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OPTIMIZATION OF EGGTRAY RAW MATERIAL MIXING PROCESS USING GENETIC ALGORITHM CASE STUDY: PT. SINAR ERA BOX GRESIK

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ABSTRACT

The rapid development of technology and the increasingly fierce competition between companies in this globalization era, requires that the company's performance runs professionally and appropriately. PT. Sinar Era Box is one of the avalan paper processing company located in Gresik. The company has several divisions, one of which is industrial packing division that uses paper waste such as egg shelves (eggtray). But the company is still less than optimal in the process of mixing eggtray raw materials. So that in the process and the results of its production sometimes experience delays and does not meet market demand. Genetic algorithm is one of algorithm to find solution of combination optimization problem, that is get optimal solution value to a problem having many solution possibilities. From the results of research that has been done has successfully built an Optimization System Process Mixing Raw Material Eggtray using genetic algorithm that can be used to find optimal value solution done mixing process of eggtray raw materials.

Keywords: *System Optimization, Genetic Algorithm (GA), Mixing, Eggtray.*

1. INTRODUCTION

1.1 Background Research

The rapid development of technology and increasingly fierce competition between companies in this globalization era, requires that the performance of the company runs professionally and appropriately. Likewise all activities which include planning and processing in order to get maximum results for the company.

PT. Kenjaya is one of the avalan paper processing companies located in Gresik. Along with the development of business opportunities from processing paper avalanches and the existence of a high level of market needs, then in 1999 the company began to explore the business of making cardboard boxes and renamed PT. Sinar Era Box. But this company still maintains the company's working principle, that the production process in the factory is very concerned about the ecosystem and materials used are environmentally friendly recycled materials. In 2011 PT. Sinar Era Box began to establish industrial packing divisions that use paper waste, such as eggtrays that are large enough to meet the American and European markets. However, the company is still not optimal in the process of mixing raw materials for making eggtray. So that in the process and production results sometimes experience delays and do not meet market demand.

Genetic algorithms are computational algorithms inspired by the theory of evolution which were later adopted into computational algorithms to find solutions to problems in a more natural way. Genetic algorithm is also a heuristic search algorithm. One of its functions is to find a solution to the problem of combination optimization, namely to get an optimal solution value for a problem that has many possible solutions. The basic theory of Genetic Algorithms was developed by John Holland early in 1975 at the University of Michigan, United States. Where the principle of a genetic algorithm is taken from Darwin's theory, that is, every living thing will reduce one or several characters to a child or offspring.

Based on the description above, a study will be conducted on the Eggtray Raw Material Mixing Process Optimization System Using the Genetic Algorithm Method. As expected to optimize the eggtray raw material mixing process in the company PT Sinar Era Box Gresik.

2. LITERATURE REVIEW

[1] Direct marketing is the process of identifying potential buyers of certain products and promoting products accordingly. The implementation of direct marketing from time to time produces data and information in the form of reports that need to be analyzed by managers in support of decision making. However it is a difficult task for managers to analyze data is complex and broad. This difficulty has led to the development of business intelligence techniques, which aim to classify knowledge that is useful to support decision making. Support vector machine algorithm is able to overcome high-dimensional data sets, overcome the problem of classification and regression with linear or nonlinear kernels, which can be an algorithm capability for classification and regression, but support vector machines have problems in selecting appropriate parameters to improve optimization. To overcome this problem a genetic algorithm method is needed to select the appropriate parameters in the support vector machine method. Several experiments were carried out to obtain optimal accuracy and the proposed method was the application of an algorithm for optimization of parameters in a support vector machine. The results of the study using support vector machine methods and genetic algorithms showed more accurate results from previous studies for direct marketing predictions.

3. SUPPORTING THEORY

3.1 Optimization System

Many ways are done in solving problems to give the best results. The way to give the best results is called system optimization or optimization techniques. This technique can provide the best solution from the results of decisions that have been taken from the problem at hand. Optimization techniques are used to give the best results from the worst or the best thing, depending on the problem at hand.

3.2 Mixing

Mixing is a process of mixing ingredients so that they can be combined into a homogeneous uniform and have a perfect spread. The principle of mixing is based on increasing randomization and distribution of two or more components that have different properties.

3.3 Eggtray

Eggtray is a tool that serves as a place to store eggs, with this tool the eggs can be carried in large quantities without having to fear breaking. Eggtray can be made from used paper materials, such as cardboard, kora, books and others. The process of making this tool is that all the paper material has been crushed and made into new pulp and then printed by machine. Eggtray is usually made in 2 forms, namely for chicken eggs and quail eggs, each of which has a different curvature adjusted to the size of the eggs to be accommodated.

3.4 Genetic Algorithm

Genetic algorithms are search techniques in computer science to find solution estimates for search optimization and problems. Genetic algorithms are a special class of evolutionary algorithms using techniques inspired by evolutionary biology such as inheritance, mutations, natural selection and recombination (crossover).

