MOBILE JAWI COURSEWARE USING SERIOUS GAME APPROACH

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Thesis submitted in fulfillment of the requirements
for the award of the degree of
Bachelor of Computer Science (Graphics & Multimedia Technology) with Honors

Faculty of Computer Systems & Software Engineering
UNIVERSITI MALAYSIA PAHANG

SEPTEMBER 2018

ACKNOWLEDGEMENTS

First and foremost praise to Almighty Allah for all his blessings for giving me patience and good health throughout the duration of this project development. I would like to dedicate my highest gratitude for those who have involved directly or indirectly during this project development. Special thanks to Prof. Madya Dr. Ruzaini Abdullah Arshah in supporting me and being a helpful supervisor for all of his comments, supervision, ideas, suggestions and all the given guidelines for me to complete this project development. It has been an interesting and exciting learning period for me throughout this whole semesters. To my dearest friends from BCG and also other courses, who always been supporting me and giving me advices, thank you for all the motivation words, ideas and critics that helps me to improve a lot during my project development.

Finally, to my beloved family, a million thank you for always giving me moral supports especially to my parents who always asked regarding this project development and make sure that I am able to finish this project successfully. Thanks for all the encouragement, moral supports and prayers for all this time.

ABSTRAK

Mobile Jawi Courseware using Serious Game Approach adalah aplikasi yang direka untuk pelajar prasekolah untuk menguasai Bahasa Jawi dengan cara yang berkesan dan menarik. Sejarah pendidikan di Malaysia menunjukkan bahawa Pendidikan Islam telah diajar sama ada dengan menggunakan buku atau teks yang ditulis dalam bahasa Jawi dan masih diamalkan sehingga sekarang. Kelemahannya adalah pelajar yang tidak dapat menguasai kemahiran membaca dan menulis Jawi akan ketinggalam dalam mata pelajaran Pendidikan Islam kerana Jawi adalah medium pengajaran subjek-subjek ini. Aplikasi ini akan menyediakan modul pembelajaran dan juga modul permainan mini. Pelajar dapat mempelajari huruf Jawi dan juga ejaan Jawi menerusi modul pembelajaran. Modul pembelajaran dapat membantu mereka memahami dengan lebih baik dan dapat menghafal setiap huruf dan juga dapat membantu mereka menguasai ejaan Jawi. Modul permainan mini pula adalah platform untuk pelajar menguji pemahaman dan pengetahuan mereka. Beberapa permainan telah disediakan untuk mereka bermain dan skor akan diberikan untuk setiap permainan. Aplikasi ini adalah aplikasi berasaskan telefon mudah alih untuk platform android. Untuk membangunkan aplikasi ini, metodologi ADDIE akan dijadikan rujukan sepanjang pembangunan dari awal hingga akhir. Fasa untuk pembangunan aplikasi ini adalah analisis keperluan, reka bentuk sistem, pembangunan, pelaksanaan sistem dan penilaian terakhir. Akhir sekali, hasil yang dijangkakan dari aplikasi ini adalah kanak-kanak akan dapat mempelajari Bahasa Jawi dengan cara yang berkesan dan menarik. Selain itu, elemen permainan yang serius dan pembelajaran yang menyeronokkan dapat membina minat kanak-kanak untuk belajar dan aplikasi ini dapat membantu para guru untuk mengajar pelajar mereka di masa depan. Aplikasi ini juga boleh digunakan oleh orang dewasa yang mempunyai minat untuk mula belajar Jawi pada masa akan datang.

ABSTRACT

Mobile Jawi Courseware using Serious Game Approach is an application designed for preschool students to master Jawi Language in effective and interesting way. The history of education in Malaysia shows that the Islamic Education has been taught either by using books or texts written in Jawi and still being practiced today. The drawback is students who are unable to master Jawi reading and writing skills will be left out in the Islamic subjects as Jawi is the medium of instruction of these subjects. This application will provide the learning module and also the mini games module. Students can learn Jawi character and also Jawi spelling through the learning module. The learning module can help them understand better and can memorize each character and also can help them master in Jawi spelling. While the mini games module is the platform for student to test their understanding and knowledge. There will be a few games provided for them to play and score will be given for each game. This application is a mobile based application for android platform. In order to develop this application, ADDIE methodology will be applied throughout the development from start to the end. The phase will be requirement analysis, system design, development, system implementation and lastly evaluation. Lastly, the expected outcomes from the application is children will be able to learn Jawi Language in an effective and attractive way. Besides, the element of serious game and fun learning can build children interest to learn and this application can be a good help for teachers to teach their students in future. This application also can be used by adult that have interest to start learning Jawi in the future.

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LIST OF ABBREVIATIONS

ADDIE	Analyse, Design, Development, Implementation, Evaluation
FSKKP	Faculty of Computer System and Software Engineering
RAD	Rapid Application Development
RUP	Rational Unified Process
SDLC	System Development Life Cycle
UMP	University Malaysia Pahang

CHAPTER 1

INTRODUCTION

1.1 Background

Serious Game for Jawi Learning in Mobile Application is a system designed for preschool students to master Jawi Language in effective and interesting way. When it comes to education, technology has become an influential factor. For effective teaching and learning, advances in computer and mobile technology have allowed educators to develop new technology that can attract students' interest. Computers and mobile are an ideal medium used to facilitate education, especially to children. Learning for children does not necessarily have to be based on text book. Digital game-based learning could be one of the best approach in learning process especially it involves serious game. Serious game is defined as a computer or a digital games that have the game approach which provide not only entertainment but also educate and train those who use it (Saavedra, Rodríguez, Arteaga, Salgado, & Ordoñez, 2014). Besides, serious games are also games whose primary objective is not fun or entertainment, rather learning or practicing a skill. Its use has grown, particularly in such sectors as education, defence, aeronautics, science or health. Its purpose can be one of many, from training firefighter crews in emergency situations to training a sales team, teaching mathematics or practicing a language. There are many advantages of learning through serious game. Some of them are, most of serious game offers easy and user friendly interface, it also may help students to master better literature skills and also helps student to improve their listening skill and their vocabulary (Kokkalia, Drigas, Economou, Roussos, & Choli, 2017).

1.2 Problem Statement

Firstly, the history of education in Malaysia shows that the Islamic Education has been taught either by using books or texts written in Jawi and still being practiced today. The drawback is students who are unable to master Jawi reading and writing skills will be left out in the Islamic subjects as Jawi is the medium of instruction of these subjects. Nik Yaacop emphasized that learning to write Jawi must be taught at early age (Games, 2013).

Secondly, although Jawi language is being taught in primary schools, they are using methods that are less attractive and effective for children's interest. A study shows that methods of teaching Jawi are now done by face to face between teachers and student and teachers are still depending on learning activities using boards and cards. Hence, children become uninterested and quickly become bored.

Lastly, a study shows that the teachers still do not have sufficient software or computer teaching aids to teach Jawi writing and reading skills (Mat Amin et. al, 2011). Besides, studies on the use of technology among teachers indicate that only 8% of all teachers use the software in teaching Jawi (M. Yusoff, 2010). But based on the existing software, there are maybe some lack in some modules of the software based on the fun teaching and games that failed to attract students' attention.

1.3 Objective

The aim of this system is to provide a tool that can ease the student use. The objectives are:

i. To design a mobile Jawi courseware using game-based learning.
ii. To develop an E-learning courseware for Jawi Language with serious game.
iii. To test the effectiveness of the system toward the students.

1.4 Scope

To achieve the objectives there are several scope which needed to be considered before proceed to the main project.

i. This system is develop for mobile application in android platform.
ii. The system is focusing on preschool student as the target user.
iii. This system is build using Unity software.

1.5 Report Organization

This report consists of 5 chapters. Chapter 1 will discuss about the introduction of the project. The further discussion will be about the problem statement, objectives of study and scope.

Chapter 2 will discuss about Literature Review of the project. This chapter will explain about the previous and recent system of Serious Game for Jawi Learning. There will be a comparison between the method and techniques based on previous and recent system as well. From previous chapter, the problems, objectives, and scope has been identified.

Chapter 3 will discuss about Methodology of the project. This chapter proposed the methodology of the project and there will be detail explanations about the method use and technique use as well. The method and technique used is based on finding during Literature Review.

Chapter 4 will discuss about Result and Discussion of project. This chapter is about discussion on the finding of the project that consist of the problem, objective, the technique used and expected result.

Chapter 5 contains the conclusion of the project. This chapter will conclude the project that have been done.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will describe about the existing work, solution or system that have been done by others. This chapter aim to analyse on the existing system design to make a better design for the proposed application. This chapter will explain in detail what is the technique, method, hardware and technologies which are suitable to be adapted into the project or system. For project-based proposal, we are required to do a comparison between three existing system based on their user friendly, modules or features, graphic quality and etc. The subtopics also will discuss on the strengths and weaknesses on the three existing systems. Lastly, we will compare possible and relevant hardware, technologies and tools that can be used to develop the proposed system.

2.1.1 What Make an Effective and Interesting Mobile Learning Tools

There are several suggestions from literature stating that a good mobile learning tools should have the following criteria:

i. Learners are generally expecting an immediate response from their mobile device. Contextual notions and usage of time should also be reflected in the design of mobile learning tools or known as user-friendly (Gipple & Lord, 2013).

ii. Mobile learning applications should be quick and easy to setup and install in any system or device which leads to the availability in any environment (Sarrab, Hafedh, & Bader, 2015).

iii. The functionality of Mobile learning application should be useful and suitable enough to meet different learning and educational objectives, instructors and learners' needs and the situation. Mobile learning applications should be flexible, simple and self-explanatory, to provide the required services to suit demand (Gipple & Lord, 2013).

2.1.2 What Make Serious Game Should be Included in Learning Tools

The element of serious game should be including in learning tools because we want to justify that we want to develop an interesting, effective and user-friendly system that people want to use and get a good result and feedback from users.

2.2 Review Existing System (Strength and Weaknesses)

The following section will review the three existing system focusing on the strength and weaknesses of the system.

2.2.1 System 1: Mari Belajar Jawi

Mari Belajar Jawi can be accessed using mobile by installing the application in Google Play Store or the App Store. Figure 2.1 shows the main interfaces of the system.

