DEVELOPMENT OF SCRATCH PROGRAMMING GAME IN MOBILE APPLICATION

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This report is submitted in partial fulfillment of the requirements for the Bachelor of

Information Technology (Game Technology) with Honours

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2017

BORANG PENGESAHAN STATUS TESIS

JUDUL: DEVELOPMENT OF SCRATCH PROGRAMMING GAME IN MOBILE APPLICATION

SESI PENGAJIAN: 2017

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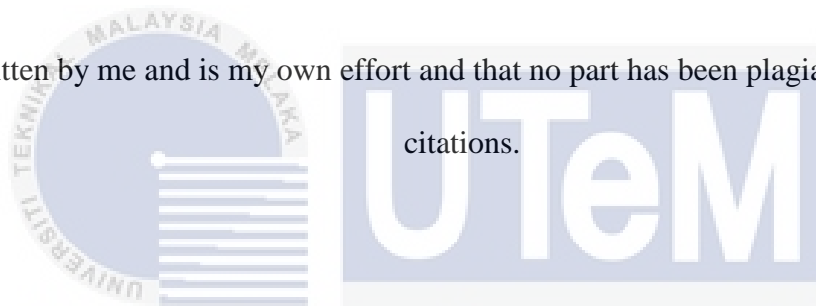Ulu Gali, 27600 Raub, Pahang.   MOHAMMAD

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I declare that I have read this project report and found the project is appropriate in term of the scope and quality for the award of Bachelor of Information Technology (Game Technology) With Honours.

SUPERVISOR: **DR SITI NURUL MAHFUZAH BT MOHAMMAD**

DATE: **25 MAY 2017**

DEDICATION

To my beloved family, a million thanks for supporting me from the beginning until now. To my supervisor, Dr Siti Nurul Mahfuzah binti Muhammad, and my evaluator, Puan Shahrul Badariah binti Mat Sah, thank you for your guidance in developing this project into completeness. To my friends, thank you for helping me to finish this project.

ACKNOWLEDGEMENTS

ABSTRACT

This game is develop to give an early exposure to young children for learning programming using scratch programming game. The genre of the game is puzzle game. This game can be played for those who do not have any experience programming and is all-ages friendly but the target audience are young children aged 5-6 years old. Children can have fun and learn real programming logic through game. By ordering a set of commands such as turn left, turn right and straight forward, player will be able to solve different challenging puzzle. The character will act based on commands given. The development of this game consists of four phase, concepting, pre-production, production and post production. The objectives of the game are to study the scratch programming through this game, to develop the scratch programming game in mobile apps and to test the effectiveness of logical thinking in programming language through this game. Children get early exposure about fundamental of codings. Children can solve problems using analytical and logical thinking skills.
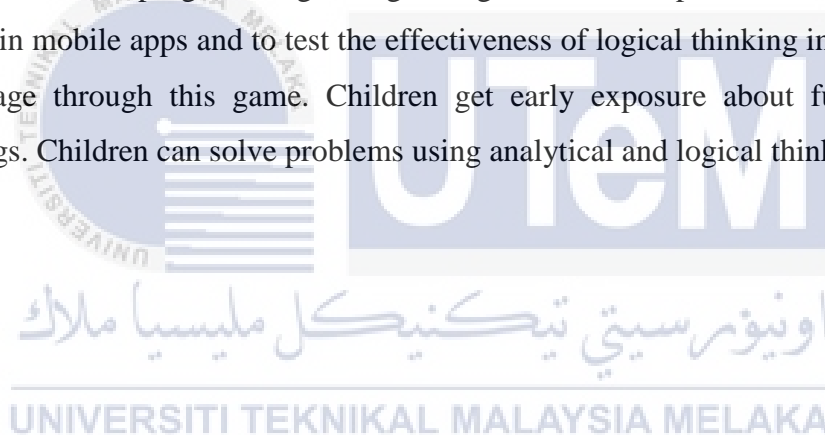
ABSTRAK

Permainan ini dibangunkan untuk memberi pendedahan awal kepada kanak-kanak untuk mempelajari 'programming' menggunakan 'scratch programming'. Genre permainan ini adalah permainan susun suai. Permainan ini boleh dimain oleh seseorang yang tiada pengalaman dalam 'programming' and sesuai untuk setiap golongan umur tetapi kelompok sasaran adalah kanak-kanak berumur 5-6 tahun. Kanak-kanak boleh bermain dan belajar logik 'programming' sebenar melalui permainan ini. Dengan menyusun arahan seperti kiri, kanan, dan atas, pemain boleh menyelesaikan susun suai yang mencabar. Karakter akan bergerak berdasarkan arahan yang diber. Pembangunan permainan ini mempunyai empat fasa iaitu konsep, pre-produksi, produksi, pos-produksi. Objektif permainan ini adalah untuk belajar mengenai 'scratch programming', pembangunan permainan di dalam aplikasi mobil dan keberkesanan dalam pemikiran logic di dalam 'programming' melalui permainan ini. Kanak-kanak dapat pendedahan awal tentang asas 'coding'. Kanak-kanak juga boleh menyelesaikan masalah menggunakan analitikal dan skil pemikiran logikal

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CHAPTER I

INTRODUCTION

1.1 Introduction

As digital creation tools increase in prevalence, early childhood education remains an area where few education technologies focused on digital creation or high-level thinking. This game is developed to give an early exposure to children about programming. This game intended for young children aged 5-6 years old tend to focus on logic thinking rather than content creation or high-level thinking. The genre of the game is puzzle game.

This game will be develop using Unity 5 game engine. This game will needs player to solve the problem and learn programming logic. The aim of this coding puzzle is to give an early exposure and to introduce basic programming logic to young children. It helps player to learn the essence of coding. By ordering a set of commands such as turn left, turn right and straight forward, player will be able to solve different challenging puzzle. The character will act based on commands given.

Scratch is a computer programming and an online community where children able to code and share all of the interactive media that they have developed such games and animation with people around the globe. As children develop with Scratch, they can discover things creatively, work collaboratively with other children, and reason systematically.

1.2 Problem Statement

Computer programming is generally considered important efficiency. The importance of computer programming education stems not only from the economic but also the interests of their learning environment. Computer programming is a key skill to understand many other areas computer science. Furthermore, some specific computer programming system can be considered as compatible, general purpose, the learning environment. Computer programming can be exploited for the development of problem solving, creative thinking and logic. Computer program also offered non-majors in higher education programs that are not associated with clear and easy to computer science. Although very important, the efficiency of computer programming is considered difficult to grow. Students often have difficulty in understanding the concept of the center and authoring program that meets certain specifications. The rate of students who fail or drop out introductory computer programming course estimated (15-30)%. Various approaches have been proposed to improve attendance and soften the difficulty of learning a new programming language, such as the development of educational programs that make the program more interesting to learn. (Georgios Fesakis, Kiriaki Serafeim, 2009).

Coding will be officially added to the syllabuses of national school starting 2017 as computer coding will incorporated into the pedagogy of teaching. The coding is embedded as an official curriculum in schools starting from standard three onwards. This is an initiative to encourage youth to participate as technology makers instead of being just users. Besides, learning computer coding can encourage the cognitive and higher thinking as well as embedding IT as a teaching and learning tool. (Aizyl Azlee, 2016)

1.3 Project Objectives

The project is based on the following objectives:

a. To study the scratch programming through this game.
b. To develop the scratch programming game in mobile apps.
c. To test the effectiveness of logical thinking in programming language through this game.

1.4 Scope

Code Ville will be developed using Unity 5 engine. This game is a puzzle game because player needs to arrange a set of command to move the character. The target audience for this game is 5-6 years old children.

1.5 Project Significance

The target users that will benefits from the project are children can learn the fundamental of coding based on how they arrange a set of commands to the character chosen. The contributions when the project is successfully developed will be users get to know about the fundamental of coding and interesting places in Malacca city that can be as the tourism place.

1.6 Conclusion

As a conclusion, this project might be useful to those who want to learn about the programming logic and the tourism in Malacca city as the game is set at Malacca city. This project will achieve the entire objectives stated earlier. The next chapter to be developed discusses about literature review and project methodology.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

In this chapter, will discuss in details about the related literature review that have been written earlier to support the project title. Literature review is referred to the study on collection of published materials in selected area of studies such as articles, journals, thesis, online library, technical documents and case studies. Literature review should give theoretical base for research and support the research topic through analysis, summarize and evaluation of the literature.

2.2 Genre (Puzzle Games)

According to Linehan, C. et al (2014) puzzle games as those video games where problem unravelling is the central mechanic. Puzzle games can help to focus on generating fun mostly from problem solving. Most of the puzzle game focused on problem solving. Designing a puzzle game can teach us about the designing game based on digital game such as mobile game and video game because designing goal of the game are like learning. Puzzle game can help in several problems where puzzle is involves a problem solving skills, improving

logical thinking skills, help in recognising patterns and sequence solving of the puzzle. Some puzzle are develop with the time limited so that player will need to solve the problem within time limit.

Puzzle games emphasis on logical and conceptual task even the game have a time pressure and other action. Puzzle games usually have a series of related puzzle with a variety of challenge. The challenge could involves pattern recognition and logic. Puzzle games usually have a simple set of rules. Player needs to unravel hints to accomplish the winning condition which then player will be able to move to a new level. Completing puzzle will lead to more difficult and challenging challenge.

2.3 Learning Content (Computer Programming)

The system is designed for children, there are three broad motivation to introduce children to programming as a learning tool that allows children to discover new ideas, as medium for children to express their self, and as a springboard into career that involves computing. One programming system for discovering ideas trying to accommodate children with a calculation in to discover and polish their own thinking. (Caitlin Kelleher et al, 2007).

According to JH Maloney et al (2008), in schools, the combination of computer programming is relatively restricted and inconsistent to its value. Furthermore, the school in the 80s and 90s is very different compared to nowadays, the facilities provided, the exposure of children to ICT inside and outside school and expertise development and familiarize tutors with ICT. Programming education needed computers for learning the fundamental of programming in the school. There is programming environment that can help the development of the programming that suitable for children such as simplified syntax, programming with the use of command symbols on tiles that children can drag and drop to compose programs, immediate execution of commands without the compiling linking phase.

Early programming languages were difficult to understand and many students cannot understand the logic and the syntax of the programming. Programming has been introduced with the boring code that only contains word and number lines by lines where most of the young people are not interested with programming language. Besides, the programming language also does not have a true expert to teach the beginner the right programming concepts. (Mitchel Resnick et al, 2009).

2.4 Scratch

According to John Maloney et al, 2009 scratch is a visual programming environment that lets users create interactive, media rich projects. The Scratch application is the application where user can create their own project using media and programming scripts. Graphics and audio can be developed and import in Scratch application using a built-in tool in the application. Programming is done by snapping together the command blocks to control the sprite.The Scratch programming was designed to invite scripting, provide immediate feedback for script execution, and make execution and data visible to encourage self-directed learning.

2.5 Existing Games

The Foos Codespark and Lightbot are the reference to develop the scratch programming game.

2.5.1 The Foos Codespark

Figure 2.0: The Foos Codespark. Adaptation from Google

The Foos (codeSpark) Make games! Kids learn programming is a game where children can learn to code the game with some sequence of adventure. The gameplay of the game is based on curriculum from MIT and Exploring Computer Science at UCLA. The programming concepts have in this game include pattern recognition for the player to recognise the difference pattern, problem solving where the player need to solve problem to continue to other level and sequencing where the player need to arrange the command by following the sequence, Children can become more creative and think critically finish the level.

