PARADISE CORE

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Content

Section 1 – Introduction and Project Ideas

1.1 Project Ideas from Each Group Member

At the beginning of the project, every member in our group has their own game ideas and we cannot agree on whether to design a 2D or 3D game, a shooting game or a simulation game, a sullen background or peaceful atmosphere and so forth. In order to reach an agreement and absorb all the merits from every group member, we conduct several discussions to decide on the final game idea.

Yifei Zhao's Idea

It is an RPG (Role-Playing Game) and puzzle game with some elements of combat, which is based on 2D plane map. This game is similar to METROID, which requires players to find some tools to pass through some gears which are impenetrable without specific tools**.** For example, a flashlight can help the characters go in dark places in the map. At the beginning, characters cannot kill the monsters in the map so characters should run away or hide to avoid the monsters. However, characters can get new abilities to solve the monster, or interact with traps in the map to solve monsters. After player has collected all the necessary clues in different places of the map, the truth of the story will be shown, and the game is completed. Game of reference is displayed in Fig. 1-1.

Fig. 1-1: *To the Moon*

Boning Li's Idea

The first proposal is *inside*, which is the 3D version of *limbo*. It is an action and adventure game, with a better render than *limbo*. There is no need for players to fight against enemies, but to avoid being noticed by them via making use of the items provided. This game requires players to be patient enough to find the mechanism that can help them go forward. The second one is a game called *Getting over it with Bennett Foddy*. When the game was published, many anchors tried this game and attracted many other people to buy and enjoy this game. It is similar to the first one, except that there are no enemies. Game of references are shown in Fig. 1-2 and Fig. 1-3.

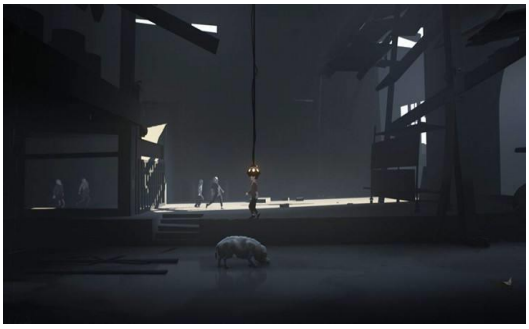


Fig. 1-2: *Inside*

Fig. 1-3: *Getting Over it with Bennett Foddy*

Qi Li's Idea

The idea is a 2D pixel style open world role playing game. 2D game is easier for us to build comparing to 3D ones, especially on 3D modeling. Pixel style is a style of game screen, in which the pixels are magnified and form a retro style game screen content. Besides, unlike realistic style, pixel style objects (elements in the game, i.e., characters) requires less details and can be easily drawn by some software like *RPG Maker MV*. Open world games are widely known by the high freedom of playing. For instance, in *Grand Theft Auto* series, the players do not have to always focus on the missions, just walking in the street is available and will seldom affect the storyline. Reference game: *Stardew Valley* (Fig. 1-4). This idea offers a clear direction of the game, it is not hard to complete it using LibGDX. However, the disadvantage is also clear. As an open world RPG, there will be more interaction than the traditional ones, which means there will be more decision-making mechanism in the game, the amount of code and the difficulty of optimizing process will be a challenge.

Fig. 1-4: *Stardew Valley*

Yifan Ren's Idea

The proposed idea is a 2D Multiplayer Business Operational Competitive Game. The idea for the game comes from a combination of two games which are *Monopoly* and *Pummel Party* as displayed in Fig. 1-5. It is a casual game which is for Peace and Love. It is also a competitive game which is for the game playability. In order to avoid causing the boredom, the economy element instead of the fighting element is used for the competition. The competition is the core of the game durability. On the basis of

Monopoly, many kinds of competitive games after each round.

Fig. 1-5: *Pummel Party*

Yang Tang's Idea

In the dim and dark background, the player needs to manipulate a little boy to escape the traps in the scene and break various mechanisms and obstacles to successfully escape the danger. Traps may include rolling rocks, pits, or sudden beasts. Mechanisms may include the player needing to push a box to fill a depression in the road, jump on a rope to fly over a canyon, or cross a river with a bird in the air. Along the way, characters can increase their movement speed by capturing energy stones. As for the background of the game, when the doomsday comes, the little boy needs to overcome various difficulties in order to save his families. Every time a game node is reached, a family member can be rescued and continue to promote the development of the game. The gloomy game scene adds to the sad atmosphere of the little boy losing his family. The illustrations of game are shown in Fig. 1-6 and Fig. 1-7.

Fig. 1-6: *Limbo*

Fig. 1-7: *Limbo*

Yiqian Zhang's Idea

A combat-based platformer in which the player controls one or two characters, depending on whether the player is playing as an individual or as a pair. Each level includes a hidden mechanic, which players can use to gain additional gains to make it easier to complete. As the player grows, the complexity of each level increases, giving the player a greater sense of accomplishment as they tackle harder and harder bosses or trigger hidden mechanics. For players, the additional hidden mechanism will take the form of screen prompts or rewards. When the player reaches the trigger condition,

you will get a reward. When you pass the level, a new storyline will be unlocked, and the final game clearance will unlock the character of the background story. Game of references are shown in Fig. 1-8 and Fig. 1-9.

Fig. 1-8: *Adventure Island*

Fig. 1-9: *Dreaming Westward Journey*

1.2 Final Choice

The final idea for our game is the combination of Yang Tang's and Boning Li's ideas which is basically a strategy game. The player needs to control the protagonist to advance through the keyboard, and there will be various traps, obstacles or hidden props in a linear game map. It requires player to utilize the hint information implicit in the game map to make reasonable inferences and look for the exit according to clues step by step.

