A SERIOUS GAME TO MAKE LEARNING JAPANESE (KATAKANA) EASIER

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ABSTRAK

Pembelajaran bahasa asing boleh menjadi sukar pada usia lanjut. Walaubagaimanapun, pada masa ini terdapat banyak jenis aplikasi permainan dan bahan dalam talian yang dapat membantu semua peringkat umur belajar bahasa asing. Sesetengah masalah yang dikesan adalah pengguna mendapati kesukaran untuk belajar bahasa asing, aplikasi yang tidak cukup menarik dan pengguna takut membuat kesilapan ketika belajar. Projek ini akan menyelesaikan masalah tersebut dengan mereka bentuk dan membangunkan permainan yang serius untuk meningkatkan keupayaan pelajar belajar bahasa Jepun dan menguji sistem. Terdapat dua bidang yang perlu dipertimbangkan dalam pembelajaran bahasa dan pengajaran menggunakan dengan permainan video. Kedua-dua bidang ini adalah *Computer-assisted Language Learning* (CALL) dan *Digital game- based Learning* (DGBL). Untuk projek ini, bidang yang akan digunakan ialah DGBL. Ia tidak digunakan sebagai bantuan tetapi untuk membuat bahan pembelajaran lebih seronok dengan menambah beberapa mekanik permainan yang menarik. Projek ini menggunakan metodologi *Rapid Application Development* (RAD). Kesimpulannya, projek ini telah membangunkan aplikasi permainan yang berguna yang boleh digunakan oleh pelajar dan orang yang berminat untuk mempelajari bahasa Jepun.

ABSTRACT

Learning foreign language can be difficult at later age. Although, currently there are many different type of gaming apps and online material that can help people of all ages to learn foreign language. The problems are identified when user find it difficult to learn foreign language when the application is not engaging enough and user afraid of making mistakes when learning. Therefore, this project may solve those problems by designing and developing a serious game in order to increase learner's ability to learn Japanese language and tests its system. There are two fields that needs to be considered in language learning and teaching using with video games. The two fields are Computer-assisted Language Learning (CALL) and Digital game-based Learning (DGBL). For this project, the fields that will be used is DGBL. It is not used as an assistance but to make the learning material more fun by adding few engaging game mechanics. This project uses Rapid Application Development methodology. In conclusion, this project has developed a useful game application that can be used by students and people interested in learning Japanese language.

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LIST OF ABBREVIATIONS

CALL	Computer-assisted Language Learning
DGBL	Digital game-based Learning
RAD	Rapid Application Development

CHAPTER 1

INTRODUCTION

1.1 Introduction

Learning foreign language at a later age can be quite a challenging fit. However, nowadays there are many different type of gaming apps and online material that can help people of all ages to learn foreign language. One current language learning game that is notable to mention is Japanese Word Dungeon. The game works by making the player battle with monster while going through a dungeon. However, the player can only attack the monster by choosing the correct Japanese character. This makes the game interesting by making the player memorize Japanese character in order to defeat their enemies and go to the next level. Another good example of a language learning game is Japanese Spy: Learn Japanese. The game makes the player learn Japanese by giving the player a task they need to complete. Each task has its own mini game and this makes the learning experience fun.

All the games mentioned above are several examples of a language learning game. In term of strength, the reason for using game in learning foreign language is because they can learn foreign language by easier and fun way. This is because instead of learning language by memorization and quiz, learner can play a game that requires the same method. The game makes learning foreign language experience fun and memorizing easier. In term of weakness, learning foreign language through game is not really good because balancing learning and interesting gameplay is hard. The gameplay should not hinder the process of learning.

Therefore, this project general problem proposes a solution to make a serious game about learning foreign language. In particular, this project intends to make a game about learning one of the Japanese character, Katakana.

1.2 Problem Statement

Problem cannot be avoided when developing this project and this project have some issues that needs to be solved. Below is some problem that can be identified in this project:

i. Difficulty to memorize:

It is difficult for people to learn and memorize new foreign language and retain the knowledge. The true aim of making this serious game on learning the Japanese language is so that the learner will have an easier time recalling and memorizing in using Japanese daily. Game can make vocabulary and grammar learning more enjoyable and provide the language learners with a meaningful context to practice communicatively (Ketterlinus, 2017). This shows that game can help in learning and memorizing a foreign language better.

ii. Hard to concentrate:

A serious game is about making learning fun. Learning foreign language can be hard and student may have a hard time to concentrate on learning because of the boring process. Turning a learning material into a game can make the learning process entertaining enough for the learner to pay attention while learning. When they are enjoying the learning process it will make them easier to concentrate and learn the language. By playing game, the player or learner will have to concentrate on a set of goal and purpose on getting the right answer or passing a certain course of event. Chik and Ho (2017) found that setting own goals and purposes, being in control, and being proactive were essential for learners to persist with the learning materials over time. This shows that when there is goal and aims to achieve by the player, it will motivate them to achieve the right result.

iii. Difficulty to learn from mistakes:

Making mistakes is a common problem in learning. However, making a mistake while learning language can make you feel frustrated. This is not a problem if you learn using game. According to Ketterlinus (2017), due to the fun and interactive nature of language games, learners can practice target language structures without worrying about making mistakes or being watched. Memorizing is easier done when you do not have to worry about making mistakes in front of your whole class. Also, gaming provides the player or learner to play and memorize the part they have a hard time learning by repeating that certain level in the game. This is the reason why people tend to learn foreign language on their own.

1.3 Objective

The aim of this project is to make learning Japanese character, Katakana easier. Below are the objectives this project need to achieve and target aim:

i. To design a serious game for Japanese Characters, Katakana.
ii. To develop a serious game on learning the Japanese characters, Katakana.
iii. To test and evaluate the user acceptance of the developed game.

1.4 Scope

Every project has a range of scope that needs to be done. Below is the scope of this project:

i. Develop a 2D game that can be played on PC.
ii. The target user is students especially from UMP who wants to learn Japanese.
iii. The user is expected to at least know basic Japanese characters such as Hiragana.
iv. The game is developed using Unity.

1.5 Significance

The significance of this project is to developed a game that will make learning Japanese easier. This project could also show that learning in general are easier when gaming is involved. This is not just because gaming is fun by itself, it is also because gaming requires the learner to engage and think in a fun environment. Learning in a stress free and enjoyable environment makes learning process easier. Overall, this project should be useful and beneficial to UMP students or anyone who wants to learn Japanese.

1.6 Summary

This chapter discusses about introduction to a serious game of learning Japanese language. The problem statement describes about the current problem in learning foreign language through game. The project objectives list a set of goal that the project need to achieve. Scope of the project is the boundary required in completing the project while, significance is to show the importance of this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter describes a serious game on learning the Japanese language specifically the Katakana characters. This project will be a knowledge based serious game. It will be developed for UMP students to help in making learning Japanese language fun and easier. This chapter will describe the research of previous studies on implementing game in language learning program. There will also be a review on current existing game and the comparison between development tools.

2.1 Game

Game is an activity that we play when we are bored. We play game to fill our time. A game can be a tool that can help in making fun activities for individuals and group alike. According to Talak-kiryk (2010), games are fun activities that encourages interaction, reasoning, learning, and problem solving strategies. A game can be about testing player's strengths, skills, understanding and many others. It may be a single player or involve a group of people. A game has set of rules that needs to be followed. Player needs to get points by solving an activity set by the game in order to win the game.

There is game that you can play physically and game that you can play through an electronic device. This project focuses on the latter meaning video games. Main purpose of video game is to entertain people. Video game can be something as simple as a point and click adventure to solve complicated puzzles. It can be a clicker game where player just have to click on the screen multiple time to get money. It also can be an adventure fantasy game where player have to travel from a region to another to save the

princess. Some people are just casual gamers but there are also gamer who devoted their life to gaming.

Overall, game may be viewed as something to waste your time with by some people. However, other than being fun, game have its own advantages. For an example, a gamer who are devoted to play a shooter game have a good cognitive skill. As stated by Granic, Lobel, & Engels (2014), contrary to conventional beliefs that playing video games is intellectually lazy and sedating, it turns out that playing these games promotes a wide range of cognitive skills. Game not only can be used as an entertainment but it also trains the gamer by strengthening their cognitive skills.

2.2 Serious Game

There are two types of game. One is for entertainment and another is for educational purposes. This project focuses on education. As stated by Ulicsak (2010), the term serious game will be used to refer to digital games such as simulations and edutainment with the purpose of educating specific default skills or knowledge. Serious game purpose is more toward educating rather than entertaining. However, serious game still needs the fun aspect in order to gain interest of its learner. Serious game can be similar to gamification of educational material. Gamification is applying gaming aspects in a certain subject to make it more interesting. It involves integrating gaming mechanics to make the material more engaging for the learner. Just like serious game, gamification is done in order to make a serious subject more interesting and fun for the people who wants to use it.

Serious game has several benefits for the learner. It motivates the learner. This is because learner have instincts to achieve goal. Serious game is just like normal game. It has its own goal and achievement that the player can get through gaining point and getting to the next level. This takes the boredom out of learning in a traditional way. Other than that, serious game makes learning environment fun for the learner. The learner would not be afraid of making mistakes because it is just a game. The learner might even have a friendly competition with their peers to see who gets the higher score. Serious game also makes the learner practice the knowledge they gain. Knowledge is useless unless it is used. Practicing the knowledge that the learner has gained also helps in retaining the knowledge better. This is the reason for making a game out of learning material.

2.3 Serious Game in Language Learning

Serious games are used to include learning material in a fun game environment. This is why language learning game is a serious game. As stated by (Sørensen & Meyer (2007), games should be known as important models for the design of educational material for language learning and teaching as games are mainly seen as a framework for allowing a meaningful context for language acquisition. Games can be used as structuring game design in refining language learning skill.

There are two fields in this project that needs to look up to in language learning and teaching with video games. The two fields are Computer-assisted Language Learning (CALL) and Digital game-based Learning (DGBL). CALL is an approach on using application in language learning. Traditional CALL involves engaging the learner to response in simple ways such as typing the answer. Overall, it is similar to traditional teacher-student approach where a teacher will teach and correct the student's response. According to Davies (2002), distinct error analysis and response were a common feature in traditional CALL, and the more advanced programs would attempt to analyse the learner's response, pinpoint errors, and branch to help and remedial activities. CALL is also used as an assist at school with a teacher supervising.

Digital game-based Learning (DGBL) is not focused solely on language learning material. It can be used for learning different subjects. It can focus on language learning but, it can also be used for focusing other training and teaching material. As stated by Eskelinen (2012), Digital game-based learning games are central and seen as a potential main form of teaching. It is not used as an assistance or just to make the learning material more fun by adding few engaging game mechanics. DGBL uses game as a tool to teach. Overall, this project leans more towards DGBL rather than CALL.

2.4 Current Existing System

There are several current existing language learning game that can be found in the internet and through the google application store. Below is some example of existing language learning game:

i. Japanese Word Dungeon.

Japanese Word Dungeon is a game made by Terry Young Studio that focuses on learning the Japanese Kana character such as Hiragana and Katakana. The storyline goes that the player is a knight that needs fund in order to go to Japan and save the princess. The gameplay is simple. The player needs to battle with monsters such as orcs and ogres while going through a dungeon. The player can only attack the monster by choosing the correct Japanese character. This makes for a fun game to learn and play by making the player memorize Japanese character in order to defeat the enemies and go to the next level.

The advantage of this game other than being free is its interesting premise. Most learning game tends to be too serious and focuses the game with teaching material. This game however, took the concept of something similar to dungeon adventure and make the game a learning experience. This game helps people who have a hard time memorizing Hiragana and Katakana by making a fun experience while trying to memorize.

The disadvantage of this game is how easy it is. A game is supposed to be challenging. The game makes it easier by giving the player an introduction screen that have possible answers before the starting of each dungeon. This game is not for impatient player who learns fast and want to go to the next dungeon because the game also requires a lot of grinding. The monsters that player have to face are usually several level higher than the player's character. This means that the player needs to play in their current dungeon several times to defeat the monster.

From the strengths and weaknesses in this game, there are several problems that can be identified. The problem is the game is too easy. Although the game is easy, the player needs to level grinding for their way through the dungeon. These are just some small flaws that the game has. According to Talak-kiryk (2010), games provide for inventive, liberty and higher order thinking. The grinding done in this game makes this game repetitive.

Figure 2.1: Main menu of the game.

Figure 2.2: Game play interface.

ii. Japanese-Spy: Learn Japanese.

Japanese-spy Learn Japanese is a game made by Overpass Apps. It is a game about learning Japanese through words and phrases. The storyline of the game is the player needs to learn Japanese as a spy in order to save the North Japanese President and the world. For each level, the player will be given a task or a mission that they need to complete. To play the game, the player needs to take on a mission. Once the player agrees to do the mission, they will be given a map of Japan and the location of the training facilities they need to go in order to complete the task and learn Japanese. The gameplay needs the player to choose the correct hiragana words. For example, in one mission the player has to shoot a target. The player needs to choose the correct number that the target has in hiragana to complete the task.

