



Mobile Game using Hand Gesture

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ABSTRACT

In the modern age, human-computer interaction has become an important part of our lives. Most of the people uses mouse, keyboard or pen to interact with computers, but it will not adequate for them. A mobile game, which named as *Flying Wau* was developed to make the interaction between computer and human as natural as the interaction between humans. Player need to control the movement of Wau by using hand gesture. Extreme programming is selected as the game methodology. After the requirements were gathered, a prototype has been developed and a field study was carried out for evaluating the usability of the prototype. According to the results of evaluation, most of the respondents are satisfied with the games. However, some gave feedback that it is too difficult to control the Wau. Therefore, it still needs some improvements on the character's movement control to make the game smoother and user friendly. It can be a reference model for developers and researchers in the area to develop similar games or enhancing the capabilities of similar games.

Key words: hand gestures, mobile game applications, Unity, Mano Motion.

1. INTRODUCTION

Game is an activity that someone engages in for amusement. People play games because it is fun. With the development of technology, the thrill and allure of playing games has increased with more visual creativity, stimulus and satisfaction. In 2007, mobile phones are released. Because of this, the mobile gaming technology had developed. It is booming with the arrival of mobile game applications. Physical and wireless internet games, including those on smartphones and social media, were worth \$5.9 billion in 2011, compared with \$2.03 billion on video game consoles and PC software in 2011 [1]. Besides that, playing games also bring many benefit to us. It helps to relieve your stress and reduce your depression. Gaming is not only beneficial to teenagers and adults, but to children as well. Parents realize that playing games can help children to improve their academic skills that specifically aimed at enhancing their cognitive and creative skills.

There are some amazing advances in technology have made the future of gaming become brighter. One of the advances is gesture control. Gesture is a movement of part of body,

especially hand to express an idea or meaning[2]. Gesture control will allows us to connect with their experience by using hand gestures. For example, we can pinch and spread to zoom in and out the screen, or flick to jump to the next screen and scroll extra fast.

The main goal of this project is to develop a mobile game that can play by using hand gestures. It is an endless runner mobile game that apply Malaysian traditional game, which is Wau. Wau is the main character of this game. It is one of the popular traditional games in Malaysia since hundreds of years ago. In this game, user take the role of wau that upon flying in the sky. As they fly, they need to dodge the obstacles. If it crashes on an obstacle, they will lose. User need to control the movement of the wau by using hand gesture.

2. BACKGROUND

In the modern age, human-computer interaction has become an important part of our lives. Most of the people uses keyboard, mouse or pen to interact with computers, but it will not enough for them. Hand held devices, like mobile phones which very small in size are very difficult to interact with them due to their determined input spaces and small touch screen or keyboard [3]. Besides that, users especially for those who have big hands, difficult fill in one hand if they are using a small size of phone. It will let them feel uncomfortable when playing games.

Project Significance

The significance of this mobile game is to make the interaction between computer and human as natural as the interaction between humans. The development and growth in contact with computing devices has increased rapidly lately. We could not stay alone with the impact of it as a human being, and it has become our key thing [3].

By developing the mobile game using hand gesture, it can help in speeding up the game development industry. The games industry will influence the economy indirectly since technological and service innovations developed for entertainment games are spilling over into other sectors and non-leisure applications .

Besides that, user can get new experience while playing this game, which control by hand gesture. Normally, people play

the mobile games by using touch screen. After they have played this games, they will feel amazing with it.

Since the new technology have developed, it will attract more new users to use and play this game. It can also let them feel interested to learn and understand more about our culture.

Objective

Following are the objective of this system:

- To identify the requirement for mobile games using hand gesture.
- To develop the prototype of mobile games using hand gesture.
- To evaluate the usability of mobile games using hand gesture.

Scope

This project will focus on developing a mobile games application that control by using hand gestures. This game application will focus on establishing an evolutionary model of technological change. The differential evolution model can improve the concept of the game from the previous gameplay experience. Only Android users are available to install this game application in their mobile phone.

