DOTS GAME FOR CHILDREN WITH AUTISM

(MY DOTS)

AMIRAH AZHANI BINTI MUHSIN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DOTS GAME FOR CHILDREN WITH AUTISM

(MY DOTS)

AMIRAH AZHANI BINTI MUHSIN

This report is submitted in partial fulfilment of the requirements for the

Bachelor of Computer Science (Interactive Media) With Honours

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2016

BORANG PENGESAHAN STATUS TESIS

JUDUL: **DOTS GAME FOR CHILDREN WITH AUTISM (MY DOTS)**

SESI PENGAJIAN: **SEMESTER II 2015/2016**

Saya **AMIRAH AZHANI BINTI MUHSIN (B031410069)**

mengaku membenarkan tesis (PSM/Sarjana/Doktor Falsafah) ini disimpan di Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dengan syarat-syarat kegunaan seperti berikut:

1. Tesis dan projek adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. ** Sila tandakan (/)

____ SULIT (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

____ TERHAD (Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

_/_ TIDAK TERHAD

(TANDATANGAN PENULIS)

Alamat tetap :
No 38, Jalan Srikaya 2,
Bandar Segamat Baru, 85000
Segamat, Johor

Tarikh : 30 Ogos 2016

(TANDATANGAN PENYELIA)

MUHAMMAD HAZIQ LIM BIN ABDULLAH
Pensyarah Kanan
Fakulti Teknologi Maklumat dan Komunikasi
Universiti Teknikal Malaysia Melaka (UTeM)

Tarikh : 30 Ogos 2016

DECLARATION

I hereby declare that this project report entitled

DOTS GAME FOR CHILDREN WITH AUTISM

(MY DOTS)

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT : _____ Date : 29/08/16

(AMIRAH AZHANI BT. MUHSIN)

I hereby declare that I have read this project report and found this project report is sufficient in term of the scope and quality for the award of

Bachelor of Computer Science (Interactive Media) With Honours

SUPERVISOR: _____ Date : 29/08/16

(EN. MUHAMAD HAZIQ LIM ABDULLAH)

DEDICATION

This final project is dedicated to my beloved parents for their endless support and helps when I need it, always pray the best for me and give me a lots of useful advices in process of develop this project.

To my supervisor who has guided, give me a lot of supports and always be patient with me while making the progress for this project, En. Muhamad Haziq Lim Abdullah (UTeM).

To my evaluator who gives a good advices and feedback on this project, Madam Tarisa Makina Kinatakaningrum.

Last but not least, to all my beloved friends who always help me from the beginning of this project until the end of it.

ACKNOLEDGEMENT

Bismillahirrahmanirrahim,

Firstly, I would like to give all the praise to Allah S.W.T for giving me strength and patience for the whole process of completing this project. Without Him, I am sure I cannot complete this project according to what have been planned.

I would like to thank to people around me who keep support, guide and help me during the development of this project. I am highly indebted to my supervisor, En. Muhamad Haziq Lim Abdullah for his guidance, constant supervision and kindness in completing this project.

I also would like to give special appreciation to my parents and siblings as always support and pray the best for me.

Besides, I would like to give credit to my fellow friends who helped me from scratch until this project has been complete. Thanks to my colleague who willingly helped me out with all their abilities and times.

Thank you to faculty too as this project really teach me a lot and test my skills and knowledge about what I have learned since my first year until last year.

Thank you.

ABSTRACT

This project discusses about Dots Game Application using mobile technology for children with autism. Many children with autism frequently lost their concentration in study during their class. A child with autism has an average or above average level of intelligence, but has difficulty to concentrate during the lesson. So, this project is aim to attract their attention and gain more interest in their study especially in learning alphabets. This gesture based drawing or connecting the dots games was proposed which have two parts, user interface design and touch input gesture. The user interface design was created as interesting as possible to increase their attention. The touch input gesture detects the finger movement of the user and process the data to the applications. To develop this game, gesture recognition devices have to be used to connect all the dots available to be form of alphabets. After making several analyses on the findings, children with autism were enjoyed playing the game because with simple user interface design and simple audio instruction able to attract them to play while learning. Besides, it also can act as supporting tools that able to motivate them in classroom activity. The current work is part of the ongoing study for developing a new learning application design framework for the children with autism. This effort will help in improving the learning and hence living standard of special children.

ABSTRAK

Projek ini membincangkan tentang aplikasi My Dots menggunakan telefon pintar Android. Bagi kanak-kanak autism, mereka sering hilang konsentrasi semasa belajar di dalam kelas. Oleh itu, projek ini bertujuan untuk menarik perhatian dan minat mereka semasa belajar terutama sekali semasa belajar mengenal huruf. Isyarat gerakan permainan berasaskan lukisan atau menyambung titik-titik yang dicadangkan merangkumi dua bahagian iaitu antara muka pengguna dan isyarat sentuhan pada paparan skrin. Antara muka pengguna perlu direka dengan menarik dan interaktif untuk mengambil perhatian kanak-kanak tersebut. Isyarat sentuhan pula boleh mengesan pergerakan rangka pengguna dan memproses data kepada aplikasi ini. Untuk membangunkan sistem ini, teknologi telefon pintar digunakan bagi melengkapkan projek ini. Selepas membuat beberapa analisis, kanak-kanak autism ini sangat seronok bermain aplikasi tersebut kerana reka bentuk antara muka pengguna yang dan arahan audio yang mudah dapat menarik minat mereka untuk belajar sambal bermain. Selain itu, ia juga boleh bertindak sebagai alat membantu pembelajaran di dalam kelas untuk memberi motivasi kepada mereka di dalam kelas. Kerja-kerja semasa adalah sebahagian daripada kajian yang sedang berlangsung untuk membangunkan aplikasi ini. Usaha ini dapat membantu meningkatkan pembelajaran kanak-kanak autism tersebut.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION

1.1 Introduction

Children with autism typically have difficulty to socialise and communicate appropriately. Most of them are usually nonverbal, has a habit of repetitive conversation and gibberish talk. They also emotionally detached and not able to interact with environment and people around them. In 2004, the Ministry of Health confirmed that 1 out of 600 children in Malaysia is Autistic. There is no cure for these kind of children. Thus, there are many ways of learning strategies that can help them to get a better education.

The use of mobile application is rising along with the latest development of technology. With existence of smart phones and tablets can help to improve people's productivity. Therefore, My Dots is an interactive and gesture-controlled game by using touch input sensor on Android smartphone device to enhance and support basic and fun experiences for children in their engagement in interaction with the games.

Educational application for children with autism can teach the children how to communicate and interact with others with a better way (Aziz, 2014). By using touch gestures, the application will provide a new ways of technique which provides the opportunities for children to choose and select what they want and thus can prevent any misunderstanding communication.

My Dots is a simple, fun and interactive game where the player has the objective to connect every dots given to form a shape of selecting alphabets. This game teaches children not only on how to write or draw but it also to recognise and pronounce it along with the sounds in a kid friendly way. They will be able to support of their children's learning process through this games. Therefore, by using psychological methods in mobile games make these games unique and effective treating for children with autism (Adly, 2012).

1.2 Problem Statement

Children with autism will eventually lose concentration in their study. The same of learning style can make the student feel bored in this class. Therefore, the potential mobile technology is needed to create an opportunity to over come these problem is necessary. With mobile technology, children with autism are edutaining themselves and learning like never before (Aziz, 2014). As a matter of fact, mobile technology also not only motivates but allows children with autism to concentrate during learning and demonstrate what they have learned.

1.3 Objectives

The project objectives are:

- To investigate the potential of mobile technology to connect every dots given to form a shape of alphabets by utilising children's touch sensor as supporting tools.
- To develop Dots Game for children with Autism (My Dots) using mobile technology for interactive game with gesture recognition using touch sensor.
- To evaluate the usability of the My Dots for students and teachers in a classroom.

1.4 Scopes

This project is divided into two scopes for this project which are the group of an alphabet; Vocal and Consonant. A lowercase letters from a to z were chosen and the explanation is the following below:

1.4.1 Vocal

A lowercase letters which are 'a', 'e', 'i', 'o' and 'u' will be used to complete the list of alphabet provided Between these 5 letters, they have a different way of writing and drawing. It aims to expose and teach autistic children a variety of different shape of letter. So, a group of alphabets given in this game can help children with autism are easy to recognise the letters.

1.4.2 Consonant

A lowercase letters for a group of consonant has a large of number compare to a vocal group. From letter a to z, the list of vocal is excluded and the rest are the consonant letters. This group is considering as a main task because some of the students are little bit confused with the shape of certain alphabet for example ‘b’ and ‘d’ letters or ‘p’ and ‘q’ letters. Therefore, we want to observe the effectiveness of this game by using touch sensor especially for children with autism.

1.5 Project Significance

In this project, children with autism get the most benefit from this game application. This interactive game can attract them and make the duration of attention during learning longer. Through the application, children can practice writing each letter individually until they get it right. Besides that, the teachers are easier to teach their students in the class by using mobile because it can use as a teaching tools.

1.6 Conclusion

This chapter explains overview about the project of a game application which can attract the concentration of children with autism with fun and entertaining ways by using mobile technology. In the project background, there is an explanation about what the project about, what the project will do and the benefit of the project. There are details explanations about the problem with the concentration with autism during study. The objectives for this project are stated. Then in the scope section, there are explanations about target user and contents of this project. Lastly, the expected results have been decided.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

This section will provide the literature review for any previous system that related to this project. Comparisons will be made among the existing project. A comparison is based on the domain for this project, techniques for developing the project, current technology used, different multimedia skill and combining the interactive game development skill to achieve learning experience. This section also explains the methods that have been used in developing this project. Project's requirement' list such as software and hardware are also available.

2.2 Domain

An individual with autism has difficulty interacting with other people due to an inability to understand social sign. For example, children with autism often have trouble to cooperate with other peers. They prefer to continue with their own repetitive activities. Consequently, learning environment is important in promoting the development of children with autism. Environments can attract and stimulate their interest when they participate in skill enhancing activities.

With the advancement of technology, visual approach can be applied in mobile applications in order to help these kind of children. Based on Shane, individuals with autism engage with interactive materials through screen technology more than they engage with any other leisure activity (Shane HC, 2008). The touch screen interface makes it appealing and simple to use, particularly for those who have weak fine motor skills (Song, 2016). Therefore, we would like to explore the idea of mobile game as interactive technology and to discuss how it can facilitate and enhance teaching and learning.

a) Technology can support children with autism

Mobile technology has penetrated the education market as well as making disabled student's lives simpler. For children with autism, it is not easy to keep them interested in learning as they are easily distracted. Therefore, with the aid of mobile technology devices like smartphone or tablets, they can be more focused and motivated to learn. Wan Fatimah Wan Ahmad argues most children with autism respond well to the visual display that tablet offers and even though sometimes technology is inconvenient (Wan Fatimah Wan Ahmad, 2015). Technology devices may also motivate students to follow schedule more consistently as well as can increase appropriate behaviours. Shane and Albert support that children with autism prefer to spend their leisure time engaging in activities centred on electronic media screens

(Shane HC, 2008). The devices and applications are easy and can be learn quickly. The touch screen interface makes it attractive and easy to use as well. However, Cardon claims mobile technology become a useful tool for children with autism to support the development of imitation (Cardon, 2012).

b) Touch screen sensor can help improve communication skills

According to Nicholas, children with autism may struggle with slower brain timing (Nicholas B, 2007). He believes this can be seen through a lack of attention, challenged communication, disrupted processing of sensory information and a lack of coordination in children with autism. Learning can be more fun and interactive using touch screen. The touch-screen technology is exciting because it allows children communicate, learn and play intuitive ways (January, 2012). Mobile game has proved to be important in enhancing children's spontaneous communication among children with autism. This technology can improve their communication and social skills, such as making positive statement to their friends and support their ability to help each other.

c) Mobile technology as a teaching tools in the classroom

The appearance of mobile technologies has the potential to improve the classroom's interaction. Certain classical methods or techniques that such as writing on the whiteboard and printed worksheets soon became obsolete and new technology began to play an active role in how teachers planned to teach their students as well as how students began to learn (Projects, 2013). The touchscreen device can transform the learning environment in the classroom. Woollasaton found that the technology devices can boost motivation among the children with autism and also increasing their attention span and ability to interact socially (Woollasaton, 2014). Topcliffe Primary School (2014) in Birmingham recently introduced touchscreen devices into classrooms and similarly noticed an improvement among the children with autism. Buzzi also pointed out that mobile devices are one of the best kinds of devices that can

help students with learning disabilities such as children with autism to learn subjects (Buzzi, 2012). Besides, teachers can personalize the platform to focus on individual student's needs and can easily supervise students while on the devices. Fernandez-Lopez supports further implementation of mobile technology into special needs classrooms in the future to promote social academic development in students with autism (Álvaro Fernández-Lópeza, 2013).

