Design and development of 2D game 'Adventurous spirit'

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Abstract. In the present world, 2D games continue to be a significant component of the gaming industry. This article aims to discuss the process of designing and developing the 2D game "Adventurous spirit," while analyzing its essential elements and Unreal Engine technology. We will introduce the principles of game design, the intentions and purposes behind designing the game, the development process, as well as the tools and techniques employed. This 2D game is developed using the currently popular Unreal Engine, showcasing the final game outcome. Through the presentation in this report, readers will gain insights into the fundamental knowledge and practical experiences of 2D game design and development, along with some technical aspects and operations related to Unreal Engine development. Additionally, the genre of this game is a 2D side-scrolling game, where players enhance character abilities and levels through defeating monsters, and they can explore by selecting different characters.

Keywords: Adventurous Spirit, Unreal Engine, 2D Game, Purpose.

1. Introduction

2D games refer to games that utilize two-dimensional graphics (flat images) to present visuals and scenes. 2D games have always been a crucial component of the gaming industry. Through flat graphics and simple animation effects, they provide players with rich entertainment experiences. With the widespread use of computers and mobile devices, 2D games have found broad application on various platforms, attracting player engagement. The design and development of 2D games constitute a challenging process. Exploring the background of 2D games holds significant importance as it encompasses various aspects such as game aesthetics, user experience, and game performance optimization. During the design phase, the development team must contemplate how to create an interesting, creative, and captivating game world. In the development phase, a range of techniques and tools is needed to transform the game concept into reality, crafting a stable, smooth, and interactive gaming experience. The background of a 2D game is a vital element that can influence the game's aesthetics and visual effects. By studying how to design engaging, fitting, and harmonious 2D game backgrounds that align with the game's style and narrative, the game's artistic quality and challenge can be elevated. Moreover, the background can directly interact with players.

Research into the design and development of 2D games can potentially lead to game innovation through aspects like artistic design, storyline construction, and level design, creating a unique gaming experience and style. Due to their straightforward controls and relatively low hardware requirements, 2D games are suitable for various gaming platforms and devices, especially mobile devices like smartphones and tablets. Excelling in 2D design and development serves as an entry-level endeavor in

game development, aiding beginners in understanding the fundamental principles and techniques of game development.

This article, through the depiction of the game "Adventurous spirit," provides readers with an introduction to game engines, principles and methods of game design, development processes, and game testing. It presents readers with a novel and practical approach to game development. By narrating the production process of this game, readers gain a deeper impression of Unreal Engine, encouraging them to use Unreal Engine to independently develop and research a new game that aligns with their own objectives.

2. Game Design and Principles

This section aims to explain to the readers the game's design objectives, gameplay, and some preparatory work. Although many books mainly focus on the use of fantasy engines for good 3D games, the 2D game market is the easiest path for independent developers to develop, as 2D game production costs are generally low and easier to produce [1].

2.1. Game Design Objectives

Game Title: "Adventurous spirit"

Design Concept:
- Gameplay Flow: In the game, players need to select and control a character, continuously attack enemies, eliminate them to protect themselves, and enhance their character's level.
- Character Abilities: Characters can use weapons to attack enemies, gain experience points, and level up.
- Level Design: The level offers two different types of enemies with varying health and damage values. Players need to adapt flexibly by utilizing terrain, performing jumping actions, and executing attacks.

Preparation of Art Assets:
- Characters and Enemies: Utilizing existing resources for players, enemies, and scenes.
- User Interface: The game starts with a scene where players select their character. After selection, players need to control their character to defeat enemies and level up.
- Animation and Effects: Animation designs were implemented for interactions between characters and enemies. Game effects were added, including phased disappearance of defeated enemies and updated UI feedback for character damage.

Final Outcome: Through design, art asset preparation, and programming development, the 2D side-scrolling game "Adventurous spirit" was ultimately completed. The game features a leveling system, challenging players with diverse enemies. The exquisite art design and exciting sound effects contribute to an enjoyable gaming experience for players.