3. METHODOLOGY OF THE STUDY

Game application development requires a systematic approach of methodology to produce a satisfying result. Extreme programming model (XP) is selected in this project as the most suitable methodology to complete the system. It allows people involved in the project to feel confident in the direction of project is taking and help to understand their personal feedback and insight is as necessary and welcome as anyone else. According to XP methodology, it can be classified into 5 phases which are planning, designing, coding, testing and listening. Figure 1 shows the phases in the XP methodology.

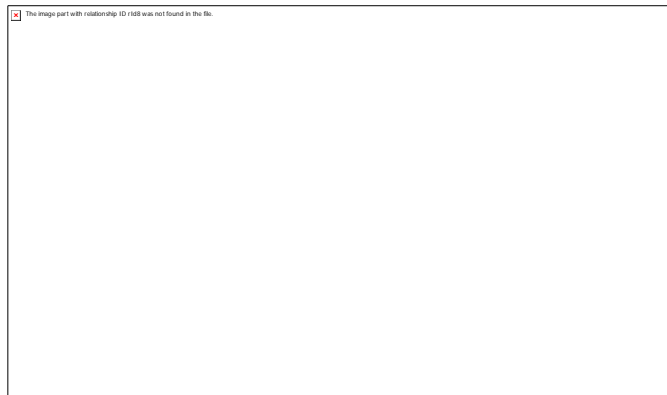


Figure 1: Extreme Programming Model

In planning phase, a meeting will be held with supervisor to discuss about all the necessary requirement on the game's value. Usually, it provided in short user stories, which define the functionality of the game, along with the business value and priority of each of those features. At the designing phase, the main features of the future code will be defined. Simplicity is one of the main principles of XP methodology[1]. Therefore, it must be start with the simplest design. The functionality might not be added too early. Developer refactor often to keep their code clear and concise. The code will be started to implement in the coding phase. It will be reviewed and allowed to add functionality, fix bugs or refactor. Besides that, developer is also allowed to simplify the code without affecting the functionality of the final product. Extreme programming methodology integrates the testing phase with the development phases, rather than at the end of the development phases. All the codes must pass through unit tests to eliminate the bugs. Otherwise, it cannot be released. Besides that, there is another key test, which is user acceptance tests, based on their specifications. While the acceptance test run at the completion of the coding, developer will provide the user with the results of the acceptance tests along with the demonstrations. Listening phase is to receive the feedback from user. Each of the feedback that specifies revised requirement will become the basis of a new design. If the user remains satisfied with the testing results, then the iteration will be end there. Otherwise, the design for new iteration will start, which again follow the design-coding-testing-listening cycle.

4. DESIGN AND DEVELOPMENT

In the section, it describes about the design and development of the mobile game, Flying Wau. The section will be divided into two sub-sections, which is (A) list of requirement of Flying Wau and (B) prototype development of Flying Wau.

A. List of requirement of Flying Wau

In order to develop the requirement of Flying Wau, two methods were implemented which are (1) discussion with supervisor and (2) analysing documents and apps from the Internet. Several meeting had held with supervisor to discuss about the requirement on the game's value.

In the secondary requirements gathering process, all the documents will be searched by using Google searching engine. Some mobile games will be installed and played by developers to explore the different kinds of games and the main functionalities which needed to add in the game. After that, all the documents will be gathered and analysed to develop the requirement of Flying Wau. According to Table 1 and 2, it lists five functional requirements and three non-functional requirements that generated from those process.

