

Implementation and Impact of Virtual Reality on Survival Horror Games

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Abstract— Currently, games are an important part of human life. Not only serves as entertainment, games nowadays also serve as education, communication, socialization, and even a job for some people. This makes technology in the game world more developed and closer to reality. One of the popular and interesting technologies is virtual reality. This technology has various elements, but the most important element is the immersion element, which can give users the sensation to feel as if they are in a real environment. In this research, the authors examine the effects of virtual reality when combined with horror games. The selection of horror games was made because this genre is one of the genres with the fastest immersion element compared to other game genres. In addition to the use of virtual reality technology, considering that horror games require complex particle simulations and good lighting, the authors use the Unreal Engine as the main engine in this game. The test method used in this study is the beta testing method with the assessment using the user acceptance method. The conclusion was that virtual reality technology combined with the advantages of the unreal engine caused game players to get a tenser atmosphere.

Keywords— Horror Game, Virtual Reality, Oculus Rift, Immersion Element.

I. INTRODUCTION

Virtual reality is one of the most advanced technologies, especially in the video game industry. One of the elements that makes this technology very suitable to be combined with horror games is the immersion element. This element in virtual reality technology provides a sensation that brings game players to feel as if they are in the game. Unreal Engine is an engine that can create games with virtual reality features. The performance of this engine is among the best, from handling complex particle simulation systems to sophisticated dynamic lighting and excellent graphics capabilities.

The features in this horror game are also designed to be attractive and interactive, including virtual reality menus, stories delivered through cutscenes, and documents that players can read with the hand motion feature. With hand motion, it allows players to use hand movements in the virtual world and be synchronized with player hand movements in the real world. So with interacting with objects in the game, players can actually feel like playing in their real world.

Previous research has utilized virtual reality technology to create an Android-based platformer genre game using a gyroscope sensor that functions well when used as the main movement control [1]. Game technology can also be used as a means to build implementable agents for health therapy [2], and as a learning medium [3]–[7]

II. LITERATURE REVIEW

In this research, further learning is needed regarding reference theories and the engine used. The theories and engines that will be explained include the theory of video games, game engines, virtual reality, and the Unreal Engine.

The explanation process will be carried out briefly and concisely regarding each component and theory.

A. Last Research

Based on some recent research related to virtual reality in a game, some things that can be concluded are [8]–[10]:

1) *Research Methods (Validation)*: In all studies related to Virtual Reality, the method used in validating the research is the same (user acceptance). However, the number of users who validate varies, ranging from 20 to 40 people. In this case, all users are asked to do a trial and provide input related to their experience.

2) *Game Genre*: Regarding the impact of VR on game genres, each study tries several different game genres. Game genres that have been studied include strategy, culture, and violence (example: fighting).

3) *Research Result*: All studies with the three genres above give the same result: the use of virtual reality provides a better and more interesting experience for users than without virtual reality.

Based on the studies done, in this study, the researchers focused on the impact of virtual reality at horror games. Considering horror games are one of the games that provide the most immersion elements.

B. Video Game [11]–[13]

A video game is an electronic game that involves a user interface to produce visual output on a video device such as a TV screen or computer monitor. Where the video device is called a platform. A platform is a combination of electronic

components or computer hardware that is specifically designed and assembled with software to run video games. The platforms that are often encountered in this era are PC, arcade, mobile and virtual reality. But unlike other platforms, virtual reality requires additional equipment such as a head-mounted unit equipped with stereoscopic screens and motion tracking to detect head movement.

Video games are categorized by their underlying characteristics or purposes, not by the type of gameplay of the game, and we can be called them Genre. There are various genres in this world. For example, action games are a game where the player controls and becomes the center of the action. Action-Adventure Games is a combination of two game mechanics, action and adventure mechanics; RPG or role-playing game is a game where players play the roles of characters and collaborate to knit a story together.

C. Horror Game

Horror is one of the popular game genres circulating in the community. Many game companies have entered this genre to increase their selling power, for example, Capcom with the Resident Evil series, Konami with the Silent Hill series, and many other game companies. Based on research related to horror games, the dramatic effects of terror, fear, and restlessness have a great emotional impact on players. But why is this genre still being played? Based on the same research, it turns out that many game players enjoy the sensation of fear given by horror games, and the gender of the players does not influence this; both men and women feel the same experience when playing horror games.

D. Game Engine

Game engine is software designed and created to help create a game [14]-[16]. A game engine is usually built by encapsulating, the layman's language collects some of the basic functions commonly used in a game. Such as rendering functions, audio, network, or other game effects. Game engine is a framework for making games, where the game engine provides the tools and structures needed in the game. An example of its use is that objects in the game are stored in memory, and memory management manages when certain memory objects appear and regulate the area being explored.