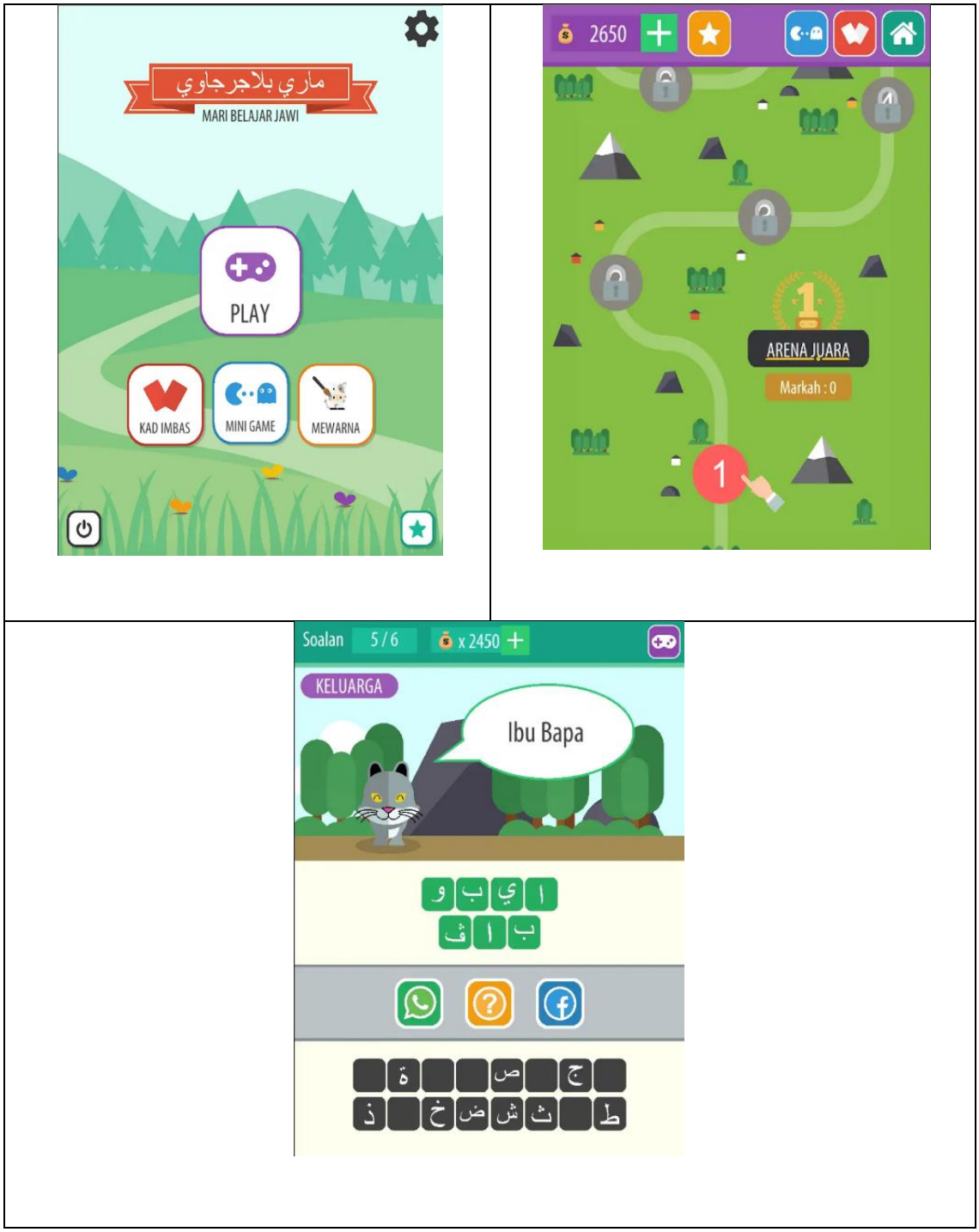

Figure 2.1 Main Interfaces of Mari Belajar Jawi

The system provides an easy and user-friendly interfaces that can use by children. Each interface provides the information and buttons that easy to be understand. However,

this application has some weaknesses that we spotted from other user's feedback which this application consumes more battery while playing the game and also come with many advertisements that can make user become distracted and uninterested to use it.
The summary of the strength and weaknesses of the system are shown in Table 2.1.

Table 2.1 The Summary of the Strength and Weaknesses of the System

Strength	Weaknesses
• Easy to understand and user friendly. • Available to be use and learn Jawi anywhere and anytime.	• This application consumes more battery. • Contain many advertisement.

2.2.2 System 2: Rainbow Jawi

Rainbow Jawi can be accessed using mobile by installing the application in Google Play Store or the App Store.

Figure 2.2 shows the main interfaces of the system.

Figure 2.2 Main Interface for Rainbow Jawi

The system provides an interesting and attractive design for each interface. The design can attract student who didn't interested to learn Jawi. This application also provides an interactive way to learn Jawi and it can be very addictive. However, this application also has weakness that we spotted from other user's feedback which the advertisement still appears although user has purchased the full version of the application. The summary of the strength and weaknesses of the system are shown in Table 2.1.

Table 2.1 The Summary of the Strength and Weaknesses of the System

Strength	Weakness
• Can attract student who didn't interested to learn Jawi. • This application provide an interactive way to learn Jawi and it can be very addictive.	• Advertisement still appear although user has purchased the full version of this application.

2.2.3 System 3: Belajar Huruf Jawi Alif Ba Ta

Belajar Huruf Jawi Alif Ba Ta can be accessed using mobile by installing the application in Google Play Store or the App Store.

Figure 2.2 shows the main interfaces of the system.

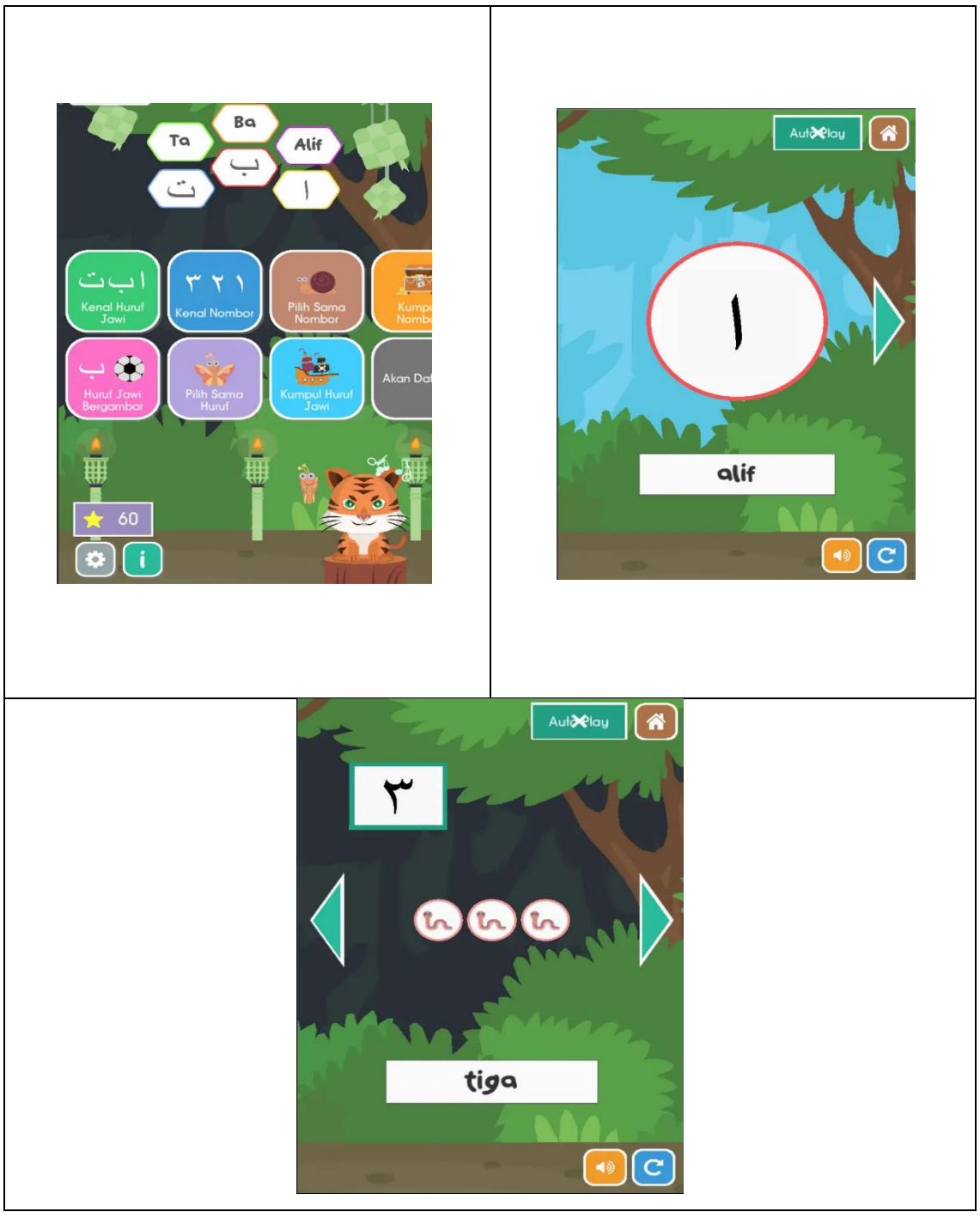

Figure 2.2 Main Interfaces for Belajar Huruf Jawi Alif Ba Ta

The system provides good modules for learning Jawi's character and also numbers in Jawi. The application also has good quality of graphics and audio. However, this application also has weakness that we spotted from other user's feedback which the advertisement always appear every time user want to start the learning modules.

The summary of the strength and weaknesses of the system are shown in Table 2.2.

Table 2.2 The Summary of the Strength and Weaknesses of the System

Strength	Weakness
• The application provides good modules for learning Jawi's character and also numbers in Jawi. • This application has good quality of graphics and audio.	• Advertisement always appear every time user want to start the learning modules.

2.3 Comparison of Existing System

2.3.1 Mari Belajar Jawi

Mari Belajar Jawi can be installed using mobile from Google Play Store or App Store. It provides user-friendly interfaces based on the understandable instructions but not on the consistency of the layout for each interface. The first feature that is provided in this application are the first one is the scan card which they provides Jawi character one by one with audio. The second one is colouring module. The third one is writing module where students can learn how to write Jawi character easily. The fourth one is mini game module where they provide a few mini games that student can play such as they give the Malay word and students have to pick the correct Jawi spelling for the word and vice versa. And lastly, the play module where in this stage, students have to spell in Jawi the word provided in Malay by themselves by clicking the character card provided below.

2.3.2 Rainbow Jawi

Rainbow Jawi also can be installed using mobile from Google Play Store or App Store. It provides user-friendly interfaces based on the understandable instructions and the consistency of the layout for each interface. There are two main modules, namely module and game modules. Both of these modules covering various aspects of Jawi learning of where to start. Children are given the opportunity to Jawi character, writing, recognize limbs and animals and many more. Having studied the science, children can practice the art in gaming activities to increase the advanced and proficient in learning Jawi. The application also provides space for parents who want to monitor the performance of the children during the game and displays the information in the application. It includes the amount of time learning and playing, the number of activities that have been completed. The application also provides with Augmented Reality module which users have to buy their flash card in order to use the AR scanner.

2.3.3 Belajar Huruf Alif Ba Ta

Belajar Huruf Jawi Alif Ba Ta also can be installed using mobile from Google Play Store or App Store. It provides user-friendly interfaces based on the understandable instructions and the consistency of the layout for each interface. This application provides four main modules or features which are Alif Ba Ta's voice by children, learn the Jawi characters, learn Jawi using picture and learn the numbers in Jawi.

The summary of the comparison between three existing system is shown in Table 2.3.

Table 2.3 The Summary of the Comparison between Three Existing System

Criteria/ Application		Mari Belajar Jawi	Rainbow Jawi	Belajar Huruf Jawi Alif Ba Ta
User-friendly	**Understa-ndable Instructio-ns**	Yes	Yes	Yes
	Consisten-cy of The Layout for each interface	No	Yes	Yes
Element of Serious Game		Yes. This application provides games with the element of serious game. But the serious games provided are not very interesting because it's just involve with the basic Jawi character that a primary school student has learned during their preschool.	Yes. This application provides games with the element of serious game. Student able to learn while playing the game but the multimedia elements used in the application are not very interesting and attractive because there are too many things in one interface.	No. This application do not provides the element of serious game. This application more focus on the basic learning and knowing Jawi character.
Platform		Mobile	Mobile	Mobile
Developer		Good Deeds Studio	Cool Code MY	Syumul Studio

2.4 Comparison of the Tools

In order to develop the proposed system, there will be one tool or software that will be use. This section will focusing on the comparison of three tools which are Unity, Android Studio and Microsoft Visual Studio. The comparison will be based on some criteria and the best tool will be chosen for the development of the proposed system.

2.4.1 Unity

Basically Unity3D is a quick learning tool because it itself described as a game development ecosystem that means it is not just represented as a mere platform. It came out with a set of power tool that can be called as assets. During the development, it helps to smooth out the potential crease. In the assets store, you can easily get a readymade version of assets which can be customized, you can download it from the assets store. Unity3D shows that it follows a certain principle in generating a code which means write once, deploy everywhere. By creating a single code using unity framework, developers can easily deploy it on various platforms, including Play Stations, Android, iOS and Blackberry. With this, developing an application is easier for both game owners and game development companies. The latest version of the unity tool has a feature which supports mobile platforms for iOS and Android. A game developer who has a passion of developing game using Unity3D tool can also convert it as his profession, as it is low cost technology. So by using this tool's features and your innovative idea and skills, you can develop an outstanding game (*Mobile game developer survey leans heavily toward iOS, Unity*, 2012).

