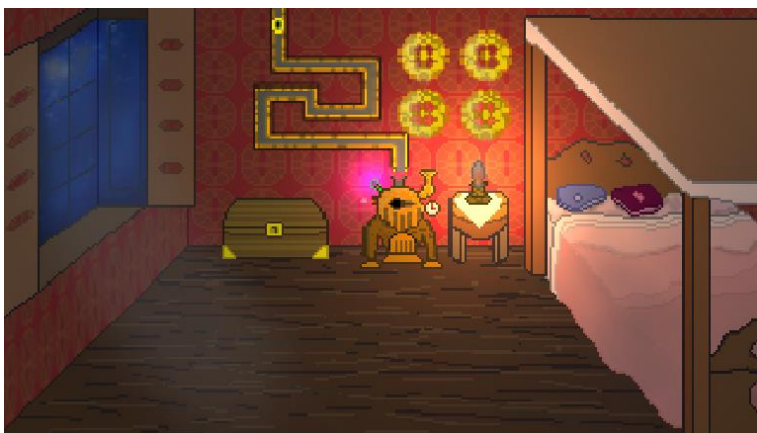
**Rooms:**



*Hall*



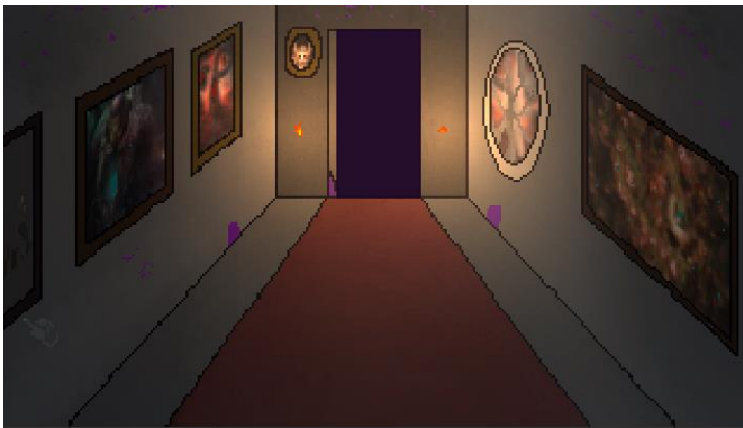
*Corridor*



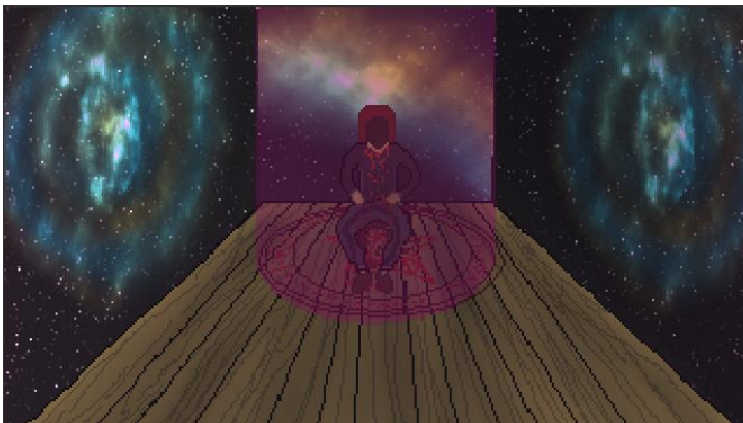
*Mr. Marple's bedroom*



*Final Corridor*



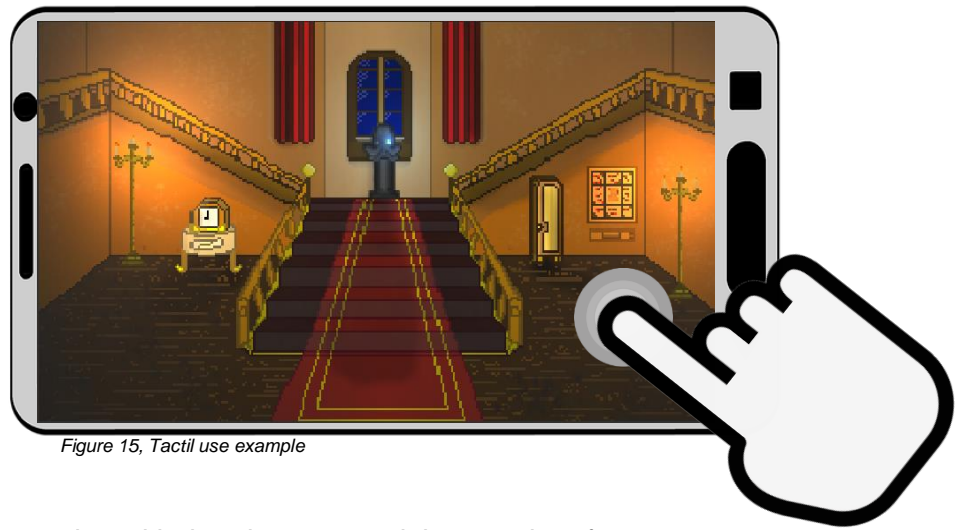
*Opened Final Corridor*



*Final Room*



### 3.2.9 Controls



*Figure 15, Tactil use example*

Touch Screen: Interacting with the elements and the user interface.

## 3.3 Design Decisions

This section explains the problems and decisions taken in the course of the project development.

### 3.3.1 Problems encountered

#### **Augmented Reality**

Initially the first decision that had to be made was whether to use Unity3D's Vuforia package, which allowed the creation of augmented reality environments to create a much more interactive experience for users, bringing the videogame even closer to the Escape Room genre. The problem is the lack of fluidity with which this resource pack works, it is incomplete for something that a project accesses on a continuous basis. Multiple errors were found, due to the use of the mobile device's camera to generate three-dimensional models, sometimes the camera failed in Xiaomi brand devices that inverted the range of colours, the warm ones became cold and vice versa. QR codes corresponding to 3D models were sometimes not detected properly, so that a task that should have been simple and intuitive became frustrating, slowing down gameplay and hindering the narrative, due to the interruption. In the end, it was decided not to include this functionality, increasing the performance of the videogame and reducing the storage required by not including the 3D models in the project.

#### **Collision Detection**

When detecting the touch of the mobile device on certain interactive objects, errors related to the Event Manager, a script that controls certain events such as the storage of objects in the inventory, their use and the activation of animations, occurred due to an overlapping of calls made in the same scene.