Reasons for choosing this game:

With respect to Yifei Zhao's game idea, it includes few game elements, which means that the gameplay is relatively monotonous and cannot maintain the continuous interest of the players. As for Yiqian Zhang's idea, it contains too many complex magic skills, which requires High-end drawing ability and judgment boundary and thus, the final effect may not be satisfactory. Plus, Yifan Ren's game idea lacks storyline, which could be tedious and Qi Li's idea is too complicated to design, which exceeds our ability. Consequently, we finally combined Yang Tang's and Boning Li's ideas, which are almost the same type with various advantages listed below.

Advantages of the idea:

First of all, this is not a fighting game, which means that it does not contain any violent element and thereby appealing to general public including children, girls and even the elderly. More importantly, in the process of the game, players need to find an exit through a series of clues, so it can greatly improve the player's imagination and interest in exploring unknown areas. In addition, some game links require the player to accurately grasp the movement of the character, so to a certain extent the player's mental agility and finger flexibility could be exercised.

Section 2 – Game Design

2.1 Game Storyline, Gameplay and Features

Game Storyline

Main characters: Human Valiant, Prophet(cheater), and God of Nothingness (GoN).
Other characters: Fire Lord, Water Lord, Earth Lord, and Air Lord.

At the origination of the world, God of nothingness created four lords with different powers, corresponding to Fire, Water, Earth and Air, respectively. These 4 powers also represented 4 elements making up the world. After GoN created the frame of the world and Lords created everything else, GoN went back to the Nothingness Land and Lords produced 4 jewels with their powers. Each jewel was settled in a corresponding temple created by that Lord. Then, 4 Lords slipped into a dead sleep. With the power of jewels, humans succeeded developing fast and making huge progress. Nonetheless, due to the fight of resources and wealth, people all over the world gradually got into the war.

Our human valiant has an overall sense of justice, always pursuing the peace. Born in such a world filled with conflicts and war, he has witnessed countless tragedies while he's not able to change it, feeling helpless. However, at one night, a prophet broke into his dream. The prophet told valiant that Lords felt bored to manage the order of the world so they just gave the jewels to humans and left, desiring that humans would slip into war and destroy themselves. To save the world, prophet said that valiant should take all the jewels and reserve them in one box since the power of jewels is too dangerous for humans. Prophet also mentioned that he would damage those jewels as soon as valiant collected 4 jewels successfully and deliver the box to him. Finally, valiant received a box from prophet, being told that the box is also the key to open the gates of temples. When valiant woke up, wondering whether his dream was realistic, he saw a box beside the pillow, the same as the one he saw in his dream. Therefore, he sworn that he would complete this duty.

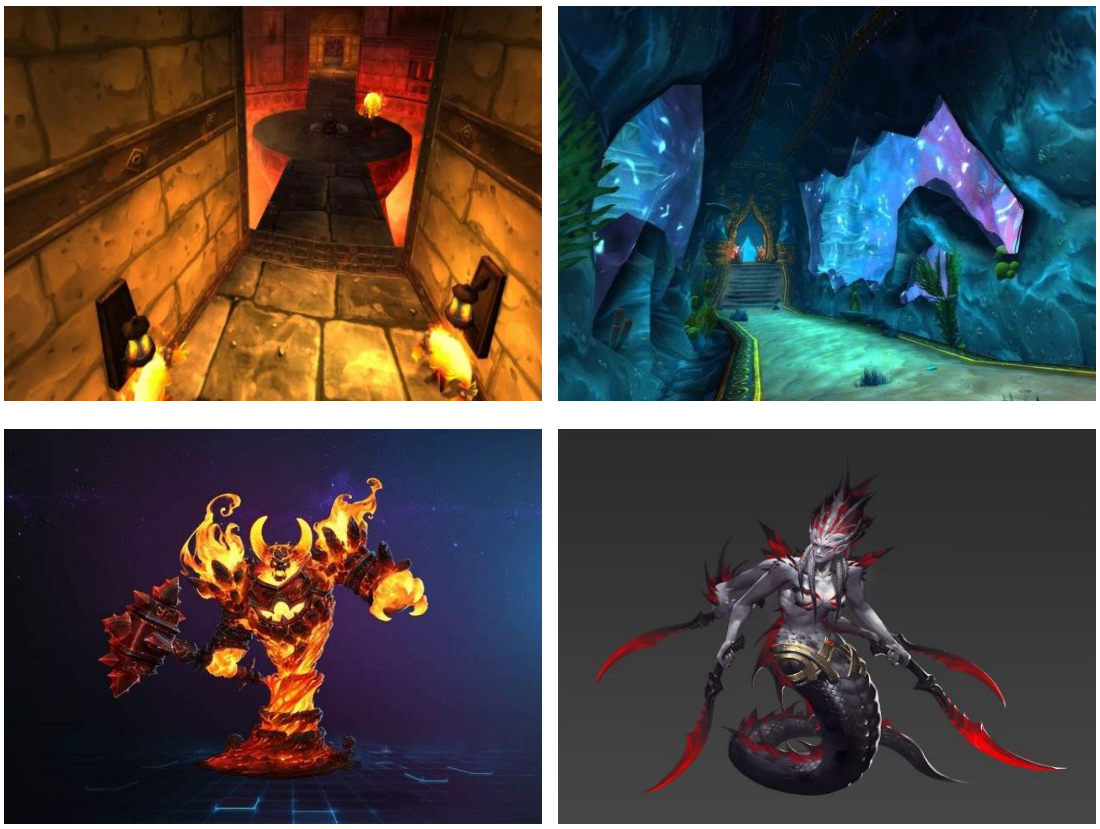
Gameplay

1. The game will provide keyboard or gamepad control for movement and interaction with short response times, so the game executes in real time.
2. The game will be played from a 2D perspective, with the player at the center of the frame and the surrounding environment. But maps and environments will be modeled in 3D, so visually appealing graphics will improve the game's overall rating.
3. The story of the game will be revealed step by step along with the clearance. Players will enjoy the clearance while unlocking layer after layer of story.
4. The game will have five unique theme levels, each with its own mechanic and enemy type.
5. Players can select all four levels of their own attributes to unlock the ultimate level - level 5.
6. At the beginning of the game, players use weaker equipment and then pick up items from the level to gain skill enhancements or new abilities.

