Contents

1 Introduction and Project Ideas

1.1 Initial Ideas

1.1.1 Li's Ideas

My idea was to make a role-playing real-time combat type of game. Set in a fictional magical world, the main character is a ghost. He was awakened from his endless sleep and found that he had become a ghost. He was very surprised and determined to find out the truth of the matter. The player needs to control the protagonist in the tomb to move forward, killing the skeleton soldiers encountered on the road, constantly moving towards the tomb center. Players explore the tomb like a treasure cave, during the exploration, players can consult ancient books to get clues to pick up, pick up magic scrolls to learn magic skills, equip weapons to improve combat effectiveness. After the player has explored all the caves, all the clues can be pieced together to tell the true cause of the hero's death, and the god will give the hero a new life after the player has gone through all the difficulties.

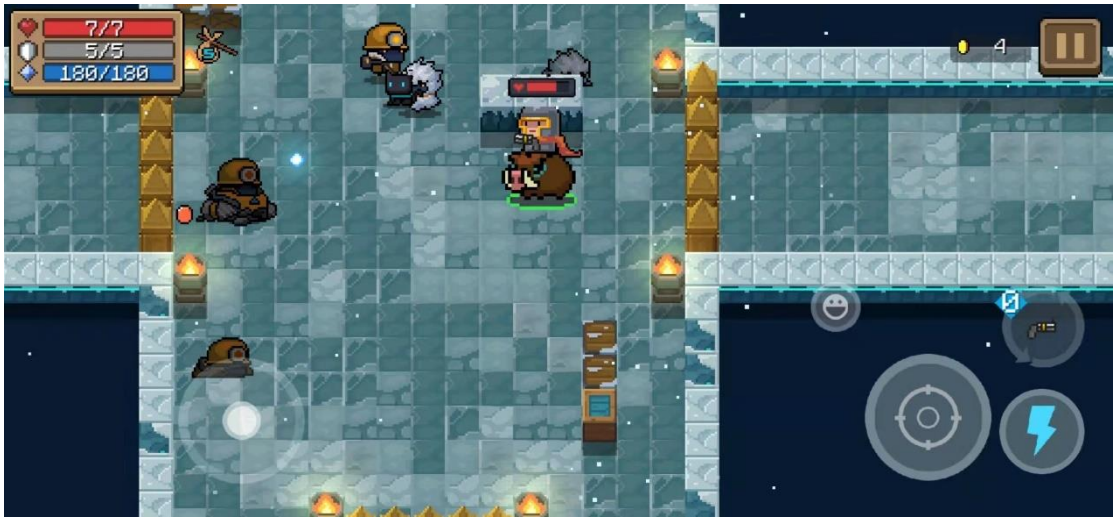


Figure 1.1 Vigorous knight

1.1.2 Liu's Ideas

My idea is a puzzle-seeking role-playing game. In the game, players can control the role to interact with objects or NPCs in the scene and game with the enemy. The background is set in a villa, where the player's character was trapped inside, and the player had to figure out how to escape the villa and avoid being killed by monsters. In the game, the player will have multiple controllable characters. When the player controls a character, other characters will independently carry out small-scale actions and may die due to encountering monsters. Some puzzles in the game require two or more characters to solve. The monster can roam in the villa and kill the characters around it. Players get different

outcomes based on their in-game performance. After the discussion, we decided that such games would be more domestic, so I came up with the idea of a roguelike full of randomness, where the player's experience is different every time they play.
We can learn from the Forbidden Forest of “Harry Potter's Enchanted Awakening”.

1.1.3 Wang’s Ideas

It is an open world with some terrific elements in 3-dimensional. The player acts as a historical hero who forgets who he is to navigate and explore the world that including a fight with enemies and cracking the collected clues from the world. The hero is killed by others and he will get the truth of his death which is completely different from what is written in historical records. The design of enemies would reflect the theme of the game, for example, skeletons and zombies for a horror-based game. motivation for the player will come in the form of on-screen prompts or trophies, awarded when the player meets certain conditions and a story that slowly reveals what’s the hero’s identity. The game has a timer and the player shall seek the next clue before the time runs out. The game is connected with Chinese culture and requires some ability of thinking.

1.1.4 Yao’s Ideas

My initial idea was a tomb adventure 3-decisional game just like “Tomb Raider”. The theme is cultural relics protection against other different forces which is based on my favorite novel “Tomb Notes” and promotes the Chinese extensive and profound culture. The tomb is a gloomy dungeon and there are some monster and player who act as an archaeologist and is apt to have some abilities to explore the tomb. The player could conquer these monsters or hide away from them; he is aiming to decode some kinds of machine-operated and ultimately take away the worthy heritage and get away from the attack of other enemies. During the adventure in the tomb, a player could attain an unexceptional historic truth that has some relation with him. The tomb contains some parts of scenes and in every place, a player should gather clues and cope with the puzzle game to get into other places. Other enemies are also deal with these puzzle games in the tomb and players could even me and set them and fight with them with wits and courage to stop them finally get the goods.

1.1.5 Yu’s Ideas

The primary idea of our game is based on the evolutionary mechanism. The player can manipulate a slime, which can strengthen itself through eating other living creatures and obtaining their specific skills or power. The core of the game mechanism is players can enhance their slime through exploring the world to gain more resources, fighting with other living creatures, and gaining the power to evolve. Besides, the evolution is not just spontaneous, some beasts will chase the slime and the weak slime will be eliminated. The whole background of the game is a jungle with massive natural resources while the model of character is low-poly style.

1.2 Final Choice

We finally try to design an emersion game in which the player acts as a resurgent human who forgets who he is and could fight with enemies in the virtual scene to seek clues about his identity. The setting is 3 decisional but the perspective is from top-down, the scenes and enemies are random and the level is limitless. Players can explore the un-acquired world, collect varied skills, defeat numerous small monsters and big bosses. The truth is merely a given award to the player. The character can move, jump, run, rest who has the status of being alive and dead with a health bar, the status of being able to realize skills with magic bar. And the character also has some additional operations like buying skills, medicine for blood, and magic return. The character can interact with game characters and scenes such as getting some information and communicating with a non-player character. The player will face a limitless Roguelike level which generates random mini-maps and random buffs, which can either make the player stronger or weaker so the player's goal is to survive longer and get more details about his identity.

2 Project Design

2.1 Desired Game Features, Story, and Gameplay

2.1.1 Story

What's the truth of history? History is written by later generations. King Zhou of Shang, what's his history and the truth of the perish of Shang Dynasty? Maybe the text record is pure fake.

The player takes the role of King Zhou to fight with former enemies to know the minute details about the life of the empire of the Shang Dynasty. The blench gives birth to the empire in a virtual world with the truth of something about him. You should act like him to conquer limitless enemies to get hints.

The gods have dominated humans for thousands of years and enslaved humans exploiting minerals for them. Mankind rage about it but dare not to resist the powerful force of gods. The King Zhou of Shang feels the rough lives of ordinary workers when he traveled around the country when he is merely a youngster and he endeavor to refuse to obey commands of the gods because of it. Therefore, the gods give hands to the kingdom of Qi for the King of Qi in compliance and The King Wu of Zhou resorts to the gods. The King of Zhou came across Su Daji who comes from gods and they fell in love with each other. Su Daji teaches humans the advanced method to make wine, reserve meat, and forge bronze wares. However, the laws in gods permit the love between God and humankind and help The King Wu of Zhou with the slogan take back the sinner of gods. The King of Zhou died at the end under the sieges of enemies and betrayed friends while Su Daji jumped down the Star

Floor in the fire.

2.1.2 Theme

Most gamers are usually busy, they prefer to get happy in the game quickly. Only a few are hardcore gamers. Therefore, our game mode with simple playing method but a stimulating process. Players can grow rapidly in a short time, and this growth is unpredictable. Players can be in this unpredictable growth and get full of happiness. In the game, we also designed a complete storyline. Some interesting clues are left in the game for players to explore. It will make players get different hidden endings.

