Engineering And Technology International Journal
November 2020 | Vol. 2 | No. 3
E-ISSN : 2714-755X
DOI: -

Goods Layout Modeling and Simulation Using Genetic Algorithms

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Abstract

Arrangement of goods in conventional containers takes a long time and relies on the skills of employees or employees. The result of this method is very dependent on the condition of the employee. From the above background, it is necessary to build a computerized system that helps companies to optimize the pattern of arranging goods in containers whose solutions can be searched by genetic algorithms. Genetic algorithm as a search solution method based on natural selection to get an individual with the best gene arrangement, is able to provide a solution on how the pattern of goods arrangement is optimized through an iterative process for several generations with operators namely reproduction, crossing over, and mutation. By entering the input in the form of space and item specifications along with the genetic algorithm operator probability, the genetic process will find a pattern of arrangement of items based on the best fitness or value, i.e. the less empty space is left.

Keywords— *Algorithm, Genetics, Container,*

INTRODUCTION

Today the development of the manufacturing system is getting tighter, this is its impact on the company's competition is relatively heavy. Facing intense competition requires strategies from all aspects including product, process and schedule aspects. The problems of the industrial world are not only related to how much investment needs to be invested, production systems and procedures, marketing of production products and so on, but also related to facility planning, both problems with facility location and facility design issues.

Facility design includes facility system design, plant layout and material handling system (material transfer). Among the three facilities design activities above have a very close relationship so that the design process needs to be carried out in an integrated manner. A good layout is one that can handle the entire material handling system. To overcome this problem, it is necessary to apply a facility layout that meets the needs in several aspects. The problem of facility layout is a classic problem where on the one hand the company is required to optimize its production by improving the layout of the facility and on the other hand the improvement of the layout of the facilities carried out must really be utilized by the company so that it can be utilized optimally. able to increase productivity.

Facility arrangement plays a role in the smooth production process so that an orderly, safe and comfortable workflow can be achieved. Facility layout is concerned with planning the layout of machines, equipment, material flow, products in the warehouse and the people who work at each work station. Along with the development of the business world, competence in all fields is also required to reduce costs with the aim of increasing profits. One of the factors that often causes high costs in the business world is the process of sending goods from one place to another using transportation services.

In this discussion, we will describe optimizing the layout of goods in the warehouse so that it does not cause large costs. One of the factors that often occurs over cost is the amount of empty space in the storage warehouse because the pattern of arrangement of goods is not optimal, so another warehouse is needed to accommodate the rest of the goods.

RESEARCH METHODS

The application to be built is a GUI (Graphical User Interface) software that is user friendly so that it is easy to use by users. This stage is very important in software planning and design. This step greatly affects the design made and its implementation. The analytical method used to analyze software requirements in the warehouse layout optimization system with this genetic algorithm is a structured approach complete with tools in the form of computers and the necessary techniques, namely the methods and functions needed in system development, so that it will produce the results of the developed system. system whose structure can be well defined.

In the software design "Optimization of the Layout of Goods in the Warehouse With Genetic Algorithms", the method used to meet the needs, analysis, design and implementation is in accordance with the characteristics of the program created.

RESULTS AND DISCUSSION

Design Method

The design method carried out at the design stage of the warehouse layout optimization system with the Genetic Algorithm is implemented using a Flow Chart.

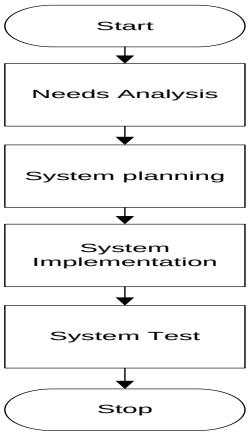
Design Results

The results at the design stage are closely related to the results of the analysis stage, because at the analysis stage the functions and methods used, the hardware and software systems used, and the expected interface have been determined. From the results of the analysis phase, it is obtained an overview of the optimization system for the layout of goods in the warehouse with Genetic Algorithms. The design of the optimization system for the layout of goods in the warehouse with genetic algorithms consists of 2 parts, namely:

1. Database, the part that is used to store data from the system in the form of warehouse dimensions and goods dimensions, so that it can be reused for processing and processing results systems.
2. Software layout optimization of goods in the warehouse that processes data to find the optimum layout

System Flowchart

The following is an image of the flow diagram of the Optimization System for the layout of goods in the warehouse with Genetic Algorithms