Figure 1. Computer Architecture in Games

Based on Figure 1, the computer works on a principle known as the "Layer of Abstracted Complexity", which means that everything in the computer is built on something complex that has been abstracted to become easier to work with. Thanks to abstraction layers, we can command the game engine to draw 3D characters indoors without worrying about what electrical signals we need to send to display the right pixels.

E. Unreal Engine [17]-[19]

Unreal Engine is a game engine developed by Epic Games, first showcased in 1998 with a game with a first-person shooter genre called Unreal. With code written in C++, Unreal Engine has a high degree of portability and is a tool used by many game developers today. The current release is Unreal Engine 5, which was designed for Microsoft's DirectX 11.

The Unreal Engine consists of several components that work together to create a game. Its huge system of tools and editors allows users to manage assets and manipulate them to make the gameplay the way the user wants. The Unreal Engine components include the Sound Engine, Physics Engine, Graphics Engine, Input and Gameplay Framework, and Online Module.

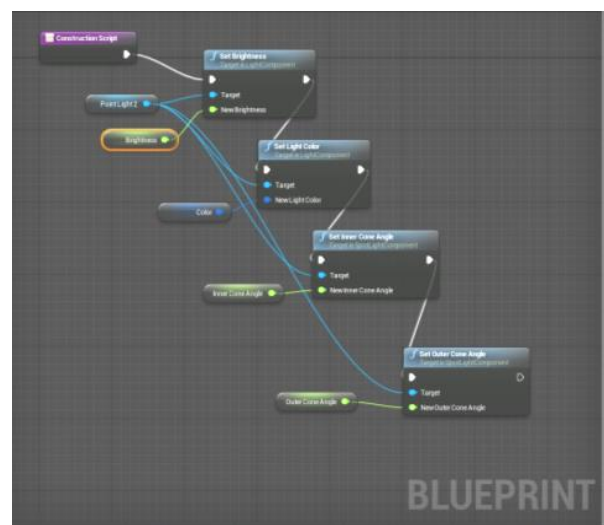


Figure 2. Unreal engine blueprint editor

Blueprints on Unreal Engine is a complete coding system based on the concept of using a node-based interface to create gameplay elements in the blueprint editor (figure 2). As with scripting languages in general, blueprints are used to define object-oriented (OO) classes or objects on the engine. Objects in the unreal engine are often also referred to as "blueprints".

F. Virtual Reality

Virtual reality is a technology that allows users to interact with a virtual world environment that is simulated by a computer, so the users can feel they are in that environment. The main device that is most needed is a headset to feel the sensation of virtual reality [20]-[22]. Virtual reality consists of two words, namely virtual and reality which means virtual and

reality. There are four important elements in virtual reality. The four elements are as follows:

- 1) *Virtual world*: content creates a virtual world in the form of a screenplay or script.
- 2) *Immersion*: a sensation that brings users to feel that they are in a real environment that is fictitious.
- 3) *Sensory feedback*: serves to convey information from the virtual world to the user's senses, including sight, audio, and touch.
- 4) *Interactivity*: serves to respond to actions from users so that users can interact directly in the virtual world.

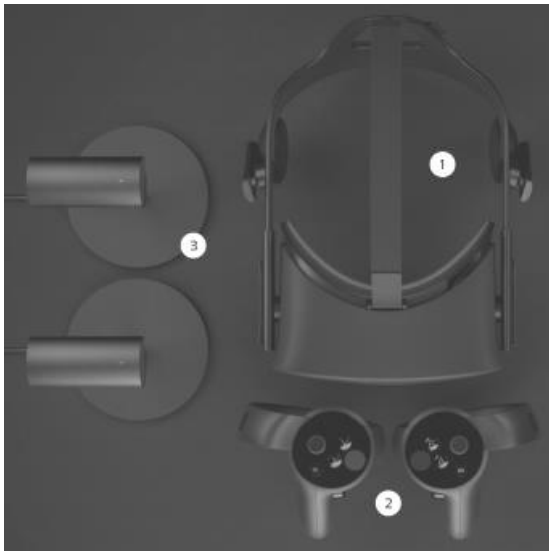


Figure 3. Virtual reality device

Devices (Figure 3) used in virtual reality systems include Head-Mounted Display (a type of device that has a screen mounted in front of the user's eyes) and input devices (devices that provide users with a more natural way to navigate and interact in a virtual environment).

