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AlamCera: A Malay Folklore Mobile Game Development Based On Action Adventure Game

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Abstract

Malay folklore are traditional stories and legends, spread by the Malays as a teaching medium that is currently delivered to society through oral storytelling, books, e-books and animation. However, there is a lack of interactive games based on Malay folklore available on the market. Thus, AlamCera is proposed to consist of four levels based on popular folktales including Sang Kancil, Mat Jenin, Batu Belah Batu Bertangkup and Sang Kelembai. Using a 2D pixel art style and side-scrolling gameplay, with action adventure elements such as battling enemies and completing story quests. The Game Development Life Cycle (GDLC) methodology is utilized with development tools like Aseprite and Unity to build on the Android mobile platform. The testing result from the System Usability Scale shows a 68.3 score indicating the game's gameplay and usability experience is satisfying to the majority of users. Future works include branching storyline, enhanced interaction mechanics and multilingual support.

1. Introduction

Malay folklore encompasses traditional stories, myths, and legends shared by the Malay people, often passed down orally or through written literature. These narratives, frequently imparted by elders, carry important moral lessons that shape the cultural identity of the Malay race. For instance, the tale of Si Tanggang teaches respect and gratitude towards parents. According to Vivien Yew Wong Chin, a senior lecturer in cultural anthropology at Universiti Kebangsaan Malaysia, folktales remain culturally significant today, resonating with both young and old [1].

In contemporary society, Malay folklore has evolved from oral traditions to written and animated formats that appeal to younger audiences. Children and young adults engage with these stories through books, e-books, and animated shows. These formats enhance storytelling with illustrations, but the interactivity and user participation are often lacking. A preliminary study on the awareness of Malaysian folktales revealed that many Malaysians, aged 15 to 45, are more familiar with Western folktales, primarily due to the influence of modern technology and popular games that focus on Western narratives [2].

The current gaming market lacks interactive applications based on Malay folklore. Although there have been some projects, such as a role-playing game (RPG) about Puteri Gunung Ledang [3] and an adventure game about Tun Mamat [4], these are limited and not widely available on public platforms. Consequently, there is a noticeable absence of interactive applications that bring Malay folklore to life, which diminishes their visibility among younger generations. Most existing apps in the Google Play Store, like Kumpulan Dongeng Anak Offline [5], are merely digital versions of books with minimal interactivity. Furthermore, popular interactive games like

Apple Knight [6] and Grimvalor [7] focus on original stories rather than traditional ones, missing the opportunity to engage players with Malay folklore.

Hence, the project aims to design an interactive AlamCera game based on action adventure genre, develop an AlamCera game on the mobile platform and evaluate the usability of the AlamCera game application through user feedback and testing. The AlamCera game will be developed using Unity for gameplay and Aseprite for asset creation, targeting users aged 9 to 15, aligning with Piaget's cognitive development theory [8]. It will feature four levels based on Malay folklore stories: Sang Kancil, Mat Jenin, Batu Belah Batu Bertangkup, and Sang Kelembai [9], each imparting essential moral values while allowing players to interact with characters and defeat enemies. Designed as a 2D pixel art-style, offline, single-player game, it will incorporate real-time combat, item gathering, and quest-solving mechanics, guided by the Game Development Life Cycle (GDLC) methodology [10]. Players will control their characters using buttons, navigating a visually appealing environment filled with folklore elements. The game aims to engage and educate players about Malay culture, preserving these stories for the younger generation and promoting an understanding of their cultural heritage in the face of Western narratives.

The rest of the paper is organized as follows: Section 2 covers the domain of study, the technology used, and the result of the comparative analysis. Section 3 describes the Game Development Life Cycle (GDLC) methodology that has been chosen to be used in this project, as well as the output of the analysis and design phases of this project. Furthermore, Section 4 discusses the result and discussion, while Section 5 states the conclusion of the current progress.

2. Related Work

This section discusses the background of the study, the technology used, and the result of the comparative analysis.

2.1 Malay Folklore

Malay folklore consists of oral tales, myths, and legends passed down through generations, serving as cautionary and moral stories that reflect the beliefs and values of the Malay people [1]. While rooted in the cultural and social contexts of the Malay Peninsula, the exact origins and creators of these tales are hard to pinpoint due to their oral transmission, which can lead to alterations over time. Today, Malay folklore is preserved through various modern mediums such as picture storybooks, e-books, and animated series like Pada Zaman Dahulu [11]. However, these formats are often passive, limiting audience engagement and deep identification with the stories. In contrast, video games offer interactive experiences that foster emotional connections, allowing players to engage with narratives in a meaningful way [12]. Adapting Malay folklore into game format enhances engagement and enables players to experience the stories firsthand, encouraging appreciation for their cultural roots while ensuring the longevity of these narratives in a digital age.

2.2 Interactive Games

Interactive games are applications that enable communication between the game and the player, allowing users to input actions like controlling elements or making choices. The game then responds based on the player's actions, which enhances engagement through continuous feedback [13]. The advancement of technology has transformed interactive games from simple designs, like Pong, to complex experiences that require quick reflexes and problem-solving skills. This evolution has made gaming a dominant form of entertainment, as evidenced by a study conducted by Newzoo from February to May 2023, which surveyed 74,295 respondents across 36 countries. The study found that 93% of the younger generation, including Generation Alpha and Generation Z, are video game players [14]. Additionally, even those who do not play games may engage with gaming culture by watching "Let's Play" videos on platforms like YouTube and Twitch. This growing trend is driven by various motivations, such as learning new gameplay strategies from experienced players, exploring games they cannot access due to cost or age restrictions, and staying updated on gaming trends. Viewers also find value in the social experience by connecting with like-minded peers, joining live chats, and becoming part of a broader fan community. Moreover, the entertaining nature of charismatic gaming content creators, who often blend gameplay with storytelling and humor, adds to the appeal. These factors transform gaming from a solitary hobby into a shared and immersive cultural phenomenon that extends beyond the act of playing itself [15].

2.2.1 Action Adventure

Action adventure is a gaming genre that blends intense action sequences with exploration, quests, and puzzles that advance the narrative [13]. The action component emphasizes fast-paced gameplay and physical challenges like hand-eye coordination and reflexes, while the adventure aspect focuses on storytelling,

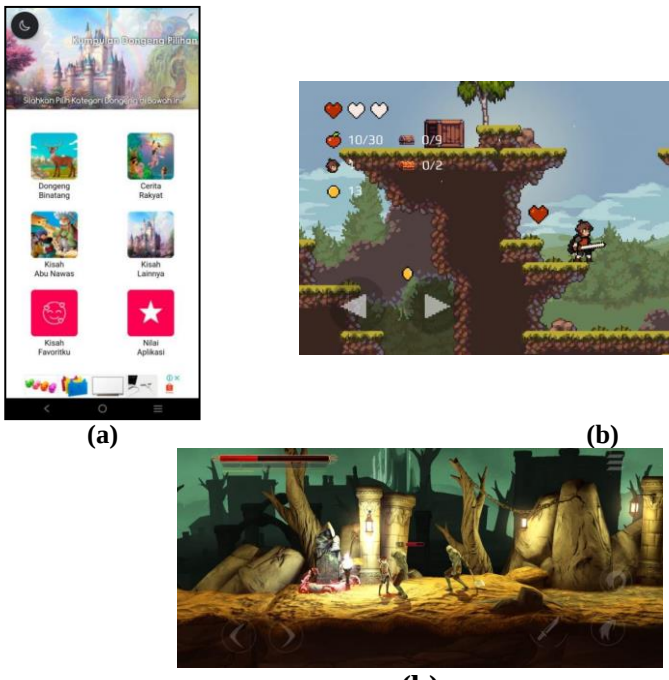
exploration, and puzzle-solving. Players navigate various environments, interact with key characters, and manage inventories, engaging deeply with the plot and characters. This genre is versatile, incorporating elements from first-person or third-person views, platformers, and survival simulators [16]. A modern example is The Legend of Zelda: Tears of the Kingdom, which combines real-time combat with exploration and narrative [17]. For this project, a platformer action adventure game was chosen, as its mix of action and storytelling is ideal for integrating rich narratives like Malay folklore. Platformers encourage exploration and critical thinking, allowing players to connect with a fictional narrative and its characters, providing a diverse experience appealing to a broader audience than other genres.