The advantage to this game is the variety of skills. The game shows two different skills that the player can apply while playing the game which are memorizing skills and listening skills. For memorizing skills, the player needs to learn the hiragana characters and its meaning. For listening skills, the player needs to pay attention to an audio in order to get the correct answer.

The disadvantage of this game is that it tries to teach many modules in one game. It could teach you basic but not a profound knowledge on each module. Japanese language has three types of character that are hard to learn in one seating.

There are several problems that can be identified with this game. The problem is the developer not providing the player with basic Japanese character for them to at least be familiar with before playing the game. Another problem is the words and phrases given are limited. The game has a wider range of words and phrases to be used but only limited to numbers, animals, body parts, colors, size and verbs.

Figure 2.3: Main menu of the game 2.

Figure 2.4: Game play interface 2.

iii. Kanji no Owari - Learn Japanese.

Kanji no Owari, also known as “The Kanji’s End”, is a game made by Sekai Project. The game helps player in memorizing Hiragana, Katakana and Kanji characters. The gameplay starts with the player picking character class, equip the character, and go to the world map. To slay enemies, player have to choose the correct answer otherwise the player’s character will take damage. The game has two different modes; Kana Mode and Kanji Mode. In Kana mode, player can either choose between Hiragana and Katakana or choose both. This mode is considered as training phase. In Kanji mode, player can choose combination of English and the Kana or just the Kana and Romaji as readings that appear on the game. For both mode, the player can show or hide a review sheet to help gameplay.

The advantage of this game is the different mode the game offers. The game can help player to review on Hiragana, Katakana, and Kanji characters. It can help in memorization better with its Word Gems or Trivia that is shown after every round. The Word Gems display meanings and readings of the character used in the previous round. Meanings that are displayed in accordance to the character can help player to memorize the character better.

The disadvantage of this game is the difficulty to memorize all three type of character in short time especially Kanji. This game is not for beginners that does not know Kanji at all. The game does not give the player enough time to learn Kanji. In one minute, the player has to learn five kanji just to change it completely the next time. The player has no time to memorize and makes it harder to play the game.

The problem with this game is the difficulty level is too high for player who just had started to play the game. A player that had just want to start learning Japanese will have a hard time playing it. Overall, the game is good for player who already knows Kana and basic Kanji. It can be used to review the Kana and Kanji that player have learn but not as a beginner that only knows the basic Kana characters.

Figure 2.5: World Map Stage Menu Interface.

Figure 2.6: Game play Interface 3.

2.4.1 Comparison between Current Existing System (Game).

Each game has its own strengths and weaknesses. Below is some comparison this project can conclude:

Game	Strength	Weakness	Conclusion
Japanese Word Dungeon	i. It teaches basic Kana characters. ii. It teaches regular words used in Japanese.	i. The gameplay is too easy. ii. The gameplay is too repetitive.	The game is too easy as it only cover basic Kana in its gameplay.

Japanese-Spy: Learn Japanese	i. ii. .	It trains player with words in different categories. It trains player with memorization and listening skills	i. ii.	It does not explain or provide basic Hiragana characters' table. The words and phrases used are limited to several categories.	This game tries to teach many module at once instead of focusing on just one.
Kanji no Owari- Learn Japanese	i. ii.	It provides both Kana character and Kanji Character . It provides meaning	i. ii.	It is not suitable to be played by beginner. It only provides a short time for learning Kanji.	The game covers both Kana and Kanji characters but it is too hard for beginner who does not know Kanji.

Table 2.1: Comparison between existing game system.

Overall, all the game compared in this literature review teaches and tests players with Japanese characters. All three games also cover basic words used regularly in Japanese. These games tries to diversify its learning material which is the opposite to this project as the project plans to focus on only one type of character instead of trying to teach everything inside a single game.

2.5 Tools of Development

There are several tools of development that can be used to develop this project. The tools used for developing this project must have a 2D option since this project develops 2D game. Below are some tools that can be compared:

Tools	**Description**	**Requirement**	**Limitation**
Unity	i. Support 2D and 3D engine. ii. Free Unity license for students. iii. Support broad range of Platform. iv. Support three coding languages: - C# - JavaScript - Boo	i. OS: Windows 7 SP1 and up (64-bit versions only) while Mac OS X 10.9 and up. ii. CPU: SSE2 instruction set support. iii. Graphics card with DX10 capabilities.	i. The price is expensive if user require all features. ii. It requires a lot of space on your hard drive. iii. It has no editor for Linux.
Godot Engine	i. Support 2D and 3D engine.	i. OS: Windows 7 and up.	i. GDScript is not meant to

	ii. Free and open source. iii. Support wide range of platform. iv. Uses programming language called GDScript.	Graphics: OpenGL 3.3 and up.	support large games. ii. Difficult to find Tutorial.
Game Maker: Studio	i. Uses drag-and drop OR Code. ii. It has a free version. iii. It has built-in advance features such as: - Add-in app - purchases - Real-time - analytics	i. OS: Windows Vista, XP, 7 and up. ii. Graphic cards: compatible and at least 32MB memory.	i. The price is expensive if developer require to use all export modules and features. ii. Not suitable for programming based developer.

Table 2.2: Comparison of different software for game development.

Overall, it is concluded that this project will be developed using Unity. The reason for using it is because of its free license for student. Another reason for using Unity is because this project must include element of programming which Unity provides in term of coding language used. The tool chosen is also widely used so it is easy to refer from experts and people who have used it.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter covers the methodology, design, software, hardware, testing and implementation of this project. For this project's software methodology, this project will be using Rapid Application Development (RAD) approach. This chapter will show and give justification to using RAD, tools used in development, the framework of the project and flowchart on how the system work. The designs for the overall system which consists of storyboards, data flow, user interface and modules are also has been describe.

3.2 Methodology

Methodology refers to a set of procedure that can be followed when developing software. There are many type of methodology that can be used during a software development project. This project's software methodology uses Rapid Application Development (RAD).

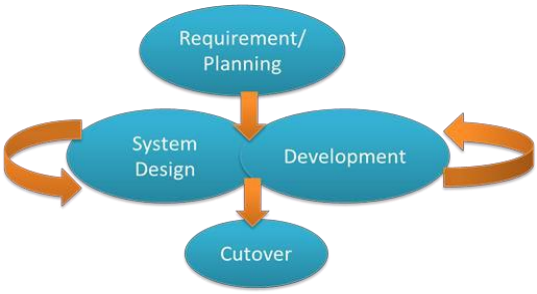


Figure 3.1: above shows Rapid Application Development model.

Rapid Application Development (RAD) model is a methodology that provide fast development with high-quality result. It does so by delivering working prototype as frequently as possible and uses it to refine the next prototype until the software is complete. This way, it can accelerate the development process. As stated by Powell-Morse (2016), RAD is a replacement for waterfall model that mostly focuses on planning and sequential design. It uses least amount of planning and provide an early system integration. RAD generally follows four basic phase. The phase is requirement, system design, development and cutover.

There reasons for using RAD as software development project methodology is it helps in testing for errors and problem in system's code. Since RAD requires reproducing many prototype, it allows the system to be tested for every prototype it produces. This makes it easier for identifying the game problem and solving the code error before completion of the overall system. RAD enables the total time for testing to be reduces as testing for the prototypes have been done in a continuous process.

i. Requirement Phase:

In this phase, this project will need to identify and study the project's requirements in order to build the 2D game. The project needs to gather all the requirements that are related to the project. The requirements can be collected from potential user and similar application found in the market. The requirements are then analyzed whether or not it is suitable and related to the project or not. Based on the analysis, there are a few modules which are Game Application Module, Interface Module, Game Controller Module and Player Module.

This project's requirement can be obtained from UMP students who wants to learn Japanese. It also obtains requirement from similar application such as Japanese Word Dungeon and Japanese Spy: Learn Japanese. After collecting the requirement, this project can develop a quick design based on UMP student's preference and similar applications.

ii. System Design Phase:

During this phase, this project needs to provide a design of the overall system. This includes storyboards, data flow, user interface and modules. The game is designed based on previously collected requirement.

Based on the requirements identified and collected from UMP students and similar game system, this phase will start by designing the game application module. The main module contains all the other module. The player module contains and hold data of the player. After designing the player module, the phase will proceed to designing the second module which is the gameplay module. The game controller module is a controller that communicate data from player module to interface module. For example, this module can mediate the player's name to make it appear on the game interface. Lastly, the interface module displays visible object such as button and panels on the interface. It can also obtain data from player module to be displayed onto the game interface.

iii. Development Phase:

During this phase the requirement and design will be implemented to build a prototype. It will build a prototype and refine it continuously. The prototype is implemented based on its previous prototype. According to Powell-Morse (2016), once basic user and system design has begun, the development phase where most of the actual application coding, testing, and integration takes place.

The project development starts with collecting requirement from existing systems. The system will be compared and analyzed to find its strengths and weaknesses. Based on the strengths and weaknesses obtained from existing system, this project's system will be improved and enhanced.

Based on the requirement, the project will start to design storyboards, data flow, user interface and modules. The context diagram, use case diagram, storyboard, general architecture and package diagram are drawn based on the design. The diagrams show the system's overall flow.

After designing, the project starts its development by installing Unity software. It creates local database in Unity by using phpmyadmin database. The setup starts with downloading and starting the Xampp. Then, create a folder to contain the php files in its htdocs file. The php file will be used to connect Unity with online database phpmyadmin. After writing its code, connect it with the C# script in Unity. The connectivity can be checked simply by typing 'localhost' followed by the database name, its document folder and the php file name. The source code to connect the database and the system are as shown on figure 3.2.

```php
<?php
$servername = "localhost";
$username = "root";
$password = "";
$dbname = "ayj_project";

// Create connection
$conn = new mysqli($servername, $username, $password, $dbname);

// Check connection
if ($conn->connect_error) {
    die("Connection failed: " . $conn->connect_error);
}
echo "Connected Successfully";

$sql = "SELECT username, email FROM user";
$result = $conn->query($sql);

if ($result->num_rows > 0) {
    // output data of each row
    while($row = $result->fetch_assoc()) {
        echo "username: " . $row["username"]. " - email: " . $row["email"]. "<br>";
    }
} else {
    echo "0 results";
}
$conn->close();

?>
```

Figure 3.2: Database connection algorithm.

Lastly, the system will be tested by inserting the input. The output is received by testing its function while the system is executed. If there is an error, fix the error by double clicking on the error message or open the script.

iv. Cutover:

According to Powell-Morse (2016), the development team to have some time to move components to a live production environment, where any necessary full-scale testing or team training can take place as the final cutover or transition stage is provided. This is the phase where testing will be done. Programming component are tested during prototyping and this reduces the risk of potential problem or error. Testing that this project will be conducting is black box testing and white box testing.

a) Black-box Testing:

Black-box testing or specifications based testing is a software testing that tests for the game's functionality based on its specifications. This type of testing method can be applied to other level of software testing such as unit, integration, system and acceptance test.

b) White-box Testing:

White-box testing or clear box testing is the testing of a software solution's internal coding. It mainly focuses on reinforcing the security, the flows of inputs and outputs of the application, and improving design and usability.

3.2.1 Use case Diagram

The use case diagram is used to show the relationship between user's interaction with the system.

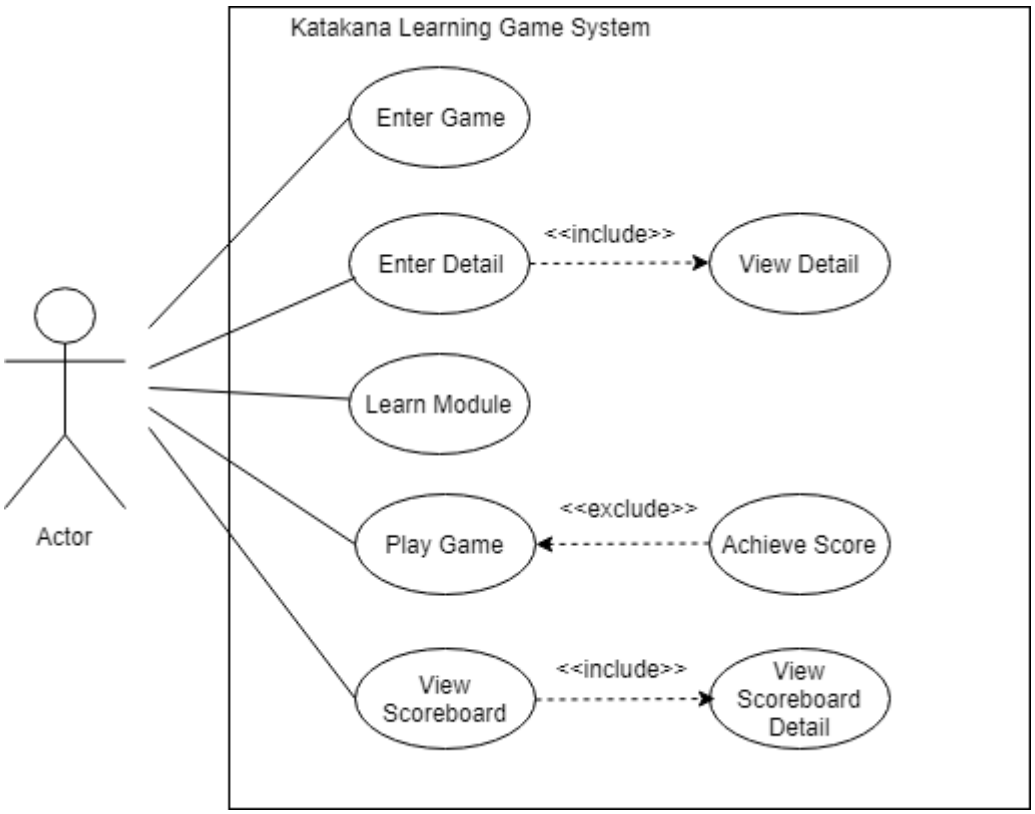


Figure 3.3: Use case Diagram.