The story takes place in the Shang Dynasty and the protagonist is the king. Our game will guide players to know different King Zhou from another angle. In many people's eyes, King Zhou is a cruel monarch. But he was a valiant and intelligent man. History is written by the winners. We want to change the stereotype about King Zhou by our game. To make the game more interesting, we added some fantasy content, such as god in religion and the influence of god on people.

Here we refer to the plot of ‘Fengshen list’, ‘Wu Geng Ji’ and historical facts, and finally, make our story.

2.1.3 Gameplay

There are three major scenarios of the game, the action-choosing scene, the action scene, and the rewarding scene. The “big map” figure shows the abstraction of an action-choosing scene, and the player will control the movement of the character to choose one of the three options which come from fight(dangerous), fight(normal), rest, shop, and explore these five options randomly to continue the next operation. The second stage depends on what the player has chosen on the first stage. In the explore mode, players can get skills to improve themselves or get money. In the shop, players can purchase some special skills, medicine, or shield. In the rest mode, players can manipulate the character to recover the health value or magic value. The “fighting” figure shows the mechanism of battle. In the normal fighting mode, players will confront a common beast and get an ordinary reward. In the dangerous fighting mode, players have to beat the fiercer beast while they can acquire more abundant rewards as well. After players beat the beast, there is three random attribute bonus such as improving the attack power, strengthening the shield as the “reward” figure shows, players can choose one of them and the bonus will continue in the following game until the character died.

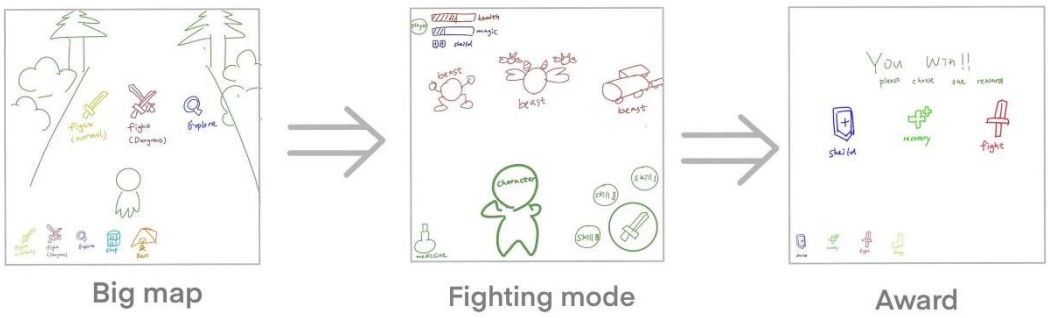
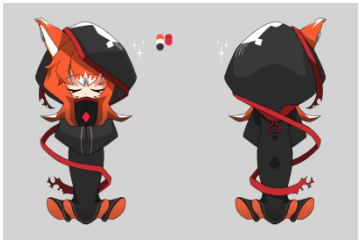


Figure 2.1 The abstraction of gameplay
(These pictures are designed independently by our team.)

2.1.4 Character

The characters and plot of the game will revolve around finding the memories of a teenager. Players will face human soldiers, mythological soldiers, soldier commanders, and legendary gods. Enemies vary in their abilities and require changing of strategy to defeat them and gain memory clues. Also, players can get extra help from mystery merchants. Many factors affect the player's experience.

Table 2.1 Characters
(These pictures are designed independently by our team.)

Name	Description	Abilities	Concept-Image
The young Zhou (The player)	A teenager wakes up in a strange place with no memory. He follows the mysterious guidance and begins to move forward to find the truth.	Able to attack enemies and learn skills. Able to get stronger and gain identity clues by moving forward.	
Mysterious businessman	A mysterious person who will not hurt the teenager. Occasionally meet in the journey.	Show up somewhere on the road, randomly selling skills, clues, or beneficial	

	She is always willing to offer some help.	potions. Most of the time goods are on sale.	
Ziya (The elite of the enemy)	A famous consigliere whose presence inspires enemy soldiers. He is unfathomable and always in the back of the field but rarely out.	All soldiers will be enhanced. When more than half of the soldiers have died, the remains will be improved again. Voluntarily leave the battlefield when all soldiers die. The player cannot deal damage to him.	
Golden armor (The leader of common enemies)	Wearing very bright armor of pure gold. Both physical strength and spiritual strength are excellent	Use both physical and psychic attacks. the shield generates a shield at the start and will not take damage until the shield is broken	
Immortal·yin (Common enemy)	Wearing normal mithril armor and a blue uniform that enhances psychic power. Psychic strength is excellent.	Using a psychic attack, the shield resists some physical damage	
Immortal·yang (Common enemy)	Wearing plain mithril armor. The physical strength is excellent.	Using physical attacks, the shield can resist some physical damage	

2.1.5 Game Features

Any popular game usually has its unique game characteristics, which is often the place that attracts players the most. When designing the game, we fully considered this point and gave the game a lot of ingenuity. Now we choose the four most important points to explain.

Randomness

Randomness is the core and essential feature of the whole game, and the core gameplay of the game. The player will be randomly presented with three options at the start of the game, each of which will appear randomly between battle, explore, rest, and mystery merchant. The number of monsters you encounter in the game is also random. The amount of gold the player rewards after completing the game is also random. In the level, there is a certain probability that the player will encounter a mysterious merchant, and the goods that the mysterious merchant will be able to exchange each time are uncertain. The existence of random algorithms changes many aspects of the game from a certain event to an uncertain event, which will lead to two results. One is that the player's expectations are greater than the results. The other is when the player's expectations are less than the outcome. The randomness of these two outcomes triggers dopamine in the player, making them more focused on the process and outcome of the game.

Environmental Storytelling

We want to create some kind of bond between the player and the game world, and this requires that our story and environment choices within the game world be highly matched. At the same time, we need to have a clear understanding of the player's mental state, which requires us to guide the player through the course of the game so that the player's mental state matches the environment. The advantage of this is that you don't have to tell the story to the player through lengthy text or audio cues, for example, when you enter a scene, the picture is ruined, the music is bleak, and the words "Old King City" give the player a sense of what happened in the past. This engages the player's imagination and makes them more thoughtful and fun to play the game.

Psychological Factor

We used a lot of psychological conclusions when designing this game. For example, to avoid the repeated design of indirect rewards, the " Skinner box" experiment is used, dopamine rewards used in feedback, and so on. We use these psychological research results to increase the attractiveness of our games. The core principle of game design is fun, and if you want a game to be fun, you have to give up many conventional boring designs. A game that incorporates psychological factors will give players more affirmation and recognition from the game, and players will naturally love this game during the game.