2.2. Basic Gameplay and Preparatory Work

For media form variables, there are many variables that can be changed within the game, such as the type of game controller and the perception of object motion within the game. We can adjust motion perception by allowing players to watch the game in 2D or 3D [2]. The primary controls for this game are as follows: Press 'a' to move left, 's' to move down, 'w' to move up, 'd' to move right, 'j' to attack, and 'space' to jump. The specific keyboard controls are illustrated in figure 1.
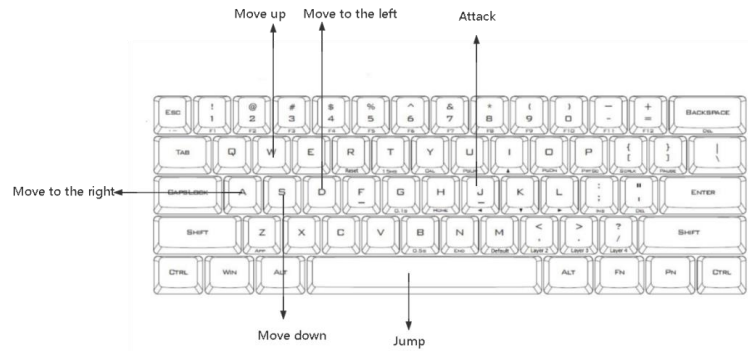
Figure 1. Keyboard Controls.

The game is set in a 2D environment, featuring platforms, ropes, background illustrations, and monsters. As shown in the figure 2.

Figure 2. Scene.

The scene is built on the backdrop of an adventure island, with the purpose of enabling players to enhance themselves by defeating enemies. The overall scene construction employs green and earthy yellow colors. The strong contrast in colors creates a visual impact on players.

At the beginning of the game, the system provides players with two characters to choose from, allowing players to select their preferred character based on their preferences. Playing games can relax players and make them feel mentally happy. If you have more changes, such as item maps or enemies, players will gain a more influential effect on their previous emotions [3]. Players can choose different characters to meet their needs. As shown in the figure 3.
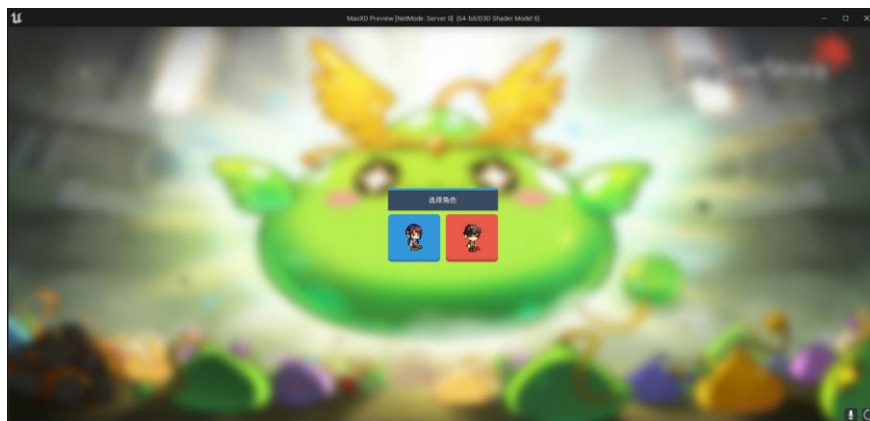
Figure 3. Character Selection.

Within this character, we analyze the character's skeleton and determine their attack range. The rectangular area in front of the character represents the player's attack range. Players can inflict damage on monsters within this area (Figure 4).


Figure 4. Character Skeleton.

Whether in 3D or 2D games, good sound effects often have the ability to spark player interest. In the development of this game, a variety of sound effects have been gradually added to enhance the gameplay. Different actions and stages trigger distinct sound effects within the scene. These sound effects prevent players from feeling bored during gameplay and contribute to an engaging and enjoyable player experience (Figure 5).

Figure 5. Sound Effect Files.