The analysis described indicates that mobile technology has high potential to improve classroom interaction as well as to enhance student creativity. It also capable as a teaching tools to enhance the way of learning. Additionally, through the game, children with Autism will become familiar the learning data and ideas, with the tools that will help them to learn, and will increase the feeling of self-esteem, self-understanding and independence. Mobile technology is probably the best devices can perform interaction between the game and the users.

2.3 Existing System

In this project, four existing systems have been evaluated to get an overview for designing our system. There are Kids Academy 123 Tracing, LetterSchool Cursive Writing, Letter Tracing ABCYa.com and Alphabet Trace. Each system is explained below:

i. Kids Academy 123 Tracing – Learn to write the numbers easily.

Kids Academy 123 Tracing is an IOS Application based that teaches kids numbers with engaging game and it is one of the early learning tool for young children. Based on Figure 2.1 below, it's almost like connect the dots where they will start at one point, trace the dotted line making sure to collect the fireflies, ending at the finishing point and then it will form a shape of number. Kids will be able to learn numbers 1 to 10 repeatedly saving more fireflies in the process and earning medals as rewards. This application is very finger friendly with a wide margin for error so kids don't feel discouraged if they are not perfect.

Figure 2.1 : Kids Academy 123 Tracing game application

ii. LetterSchool Cursive Writing

LetterSchool Cursive Writing is also an IOS Application based where it is designed to teach the kids on how to write their uppercase and lowercase letters and also numbers in cursive as shown as Figure 2.2 below. Through the application, kids can practice writing each letter individually until they get it right. At each level, kids are given three different opportunities to trace each letter and number. Uppercase and lowercase letters are covered separately. Both of the levels are fairly similar. This helps ensure that kids truly do master the shape of each letter before they move on to combine the letters to form a word. This is very simple and easy application that have a minimalist and colourful design which give the the attraction to the children.

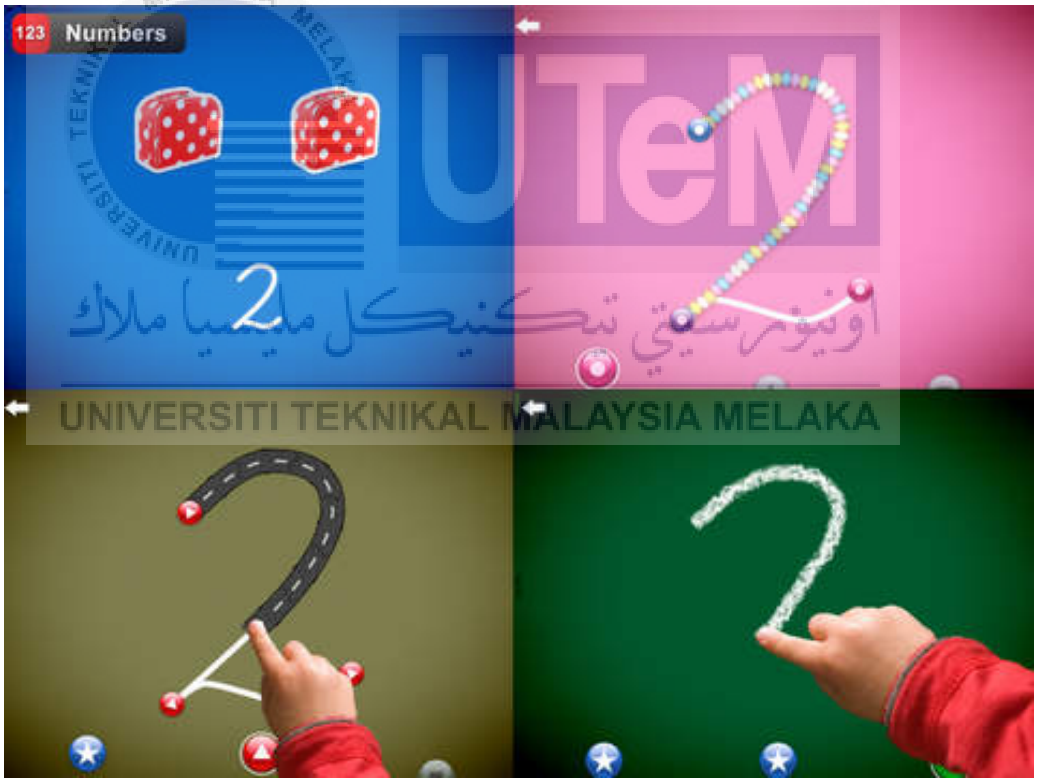


Figure 2.2 : LetterSchool Cursive Writing game application

iii. Letter Tracing ABCYa.com

ABCya Letter Tracing has been one of the most popular kindergarten educational gaming website in the world. The objective of the game is similar with Kids Academy 123 Tracing where the user needs to connect every dots until it forms a shape of alphabet. But, this game is using website as a main platform where they must use a mouse to play this game. This also can help to teach the kids writing each letter until they get it right. Figure 2.3 shows, only uppercase letters are provided in this game. The game is very simple, easy to understand and the children will enjoy playing it.

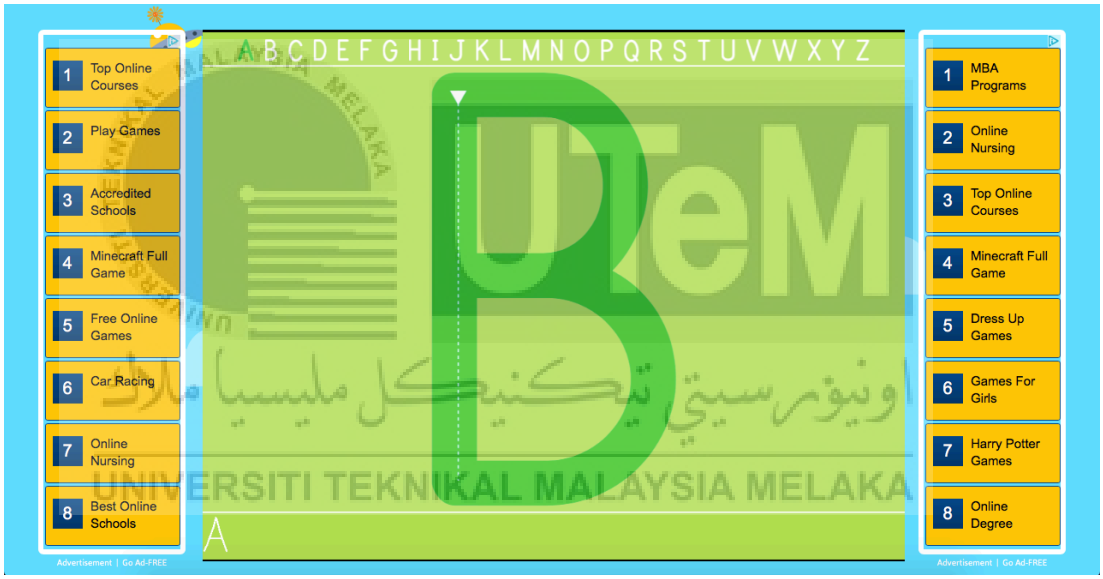


Figure 2.3 : Letter Tracing Online Game

iv. Alphabet Trace

Based on Figure 2.4, Alphabet Trace is a riveting learning game designed to help children improve their skill of writing English uppercase and lowercase letter. This game does not just boost hand-eye coordination of young learners on the children with autism spectrum, but also helps them develop basic writing skills and learn the English

alphabets. It designed for special needs children aged 2-7 years. Alphabet trace game offer a variety of different accuracy level for child's preferences and skill levels and also enable/disable features such as background music and training. Moreover, users can also select rewards from a set of three options which are teddy bear, ball and star. This interactive game can help children perform learning activities in an engaging and fun environment, thus creating playful learning experience.

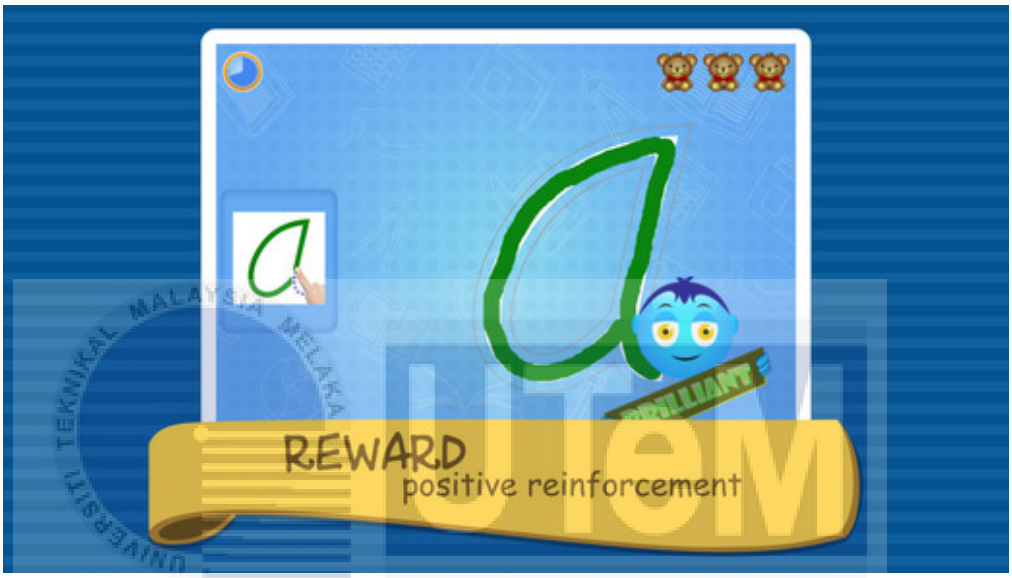


Figure 2.4 : The gameplay for Alphabet Trace

2.3.1 Comparison of Existing System

The purpose of comparison between these existing system is to analyse the difference of those system in terms of usefulness, interactivity, multimedia elements and also advantages and disadvantages for each game. Table 2.1 shows the comparison of existing system and is explained with details below.

Table 2.1 : Comparison of existing system

	Kids Academy 123 Tracing	LetterSchool Cursive Writing	Letter Tracing	Alphabet Trace
Platform	Android	IOS	Websites	IOS
Target User	Preschool	Preschool	Preschool	Preschool
Disabilities user	No	Yes. It suitable for kids with dyspraxia and dyslexia.	No	Yes. It suitable for children with Autism.
Language	English	English	English	English
Text				
Audio	Has audio instructions and also brought the nursery rhymes for encouragement.	Lively and fun sound effects.	• Has a background music. • Lively and fun sound effects.	• Has a background music. • Reward voice is provided.
Graphics	• Clean and bright graphics. • Green leaves and fireflies themed concept.	• Simple and bright graphics. • Colourful themed concept • Color: Specific color for each task.	• Clean and bright graphics. • Minimalist themed concept. • Color: Bright color.	• Neat interface and bright graphics. • Blue themed color.

