LOCATION-BASED ADVENTURE GAME TO ENGAGE TOURIST IN DISCOVERING LOCAL LANDMARKS WITH DEEPAI

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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
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DECLARATION

I hereby declare that this project report entitled

LOCATION-BASED ADVENTURE GAME TO ENGAGE TOURIST IN

DISCOVERING LOCAL LANDMARKS WITH DEEPAI

is written by me and is my own effort and that no part has been plagiarized

without citations.

STUDENT   : _____   Date : 9/9/2021
                          (TOH QI QI)

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 Information Technology (Game Technology) with Honours.

SUPERVISOR   : _____   Date : 10 September 2021
                          (TS. SYARIFFANOR BT HISHAM)

DEDICATION

To my beloved parents.

ACKNOWLEDGEMENTS

ABSTRACT

This project is a treasure hunting game that requires real-time interaction with the real world. This game aims to understand the effectiveness of promoting and applying the art style of autistic students in real-life applications through a treasure hunting mobile application game. The present 2D adventure mobile game on the market lacks local Malaysian history. This initiative has the potential to aid our younger generation in gaining a better appreciation and knowledge of local history. Learning in-game also entice many gamers to learn history while having fun with the game. In this game, users have to find the correct answer and snap a photo of the answer's building. After that, the user can choose the art style created by autistic kids to transform that photo into a new style. Game Development Life Cycle (GDLC) is used to develop this project. GDLC has six phases. There are initiation, pre-production, production, testing, beta, and release. In the initiam phase, the idea and genre of the game are proposed. After the proposal is approved, pre-production research on the game idea, design, and levels. Development of the game is conducted in the production phase. Once the game is finished, the testing phase is carried out to test the game. Testing of the game is carried out on the targeted audience to check the game error and its efficiency. The correction is done after getting all the feedback. During the beta phase, a beta version is released for further testing. All the collected data or feedback are analyzed, and correction is done before releasing the final version. In the last phase, the release phase, the game's final version is released for evaluation and might as well be for marketing. The expected outcome of the game is research on the effectiveness of promoting the autistic kids drawing style to the real-world application through gamification. To summarize, this project achieved all the objectives proposed, and the results of the testing also show that overall, participants are satisfied with the game, but several improvements need to be made, such as the movement of the character in the mini-game is challenging to grasp and control.

ABSTRAK

Projek ini adalah permainan pencarian harta karun yang memerlukan interaksi nyata dengan dunia sebenar. Permainan ini bertujuan untuk meneliti keberkesanan mempromosikan dan menggunakan gaya seni pelajar autistik dalam aplikasi kehidupan sebenar melalui permainan aplikasi mudah alih harta karun. Permainan mudah alih pengembaraan 2D yang ada di pasaran tidak mempunyai sejarah tempatan Malaysia. Inisiatif ini berpotensi untuk membantu generasi muda kita dalam memperoleh penghargaan dan pengetahuan yang lebih baik mengenai sejarah tempatan. Belajar dalam permainan juga menarik sebilangan besar pemain untuk belajar sejarah sambil berseronok dengan permainan. Dalam permainan ini, pengguna harus mencari tempat yang betul dan mengangkapkan foto tempat tersebut. Selepas itu, pengguna boleh memilih gaya seni yang dibuat oleh kanak-kanak autistik untuk mengubah foto itu menjadi gaya baru. Untuk membangunkan projek tersebut, Game Development Life Cycle (GDLC) telah digunakan. GDLC mempunyai enam fasa. Terdapat inisiasi, pra-produksi, produksi, pengujian, beta dan pelepasan. Pada fasa permulaan, idea dan genre permainan dicadangkan. Setelah proposal disetujui, penyelidikan mengenai idea permainan, reka bentuk dan tahap permainan dilakukan pada fasa pra-produksi. Pengembangan permainan dilakukan dalam fasa pengeluaran. Setelah permainan selesai, fasa pengujian dijalankan untuk menguji permainan. Pengujian permainan dilakukan pada khalayak yang disasarkan untuk memeriksa kesalahan permainan dan juga kecekapannya. Pembetulan dilakukan setelah mendapat semua maklum balas. Selama fasa beta, versi beta dikeluarkan untuk pengujian lebih lanjut. Semua data atau maklum balas yang dikumpulkan dianalisis, dan pembetulan dilakukan sebelum melepaskan versi akhir permainan. Pada fasa terakhir, fase pelepasan, versi akhir permainan dirilis untuk penilaian dan mungkin juga untuk pemasaran. Hasil permainan yang diharapkan adalah penyelidikan mengenai keberkesanan mempromosikan gaya menggambar kanak-kanak autistik ke aplikasi dunia nyata melalui gamifikasi. Kesimpulannya, projeck ini mencapai semua objektif yang dinyatakan dan hasil ujian juga menunjukkan bahawa keseluruhan peserta berpuas hati dengan project ini tetapi mempunyai beberapa penambahbaikan perlu dilakukan seperti pergerakan watak dalam permainan mini sukar untuk dikawal..

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LIST OF ABBREVIATIONS

DEEPAI	**-**	**Deep Artificial Intelligence**
GPS	**-**	**Global Positioning System**
SDK	**-**	**Software Development Kit**
UI	**-**	**User Interface**
GUI	**-**	**Graphic User Interface**
REST	**-**	**Representational State Transfer**
API	**-**	**Application Programming Interface**
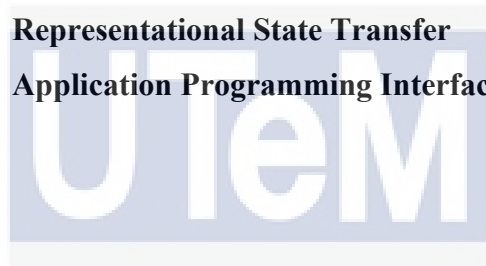
CHAPTER 1: INTRODUCTION

This project aims to develop an android application game to promote Melaka and applying the art style of autistic students to real-life applications through treasure hunting mobile application games.

1.1   Project Background

Geocaching Melaka is an adventure 2D mobile game that requires real-time interaction with the real world. The game's storyline applies the concept of a short-term repeatable background story (citation author, year). The famous examples of the game which use this technique are subway surfer, temple run, and fruit ninja. In this game, the story set on Alice is an apprentice of an archaeologist named John. However, John was found missing when investigating Melaka's history in Malaysia. Alice searches high and low for her teacher John and found a suspicious map with a hidden clue about her missing teacher in a safe box underground of her teacher's house. Hence, the adventurer of an apprentice begins.

1.2   Problem Statement

Malaysia's unique history is rarely used as content in the commercial 2D mobile game application. Therefore, the Malaysian younger generation tends to lack understanding and appreciation towards the local history of multi-ethnic communities in Malaysia. Therefore, it hoped that this game would encourage the Malaysian younger generation to learn history while having fun with the game.

1.3 Objectives

- To explore geosocial and Geocaching services in the tourism app.

- To implement a Global Navigation Satellite System (GNSS) to navigate the user to the correct location.

- To integrate style transfer REST-API services with the Tourism Gamification mobile application.

1.4 Goals and Genre

This project aims to develop an adventure game for tourists with the integration with DeepAI technology. This game aims to research the effectiveness of promoting and applying the art style of autistic students in real-life applications through treasure hunting mobile application games.

The genre of the game is adventure 2D mobile game. 2D mobile game is a game that proceeds the game or the story by moving along with the mobile. In the application, a mini-game requires the user to control the character and move around the screen to avoid obstacles and collect the Tricycle to accumulate scores for unlocking clues to the next phase.

1.5 Game Features

The target audience is primarily youths, which in this context means those above 18 years old. Youths are chosen because most of the tourism range around 18-40. The game has three open levels and one lock level. Each level consists of a mini-game, image clue, GPS location, image capturing, and DeepAI style transformation. Meanwhile, different map layouts are introduced in each of the mini-game.

The rules of the game are straightforward. First, the player needs to play the game to accumulate the score to unlock clues. The clues will help the player to find the hidden location.

1.6   Conclusion

In conclusion, this chapter is about the background, problem statement, objective, genre, and game features. Then, an explanation of each part is discussed in detail. This project aims to develop an adventure game for tourists with the integration with DeepAI technology. The next chapter, Chapter 2, will be on the Literature Review and Methodology used in the project.

CHAPTER 2: LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

This chapter will be on literature review. The game genre and project methodology will be explained in detail. Existing games will be discussed as well as compared with the game in this project. Discussion on the past research or findings will also be discussed in this chapter.

2.2 Genre

The game genre for this project is a 2D adventure game. This game consists of stories and mini-games. The mini-game has a scoring system that will be used to unlock the clues given by that place. The player needs to control the character to avoid the obstacle and collect the Tricycle item in the mini-game.

2.3 Existing Games

A few similar games have been developed, such as Geocaching, Treasure-HIT, Treasure Hunt, Ocean Game, etc. These games were developed with the purpose of promoting the activity of Geocaching. As for this project, Geocaching Melaka is developed to promote and apply the art style of autistic students in real-life applications through treasure hunting mobile application games.

Treasure-HIT is similar to the existing game, Geocaching which promotes the activity of Geocaching and GPS usage. Treasure-HIT is to learn about its history and geography and be aware of the local sites of interest.

The target audience for Geocaching is voluntary participants, while the target audience for Treasure – HIT is teachers and students. Teachers create and control the activities, and the player(student) plays the game. Besides that, the technology implementation in both games is GPS and mobile platforms.

Furthermore, the gameplay of Geocaching is hiding & seek containers to find the hidden geocache. Besides that, Treasure-HIT gameplay attaches clues that direct the players to the location and offer specific activities for each location.

2.3.1   Comparison of Existing Games

As mentioned in 2.3 Existing Game, there have a few similar games have been developed. The table below shows the comparison of the current game and the existing game.

Table 2.1: Comparison of the current game and existing game

No	Name of the project	Target audience	Purpose of project	Mechanic/ gameplay	Technology behind it
1	Geocaching	Voluntary participants	To give the US military advantage with GPS hardware, to promote Geocaching and GPS usage.	Hide & seek container, finding the hidden geocache.	GPS, mobile
2	Treasure-HIT	Teacher and student. Teachers create and control activities, and players (students) play the game.	To familiarize students with their close vicinity, learn about its history and geography, and be aware of the local sites of interest.	Attach clues that direct the players to the location and offer specific activities for each location	Mobile, Google Maps, and Google Street API

3	Treasure Hunt	8 – 12 years old children who are in cognitive-behavioral treatment for various disorders.	This game has including therapeutic concepts into game. Children can be offered attractive electronic homework assignments that enable them to rehearse and repeat basic psychoeducational concepts they learned during therapy sessions.	This game is an interactive adventure game with six levels. Each of the six levels of the game corresponds to a specific step in cognitive-behavior treatment. The maximum amount of time needed to solve all tasks of a level is about twenty minutes.	Treasure Hunt is a 2.5D Flash adventure game programmed with an Action script and XML.
4	Ocean Game	9 – 10 years old students	To fuse engagement and entertainment by offering a gaming experience in line with the learning goals of the museum.	A treasure-hunt-based mobile game for the player to search and collect a plethora of marine animals and learn about their key characteristics in the context of the Natural History Museum of Funchal (NHMF), Portugal.	Mobile interactive technology in museum settings

5	Museum Treasure Hunt	11-14 years old students	Education game exploits graphics and interaction both for gaming and for learning. Students can be further intrigued by using objects and equipment they are familiar with, yet unanticipated ways.	The player has to search for the "materializations" of the solution to a sequence of riddles and photograph them by personal camera phone.	QR code, mobile
6	The potential of treasure hunt game to generate positive emotions in learners: experience local geography and history using GPS device	2nd and 4th class pupils in the centrally located school in Pori, Finland (110 students)	To study findings, demonstrate that the children reported the most positive experiences of this treasure hunt game.	Children's interactions using letterboxing and geocaching treasure hunt games as a creative pedagogical design where technology was exploited to solve clues.	GPS
7	Treasure Hunt with Intelligent Luminaires	Voluntary participants	To create a situation-aware real-time control system that adapts automatically to person behavior in ambient space.	Monitor and track people's behavior are getting more common. At the same time, novel lighting controls the LED technologies allow real dynamic	A treasure hunt game uses depth sensor-based people tracking service, wirelessly controlled RGB LED, and a light controlling unit where LED bulbs change their

				time controlling of the illumination systems.	color according to person position and movement in a room.
8	H-Treasure Hunt	Any visitors	This game act as a tour guide, helping users learn about the historic site and artifacts.	Players wear Head Mounted Display (HMD) and explore a historic site interacting with artifacts to complete the mission.	GPS, Head Mounted Display (HMD)
9	Snap2Play	25 -40 years old people	This game is to deploy and evaluating of a mixed reality location-based mobile treasure hunt.	They are using technologies such as place recognition, accelerometers, and GPS tracking for enhancing the interaction with the game and, therefore, the game's playability.	Mixed Reality, the mobile phone that including cameras, GPS, orientation sensors, tactile surfaces, and vibrotactile display
10	Code Hunting Games	Member of the CodeMOOC community	The proposed system transposes the classical scheme of "treasure hunt" games into a mixed-reality game, where players must physically	An online multiplayer game that challenges players with abstract coding puzzles that are tied to a geographical location.	Multiplayer, chatbot, online, mobile.

			move to advance in the game while at the same time interacting with a chatbot through an online messaging system.		
11	Pieces of the Past, Maya Treasure Hunt	Voluntary participants	To build an educational virtual reality (VR) puzzle game set in an archaeological context.	The player can link the Mayan ruin between its current state and the past by collecting artifacts and evidence and discovering this site's architectural beauty and historical richness.	Virtual reality (VR)
12	Geocaching Melaka	Youths	To develop an adventure game for tourism that integrate with DeepAI	Attach hints for the player to the location, provide a mini-game in each place, capture photos, and use DeepAI to transfer style.	Mobile, GPS, DeepAI

2.4   Project Methodology

Game Development Life Cycle (GDLC) methodology is chosen for this project. GDLC has six phases (Widyani, 2013). There are initiation, pre-production, production, testing, beta, and release (Widyani, 2013).