G. Extreme Programming

The game development method used in this study is extreme programming methodology. We use this method because our team consists of several people from designers to testers, in making the horror game. Each division also not only consists of 1 person but several people. By used extreme programming, it will make the development easier and more neatly organized.

There are four stages (figure 4) in one iteration, including Planning, Design, Coding, and Testing. This iteration is carried out six times, where iterations 1-5 are carried out for levels 1-5, and the last iteration is for making virtual reality menus and games as a whole. The following are the steps for working on this system based on the extreme programming methodology [23]-[25].

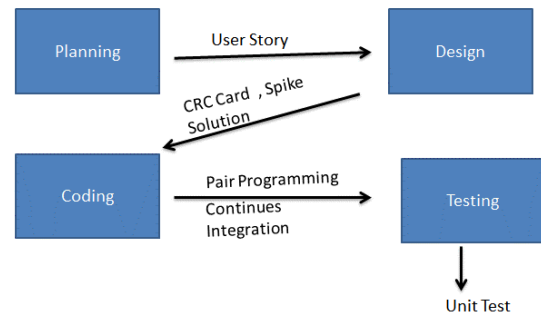


Figure 4. Extreme programming phased

1) *Planning*: Planning activities focus on getting a picture of the features and functions of the game to be built. This activity begins by making a collection of stories or images obtained from several references, which will then become the basic description of this research.

2) *Design*: Aims to set the logical pattern in the system. The design of the Extreme Programming model becomes a guide in building games based on reference games.

3) *Coding*: Game coding where XP applies the concept of pair programming where two programmers develop each task of a module.

4) *Testing*: The testing stage is the stage that will be carried out after the game system coding stage has been completed. Researchers and a game testing team will carry out alpha testing. After doing Alpha testing, the next stage is Beta testing, where the tester will be given a questionnaire to get an assessment along with the final results of this research.

III. RESEARCH METHODOLOGY

In this study, there are several important stages, including literature study, game development, graphic testing, and testing the impact of virtual reality on games. Several pieces of literature have been used in the game development phase [26]-[30] so that the game can provide the best horror effect.

A. Game Explanation

This game is made for the PC platform with Oculus Rift. It is a single-player game with a first-person virtual reality perspective and survival horror theme. The objective is to make the player get out of the ancient building, which the enemies will intercept. Players cannot attack enemies but must run and hide, sneaking past enemies to stay afloat. Lastly, the player only has a flashlight as a lighting device where the battery limits the energy.

B. Game Architecture

When the player opens the game, the player will be faced with the main menu page. On the main menu, there are several options including, Start Game, Load Game, Quality Settings, and Exit Game. The Start Game option is an option to start the game from the beginning, while the Load Game option can continue the game according to the last Checkpoint that the player has passed.

Figure 5 is this game architecture in the form of a block diagram. The New Game and Load Game options will direct the player to the game or Gameplay. In this game, players can return to the Main Menu by opening the Pause Menu and then selecting the Back to Main Menu option. Players can also continue the game while in the Pause Menu by selecting the Continue option. The Settings option on the Main Menu is an option to set the quality of the image that will be displayed on the screen. The Exit Game option on the Main Menu is an option to exit the game application.

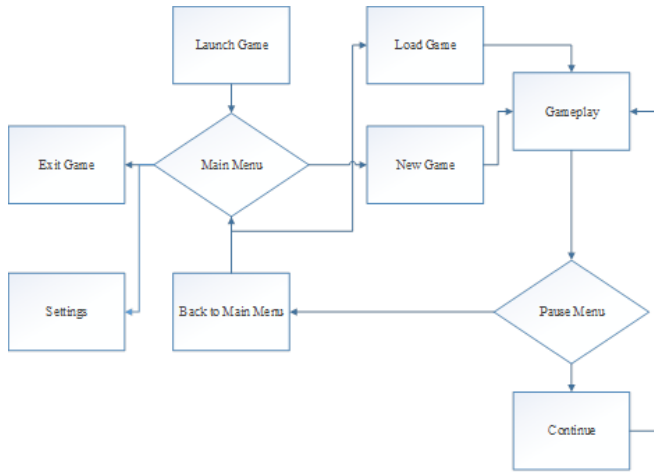


Figure 5. Game Architecture

C. Missions in Game

There are five areas in this game where each area will have different missions and obstacles: read a letter, run for enemies, or find an object. Each area also has several checkpoints. If the player has completed the mission in a certain area, the player cannot return to that area. The player is declared failed to complete the mission when the player dies. Dead players will respawn at the last Checkpoint the player has reached.