The concept of genetic algorithms was first introduced by John Holland in 1978. The purpose of this concept is to apply what becomes in the process of reproduction in living things in the universe into the process of finding solutions to several problems in mathematics and informatics.

This genetic algorithm is seen as an abstract form of the evolution of living things. This genetic algorithm contains sequential procedures for processing a population into another new population. This algorithm uses the process of natural selection inspired by genetic theory, with several operators, namely: cross-breeding (crossover), and mutation [2].

3.5 Flow of Genetic Algorithms

The general steps in genetic algorithms are as follows:

1) Initializing the chromosome population
2) Random population generation or initial solution (random).
3) Evaluate each chromosome in the population using the evaluation function equation (fitness function).

4) Select or select some members of the population as a solution that is suitable for the parent for the next generation.
5) Creating a new (descent) solution by marrying the solution from the parent by means of crossover.
6) Gene mutations to remove or delete members of the old unproductive population to create new solutions to enter the population.
7) If the termination rules are met, stop and remove the best chromosome. If not, go back to step 3.

3.5 Genetic Algorithm Flowchart

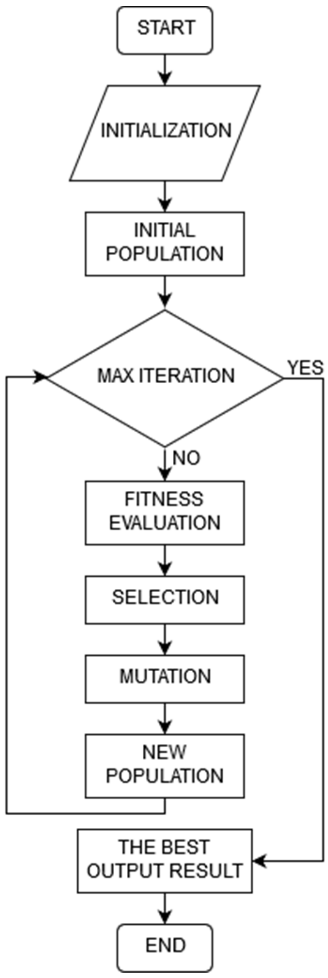

Figure 3.1 Genetic Algorithm Flowchart

4. SYSTEM ANALYSIS AND DESIGN

4.1 System Requirements Analysis

At the needs analysis stage the system has the task of identifying, evaluating the problems and expected needs. So that improvements can be arranged in the process of mixing eggtray raw materials. System requirements consist of input, process and output results from the optimization process. System requirements analysis is performed to find out what data is needed by the system, so it can be processed and produce information needed by the user.

4.2 Data Requirements

Data requirements that exist in the system consist of input data and output data. The input data in question is data entered by the author of the software which is then processed in the system to produce new data. While the output data is the data desired by the user to be displayed or completed by the system in accordance with the previous input data that has been processed by the system.

a) Input Data
Input data needed by the system are:
1. Variable raw materials for the mixing process.
2. The number of iterations for the GA process in the optimization of eggtray raw material mixing process.
3. The probability of mutation
4. Username and password

b) Output Data
Output data generated by the application are:
1. Optimization of the mixing of raw materials
The results of running GA optimization, this value is the final output of the optimization of eggtray raw material mixing process that has a combination of optimized variables.
2. Graph
Graph of fitness value obtained from the iteration process to make it easier to show the comparison of the optimal value of the solution.
3. History of Optimization Result
Historical data from the results of the optimization process mixing eggtray raw materials.

4.3 Flowchart of the System to be Built

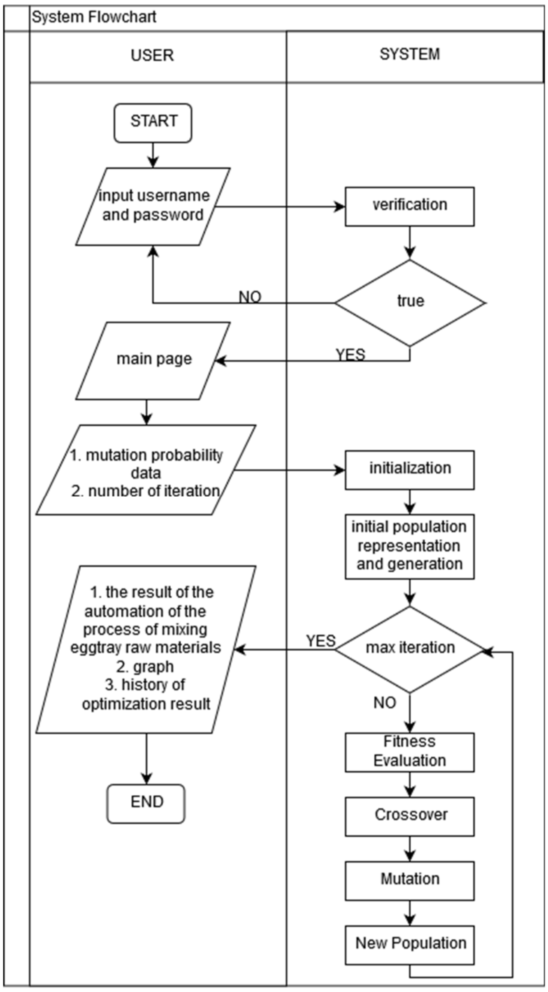

Figure 4.1 Flowchart of The System to be Build

4.4 Genetic Algorithm Method in Optimizing the Mixing Process of EggTray Raw Materials

In explaining the process flow that runs on the optimization of the mixing process of eggtray raw materials using genetic algorithms that have the following procedures:

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1) Initialization
The chromosome coding technique used is encoding binary numbers. Following is an example of initialization with binary encoding.