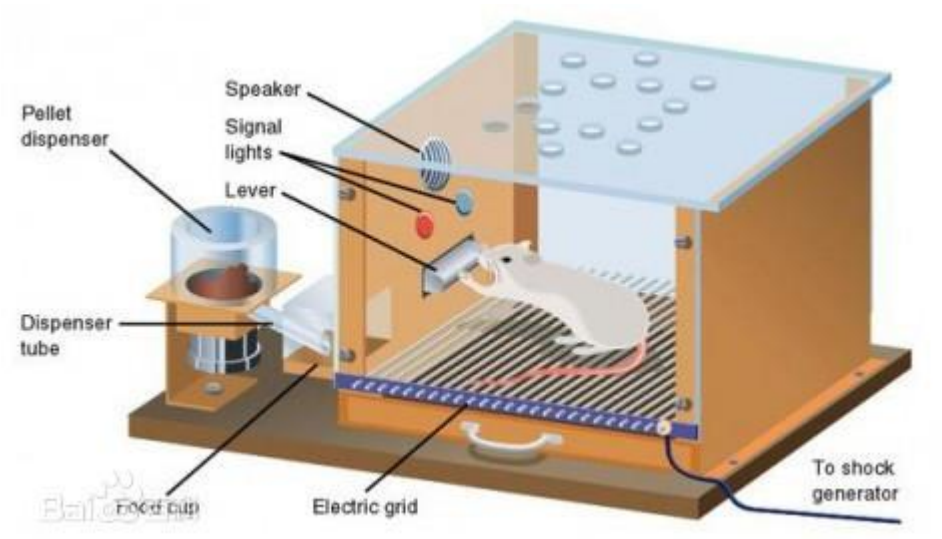


Figure 2.2 Skinner box

Automatic Adjustment

The essence of the game is to enrich people's spiritual life and relieve people from the heavy pressure of life. This requires us to design games without letting players choose to abandon the game because of the difficulty of the game. Such games are very failures. Everyone has different game abilities because of their gender, age, and occupation. We will design an algorithm to study the current player's game ability value. The game ability value is a value that directly reflects the game player's game ability. Our game difficulty will also be adjusted according to the player's game ability value. Of course, these are achieved under the premise of not affecting the core gameplay of the game. Adjusting the difficulty of the game does not change the randomness, but for players with weak game ability, the number of random mobs will be reduced each time. As the player's game ability improves, we will gradually increase the difficulty of the game.

2.2 Game Design Principle

No matter what kind of game you are designing, the core principle that you must follow is fun. We divide the game principle into six parts. Interactivity-let the player become the main body of the game. Diversity of gameplay-liberate creativity from a single-mode. Avoid repetition-the most effective way to not get bored. The fairness of the gameplay-guarantee the game is fair to the players. Feedback-the dopamine effect of the game. The goals pursued and the achieved-the game is not a punishment.

2.2.1 Interactivity

Environmental Storytelling

The setting of a story conveys important concepts and information to the audience. This is why games should always treat their Settings like the living environment in which we play. The more detailed and interesting the world, the more the player will feel the desire to explore it. Our game will express the culture of a game world in terms of setting (room decoration, building graffiti, etc.), NPC talk (complementing the story details of the world), sound + text + animation, and let the environment, setting, dialogue, etc. take on the responsibility of telling the story. When game players touch these virtual things in the game world, they can also gain a sense of belonging, thus building a good bridge between game users and the game.

Multi-level Interactivity

We are committed to creating multi-level and multi-dimensional communication with users. The first is our control over the movement of the game's characters. We use the keyboard "W", "A", "S", "D" to control the character's forward and backward left movement. The reason we designed it this way is to embrace diversity. We've also added the ability for character clicks to trigger voice dialogues, which is designed to establish a lasting bond between the character and the player and foster a sense of companionship. We also added an automated voice system for the characters to act as assistants. When the player passes a level or kills a boss, there is a voice praising him or her, a voice encouraging him or her to fail, a voice reminding him or her that he or she is online for too long, and so on.

2.2.2 Diversity of Gameplay

Single gameplay cannot meet the needs of current game players. Players are a cognitive process of self-exploration during the game. Therefore, we need to design multiple gameplays for a game.

1) In the game character design, we have designed a variety of character attributes. Such as health, attack power, defense power, attack speed, etc. Players can allocate them according to their needs every time they get attribute bonuses. If some players love strong attack power and their skills are good enough to avoid most of the damage, then he can allocate all his attribute points to increase attack power and become an assassin player. If the player's skills are not so good and he is accustomed to attacking while standing still, he can assign most of his attribute points to his health and become a meat shield tank. In short, according to everyone's habits, players can always find gameplay that suits them.
2) Similarly, we also have a skill system. If the player chooses a mage that can attack from a distance, it is recommended that he choose the continuous damage of fire

attribute skills with water attribute defense. If it is a melee swordsman, it is recommended that he choose skills that increase movement speed. Different collocations can form different genres, and as long as players carefully explore, they can unlock a variety of new gameplay.

2.2.3 Avoid Repetition

Indirect Rewards

Behaviorism was conceived as a great way to engage players, and we used it in our design. Instead of giving the player a gold coin (variable reward vs fixed reward) when they win, they can be given a chance to earn a certain amount of gold, for example by telling the player to settle with a bonus block in the next level and double the reward. Or reward the player for interacting with the system (the number of times a feature can be performed), such as passing 10 levels in a row, instead of gold coins, the reward becomes a key clue to unlock a game. Using these methods will make the game less boring than it seems, and the player will actively engage with the game, effectively avoiding repetition.

Randomness

Randomness will be the core gameplay of the entire game. Players will get a certain attribute bonus after passing the level, and the attribute bonus to be obtained is unknowable. We use a random algorithm to randomly increase the attributes of each reward within a certain range, such as increasing 10 points of health, 2 points of attack power, and 2 points of defense. Players have a certain chance to encounter mysterious merchants during the battle or exploration process of the game, and they can buy powerful skill books from the mysterious store. The merchandise sold in the store is also deployed by a random algorithm, and what you see is different every time. During the battle, the number and types of creeps appearing are also not fixed. If you are lucky, you may be able to clear the level very easily. It can be said that randomness fills the entire game, making the game not very monotonous.

2.2.4 The Fairness of the Gameplay

Symmetry

The symmetry of the game is reflected in any game player who will have the same game experience. No matter the player enters the game at any time, any device, the game operations required for the game, the game information obtained, and the game process that needs to be performed will be the same. Of course, the same here refers to the operating experience, not the same. Because the game will design a lot of random elements to enrich the player's game experience, but the randomness of the game felt by

each player will be the same, and we can't predict it here.

Value Balance

During the game, many values are specially considered when we design the game, such as the monster's blood volume and our attack damage, game revenue and gold coin expenditures for purchasing items, the possible clearance time of the game, and the player's patience. and many more. These things are very important for the balance of a game. Assuming that the average game time that players are used to through the survey is 20 minutes, then we will design the game time for each level to be 1-2 minutes so that I will pass the game level as much as possible.

2.2.5 Feedback

During the game, players will receive two kinds of rewards. The first type of reward is a natural reward, including the release of dopamine (pleasure) that the player gets from learning new behaviors and overcoming challenges posed by the game. The second type of reward is a manual reward, where we reward the player with a certain amount of gold after completing the game. We also designed an achievement system that triggers certain achievements when the player plays for a certain amount of time. In addition to special medals, achievements are rewarded with substantial rewards, such as gold coins and potions, to motivate players. We use artificial rewards to augment the natural rewards that the player receives to increase the enjoyment of the game. Of course, there are also mechanics designed to interrupt the dopamine response and prevent addiction. For example, set a certain amount of online time, after which the user's benefits will gradually decrease.

2.2.6 The Goals Pursued and Achieved

Often in games, game designers inadvertently punished players because they set the game too hard. Of course, sometimes increasing the difficulty of the game is to bring a feeling of "proud" or "difficulty and fun." Frustration and anger should not be the feelings left by the game designer to the player. When the player leaves the game, he should be full of satisfaction due to the completion of certain things. The Buster principle is simple: be nice to your players and let the game automatically adjust (adjust backstage without the player's knowledge) the difficulty of a particular skill to adapt to the player's ability or the player's frustration. (That is, when losing streak or winning streak, the game will automatically take countermeasures, so that players get a good experience, to reduce the player's idea of directly discarding the game) This is not a recommendation to make all games easy. It's just that we have to realize that making the game unusually difficult is not a good experience for players. In short, don't torture players. First, throw them an easy-to-solve problem, and then give them rewards to encourage them to keep trying.

2.3 Game Rules

Game rules are not unimportant for a good game, because good game rules are a prerequisite for the game to remain balanced and stable, and for players to have a good gaming experience. Before designing the game, game designers plan the overall situation and design a reasonable rule. First, we will introduce the main rules, and then introduce the world-related rules, role-related rules, prop-related rules, battle-related rules, and economic-related rules according to the elements of the game.

