The Implementation of RPG Concept on Breakout Games Using LibGDX Framework

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Article Info	ABSTRACT
	As technology becomes more global, RPG games runs into a good development. One of which is a combination of RPG with another games. This journal aims to combine the breakout games and the RPG which has its characteristics. This game development uses prototyping method, in which analysing the necessity and determining the goals of the software. Then, prototype will be created and evaluated regularly so that the result can use 2D graphics. This game also can be used as a reference to reflexes practising. A modeling is conducted to design 'use case,' scenario process, activity diagram, class diagram, and sequence diagram as well as to conduct an interface design. A calibration that is used, is calibrating the programme which is created as well as the features in the programme itself. It can be concluded that the construction of RPG games combination and breakout using eclipse and libgdx works well. In addition, it uses the components such as TMX tile map, sprite, sprite batching, box2d and input handling.

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1. INTRODUCTION

Games have been used in schools for many years to help children learn skills in math, language, geography, science, and other domains in an interesting and motivating way[1]. As the growth in world of game increases, it does not mean that the enhancement on the features in a game itself going well. Many games in this era , have started to use graphics quality and hardware such as, a controller which used cable before, but now it uses wirelessly[2]. Also, many games are not aware of the use of those features. In addition, a lot of games have been created, such as: action, adventure, sport, stimuation, fantasy, cards, board games, role-playing game and there is also the combination of those games[3].

In the early twentieth century, two unrelated parallel developments eventually converged into what we call RPGs today, The first development was a set of simple rules written in 1913 by H.G. Wells in the form of a war game called little wars and The second development during this time was in the form of a series of novels[4]. Certainly, RPGs have had bad press[5] but judging by the favorable results of investigations, these fears do not have any scientific proof; RPG players do not have suicidal tendencies, have fewer criminal tendencies, and more imagination and empathy[6].

RPG is a typical of game where the player leads the character in the game. The important thing is how to increase the character's ability that is played in this game. The attribute for each level and the experience point are connected to each other effectively to measure the characters' growth[7]. The character can practice, learn about a new ability, and find a better equipment, and become stronger. As the story goes by, the character will fight with a stronger enemy. RPGs may be defined as a system for creating stories based on rules. They allow a group of players and a game director (also known as Game Master or Narrator) to participate and interact using their imagination to determine what could happen[6][8]. Fifty-two articles from the role-playing game (RPG) subset ofSGs are identified, synthesised and analysed using a multi-criteria evaluation framework[9].

Arcade is one of the games' circles. The typical of this game is commonly in the form of consolation machine using coins[3]. Mostly, it is in the form of video game or mechanical electro and prized games. On

the other hand, the popularity of this game is going down recently. It is because this game cannot compete with a console game as it can be played at home.

One of arcade games is Breakout. In this game, there will be a certain rows of bar on the top of the game. A ball will move in a screen, then it will bounce up and bounce to the left and to the right side of the screen. If it touches the bars, then the bars will be bounced and broken. In addition, the player will lose right after the ball touches the bottom of the game screen[10]. Nowadays, some researchers and teachers around the world have shown deep interest in RPGs as an educational tool[11].

The combination of Breakout and RPG will become something interesting. RPG has a plot, and the characters in that game need to be developed. Meanwhile, Breakout game is more challenging as the player needs to direct the ball so that it can break the bars and defend the ball for fear that it will touch the bottom of the game screen.

2.   METHOD

The method that is used in this research is prototyping level. According to Roger S. Pressman, the process of prototyping model starts in a communication. The developer meets a stakeholder to determine the overall goals of creating a software and identify the necessity of the software itself. The repetition of prototyping process is planned quickly with a modelling (in the form of quick design). Then, a design is heading to a prototype construction. After that, the prototype will be given and evaluated by the stakeholder, who provides a feedback which can be used to explain more about the software's necessity. The repetition will occur till the prototype becomes a software which satisfy the stakeholder, as well as make the developer to become more understand about what to do[12].
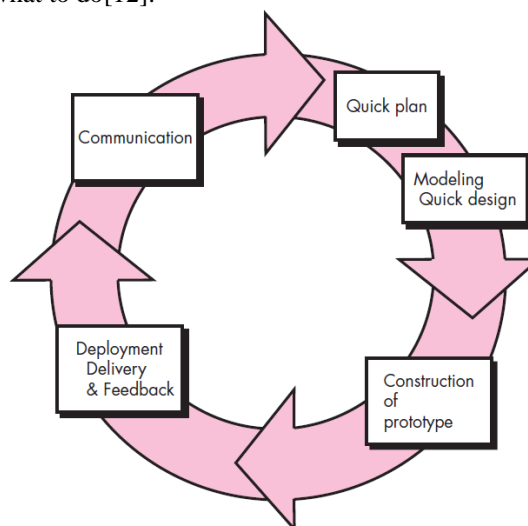