Table 1: Functional Requirement

Requirement ID	Requirement Description	Priority
FYW_1	Play Game	
FYW_1_1	Player can control the movement of Wau.	M
FYW_1_2	Player can dodge the obstacles.	M
FYW_2	View the high score	
FYW_2_1	Player can view the high score.	M
FYW_3	Change Wau's skin	
FYW_3_1	Player can choose the Wau's skin.	D
FYW_4	View Tutorial	
FYW_4_1	Player can view the tutorial.	M
FYW_5	Change Settings	
FYW_5_1	Player can play or mute the background music.	D
FYW_5_2	Player can play or mute the sound effect.	D
FYW_5_3	Player can view the information about system.	D

Once the requirements were developed, it will be visualized and modelled by using the Unified Modelling Language (UML). Those models which used in this part use case diagram, sequence diagram and class diagram. It was drawing by using StarUML. Figure 2 shows the use case diagram which represent the interaction between the use case and actors for the game. There are five major use cases, which are play game, view the high score, change Wau's skin, view tutorial and change settings. According to Figure 3, 4, 5, 6 and 7, it detailed out the flow on how each use case function. Based on Figure 8, it shows the attributes and operations of the game.

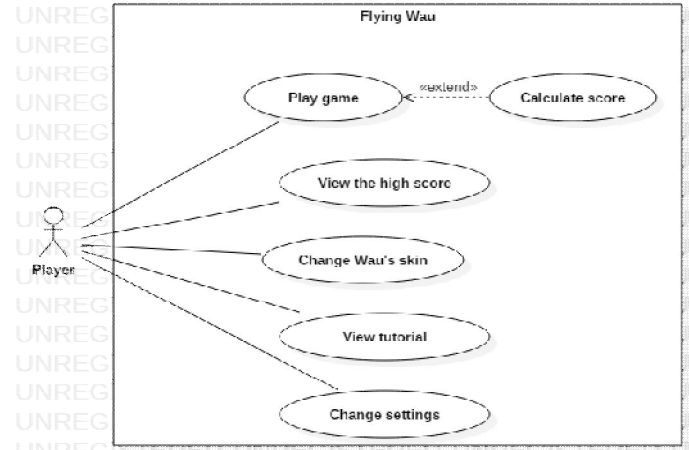


Figure 2: Use case diagram

Table 2: Non-Functional Requirement

Requirement ID	Requirement Description	Priority
FYW_6	Reliability	
FYW_6_1	System should not crash more than once per 10 hours.	M
FYW_6_2	If the system has been crashed, it should display main page when reloaded again.	M
FYW_7	Performance	
FYW_7_1	System should be able to calculate the score within 5 seconds.	M
FYW_7_2	System should be able to record high score into the system within 3 seconds.	M
FYW_7_3	System should be able to calculate the score for each game accurately.	M
FYW_8	Usability	
FYW_8_1	System should stay working smoothly without any interruption.	M