#### **Screen Resolution**

The adjustment of each of the elements of the UI, images and canvas to the resolution of the screen gave problems at the beginning because it had to be adjusted to a mobile format, so when using the Pixel Art format many of the images looked with very poor quality or much smaller than they should be. Therefore we proceeded to set the resolution to a size of 320x180 that for a computer is small, but for a mobile device is perfect and also use the Unity Pixel Perfect Camera package that renders the pixels without applying antialiasing and without reducing the quality of the images, as the camera "sees" them in the editor of the Unity application.

### 3.3.2 Changes in design and mechanics

#### Bluetooth Beacon<sup>25</sup>

It was originally envisaged that many more rooms would be added, with the intention of tackling many more rooms in what would be a Victorian mansion, but each with a reduced number of puzzles. Taking into account that the main mechanic to change from one room to another is that the user must approach the Bluetooth beacon corresponding to each room, so if the number of rooms is too high the experience is more tedious as the player to explore and try to investigate is constantly forced to move, so it has been decided to reduce the number of rooms and increase the number of elements in each of them, in addition to grouping the rooms into groups to reduce the number of beacons used.

#### Mechanics

The interactive elements in the Hall (statue, clock, wardrobe, scroll) when touched produced a zoom in the camera to give the impression that the view was zooming in on them, this caused a significant drop in resolution and the player's attention could be scattered, making puzzles and moving elements difficult to complete. This option was modified by creating extra assets that would correspond to the zoomed-in camera view, but with much more detail.



Figure 16, Hall furniture detail

The inventory was originally intended to be continuously visible at the bottom centre of the screen, but this greatly reduced the visibility of the items on screen and was eventually changed to be accessible via a button.