Children can learn to program by unravelling a sequence of puzzle challenges, using a graphic and media element to interpret coding language. CodeSpark Academy with The Foos coding for children makes learning how to program but looks like playing game. The Foosville animated world, the character is causing havoc, the application has many scenes where players need to help the character to achieve the target by making the character moving using the arranged code. In one puzzle, children can program or code so the police can move to take her donut. Children will play through numerous programming by building a set of command to solve puzzles in different locations to make the make more

interesting. CodeSpark Academy with The Foos coding for kids uses its own visual programming language to help teaching children about fundamental of programming. Each action that is described as an animated and intractable icon to make it easier for young children to understand the function of the icon. Children can get new icon/action button as they can solve the harder puzzles, which the action button will teach them a new programming concepts such as looping and condition. (The Foos (codeSpark), 2016)

2.5.2 Lightbot

Figure 2.1: Lightbot. Adaptation from google

Light-bot is a puzzle game that help children to learn the fundamental of programming language. This programming application was developed by an undergraduate student for children to learn programming concept easier and enjoy learning programming. The instructions are very simple, so player can easily solve the game without other distraction. Player can move a robot along the maze by dragging and dropping the commands box into correct place, then specified tiles are lighting up as the robot move. Children can unlock the new programming concepts by completing the challenges level. Children accumulate stars to achieve some achievements such as completing the program in small number of steps.
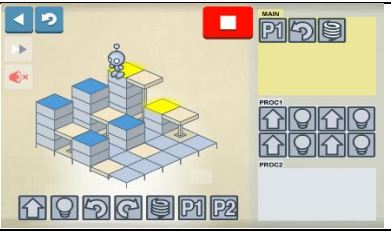
Children can work with programming concepts such as functions, looping, and conditionals.

With the push to get students programming, teachers need a various of teaching tools to get a variety of students and learners. Light-bot is a good programming game that can be use to introduce the programming concept to children such loop and procedures because the design that comes with separate folders for each. All of the levels have different challenge so player is not bored when they play the game. They can solve the game differently using their creative and critical thinking.

2.5.3 Comparison of Existing Games

Table 2.0: Comparison of Existing Games

	The Foos codespark	Lightbot
Screenshots		
Platform	iPhone, iPod Touch, iPad, Android, Chromebook, Fire phone, Kindle Fire, Windows Phone	iPhone, iPod Touch, iPad, Android
Genre	Action puzzle	Puzzle
Feature	Thinking & Reasoning: game logic, strategy, thinking critically	Thinking & Reasoning: game logic, problem solving, thinking critically
Computer science concept/Scratch programming elements	Pattern recognition, sequencing, debugging, loops and conditionals.	Basics, procedures/functions, loop.
Design	Cute character, colourful environment.	Simple character, interactive environment.

The Lightbot and The Foos Codespark is a game where contain of programming concepts. Both game teaches the basics of computer programming through a variety of interactive learning activities including puzzles, pattern recognition and sequencing. The design for both games are suitable for children as their characters are cute and the environment are colourful and simple.

2.6 Project Methodology

The methodology that uses for this project is Game Development Life Cycle (GDLC) model. GDLC is an approach how to handle a game development project. This model will guide through needed steps to develop a game and minimize the risk. GDLC consists of six stages which are initiation, pre-production, production, testing, beta and release product.

For the first phase, which is initiation, it is brainstorming session with supervisor and the student about the idea for development of the game. The discussion things such as the title of the game, gameplay, storyline, character design, the game features, target user, platform for the game and interface design. Besides that, deciding what software will use to develop the game.

Pre – production stages is the process where the activities on gathering the information, identify the problem statement, objectives of the game, project scope, develop schedule and cost estimate. Do the analysis to discuss and list the flow of the game will be carried out such as how to play, the game background, the challenge or mission, menus, storyline interfaces and user interfaces in the game. After the analysis are done, it is the time to design the system architecture based on the flow of the game and will be carried out such as graphics design, music background, sound effect, character design, animation and background design. This stage may take a longest time in developing the game.

Production stages is the first phase to develop the coding, analysis will be done to implementation the requirement in the planning. Troubleshooting to solve any problems and bugs that should fix before do the documentation. This stage may take a few times on development process.

For the testing stage, it is conducted to test the game features, value, concept, design and everything. The test is used to assess the game that need test plan, scenario and several discussions with the supervisor. After the testing is conducted, there will be generated the test report which includes all errors and several things which should be omitted or include. The test result will end up in two different decision in the context Beta Testing. Beta stages will be conducted by the target users that will give the feedback whether to refine the game or the game is already fine. The goal of beta testing is to find any bugs lurking in the game towards current game build. After finish the beta testing, move to the release stage.

Release stage is the process that related to present the final product to the evaluator to get a feedback whether to improve the game in PSM 2 or just fix a few bugs in the game.
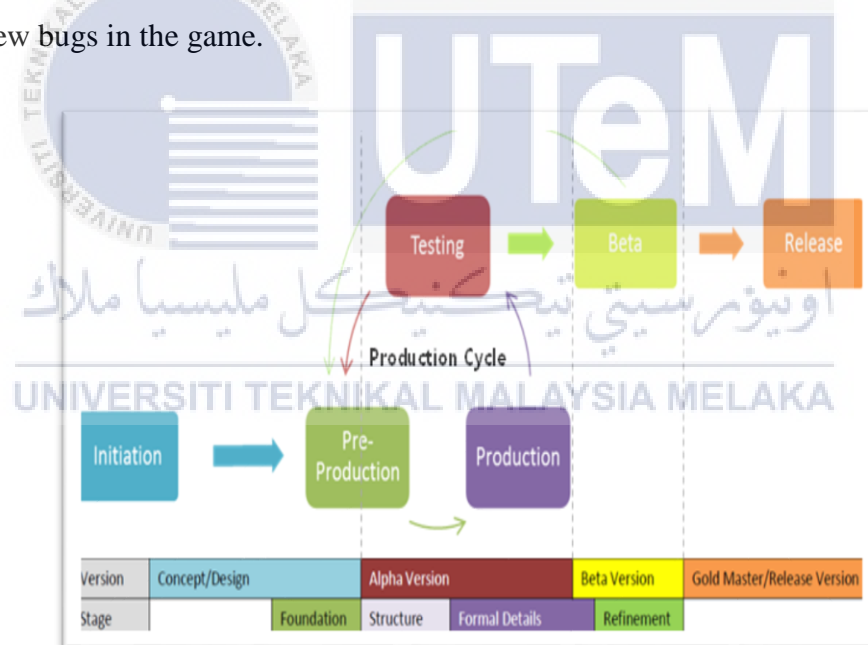
Figure 2.2: Game Development Life Cycle. Adaptation from google

2.7 Conclusion

In this chapter, more explanation about the programming logic, problem solving and thinking critically in programming games. This games teaching children the fundamental of programming but also makes the children enjoy learning programming by playing games. The next activities to be developed are about analysis in the current scenario and the project, software and hardware requirement analysis.

CHAPTER III
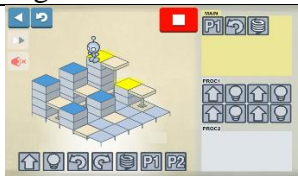
ANALYSIS

3.1 Requirement Analysis

Project requirement consists of hardware and software that support the development of the project.

3.1.1 Project Requirement

Table 3.0: Project Requirement – Analysis of system to be developed.

	The Foos codespark	Lightbot	CodeVille
Screenshots			
Platform	iPhone, iPod Touch, iPad, Android, Chromebook, Fire phone, Kindle Fire, Windows Phone	iPhone, iPod Touch, iPad, Android	Android
Genre	Action puzzle	Puzzle	Puzzle
Feature	critically Thinking & Reasoning: logic, strategy, thinking	Thinking & Reasoning: logic, problem solving, strategy, thinking critically	Thinking & Reasoning: logic, problem solving

Target Audience	Kids 4-9	Kids 4-8	Kids 4-6
Scratch elements/ programming concepts	Pattern recognition, sequencing, debugging, loops and conditionals.	Basics, procedures/functions, loop.	Basics, functions.

3.1.2 Technical Requirement

The hardware that is needed to develop this project is laptop while the game engine that are used to develop the game is Unity 5.4.3. The language that are used in this project is C# language. The other tools that are used in this game such as Adobe Illustrator CS6, Adobe Photoshop CS6 and Microsoft Visual Studio 2013.

3.1.2.1 Software Requirement

Software requirement is divided into game engine, game development tool and game art.

Table 3.1: Software Requirement

	Software	Purpose
Game Art	Adobe Illustrator CS6	It is used to trace the character and asset in the game.
	Adobe Photoshop CS6	It is used to edit and create the game world and background for the user interface in the game.
Game Engine	Unity 5.4.3	Unity 5.4.3 is the game engine that allow user to develop game. It is used to develop the game.
Game Development Tool	Microsoft Visual Studio 2013	It is used for the programming part with C# as the language.

3.1.2.2 Hardware Requirement

Personal Computer:

- MSI GE62 6QC Apache
- Windows 10
- Intel ® Core ™ i7
- RAM: 8 GB
- Graphics Card: NVIDIA GTX 960M GPU

3.1.2.3 Project Milestone and Gantt Chart

Table 3.2: Gantt Chart of Project Activities

No	Task	Week													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Meet up and discussion with supervisor	■													
2	Prepare the proposal		■												
3	Submission of proposal			■											
4	Design the game play				■										
5	Construct the architecture					■									
6	Construct the flow board						■								
7	Construct the hierarchy of challenge						■								
8	Designing the game rules							■							
9	Project implementation								■	■	■	■	■		
10	Final presentation													■	
11	Preparation of project report														■
12	Submission of project report														■

Table 3.3: Milestones and Dates

Key Milestones	Start Date	End Date
Proposal PSM: submission	28 Dec 2016	9 Jan 2017
Chapter1: Game Development Begins	13 Feb 2017	3 Mar 2017
Chapter 2	6 Mar 2017	17 Mar 2017
Chapter 3	20 Mar 2017	31 Mar 2017
Mid Semester Break	1 Apr 2017	9 Apr 2017
Chapter 4	10 Apr 2017	21 Apr 2017
Project Demo	24 Apr 2017	5 May 2017
Draft PSM Report	8 May 2017	12 May 2017
PSM Report	15 May 2017	19 May 2017
Submit PSM Report	22 May 2017	23 May 2017
Final Presentation	24 May 2017	25 May 2017

This project is start on 28 December 2016 where this time need to purpose the idea for the project and submit it on 26 January 2017. On 13 February 2017, update the proposal and make a change before upload it to Ulearn. 6 March 2017 until 9 March 2017, start to do report for Chapter 1. For progress 1, I've started to do the designing the game world for the game. Progress 2, I've created the character design using Adobe Illustrator and start to do report Chapter 2. After the mid semester break, I've start to develop the game and deliver report chapter 2. For the progress 4, I've continue to develop the game and start the report chapter 3. Last progress, I need to fix the bugs in the game and deliver report chapter 3. I've also start to do the chapter 4 report.

3.2 Conclusion

As the conclusion, analysis is the important process in order to defining what the system will be when it is done. The next activities to be developed are about the user interface design and the flow board.