In the initiation phase, the idea and genre of the game will be proposed. After the proposal is approved, research on the game idea, game design, and levels will be done in the pre-production phase. Development of the game will be conducted in the production phase. Once the game is finished, the testing phase will be carried out to test the game.

Testing of the game will be carried out on the targeted audience to check the game error and its efficiency. Finally, the correction will be done after getting all the feedback. During the beta phase, a beta version will be released for further testing. All the collected data or feedback will be analyzed, and correction will be done before releasing the final version. In the last phase, the release phase, the game's final version will be released for evaluation and might as well be for marketing.
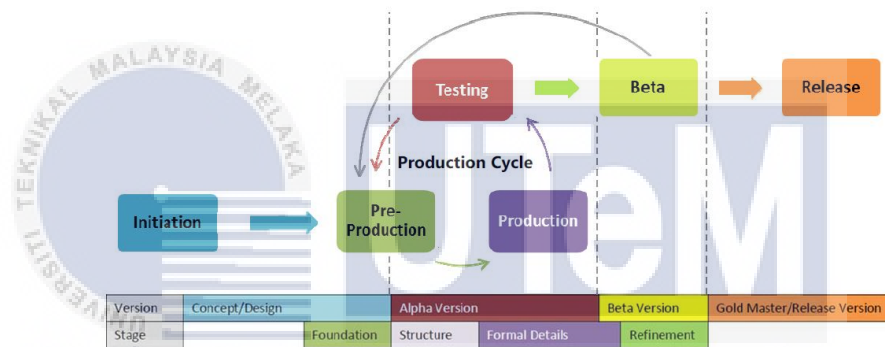
Fig. 7. The Proposed GDLC model. It consists of 6 development phases. Production cycle consists of Pre-production, Production, and Testing.

Figure 2.1: Game Development Life Cycle Phases (Widyani, 2013)

2.5   Conclusion

To summarize, there are games similar to this project: Geocaching and Treasure HIT. These games have been used as tools for people to promote Geocaching and GPS usage. Geocaching Melaka is unique because of its integration with the DeepAI style transformation. In short, Game Development Life Cycle (GDLC) is used as the project methodology. This cycle contains six phases in which different tasks will be done in each phase. Next on Chapter 3 will analyze the game project requirement, such as the software and hardware requirements, technical requirement, etc.

CHAPTER 3: ANALYSIS

3.1 Requirement Analysis

All requirements of the application were listed based on the user's needs. Besides, the requirements were also identified by comparing them with the existing system. Therefore, the conditions collected are the improvisation version of the current system.

3.1.1 Project Requirement

This section will be on analyzing and discussing similar games that are related to this project. For example, a similar game that used to do analysis is Treasure - HIT. The analysis is based on Table 3.1.

Table 3.1: Comparison of Treasure-HIT and Geocaching Melaka

Treasure - HIT	Games	Geocaching Melaka
There are two types of players, which are teacher and student. Teachers create and control activities, and students play the game.	**Player Roles**	The player takes the role of an apprentice archaeologist named John. However, John was found missing. So, the player needs to complete the game to find her missing teacher.
Attach clues that direct the players to the location and offer specific activities for each location.	**Mechanic / Gameplay**	Provides hints for the player to historical location, provides a mini-game in each place,

		captures photos, and uses DeepAI to transfer style.
Successfully find the location	**Victory Condition**	Successfully unlock the location to find John.
Simple interface with press the button to answer the question.	**User Interface**	Simple and easy understand interface with a self-explanatory button.
The camera model in this game is based on the phone camera resolution.	**Camera Models**	The camera model in this game is based on the phone camera resolution.

3.1.2   Technical Requirement

The hardware used in the project is Predator Helios 300 laptop. The software used is Visual Studio Code as the editor. The SDK used for this research is Android SDK and Flutter. Flutter SDK is Google's UI toolkit for crafting beautiful, natively compiled mobile, web, and desktop applications from a single code-based.

3.1.3   Software Requirement

SDK

- Android SDK- Android SDK contains API libraries that need to build Android applications. It comprises the emulator, Android SDK manages, and so on.

- Flutter SDK – Flutter is a free and open-source Google mobile UI framework that provides developers a fast and expressive way to build native apps on both IOS and Android.

Source Code Editor

- Visual Studio Code – Visual Studio Code features a lightning-fast source code editor. Flutter using Dart programming and Visual Studio Code has a plugin for Dart programming.

Game Art

- Adobe Photoshop 2021 – A graphic editor used to create and design all the assets needed for this project.

- DragonBonesPro – A software that use to create the animation needed for this project.

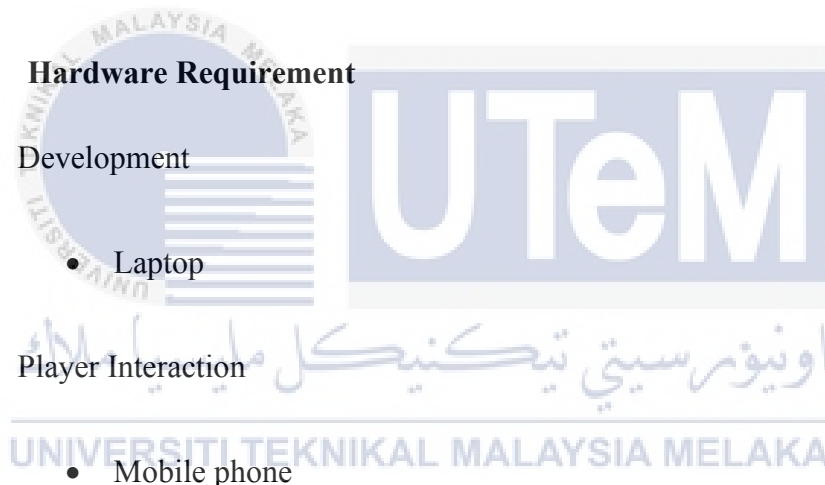### 3.1.4 Hardware Requirement

Development

- Laptop

Player Interaction

- Mobile phone

3.2 Project Schedule and Milestone

Figure 3.1 below shows the Gantt Chart for this project. While Table 3.1 below shows the Key Milestones for this project.

Figure 3.1: Gantt Chart

Table 3.2: Key Milestones

Key Milestones	Start Date	End Date
Project kick-off	15 March 2021	15 April 2021
Prepare proposal and Game Design Concept	15 April 2021	6 May 2021
Game customization	6 May 2021	27 May 2021
Game Elements Implemented	27 May 2021	27 June 2021
Bug fixing and finishing game	27 June 2021	11 July 2021
Report and presentation	11 July 2021	25 July 2021
Project completion		31 August 2021

Based on figure 3.2, the project kick-off on 15th March. Then, the following week is used for ideas discussing with the supervisor. The development phase included pre-production and production that begins from 15th April until 27th June.

During the testing phase, game testing is carried out on the targeted audience to check on the game error and its efficiency. The correction will be done after getting all the feedback.

In the final phase release phase, the final version of the game will be released. The final report and presentation will be done from 11th July to 25 July. The final project and thesis will be done on 31st August.

3.3   Conclusion

In this chapter, project requirements are discussed and analyzed, including hardware, software, and technical tools used, such as laptops, source code editors, and more. In the next chapter, the design of the game will be discussed.

CHAPTER 4: DESIGN

4.1   Introduction

This chapter will discuss the design of Geocaching Melaka. The game design, including game architecture, gameplay, core mechanics, and flow board, will be discussed and explained.

4.2   Game Architecture

The game architecture applied for this project is a layered architecture. The architecture consists of four layers. The based layer or Layer 1 is the main software use for game development. Layer 2 shows the SDK or plugin use for this game. Next, Layer 3 is the specific element for Layer 2. For example, the game assets are 2D assets and will be using dart programming for the behavior of the assets. The final layer, or Layer 4, is the element in Layer 3 used for the different functions in the game, such as UI elements, game mechanics, and game states.
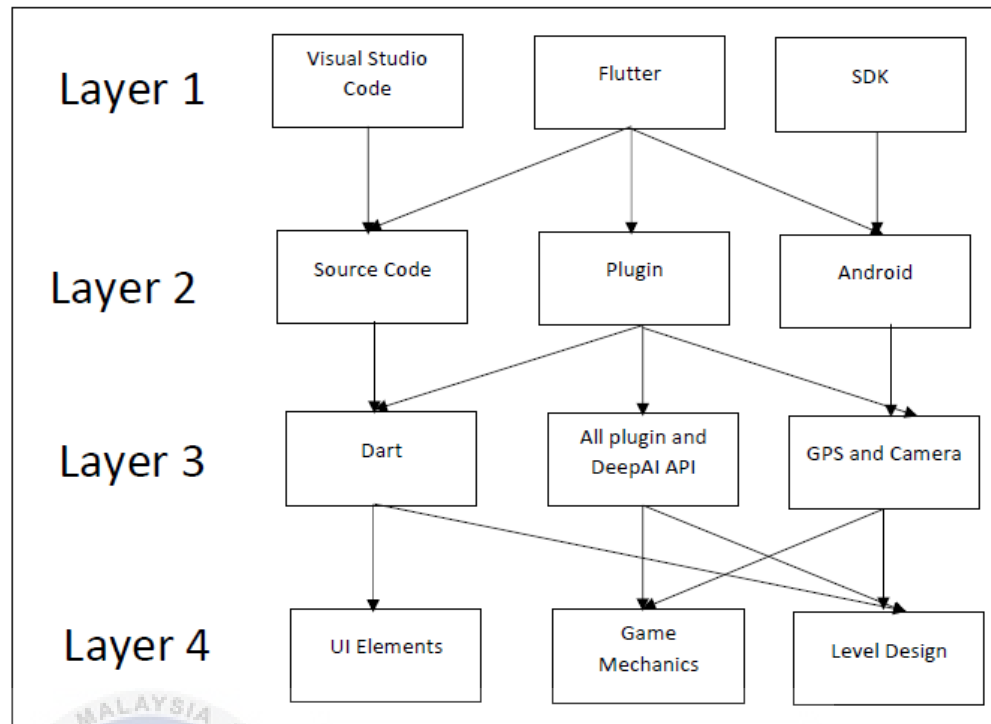
Figure 4.1: Game Architecture

4.3 Game Design

The game design of Geocaching Melaka includes gameplay, core mechanics, flowboard, level progression, and user interface are explained in this sub-chapter.

4.3.1 Gameplay

Geocaching Melaka consists of only four levels. Initially, three unlock levels are given to players as a freedom to choose which level to begin. After unlocking three levels, a hidden level will be unlocked and available for the player to choose from.

