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SIDE-SCROLLING GAME OF THE LEGEND OF NAYA SENTIKA USING THE FEATURE-DRIVEN DEVELOPMENT (FDD) METHOD

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ABSTRACT

Games are highly favored applications among Gen Z, and nearly every smart device comes with games installed. However, this generation should ideally be more inclined towards educational applications. Therefore, this research aims to develop an educational and entertaining platform based on folk tales that can be played on smartphones. This initiative is motivated by the lack of knowledge among today's youth about traditional folk tales. By using games as a medium, the author seeks to preserve Indonesian folklore that is gradually being forgotten, making it more engaging and enjoyable. The development method chosen for creating this folklore-themed game is Feature-Driven Development (FDD), as conceptualized by Peter Coad. FDD consists of five stages: developing an overall model, building a feature list, planning by feature, designing by feature, and building by feature. The result of the development process using FDD is a game platform with the folklore theme of Naya Sentika, titled *"The Legend of Naya Sentika,"* which can be played on smartphones. For the development, the researcher used Unity as the main software, along with C# as the programming language, written in Visual Studio for scripting.

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1. INTRODUCTION

In Indonesia, folklore is abundant. Folklore itself refers to stories originating from communities, evolving within society and passed down orally from generation to generation [1][2][3]. These tales, inherited from ancestors, are rich in moral values and serve as cultural heritage. Many stories and philosophies, when revived, have a positive impact by teaching lessons of perseverance, exemplary qualities, and wisdom to the younger generation [4][5][6]. One example is the story *"The Legend of Naya Sentika"* by Umi Farida. Folklore represents each region's unique cultural identity, reflecting the diverse cultural heritage and history of various areas [7].

One such Indonesian folktale is Naya Sentika, which originates from Java. This story conveys moral values, emphasizing respect for tradition and resilience in overcoming challenges [8][9][10]. Games are a popular form of entertainment enjoyed by people of all ages—from children to adults and the elderly [11][12][13]. Beyond providing a break from daily routines, games also serve to train problem-solving skills, as players seek solutions to in-game challenges [14][15]. Previously, games were played traditionally; however, as technology has advanced, so have games, transitioning to digital platforms [16][17].

Nowadays, many new games utilize modern technology in their development and use. Playing games has become a learning tool [18][19]. Games are part of interactive and engaging educational technology and media, which can increase students' motivation to learn [20][21][22]. The Legend of Naya Sentika is a story from Central Java, written by Umi Farida [7]. This story recounts the Diponegoro War, which lasted five years, from 1825 to 1830, resulting in the deaths of approximately 200,000 Javanese people and 8,000 Dutch soldiers. In this historical tale, Prince Diponegoro, as the war leader, was ultimately captured through deception by Dutch forces. However, his soldiers continued the fight [7][8].

Among these warriors was a troop led by Naya Sentika. She commanded her soldiers to resist the colonizers, moving from village to village and using guerrilla tactics [7][8]. Unfortunately, Naya Sentika was later captured when

unprepared, as the Dutch used deceptive strategies. She was put into a barrel and cast into the sea. This conflict involving Naya Sentika became known as the "Bangsri War." Combining these two elements, the idea of developing a game based on the Legend of Naya Sentika is intriguing and can provide value to players [8]. Furthermore, using the Feature-Driven Development (FDD) method is expected to accelerate the game development process and result in a high-quality game that meets players' needs [23].

2. METHOD

This section explains the methods and application of the approaches used in this research development, ensuring that the research is scientific. The following are the implementation steps for this research, following the outlined sequence:

2.1 Data Collection

Data collection is conducted through several methods, in accordance with data collection principles and the data requirements based on the analysis needs, following the system development method used in this research. The methods are as follows:

2.1.1 Document Study

The document study involves detailing and analyzing various documents relevant to computer users in West Java, who meet the criteria aligned with the needs of the system to be developed. These documents include user guides, reports, and related documentation that can provide insights into the needs, preferences, and challenges faced by users. Through this document analysis, significant variables can be identified and used as benchmarks in designing and developing the system, ensuring the integration of features and solutions that align with user expectations.