2.4.2 Android Studio

Android Studio allows you to drag-and-drop UI components, preview layouts on multiple screen configurations. Preview appears instantly as you change in the layout editor. You can choose a language, and can see the preview of layout with that locale. While adding colours as a resource, and we can see the colour preview at the left hand side of the editor. If you point to a line and it gives detailed explanation about an exception based on the annotation added. And you can also know which constants are allowed for which API. It also has the powerful code completion. You can also inspect code in whole project, InteliJ lists all Lint errors during code inspection. This tool can be deploy in several platform such as Windows, MacOS and Linux (Olanoff, 2013).

2.4.3 Microsoft Visual Studio

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs, as well as websites, web apps, web services and mobile apps. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code.

Visual Studio includes a code editor supporting IntelliSense (the code completion component) as well as code refactoring. The integrated debugger works both as a source-level debugger and a machine-level debugger. Other built-in tools include a code profiler, forms designer for building GUI applications, web designer, class designer, and database schema designer. It accepts plug-ins that enhance the functionality at almost every level including adding support for source control systems and adding new toolsets like editors and visual designers for domain-specific languages or toolsets for other aspects of the software development lifecycle(Abraham, n.d.).

The summary of the comparison between three tools is shown in Table 2.4.

Table 2.4 The Summary of the Comparison between Three Tools

Criteria/Tools		**Unity**	**Android Studio**	**Microsoft Visual Studio**
Features	Rich layout editor	Yes	No	No
	Rich color preview editor	Yes	Yes	Yes
	Low cost technology	Yes	Yes	No
	A single code can be deployed for multiple platforms	Yes	Yes	Yes
Programming Language		C#	Java	Python, JavaScript
Platform		iOS, Android, Windows, PlayStation	Windows, MacOS, Linux	Windows, Mobile Apps, Web Apps

2.4.4 Conclusion (Chosen Tool)

Based on the comparison of three tools above, tool that will be use for the development of the proposed system is Unity. Unity software fulfil the requirement that needed for the development of the serious game. Furthermore, I am familiar with Unity Software because had been used the software to develop game before. The C# language also the easiest among the other languages in other tools. So, I decide to use Unity Software to develop the proposed system.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will discuss about the methodology that will be applied in the application. In order to develop a system, selecting and using a suitable method is very important as this process will give a huge impact on the system that will be developed. In order to produce high quality and effective product, there are many methods that can be used in System Development Life Cycle (SDLC) which have completely different technique use, type of approach and it depends on the requirements of the projects. Every method, has their own characteristics that can be used in development process which include planning stage, design, development and maintenance. There are several model that we can use such as ADDIE, Spiral, Waterfall, Rapid Application Development (RAD), Agile and Rational Unified Process (RUP).

The general system of SDLC is been applied in the application. However, the detailed method is on the project. Each methodology is different from the others due to what the system needed and its intricacy. As for this application, the development apply the ADDIE-Model methodology as it is competent with the system requirements. Further explanation will be done on this chapter later on.

3.2 ADDIE-Model Methodology

The design and development of serious games includes various phases with different purposes. There is a difference between designing and developing. The ADDIE-model is an often-used high-level organization of the design and development process, distinguishing between phases of analysis, design, development, implementation (in the context of use), and evaluation. Additionally, it supports an iterative approach where results from a previous evaluation feed into the analysis and design phases of the next iteration and hence incrementally improves the design or the product (Braad, Gregor, & Sandovar, 2016).

Figure 3.2.1 shows the visualization of the cyclic ADDIE Model process that will be applied in the application.

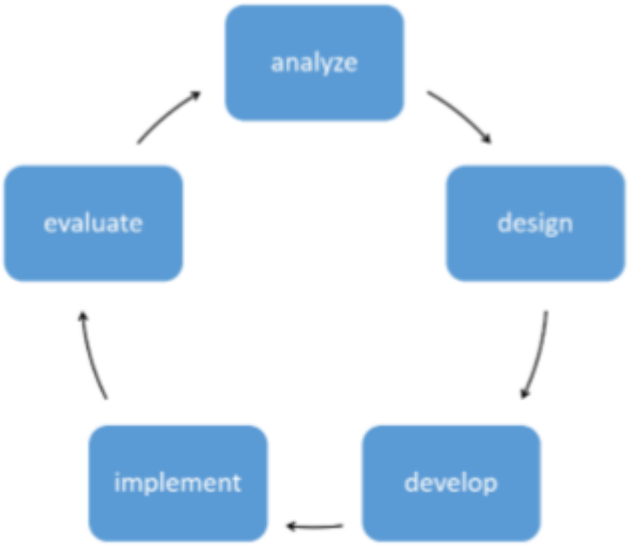

Figure 3.2.1 The Visualisation of the Cyclic ADDIE-Model Process

This cyclic and phasic approach underlies various other existing approach to serious game design. In an attempt to reduce design complexity, and hence development costs, the EMERGO-toolkit and associated approach are based on the ADDIE-cycle and focus on how to address case requirements in the design.

Table 3.1 shows the summary of ADDIE-Model methodology.

Table 3.1 The Summary of ADDIE-Model Methodology

Technique	Characteristics	Development phase
ADDIE-Model	The cyclic and phasic approach underlies various other existing approach to serious game design.	- Analysis Phase(P1) - Design Phase(P2) - Development Phase(P3) - Implementation Phase(P4) - Evaluation Phase(P5)

3.2.1 Requirement Analysis (P1)

For this phase, requirement is analysed based on the problem and objective that have been identified. Besides, the requirement is analysed based on the previous project or application that that have been done by others. The aim is to analyse on the existing system design to make a better design for the proposed application. This phase is based on the searching in the Internet. The searching and survey is based on the relevant characteristics according to the proposed application that will be develop. Besides, the process to find and analyse the real requirement will take a long period of time. This application will be based on the existing system and interface. From the existing system, I get the idea to create my own interfaces and develop my own application.

3.2.2 System Design (P2)

All the diagram needed in order to develop the application is design during this phase. Use case diagram shows the rough flow of the application and the description will describe about the pre-condition, post-condition, normal flow, alternative flow and exception flow if it exist. Then, flow chart will briefly shows the whole process from start the game until quit the game. Context Diagram is use to identify the system graphically.

It shows the interaction between the Players which as an external entities with the Mobile Jawi Courseware using Serious Game Approach itself. Lastly, the storyboard will show each of the user interface that will be develop for the application and prototype creation will be done.

3.2.3 Development Phase (P3)

In this phase, the real application will be developed using Unity software. Each of the interface will be developed accordingly to the prototype and storyboard that match to the system design phase. Each function in the interface will be work and the game will be full develop.

3.2.4 Implementation (P4)

In this phase, a procedure for training the users is develop. The functional of the serious game application also will be ensured. Then, the application will be test by random player. After some modification, once again we will test the integration of all for the application to make sure it is well developed.

3.2.5 User Acceptance Test (P5)

This phase will be based on evaluation phase in ADDIE-model. We will evaluate and test user acceptance for the application. We will make sure that this application fulfil the objectives that have been surveyed during requirement analysis phase. In this phase, we will evaluate the feedbacks from the random player that have tested the application.

3.3 Hardware and Software

This section will show the hardware and software used throughout the development of the application until the end.

3.3.1 Hardware Requirement

Table 3.2 shows the detailed hardware specification used throughout the development of the application until the end.

Table 3.2 Hardware Used for the Application

HARDWARE	SPECIFICATION	MINIMUM REQUIREMENT
Laptop	Processor	AMD A8-6410 APU with AMD Radeon R5 Graphics
	RAM	4.00 GB
	Hard Disk	500 GB

3.3.2 Software Requirement

Table 3.3 shows the detailed software used throughout the development of the application until the end.

Table 3.3 Software Used for the Application

SOFTWARE	FUNCTION
• Microsoft Word 2013	• Proposal preparation and project documentation
• Microsoft Power Point 2013	• Design User Interface and prototype
• Microsoft Visio 2013	• Design of Context Diagram, Use Case Diagram, Flow Chart
• Microsoft Project 2013	• Gantt Chart Design
Operating System: • Windows 10.0 Pro 64-bit	• Platform to develop, compiling, testing, and debugging system
• Unity • SQLite	• Develop codes and system interface • Database Design and Management

3.3.3 Software Architecture

In order to develop this application, Unity Software will be used until the end starting from creating the interface, writing the code using c# language for each function and also the connection to its database which is SQLite. Then, the code will be connect to the web server and the application will be fully develop and can be test by user. Figure 3.3 shows the summary of the software architecture that will be build.

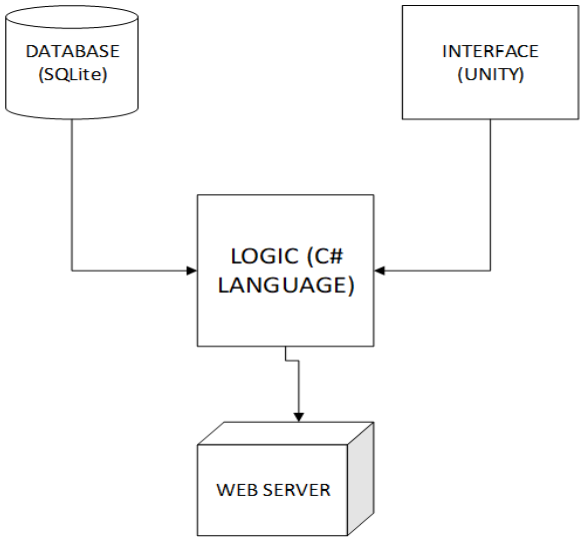

Figure 3.3 Software Architecture of the Application

3.4 Use Case Diagram

Figure 3.4 shows the overall use case of the application. The use case shows the flow of the game from phase to another phase.

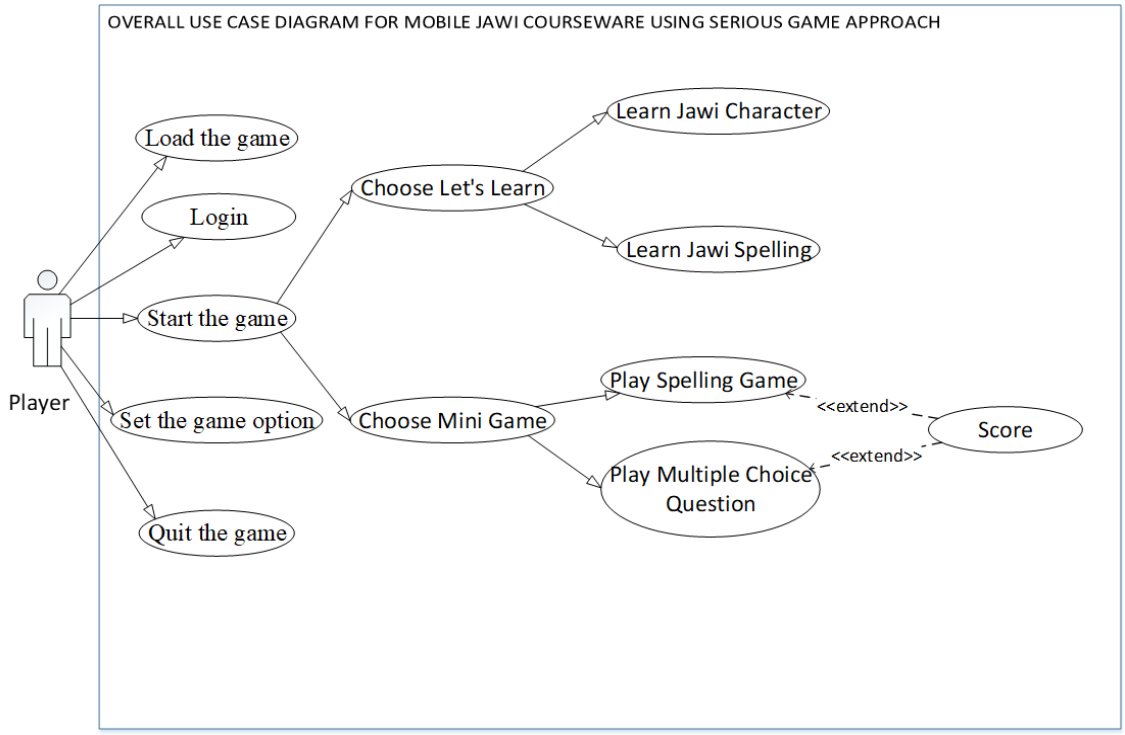

Figure 3.4 Overall Use Case Diagram for Mobile Courseware using Serious Game Approach

Table 3.5 and Table 3.5 show the use case description for load the game and login and start the game respectively. The use case description is based on the use case diagram that has been created.