Figure 1. Prototype Development Model

Prototype development model has some advantages, such as[13]:
- Prototype involves a user in analysing and designing.
- Has the ability to catch the necessity concretely.
- Can be used standalone.
- Is used to increase SDLC.

On communication level, the researcher will collect the information, literature study, analyse the combination of the games' concept, and determine the framework that is used. In creating the concept of the game, there is a gameplay, which is something that we have to be aware of. It is because the gameplay consists of challenges and actions that are offered in a game[7]. On quick plan level and modelling quick design, the researcher will make a general illustration of the game, use case diagramme, and the interface design. Use case diagramme is used to represent the interaction between the user and the system and these diagrams describe, in outline, the use cases associated with a system[14][15]. After that, the prototype of the design will be created.

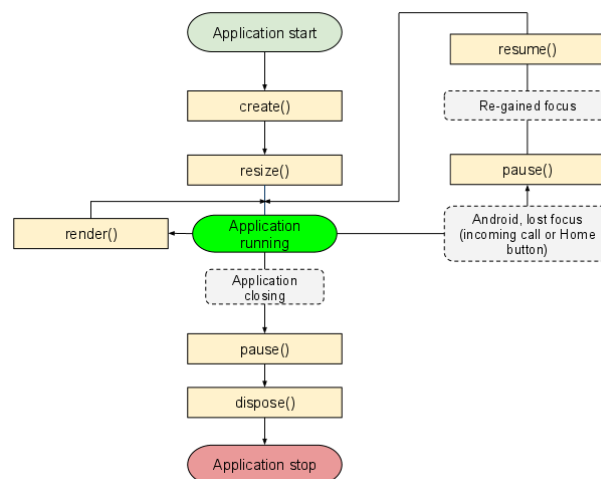The production of this game uses libgdx framework, which has life cycle as follows:

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Figure 2. Libgdx Life Cycle

Table 1. Libgdx Cycle Method

Methods' Name	Description
Create()	This method will be used once as the application is created.
Resize(int width, int height)	This method will always be used when the size of the game screen is changing, and it is not in pause mode. This method is also used once after creating method. There is a wide size and a screen height in the parameter of this method once being re-sized.
Render()	The method which is used as a game repetition in the application is render. The game logic is commonly updated in this method.
Pause()	In android, this method is used when the home button is pushed or when there is a phone call. In desktop, this method is only used once before dispose method. It is a great place to save a game status.
Resume()	This method is only used on android, to continue the application from pause status.
Dispose()	This method is used to close the application.

Libgdx framework has some features, such as:

- Has 2D particle system, supports tmx map, and manipulate bitmap.
- Supports music and sound effect, such as WAV, MP3, and OGG.
- Uses abstraction for mouse, touchscreen, keyboard, accelerometer, and compass.
- Has equipments, such as particle editor, texture packer, and bitmap font generator.

After this, the prototype will be given, evaluated, and tested by the stakeholder, and the stakeholder will give some feedbacks and then this prototype will go to communication level for being revised, it is based on the feedback given.

3.   RESULTS AND DISCUSSION

The game which is designed is a combination of Breakout and RPG, in which the fight system uses the basic rules of "Breakout" game. The bat in "Breakout" game is used as a weapon of those three characters. In playing that game, the character can be changed if the ball could not be caught. The bars' row will have a defense, hit-point, and attack. Those three aspects will influence the difficulty of each stages. The character has to have a strong defense in order to destroy the bars' row using the ball. The character also has to have a strong defense and a big hit-point in order to survive from the ball attack that cannot be caught by the player.