The Escape Rooms have the characteristic of having a time limit resulting in a time trial. This mechanic was eventually removed from the game because the fact of constantly watching the timer caused unnecessary stress and too much attention from the user, reducing the importance of the details and the rest of the elements present in puzzles and rooms, contrary to what we wanted to achieve when designing the gameplay and the atmosphere..

## 3.4 Implementation

This section explains the programming procedures, the tools used and the logic applied in the design of each of the elements that form part of the video game.

### 3.4.1 Tools used

**Unity3D<sup>26</sup>**: Graphics engine widely used in the independent videogame industry due to its power, versatility and the fact that it is free. Its environment allows video games to be created with a large amount of visual feedback, giving unique capabilities to its editor in which scripts and files can be added, removed or added without the need to access the file explorer or program directly. The community generated from this is so large that there are a multitude of tutorials, classes and free projects ready to learn how to use this engine.

**Krita<sup>27</sup>**: Free digital drawing program that allows you to create art in different artistic styles. Chosen for its versatility, with a multitude of brushes designed to give texture, add lights, create landscapes, multiple resolution settings and editing programs, and implements a series of brushes designed directly for Pixel Art aesthetics which has greatly facilitated the entire process of drawing and creating the assets for this video game.

### 3.4.2 Inventory logic

Each of the elements that can be stored in the inventory have a tag called "pickeable" so that when the player interacts with an element with this tag, it is checked if it is in the database of storable items, if it is, it is deleted and stored in the player's inventory, associating the corresponding sprite to the UI and the slot showing the corresponding image when the inventory is opened.

All this is associated with the name of the object that the player clicks on and the name is searched in the database and in the files to find the image.

The main static scripts are:

**Item**: Class that controls the elements that each of the objects to be stored in the inventory must have. Each one has an id, name, description and the path to the associated image.

**ItemDatabase**: Database that contains all the items of the videogame that can be stored in the videogame, the inventory when it starts creates this database and associates it.

**Inventory**: Main class of the inventory system. It keeps track of every item the player has, adds and removes them depending on the event that occurs. It provides updated information on when an item has already been picked up so that it does not have to be generated again when reloading the corresponding scene.

### 3.4.3 Interaction System

The system that allows the player to interact with each of the elements is based on the "interactive" and "picketable" tags. "Interactive" for those elements that when selected execute an event and "Picketable" for those that are stored in the inventory (as explained above). The script works using the `GetMouseButtonDown(0)` method that allows to detect when the main mouse button is pressed, this also works with devices with touch interface. This method uses Unity's Raycast technology which generates a ray from where the mouse is located and checks which elements it collides with.

All these objects have a Collider (element of the Unity Physics system that allows to detect collisions) added to them. When the ray generated by the Raycast collides, it allows to call certain functions of the script.

