

Fuzzy Mamdani Implementation For Selection of Bicycle Track on Gharib Game

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Abstract - Game is an entertainment media that is in demand nearly all walks of life. The quality of the game is determined by several aspects, both from artificial intelligence, content is presented, and so forth. Artificial intelligence is required by a game in order to create the action and the reaction to achieve the realistic level. The interesting, educational game is one of the breakthrough content that is educational as interesting learning media. This paper describes how the process of making educational games that can be enjoyed. Game Learning Gharib is a diversified educational game First Player Shooter (FPS) to use traditional desktop-based Engine Unity3D. Player in this game in the form of a bicycle which has a mission to collect points that will be hindered by the enemy provided NPCs walking around the streets where the player. In this study, methods of artificial intelligence used to recommend the player to play on scene 1 or scene 2 using a Mamdani fuzzy algorithm. Testing is done on the desktop. And the decision which is derived from the output of which 51.42% is slow, normal and fast 25.714% to 22.85%.

Keywords: *fuzzy Mamdani, Game, Game Education*

1. Introduction

One of the developments of today's technology favored by the public at large that game. The game play is a tool for learning is now very popular with the public. Games on the computer is a simulation of the real form of human life. Games can also be educational for specially made to support the learning process as an example of a game that will be made, given the public's view of the game is still as an entertainment than learning media. Due to the nature of the game is challenging, with either type of game is a game simulation that requires players to use a mock bicycle used to playing it.

Gharib learning is one of the aspects of reading the Qur'an or qira'ah, not just a letter saying the Arabic fluently is one aspect of the study of the most rarely discussed both among students as well as students, when reading the Qur'an belonging to worship *mahdlah* the most important.

Games also teach a lot of skill and can be used as an educational alternative. Playing games is a new literacy in education [1]. This led to the need for increased gaming applications intended as a medium of learning fun for children. Not only for early ages, even teens were also important to get a bit of learning since no teens involved in the gaming world.

In this experiment, researchers created a game that contains instructional reading Gharib.

2. Material and Method

2.1. Game

Game an activity that you do for fun that has rules, and that you can win or lose [2]. "The game is a computer game created with the techniques and methods of animation. If you want to explore the use of animation must understand making games. Or if you want to make a game, he must understand the techniques and methods of animation, because both are interrelated".

According to Teresa Dillon (futurelab.com, 2005) the basic elements of a Game: Game Rule, Plot, Theme, Character, Object, Text, graphics, sound, animation, user interface [3].

2.2. Fuzzy Logic

Fuzzy term in the Oxford dictionary is defined as a blurred, indistinct, imprecisely defined, confused, or vague. Logic is the rationale, the logic is classically associated with the proposition to a value of 1 (true) or 0 (false). Thus, fuzzy logic is an extension of classical logic and set theory. A variable linguistic truth value "true", unlike classical logic, which has a logic value of right and wrong. The truth of a statement or a value proposition in fuzzy logic is in the range of the interval [4].

2.2.1. Fuzzy Set

Fuzzy set is a set in which the membership of each element does not have clear boundaries. The underlying concept of fuzzy sets, fuzzy logic implies that the truth of any statement is simply a matter of degree. Similar statements have also been put forward by Lotfi A. Zadeh: "As complexity rises, precise statements lose meaning and meaningful statements lose precision" (Agus Naba, 2009) [5].

2.2.2. Membership Function

Membership function defines how each point in the input space is mapped into the weight or degree of membership between 0 and 1. In set theory, the input space known as the universe of discourse.

Fuzzy set is the development of a classic set. If X is the universe of discourse and the elements denoted by x, then a fuzzy set A in X is defined by:

$$A = \{x, \mu_A(x) \mid x \in X\}$$

$\mu_A(x)$ is the membership function of x and A. Membership function maps each element of x to degrees of membership between 0 and 1.

2.3. Mamdani Method

Fuzzy inference system Mamdani method is also known by the name of Max-Min method. Mamdani method works based on linguistic rules. This method was introduced by H. Ebrahim Mamdani in 1975 [6]. To get the output (result), it takes 4 steps:

2.3.1. Formation of fuzzy set

Determine all the variables involved in the process will be determined. For each input variable, specify an appropriate fuzzification function. In Mamdani method, both the variable input and output variables are divided into one or more set of fuzzy.

2.3.2. Application functionality implications

Make basis of rules, namely the rules in the form of fuzzy implications that states the relationship between the input variables to the output variable. In Mamdani method, the implication functions used are Min. The general form is as follows:

$$\text{If } a \text{ is } \hat{A}_i \text{ and } b \text{ are } B_j, \text{ then } c \text{ is } C_i$$

A_i , B_j , and C_i is fuzzy predicates that a linguistic value of each variable. The number of rules determined by the number of linguistic values for each variable input.

2.3.3. Composition rules

If the system consists of several rules, the inference derived from the collection and correlation between rules. There are three methods used in performing fuzzy inference systems.