This game tells about a country which is led by a king. In that country, there are three races that cooperate with each other. They are, elf, warrrior, and sorcerer. A darkness strength then attacks that kingdom in order to kidnap a princess and orb who are very important in that kingdom. Each races gather in order to send the soldiers and are going to save the princess and the kingdom from a distruction. The soldiers that are sent are the shatter from orb. It is because only by using orb's power, the king of the darkness can be defeated.

During the journey of the story, the player will face a challenging stage in this game. The character can use and improve his/her skill. The character can also be developed by improving the status, from the point he/she gets when the character is going to the next level. By finisihing the stage, the player can get the experience point and craft point to create an item, which can make the character stronger.

3.1. Characters

The player can have some characters in this game, such as:

1.   Warrior

It is a character which has the ability to attack and has a strong defense. This character also has a lot of hit-points. Table 2 consists of the explanation of the status that can be improved to the warrior.

Table 2. Warrior Status

Status	Attack	Defense	Max HP	Max MP	Critical Chance
Strength	2	-	-	-	-
Agility	1	-	-	-	0,5 %
Inteligent	-	-	-	2	-
Vitality	-	2	3	-	-

Table 3. Warrior's Skill

Name	MP	Cooldown	Duration	Description
Heavy Slash	55	10	2	Improve the attack for about 10% + 1% * Skill Level.
Shield Charge	75	15	5	Ream the bat for about 25%.
Provoke	100	20	4	Improve the enemy's attack for about 10% + 10% * Skill Level, and reduce the enemy's fortress for about 20% + 5% * Skill Level.
Life Steal	130	25	7	Increase the character's hit-point when the ball touches hte bars. Hit-point increasing: (5% + 1% * Skill Level) *(the enemy's attack– the enemy's defense).
Stomp	90% * Max MP	30	-	Attack all bars for about (10% + 3% * Skill Level) * the character's attack. On second level there is an effect to reduce the enemy's defense for about 10%.

2.   Elf

Elf is a character which has special quality in liveliness and the big critical possibility. Table 4 consists of the explanation of the status that can be improved to the elf.

Table 4. Elf Status

Status	Attack	Defense	Max HP	Max MP	Critical Chance
Strength	1	-	-	-	-
Agility	1,5	-	-	-	1 %
Inteligent	-	-	-	2	-
Vitality	-	1,5	2	-	-

Table 5. Elf's Skill

Name	MP	Cooldown	Duration	Description
Focus Shoot	55	10	2	Improve critical change of the character for about 10% + 1% * Skill Level.
Multi Ball	75	15	5	Increase the total amout of the ball to two (for skill level 1-3), three (for skill level 4)
Slow Motion	100	20	4	Reduce the ball's speed for about 50% when the ball is in the area. This area is in front of the character. It spreads out as wide as a board game and its height is about five bars.
Show Time	130	25	7	Reduce a cooldown for about 10% + 1% * Skill Level.
Arrow Shower	90% * MaxMP	30	-	Attack all bars for about (10% + 3% * Skill Level) * the character's attack. On second level there is an effect to reduce the enemy's hit-point for about 1% per second.

3.   Sorcerer

It is an excellent character in using magic and has a big magic-point. Table 6 consists of the explanation of the status that can be improved to the sorcerer.

Table 6. Sorcerer Status

Status	Attack	Defense	Max HP	Max MP	Critical Chance
Strength	-	-	-	-	-
Agility	1	-	-	-	0,5 %
Inteligent	2	-	-	3	-
Vitality	-	1,5	2	-	-

Table 7. Elf's Skill

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Name	MP	Cooldown	Duration	Description
Blessing	55	10	2	Improve all status for 6% + 1% * Skill Level.
Restore	75	15	5	Improve the magic-point about 10% + 1% * Skill Level.
Magnetic	100	20	4	Make the ball stick on the bat.
Savety Wall	130	25	7	Create the defense behind the character to prevent from the enemy's attack for once.
Falling Star	90% * MaxMP	30	-	Attack all bars for about (10% + 3% * Skill Level) * the character's attack. On second level there is an effect to reduce the enemy's hit-point for about 1% per second.

