

# Development "Acep the Explorer" an Educational Game Introduction Animal Ecosystem

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**Abstract:** Acep the Explorer is a game about animal ecosystem, this lesson is a must-know lesson for elementary school children who aim to introduce to children who are just beginning to know animals that are foreign to them, so that children can recognize the animals and place them according to their own ecology. Educational games are games designed or created to stimulate thought including increasing concentration and problem solving. This game developed by multimedia development system, start from concept, design, until testing. AI development is also carried out in this game, we use a finite state automata to create enemies that annoy players. The result of this research, an educational game about animal ecosystem and the children's response to the use of educational games know animals according to ecosystem is good, children can get to know animals according to their ecosystem. And the AI, the Finite state automata in this game makes the game more challenging, interesting and fun. Because in this game they can learn while playing games and face some obstacles and destroy the enemy hunting device and complete the game. This research contributes to combining AI technology with educational games to make students learning about animal ecosystems more interesting and challenging.

**Index Terms:** Educational games, Animal Ecosystem, Finite State Automata, Explorer

## 1. Introduction

One of the causes of learning difficulties of elementary school students because there are too many foreign terms [1,2], the material is too dense, students should memorize the material, students seem difficult to understand the material without the availability of media [1,3], The teaching method of the teacher is also boring and too monotonous because the teacher is only driven to the book and it is not pleasant for students [4-6]. This has an impact on the lack of interest and motivation of children's learning and most children are more concerned with playing games than learning [7-10]. Game is a form of participatory, interactive and entertainment [6,8]. Watching television, reading, and going to the theater is all forms of passive entertainment [5,11]. Therefore, an interesting educational game is made that adds interest in learning and makes it easier for children to learn about getting to know animals according to their ecology.

Educational games are games designed or created to stimulate thinking including increasing concentration and solving problems [9,10,12,13]. Previously there was research on "Development of Educational Game-Based Learning Media for The Introduction of Animals and Their Ecology in Tk Aisyiyah Bolon Colomadu" [14]. Where the introduction of Ecosystem introduces 3 ecosystems namely Forest, Water, and Desert. The introduction of animals is only an image [14]. From the study that distinguishes with this study is the study which only focuses on introducing 3 ecosystem that in general namely desert, polar and forest so that children who are 8 - 9 years old or the same as elementary school children in grade 3 are not too confused if too many ecosystem are introduced because the ecology is learned in the advanced class [15], and in the making of this game, we implements the Finite State Automata method.

Finite State Automata (FSA) is one of the areas of AI (Artificial Intelligence) that can be applied to AI games [16-21]. The principle of working using the following 3 things: state, event and action [19,22]. The FSA can be referred to

as Non-Player Characters (NPC) [23,24] or also referred to as agents is an in-game entity that is not directly controlled by the player [16,24]. The NPC is controlled automatically by the computer [23].

In this study, the authors will create a game titled "Acep the Explorer" in which the game will implement the Finite State Automata (FSA) method. The title Acep the Explorer is derived from "Acep" taken from the author's nickname while "The Explorer" means explorer or adventure. In this game tells the story of Acep, a student who wants to be adventure and know about animals and their ecology. Where the animals that are there should not be killed either dangerous or harmless animals, and there will be some obstacles that must be passed or avoided and destroyed like an enemy NPC (Non-Playable Character). In this game there are 3 levels: easy, medium/normal, hard, according to the category of obstacles or hunter in this game such as in the easy level some cactus plants avoided because of spikes, crystals because sharp, mushrooms because toxic, hunter there are 2 categories namely patrol and chase, which in the moderate level is a patrol hunter, the category of hunter that are in the difficult level is chasing. And this game there is action forward, backward and jump looking for keys and answer questions that will appear when taking the city and when opening the door will appear a survivor image indicating that we have successfully completed the level. In-game questions related to ecosystem information. The objectives of this research are, increase learning interest and make it easier for children to get to know animals according to their ecology, against interaction between the main character and the hunter trap enemy, the interaction between the animal and the main character. This paper give contributes to combining AI technology with educational games to make students learning about animal ecosystems more interesting and challenging

## 2. Methodology

### 2.1. Multimedia Development Cycle

Multimedia development methodology consists of six stages, namely [25-27]:

#### 1. Concept

Concept is the stage for determining the purpose and who is the user of the program (audience identification). The purpose and end user of the program affects the nuances of multimedia as a reflection of the identity of organizations that want information to reach the end user.