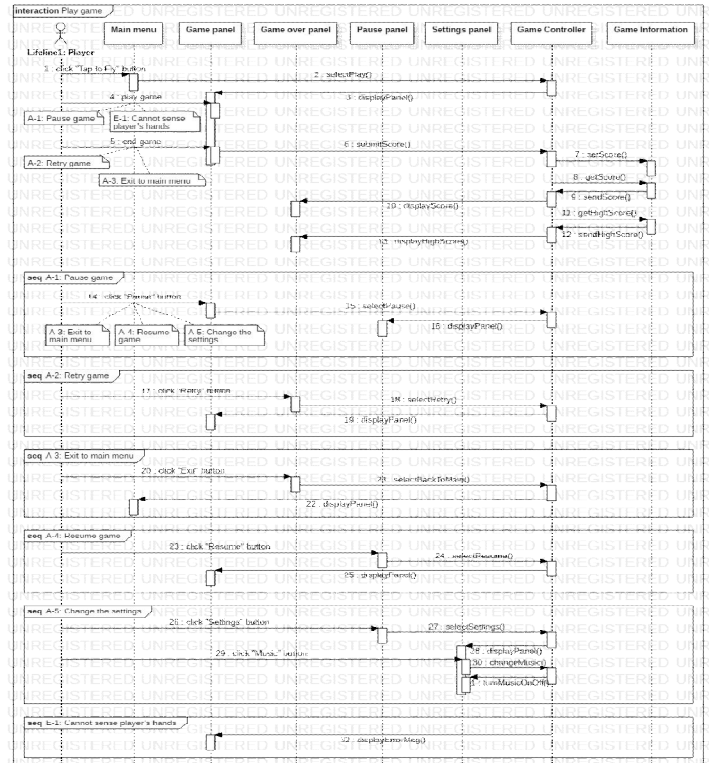


Figure 3: Sequence diagram of Play Game

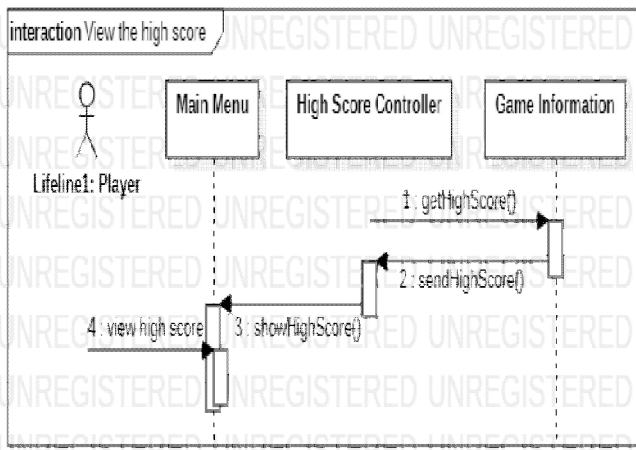


Figure 4: Sequence diagram of View the High Score

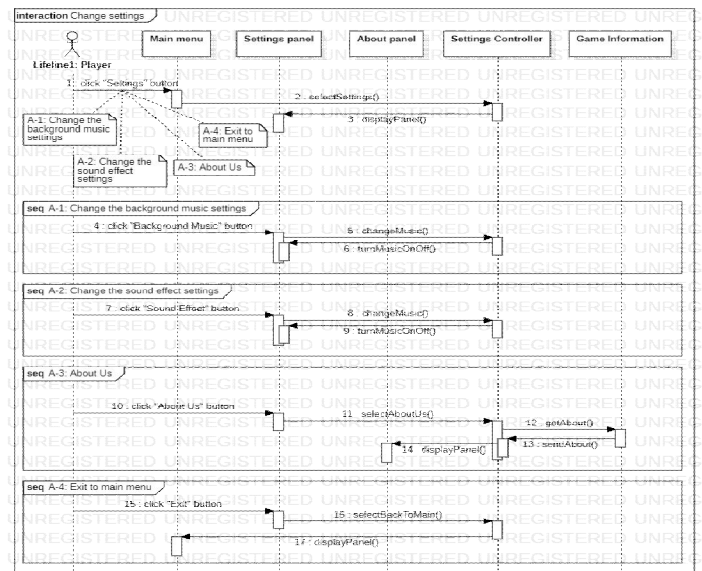


Figure 7: Sequence diagram of Change Settings

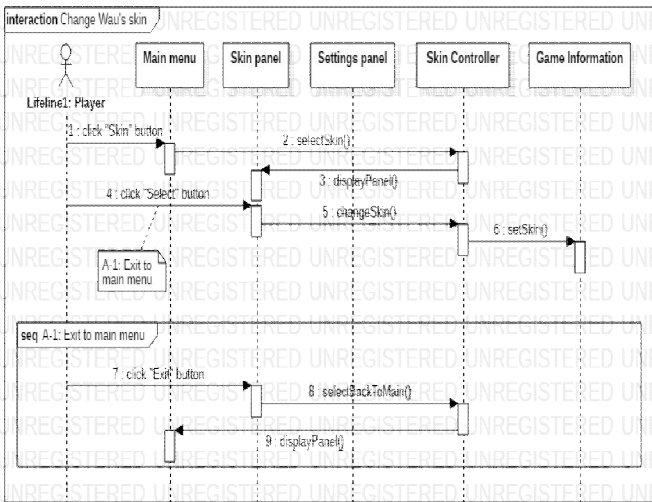


Figure 5: Sequence diagram of Change Wau's Skin

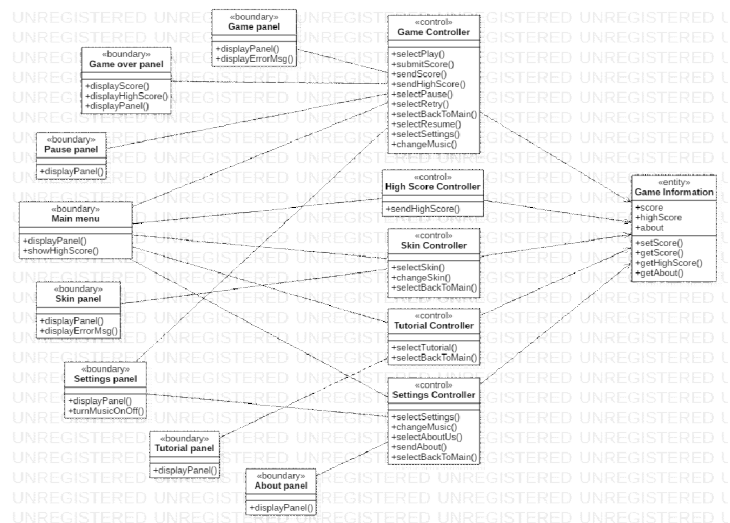


Figure 8: Class diagram

B. Prototype development of Flying Wau

A prototype of Flying Wau was developed by using Unity and ManoMotion. Unity is a cross-platform game engine with a built-in IDE developed by Unity Technologies[2]. It is mainly used to developed the game. ManoMotion provides a framework to allow the player interest with mobile phone through hand gestures. Figure 9, 10, 11, 12, 13 and 14 shows the interface of Flying Wau.