Table 3.4 Use Case Decsription for Load Game and Login

Use case Name :	Load Game and Login
Actors :	Player
Descriptions :	To provide login system.
Pre-conditions :	1. The Player need to open the game.
Post-conditions :	1. Player can start the game after login and Player's name will appear in the next page.
Normal flow :	1. Open the game 2. Login to the game by entering name.
Alternative Flows :	-
Exceptions :	-

Table 3.5 Use Case Description for Start the Game

Use case Name :	Start the game
Actors :	Player
Descriptions :	Player can choose either to learn or play the game.
Pre-conditions :	The Player need to login by entering the name.
Post-conditions :	1. Player will enter into learn mode after they click 'Let's Learn' button. 2. Player will enter into game mode after they click 'Mini Games' button.
Normal flow :	1. Choose either to learn or play the games. 2. Enter learn mode. 3. Choose either to learn Jawi character or Jawi spelling. 4. Enter mini games. 5. Choose either to play Spelling or Multiple Choice Question 6. Popup score will appear.
Alternative Flows :	1a. If Player do not want to enter learn module: 1. Player can straight away play the mini games.
Exceptions :	-

3.5 Flow Chart Diagram

Figure 3.5 shows the flow chart of this project which consists the whole flow processes from start until the end.

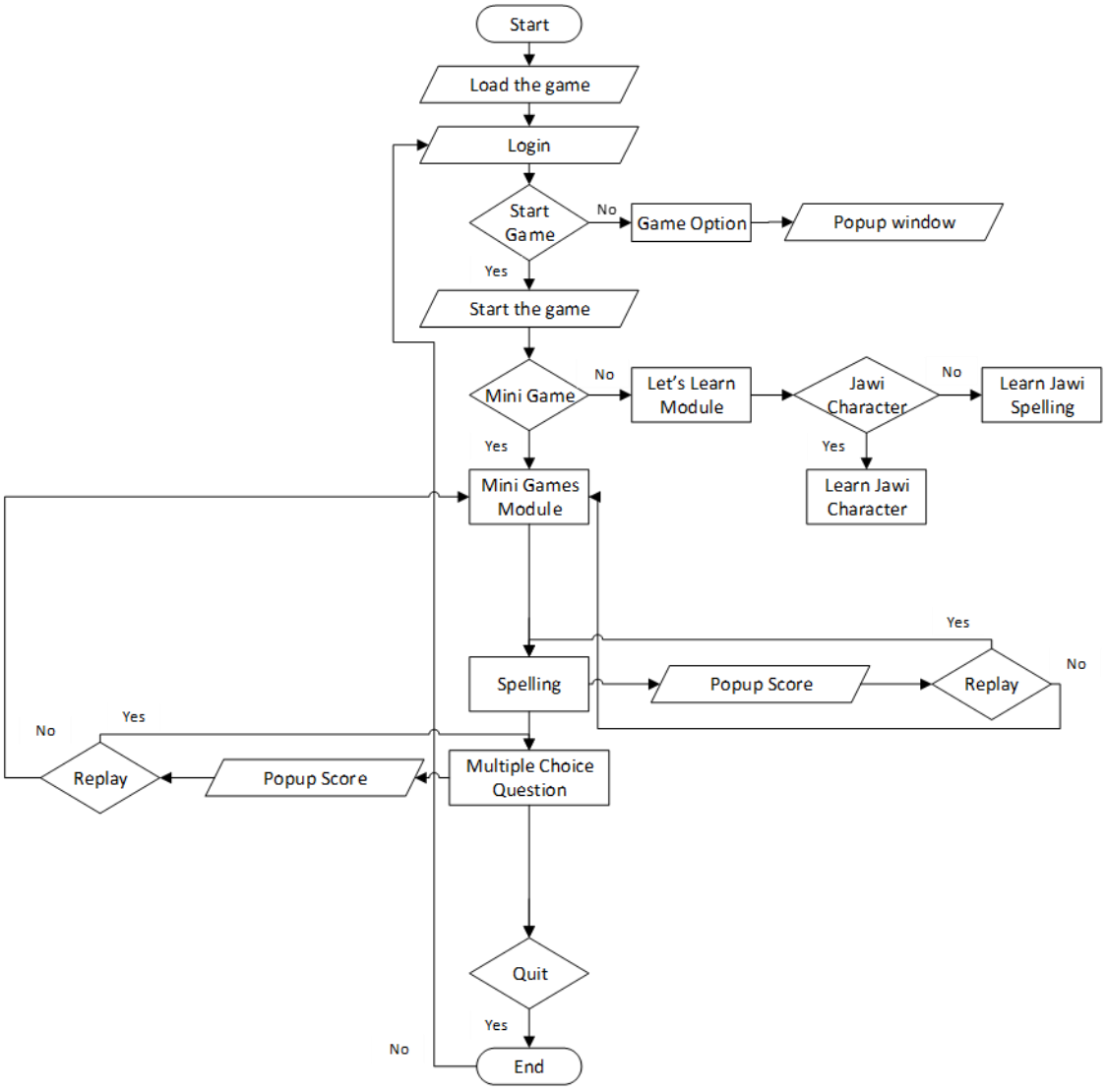

Figure 3.5 Flow Chart of the Application

Player need to load the game to start playing the game. Firstly, player need to login by just entering their name. Their name will appear on the next page. On the next page, player can customize the game option or start to play the game. Once player start the game, they can choose either to enter Learn mode or Mini Games mode. In the Learn mode, player can choose either to learn Jawi Character or Jawi Spelling. While in the Mini Games mode, player can choose either to play the Spelling game or Multiple Choice Questions game. After each of the game, popup message will appear to review the score. Player can choose either to replay or go back to the page where they can choose other games. If not, player can easily quit the game by clicking exit button.

3.6 Context Diagram

Figure 3.6 shows a context diagram for the application.

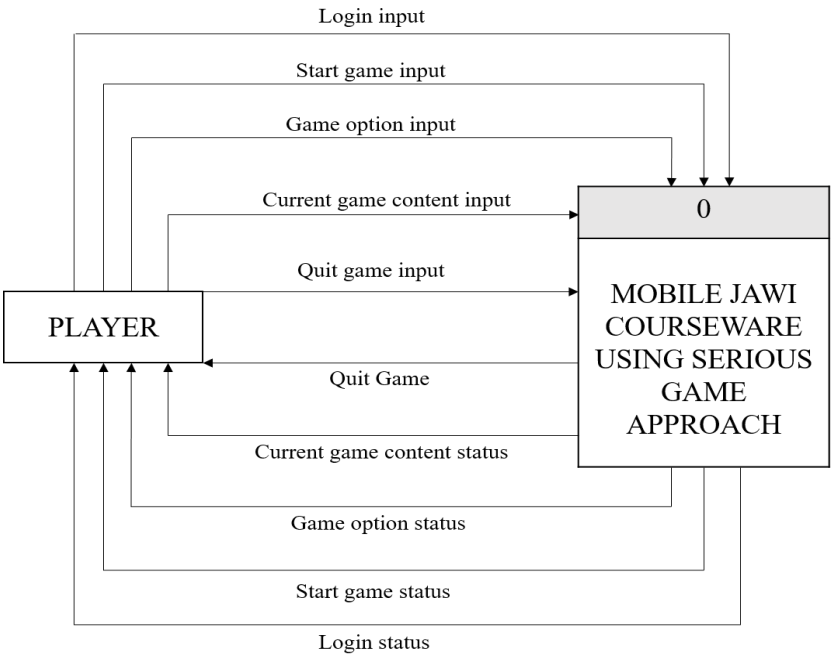

Figure 3.6 Context Diagram of the Application

Context Diagram is use to identifies the system graphically. It shows the interaction between the Players which as an external entities with the Mobile Jawi Courseware using Serious Game Approach itself.

The relation shows what the Player as a user give to the serious game application and what the application give to the treasurer as a feedback from the application. Which means, they undergoes interaction relationship between the external and internal of the application.

As the Player login into the game, the interaction occur here and application give the feedback to the Player that the Player will see the login status by seeing their name on the next page.

For the start game and game option input, as Player enter the next page, the interaction occur here and Player will get status by either straight away start the game or customize the game option.

For current game content input, the interaction occur here and Player will get the status include the process of playing the game and the score. Lastly, as for quit game input, the application will send back the status by exiting the game.

3.7 Storyboard

Figure 3.7 shows the whole storyboard flow for the serious game application. Each interface will link to other interface and every interface contain back button, next button and home button. Each interface also will contain quit button that will ease user to quit anytime without having to go back to the homepage. The interface of each figure will be showed in the next section.

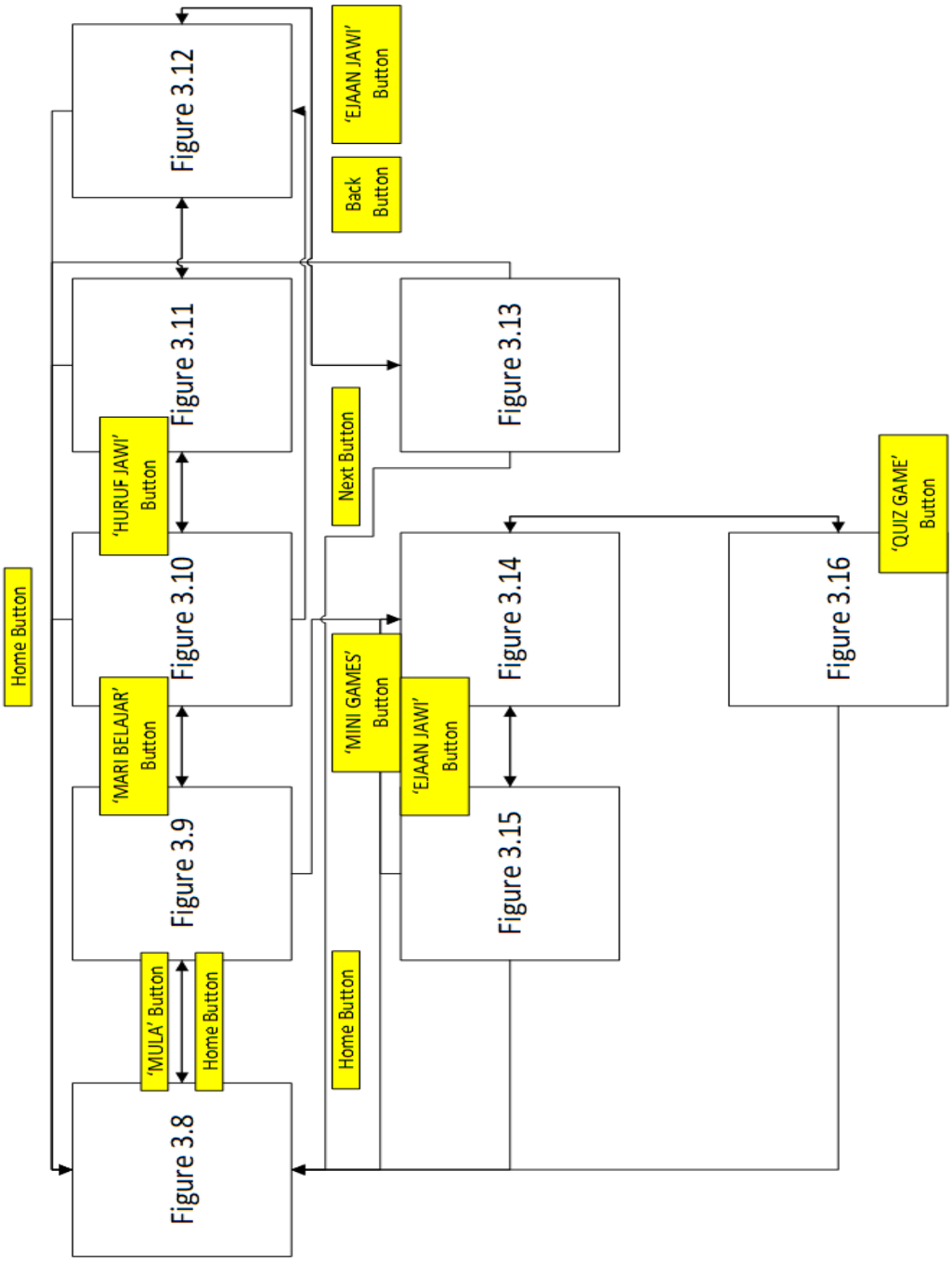

Figure 3.7 Storyboard of the Application

3.8 Interfaces

This section will show the interfaces that have been create for the serious game application.