2.3 Mobile Operating System

Mobile operating systems like Android and iOS are designed for mobile devices, offering user-friendly interfaces and supporting various applications. They manage power consumption efficiently to extend battery life, ensuring seamless user experiences. Android is the most popular mobile operating system due to its open-source nature, allowing widespread integration into various devices, while Apple's system is exclusive to its hardware [18]. For the AlamCera game application, an Android mobile operating system was chosen because it allows flexible, portable gameplay on phones and tablets, making it convenient for users to engage with the game anywhere. A 2023 study by Shah and Phadke [19] found that 66 out of 90 children aged 0 to 4 used mobile phones, with 25.8% playing games, highlighting the user-friendly touchscreen input that facilitates intuitive interactions for young children. By utilizing the Android mobile operating system, AlamCera can effectively engage its target audience while providing an enjoyable and educational experience. This is supported by the findings of Rakimahwati [20], who demonstrated that Android-based educational games are not only practical and effective but also highly engaging for early learners. Their study highlighted how Android mobile platforms allow children to access educational content conveniently at home, especially during the Covid-19 pandemic. Moreover, the interactive features and multimedia elements of Android applications were shown to significantly improve children's reading skills. Thus, integrating AlamCera into the Android mobile platform similarly enables a wide reach and supports immersive, play-based learning tailored to young users.

2.4 Comparative Analysis

Comparative analyses were conducted on three related applications to the proposed system. The three applications are Kumpulan Dongeng Anak Offline[5], Apple Knight[6], and Grimvalor[7], as shown in Fig. 1(a), (b), and (c), respectively. Table 1 shows the result of the comparative analysis.



(a) **(b)**

(b)

Fig. 1 *(a) Kumpulan Dongeng Anak Offline[5]; (b) Apple Knight [6]; (c) Grimvalor [7]*

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Table 1 *Application Comparison*

Features/Applications	Kumpulan Dongeng Anak Offline [5]	Apple Knight [6]	Grimvalor [7]	AlamCera
Operating System	Android	Android and iOS	Anroid and iOS	Android
Graphic	2D graphic	2D-pixelated art style	3D graphic	2D-pixelated art style
Goal	None	Save the kingdom by defeating the Evil Wizard	Discover the fate of the Vallaris kingdom's lost king	Save the king of AlamCera from Sang Kelembai
Metaphors	None	Forest	Dark caves, ruined castles and snowy mountaintops.	Malaysian forest, village and cave environment.
Levels	None	5 levels with 10 sub-levels in each level	5 levels	4 levels
Collectable	None	Gold coins, hearts and apples	Treasures and soul shards	Health items and quest items
Booster	None	Movement speed, critical hits, triple jumps, invincibility	Stun ability, critical hits	Movement speed, dash ability, higher jumps
Advantages	Tells the whole original storyline of folktales	Bright and beautiful modern pixel art style	Smooth and responsive on-screen control which causes fighting to be fun	Includes Malay folklore and environments in a modern pixel art style

3. Methodology

The AlamCera mobile game application has been developed using the Game Development Life Cycle methodology, as depicted in Fig. 2 due to it being a game application and for its comprehensive coverage on the game development process. The six phases of this methodology are the Initiation phase, pre-production phase, production phase, testing phase, beta phase, and release phase. Appendix A provides a summary of the output of the six phases of the GDLC methodology.

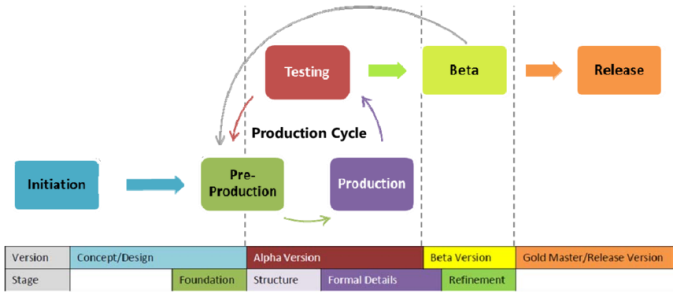


Fig. 2 *Game Development Life Cycle [10]*

3.1 Initiation Phase

The initiation phase begins the Game Development Life Cycle (GDLC) by defining the project's title, objectives, scope, and requirements. Next, Application Development Workflow in Appendix A summarizes the output from the GDLC methodology. A Subject Matter Expert (SME), Puan Norhibah binti Yahaya, a Malay teacher from Sekolah Kebangsaan Bandar Mersing, was interviewed with 6 questions asked to gain insights into Malay folklore, which helped identify user requirements for the game as seen in Table 2. The interview was transcribed and can be found in Appendix B. After establishing these requirements, both functional and non-functional needs for the AlamCera game were determined in Table 3 and Table 4 respectively.

Table 2 *User Requirements*

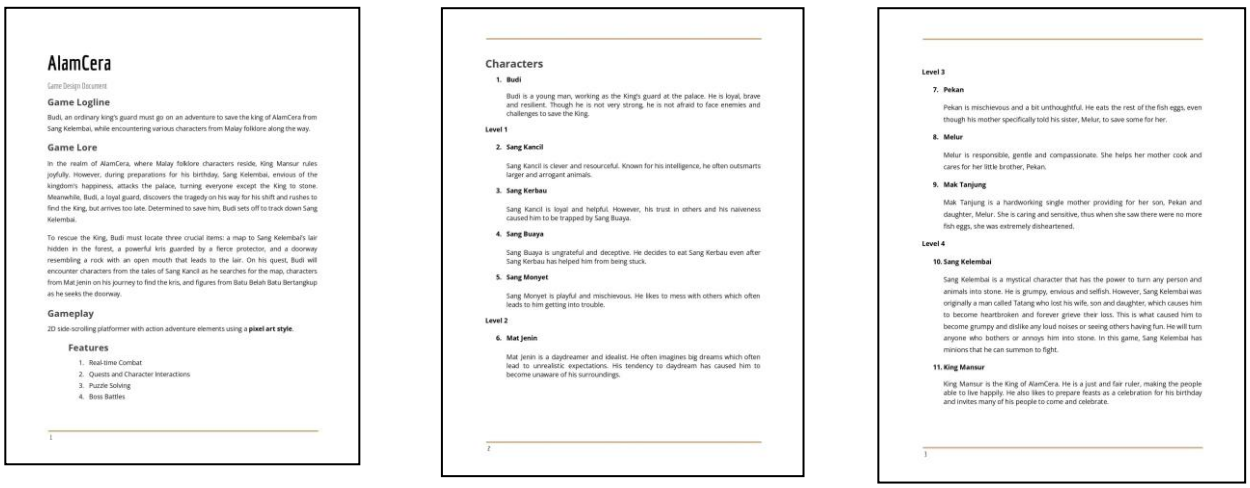
Stakeholder Category	Role in Product	Design Implications	Action Needed
Subject Matter Expert (Malay Teacher at Sekolah Kebangsaan Bandar Mersing)	Content consultant expert in the related field	Based on the interview, cultural relevance	● Design characters and stories based on Malay folklore ● Design player character with traditional Malay attire ● Create game environment that represents Malaysian environments
		Storytelling mechanics	● Adapt the Malay folklore narrative for modern audiences ● Adapt the stories to fit the gameplay narrative
		Educational components	● Develop a mechanism for imparting moral teachings found in the folklore
		Cultural sensitivity	● Avoid from highlighting deaths and negativity in the Malay folklore ● Create an alternate narrative to give a hopeful ending
		Level design	● Implement power-ups and boosters for the player character to get stronger as he progresses to the next level

3.2 Pre-production Phase

In the Pre-Production Phase, detailed planning occurs, starting with a storyboard created in Canva to visualize AlamCera's narrative and gameplay, attached in Appendix C helping identify potential interface issues. A flowchart has been attached to Appendix D until Appendix H and navigation structure in Appendix I are also made using draw.io to show how users will navigate the game. Next, creating Game Design Documents (GDD) is crucial, as it helps in defining gameplay, logline, game lore, mechanics as seen in Fig 3 (a), and defining the characters that will be included in each level as seen in Fig 3 (b) and (c).

