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Design and Devolvement of Facility Planning Under Manufacturing and Material Handling System

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Abstract
Facility layout approaches have assumed infinite capacities for the production system and material handling in determining the layout. This study conducts research on addressing dynamic facility layout designs in which the demand varies from one time period to the next while taking into consideration finite capacity constraints for both the logistics and production systems. The research uses a genetic algorithm to develop the facility layout for each time period. Simulation studies are conducted for the developed layout to determine if demand can be met for the given time period. The research develops functions that can be used to evaluate the costs of changes in the parameters, such as increased production capacity, increased material handling capacity, or a combination of both parameters, to meet the demand. The aim of this research is to minimize the cost of meeting demand over a given time period under dynamic conditions.

Keywords: *Capacity constraints, Dynamic conditions, Facility layout, Simulation, problem design*

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I. Introduction

Facility layout and material handling costs represent the next frontier in product cost reduction. Facility layout is concerned with the location and arrangement of departments, cells or machines on the shop floor. Material handling is concerned with equipment and logistics associated with transportation of products The facility location problem. Good approximation algorithms are known in the literature for this problem. Our objective is to seek possible improvements in one of the Approximation algorithms for the facility location problem One of the most important decisions in the logistical planning is to establish where the locations have to be (whether factories, warehouse, markets, etc). The Facility Location Problem (FLP) has been widely studied by different authors, often specialists from Operation Research and Logistic areas. This kind of problem is a well-known NP-Hard, Genetic algorithm and Tabu search method of combination optimization problem which is encountered frequently in decision making process, beside in logistics system. In FLP there is a set of locations at which we may build a facility (such as a warehouse), where the cost of building dependents of each location

The most widely studied model in discrete facility location is the so-called Uncapacitated Facility Location Problem, also known as plant location problem or warehouse location problem. Here we are given two finite sets of customers and potential facilities, respectively, a fixed cost associated with opening each single facility, and a nonnegative distance for any two elements, satisfying the triangle inequality. The goal is to select a subset of the potential facilities (open them) and assign each customer to a selected (open) facility, such that the total opening cost plus the total service cost is minimum. Many Economical decision problems concern selecting and/or placing certain facilities to serve given demands efficiently. Examples are manufacturing plants, storage facilities, depots, warehouses, libraries, fire stations, hospitals, base stations for wireless services like TV broadcasting or mobile phone service, etc. The problems have in common that a set of facilities, each with a certain position, has to be chosen, and the objective is to meet the demand (of customers, users etc.) best. Facility location problems, which occur also in less obvious contexts, indeed have numerous applications. Plant layout affects the output and has significant impact on the cost and efficiency of the operations. Plant layout problems can occur in a large number of ways and can have significant effects on the overall effectiveness of the production system Approximately 8% of the Gross National Product (GNP) has been spent annually on new facilities in the Unites States, and it is generally agreed that effective facilities planning can reduce material handling cost and transportation cost by at least 10 to 30%.The size of the investment in new facilities each year makes the field of facilities planning important.

II. Review Of Survey

The most well known heuristic methods in optimizing layout design are Tabu Search (TS), Simulated Annealing (SA) and Genetic Algorithms (GA). The popularity of these heuristics has flourished in recent years and several published studies can be found in the literature. [2] Classify heuristics methods into tailored and general. While tailored heuristics have a limited applicability to a specific problem, general algorithms define a strategy for obtaining approximate solutions and thus are widely applicable to various forms of combinatorial optimization problems. Genetic algorithm (GA) is developed for the multi-objective facility layout problem and found out the optimal facility location for a particular problem considering the two objectives, i.e. minimization of the material handling cost and maximization of the closeness rating score.

Tabu Search (TS) is a Mathematical Optimization Method of belonging to the class of local search techniques [9] Tabu search enhances the performance of a local search method by using memory structures, once a potential solution has been determined; it is marked as taboo, so that the algorithm does not visit that possibility repeatedly Computing to find Exact or Approximate solutions to optimization and search problems [9] Genetic Algorithms are categorized as global search heuristics. Genetic algorithms are a particular class of evolutionary algorithms (EA) that use techniques inspired by evolutionary biology such as inheritance, mutation, selection, and crossover [5]