Table 4.1 Examples of initialization with binary encoding

J_pos			Duplek			Glondongan			Karton		
desimal	nilai	biner	desimal	nilai	biner	desimal	nilai	biner	desimal	nilai	biner
0	752	0000	0	161	0000	0	161	0000	0	247	0000
1	1065	0001	1	288	0001	1	225	0001	1	282	0001
2	1377	0010	2	415	0010	2	289	0010	2	317	0010
3	1689	0011	3	542	0011	3	353	0011	3	352	0011
4	2001	0100	4	669	0100	4	417	0100	4	387	0100
5	2313	0101	5	796	0101	5	481	0101	5	422	0101
6	2625	0110	6	923	0110	6	545	0110	6	457	0110
7	2937	0111	7	1050	0111	7	609	0111	7	492	0111
8	3249	1000	8	1177	1000	8	673	1000	8	527	1000
9	3561	1001	9	1304	1001	9	737	1001	9	562	1001
10	3873	1010	10	1431	1010	10	801	1010	10	597	1010
11	4185	1011	11	1558	1011	11	865	1011	11	632	1011
12	4497	1100	12	1685	1100	12	929	1100	12	667	1100
13	4809	1101	13	1812	1101	13	993	1101	13	702	1101
14	5121	1110	14	1939	1110	14	1057	1110	14	737	1110
15	5433	1111	15	2066	1111	15	1121	1111	15	772	1111

2) Initial Population (1st Generation)
Determining the initial population is the process of generating a number of chromosomes randomly. In this study a chromosome will be declared as an optimal solution for mixing eggtray raw materials. Where the chromosome consists of a collection of genes that contain information that affects the value of mixing eggtray raw materials.

Table 4.2 Examples of randomly generated initial population generation

C	Jawa pos	x1	Duplek	x2	Gelondongan	x3	Karton	x4	Total bahan	Total mixing
1	3873	1010	542	0011	993	1101	492	0111	4920	164
2	5121	1110	542	0011	1121	1111	247	0000	2460	82
3	1065	0001	288	0001	289	0010	387	0100	1500	50
4	3873	1010	1304	1001	353	0011	702	1101	3510	117
5	2313	0101	161	0000	609	0111	282	0001	1590	53
6	2625	0110	669	0100	737	1001	562	1001	3750	125
7	1689	0011	669	0100	993	1101	387	0100	2400	80
8	2625	0110	2066	1111	1121	1111	702	1101	3750	125
9	4185	1011	1558	1011	801	1010	527	1000	5250	175
10	5121	1110	1685	1100	353	0011	492	0111	3510	117

3) Evaluation of fitness functions
A chromosome is evaluated based on a certain function as the best measure. In natural selection, individuals with high fitness value are individuals who will survive. While individuals with low fitness values will die. The function used to measure the value of compatibility or the degree of optimality of a chromosome is called the fitness function. The value generated from the function indicates how optimal the solution is obtained. In this case the fitness function evaluation is used based on the provisions obtained from PT. Sinar Era Box.

Table 4.3 The formula for mixing the ingredients of eggtray

BAHAN BAKU	%	KEBUTUHAN BAHAN DALAM 1X MIXER
AMPAS (J.POS)	70%	21 (kg)
KARTON	10%	3(kg)
GELONDONGAN	10%	3(kg)
DUPLEK	10%	3(kg)
TOTAL BAHAN		30(kg)

Nilai fitness per kromosom= min $mix\,(x_1/21,\ x_2/3,\ x_3/3,\ x_4 3))$...persamaan 4.1

Nilai fitness per populasi= max $mix \sum_{i=1}^{pop}$ min $mix_i(x_1, x_2, x_3, x_4)$......persamaan 4.2

Explanation:
X1 = Pulp (j.pos)
X2 = Cardboard
X3 = Logs
X4 = Duplex
Total mixing = rounding down from the fitness value per chromosome

Nilai fitness kromosom ke 1 = (3873 / 21) , (542 / 3) , (993 / 3) , (492 / 3)
= (184.43) , (180.67), (331), (164)
= 164

Nilai fitness kromosom ke 2 = (5121 / 21) , (542 / 3) , (1121 / 3) , (247 / 3)
= (243.86) , (180.67) , (373.67) , (82.33)
= 82.33

Nilai fitness kromosom ke 3 = (1065 / 21) , (288 / 3) , (289 / 3) , (387 / 3)
= (50.71) , (96) , (96.33) , (129)
= 50.71