Figure 3.3 shows the use case for this project. Based on the figure, it shows the interaction of the player with the system such as enter game, enter detail, choose level, learn module, play game, and view achievement.

3.2.2 Context Diagram.

The context diagram shows the player entity interaction with the system.

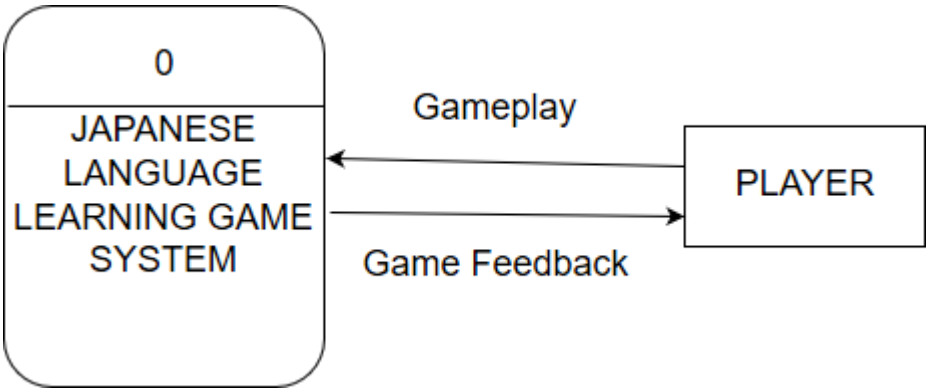


Figure 3.4: Context Diagram.

Figure 3.4 shows the system which is Japanese Language Learning Game System and player. The system gives game content to the player. Then, the player can use the content to play and interact with the system. The system will then give feedback to the player based upon the player's action.

3.2.3 Storyboard

Storyboard are made to help user to imagine how the system will appear like in real life. It will also be used as a reference to creating the game interface.

Interface

Main Menu Page

Description

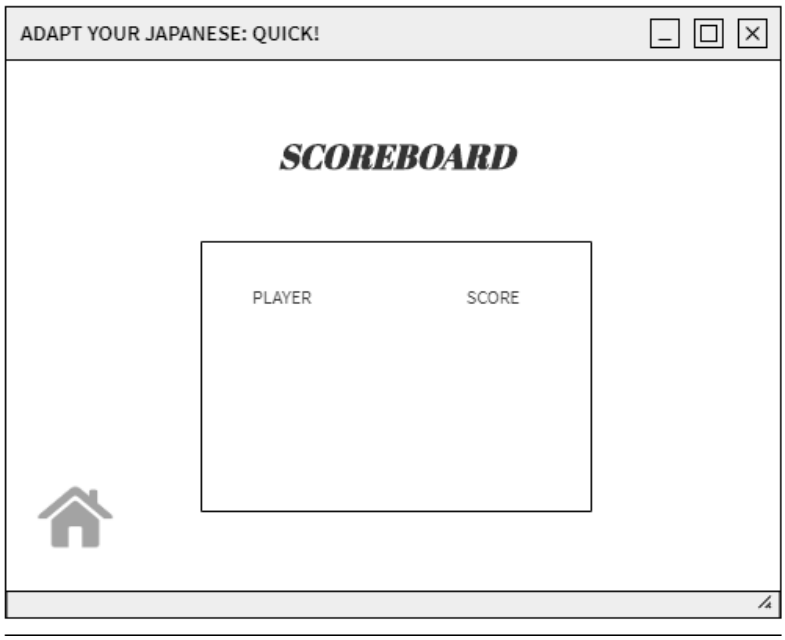
- This is the interface for the main menu page.

Buttons:

- This page has three buttons which are Start, Scoreboard and Exit button.

Function:

i. Start button - links the player to Login Page.
ii. Scoreboard button - links player to Scoreboard page.
iii. Exit button - allows player to exit game.



Scoreboard Page

Description

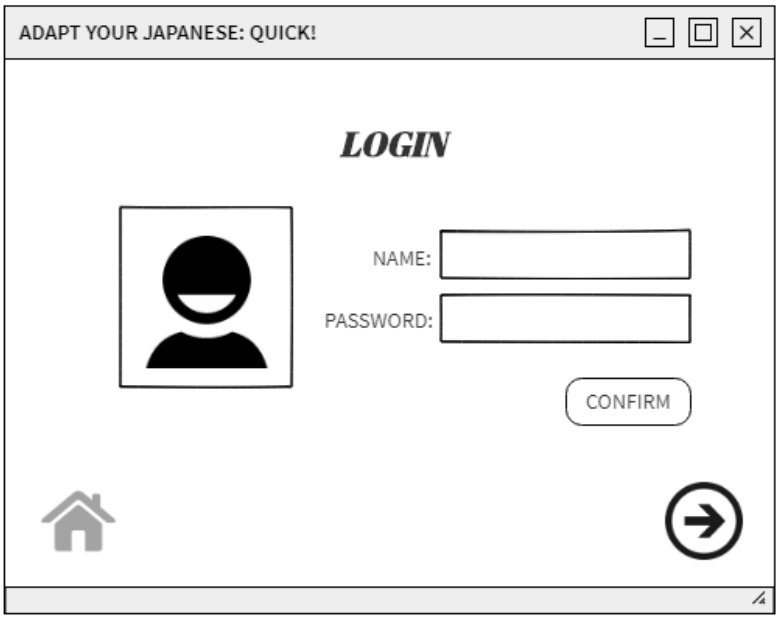
- This is the interface for scoreboard page.

Buttons:

- This page has a home button.

Function:

i. Home button - links the player to Main Menu Page.
ii. Panel – Show player and score



Login Page

Description:

- This is the interface for login page.

Buttons:

- This page has home button, confirm button and next button.

Function:

i. Home button - links the player to Main Menu Page.
ii. Detail allocation - player enter character name and password in space given.
iii. Confirm button - player details are added to the database.
iv. Next button - links player to lesson page.

Register Page

Description:

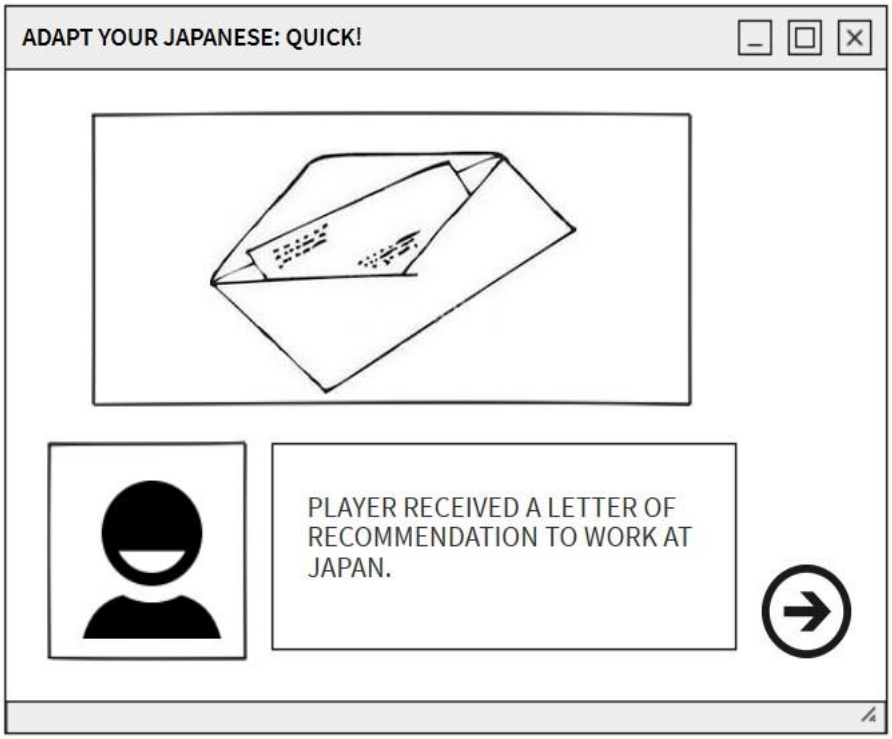
- This is the interface for register page.

Buttons:

- This page has home button, confirm button and back button.

Function:

v. Home button - links the player to Main Menu Page.
vi. Detail allocation - player enter character name, password and email in space given.
vii. Confirm button - player details are added to the database.
viii. Back button - links player to login page.



Introduction Story Page

Description:

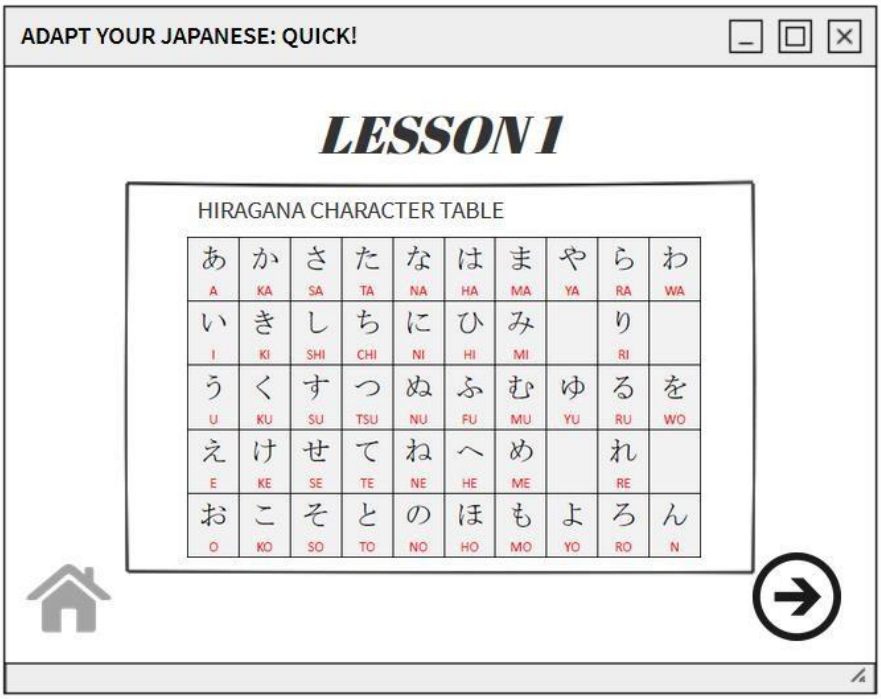
- This is the interface for introduction story page.

Buttons:

- This page only has a next button.

Function:

i. Next button - allows player to read the story and until it links to the Level 1 main page.



Lesson Page

Description:

- This is the interface for player details page.

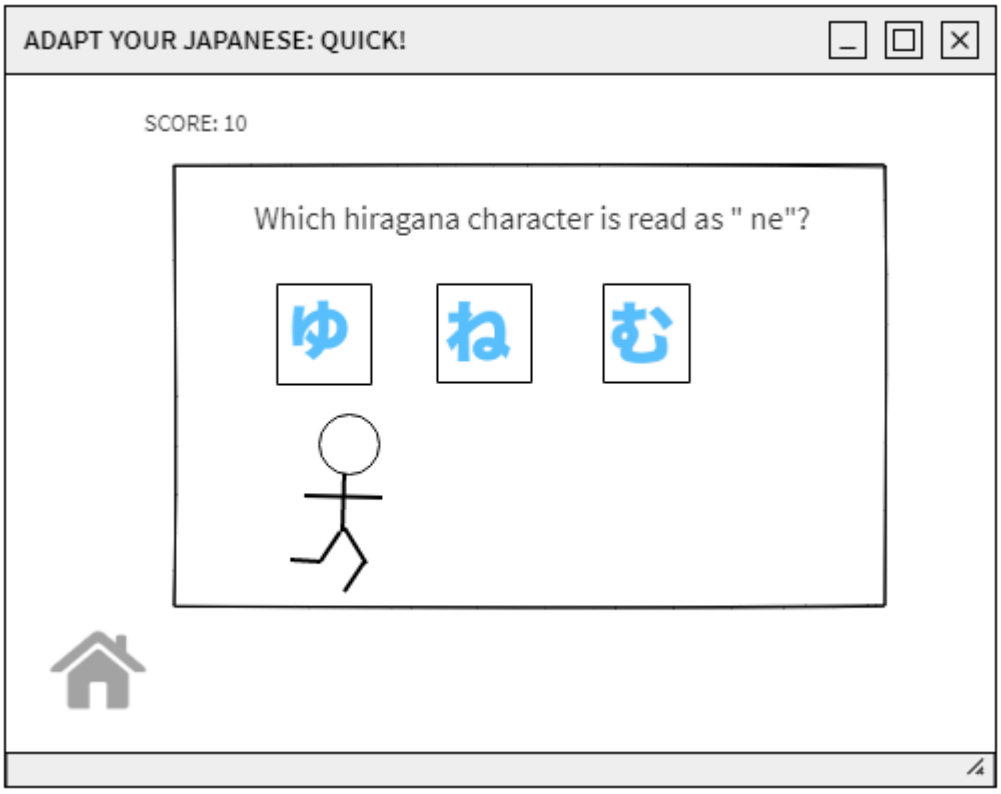
Buttons:

- This page has home button and next button.

