

Ultranus: a Novel Indonesian Cultural Game using Artificial Intelligence

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Abstract— The development of smartphone technology so rapidly as well as the development of games on smartphones. The interest of the game users on the smartphone depends on the criteria and features of the game that is the category and difficulty level in the game. Interest and level of children's games are different from adult users. This research develops a snake ladder game called Ultranus that is for children's games and children with special needs. This game uses snakes and ladders as a storyboard and rule. Storyboard on Indonesian culture. Determination of categories and levels in this game using Artificial Intelligence. Level determination using forward chaining algorithm while category determination using backward chaining algorithm. The results of the implementation and testing of this game obtained level of accuracy for the level of 80% and the category of 90%.

Keywords—Game, Artificial Intelligence, Forward Chaining, Backward Chaining.

I. INTRODUCTION

The development of information technology is currently very rapid, especially for smartphones and computers. The development of smartphone technology in Indonesia is increasing rapidly from year to year, which is 17-20% increase every year, this proves that technology is very influential on Indonesian society, especially children [1-2]. Technological developments also affect children's activities. It indicated by the increasing number of a phenomenon of children who hold a smartphone every day. This phenomenon reinforced with children who prefer a smartphone than playing with peers. For that required education facilities through a smartphone in the form of games and entertainment according to their age level [4-5].

Since 2013 in Indonesia, 72 percent of children under the age of 8 have used gadgets such as smartphones, tablets, and iPods, where the majority of 2-year-olds prefer to use tablets or smartphones every day. Compared to 2011 the figure is still at 38 percent [6]. As shown in Figure 1 where the survey results in 2015 show 55 respondents smartphone users aged 9-13 years with various brands of smartphones used by elementary school students grade 4, 5, up to 6 and indirectly also indicate that the respondent has been bought smartphone by their parents, this survey was conducted by a teacher who was in one of the

primary schools with the category of parents of the middle-class economy [7].

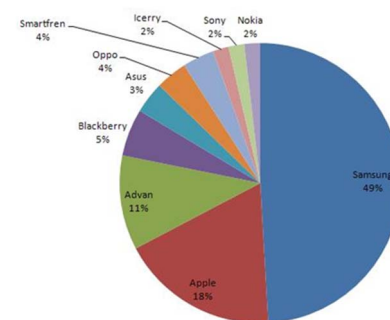


Fig. 1. Smartphone User Data

One of the content favored by kids smartphone users is games. The game often accused of having a negative influence on children. Games have positive functions and benefits for children, among them, children know computer technology, lessons to follow directions and rules, problem-solving and logic exercises, train motor nerves and spatial skills, build parental communication while playing together, and provide entertainment [7]. However, it is still rare to find educational games for children, especially those that fit the category and level of difficulty. Games that are supportive of learning in schools, especially education culture Indonesia is still challenging to find.

Snake ladder is one of the traditional games in Indonesia. The ladder snake is made up of boards and stairs that are matching by 2 or more people. The ladder snake game is a square-shaped board game that divided into small squares, and on each box, there are two possibilities: a ladder or a snake that will connect with the other boxes. This game made in 1870. There is no standard board game on the landing snakes; everyone can make his or her boards with different boxes, snakes, and ladders [8].

This research develops smartphone application based on Expert System. This application is an audio-video educational game that aims to improve children's understanding of the culture of the Indonesian archipelago. In this game has the selection of levels and categories using Expert System so that

users feel comfortable playing the game by the level of user ability that is children and children special needs.

II. ARTIFICIAL INTELLIGENCE

A. Selection level and category

The game designed in this study is a leveling game, where the power of the game lies at different difficulty levels at each level. This game runs android platform on a smartphone. In one game this game can be played by the user and multiuser.

In this Ultranus Game utilize Artificial Intelligence (AI). AI used is FC (Forward Chaining) method and BC (Backward Chaining) method. Mainly the forward chaining method is used to determine whether the user can continue the game to the next level or not. The forward chaining method is an algorithm that focuses on a data-driven approach. In this approach, the tracking starts from the input information and then tries to illustrate the conclusions. In this case, it is called the inference multiplication chain that connects the problem with its solution. The forward chaining method, ie the chain is searched or traced from the problem to get the solution [9]

According to Meenakshi Batra and Vijay Batra in his journal in March 2006 stated that the concept of forwarding Chaining is useful enough to train mentally disabled children [10]. In this ultranus game using backward chaining method to determine the category of this game. The ultranus game category divided into four categories for children with classification, i.e., 1-3 years, 4-7 years, 8-10 years and special needs.