2.1.2 Literature Study

To facilitate the research process, a literature study will be conducted throughout the duration of the research. This includes collecting related journals and books, both offline and online (e-journals and e-books). Reading, quoting, and rephrasing in this research, along with properly citing sources, including titles and authors, will be carried out meticulously to ensure valid and theoretical results to support the preparation of this research report.

2.2 Design Methodology

The following is the design method for the system using Feature-Driven Development [24][25], as illustrated in the diagram below:

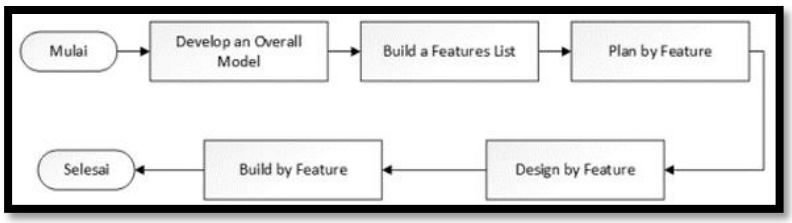


Figure 1. Feature Driven Development Method

FDD is divided into five structured and interdependent stages:

1. Develop an Overall Model
   In this step, the researcher defines the context and overall scope of the project. Multiple models can be produced, and the researcher reviews them to select the most optimal model for the project based on requirements.
2. Build a Feature List
   In this step, the overall model and documentation of requirements are used to create a comprehensive list of features needed by the system users.
3. Plan by Features
   A high-level plan will be created in this step, derived from the previously approved feature list. This plan will include a schedule for major project milestones and detailed timelines for each feature.
4. Design by Feature
   This step is iterative, with each iteration lasting several days but not exceeding two weeks. The researcher generates a design package for each class, along with sequence diagrams. These design packages and diagrams are reviewed for approval.
5. Build by Feature
   This is the final step in the FDD process. At this stage, the design is implemented (coded), after which the code is reviewed and undergoes testing. This step is also iterative, similar to the design by feature step. Once all iterations are completed, the developed features are published in the main build, and a new set of features begins, continuing the cycle.

2.3. System Requirements

The system requirements as supporting devices for system development are divided into two categories: hardware and software. The details are as follows:

a. System Hardware Requirements: The computer used as the hardware for designing this game has the following

b. specifications: 1. Processor: Intel Core i5-750, 2. VGA: NVIDIA GeForce GT1030 2GB, 3. Storage: 256GB SSD & 500GB HDD, 4. RAM: 8GB DDR3, 5. Peripherals: Mouse, Keyboard, and Speaker
c. System Software Requirements: 1. OS: Windows 10 Pro, 2. Bahasa: C#, 3. Editor Code: Visual Studio Code, 4. Editor Asset: Aseprite, Photoshop, and 4. Game Engine: Unity Engine.

3. RESULTS AND DISCUSSION

At this stage, it is the implementation of the research method or the planned application development. Therefore, this section describes the stages of the research execution according to FDD, making this research scientific.

3.1 Research Planning Analysis

In the research planning analysis, the author details the steps that will be taken throughout the research, including the schedule of activities.

3.2 System Requirements Analysis

In the system requirements analysis, the author conducts an analysis of the needs required by the system. This involves the preparation of user stories, functional requirements, and non-functional requirements. Once the necessary requirements have been identified, the next step is to outline the general description of the system to be designed.