7. Each level has a different mechanic of enemies, which are dealt with in different ways.
8. Various props have their own pros and cons. For example, invisible cloaks can avoid monsters but cannot destroy them during use.
9. Avoiding collisions with the enemy/terrain is the player's primary survival condition, and the player must avoid or defeat the enemy in order to move forward.
10. Upon death, the hero is cast out of the world of the current stat and has the option to restart the level.

Theme

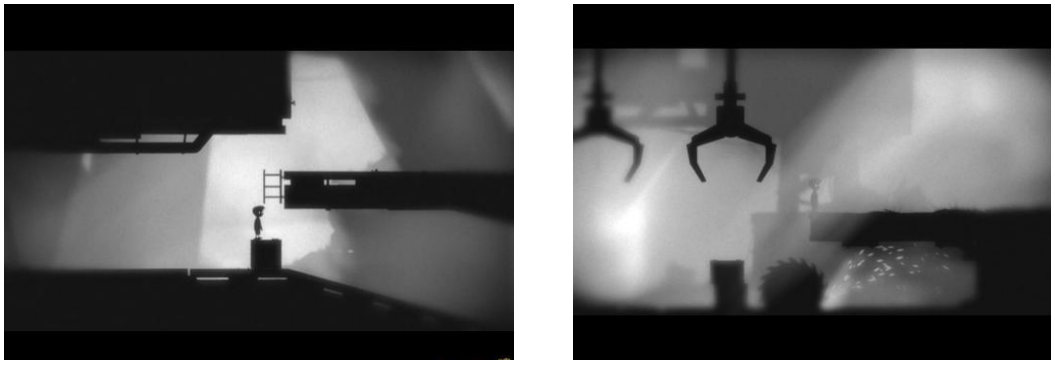
The story is about hero's adventure in paradise, so the atmosphere is excited and stately, which would be performed by the music that changes with the development of story. There are six maps in the game representing different elements including fire and water. Therefore, there are different themes on maps which would be shown on the color and gears design of the map. In the different maps, there are also different enemies that designed according to the theme of map, including their appearance and action.



Figures: Map themes in game – *World of Warcraft*

The setting of the game is in paradise including outside and inside the castles in each map, the inside part is generally more difficult than outside. The different maps include fire, water, ground, air, void and the final map. The main mission of players is to go through the traps and enemies and find the key in the destination of the castle. After

players have collected all the necessary tools, the characters would be transported to the final map automatically and find the truth of the story here.



Figures: Puzzles in the game *limbo*

The puzzles in the game is the most important element of our game, so that various interesting puzzles are needed. Players should be attentive on how to interact with the map to go through the traps or avoid enemies, because there are not common methods that can deal with all the traps and enemies.

Game Features

The purpose of the game is to make the players enjoyable, therefore, it is important whether players are interested with the game. According to our analysis about the sales and assessment of the games on the popular game downloading platform – steam, a successful game usually has unique and interesting gameplay, some of them even have lower image quality and special effects than some unpopular games. Therefore, the features of our game are to avoid dull and boring interaction for players. Players need to keep finding out new method to interact with the game and experience the truth of the story. Due to the limit of resource, our game focuses on the storyline and gameplay to attract players. We try to build up a new gameplay system that players interact with the game, which means various puzzles would replace the dull fight scene in normal RPG, and the new skills brought by equipment replace keys to unlock the new areas of maps.

Story mode – The storyline can be divided in two part. In the first part, players can choose playing order they like. After finding all the clues and necessary tools in four maps, players can move to the second part which has final two maps with fixed order.

Fight scenes – Many of games have defects on fight scenes, as the result of dull interaction. Players could be bored soon with console game, if there are a lot of repetitive elements. Therefore, we cancel the common fight scenes that players should deal with different monsters with specific methods.

Enemies – There are different enemies in different maps, which correspond to the theme of the maps, and they have different attack modes. Generally, the characters cannot attack the monsters directly, they need to run away to escape them, and sometimes they can take advantage of the gears, tools or traps in the map to kill the monsters.

Puzzle – There are many gears or traps in the map, which players need to solve them to move on. It can be word puzzles that players need to input correct answer with clues in the map, or gears players need do the correct operation.
Key item – There are two kinds of tools in the game. Key item is one of them, which is necessary for pushing the plots, including keys for specific doors and important equipment. The equipment is also key item, for an instance, the jump shoes can help the characters jump twice to arrive the higher spaces.
Map – As mentioned, the first part is open for the players. However, players need some 'key item' to unlock the map to move forward.
Normal tool – Another kind of tools is normal tool, which is not necessary but can help players move easier and faster. The normal tool can be lasting or one-off, and sometimes they need to be combined to use. For example, a gun is lasting and its bullets are one-off.

Ambitious Features
Battle of Boss – Each map has a boss that is a special enemy immune to any attack from tools. Players need to complete a special puzzle in allotted time to solve the boss. In this process, boss would keep disturbing the character.
Achievement system – If the players complete specific motion in the game, such as killing enemies by guiding them into trap or arrive the secret room, they will gain a reward shown what they've done, which can be checked in the game all the time.
Shopping system – Players can use a kind of currency to buy part of one-off normal tool in the specific place in the map.
Encyclopedia – A book that record the information about the tools and enemies that players meet. It can give more details about the background story and can also imply some clues of puzzles.

