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No Escape: A 2D Top-Down Shooting Roguelike Game Embedded with Drunkard Walk Algorithm

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ABSTRACT

Video Game is a part of the entertainment that grows rapidly every year along with the development of content and demand from players. To enhance the development of content, the game must be able to create a non-boring game atmosphere such as increasing Replay-ability, which is repeatedly and unique content produced to increase long-term enjoyment. One genre of games that can achieve Replay-ability is the Roguelike game, where the game relies on Procedural Content Generation as a container for games and permadeath systems. By providing Procedural Content Generation, game content that is created automatically and randomly can increase the value of Replay-ability. One algorithm that is part of the Procedural Content Generation algorithm is the Drunkard Walk, where this algorithm creates space and content from a game based on the direction the algorithm is going. Uncertain movements can produce random space and content. However, this method does not have much research in the development of procedural content generation games. Based on this problem, a Roguelike game was built that applied the traditional method of Top-Down Shooting and implemented the Drunkard Walk algorithm to increase the level of player satisfaction with the game they were playing. This game was successfully built and tested on 30 respondents to find out the level of satisfaction of respondents with the game that was made. The tested game is then evaluated with the Game User Experience Satisfaction Scale (GUESS) and gets a 71% (Good) result in its level of satisfaction.

Key words: Drunkard Walk, Roguelike, Satisfaction Scale, Video Game.

1. INTRODUCTION

Video Game is a type of game that is played by players who interact with videodevices that produces visual feedback from video devices. Those devices consist of computers, game consoles, mobile phones, and arcade machines [1]. Video games are everywhere, and everyday exists by millions of people who played video games [2]. Approximately 68% of households in America spend their time playing video games with an averages player aged 35 years and average experiences playing in video games for 12 years [2]. However, with the development of content, the demand for quality new content keeps increasing along with the cost production and the difficulty of measuring the budget to create game content [3]. To solve those problem and improve the development of content, games must have replayability content. One of the solutions that fulfill the replayability is to implement Roguelike into a game [4].

Roguelike is a subgenre of Role-Playing Game (RPG) characterized by a dungeon crawl through the Procedural Content Generation (PCG) level and permanent death [5]. Procedural Content Generation is a method to create content in the game randomly and generated by a computer. The generated content consists of level, object, player, enemies, stories, and others [6]. One of the implementations of PCG is Drunkard Walk, where the labyrinth is created randomly based on the direction of the algorithm that moves as desired by the algorithm.

Although PCG could help for reducing the cost of development content there aren't a lot of research conducted regarding this topic and resulting some weakness such as lack of designer control over the generation results that cause difficulty to generate content that would satisfy the artist and also the player itself [7].

To be able to overcome the problems provided by PCG, Multi-Level Multi-Content is needed in which the game can produce a variety of quality content in accordance with the expected design by combining the mechanism of PCG with narrative properties or providing an achievement but does not eliminate the nature of ludology that is a mechanism and rules created in the game roguelike [8].

Based on the study above, the design and development of the Roguelike 2D Top-Down Shooting game use the Drunkard Walk algorithm is created for producing PCG content. Drunkard Walk is a part of Dungeon Generation that implements Random Walks as the flow of Dungeon creation. Drunkard Walk guarantees connectivity from taking the first grid to the next grid and regulates the possibility of grid sets

that have been carved. To find out Drunkard Walk's ability for User Experience, it takes a survey based on the level of player satisfaction with a game that generates random content - one survey required by using Game User Experience Satisfaction Scales (GUESS).

2. VIDEO GAME DESIGN

Video Games are designed based on ideas and rules to create existing game mechanisms. All players want the game to be good. Good games are created because they are fun [9]. When designing a game, there are a few things that can be considered as follows [9].

1) Where to get the ideas?
2) What is our Target audiences?
3) How to design a game?
4) Is this game fun?
5) Does this story have a good narrative?