3.3 Production Phase

The Production Phase is when the AlamCera game is actively developed. Key activities include coding based on defined requirements, creating assets like buttons as seen in Table 5, interface as in Appendix J, backgrounds, and 2D models, and integrating gameplay features. Development follows the storyboard from the Pre-Production Phase to maintain the game's vision. The Unity engine is used for development, with coding in Visual Studio Code using C#. Art assets, including UI elements, characters, and backgrounds, are created in Aseprite, and some templates are sourced from free resources on Itch.io. During this phase, core mechanics, game content, and levels are built and refined. Audacity is used to edit audio and music, sourced from free sites like Pixabay, Freesound, and Free Music Archive. This phase is the longest and most resource-intensive part of the Game Development Life Cycle (GDLC), requiring careful attention to detail for a polished final product.



(a) **(b)** **(c)**

Fig. 3 *(a) Game Design Document 1; (b) Game Design Document 2; (c) Game Design Document 3*

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Table 3 *Functional Requirements*

Functional Requirements	Module	Description	Description
User Interaction	Play	● The system shall provide users with the ability to start the game application ● The system shall provide users with the ability to select levels ● The system shall provide the users with the ability to control the player character's movement and combat ● The system shall provide the users with the ability to control the player character's interaction	● The system shall provide the users with the ability to trap enemies for a few seconds ● The system shall provide the users with the ability to heal by collecting hearts ● The system shall provide the ability for players to go to the next dialogue ● The system shall provide the players with the ability to skip dialogue and certain cutscenes ● The system shall provide the players with the ability to save checkpoint
	Settings	● The system shall provide players with the ability to adjust the volume for music and sound	
	Credits	● The system shall provide the players with the ability to see the Credits page and exit out of the credits page	
	Exit	● The system shall provide the players with the ability to exit the application	
Autonoumous System Activities	Play	● The system shall display the game over menu if the player character's health drops to 0 ● The system shall display the you win menu if the players complete all the quests and reached the end of the level ● The system shall deduct the players' health if the player character's get hit by obstacles or enemies ● The system shall add to the players' health when the players collects hearts ● The system shall provide collectable for players to collect over the course of the level ● The system shall provide score for each collectable that players collect	● The system shall provide enemies for the players to engage in combat ● The system shall provide obstacles that players need to avoid ● The system shall provide hearts for players to heal ● The system shall add to the collectible counter for each collectible collected ● The system shall reduce the boss enemy's health when players attack ● The system shall add 10 points for each collectible collected ● The system shall save the highest score of the current level based on the amount of collectibles collected ● The system shall play a cutscene at certain points of the level
	Settings	● The system shall play the background music and sound for the game elements ● The system shall pause the background music and sound when the game is paused	

Table 4 *Non-functional Requirements*

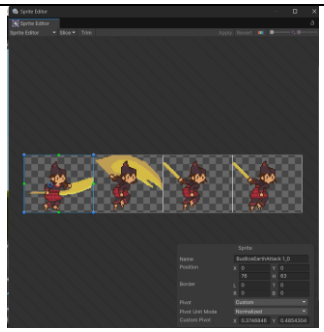
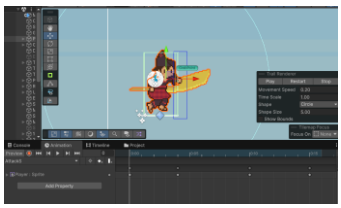
Non-functional Requirements	Description
Performance	• The application shall be able to respond within 3 seconds • The application shall be able to operate without the need for the Internet
Operational	• The application shall be able to operate on any Android device with Android Version 7 and above
Usability	• The application shall be user-friendly and easy to use for the user
Cultural	• This application shall be developed in English
Graphical User Interface Support	• The application shall support all elements in terms of multimedia, which includes texts, graphics, animations, and audio for different sizes of display resolution on Android devices
Legal	• Users cannot modify any information displayed in the application

Table 5 *Assets Creation*

Button	Description	Button	Description	Button	Description
	• Play button to navigate to level selection page		• Home button to navigate to the main menu.		• Skip button to skip dialogue and cutscenes.
	• Credits button to navigate to the credits page.		• Alternate settings button to navigate to settings page.		• Save button to respawn at specific checkpoint.
	• Settings button to navigate to the settings page.		• Replay button to replay current level.		• Left arrow button to move player to the left.
	• Exit button to exit out of the game application.		• Next level button to navigate to the next level.		• Right arrow button to move player to the right.
	• Resume button to return to gameplay after pausing.		• Dash button to dash.		• Trap button to trap enemies for a few seconds.
	• Throw button throws chili pepper.		• Throw button throws bananas.		• Jump button to jump.
	• Next button continues dialogue.		• Finish button finishes dialogue.		• Interact button to interact with interactable objects.

After the design and creation of the game's assets and animations were completed, they were implemented into the application using Unity's game engine. This process involved importing the 2D assets, organizing them within the scene, and applying animations to the appropriate game objects. In Table 6, several examples of the implementation of 2D assets are shown, including the 2D models, animation and level element. Table 7 presents examples of C# script developed to support the game's key features. This includes the Player Movement script, which controls the player character's movement, jumping, dashing, animations, throwing projectiles and other actions using Unity's Input System.

Table 6 *Implementation of Assets*

Assets	Development	Description
2D Models		• Characters and 2D models with animation are exported as sprite sheets from Aseprite, • In Unity, the Sprite Editor is used to slice the sprite sheet into individual frames for animation. • The pivot points is adjusted to match the character's position.
Animation		• In the Animation window, after creating an Animator for the Player character game object, a new animation clip is created with title such as "Idle". • The sliced frames from the Project window are dragged and dropped into the timeline in the Animation window.
Level		• The level is created by combining all the background assets into one large image file. • In Unity, the image is imported and added to the Tile Palette for level design. • Using the Tile Palette, the game environment is easily painted on a grid.

3.4 Testing Phase

In the Testing Phase, internal testing evaluates the usability and playability of the AlamCera game. The first is the Formal Details Testing, which focuses on evaluating the game's functionality and gameplay balance. The Formal Details Testing was done through alpha testing which checks if each features of the game is working as intended. The second is the Refinement Testing, which assesses for engagement and accessibility of the game. This testing was done throughout the development on both the Unity engine and the Android Vivo 21e phone. Alpha testing is conducted to ensure gameplay and features work as intended as can be seen in Table 8. The test results will help identify areas for improvement, resolve issues, and enhance the overall player experience.

3.5 Beta Phase

The Beta Phase involves releasing the game to the target audience, aged 9 to 15, to gather feedback. This helps identify bugs, performance issues, and gameplay experiences. Based on this feedback, adjustments are made to improve the game before the official release. This phase is essential for ensuring the game meets quality standards and provides an engaging experience for players. The beta testing was carried out at Sekolah Kebangsaan Sri Mersing with a total of 30 students aged 12 years old with the help of a teacher, Mrs. Zuraidah binti Yaacob. The students were allowed to bring their own devices to school in order to test the game application. Approximately half of the devices were compatible and successfully downloaded and ran the game for testing. The remaining devices were unable to download the game due to being iOS phones or had restrictions that blocked the installation of apps from foreign sources, rather than due to any compatibility issues with the game itself.