2.2 Game Props

Since our game is expected to be a puzzle game, which means that there would be little fight or conflict, rather the character will apply various game props occurring in the map to go through the barricade. Therefore, during the discussion in this semester, we conjured up several props that might be designed in the future development. Some of the game props are listed in Table 2-1 with their corresponding description.

Table 2-1 Game props

	Torch: Items that can illuminate nearby dark areas. After being used, the character can temporarily gain vision of nearby invisible areas until it is interrupted by a monster or stepped on a trap.

Table 2-1 (Continuous) Game props

	Floating air wings: Special props in the ultimate level. After the character is used, it can avoid the influence of gravity and float in the air for a period of time, and move faster in the floating state. Continue to hit by a monster or touch damage-like terrain.
	Invisibility cloak: Puts the hero into invisibility for 30 seconds, where he can touch terrain traps or monster guards without losing health. Can be triggered by the player's own choice, triggered cannot be cancelled.
	Pop candy: Enables the main character's jumping ability to evolve until the end of this level. Since evolution, pressing the jump button twice in a row will trigger a two-step jump, i.e. two jumps in a row.
	Wand of magic: Wand skills are different in different levels. This is mainly done by collecting magic factors to enable the wand to be fully charged and then casting an attack.
	Sprinting boot: slightly increases the hero's movement speed until his health is reduced.
	In a short time, it becomes a shadow that can pass through enemies and net obstacles.

2.3 Game Principles

The creed of designing games is to bring fun to the players. In our game, the principle is to pleasure the players with achievability of getting to the end of the map. It can be explained in three parts: interactivity, feedback, and gameplay variety.

Interactivity

The interactivity of the game is based on the input of keyboards (or controllers). As a 2D platform game, the player can press “A” and “D” to move horizontally and press “W” or spacebar to jump. Also, in some situations, the play can press “W” or “S” to use the

ladders. Conversations are important for solving puzzles and describe some details of the world in the game. Another interactivity often reflects by maps, characters and game props. For example, some props like keys, are able to achieve the interaction between the character and the maps. Combining map puzzles with game props is an essential way for our game to create interactions. With these abundant interactions, the player will get more feedbacks from the game.

Feedback

As mentioned before, feedbacks are based on interactions. Without feedbacks, the interactions are nonsense. Feedbacks are neutral, positive and negative. Movements, conversations are direct neutral feedbacks, which can promote the processes of game and storyline. Gaining rewards, collecting props, get to the end of the map, and even pass the whole game are positive feedbacks. It can also promote the course during playing, but it is more like “keys” of the game. Besides, the negative feedbacks are also important. The adventures are not always peaceful. Going through failures, for instance, the character dies in the game, can encourage the players to continue playing. After that, the players may gain satisfaction and achievability from their successes. Anyway, the positive and negative feedbacks must be balanced so that can we make full use of them to keep the enthusiasm of the players to play.

Gameplay Variety

To achieve the creed of having fun in game, the most primary requirement is to play. It is not enough only with attraction, because if the game cannot keep the enthusiasm of the players, the game will not be played integrally. Thus, the diversity of gameplay is extremely significant. Firstly, as a 2D-platform game, referring to Super Mario, all maps must be unique. Also, the diversity will be directly reflected by interactions and feedbacks. So, as a puzzle game, the interactions between the characters and maps are designed to be different. The diversity of game props can also bring the diversification for the game.

2.4 Game Rules

To keep the game consistent and fair, a set of core rules is essential. These rules can be divided into three different categories - constructive rules, abstracting core mathematical rules, defining basic game logic; Operational rules, players follow the shape rules of the game itself; Implicit rules, refer to "unwritten" rules of behavior that are not clarified in the game.

Constitutive Rules:

- C. 1. Players cannot escape the boundaries of the game, nor can they pass through solid objects in the game, such as walls and obstacles.
- C. 2. When a player touches an enemy or an enemy projection, it takes damage relative to the enemy's strength.
- C. 3. Players will pick up items such as sprinting boots and invisibility cloaks by

walking through qualified items in the game level.
- C. 4. Character's Health Point is 100.
- C. 5. If an entity (player or enemy) loses all health, it dies and is removed from the game.
- C. 6. The player has a constant movement speed.
- C. 7. Players can set the maximum distance for both horizontal and vertical jumps.
- C. 8. Each weapon has its own function and can be used in a different order if multiple items are collected, and character can carry up to two items at a time.

Operational Rules:
- O. 1. Players must collect all mission critical items to enter the next level.
- O. 2. Required items will be prompted so that the player can move through the level at a reasonable speed without getting stuck.
- O. 3. The Boss level will provide players with additional skills or items to make the level more comfortable.
- O. 4. Item upgrades and new items will be available to the player as they are unlocked or enhanced as the game progresses.
- O. 5. Players can be attacked multiple times by enemies until their health is reduced to zero.
- O. 6. Player is banished from the world upon death.

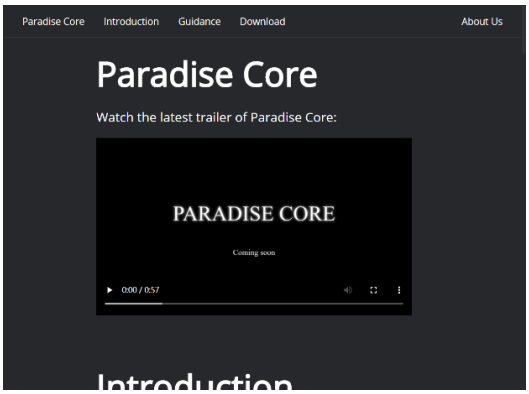
Implicit Rules:
- I. 1. Players cannot have unlimited health.
- I. 2. Players cannot unlock the ultimate level without first passing through the four attribute levels.
- I. 3. Players will no longer be able to pass through exit checkpoints without required items
- I. 4. Mission critical items cannot be hidden in game secrets