B. Forward chaining

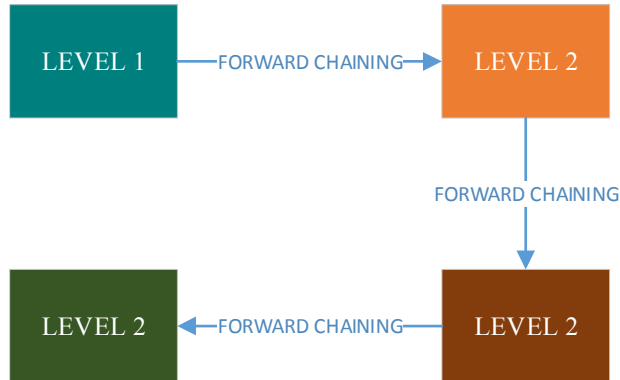


Fig. 2. Rule of the level game

The Forward Chaining method is a chain that follows from the problem of getting a solution. Another way of describing forward chaining is to refer to facts to conclude. [11]. The forward chaining method also defined as a data-driven approach. In this tracking, approach begins with information input, and then try to illustrate conclusion. So this method is also often called "Data-driven"[11].

In carrying forward chaining methods, there are several steps: first, incorporating a known set of facts into working memory; second, deriving new facts according to the rules by a place with known facts. In the forward chaining method, this process continues until it reaches the goal or no more extended rules that match the known facts. So the path taken for the Steps that create the rule based on forwarding chaining is [11]:

1. The problem. In this process is to determine the problem domain and knowledge acquisition.
2. Input Data. The next process is to enter the initial data to start the inference.
3. Data Control Structure. In a complex game or application model requires an extra premise to help control.

The use of variables in this game as a method of forwarding chaining method for the development of this game is as described in Table 1. The result variables used as described in Table 2 and the level variables used as described in Table 3. The process of determining the level using forward chaining as described in Figure 2.

TABLE I. VARIABLE RULE.

No.	Rule Code	Condition	Information
1.	R01	[0,1,2,3]	Bonus
2.	RXX

TABLE II. VARIABLE RESULTS

No.	Rule Code	Review
1	H01	Congratulations, Gold, Coin, Bonus
2.	HXX

TABLE III. VARIABLE LEVEL

No.	Rule Code	Information
1	L01	Next Level
2	LXX

C. Backward chaining

Backward Chaining is reasoning that starts from the hypothesis and then traces back the facts that support the hypothesis. Backward chaining also described as the reasoning form from goal to subgoal with the understanding of reaching a goal means to meet the subgoal therefore backward chaining reasoning is also called top-down reasoning [12]. The inference chain for backward chaining can see in Figure 3, where the reasoning process starts from H1 or H2 or H3, suppose we start from H1 it will look for facts related to H1 to prove that hypothesis H1 is correct. The value of fact A is unknown then H1 cannot be verified, then the inference process switches to H2. Moreover, so on until obtained evidence/evidence that proves the truth of a hypothesis[12].

In designing this game for the required category of facts as shown in table 4 which contains about 60 questions randomly assigned as much as 5 for each category with the number of categories as five shown in table 5. After determining the facts and reasoning process then make a decision tree like that shown in Figure 3.

TABLE IV. QUESTIONS ABOUT CATEGORIES

No	Question	A	B	C	D	E
1	Is Mr. Jokowi the President now?	B	B	B	B	B
2	Next Question

TABLE V. CATEGORY

No	Category	Information
1	A	Age 3-6
2	B	Age 7-9
3	C	Age 10-12
4	D	Children Special Needs Age 3-8 years
5	E	Children Special Needs aged 9-12 years