CHAPTER IV

DESIGN

4.1 Introduction

In this chapter, the overflow of the project will be explained in detail. The aspects that will be discussed on this project are focus on game design, game architecture, and game art. In game architecture, there will provide the big picture that explain all the architecture flow in the game. It is also will provide the flow board where it shows the flow in the game.
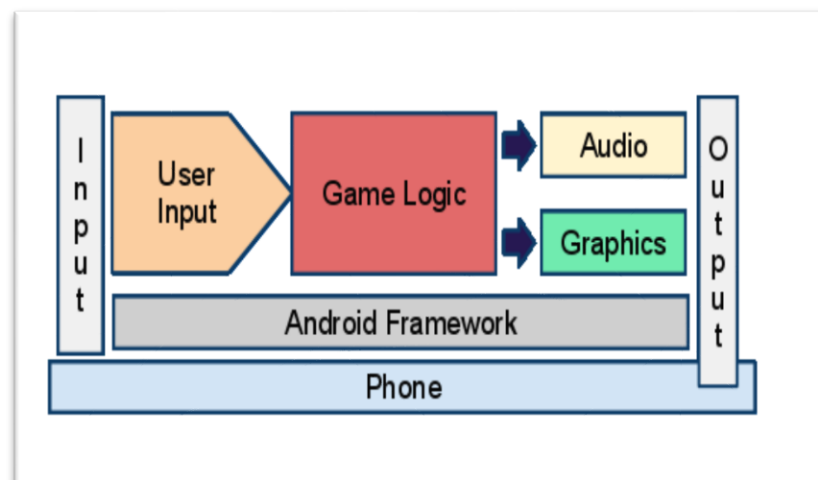
4.2 Game Architecture

Figure 4.0 Game architecture. Adaptation from Google

In game architecture, the programming will be produced in the game engine part. The input device for this game is touch input. For the programming part, need to write the codes that can control using touch input. After that, the game logic contains physics engine to produce a better game. It is used for make the rigid body for each asset in this game. The game mechanics run the function of. Next, the game output with audio and graphics is presented. The audio is divided to two categories which are sound effect and music background. For the sound effect, it will be played when the player managed to collect points and maps.

4.3 Preliminary Design

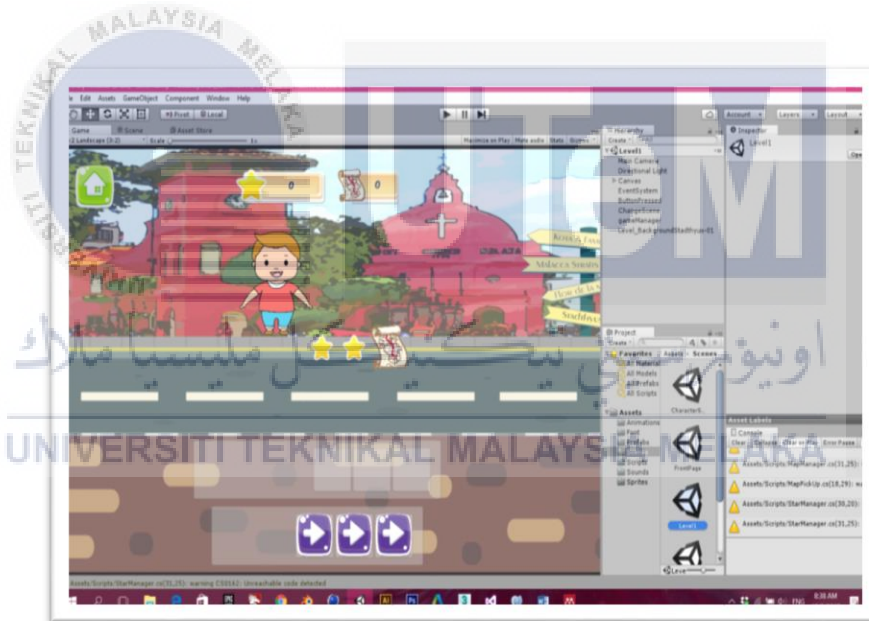Preliminary design is the initial design of the Code Ville game development.
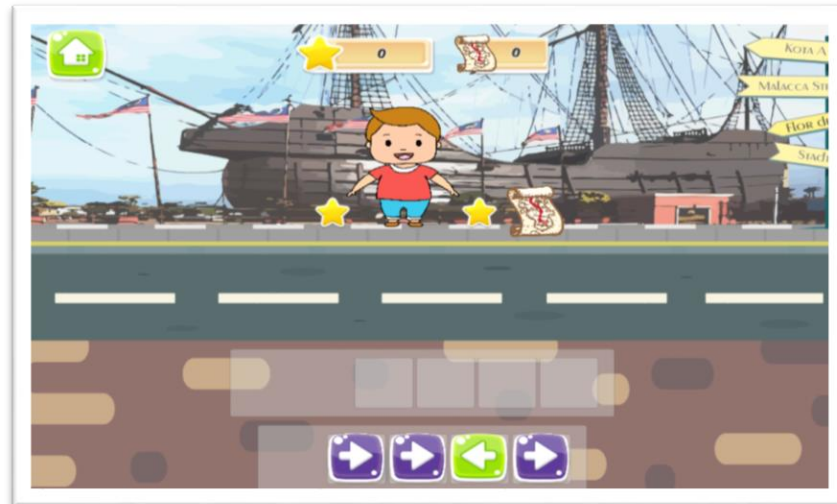

Figure 4.1: Preliminary Design of Level 1

Figure 4.2: Preliminary Design of Level 2

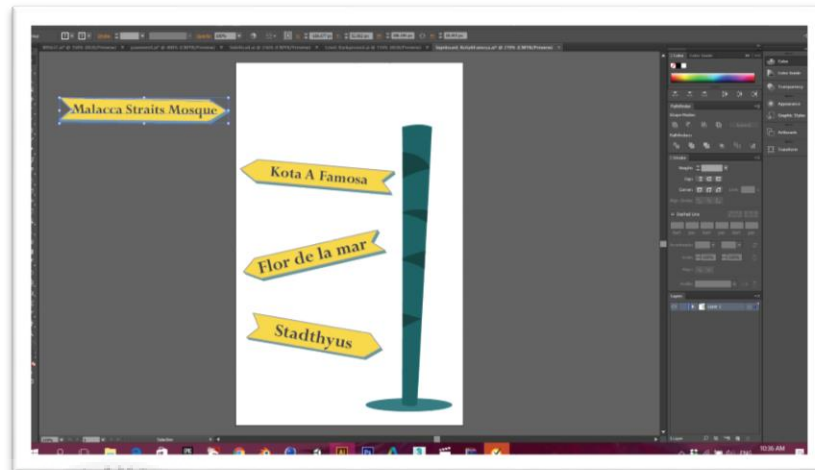**4.3.1 Storyboard**
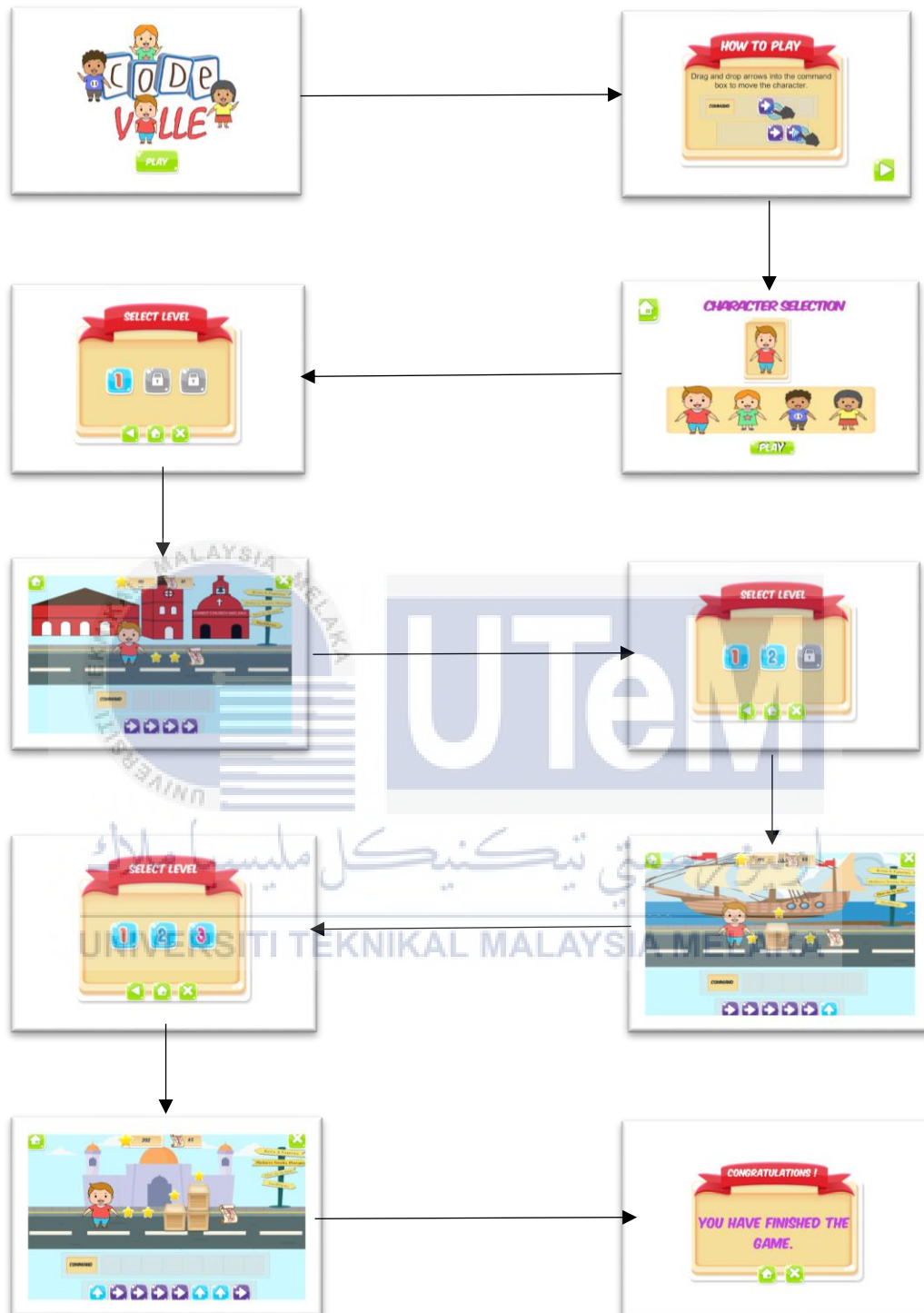
4.4 Game Art

In this game, the game art can divide into few sections which are game background, game assets and menu.

4.3: Signboard design using Adobe Illustrator 6
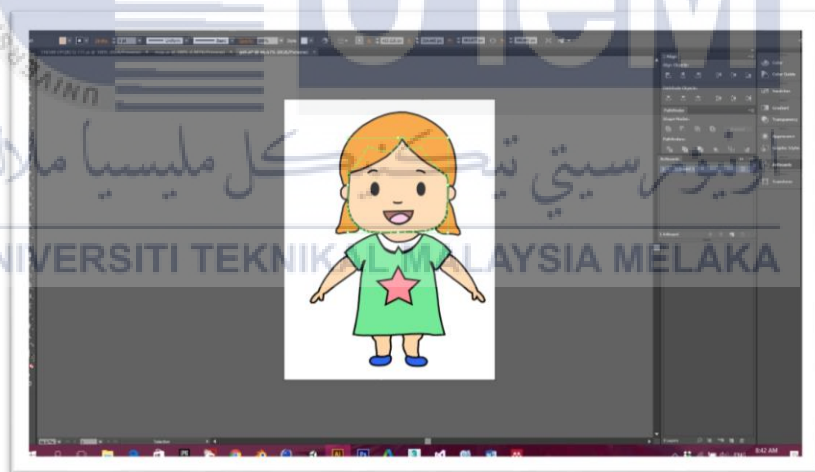
4.4: Character design using Adobe Illustrator 6

4.4.1 Game World

For the game world, the environment is in Malacca. The background image used in the game are the famous buildings in Malacca.