	Kids Academy 123 Tracing	LetterSchool Cursive Writing	Letter Tracing	Alphabet Trace
Animation	The user needs to catch the fireflies along the lines given but at the same they are tracing a number. The fireflies will be inserted to the jar.	• The intro introduces the sound, shape, and name of the letter or number. • When the task is complete, the letter lights up like Disney style, making the user feel all warm and grand.	• After they finish the task, the letter will dance and pronounce itself. • The arrow will animate to provide a guidance tips for the user.	• Simple animation is used to show and how to pronounce each of the alphabets.
Error prevention	Audio and Text.	Audio only.	Audio only.	Audio only.
Repetition	Repetition is occur when the user complete their first draw, they have to re-draw it again with the same task but different way.	Has a repetition when the level is increase but more challenging.	Repetition will occur when the player loses the game.	Repetition will occur when the player loses the game.
Help and documentation	Help instruction by using audio and text.	Help instruction by using text.	Help instruction by using audio and text.	Help instruction by using audio and text.
Advantages	• Kids-friendly navigation.	• Practice writing lowercase and also uppercase.	• Practice writing uppercase letters.	• Practice writing both lowercase and uppercase letters.

	Kids Academy 123 Tracing	LetterSchool Cursive Writing	Letter Tracing	Alphabet Trace
		• Ability to show the user's handwriting as the default placeholder.		• Option to randomize the alphabet for advanced learners. • Multi-level accuracy control.
Disadvantages	• Only let the user trace the number 1-10.	• No exit button, unless press the home button.	• Not provide uppercase letters. • Need to use mouse to complete this game.	• There is not much choice for this game.

Based on the Table 2.1 shows that most of the existing game applications have the same type of interaction in terms of audio, graphics and text use in the game although the different platforms are used. We can see that English Language is used in many of game application compared to other languages. In term of user engagement, the game shows a different interaction such as some the user needs to catch the fireflies or pop the balloons. For error prevention, most of the game are using an audio to let the user know if they make a mistake. But, the text also can help the user to recognize their error. Using both and text is a good choice to put in the error prevention because the users are easy to see their mistake by hearing and read the simple text. Besides that, for the repetition, almost all the existing system use this kind of interaction. Usually, repetition is occurring when the player loses the game. And lastly, for help and documentation, all the game is using text to display their instruction but only one existing system use both audio and text to guide the user.

The proposed key concept for design requirement for this project as the following details in the Table 2.2 below.

Table 2.2 : Summary of Proposed Design

Application Name	My Dots
Language	Malay
Text	Serif font
Audio	Lively and fun sound effects.
Graphics	Bright color will be used.
Animation	The animation of buttons is provided to make the users are easy to recognize the navigation.
Repetition	Repetition is occur when the player fail to complete the task correcting.
Error prevention	Audio and Text.
Help and Documentation	Help instruction by using audio and text.

2.4 Project Methodology

The methodology used for this project is Agile Methodology as shown in the Figure 2.5 below.

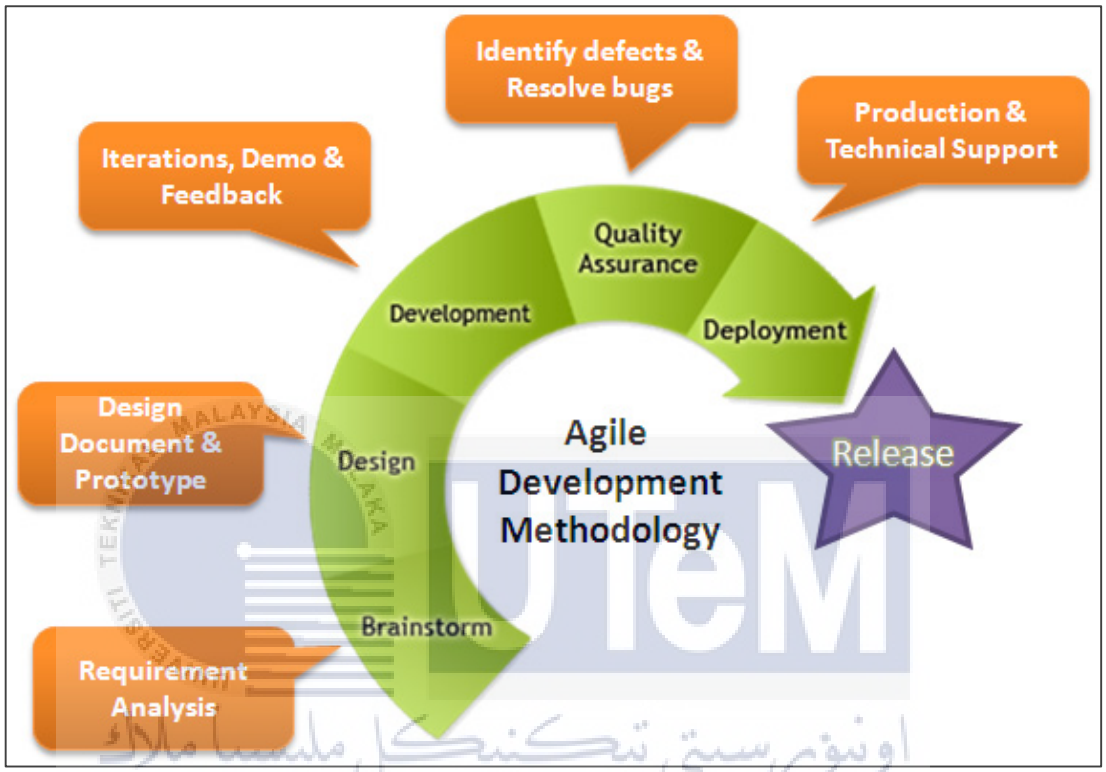


Figure 2.5 : Agile Development Methodology Phases adopted from Satish Kodukula (2015)

i. Brainstorm Phase

In Brainstorm phase, the observation and understanding the project's problem are deformed. We need to do some research about Kinect technology for autistic children and brainstorming an idea to find the solution. In this stage, an actionable proposal that aligns with project's objective is presented. There has a critic session and improvement in the idea making between the student and supervisor.

ii. Design Phase

Next, in the design process, we need roughly sketch the design plan first on the paper. After the initial design is approved, we to to transfer it as a digital design by using and Adobe Creative Suite software to design the interfaces based on the analysis data that we get. All the result will be analyze again before we proceed to develop the game.

iii. Development Phase

For the development process, we are using C# language to make sure all the elements of the game function can be used by using Unity software. This stage is a crucial stage as the final product is developed. The product is develop step by step and page by page according to design plan.

iv. Quality Assurance Phase

Quality Assurance phase is executed after the final product is created. At this stage, the game is tested by the target user and expert. Based on the testing session, the student reflected the weakness and strength of the final game application. The test data is collected to see either the product meets the objective of the project or not.

v. Deployment Phase

Finally, Deployment stage will occur. At this stage, the product will be finalized. This means that the product is ready to used in real environment by all end user. If we want to check again and correct anything on the game, we can go back to development phase to fix what needs to.

2.5 Project Requirements

There is a several software and hardware that required and play an important role in developing the game application. Both software requirements are explained as following below.

2.5.1 Software Requirements

Below are the minimum software requirements that can be used to develop this game:

- Adobe Illustrator CS6
- Audacity 2.0
- Unity 5.3
- Microsoft Words 2015

2.5.2 Hardware Requirements

Here is the hardware required to develop this project based on the Table 2.3 below:

Table 2.3 : The list of Hardware Requirement

Personal Laptop	Macbook Pro 13 inch (Early 2011) 2.3 GHz Intel Core i5 8GB 1600 MHz DDR3 OSX El Capitan 250GB
Mobile Device	Lenovo S850 Android Smartphone

2.6 Conclusion

This chapter explains about the comparison of the existing system and literature review done for this project. There is also have an explanation about the methodology development used on this project. This is important to ensure the development process is going smooth. Besides that, this chapter also explains about the list of software and hardware requirement that we currently in used.

CHAPTER III

ANALYSIS

3.1 Introduction

This chapter consist about the important phases in this project which is the analysis of the product. In the analysis phase, it requires the understanding of the user and system requirements. Furthermore, this chapter will explain about the fact and findings of the project. This is done by doing some research for the current game application by using mobile device. So, the purpose for all this activity is to gain a better understanding to complete the product development.

3.2 Current Scenario Analysis

This analysis will clarify the description regarding the current system. Observations or scenario analysis of the current system is important because it can lead to another future scenario that may affect the future results of the project.

One of the example of current game application that using Mobile Apps especially for autistic children is *Picaa*. *Picaa* is a game that use the iOS platform has been found can give the positive impact in the development of learning skills for children who have special educational needs. Evaluation results showed that the basic skills (language, math, environmental awareness and social) of these children have improved. Due to the interface and the contents of the activities in *Picaa* which was adapted specifically for individual players. Adaptability has been identified as a key design requirement for new technologies in the mental health care field (Cristina Botella, 2006). Besides, most of game applications provide a reward to those users who can complete the game correctly. Paper argues by using objects, food, and actions as rewards for desired behaviour can increase the engagement of the participants to play with technological devices (Paper, 2016).

However, there is still no game application by using mobile device that provide a feature such as by using malay language for autistic children is developed in Malaysia especially connecting the dots games. This is such a great opportunity to build a new brand mobile apps where it can help children with autism write or trace the alphabets.

3.3 Requirement Analysis

3.3.1 Project Requirement

The genre of this project is game based learning or casual game. As there still lack of learning tools used in our country, this project is designed to improve the methods of learning especially for children with autism. So, we decided to develop a game application and choose mobile technology as an additional tool to boost the student's interest during their learning process. Based on the existing game application, most of it use English as the main language for their game. For developing this project, we decided to choose Malay language because there still no game application by using mobile devices that use this language. This also can help the children who live in rural areas to use this game as a learning tools in their classroom.

At the beginning of the game, the user will see the play menu as this is an introduction of the game. After they click the 'Mula' button, they will see an instruction page where the information on how to play the game is shown by using graphics. Next, 'Seterusnya' button need to be clicked to proceed the next page and the Main Menu will appear. The user can click any letter provided from a to z letter to start playing the game. So the the challenge for this game, the player needs to complete the task given by drawing or connect every dots given. After player finish the task, they will win the game. We use the basic and simple game because the target user is children with autism. This game can encourage the students to play and work together where they can improve their social skills.

So, Figure 3.1 below shows the gameplay flow board of this project that we want to develop to make the gameplay easy to understand by children with autism.

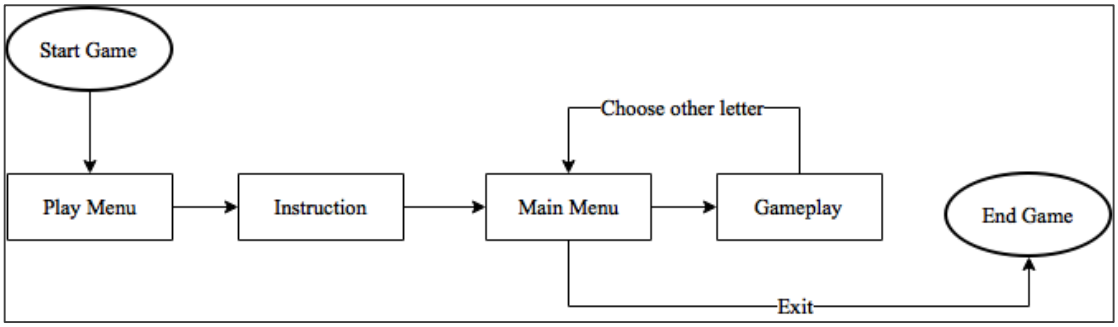


Figure 3.1 : Gameplay flow board

3.3.2 Software Requirement

Table 3.1 shows the list of software requirement to develop this project. There are three software is used to complete this project.

Table 3.1 : List of Software Requirement

Software	Purpose
Unity 5.3	To develop content of the game by using C# language.
Adobe Illustrator CS6	To design and trace the graphics
Audacity 2.0	To record and edit the audio

3.3.3 Hardware Requirement

Table 3.2 shows the list of hardware requirement when develop this project. There is hardware is used to develop this project.

Table 3.2 : List of Hardware Requirement.

Hardware	Purpose
Macbook Pro 13-inch early 2011 2.3 GHz Intel Core i5 8GB 1600 MHz DDR3 OS X El Capitan	To develop the content of the project, which can only be applying in computer.