Function:

i. Home button - links the player to Main Menu Page.

ii. Next button - links player to game page.



Game Page

Description:

- This is the interface for game level page. This is an example page.

Buttons:

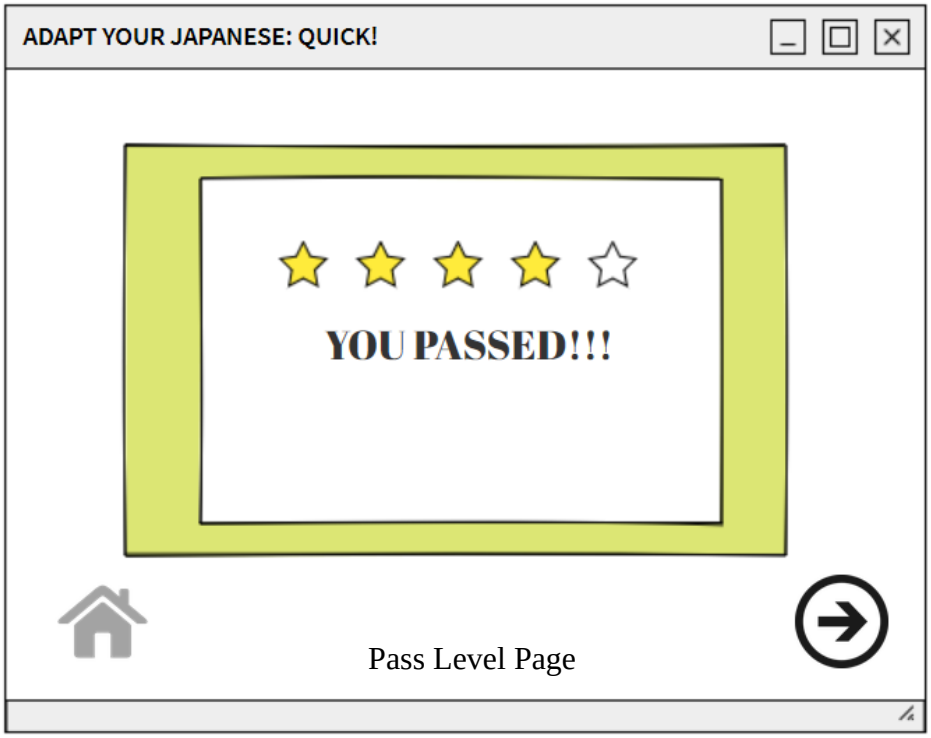
- This page has home button.

Function:

i. Character - can be moved using keyboard.

ii. Answer box – can be destroyed when collide with character.

iii. Score allocation – Score increase or decrease depends on if the character destroys the correct answer box.



Pass Level Page

Description:

- This is the interface for pass level page.

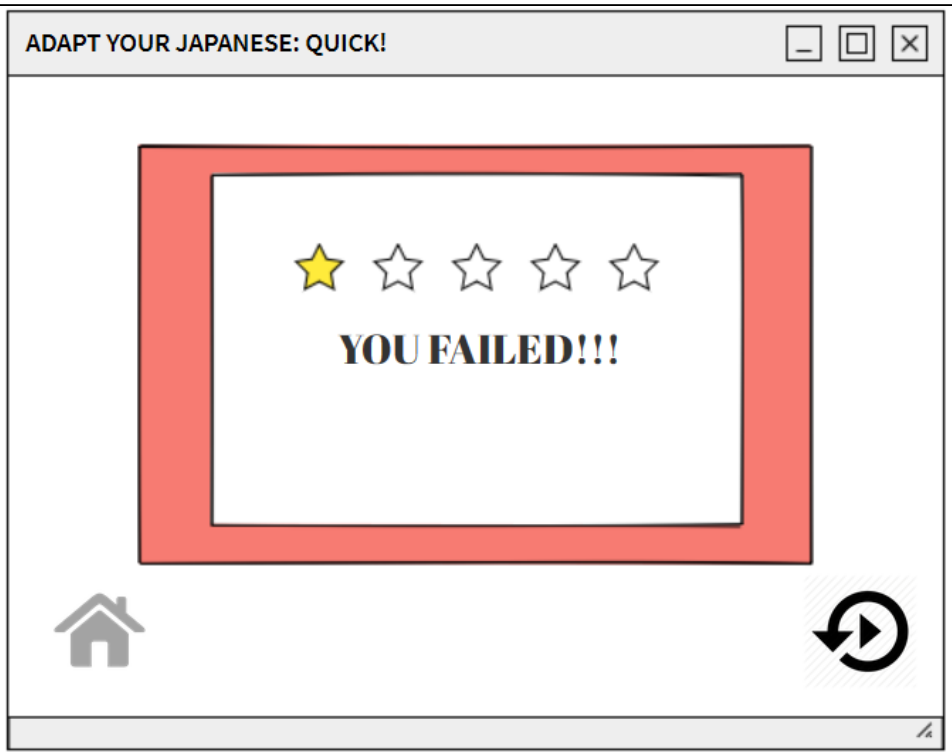
Buttons:

- This page has home button and next button.

Function:

i. Home button - links the player to Main Menu Page.

ii. Next button - links player to game level page.



Fail Level Page

Description:

- This is the interface for fail level page.

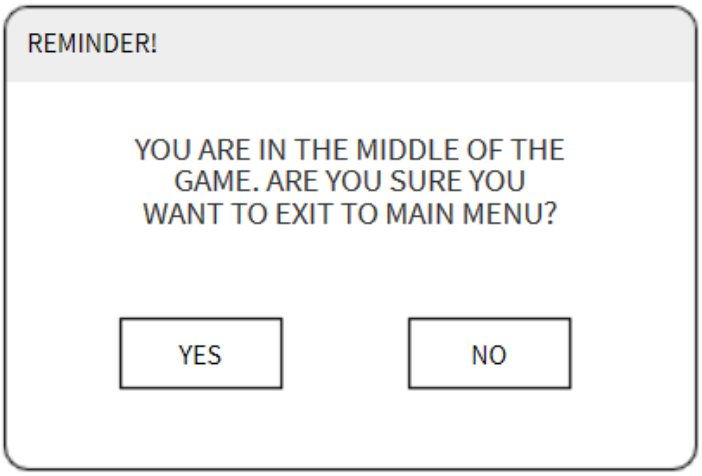
Buttons:

- This page has home button and replay button.

Function:

i. Home button - links the player to Main Menu Page.

ii. Replay button - links player to start of the game level page.



Pop up Page

Description:

- This is the interface for reminder page pop up.

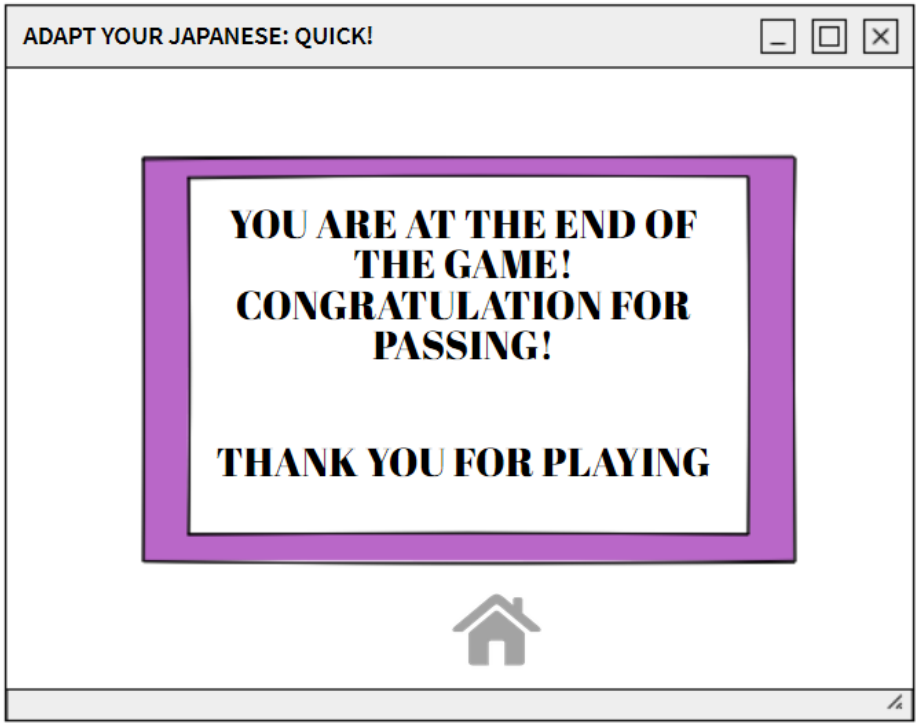
Buttons:

- This page has yes button and no button.

Function:

i. ‘Yes’ button - links the player to Main Menu Page.

ii. ‘No’ button - links player to continue game level page.



Ending Page

Description:

- This is the interface for ending page.

Buttons:

- This page has home button.

Function:

i. Home button - links the player to Main Menu Page.

Table 3.1: Storyboard and its description.

3.2.4 General Architecture.

The general architecture diagram describes the system process and what parts are involved.

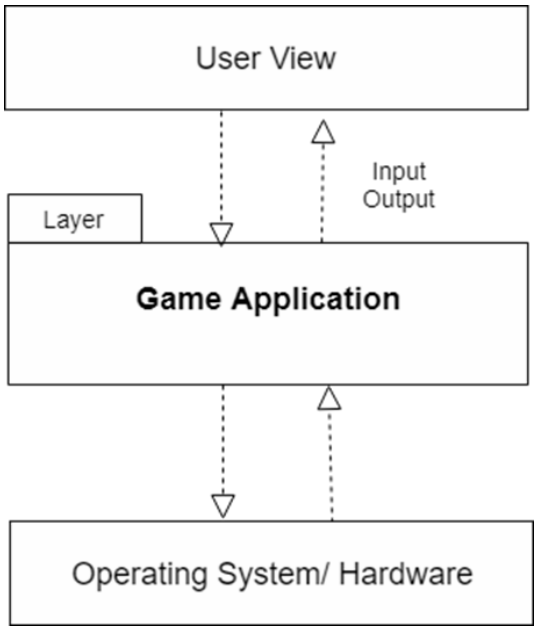


Figure 3.5: General Architecture.

Figure 3.5 shows the general architecture of this system. The user view insert input and receive output from the Game Application Layer. The layer needs the operating system and hardware in order to work.

3.2.5 Package Module

The package module shows what will be inside each module and what its function are supposed to work.

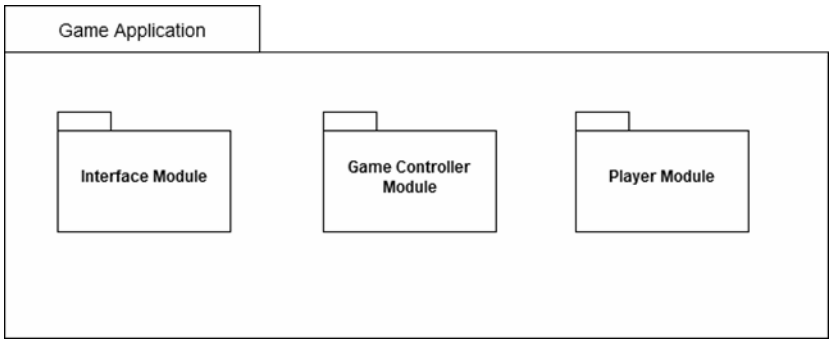


Figure 3.6: Package Module.

Figure 3.6 shows the package module for this project. The main module is the game application module. Inside the module it has interface module, game controller module and player module.

3.2.5.1 Game Application Module.

The Game Application module contains all sub module. It is the module that acts as the main system. Through this module, player view the interface, control the game and contain the player's data.

3.2.5.2 Interface Module.

The interface module contains object that corresponds to something to be displayed on the player's screen. For example, the player can use the home button to go back to the main menu screen. It can also use data from player module to display and create custom object.