Each level consists of a mini-game that has a different map layout. The player needs to complete the mini-game to unlock the clues given, such as image, location, place history, and GPS location. After the player finds the place, the player needs to capture the picture, choose the drawing style of autism, and transform the image with DeepAI to produce a new arts-based image. Upon receiving the new image, the player considers finishing that level, and one key will be rewarded.

After the player collects all three keys, the hidden level will be unlocked. John or the missing teacher from the game will be found when the player completes the game's last level.

4.3.2 Core Mechanics

The core mechanics of this game involves photo capturing, scoring system, collectibles, and count of the collectibles. The score will begin with 0 and start to increase when the player collects items from the mini-game. Besides, after the player captures the photo and processes it with DeepAI, it will trigger the pop-out windows showing that the player had cleared the level, and one key will be rewarded.

4.3.3 Flowboard

Figure 4.2 and Figure 4.3 below showed the flowboard of the game Geocaching Melaka. In Figure 4.2, the game starts with a game menu. When the "How To Play" button is press, the player will see the background story. At the bottom, there has a button arrow for the previous and next for "How To Play."

Next, If the player press next, will see the Characters for this game. After that, the player will see the tutorial and button instructions. If the player presses the "Exit" button, the game will exit. When the player presses "Start Game," the player sees that three unlock levels are given to the player as freedom for them to choose which level to begin. Figure 4.3 below show the Mini-Game Map Layout for different level, the uploaded image for transferring the style using DeepAI and the winning interface.
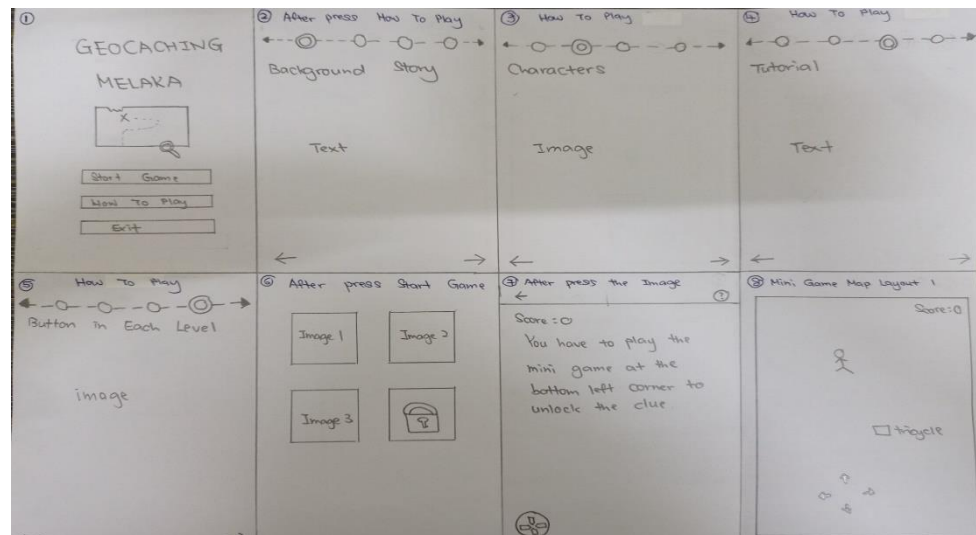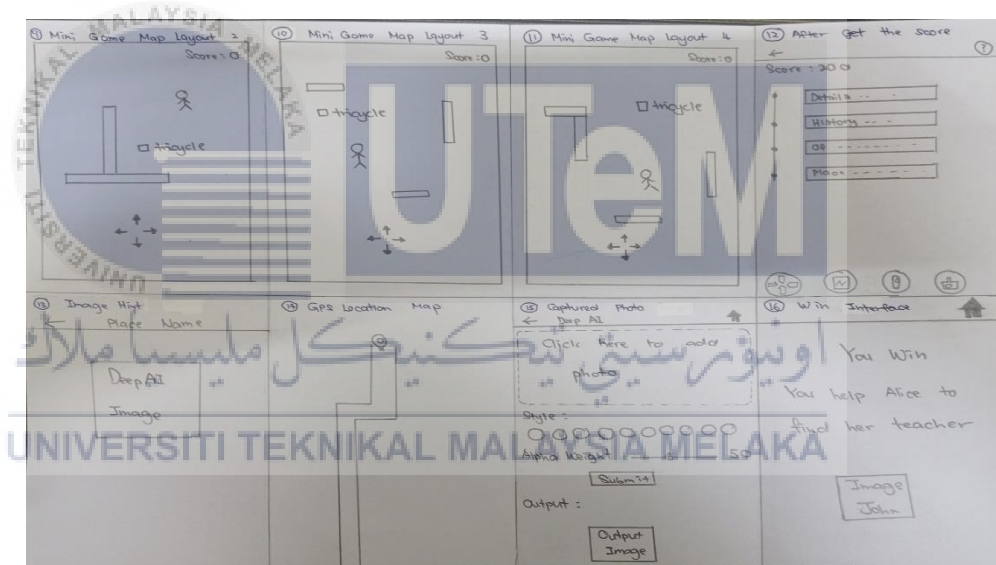
Figure 4.2: Flowboard 1

Figure 4.3: Flowboard 2

4.3.4 Level Progression

Level one of the games is set to be Malaka A Famosa location. At that level, the mini-game has a more straightforward map layout and requires a lower score to unlock the clues. Malaka Fort is the target location in the next level and requires a higher score to unlock clues in the mini-game. Similarly, the next level Malaka River will require a higher score than Melaka Fort to unlock the clues. The last level of the game is the Maritime Museum location. The pre-requisite for this level is the completion of the existing three-level.

4.3.5 Storyline

Alice is the apprentice of an archaeologist named John. However, John was found missing when investigating Melaka's history in Malaysia. Alice searches high and low for her teacher John and found a suspicious map with a hidden clue about her missing teacher in a safe box underground of her teacher's house. Hence, the adventurer of an apprentice begins.

### 4.3.6 User Interface / Interaction Model

The UI of the game is designed in a simple minimalist style. The main menu consists of the game title, logo, and three buttons: Start button, How To Play button, and Exit button. The Start Button will provide the photo button. When the player presses the image button, the game started. Inside the level, four buttons are located on the bottom screen: mini-game button, image button, location button, and camera button. In the mini-game, there are four navigation buttons. The four navigation button is used to control the character to move to around and collect the Tricycle.

4.4 Game Art

Most of the assets that are used in the Geocaching Melaka are download from royalty-free images. However, some of the photos that needed to be edited are edit using Adobe Photoshop 2020.

4.4.1 Game World

The game world of this project is located in Melaka. The background image is the Melaka River. Each level button image is based on the old photo of that place. The image clue given is the image that the DeepAI has already processed.
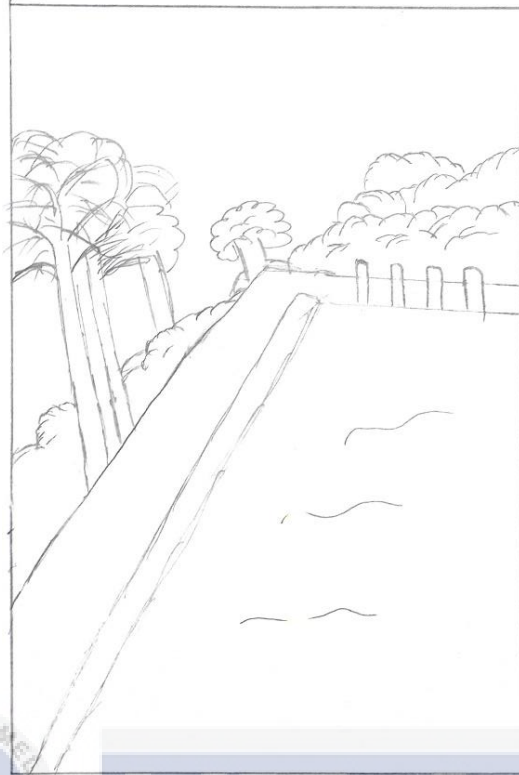
Figure 4.4: Game World Sketch

Figure 4.5: Game World

4.4.2 Character Design

There have two characters in this project which are Alice and John. Alice is an apprentice learning the history of Melaka. She has a teacher known as John.

The collectibles are Tricycle which is a trademark vehicle that can be found around Melaka.

Figure 4.6: Main Character Sketch

Figure 4.7: Main Character
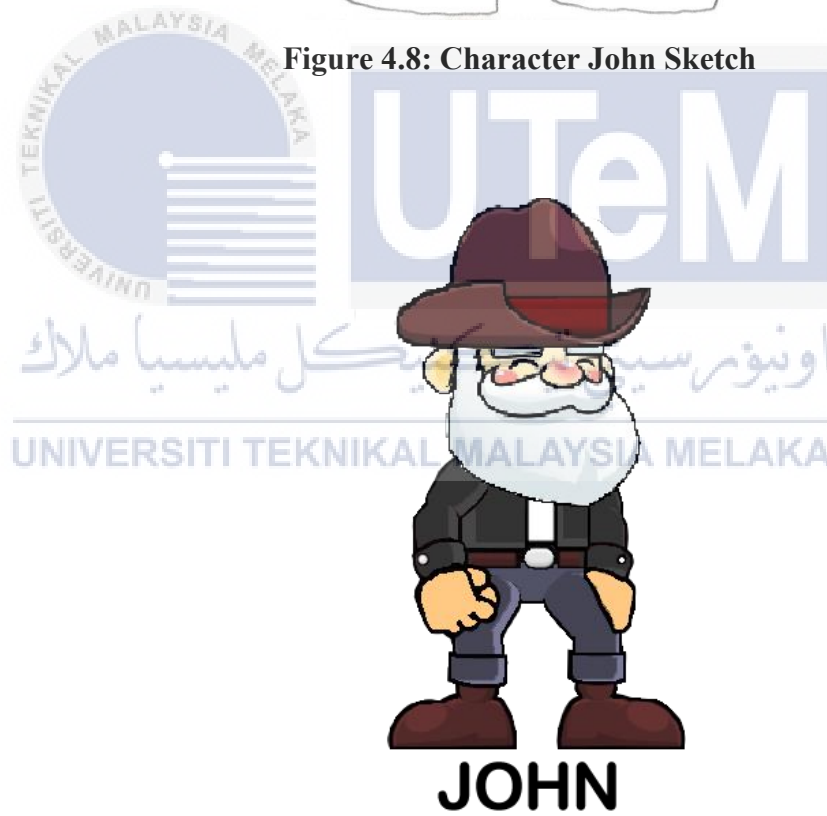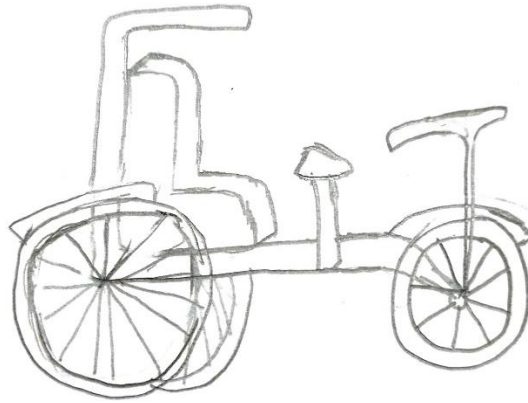
Figure 4.8: Character John Sketch

Figure 4.9: Character John

Figure 4.10: Tricycle Sketch

Figure 4.11: Tricycle

4.4.3 Camera Model

The camera model in this game is based on the phone screen. So, if the screen size is more extensive, then the game's screen will appear bigger.

4.4.4 Audio / Sound Effect

The button that controls the sound effect is provided. When the player presses the button, sound effects will play.

4.5 Conclusion

In conclusion, this chapter has discussed game architecture, game design, and game art. The type of game architecture used is Layered Architecture. As for the design, including gameplay, core mechanics, flowboard, level progression, and UI are explained in detail. Besides, the character design and game world also explains the purpose and relatedness of the game. The upcoming chapter will be on the implementation.

CHAPTER 5: IMPLEMENTATION

5.1   Introduction

This chapter covers the activities executed during the implementation phase. The creation of game art, graphics, audio, animation, integration of game components, configuration management, and implementation are detailed section by section along with the chapter. This chapter is based on 4.4 Game Art and focuses more on the conversion and integration of the game art.