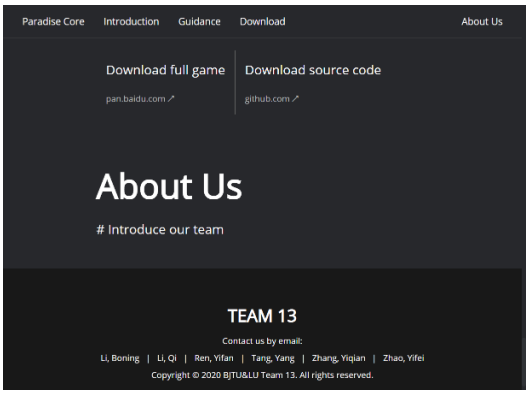
2.5 Game Site

We selected Raspberry Pi Zero W as our web server, considered its advantage of low power dissipation. In order to maximally cut down performance loss, we selected Raspberry Pi OS Lite as the operating system, which is based on Linux without desktop. After setting up configurations and burning the system into the Raspberry Pi, we used PuTTy to operate it via SSH in local area network. Then, we used apt command to install Nginx (1.14.2), PHP (7.3.19), and MariaDB (10.3.25), in which Nginx is the high-performance open source server, PHP and its module PHP-fpm are used to parse dynamic Web pages written PHP (.php files), and MariaDB is the database managing system which is completely compatible with MySQL. Besides, we used ittun, which is a free NAT (Network Address Translate) traversal application, to implement NAT-DDNS (Network Address Translation – Dynamic Domain Name Server), so that the site can be visited in the Internet instead of local area network.

The first assumed usage of the game site was showing artworks, information of the

game, which has been designed as shown in the figure below. Moreover, the site will play a game community which allows players share their artworks, screenshots and even ideas about our game. The website will aperiodically come up online on http://paradisecore.ittun.com/ during the debugging stage.





Figures: Some finished parts of the game site

Section 3 – Software Engineering

3.1 Software Requirement

Functional Requirement:

- System function: This game is developed for entertaining purpose so it provides a relaxing experience for users (players). As players go forward, they will gradually approach the “truth” of the story and understand what is going on in this virtual world. This game does not require players to spend much time thinking or practicing to pass and the background story is very attractive. Therefore, users will certainly enjoy and relax themselves when playing this game.
- Input: The game receives input from users by continuously listening for the keyboard to be pressed. As soon as some specific keys are pressed, such as moving and interacting key, the program will react immediately and show the resulting outcome to users.
- Output: If some events that can be listened by listeners happens, they will be processed properly and the screen may be repainted due to some change caused by those process. For example, after user presses D, then the character should move to right and the movement should be displayed for the player. Such action will be completed by repainting the screen after change has been made.
- Exceptions: Exceptions are possible in this game. Since the game map is relatively complicated, there will be some “traps” for users. For instance, the map is designed linearly and some items can be essential for overcoming some obstacles. However, such items may be used only once and will disappear after consumption. If the player turn back and the character may not be able to get over the obstacle again

because items are not available. To deal with such exceptions, the game offers some instructions like escape for user to go back to the last recorded location.

Non-Functional Requirement:

- Product requirement: This game promises the usability for users so that they can play it without errors over 5%. Also, it has satisfying performance by implementing multithread, which makes the game run fluently. Since it does not need a user to create an account to start the game, it is not necessary to worry about any private information being revealed. Therefore, this product is usably, efficient and reliable.
- Organizational requirement: The product is written in Java in Windows so it should be run in an environment containing JVM, with JDK later than 1.8. Besides, a keyboard is necessary because the game reacts according to the input via listening which key is pressed. In addition to a keyboard, the operating system should differ from Android since it is not a mobile phone application.
- External requirement: Remember that this product is not used for commercial purpose and such behavior is forbidden. No one is allowed to sell it by any form. Moreover, the background story comes from original ideas and does not break any piece of law or ethical rules so authors should not be prosecuted for legal obligation due to these reasons.

3.2 Use Cases

The basic use cases for player to enjoy the game is described in Fig. 3-1. In addition, it also provides the use case tables detailing the actors, preconditions, scenario, exceptions and so forth.