As a result, the students were divided into six groups according to their seating arrangement, and each group was given two hours to test the game. Within their groups, students took turns playing the game and then passed the device to other members to ensure everyone had hands-on experience. After the testing session, students were provided with the System Usability Scale (SUS) [21] questionnaire in physical paper format. Once completed, after the testing, the responses were manually entered into a Google Form spreadsheet to facilitate easier visualization through automatically generated charts. During the beta testing session, several bugs and issues were observed. For example, in some instances, the player character fell through the level floor or became stuck at certain wall collisions. Additionally, there were cases where the player touched the heart collectible object but did not receive the expected reward or health increase. These findings impacted the SUS scores,

reflecting the usability challenges experienced during testing. The overall results of this beta testing process are presented in the Results and Discussion section.

Table 7 *C# scripts*

Script	Description	Script	Description

● `private void Start()`
`{ inputSystem.Player.Move.performed += context => Move(context);`
`inputSystem.Player.Move.canceled += context => Move(context);`
`inputSystem.Player.Jump.performed += context => Jump(context);`
`inputSystem.Player.Dash.performed += context => Dash(context);`
`// Subscribe to the Attack action`
`inputSystem.Player.Throw.performed += context => ThrowProjectile(context);`
`// Subscribe to the Attack action`
`inputSystem.Player.Enable();`
`// Enable the Player action map}`
	In the Start function, the Input system listens to the player's keyboard or controller input.	● `public void Move(InputAction.CallbackContext context)`
		`{if (context.performed)`
		`{horizontalMovement = context.ReadValue<Vector2>().x;}`
		`else if (context.canceled)`
		`{horizontalMovement = 0f; // Reset to zero when input is released`
		`}}`
			Move() function updates the horizontal movement based on player's input to allow for moving left and right.

● `public void Jump(InputAction.CallbackContext context)`
`{`
`if (jumpsRemaining > 0)`
`{`
`if (context.performed)`
`{`
`// Hold down jump button = full height`
`rb.linearVelocity = new Vector2(rb.linearVelocity.x, jumpPower);`
`jumpsRemaining--;`
`JumpEffect();`
`}`
`else if (context.canceled)`
`{`
`// light tap jump button = half height`
`rb.linearVelocity = new Vector2(rb.linearVelocity.x, rb.linearVelocity.y * 0.5f);`
`jumpsRemaining--;`
`JumpEffect();} }`
	Jump() function supports both regular jumps and wall jumps, adjusting velocity and player orientation accordingly, with logic for jump height based on input hold or release.	● `private IEnumerator DelayedThrow()`
		`{`
		`isOnCooldown = true; // Set cooldown active`
		`yield return new WaitForSeconds(throwDelay); // Wait for the delay`
		`Instantiate(ProjectilePrefab, LaunchOffset.position, transform.rotation);`
		`SoundEffectManager.Play("Throw");`
		`yield return new WaitForSeconds(0.2f); // Wait for the cooldown duration`
		`isOnCooldown = false; // Reset cooldown`
		`}`
			DelayedThrow() function is a coroutine to instantiate a projectile prefab with a cooldown to prevent spamming, and play a throw sound effect.

Table 8 *Functional Testing*

Test	Expected Result	Actual Result	Corrective Action
Play button	Opens up the level selection panel.	Works well as intended.	Not Required.
Settings button	Opens up the settings panel.	Works well as intended.	Not Required.
Credits button	Opens up the credits panel.	Works well as intended.	Not Required.
Exit button	Exits out of the application.	Able to exit in Unity editor but not in Android phone.	Add a new line of coding to ensure it exits in the actual build.
Move left and right button	Moves the player character left and right in the level.	Works well as intended.	Not Required.
Trap button	Player character traps enemy character for a few seconds.	Works well as intended.	Not Required.
Jump button	Allows player character to jump.	Works well as intended.	Not Required.
Interact button	Allows player character to interact with interactable objects.	Players cannot interact with interactable objects	Add the IInteractable script to the interactable objects' scripts.
Dash button	Allows player to dash for a few seconds.	Works well as intended.	Not Required.
Throw button	Allows player to throw objects.	Player can spam the button.	Add a cool down for delayed throw to prevent spamming.

3.6 Release Phase

The Release Phase is the final step in game development. The game will be officially launched on the Itch.io website, allowing users to discover, download, and play it on their Android devices. This phase lets players engage with the game's mechanics, explore its story, and enjoy the immersive environments created during development.

4. Result and Discussion

This section present an analysis on the results obtained from the System Usability Scale (SUS) testing that was conducted with 30 student ages 12 years old from Sekolah Kebangsaan Sri Mersing which is shown in Fig. 4 and Fig. 5. Based on industry benchmarks, a score of 80.3 or above is considered excellent (Grade A), a score of around 68 is average (Grade C) and a score of 51 or below indicates poor usability (Grade F).

In Fig 4(a), it showed that there is a generally favorable tendency to frequently use the system, with a majority of 53.3% students indicating a strong agreement while 20% of students agree. However, 16.7% of students are neutral about this statement while 3.3% of student disagree and 6.7% of student strongly disagree. This shows that most students are willing and motivated to use the system regularly, indicating a positive first impression and engagement with the application. Next, in Fig 4(b) about 33.3% of students strongly disagree and 16.7% disagree that the system is unnecessarily complex. Meanwhile, 16.7% of student are equally neutral, agree and strongly agree that the system is unnecessarily complex respectively. This shows that while a majority of students do not find the system overly complicated, a portion still experiences some level of complexity, suggesting areas for interface or instructional clarity improvements. Then, in Fig 4(c) 50% of the student strongly agree and 30% agree that the system easy to use. However, 10% of students are neutral while 3.3% disagree and 6.7% of student strongly disagree. This shows that most students find the system user-friendly and accessible, which support usability and ease-of-use goals.

On the other hand, in Fig 4 (d), the majority of student which are 30% are undecided on if they would need the support of a technical person to be able to use this system. Meanwhile, 16.7% strongly agree and 23.3% agree that they would need support, while 6.7% disagree and 23.3% of student strongly disagree that they would need support which shows that opinions are divided, but a considerable numbers of students feel confident using the application independently, although some might still benefit from guidance or tutorials. Then, in Fig 4(e), the majority of 35.7% student strongly agree while 33.3% of student agree that the various functions in this system were well integrated. However, there is 23.3% students who are neutral on this statement while 6.7% of students strongly disagree. This indicates that most students perceive the system as well-organized and cohesive in its features, enhancing the overall user experience. Subsequently, in Fig 4(f), the majority of student which are 46.7% strongly disagree while 26.7% student disagree that there was too much inconsistency in the system. However, there are still 10% of students who are neutral while 13.3% agree and 3.3% students strongly disagree with this statement. Thus, the system is largely seen as consistent in its design and behavior, though a small minority may have notices irregularities in interaction or layout.

Other than that, in Fig 4(g), 56.7% of student strongly agree while 30% agree that most people would learn to use this system very quickly. Meanwhile 6.7% students are neutral and 6.7% student strongly disagree. This shows that the system is perceived as intuitive and easy to learn, making it accessible even for new users. Next, in Fig 4(h), there is a tie in which the majority 36.7% student strongly disagree and are neutral that the system is very cumbersome to use. Then, there are 6.7% students who disagree that the system is very cumbersome to use, while 10% student agree and the other 10% strongly agree. This shows that while many students do not find the system difficult to use, there may still be aspects that confuse or slow down some users, potentially due to specific design elements or user expectations. After that, in Fig 4(i), the majority of student 50% strongly agree that they feel very confident using the system while 33.3% of student agrees. However, 3.3% of students are neutral while 6.7% disagree and 6.7% strongly disagree. This shows that most users feel self-assured when navigating the system, which is a strong indicator of usability and user satisfaction. Finally, in Fig 4(j), there is a tie in between three options. In which 26.7% of students respectively strongly disagree, are neutral and strongly agree that they need to learn a lot of things before they could get going with this system. Meanwhile, 3.3% disagree and 16.7% agrees. This shows that perceptions are mixed, but overall, many students do not feel overwhelmed by the system's learning curve, although a portion may need introductory support or clearer onboarding.