5.2   Creation of Game Art

The pipeline for the 2D game art creation is concept, design, and conversion. In the concept phase, research on the art concept is done to determine which 2D art concept to use in the game. In the creation phase, the game character or assets example is referred to in creating the game art. Sketches of the game character are done here. The illustrations are scanned and moved into the editor software for digitized and color in the conversion phase.

5.2.1   Production of Graphics

Both game world and the main character of the game are primarily sketched on paper. Royal free photo that takes by other people about Melaka photos is used. The character is digital by using Adobe Photoshop 2021. When the characters are all done painting, it is export into a PNG file to be imported into Visual Studio Code.

5.2.2   Production of Audio

The audio in this game is using the royal free audio sound. The audio first search on an online free resource platform, then download and import to Visual Studio Code.

5.2.3   Production of Animation

The animation of the character is using DragonBonesPro. First, the character is digitally drawn using Adobe Photoshop 2021. Then import the PSD file into DragonBonesPro and create the animation. After the animation is complete, export it to frame the image and import it into Visual Studio Code.

5.3   Integration of Game Components

The implementation of this project was done using Flutter. The whole project is using Dart programming, and they are integrated with a few plugins.

5.3.1   Deep Artificial Intelligent (DeepAI)

Deep Artificial Intelligent(DeepAI) is a Neural Network Style Transfer Art. DeepAI is a new form of artwork created using Deep Learning that implements the computer vision technique — Convolutional Neural Network (CNN) to extract features and patterns from a style image and apply it to another image. In this project, the user needs to capture the photo and select the predefined style image. Then, the captured image can be transformed using DeepAI to generate a much more interactive and beautiful art style.

Figure 5.1: The process of DeepAI

Figure 5.1 above shows that the technical illustration of DeepAI neural network architecture. An input image and a style image are parsed to the input layer of the architecture. After the feature extraction and convolutional layers that perform the max-pooling method process the input image, an output image that resembles the style image and input image is then generated. An example of the output is depicted in Figure 5.2 below.

Figure 5.2: Example image use to transformed using DeepAI

5.3.2   Global Navigation Satellite System (GNSS)

GNSS is a general term describing any satellite constellation that provides positioning, navigation, and timing (PNT) services on a global, regional basis. In materializing the Geocaching and geosocial application, a GNSS system such as GPS must be used. Furthermore, the navigation system provided by the GPS must be accurate to avoid the user's frustration during the process. In this project, the GPS will be used to help the user go to the landmark location.

5.3.3   Mini-Game

In this project, the game has three open levels and one lock level. Each level consists of a mini-game. Each of the mini-game has a different map layout. The player

needs to play the mini-game to accumulate the score to unlock clues. The clues will help the player to go to the next level and find the hidden location.

5.3.4 Representational State Transfer (REST) Application Programming Interface (API)

In this context, style transfer refers to a technique to transfer a style of an image to another image. DeepAI is a style transfer application that provides representational state transfer (REST) access for easy use. In Flutter, proper management of the REST API needs to be set up and testing to avoid errors during the production phase. The style transfer will be embedded in the geocaching section, where users need to move to an old photo and recapture the image. The recaptured image can be transformed using DeepAI to generate a much more interactive and beautiful art style.

5.4 Game Configuration Management

Once everything is done, Geocaching Melaka is published on an Android phone. The configuration setup is explained in 5.4.1 Configuration Setup.

5.4.1 Configuration Setup

First, go to Flutter's official website to download the installation zip file and extract it into one folder. After that, go to Visual Studio Code to add the "Flutter" and "Dart" extensions. Finally, to create a new project, type the command in the terminal, which is "flutter create project name."

There have two modes which are debugged mode and release mode. In the development phase, debug mode is used, while release mode is used in the release phase.

To run the apps, select "Terminal" in Visual Studio Code, then type "flutter run" to run the application in debug mode. To publish to the application, type "flutter build apk" to release the application. After the APK is built, then can release the APK to use. Finally, the player needs to install the APK on the phone to start playing the game.

5.4.2 Version Control Procedure

The game version of the project is kept in a different folder. This is to prevent the mixture of the work and also the version of the game. The version for this project is in the Beta version, as the game is not at its full potential yet. The playtesting result is recorded for future reference to improve this game.

5.5 Implementation Status

Based on the Gantt Chart in Chapter 3, the first task is to think about the idea and develop the proposed game. It took one week to conduct and finished in time. The second task is doing proposal and game design concepts. The proposal and game design concept will be done within three weeks. The third task is to implement basic coding and game object into a project. It will take three weeks to complete. The fourth task is to implement the main game elements. References for the character and assets design and implementation are done here. It took four weeks to complete. The fifth task is the implementation of the bug fixing and finishes the game. It takes two weeks to do testing and debug the project. The project is then completed in this task. The last task is to finish the report and do the presentation, which demonstrates the finished game to the evaluator, and it took two weeks to complete.

5.6 Conclusion

In conclusion, the implementation phase is critical for the game mechanics to work and be playable. This chapter explains the implementation phase, which involves the media and components in the game. All the modules are working on specific software to turn into the desired game. In the next chapter, testing for target group users is conducted for further feedback through questionnaires.

CHAPTER 6: TESTING

6.1 Introduction

This chapter discusses the test method and results to identify bugs and errors during the development. A total of twenty youths with ten males and ten females participated in the testing. Besides that, this project also involved two experts who participated in the interview session. The test plan consisting of two testing methods was prepared and conducted to ensure that the application has passed all the tests and met its requirement. At the end of this chapter, we will discuss the collected testing result and review the effectiveness and user acceptance of the mobile game application.

6.2 Test Plan

The purpose of this testing is to evaluate the game by implementing it in the Geocaching Melaka. A good testing plan can help the developer in enhancing their application into a better application. These elements being tested are demographics of the users, usability / playtesting, engagement / creative freedom, visual aesthetics, game design, and knowledge improvement.

6.3 Test Implementation

Test implementation is the process of how the procedure of the test is conduct. Interview and survey are used for the game testing. The game's download link is provided for all participants to try out before answering the questionnaire. The participant can watch the video given if they are unable to download it. After that, the

participant needs to answer some questions. The test is conducted on twenty youths with an equal amount of gender.

On the other hand, an interview session is carried out for two experts. The interview question and answers are recorded in Table 6.1. and the survey is conducted using Google Forms. Questions asked in the survey will be listed in Table 6.4. detailed procedure of the test implementation is describing in Table 6.2 and Table 6.3. Finally, Table 6.10 will be discussed on the suggestion for improvement from the respondents.

Table 6.1: Interview Session

No	Questions	Answer
1.	Does the font text, background image, or background color that I have used suitable for the game?	Yes, pretty good, but the button color is not consistent. If using the exact font text and the same color would be good.
2.	How is the gameplay of the game?	DeepAI concept is excellent, and the gameplay is straightforward. However, the character movement did not smooth, and sometimes, the mini-game cannot pick up the item.
3.	Do you think is the mini-game in each level can increase the fun factor for this game?	Yes, but if have multiple various games or maybe add different speed or bomb to minus the score is better.
4.	How do you think about this game after playing with it?	This game is a good game for tourists. Besides that, this is a new concept game. So, feel fresh and unique idea to play like this.
5.	Is there any part of the game that makes you bored when playing the game? Why?	This game is not boring but too straightforward, but it will feel boring if the character dies many times in the mini-game. This is because a repeat of gameplay will feel boring. Maybe

		some challenges can be added to the mini-game.
6.	Do you have any suggestions for improvement of the game?	- Disable screenshots or just enable the camera. - Disable phone back button. - Solve the Tricycle appear at collider box. - Add a minus point in the mini-game or add character speed. - Do different mini-games. - Explain the art is the autism art. - Maybe we can try gesture control instead of the arrow button. - Maybe we can add all button sound.
7.	Do you encounter any bugs when playing this game?	- Can screenshot the image to upload. - Hard to control in the mini-game. - Tricycle appears at collider box. - The default phone back button did not save the data. - DeepAI process load infinity, so maybe we can put time out.
8.	Based on your opinion, what is the problem that students or other people faced when learning Melaka history?	The textbook has too many texts, and this causes the reader to feel very boring.
9.	Based on your opinion, is this game can help to increase the knowledge of Melaka history?	Yes, the details of the history are straightforward to read.
10.	DeepAI is using in this game to transfer autism art to be a beautiful new art style. Based on your opinion, is DeepAI an effective way to expose autistic art to the public and generate value for their art?	It is a good way, but I need to explain the style is autism art.

Table 6.2: Procedure of Interview session

| No.	Description	Time Allocated
1.	Set up recording equipment. *including camera, laptop	20 mins
2.	Interview session with alumni UTeM.	30 mins
3.	Thank you and wrap up.	10 minutes

Table 6.3: Procedure of Survey

No.	Description
1.	Upload apk into Google Drive.
2.	Create a question for the questionnaire.
3.	Send Google Drive link and Google Forms to the participant.
4.	Answer the questionnaire.

6.4 Test Result and Analysis

In the proposed questionnaire, there are a set of demographic findings. A total of 5 factors were considered for evaluating the game: usability / playtesting, engagement / creative freedom, and visual aesthetics: game design and knowledge improvement. The score method used in the questionnaire is based on Linkert Scale, where the participant needs to answer the question based on the score and its description.

Table 6.4: Scoring for Evaluation Test

Description	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Score	1	2	3	4	5
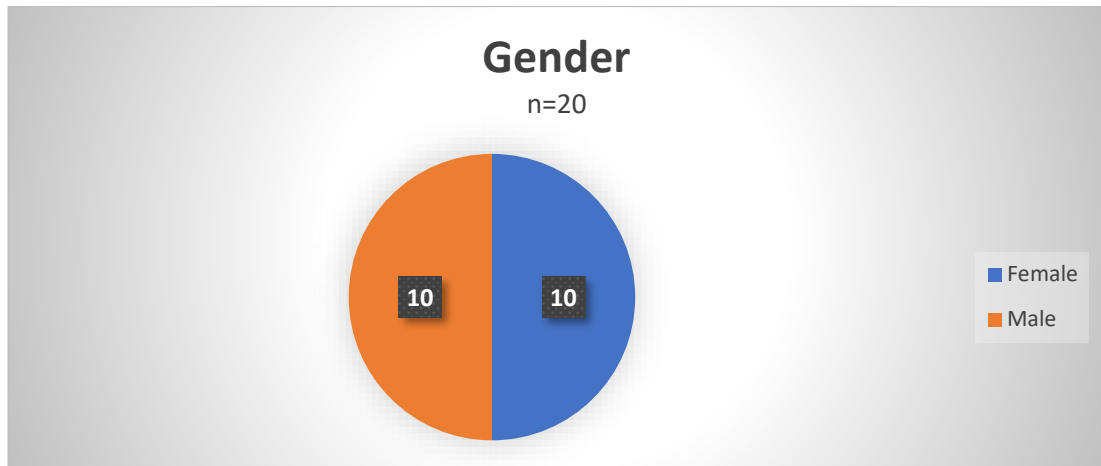
Figure 6.1: Gender of respondents

Figure 6.1 shows that 10 out of 20 respondents are male, 50%, and 10 out of the respondents (50%) are female.
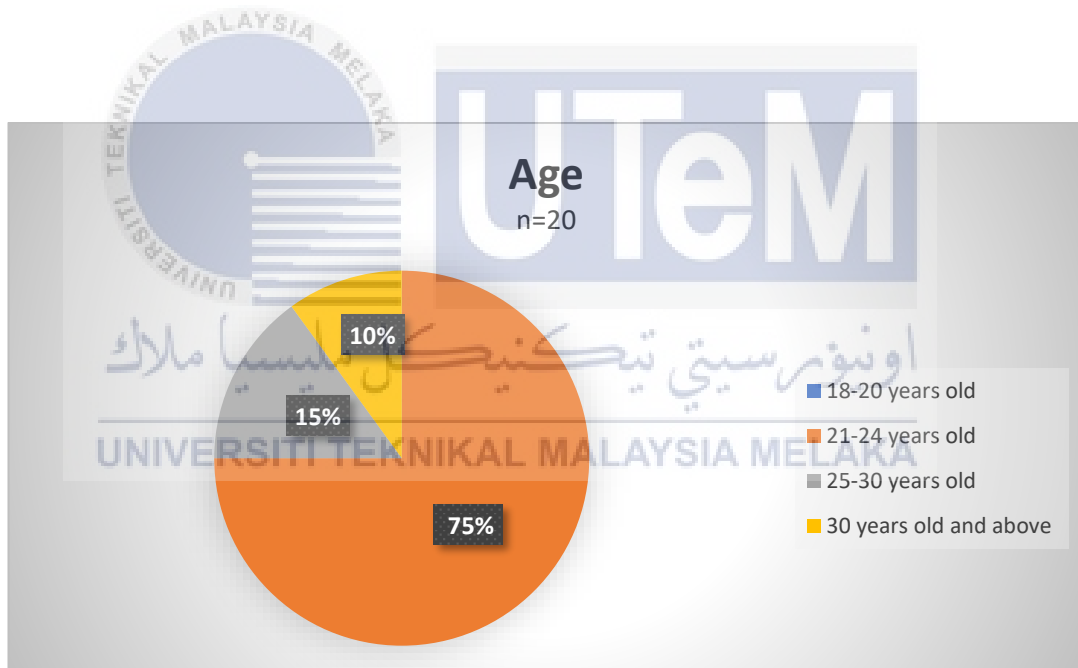
Figure 6.2: Age of the respondents