On table 7, we can see the item we can get at the battle and also when we success to destroy the bars.

Table 8. Drop Item

The name of the item	Description	Duration (Second)
Orange Potion	Improve 10% for all status.	10
Green Potion	Improve 10% for all status.	8
Red Potion	Improve 7% for the attack.	8
Black Potion	Give 2% burn effect * MaxHP of the player.	5
Purple Potion	Give 3% poisoned effect * MaxHP of the player.	5

The equipments that can be created in the game are on the table 9, table 10, and table 11.

Table 9. Weapon of the Character

The name of the item	Description	Requirement Level	Duration (Second)		Craft Point
			Physical	Magic	
Warrior	Common Sword	2	5	0	30
	Master Sword	11	15	0	100
Elf	Common Bow	2	5	0	30
	Mythical Bow	11	15	0	100
Sorcerer	Common Staff	2	0	5	30
	Mythical Staff	11	0	15	100

Table 10. Upper Character

The name of the item	Description	Requirement Level	Duration (Second)		Craft Point
			Physical	Magic	
Warrior	Common Upper	2	5	10	20
	Master Upper	11	10	20	75
Elf	Common Upper	2	5	10	20
	Mythical Upper	11	10	20	75
Sorcerer	Common Upper	2	5	10	20
	Mythical Upper	11	10	20	75

Table 11. Lower Character

The name of the item	Description	Requirement Level	Duration (Second)		Craft Point
			Physical	Magic	
Warrior	Common Lower	2	5	10	20
	Master Upper	11	10	20	75
Elf	Common Upper	2	5	10	20
Sorcerer	Mythical Upper	11	10	20	75
	Common Upper	2	5	10	20

Table 12 consists of the list of the enemies that are on the game.

Table 12. Types of the Enemy

Monster's name	Attack	Defense	HP Amount	Types of Attack
Fox (Canis lupus)	65	10	25	-
Wild Boar (Sus scrofa vittatus)	80	20	30	Paralized
Bear (Helarctos malayanus)	100	35	55	Confuse
Komodo (Varanus komodoensis)	130	45	65	Blind
Two-horned rhinoceros (Dicerorhinus sumatrensis)	195	80	140	Confuse, Blind

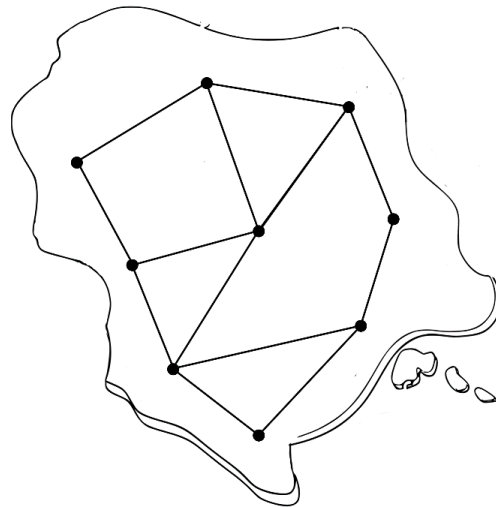Figure 3. Game Map

Figure 3 shows a map in a game. The circles are a place to start a misson or to enter a stage. The character can move from one circle to another circles and the character can enter the stage to have a battle. When the character has come to the next circle, there is also a probability to fight the enemy in accordance with the mission that is running.
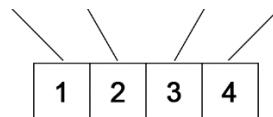

Figure 4. The Direction of the Ball's Reflection

The paddle board in figure 4 has different balls' directions. In the first part, the ball will bounce 45° to the left. In the second part, the ball will bounce 60° to the left. In the third part, the ball will bounce 60° to the right. Furthermore, in the fourth part the ball will bounce 45° to the right.
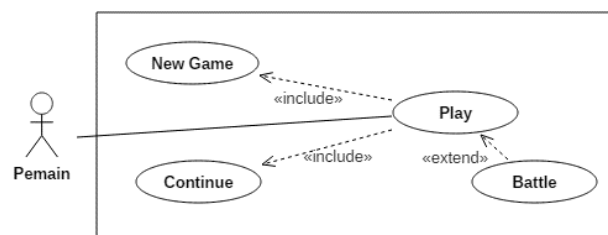
3.2. Use Case Diagram

Figure 4. Use Case Diagram

Use case diagram in figure 5 describes the user to start a new game, or to continue a game from the data that has beem saved before. In that game, we also can find them to improve the status, the equipment store, special ability, create the equipment, and choose the battle place.