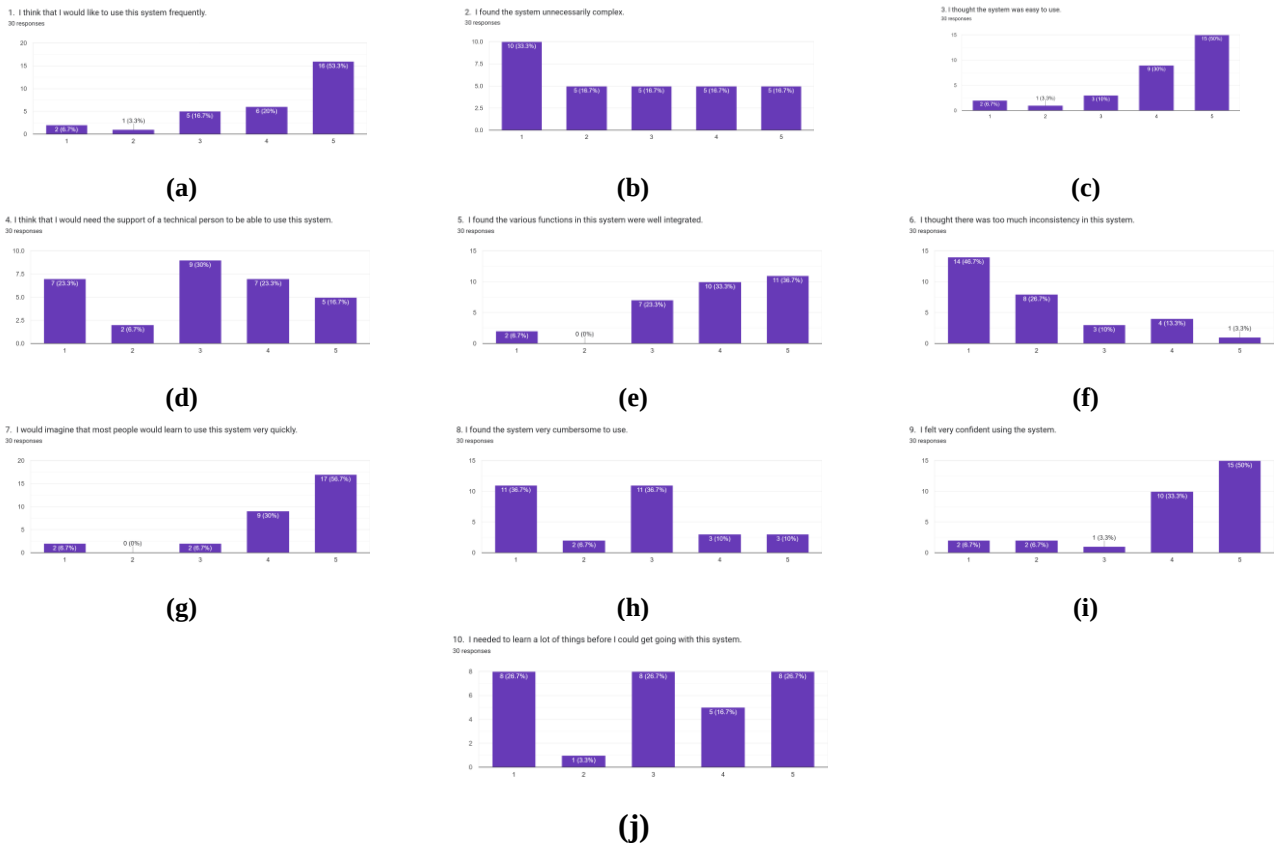


Fig. 4 *(a) User Analysis 1; (b) User Analysis 2; (c) User Analysis 3; (d) User Analysis 4; (e)User Analysis 5; (f) User Analysis 6; (g)User Analysis 7; (h)User Analysis 8; (i) User Analysis 9; (j)User Analysis 10*

Fig. 5 *User testing*

The following formula was applied to get usability results based on the SUS:

$$Total\ score = (x + y) \times 2.5$$

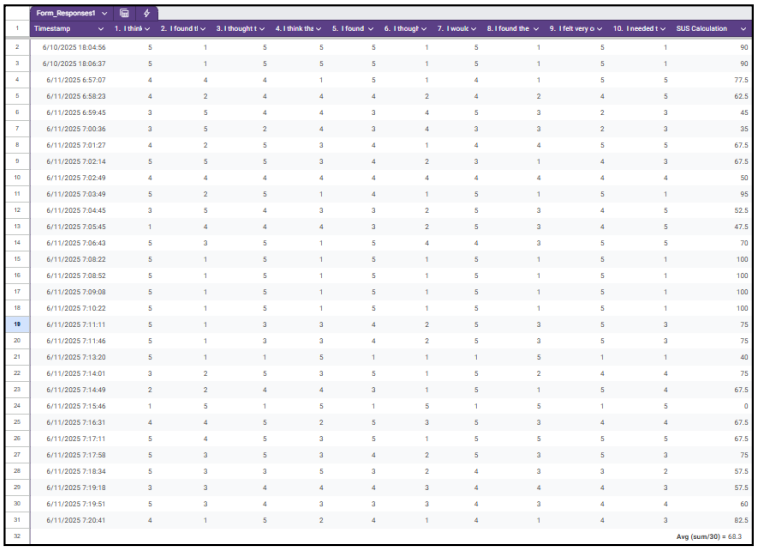
$$x = Odd\ items\ (Q1, Q3, Q5, Q7, Q9) = sum - 1$$
$$y = Even\ items\ (Q2, Q4, Q6, Q8, Q10) = 5 - sum$$

Therefore, the average score is =

$$\frac{90 + 90 + 77.5 + 62.5 + 45 + 35 + 67.5 + 67.5 + 50 + 95 + 52.5 + 47.5 + 70 + 100 + 100 + 100 + 100 + 75 + 75 + 40 + 75 + 67.5 + 0 + 67.5 + 67.5 + 75 + 57.5 + 57.5 + 60 + 82.5}{30}$$

= 68.3

After analyzing the results obtained from all 10 statements, we are able to obtain the average SUS score for AlamCera which is 68.3 (Grade C) as seen in Fig. 6. This shows that this mobile game application is rated as "Okay" in terms of its gameplay and overall usability experience. It is well-received by most users, although there are areas where small improvement can enhance usability further, such as tutorials during the gameplay.