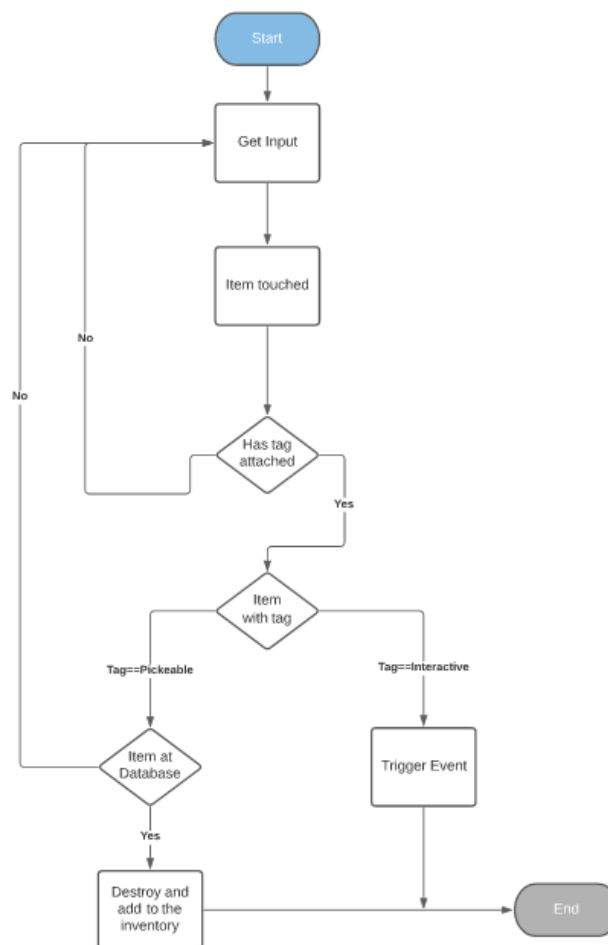


Figure 17, Inventory Dialog Flow

### **3.4.4 Game Manager Script**

Static script that controls multiple functionalities of the videogame using basic logic and values of 1 and 0.

It detects events that have been executed, such as the generation of objects that have been stored, when they have been used and the animations that have been triggered, as well as the control of cinematics and narrative frames.

### **3.4.5 Narrative System**

The dialog box system works by accessing the GameManager script and checking whether a box has already been read or not. If not, a square is generated in the user interface which accesses a script named "TextBoxController" to which is passed the name of the file to be opened and which stores the text to be displayed in the dialog box. To display the text, the "SHOW\_TEXT" function of the EventMannager is called, a script which can be called dynamically and which relates different methods of the project via StartListening() and TriggerEvent().

### **3.4.6 Use Item**

Each item has a single use and can only be used in a specific place that the user will have to discover. In case the item is stored in the correct place, it is deleted and the corresponding event is executed.

### **3.4.7 Bluetooth Implementation**

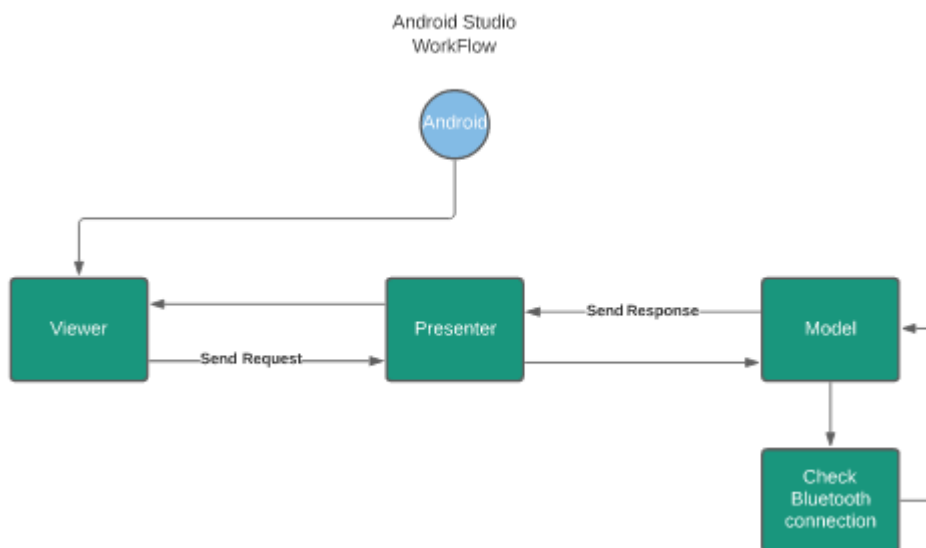
It has not been possible to finish implementing the Bluetooth functionality due to the errors that occurred during the process related to the association of Unity and the SDK used by the AndroidStudio platform and with the null recognition of the Bluetooth beacons. Therefore, it has been concluded that the project itself should be divided into two parts, one in Unity that contains all the functionality of the videogame; assets, mechanics, rooms, logic and another that contains the logic associated with the Bluetooth system developed in Android Studio, so that the necessary functionalities for the development of this system can be accessed in a much more efficient and intuitive way. This would require much more time to dedicate to the project in order to realise a system that would work efficiently and optimally so as not to hinder the user's gameplay throughout the game experience. If the method used for the realisation of the Bluetooth system did not work properly it would be a tedious process for the player due to failures in the connection with the beacons, blocking on underpowered mobile devices, etc.

