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Case Study of Improvement Algorithm of Layout Design Using Craft Algorithm

Mr. VirendraPatil,
Scholar, M.Tech. Mechanical,
Digital Manufacturing,
Sanjay Ghodawat University, Kolhapur.

Prof. Prashant M. Sagare,
Assistant Professor,
Department of Mechanical Engineering,
Sanjay Ghodawat Institutes, Kolhapur.

Abstract:
Facility layout design is the field of selecting the most effective arrangement of physicalfacilities to allow the greater efficiency in the combination of resources to produce a product. The manufacturing facility needs to be responsive to the frequent changes in demand while minimizing material handling. Material moving faster, manufacturing time is also reduced. Now a days computer programs are used to assist the layout planner in generating alternate layout.There are two types computerized layout algorithm 1.Constructive Type Algorithm and2.Improvement Type Algorithm.In this paper, Improvement Type AlgorithmCRAFT Is consideration of the type of materials handling systemwas developed for situations in which materials handling costs were a major consideration, its goal is to minimize the total cost of moving items between departments. Travel chart is also used to assist CRAFT technique to compare the existing and improved layout. All these aspects are explained in this paper with the help of a case study.

Keywords: CRAFT.

Introduction:

In general, the layout of a manufacturing plant is a methodical arrangement of departments that are important for manufacturing goods and the delivery of various services. In a facility layout the location of facilities like the machine tools, machine shop, warehouse, manufacturing cells and work centers largely affects the performance of the job that is being carried out. Generally manufacturing units face problems which are related to the location of departments on the shop floor of the plant. Hence it is very important that the layout of the plant be optimized in order to obtain better utilization of the plant facilities.

For many years, researchers and industrial experts have felt the need of a promising and reliable set of tools that could help in changing the industrial scenario with respect to production cost, production time, plant level customization, effective floor space utilization and other relevant parameters that govern the different stages of product development.[2]

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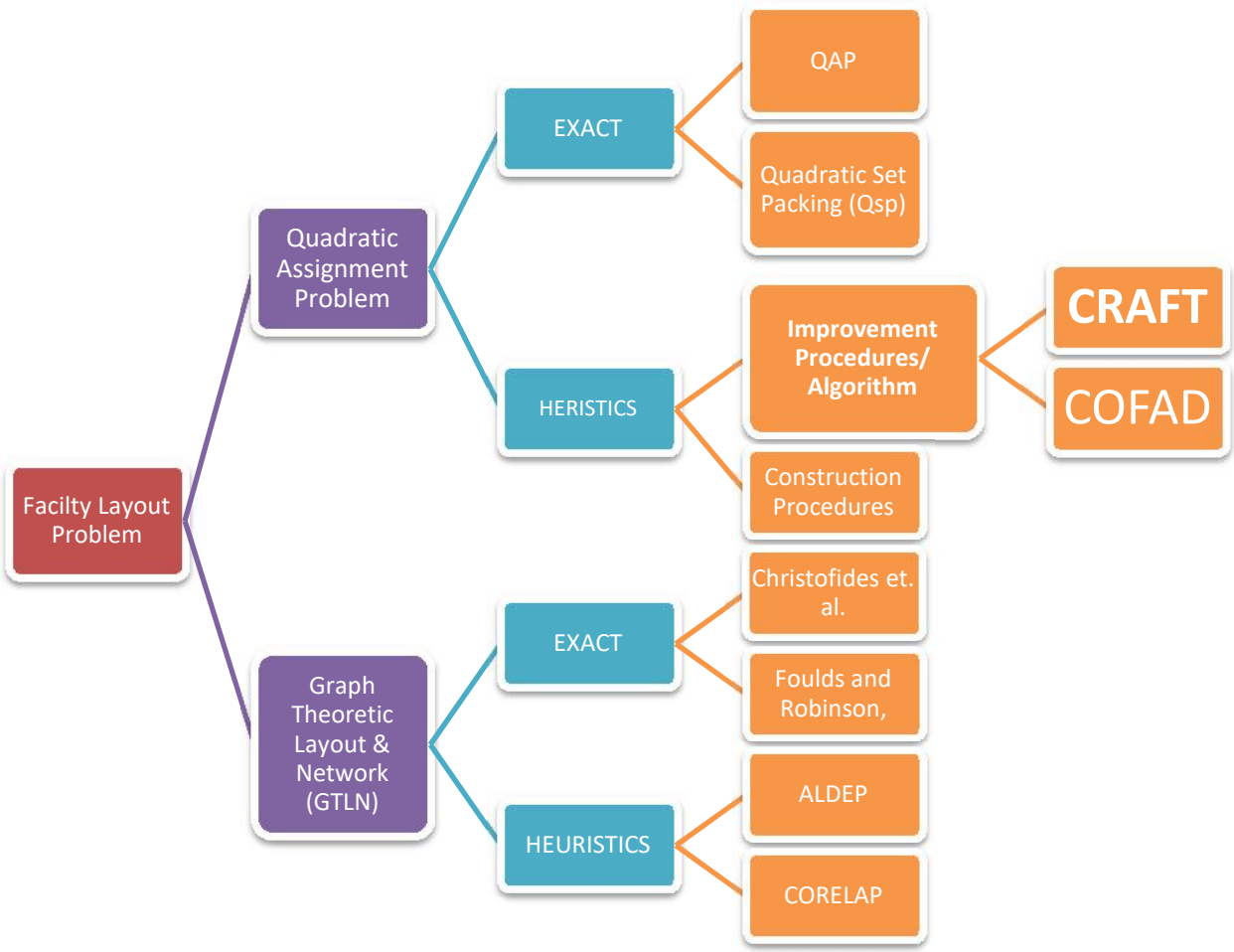
Morphology of Layout Programs:



Importance of Plant Layout:

1. The basic objective of the plant layout is to develop a facility layout that should be functionally better for the industryand cost savings.[2]
2. The better industries the placing of necessary departments such as the operating and recoveryrooms should be close together and keeping apart those departments which should not be together.[2]
3. Overall the Facility Layout includes the features of a layout which may not be immediately quantifiable, suchas facilitating communication and improving staff safety.[2]

Plant Layout Objectives:

Generally the typical plant layout should possess the following objectives:

1. Economic demands such as investments in equipment and material handling cost are to be minimized.[3]
2. Requirement of product design and volume is to be satisfied. [3]
3. Requisite of process equipment and capacity such as minimize overall production time; maintain flexibility of arrangement and operations are to be justified. [3]
4. Different types of material handling equipment are to be facilitated in the manufacturing process. [3]

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5. The quality of work life provided for employee convenience, safety and comfort; facilitate the organizational structure must be the basic priority. [3]
6. Requirement of building and site constraints such as utilizing existing space most effectively.[3]

Literature Review:

'Computerized Relative Allocation of Facilities Technique' (CRAFT) was proposed in 1964. It is an improvement type of algorithm used for layout optimization of existing facilities. The basic goal of the algorithm is to minimize transportation cost.

CRAFT input requirements are as follows:

1. Initial Layout.[2]
2. Flow Data.[2]
3. Cost per unit distance.[2]
4. Total number of departments.[2]
5. Fixed departments & their location.[2]
6. Area of departments.[2]

Procedure adopted for using CRAFT:

1. Calculate the inter department rectilinear distances. [2]
2. Calculate the initial cost of the layout by multiplying the from-to matrix with the cost matrix. [2]
3. CRAFT then considers all the possible two-way or three-way department exchanges and identifies the best "exchange". [2]
4. Update the layout and calculate the new department centroids. [2]
5. The above procedure is repeated until no further reduction in the cost can be obtained. [2]

Example 1

Consider the following layout problem with unit cost matrix (as in table1.2). Use CRAFT algorithm to obtain layout. The initial layout is shown in table 1.1 & the flow matrix in table.

Table 01 : Initial Layout

7	7	
A	B	7
D	C	7
7	7	

Assume the unit cost per Transfer to be 1

Table: 1.2.Flow Matrix

Department	**A**	**B**	**C**	**D**
A		30	25	45
B	20		15	20
C	10	20		10
D	100	10	5	

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Solution:

1. Centroids of the department for given initial layout are as:

(XA, YA) = 3.5, 10.5

(XB, YB) = 10.5, 10.5

(XC, YC) = 10.5, 3.5

(XD, YD) = 3.5, 3.5

2. Using the Rectilinear Distance, we draw the distance matrix as shown in table1.3

Table. 1.3: Distance Matrix

Department	**A**	**B**	**C**	**D**
A	0	7	14	7
B	7	0	7	14
C	14	7	0	7
D	7	14	7	0

3. Total material handling cost is calculated as by

Total cost = Flow x Distance x Unit cost

Fig.1.4. Total Cost Matrix

Department	A	B	C	D	Cost
A	0	210	350	315	875
B	140	0	105	280	525
C	140	140	0	70	350
D	700	140	35	0	875
Total Cost					2625

4. Departmental Interchanges:

- Consider various departmental interchanges for improvement
- Departmental interchange is possible fordepartments having common boundary or equal area.

Departmental pair	**Reason**
A-B	Common border & Equal area
A-C	Equal area
A-D	Common border & Equal area
B-C	Common border & Equal area
B-D	Equal area
C-D	Common border & Equal area

Possible Departmental Interchanges are shown in table 1.5

5.For the purpose of calculating material handling cost, interchange would mean change in the centroid. In the same way as we calculated the total cost for the initial layout, we calculate the total cost for each of the possible interchanges, & select the layout that gives the least total cost.

Conclusions:

After performing layout optimization using CRAFT, we observe that a good planned and optimized manufacturing system results into a profitable production cycle.Properly locating various machines, production facilities & employeeamenities in the industry leads to better utilization of the machines and higher production rates.

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