- New Game

  In this use case, the player can start a new game.
- Continue

  In this use case, the player can continue a game as it has been saved before.
- Play

  In this use case, the player can choose the menu such as, the battle location, equipment store (inventory), create the equipment (craft equipment), improve the status (status upgrade), and improve or reduce skill.
- Battle

  In this case, the player can enter the stage and have a battle.

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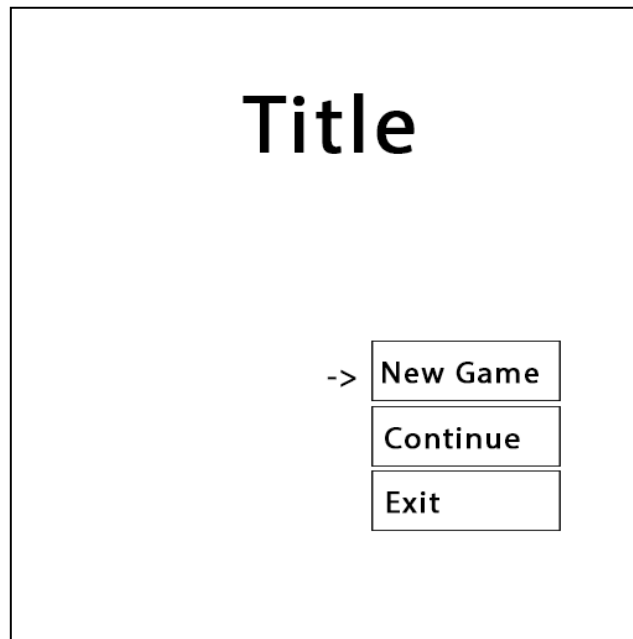
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3.3. Interface Design

Figure 6. The Main Menu of the Game

Figure 6 tells about the main menu of the game. It has "new game," "continue," and also "exit" buttons. New game is used to start a new game. Continue is used to continue the game. Exit is used to quit from the game.
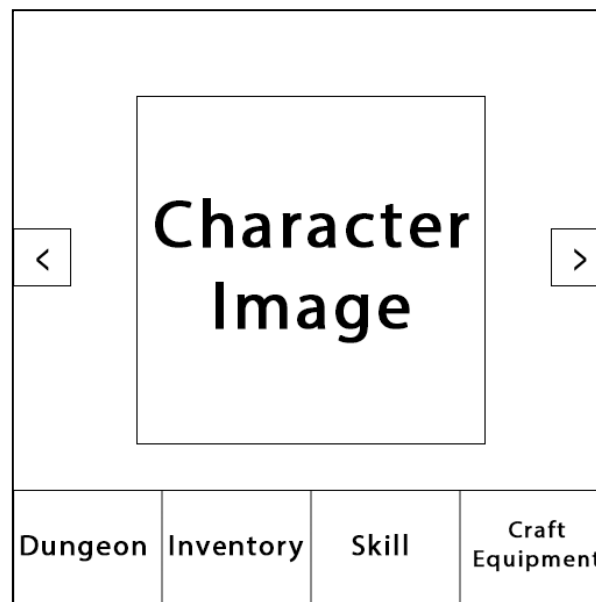

