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A Review on Implementation of Rank Positional Weight Technique in Balancing of Production Line in a Manufacturing Industry

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Abstract- Assembly line defines that manufacturing technique in which a product is carried with the aid of some form of mechanized conveyor among stations at which the diverse operations important to its assembly are finished. It is used to gather quickly large numbers of a uniform product. At first, Assembly line were evolved for a fee efficient mass manufacturing of standardized merchandise, designed to take advantage of an excessive specialization of labour. There are wide varieties of approaches through which assembly Line Balancing may be described. Various approaches of defining ALB are discussed in this segment. Assembly Line Balancing can be defined as assigning range of work factors to numerous workstations to be able to maximize Balancing performance (BE) or to reduce range of workstations (N) or to accomplish another given objective function for a given volume of output without violating the precedence relationship.

Keywords: Assembly line, manufacturing technique, balancing performance.

I. INTRODUCTION

Assembly involves the joining collectively of two or more separate parts to for mane entity (assembly or subassembly). [1] The processes used to accomplish the assembly of the components can be divided into three major categories.

1. Mechanical Fastening:
Mechanical action to hold components together. Threaded fasteners-screws, bolts, nuts etc. Rivets, crimping and other methods Press fits snap fits – temporary interface of the two parts C-ring. Sewing and stitching–for soft, thin material.

2. Joining Methods:
Welding, brazing and soldering.

3. Adhesive Bonding:
Thermoplastic, thermosetting (chemical reaction).

There are numerous methods utilized in industry to accomplish the assembly processes. Essential methods can be categorized:

1. Manual Single-Station Assembly:
- Consist of a single workplace to accomplish the product or some major subassembly of the product.
- Generally used on a product that is complex and produced in small quantities, one or more workers depending on the size of the product and the production rate. [2]
- Such as machine tools, industrial equipment, aircraft, ships and complex consumer products (appliances, car etc.)

2. Manual Assembly Lines:
- Consist of multiple work stations in which the assembly work is accomplished as the product (subassembly) is passed from station to station along the line.
- At each work station one or more human workers perform a portion of the total assembly work on the product, by adding one or more components to the existing subassembly.

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3. Automated Assembly System:
Use of automated methods at the work stations rather than human beings.

III. ASSEMBLYLINE

Assembly line defines that manufacturing technique in which a product is carried with the aid of some form of mechanized convey or among stations at which the diverse operations important to its assembly are finished. It is used to gather quickly large numbers of a uniform product. At first, Assembly line was evolved for a fee efficient mass manufacturing of standardized merchandise, designed to take advantage of an excessive specialization of labour and the related mastering effects [3].

Within the every other hand while we used assembly line balancing (ALB) this makes efficient flow-line systems available for low extent assembly-to-order production and allows contemporary manufacturing strategies like mass customization.

This in turn ensure that the via planning and implementation of assembly systems will continue to be of high sensible relevance within the future and additionally assembly line balancing trouble involves an assignment of diverse responsibilities to the workstations, whilst optimizing one or greater goals without violating regulations imposed on the line. In practice, it is frequently proper to easy out the workload assignments, and assigns related responsibilities to the same workstation if feasible [4].

IV. LINE BALANCING

Line balancing is a critical tool to decrease production time, maximizing the output or minimizing the cost of a product. In different phrase, line balancing is one of the critical component to the design stage for go with the flow-line manufacturing systems.

In line balancing the crucial statistics is the info of the process goes with the flow and the cycle time at each work station [13]. The classical line balancing problem consists of assigning each assignment to a computing device such that the numbers of workstations are minimized and precedence constraints are happy. The sum of time for all operations of this workstation must now not exceed the given cycle time. The distinction among the cycle time and computer time is known as idle time. The balance delay time can handiest be minimum if the number of work station is minimum. The dual troubles are minimization of the cycle time for a given variety of work stations.

Enhancing bottleneck workstation is the principle objective the line balancing tool. To reach the goal, the cycle time records at every work station want to be taken in making the evaluation. There are varieties of parameters that can be balanced on the work stations which might be balance through time, stability through work content, stability material, and stability by using inventory. Stability by using time is relating to the cycle time of the workstation.

In this time period one wants to utilize time study method for records series [14]. All of the time this is worried within the operation might be taken. After that a positive amount of allowance is given to the operation particularly for the operated work station.

The second parameter that can be balanced is the work content. A few workstations are balanced perfectly and should be left on my own. Work content material at others will need to be shifted around or taken out of its unique collection [15].

New approaches of operation can be created to make the road waft properly. Balancing by way of work content ought to make use of the understanding and revel in of operators and engineers.