Figure 6.2 shows that majority of the respondents are age between 21 to 24 years old which is 75%. In addition, 15% of them are 25 to 30 years old, and 10% are 30 years old and above.
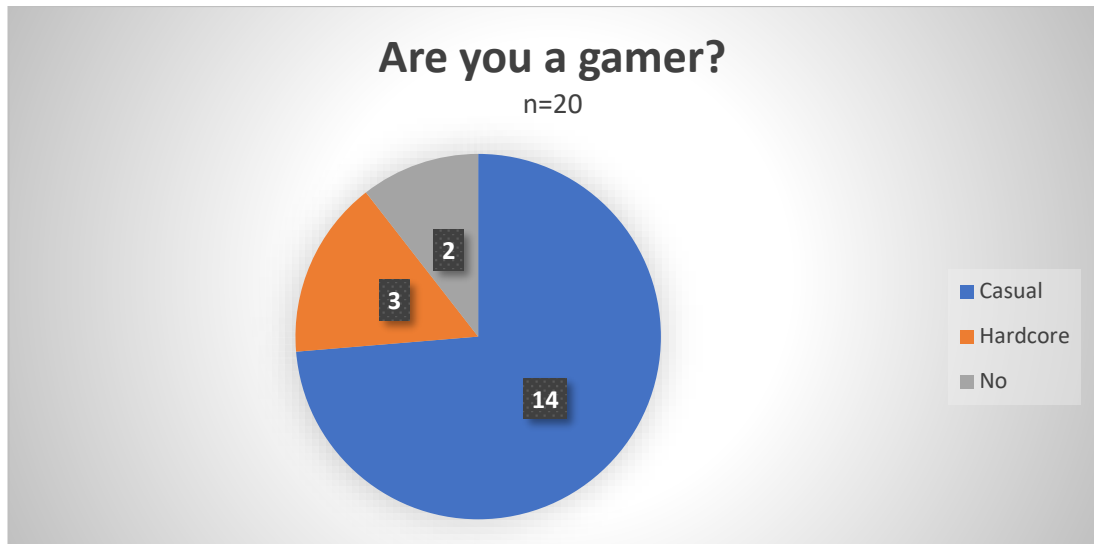
Figure 6.3: Data on how many gamers

Figure 3.3 shows that 14 out of 20 respondents (74%) are casual gamers, and 3 out of 20 respondents (16%) are hardcore gamers. Some of the respondents are not a gamer which is only 2 (10%) of them.
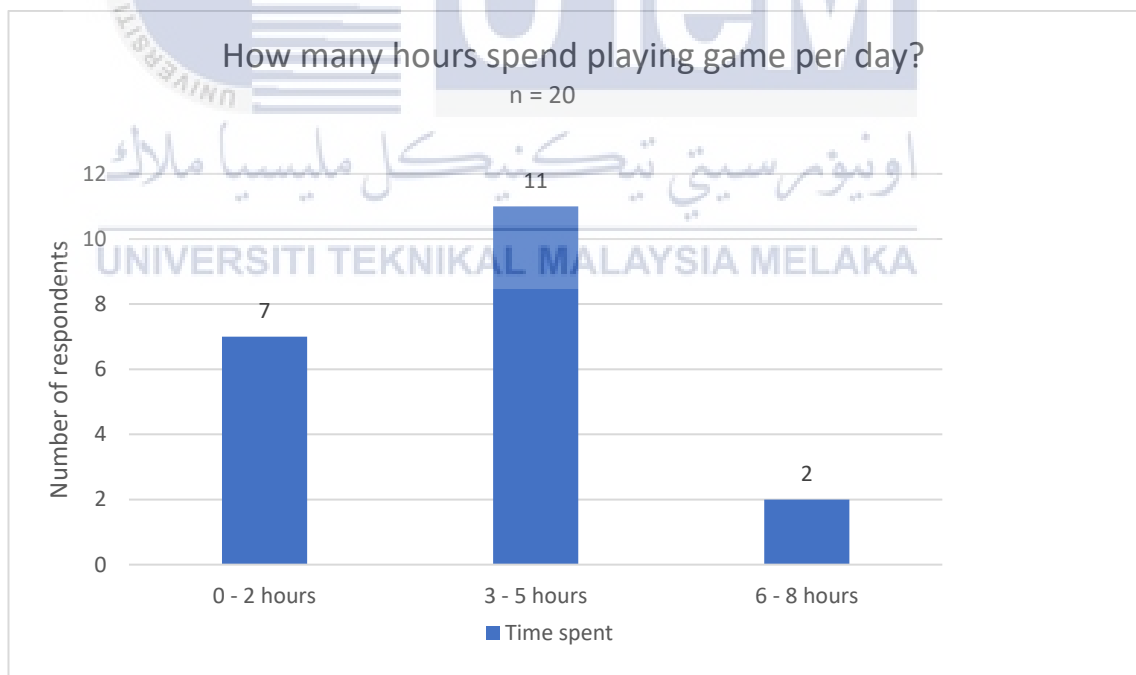
Figure 6.4: Hours Spend Playing Game Per Day Data

Figure 6.4 shows that 11 out of the 20 respondents the majority respondents play games 3-5 hours per day (55%), 7 out of the 20 respondents are play games 0-2 hours per day (35%), and 2 of them are playing 6-8 hours per day (10%).

Table 6.5: Question for Usability / Playtesting

	Question	Mean
Usability / Playtesting		
1	I find it is easy to learn how to play this game	4.25
2	I find the game's menus are user friendly	4.2
3	I find the instruction provided in the game is clear	4.2
4	I find the game is easy to play	4.2
		4.21
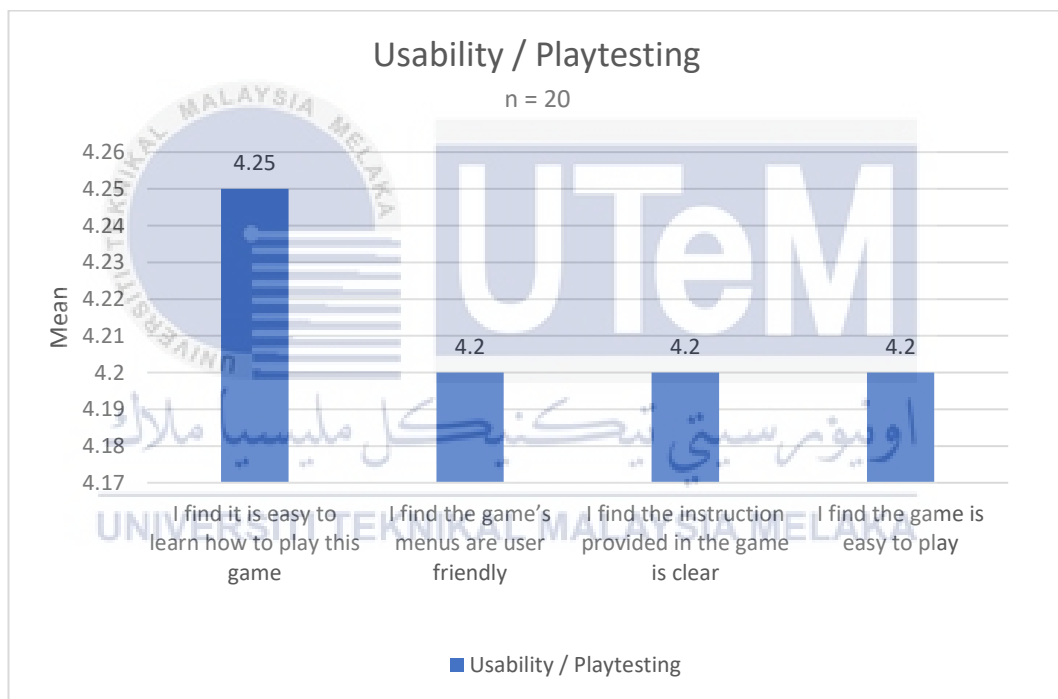
Figure 6.5: Usability / Playtesting Mean Graph

Based on Figure 6.5, there are four evaluations, including how easy to learn to play the game, user-friendly menus, clear information provided in the game, and how easy to play the game. We can see that the mean for four evaluations ranges between 4.2 to 4.25. Thus, from the result above, we can see that most of the respondents agree that they can quickly learn how to play this game.

Table 6.6: Question for Engagement / Creative Freedom

	Question	Mean
Engagement / Creative Freedom		
1	I enjoy playing the game	3.65
2	I can play the game the way I want	3.85
3	I will recommend this game to others	4.05
4	I find the game is unique or original	4.05
		3.9
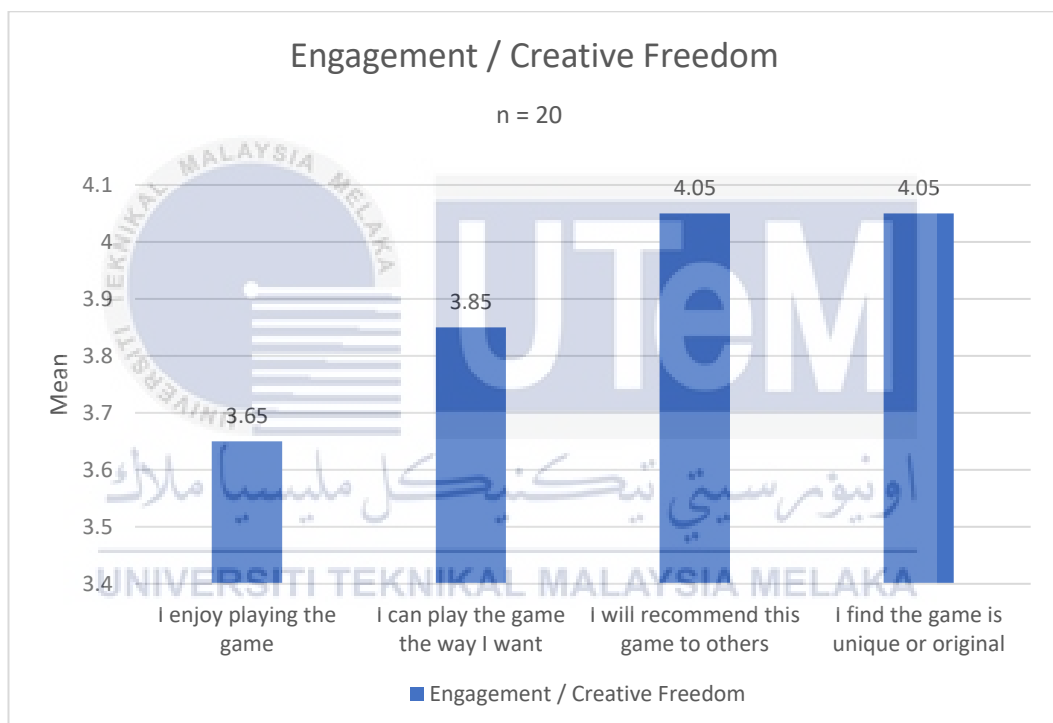
Figure 6.6: Engagement / Creative Freedom Mean Graph

Based on Figure 6.6 above is the Engagement / Creative Freedom Mean Graph. There are four evaluations including on this graph which are enjoyment when playing the game, can play the game they want, do player will recommend this game to other and do player agree that the game is unique or original. Based on the graph, we can see that the respondents agree this game is unique or original and will recommend this game to other players, but at the same time, some of the respondents feel that they did not enjoy playing the game.