3.2.1 User Story

In this stage, a needs analysis is conducted to design a folk tale-themed game aimed at providing an immersive and educational experience regarding traditional folk stories. Based on the research, the author identifies the following issues:

1. Loss of Interest in Traditional Folk Tales: Many young generations are losing interest in traditional folk tales as they are more attracted to modern entertainment. This trend has resulted in a decline in knowledge and appreciation of local cultural heritage.
2. Lack of Interactivity in Cultural Learning**:** Learning about folk tales often feels rigid and less engaging for younger generations. The lack of interactivity in storytelling can hinder a deeper understanding of the cultural values contained within folk tales.
3. Limited Access to Folk Tales**:** Access to traditional folk tales may be restricted due to geographic factors or a lack of easily accessible information sources. This hinders efforts to preserve folk tales and prevents younger generations from becoming familiar with them.

3.2.2 Functional Requirements

In the development of a folk tale-themed game, functional requirements include a strong consistency with the core folk tale being adapted, maintaining fidelity to the characters, plot, and essential elements within the story. Additionally, the visual and artistic design should create an environment that respects the art style and aesthetics associated with the folk tale. Puzzles and challenges within the game should be based on symbolism inspired by the folk tale, allowing players to understand the cultural and moral elements present in the story. Developers should also provide choices in the storyline that have significant impacts, as well as direct the selection of sound and music to create an atmosphere that aligns with the narrative.

3.2.3 Non-Functional Requirements

In the analysis of non-functional requirements, the author examines the needs related to hardware, software, and user specifications necessary to run the system that will be built. Below is an explanation of each part of the non-functional requirements:

1. Hardware: This analysis of hardware requirements outlines the hardware needed for the system being developed. A computer with the following specifications is required: a. A quad-core or octa-core processor with a minimum speed of 2 Gigahertz (GHz). b. A minimum of 512 Megabytes (MB) of Random Access Memory (RAM).
2. Software: This analysis of software requirements outlines the software needed for the system being developed.
3. User Specifications: This analysis of user specifications describes the criteria that users should have a good understanding of how to play the game. Adequate support and user guidance are important factors to ensure effective use of the game and to enhance user satisfaction.

3.3 Analysis of System Development Requirements

In the analysis of system development requirements, the author identifies the hardware and software needs necessary for developing the system. Below are the hardware and software requirements explained as follows:

3.3.1 Hardware Requirements

In developing the system, the author requires the following hardware: 1. Intel Core i3/i5 processor, at least 2nd generation. 2. Minimum of 8GB RAM or more. 3. At least 8GB of available storage space.

3.3.2 Software Requirements

Based on the system to be designed, the author requires a laptop or computer with Windows, Linux, or macOS operating systems. Additionally, for the smartphone devices to be used in system testing, an Android operating system of at least version 5.0 (Lollipop) or newer is needed. For developing the system, the author requires the following software: 1. Code Editor: Visual Studio Code, 2. Programming Language: C#, 3. Asset Editor: Aseprite, and 4. Game Engine: Unity Engine.

3.4 System Design

In the system design phase, the author uses UML modeling tools to design the system as a whole. The author also designs the interface using wireframes, as well as the database requirements and system architecture needed to build the system. The system design is described as follows:

3.4.1 Unified Modelling Language

UML can be used to visualize and design the system structure graphically. The following designs will be created in this work:

a. Use Case Diagram

Based on the prior analysis, modeling from the user's perspective is then created using a use case diagram. The use case diagram is created from the user's perspective, simulating their involvement in the system's analysis and design stages. The use case diagram illustrates the application's functionality. Below is the use case diagram for the game *Sentika's Resilience*, illustrating the game's functionalities for the user.