3.2.5.3 Game Controller Module.

The game controller module is the middleman between the interface module and the player module. It acts as the controller that send data to and from interface module and player module. It also carries out all the application specific task such as input from user and loading data.

3.2.5.2 Player Module.

The player module holds data and describe the logic for handling the data. Its object is not directly displayed. For example, it holds data such as the player's name and has a way that can access and change this data.

3.3 Hardware and Software Requirement.

There are several software and hardware requirement needed to develop this project. The table below shows the hardware used throughout the development of this project:

Hardware	**Description**	**Importance**
Asus A555LF Laptop	i. a portable computer. ii. made by AsusTek Computer Inc.	It is used during documentation and development of project.
Huion H420 Graphic Tablet	i. a drawing tablet ii. made by Graphics Technology (HK) Ltd.	It is used during development of project and is important for drawing 2D sprite for the game.

Table 3.2: List of hardware requirements.

The table below shows the software used throughout the development of this project:

Software:	**Description:**	**Importance**
Unity	- it is a cross-platform game engine used mostly for developing three-dimensional and two-dimensional video games. - it can also develop simulations and can be run on computers, consoles, and mobile devices.	Unity is important in order to develop the 2D game using C# language and manage database using SQLite, a database plugin provided for the software.
Xampp	- it is a free and open-source cross-platform web server.	Xampp is used in this project to connect Unity with an online database.
Microsoft Word	- it is a graphical word processor. - user can type and save document using it.	It is used in this project mainly for documentation purposes.
GanttPro	- it is a free online project management software tool. - it provides project management tools.	It is used in this project to develop a Gantt chart.
Draw.io	- it is a free online diagram software tool - it provides tool that makes drawing diagram easier.	It is used to make use case diagram, context diagram, general architecture and package module.

Mockflow	-it is a free online wireframe tools, prototyping tools, UI mock-ups and UX suite.	It is used to make the game storyboard.
FireAlpaca	- it is a free painting software.	It is used in this project to provide graphical image and 2D sprites in the game.

Table 3.3: List of software requirements.

3.4 Gantt Chart

This section shows the overall timeline and the estimation of each phase of this project. **Refer to Appendix A.**

3.5 Conclusion

In conclusion, this chapter shows the methodology used to develop this software is Rapid Application Development. It also shows the different phases such as Requirement phase, System Design Phase, Development Phase and Cutover Phase. It shows the overall design of the system and requirement for the hardware and software. It also shows the estimated timeline of this project.

CHAPTER 4

IMPLEMENTATION

4.1 Introduction

This chapter describes the process of the development and implementation of the project. This includes all the main function and algorithm that are involved and used to accomplish the objective of this serious game. The programming codes used to run the function and navigate from one interface to another will also be included and explained.

4.2 Implementation

The first part that needs to be done when implementing this serious game is the development of the game interface. There are five modules that are used to develop the interface which are the login and register module, the first exercise module, the second exercise module, the third exercise module and lastly, the test module.

4.2.1 Implementation Requirement

The first module is the login and register module in which the user needs to register first by filling in their details such as username, email and password. If the player is registered, the player will be able to login using their username and password. The second to fourth module is an exercise module in which the user will be given a lesson note before they can play a game where they need to move the game character to the right answer box based on the question given in the module. The last module is the test module where the three exercise module will be combined and user will be tested. C# was used throughout this game whether for the game mechanics or for the navigation.

4.2.2 Development

When developing modules, the most important part of the modules is the coding script used to allow the game to function. This game was made using Unity that uses C# script to run the game.

```
void PlayerMove() {
    //CONTROLS
    moveX = Input.GetAxis("Horizontal");
    if (Input.GetButtonDown("Jump"))
    {
        Jump();
    }
    //ANIMATIONS

    //PLAYER DIRECTION
    if (moveX < 0.0f && facingRight == false)
    {
        FlipPlayer();
    } else if (moveX > 0.0f && facingRight == true)
    {
        FlipPlayer();
    }
    //PHYSICS
    gameObject.GetComponent<Rigidbody2D>().velocity = new Vector2(moveX * playerSpeed, gameObject.GetComponent<Rigidbody2D>().velocity.y);
}
void Jump()
{
    //JUMP CODE
    GetComponent<Rigidbody2D>().AddForce(Vector2.up * playerJumpPower);
}

void FlipPlayer()
{
    facingRight = !facingRight;
    Vector2 localScale = gameObject.transform.localScale;
    localScale.x *= -1;
    transform.localScale = localScale;
}
```

Figure 4.1.0: Script for character movement.

The C# script above is used for the character's movement. This script allows user to move character left right using left and right arrow. The character's image is flipped to where the arrow is going. It also enables user to jump using the space button.

```
6   public class Player_Health : MonoBehaviour {
7       public int health;
8       public bool hasDied;
9
10      // Use this for initialization
11      void Start () {
12          hasDied = false;
13      }
14
15      // Update is called once per frame
16      void Update () {
17          if (gameObject.transform.position.y
18          {
19              hasDied = true;
20          }
21          if (hasDied == true)
22          {
23              StartCoroutine("Die");
24          }
25      }
26
27      IEnumerator Die ()
28          {
29          SceneManager.LoadScene("Practice1");
30          yield return null;
31          }
32
33  }
```

Figure 4.1.1: Script for player fall.

This C# script is used when the character falls into the potholes that needed to be avoided when playing during exercises and test. If the character falls, the character will automatically reset to the beginning of the exercise or test.

```
6   public class Score : MonoBehaviour {
7
8       public static int scoreValue = 0;
9       Text score;
10
11
12      // Use this for initialization
13      void Start () {
14          score = GetComponent<Text>();
15      }
16
17      // Update is called once per frame
18      void Update () {
19          score.text = scoreValue.ToString();
20      }
```

Figure 4.1.2: Script for displaying score.

```
5   public class GainScore : MonoBehaviour {
6
7       void OnTriggerEnter2D(Collider2D col)
8       {
9           Score.scoreValue += 5;
10          Destroy(gameObject);
11      }
12  }
13
```

Figure 4.1.3: Script for gaining score.

```
5   public class LoseScore : MonoBehaviour {
6
7
8       void OnTriggerEnter2D (Collider2D col){
9           Score.scoreValue -= 5;
10          Destroy (gameObject);
11      }
12  }
13
```

Figure 4.1.4: Script for losing score.

The C# script from figure 4.1.3 to 4.1.4 is the script for score. If player collide with the correct answer box, the score increase by 5 point and if the player answer wrong, the score decrease by 5 point.

```
36  public IEnumerator Login(string username, string password)
37  {
38      WWWForm form = new WWWForm();
39      form.AddField("loginUser", username);
40      form.AddField("loginPass", password);
41
42      using (UnityWebRequest www = UnityWebRequest.Post("http://localhost/UnityBackend/Login.php", form))
43      {
44          yield return www.SendWebRequest();
45
46          if (www.isNetworkError || www.isHttpError)
47          {
48              Debug.Log(www.error);
49          }
50          else
51          {
52              Debug.Log(www.downloadHandler.text);
53          }
54      }
55  }
```

Figure 4.1.5: Script for login connecting to PHP file.

```php
$sql = "SELECT password FROM user WHERE username = '" . $loginUser . "'";

$result = $conn->query($sql);

if ($result->num_rows > 0) {
    // output data of each row
    while($row = $result->fetch_assoc()) {

        if ($row["password"] == $loginPass){
            echo "Login Successful";
            //get user data here

            //get player info

            //modify player data
    }
        else
        {
            echo "Wrong credentials";
            }}
    }
else {
    echo "User does not exist";
}
```

Figure 4.1.6: Login PHP file that connects to database.

```
public IEnumerator RegisterUser(string username, string password, string email)
{
    WWWForm form = new WWWForm();
    form.AddField("loginUser", username);
    form.AddField("loginPass", password);
    form.AddField("loginEmail", email);

    using (UnityWebRequest www = UnityWebRequest.Post("http://localhost/UnityBackend/RegisterUser.php", form))
    {
        yield return www.SendWebRequest();

        if (www.isNetworkError || www.isHttpError)
        {
            Debug.Log(www.error);
        }
        else
        {
            Debug.Log(www.downloadHandler.text);
        }
    }
}
```

Figure 4.1.7: Script for register user that connects to a PHP file.

```php
$sql = "SELECT username FROM user WHERE username = '" . $loginUser . "'";
$result = $conn->query($sql);

if ($result->num_rows > 0) {
    //tell user name is already taken
    echo "Username already taken";

    //insert user and password into database
    }else{
        echo "Creating user...";
        //insert user n password into db
        $sql2 = "INSERT INTO user (username, password, email) VALUES ('" . $loginUser . "

        if ($conn->query($sql2) === TRUE) {
            echo "New record created successfully";
        } else {
            echo "Error: " . $sql2 . "<br>" . $conn->error;
    }
```

Figure 4.1.8: Register PHP file that connects to database.

The C# script and PHP file from figure 4.1.5 and 4.1.6 is used to enable player to enter login detail from an online database. While the C# script and PHP file from figure 4.1.7 and 4.1.8 is used to enable player to enter register detail into an online database.

4.3 User Manual

Modules implemented into this serious game helps user learning while gaming. User will be directed to the login and register module and fill in their details before they navigate to the first exercise of the game.

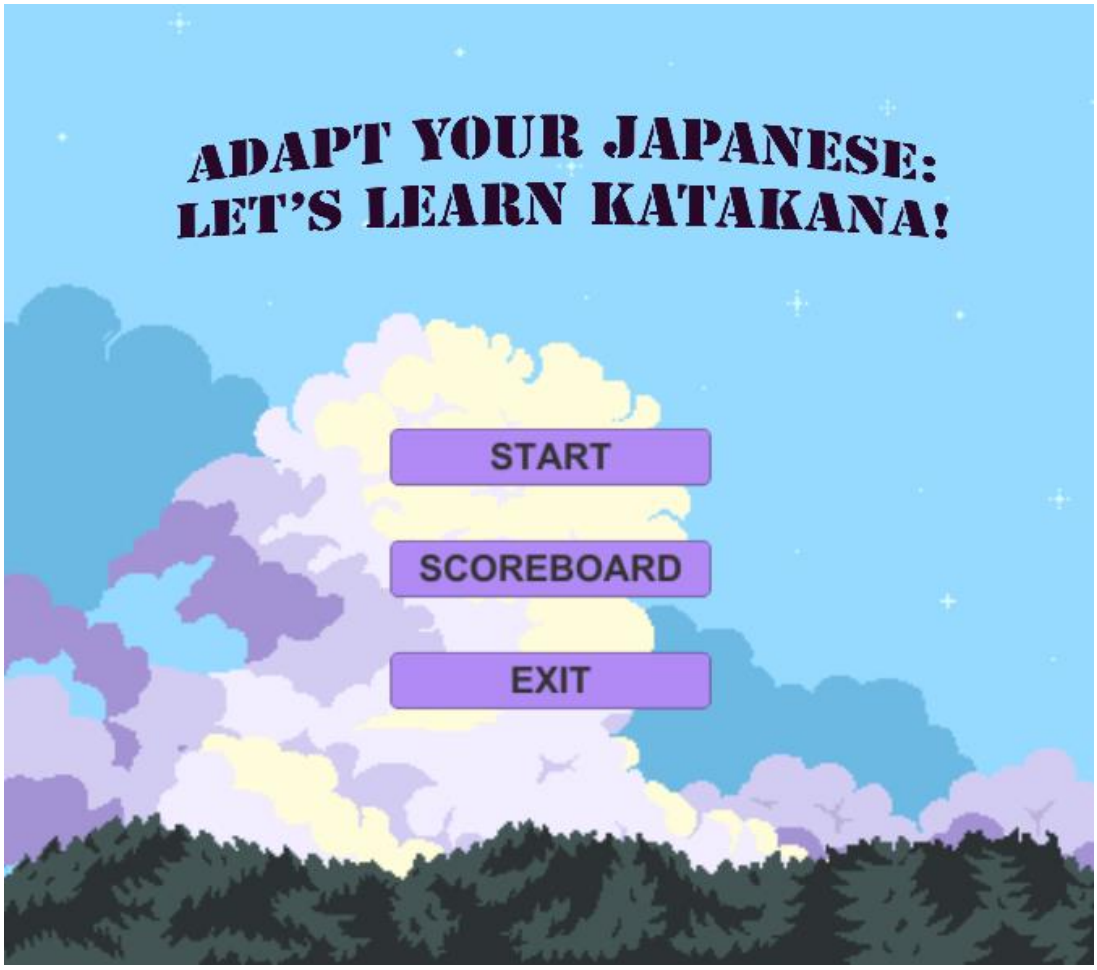


Figure 4.2.0: Main menu page.

The user can navigate to different scene on this page. The start game button will navigate the user to the login page. The scoreboard button will navigate the user to the scoreboard page. Lastly, the exit game button will exit the game application window for the user.