3.8.1 Homepage

Figure 3.7 shows the Homepage. The ‘MULA’ button will link to the next page which is the Choose Module Page in Figure 3.8. There are also ‘Home’ and ‘Quit’ button in this page. The ‘GAME OPTION’ button will pop up a window such as Figure 3.16 that player can change the setting inside. The background of the interface is set to be similar from start to the end of the game. This shows the consistency of the background design and also the placement of each button in each interface are same.

Figure 3.7 Homepage

3.8.2 Choose Module Page

Figure 3.8 shows the Choose Module Page that contain ‘MARI BELAJAR’ button that will link to interface in Figure 3.9. There also ‘MINI GAMES’ button that will link to the interface in Figure 3.13. Then, the placement of the ‘Home’, ‘Setting’ and ‘Quit’ button will be the same for each interface.

Figure 3.8 Choose Module Page

3.8.3 ‘MARI BELAJAR’ Module Page

Figure 3.9 shows the ‘MARI BELAJAR’ Module Page. In this page, there will be two main button which is ‘HURUF JAWI’ button that will link to the interface in Figure 3.10 and another button is ‘EJAAN JAWI’ that will link to the interface in Figure 3.11. Then, the placement of the ‘Back’, ‘Home’, ‘Setting’ and ‘Quit’ button will be the same for each interface.

Figure 3.9 ‘MARI BELAJAR’ Module Page

3.8.4 ‘HURUF JAWI’ Page

Figure 3.10 shows the interface for ‘HURUF JAWI’ Page. This page aims to teach player the Jawi character one by one. Each character can be clicked and the audio for each character will be played. Player can learn in attractive and effective way through this.

Figure 3.10 ‘HURUF JAWI’ Page

3.8.5 ‘EJAAN JAWI (Alif)’ Page

Figure 3.11 shows the interface for the ‘EJAAN JAWI (Alif)’ Page. This page will provide the spelling of something that start with ‘Alif’ character. Player can click on ‘Sound’ button to play the audio of the spelling. To proceed to the next character, player can click on ‘Next’ button and next interface will appear until the end of the character.

Figure 3.11 ‘EJAAN JAWI (Alif)’ Page

3.8.6 ‘EJAAN JAWI (Ba)’ Page

Figure 3.12 shows the interface for the ‘EJAAN JAWI (Ba)’ Page. This page will provide the spelling of something that start with ‘Ba’ character. Player can click on ‘Sound’ button to play the audio of the spelling. To proceed to the next character, player can click on ‘Next’ button and next interface will appear until the end of the character.

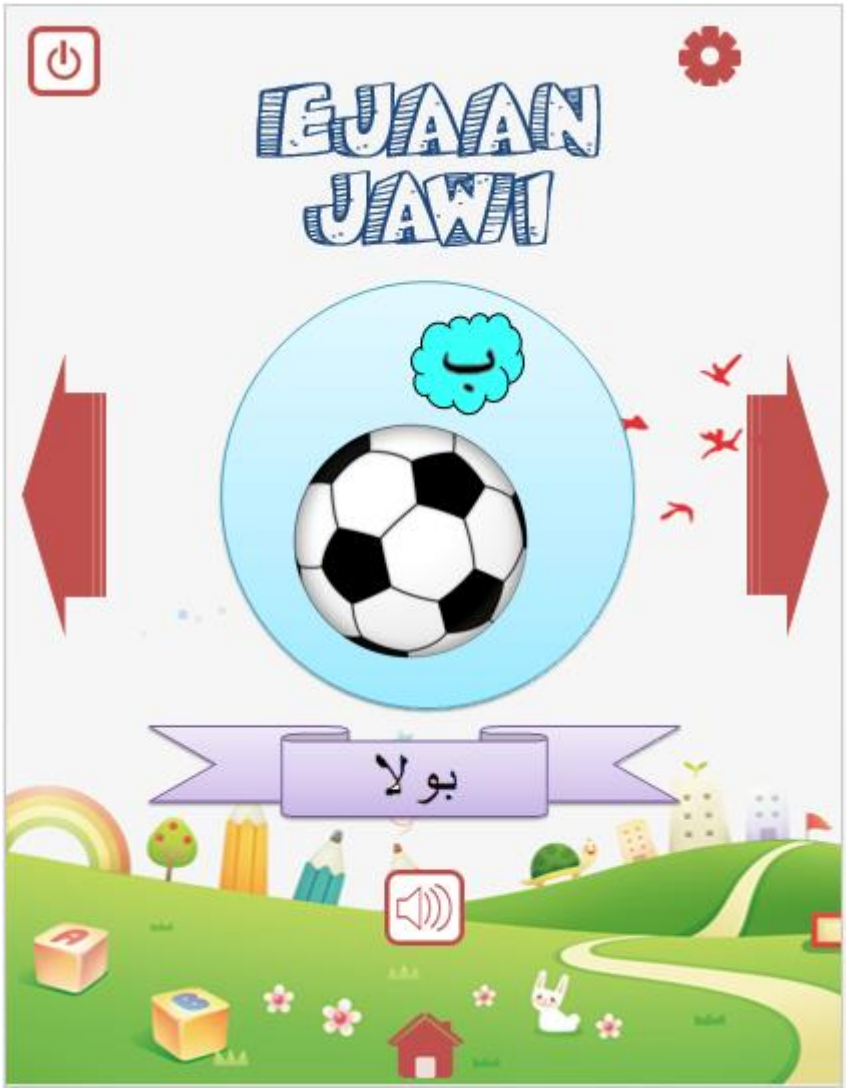

Figure 3.12 ‘EJAAN JAWI (Ba)’ Page

3.8.7 Mini Games Module Page

Figure 3.13 shows the interface of Mini Games Module Page. This page contain four button that will link to each game provided. The ‘EJAAN JAWI’ button will link the interface in Figure 3.14 and the ‘QUIZ GAME’ button will link to the interface in Figure 3.15.

Figure 3.13 Mini Games Module Page

3.8.8 ‘EJAAN JAWI’ Game Page

Figure 3.14 shows the interface for the ‘EJAAN JAWI’ Game Page. Player need to click on the scramble Jawi character into the box provided based on the picture given at the top of the page. If player able to answer all the questions provided correctly, a pop up score will appear as in Figure 3.17.

Figure 3.14 ‘EJAAN JAWI’ Game Page

3.8.9 ‘QUIZ GAME’ Game Page

Figure 3.15 shows the interface for the ‘QUIZ GAME’ Game Page. Player need to click on the right answer provided at the bottom based on the word given at the top of the page. If player able to answer all the questions provided correctly, a pop up score will appear as in Figure 3.17.

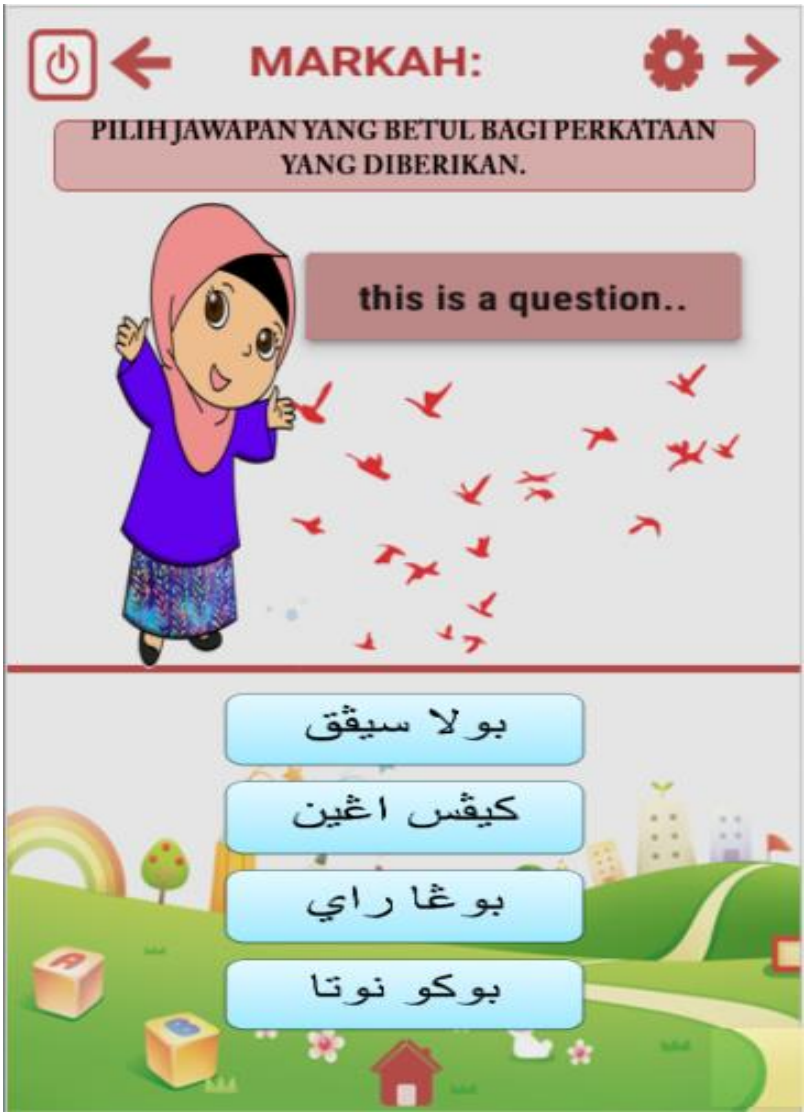

Figure 3.15 ‘QUIZ GAME’ Game Page

3.8.10 Game Option/ Setting Popup Window

Figure 3.16 shows the Game Option or Setting Popup Window of the game. This popup window will appear if player click on ‘GAME OPTION’ button in each interfaces. Player can change the setting inside the popup window of the application.

Figure 3.16 Game Option/ Setting Popup Window

3.8.11 Popup Score

Figure 3.17 and Figure 3.18 shows the correct and wrong answer popup of the game application. This popup will appear after player answer each of the questions provided in each Mini Games with correct or wrong answer.

Figure 3.17 Correct Answer Popup

Figure 3.18 Wrong Answer Popup

3.9 Conclusion

In conclusion, this chapter discussed about the methodology that have been adapted and applied in the serious game application. The development of this application is based on ADDIE-Model methodology. This method has five phase which are analysis, system design, development, implementation and evaluation. Requirement analysis is based on the objectives and problem statement that have been analysed and it is analysed from the existing application that have been done by other. The second phase which is system design is where the creating of storyboard, interface, context diagram, use case diagram and flow chart. The third phase which is development phase is where the real interface and functional application is being developed. The fourth phase which is implementation is a stage where the functional of the application is being tested. Lastly, the user acceptance test which based on evaluation phase is done. The user acceptance are being tested and the result is being evaluate in order to get the best result from the application.