The game has introduced a monster system, incorporating two types of monsters within the game scene: the snail and the pig. These monsters possess attributes such as attack damage, health points, and experience points (Figure 6). Upon collision with the player, a series of blueprint logics are triggered, involving actions such as UI changes and more, although not limited to them. In addition, automatic pathfinding and chasing player AI algorithms have been added to these two monsters. When the monster is attacked, they will chase the character based on its position. Between accuracy and speed, prototype detection is specialized, but it is easy to find a balance and the target algorithm can enable monsters to track the protagonist [4].
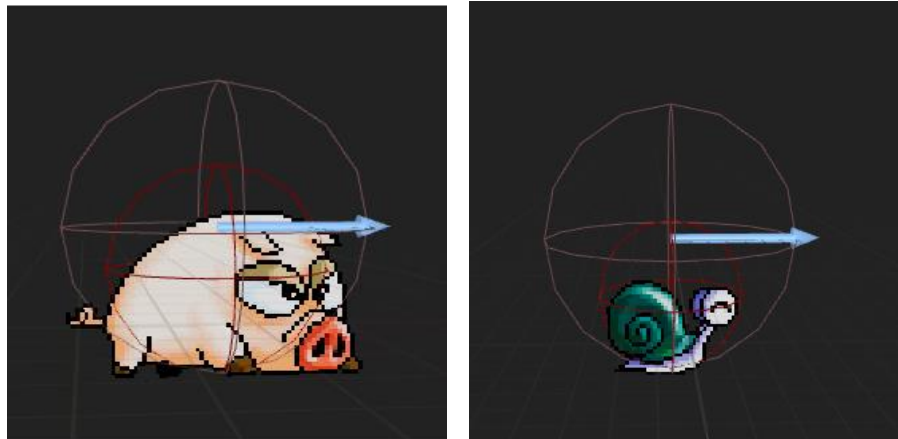
Figure 6. Pig Skeleton & Snail Skeleton.

2.3. Level Design

Well-designed levels are a key factor in the success of a 2D game. A diverse range of monster types and quantities adds a considerable level of challenge to the game. However, this challenge is within a reasonable range, allowing players to overcome it through their understanding of the game and their own actions. This leads to players feeling a sense of satisfaction and accomplishment during gameplay. In this game, our level design involves a player spawn point on the first level. In addition to the player, the first level contains several snails and pigs. Notably, on the left side of the map, there is a unique resource rope that players can use to climb to the second level. The difficulty increases on the second level, populated entirely by pig monsters. Players have the choice to play on the first level or climb to the second level based on their preferences. Interaction design plays a crucial role in the entire game because it serves as the language character for both the player and the game [4].When a character is attacked, there will be feedback of injury, and at the same time, there will also be feedback when the character is attacked, which is what we call a feedback system.

3. Development Process

3.1. Game Concept and Planning

In the initial stages of game development, it's essential to clarify the game's concept and planning. This involves determining the game's genre, target audience, game mechanics, and level design. In this game, the genre is a 2D side-scrolling game, targeted at two groups: those who enjoy 2D side-scrolling games and those interested in games Adventurous spirit. The game mechanics allow players to choose different characters, freely move, jump, and attack within levels. The game map consists of various areas and scenes. Characters level up and gain experience by defeating enemies, thereby enhancing their attributes and abilities.

3.2. Programming and Development

The primary development tool for this game is the Unreal Engine, developed by Epic Games.One of the most mainstream development engines in recent years is the Unreal Engine. The lighting rendering function and blueprint programming system are both important functions of the virtual engine. So, for the better development of Manchu games and Yingge users, the Unreal Engine is our best choice [5]. It's a game engine known for creating high-quality 3D games, virtual reality (VR), augmented reality (AR), and real-time animations. It's widely used in various domains such as game development, film and TV production, virtual tours, and training simulations. The game utilizes Blueprint scripting. This game engine provides designers with a variety of tools necessary for game development, with the goal of enabling developers to rapidly transition from zero experience to entry-level in game development. In simple terms, developers use the game engine as an intermediary to facilitate game development.

Game input logic is set directly within the Unreal Engine's settings. Within the Input settings of the Unreal Engine, player movement and attack settings are defined. These inputs are then bound or defined within the character's Blueprint.

3.3. Advantages of Unreal Engine

a)   Powerful Graphics Rendering: Unreal Engine boasts impressive graphics rendering quality, supporting high-quality lighting effects, detailed materials, and special effects that make game scenes more realistic.

b)   Visual Editing: Unreal Engine offers intuitive and user-friendly visual editing tools, allowing developers to preview and adjust scenes, characters, effects, etc., in real-time within the editor. This significantly enhances development efficiency.

c)   Cross-Platform Support: Unreal Engine supports various platforms, including PC, console games, mobile devices, VR/AR devices, etc., enabling developers to release games and content across multiple platforms.

d)   Blueprint System: Unreal Engine's Blueprint system is a visual scripting language that enables developers to create game logic and interactive behaviors by dragging and linking nodes, eliminating the need to write code.

e)   Community and Resources: Unreal Engine has a vast developer community, providing abundant tutorials, resources, plugins, and templates, facilitating the rapid development of high-quality games and content.

f)   Customizability: Unreal Engine allows developers to customize and extend the engine to meet the needs of specific projects, achieving advanced effects and functionalities.

g)   Real-Time Preview: Unreal Engine is renowned for its real-time rendering capability, allowing developers to instantly see the results of modifications within the editor, significantly speeding up development iteration.