4.4.2 Character Design

In this project, the character design is the same but different skin tone, hair colour and type, and the character's attire.
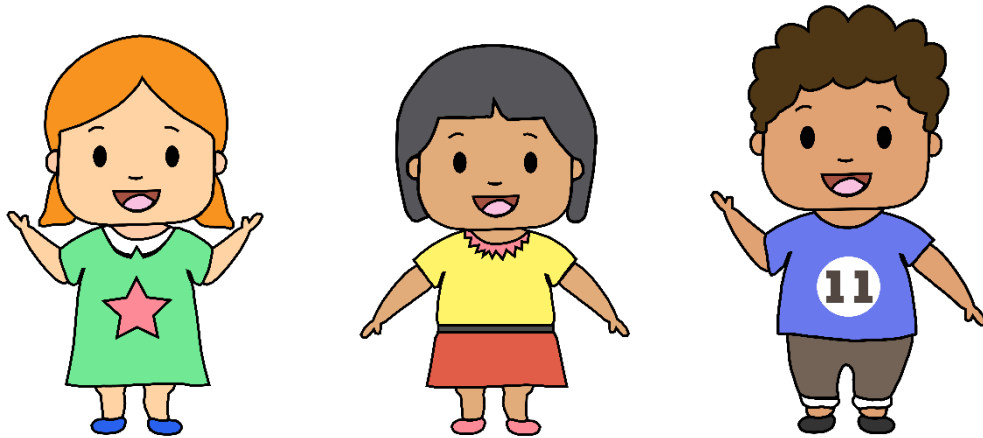
Figure 4.5: Characters in the game

4.4.3 Camera Model

This project using single screen camera model because it is a 2D game.

4.4.4 Audio / Sound Effect

For this project, the audio divided into three section; music background, intro music and sound effect.

Figure 4.6: Audio in the Code Ville game

4.5 Conclusion

Design is the important phase of developing a game. This is because the design will be used as a guideline to develop the game based on the idea proposed to understand the concept of the game. From the graphic, animation and audio used are the rough idea of the game before it can be used in the game.

CHAPTER V

IMPLEMENTATION

5.1 Introduction

This chapter will be elaborate more about the implementation of the development of the game prototype. Implementation is a process where the game is developed in game engine and produced a final product for users. This phase combines the multimedia elements such as graphics, audio and animation to make the game more interesting. Lastly, this chapter will explain in details about the result of this project.

5.2 Media Creation

The multimedia elements is involved for the user interface and the character of the game. This media creation can help the production of game prototype more enjoyable, interactive and playable.

5.2.1 Production of Graphics

The graphics for this game have been developed using Adobe Illustrator. This is because Adobe Illustrator use a vector file format. Vector graphics have a small file size but able to scale the image without loss of the quality as in game the graphics can be scale with screen size. Vector graphics produce a sharp and clear image also can easily interpreted. All the graphics used in this game are 2D graphics. The background images used in this project are the famous buildings in Malacca. In each level has a different background image. The characters used in this game are played as a tourist that need to collect the map to make tour around Malacca.

The colour used in the production of graphics are colourful and bright because the target audience for this project are children. Most pre-schoolers want to discover and interact with applications rapidly, but they do not have a specific task in mind. Therefore, the design of the graphics is interesting and exploratory, but organized and focused. The colour used for the command arrows in the game represents the different commands. The colour makes the player easier to visually differentiate the function of the commands. Besides, the player can recognise objects quickly when the object is coloured differently.

Figure 5.0: Creating A button

5.3 Unity3D Game Engine

Unity3D game engine is the game engine used to develop this project. Unity3D is a cross-platform 3D engine and user friendly development where it is easy to learn for beginner and it can be powerful for the expert. Canvas in Unity3D is an element represents the intangible space where UI is placed and rendered.
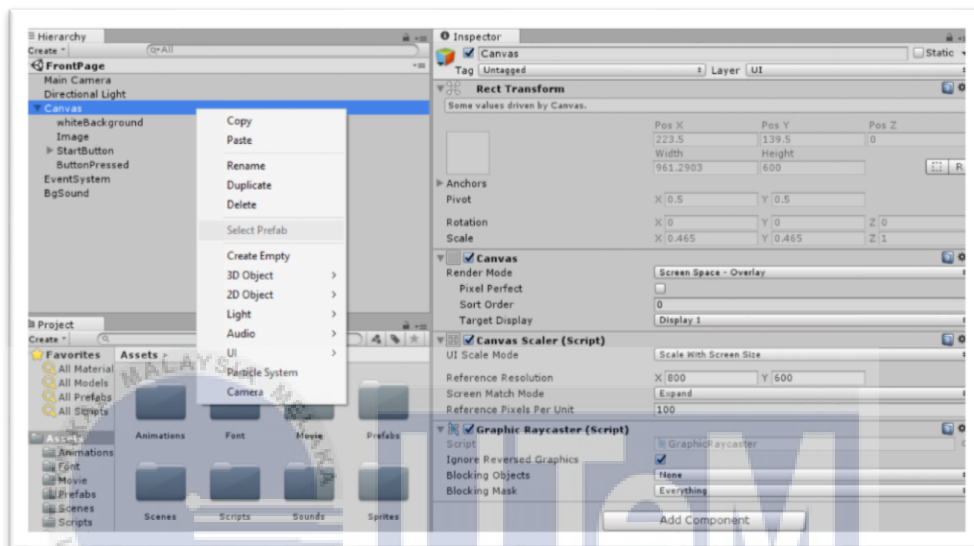

Figure 5.1: Canvas in Unity3D Game Engine

5.3.1 Animation

The animations in the game have been created using Unity3D game engine. The animation is important in the game because it can attract audience to enjoy playing the game. The animation in this game is used for buttons and the character selection.

The movement of the animation can be controlled using key frame in Animation window. There are four interactables to trigger the animation of the button which are normal trigger, highlighted trigger, pressed trigger and disabled trigger. Animation in Unity3D game engine also supports enumerators which the animation can loop through all animation states.
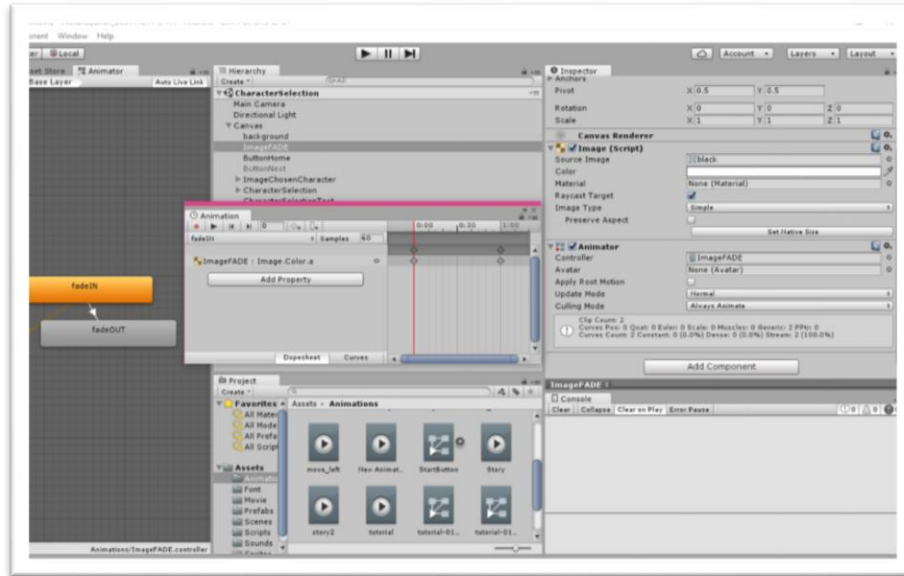
Figure 5.2: Animation window in Unity3D

5.3.2 Scene

Scene is important in the development of this game. Scene is where the level of the game is developed. Each scene is this game is unique. This game contains ten scenes which are level, main menu and instruction of the game. Each scene has their number at built setting, so that it is easier to code for changing scene. Scenes can be built in many platforms such as Android, iOS and PC. This game is built for Android platform.
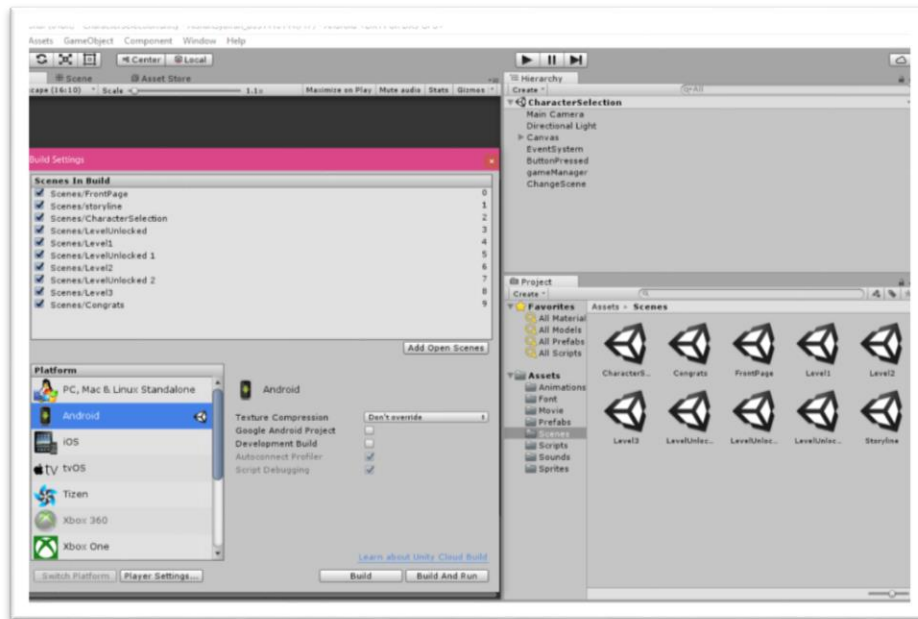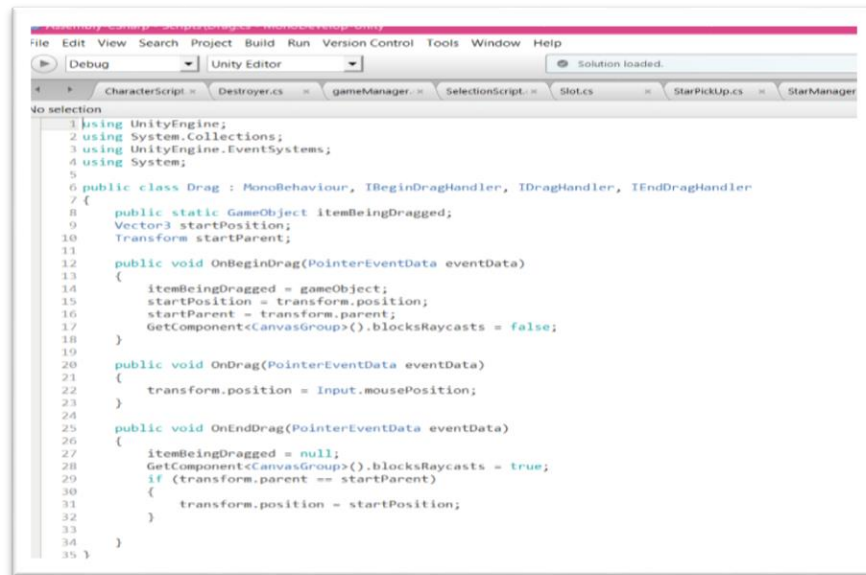
Figure 5.3: Scenes in Unity3D

5.3.3 Scripts

Scripting is essential in all games. Scripts is needed to give action to the input from player and arranging the events in the gameplay to occur when they should. The scripts involved for scoring system, changing scenes, playing sound effects, moving the character and character selection. The script is written in external script editor monodevelop using assembly-CSharp language.