CHAPTER 4

IMPLEMENTATION, TESTING AND RESULT DISCUSSION

4.1 Introduction

This chapter will discuss about the implementation, testing and the result of testing of Mobile Jawi Courseware using Serious Game Approach for preschool students that have been created using Unity software. In implementation, the discussion will be elaborated based on the processes involved during the development phase of the game. The interfaces and coding of each function also will be inserted in this chapter to give understanding on how the game works and build using the Unity software. Besides, the evaluation phase will be elaborated on how the evaluation and testing were conducted to detect the errors that occur in the game application.

4.2 Implementation

The implementation of the Mobile Jawi Courseware game application is based on the requirement that have been collected during the requirement analysis phase. The development of the application need to meet all the requirements for functionality of the application to be successful to be used by preschool students. All the game elements such as graphics, audio and images will be implement in this application to make the application more interactive and fun. The next section will discussed on the used of Unity software in implementing the application.

4.2.1 Stage of Implementation

Unity is the most common software for game development as it provides all tools that allowed developer to create game without build in programming in the Unity so that the application will works well. Unity is the best platform in creating game application

as its provided medium for all elements works such as animation, video, audio and graphic as well. Unity version 5.3.5 is used in the project. Figure 4.1 and onward shows the step on how Mobile Jawi Courseware game application have been developed using Unity.

Figure 4.1 shows the Unity software main page. Firstly, open the Unity software and click on new to open new project. Create the project name "MOBILE JAWI COURSEWARE" and click 2D as the game will be created in 2-Dimensional. Then, click create project.

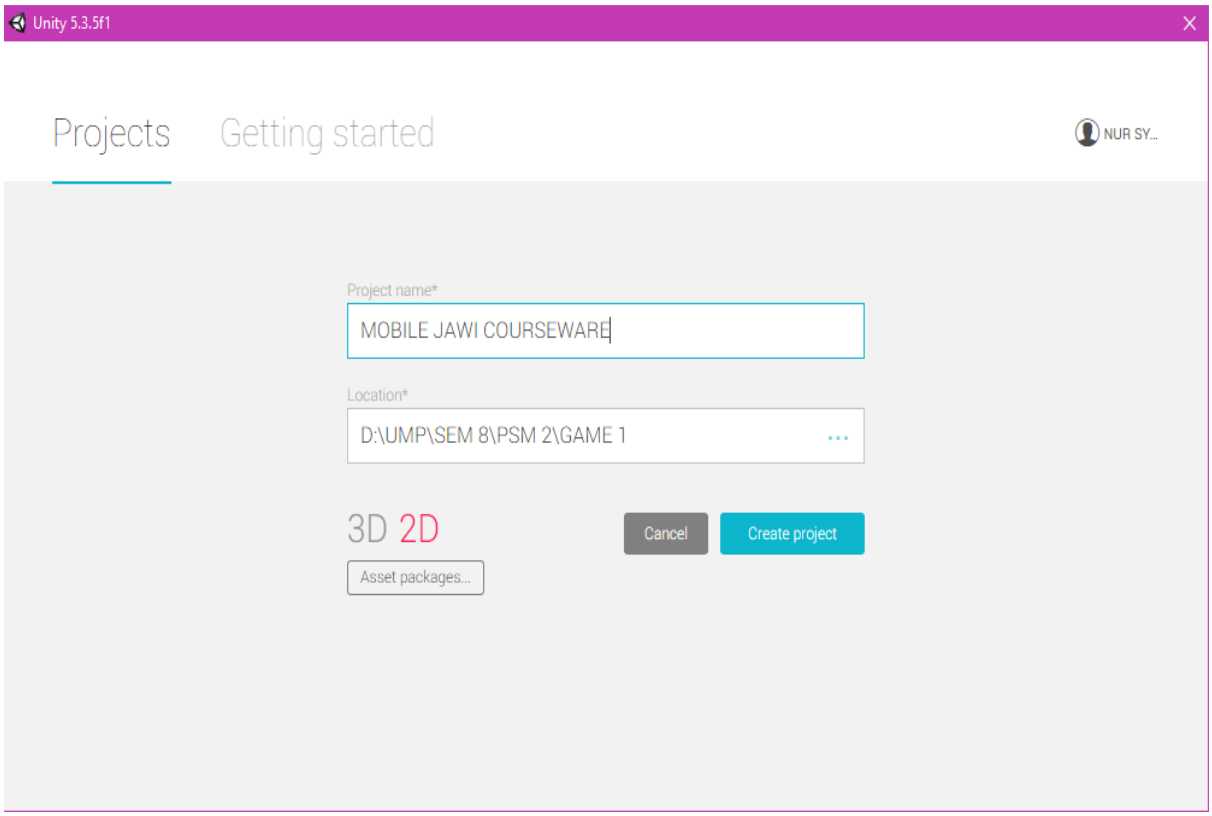

Figure 4.1 The Unity Software main page

Figure 4.2 shows the Unity created scene. Go to the file and click on the new scene. Save the scene as “Homepage”. Create the other scene such as “Mari Belajar”, “Mini Games” “Huruf Jawi”, “Ejaan Jawi”, “Ejaan Jawi Game”, “Quiz Game” and others using the same method.

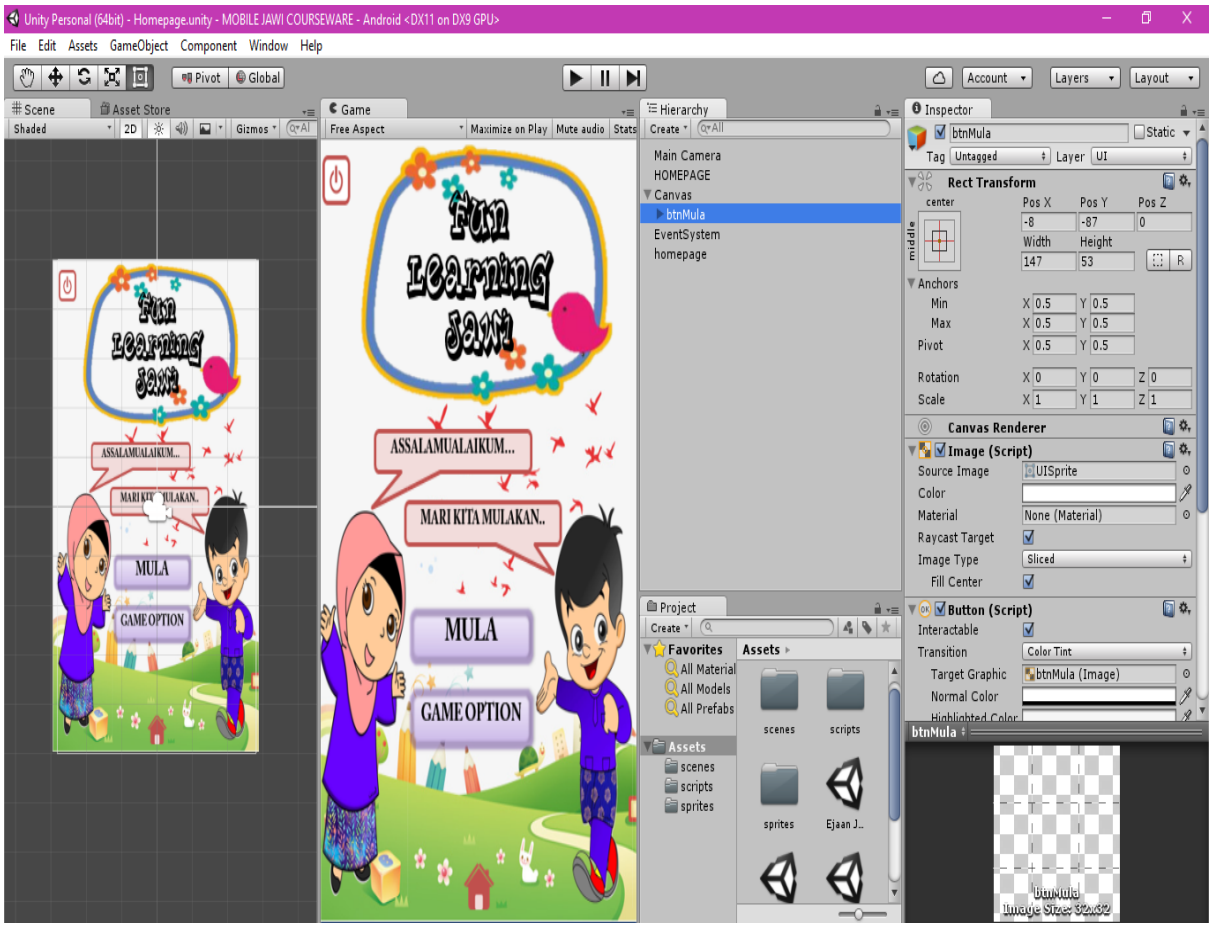

Figure 4.2 The Unity Create Scene

Figure 4.3 shows the Homepage interface. The ‘MULA’ button will link to the next page which is the Choose Module Page in Figure 4.5. There are also ‘Game Option’ and ‘Quit’ button in this page.

Figure 4.3 Homepage

Figure 4.4 show the script that used to load from one scene to another scene. Figure 4.5 show the inspector that need to be filled by entering the scene name that will be loaded based on the onclick() function of specific button. This script will be used for all of the linking button in this game application.

```
using UnityEngine;
using UnityEngine.SceneManagement;

public class homepageManager : MonoBehaviour {

    public void PlayGame(string scenename)
    {
        SceneManager.LoadScene(scenename);
    }

    public void Exit(string scenename)
    {
        Debug.Log("Exit");
        Application.Quit();
    }
}
```

Figure 4.4 Load Scene and Exit Script

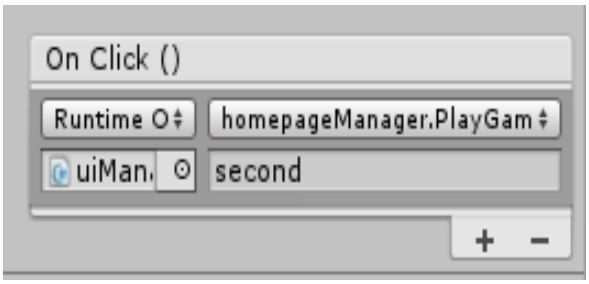

Figure 4.5 Inspector for load scene button

Figure 4.6 show the script to enable the popup option to be appeared as the button is clicked. The popup option need to be create as a panel and set it as prefabs in the unity in order to make in invisible only after user click the button. While Figure 4.7 shows the inspector that make the system aware which function need to be done after clicking a specific button.

```
using UnityEngine;
using UnityEngine.UI;

public class popupOptionManager : MonoBehaviour {

    public Button optionButton;

    public GameObject popupOption;

    private void Awake()
    {
        optionButton.onClick.AddListener(OpenPopupOption);
    }


    public void OpenPopupOption()
    {
        popupOption.SetActive(true);
    }
}
```

Figure 4.6 Popup Option Script

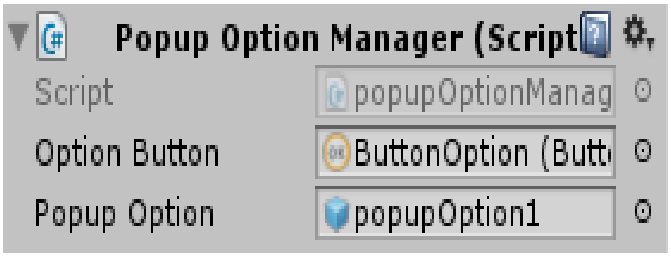

Figure 4.7 Inspector for popup option

Figure 4.8 shows the Choose Module Page that contain ‘MARI BELAJAR’ button that will link to interface in Figure 4.9. There also ‘MINI GAMES’ button that will link to the interface in Figure 4.13. All of the load scene button use the same script as shown in Figure 4.4. The function of the option button also used the same script as shown in Figure 4.6.