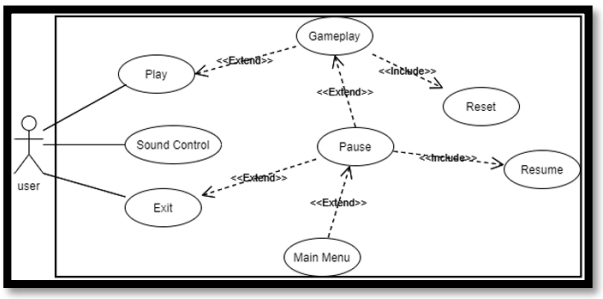


Figure 2. Use Case Diagram

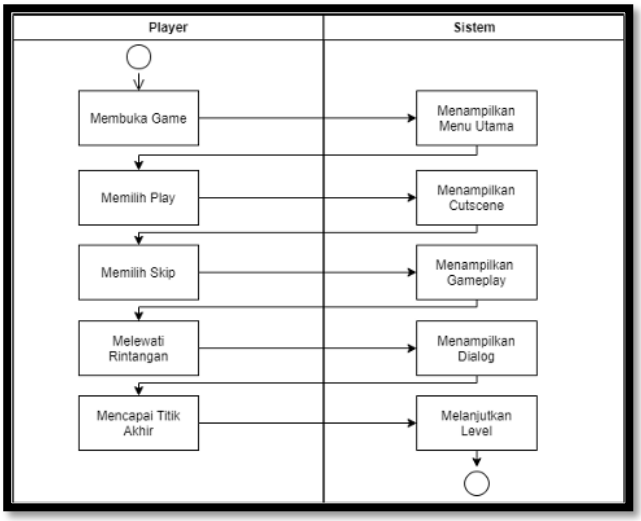
For the explanation of the use case diagram with the user actor, when the user first opens the game, they will see the splash screen and then be directed to the main menu, which serves as the primary menu of the game. After that, the user will be presented with three menu options: play, options, and exit. The use case outlines the various functions within the use case. Below is the use case definition for the game *Sentika's Resilience*:

Table 1. Use Case Definition

Use case	Description
User	Acting as the user or player
Play	A button to start the game
Sound Control	Adjust the in-game sound
Exit	A button to exit the game
Reset	Resets the player's starting position
Pause Game	Functions to pause the game temporarily
Main Menu	Displays the main menu with three options: Play, Options, and Exit
Resume	A button to resume the game

b. Activity diagram

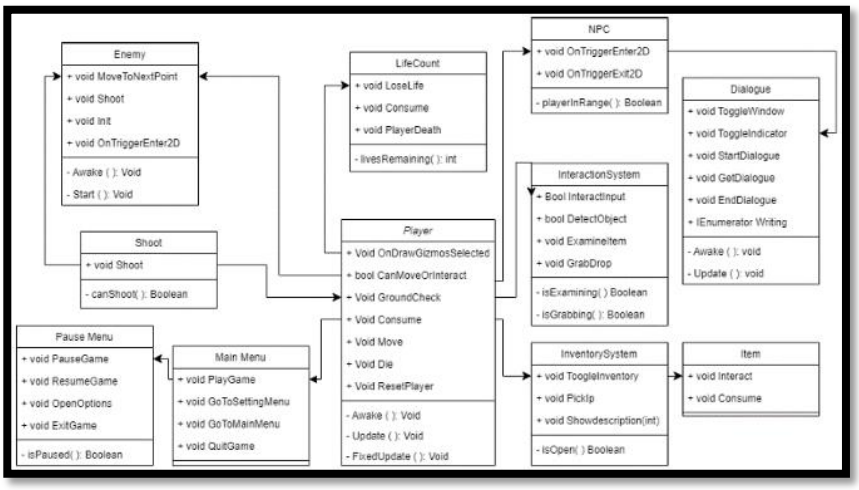
The activity diagram is used to model the processes occurring within the system, illustrating the activities for each function. It includes: Start Activity Diagram, Pause Activity Diagram, and Exit Activity Diagram.



Gambar 3. Activity Diagram Mulai

c. Class Diagram

The class diagram illustrates the system structure in terms of defining the classes that will be created to build the system. A class consists of three main parts: attributes, operations, and name. Each class in the system structure must be able to perform functions according to the system requirements. Below is the class diagram for the game *Sentika's Resilience*.