Figure 5.4: Dragging game object

Figure 5.5: Playing sound effects when button is clicked

5.3.4 Audio

The audio is one of the essential element in games. The audio used in this game are sound effects and background music. Sound effects give feedback to the player when player has done something. Effective sound can bring more fun and entertaining. Audio also can make player immerse with the game world. The sound effect in this game played when player able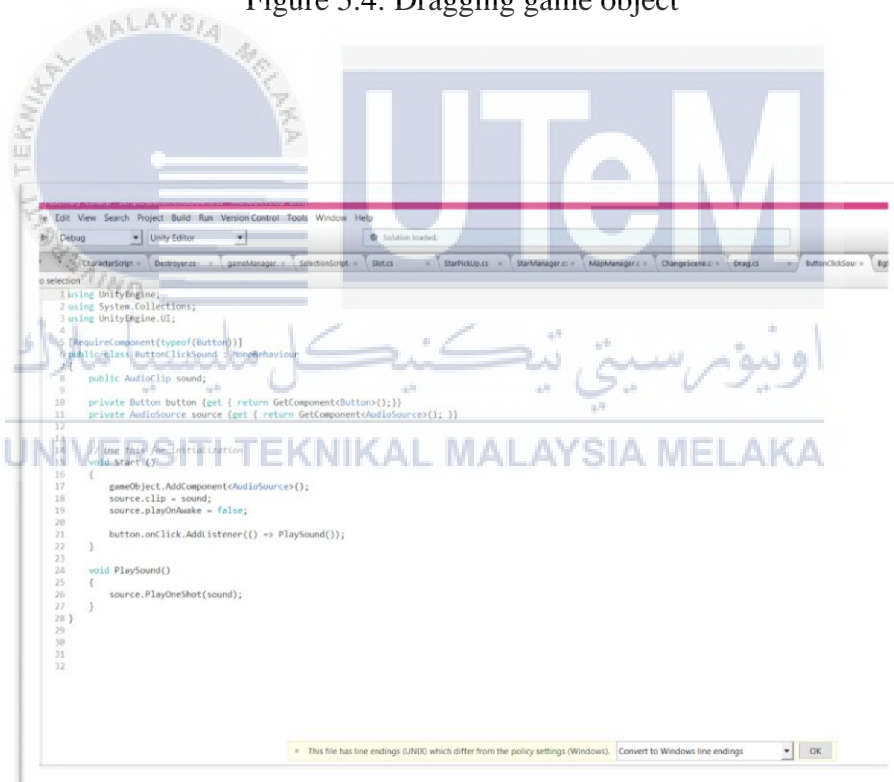 to collect stars and map and when player clicked on button. The background music used in this game is played when player open the game and the music keep looping. The audio file format used in this game are *mp3 and *wav. The audio used in this project is royalty free audio source from YouTube.com and SoundBible.com. The audio sources were imported into the Unity3D game engine are shown as below:

a) Background music: Happy Music for Kids – Playground music for kids (mp3)

b) Sound effects:
    i.   Clicking button: Tiny Button Push (mp3)
    ii. Stars and Map collected: 264981_renatalmar_sfx-magic (wav)
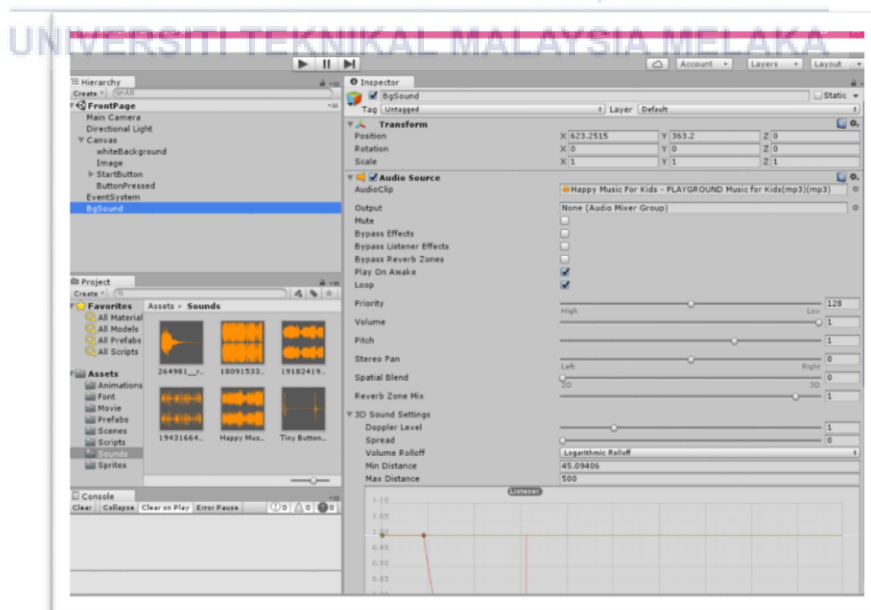
Figure 5.6: Background music used in the game

5.4 Product Configuration Management

Product configuration management in game development is essential because it is the process to establish and maintaining the performance and the functionality of the game. This project has undergone several product configuration management to tested the performance as planned and is recognized and documented in details to support its expected life cycle. Hence, this part will explain in details about the game engine used to develop this game, plug in libraries and others.

5.5 Implementation Setup

This is the duration that needed to implement the design, development, and testing to finish the game prototype.

Table 5.4 Project duration

	Description	Duration to complete	Status
Design	The design of game environment and character	3 weeks	On time
Development	Process of the development of the game	3 months	On time
Testing	Testing the prototype of the game	2 weeks	On time

5.6 Conclusion

This chapter is elaborate about the details that been used to develop the game prototype. This phase involves the development of the game prototype in Unity3D game engine where the media elements and scripts were combined to produce the game prototype.

CHAPTER VI

TESTING

6.1 Introduction

This testing chapter will elaborate about testing process. Testing is final phase that involves in developing this game prototype. The game is tested with the target audience and the target audience that has been chosen are children in Kampung Ulu Gali, Raub.

6.2 Test Plan

Planning the testing phase which includes test user and test environment.

6.2.1 Test User

a) Target Audience

This group of target audience is tested to test the effectiveness of this application whether it is suitable or not. These tester results are important because they are the target audience for this game prototype.

b) Expert

This group is one of the main parts of this game development process. This phase is using them to test the functionality of the game prototype whether it is suitable or not to learn programming. This group is declared as an expert because of their experience in developing game.

6.2.2 Test Environment

Test environment for this game prototype testing is where a location has been chosen to test the effectiveness and usability of the game prototype. Besides, the hardware and software configuration and the preparation prior to testing phase are defined. The hardware required for the testing is Oppo R9s with Android version 6.0.1.
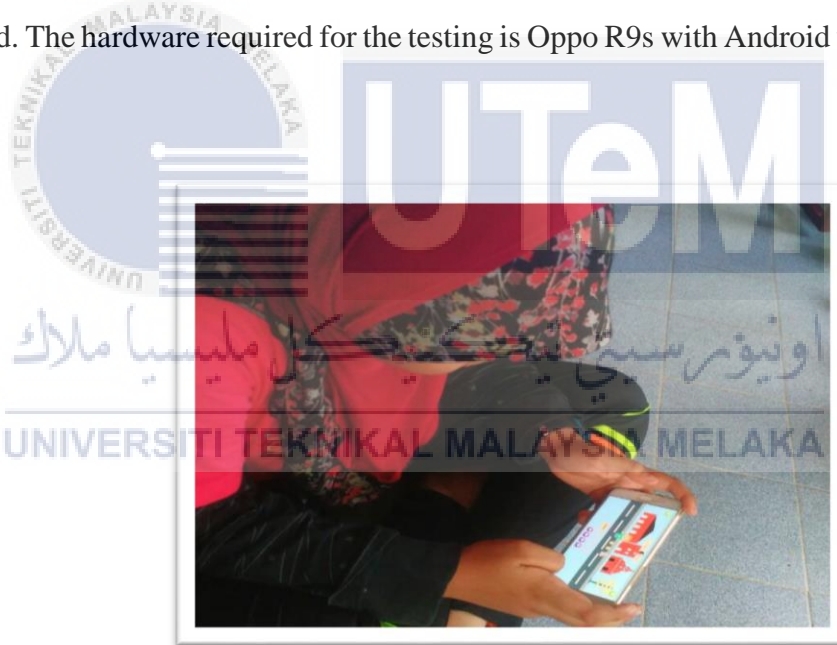
Figure 6.1: Testing the game prototype

Figure 6.2: Testing the game prototype

6.3 Test Design

Test design is to evaluate the effectiveness of the game and the usability of the game can help in learning basic programming concept. There are two questionnaires that used in this game. One for target audience and the other one for expert. The questionnaires can be refer in Appendix A.

6.3.1 Effectiveness Test

The effectiveness test is the question from Section B of questionnaire. The target audience needs to play the game by arranging the command for the character to move. This is to test the logical thinking of the target audience to solve the puzzles.

6.3.2 Usability Test

Usability test is where the question from section C of questionnaire. The usability test is to find out the interaction between the target audience and the game. This testing is to test how player manage to play the game without asking for help.

6.4 Test Result and Analysis

The result and the analysis of the game testing is calculated.