Figure 4.8 Choose Module Page

Figure 4.9 shows the ‘MARI BELAJAR’ Module Page. In this page, there will be two main button which is ‘HURUF JAWI’ button that will link to the interface in Figure 4.10 and another button is ‘EJAAN JAWI’ that will link to the interface in Figure 4.12. All of the load scene button in this page also used the same script as shown in Figure 4.4. The function of the option button also used the same script as shown in Figure 4.6.

Figure 4.9 ‘MARI BELAJAR’ Module Page

Figure 4.10 shows the interface for ‘HURUF JAWI’ Page. This page aims to teach player the Jawi character one by one. Each character can be clicked and the audio for each character will be played. Player can learn in attractive and effective way through this.

Figure 4.10 ‘HURUF JAWI’ Page

Figure 4.11 shows the audio source for each button of the character. Audio source need to be import inside unity assets with wav. format in order for the audio to be function.

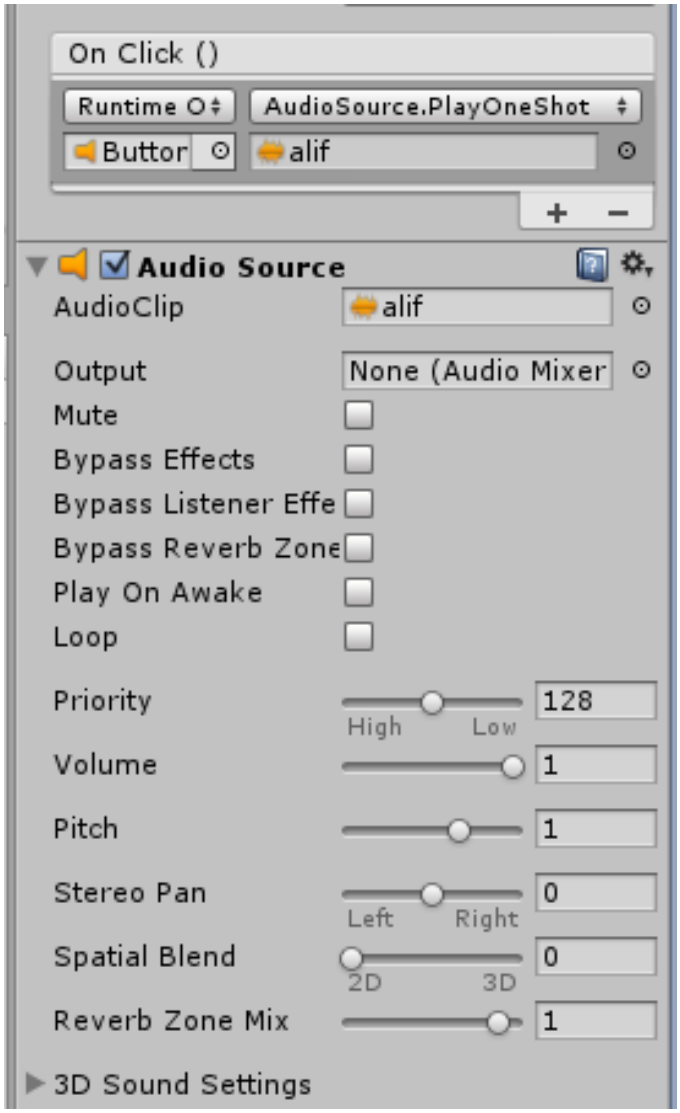

Figure 4.11 Audio Source

Figure 4.12 shows the interface for the ‘EJAAN JAWI (Ba)’ Page. This page will provide the spelling of something that start with ‘Alif’ character. Player can click on ‘Sound’ button to play the audio of the spelling. The audio source for the ‘Sound’ button is same as in Figure 4.11. To proceed to the next character, player can click on ‘Next’ button and next interface will appear until the end of the character.

Figure 4.12 ‘EJAAN JAWI (Ba)’ Page

Figure 4.13 shows the interface of Mini Games Module Page. This page contain two buttons that will link to each game provided. The ‘EJAAN JAWI’ button will link the interface in Figure 4.14 and the ‘QUIZ GAME’ button will link to the interface in Figure 4.17. All of the load scene button in this page also used the same script as shown in Figure 4.4. The function of the option button also used the same script as shown in Figure 4.6.

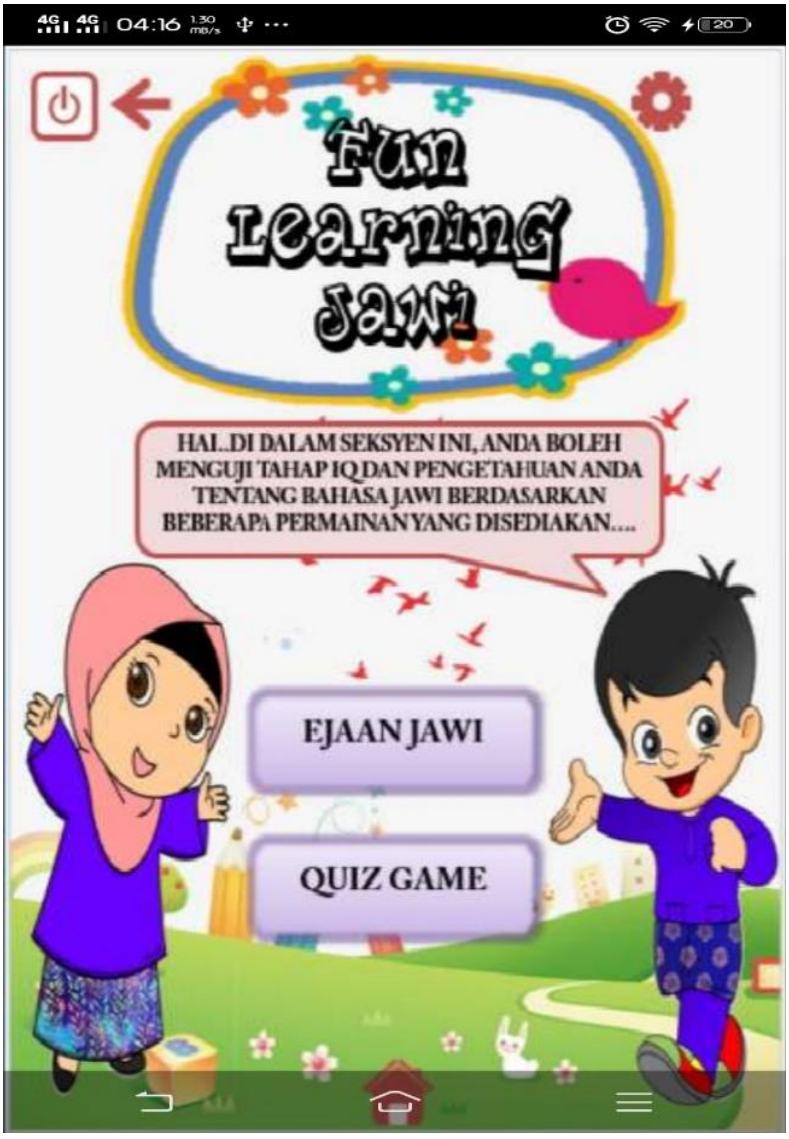

Figure 4.13 Mini Games Module Page

Figure 4.14 shows the interface for the ‘EJAAN JAWI’ Game Page. Player need to click on the scramble Jawi character into the box provided based on the picture given at the top of the page.

Figure 4.14 ‘EJAAN JAWI’ Game Page

Figure 4.15 show the script for the drag and drop function for the game while Figure 4.16 shows the event trigger that give instruction to the system for the drag function and where is the right place to drop the character.

```
    using UnityEngine;
    using System.Collections;
    using UnityEngine.SceneManagement;

    public class gameEjaanJawiManager5 : MonoBehaviour {

        public GameObject zai, yaa, ra, alif, fa, haa, zaiAns, yaaAns, raAns,
alifAns, faAns, haaAns;

        Vector2 zaiInitialPos, yaaInitialPos, raInitialPos, alifInitialPos,
faInitialPos, haaInitialPos;

        // Use this for initialization
        void Start()
        {
            zaiInitialPos = zai.transform.position;
            yaaInitialPos = yaa.transform.position;
            raInitialPos = ra.transform.position;
            alifInitialPos = alif.transform.position;
            faInitialPos = fa.transform.position;
            haaInitialPos = haa.transform.position;
        }


        public void DragZai()
        {
            zai.transform.position = Input.mousePosition;
        }


       public void DropZai()
        {
            float Distance = Vector3.Distance(zai.transform.position,
zaiAns.transform.position);
            if (Distance < 50)
            {
                zai.transform.position = zaiAns.transform.position;
            }
            else
            {
                zai.transform.position = zaiInitialPos;
            }
        }
```

Figure 4.15 Drag and Drop Script

Figure 4.16 Event Trigger for Drag and Drop

Figure 4.17 shows the interface for the ‘QUIZ GAME’ Page. Player need to click on the right answer provided at the bottom based on the word given at the top of the page.

Figure 4.17 ‘QUIZ GAME’ Page

Figure 4.18 shows the script on how to determine the correct answer for each question provided.

```
    using UnityEngine;
    using System.Collections;
    using System.Collections.Generic;
    using System.Linq;
    using UnityEngine.UI;
    using UnityEngine.SceneManagement;

    public class gameMCQManager : MonoBehaviour {

        public Button bolaSepak, kipasAngin, bungaRaya, bukuNota;

        public GameObject CorrectPopup, WrongPopup;

        public Question[] questions;
        private static List<Question> unansweredQuestions;

        private Question currentQuestion;

        [SerializeField]
        private Text jawiWordText;

        void Start()
        {
            if (unansweredQuestions == null || unansweredQuestions.Count == 0)
            {
                unansweredQuestions = questions.ToList<Question>();
            }

            SetCurrentQuestion();


        }


        void SetCurrentQuestion()
        {

            int randomQuestionIndex = Random.Range(0,
unansweredQuestions.Count);
            currentQuestion = unansweredQuestions[randomQuestionIndex];

            jawiWordText.text = currentQuestion.jawiWord;

            unansweredQuestions.RemoveAt(randomQuestionIndex);
        }

        public void UserSelectTrue()
        {

            if (currentQuestion.isTrue)
```

```
            {
                Debug.Log("CORRECT!");
            }
            else
            {
                Debug.Log("WRONG!");
            }
        }

        public void UserSelectFalse()
        {
            if (!currentQuestion.isTrue)
            {
                Debug.Log("CORRECT!");
            }
            else
            {
                Debug.Log("WRONG!");
            }
        }
```

Figure 4.18 Quiz game script

Figure 4.19 shows the popup option window for each interface with the audio setting inside. User can adjust the volume of the music and audio according to their preferences. The script for the popup option window has been shown in Figure 4.6.

Figure 4.19 Popup option window

Figure 4.20 shows the script of how the volume slider in popup option window function.

```
using UnityEngine;
using System.Collections;
using UnityEngine.UI;
using System.Collections.Generic;

public class volumeManager : MonoBehaviour {

    public Slider Volume;
    public AudioSource myMusic;

   // Update is called once per frame
   void Update () {

        myMusic.volume = Volume.value;

   }
}
```

Figure 4.20 Volume Slider Script

Figure 4.21 shows the correct popup window for the correct answer for each game while Figure 4.22 shows the wrong popup window for the wrong answer for each game.

Figure 4.21 Correct Popup Window

Figure 4.22 Wrong popup window

Figure 4.

Figure 4.23 shows the script of the correct and wrong answer for the game and also the script of the correct and wrong popup function.

```
    public void Awake()
        {
            bolaSepak.onClick.AddListener(OpenCorrectPopup);
            kipasAngin.onClick.AddListener(OpenWrongPopup);
            bukuNota.onClick.AddListener(OpenWrongPopup);
            bungaRaya.onClick.AddListener(OpenWrongPopup);
        }

        public void OpenCorrectPopup()
        {
            CorrectPopup.SetActive(true);
        }

        public void OpenWrongPopup()
        {
            WrongPopup.SetActive(true);
        }
```

Figure 4.23 Correct and wrong answer script

4.3 Testing and Result Discussion

In this phase, several tests are done to discover any error that occur in the game application. The aim of the test is to find out the functionality of the game application to the user. If there is problem occurred during the test, the developer need to revise the application and do corrections, which mean go back to the development phase. These process is allowed in ADDIE methods. The further improvement from any disfunctionality in the application is implement based on the testing. The type of testing used is User Acceptance Testing (UAT). This test considered successful when all the features and functionality are working as expected. Table 4.1 below shows the test case of Mobile Jawi Courseware that tested by several random people. This test case aims to test the game application functionality and to detect any of game errors.