Nilai fitness kromosom ke 4 = (3873 / 21) , (1304 / 3) , (353 / 3) , (702 / 3)
= (184.43) , (434.67) , (117.67) , (234)
= 117.67

Nilai fitness kromosom ke 5 = (2313 / 21) , (161 / 3) , (609 / 3) , (282 / 3)
= (110.14) , (53.67) , (203) , (94)
= 53.67

Nilai fitness kromosom ke 6 = (2625 / 21) , (669 / 3) , (737 / 3) , (562 / 3)
= (125) , (223) , (245.67) , (187.33)
= 125

Nilai fitness kromosom ke 7 = (1689 / 21) , (669 / 3) , (993 / 3) , (387 / 3)
= (80.43) , (223) , (331) , (129)
= 80.43

Nilai fitness kromosom ke 8 = (2625 / 21) , (2066 / 3) , (1121 / 3) , (702 / 3)
= (125) , (688.67) , (373.67) , (234)
= 125

Nilai fitness kromosom ke 9 = (4185 / 21) , (1558 / 3) , (801 / 3) , (527 / 3)
= (199.29) , (519.33) , (267) , (175.67)
= 175.67

Nilai fitness kromosom ke 10 = (5121 / 21) , (1685 / 3) , (353 / 3) , (492 / 3)
= (243.86) , (561.67) , (117.67) , (164)
= 117.67

So that the fitness results obtained from each chromosome are as follows.

Table 4.4 Example of fitness calculation results

C	Fitness	Max fitness
1	164	175.67
2	82.33	
3	50.71	
4	117.67	
5	53.67	
6	125	
7	80.43	
8	125	
9	175.67	
10	117.67	

4) Selection

The selection process is carried out using roulette wheel selection. This selection method with a roulette machine is the simplest method and is often known as stochastic sampling with replacement. The steps are as follows:

a) The results of the fitness values obtained for each chromosome are then added together. Suppose fitness (Pk) is the k-th individual fitness value. Then the total fitness can be calculated as follows:

$$\text{Total } Fitness = \sum_{k=1}^{popSize} fitness(P_k) \text{.......................................(Persamaan 4.3)}$$

Total fitness = 164 + 82.33 + 50.71 + 117.67 + 53.67 + 125 + 80.43 + 125 + 175.67 + 117.67

= 1092.14

Table 4.5 Example of total fitness results

C	Fitness
1	164
2	82.33
3	50.71
4	117.67
5	53.67
6	125
7	80.43
8	125
9	175.67
10	117.67
Total fitness	1092.14

b) Then calculate the value of fitness probability and cumulative fitness of each chromosome (individual).

$$prob_k = \frac{fitness(P_k)}{totalFitness}, \quad k = 1,2,\ldots,popSize \text{.............................(Persamaan 4.4)}$$

Pf kromosom 1 = 164 / 1092.14 = 0.15

Pf kromosom 2 = 82.33 / 1092.14 = 0.08

Pf kromosom 3 = 50.71 / 1092.14 = 0.05

Pf kromosom 4 = 117.67 / 1092.14 = 0.11

Pf kromosom 5 = 53.67 / 1092.14 = 0.05

Pf kromosom 6 = 125 / 1092.14 = 0.11

Pf kromosom 7 = 80.43 / 1092.14 = 0.07

Pf kromosom 8 = 125 / 1092.14 = 0.11

Pf kromosom 9 = 175.67 / 1092.14 = 0.16

Pf kromosom 10 = 117.67 / 1092.14 = 0.11

Table 4.6 Example results of fitness probability

C	Pf
1	0.15
2	0.08
3	0.05
4	0.11
5	0.05
6	0.11
7	0.07
8	0.11
9	0.16
10	0.11

$$
\begin{aligned}
Qfkromosom1 &= 0.15 \\
Qfkromosom2 &= 0.08 + 0.15 \\
&= 0.23 \\
Qfkromosom3 &= 0.05 + 0.23 \\
&= 0.28 \\
Qfkromosom4 &= 0.11 + 0.28 \\
&= 0.39 \\
Qfkromosom5 &= 0.05 + 0.39 \\
&= 0.44 \\
Qfkromosom6 &= 0.11 + 0.44 \\
&= 0.55 \\
Qfkromosom7 &= 0.07 + 0.55 \\
&= 0.62 \\
Qfkromosom8 &= 0.11 + 0.62 \\
&= 0.73 \\
Qfkromosom9 &= 0.16 + 0.73 \\
&= 0.89 \\
Qfkromosom10 &= 0.11 + 0.89 \\
&= 1
\end{aligned}
$$

Table 4.7 Example of cumulative fitness results

C	Qf
1	0.15
2	0.23
3	0.28
4	0.39
5	0.44
6	0.55
7	0.62
8	0.73
9	0.89
10	1

c) After that, determine the cumulative value interval (0-1) for each chromosome
d) Select the parent who is the candidate for the new population by generating one random number (0 - 1) and the chromosome that will be selected if the random number generated is within its cumulative interval.
e) Perform step 4 as much as population size, so that a new population structure is formed.
f) Done