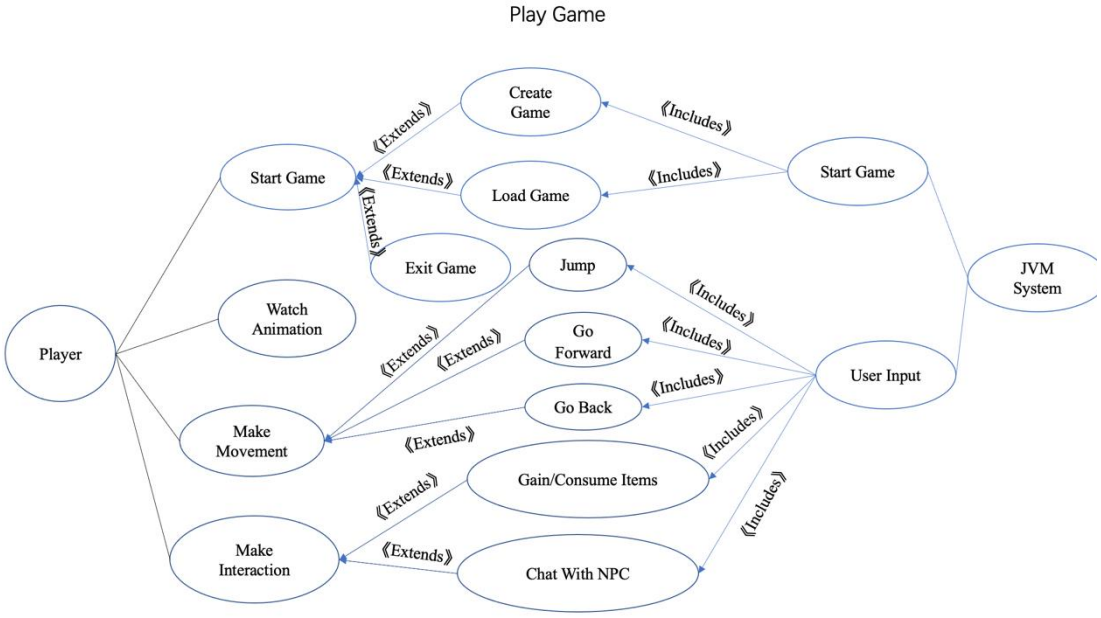


Fig. 3-1: Use cases

After launching, user should press the Start button to create a new game or load the saved game via Load button. At the beginning of each level, an animation will be played

to illustrate the basic information for this level and player can press space to skip it. Operation for moving the character can be completed through W-A-S-D or direction keys alternatively. Actions like picking up items is performed when player invokes consumption methods with key E. In addition to all above, one more thing that the player can do is to interact with NPCs such as communicating, by pressing F to use interaction function. Use-Case tables are displayed in Table 3-1 and Table 3-2

Table 3-1 Use-Case table for "Start Game"

Use Case Name:	Start Game
Scope:	"Paradise Core"
Primary Actor:	User
Secondary Actor:	JVM System
Summary:	User runs the game in the JVM and play the game.
Preconditions:	User has runnable JVM and executable source code.
Main Success Scenario:	1. The game is executed without errors. 2. User successfully sees the menu and choose to start a new game. 3. User can watch the animation after game starts.
Alternatives:	2.a. User can load a game that is saved before.
Exceptions:	2.b. User does not choose any item and stay.
Postconditions:	User succeeds finishing the animation and go forward to play the game.

Table 3-2 Use-Case table for "Make Movement"

Use Case Name:	Make Movement
Scope:	"Paradise Core"
Primary Actor:	User
Secondary Actor:	JVM System
Summary:	User changes the location of character by pressing corresponding keys which control the movement of character.
Preconditions:	User has entered the game.
Main Success Scenario:	1. The character moves to right when user presses *D.* 2. The character moves to left when user presses *A.* 3. The character jumps when user presses *W.* 4. The character jumps to right if both *D* and *W* are pressed. 5. The character jumps to left if both *A* and *W* are pressed.
Alternatives:	1.a. Character moves to right if user presses →.
Exceptions:	1.b. The character does not move if no key is pressed.
Postconditions:	Character arrives a new location after the movement finished.

3.3 Acceptance Test

In order to make the game progress in line with our expectations and detect bugs in the game design process, 21 acceptance tests listed in Table 3-3 are supposed to be carried out, and each test will be carried out in different scenarios and different backgrounds to ensure that all possible problems in the game are covered so that improving the reliability of the game itself and the playability of players.

Table 3-3 Acceptance Test

ID	Description	Input	Expected Output	P/F
1	Test that “Start Game” button works	Click Start Game” button	Game starts	
2	Test that “Mute” button works	Click “Mute” button	Sound effects closed	
3	Test that player can choose the first level	Click “level” button	Game starts with different levels	
4	Player can move left/right	A / D or ← / →	Player moves left/right	
5	Player can jump and crouch	W / S or ↑ / ↓ or SPACE	Players jumps and crouches	
6	Player cannot penetrate solid object	Movement near the solid barrier	Player does not go through the obstacles	
7	Player can interact with NPCs	Player gets close to the NPC and enters “F”	Player starts to interact with NPCs	
8	Player can up and down stairs	Player comes to stairs and enters W / S or ↑ / ↓	Player bounces up and down the stairs	
9	Player can mount the ladder	Player moves near the ladder	Player climbs the ladder	
10	Player can grab the rope and slide	Player gets close to the rope	Player grapples the rope and slides automatically	
11	Player can push boxes	Player enter A/D or → / ← near the box	Box can be moved in the direction of player’s movement	
12	Player can open the backpack and choose the props	TAB	Backpack opened	

Table 3-3 (Continuous) Acceptance Test

ID	Description	Input	Expected Output	P/F
13	Game props picked up can be put into backpack	Player picks up the props	Game props stored in the backpack	
14	Player can apply props	E	Game props are used or employed	
15	Enemies can be killed by player's weapons	Weapons collide with enemies	Enemies disappear	
16	Collision with enemies and obstacles reduces Health Point	Player collides with enemies or particular obstacles	Player dies or Health Point diminished	
17	Sound effects are available	Regular gameplay	Sound effects are audible	
18	Make sure every game level could be encountered	Multiple game runs	Each game level is encountered as the game conducts	
19	Game state can be saved after getting through a level	Player gets through a level, resume the game	Game continues at the start of a particular level	
20	Player can return to main menu	ESC	Main menu interface displayed	
21	Test that player dies	Player gets into traps or collide with enemies	"Game over" screen displayed	

Section 4 – Implementation Plans

4.1 Task List for the Project

At the beginning of the project, we sketch out the main tasks during week 3 – 8, and each task is assigned to one or more group members to complete. Basically, at the end of the week 8, every member has finished their own part, though sometimes there might be some delays, which however, do not cause the delay of the whole project. The task list for week 3 – 8 is displayed in Fig. 4-1.