	Timestamp	1. I think	2. I found tl	3. I thought t	4. I think tha	5. I found	6. I thought	7. I would	8. I found the	9. I felt very c	10. I needed t	SUS Calculation
2	6/10/2025 18:04:56	5	1	5	5	5	1	5	1	5	1	90
3	6/10/2025 18:06:37	5	1	5	5	5	1	5	1	5	1	90
4	6/11/2025 6:57:07	4	4	4	1	5	1	4	1	5	5	77.5
5	6/11/2025 6:58:23	4	2	4	4	4	2	4	2	4	5	62.5
6	6/11/2025 6:59:45	3	5	4	4	3	4	5	3	2	3	45
7	6/11/2025 7:00:36	3	5	2	4	3	4	3	3	2	3	35
8	6/11/2025 7:01:27	4	2	5	3	4	1	4	4	5	5	67.5
9	6/11/2025 7:02:14	5	5	5	3	4	2	3	1	4	3	67.5
10	6/11/2025 7:02:49	4	4	4	4	4	4	4	4	4	4	50
11	6/11/2025 7:03:49	5	2	5	1	4	1	5	1	5	1	95
12	6/11/2025 7:04:45	3	5	4	3	3	2	5	3	4	5	52.5
13	6/11/2025 7:05:45	1	4	4	4	3	2	5	3	4	5	47.5
14	6/11/2025 7:06:43	5	3	5	1	5	4	4	3	5	5	70
15	6/11/2025 7:08:22	5	1	5	1	5	1	5	1	5	1	100
16	6/11/2025 7:08:52	5	1	5	1	5	1	5	1	5	1	100
17	6/11/2025 7:09:08	5	1	5	1	5	1	5	1	5	1	100
18	6/11/2025 7:10:22	5	1	5	1	5	1	5	1	5	1	100
19	6/11/2025 7:11:11	5	1	3	3	4	2	5	3	5	3	75
20	6/11/2025 7:11:46	5	1	3	3	4	2	5	3	5	3	75
21	6/11/2025 7:13:20	5	1	1	5	1	1	1	5	1	1	40
22	6/11/2025 7:14:01	3	2	5	3	5	1	5	2	4	4	75
23	6/11/2025 7:14:49	2	2	4	4	3	1	5	1	5	4	67.5
24	6/11/2025 7:15:46	1	5	1	5	1	5	1	5	1	5	0
25	6/11/2025 7:16:31	4	4	5	2	5	3	5	3	4	4	67.5
26	6/11/2025 7:17:11	5	4	5	3	5	1	5	5	5	5	67.5
27	6/11/2025 7:17:58	5	3	5	3	4	2	5	3	5	3	75
28	6/11/2025 7:18:34	5	3	3	5	3	2	4	3	3	2	57.5
29	6/11/2025 7:19:18	3	3	4	4	4	3	4	4	4	3	57.5
30	6/11/2025 7:19:51	5	3	4	3	3	3	4	3	4	4	60
31	6/11/2025 7:20:41	4	1	5	2	4	1	4	1	4	3	82.5
32												Avg (sum/30) = 68.3

Fig. 6 *System Usability Scale Score*

5. Conclusion

In conclusion, the development and testing of the AlamCera mobile game application shows that the application is effective in delivering an engaging and fun game based on Malay folklore. All three objectives were successfully achieved. Firstly, AlamCera was design as an interactive action-adventure game that integrates cultural Malay storytelling with exciting gameplay. Secondly, the game was developed for the mobile platform, making it accessible and user-friendly. Lastly, usability evaluation was conducted through user feedback and testing, which showed positive responses in terms of game functionality and overall experience.

By using the Game Development Life Cycle (GDLC) methodology, AlamCera was systematically developed and completed on schedule. The advantages and limitations of the AlamCera application can be concluded in Table 9. Beyond its engaging gameplay, the game contributes to cultural preservation, education, and youth engagement by reimagining Malay folklore through interactive storytelling that is appealing to the digital-native younger generations. It enables players to connect directly with traditional characters and teaches moral values through storytelling and in-game challenges, making it a valuable tool for cultural appreciation and supporting Malaysia's digital creative sector. Future improvements will focus on implementing a branching storyline, by allowing players to influence the outcomes of the story to enhance narrative depth and replayability, upgrading the interaction system for greater player agency and emotional investment, and finally introducing multilingual support such as Malay and Mandarin to increase accessibility and appeal across diverse audiences. These features aim to make AlamCera a more immersive, inclusive, and culturally meaningful experience.

Table 9 *Advantages and limitations of AlamCera*

Advantages	Limitations
- Act as a media to promote Malay folklore - Engaging gameplay mechanics - Has narrative depth	- Linear storyline - Limited interaction depth - Language limitation due to only being available in English

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

This journal requires that all authors take public responsibility for the content of the work submitted for review. The contributions of all authors must be described in the following manner:

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Nur Alya Adlina binti Mohamad Lazi, Norhalina binti Senan;* ***data collection:*** *Norhalina binti Senan;;* ***analysis and interpretation of results:*** *Nur Alya Adlina binti Mohamad Lazi, Norhalina binti Senan;* ***draft manuscript preparation:*** *Norhalina binti Senan. All authors reviewed the results and approved the final version of the manuscript.*

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Appendix A: Summary of The Output of the Game Development Life Cycle

Table 9 *Application Development Workflow*

Phase	Activity	Output	Phase	Activity	Ouput
Initiation Phase	● Identify project title, objectives and scope ● Identify initial requirements from SME ● Identify system requirements ● Identify hardware and software requirements	● Project title, background, problem statement, objectives and project scope ● User requirement ● Functional and non-functional requirement ● Hardware and software requirement ● Gantt Chart for PSM1 and PSM2	Testing Phase	● Conduct Formal Details Testing through alpha testing ● Conduct Refinement Testing	● Bugs and game balance identified and resolved ● Engagement and accessibility identification
Pre-Production Phase	● Design a storyboard ● Design a flowchart ● Design a navigation structure ● Determine the project timeline ● Create Game Design Document (GDD)	● Storyboard ● Flowchart ● Navigation Structure ● Game logline, game lore, gameplay and characters	Beta Phase	● Perform functionality testing	● User feedback
Production Phase	● Develop user interfaces and main menu ● Develop character movement controller ● Develop combat and health system ● Develop enemy behavior ● Develop interaction and dialogue system ● Create 2D art and animation for user interface, characters, prop and background ● Develop cutscenes ● Integrate audio, sound effects and music	● User interfaces and main menu ● Character movement controller ● Combat and health system ● Enemy behavior ● Interaction and dialogue system ● 2D art and animation for user interface, characters, prop and background ● Cutscenes ● Integrated audio, sound effects and music	Release Phase	● Distribute game online	● Game distributed online

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Appendix B: Interview transcript with SME

Alya: Assalammualaikum, Cikgu Norhibah, I am Nur Alya Adlina binti Mohamad Lazi, a final year student from UTHM I am currently doing my final year project which is to develop an action adventure mobile game application based on action adventure titled " AlamCera". May I please ask you to introduce yourself and your experience with Malay folklore?

Pn. Norhibah: Waalaikummusalam Alya, of course. I am Norhibah binti Yahaya, a teacher at Sekolah Kebangsaan Bandar Mersing. But before that, I was a teacher at Sekolah Kebangsaan Sri Mersing, in which I have had experience with guiding students in Malay storytelling competitions to tell Malay folktales story. I was also the librarian at the school, in which the library contain many Malay folktales books for children.

Alya: Alright, thank you, Cikgu Norhibah. I will now start the interview. The first question is, what is the history behind the existence of Malay folklore?

Pn. Norhibah: Malay folklore are an important part of Malay culture which is passed down orally from generations to generations before it was documented. The origins of them involves influences from history, culture, religion and interaction with other nations that traded or colonized the Nusantara region. These tales also contain local elements and beliefs from animism, Hindu-Buddhism, and Islam.

Alya: Second question, what is the role of folktales in the cultural identity if the Malay community?

Pn. Norhibah: They serve as informal educational tools where the older generation shares values, beliefs and traditions with the younger generations. The older folks usually like to adapt these stories to teach the younger generations lessons. For example, when I was younger, my mother liked to remind to not stay out too late or else Sang Kelembai will catch me and turn me to stone.

Alya: Really? That's interesting! I've actually never heard of that one before. Now next, the third question, is Malay folklore getting less attention and being forgotten in the current century, compared to Western folklore?

anything negative in the game, but change it to something positive. You can also promote the game in any platform.

Alya: I will keep those in mind. Thank you again, Cikgu Norhibah.

(continued) Pn. Norhibah: Yes, it's mostly because of globalization and the lack of effort to modernize Malay folktales. Western stories like Snow White keep getting new versions with cool animations, while our own stories rarely get that treatment. Plus, they're not really emphasized in schools anymore, so kids today don't grow up with them. I once asked my class about Pak Pandir, and none of them knew who he was!

Alya: Fourth question, in your opinion, will adding more interactivity to Malay folklore attract the younger generation?

Pn. Norhibah: Definitely! Making games, apps, or websites based on Malay folktales can really grab the younger generation's interest. Imagine a game where your choices shape the story—that would make it way more fun and engaging!

Alya: Fifth question, is there any parts or cultural sensitivity that I need to pay attention to when adapting these tales in mobile game application form?