3.4 Project Schedule and Milestones

This project was scheduled from March until June for Phase I and from July until August for Phase II. For Phase I, this project focused more develop the game application. In the Phase II, this project is tested and evaluated to see either the project is achieved the objective or not. Table 3.3 shows the project schedule of this project and Table 3.4 shows the Gantt Chart of the project as following below.

Table 3.3 : Project Schedule

Activities	Start Date	End Date	Result
Planning	22/2/2016	11/3/2016	Project plan
Design	14/3/2016	8/4/2016	Storyboard User Interface Design
Development	18/4/2016	20/5/2016	Build a game design with all the functions
Editing and Correcting	30/5/2016	15/7/2016	Fix the problem issues and improving the games design
Testing and Evaluate	18/7/2016	29/7/2016	Testing overall system and user testing
Development	1/8/2016	12/8/2016	Finalize the product

Table 3.4 : Project's Milestone

Activity	Week														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Planning															
Find a current problem scenario															
Create project's objectives															
Create a project's title															
Collect data for documentation															
Design															
Design the user interfaces															
Discuss with supervisor															
Re-design the interfaces															
Collect data for documentation															
Development															
List all the functions															
Build a game design															
Discuss with the supervisor															
Fix the problem issue															
Improving the game design															
Collect data for documentation															
Quality Assurance															
Testing overall system															
User Testing															
Collect data for documentation															
Development															
Finalize the product															
Documentation															

3.5 Conclusion

This chapter analyses all the data and information from Chapter 1 and Chapter 2. The current system scenario and the requirement analysis of the project provide a solution and idea to meet the project objectives and make a better output of this project. Project schedule and Milestones is also provided to see the flow and the process of the project development The next chapter will discuss about the design of this project including the system architecture and user interface design.

CHAPTER IV

DESIGN

4.1 Introduction

This chapter will identify the outcome from the analysis done in previous chapter. In this chapter, it will show the overall flow of the game and the details of the game design. All the work in designing phase will be use as the interface of the game. It is important phase in developing game because nobody will play the game if the game does not have any interface design.

4.2 System Architecture

System architecture was identified and design in this phase. Contact diagram and system diagram was build to show the structural design of game application. There are five main page in this game which are Play Menu, Instruction (How to Play) page, Alphabet Menu and the Gameplay. In the Play Menu, it displays an introduction game that contain a logo on it. First page is very important where it can give the user their first impression about the game. The user need to click the 'Mula' button to proceed on the next page. Next, the instruction page will show the user on how to play the game. Then, the user need to click the 'Seterusnya' button to continue the next section. In the Alphabet Menu page, there is a choices of letters where user can choose which letter that they want to play first. In the gameplay mode, if the user gets the correct answer, it will display the next task. If they make a mistake, they need to re-do it again their current task. After all task is finished, a positive voice will be heard to give them spirit and motivation when play this game.

The System Diagram of the project is shown in Figure 4.1 below.

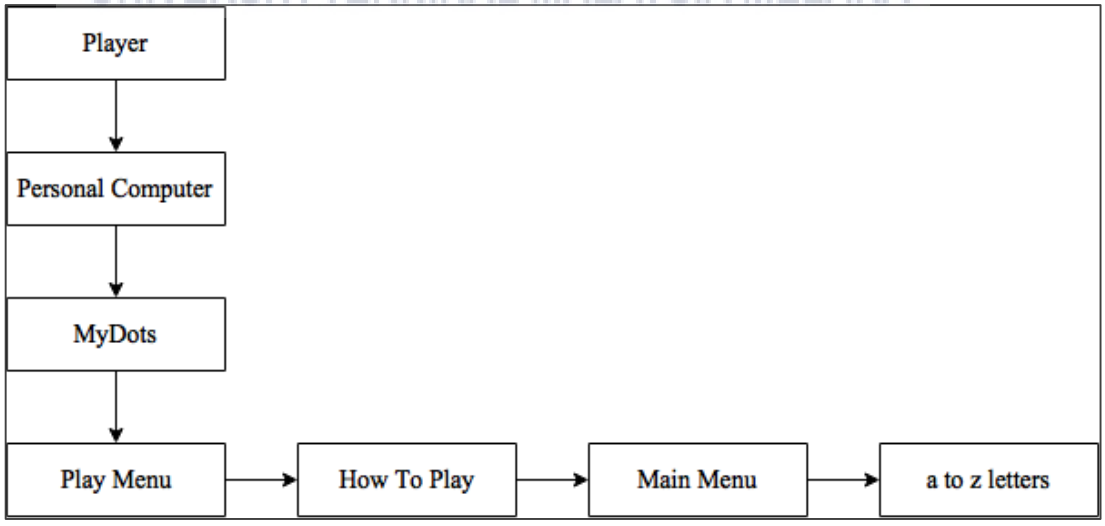


Figure 4.1 : System Diagram of the game

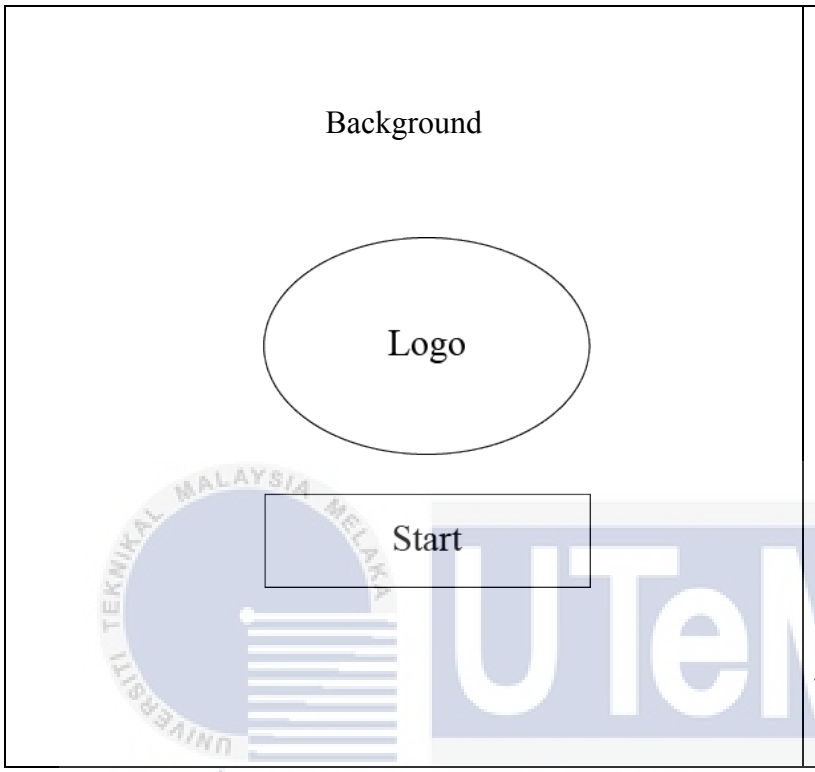
4.3 Preliminary Design

4.3.1 Storyboard Design

Storyboard design were draft to get a view of the project. This task is important to study details of the design which is used as a platform in delivering to user. Early planning was done in designing the project. The detailed storyboard is shown as the following below.

Figure 4.2 shows the details of storyboard design for Start Page. This page contains blue themed background layout, an official logo and also ‘Mula’ button which act as a start button.

SUBJECT	PROJEK SARJANA MUDA	**DESIGNER**	AMIRAH AZHANI MUHSIN
PROJECT	DOTS GAME FOR CHILDREN WITH AUTISM	**PAGE**	START MENU



Graphics:

Background layout.

Game's logo.

Start Button

Action:

If we click 'Start' button, we will go to the next page (How To Play)

Animation:

The button is moving up and down like dancing or jumping.

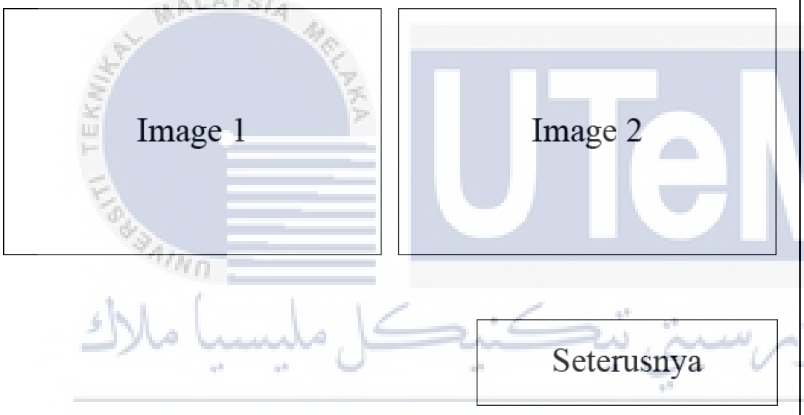
Figure 4.2 : Storyboard Design for Start Page

Pseudocode:

- User click *MulaButton*
- The *InstructionMenu* scene will be loaded.
- After the button is released, the audio clip will be played.

Figure 4.3 shows the details of storyboard design for 'How To Play' Page. This page consists of blue themed background layout, instruction images and 'Seterusnya' button.

SUBJECT	PROJEK SARJANA MUDA	**DESIGNER**	AMIRAH AZHANI MUHSIN
PROJECT	DOTS GAME FOR CHILDREN WITH AUTISM	**PAGE**	HOW TO PLAY



Graphics:

Background layout.

Image 1: Step 1's image

Image 2: Step 2's image

Next Button

Action:

If we click 'Seterusnya' button, we will go to the next page (Alphabet Menu)

Animation:

The button is moving up and down like dancing or jumping.

Figure 4.3 : Storyboard Design for Start Page

Pseudocode:

- User click *HelpButton*
- The *AlphabetMenu* scene will be loaded.
- After the button is released, the audio clip will be played.

Figure 4.4 shows the details of storyboard design for 'How To Play' Page. This page contains background layout and a group of lowercase alphabet which is a to z letters. All of these letters act as a button.

SUBJECT	PROJEK SARJANA MUDA	**DESIGNER**	AMIRAH AZHANI MUHSIN
PROJECT	DOTS GAME FOR CHILDREN WITH AUTISM	**PAGE**	ALPHABET MENU

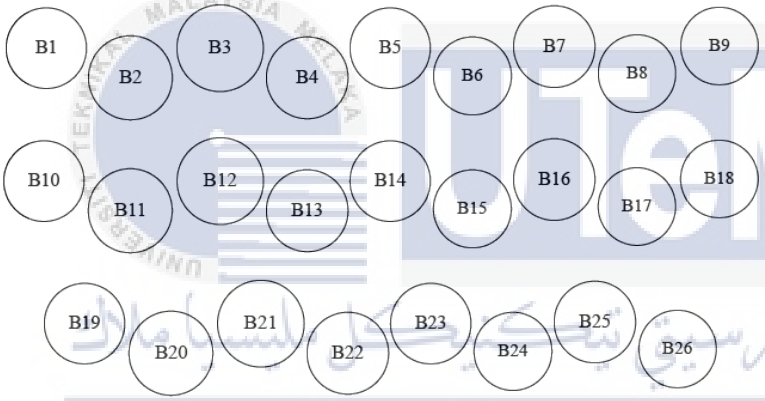
Background  	**Graphics:** Background layout. **Buttons :** A group of buttons that consists from a to z. **Action:** If we click any button provided, it will directly go to the gameplay page. **Animation:** Each button is moving up and down looks like dancing or jumping.

Figure 4.4 : Storyboard Design for Alphabet Menu Page

Pseudocode:

- User click each of alphabet buttons.
- The *AlphabetWriting* scene will be loaded.
- After the button is released, the audio clip will be played.

Figure 4.5 shows the details of storyboard design for 'Gameplay' Page. This page consists of simple background layout, official logo, a group of buttons, and space for user to play the game.

