IIMPLEMENTATION OF FUZZY LOGIC TO DETERMINE VALUE OF LIGHT INTENSITY AND SPEED MOVEMENT OF DOORS IN ELECTRICAL RESISTANCE GAME

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ABSTRACT

Simulation games is a type of game that requires the player directly to do something active, simulation games can be in the adaptation of the situation or condition in a real world. On voltage and electric current are simulated on the amount of voltage and current magnitudes entered against objects such as lamps lighting and door (Rolling Door Electric), the principle of light control is commonly used on-off and the principle controling of a door used open and close, with these principles can be a problem when the incoming voltage and current are not in accordance with the specifications of lights and doors, causing the intensity of light that is not appropriate (Off, Blink, Dim and Broke) and the movement speed of the open doors that do not fit (Very Slow and Slow).
From this problem then built in electrical resistance simulation game by applying fuzzy logic algorithms, In this game there are two variable voltage and variable currents. Fuzzy logic algorithm implementation in the electrical resistance of a simulation game can determine a decision light of intensity and the speed movement of the doors. This game has the goal of keeping the action of light intensity and speed movement of the door in accordance with the parameters of voltage and electric current entry. The players have to turn on the light with the light of intensity and opened the door with speed quickly by controlling the amount of voltage and electric current to be entered on the lights and the door using barriers. The model used in fuzzy logic is the Tsukamoto model.
Once the implementation phase is completed, then the testing phase of the game. Adjusted at the level of conformance testing defuzzification with predefined variables. After testing it on get the conclusion that the rule has been tested in accordance with the design and fuzzy logic can produce action decisions light intensity and speed of the door based on the voltage and electric current entry.

Keyword: Fuzzy Logic, Artificial Intelligence, Light Intensity , Speed Open Door.

1. INTRODUCTION

Simulation games is a type of game that requires the player directly to do something active, simulation games can be in the adaptation of the situation or condition in a real world. one simulating the rescue of flood victims in the game Rescue Flood Victim [1], which in this game is to use fuzzy logic to control NPC flood victims in determining the decision to flee or to survive by evacuation distance parameter , stamina and water level.

On voltage and electric current are simulated on the amount of voltage and current magnitudes entered against objects such as lamps lighting and doors (Rolling Door Electric), which is a device that uses electrical energy is transformed into light energy in the light and energy of motion to the door , the light control generally used the principle of on-off and control door opening and closing use principle , the principle becomes a problem when the incoming voltage and current are not in accordance with the specifications of lights and doors , causing the intensity of light that is not appropriate (Off, Blink, Dim and Rupture) and the movement speed of the open door that does not fit (Very Slow and Slow). To be able to determine the decision of light intensity and speed of the door based on the amount of voltage and electric current coming from the power source is needed fuzzy logic, because fuzzy logic is a kind of artificial intelligence methods in decision making.

From this problem then constructed Electrical Resistance game where the game is the player required to turn on the light with the intensity of light and opened the door to door speed quickly by controlling the amount of voltage and electric current to be entered on the lights and the door using electrical resistance .
Based on the terms described above, so in this study will apply fuzzy logic algorithm in Electrical Resistance game .

1.1 *Game*

The game is something that could be played by certain rules so that there are no winners and losers, usually in the context of no serious or entertainment

purposes. A way of learning that is used in analyzing the interaction between a number of players and individuals who show rational strategies

Game theory was first discovered by a group of mathematicians , which contains [2] :

" The game consists of a set of rules that establish competitive situation from two to several people or groups by choosing a strategy that is built to maximize his own victory or even to minimize the opponent victory. Regulations memnentukan possible actions for each player, some of the information received by each player as the progress of play, and a number of victory or defeat in a variety of situations. At the time of processing capabilities in computers are getting faster, the developers also continue to create increasingly sophisticated game engine with graphics that appear 3D (3-dimensional). Therefore, polygon count 3D game with a very large and sophisticated lighting , texture mapping is also being produced. 3D games represented in the form of three -dimensional objects so that objects will look more real as in real life.

Game type 3D is a game with good graphics in the depiction in reality, most of these games have a displacement camera (angle) to 360 degrees so that the whole world can see the game.