Table 6.7: Question for Visual Aesthetics

	Question	Mean
Visual Aesthetics		
1	I enjoy the game's graphics	3.7
2	I find the graphics of the game fit the mood or style of the game	3.75
3	I find the GUI is easy to understand	4.2
4	I find the level design of the game is good	4
		3.91
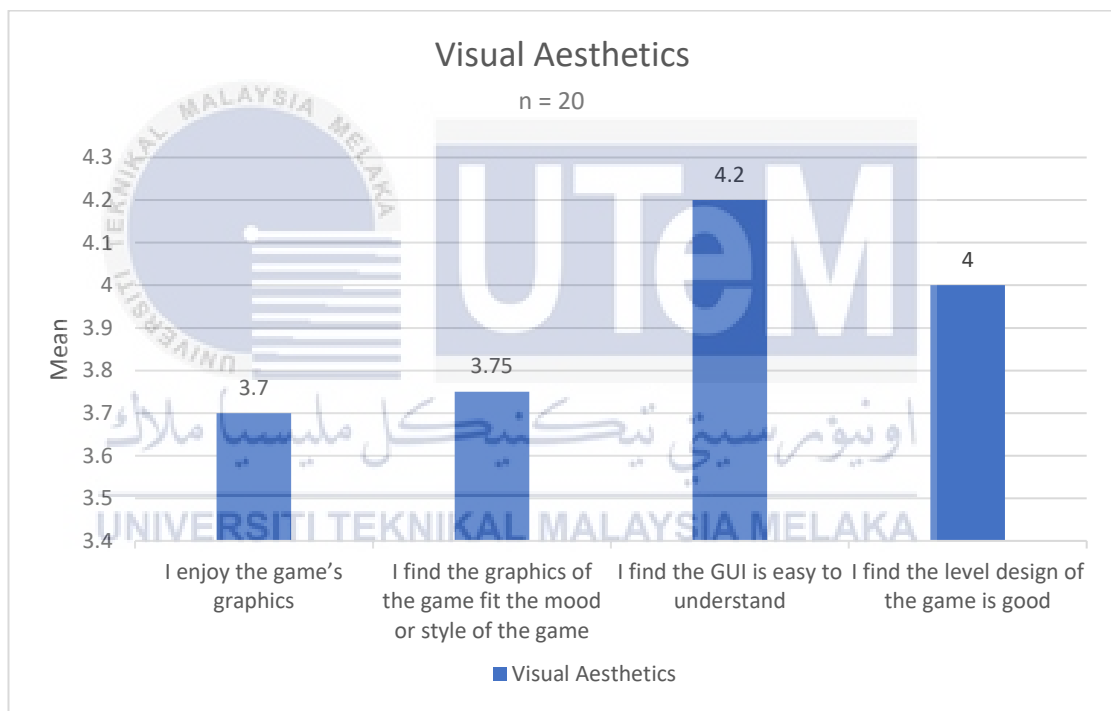
Figure 6.7: Visual Aesthetics Mean Graph

Based on Figure 6.7, there are four evaluations, including how well the respondent enjoys the game's graphics, graphic of the game fit the mood or style of the game, GUI is easy to understand, and the game's level design is good. The result shows that the majority of the respondents agree that the GUI is easy to understand. However, we can conclude that the graphic in the game still has some weaknesses to receive maximum satisfaction from the respondents.

Table 6.8: Question for Game Design

Question		Mean
Game Design		
1	I find the mini-games are challenging	3.9
2	I find the game story is interesting	4.15
		4.03
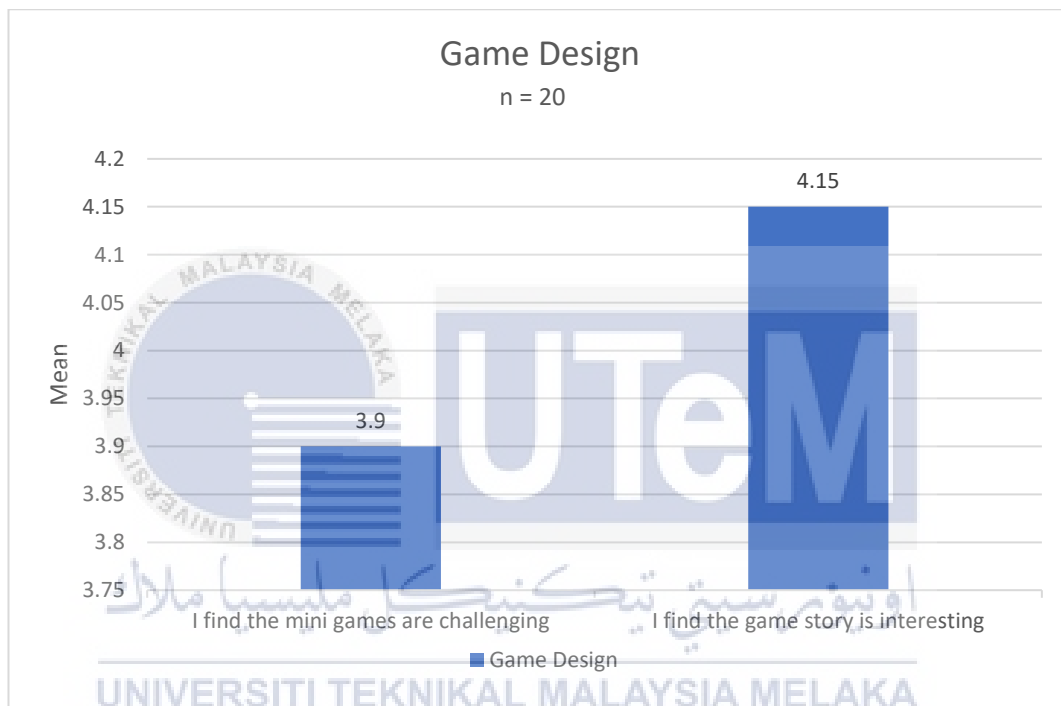
Figure 6.8: Game Design Mean Graph

Based on Figure 6.8, there are two evaluations to evaluate in the Game Design. From the result, we can see that the respondents agree that the game story is interesting, but at the same time, the respondents also feel that the mini-games are challenging.

Table 6.9: Question for Knowledge Improvement

Question		Mean
Knowledge Improvement		
1	The game increases my knowledge of the history of Melaka	3.45
2	The game help me easy to find the popular landmark Melaka	4.15
		3.8
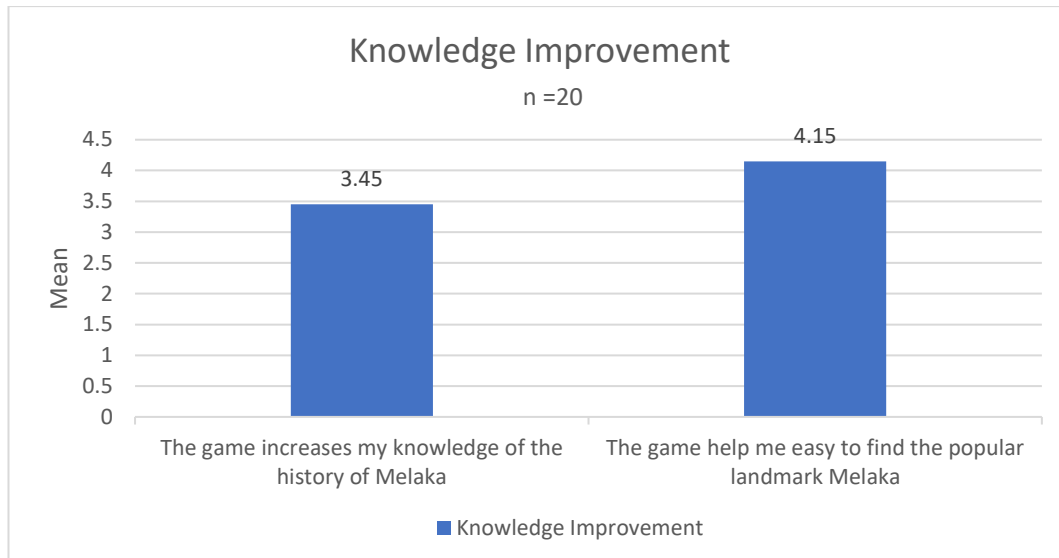
Figure 6.9: Knowledge Improvement Mean Graph

Based on Figure 6.5, there are two evaluations, including increases their knowledge of the history of Melaka in the game and how the game can help them find the popular landmark Melaka. The graph above shows that the mean score above 4 stated that the respondents could easily find the popular landmark Melaka. Besides that, in the chart above, we also can know that some of the respondents disagree that this game can increase their knowledge of the history of Melaka.

Table 6.10: Suggestion for improvement

Category	Suggestion for improvement
Mini-Game	Bring more mini-game and prevent a bug in mini-game
	Add some background music and add more mini-game
	Increase sensitivity of the control, and debug the error
Gameplay	Spawn sometimes spawn under the button UI, make it hard for the user to predict, so my suggestion is to make the user can control the movements by swiping/touch the control
	Really nice game; introduce more places would be cool.

Based on Table 6.10, we can see that there can be two categories of suggestions for improvement: one part for improving mini-game and another part for gameplay. The respondents suggest bringing various mini-games to different levels from the table above, adding background music, increasing the control's sensitivity, and debugging

the bug. Besides that, respondents suggest changing the control button in the mini-game to swiping or touch control. Lastly, there have one respondent who suggests introducing more places in this game would be cool.

6.5   Conclusion

In conclusion, this chapter discussed the testing carried out in the game. From the survey above, we can see that there have four components to evaluate. Most respondents agree that usability / playtesting fulfills their requirements. Besides that, some respondents do not agree that this game could help them increase their knowledge about Melaka history. Last but not least, based on the respondents' recommendation, the game can be improved by adding various types of mini-game in each level and adding some background music or place in the game. The next chapter will discuss the observation of strengths and weaknesses, proposition for improvement, and contribution.
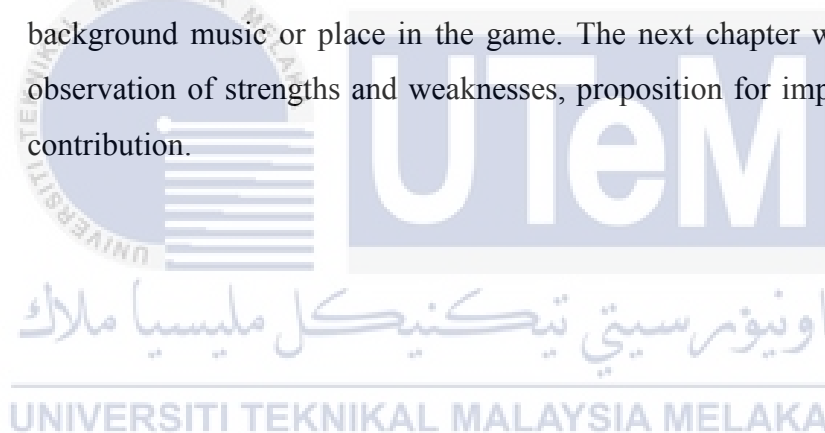
CHAPTER 7: PROJECT CONCLUSION

7.1 Observation of Strength and Weakness

The strength and weaknesses of the game are discovered after the testing phase. Feedbacks from the users that take part in the survey are helpful to point out the good and flaw of the game. The strength of the Geocaching Melaka is it has simple gameplay which all types of the player are suitable. So, most of the respondents agree that this game is easy to learn how to play this game. Besides that, most of the respondents agree that this game is unique and original. As for the weakness, the movement control of the character in the mini-game is not very smooth, which causes the player to have some difficulties controlling the character to avoid an obstacle or collect the item.

Moreover, based on the survey, some of the respondents agree that this game can help increase knowledge of the history of Melaka. During the testing phase, errors were found. The problems were solved by debugging the errors. The lesson learned from the project is every issue has a solution for it.

7.2 Proposition for Improvement

In order to improve the performance of this project, some improvement ideas are collected from the respondents. Based on the survey, the mini-game can add different types of mini-games to avoid getting bored. The movement control needs to be fixed, such as increasing the control sensitivity for the player to control the character. Furthermore, introduce more places in the game for the player. Finally, the number of collectibles can increase to allow the player to have more fun when playing.

7.3   Contribution

This project has promoted learning the Melaka history. This game aims to research the effectiveness of promoting and applying the art style of autistic students in real-life applications through treasure hunting mobile application games. This game is hope to while promoting and applying the art style of autistic students in the real-life application can also promote learning the Melaka history.

