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Implementation of Inventory Checking System Using Finite State Machine in Role Playing Game

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Abstract— This study aims to implement an inventory checking system combined with ***Finite State Machine (FSM)*** *in the* ***Role Playing Game (RPG) game genre using*** *Arnold Hendrick's Game Development Life Cycle (GDLC)* ***development method****. In RPG games, inventory management is a crucial aspect that affects the gameplay, especially in the management of quests and item crafting features. The FSM approach is used to manage state and state transitions in randomly completed quests, providing more flexible dynamics in the completion of in-game tasks. The GDLC method was chosen to ensure that system development is carried out in a structured manner, starting from planning, design, implementation, to testing. This research integrates FSM in the* ***RPG Maker MV*** *game engine, which allows developers to dynamically set various quest variables and optimize the item crafting process. By implementing FSM, items can be combined based on predefined state conditions, creating a more complex and interactive gameplay experience. The results of this study show that the application of FSM in the inventory checking system has a significant impact on flexibility in quest management and crafting. Quest variables that can be completed freely according to the player's choice, Overall, Finite State Machine can provide interactivity and depth of gameplay in RPGs with various quests that are tiered with each level, especially in the use of RPG Maker MV as an engine to apply various supporting variables to create flexibility in completing missions.*

Keywords : *Finite State Machine, Rpg, Game Engine, Inventory*

I. INTRODUCTION

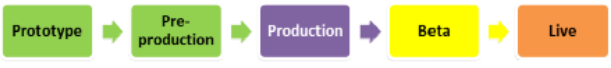
Role Playing Game (RPG)-**based games** have become one of the most in-demand game genres due to their ability to provide immersive narrative experiences and complex interactions. In RPG game development, one of the important elements that affect the player experience is the **inventory** system. This system allows players to manage items, weapons, or other resources found during the game. The Inventory system itself can be one of the important elements to support how a story can be more interesting when in a certain quest there is a mission for *Crafting* to create supporting items from the course of a mission.

Role Playing Game itself is a type of game where the player controls a character to follow the storyline provided [1]. This type of game has the essence of story value that affects the control of the characters in the game which will usually get stronger as the story progresses in the game. This game usually has a set type of setting in a certain set of time in an imaginary world so that Role Playing Games can provide a unique experience in strategizing for the layer to be able to complete each mission.[2].

Finite State machine is one of the techniques used in game development. [4] FSM is often used in system programming and design to set up condition-dependent logic, such as in game development (character AI, event systems), control systems, and other software that requires structured state management [5]. The FSM model can be implemented efficiently by utilizing events and switches that allow characters to switch between states based on player actions [7]. The storyline can be processed with various character situations through a series of logically arranged events [8]. This research aims to answer this need by developing an inventory checking system combined with the Finite State Machine method which can help to increase the efficiency and flexibility of the inventory management system in the game, especially in the Supporting Items area in the main story.

II. RESEARCH METHODS

In this study, there is a need for a systematic approach to collect, analyze, and interpret data to answer research questions. This method includes techniques, procedures, and strategies designed to ensure that the research process is carried out in a structured and reliable manner The researcher uses a development method based on Arnold Hendrick's GDLC [3], which in this phase consists of 5 steps as follows



Gambar 1. Arnold Hendrick's GDLC

The main points in making a game with this method are as follows:

1. **Prototype Phase**
   Create a rough design of the existing game, such as creating maps, characters and some items used in the game prototype.

2. **Pre Production**
   Creating game documentation related to game design documents and Flow Of Game that will be applied in the game, making it easier to create events and the flow of how this story is presented.
3. **Production**
   At this stage, it is related to how a game asset has been formed, creating code and integrating assets that have been provided previously so that a complete storyline is obtained.
4. **Beta**
   It is a stage where testing is carried out by users to get feedback from the game presented
5. **Live**
   At this stage, the game has passed the test in both the Alpha and Beta stages

III. RESULT AND ANALYSIS

3.1 Prototype Stage

At the Prototype stage, what needs to be done is to prepare some basic assets to be included in the game as follows:

1. Character assets.
   Characters are an important role in a game, with characters, players can enjoy the storyline presented as if they were the heroes in the story

Figure 2. Main Character Bedu

2. Peta Game

   The game map is one of the essences that needs to be present to describe the situation and conditions of an area, to build the story elements presented in order to give an impression of the events that occurred. Using the game map can also increase the sense of exploration according to hidden places, to get special items and or get hidden side missions that can give a sense of curiosity from the player, so that the map map is always one of the mechanin gameplay in games with the type of role playing game.