A. Max Method (Maximum)

In this method, a solution of fuzzy sets obtained by taking the maximum value rule, then use that value to modify the fuzzy region and applying it to output using OR operator (combined). If all the proportions have been evaluated, then the output will contain a fuzzy set which reflect the contribution of each proportion. In general it can be written:

$$\mu(x_i) = \max(\mu_{sf}(x_i), \mu_{kf}(x_i))$$

B. Additive Method (Sum)

In this method, a solution of fuzzy sets obtained by the summation of all output fuzzy area.

C. Probabilistic Method (probor)

In this method, a solution of fuzzy sets obtained by multiplication of all output fuzzy areas.

2.3.4. Defuzzy

Input from the defuzzification process is a fuzzy set obtained from the composition of the fuzzy rules, while the resulting output is a fuzzy set of numbers in the domain. So if given a fuzzy set within a certain range, it should be taken a certain crisp value as output. There are several methods of defuzzification in composition Mamdani rules.

3. PERANCANGAN DAN IMPLEMENTASI SISTEM

This fuzzy method is used when determining the path that will be played in the game.

3.1. Finite State Machine Design.

Finite State Machine consists of several states that can transition into each other. Figure 1 shows the enemy NPC behavior, Player, and Item that are modeled with FSM.

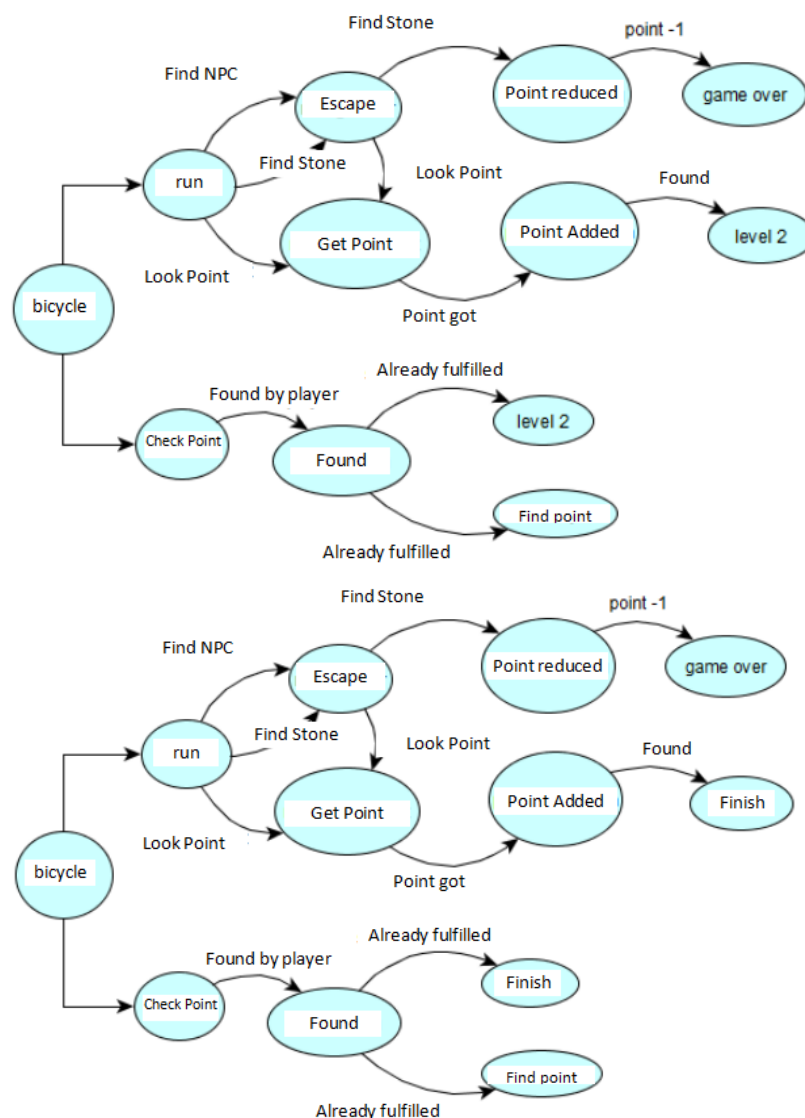


Figure 1. Enemy NPC Behavior Level 1 and Level 2

3.2. Fuzzy Design

Fuzzy logic is used for track path determination to allow players to choose on the track. The method used is fuzzy Sugeno.

From the variables used, the linguistic value of each variable is as follows:

1. Variable age is divided into 3 namely: adolescent, middle-aged, old
2. The weight of the body is divided into 3 namely: light, heavy, medium.
3. Variable pulsations before playing there are 3 namely: slow, normal, fast

The "age" variable has 3 fuzzy sets of young, middle-aged, old. The degree of membership for the "player distance" variable has different values at 0-100 intervals.