Table 4.8 Examples Selection Result

pf	qf	rw	kromosom terpilih
0.15	0.15	0.64	8
0.08	0.23	0.08	1
0.05	0.28	0.47	6
0.11	0.39	0.38	4
0.05	0.44	0.72	8
0.11	0.55	0.06	1
0.07	0.62	0.26	3
0.11	0.73	0.82	9
0.16	0.89	0.17	2
0.11	1.00	0.79	9

5) Crossover
After the selection process, the next step is to do a crossover or interbreed the selected parent (chromosome):

Table 4.9 The chromosome example is selected

C	X1	X2	X3	X4
8	0110	1111	1111	1101
1	1010	0011	1101	0111
6	0110	0100	1001	1001
4	1010	1001	0011	1101
8	0110	1111	1111	1101
1	1010	0011	1101	0111
3	0001	0001	0010	0100
9	1011	1011	1010	1000
2	1110	0011	1111	0000
9	1011	1011	1010	1000

a) Determine one intersection randomly depending on the length of the chromosome and do a crossing operation on all chromosome pairs in sequence, ie chromosome 1 will be crossed with chromosome 2, chromosome 2 will be crossed with chromosome 3, and so on.

Table 4.10 Examples of chromosome results after the crossover process

X1	X2	X3	X4
1010	0011	1111	1101
0110	1111	1101	0111
1010	1001	1001	1001
0110	0100	0011	1101
1010	0011	1111	1101
0110	1111	1101	0111
1011	1011	0010	0100
0001	0001	1010	1000
1011	1011	1111	0000
1110	0011	1010	1000

b) Done.

6) Mutation

The process of mutation is a process of possibly modifying the information of genes on a chromosome. This change can make duplication solutions have lower or higher fitness values than the parent solution. But if a solution with a higher fitness value is obtained then the bias so in the next iteration the mutation solution is obtained which is better at the fitness value than the parent solution. The steps in the mutation process are as follows:

a) The process of mutation begins by first determining the probability of the mutation P (m).
b) After that count the total genes and the number of mutations:
Total_gen = (the number of genes in one chromosome) * number of pollulations.
Total_gen = 16*10 =160
Number of mutations = probability of mutation P(m) * total genes

= 10%*160
= 10/100*160
= 16

The mutation process is carried out as many as the number of mutations obtained, namely 16 mutation points.
c) Determine the position of the gene to be mutated by generating random numbers between index 0 to 159 mutation points for each gene. (113, 152, 153, 144, 122, 59, 16, 60, 93, 16, 5, 135, 157, 106, 63, 0).

Table 4.11 Examples of mutation points in Chromosome

	C	XI	X2	X3	X4
15	1	1010	0011	1111	1101
31	2	0110	1111	1101	0111
47	3	1010	1001	1001	1001
63	4	0110	0100	0011	1101
79	5	1010	0011	1111	1101
95	6	0110	1111	1101	0111
111	7	1011	1011	0010	0100
127	8	0001	0001	1010	1000
143	9	1011	1011	1111	0000
159	10	1110	0011	1010	1000

d) If the random number in the mutation point has been obtained, then the value of the gene affected by the mutation process will be replaced, if at first it is 0 then it will be replaced by 1. So, on the contrary, if it is worth 1 then it will be replaced by 0.

Table 4.12 Example mutation results

C	Jawa pos	x1	Duplek	x2	Gelondongan	x3	Karton	x4
1	1377	0010	1050	0111	1121	1111	702	1101
2	5121	1110	2066	1111	993	1101	492	0111
3	3873	1010	1304	1001	737	1001	562	1001
4	2625	0110	669	0100	289	0010	387	0100
5	3873	1010	542	0011	1121	1111	702	1101
6	2625	0110	2066	1111	993	1101	772	1111
7	4185	1011	1158	1011	161	0000	247	0000
8	2313	0101	288	0001	673	1000	667	1100
9	4185	1011	1431	1010	1121	1111	247	0000
10	2625	0110	542	0011	545	0110	667	1100

e) New Population (2nd Generation)

Table 4.14 Contoh New Population on 2nd generation

C	Jawa pos	x1	Duplek	x2	Gelondongan	x3	Karton	x4	Total bahan	Maksimum mixing
1	1377	0010	1050	0111	1121	1111	702	1101	4250	65
2	5121	1110	2066	1111	993	1101	492	0111	8672	164
3	3873	1010	1304	1001	737	1001	562	1001	6476	184
4	2625	0110	669	0100	289	0010	387	0100	3970	96
5	3873	1010	542	0011	1121	1111	702	1101	6238	180
6	2625	0110	2066	1111	993	1101	772	1111	6456	125
7	4185	1011	1158	1011	161	0000	247	0000	5751	82
8	2313	0101	288	0001	673	1000	667	1100	3941	96
9	4185	1011	1431	1010	1121	1111	247	0000	6984	82
10	2625	0110	542	0011	545	0110	667	1100	4379	125

f) Fitness (2nd Generation)

Table 4.15 Examples of results of fitness calculations in 2nd Generation

C	Fitness	Max fitness
1	65.57	184.43
2	164	
3	184.43	
4	96.33	
5	180.67	
6	125	
7	82.33	
8	96	
9	82.33	
10	125	

7) Condition Complete

The complete condition that can stop the process of genetic algorithms is if the number of generations or iterations has reached a predetermined maximum point. So that the optimization results obtained mixing Eggtray raw materials with the best fitness value is in the 2nd generation of the 3rd chromosome.