2.3.1 Constitutive Rules

Players need to constantly challenge each level and collect clues through as many levels as possible to understand the truth of their death. After the player clicks the start game button, they will enter the game mode selection interface. The game mode is battle, exploration, rest, three randomly appearing in the store (the three may be the same), the player can choose one of these three. If the player chooses to fight, the player character will be teleported to the level. The clearance conditions for each level are the same, that is, to kill all the mobs, bosses. The player's attack methods are only normal attacks and skills. Players will be given certain rewards after clearing the level. After the player dies or saves, the player character can recover a certain amount of HP and mana in the rest area within a certain period. If the player chooses the exploration mode, the player will receive a certain number of life potions and magic potions, and a certain probability will meet the mysterious shop to purchase skill books. The mystery shop sells potions and scarce skill books. Under normal circumstances, the probability of appearing is extremely low.

2.3.2 World Rules

The relevant rules of the game world are the rules reflected when the player interacts with the game world. It is mainly manifested in two aspects. The first is what the player can do in the game world, and the second is whether the environment of the game world can affect the player.

1) The game world is a non-open exploration world. Before the game starts, the player can explore the game world according to a unique route; after the game starts, the player can only move within a certain range.
2) Environmental factors in the game, such as strong wind, heavy rain, and other weather do not affect the character's attributes.

2.2.3 Role Rules

Role-related rules are used to define the operations that a role can implement.

1) The form of movement of the game character is walking, and the way of movement is through the player through the keyboard "W", "A", "S", "D" to move forward, backward,

left, and right.

2) There are no levels of game characters, but each character has different attributes. Attributes refer to the value of the inherent abilities of the character, such as lifetime value, combat power, and defense power. This means that the role itself does not have a level of pros and cons, but a different balance of attributes of each role.
3) Each time the player passes a level, the attributes of the character used will be added. The addition of attributes will increase the strength of the game character, such as increased health, increased combat power, or increased defense.
4) There is a skill system. Players can swap a random stat skill when they meet a mysterious merchant. There is a limit to how many skills you can acquire, usually 3. There are no levels of skill. Each skill brings different effects, not strong or weak. For example, fire increases burn damage, and attacks have a short duration the damage. The Water ability increases your defense for a short time.
5) Another important system related to the character is the achievement system. Players can obtain corresponding achievements by accumulating the number of kills, passing the number of levels, and survival time. While unlocking achievements, we will give players certain rewards.
6) There are no weapons in the game, and each character has a default weapon. The style of the default weapon determines the form of its ordinary attack. For example, a character's default weapon is a sword, then the default attack method of the character is to use a sword to slash; if it is a gun, it can shoot remotely.
7) There are only two attack methods for the characters in the game. The first is a normal attack, and the second is an attack using randomly acquired skills.

2.3.4 Prop Rules

The rules related to props are used to balance the game and increase the player's sense of game experience. We only designed in-game props to help players pass the level.

1) Health Potion: When the player's health is too low, the health potion can be used to restore a certain amount of health.
2) Magic potion: A certain amount of magic power is required for the player to release a skill, and the magic potion can restore a certain amount of magic value.
3) Mysterious merchant's treasure chest: When you meet a mysterious merchant, you can pay him a certain number of items such as gold coins, or health points, and the attribute points are used to exchange powerful treasures. The treasure may be an attribute skill book (you can get an attributed skill after using it), or an enhanced book (you can get an increase in attribute points after using it).

2.3.5 Battle Rules

Combat-related rules include both sides of the battle, combat methods, game modes, player attributes, and death resurrection rules.

1) Both sides of the battle: mobs in ordinary levels, bosses in difficult levels, and game

characters controlled by the player

2) Combat mode: ARPG, real-time role-playing battle
3) Game mode: The levels in the game are unlimited, and the monsters in each level are limited. The condition for clearance is that the player needs to destroy all monsters at each level. Players can choose to save the archive each time they pass a level, and after saving the archive, select the next level or exit the game. If the player dies halfway and the game will be saved automatically, the player will continue the game from this level.
4) Player attributes: The health value consumed by the player in the process of clearing can only be restored through the health potion, the player does not increase the health value after clearing the level of learning skills. After the player's character's health is reduced to 0, the character is killed. In the game start interface, the recovery area will be randomly brushed out, and a certain amount of health will be restored after clicking to enter.
5) Death and resurrection rules: After the player dies, they will be saved automatically and cannot be resurrected. After recovering their health and mana in the rest area, they can enter the game through the previous save.

2.3.6 Money Rules

The game has an economic internal circulation system. After passing the level, players will get a certain amount of gold rewards, which are used to purchase medicines and exchange items with mysterious merchants. The price of game items needs to be set in an appropriate range so that the gold coins in the player's hand can be continuously recycled, which stimulates the player to play the game.

3 Software Engineering

3.1 Software Requirements

3.1.1 Functional Requirements and Non-Functional Requirements

There are our group project's requirements we shall realize.

Functional Requirements

- The system must allow one user to play the game
- The system must listen to some input device to interpret the user’s actions
- The system must allow the user to save and load their game states
- The game must challenge the user to overcome obstacles before they progress
- The level of the game must be limitless

- The game must allow a user to acquire more skills, as to give the game variety
- The game must have sound effects
- The game must have various scenes
- The game must have no game-breaking (either crashing or cheating) bugs
- The game must be played from a 3-D side on perspective
- The game shall have a title screen with buttons on to start the game
- The player shall have to kill then enemies on the current floor to progress
- The player shall be able to pause the game during the gameplay and nothing that has been gathered in the game shall be lost
- The player shall be met with a menu screen upon starting the game which provides the ability to start the game, continue the game and exit the game
- The game must allow players to get some random buff and come across tougher enemies
- The game must allow players have choices for the next action and buff gotten.
- The game must allow players getting money during the game to buy blood or magic medicine and skills from the seller

Non-Functional Requirements

- The game shall have a failure rate of no more than 5%
- The game shall start within 5 seconds
- The game shall be positively reviewed at least an average of 75%
- The game shall have a maximum input response time of 20ms
- The game shall run at a rate of at least 30fps
- The game shall run on standard hardware
- The game's code shall be maintained using appropriate version control

3.1.2 Use Cases

Based on the interfaces and operating processes of the game, the use cases are divided into three parts, "main page", "interactive in big map" and "fight mode".

Main Page

Once players enter the game, the main page is the first page they are faced with, and a player can choose to "start a new game", "load the previous record", "view the achievement" and "change the settings".