In order to be able to use the Bluetooth tool of the mobile devices in an efficient way, it is necessary to use the plugin “FantomPlugin” created by “Fantom” in Unity that allows to add the basic permissions by calling the scripts executed and programmed by AndroidStudio and that

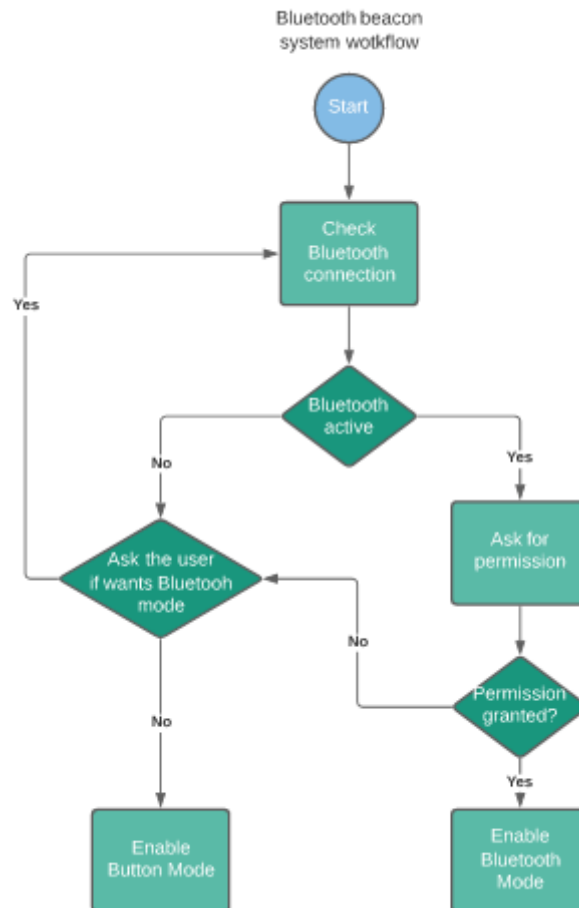
implements a set of methods that act depending on whether Bluetooth has been detected, if not and if permission has been given to use it.

To obtain the necessary permissions, the AndroidManifest.xml file is modified by adding the lines “<uses-permission android:name=“android.permission.BLUETOOTH\_ADMIN”/>” and “<uses-permission android:name=“android.permission.BLUETOOTH”/>”, for the Bluetooth “<uses-permission android:name=“android.permission.ACCESS\_COARSE\_LOCATION”/>” and “<uses-permission android:name=“android.permission.ACCESS\_FINE\_LOCATION”/>” and to be able to access global positioning in order to use Bluetooth beacons.

In order to be able to access these permissions in an optimal way, the AndroidStudio tool would have to be integrated into Unity and the files in which the recognition and access to Bluetooth, as well as the beacons, are developed would have to be executed. In this way, the structure of the code in AndroidStudio would follow the one seen in the subject VJ1229-Mobile Device Applications, MVP, Model, View, Presenter. In this case, the files belonging to the Model would be in charge of requesting permissions from the user, as well as detecting if Bluetooth and global positioning are activated, this would be communicated to Unity by means of the methods positioned in the file that would act as Viewer, passing previously through the Presenter.