Material is one the parameter that may be balanced. Example of this method can be cited the individual work elements, recognition to out sized elements that requires large work station.Although in the suitable environment, operators have to live of their workstations while not having to leave for any motive, it could be important to permit time for lifting components or a bit walking to retrieve them from boxes. Small bits of waste like these will stay within the operation for some time.

The final parameter that may be stability is inventory. While excessive stock is waste, having a few inventories can assist in line balancing. To stability by stock, the brand new design of the gap a work

station to allow an operator to work on multiple units. [16]

Line balancing may be carried out in two techniques, conventional and simulation. Inside the conventional approach it'll involve a few algorithms to outline the problem. In the cutting-edge world, simulation is used to define the issues and mechanically clear up the trouble with the line balancing. Even though there are different techniques in line balancing device however each of this method calls for the identical statistics collection method.

Line balancing operates under conditions:

1. Priority Constraint:

Products can't pass to different stations if it does not fulfill required mission at that station. It should not pass stations due to the fact certain duties want to be executed earlier than others in line with the set sequence.

2. Cycle time Restriction:

Cycle time is maximum time for products spend in every workstation. Different work station has different cycle time.

V. LITERATURE SURVEY

Joyal George Mathew and Biju Augustine. P (2017) minimized workloads and people at the assembly line at the same time as assembly a required output. The production charge is relying on how nicely the line is working. A new layout will be proposed to make the assembly line acquire its required manufacturing rate. The work includes evaluation of present production line for identifying the resources of waste in differentiating price brought time and non-cost brought time. Line balancing was achieved to minimize the idle time and enhance cycle efficiency via reducing the range of work stations [1].

Mahmud Parvez et al (2017) focused on improving overall efficiency of single model assembly line by means of lowering the bottleneck activities, cycle time and distribution of work load at every work station by means of line balancing; using line balancing strategies specifically work sharing technique. The method adopted includes calculation of cycle time of procedure, identifying bottleneck activities, calculating overall work load on station and distribution of work load the use of code block (C++) software on each computer also remodeling the format by means of line balancing, if you want to enhance the efficiency offline and increase overall productivity [2].

Pratik Anil kumar Dudhedia et al (2017) founded productivity is immediately effects on cost and growth of an organization so, productivity development is very vital for any employer to acquire organizational goal. In industries all through production many issues occur like breakdown of production line, slow rate of manufacturing, improper managing of material, intellectual fatigue of employees, and many others.

So, reduce or elimination of all above issues booms the manufacturing charge as well as increase in income. By way of identifying the problems they may be resolve via time look at, method observe and work study [3].

Prabhuling Umarani & Keshav Valase (2017) focused specially on line balancing and layout work. The aim of assembly line stability in stitching lines is to assign obligations to the workstations, in order that the machines of the computing device can carry out the assigned obligations with a balanced loading. The primary goal of line balancing is to distribute the assignment over the every work station so that idle time of labour work can be minimized.

Line balancing problem at grouping the resources or labour in an efficient and best pattern if you want to attain a premier or proper balance of the resources and flows of the production or assembly strategies. Assembly Line Balancing (ALB) is the term typically used to refer to the selection system of assigning responsibilities to workstations in a chain manner to manufacturing machine [4].

Mohd Salman Khan & Saurabh Jha P (2017) studied assembly line balancing is one of the important problem as a long way as a production plant is taken into consideration. The plant productiveness entirely relies upon in this parameter and for this reason balancing and figuring out the idle time in a manufacturing waft becomes very mandatory. A production line of a high deck body is taken into consideration for this research work and time study is performed for you to decide the usual time for each manner.

Then, rank positional weighted method (RPW) is

evaluated with the help of standardized statistics to solve the assembly line problem and defines the road performance which provides a higher productiveness inside the existing flow line by way of lowering the idle time [5].

Sudharsan Sridhar et al (2017) approached a Shaft production enterprise in Coimbatore, India, and proposed an answer in growing the production of Shaft by the approach of line balancing. In this work, we speak fixing the line balancing problem in two exceptional platforms; the primary, by using rearranging the present duties over the workstations, and the second one, through the usage of Timer pro professional software program whilst grouping similar types of sports to find out the most optimized productivity.

The results obtained have been optimistic and profitable to the corporation. They had been capable of increase production of Shafts by using 4628 Shafts with the aid of rearranging, and55, 770 Shafts by way of the use of the Timer professional software program. This idea indicates the employer ought to trade its model line of operations for better productiveness and profitability [6].