SUBJECT	PROJEK SARJANA MUDA	**DESIGNER**	AMIRAH AZHANI MUHSIN
PROJECT	DOTS GAME FOR CHILDREN WITH AUTISM	**PAGE**	GAMEPLAY

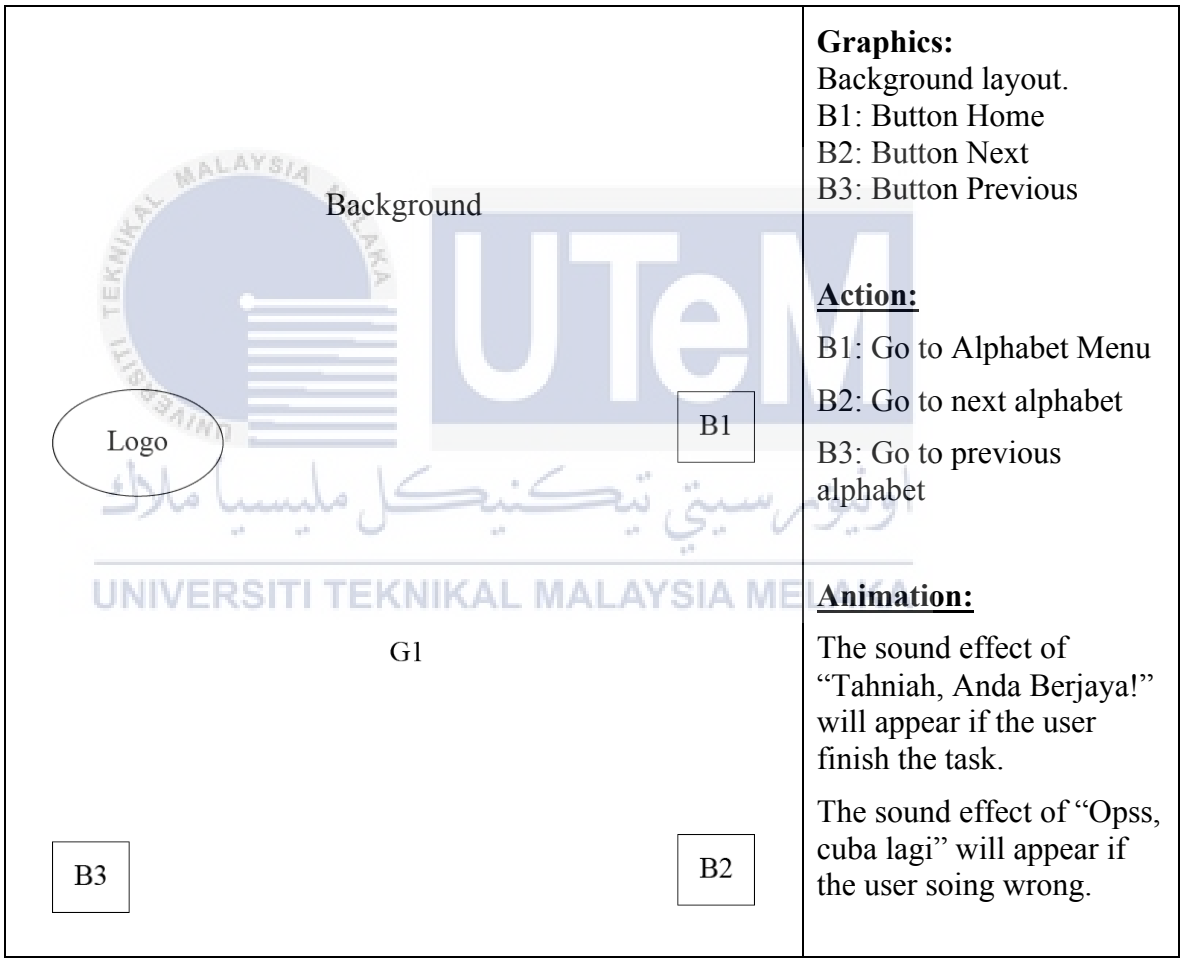


Figure 4.5 : Storyboard Design for Gameplay Page

Pseudocode:

- If user click *HomeButton*
- The *AlphabetMenu* scene will be loaded.
- After the button is released, the audio clip will be played.

- If user click *NextButton*
- The *LoadTheNextLetter* scene will be loaded.
- After the button is released, the audio clip will be played.

- If user click *PreviousButton*
- The *LoadThePreviousLetter* scene will be loaded.
- After the button is released, the audio clip will be played.

- If user click *RefreshButton*
- The *AlphabetWritingr* scene will be restart back.
- After the button is released, the audio clip will be played.
- Foreach the game will destroy

4.3 User Interface Design

User Interface Design has been designed according to the storyboard design that has been created. The design was done by using Adobe Illustrator CS6. We just simply follow all the characteristic that we have decided before as stated in the Summary Propose Design in the Table 2.2.

i. Navigation Design

Navigation structure of this game is shown as Figure 4.6 through the navigation flow. The flows of every interface are shown until the last page of the game.

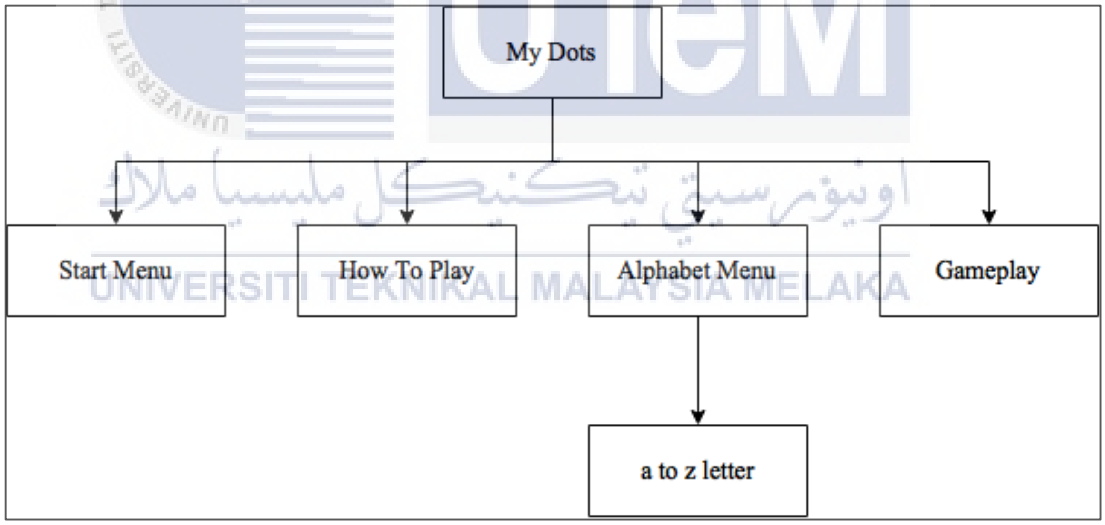


Figure 4.6 : Navigation flow of the game

ii. Input Design

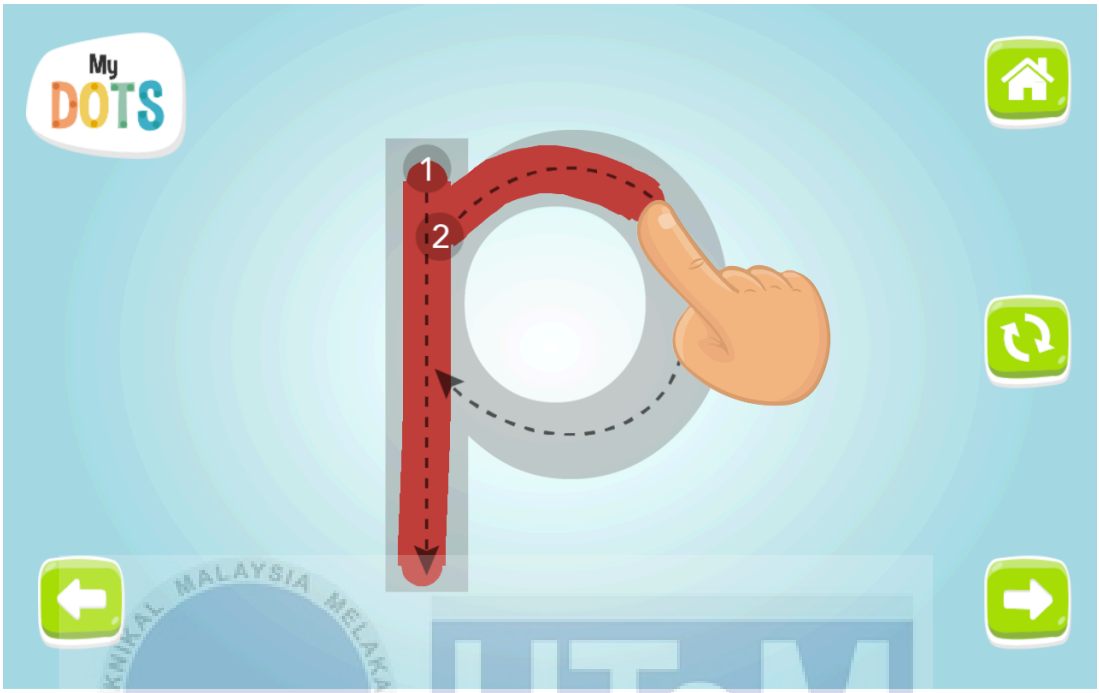


Figure 4.7 : User is tracing the alphabet

For this project, the user needs to trace or connect the dots given for each alphabet. Based on Figure 4.3 above, if they trace the letter correctly, the game will detect the shape of the alphabet. Therefore, the user need to use a Kinect console as the input device to complete this game.

iii. Output Design

The output design is to create an interactive page where the user can do some interaction in the page. Basically in every single page have at least one button to click. The interface designs are explains as following below.

Figure 4.8 : Interface design of Play Menu

Figure 4.4 is the interface design for the Play Menu. There is only one button which is 'MULA', that indicate the user to enter into another page.

Figure 4.9 : Interface design of Instruction Page

Figure 4.5 is the interface design for the Instruction Page. It also has only one button which is ‘SETERUSNYA’, that indicate the user to enter into next page.

Figure 4.10 : Interface of Menu Page

Figure 4.6 shows the interface design for the Menu Page. The user can click any alphabet button provided to play the game while if the user wants to exit the game, they just simply click the ’X’ button.

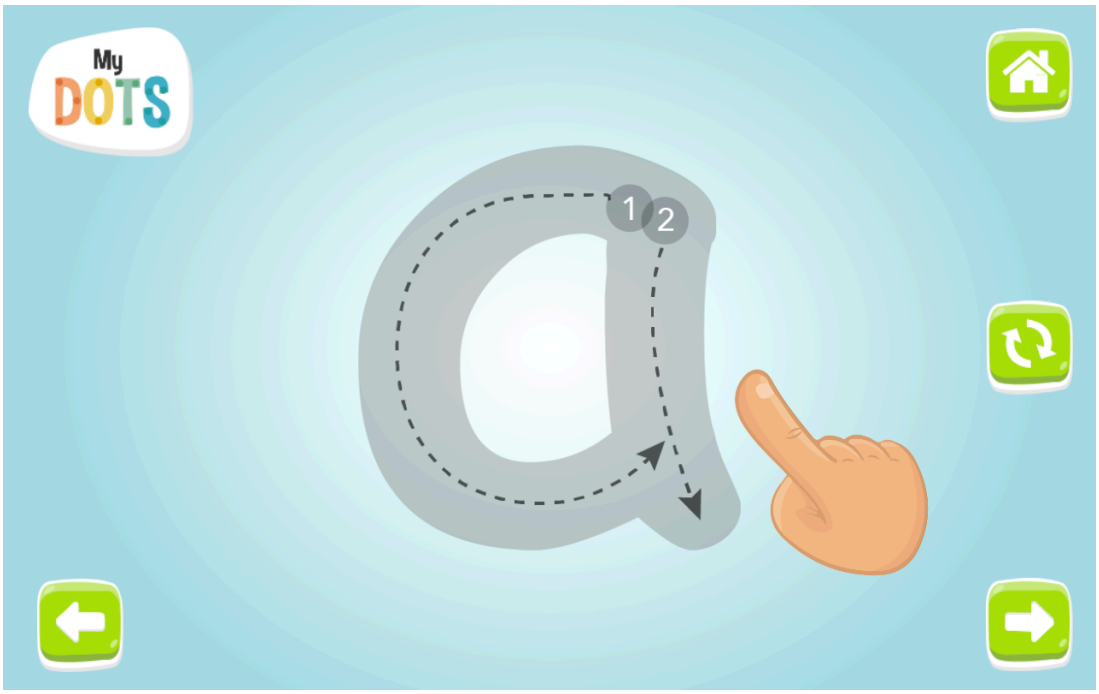


Figure 4.11 : Interface of Gameplay

Figure 4.7 is the interface design for Gameplay. This is where the player needs to draw the letter from dot to dot. They can click 'Next' and 'Previous' Button if they want to. The home button is also provided, if the user wants to get back to the Menu Page.

iv. Metaphors

To build this game, we use Malay language as a main language to make the user easy to understand and also to make it localize for autistic children in Malaysia. Additionally, by using a bright color with the local fruits themed also can make the children familiar with the learning data and ideas.