Ingame design, although there are different types and genres, basically, there are similarities elements in each game that is created. Those elements are divided into two, i.e., Formal Elements and Dramatic Elements [10].

Formal elements are elements that design the overall structure of the game [10]. There are eight Formal elements as follows.

1) Players, how player interacts.
2) Objectives, main goal from the game.
3) Procedures, instructions from the game.
4) Rules, common regulation that being set up in game.
5) Resources, items or something to help the players.
6) Conflict, the main problem of the narratives.
7) Boundaries, the limitations from the game.
8) Outcome, the result from the game.

Dramatic Element is an element that aims to attract the attention of players to create a dramatic game experience [10]. There are six Dramatic elements as follows.

1) Challenge, things that challenge the player.
2) Play, type of the game.
3) Premise, background story of the game.
4) Character, the player who become main character.
5) Story, whole narratives of the game.
6) World Building, game space from the game.

3. DRUNKARD WALK AND PATHFINDING

Drunkard Walk or also known as Random Walk, is one of the content creation techniques from Procedural Dungeon Generation that produces content based on a random process. Random Walk starts from taking the starting point of a grid and move continuously at random and fill the empty grid on the grid provided to produce a space maze the level of a game without the rest of the empty grid [12].

A * algorithm is one part of Pathfinding that is often used as Artificial Intelligence for game programming. In this algorithm, the enemy acts as a pathfinder to find players who act as targets. To achieve the target, this algorithm looks for potential paths that have the smallest size to create efficiency values when searching for targets [13].

4. NO ESCAPE GAME DESIGN

The game is called No Escape, which comes from the game conditions that are survival due to many roguelikes games have a permadeath system, and also, it implemented inside a random generated maze. The Formal Elements contained in the game can be described as follows:

1) Player: Single Player
2) Objectives: Defeat all enemies in one level of a game to be able to access to the next level.
3) Procedures
a) Select the start menu to start the game.
b) When the start option is selected, the player will enter the story cut scene part of a game.
c) Depending on how the game was generated, finish the objective, given which the player must defeat all the enemies in order to proceed to the next level.
d) There are three types of Bosses in this game; all three Bosses have different amounts of blood and have special powers in the form of awakening minions.
e) If the player's health reaches zero, then the player will go to the game over scene.
f) If the player finished the whole level, then the player would get the last cut scene and then back to the main menu.
g) When a player chooses a menu option, the player will directly enter the main menu scene, and the player will start the game at the initial level and return to the second procedure.
4) Rules
a) Players use the keyboard and mouse to play the game.
b) Players must defeat all enemies to be able to access the next level.
c) Players defeat the enemy by attacking the enemy until the enemy runs out of lives
5) Resources
a) Player Health: Show the current health of the player that affects movement speed and torch size. Start from 10.
b) Ammunition: Show the current ammunition of the player’s weapon. Start from 150.
c) Food: Show the current food amount of the player that affects player movement. Start from 20.
6) Conflict: Complete each level generated and stay alive with enemies who try to attack the player until the player's life reaches 0.
7) Boundaries: Players interact with the keyboard and mouse control. Game Space is created in the form of a dungeon, and players will always be in a dungeon.
8) Outcomes
Statistics: Show statistics of players who have played the game, such as the number of enemies killed.

The Dramatic Elements of the game can be described as follows:

1) Challenge: Destroy all enemies in a level game.
2) Play: Rule-Based Play. Players have rules and instructions when playing the game.
3) Character: Survivor armed with a weapon.
4) Premise: A survivor who survived the post-apocalypse who claimed the lives of his three younger siblings. Survivor wants to avenge the loss of his sister by defeating all zombies.
5) Story: One day, in an area that has been dominated by zombies, there is the only survivor who survived from an apocalypse. Armed with a gun and a picture of the survivor's memories with his sister, he wants to avenge the deaths of his younger siblings. But to avenge him, he must face the enemies that exist, such as zombies, bandits who syndicate as the mastermind of the occurrence of an apocalypse, and also husk, namely zombies that have evolved.
6) World Building: This game has three different types of settings to give players a different atmosphere.

a) Desert Cave (Level 1 to Level 5)
b) Hidden Tribes (Level 6 to Level 10)
c) Cursed Laboratory (Level 11 to Level 15)

5. RESULTS AND DISCUSSION

Based on the implementation that was done, the game had been created, and the following screenshots were directly taken from the game.