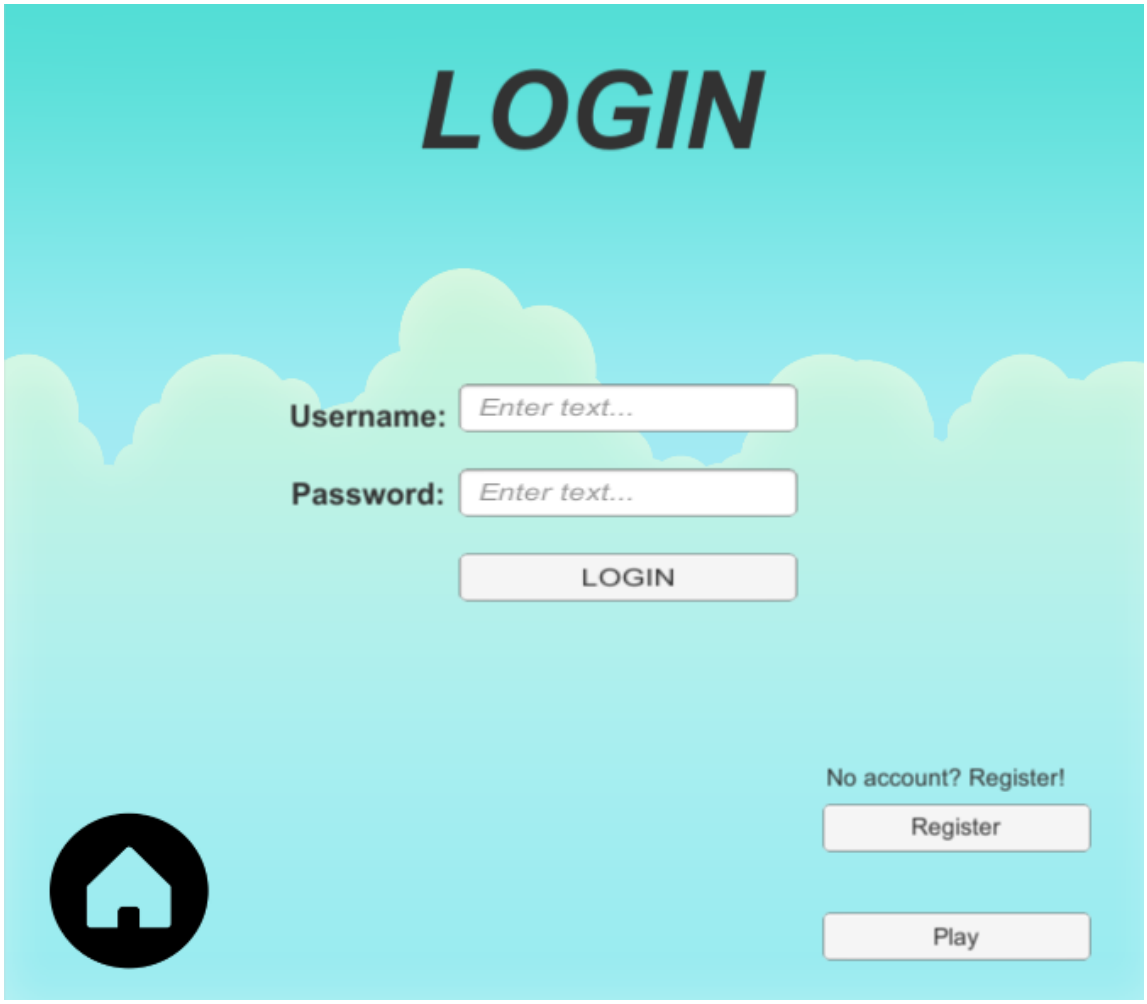


Figure 4.2.1: Login page.

After user is directed to this page, they need to fill in the login details. The user clicks the login button and if the details match up with the detail inside the database the game will display message “Login Successful”, if not error message will appear. Player can click the play button and be directed to story page. If player click the home button they will be directed to the main menu page. If the player clicked the Register button they will be directed to the register page.

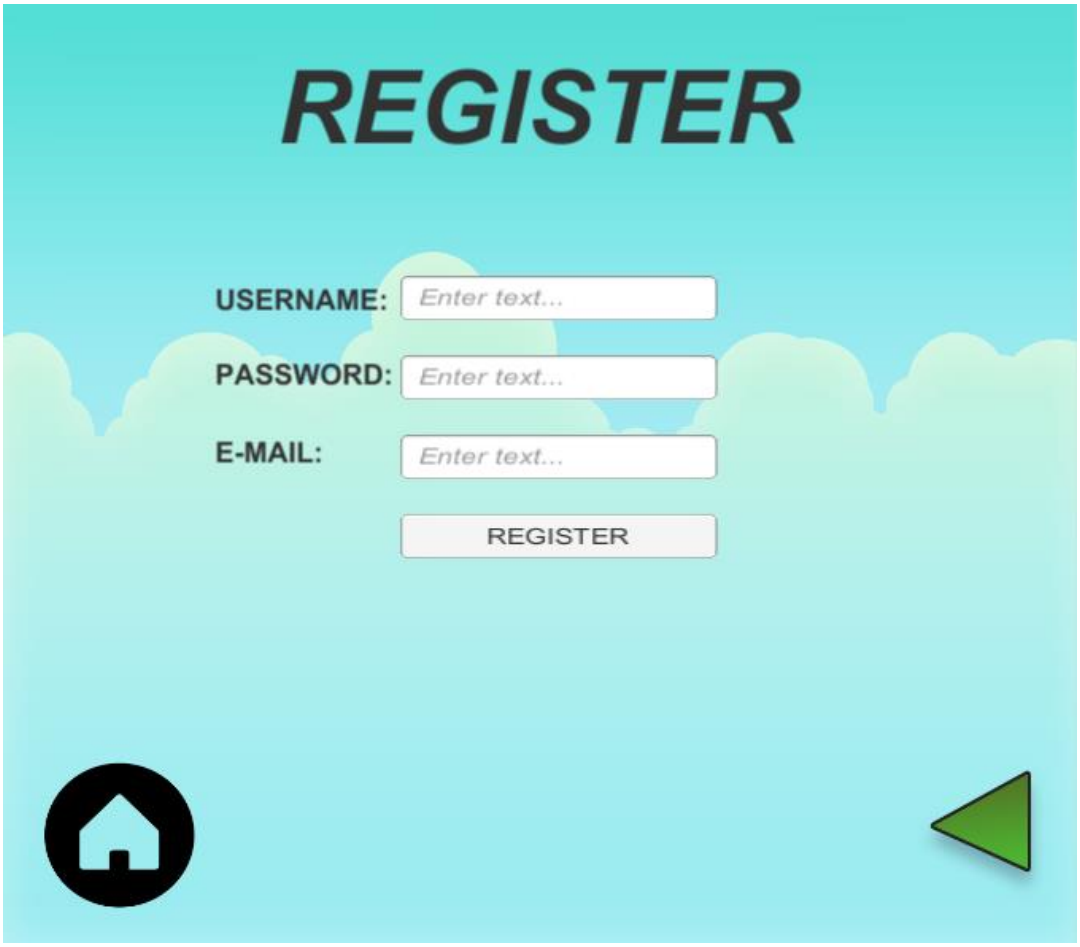


Figure 4.2.3: Register page.

User directed to this page needs to fill in the registration details. The details will then be saved into the database once the user clicked the Register button. Then, the user will need to click the back button to go back to the login page for them log in and start the lesson and exercise. The home button will direct the user to the main menu.

Figure 4.2.4: Story page.

In this page, user can navigate to learn the storyline. This page contains info that are useful during the third practice page. There is a home button that will navigate the user to the main menu page. There is also a next button that will navigate the user to the next story until the last story that will navigate to the lesson page.

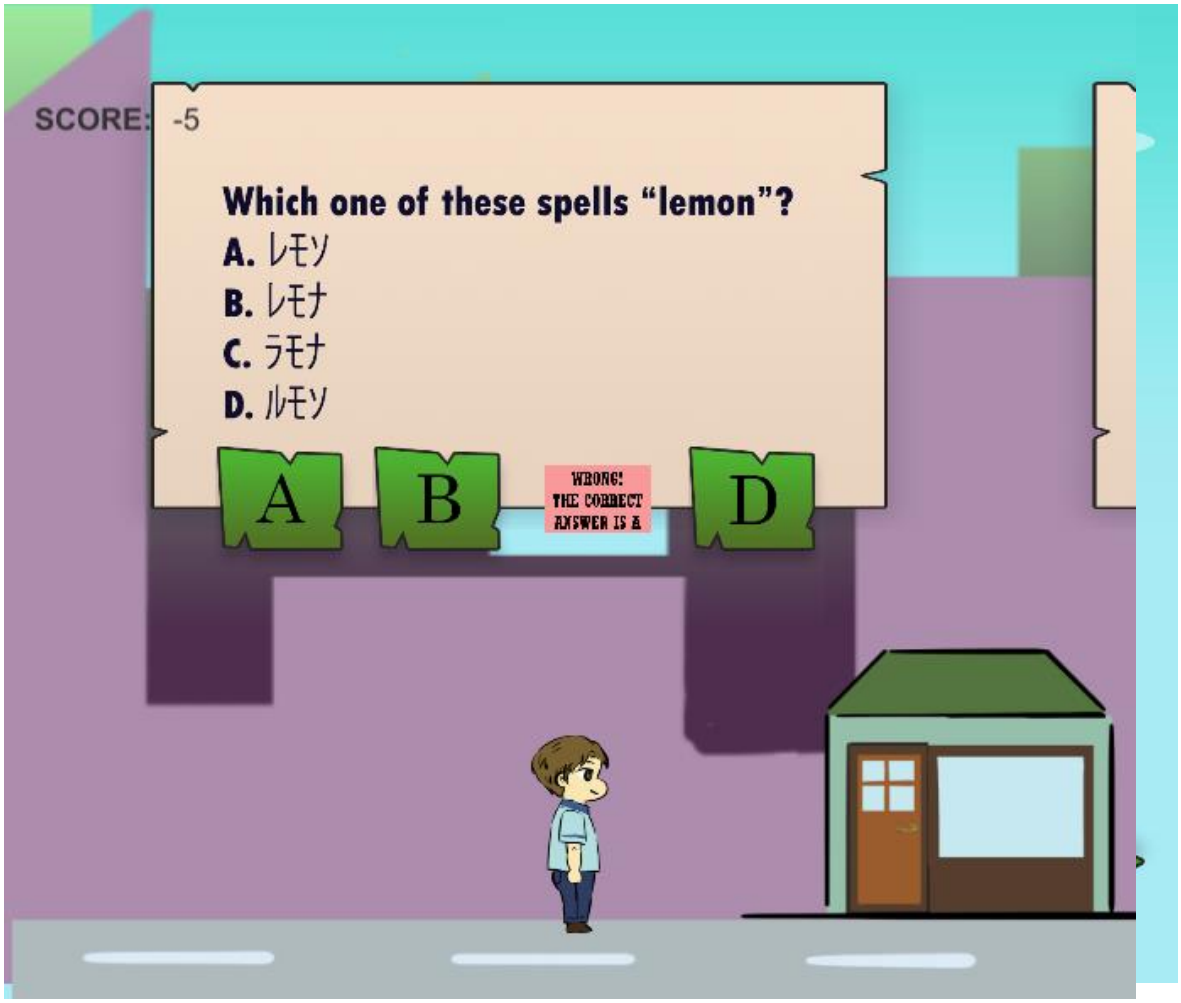


Figure 4.2.5: Lesson page.

This page shows the katakana alphabet table. It has two button which are the home button that will navigate the user to main menu and the next button that will navigate the user to the first exercise page.

Figure 4.2.6: The exercise page.

This page allows the player to move the game character. The user will be given a set of questions that they need to answer. The user answers the by making the character collide with one of the red box. If the answer is correct, the box will turn into a star, if the answer is incorrect, the box will turn into an “x” mark. The user must also avoid potholes on the ground otherwise the character will die and respawn at the start of the exercise page. There are three exercise page before the player can go to the test page.

