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मानविकी एवं समाजविज्ञान की दिभाषी शोध-पत्रिका

# मध्य भारती

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## मानविकी एवं समाजविज्ञान की दिभाषी शोध-पत्रिका

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## मध्य भारती

मानविकी एवं समाजविज्ञान की द्विभाषी शोध-पत्रिका

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प्रकाशित रचनाओं के अभिमत से डॉक्टर हरीसिंह गौर विश्वविद्यालय, सागर या सम्पादकों की सहमति अनिवार्य नहीं है, तथा यहाँ प्रकाशित आलेखों 'प्लेजिरिज्म' (Plagiarism) सम्बन्धी शुचिता की जिम्मेदारी लेखकों की है।

#### सम्पादकीय पत्र व्यवहार ः

मध्य भारती डॉक्टर हरीसिंह गौर विश्वविद्यालय सागर - 470003 (म.प्र.)

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अमन प्रकाशन कटरा नमक मंडी, सागर (म.प्र.)

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UGC Care Group I John January - June 100 UGe Val-84 No. 29, January June June June

# CONSTRUCT AND OPTIMIZE PLANT LAYOUT USING META-HEURISTIC

# Mr.Rushabh S. Korade Student International Institute of Management science chinch<sub>Wad</sub> <u>Rushabhkorade.10@gmail.com</u> <u>Rushabhkorade.10@gmail.com</u> **Rushabh S. Korade** Student International Institute of Management science chinch<sub>wad</sub>, p<sub>th</sub> **Mr. Gangadhar D. Dukare** International Institute@gmail.com angadhardukare@gmail.com

**Abstract**— In the growing global competition, optimization is the key for the survival of  $a_{ny}$  busines the growing global competition in an organization, optimization plays a vital **Abstract**— In the growing global competition, optimization is the Key for the survival of any busine organization. Among different functions in an organization, optimization plays a vital vital organization. Among different functions in productivity improvement. This can be done which automatically result in productivity implementation be done be done **Abstract** In the growing global competition, optimization, optimization plays a vital busine organization. Among different functions in an organization, optimization plays a vital vital minimizing wastages which automatically result in productivity improvement. This can be done minimizing wastages which automatically result in productivity improvement with fitting of pro-of suitable techniques augmented with fitting of proorganization. Among different functional result in productions and implementation of the initial starting from the stage of manufacturing processes, material handling, and implementation of or properties the discipline of adjusting a process so as a logorithe starting from the stage of the usage of suitable techniques augmented with fitting algorithe starting from the stage of the discipline of adjusting a process so as a logorithe starting from the stage of the discipline of adjusting a process so as a logorithe starting from the stage of the discipline of adjusting a process so as a logorithe starting from the stage of the discipline of adjusting a process so as a logorithe starting from the starting from the stage of the discipline of adjusting a process so as a logorithe starting from the starting from the stage of the discipline of adjusting a process so as a logorithe starting from the starting from the stage of the discipline of adjusting a process so as a logorithe starting from the starting from the starting from the stage of the discipline of adjusting a process so as a logorithe starting from the starting from the stage of the discipline of adjusting a process so as a logorithe starting from the starting f minimizing wastages which automated processes, material neuronal processes, material neuronal processes, material neuronal processes, material neuronal process and the starting from the stage of manufacturing processes, material neuronal neuronal process and the starting from the stage of manufacturing processes, material neuronal neuronal neuronal process and the starting from the stage of manufacturing processes, material neuronal neuron starting from the stage of manufacturing is the usage of suitable techniques using a process so as to optimization is the discipline of adjusting a process so as to optimization of the state of the s

**Introduction:** When constructing a new layout, one of the problems that occur in a manufacturing plant is When constructing a new layout, one of the facility. Plant layout is the arrangement of facility is to be a set of the facility of **Introduction:** When constructing a new layout, one of the problems that a subscription of the arrangement of  $f_{acilities}$  determine the location of each department in the facility. Plant layout is the arrangement of  $f_{acilities}$  determine the location of each department in the facility and efficiently. It includes removal of bottlenetwhen constructing a new layer and the facility. I take the factory of the facilities and the factory of the factory of the such that the factory or workplace runs smoothly and efficiently. It includes removal of bottlenecks such that the factory or workplace cost, and improved utilization of the workplace. such that the factory or workplace runs smoothly and entered utilization of the workplace. Various improved material handling, decreased cost, and improved are Automated Layout Design Provide Design Provide Content and the second sec improved material handling, decreased cost, and improved are Automated Layout Design Program heuristic tools for constructing and improving plant layouts are Automated Layout Design Program Allocation of Facilities Technique (CRAFT), Computer Allocation (CRAFT), Computer (CRAF heuristic tools for constructing and improving plant layout and the constructing (CRAFT), Computerized (ALDEP), Computerized Relative Allocation of Facilities Technique (CRAFT), Computerized (ALDEP), computerized Relative Allocation of the meta-heuristic approach (ALDEP), Computerized Relative Allocation of Factures (ALDEP), Computerized Relationship Layout Planning (CORELAP), etc. ALDEP is one of the meta-heuristic approaches that Relationship can be used for the construction of the new layout from the given relationship