6.4.1 Demography
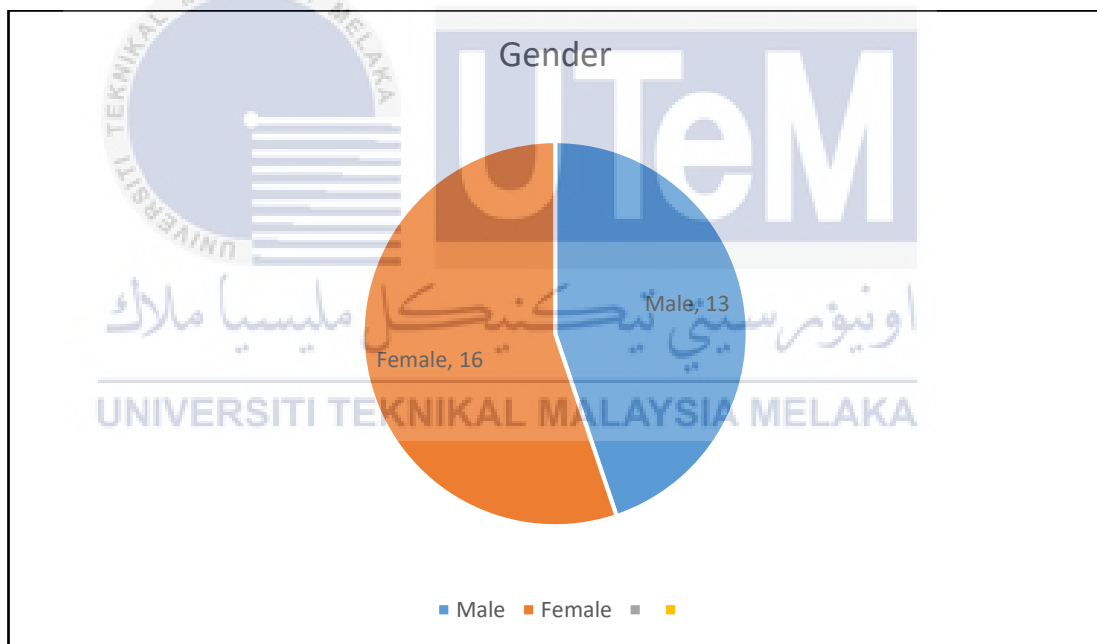
Figure 6.3: Gender of respondent

Based on the pie chart above, there are 30 respondents are tested for this project. 16 respondents are female while other 13 respondents are male.
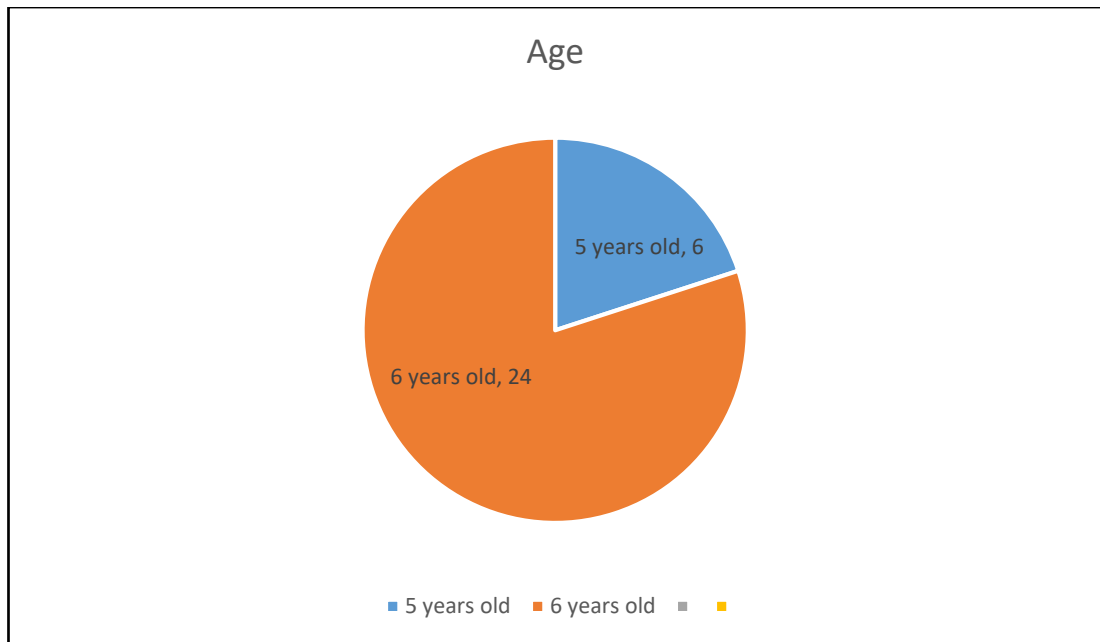
Figure 6.4: Age of respondents

The pie chart above shows that there are 24 of the respondents are 6 years old and 6 of the respondents are 5 years old.

Playing mobile games

yes, 30

■ yes ■ no ■ ■
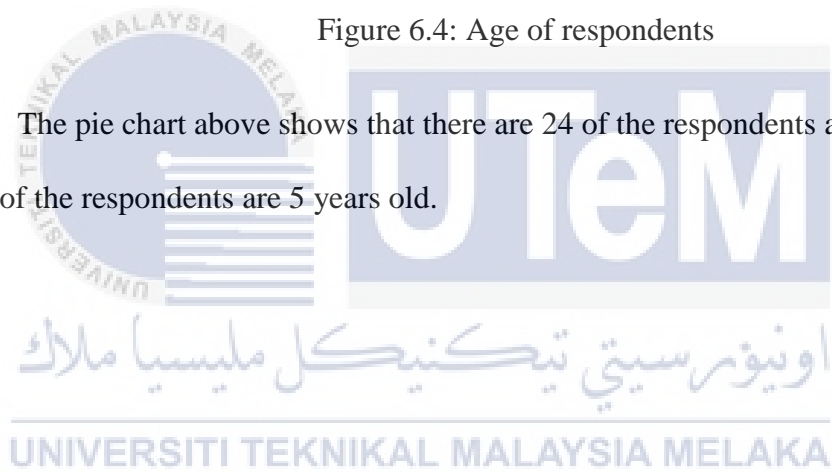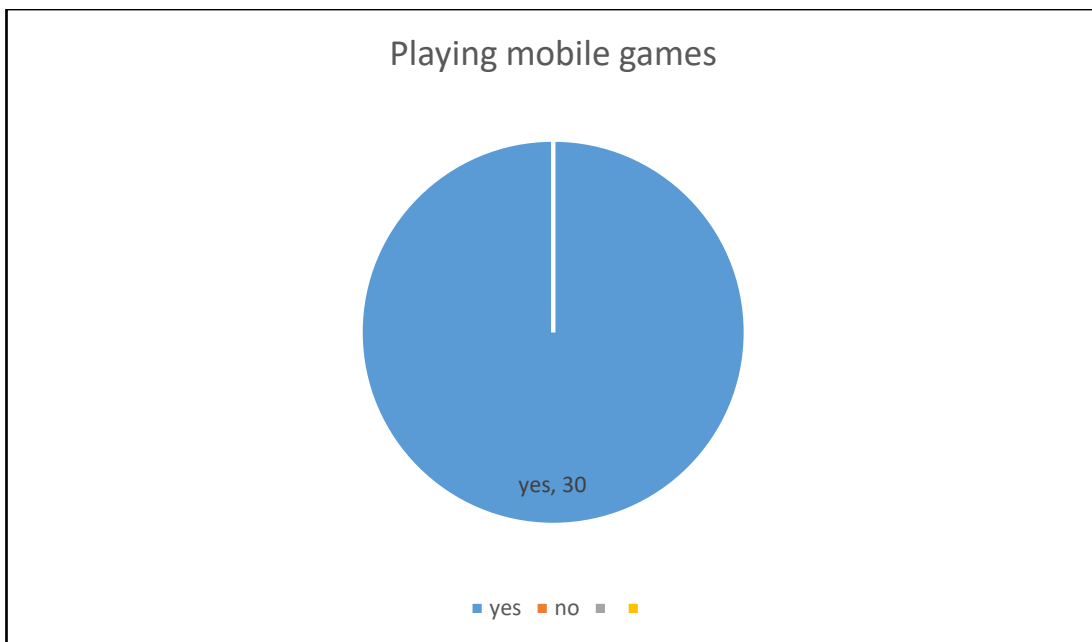
Figure 6.5: Respondents that playing mobile games

The pie chart shows that all the respondents are playing mobile games.
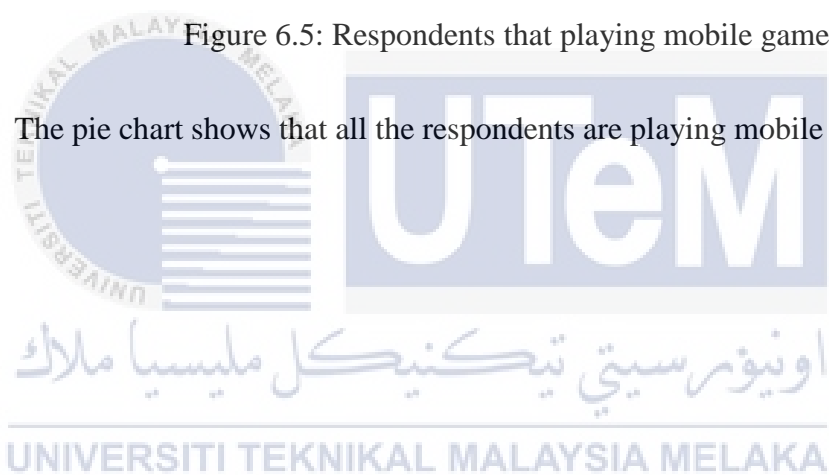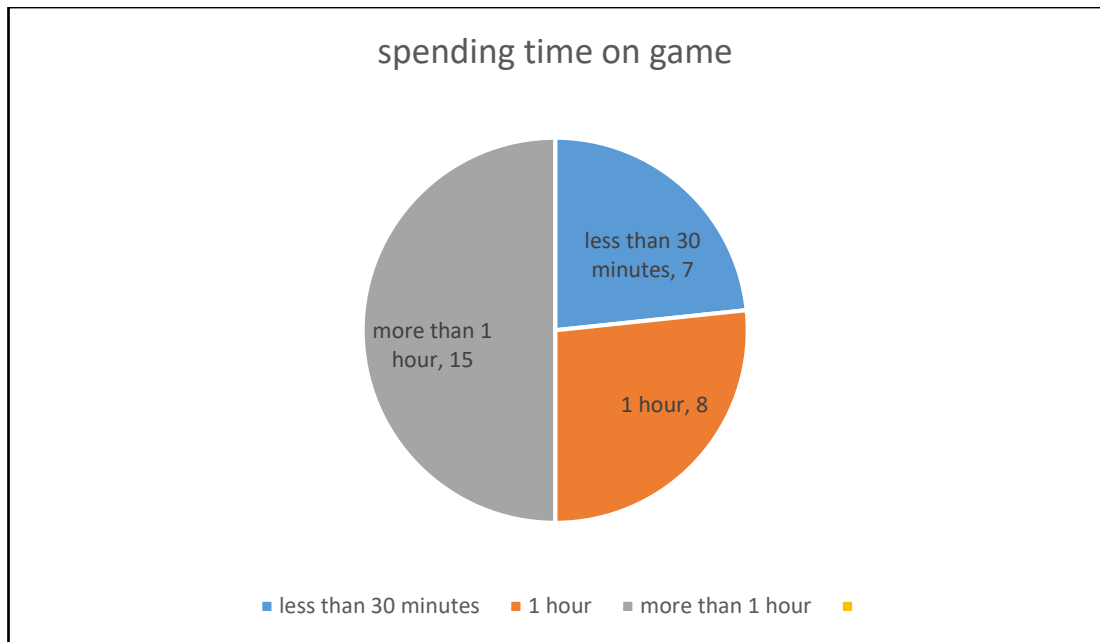
Figure 6.6: Respondents spending time on games

The figure above shows that the number of respondents spending time on games. Half of the respondents are spending more than 1 hour on games. 7 of the respondents spend less than 30 minutes on games while 8 of the respondents spend 1 hour on games.