#### 2. Design

Design is the stage of creating specifications regarding the program architecture, style, appearance, and material or material needs for the program.

#### 3. Material Collecting

Material Collecting is the stage of collecting materials according to the needs of the work. Such materials, such as clip art, photos, animations, video, audio, etc. that can be obtained for free or by booking to others according to the design.

#### 4. Assembly

The Assembly stage is the stage of creating all objects or multimedia materials. Application creation is based on design stages, such as storyboards, flow charts, and navigation structures.

#### 5. Testing

The Testing stage is done after completing the assembly stage by running the application or program and seeing if there is an error or not. The test method used is UAT (User Acceptance Test) where a test process conducted by the user with the output result of a test result document that can be made proof that the software has been received and already meets the requested needs.

### 2.2. Concept and Design of Finite State Automata Model

Based on the results of data analysis, a method is needed to design NPC enemy behavior. The method that will be used is Finite State Automata (FSA). In addition to the control system, FSA is a model commonly used to design intelligent agent behavior in games that has the advantage of simplicity of computation and ease of understanding and implementation [18,21]. Determination of the state diagram according to the type of behavior that has been determined [17,20], with certain conditions that can smooth the flow of the game [19]. The following image is a state diagram according to the design.

Figure 1 (a) shows, easy level category finite state automata diagram. Players must avoid cactus plants that are thorny because they are dangerous if they are hit, they will die. Figure 1 (b) shows, normal level category finite state automata diagram. The obstacle at this level is that the hunter that acts as an NPC will move back and forth to block the player's path. There are vertical or horizontal forms, some are in the air and some are at the bottom of the bottom and

will mix with the obstacles that are at the easy level and the player must not be hit if they are hit then they will die.

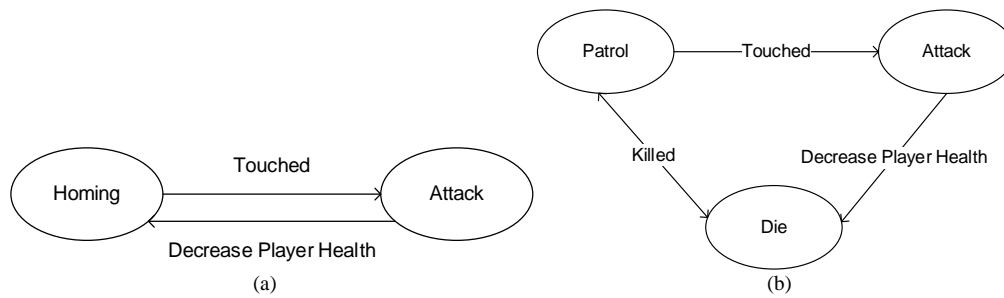


Fig.1. Diagram of the Finite State Automata Category Easy Level (a) and Normal Level Category (b).

Different than 2 model above, figure 2 shows, finite state automata diagram for difficult level category. The obstacle in this level is that the hunter that acts as an NPC will run after or follow the player and will mix with the obstacles at the easy and medium levels, if the player is hit it will die.

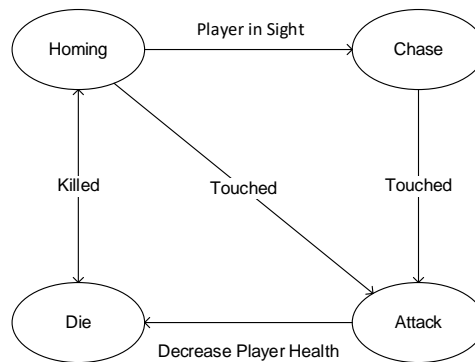


Fig.2. Finite State Automata Diagram for Hard Level Categories

Figure 3 (a) shows, animal category finite state automata diagram. The animal carcass will remain silent and when the player touches the animal, the animal will issue information. Figure 3 (b) shows, finite state automata diagram of category Acep the adventurer main character. If the main character will step on or destroy the enemy / NPC if the enemy has disappeared then continue the game.