4.4 Conclusion

This chapter allowed developer to explore more innovative ways of delivering the content. System architecture and context diagram was defined to understand the way of the game is works. Navigation flow was created to recognize flow of this system. Design phase is also important because it will show the illustrate of all the game content. For the next chapter, the implementation phase will be explained. This phase will have more detailed information about the product and the problems occur during the development.

CHAPTER V

IMPLEMENTATION

5.1 Introduction

In this chapter, there is an explanation for the process of developing this project. This chapter will describe the whole project and discuss the process of project implementation. The implementation process is required to ensure the project run smoothly including installation, configuration and make the necessary changes. This chapter also contains some documentations of Media Creation, Media Integration, Product Configuration Management and Implementation Status.

5.2 Media Creation

Media creation consists of the production of text, graphics, buttons and audio elements. This part will explain the process of each multimedia elements is created. The output results of these elements are then put together to generate the final product of the game.

5.2.1 Production of Graphics

Graphics are important to make the game application more attractive and easy to understand. At early stage, all source photo from the internet will be collected intended to use as a reference. After that, the combination designs and ideas from all the sources will produce one new fresh idea to create a new graphic by yourself. Adobe Illustrator CS6 or Adobe Photoshop CS6 is a suitable software to express the creativity of the ideas itself. The right selections of colour also are important to make the game more interesting. For example, the background layouts and some graphics icons on Start Page. In Figure 5.1, the process flow in production of Graphics is shown.

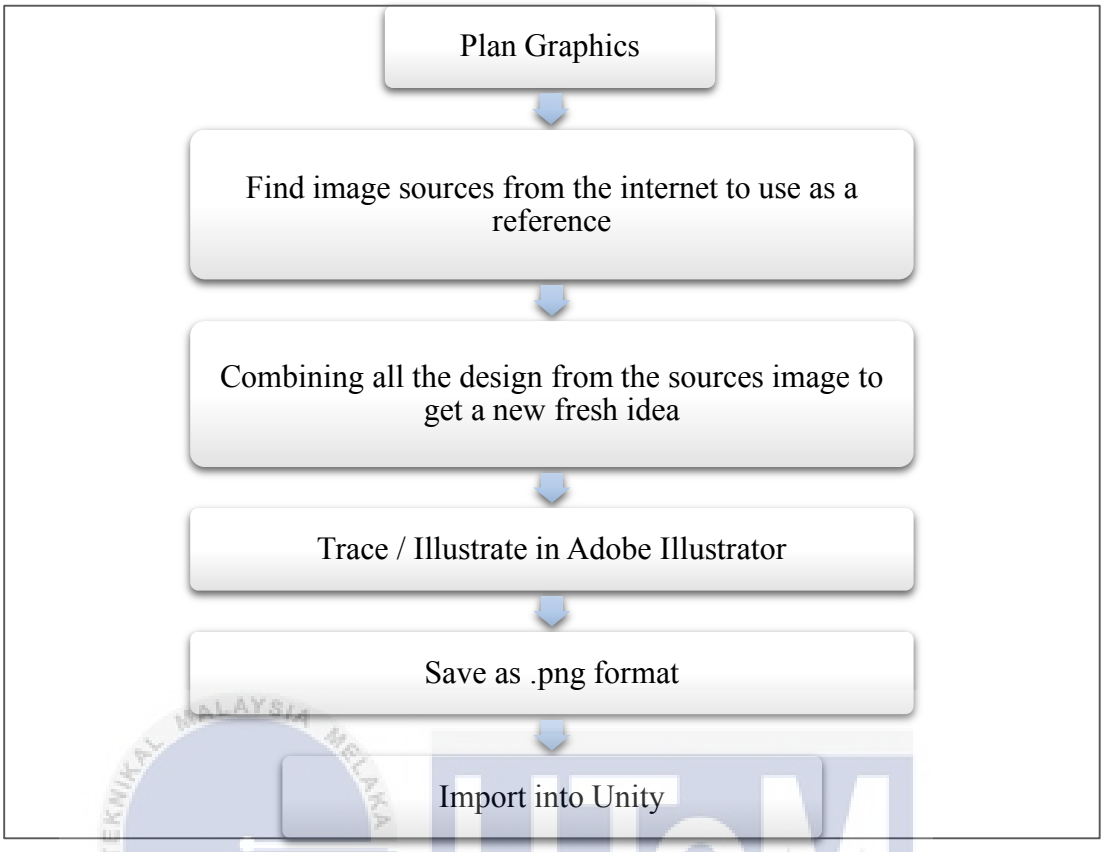


Figure 5.1 : Process flow in production of Graphics

5.2.2 Production of Text

Texts are not used widely in this project. This element is used mainly to the buttons and icons. The appropriate and bigger size fonts are used especially for children with Autism to make them easier to recognize and use it. Most of the buttons was created from Adobe Illustrator CS6. The process almost similar to production of graphics where the buttons that is created were saved to .png format. The output of this element will import to the Unity for the next process. Figure 5.2 give the details about the process flow of text production in this project.

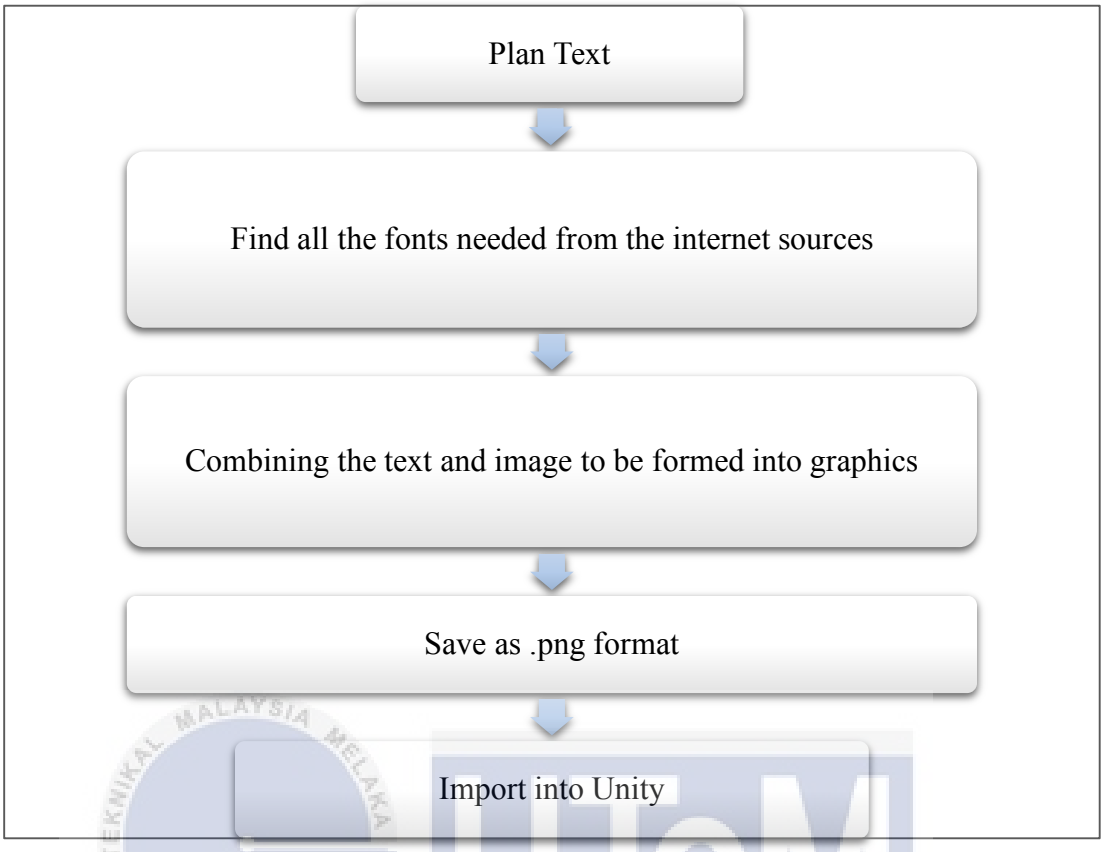


Figure 5.2 : Process flow in production of text

5.2.3 Production of Audio

In this project, the audio is used to give the instructions to the user. For example, the voice over for “Tahniah, anda berjaya!” and also the voice over for “Oopss, cuba lagi!” is a recording of the human voice. The voice is recorded by using a voice recorder and then it was edited by using Audacity 2.0.6. All the audio was saved as .mp3 file format. Figure 5.3 show the details about the process flow of audio production for this project.

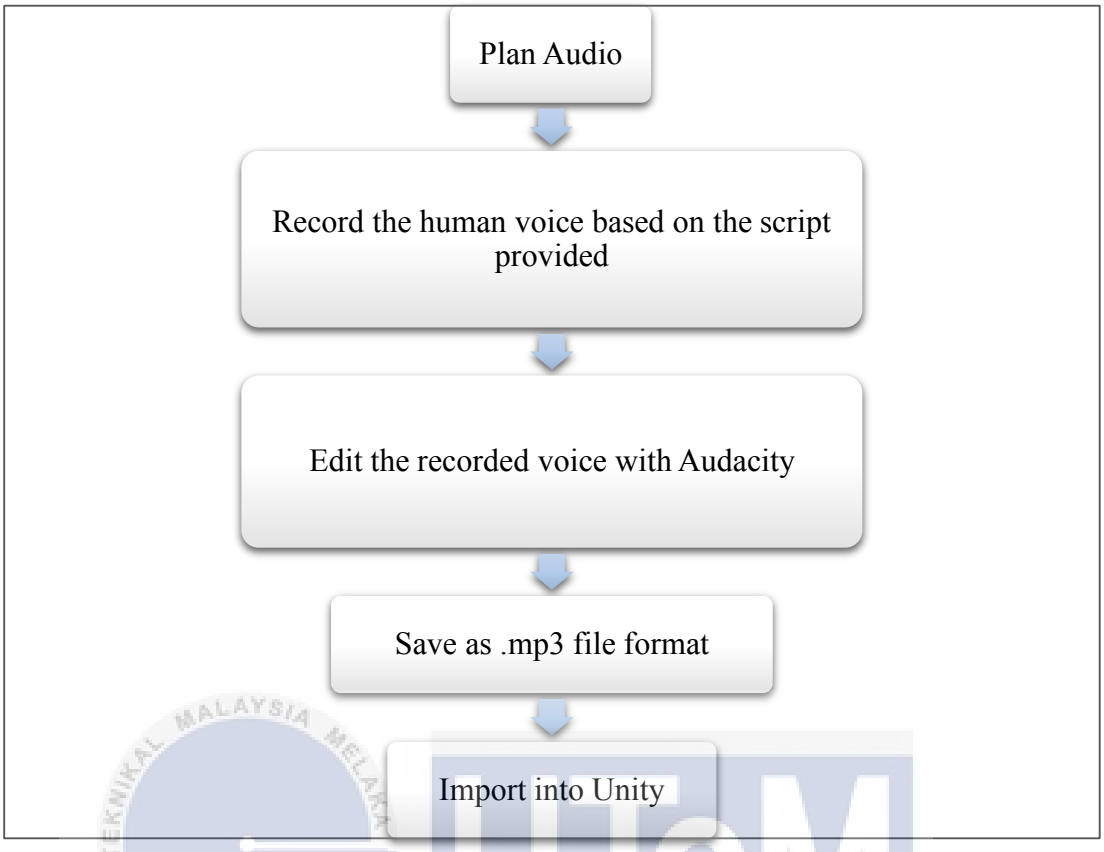


Figure 5.3 : Process flow in production of Audio

5.3 Media Integration

Integration process is done in Unity 5.3. All the elements which are graphics, audio and text are integrated into the mobile application using this software. This application only used C# language to build this complete project. Arrangement for the design layout, buttons and logo can be done manually with the right procedure. Then, the project will be saved in Unity folder and build as .apk file format. User can view the final product in the smartphone device. Figure 5.4 shows the process flow in media integration.