Figure 3. Map of Forest Market

The map used to get the first Quest is related to the player's inventory system

Figure 4. Home Map

3. Item

In addition to character assets and maps, assets are also needed for items, where this item will be one of the requirements for how the inventory system is implemented, here are some items used in the game

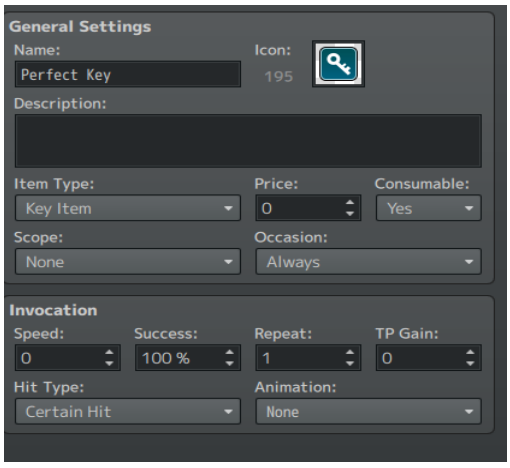


Figure 5. Perfect key

3.2 Pre Production

There are several steps that need to be taken at this stage, which are as follows:

1. System Description
   The implementation of Finite State Machine will consist of 2 stages, namely the initiation process and the process of finding items for crafting, in this mission systemically, players must find three items that are used to create new items. Players cannot refuse to be given the mission.

2. Storyline
   The storyline used in the story of this game is a soldier who is sent by the captain to look for food supplies because the food supply has run out. To get the hunting tool, Bedu has to find a trader, after meeting the trader, Bedu cannot open the weapon box because the key used is damaged, so the trader gives the option to repair the key to the blacksmith to get a new key. By applying the Finite State Machine, players can freely take random quests to complete the desired Item.

3. Flow Of Game (Pandai Besi)
   The flow of the game is a flow that occurs when a story is initiated, in this flow it is also applied finite state machine referring to figure 6 and table 1.

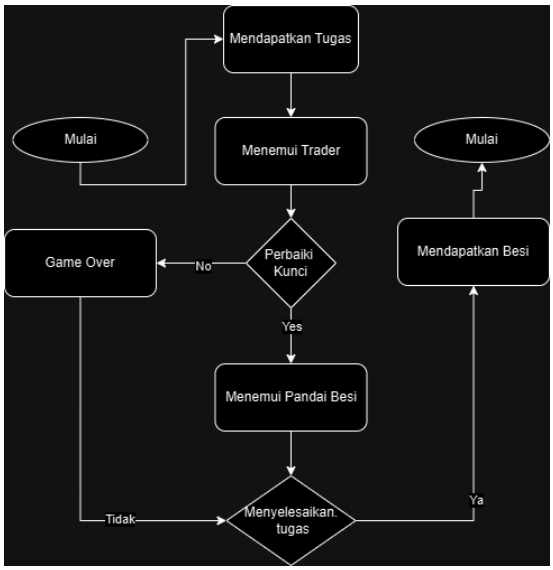


Figure 6. Flow Of Game (Blacksmith)

The image above is the flow from the beginning of the point quest begins, at this stage the finite state machine method has been given in several forms as follows which are used as the finite state machine transition table [9].

Table 1. Blacksmith FSM

State	Event	Action
Idle	Meet the Trader (true)	Grants Missions to obtain iron Items
Idle	Meet with a Trader (False)	Mission not assigned
Mission Given	Failed to complete the Mission	Game Over
Mission Given	Successfully complete the Mission	Obtain Iron Items from completed missions

4. Flow Of Game (Running Man)
   The following is the flow of the Game from Running Man combined with the Finite State Machine, here players must complete the missions given in order to get a wooden item to repair the broken key, this item is one of the important items to complete because the item obtained is an important item as the key to completing the story.

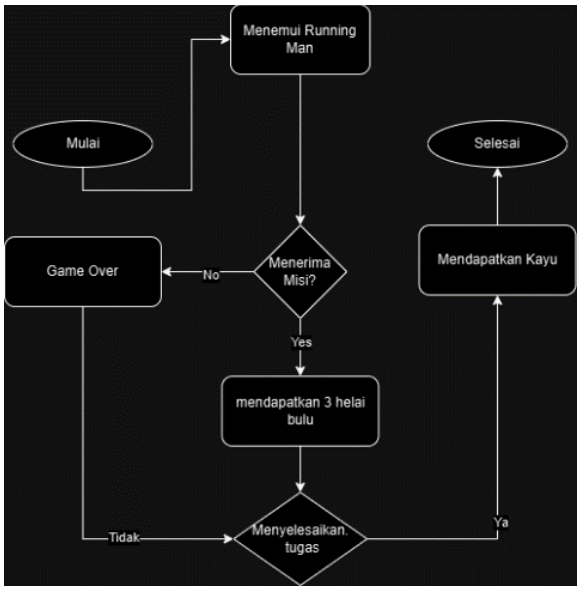


Figure 7. Flow Of Game (Running Man)