Pn. Norhibah: Yes, for one, you need to ensure the authenticity of the stories by staying true to the themes, and moral values. When turning folktales into a game, it's important to keep the original message and moral values intact. Try not to change too much or it might lose its meaning. Also, make sure Malay culture is shown in a respectful way through the characters, clothes, and traditions—without using stereotypes. Like, don't just show Pak Pandir as silly; highlight Mak Mandir's cleverness too. Some stories also touch on religion, so be careful not to include anything that goes against Islamic beliefs. And since some tales have dark themes, like the mother in Batu Belah Batu Bertangkup dying, it's better to adapt those parts—maybe let the player save her instead, so the story still teaches a lesson but in a more positive way for kids.

Alya: Alright, Cikgu. Thank you so much for the answers. Now, I will show you the storyboard for the AlamCera game.

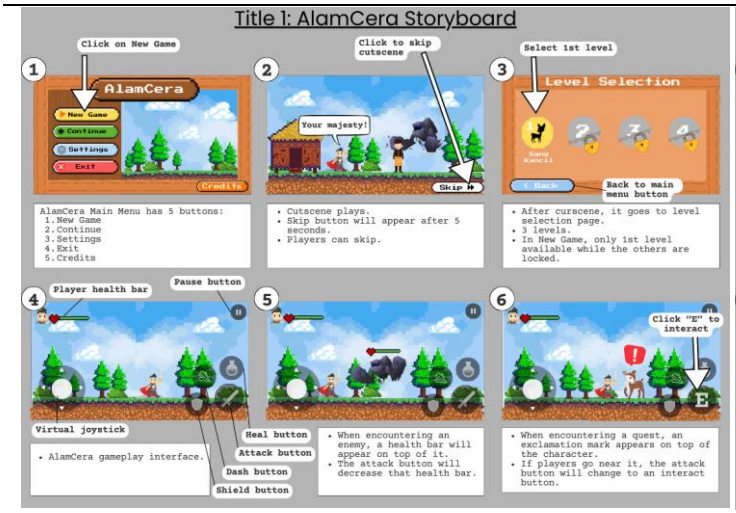
Pn. Norhibah: (After seeing the storyboard) This is really interesting, and I'm glad the main character is wearing an outfit that represent Malay culture.

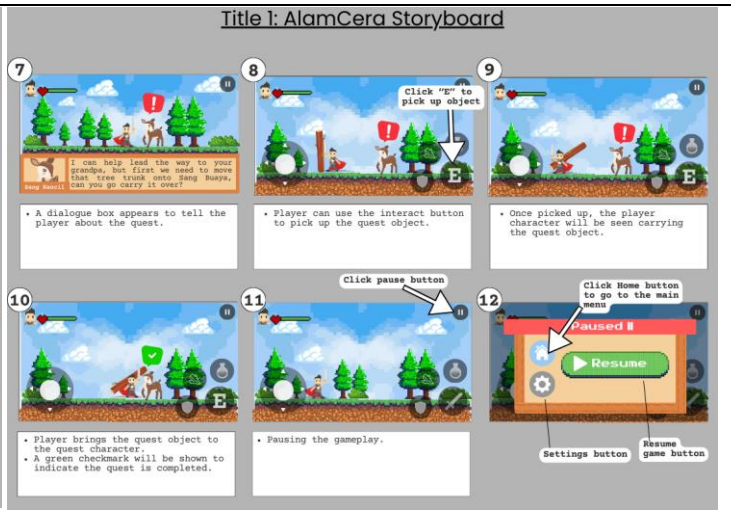
Alya: Do you have any suggestions for improvements?

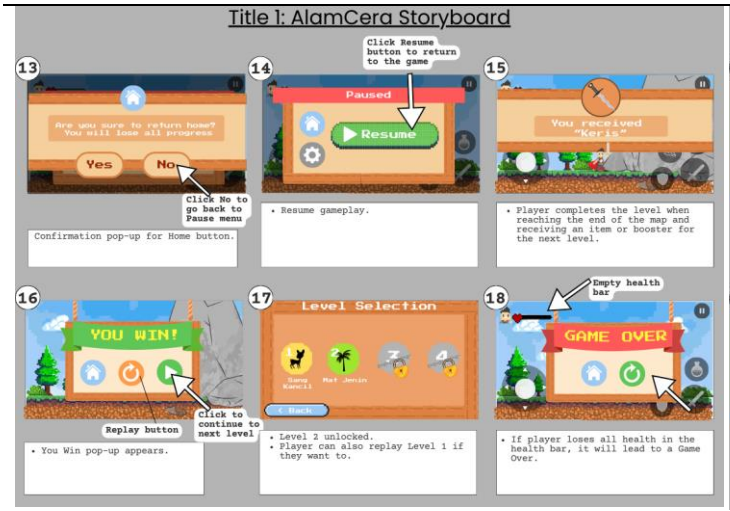
Pn. Norhibah: You can add at the end of each level, maybe show the moral values of the Malay folklore included in the level so that the players will clearly understand the message of the story and to not promote negativity.

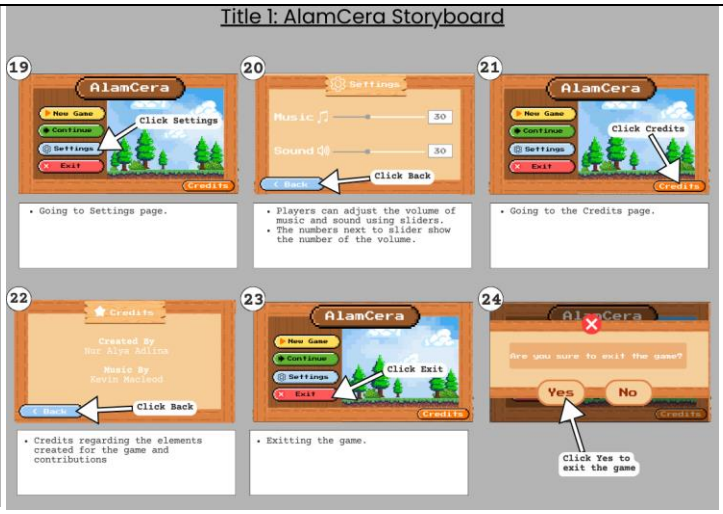
Alya: Those are really good suggestions! Alright, that is all from me. Thank you so much Cikgu Norhibah.

