PROCESS DESIGN FOR PRODUCTIVITY IMPROVEMENT WITH AUTOMATION

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Abstract: Manufacturing companies in industrialized countries are facing the challenge of achieving shorter times-to-market for their products while also coping with higher and more frequent initial planning efforts for customer specific products. Computerized process arranging is suited to break up this contention by decreasing manual arranging endeavors and improving arranging profitability. A gathering, handling, arranging, framework lessening the human mediation and computational exertion is examined. This paper is presents with "Process design for productivity improvement with automation" which studies efficient and effective use of ideal time to improve productivity and automation.

Index Terms – Process design, Process planning, Productivity, Automation.

I INTRODUCTION

Ensuring a competitive time-to-market for product development and time-to-customer for order fulfillment respectively are important requirements for manufacturing companies. These challenges are especially valid for individual and small batch production. Decreasing product lifecycles as well as the development towards customer individual product variants lead to an increase in planning efforts per unit produced and the necessity to rationalize planning activities. In addition to planning efficiency, the use of process sheets as a crucial document for production control activities, poses quality requirements on the planning process that are often not met in reality. The use of incorrect enterprise resource planning (ERP) master data and disregard of product and/or process changes can lead to the use of incorrect process sheets. Implicit planning knowledge of domain experts furthermore can lead to non-standardized, inconsistent planning processes and results. In order to further improve process planning efficiency, it is necessary to automate the externalization of process planning knowledge.

II LITERATURE SURVEY

The Robotic equipment has found great application to a broad range of automatic assembly systems, specifically in the assembly lines of automotive industry, electronics, rubber/plastics and metal/machinery industrial sectors. The robots' intrinsic characteristics, such as high accuracy, speed, repeatability, strength and reliability, have enabled production firms to invest in large scale installations that can work around the clock with minimal human intervention. Nevertheless, technological limitations impose the contribution of human operators on the process, by providing support to the system [1].

In the automotive industry, the typical structure of an assembly plant involves four stages: stamping, body shop, paint and final assembly (FA). The majority of assembly operations take place in the body shop and FA. High levels of automation are typically introduced during the assembly of the body in white (BIW), while hybrid human/machine systems are found at the FA stage. In general, four approaches could be distinguished in the design of an assembly system: (1) manual assembly, (2) flexible assembly, (3) semi-automated assembly and (4) fixed assembly. These assembly principles and the respective assembly system performances, in terms of production volumes, number of variants, batch sizes and flexibility, are presented in Fig. 1 [2]

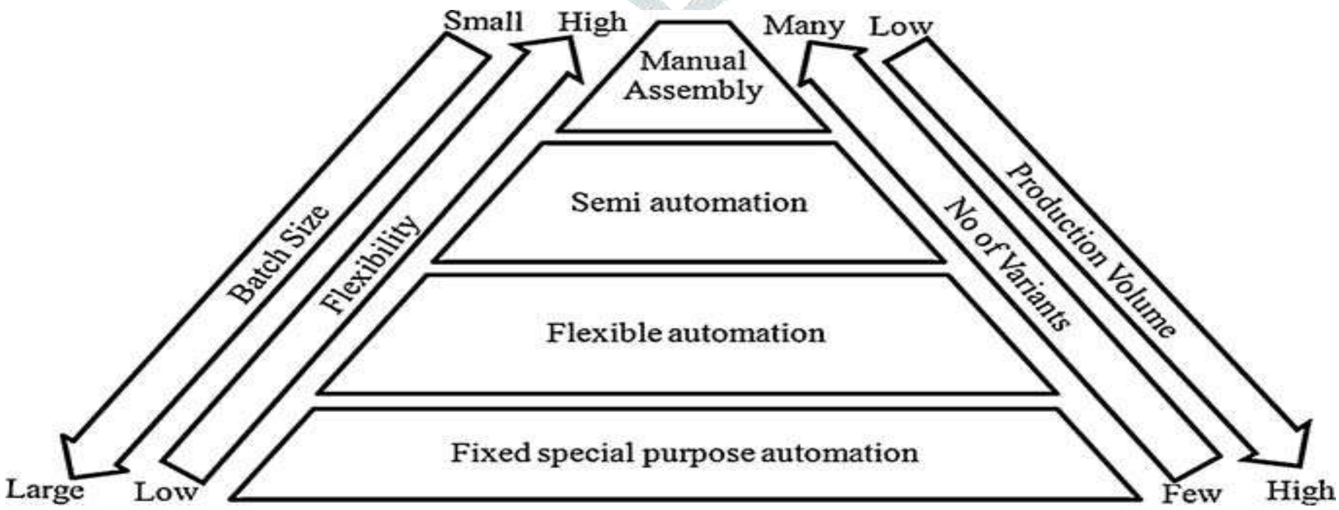

Fig.1. Performance characteristics of assembly systems following different assembly principles.