In summary, Unreal Engine is a powerful and flexible game engine known for its exceptional graphics rendering and real-time preview capabilities. It's suitable for developing various types of games and virtual reality content. Its user-friendliness, customizability, and extensive community support make it a preferred choice for many developers and game production companies.

4. Testing and Optimization

In the initial and intermediate stages of development, the main testing involves the development and coding of the game. In the later stages of the game's development, as the core game mechanics are mostly completed, user feedback and suggestions are collected from those who have played the game. Additionally, bugs in the game are addressed, and optimization issues are tackled. We can use GPU acceleration to solve complex information problems, which is fast and efficient [6]. Orderly operation requires specialized hardware and cannot be lower than the minimum hardware requirements. The new generation of games requires more complex and higher requirements. A decisive issue to consider when planning to release software is hardware requirements [7].

The testing environment is depicted in the Table 1.

Table 1. PC Side Operation Recuperation.

CPU	3.2GHz
Operator System	Windows 11 64bit
Processor	AMD Ryzen 7 5800H with Radeon Graphics
Memory	32768MB RAM

Under this configuration, the visual display is shown in the following figure 7.

Figure 7. Game Interface.

The use of abstract games for entertainment is the effort of Leibniz and Weikman, and secondly, in order to facilitate operational planning and decision-making, it is necessary to enhance the strategic intuition of the game [8]. The game offers various aspects for players to evaluate and invites them to provide ratings. A significant feature of games and serious computer games that cannot be ignored is feedback, as learners can obtain useful information through them [9]. The table 2 shows the ratings given by the players during testing.

Table 2. Rating.

Player	Player1	Player2	Player3	Player4
Play ability	90	93	91	87
Sound Effect	98	86	99	94
Impact Sensation	95	92	94	91
Sense of Achievement	90	91	91	93

Based on the experiences of the four players as indicated in Table 2, the game has strengths and some weaknesses. The strengths include the game's sound effects and impact sensation, which received relatively high recognition. However, there are shortcomings in terms of playability and sense of achievement. Subsequent work should focus on improving these aspects, such as introducing new gameplay modes like PvE and PvP, enhancing the game's item system, and addressing the sense of achievement by implementing an achievement system that allows players to earn achievements and enhance their sense of accomplishment. Perhaps participants are more affected by 3D games and the results of 2D games, not the results of the classroom [10].

5. Conclusion

The design and development of 2D games constitute a comprehensive blend of art and technology. This paper has covered various aspects of 2D games, analyzing and discussing them from the perspectives of game design, artistic style, and technical implementation.

Firstly, 2D games, as one of the classic forms in the gaming industry, possess unique charm and a broad audience base. Their clear visuals and simple gameplay contribute to their popularity across different age groups. Secondly, game design stands as a pivotal factor for the success of 2D games. Innovative gameplay mechanics, engaging narratives, balanced difficulty levels, and reward systems enhance player engagement and retention. Moreover, by prioritizing user experience with intuitive controls, smooth game progression, and effective tutorials, player satisfaction can be significantly elevated.

Additionally, artistic style plays a crucial role in 2D games. Different artistic styles provide games with distinct visual characteristics, increasing their overall appeal. Detailed character design, rich background details, and exquisite visual effects enhance player immersion.

From a technical standpoint, selecting the appropriate engine and tools is essential for 2D games. In this context, our primary development tool is the Unreal Engine developed by Epic Games. Developers can efficiently employ this engine to expedite the development process and reduce time-to-market. Additionally, technical optimization and performance testing are critical steps to ensure smooth gameplay, particularly on resource-constrained platforms like mobile devices.

In summary, 2D games hold an irreplaceable position within the gaming industry. Their characteristics and advantages in game design, artistic representation, and technical implementation continue to captivate the attention of both players and developers. However, with ongoing technological advancements and shifting player demands, 2D games must continue to innovate and evolve to maintain their competitive edge in the broader gaming market.

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