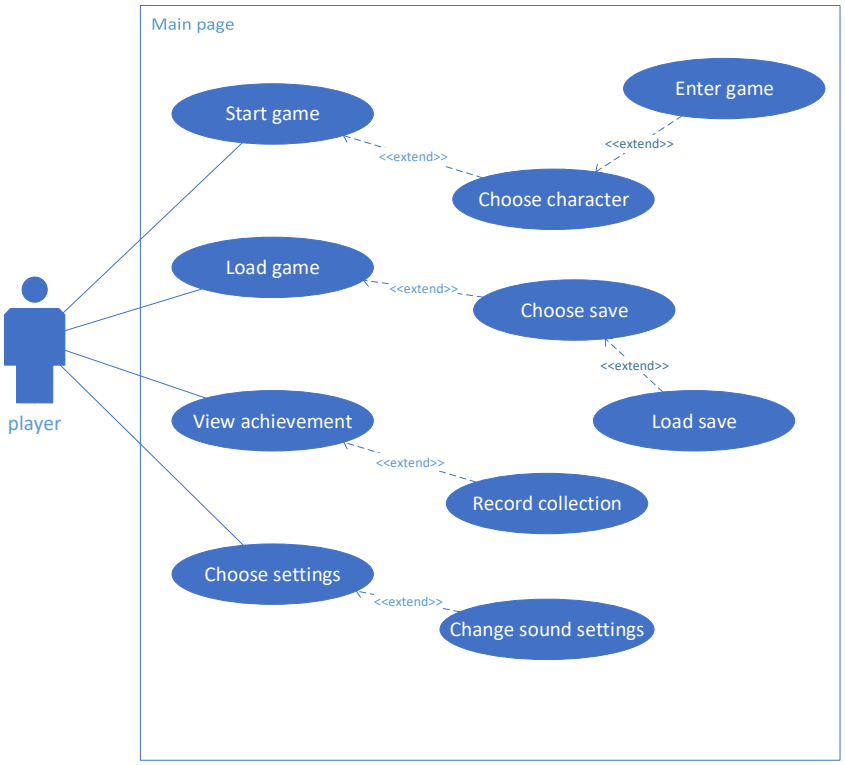


Figure 3.1 The use case of the main page

Table 3.1 The use case of new game

Use Name	**New game**
Scope	Main page
Primary actor	Player
Secondary actor	None
Summary	Player start new game
Precondition	Player is in the main page
Main success scenario	1. Player click the “start game” button
	2. Player choose a character
	3. Player enter the game
Alternatives	1a. Player change the ordinary settings.
	1b. Player view the record of achievement
Exceptions	There is no sufficient storage to run the game.
Postcondition	A new game is started, and new record is established.

Table 3.2 The use case of the Load game

Use Name	**Load game**
Scope	Main menu
Primary actor	Player
Secondary actor	None
Summary	Player load game based on previous saving record.
Precondition	Player is in the main page
Main success scenario	1. Player click the “load game” button
	2. Player choose a save
	3. Player enter that record
Alternatives	None
Exceptions	There is no previous saving record.
Postcondition	Enter the previous record and continue the game.

Big Map

After getting into the game successfully, the player enters the big map and has to make some interaction. There are 5 kinds of interaction in total.

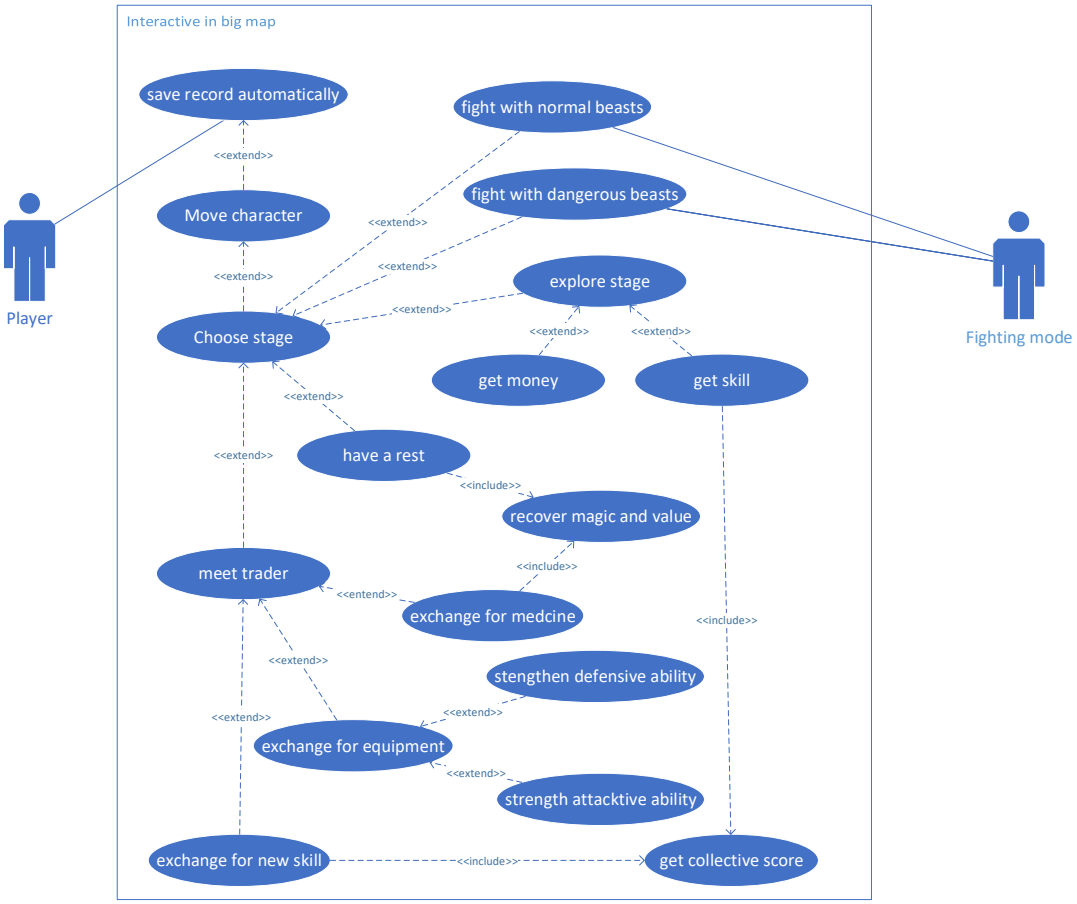


Figure 3.2 The use case of interactive in a big map

Table 3.3 The use case of interactive in a big map

Use Name	**Interactive in big map**
Scope	Big map
Primary actor	Player
Secondary actor	Fighting mode
Summary	Player do some interaction in big map and subsequent operation
Precondition	Player enter the game successfully and be in the big map
Main success scenario	1. The game archive automatically.
	2. Player manipulate the movement of character.
	3. Player choose different stage.
	4. The character gets different rewards and buff or debuff.

Alternatives	3a. Player choose the fighting mode. 3b. Player choose the explore mode. 3c. Player choose to have rest. 3d. Player choose to go to the shop. 4a. Player get into fighting system. 4b. Player get the special reward after successful exploration. 5b. Player get only some money. 4c. Player recover the magic value and health value. 4d. Player buy the goods.
Exceptions	1a. Player enter the wrong mode after make selection. End up with no thing. 1d. Player want to purchase something without enough money. Pop-up prompt.
Postcondition	Move to the corresponding stage.

Fighting Mode

If the player chooses the fighting(normal) or fighting(dangerous), the game will enter the fighting mode. In the fighting mode, a player can choose to start a battle, and move, attack beasts, use props and he will be attacked by the monster as well. The battle will clear after the health value of the player decline to zero or the player defeat all the beasts in the scene.