Table 4.1 The Test Case of Mobile Jawi Courseware using Serious Game Approach

TEST CASE	INPUT	EXPECTED RESULT	ACTUAL RESULT	PASS/FAIL
"MULA" button will bring user to Module Page.	Click the "MULA" button	Move to Module Page	Move to Module Page	Pass
"GAME OPTION" button will pop up a window	Click the "GAME OPTION" button	A window will pop up showing the audio setting that users can adjust by themselves	A window will pop up showing the audio setting that users can adjust by themselves	Pass
"MARI BELAJAR" button will bring user to "Mari Belajar" module page	Click the "MARI BELAJAR" button	Move to "Mari Belajar" module page	Move to "Mari Belajar" module page	Pass
"MINI GAMES" button will bring user to Mini Games module page	Click the "MINI GAMES" button	Move to Mini Games module page	Move to Mini Games module page	Pass
"HURUF JAWI" button will bring user to "Huruf Jawi" page	Click the "HURUF JAWI" button	Move to "Huruf Jawi" page	Move to "Huruf Jawi" page	Pass

"EJAAN JAWI" button will bring user to "Ejaan Jawi" page	Click the "EJAAN JAWI" button	Move to "Ejaan Jawi" page	Move to "Ejaan Jawi" page	Pass
"Sound" button in each 'Ejaan Jawi' page will produce the audio for each word based on the first character	Click the "Sound" button	An audio for the word provided will be produced	An audio for the word provided will be produced	Pass
"EJAAN JAWI" button in choosing game page will bring user to "Ejaan Jawi" game page	Click the "EJAAN JAWI" button	Move to "Ejaan Jawi" game page	Move to "Ejaan Jawi" game page	Pass
"QUIZ GAME" button will bring user to "QUIZ GAME" game page	Click the "QUIZ GAME" button	Move to "QUIZ GAME" game page	Move to "QUIZ GAME" game page	Pass
Exit button will exit the game	Click the exit button	The game will immediately exit	The game will immediately exit	Pass

Next button will bring user to the next page	Click the next button	Move to the next page	Move to the next page	Pass
Back button will bring user to the previous page	Click the back button	Move to the previous page	Move to the previous page	Pass
Home button will bring user to the Homepage	Click the home button	Move to the Homepage	Move to the Homepage	Pass
Replay button in the game page will enable user to repeat the current game	Click the replay button	Repeat the current game	Repeat the current game	Pass

4.4 Conclusion

This chapter covers about the implementation, testing and the result discussion. The development of Mobile Jawi Courseware using Serious Game Approach involving a software application which is Unity. Unity is the best application of game development which provides tools and easiest ways to create all elements needed in the game such as animation, audio and video. Besides, the game development has fulfil all the requirements needed based on the analysis that has been done. The testing phase shows that the game application is function well and need to be improved based on the interactive part so the game will be more fun and interesting.

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter will be described about the introduction, conclusion, the application constraints and also the future enhancements. From this chapter, the summarization of all four chapter which are introduction, literature review, methodology and implementation, testing and result discussion will be described. Besides, this chapter will also describe on how this project development can be improved more based on its interfaces, features based on the scripting. The project constraints such as the error in the development phase also will be elaborated in this chapter.

5.2 Conclusion

In conclusion, Mobile Jawi Courseware using Serious Game Approach is developed to gain preschool students' interest to learn Jawi. Children nowadays tend to be quickly bored when it comes to learning. This application can be a good help for them to be more interest to learn Jawi. This application is the solution for the problems that have been mentioned in the problem statement part in Chapter 1. The reason for this application is developed as mobile application is to ease the use of the application for users. Users just need to install the game application in their mobile in order to play the game anytime and anywhere instead of they have to play the game application in computer or laptop. This game application provided two modules which are "Mari Belajar" and "Mini Game". "Mari Belajar" module provide the learning session which user can learn the basic Jawi Character from beginning to the end with the pronounciation of each character and also they can learn the Jawi spelling for each of the character. Each interface of the Jawi spelling contain a sound button that can be click to enable the audio for each word. While "Mini Game" module provide two games that can be played by

users. So the result from the game application is the application able to help student to be more expert in Jawi especially in Jawi spelling. Besides, this game application has fulfilled the objective according to the result from Chapter 4. From the result, its show that this game application provide the effectiveness for students as the game application attract their interest to learn Jawi. This Mobile Jawi Courseware game application is also an alternative way for parents and teachers to attract their children and students to learn Jawi in effective way whether at home or school.

5.3 Application Constraint

In this serious game application development, there are some constraints throughout the application development. The first one is the functionality where there are some functionality that can't run smoothly because of the code errors. The score for the mini games does not appear according to the code written in the c# script.

Secondly, a few enhancements need to be done to improve the functionality and the quality of the serious game application. The learning module can be improved in order to give more attractive views to the users. Besides, the Mini Game module also need to be improve as this application only provide two types of game that can be played.

5.4 Future Enhancement

From the application constraints that has been discussed, there are few future enhancement that can be done to give better illusions for this mobile Jawi courseware using serious game approach in the future. Firstly, more interaction and features such as animation and videos can be provide this game application in order to make it more interesting for learning process.

Secondly, the learning module can be improved by adding an Augmented Reality features for each spelling of the word. The Mini Game module also can be improved by adding more games in order to enable users to experience more varieties of game and enable them to gain more knowledge in Jawi learning.

REFERENCES

Abraham, T. F. (n.d.). *Background Compilation in Visual Studio 2002, 2003 and 2005*. Retrieved from http://www.tfabraham.com/blog/2005/12/background-compilation-in-visual-studio-2002-2003-and-2005/

Braad, E., Gregor, Ž., & Sandovar, A. (2016). Entertainment Computing and Serious Games, *9970*(October). https://doi.org/10.1007/978-3-319-46152-6

Games, C. (2013). Digital Game Based Learning Framework for Jawi Character Formation. *Annual International Conference on Computer Games, Multimedia & Allied Technology*, (Cgat), 6–12. https://doi.org/10.5176/2251-1679

Gipple, J., & Lord, E. (2013). Understanding Mobile Learning and Best Practices, 18. Retrieved from http://www.icslearninggroup.com/whitepapers/understanding-mobile-learning-and-best-practices/

Kokkalia, G., Drigas, A., Economou, A., Roussos, P., & Choli, S. (2017). The use of serious games in preschool education. *International Journal of Emerging Technologies in Learning*, *12*(11), 15–27. https://doi.org/10.3991/ijet.v12i11.6991

Mobile game developer survey leans heavily toward iOS, Unity. (2012). Gamasutra. Retrieved from http://www.gamasutra.com/view/news/169846/Mobile_game_developer_survey_leans_heavily_toward_iOS_Unity.php

Olanoff, D. (2013). Google Launches Android Studio And New Features For Developer Console, Including Beta Releases And Staged Rollout. *TechCrunch*. Retrieved from https://techcrunch.com/2013/05/15/google-launches-android-studio-a-development-tool-for-apps/

Saavedra, A. B., Rodríguez, F. J. Á., Arteaga, J. M., Salgado, R. S., & Ordoñez, C. A. C. (2014). A serious game development process using competency approach. *Proceedings of the XV International Conference on Human Computer Interaction -*

Interacción '14, (April 2016), 1–9. https://doi.org/10.1145/2662253.2662352

Sarrab, M., Hafedh, A. S., & Bader, A. M. (2015). System Quality Characteristics. *Turkish Online Journal of Distance Education*, *16*(4), 18–28. Retrieved from https://goo.gl/ju867y

APPENDIX A

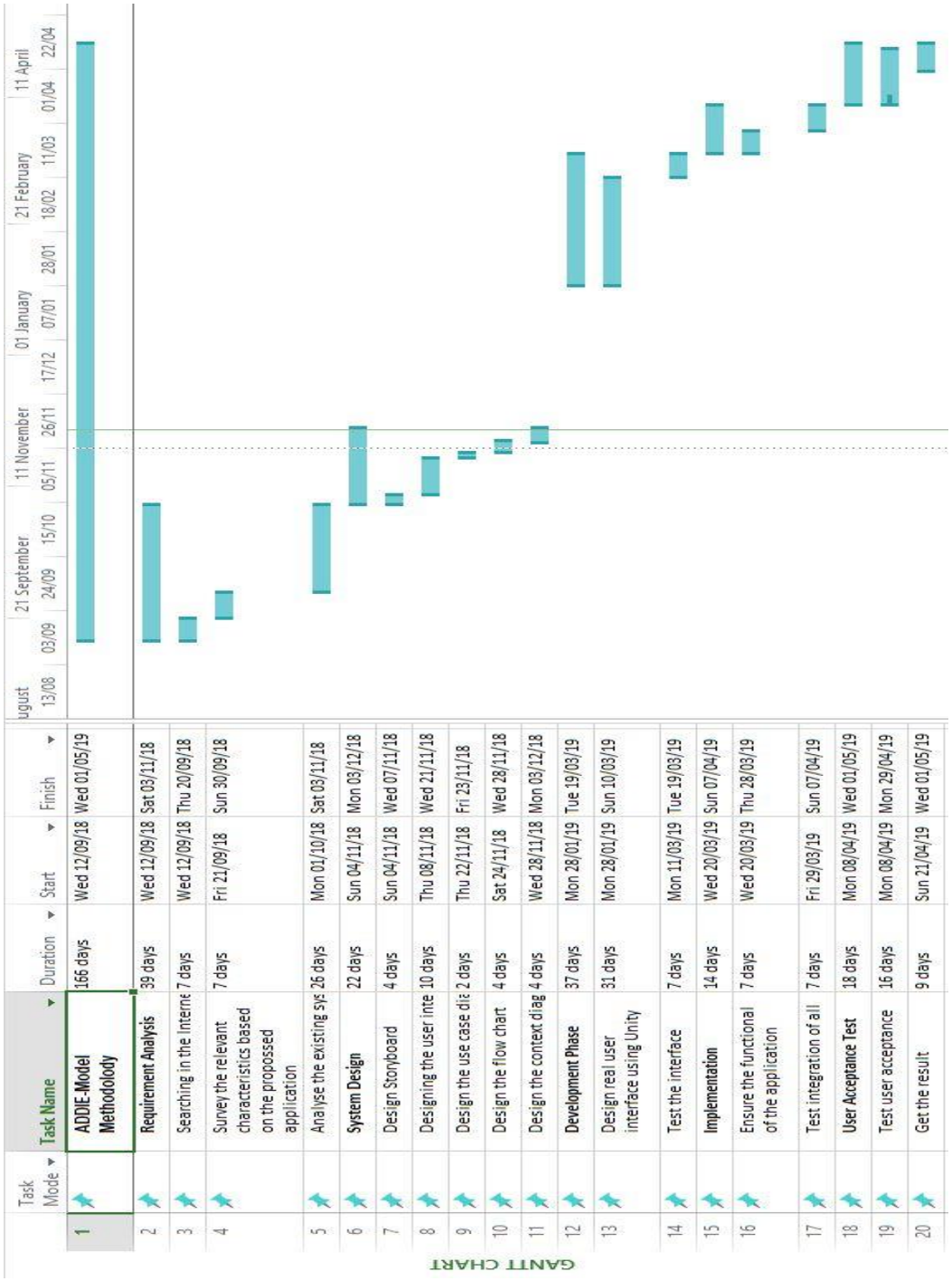

Figure 1 Gantt Chart