Gambar 4. Class Diagram

In the Class Diagram above, there are 11 classes with the following relationships:

1. Class Player: The Player class is connected to the Enemy class, where the Enemy class will automatically attack the Player class upon detecting it.
2. Class LifeCount: LifeCount is related to the Player class, where the player's life count will decrease when the Player class is hit by the Enemy class.
3. Class Enemy: The Enemy class is related to both the Player and Shoot classes. When the Enemy detects the presence of the Player, the Shoot class will be triggered.
4. Class Shoot: The Shoot class is connected to both the Enemy and Player classes. When the Player and Enemy classes intend to attack each other, the Shoot class is utilized.
5. Class MainMenu: The MainMenu class is connected to the Player and Pause classes. When the player starts the game, the MainMenu class is displayed.
6. Class Pause: The Pause class is related to the Player class. When the player wishes to temporarily stop the game by pressing a button, the Pause class is displayed.
7. Class NPC: The NPC class is connected to the Player and Dialogue classes. When the NPC detects the presence of the player, the player can interact with the NPC.
8. Class Dialogue: The Dialogue class is related to the NPC class. When the NPC detects the player's presence, the dialogue is triggered and displays text.
9. Class InteractionSystem: The InteractionSystem class is connected to the Player and Item classes. When the player detects an item, they can interact with it.
10. Class InventorySystem: The InventorySystem class is connected to the Item class. When the player detects an item, they can pick it up, and it is stored in the inventory.
11. Class Item: The Item class is related to both the Player and Inventory classes. When an item is detected by the player, it can be interacted with or picked up

d. Sequence Diagram

A Sequence Diagram illustrates how an operation is performed, what messages are sent, and the timing of these operations. This diagram is organized based on time, with objects related to the operation sequence arranged from left to right according to the chronological order of messages. Below are the types of Sequence Diagrams for the Sentika's Resilience Game: Sequence Diagram Splashscreen, Sequence Diagram Play, Sequence Diagram Option, Sequence Diagram Pause, and Sequence Diagram Exit.

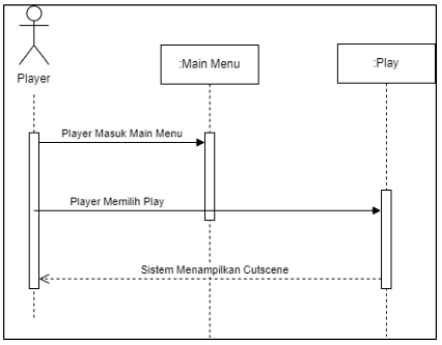


Figure 5. Sequence Diagram Play

This play diagram illustrates the process of starting the game and displaying the main application menu. The player enters the main menu, selects the play button, and then the system presents a cutscene.

3.4.2 User Interface Design

In game development, an interface design is necessary to facilitate user interaction with the game system. The interface provides the layout of a system's pages, which is used for data input and produces output interfaces that meet user needs. The interface designs for the game **Sentika's Resilience: Rise of the Archipelago** are as follows: Initial Menu, Cutscene Interface Design, Stage Interface Design, and Pause Menu Interface Design.

Figure 6. Gameplay Interface Design

In the gameplay interface, several UI elements are present, including the lifecount and pause options. The lifecount serves to display the player's health status, while the pause feature allows the game to be temporarily halted.

3.5 Implementation

System Implementation**,** The system implementation is the stage of development that translates the design into executable code. Initially, the specifications for the hardware and software that will be implemented in the program will be outlined, which are essential for executing the program. This involves detailing the design into classes written in the C# programming language.