4.5 DFD

Data Flow Diagrams are used to describe the processes that exist in a system. In the following DFD will be seen how the data flow on the system that is running. Starting from incoming data to outgoing data. Every data that is processed has an effect on the current system.

4.5.1 DFD Level 0 Eggtray Raw Material Mixing Process Optimization System

DFD level 0 in Figure 4.5 shows that in general the system consists of 1 entity and one process. The entity is the user. The process is an optimization of the mixing process of eggtray raw materials in order to obtain the optimal number of mixing processes.

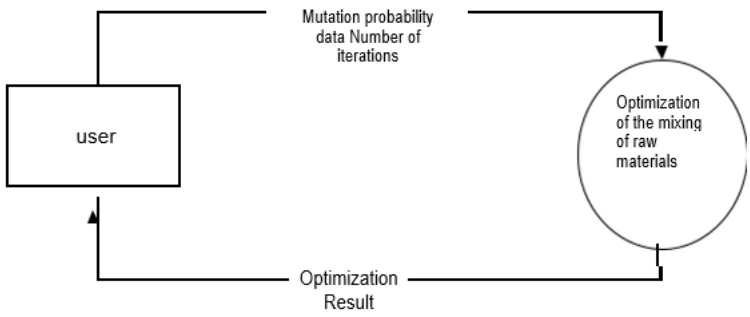

Figure 4.5 DFD Level 0 Eggtray raw material mixing process optimization system

4.5.2 DFD Level 1 The Process of Optimizing the Eggtray Raw Material Mixing Process

DFD level 1 on Figure 4.6 explained that in the Eggtray Raw Material Mixing Process Optimization System there are 7 data processing processes that will be output solutions that are expected by the user. The data processing includes initial initiation, initial population generation, evaluation of fitness values, chromosome selection, crossover, mutation, and new population. Then the optimization data or solution will be displayed to the user.

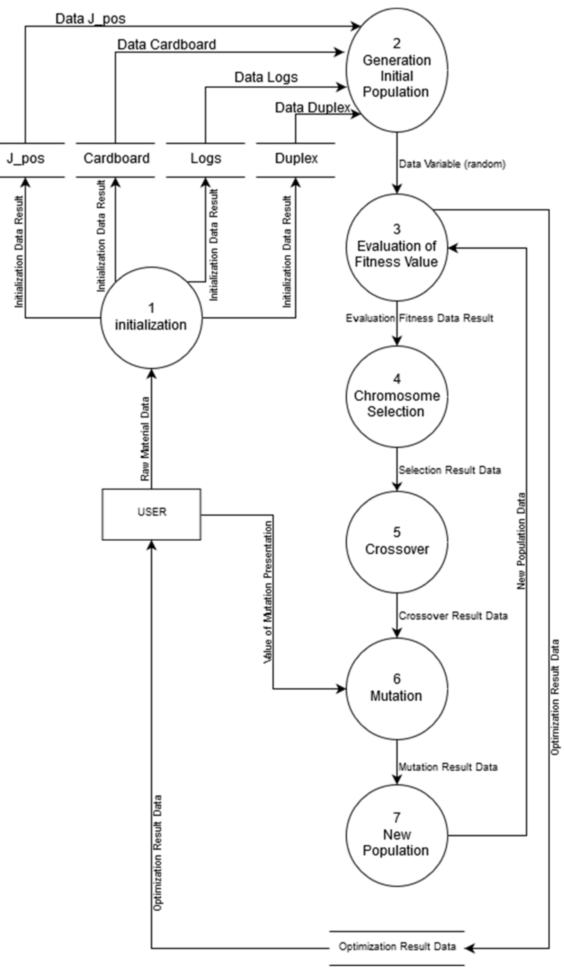

Figure 4.6 DFD Level 1 The optimization process of eggtray raw material mixing process.

4.6 Entity Relationship Diagram (ERD)

ERD is a model to explain the relationship between data in a database based on data base objects that have relationships between each table. In each table, each data record organized in the same structure has a key file that will be the link between the existing tables and those related to each other.