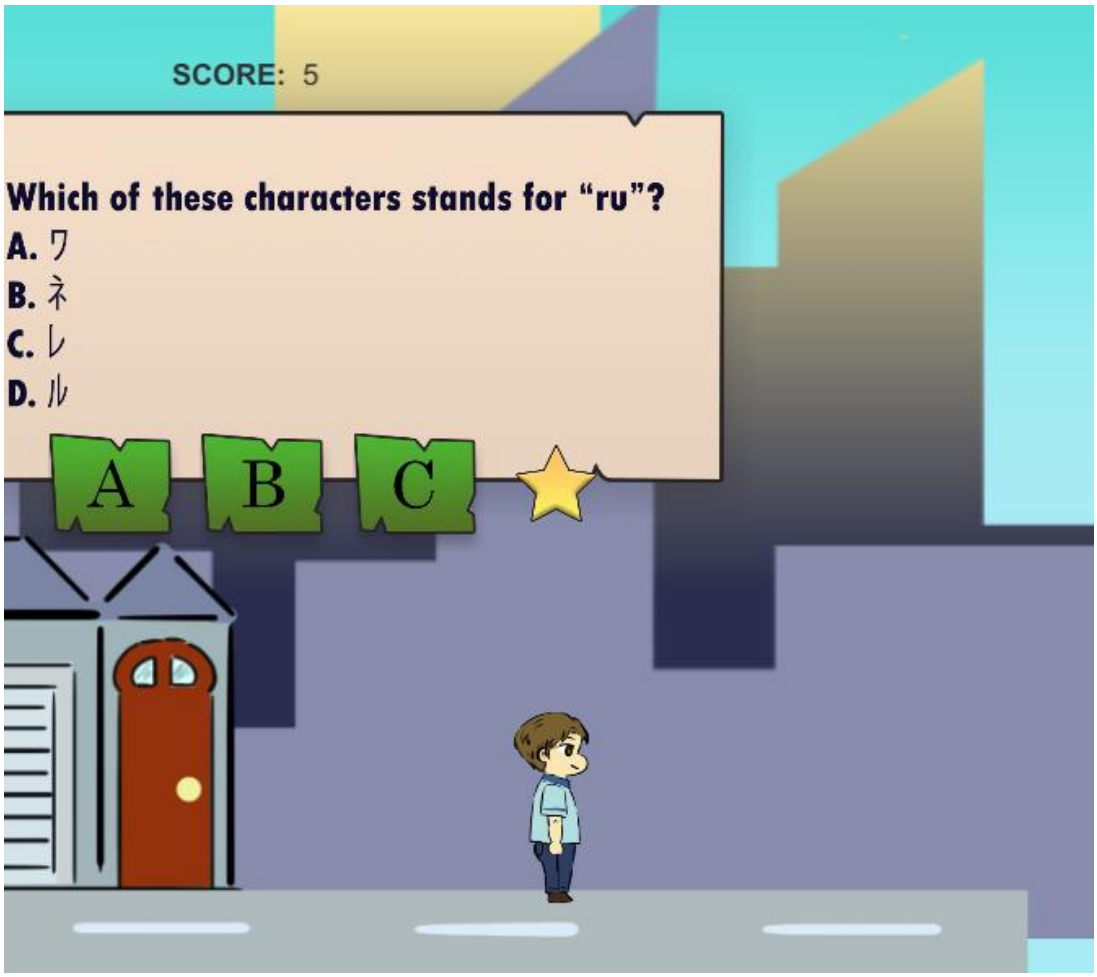


Figure 4.2.7: The exercise page.

This page also allows the player to move the game character. The user will be given a set of questions that they need to answer. The difference with the previous one is that it displays the score on top left of the scene. The score displayed would be saved into a database and should be displayed on the scoreboard page.

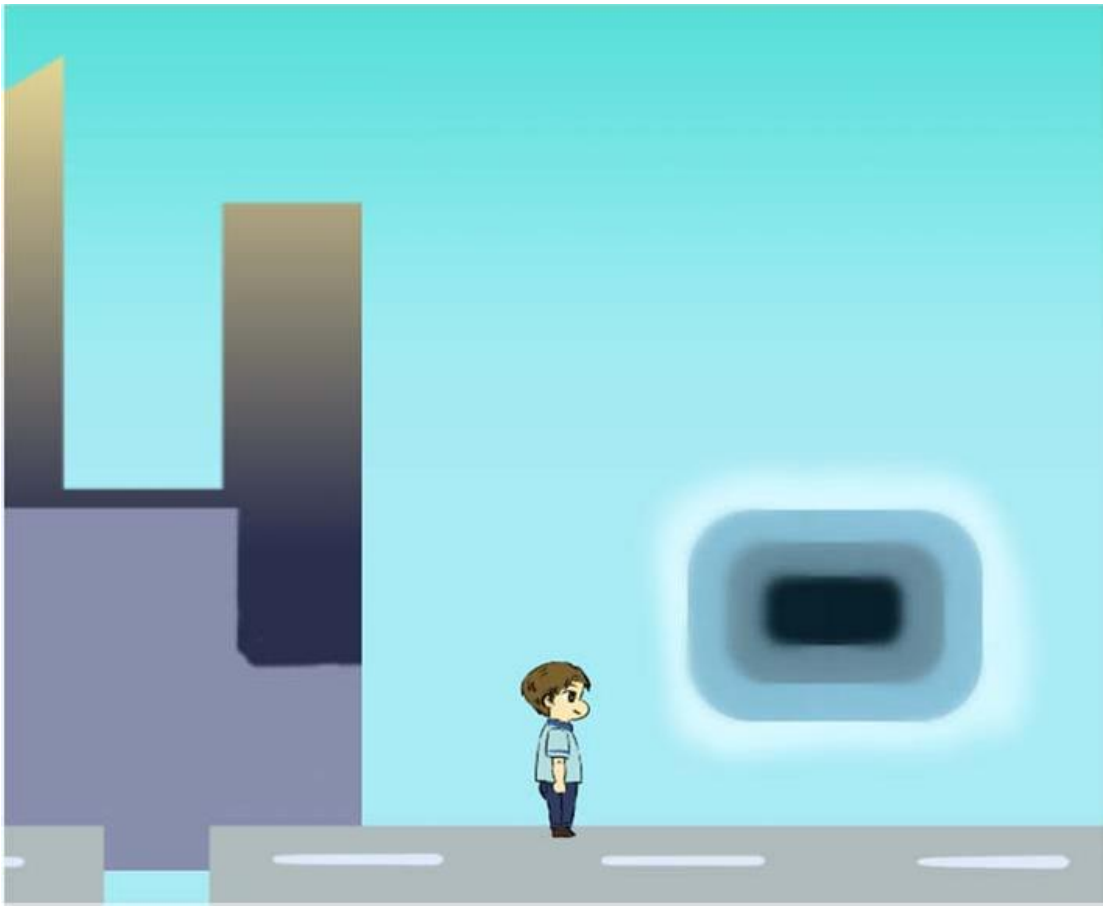


Figure 4.2.8: End of exercise page.

At every end of exercise page, there will be a portal that enables the player to go to the next lesson. This does not apply to the third exercise page as it directs the user to the test page. The test page also has this layout at the end but, it directs the user to scoreboard page.

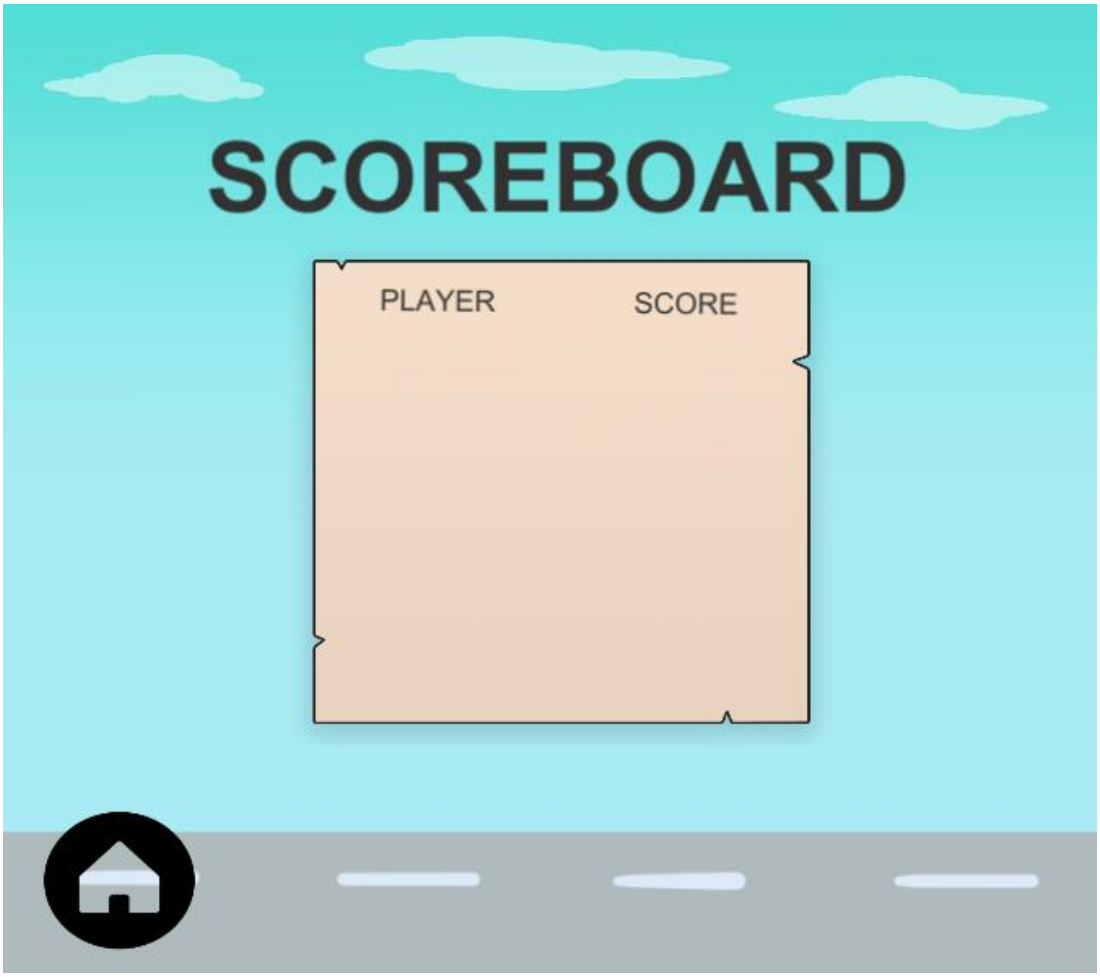


Figure 4.2.9: Scoreboard page.

This page displays the current and previous record of player's name and their score during the test. The home button will direct user to the main menu.

4.4 Testing and Result

User will be given a questionnaire for testing the game functionality. The data is collected from the students of UMP.

4.4.1 User Acceptance Test

The functionality of this serious game is tested by users and the result obtained are below:

Test Scenario	Test Case	Test Data	Expected Result	Actual Result
Main Menu (Start button)	Check if the button navigate the user to login page.	-	User should be in login page.	User will be directed to the login page.
Main Menu (Scoreboard)	Check if the button navigate the user to scoreboard page.	-	User should be able to see the record from	User will be directed to the scoreboard
Main Menu (Exit button)	Check if the button can close the game application	-	User will exit from the game application	The game application will be closed.
Scoreboard (Panel)	Check if there is record from previous player.	-	User should be able to see Score from previous user.	User will be able to see score from previous user.

Scoreboard page (home button)	Check if button navigate user to main menu.	-	User should be in main menu.	User will be directed to the main menu.
Lesson page (Home button)	Check if button navigate to main menu.	-	User should be in main menu.	User will be directed to the main menu.
Lesson page (next button)	Check if button navigate to exercise page.	-	User should be in exercise page.	User will be directed to the exercise page.

Table 4.1: General UAT.

MODULE 1 (Login & Register)				
Login page (Enter detail box & login button)	Check if the detail box can be entered and the check button confirm detail.	- Username - Password	User's detail should be confirmed once they clicked the login button.	Game display "Login Successful" message.
Login page (Play button)	Check if play button navigate the user to lesson page.	-	User should be in login page.	User will be directed to login page.
Login page (Register button)	Check if button navigate user to register page.	-	User should be in register page.	User will be directed to the register page.

Login page (home button)	Check if button navigate user to main menu.	-	User should be in main menu.	User will be directed to the main
Register page (Enter detail box & register button)	Check if the detail box can be entered and the data inserted into the database.	- Username - Password - Email address	User's detail should be confirmed once they clicked the button.	Game display "Creating user…" message.
Register page (home button)	Check if button navigate user to main menu.	-	User should be in main menu.	User will be directed to the main menu.
Register page (back button)	Check if button navigate user to login page	-	User should be in login page.	User will be directed to login page.

Table 4.2: Module 1 UAT.

MODULE 2, 3, 4 & 5 (Exercises & test)				
Exercise & Test page (movement)	Check if the character can move left, right and jump using keyboard.	-	User should be able to move the character.	User will be able to navigate and jump to avoid obstacle.

Exercise & Test page (answer box)	Check if character can destroy answer box.	-	User should be able to destroy answer box.	User will be able to destroy answer box only once per question.
Exercise & Test page (correct answer box)	Check once character destroy the answer box and reveal a star.	-	User should be able to see a star symbol once the box is destroyed.	User will see a star symbol once the box is destroyed.
Exercise & Test page (wrong answer box)	Check once character destroy the answer box and reveal an ‘x’ mark.	-	User should be able to see an ‘x’ symbol once the box is destroyed.	User will see an ‘x’ symbol once the box is destroyed.
Exercise & Test page	Check if the score is displayed on the top left corner of the screen.	-	User should be able to see the score increase and decrease whenever character answer.	User will be able to see the score increase and decrease.