Figure 1: Main Menu Display

Figure 1 shows the main menu of the game that captured in-game. Here the player can access how to play, statistics, settings, and play the game. There is also an exit button to quit from the game but show the credits first, which could be seen in Figure 2.

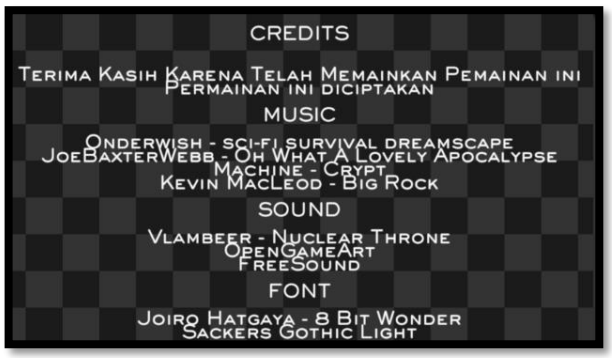

Figure 2: Credits Display

To start, the game player should click the start button, which redirects with the initial cut scene that was displayed in Figure 3. Each cut scene would be appeared before the boss stage and after the boss stage. After that,the player will have to click next in order to play the game.

Figure 3: Cut Scene Display

After the player clicks next from the cut Scene display, the player would be transferred into the gameplay scene in which dominance by darkness scene and it only provides bright circle light as a torch for the player. The cut scene display would be transferred into a gameplay scene for a few seconds that was displayed in Figure 4.

Figure 4: Gameplay Scene

Figure 4 shows the gameplay scene in which the player should deal with all enemies in that scene in order to proceed with the next level. It has several item displays such as health, ammo, and also food. This scene is generated using the Drunkard Walk Algorithm for creating the room of combined corridor that became maze that connected each other.

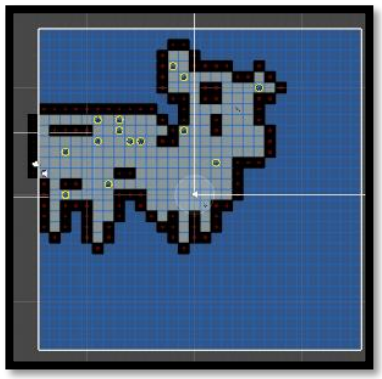

Figure 5: Generated Dungeon

Figure 5 shows the result of the scene that is generated by the Drunkard Walk. It also generated random placement for the enemies, items, and also player position in order to bring the randomness gameplay. The player should defeat all of the enemies in order to proceed to the next level.

Figure 6: Game Over Screen

Figure 6 shows the condition if the player has run out of lives, it would show the game over screen that have quotes from Israelmore Ayivor. After that, the player has two options, which both of them would reset the progress of the game. One of them was a retry button to start from the first level, and another one was a menu button to proceed into the main menu scene.

The next step after design and implementations is to conduct testing of the application. The total of the minimum sample needed in order to do research is 30 [14]. The evaluation that is used for the player satisfaction scale was GUESS. GUESS is a method for measuring the validation of a game based on the nature and characteristics of a game. This method has 9 subscales consisting of 55 types of questions based on existing subscales which are: Usability/ playability, Narratives, Play engrossment, Enjoyment, Creative Freedom, Audio aesthetics, Personal gratification, Social connectivity, and Visual aesthetics [15]. GUESS is based on a seven-point Likert scale with a respond anchor from 1 = Strongly Disagree to 7 = Strongly Agree [15].