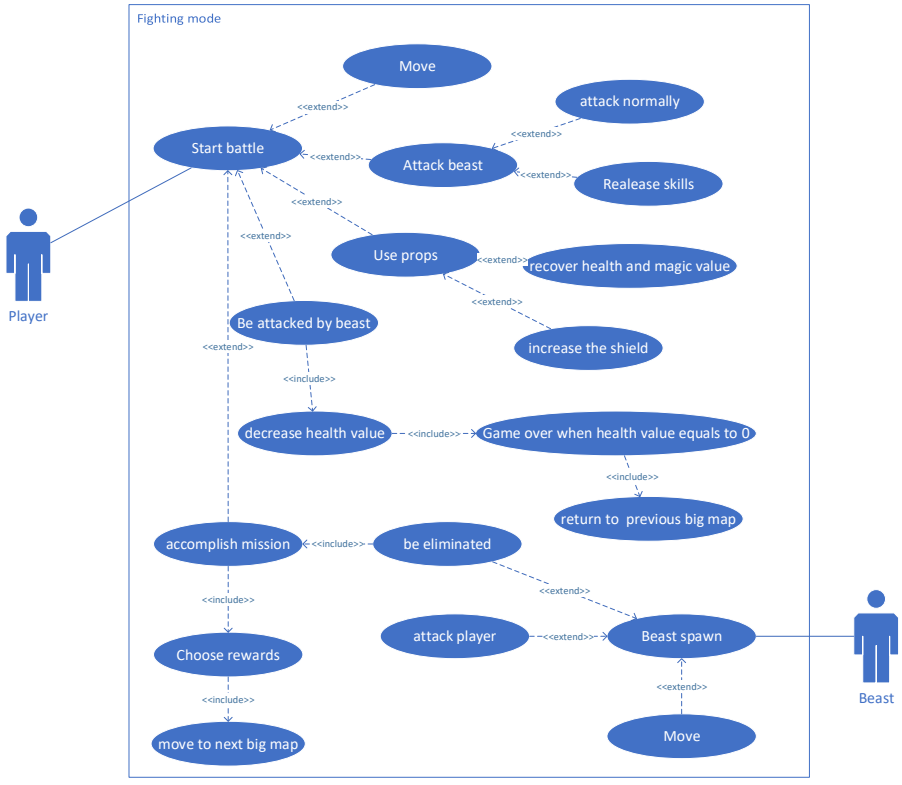


Figure 3.3 The use case of fighting mode

Table 3.4 The use case of fighting mode

Use Name	**Fighting mode**
Scope	Fighting(normal)&fighting(dangerous)
Primary actor	Player
Secondary actor	Beast
Summary	Player battle with beast.
Precondition	Player choose the fighting(normal) or fighting(dangerous) mode.
Main success scenario	1. Battle starts after player prepared well.
	2. Player fights with beast.
	3. Player use props to strengthen himself.
	4. Player defeat the beasts.
	5. Player choose a reward.
Alternatives	2a. Player use skills and generate huge damage.
	2b. Player attack the beast normally.
	2c. Beast lock the location of player and attack him in range.
	3a. Player use medicine to recover magic and health.
	3b. Player use shield to enhance defense.
	4a. Player fail to defeat beast.
Exceptions	1.The player fails to generate damage on beast, player click the refresh button and restart the game.
	2.The quantities of beast exceeds the capacity of the system.
Postcondition	Player get attribute bonus and move to the next big map.

3.2 Acceptance Tests

An acceptance test is the software testing activity before the release of the game after the completion of functional testing and system testing. Acceptance testing is usually performed by users, and this test will be performed by the development team. The acceptance test will verify that the functionality and performance meet the expected output, and identify the remaining flaws in the game as much as possible for further improvement. The following table provides a detailed acceptance test plan.

Table 3.5 Acceptance Tests

ID	Description	Input	Expected output	Pass/Fail
1	Test that 'Play' button works	Click 'Play' button	The game begins playing	
2	Test that 'Load' button works	Click 'Load' button	Player can return to the previous game interface and load previous game data	
3	Test that 'Mute' button works	Click 'Mute' button	Switch off game Music	

4	Test that 'View achievement' button works	Click 'View achievement' button	Display the player's achievements	
5	Test that 'Choose modes' can work	Multiple clicks	Player can get three random modes (there are five modes) every time	
6	Test that 'Fight' button works	Click 'Fight' button	Players enter fighting mode and game randomly generates level and map	
7	Test that 'Explore' button works	Click 'Explore' button	Player enters exploration mode and may receive money or skill	
8	Test that 'Rest' button works	Click 'Rest' button	Players enter rest mode to recover magic and value	
9	Test that 'Meet trader' button works	Multiple clicks	Payers can buy skill books or health potions from merchants	
10	Test that sound effects are audible	Regular gameplay	Sound effects are audible	
11	Test that player can move freely	Click 'W','A','S','D' keys from keyboard	Player moves in respective direction for each key W:front A: left S:back D:right	
12	Player health is reduced after being hit by an enemy	Hit by the enemy many times	Player health is reduced based on enemy skill damage	
13	Test that player is dead when the health bar is 0	Take large amounts of damage	Players dies and can return to main screen	
14	Test that player can pause the game	Click 'ESC' key	Game can be paused and user data can be stored in database	
15	Test that each level of the game is random	Play the character multiple times to enter new levels	Each level has unqiue map and enemies	
16	Test that players can get random buff on each level of the game	Play the character multiple times to enter new levels	Every level drops random skills	
17	Players can enhance properties after getting buffs	Enter new levels multiple times to get a random buff	Characters can earn different attribute addition	
18	Test that normal circulation of money	Character earn money	Player can use money to buy skills, potions, etc., while reducing the amount of money	

19	Test that player could not penetrate NPC and enemies	Move player to enemy and npc	They are impenetrable	
20	Test that player can not move through walls	Any movement of the character near the wall	Characters can't walk through walls	
21	Tests that whether haracter's damage against monsters is effective	Control the character to attack the monster until the monster health is 0	Monsters die and disappear from the map	
22	Test that defeat all monsters and proceed to the next level	The character defeats all monsters in the level	A sign indicating whether to proceed to the next level appears, and the character can also choose to return to the main screen	

4 Implementation Plans

The implementation plan is the final part of the design report. It can be divided into three parts. Firstly, we will introduce the entire task list throughout this term and risk assessment. Second, the project plan could be given, including milestones and deliverables. At the end of this part, we would like to describe the activity network diagram and Gantt chart, which is calculated by a critical path algorithm.

4.1 Task List

In this part, we will give specific implementation plans, including personnel allocation and temporal planning. The task list will be divided into two parts. The first part will introduce the task list throughout the term and the second part is a risk assessment about this project.

4.1.1 Task List throughout the Term

The first nine weeks of the game design task list are shown in the table below, which divides the entire game design content into specific modules. The table describes the specific tasks of each week and the participation of each person in detail. Students who are responsible for and participate in each task will be marked green.

Table 4.1 Task List

Week	Task	Members assigned				
		Li	Yao	Wang	Yu	Liu
1	Brainstorming					
2	Determine the type of game and general gameplay					
	Visualize the context and identity of the player					
	Create task list					
	Theme					
3	Finalise game story					
	Characters and enemies					
	Initial game features					
	Initial gameplay					
4	Finalise game title					
	Finalise game features					
	Finalise gameplay					
	Conceive game principles					
5	Finalise game principles					
	Finalise game rules					
	Characters and enemies					
6	Conceive requirements					
	Design functional requirements					
	Design non-functional requirements					
7	Use cases					
	Acceptance tests					
8	Activity network					
	Critical path					
9	Project plan					

4.1.2 Risk Assessment

The game development is risky and the risk does not affect the development of the game until the development has started. Therefore, a lack of risk assessment to the development of the game and risk avoidance measures are likely to lead to the failure of the development. Risk assessment is an important link to avoid a loss to put forward feasible risk avoidance measures after careful consideration.

The following table mainly evaluates risks involved in game development, including risks that may occur during the game development cycle and risks that may be caused by changes in the external environment during software implementation. The risks mentioned in the table are analyzed in detail, including the likelihood of the occurrence of the risk and the extent of the impact, and the corresponding contingency plan are put forward.