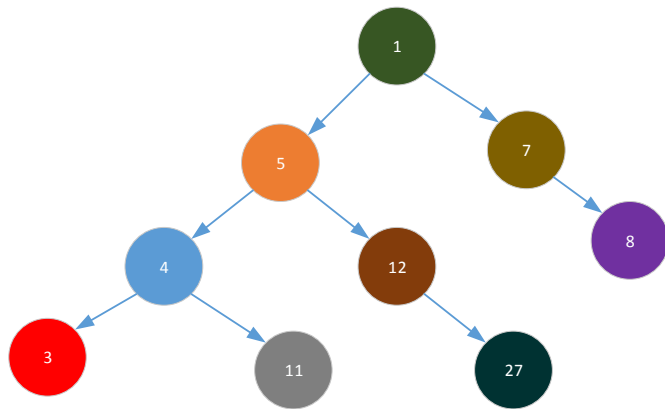


Fig. 3. Tree of decision

III. DESIGN SYSTEM

In this section is divided into two namely the method used and the user interface in this game. The method used in designing and implementing this game by the algorithm method that will use is forward chaining and backward chaining. For the user interface, the selection of user interfaces based on data collection from media experts, model experts, and material experts for children's games. The user interface option also based on a child with special needs.

A. Method

This study used the experimental method [13] as shown in Figure 4. This study begins with the study of interest literature and user model of the game in android and then collecting data from snake ladder game. After the two steps above is done algorithm design to perform user classification in the form of category and level of difficulty game in the form of level. The user category uses backward chaining algorithms and level determination using forward chaining algorithms. The next step is to design the game as a whole and then check the accuracy for categories and levels. If the accuracy of the game is more than 70%, then the game is uploaded play store.

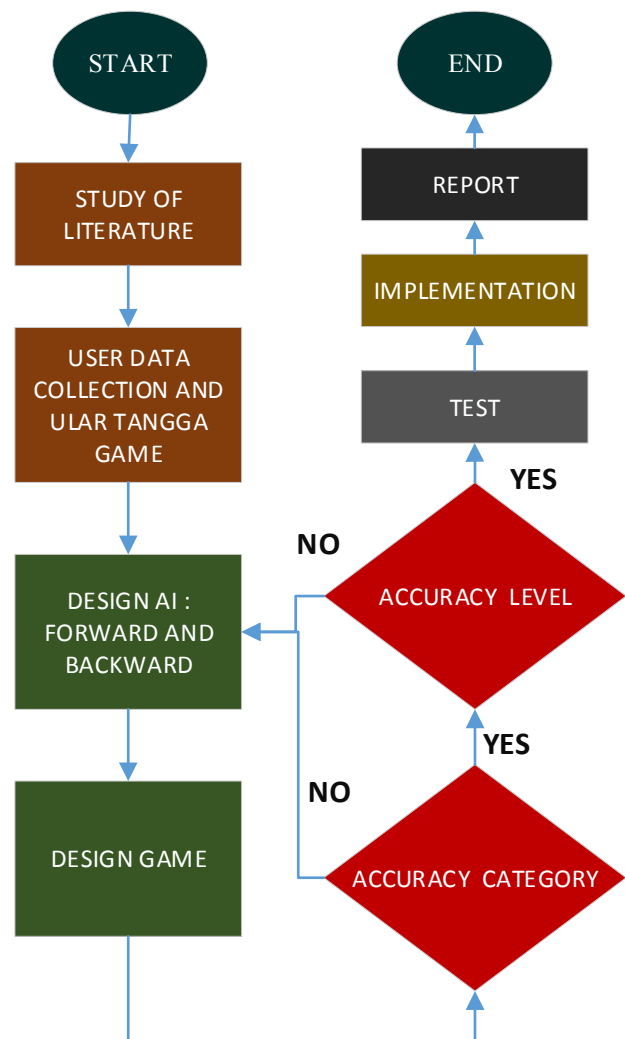


Fig. 4. Method

B. User Interface

The Ultranus Game view is divided into several views as shown in Figure 5, namely:

1. The initial game view as shown in Figure 5 (a) where the user interface shows the theme of this game.



Fig. 5. Interface of the ultranus game (a) The initial game, (b) Game start choice, (c) Multiplayer choice, (d) Carakter choice, (e) Start Game, (f) Cultural Knowledge, (g) End Game and (h) Choice for Play again

2. Initial game view by giving the option to start the game or exit as shown in Figure 5.b
3. Display options, there are two options namely single or more than one as shown in Figure 5.c.
4. Display the player character selection to used as shown in Figure 5.d
5. The initial view starts the game. The selection is a single user where the user fights his smartphone as shown in Figure 5.e.
6. Display where each in-game box has its feature with the Indonesian culture storyboard as shown in Figure 5.f.
7. Display Finish the game, where the game has been completed and won by either party as shown in Figure 5.g
8. End Display game. In this view, the user chooses to continue the game or finish the game as shown in Figure 5.h.