between the departments desired. The purpose of this study is to understand the ALDEP methodology for the generation of optimal and manually there aren't enough layouts to find the t The purpose of this study is to understand the ALULE and the neuron of optimal and feasible layouts. When layouts are generated manually there aren't enough layouts to find the best one feasible layouts. When layouts are generated manually there aren't enough layouts to find the best one feasible layouts. When layouts are generated manually and use best one to fulfill the purpose. That's why a programming tool was considered to generate 'n' number of layouts in the state construction approach that was used is CODER and the state of the to fulfill the purpose. That's why a programming tool and approach that was used is CORELAP. The to find the optimal one amongst all. Another construction approach that was used is CORELAP. The to find the optimal one amongst an. Another concerns an improvement algorithm called CRAFT. The layout was created using this and optimized using an improvement algorithm called CRAFT. The distances were then measured with the help of AutoCAD for every layout (ALDEP, CORELAP, CRAFT) and compared to find the optimal layout amongst all.

#### Scope & Objective Of Study:

Problem Identification:

- The company is expanding its unit since its existing capacity cannot possibly supply the demand.
- > For this, they have provided us with the processing sequence and size of the departments using which we need to construct a facility layout.

#### **Objectives:**

- > To construct a plant layout using ALDEP.
- To construct a layout using ALDEP and understand the ALDEP methodology of generating layouts so that we can generate some of the possible layouts according to the relationship given and find the optimum layout.

#### Theory:

ALDEP:-

ALDEP stands for Automated Layout Design Program. It was developed by Seehof and Evans. It is

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## UGC Care Group I Journal

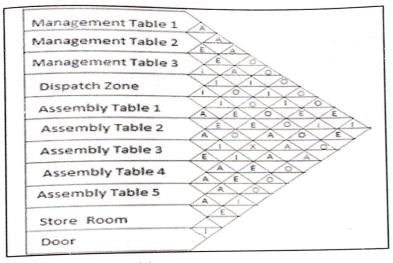
### Vol-84 No. 29, January – June: 2023

Vol-84 No. 29, January – June: 2023 a construction routine. ALDEP is a variation of CORELAP. Its objective is also to create a layout also a "high-ranking" departments close together. Determined there <sup>also</sup> "high-ranking dependences close together. But ALDEP has special characteristics of with mness, up to three floors capability, and departments (docks, elevators, aisles) that can be fixed. constituents departments close together. <sup>nn</sup>domness, up to ALDEP are length, width, and area of each floor; location and size of restricted area the input data of ALDEP are length, width, and area of each floor; location and size of restricted area The input data the scale of layout printout; the number of layouts to be generated; the number of for the scale department areas; relationship chert <sup>11</sup> each floor, the number of layouts to be generated; the number of layouts to be generated; the number of departments; departments; cleation procedure (sequence) of ALDED. departments, selection procedure (sequence) of ALDEP: avoul Selection select a department Randomly select a department.

- Randomic department with an important relationship with previous departments. If none, add an Add a partment randomly
- Adu a important department randomly.
- P Continue until all departments are added.

### CORELAP:-

CORELAP stands for Computerized Relationship Layout Planning. It was developed by Lee and CORELAP is the oldest and best the CORELAI 967.CORELAP is the oldest and best-known construction routine. Its objective is to create Moore in this "high-ranking" departments close together. It is a computerized version of Muther's a layout Planning (SLP). The a layout the start of the approximations used in the relationship diagram may be more systematic to then the exact cost approach a first start of the start of th Systematic than the exact cost approach of CRAFT and COFAD because of a lack of data. The appropriate than of CORELAP is that the densit appropriate of CORELAP is that the department will have a dispatch area and a receiving area on the assumption of Lougut nearest its neighbor. The assumption of its layout nearest its neighbor. The input data of CORELAP are a number of departments; side of the relationship chart; and weights for the relationship chart. The optional input data department areas; relationship chart; and weights for the relationship chart. The optional input data department of output printout; length to width ratio; and department pre-assignment (only along the periphery of the layout).