1.2 Artificial Intelligence

Artificial intelligence is derived from the English "Artificial Intelligence" or abbreviated AI , namely intelligence is an adjective that means intelligent, whereas artificial artificial means. Intelligence is meant here sulking on a machine that is able to think, to weigh the actions taken, and capable of taking such decisions made by humans.

According to Prof. Elder Dadios [3] The artificial intelligence is part of computer science that studies how to make a machine (computer) can do the job as human beings could even be better than humans. In order for the machine (computer) can be intelligent then it must be given a stock of knowledge and have the ability to reason. There are two main parts needed application, artificial intelligence is:

1. Knowledge Base iscontains facts, theories, ideas and relationships with each other .
2. Inference Engine is the ability to draw conclusions based on knowledge.

Artificial intelligence has advantages compared with natural intelligence
among others :

1. More permanent. because intelligence Artificial does not change during the computer system and the program does not change it.
2. More easily duplicated and distributed.
3. Cheaper, because it provides a service computer easier and cheaper than to bring someone to do a number of jobs in the long term.
4. Be consistent and thorough.
5. Can do the task faster.

1.3 Fuzzy Logic

Fuzzy logic is derived from fuzzy set. Unlike the decisive set, where an object can become a member or not a member, fuzzy set is the set of the objects that membership is only partially. Examples of fuzzy set, for example, set the grouping of vehicles which go fast and slow driving. In the decisive set, it can be determined that the vehicle is driving at speeds over 100 km/h, including the set quickly, while the oncoming vehicle is less than 100 km/h, including the set slow. In the fuzzy set membership of a vehicle is not 100% 100% faster or slower. An oncoming vehicle at a speed of 80 km/h has a membership of 80% faster or 20% slower. Reference [4] explains that fuzzy Association has two attributes , namely :

1. Linguistics, which is naming a grou representing particular state or condition by using natural language, such as : fast, normal, slow
2. Numerical , namely a value (number) that indicates the size of a variable such as : 32, 43 ,55 .

Both of these attributes will be used later to determine the rules in fuzzy logic. In fuzzy logic there are things that need to be addressed:

1. The membership function is a curve is
2. shows the mapping of points of input data into membership values (degrees of membership) which has the interval between 0 to 1 Some functions that can be used is a linear representation, curves. These so-called fuzzy logic or basic operators Zadeh such as :
   a. AND operator associated with intersection operation on the set. Results of operations (α - predicate) AND is obtained by taking the smallest membership value among the elements in the sets are interrelated .
      $\mu A \cap B = \min$ ($\mu A\ x$, μB [y])
   b. Operator OR associated with surgery union on the set . α - predicate as the result of an OR operation is obtained by taking the smallest membership value

1.4 LED Lamp (*Light Emitting Diode)*

Light Emitting Diode or LED is often abbreviated with electronic components that can emit monochromatic light when a given voltage is developed. LED is a family of diodes made of semiconductor materials. The colors of light emitted by LEDs depends on the type of semiconductor material he used. LEDs also emit infrared light that is not visible to the eye as we often encounter on the Remote Control Remote Control TV or other electronic devices.

LED shape similar to a bulb (bulb) is small and can be paired easily into a variety of electronic devices. Unlike the Incandescent Lamps, LED does

not require burning filament so as not to cause heat to produce light. Therefore, the current LED (Light Emitting Diode) is a small form has been widely used as a torch light in the LCD TV to replace the lamp tube.

In the study conducted by Philip Tarigan [5], Stating that the light intensity can be adjusted by adjusting the amount of voltage and current into the lamp.

1.5 Door (*Rolling Door Electrict*)

The door is an opening in the wall / field that facilitates the circulation between spaces surrounded by walls/areas. The door is usually found in buildings, such as houses. In addition, there are also doors on vehicles, cabinets, and others.

Most of the doors are made of wood, the limited use made of aluminum, steel and PVC plastic. At the door of his development into a model one or Rolling Door sliding doors, combined with the motor, so that opening and closing of the door using the control with the power, movement speed door is open or closed is affected by the voltage and electric current, as well as IC (Integrated Circuit) the motor that adjusts the movement of the door with the incoming voltage and current [6].