D. Virtual Reality Menu

In this game, we have a different form of the main menu with the main menu in the general game (figure 6). The difference is, the main menu in this game is in the form of a room containing options that the player can select. The player can select an option by moving closer to the option and selecting it.



Figure 6. Virtual Reality Menu

E. Game Story

The story in the game will be conveyed in several ways, including cut scenes, dialogues, and documents that can be read by players in the game. The following Figure 7 is story board that tell us about this game main story.

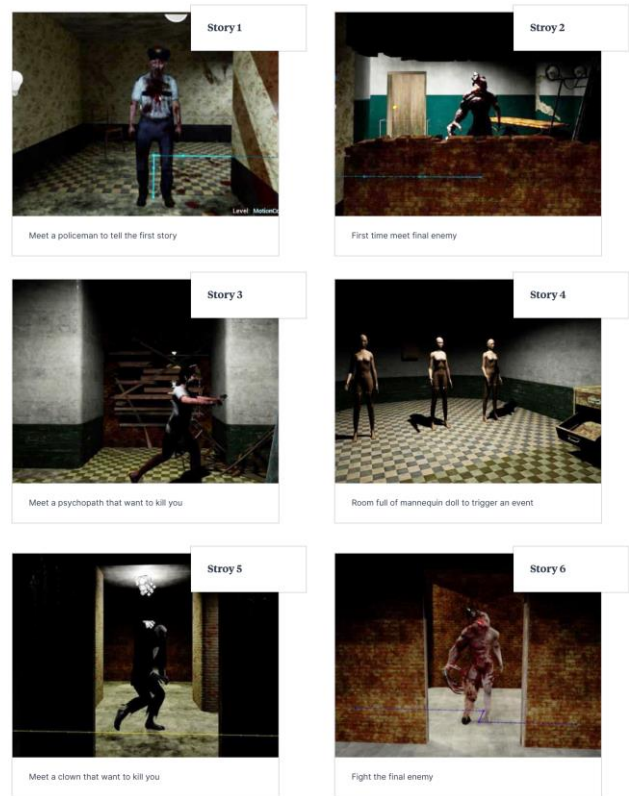


Figure 7. Story Board

F. Hand Motion in Game

This feature is one of the features of the Oculus Touch controller in Figure 8 that allows players to move their hands in the game according to the player's movements in the real world. This feature is useful in object interaction, for example, when the player takes the battery, takes documents, and opens doors.

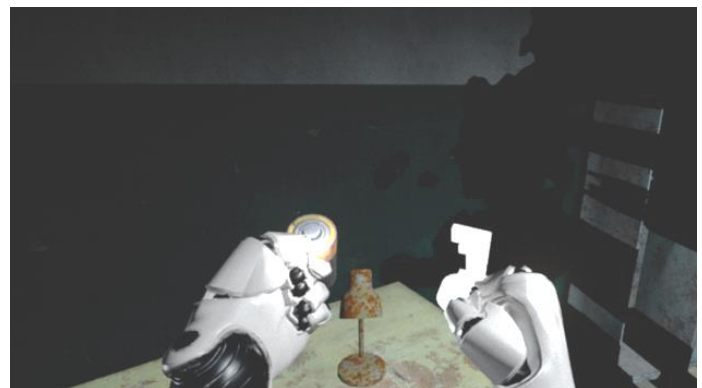


Figure 8. Hand Motion Feature

After game development is done, in the testing stage, this study uses a questionnaire method to determinat the impact of virtual reality on horror games and feedback on how well the games developed in this study. The result will be discussed in the result and discussion section below.

IV. RESULT AND DISCUSSION

The test in this study was carried out in 2 stages: the game feasibility trial stage and the virtual reality impact in the horror games stage. To test the game's feasibility, it is divided into 2 major aspects: the general aspect and the visual aspect. Meanwhile, the visual reality impact test only has one aspect. The three aspects will consist of several important questions that are expected to represent each aspect of the trial.

The test will be conducted by 50 users with 35 people who are gamers while 15 people rarely play games. Thirty people are men, and 20 people are women. Forty people have played horror games, and ten never have.

A. Game Feasibility Trial Stage

This stage is divided into two main aspects: general aspects and visual aspects. Both of them are important to understand how good the game we created is in the user's eyes. Because if the game is not good enough, it is impossible to get the correct measurement in the Virtual Reality Impact Trial Stage.