#### **Relationship Chart**

- > CORELAP uses the letter symbols A, E, I, O, U and X for the closeness relationship:
- A = Absolutely necessary
- > E = Especially important
- i = Important
- $\rightarrow$  0 = Ordinary closeness
- $\rightarrow$  U = Unimportant
- $\rightarrow$  X = Not desirable

The letter ratings are converted to their numerical equivalents (A = 6, E = 5, etc.). The weighted relationship values ( A = 35 = 243, E = 34 = 81, etc. ) are used for placing departments. Data Collection:

UGC Care Group I John January - June N UGU Caro Carologia Vol-84 No. 29, January June Vol-84 No. 20, January June Vol-84 No. Madhya Bharti -Humanities and Social (मध्य भारती) ISSN: 0974-0066 We were provided with the Muther's grid that shows the relationship between various department by the were provided with the Muther's grid that shows the relationship between various department by the were provided with the Muther's grid that shows the relationship between various department by the were provided with the Muther's grid that shows the relationship between various department we were provided with the Muther's grid that shows the relationship between various department by the were provided with the Muther's grid that shows the relationship between various department by the were provided with the Muther's grid that shows the relationship between various department by the were provided with the Muther's grid that shows the relationship between various department by the were provided with the Muther's grid that shows the relationship between various department by the were provided with the Muther's grid that shows the relationship between various department by the were provided with the Muther's grid that shows the relationship between various department given below:

Sr.no	Dep artment	Grids	Sq. meter area meter area
	Management Table 1	30	
A	Management Table 2	18	10.26
В	Management Table 2 Management Table 3	12	6.16
C D	Dispatch Zone (including area of dispatch table)	6	4.1 2.05
E	Assembly Table 1	18	6.16
F	Assembly Table 2	18	6.16
G	Assembly Table 3	18	6.16
H	Assembly Table 4	20	6.84
I	Assembly Table 5	18	6.16
J	Store Room	46	15.73
ĸ	Door	4	1.36

#### Area of Departments

Here, 1 grid= 0.342 sq mtr

#### **Methodology:**

ALDEP:-The method used to construct the layout of the production floor is ALDEP (Automated Layout Design The method used to construct the layout of the production algorithms for designing layouts. The Program). This method is one of many construction argonation argonargonati argonargonation argonation argonation argonati use of the ALDEP method is expected to make a bench layout property of the possible layouts of ALDEP were area of each department were provided by the company. Some of the possible layouts of ALDEP were area of each department. After that their relationship matrix and areas of each department. area of each department were provided by the company. Some experiment. After that their relationship created manually using relationship matrix and areas of each department. After that their relationship created manually using relationship highest relationship score was considered to be the source of the the the source of the the source of the the sour created manually using relationship matrix and areas of each operation of the user relationship score was calculated. The layout having highest relationship score was calculated. The layout having highest relationship score was considered to be the optimal

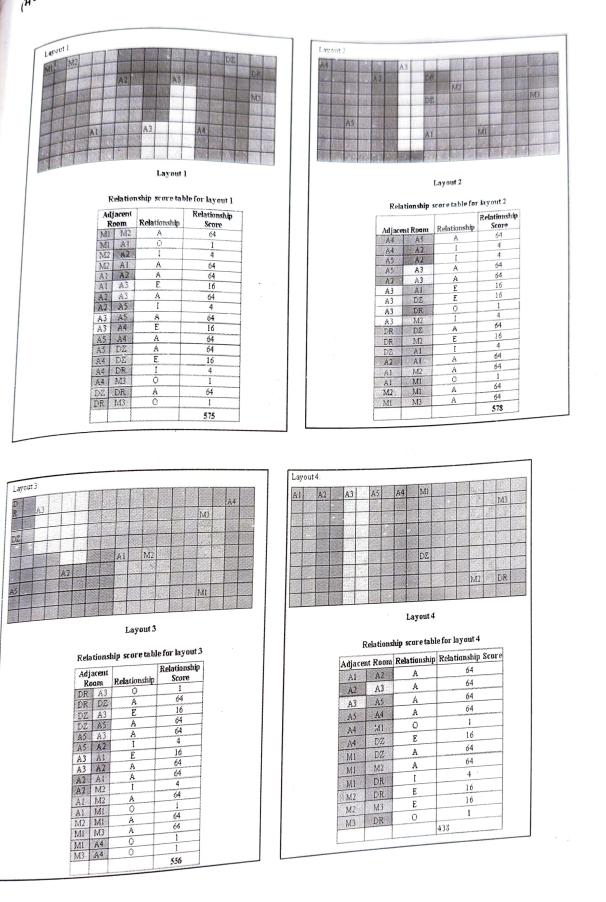
#### AUTOCAD:-

AUTOCAD:-After the construction of some of the possible layouts, optimal layout was made using AutoCAD. After the construction of some of the possible injoint, opening AutoCAD. Firstly, centroids of each department were found using the MASSPROP command and marked using interview that the centroid of each department was connected according the POINT command. After that, the centroid of each department was connected according to the processing sequence in the layout. The total distance was then calculated using the DIST command.