1.6 Ohm Law

Ohm's law, the basic law that states the relationship between Flow Power (I), voltage (V) and Constraints (R). Ohm 's Law in English called "Ohm 's Laws". Ohm 's Law was first introduced by a German physicist named Georg Simon Ohm [7]. At Fundamentally sound of Ohm's Law is "Large electric current (I) flowing through a conductor or conductors to be directly proportional to the potential difference/voltage (V) applied to him and inversely proportional to its resistance (R)". Ohm's law is expressed mathematically by the equation :

$$V=I.R$$

Where :

a) I is the electric current that flows in a conductor in units of Ampere .
b) V is the voltage that is present in both ends of the conductor in volts .
c) R is the electrical resistance value (resistance) contained in a conductor in ohms.

2. CONTENTS OF RESEARCH

2.1 Problem Analysis

On the game problem analysis Electrical resistance to be built is the action of light (off, blink , dim, bright and tableware) and the speed of the door (slow, fast and very slow) should be able to adjust the voltage and current coming from the power supply, So lights must be lit with the appropriate light intensity and speed of the doors can be moving at a speed appropriate to the input voltage and current, therefore it is necessary fuzzy logic to represent it.

2.2 Game Analysis

Electrical Resistance game has a background of a room characterized as a warehouse. Case warehouse experience off the lights and door rolling door electrict can not operate because of its electrical resistor or death caused by electrical resistance is broken, then the officer came electricity plant that will resolve the problem until the electricity in the barn lit and the lights came back to life and the door can be move back to the specified time limit, if the time runs out or captured enemy players then the game will immediately end. In the game, players act as electrical officer, where players are required to turn on the lights on the light and opened the door to the fast pace of a room based on the input variables are Voltage, Current, and Barriers. By the way players must calculate ideal for light barriers and doors using ohms law and collect constraints contained in the game room area, and the barriers become the deciding how much voltage and current to be entered on the lights and the door, then at this stage fuzzy logic run and will produce the behavior of light and the speed of movement of the door which varied according to the incoming voltage and current, the enemy movement speed is determined by the action of light intensity in the can, when the lights die and rupture enemy movement will be slow, light flickering movement the enemy is, dim light movement of enemy fast and light movement of the enemy very quickly.

2.3 Input Analysis

Analysis of the input is done in this research is to analyze the variables in the game and in the fuzzy logic algorithm , among other variables Barriers (R), Voltage (V) and currents (I).

2.3.1 Input Analysis in Game

Variable Constraints (R) is used to limit the current and voltage that will go from the voltage supply to the door and lights, barriers between the specifications obtained from the calculation of specifications of lamps and door with supply voltage using ohms law formula :

R = (Power Supply - V.(lamp or door) / I.(lamp or door)

Sample Case :

Players should find resistance value required to turn on the lights with Specifications Power Supply and lights as following :

Power Supply = 220V
Lamp Spesification = 20V10A

Then solved by the above formula

R=(220V – 20V) / 10A
= 200V /10A
= 20 Ω

So it takes a number of obstacles or R 20 Ω to be lights brightly.

2.3.2 Input Analysis In Fuzzy Logic

Here are two input variables in the process with fuzzy logic in electrical resistance game:

1. Current
   By Degrees Membership:
   Very Low, Low, Enough, High and Very High.
   This variable to indicate how much electrical current will go into objects (lights or door), this variable is affected by Supply voltage, Barriers and Constraints object, calculated using the formula:
   I_MasukObjek=(Power Supply)/ ((R + R (object)
   Where I Go The object is Inflows Objects (lights and doors).
2. Voltage
   By Degrees Membership:
   Very Low, Low, Enough, High and Very High.
   This variable is to show how big the voltage that will go into objects (lights or doors), Variable current is influenced by the object and obstacle objects with the formula:
   R_objek = V_objek / I_objek
   V_MasukObjek= I_ (incoming object) x R_objek
   Where V is the voltage Go Objects (lights and doors) and R is the resistance of the Object Object (Lamp and Doors).

2.3.3 Output Analysis In Fuzzy Logic

Here are two variable outputs the electrical resistance of the decision on game :

1. Intensity Light
   With a degree of membership :
   Dead , Blink , Dim , Bright and Tableware .
2. Speed Doors
   With a degree of membership :
   Slow , Fast and Very Slow.