Week	Tasks	Yifei Zhao	Boning Li	Qi Li	Yifan Ren	Yang Tang	Yiqian Zhang	Finished
3	Each Group Member Thinks About The Game Idea							Yes
	Determine The Final Game Idea From The Previous Ideas							Yes
	Determine The Game Title							Yes
	Create The Task List							Yes
	Discuss About The Game Features And Gameplay							Yes
4	Design The Game Background And Storyline							Yes
	Discuss About The Game Rules And Principles							Yes
	Develop More Game Features And Gameplay							Yes
	Design An Official Website For The Game							Yes
	Disign Drawings Of Characters And Enemies							Yes
5	Finalise The Game Features And Gameplay							Yes
	Finalise The Game Background And Storyline							Yes
	Create The Frame Of The Official Website							Yes
	Design Game Interlude Animation							Yes
	Design Game Logo							Yes
6	Finalise The Game Rules							Yes
	Finalise The Game Principles							Yes
	Software Requirement							Yes
	Use Cases							Yes
7	Risk Assessment Table							Yes
	Milestones Table							Yes
	Deliverables Table							Yes
	Create Game Logo							Yes
	Create An Official Website For The Game							Yes
8	Produce Drawings Of Characters And Enemies							Yes
	Activity Network							Yes
	Gantt Chart							Yes
	Acceptance Tests							Yes
	Project Schedule							Yes
	Finish The Report							Yes

Legend:

Assigned	
Not Assigned	

Fig. 4-1: Task List

4.2 Risk Assessment

Under the condition that in this semester, many of the group members are quite busy loaded with burdensome coursework and examinations, and the conflicts and contradictions might arise among group members as well, there exists the possibility that our project might not be conducted on schedule. Consequently, Risk assessment displayed in Fig. 4-2 could considerably assist us to deal with many unanticipated problems.

Risk Assessment					
Num.	Risk	Description	Likelihood	Impact	Contingency Plan
1	Group member is unable to contribute.	A member of the group is loaded with too many assignments of other courses or lacks enthusiasm.	High	Mild	Share the workload for that particular member and the delegation of tasks should be updated so that the game could be accomplished on time.
2	The project cannot be completed before deadline.	The group leader underestimate the schedule of the project.	High	Serious	Make more efforts on the project and accelerate the schedule.
3	The conflict or disagreement between group members.	One or more group members have antithetical standpoints against other members and difficult to cooperate.	Moderate	Catastrophic	Seek for help from tutors or group leader should reconcile the contradiction so that the schedule will not be impeded.
4	Ambivalent view on coding styles.	Different group member proposes various implementation on given component.	High	Serious	Seek for advice from other group members and discuss about which implementation is more efficient and concise.
5	Delete the important files by accident.	The relevant files get lost accidently without any backups.	Low	Catastrophic	Every group member should store one copy of the files and upload important files on OneDrive or iCloud or update the code on GitHub at any time.
6	Encounter the extremely unsolvable bugs.	Some intractable bugs occur that cannot be resolved by any members.	Moderate	Serious	Seek for assistance from senior schoolmates or contact professionals on the internet.

Fig. 4-2: Risk Assessment

4.3 Milestones and Deliverables

During the game implementation, there are major points known as milestones in the schedule that could facilitate progress assessment and work products known as deliverables that could be delivered to customers.

Fig. 4-3 displays the milestones including the point's dependencies, start date and end date, duration as well as the deliverables of the project which shown in Fig. 4-4.

Milestones						
Num.	Description	Dependencies	Accptance Test	Start Date	End Date	Duration
1	Design The Interface	-		16/11/2020	20/11/2020	5
2	Design The Game Background	-		23/11/2020	06/12/2020	14
3	Design The Sound Systems	-		21/11/2020	20/12/2020	30
4	Create The Game Logo	-		16/11/2020	20/11/2020	5
5	Create The Interlude Animation	-		16/11/2020	22/11/2020	7
6	Draw The Game Chatacters	-		16/11/2020	29/11/2020	14
7	Implement The Main Menu	Task 1		23/11/2020	20/12/2020	28
8	Design The Map	Task 1		23/11/2020	20/12/2020	28
9	Create The Game Website	Task 6		16/11/2020	29/11/2020	14
10	Implement Main Movement	Task 1, 6, 8		11/01/2021	17/01/2021	7
11	Implement Pick Ups In Game	Task 8, 10		11/01/2021	17/01/2021	7
12	Implement Barricade And Enemies	Task 8, 10		11/01/2021	07/02/2021	28
13	Interaction Between Game Props And Elements In The Map	Task 8, 10		25/01/2021	28/02/2021	35
14	Switchover Between Game Props	Task 10		11/01/2021	17/01/2021	7
15	Interaction Between Character And Traps	Task 8, 10		18/01/2021	28/02/2021	28
16	Design And Implement Health Point	Task 8 - 12		18/01/2021	24/01/2021	7
17	Provide The Game Tips	Task 8 - 15		11/01/2021	28/02/2021	49
18	Save And Load The Game	Task 1 - 17		01/03/2021	14/03/2021	14
19	Test For Bugs	Task 1 - 18		08/03/2021	11/04/2021	35
20	Fully Playable	Task 1 - 19		12/04/2021	16/05/2021	28

Fig. 4-3: Milestones

Deliverables	
Description	Deadline
All Menus And Game Interface Completed	29/11/2020
Characters, Game Props And Game Map Created	20/12/2020
Movement Of Character	28/02/2021
Interactions Between Character And Game Map	28/02/2021
The Uses And Switchover Of Game Props	28/02/2021
Calculation of Health Point	28/02/2021
Work Saving	14/03/2021
Finished Project	02/05/2021

Fig. 4-4: Deliverables

4.4 Activity Network

Critical Path

Critical path method documents the least time for the project to be completed, which can be used to identify the critical path, float time, and the flexibility of the project. It plays an important role in scheduling the whole game design and preventing the delay of critical points. In Table 4-1 it displays the activities encompassed in critical path including their ID, precondition, and durations. In Fig. 4-5 that below the activities it shows critical path originated from the table.