7.4   Conclusion

In conclusion, this project has met the objective set which to explore geosocial and Geocaching services in tourism app, to implement a Global Navigation Satellite System(GNSS) to navigate users to the correct location on hybrid mobile app platform, and to integrate style transfer representational state transfer (REST) application programming interface services with the Tourism Gamification mobile application. This product also has many potentials that can be polished to increase game industry marketability in Malaysia.
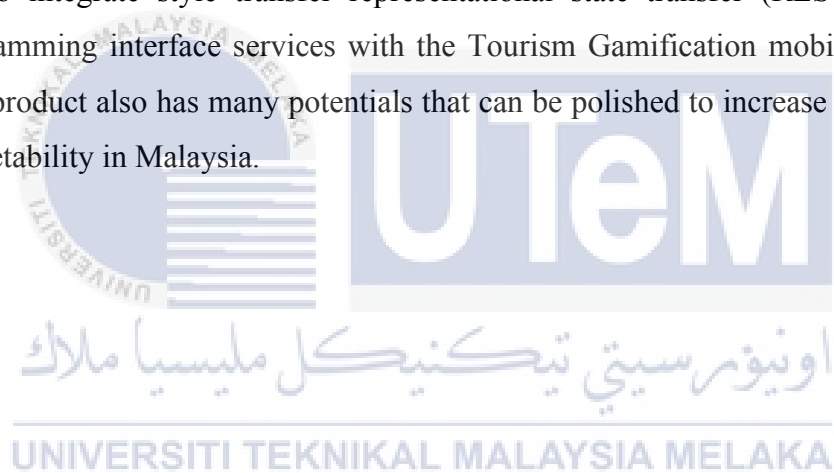
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https://www.johornow.com/english/must-visit-places-malacca/

APPENDICES

Appendix A: Questionnaire for testing plan

Gender
20 responses
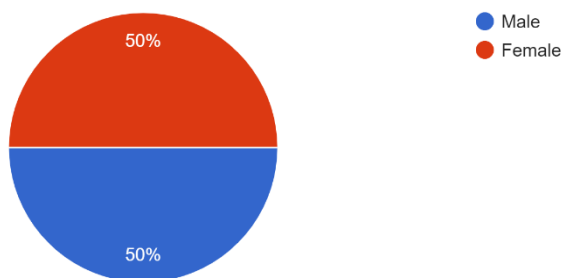
Age
20 responses
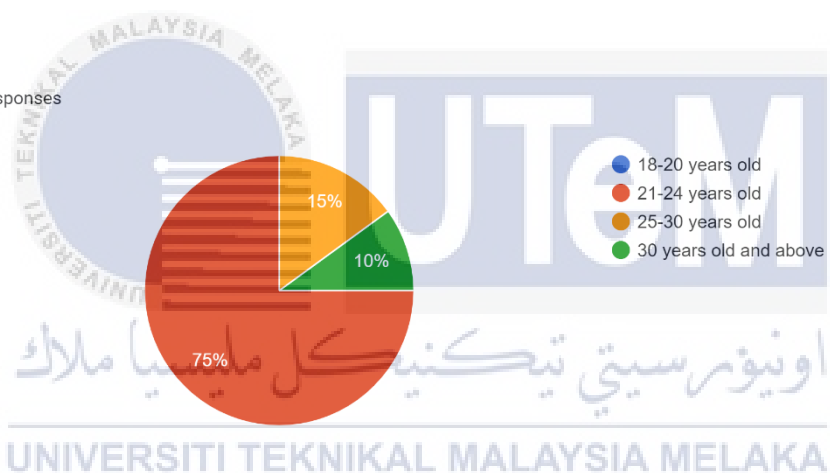
Are you a gamer?
20 responses
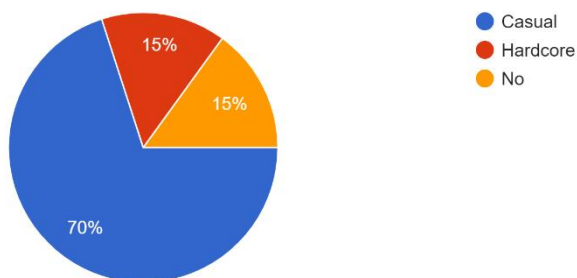
How many hours spend playing game per day?

20 responses
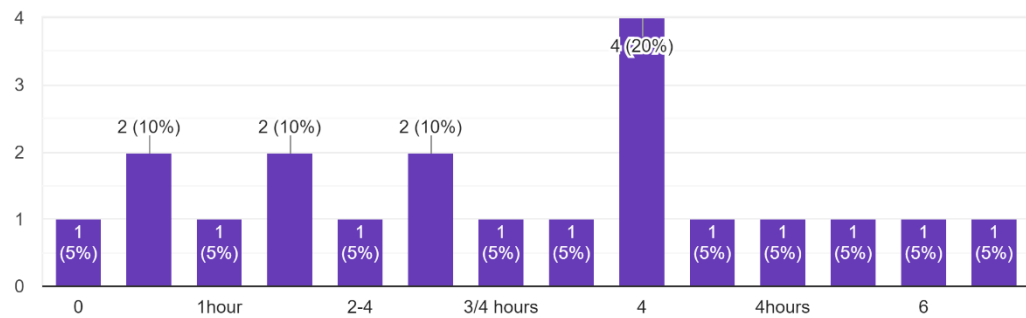
Usability / Playtesting

I find it is easy to learn how to play this game

20 responses
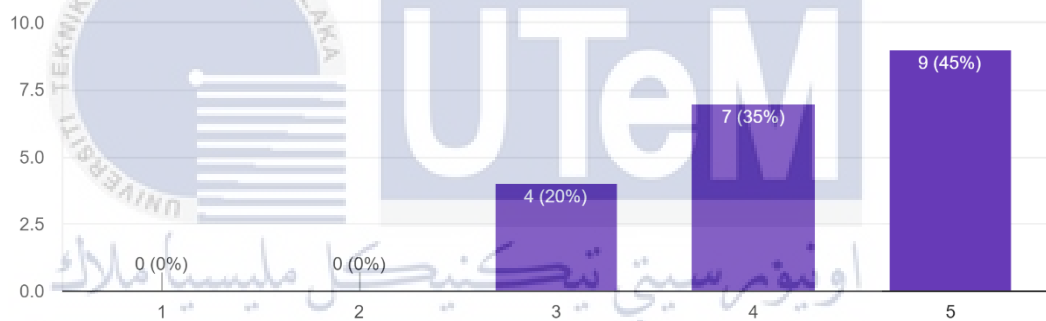
I find the game's menus are user friendly

20 responses
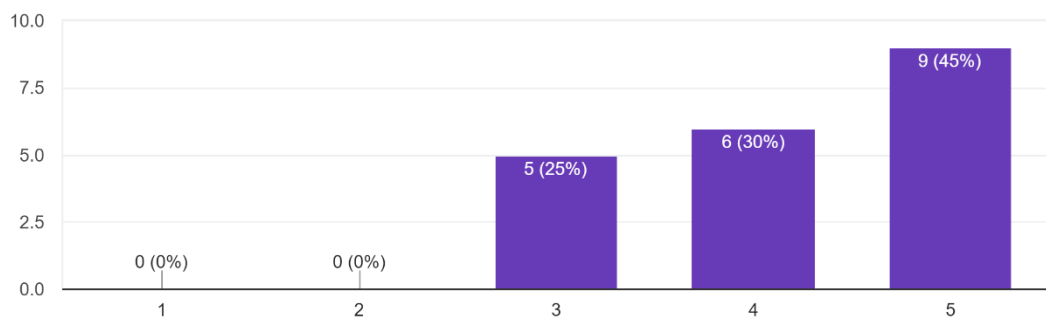
I find the instruction provided in the game is clear

20 responses
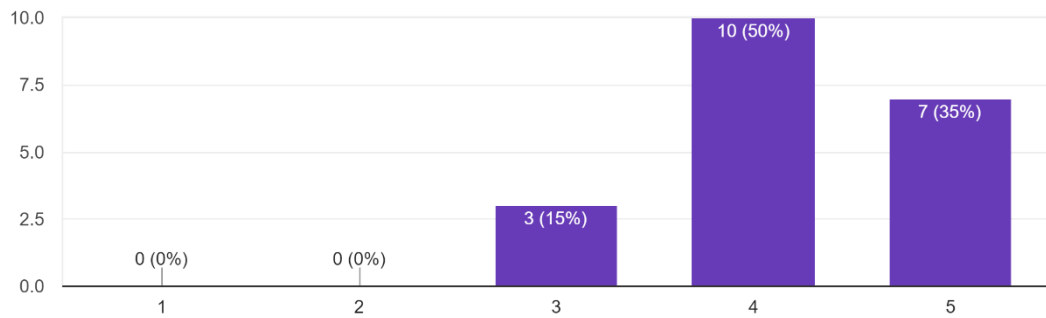
I find the game is easy to play

20 responses
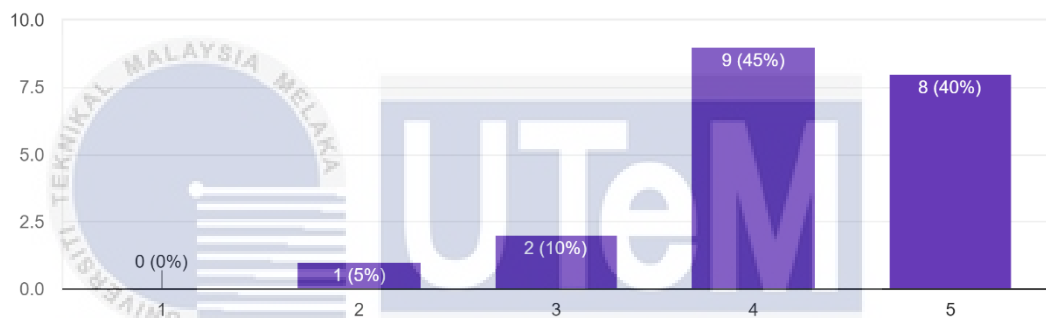
Engagement / Creative Freedom