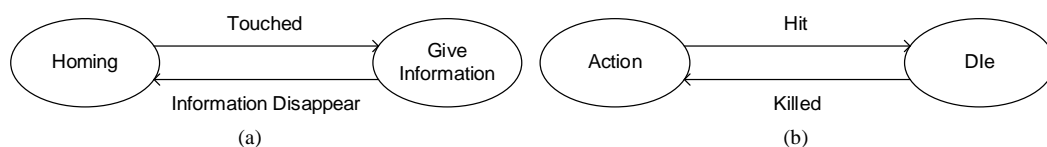


Fig.3. Diagram of Animal (a) and the Main Character (b) Category Finite State Automata

### 3. Result and Discussion

#### 3.1. Assembly

The following is a display of the start menu as shown in Figure 4 (a). The home display has the name of the game, the play button is to start the game. And there are sound buttons, tones, and game play pointers. Home game implementation is a menu display of the game application that will appear when the game storyline appears. Here is a display of the animal ecology menu options shown in Figure 4 (b).

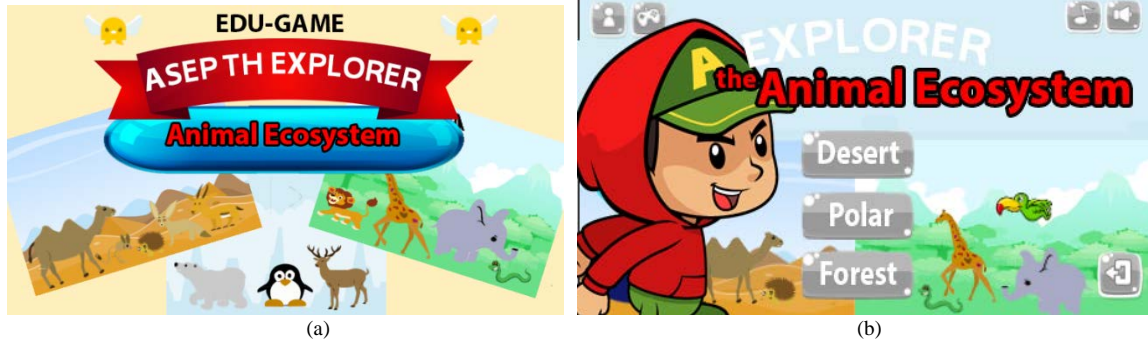


Fig.4. Initial Menu Implementation (a) and game home menu (b)

In the home feature display, there are several buttons, here is an explanation of the button Figure 4 (b) there are, hint button, sound toggle button, music toggle button, exit button, and ecosystem option button. Figure 5 shows, the implementation of the level menu is a level menu view of the game application that will appear every selection of animal ecology menus. In the level menu there are 3. Easy level of difficulty there are some dangerous plants such as cactus and mushrooms, crystal. The moderate level of difficulty is a hunter whose nature patrols or commutes. The hard level of difficulty is the hunter that chases.

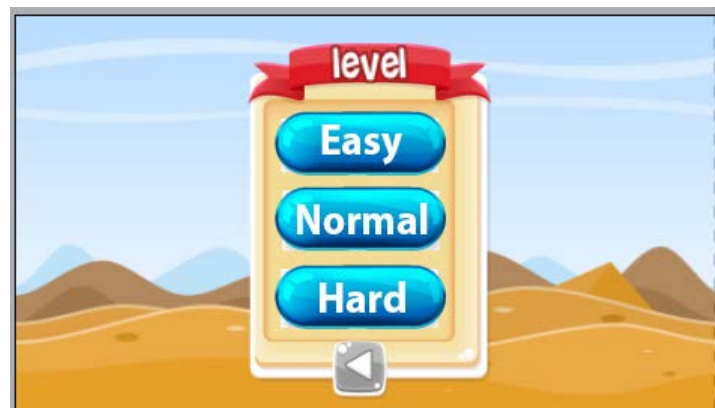


Fig.5. Level Menu Implementation

The implementation of the desert level is the view that the player plays at the desert ecosystem level that can be seen in figure 6 (a), and Figure 6 (b), shows, the polar level implementation is the view that the player plays at the polar ecosystem level. Forest level implementation is the view that players play at the forest ecosystem level that can be seen in figure 6 (c)