2.3.4 Sample Case Intensity Light Of Lamp

a) Domain Voltage Lamp 20V10A

Very Low	: 10V – 18V
Low	: 10V –18V– 20V
Enough	: 18V – 20V–22V
High	: 20V – 22V–150V
Very High	: 22V – 150V

b) Domain Current Lamp 20V10A

Very low	: 5A – 8A
Low	: 5A – 8A– 10A
Enough	: 8A–10A–12A
High	: 10A–12A– 70A
Very high	: 12A – 70A

c) Domain Current Lamp 20V10A

Dead	: 10 – 20
Blink	: 10 – 20– 30
Faint	: 20 – 30 – 40
Bright	: 30 – 40 – 50
Burst	: 40 – 50

Players entering a value of R light by 21 and R doors at 5 , with specifications Power supply is 220V , then :

Then the current into the lamp is :

I_Lamp = PowerSupply / ((R + (20V / 10A)))
= 220 / ((21 + 2)) = 9.565217 A

while the incoming voltage to the lamp is :

V_Lamp = I_Lamp x R_Lamp=9.57 A x 2Ω
=19,13043 V

a) Fuzzification Step
   1. With the values given to Voltage 19,13043 V and current 9,565217 A.
      Then Values 19,13043 stand on linguistic values.
      Degree of membership for Voltage 19,13043 V is:
      $\mu VoltageVeryLow\ (19{,}13043) = 0$
      $\mu VoltageLow\ (19{,}13043) = \frac{(20 - 19{,}13043)}{(20 - 18)} = 0{,}434783$
      $\mu VoltageEnough\ (19{,}13043) = \frac{(19{,}13043 - 18)}{(20 - 18)} = 0{,}565217$
      $\mu VoltageHigh\ (19{,}13043) = 0$
      $\mu VoltageVeryHigh\ (19{,}13043) = 0$
   2. Degree of membership for Current 9,565217 A is :
      $\mu CurrentVerylow\ (9{,}565217) = 0$
      $\mu CurrentLow\ (9{,}565217) = \frac{(10 - 9{,}565217)}{(10 - 8)} = 0{,}2173915$
      $\mu CurrentEnough\ (9{,}565217) = \frac{(9{,}565217 - 8)}{(10 - 8)} = 0{,}7826085$
      $\mu CurrentHigh\ (9{,}565217) = 0$
      $\mu CurrentVeryHigh\ (9{,}565217) = 0$

b) Phase formation rule

No	IF Voltage	AND Current	THEN	Lamp
1	IF Low	AND Low	THEN	Blink
2	IF Low	AND Enough	THEN	Blink
3	IF Enough	AND Low	THEN	Faint
4	IF Enough	AND Enough	THEN	Bright

c) Inference

[R1] IF Voltage Low AND Current Low THEN Lamp Blink

α-pred1 = μLow ∩ μLow

MIN(μLow[0,434783]; μLow[0,2173915])

= MIN (0,434783; 0,2173915)

=0,2173915

From here can be counted a single value in the universe of discourse in the variable Lamp:

$$\frac{30 - z_1}{30 - 20} = 0{,}2173915$$

$$30 - z_1 = 0{,}2173915 * (30 - 20)$$

$$z_1 = 30 - 2{,}173915$$

$$Then\ z_1 = 27{,}82608$$

[R2] IF Voltage Low AND Current Enough THEN Lamp Blink

α-pred2 = μLow ∩ μEnough

MIN(μLow [0,434783]; μEnough[0,7826085])

= MIN (0,434783; 0,7826085)

= 0,434783

From here can be counted a single value in the universe of discourse in the variable lamp:

$$\frac{30 - z_2}{30 - 20} = 0{,}434783$$

$$30 - z_2 = 0{,}434783 * (30 - 20)$$

$$z_2 = 30 - 4{,}34783$$

$$Then\ z_2 = 25.65217$$

[R3]IF Voltage Enough AND Current Low THEN Lamp Faint

α-pred3= μEnough ∩ μLow

MIN(μEnough[0,565217];μLow [0,2173915])

= MIN (0,565217 ; 0,2173915)

= 0,2173915

From here can be counted a single value in the universe of discourse in the variable lamp:

$$\frac{40 - z_3}{40 - 30} = 0{,}2173915$$

$$40 - z_3 = 0{,}2173915 * (40 - 30)$$

$$z_3 = 40 - 2{,}173915$$

$$Then\ z_3 = 37{,}82608$$

[R4] IF Voltage Enough AND Current Enough THEN Lamp Bright

α-pred4= μEnough ∩ μEnough

MIN(μEnough[0,565217];μEnough[0,7826085])