Figure 6.7: Respondents know programming language

Figure 6.7 shows that all of the respondent did not know programming language.
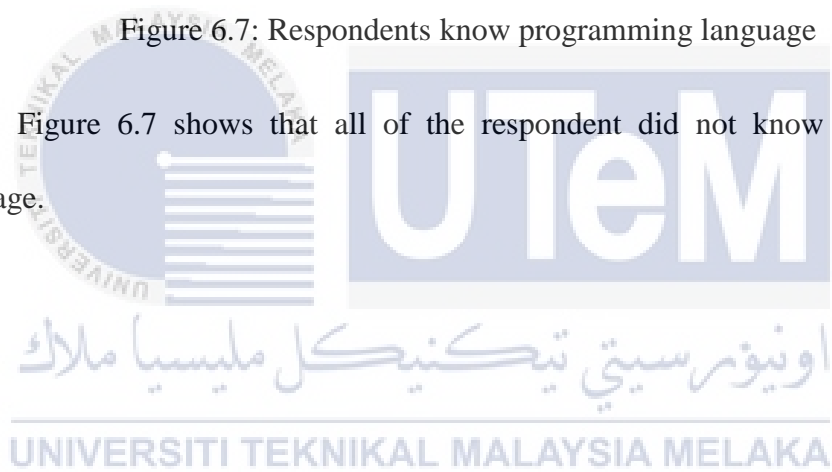
6.4.2 Effectiveness Test (Target Audience)
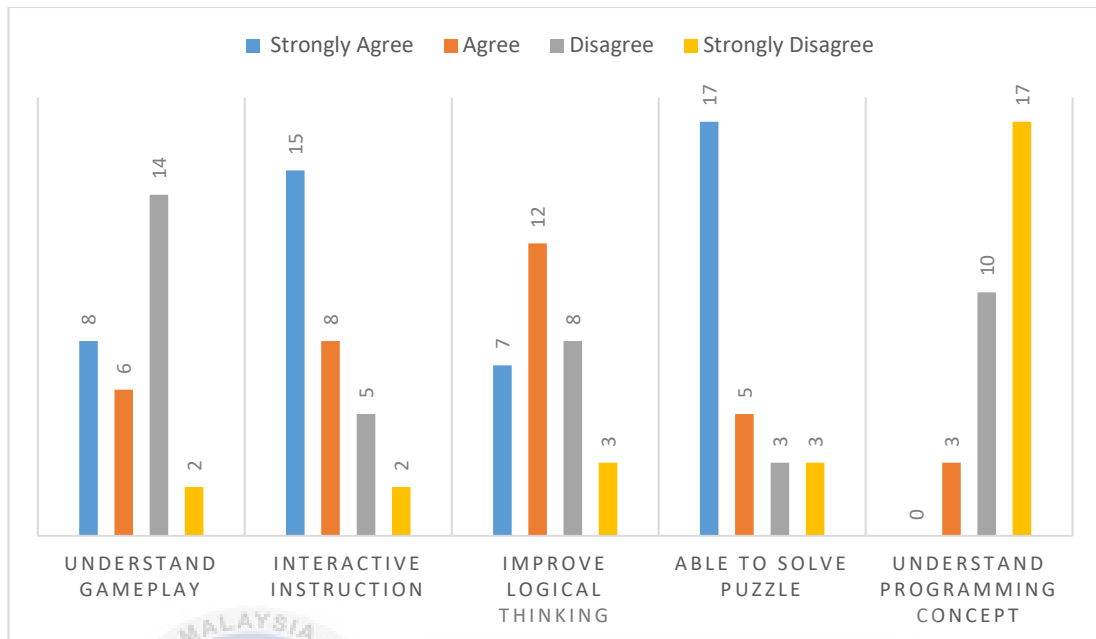
Figure 6.8: Show the effectiveness test of the target audience

Figure 6.8 shows the number of player that has been tested. From this result, 14 players were disagreed that they are understand the gameplay of the game while 2 players are not understood the gameplay as they are needed someone to assist them. 15 players were strongly agreed that they need an interactive instruction on how to play the game because they take time to read the instruction before play the game. 12 of the player agreed that this game helps to improve their logical thinking as they need to arrange the command to move the character. More than half of the player able to solve the puzzle as they managed to finished the game. 17 of the player strongly disagreed that they understand the programming concept because most of them did not exposed to the programming language.

6.4.3 Usability Test (Target Audience)
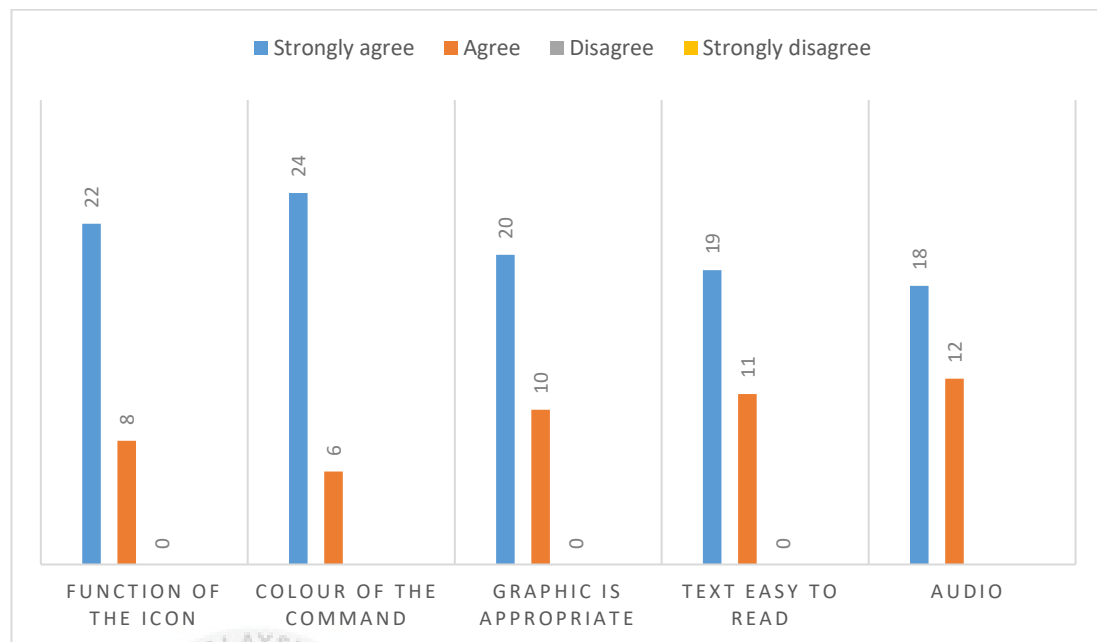
Figure 6.9: Shows the usability test of the target audience

Figure 6.9 shows the usability test that has been done to the target audience. This test is to identify the advantages and disadvantages of the game. Most of the player strongly agreed that they know the function of the icon as they know how to going back to the home screen and exit the game. 24 of them able to differentiate the action command based on the colour of the icon. Most of the player said that they are strongly agree with graphic used in the game because they are colourful. 19 of the player said that they are strongly agree that the text is easy to read because the colour is contrast. Most of the player strongly agree that audio used is suitable for the game. They feel the accomplishment when the sound effect of the stars and maps collect were played.

6.4.4 Expert Test
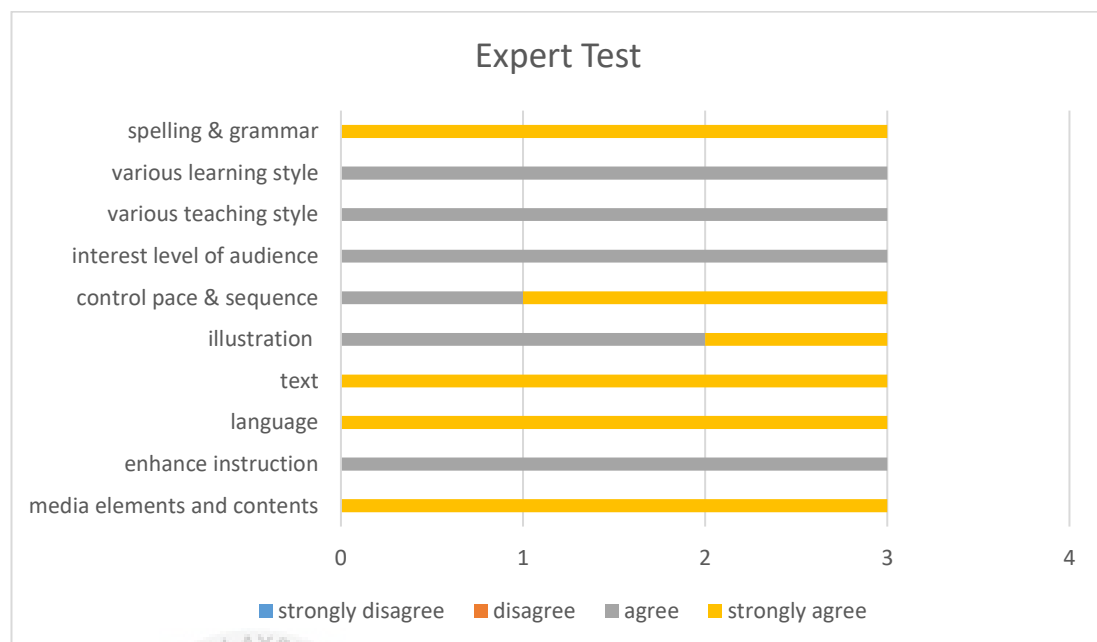
Figure 6.10: Expert data test

Based on figure 6.10, there are 3 experts were tested the game. 3 of the experts are strongly agree that media elements and content that used in this game are suitable for the target audience. 3 of the experts agree that the game can enhance instruction. All of the experts strongly agree that the text used are clear and suitable for audience. All of the experts are strongly agree that the language used is age appropriate for the audience. 2 experts agree that illustration and examples are suitable for audience while the other 1 expert strongly agree. 1 of the experts agree that audience can control pace and the sequence of the game while the other 2 experts are strongly agreed. All of the experts agree that this game is matches interest level of audience. All of the experts agree that this game can make instruction addresses various teaching and learning styles. All of the expert are strongly agree that the spelling, punctuation and grammar are correct.

6.5 Conclusion

The results shows some weaknesses of the game. The effectiveness test of the game shows that the game prototype is not effective enough. This is due to the environment and target audience used to test the game are not suitable. All the weaknesses of the game prototype will be considered to improve the game.

CHAPTER VII

CONCLUSION

7.1 Introduction

In this chapter, the weakness and the strength of the game prototype will be discussed in details.

7.2 Observation on weaknesses and strength

From the analysis data in chapter 6, the weakness and the strength of the game prototype can be seen clearly. This weaknesses and strength can be a guidance to enhance and improve the game prototype.

   a) Project weaknesses
- The character of the game is static.
- Does not have various challenges.
- The instruction of the game not suitable for the audience.

b) Project strengths

- The interface design is suitable for the target audience.

- The audio used bring the excitement to the player.

- The colour for the graphic is cheerful.

- The game is convenience to play as it is a mobile application.

7.3 Preposition for improvement

These strength and weaknesses can be used as a guideline to improve the game. There are some ways to enhance the game:

- Player should arrange the command first, then the character will move by follow the command.

- The tutorial of the game should have the demonstration on how to play the game instead of written instruction.

- The character should have animation to make the game more interesting.

- The challenges should be varied in each level such as adding obstacles.

7.4 Contribution

This game is developed to enhance logical thinking skills in programming language as now programming language has been introduced in school. Besides, they also can learn to solve the puzzles in interesting way.

7.5 Limitation

There are several limitations in this game has been recognised. The environment and the target audience used to test the game are not suitable for the target audience. This is because the language used in the game is in English while the target audience tested were studying in kindergarten that used Bahasa Malaysia as communication language. The audience cannot understand the instruction given in the game because it is in English. Besides, the question asked to the target audience is too high that they cannot understand.

7.6 Conclusion

In conclusion, this game prototype has been developed from scratch until it is finished. The CodeVille is a game that can help children to think logically and able to solve problem. The weaknesses of this game will be used as a guidance to enhance the game.

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APPENDIX A

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FACULTY OF INFORMATION COMMUNICATION
TECHNOLOGY
(FICT)

Checklist for Multimedia Expert

Instruction: For each statement below, please tick (√) with the following items.

[1] = Strongly Disagree **[2]** = Disagree **[3]** Agree **[4]** = Strongly Agree

ITEM		SCALE				
		1	2	3	4	5
1.	Graphics, media elements and content are suitable for audience					
2.	Graphics and media elements enhance instruction					
3.	Language is age appropriate					
4.	Text is clear and suitable for audience					
5.	Examples and illustrations are suitable for audience					
6.	User can control pace and sequence					
7.	Courseware matches interest level of audience					
8.	Instruction addresses various teaching styles					
9.	Instruction addresses various learning styles					
10.	Spelling, punctuation and grammar are correct					

Signed by:

……………………………….