3.5.1 Hardware Implementation

In implementing the previously described design, several hardware components are required to run this application effectively. The necessary hardware specifications include the following:

a. Minimum computer specifications required to run the game Sentika's Resilience are as follows: a. OS: Windows XP, Vista, 7, b. Processor: 2 GHz, c. Storage: 150 MB, d. RAM: 512 MB dan e. Peripheral: Mouse, Keyboard, and Speaker.
b. A laptop unit used in the design and development of the game Sentika's Resilience is a Lenovo ThinkPad X270, with the following specifications: a. Processor: Intel® Core™ i5-6200U CPU @ 2.30 GHz. b. Processor : Intel® core™ i5-6200U CPU @ 2.30Ghz, c. Memory : 8GB, d. Storage : 128GB SSD, e. Graphic : Intel® HD Graphic 520, f. Peripheral : Mouse, Keyboard dan Speaker.

3.5.2 Software Implementation

In the application and implementation of the previously designed framework, several software tools are required to create the game **Sentika's Resilience**. These include the following:

a. Unity Engine: Used as the primary tool and a kit for developing the game.
b. Visual Studio Code: Used as the tool for writing code that will be connected to the game engine.
c. Aseprite: Used as the tool for drawing sprites that will be used as game assets.

3.6 Interface Implementation

Below is the implementation of the interface or the appearance of the application.

3.6.1 Implementation of the Main Menu Display

In the main menu display, there are buttons for Play, Option, and Exit. Users can select the Play button to start playing immediately. The Option button allows users to adjust the in-game volume, while the Exit button is used to close the game. The image can be seen in Figure 7.

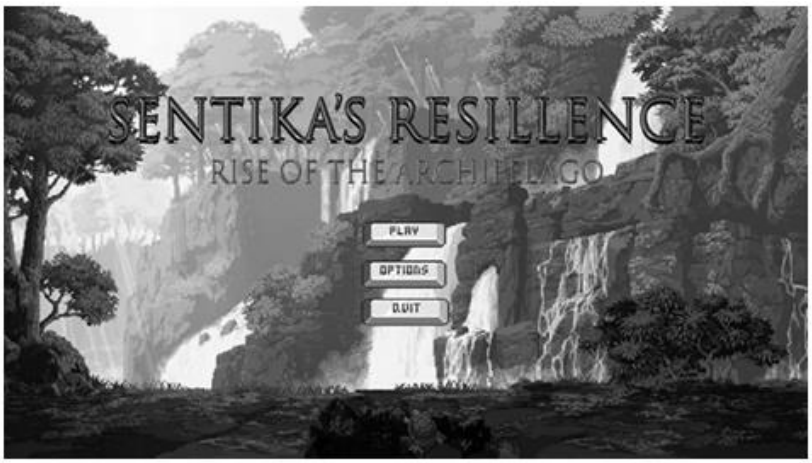


Figure 7. Main Menu Display

3.6.2 Implementation in the Play Menu

In the Play Menu display, there is a storyline that begins when the player presses the Play button located in the center. When the Play button is pressed, a cutscene will appear, and there is a skip button available to bypass the cutscene. The image can be seen in Figure 8.

Figure 8. Cutscene Display

3.6.3 Implementation in the Game Stage

The game stage display includes several UI elements. There is a pause button located at the top right, which allows the player to pause the game temporarily and display the pause menu. Additionally, the player's character has a lifecount indicator; if the player's lifecount reaches zero, the character will lose or die. Below is the game stage display when the player is using the character Naya Sentika. The image can be seen in Figure 9.

Figure 9. Game Stage Display

3.6.4 Implementation of the Pause Menu Display

In the Pause Menu display, there are several buttons, including the resume button, options button, and exit button. When the game is paused, the game background becomes slightly darker. The resume button is used to continue the game after it has been paused. The options button displays the options menu, while the exit button is used to return to the main menu. The image can be seen in Figure 10.

Figure 10. Pause Menu Display

3.6.5 Implementation of the Options Menu Display

In the Options Menu, when the player presses the options button, settings appear to adjust the game's volume, fullscreen mode, and resolution. The image can be seen in Figure 11.