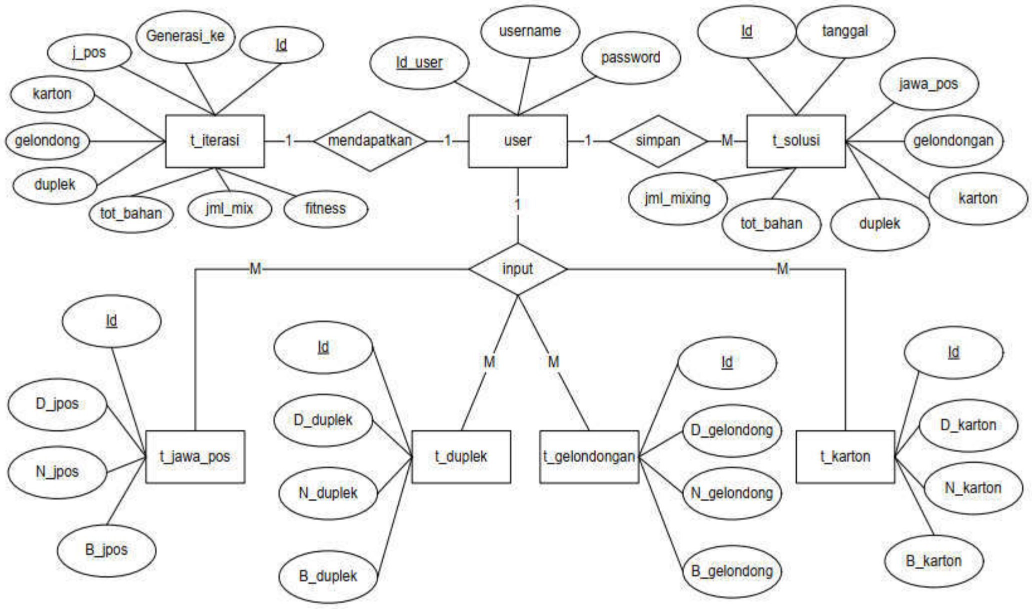

Figure 4.7 Entity Relationship Diagram (ERD)

5. SYSTEM IMPLEMENTATION

Following are the results of the implementation of the completed program:

Figure 5.1 Login page

Figure 5.2 Main Page

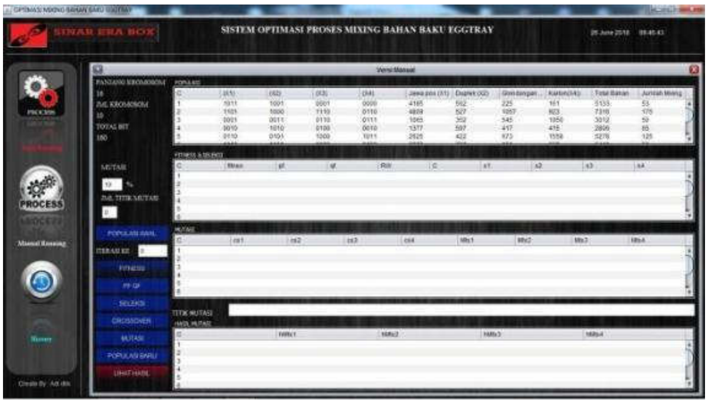

Figure 5.3 First Population Page

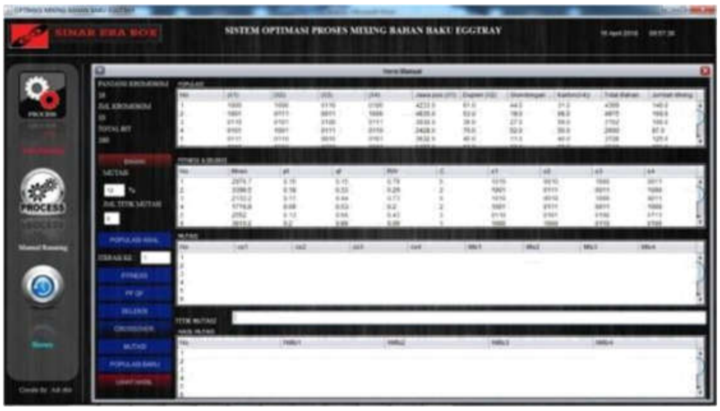

Figure 5.4 Fitness and selection page

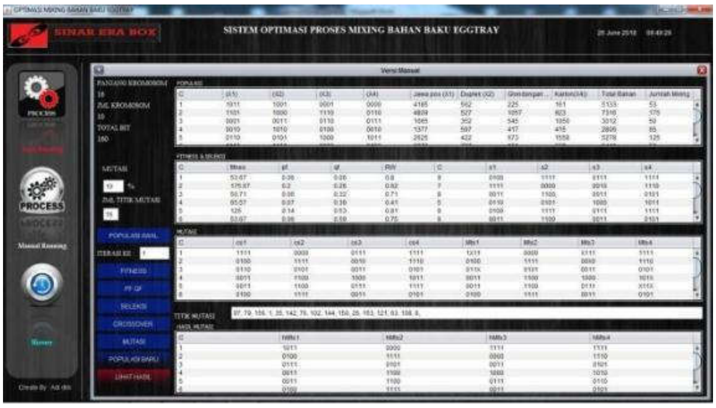

Figure 5.5 Crossover and Mutation Page

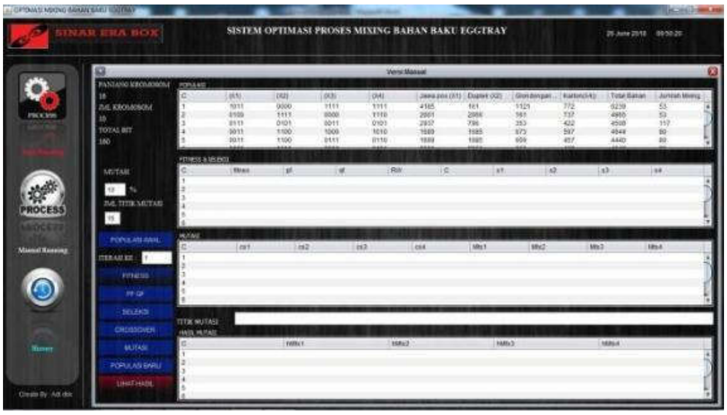

Figure 5.6 Replacement Page

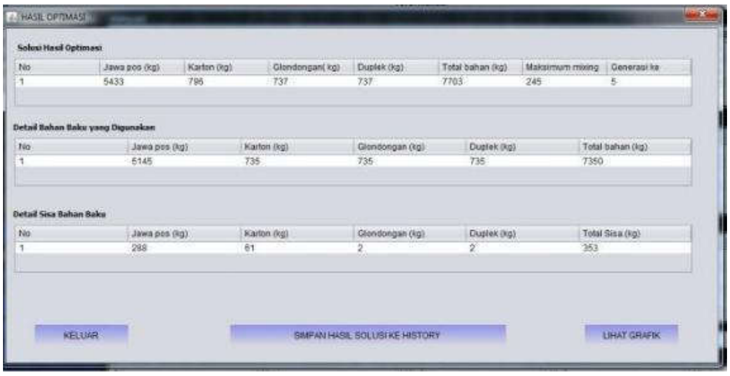

Figure 5.7 Optimization Result Page

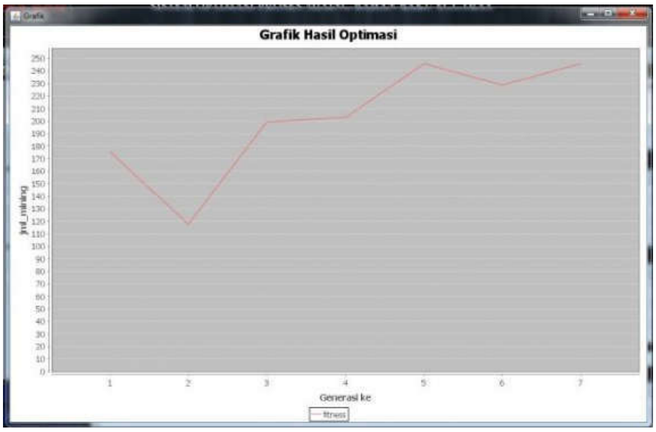

Figure 5.8 Graph of Optimization Result page

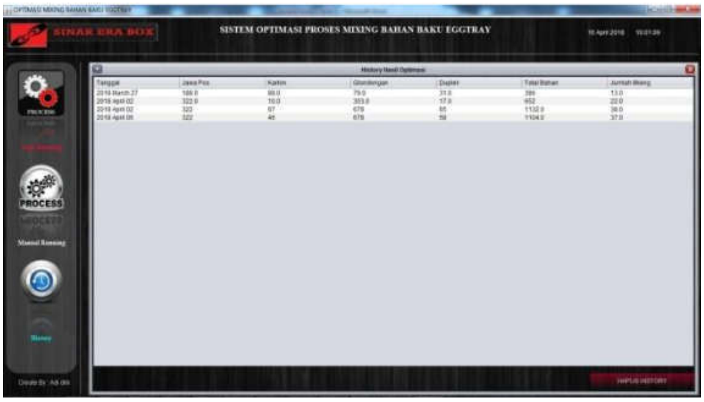

Figure 5.9 Optimization Result History Page

6. CONCLUSION

After going through a number of processes in the design and implementation of this research, some conclusions were drawn, including:

a) Designing an application for eggtray Raw Material Raw Material Process Optimization System at PT. The Era Box Gresik beam has been successfully built and has succeeded through several test processes on several functions with good results.

b) Implementation of Genetic Algorithms on an Eggtray Raw Material Mixing Process Optimization System has been successfully resolved even though there are still some shortcomings that might occur.

7. SUGGESTION

Research on the optimization of the mixing process of eggtray raw materials using genetic algorithms (Case Study at PT. Sinar Era Box) is inseparable from shortcomings and weaknesses, especially in terms of analysis. Therefore, suggestions that can be used as a reference in further research or development are as follows:

a) The system built is still very simple, especially in the available menu display features.
b) Minimalist design so that a more attractive and flexible user interface modification is needed.
c) It is hoped that the system optimization process for mixing eggtray raw materials should be able to provide a large selection of selection methods and cross-over methods.

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