Figure 7. Game Menu

Figure 7 above tells about the game menu which has several buttons such as: dungeom, inventory, skill, craft equipment, change character, and character status. Dungeon will lead the player in choosing the stage. Inventory will lead the player into the equipment store where the player can change and find the equipment he/she need. Skill will lead the player in improving or reducing and using the skill. Craft item will lead the player in creating the character's equipment. Left and right buttons on the character are used to change the character. While, if we click status character, it will lead the player to the menu for improving the character status.
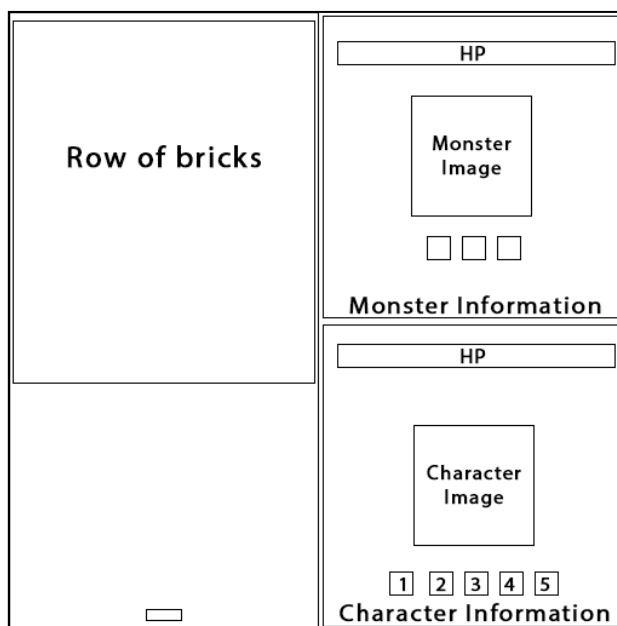
Figure 8. Stage Display

Figure 8 describes a display that can be seen when we are in a stage. There are some bars that should be destroyed. There is also skill button to use the skill. The hit-point bar is used to remain the lives of the character. Monster button is used to show the enemy. The bat in the below is used to shoot and bounce the ball.
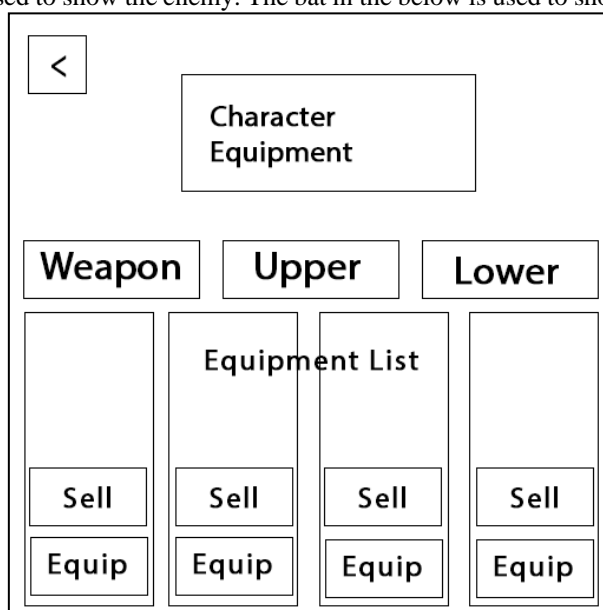

Figure 9. Inventory Display

Picture 9 above shows the player a place where he/she can change the character's equipment. Also, all equipment that have been made before are saved in the inventory. By using the equipment, the character will be stronger.

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Figure 10. Status Upgrade Display

Figure 10 above tells about the display of status upgrade which shows how to improve the character's status and also how to reset the character's status. There are four status that can be improved; str, int, agi, and vit.

3.4. Game Display

Figure 11. Main Menu of the Game

Figure 11 above shows the main screen of the game. It shows the display when we enter the game for the first time. There are three button components, such as:
- New Game, to create a new game and enter the screen menu.
- Continue, to load the saved-data and also to enter the screen menu.
- Exit, to quit the game and to save the newest data from the game.