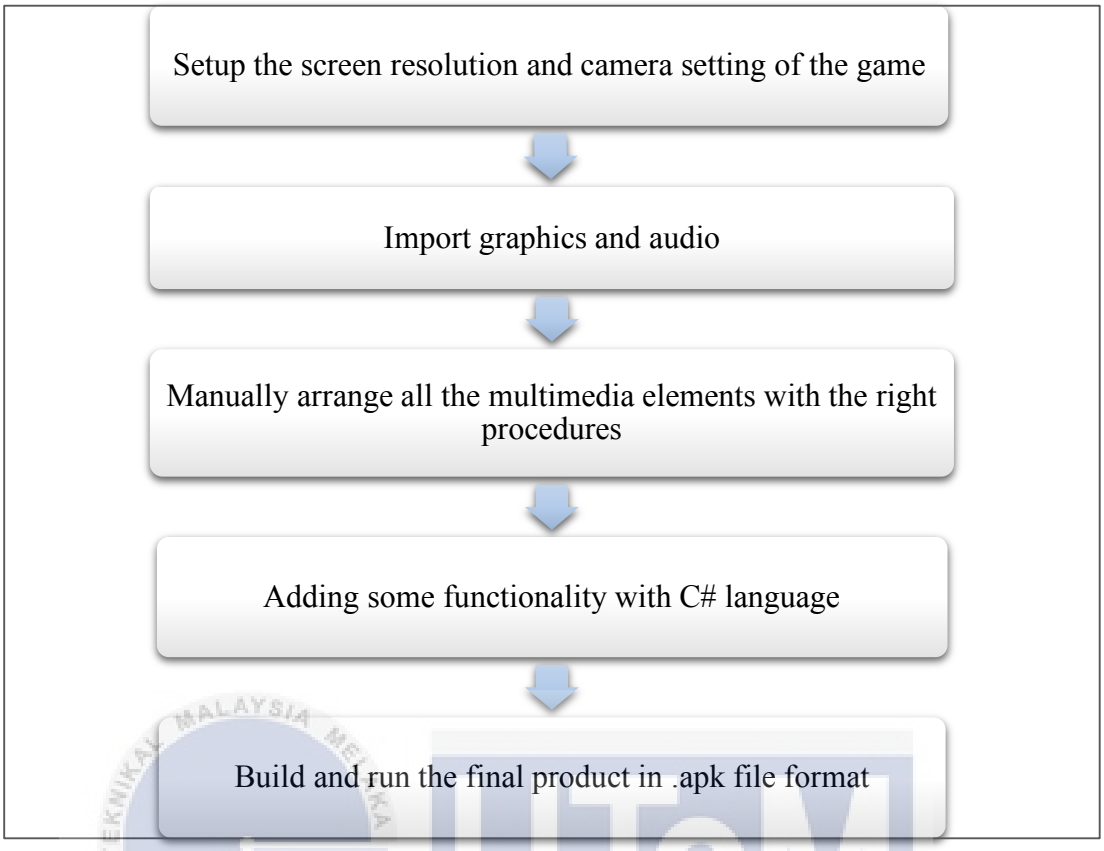
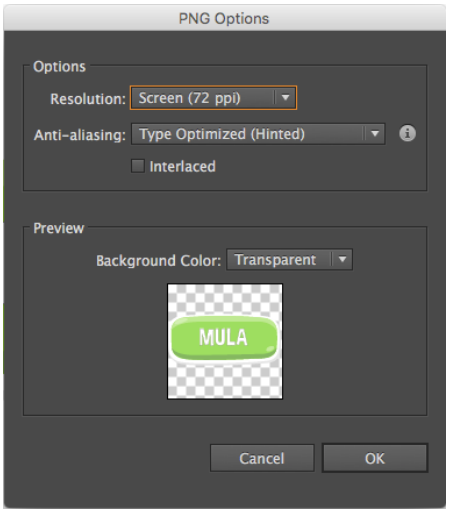
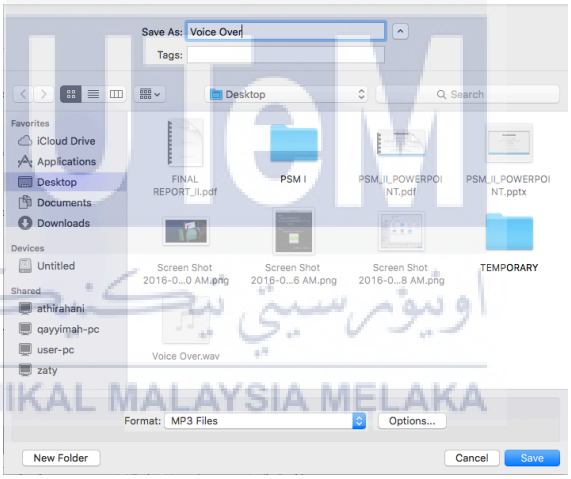
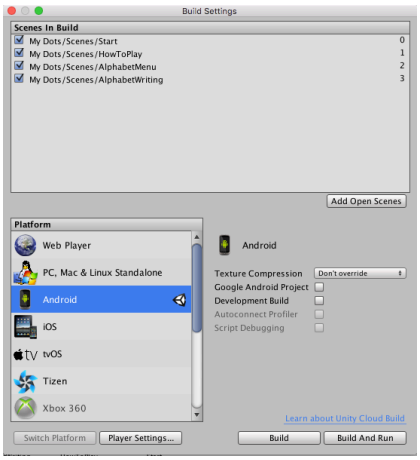


Figure 5.4 : Process flow in integration

5.4 Product Configuration Management

Product configuration management is a process where the configuration needed to be done to the product to achieve desired outcome. The setting required on software used to build this project will be shown in table below to have a better view and understanding about the settings. Table 5.1 shows the software configuration settings on Adobe Illustrator CS6, Audacity 2.0 and Unity 5.3.

Table 5.1 : Software configuration settings

Software	Settings
Adobe Illustrator CS6 - To export a .png image	
Audacity 2.0 - To export .mp3 file	
Unity 5.3 - To export an .apk file	

5.5 Implementation Status

The phase where the progress of development status for each module based on Gantt chart were described. The implementation status of the product is explained in Table 5.2.

Table 5.2 : The implementation status of the product

Scene	Description	Implementation Status
Start page	Introduction page for this game and it provides “Mula” button on it.	Complete
How To Play page	This page shows the graphics on how to play this game and it provides “Seterusnya” button on it.	Complete
Alphabet Menu page	Menu page that contains the list of lower case letter from a to z and act as a button.	Complete
Alphabet Writing page	This page is where the player playing the game.	Complete

5.6 Conclusion

The chapter has explained in details the essential things done during the implementation phase while build this mobile application. Completion of the implementation phase will take the developer into the final stage which is Testing phase. In the next chapter, the testing phase of the end product will be explained.

CHAPTER VI

TESTING AND EVALUATION

6.1 Introduction

This chapter will explain the testing done to the product after the product has been developed. The result from the testing is evaluated. The purpose of testing is to ensure that the project works according to the specification and user requirement. This chapter also will describe in details about the test plan, test strategy, test implementation and test analysis.

6.2 Test Plan

Test plan is important to set up the testing phase in the early stage. The test plan also used to verify and to ensure this project meets the requirements and specifications. Test plan consist of test user, test environment and test schedule.

6.2.1 Test User

Test user refers to person who are participate in testing activities. For this project, children with Autism in the age range 6 to10 years old will be chosen as the main test user. 3 potential children have been chosen from the class to participate this activity.

6.2.2 Test Environment

Test environment describe the location and environment of testing. The testing environment should be in a good condition to ensure the process is running smoothly. A proper setup of application and smartphone device is needed on which of the testing is going to be run. Sekolah Kebangsaan LKTP Adela, Kota Tinggi, Johor was selected to run the testing. Testing is done informal and discussion was made with the teacher in charge while observing the abilities of the user to play the game application. Before the testing is made, the camera has been prepared to take the pictures of the activities and to record the video.

6.2.3 Test Schedule

Test schedule is a guideline for the testing and evaluation to ensure the testing is running according to plan. In other words, test schedule manages the timing and the duration of the testing. During the testing activity, each student will be given 20 minutes to play the game and complete the task. The duration of time will be controlled to make sure the data is valid. The children will be using a smartphone device that is provided to play the game. Table 6.1 shows the test schedule for user testing.

Table 6.1 : Test schedule for user testing

User Tester	Duration	Date	Time	Location
Student A	20 minutes	4/8/2016	9.00AM – 9.20AM	Classroom
Student B	20 minutes	4/8/2016	9.30AM – 9.50AM	Classroom
Student C	20 minutes	4/8/2016	10.30AM – 10.50AM	Classroom

6.3 Test Strategy

Test strategy is a guideline that explain test design and determine how the testing needs to be done. The strategy for this project is testing one by one student based on test schedule. Five minutes is given for each student to explore and familiar with this game application at first. Next, the application will be closed and re-open again to see how children with Autism interact with the product and play the game. The time will be recorded although each student is given 20 minutes to complete this game. During the testing, their action will be observed and recorded. After that, an informal interview with the content expert will be conducted to get the feedback about this game. For this

case, the content expert is the teacher at Sekolah Kebangsaan LKTP Adela in Kota Tinggi.

All the testing activities will be concluded after the comments and feedbacks are given from the content expert. The observation of student reaction towards this game and also all the advice and suggestions from the content expert will be taken as the important findings so that we know the state of usability, effectiveness and learnability of this game.

6.4 Test result and analysis

Table 6.2 : Understanding with navigation using the button

User Tester	Task/Activity	Time taken to explore the scenes
Student A	Fast learner and very familiar with the mobile interface. He knows which one is button and easy to interact with it.	10 seconds
Student B	At first, he touched the entire screen to find the button. With guidance, he is able to play.	15 seconds
Student C	He touched the entire screen at first and also need a guidance to complete play game.	15 seconds

Table 6.3 : Reaction with the instruction audio

User Tester	Task/Activity
Student A	He was very happy with the sound “Tahniah, Anda Berjaya!” and keep on doing to complete the task even “Oops, cuba lagi” sound keep on playing when he trace wrongly.
Student B	He was very happy with the sound “Tahniah, Anda Berjaya!” and keep on doing to complete the task even “Oops, cuba lagi” sound keep on playing when he trace wrongly.
Student C	He was very happy with the sound “Tahniah, Anda Berjaya!” and keep on doing to complete the task even “Oops, cuba lagi” sound keep on playing when he trace wrongly.

Table 6.4 Engagement with the game

User Tester	Task/Activity	Time taken to complete the game
Student A	Able to complete all letters from a to z.	5 – 10 minutes
Student B	Able to complete all letters from a to z with guidance.	10-15 minutes
Student C	Able to complete all letters from a to z with guidance.	15-20 minutes

6.5 Analysis Testing

After the test result and analysis is done, we will do the analysis testing to know whether this game is going to fulfil the objectives or not. This study resulted in three key finding which are it can promote interaction to the children where they were interested playing the game. Secondly, this application can encourage the student to play the game when there is an audio instruction and lastly it can act as supporting tools in the classroom that able to motivate student with autism. More details will be described below.

i. Promote interaction: the children interested on playing game.

Children with autism are more interest in playing game rather than learning. They are very quick to learn new things and very familiar with this technology. During the test, the teacher asked Student A whether he liked to play games or not. Student A nodded his head and quickly to say yes happily as shown as in Figure 6.1 below. Same goes to the other children, Student B and Student C. When the application is launch, Student A read one by one the the words in the logo and then the "Mula" buttons. Then, he straight away clicked on the "Mula" button which means he knows which one need to press and which one is not.