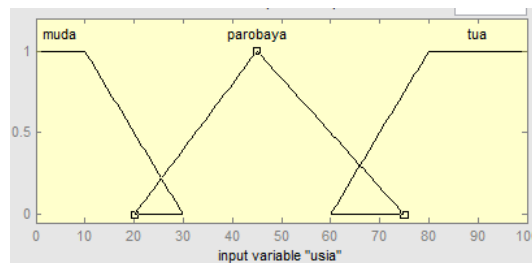


Figure 2. The degree of Membership of the Age Variable

The "weight" variable has 3 fuzzy sets ie mild, moderate, heavy. The degree of membership for the "weight" variable is 0-100.

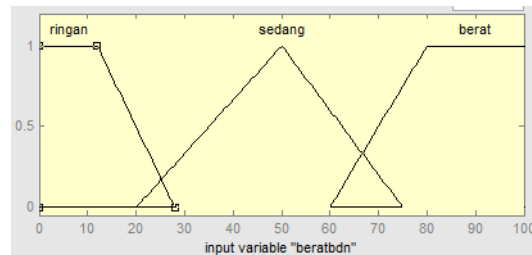


Figure 3. The Degree of Membership of Variable Weight

The "pulse before pedaling" variable has 3 fuzzy sets that are slow, normal, fast. The degree of membership for the "pulse before play" variable is 0-150.

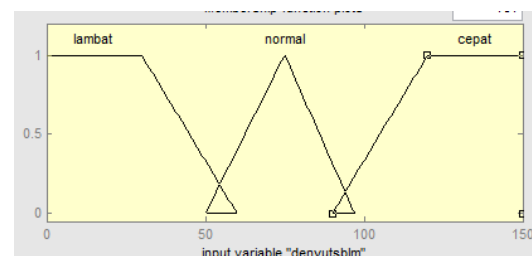


Figure 4. The Degree of Membership of The Pulse Variable Before Playing

For the output of the "decision" variable the linguistic value is divided into 3 ie fast, normal, slow.

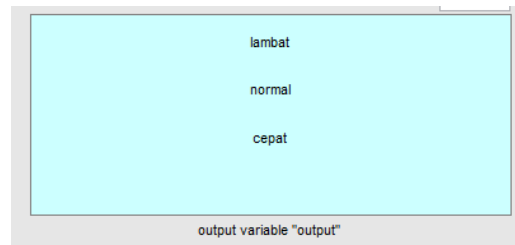


Figure 5. Decision Output Variables

The membership of the "decision" variable has linguistic value and its notation. The linguistic value is slow 3, normal 2, fast 3. The values in the "decision" variable are constant.

4. RESULT AND DISCUSSION

To get the desired result, it is necessary to test. The testing method aims to determine whether the method used can affect the results of the decision path.

The test is performed to generate a decision output value that matches the specified fuzzy parameter. The tested parameters consist of age, weight, pulse before play. For this test take several examples of variations of age, weight, and pulse before playing.



Figure 6. Game Start Screen

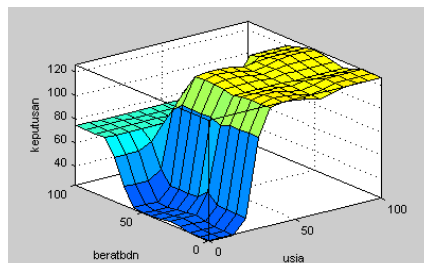


Figure 7. Age and Weight

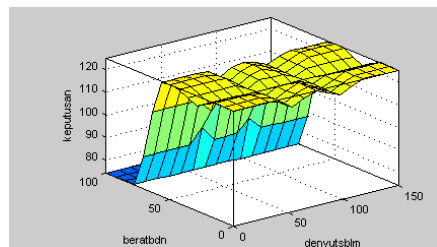


Figure 8. Weight and Pulse Before Playing

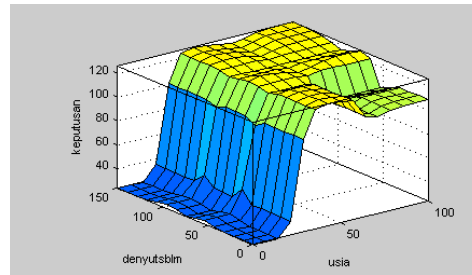


Figure 9. Age and Pulse before Play

5. Conclusion

- a) Based on the results of implementation and testing conducted by researchers, it can be concluded that:
- b) This research succeeded in making *Gharib* learning game using bike player on Unity3D as game engine and desktop based asset maker.
- c) Input age, weight, and pulse are performed when the player will start the game.
- d) The Fuzzy mamdani algorithm can be used to determine the scene to play this game, by inputting 3 variables ie age (young, middle-aged, old), weight (light, medium, heavy), pulse before play (slow, normal, fast).
- e) The fuzzy Mamdani algorithm is quite good when implemented in the *Gharib* reading introduction game, it is proved by the comparison of output using Monodevelop and Matlab of 82.875% with the difference of the not too distant numbers. And the decision resulted from the output is slow which is 51,42%, normal 25,714% and fast equal to 22,85%.

Reference

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