Figure 12. Game Menu

Figure 12 above shows the display of screen menu after we click the new game button or continue button. There are six button components, such as:

- Dungeon, to go to dungeon screen.
- Inventory, to go to inventory screen,
- Skill, to go to skill screen.
- Craft, to go to craft screen.
- Left, to change the characters to the left
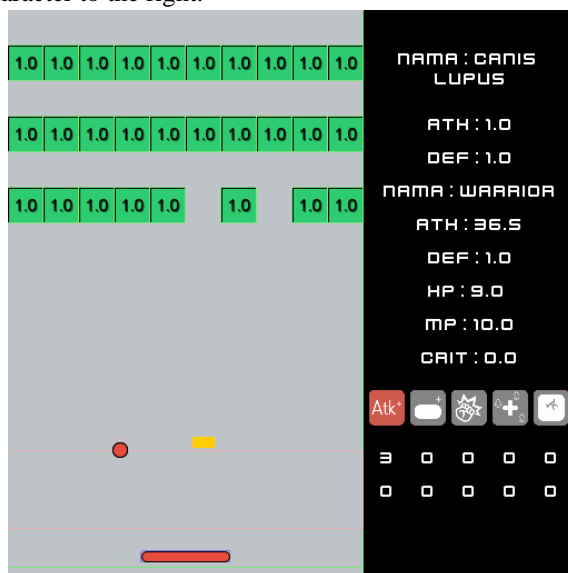- Right, to change the character to the right.

Figure 13. Stage Display

Figure 13 above tells about the play screen display when we choose the stage image. There are five components, such as:

- Brick, to show the total hit-point from the enemy.
- Arrow, to show the ball's direction.
- Ball, to destroy bricks.
- Paddle, to bounce the ball so that it will not go through the bottom of the sceen.

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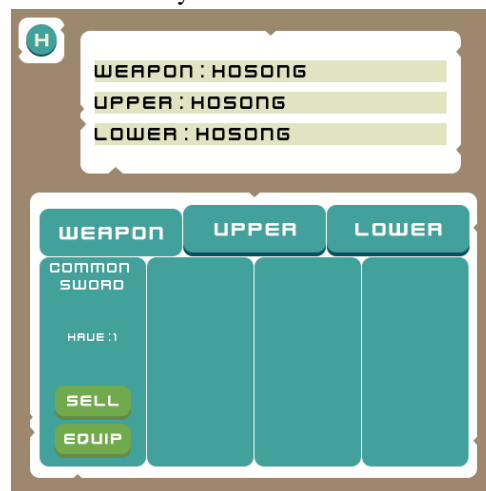- Item, will appear once the bricks are destroyed.

Figure 14. Inventory Display

Figure 14 above shows the inventory display when we click the inventory button in the screen menu. There are six components,such as:

- Button Back, to go back to the screen menu.
- Text Equipment Character, to show the equipment that is being used, and it consists of weapon, upper, and lower.
- Weapon Button, to change a display type to weapon.
- Upper Button, to change a display type to upper.
- Lower Button, to change a display type to lower.
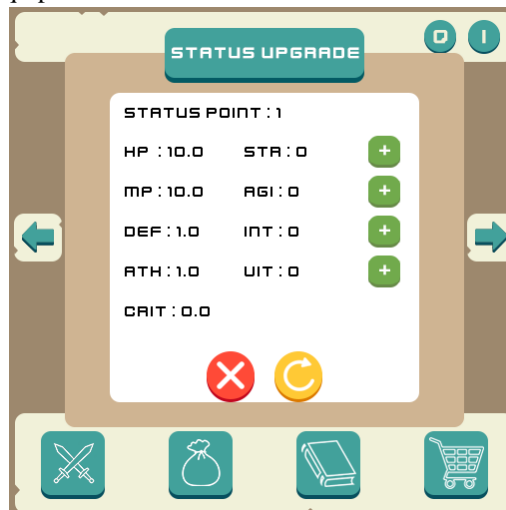- Equip Button, to use the equipment.

Figure 15. Status Upgrade Display

Figure 15 above shows the status upgrade display when we click the status upgrade button in the screen menu. There are four components, such as:

- Text Status, to show the status of each character which consists of point status, str, agi, int, vit, atk, def, hp, mp and crit.
- Up Button, to improve a basic status of each character.
- Close Button, to close the window of the status upgrade.
- Reset Button, to restore the status str, agi, int and vit back to normal.