(   )

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FACULTY OF INFORMATION COMMUNICATION TECHNOLOGY
(FICT)

QUESTIONNAIRE (Target Audience)

DEVELOPMENT OF SCRATCH PROGRAMMING GAME IN MOBILE APPLICATION

Please tick (√) in the space provided.

Section A

1. Gender

   [　] Male
   [　] Female

2. Age

   [　] 5
   [　] 6

3. Have you play mobile game?

   [　] Yes
   [　] No

4. How long you spend time per day for game?

   [　] Less than 30 minutes
   [　] 1 hour
   [　] More than 1 hour

5. Do you know programming language?

   [　] Yes
   [　] No

Section B

This section contains a few questions to answer. Please circle the number that is closest to your opinions. All categories must to be refers in the schedule below:

Score	Point
4	Strongly Agree
3	
2	⬆
1	Strongly Disagree

User Experience

No	User Experience	Score			
1.	I need time to understand the gameplay of the game	1	2	3	4
2.	I need more interactive instruction to play the game	1	2	3	4
3.	Improve my logical thinking when arrange the command	1	2	3	4
4.	I can solve the puzzle easily	1	2	3	4
5.	Help my understanding in programming concept	1	2	3	4

Section C

This section contains a few questions to answer. Please circle the number that is closest to your opinions. All categories must to be refers in the schedule below:

Score	Point
4	Strongly Agree
3	
2	⬆
1	Strongly Disagree

Usability

No	Usability	Score			
1.	I know the function of the icons in the game	1	2	3	4
2.	The colour used for command object can differentiate the action	1	2	3	4
3.	Graphic used is appropriate for my age	1	2	3	4
4.	The text used is easy to read	1	2	3	4
5.	Audio used is suitable for the game	1	2	3	4

APPENDIX B

Certificate Of Excellence

is hereby granted to

AISHAH SYAIRAH BINTI ABDUL SUKOR

as

1st Runner Up

Category: BITE (Best Product)

for outstanding performance in
**FTMK Final Year Project Showcase 2017
24 May 2017**

Fakulti Teknologi Maklumat dan Komunikasi
Universiti Teknikal Malaysia Melaka

Profesor Dr. Burairah Bin Hussin
Dekan
Fakulti Teknologi Maklumat dan Komunikasi
Universiti Teknikal Malaysia Melaka

Certificate Of Excellence

is herby granted to

AISHAH SYAIRAH BINTI ABDUL SUKOR
B031410144

as

Finalist
Category: BITE (Best Product)

for outstanding performance in
FTMK Final Year Project Showcase 2017
24 May 2017

Fakulti Teknologi Maklumat dan Komunikasi
Universiti Teknikal Malaysia Melaka

Profesor Dr. Burairah Bin Hussin
Dekan
Fakulti Teknologi Maklumat dan Komunikasi
Universiti Teknikal Malaysia Melaka

e-Learning Carnival 2017
Universiti Teknikal Malaysia Melaka

# Designing of Scratch Programming Game in Mobile Application To Improve Logical Thinking Skills

Dr. SIti Nurul Mahfuzah binti Mohamad, Aishah Syairah binti Abdul Sukor

ABSTRACT

This game is developed to give an early exposure to young children for learning programming using scratch programming game. the genre of the game is puzzle game. This game can be played for those who have no experience in programming and is all ages friendly but the target audience are young children age 4-6 year old. Children can have fun and learn real programming logic through game. By ordering a set of command such as turn left, turn right and stright forward, player will be able to solve different challenging puzzle. The character will act based on the commands given. Objectives of the games are to study programming through this game, to test the effectiveness of logical thinking in programming language through this game.
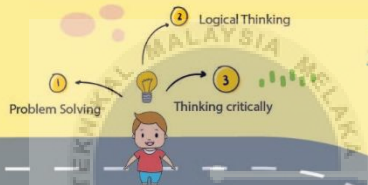
RELATED WORKS

The game does not require reading skills but it provides with visual hints to the player. Different types of instructions are introduced to the player as the level progress. Each level allows player to solve different puzzles.
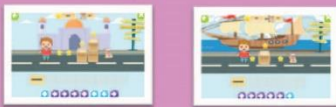
MATERIALS AND METHODS

The methodology that uses for this project is Game Development Life Cycle (GDLC) model. GDLC is an approach how to handle a game development project. This model will guide through needed steps to develop a game and minimize the risk.
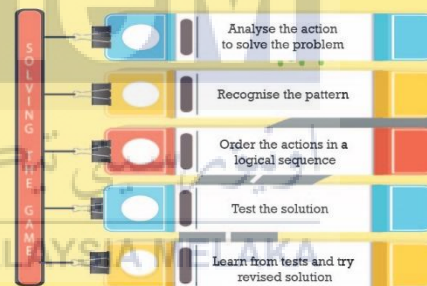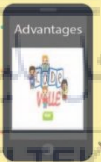
1 Problem Solving
2 Logical Thinking
3 Thinking critically

Phase of GDLC

Initiation — Pre Production — Production — Alpha Testing — Beta Testing — Release

Introduce children to programming as a tool that allows children to explore ideas.

Kids learn to program by solving a series of puzzle challenges using a visual coding language.

Early exposure of children to ICT inside and outside school.

Advantages

SOLVING THE GAME

- Analyse the action to solve the problem
- Recognise the pattern
- Order the actions in a logical sequence
- Test the solution
- Learn from tests and try revised solution

Comparison of the existing games and Code Ville

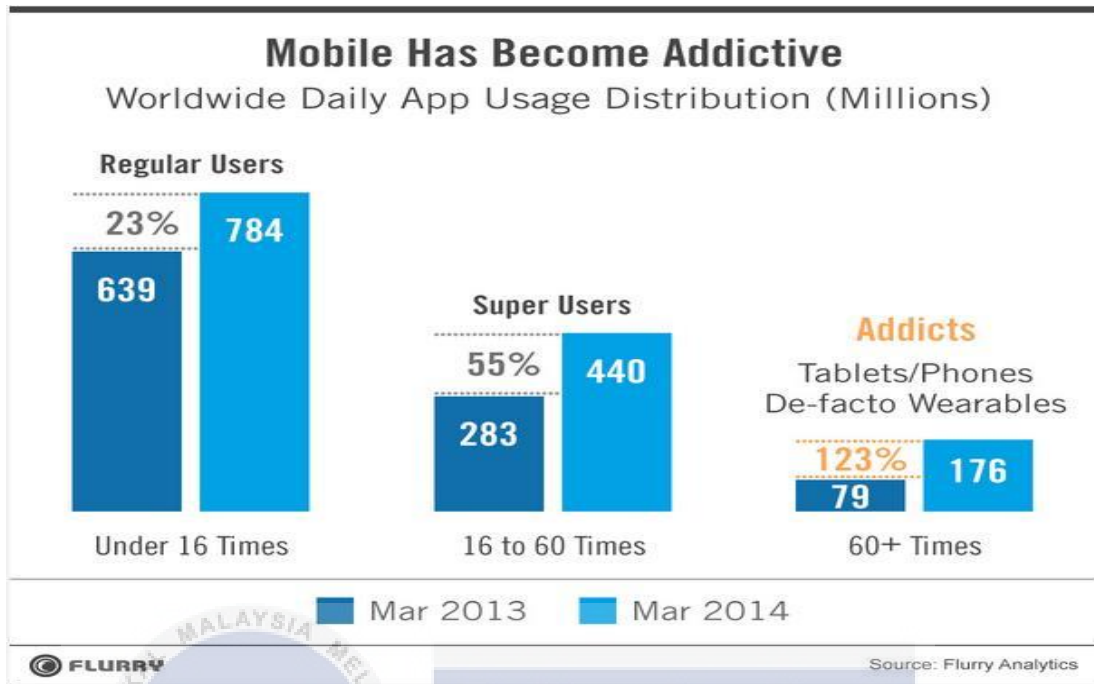|	The Foos codespark	Lightbot	CodeVille
Screenshots			
Platform	iPhone, iPod Touch, iPad, Android, Chromebook, Fire phone, Kindle Fire, Windows Phone	iPhone, iPod Touch, iPad, Android	Android
Genre	Action puzzle	Puzzle	Puzzle
Feature	Thinking & Reasoning: logic, strategy, thinking critically	Thinking & Reasoning: logic, problem solving, strategy, thinking critically	Thinking & Reasoning: logic, problem solving
Target Audience	Kids 4-9	Kids 4-8	Kids 4-6
Scratch elements/ programming concepts	Pattern recognition, sequencing, debugging, loops and conditionals.	Basics, procedures/functions, loop.	Basics, functions.

MARKET POTENTIAL

Will be released on Android Google Play.

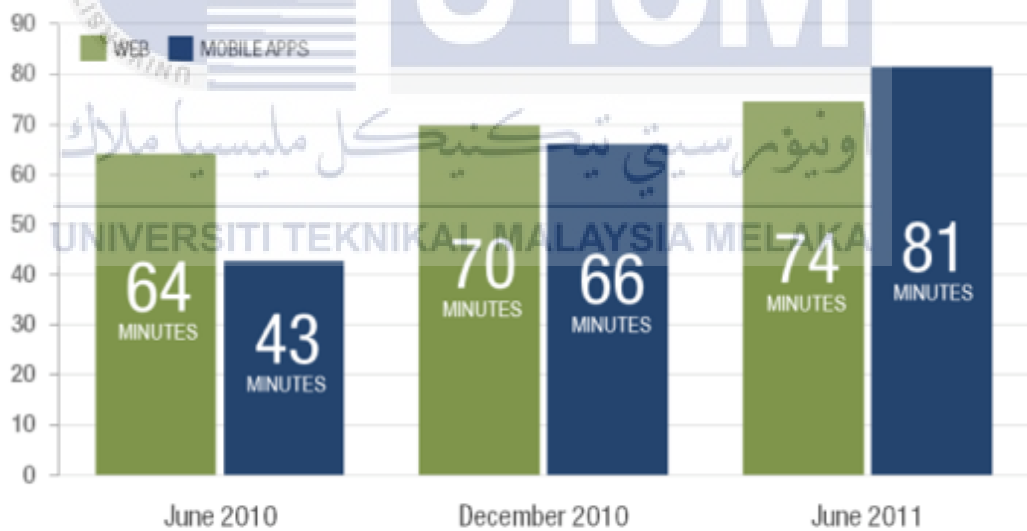Learning mobile application that is suitable for beginner in learning programming language

ACHIEVEMENTS

FTMK Final Year Project Showcase 2017
Finalist Category: BITE (Best Product)
1st Runner Up Category: BITE (Best Product)

Mobile Has Become Addictive
Worldwide Daily App Usage Distribution (Millions)

Regular Users
23% 784
639

Super Users
55% 440
283

Addicts
Tablets/Phones
De-facto Wearables
123% 176
79

Under 16 Times   16 to 60 Times   60+ Times

Mar 2013   Mar 2014

FLURRY   Source: Flurry Analytics

U.S. Mobile Apps vs. Web Consumption, Minutes per Day

WEB   MOBILE APPS

64 MINUTES   43 MINUTES   70 MINUTES   66 MINUTES   74 MINUTES   81 MINUTES

June 2010   December 2010   June 2011

FLURRY   Sources: comScore, Alexa, Flurry Analytics

Mobile Apps vs. Mobile Websites

Net Benefits of Mobile Apps vs. Mobile Website: 85%

More Convenient	55%
Faster	48%
Easier to browse	40%
Better user experience	28%
Easier to check bank account	27%
Easier to shop	26%
None of these	3%
I have no preference	11%
I prefer mobile websites	1%