Simulated annealing (SA) is a generic probabilistic meta heuristic for the global optimization problem of applied mathematics, namely locating a good approximation to the global minimum of a given function in a large search space. A mixed integer programming model and a five step heuristic algorithm were proposed to minimize material handling system [2] it is often used when the search space is discrete. For certain problems, simulated annealing may be more effective than exhaustive enumeration, provided that the goal is merely to find an acceptably good solution in a fixed amount of time, rather than the best possible solution [4] A hybrid genetic algorithm was proposed to solve single row layout design problem with unequal sized machines and unequal clearances [1]. The proposed algorithm was tested on well known data sets and the results were compared. The proposed algorithm was found with good effectiveness and improvement in solving of layout problems. Genetic algorithms were proposed to determine a common linear machine sequence for multi-products with different operation sequences and facilities [6] the proposed Algorithm can be used to reduce the number of machines in the layout, The material handling distance and material handling cost. Tabu search algorithm was used to solve single row facility layout problems and find the linear machine sequence in order to minimize total material handling cost. The algorithm finds a common linear machine layout for more than one product [7]

A Genetic Algorithm based on intra-cell formation procedure was used in the cellular layout design. To identify the suitability of a particular layout in a Given Environment, a typical manufacturing system modeled with computer software. The performance of each of the three layouts was analyzed by mean of operational parameters. The result from the simulation experiments indicated that the performance of virtual cellular layout was relatively superior to that of a functional layout and marginally inferior to a cellular layout [3]

ESSENTIAL OBJECTIVES OF PLANT LAYOUT

- Material handling costs are Reduce by new technique
- Efficiently of Utilize labor
- Provide for employee safety and health.
- Productivity of material is Improve Proper and efficient utilization.
- Reduced material handling maintenance cost
- Reduced material handling maintenance time.
- Optimized use of service facilities
- Distance optimizing in facility location
- To improve the efficiency by the plant layout using simulation.

TYPES OF LAYOUTS

A manufacturing unit, plant layout may be of four types:

1. Product or line layout
2. Process or functional layout
3. Fixed position or location layout
4. Combined or group layout

TOOLS AND TECHNIQUES

LIST OF LAYOUT

The layout evaluation checklist is used to identify the key problem areas in the present layout. **String diagram** - The string diagram is one of the simplest techniques of method study for recording and examining movement of workers and materials. It is a tool for analyzing and designing work spaces in such a way that the movement

of material, men, equipment etc.During a specified sequence of events. The string diagram is thus a form of flow diagram. In this a thread is used to measure the distance. They can be used to improvement of location plant lay out.

Outline process diagram - A outline process diagram is a process chart giving an overall picture by recording in alphabet only the main operations and inspections. In an outline process digram, only the principle operations are carried out and the inspections made to ensure the effectiveness are recorded

Flow process diagram - It is a process diagram used for setting out the sequence of the flow of a product or a procedure by recording all events under review using appropriate process diagram symbols are used in lay out.

DATA COLLECTION BY TECHNIQUES

- **Existing layout**- The covered area occupied by the machine tool and work-in-progress, storage areas of machine, raw material area or finished good area of layout was measured and scaled drawings of the floor plans for the building were made. M.S. office and AUTO-CAD used for design of plant lay out.
- **Outline Process diagram-** Outline process diagram was used to get and overall picture of primary activities Outline Process diagram for the studied process.
- **Flow Process Chart-** Flow Process Chart was used to document the detailed sequence of operations.
- **String Diagram-** String Diagrams were used to trace and measure the path of material. String diagrams were made both by hand and by software, Micro Soft office using Auto cad.
- **Simulation of diagram** -Time taken by each machine to process the component is collected and recorded. The standard time for each process is also recorded. These data are used in simulation in order to find out the overall utilization of the efficiency of the plant layout.

III. Result

To improve the efficiency by the plant layout using simulation and different types of algorithm using to lay out planning and location to increasing efficacy. Minimize the interdepartmental material handling cost and Maximizing the closeness rating score. The proposed plant layout efficiency is 128.05% which is greater than the efficiency of the current plant layout .05%. The efficiency improvement of the plant was increased up to 88.31%. And the reduction in transportation Length of 66% was achieved.

IV. Conclusion

This research paper has provided a good exposure to facility planning and layout designs for the improvement of the efficiency. The choice of which type of facility layout to adopt can have a significant impact on the long term success of a firm. This decision, therefore should not be considered lightly, but only after a thorough analysis of the operational requirements has been completed. A major issue to be addressed in facility layout decisions in manufacturing is: How flexible should the layout be in order to adjust to future changes in product demand and product mix. The study of layout has become extremely important. The most common objective of layout design, that is to minimize distance travelled.

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