Gambar 1 Diagram Alir

From the genetic algorithm process flow diagram in the genetic operation process section, there are selection, crossover and mutation procedures. The description of these procedures can be seen from the following flow chart:

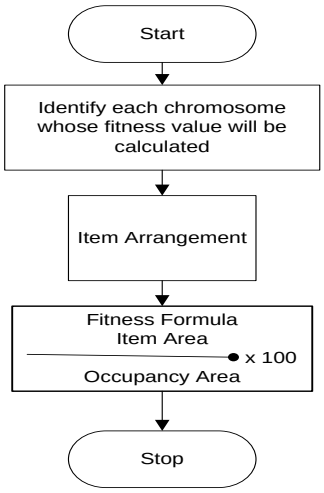
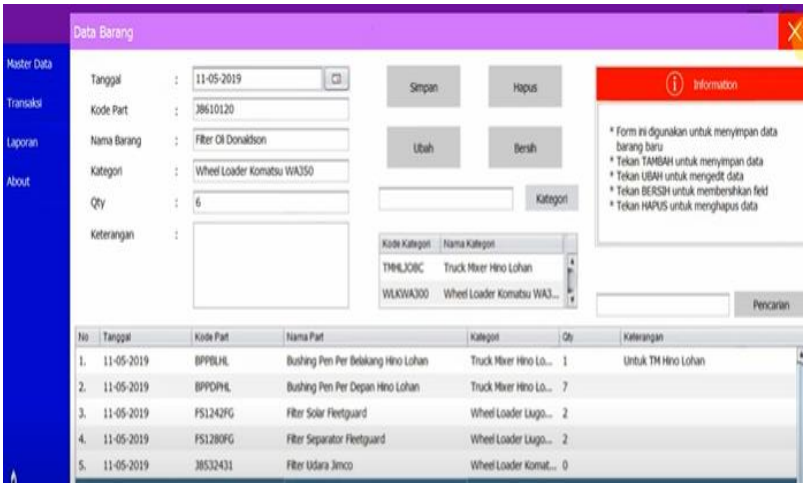


Figure 2 Flowchart of Fitness Calculating

Implementation

The system that has been designed uses a computer with a minimum Windows operating system. Microsoft Access and Java Netbeans must also be installed on the computer, the following is the interface of the application design.



Picture. 3 Item Data Input Interface Pages

In the fitness calculation flow chart above, the first process is to identify each chromosome whose fitness value will be calculated. The next process is each chromosome from its genes which are units of incoming goods, then the goods are arranged, from the preparation of each chromosome the fitness value is calculated. The fitness value is calculated from the total area of the item. incoming divided by the occupancy area. Occupancy area is a warehouse space that is considered used by goods.

Table 1. Testing Results of Application Assessment Aspects

Responden	Item	Hasil
1	3 3 4 4 3 4	21
2	4 4 4 3 3 4	22
3	4 3 4 4 3 4	22
4	5 4 4 4 5 4	26
5	4 4 4 5 4 4	25
Nilai	=	23,2

User Acceptance Test (UAT)
The recapitulation of the results of testing the application assessment aspects distributed through forms to 5 respondents can be seen in Table 1. below.

Table 1. Testing Results of Application Assessment Aspects

For each system function proposed to respondents, there are 5 answer options offered. The number of functions proposed in testing the application assessment aspect is 6 functions. Thus the value of the test results of each respondent is as follows:
1. Maximum value = 30 (5 x 6 items)
2. Third quartile value = 24 (4 x 6 items)
3. Median value = 18 (3 x 6 items)
4. Quartile value I = 12 (2 x 6 items)
5. Minimum value = 6 (1 x 6 items)

The interpretation of the value of the test results are:
1. 24 value 30, program function is rated very good

2. 18 value 23, program function is rated good
3. 12 score 17, program function is considered not good
4. 6 score 11, the program function is rated not good

From the tests carried out, the distribution of the test results for the assessment aspect of the administrator's access level application was 2 respondents said the system function was very good, 3 respondents said the system function was good, there were no respondents said the system function was not good and not good. The distribution chart of respondents' test results with application assessment aspects can be seen in the following figure.

CONCLUSION

From the results of research on the optimization system for the layout of goods in warehouses with genetic algorithms, several conclusions can be drawn:

1. Genetic algorithms as a method of finding solutions based on natural selection can be applied to find the optimal layout of goods in two-dimensional space.
2. The more generations and the number of individuals that appear in running the genetic Una algorithm, the more opportunities to get individuals with the best composition of genes.

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