Table 4.2 Risk assessment

No.	Risk	Description	Likelihood	Impact	Contingency Plan
1	Requirements change	The game was developed according to requirements, but during development the team disagreed on certain requirements, or the requirements changed	Low	Low	Identify requirements when designing the game and provide effective requirements change management process to minimize the impact of requirements change on the
2	Prerequisite tasks cannot be completed on time	The code of the underlying architecture of the game was not completed on time, resulting in a delay in the progress of the game and the schedule was not completed on time	Moderate	High	Strictly follow the plan and set the deadline. If the prerequisite task is not completed in time, students who are unable to carry out the task can help
3	Team members conflict	Conflicts between team members lead to poor communication, interface errors, and repetitive work	Low	Moderate	The team maintains a good relationship of unity and cooperation, timely communication and solution of conflicts
4	Missing important files	During the game design process, the latest version is lost and only the old version remains	Low	High	This game is a big project, every member should have a backup, with the code updates should be uploaded to the cloud in time
5	Existing libraries and functions are inadequate	Some necessary functions cannot be implemented using existing code and libraries	Low	Low	Switch the IDE and try to externalize the code needed to implement the functionality
6	Code quality is low	Correcting code blocks of poor quality requires more testing, design, and implementation effort than expected	High	Moderate	In the implementation of the plan, considering this reason, code testing and correction time proportion should be increased, members should try to strengthen their own programming level

4.2 Project Plan

4.2.1 Milestones

Milestone is an indispensable part of the project plan and it uses a conclusive marker to describe a clear beginning and end of a procedural task. The following table describes the entire game design tasks for the next semester, including the start and end date. The sequence and duration of each task is determined by the difficulty of development

Table 4.3 Milestones

Task number	Description	Dependencies	Acceptance test	Start date	Duration (Days)	End date
1	Design codes and interfaces	-	Visual	21/02/2022	7	28/02/2022
2	Menu(health bar, magic, attribute, etc)	T1	AT1-5	28/02/2022	7	07/03/2022
3	Sound system	-	AT3,10	23/02/2022	14	09/03/2022
4	3D modeling of characters, enemies, scenes,etc	-	Visual	22/02/2022	7	01/03/2022
5	Map design, walls implementation	T4	AT15	25/02/2022	7	04/03/2022
6	Add input from users and map it onto controls	-	All tests	01/03/2022	7	07/03/2022
7	Implemention of characters and walls animating	T4	AT12,13	01/03/2022	7	08/03/2022
8	Enemies on the map	T4	AT21,22	03/03/2022	14	17/03/2022
9	Skills system	T2	AT16,17	08/03/2022	7	15/03/2022
10	Movement of character and fighting	T6	AT11	07/03/2022	7	15/03/2022
11	Load game	T1-10	AT14	12/03/2022	10	22/03/2022
12	Select modes	T6	AT5-9	07/03/2022	7	15/03/2022
13	Collision detection for walls, enemies,etc	T5, T8	AT19,20	18/03/2022	7	26/03/2022
14	Testing	T1-13	All tests	26/03/2022	14	09/04/2022
15	Fully runnable	All tasks	All tests	09/04/2022	7	16/04/2022

4.2.2 Deliverables

At the beginning of a project, there must be an end goal that we need to achieve. Therefore, the phased deliverables are shown in the following table.

Table 4.4 Deliverables

Number	Description	Deadline	Total time(days)
1	Models of all sprites and backgrounds created	01/03/2022	7
2	Useable menu screens and interfaces	07/03/2022	14
3	Movement of characters	12/03/2022	20
4	Implementation of AI interacting with the player	17/03/2022	24
5	Switching modes and loading game	22/03/2022	30
6	Final product	16/04/2022	55

4.3 Activity Network

4.3.1 Activity Network Diagram

An activity network diagram is a diagram of project activities that shows the sequential relationships of activities using arrows and nodes. The corresponding figure of this

project is shown below, where T represents one person's weekly workload.

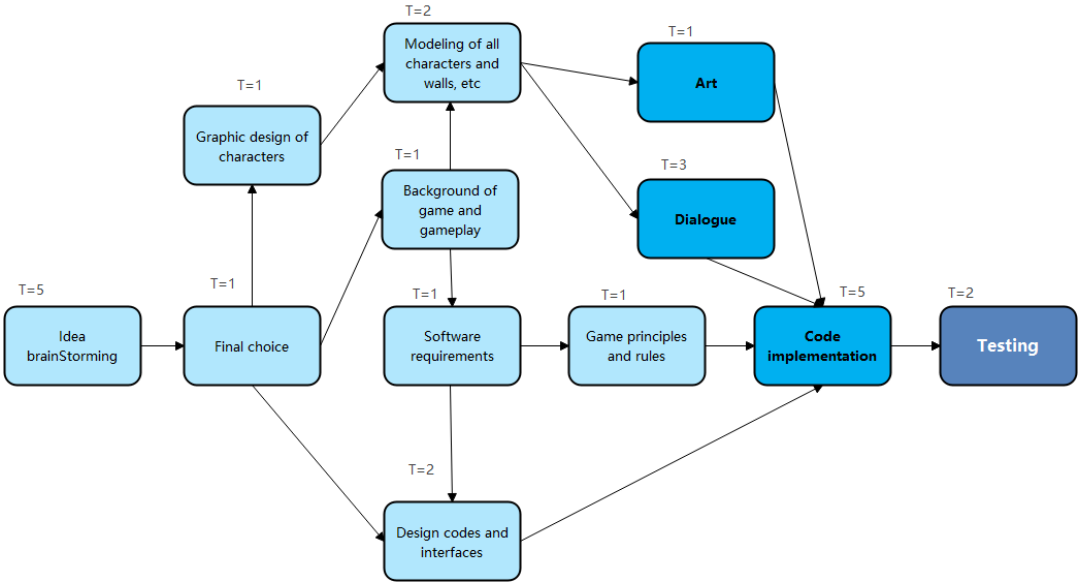


Figure 4.1 Activity network diagram

4.3.2 Gantt Chart and Critical Path

With the activity network diagram, we can determine the critical path, which expects the completion time of the project. Gantt chart can indicate the sequence and duration of a project through a list of tasks and a time scale to facilitate the implementation of the project. The detailed implementation is as follows. The horizontal axis represents time, the vertical axis represents tasks, and the blue square represents planned completion.

Table 4.5 Gantt chart

Task/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Idea brainstorming																	
Final choice																	
Graphic design of characters																	
Modeling of all characters																	
Background and gameplay																	
Software requirements																	
Design codes and interfaces																	
Game principles and rules																	
MileStones and deliverables																	
Gantt chart																	
Art development																	
Dialogue																	
Code implementation																	
Testing																	

Appendix

Reference

1. Despain, W. (2015). *100 principles of game design.* [M]. People Post Press, Beijing, 2015.
2. Wu, J. & Zhan, B. (2018). *Game Architecture Design and Planning Fundamentals (2nd Edition).* [M]. Tsinghua University Press, Beijing, 2021.

Some Manuscripts (The following pictures are original works)