Table 4-1 Activities for critical path

ID	Activities	Preconditions	Duration (days)
A	Discuss and determine the game idea	-	7
B	Decide on the game features and rules	A	28
C	Create game website	-	42
D	Design game characters and enemies	-	35
E	Design game interlude animation	-	7
F	Report completed	B	21
G	Create menus and game interfaces	F	35
H	Create characters and game map	F	35
J	Produce movement of characters	G	49
K	Interactions between character and game map	G & H	49
L	Uses and switchover of game props	G	49
M	Calculation of Health Point of character	G	41
N	Work saving system	G & M	14
O	Game testing	N	41
P	Project finished	O	28

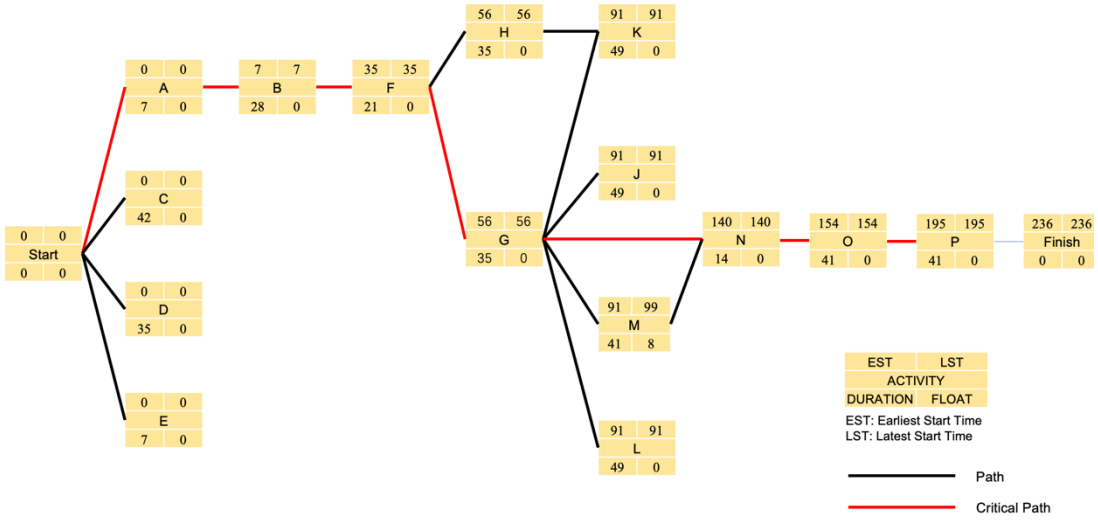


Fig. 4-5: Critical path

It can be seen from the critical path highlighted in red is the principle line required to accomplish the project on schedule. As it shows, total amount of days required for us to complete the whole project is **236** days.

Gantt Chart

Another useful tool in planning the implementation of the project is Gantt Chart. It demonstrates the planned task in given time period and which tasks could be conducted parallelly, and which tasks should be conducted after another or the dependencies among various tasks. Gantt Chart for our project is displayed in Fig. 4-6.

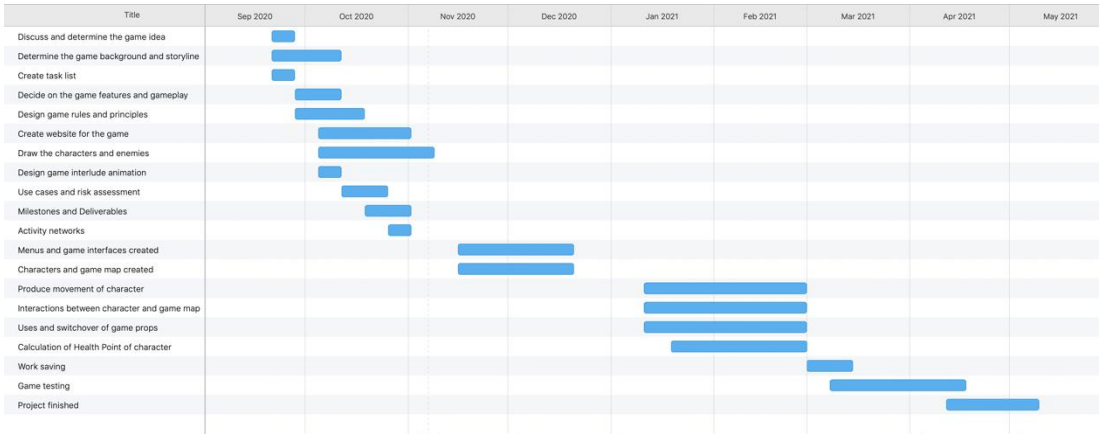


Fig. 4-6: Gantt Chart

Appendix

References

Cover:

https://lh4.googleusercontent.com/bXbdE10vTt1BcsJFki-pBAFWp8IHy6foui9nb_MazaulqNXkw1lnHJpVMTeIg3b8ZUrJrFlkR6TPT7mLMK8UBviHgMh3NJZgD4bMxooyFmdldxreHScnAtIAQfmMRtF_KI_oStc0?width=750

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Gameplay:
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Game design:
https://www.zhihu.com/question/268277689

Logo for the Game

Gods in the game

1. Vulcan and its consorts - the whole environment is a world of fire, the ground will appear the pit of fire, players accidentally fall into it will lose a lot of health, health will be burned when exhausted.

Vulcan

2. Neptune and its consorts - the overall environment is the sea world. Players may accidentally get entangled in seaweed on their feet, which will cause them to lose their strength and sink to the bottom of the sea.

Neptune

3. Earth gods and rock monsters - the whole environment for the earth yellow desert, cactus and rock monsters on the ground. Getting stabbed by a cactus or struck by a rock monster can cost your durability, and when that durability is used up, you die of thirst in the endless desert world.

Earth Gods

Some Scenarios in the Game