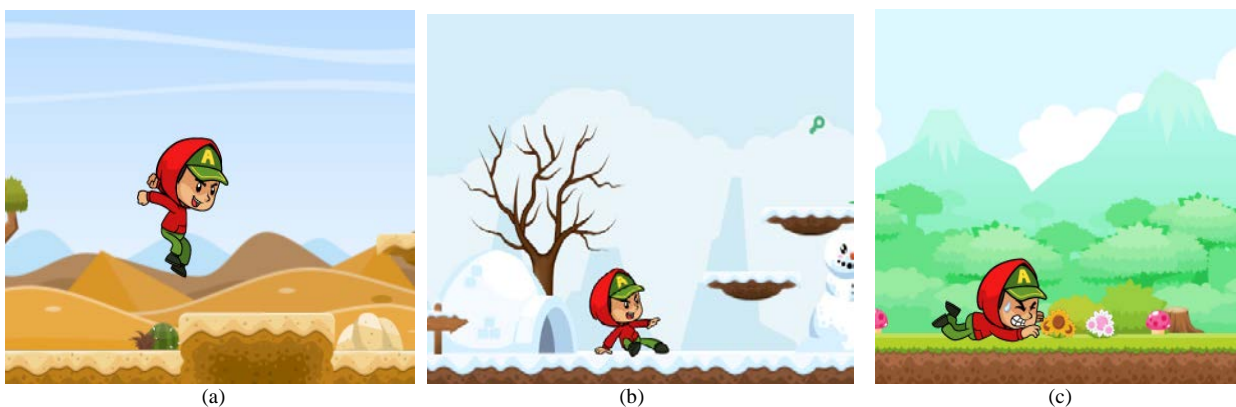


Fig.6. Level Implementation in the Desert (a), Polar (b), and Forest (c)

And for the introduction of animals there are at each level of their respective ecology, at the beginning of the level we will meet several animals, and when we will approach the animal, an information notification will appear about the animal. Figure 7 (a) shows, implementation of the animal ecology info layout is a Popup view that brings up info about the ecosystem that is being played, and the implementation of animal info layout is a Popup view that brings up info



about animals can be seen in figure 7 (b).

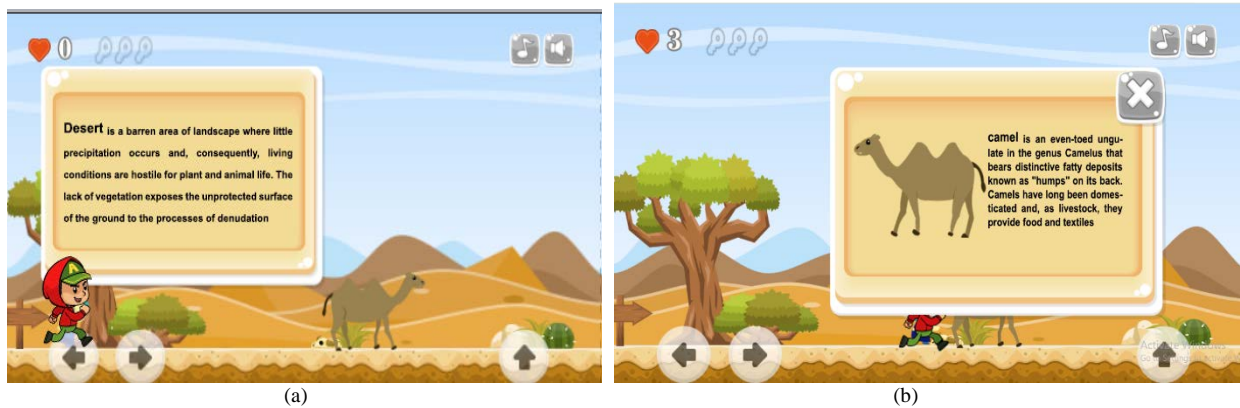


Fig.7. Ecosystem Information (a) and Animal Ecology (b) Implementation Layout

The implementation of the question layout is a Popup view that raises questions and there are 2 options can be seen in figure 8, and questions will arise when picking up a box at each level. This question can be from material books or information on each type of animal. The player must answer the questions that arise by selecting multiple answers.