IV. RESULT

Testing does testing [14] in this game at the level and category.

A. Level

Testing [9] at the level based on the AI method used forward chaining. Test data done by looking at the level of user success gained when users download the level and register their account online on Tuesday, April 17, 2018, 21.30.40. Based on the database of registered users, time created and download of the next level scheme as shown in Table 6.

TABLE VI. DATABASE ACCOUNT

N o	User/ Alias	Registrasi	Created	Download
1	Usr0001	Tuesday, 17 April 2018, 21.30.41	Wednesday, 11 April 2018, 08.45.34	Wednesday, 11 April 2018, 08.45.34
2	Usr0002	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41
3	Usr0003	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41
4	Usr0004	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41
5	Usr0005	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41
6	Usr0006	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41	No Data
7	Usr0007	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41
8	Usr0008	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41
9	Usr0009	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41	No Data
10	Usr0010	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41	Tuesday, 17 April 2018, 21.30.41

B. Category

Testing [9] on the category based on AI method used is backward chaining. Test data is obtained from user feedback when the game finishes and the level of user satisfaction. At the time accessed Tuesday, April 17, 2018, 21.30.41. The category conformity parameter is supported by downloading the next level as shown in Table 7.

TABLE VII. DATABASE ACCOUNT CATEGORY

N o	User/ Alias	Accessed	Category	Download
1	Usr0001	Tuesday, 17 April 2018, 21.30.41	suitable	Wednesday, 11 April 2018, 08.45.34
2	Usr0002	Tuesday, 17 April 2018, 21.30.41	suitable	Tuesday, 17 April 2018, 21.30.41
3	Usr0003	Tuesday, 17 April 2018, 21.30.41	suitable	Tuesday, 17 April 2018, 21.30.41
4	Usr0004	Tuesday, 17 April 2018, 21.30.41	suitable	Tuesday, 17 April 2018, 21.30.41
5	Usr0005	Tuesday, 17 April 2018, 21.30.41	Sesuai	Tuesday, 17 April 2018, 21.30.41
6	Usr0006	Tuesday, 17 April 2018, 21.30.41	No	No Data
7	Usr0007	Tuesday, 17 April 2018, 21.30.41	Sesuai	Tuesday, 17 April 2018, 21.30.41
8	Usr0008	Tuesday, 17 April 2018, 21.30.41	suitable	Tuesday, 17 April 2018, 21.30.41
9	Usr0009	Tuesday, 17 April 2018, 21.30.41	suitable	No Data
10	Usr0010	Tuesday, 17 April 2018, 21.30.41	suitable	Tuesday, 17 April 2018, 21.30.41

V. DISCUSSION

Discussion of test results from this game app [9] based on level and category. The results of this test to see the level of accuracy of game level determination based on forwarding chaining algorithm and game category determination based on backward chaining algorithm.

A. Level

The discussion for this level of accuracy I based on ten accounts accessing this app and downloading this app according to table 5 is 80% where two accounts do not continue downloading the next level scheme. Causes of a failed user where the user is not continuing this game, or the level of difficulty of this level does not match the user.

B. Category

The discussion for the accuracy of this category based on the ten accounts that access this app and provide feedback as shown in table 6 is 90% where there is only one account that provides feedback does not match the category of users and does not keep downloading the next level. However, there is one account that provides feedback by the category but does not continue downloading. One user failed to provide feedback due to where the user did not continue this game, or the level of difficulty of this level did not match the user.

VI. CONCLUSION

This research develops ultranus game that is game of snake ladder on the android system in a smartphone with the determination of level and user category using AI (Artificial Intelligence). The Ultranus game category divided into four categories for children with classification, i.e. age 1-3 years, age 4-7 years, age 8-10 years and special needs. Game category determination using backward chaining algorithm. In this game, a game level determination is level 1-5 using forward chaining algorithm. The results of testing in this game obtained that the accuracy of determining the level of 80% and determination category by 90%.

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