Tabel 2. FSM Running Man

State	Event	Action
Idle	Meet the Trader (true)	Grants Missions to obtain Wood Items
Idle	Meet with a Trader (False)	Meet with a Trader (False)
Mission Given	Failed to get 3 feathers	Game Over
Mission Given	Managed to get 3 feathers	Obtain Wood Items from completed missions

5. Flow Of Game (Knight)

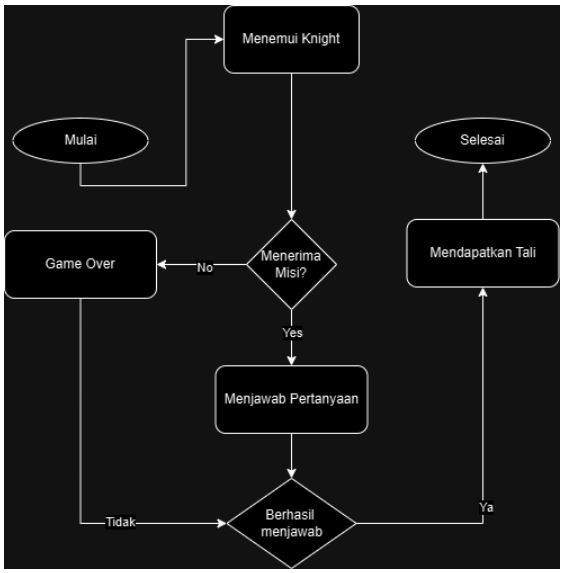


Figure 8. Flow Of Game Knight

Table 3. FSM Knight

State	Event	Action
Idle	Bertemu dengan Trader (true)	Knight Muncul
Idle	Bertemu dengan Trader (False)	Knight Tidak Muncul
Misi Diberikan	Gagal Menjawab	Game Over
Misi Diberikan	Berhasil Menjawab	Mendapatkan Item Tali dari Knight

3.3 Production

At this stage, the merger of integrated assets is carried out to create an interesting series of stories, as well as the implementation of the Finite State Machine in conducting a checking system on the RPG game made.

Figure 9. Mockups with Characters

In the image above are the positions of NPCs in giving quests for the Checking system, the flow of the Finite State Machine table for the Checking system is as follows:

Table 4. FSM Inventory Checking

State	Event	Action
Item Besi	Variable Iron Values False	The system checks if no wood is found, a message will appear "Haven't gotten Iron"
Item Besi	Iron Variable True Value	Fire Effect Animation Appears, Iron Value on Inventory is 0
Wood Items	Wood Variable with False value	The system checks if no wood is found, a message will appear "Wood has not been obtained"
Item Kayu	Variable Kayu bernilai False	Fire Effect, Wood Value on Inventory is 0
Item Tali	Variable Tali bernilai False	The system checks if no wood is found will A message appears "Haven't gotten the Rope yet"
Item Such	Variable Rope value False	Fire Effect, Rope Value on Inventory is 0
Rope, Iron and Wood	Variable Crafting bernilai True	A fire effect appears, forming a new key for the player to get the "Perfect Key"

The code creation part in implementing the finite State Machine is as follows:

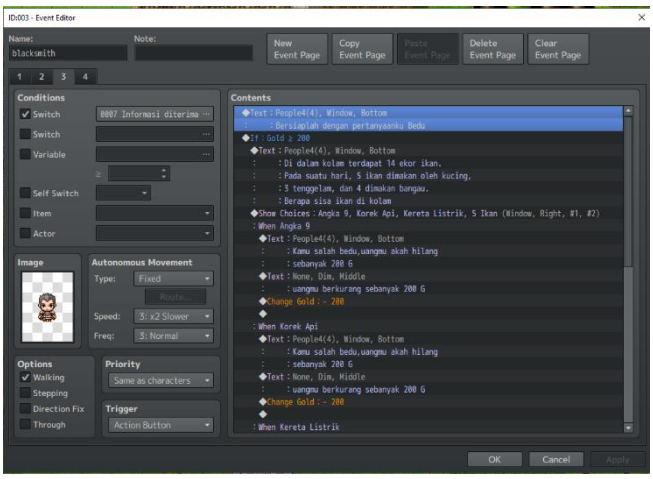


Figure 10. Blacksmith Event

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In this section, players will be given questions where every question given will have a penalty that will run, in the script above, the punishment is taken from the resources provided by the trader, so that the more mistakes are made, the more resources will be exhausted