TABEL I
 GENERAL ASPECT SCORE

Topic	Score (0-6) Gamer	Score (0-6) Non-Gamer
This horror game is interesting to play	5.2	4.7
Tutorials help understand the game	4.3	4.6
The controls and gameplay system in the game are easy to understand	4.9	4.5
The map in the game works well and is easy to understand	5	4.9
There is a tense atmosphere when playing the game	5.6	5.4
This game is worth recommending to others	5.6	5

Table I is the general aspect value in this research game. We can see in the table that this aspect has several topic questions where each topic wants to ensure that the game made is suitable for use in the next trial process. Based on this assessment, the average player gives a score of 4 or 5 (out of 6) for each topic so we can conclude that the game developed has good quality and deserves to be tested for the next aspect, which is the graphic aspect. The graphic aspect is also considered important in this trial because if the graphics provided are unattractive or inappropriate, it can be ascertained that when played in virtual reality it will not get satisfactory results, it can even cause inconvenience to players.

Figure 9 is a graph of the questionnaire on the graphics aspect game. For this graph, the author takes the results from all players (gamers or non-gamers). It can be seen that 90% of players say the graphics used are attractive. This is an important point because horror games developed when played without VR technology already seem good in terms of graphics, so when applied with VR technology, it will result in

much better results. This happens because players feel like in that place so that everything becomes more interesting.

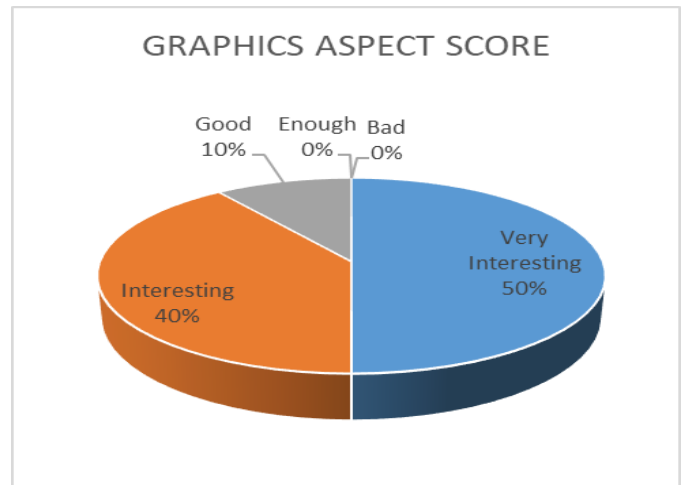


Figure 9. Graphics Aspect Score

B. Virtual Reality Impact Trial Stage

Because the game has passed the feasibility stage, the trial is continued by measuring the impact of virtual reality on the developed horror game. Can virtual reality increase the sensation of horror games, or the results obtained are the same as playing without virtual reality?

Table II shows the value of virtual reality impact when played on horror games. As before, this assessment was carried out for two groups: the gamer group and the non-gamer group. From this score, we can see that the overall impact of VR on games is very high, considering the average player rating is above 5 out of 6 (for both gamers and non-gamer).

TABEL II
 VIRTUAL REALITY IMPACT SCORE

Topic	Score (0-6) Gamer	Score (0-6) Non-Gamer
VR feature makes me feel in the game	5.2	5.4
The VR feature makes the game feel more tense	5.7	5.6
The VR feature makes the game feel more interesting to play	5.7	5.7
The objects in the game are very interactive to play with the VR feature	5	4.4
Feeling dizzy when playing games with VR features	2.4	4.1

However, through this assessment, we can also see that non-gamers are not very interested in the interaction of objects in the game and feel dizzy more easily. After going through a short interview, non-gamers are not used to seeing 3D games, let alone playing them for a long time, so that the interaction of objects in the game makes it difficult for them and increases the dizziness feeling. In contrast to non-gamers, for gamers, this is not too much of a problem, so that the assessment of object interactions is still high, and even after playing this horror game, they don't feel too dizzy.

V. CONCLUSION

This study can be concluded several important points, both in terms of making horror games and on the impact of virtual reality in this game. Here are some of the conclusions. The game in this study was developed with the Unreal Engine, and we think Unreal Engine is very suitable for making virtual reality games with a horror theme. Considering the lighting produced by the Unreal Engine is very good and very supportive of the horror game environmental conditions. Applying the right concept, story, design, sound, and artificial intelligence to game development will increase player satisfaction when playing it. This has been proven at the game trial stage, where the average score given by players is above 4 out of 6. Virtual Reality can increase players' sensation in playing horror games so that players can feel more real, interesting, tense, and even scary when playing them. This is evidenced in the trial phase of the impact of virtual reality, where the average value obtained is above 5 out of 6. For players who rarely play games or are non-gamers, virtual reality games tend to cause headaches or dizziness. This can be caused by many things, one of which is the graphic design that is not the same as the image seen by the human eye.

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