Exercise & Test page (potholes)	Check if the character reset back to the beginning if it falls into the pothole.	-	User should be able to see the character go back to the beginning of the level.	User will see the character go back to the beginning of the level.
Exercise page (portals)	Check if the character is transported to the next level if collide with portal.	-	User should be able to play the next level.	User will be able to play the next level.
Test page (portals)	Check if the character is transported to the scoreboard page if collide with portal.	-	User should be in scoreboard page.	User will be in scoreboard page.

Table 4.3: Module 2, 3, 4 & 5 UAT.

4.4.2 Test and Result Discussion

The result will show the functionality of the game application to the user. It is based on the functionality testing of the application to find out whether the result is fitting or not. The script plays an important role that enables user to play the game application and this chapter does tests to ensure that the application runs smoothly and fix any visible error. The user acceptance test is used to test whether the coding works during exercise. It also tests whether the button works and navigate the user to the correct page.

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter will provide conclusion for the overall project. Based on the study done when completing this project, it can be concluded that this project can be used to assist user in learning and improving their knowledge but there is some constraint. This chapter will include the limitations when completing this project. There are limitations in the project and of course the system itself. This chapter will also propose a suggestion for future work.

5.2 Limitation

In this project, there are some constraint that had to be dealt with throughout the development of the project. There are project limitation and system limitation that needs to be confronted.

The first one is the project time and resource. The application content is limited because of time constraint resulting in the length of gameplay being short. The application is unable to provide a practice that uses all the Katakana character available due to length of the game space and repetition that may result in boredom to the user.

The second one is the functionality of the game itself. The game does not run smoothly because there is some error in the coding. The error is that the score stored in the database does not appear on the scoreboard.

The last limitation is gameplay itself. The application is too simple in terms of gameplay. It may be due to time constraint too. The application does not have a assorted gameplay as the same type of gameplay is repeated in each level.

5.3 Future Work

Every project has its own limitation and this means that there can be an improvement to be done for future work. This are some suggestion for improving or for making a project similar to this.

The first suggestion is to invest more time in the game's content. The game only focuses on learning Katakana but not all character is used. The number of question could also be added. not repetitive and provide a more diverse gameplay. Another suggestion is to spend more time testing the code more thoroughly. The application code has some error that could be corrected.

Lastly, diversify the gameplay. The application is too simple and it can be more interesting if there was a different gameplay added into the application. This application ca has more than one type of gameplay. For an example, the game can be made into a treasure finding or hide and seek game. The application can also have a more difficult and complex platforming by adding obstacles and moving enemies.

5.4 Conclusion

Based on the objective, this project uses serious game to learn Japanese character, Katakana. It can be concluded that this project can be used to assist user in learning and improving their skills for memorizing and knowledge of when to use it. This project also allows the user to achieve their objective to learn the Katakana character by playing a game and have fun.

The final result of this project was not achieved fully, considering there are some error in the coding. However, the game achieved its objective in making the user learn and practice Katakana. This chapter shows that there are limitations and also improvement that can be done.

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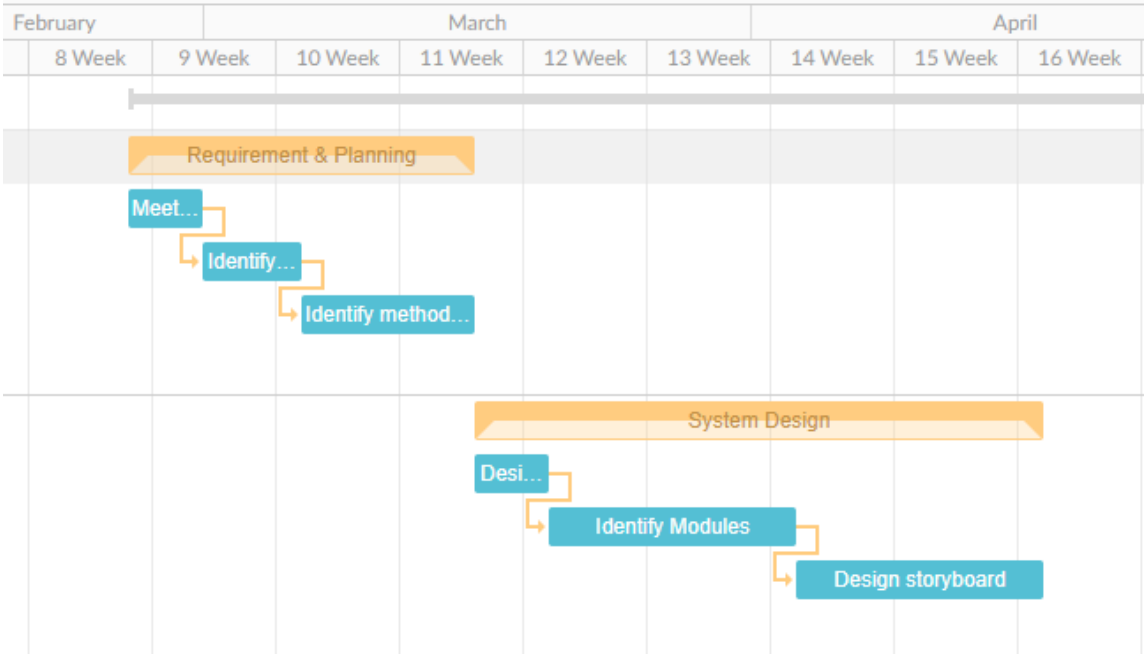
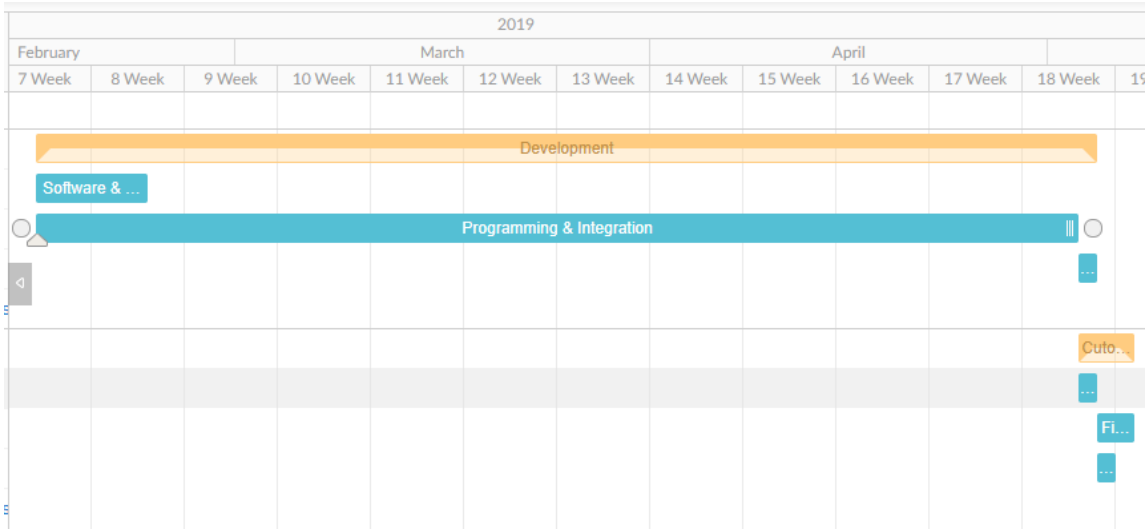
APPENDIX A
GANTT CHART





Task name	Start date	End date
	23/02/2018	06/05/2019
Requirement & Planning	23/02/2018	14/03/2018
Meeting with SV & Identify problem statement	23/02/2018	27/02/2018
Identify constraint & scope	28/02/2018	05/03/2018
Identify methodology	06/03/2018	14/03/2018
System Design	15/03/2018	16/04/2018
Design Diagram	15/03/2018	19/03/2018
Identify Modules	20/03/2018	02/04/2018
Design storyboard	03/04/2018	16/04/2018
Development	13/02/2019	02/05/2019
Software & Hardware setup	13/02/2019	20/02/2019
Programming & Integration	13/02/2019	01/05/2019
Testing	02/05/2019	02/05/2019
Cutover	02/05/2019	06/05/2019
Finish Testing	02/05/2019	02/05/2019
Finish build up system	03/05/2019	06/05/2019
Submit report	03/05/2019	03/05/2019

APPENDIX B

USER ACCEPTANCE TEST

UAT EXAMPLE:

Test Scenario	**Test Case**	**Expected Result**	**Result**	**Comments**
Main Menu (Start button)	Check if the button navigate the user to login page.	User should be in login page.		
Main Menu (Scoreboard)	Check if the button navigate the user to scoreboard page.	User should be able to see the record from		
Main Menu (Exit button)	Check if the button can close the game application	User will exit from the game application		
Scoreboard (Panel)	Check if there is record from previous player.	User should be able to see Score from previous user.		
Scoreboard page (home button)	Check if button navigate user to main menu.	User should be in main menu.		

Lesson page (Home button)	Check if button navigate to main menu.	User should be in main menu.		
Lesson page (next button)	Check if button navigate to exercise page.	User should be in exercise page.		

MODULE 1 (Login & Register)				
Login page (Enter detail box & login button)	Check if the detail box can be entered and the check button confirm detail.	User's detail should be confirmed once they clicked the login button.		
Login page (Play button)	Check if play button navigate the user to lesson page.	User should be in login page.		
Login page (Register button)	Check if button navigate user to register page.	User should be in register page.		
Login page (home button)	Check if button navigate user to main menu.	User should be in main menu.		

Register page (Enter detail box & register button)	Check if the detail box can be entered and the data inserted into the database.	User's detail should be confirmed once they clicked the button.		
Register page (home button)	Check if button navigate user to main menu.	User should be in main menu.		
Register page (back button)	Check if button navigate user to login page	User should be in login page.		

MODULE 2				
Exercise page (movement)	Check if the character can move left, right and jump using keyboard.	User should be able to move the character.		
Exercise page (answer box)	Check if character can destroy answer box.	User should be able to destroy answer box.		
Exercise page (correct answer box)	Check once character destroy the answer box and reveal a star.	User should be able to see a star symbol once the box is destroyed.		

Exercise page (wrong answer box)	Check once character destroy the answer box and reveal an ‘x’ mark.	User should be able to see an ‘x’ symbol once the box is destroyed.		
Exercise page	Check if the score is displayed on the top left corner of the screen.	User should be able to see the score increase and decrease whenever character answer.		
Exercise page (potholes)	Check if the character reset back to the beginning if it falls into the pothole.	User should be able to see the character go back to the beginning of the level.		
Exercise page (portals)	Check if the character is transported to the next level if collide with portal.	User should be able to play the next level.		

MODULE 3

Exercise page (movement)	Check if the character can move left, right and jump using keyboard.	User should be able to move the character.		
Exercise page (answer box)	Check if character can destroy answer box.	User should be able to destroy answer box.		
Exercise page (correct answer box)	Check once character destroy the answer box and reveal a star.	User should be able to see a star symbol once the box is destroyed.		
Exercise page (wrong answer box)	Check once character destroy the answer box and reveal an ‘x’ mark.	User should be able to see an ‘x’ symbol once the box is destroyed.		
Exercise page	Check if the score is displayed on the top left corner of the screen.	User should be able to see the score increase and decrease whenever character answer.		

Exercise page (potholes)	Check if the character reset back to the beginning if it falls into the pothole.	User should be able to see the character go back to the beginning of the level.		
Exercise page (portals)	Check if the character is transported to the next level if collide with portal.	User should be able to play the next level.		

MODULE 4				
Exercise page (movement)	Check if the character can move left, right and jump using keyboard.	User should be able to move the character.		
Exercise page (answer box)	Check if character can destroy answer box.	User should be able to destroy answer box.		
Exercise page (correct answer box)	Check once character destroy the answer box and reveal a star.	User should be able to see a star symbol once the box is destroyed.		

Exercise page (wrong answer box)	Check once character destroy the answer box and reveal an ‘x’ mark.	User should be able to see an ‘x’ symbol once the box is destroyed.		
Exercise page	Check if the score is displayed on the top left corner of the screen.	User should be able to see the score increase and decrease whenever character answer.		
Exercise page (potholes)	Check if the character reset back to the beginning if it falls into the pothole.	User should be able to see the character go back to the beginning of the level.		
Exercise page (portals)	Check if the character is transported to the next level if collide with portal.	User should be able to play the next level.		

MODULE 5

Test page (movement)	Check if the character can move left, right and jump using keyboard.	User should be able to move the character.		
Test page (answer box)	Check if character can destroy answer box.	User should be able to destroy answer box.		
Test page (correct answer box)	Check once character destroy the answer box and reveal a star.	User should be able to see a star symbol once the box is destroyed.		
Test page (wrong answer box)	Check once character destroy the answer box and reveal an ‘x’ mark.	User should be able to see an ‘x’ symbol once the box is destroyed.		
Test page	Check if the score is displayed on the top left corner of the screen.	User should be able to see the score increase and decrease whenever character answer.		

Test page (potholes)	Check if the character reset back to the beginning if it falls into the pothole.	User should be able to see the character go back to the beginning of the level.		
Test page (portals)	Check if the character is transported to the scoreboard page if collide with portal.	User should be in scoreboard page.		