Uncolored line arts

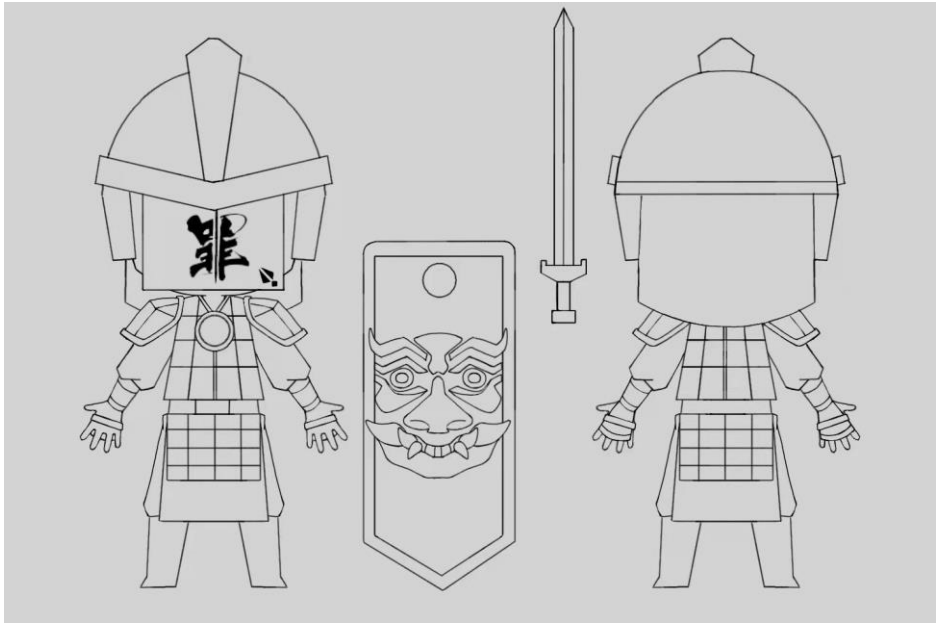


Figure 5.1 Draft of enemy

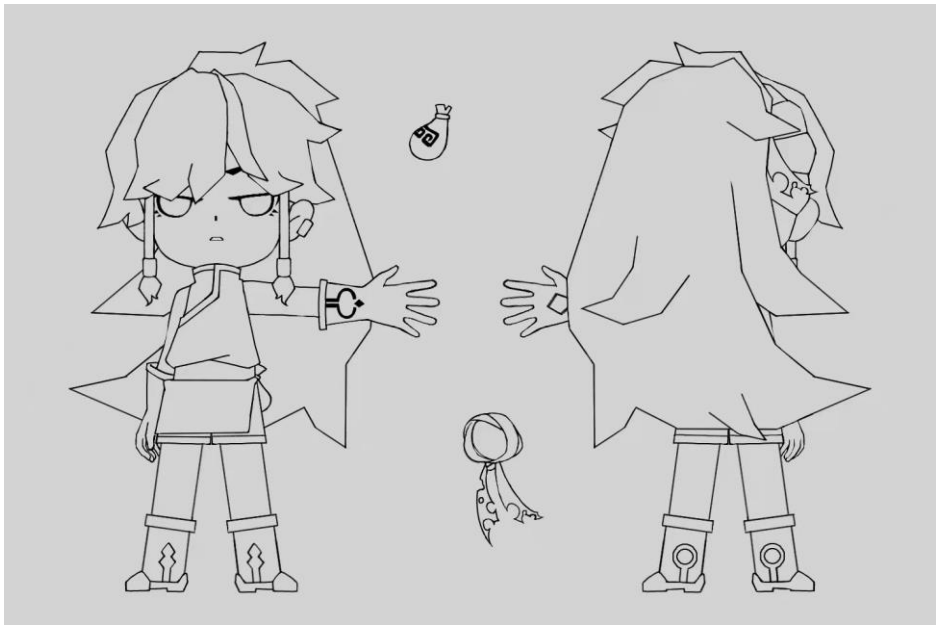


Figure 5.2 Draft of player

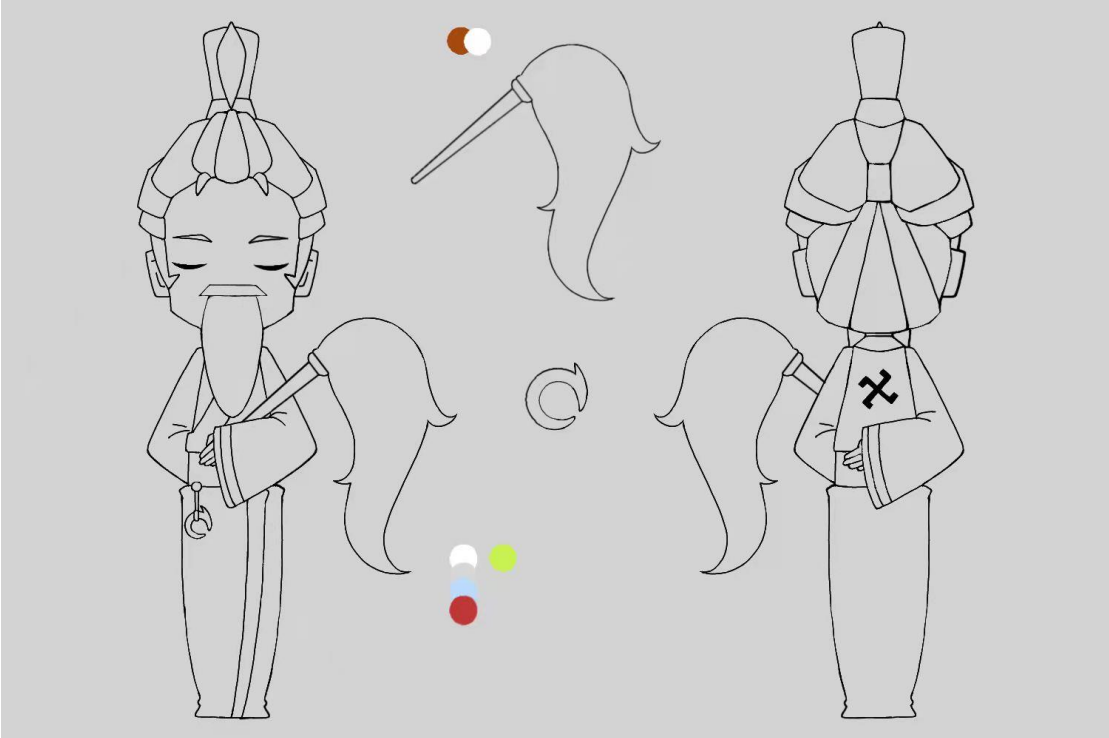


Figure 5.3 Draft of the elite of the enemy

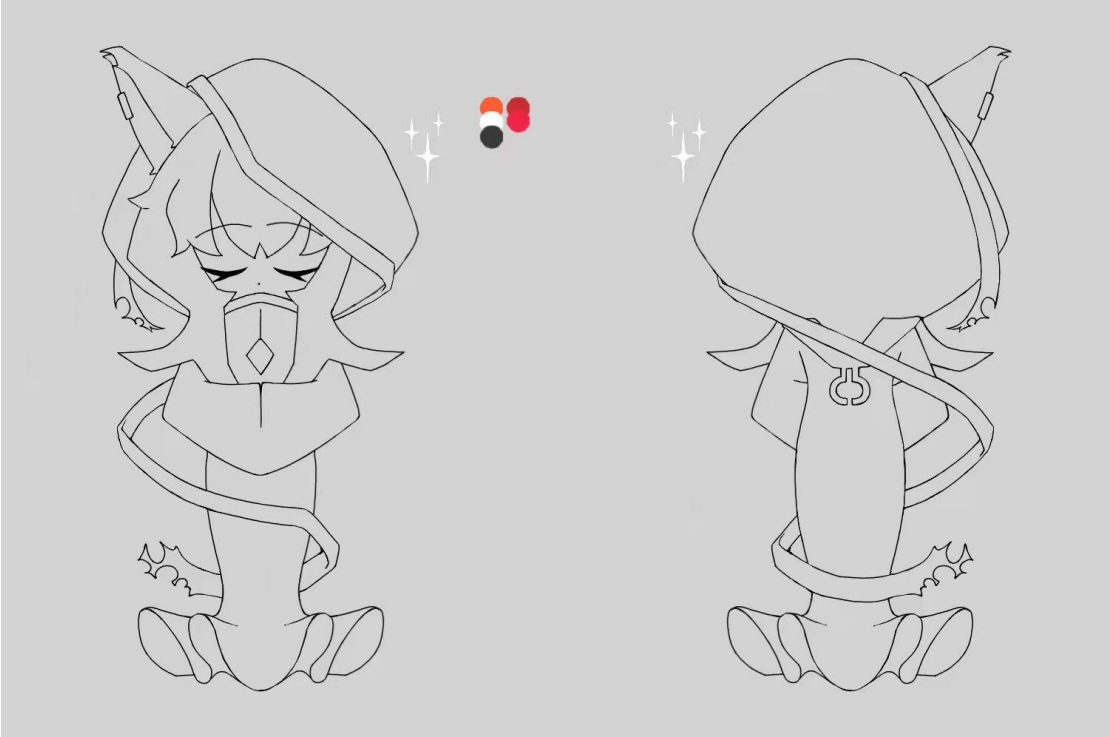


Figure 5.4 Draft of Mysterious businessman

Color manuscripts

Figure 5.5 Color draft of the player

Figure 5.6 Color draft of icon