Figure 6.1 : Student A was enjoyed playing My Dots without a guidance

According to the teacher, Encik Amirul Shazni Bin Muhsin, the level of attention of this kind of student will increase if he played Student A's favourite song. During the test, Student A playing the game while listening to a music. He became more focused and he able to complete the task quickly. This statement is supported by Whipple where music is in interventions used with children with autism can improve social behaviour, increase focus and attention, increase communication attempts and also can reduce the anxiety (Whipple, 2004). Based on Figure 6.2, things happened differently with Student B and Student C, they need an assistance or guidance to complete the task given. But still, they were very enjoyed when they are able to finish each task.

Figure 6.2 : Some student need a guidance to play this game

ii. A simple audio instructions able to encourage the children to use the application.

Most of these students are easy to understand the concept of this game. They know what they are learn through this game but Student B and Student C have a totally different behaviour. Both of them are non-verbal type of autism. Surprisingly, after they finish their task and heard "Tahniah, Anda Berjaya!" of sound, both of them constantly said "Yayy!" to show that they are very happy as shown in Figure 6.3. If they heard "Opss, cuba lagi!" of sound, they find the solution and motivate themselves to finish it until the task is successfully completed.

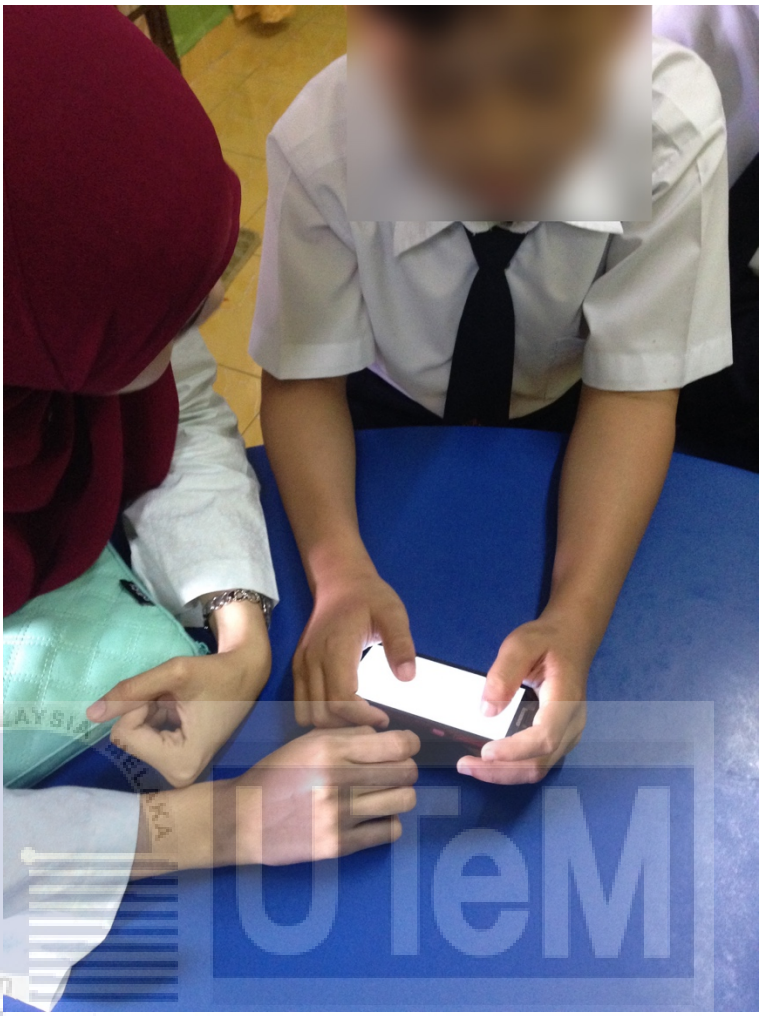


Figure 6.3 : Student B was happy after he heard the positive audio of the game.

iii. Act as supporting tools that able to motivate children in classroom activity

The students were given 20 minutes to finish this game as scheduled. However, these three students can complete the game in less than 20 minutes. Student A took only 5-10 minutes to finish this game if his favourite song is played whereas he still took in less than 15 minutes to complete the game without music. Based on Figure 6.4, he was very happy after finished his task. Besides, Student B and C took a little more time to finish the game because they need a guidance from expert as shown in Figure 6.5. It also depends on the attitude of each student for example there is a

student who is a bit slow to hear the instructions. After all, they still able to complete the game within a time. This shows they are familiar with mobile technology and they really enjoy playing this game as well as to learn how to write an alphabet. Riaza Mohd Rias (2014) supports the use of technology and multimedia increases the interest of participants with autism, helping them to learn while playing with technology.

Figure 6.4 : The student put his smiling face after the game is completed

Figure 6.5 : The student was trying to complete one of the letter

6.6 Conclusion

Testing is essential to developer to ensure that the project can perform properly without any difficulties in real time environment. In this chapter, the process of testing phase is explained including on the results of testing session. The data that have been obtained also recorded. Based on the result, the developer can learn and know the weakness and strength of the product. This weakness and strength will be explained more on the next chapter where the overall conclusion of this project is concluded.

CHAPTER VII

CONCLUSION

7.1 Introduction

This chapter will explain about the weakness and strengths of the products that has been developed for the target users, the feedback from the experience of experts and users in using and testing the product, and the further contribution of the product towards the community. This chapter will conclude all development process.

7.2 Observation on Weakness and Strengths

My Dots game application is the project that has been developed for Projek Sarjana Muda 1 and 2. Observation on the project was done to identify the strength and weakness for this game based on analysis and testing process. The major strength of the product is content. The content of the game provides more graphics and text only used in buttons only. The animated graphics and also with the bright color themed on the game can increase the level of interest among the children with Autism to play this game while learning. Besides, a short and simple instruction by using Malay Language able to encourage the children to use this application. The level of excitement is increase.

However, there are a slight of weakness occurs on this product. The weakness is the small resolution led the sensitivity of touch when the children playing the game. They are easy to make a mistakes during the tracing process. This makes user take times to complete one letter with a proper and right tracing. However, an instruction audio can help to motivate them to complete each task.

7.3 Proposition for Improvement

The preposition for improvement for this project is to add an uppercase letter from A to Z to make the product complete with all letters are provided. This can help the children with Autism recognize the small letter and upper letter case better. Besides that, it will be more engaging if we use another interaction such as Kinect technology. This kind of technology needs a little bit higher screen resolution than smartphone device where the children can play together with their friends in the classroom. All the improvement discussed in this part surely will give a greater impact to the user.

7.4 Contribution

My Dots application is built to help increase the attention of children with Autism learning and to write the alphabets by using mobile technology in the classroom. The interface design and the element of multimedia in the game are suitable with the target user. My Dots game also could enhance the interaction of classroom. It is also capable of being a tool to enhance teaching and a tool to support learning. Through this game, children with autism will become familiar the learning data and ideas that will help them to learn. The objective of the project had achieved and the product was developed followed as stated in plan.

7.5 Conclusion

In this chapter, we will identify the outcome from the analysis done in previous chapter. In this chapter, it will show the overall flow of the game and the details of the game design. All the work in designing phase will be use as the interface of the game. It is important phase in developing game because nobody will play the game if the game does not have any interface design.

REFERENCES

Álvaro Fernández-Lópeza, M. J.-F.-A.-S. (2013). Mobile learning technology based on iOS devices to support students with special education needs. *Computers & Education , 61*, 77-90.

123 Tracing Numbers: Montessori math game for kids. (2016). Retrieved from Appysmarts.com : Free & Discounted Apps For Kids: http://www.appysmarts.com/application/123-tracing-based-on-montessori-approach,id_108711.php

Adly, H. N. (2012). Serious Game for Autism Children : Review of Literature. *6* (4), 554-559.

Al-khafaji, N. J.-s.-k. (2013). M-Learning Application for Autistic Children using Android Platform. 978-981.

Apps, I. M. (Ed.). (2012). *Little Writer - The Tracing App for Kids*. (A. Inc., Producer) Retrieved from iTunes Preview: https://itunes.apple.com/en/app/little-writer-tracing-app/id515890480?mt=8

Aziz, M. Z. (2014). Educational App for Children with Autism Spectrum Disorders (ASDs). *Procedia - Procedia Computer Science , 42* (c), 70-77.

Boucenna, S. N. (2000). Interactive technologies for autistic children : A review. 1-16.

Buzzi, M. C. (2012). ABCD SW : autistic behavior & computer-based didactic software ABCD SW : Autistic Behavior & Computer-based Didactic Software. (January), 26-28.

Cardon, T. A. (2012). Teaching caregivers to implement video modeling imitation training via iPad for their children with autism. *Research in Autism Spectrum Disorders , 6* (4), 1389-1400.

Cristina Botella, R. M.-P. (2006). Using an adaptive display for the treatment of emotional disorders: a preliminary analysis of effectiveness. 586-591.

Dehkodi, S. R. (2014). Using Mobile Game Application to Teach Children with Autism Spectrum Disorder (ASD) Multiple Cues Responding: A Pilot Study. *2014 3rd International Conference on User Science and Engineering (i-USEr)* , 216-220.

Developer, W. C. (Ed.). (2015, July 9). *iTunes Preview*. (Apple Inc.) Retrieved from AlphabetTrace: https://itunes.apple.com/us/app/alphabettrace/id602061116?ls=1&mt=8

Eren, B. (2015). The Use of Music Interventions to Improve Social Skills in Adolescents with Autism Spectrum Disorders in Integrated Group Music Therapy Sessions. *Procedia - Social and Behavioral Sciences , 197*, 207-213.

Gavin Doherty, D. C. (2010). Design and evaluation guidelines for mental health technologies. *Interacting with Computers , 22*, 243–252.

Goldsmith, T. R. (2004). Use of Technology in Interventions for Children with Autism. *1* (2), 166-178.

January, A. (2012, January). Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through Age 8. 1-15.

Letter Tracing. (2016). (ABCYa.com) Retrieved from ABCYa.com: http://www.abcya.com/letter_trace.htm

Nicholas B, R. V. (2007). Association of Per1 and Npas2 with autistic disorder: support for the clock genes/social timing hypothesis. *6*, 581-592.

Paper, C. D. (2016, August). Using Mobile Game Application to Teach Children with Autism Spectrum Disorder (ASD) Multiple Cues Responding : A Pilot Study Using Mobile Game Application to Teach Children with Autism Spectrum Disorder (ASD) Multiple Cues Responding : A Pilot Study. 10-15.

Projects, S. H. (2013). iPads and Autism : The Impact of iPads on Social and Academic Development in Autism by.

Razali, N. M. (2013). Teachers ' Perceptions of Including Children with Autism in a Preschool. *9* (12), 261-267.

Shane HC, A. P. (2008, Feb 22). Eletronic screen media for persons with autism spectrum disorder. *Journal of Autism and Development Disorders* , 1499-1508.

Song, H. Y. (2016). Mobile Technology for Children with Autism Spectrum Disorder : Major Trends and Issues Spectrum Disorder : Major Trends and Issues. (October 2012).

Sung AN, B. A. (2015). From the small screen to the big world: mobile apps for teaching real-world face recognition to children with autism. *2015* (1), 37-45.

Wan Fatimah Wan Ahmad, I. N. (2015). Visual Approach of a Mobile Application for Autistic Children: Little Routine. In C. Stephanidis, *HCI International 2015 - Posters' Extended Abstracts* (pp. 436-442). Switzerland: Springer International .

Whipple, J. (2004). Music in Intervention for Children and Adolescents with Autism: A Meta-Analysis. *Journal of music therapy , 41* (2), 90-106.

Woollasaton, V. (2014). *How iPads are helping children with autism: Tablets develop communication skills because they are 'predictable and neat'*. (A. N. Ltd, Producer, & Daily Mail, The Mail on Sunday & Metro Media Group) Retrieved 2014, from Dailymail: http://www.dailymail.co.uk/sciencetech/article-2594471/How-iPads-helping-children-autism-Tablets-develop-communication-skills-predictable-neat.html