#### Layout Generation:

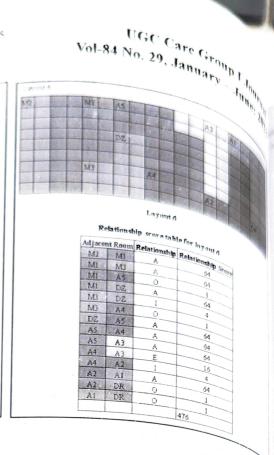
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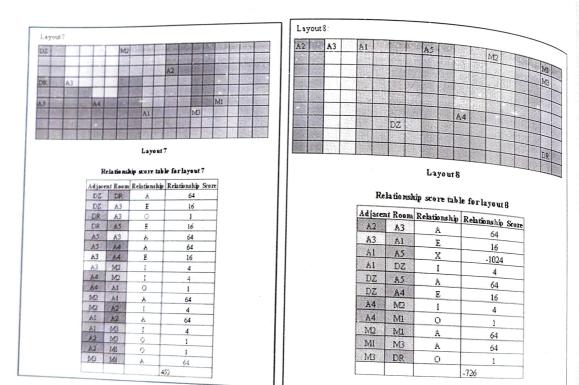
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R Layeer 5 Robutionship score table for layout S stimuchip Relationship S a Re 64 45 à 18 Ξ DE 2.8 64 DE M 64 M 3.51 AL 64 A 1.12 4 64 A AL 16 A3 64 23 DR MB A3 A3 DR M3 DR 0 426

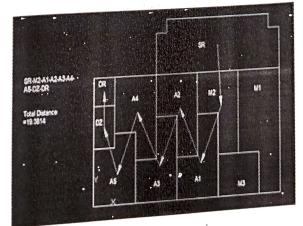




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		I	M1 20		65		A3		AI		MB	MI	+
				DR					Layout 10		vest 10		
- Internet		Layouts	,				. Re	la tio nsh	ip score table Relationship	Re		Score	
	Delations	hip score tal	le for layout 9				Adjacen DR	t Room DZ	A		64		
						100	10 m 1 m 1 m 1 m 1 m 1 m 1 m 1 m 1 m 1 m	A4	1		16		
		A	Relationship Score 64		· · · ·	I	DZ	A4	E	+-	64		
	A3 A5	1	4			I	DZ	AS	A	+	64		
	AS A2	I	4				AS	A4	A		64		
	<u>A2 A4</u>					2.2	AS	A3	E	t	16		
	<u>A4 A1</u>	0	1				· · · · · · · · · · · · · · · · · · ·	A3	е 1	1	4		
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	AI M2	Å	64					Ai	E	_	10	-	
	DZ M2	E	16	8 ja			A2	AI	A	_	4	_	
	DZ MI	A	<u>64</u>					MD	1	-	64	-	
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	51344	Å	64					MB	I		-16		
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	MB DR	0	11					Mi	A		6%		
	a contraction of the second		354										

The optimal layout is layout 10 with a score of **656**.

Autocar. The optimal layout of ALDEP was drawn in AutoCAD and the total distance of the processing sequence was calculated.



ALDEP Layout In Autocad

#### Madhya Bharti -Humanities and Social Sciences (मध्य भारती) ISSN: 0974-0066

and Social Sc 5	iences Vol-	UGC 84 No. 29,
	Centroids	]
Departments		
15	X: 1.2350 Y: 1.3325	
14	X: 2.4570 Y: 3.7440	
43	X: 3.7050 Y: 1.4625	
42	X: 4.8750 Y: 3.8025	
A1	X: 6.0450 Y: 1.4625	
M2	X: 7.2150 Y: 3.8025	
43	X: 8.1900 Y: 0.8775	
41	X: 9.4770 Y: 2.9835	-
	X: 7.0200 Y: 6.3968	-
DZ	X: 0.5850 Y: 3.2175	-
	X: 0.5850 Y: 4.6800	-