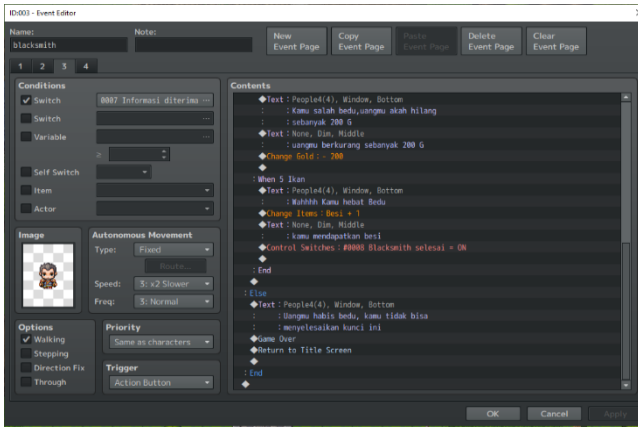

Figure 11. Iron Earning Event

After obtaining Iron, the next step is that players can freely determine whether to take a log or rope, the application of the finite state machine here provides space for how a quest can be taken at random

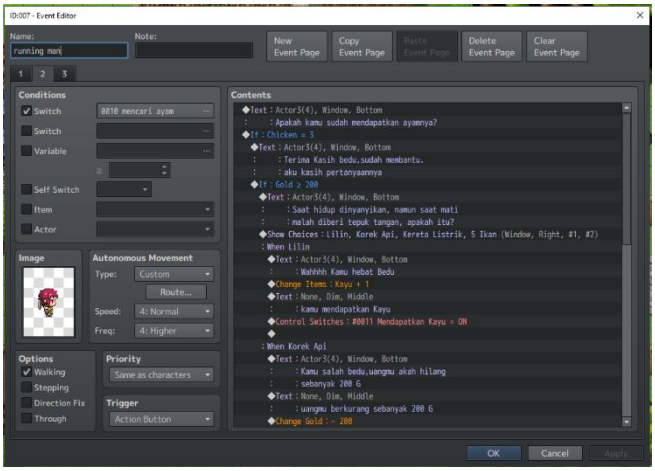

Figure 12. Rope event from running man

In this stage, the quest given to the running man will be slightly different from the quest obtained from the blacksmith and knight, while the quest given by the running man is to find 3 chicken feathers, refer to figure 13.

Figure 13. Quest Even Catching Chickens

Figure 14. FSM Checking Inventory

Refer to table 4. A message is obtained if when the item is collected but it is incomplete or there is one of the items that is missed, the system will provide a notification according to the item that has not been obtained.

Figure 15. Getting the Perfect Key

Refer to table 4. A message is obtained that when the item is collected and obtained completely, the Finite State Machine from the checkking system will run the next state, which is to combine 3 items into one to get the final perfect item Key.

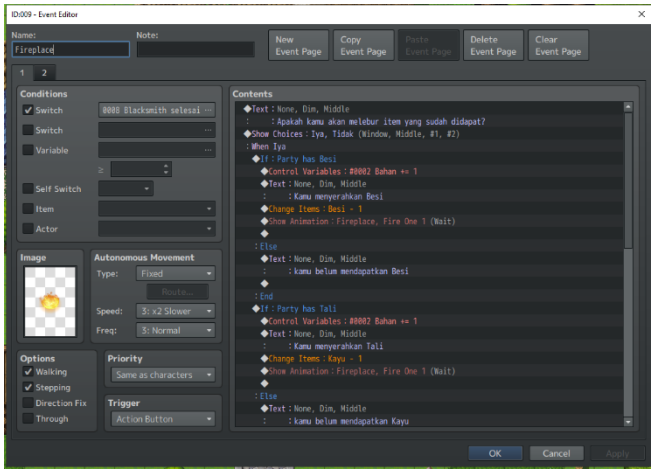

Figure 16. FSM Script for Check Inventory

VI. CONCLUSION

The application of FSM in managing quest status and transitioning conditions provides more flexibility in completing tasks, and allows the randomization of quest variables that are completed in a non-sequential manner to be one of the essences that enrich the player experience. The integration of Finite State Machine in the item crafting system using **the RPG Maker MV** engine also improves the efficiency and process of item combinations based on predetermined status, so that the use of the crafting system can be expanded further by using the level of each existing item to get a more comprehensive game experience.

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