3.4. The Game Calibration

1.   The Main Screen Calibration

Table 13. The Table of Main Screen Calibration

No	Data	Expected Result	Test Result	Status
1	New Game Button, there is no save button.	Can save a new gane and can open a screen menu.	Can save a new gane and can open a screen menu. .	Valid
2	New Game Button, there is save game.	Show text to save a new game.	Show text to save a new game.	Valid
3	Continue Button, there is no save game.	The button cannot be pushed and nothing happened.	The button cannot be pushed and nothing happened.	Valid
4	Continue Button, there is save game.	Can open the save game and open the screen menu.	Can open the save game and open the screen menu.	Valid
5	Exit Button.	Can show the text to quit the game.	Can show the text to quit the game.	Valid

2.   Screen Menu Calibration

Table 14. The Table of Screen Menu Calibration

No	Data	Expected Result	Test Result	Status
1	Dungeon Button.	Show dungeon screen.	Show dungeon screen.	Valid
2	Inventory Button.	Show inventory screen.	Show inventory screen.	Valid
3	Craft Button.	Show craft screen.	Show craft screen.	Valid
4	Left Button.	Change the character to the left.	Change the character to the left..	Valid
5	Right Button.	Change the character to the right.	Change the character to the right.	Valid

3.   Play Screen Calibration

Table 15. The Table of Play Screen Calibration

No	Data	Expected Result	Test Result	Status
1	Monster Text.	Show the information of the monster.	Show the information of the monster.	Valid
2	Karakter Text.	Show the information of the character that is going to be used.	Show the information of the character that is going to be used.	Valid
3	Image Skill	Show the picture of the character's skill.	Show the picture of the character's skill.	Valid
4	Text Skill.	Show the skill information such as cooldown and time buff.	Show the skill information such as cooldown and time buff.	Valid
5	The ball touches the bricks, the character's attack is lower than the enemy's hit-point.	The brick cannot be destroyed and the ball can bounce.	The brick cannot be destroyed and the ball can bounce.	Valid

4.   Inventory Screen Calibration

Table 16. The Table of Inventory Screen Calibration

No	Data	Expected Result	Test Result	Status
1	Back Button.	Back to screen menu.	Back to screen menu.	Valid
2	Text Equipment.	Show the equipment the character uses.	Show the equipment the character uses.	Valid
3	Weapon Button.	Change the equipment display to weapon.	Change the equipment display to weapon.	Valid
4	Upper Button.	Change the equipment display to upper.	Change the equipment display to upper.	Valid
5	Lower Button.	Change the equipment display to lower.	Change the equipment display to lower.	Valid

5.   Status Upgrade Calibration

Table 17. The Table of Main Screen Calibration

No	Data	Expected Result	Test Result	Status
1	Cross Button.	Close status upgrade window.	Close status upgrade window.	Valid
2	Reset Button.	Show text to reset the character status.	Show text to reset the character status.	Valid
3	Plus Button, status point is enough.	Improve the chosen status.	Improve the chosen status.	Valid
4	Status point text.	Show the character's status point.	Show the character's status point.	Valid
5	Status Character text.	Show the character status, such as: hp, mp, def, atk, crit, str, agi, int and vit.	Show the character status, such as: hp, mp, def, atk, crit, str, agi, int and vit.	Valid

4. CONCLUSION

RPG concept can be applied on breakout game well. By applying the features such as job system, the use of the equipment on the character, the character's special ability, the character can go to next level, the story is in the form of quest, and the battle system uses breakout game.

The game can be created well by using eclipse and the use of libgdx framework, and the use of some components such as TMX tile map to save the pattern of bar rows, sprite to ease in taking picture, sprite batching to ease the real-time picture, box2d to ease in creating the boundary box in bars, paddle board, ball and handling input that is used to receive the input from the keyboard.

Commonly, the main battle works by bouncing the ball on the board game. the character's attack is when the ball touches the bar rows. Meanwhile, the enemy's attack is when that bar rows are destroyed and show an item. When that item touches a paddle board, it can get the effect of enemy's attack.

The player's data and the game's data can be saved on the folder that is easy to be opened, when the player wants to continue the game.

In addition, there are also some suggestions for further researcher to conduct this research:

- Improve the graphic to 3D.
- The addition of character's job.
- The addition of character's equipment.
- The addition of character's skill.
- The addition of character's skill animation.
- The addition of the kind of the enemy's attack.

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