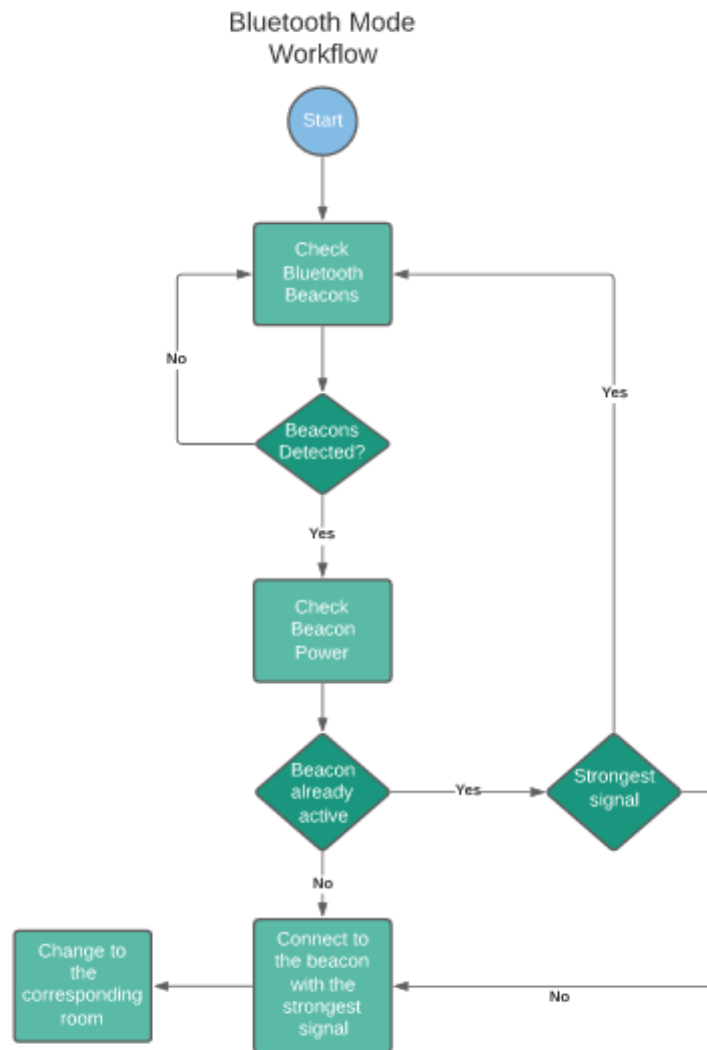


Once these data have been obtained, the script "PermissionCheckController" is in charge of carrying out the relevant actions, if Bluetooth is not detected, the user will be asked if he/she wants to play in Bluetooth mode, if so, he/she will be asked to activate it and it will be checked again, if not, the mode without Bluetooth will be activated, which will use the buttons to change rooms, if Bluetooth is detected and the player accepts the permissions, he/she will automatically switch to Bluetooth mode.





In this mode, each room is linked to a Bluetooth beacon. Each of these would be detected by the system through its minor and major, establishing if the player is near each one depending on the power detected by the beacon, switching to the associated room whose beacon has more power, this power is determined by the proximity of the mobile device to each one of them.



A range of values would be set in order to control the sensitivity of the Bluetooth beacons and with the intention that once it detects a higher power it would change if the power is n times higher than the current one, in order to avoid sudden and continuous room changes, this could cause serious problems in the gameplay. If the mobile device did not detect any Bluetooth beacon, the last room the user was in would remain on the screen.

To avoid possible problems or discomfort, it is always possible to switch from Bluetooth mode to button mode.

## 4. CONCLUSIONS

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The rise of Escape Rooms today is mainly due to the ability to immerse each of the players in the story proposed, together with the atmosphere, decoration and environment, which together with the interactive puzzles and teamwork/cooperative work provides a collective objective, making each player feel like a character in the story.

When transferring this type of game to a virtual format, achieving this immersion is much more complicated and the line between Escape Room and puzzle video game becomes a very fine line, so the need to create a more original theme is imperative to try to be more attractive, linking the puzzles with the theme. Trying to bring this experience closer to the portable format, we must try to implement certain elements that have direct physical interaction with the environment that surrounds the user using certain technologies such as Bluetooth to activate puzzles, change rooms; augmented reality to interact with certain elements or even virtual reality to transfer one hundred percent of the experience.

This paper presents a virtual Escape Room videogame that tries to cover the lack of interactive elements between the player and his environment in mobile videogames of a similar genre, bringing it closer to the Escape Room experience. It has managed to achieve the initial point, which was the immersion of the player in the atmosphere proposed by the theme of the videogame, giving a sense, cohesion and connection to the puzzles, scenarios and narrative.

# 5. FUTURE UPGRADES

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## 5.1 Modular extensions

The way the videogame is programmed allows to add new rooms in a modular way, simply by copying two elements from the rest of the rooms (RoomManager.cs and the Canvas) creating a new perfectly functional room.

## 5.2 Random mapping generation

With some improvements in the general programming and logic, it could become a modular game with random rooms or events at each game, taking advantage of the virtual capacity to change any element in a dynamic way, thus obtaining a totally different scenario in each game.

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