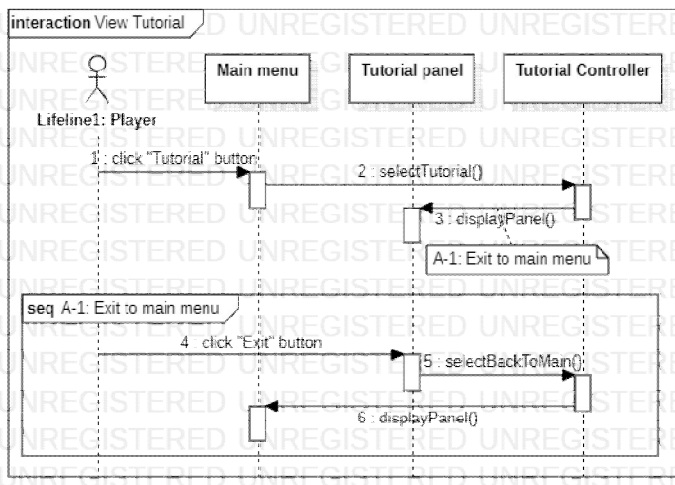


Figure 6: Sequence diagram of View Tutorial



Figure 9: Main Menu

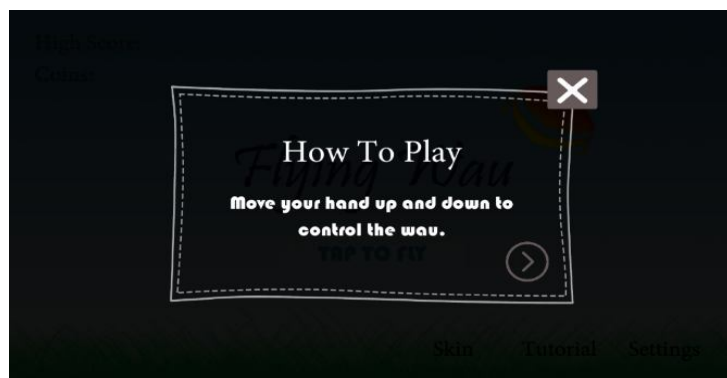


Figure 13: View Tutorial

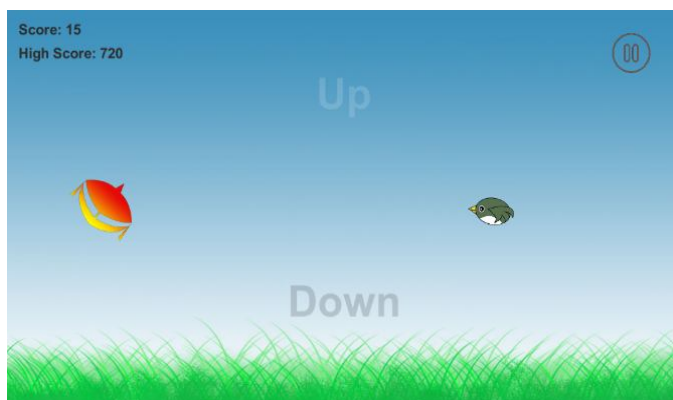


Figure 10: Game Scene



Figure 14: Change Wau's Skin

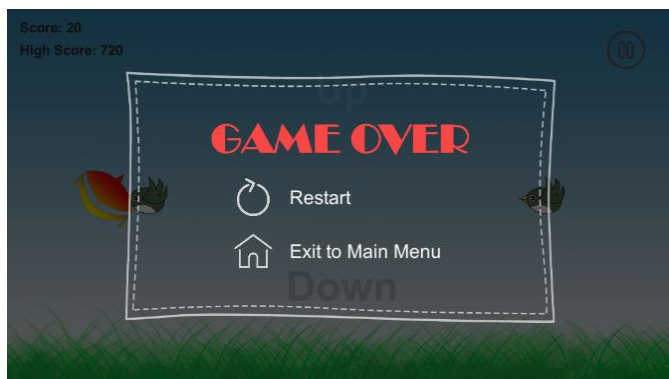


Figure 11: Game Over

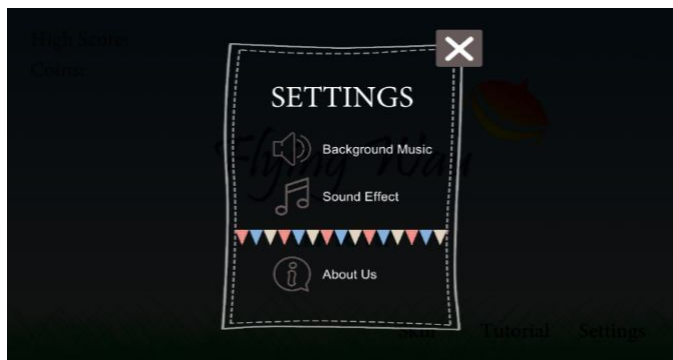


Figure 12: Change Settings

5. EVALUATION OF FLYING WAU

A. The Evaluation Setting

Usability evaluation is used to evaluate this game application by testing it with representative players. It focuses on how well players can learn and use a product to achieve their goals. It also refers to how satisfied players are with that process. This evaluation was conducted on 30 respondents. Those who interact with Flying Wau are allowed to play the game and answer the post-task questionnaire. The post-task questionnaire consists of two sections. Section A asked about the respondents' demographic information and Section B asked their opinion on Flying Wau by using a five-point Likert scale, which 1 represents strongly disagree and 5 represents strongly agree. Those respondents will provide a google form link, and they need to download and install the game which can be found in google drive. After they play it, they need to fill in the form.