= MIN (0,565217 ; 0,7826085)

= 0,565217

From here can be counted a single value in the universe of discourse in the variable lamp:

$$\frac{50 - z_3}{40 - 40} = 0{,}565217$$

$$50 - z_4 = 0{,}565217 * (50 - 40)$$

$$z_4 = 50 - 5{,}65217$$

$$Then\ z_4 = 44{,}34783$$

d) Defuzzification

$$Z = \frac{\Sigma aizi}{ai}$$

αi = Minimum values of degree membership

Zi = Domain Values on Linguistic Variable

Defuzzifikasi Values

$$Z = \frac{\begin{array}{l}(0{,}2173915 * 27{,}82608) \\ +(0{,}434783 * 25{,}65217) \\ +(0{,}2173915 * 37{,}82608)\end{array}}{\begin{array}{l}+(0{,}565217 * 44{,}34783) \\ 0{,}2173915 + 0{,}434783 \\ +0{,}2173915 + 0{,}565217\end{array}}$$

$$Z = 35{,}19104$$

Conclusion

The values obtained from the defuzzyfication process is then used to determine the decision with the following rules:

Dead : has a value 5– 14.

Blink : has a value 15 - 24.

Faint : has a value 25 – 34.

Bright : has a value 35 – 44.

Burst : has a value 45 – 55..

Then hasil nilai dari 35,19104 adalah Bright.

2.3.5 Testing On Tester Program and *Game*

Tests conducted on a test program to test the design and calculation, after appropriate Then implemented into the game, then the game is tested, for his statement can be seen in the following image:

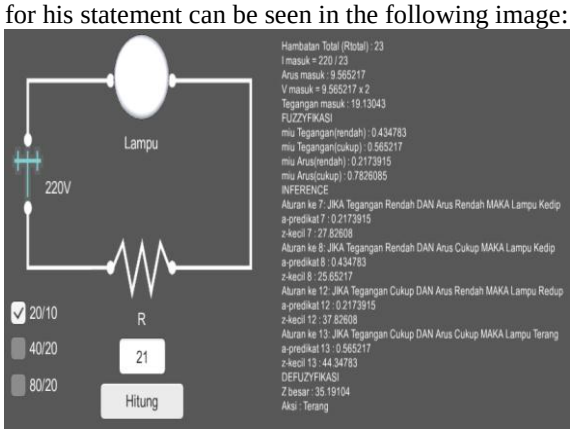


Image 1 : Calculation Lamp 20V10A On Tester Program



Image 2 : Action of light intensity Lamp 20V10A Bright

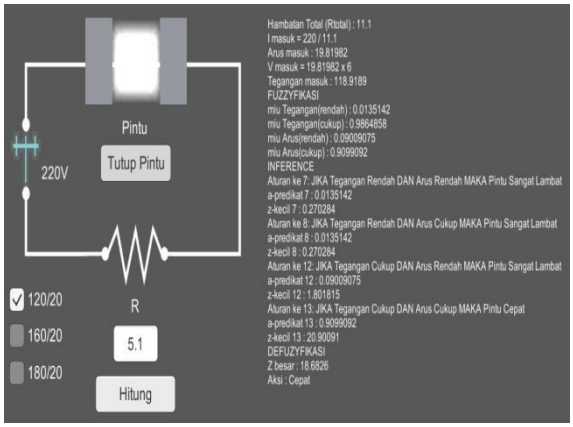


Image 3 : Calculation Door 120V20A On Tester Program.



Image 4 : Action Door movement 120V20V Fast.

3. CLOSURE

3.1 Conclusion

Based on the results obtained in the research and preparation of this paper as well adapted to the purpose, Then it is concluded that there is a correspondence between the input and output On Electrical Resistance game so Fuzzy logic can determine the value of the light intensity Lamp and Speed movement Door open.

3.2 Suggestion

Based on the results of research and implementation, advice that can be given Then Addition of electrical circuits On Electrical Resistance game is a series of parallel, so that the level of difficulty On the game will be more varied.

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