W. Grzechca (2016) approached for layout of assembly line for modular merchandise is proposed. Assembly line layout of the subassembly line for basic operations can be viewed as a single model product assembly line balancing problem and be solved by way of existing line balancing strategies. The subassembly line for the variation operations is designed as a flow line structure and is sequenced with Johnson's algorithm for 2 machines case and heuristic methods for M machines case. A very last end result of responsibilities assigning to the complex manufacturing structure is given and a first-class of final solutions is mentioned [7].

Katkuri Srikanth and Basawaraj. S. Hasu (2016) targeted on enhancing ordinary performance of single version assembly line by using decreasing the, cycle time and distribution of labour load at each work station through line balancing. The method followed consists of calculation of cycle time of process, calculating total work load on station and distribution of labour load on every computer by using line balancing, in order to improve the performance of line. This associated line is studied by time look at strategies.

The time is taken via stop watch. The guide calculation also covered in particular in line balancing algorithm. In his work a problem of line balancing for engine manufacturing has been discussed the use of ranked role weighted approach [8].

Gourav Kumar and Praveena Gowda (2016) considered the manufacturing procedure of a product wherein manufacturing is specified in terms of a sequence of duties that need to be assigned to workstations. Each venture takes a known variety of time devices to finish.

Additionally, priority constraints exist amongst obligations: each project may be assigned to station easily in any case its predecessors have been assigned to stations. The assembly line balancing trouble arises and has to be solved when an assembly line has to be configured or redesigned.

It consists of dispensing the total work load for manufacturing any unit of the product to be assembled a few of the workstations alongside the line. On this paper Rank positional weight approach is used to arrive to a possible solution for a batch manufacturing unit to increase the production price to 24 machines in line with day. Further using the equal algorithm, better answers also are proposed by using decreasing the cycle time and variety of labour stations [9].

Chirag K. Deotare & Uday A. Dabade (2015) focused directly to reduce the bottleneck areas with the aid of making use of necessary techniques. It is observed that foremost areas wherein bottleneck occurs are, head sub-assembly work station, tappet line and hot checking out of the engines.

Engine head subassembly is semiautomatic intake and exhaust key installation station. In which keys are used for locking the spring with retainer in it. There are machines one by one working on petrol engine head and diesel engine head. FTQ (first time high-quality) for diesel engine become 60% to 70% and for petrol engine it became zero%. We layout and changed manually operated tool for the device which progressed FTQ a hundred% for petrol engines. For development in hot trying out place line balancing is necessary, method leveling the work load across all approaches in a cellular or cost circulation to put off bottlenecks and excess ability.

We found out numerous NVA (non-value introduced) activities and with the assist of pare to principle we taken care of our most likely causes i.e. traffic problems of cart, undesirable movement sand managing work and so on. Via applying those all strategies the productiveness is improved from 210 to 233 i.e. 9.8% enhancements in engine assembly line [10].

Amith J Prakash and Aneesh K S (2015) targeted on productivity development of a tiller assembly line by way of the usage of operational evaluation and assembly line balancing. The prevailing preferred time within the assembly line is simply too antique and erroneous. An offer of recent well known time has been given to reduce the ineffective time.

A heuristic technique known as Ranked Positional Weighted technique is used for assembly line balancing. After the analysis of the existing time required for every duties non price introduced time, value added time and manufacturing time has been determined the use of prevent watch time observe. Micro motion look at is accomplished to find the ineffective time in every operation [11].

VI. SUMMARY OF LITERATURE SURVEY

From there view of literatures it is found that Assembly line balancing can be used almost all types of industries.

From the literature survey following points is needs to be discussed:

- Experiments in line balancing show that optimal solutions for small and medium-sized problem are possible in acceptable time.
- A new improvement in priority rule is discussed which shows that production cost is the result of both production time and cost rates.
- Numerical experiments on a newly developed heuristic algorithm i.e. variance algorithm shows better solution with more calculations ahead.
- New cost reduction techniques are developed which focus precedence, conjoining tasks and increasing operation times; combined algorithms are tested for both solution quality and optimality verification, as well as to its computational efficiency.
- A different mathematical model that combines multiple models into a single one by adding up operation times and that suggested minimizing the maximum sub cycle time.
- Experimental results of algorithm integrated with the Hoffmann heuristic shows the proposed procedure are more efficient.
- The single-model U-type assembly line balancing problem is solved by ant colony algorithms and showed very competitive performance.
- The generic algorithm mathematical model based on the assembly line balancing technology is adopted and results of real cases show that quickly and effectively than normal mathematical model.

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