I enjoy playing the game

20 responses
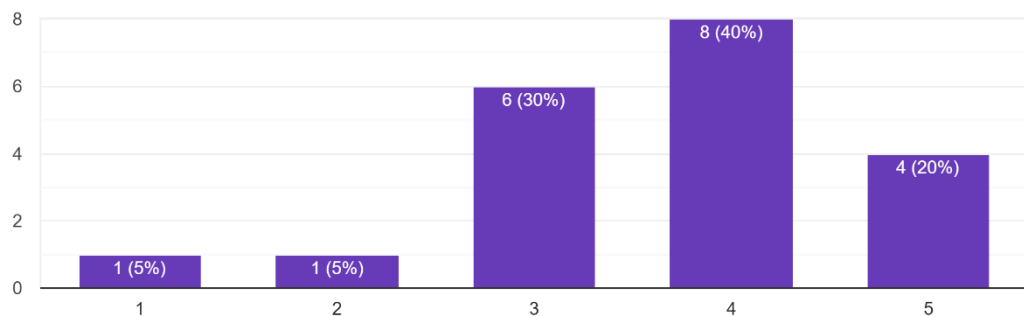
I can play the game the way I want
20 responses
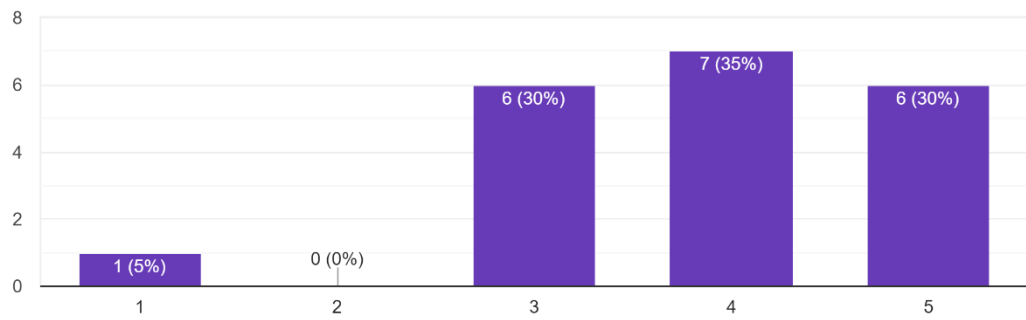
I will recommend this game to others
20 responses
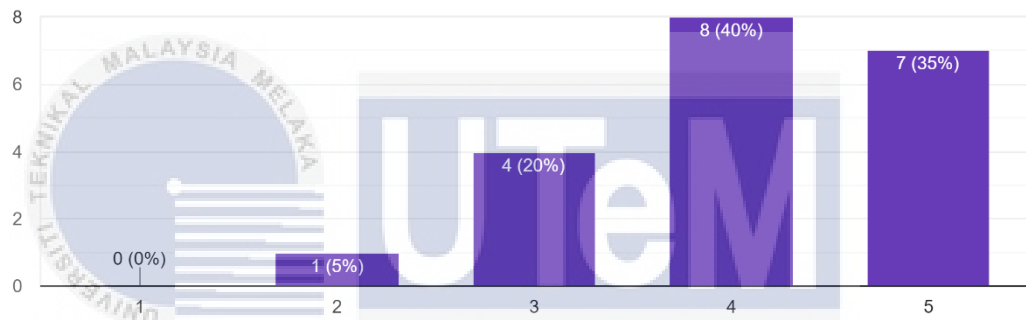
I find the game is unique or original
20 responses
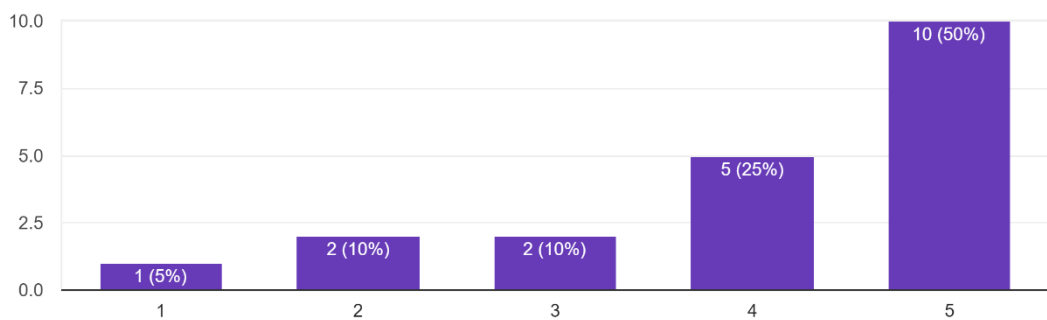
Visual Aesthetics

I enjoy the game's graphics

20 responses
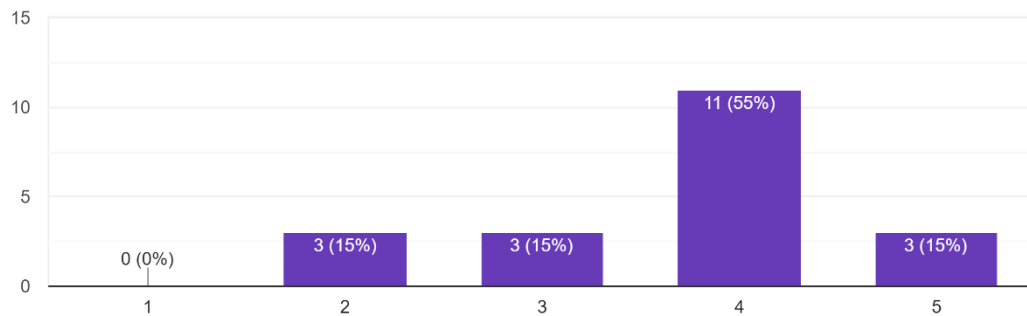
I find the graphics of the game fit the mood or style of the game

20 responses
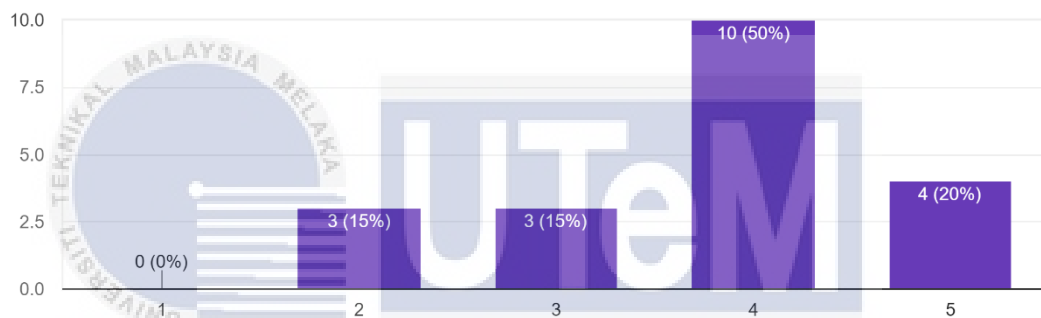
I find the GUI is easy to understand

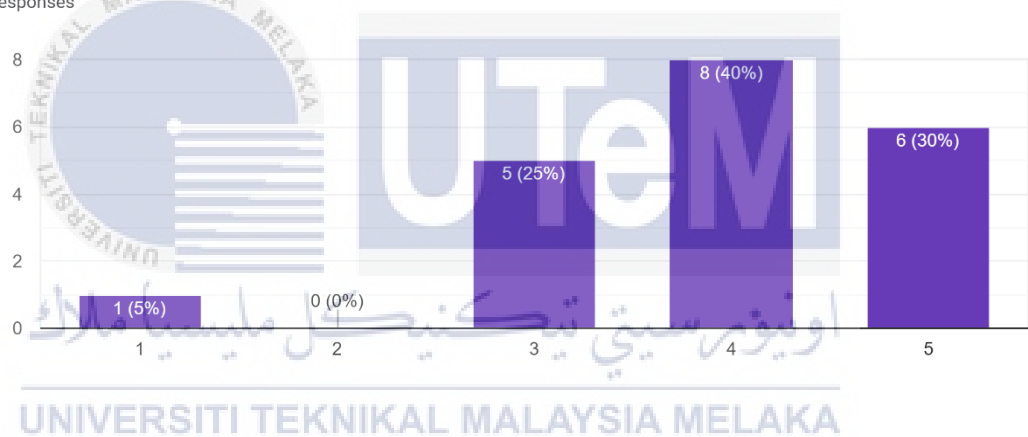20 responses
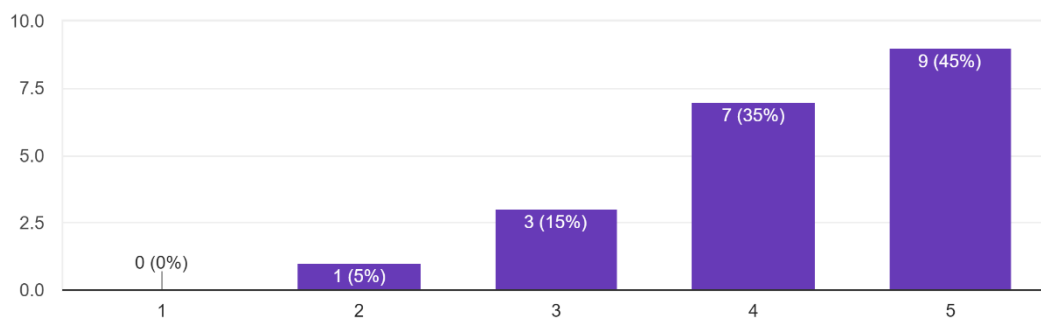
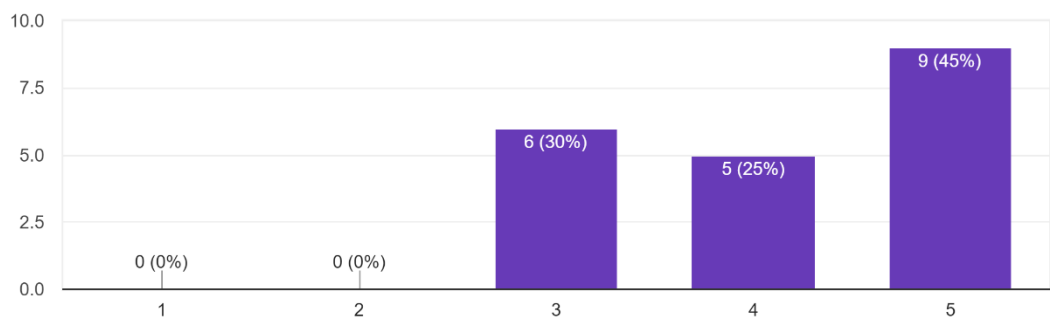I find the level design of the game is good

20 responses
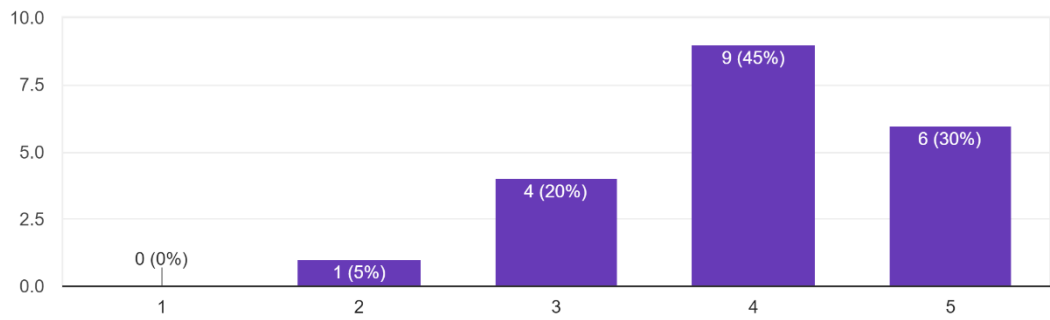
Game Design

I find the mini games are challenging
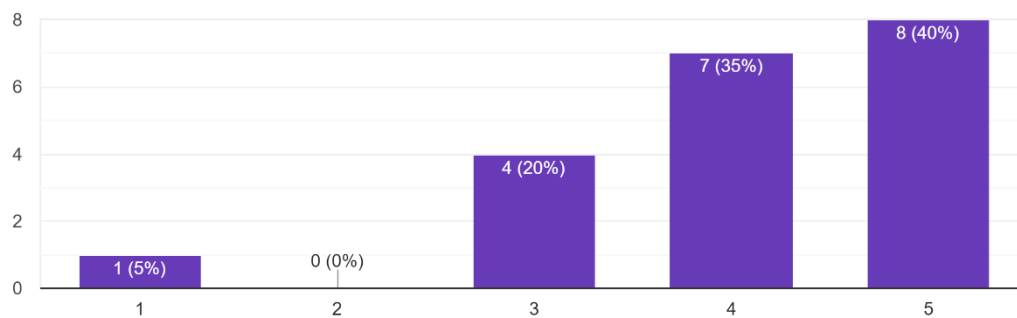
20 responses

I find the game story is interesting
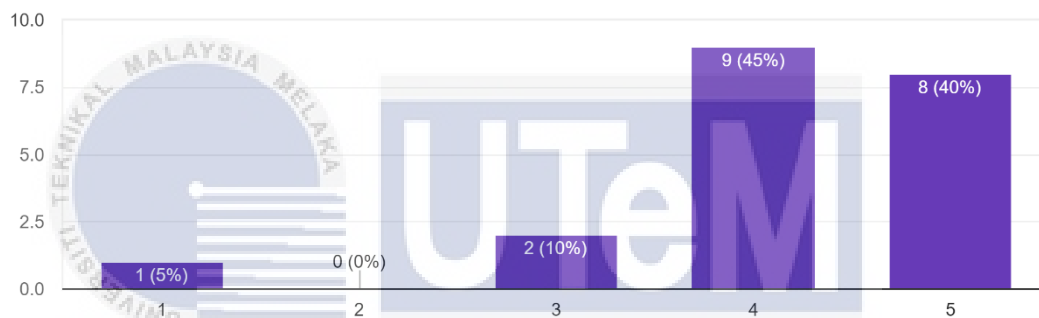
20 responses

Knowledge Improvement

The game increases my knowledge of the history of Melaka

20 responses

The game help me easy to find the popular landmark Melaka

20 responses

Suggestion for improvement:

13 responses

Overall is okay keep moving on😊

no need

No, it's good.

No

Bring more mini game and prevent bug in mini game

add some background music and add more mini game

great games

Increase sensitive of the control, and debug (cuz got bug)

-

No idea.

Really nice game, introduce more places would be cool.

Not smooth enough😂