The sample in this test is the players who play the game and fill out the GUESS questionnaire that aims to test the level of player satisfaction with the game that been played.

The questionnaire had 51 question that used a 7-point Likert Scale: 1 = strongly disagree/very bad; 2 = disagree/bad; 3 = somewhat disagree/somewhat bad; 4 = neutral; 5 = somewhat agree/somewhat good; 6 = agree/good; 7 = strongly agree/very good. To measure the overall GUESS value, the average or mean value will be taken from the combined average score of the answers to the questionnaire questions for each GUESS subscales.

According to the 7-point Likert scale used in the questionnaire, overall GUESS subscales can be generated in the following Table 1.

Table 1: Overall GUESS Scale

Interval Scale	Overall GUESS
0-13	Very Bad
14-27	Bad
28-41	Somewhat Bad
42-55	Neutral
56-69	Somewhat Good
70-83	Good
84-100	Very Good

The questions are then categorized according to the nine subscales of GUESS. But for this research, because the game is a single-player, then one factor in the form of Social Activity is not made. So that the number of questions given to players is 51 questions and eight subscales, as follows.

1. Usability : Q1, Q9, Q17, Q25, Q32, Q38, Q43, Q47, Q49, Q50, Q51
2. Narratives : Q2, Q10, Q18, Q26, Q33, Q39, Q44
3. Play Engrossment : Q3, Q11, Q19, Q27, Q34, Q40, Q45, Q48
4. Enjoyment : Q4, Q12, Q20, Q28, Q35
5. Creative Freedom : Q5, Q13, Q21, Q29, Q36, Q41, Q46
6. Audio Aesthetic : Q6, Q14, Q22, Q30
7. Personal Gratification : Q7, Q15, Q23, Q31, Q37, Q42
8. Visual Aesthetic : Q8, Q16, Q24

Based on the mean from the eight GUESS subscales, the overall GUESS value can be calculated by taking the mean that been estimated into percentages of the eight subscales, as can be seen in Table 2.

Table 2: Questionnaire Results

Subscales	Average Score
Usability/Playability	75% (Agree)
Narratives	63% (Somewhat Agree)
Play Engrossment	63% (Somewhat Agree)
Enjoyment	74% (Agree)
Creative Freedom	69% (Somewhat Agree)
Audio Aesthetic	70% (Agree)
Personal Gratification	76% (Agree)
Visual Aesthetic	76% (Agree)
Average Scale	71% (Agree)

This result shows the scores of each subscale and the final results; the game mostly received a 'Good or Agree' response from the samples with the exception of narratives, play engrossment, and creative freedom, which scores fairly good. The game satisfaction scale scores 71%, which means that the game is Good.

6. CONCLUSION

Based on the research that had been conducted to design and development a 2D top-down shooting roguelike game with drunkard walk algorithm, it can be concluded that:

- The game was successfully designed and develop using Drunkard Walk Algorithm on a computer platform. The game was built by providing 15 different game levels, where three of them are boss levels that separate game levels to provide a different game atmosphere.
- The Drunkard Walk algorithm was successfully implemented in the game. This algorithm starts from making room based on the movement of the walker list and then is given a random placement of items, enemies, and spawn players. This game was built with Unity Engine 2018 and only has one type of game mode with a different game atmosphere from the result of the room being generated.
- Based on the results of the questionnaire from 30 different respondents,it can be concluded that the game that uses the Drunkard Walk algorithm has a good level of satisfaction with a total average value of 71% with the majority of the factors of the game getting a good level of satisfaction except for Narrative factors, Play Engrossment, and Creative Freedom which get a fairly good value.

As for future directions, the game can be further developed to include some hand or movement exercises and promote learning materials, so that it can help the players as can be seen in the works of Sudarmilah et al. [16], Tazouti et al. [17], and Mazlan et al. [18].

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