UGC Care Group 1 29, January Jun

. Inhe

#### Total distance: 19.3814

### Flow Chart: Man Type And Summary Table:

#### Summary Table:

		Distance
Activity	Summary	ALDEP
Operation	5	
Movement	8	19.3814
Inspection	2	
Delay	0	-
Storage	1	
Total	16	19.3814

#### Findings & Results:

Given below are the results obtained for various layouts: Algorithm and ITS optimal relationship score

•

Algorithm	Optimal Relationship
ALDEP	656

Algorithm and the total distance of processing sequence

Algorităm Di	istance (in meters)
ALDEP 19	9.3814

The layout 10 generated by ALDEP is considered to be the most optimal layout as the distance minimum i.e. 19.3814 meters when compared to others.

#### **Conclusion And Suggestion:**

In this project, the overall cost was reduced by reducing the travel distance, work flow, time, and cost. There was a significant rise in efficiency for the proposed layout as compared to the existing layout which was achieved by integrating the ALDEP software to determine an optimum layout with high closeness rating.

The problem of existing layout is the large comparative distance between several departments

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### UGC Care Group I Journal Vol-84 No. 29, January – June: 2023

ed to travel a long distance and impedes the ed layout, the position of various department	ie ie uit					Dist.(mm)
Activity					V	ALDEP
Collection of raw material from store room.						
a summent of man from store room to management 2		•				2.6016
tespection of material	aronan an					2 (167
a remember of man from management 2 to assembly 1		•				2.6162
scembling of PCBs at assembly 1 by man	•		C	Contraction of the Contraction o	111 B MARGINE STATISTICS	2.6162
stavement of man from assembly 1 to assembly 2		•	1999, ALERT P. 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999, 1999,			2.010
recombling of wires in the product by man	•					2.6162
Movement of man from assembly 2 to assembly 3		•				
Final assembly of product	٠					2.6005
Movement of man from assembly 3 to assembly 4		•				
The poction of timal product			٠			2.7489
Movement of man from assembly 4 to assembly 5		•				
parking of product	÷					2.1193
Movement of man from assembly 5 to dispatch zone		•			•	*
erange of Droglici	-	•		-		1,4625
Movement of man from dispatch zone to door		•		-		19,3814

Leads to higher cost. al a long distance

relationship chart and using the ALDEP software.

### Future Scope:

Programming like Python can be used to generate more layouts by ALDEP methodology. Programming the done using various and a generate more layouts by ALDEP methodology. Other methodologies like CRAFT and CORELAP can also be applied to existing layout to improve it. Other means a be done using various software like Simio, Simuls, FlexSim, etc. to further optimize Simulation construction of layout and finding the total distance of the processing sequence can also be the layout. Construction Viewel D done in Microsoft Excel using Visual Basic.

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#### UGC Care Group I Journal Vol-84 No. 29, January – June: 2023

(H) alk (N) UGC Care Group Fiber (H) forced to travel a long distance and impedes the smooth material flow and leads to higher cost  $(r_{part})$  solution of various departments is altered with various others based on activity

Sr.	Activity		1			Dist.(mm)
NO.			Real Property in	1000	1	ALDEP
	Collection of raw material from store room.	Constant of	Con the	Contraction of the second	-	
1	Movement of man from store room					
2	Inspection of material					2.6016
4	Movement of man from management 2 to assembly 1 Assembling of PCBs at assembly 1 by	and present and a share the basis cost of a static Relation				a
4	Assembling of PCBs at assembly 1 by man					2.6162
6	MayPillen of them non assemble i	•			in the second second second	
7	Assembling of wires in the product by man					2.6162
8	Movement of man from assembly 2 to an		Contraction in the second s			-
0						2.6162
10	Movement of man from assembly 3 to assembly 4	•				-
11			•			2.6005
12	Movement of man from assembly 4 to assembly 5		•			
13			•			2.7489
14	A farmant of man from an	•				
15			•			2.119
16	Movement of man from dispatch zone to door		<b>.</b>			
10	aspinen zone to door		•			1.46
	Total	······		l		19.35

relationship chart and using the ALDEP software.

### Future Scope:

Future Scor programming like Python can be used to generate more layouts by ALDEP methodology.

Other methodologies like CRAFT and CORELAP can also be applied to existing layout to improve it. Other methods be done using various software like Simio, Simula, FlexSim, etc. to further optimize the layout. Construction of layout and finding the total distance of the processing sequence can also be done in Microsoft Excel using Visual Basic. References:

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