B. The Respondents' Demographic Information

Based on the results of respondents' demographic information, it shows that 76.7% of the respondents are female and 23.3% are male. Majority of the respondents came from the age group of 18-25 years old, which consists of 86.7% from the total amount. Only one respondent (3.3%)

is under 18 years old and 3 respondents (10%) are between 26 and 35 years old. Amount of 66.7% respondents would like to play mobile games. However, there are 9 respondents (30%) undecided that they like to play mobile games. Only one of them (3.33%) does not likes to play mobile games. There are 13.3% of respondents spend half an hour on mobile games and another 13.3% of them spend 2 hours on an average day. 5 respondents (16.7%) spend 1 hour and 6 respondents spend more than 2 hours on gaming. The rest of them (36.7%) spend gaming on mobile phone rarely. There are 5 respondents (16.7%) undecided that they face any problem when playing games by touch screen. 40% of the respondents do not face problem when playing games by touch screen. However, 43.3% of them face the problem. Besides that, 20% of the respondents prefer playing games without using touch screen. However, there are 14 respondents do not prefer to play games without using touch screen. 33.3% of them undecided about that. There are 14 respondents played mobile games which using hand gesture. However, the rest of them (53.3%) never play any mobile games by using hand gesture.

C. The Usability of Flying Wau

An analysis was conducted on the respondents’ responses in Section B of the post-task questionnaire. In this section, it will measure the respondents’ perception on the gameplay, graphics, sound and satisfaction of Flying Wau. Tables 3, 4, 5 and 6 show the percentage of the responses.

Table 3: The responses for gameplay of Flying Wau

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Flying Wau has proper control and flexibility.	0%	16.67%	30%	46.67%	6.67%
The concept of Flying Wau is logic and simple.	0%	3.33%	3.33%	56.67%	36.67%
The game makes sense.	0%	0%	10%	66.67%	23.33%
The game started too fast.	3.33%	23.33%	43.33%	23.33%	6.67%
The challenges, strategies and rates are balanced.	3.33%	3.33%	20%	63.33%	10%
Flying Wau provides the logic action and response to players.	0%	3.33%	23.33%	50%	23.33%

Table 4: The responses for graphics of Flying Wau

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The brightness of the scene is just right.	0%	0%	23.33%	56.67%	20%
The background is simple and it matches with the game.	0%	0%	13.33%	46.67%	40%
All the characters, such as Wau and birds are very beautiful.	0%	3.33%	13.33%	46.67%	36.67%
All the icons are easy to understand and according to the standard.	0%	0%	10%	53.33%	36.67%
The logo of Flying Wau matches with the game.	0%	0%	13.33%	50%	36.67%
All the device interface (UI) and UI game used for their respective goals.	0%	0%	26.67%	56.67%	16.67%
Overall, the game graphics is appealing.	0%	0%	13.33%	53.33%	33.33%

Table 5: The responses for sound of Flying Wau

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The volume is balance between background music and sound effect.	0%	0%	10%	56.67%	33.33%
The background music is very nice.	0%	0%	13.33%	43.33%	43.33%

The sound effect is very nice.	0%	0%	13.33%	43.33%	43.33%
Overall, the game music is appealing.	0%	0%	16.67%	40%	43.33%

Table 6: The responses for satisfaction of Flying Wau

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I am satisfied and enjoyed with Flying Wau.	0%	6.67%	20%	50%	23.33%
I would like to play Flying Wau again.	3.33%	6.67%	36.67%	30%	23.33%
I would recommend Flying Wau to my friends.	3.33%	3.33%	33.33%	40%	20%

Based on all the results gathered from the evaluation, almost all respondents are satisfied with the Flying Wau, such as the sound and graphics. However, there are few respondents gave some feedback to the game. They mentioned that it is quite difficult for them to control the wau flying up and down. Therefore, it still needs some improvements on the character's movement control part to make the game smoother and user friendly.

6. CONCLUSION AND FUTURE WORKS

This paper described about the design and development of a mobile game application which can played by using hand gesture. There are many aspects that can be studies. In addition, some function still need to be improved to make it better, because Flying Wau is not good enough. In the future work, the developer plan to add the functionality of hand gesture on other categories of mobile games, such as role-playing games and simulation games. So that, it makes the interaction between human and computer more natural as the interaction between humans.

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