Appendix C: Storyboard









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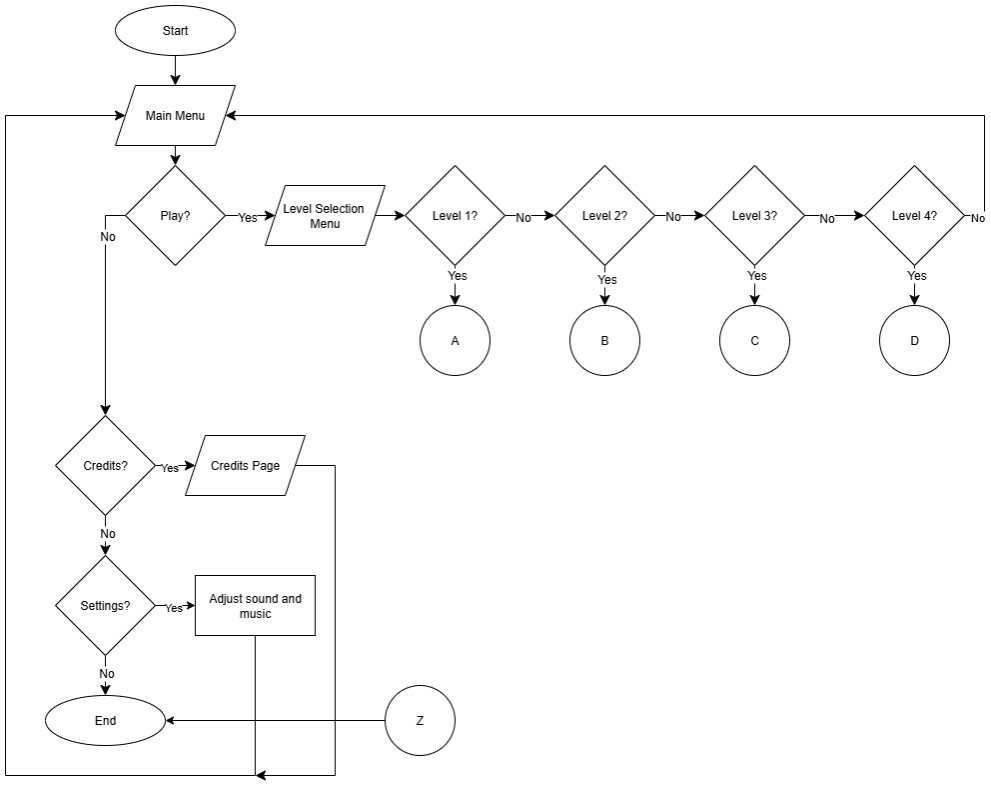
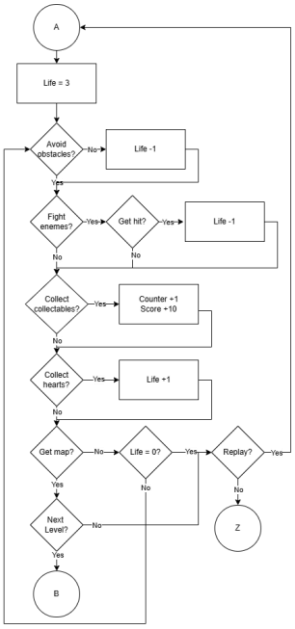
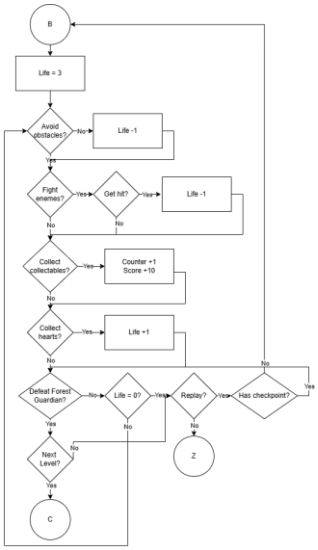
Appendix D: System Flowchart



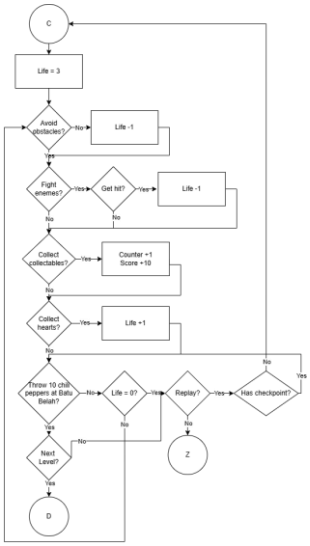
Appendix E: Level 1 Flowchart



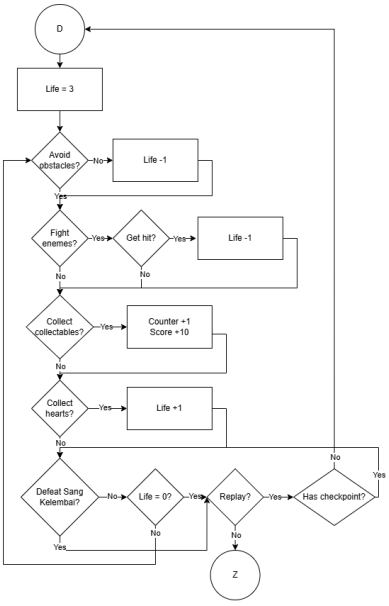
Appendix F: Level 2 Flowchart



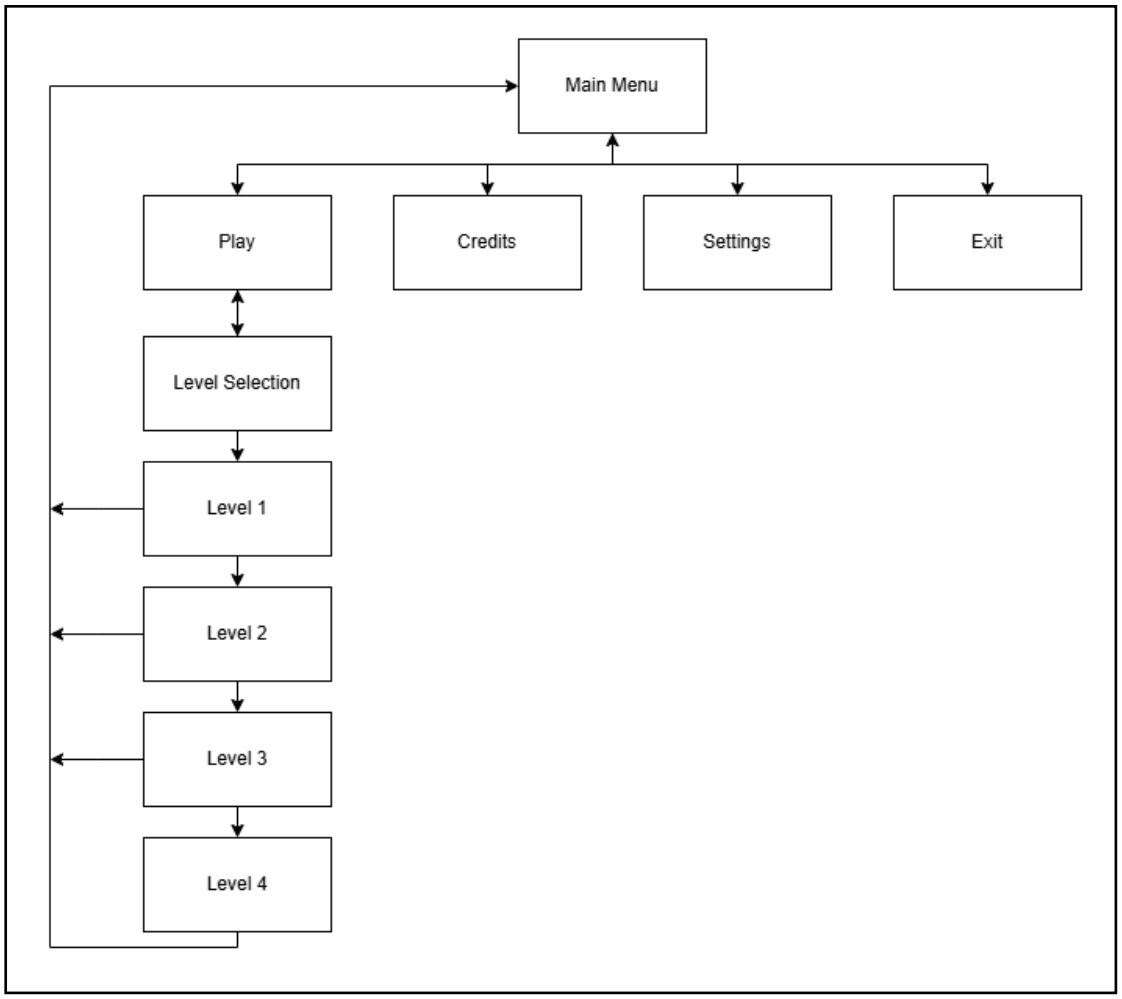
Appendix G: Level 3 Flowchart



Appendix H: Level 4 Flowchart



Appendix I: Navigation Structure



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Appendix J: Interface Design

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Main Menu Interface</td>
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Level Selection Interface</td>
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Credits Interface</td>
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Gameplay Interface</td>
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Dialogue Interface</td>
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Settings Interface</td>
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Pause Menu</td>
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You Win Interface</td>
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Game Over Interface</td>
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