Figure 11. Options Menu Display

3.7 Testing

The testing phase is designed to evaluate several key functions of the game to determine whether they perform as expected. The testing conducted on *Sentika's Resilience: Rise of the Archipelago* includes both alpha and beta testing.

3.7.1 Alpha Testing

In this testing phase, the author directly tests the game by executing all game functions and recording the results in a table. Below is the table of the alpha testing results:

Table 2. Alpha Testing of the Main Menu

Test Cases	Testing Steps	Expected Results	Result
Play Button	Press the Play button icon	Display a cutscene indicating that the game has started	Success
Options Button	Press the Options button icon	Display the settings menu	Success
Exit Button	Press the Exit button icon	Exit the program	Success

In Table 2, the tested components include the Play, Option, and Exit buttons found in the game's main menu. These buttons have been tested and found to be successful.

Table 3. Alpha Testing of the Play Menu.

Test Cases	Testing Steps	Expected Results	Result
Skip Button	Press the Skip button icon	Skip the cutscene to continue the game	Success

Next, in Table 3, the button to be tested is the Skip button, which functions to skip the ongoing cutscene.

Table 4. Alpha Testing for Stage Game or Main Game.

Test Cases	Testing Steps	Expected Results	Result
Background Parallax	Play the Game	The background will follow the player as they move	Success

Left Button	Press the Left Button	The player will move to the left	Success
Right Button	Press the Right Button	The player will move to the right	Success
Jump Button	Press the Space Button	The player will jump	Success
Projectiles Button	Press the Enter Button	The player will throw a sharpened bamboo spear	Success
Pause Button	Press the Pause Button	The game can pause and display the pause menu	Success

In Table 4, the author tested the stage game, which includes several buttons, such as those for moving left and right, jumping, attacking, and pausing the game. Each of these buttons was successfully tested.

Table 5. Alpha Testing of the Pause Menu

Test Cases	Testing Steps	Expected Results	Result
Resume Button	Press the Resume button	The game resumes successfully	Success
Option Button	Press the Option button	The settings menu is displayed	Success
Exit Button	Press the Exit button	The main menu is accessed again	Success

Next, in Table 5, the author tested the pause menu, which includes the resume button, option button, and exit button. Each of these buttons successfully passed the testing

Table 6. Alpha Testing of the Option Menu

Test Cases	Test Steps	Expected Results	Result
Slider	Press the play button	Adjust the volume	Success
Fullscreen Button	Press the toggle fullscreen button	Change the game mode to fullscreen	Success
Resolution Button	Press the dropdown button	Change to the desired resolution	Success

In Table 6, the author conducted alpha testing on the Options Menu. The Options Menu consists of the toggle fullscreen button, the resolution dropdown, and the slider. All buttons passed the tests successfully. It can be concluded that the alpha testing, which encompasses all functions or buttons in the game according to the design specifications, has been met.

4. DISCUSSION

From the conclusions drawn from the application testing using Black Box testing methods mentioned above, it can be concluded that the application is functioning optimally. However, it is important to note that errors may still occur while the game is in operation. If such issues arise, the researcher will take corrective actions to ensure that the game functions as intended.

5. CONCLUSION

In this study, the implementation of Feature-Driven Development (FDD) in designing the video game "Sentika's Resilience: Rise of the Archipelago" has successfully provided a structured and focused framework for developing a game within the Story Adventure genre. The FDD process effectively guided the steps for developing key features that support the storyline, gameplay mechanics, and player interactions with the game environment. The results of this implementation demonstrate that FDD has the potential to create a cohesive and immersive gaming experience. Through the application of FDD, the game "Sentika's Resilience: Rise of the Archipelago" has succeeded in delivering a more directed and satisfying gameplay experience. Features that were clearly designed and implemented separately allow players to experience a rich narrative and smooth gameplay. This not only enhances the entertainment value of the game but also provides opportunities for players to engage with a strong narrative and gain educational benefits through its structured storytelling elements.

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