Fig.8. Implementation Layout Questions

Figure 9 (a) shows, the implementation of the retry layout is a Popup view that appears when answering the wrong question. The emoticon will display as shown below, if the player's answer is wrong, the game will be repeated at a level that fails to answer the question that is displayed. the correct layout implementation is a Popup view that appears when answering questions correctly can be seen in figure 9 (b), The emoticon will appear as shown on the side if the player's answer is correct, and opens the next game level.



Fig.9. Implementation Incorrect answer emoticon (a) and correct answer emoticon (b)

The implementation of the game over layout is a Popup view that appears when the game is over and the game can be re-viewed in figure 10 (a), and implementation of the layout successfully completing the level is a Popup view that appears if it has successfully completed the level and will allow the image to be safely re-visible in figure 10 (b).

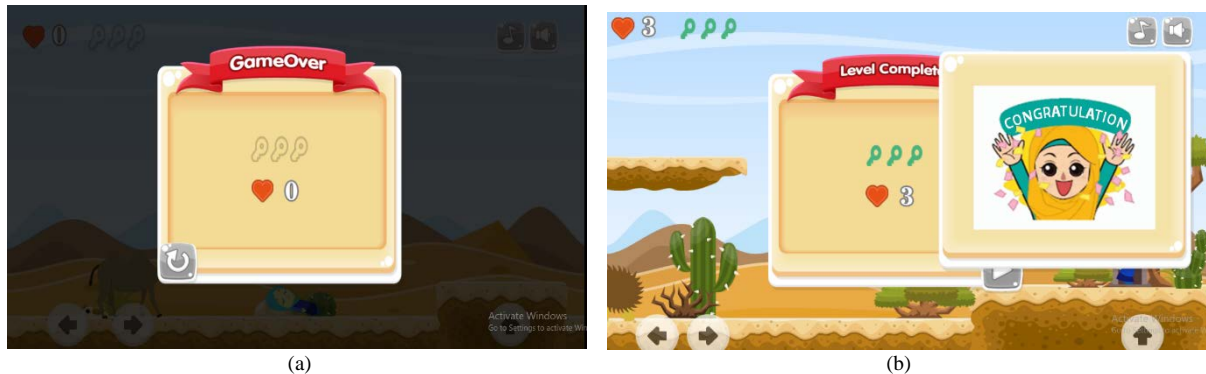


Fig.10. Layout Implementation Game Over (a) and Successfully Completes Level (b)

### 3.2. User Acceptance Testing (UAT)

UAT is a live app test in an environment that cannot be controlled [28,29]. The testing was conducted using a simple questionnaire filled out by teachers and elementary school students. In this study, the beta testing was conducted on 2 teachers and 8 students who had to answer two questions referring to the gameplay and the game agent role. Questionnaires are made as simple as possible so that children can also fill it out. This result shown in the Table 1.

Table 1. Result of Beta Testing

Question	Respondent's Questions			Total respondents
	Good	Satisfactory	Poor	
How is this educational game?	7	3	0	10
How is the characters Game and enemy?	8	1	1	10
Total Answer	15	4	1	20

From the result of beta test in Table 1, it can be calculated for answer "less" with 0, for answer "satisfactory" with 1, and answer "good" with 2. After that, the mean percentage of respondent value can be calculated (1).

$$\bar{X} = \frac{15 \times 2 + 4 \times 1 + 1 \times 0}{20 \times 2} \times 100 = 85\% \quad (1)$$

Based on the percentage calculation, the percentage is 85%. It means the first aid educational game is acceptable as seen from the percentage obtained, above the minimum percentage of 50% (good), and close to 100% (very good)

## 4. Conclusion

Children's response to the use of educational games know animals according to ecosystem is quite good, children can get to know animals according to their ecology. Because finite state automata in this game makes the game more challenging, interesting and fun. Because in this game they can learn while playing games and face some obstacles and destroy the hunter hunting device and complete the game. Thus the game application educational games know animals by ecosystem for children aged 8-9 years or grade 3 elementary school is worth using as a medium in the learning process. The final test results prove that incorporating AI technology in educational games improves children's learning abilities

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