Knowledge-based engineering (KBE) technology provides the capability to:

- Automated processes in a product development lifecycle, leading to a reduction in time and cost.
- ensure consistent quality of outputs from an engineering process

- verify designs against standards
- capture engineering knowledge for later reuse
- Retain knowledge of domain experts. [3]

III PROBLEM DEFINITION

Process required for assembly of load body of heavy vehicle is too slow with manual assembly line. Depend upon manufacturing engineer's experience and knowledge of production facilities, equipment and their capabilities, processes and tooling, this method is time consuming and may not to be consistence and optimum.

IV OBJECTIVES

1) To reduce time required for assembly of load body.
2) To improve productivity as well as quality.
3) To replace labours with automation.
4) Minimizing cost without affecting the above factors.

V ASSEMBLY LINE

The layout of the old and the new assembly line is drawn in the form of block diagram. The productivity of the both assembly line were observed for assembling the one unit. The modified assembly line we found very effective as compared to old assembly line. It can be observed from the block diagram that in old assembly line we have less number of robots to complete the assembly as compared to new assembly line. The addition benefit of the new assembly line is, its having automated inspection robot only MIG welding stage we found manual in new assembly line.

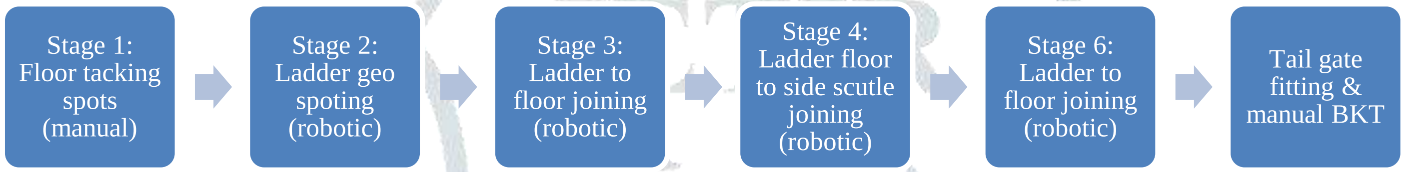

Fig. 2: Block diagram of old assembly line

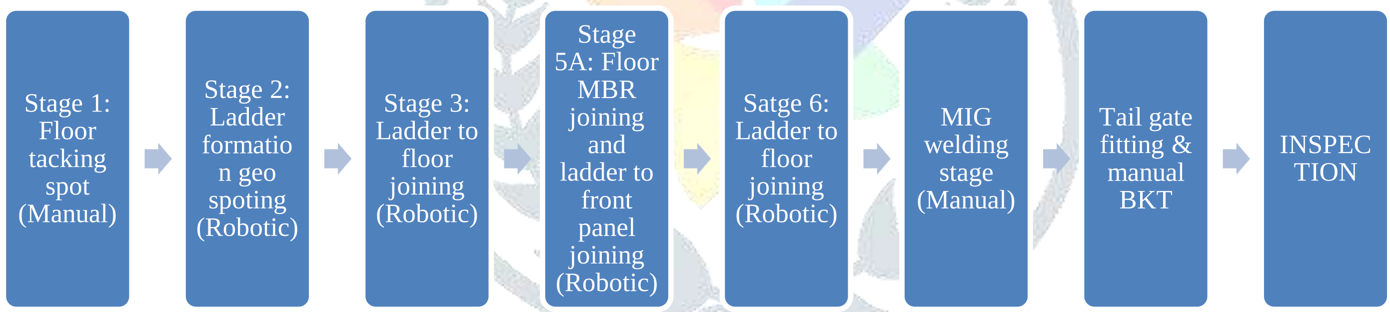

Fig. 3: Block diagram of new assembly line

The comparison is done in between old & new assembly line to find out the efficiency of the both assembly line the parameters considering for the comparison are
(1) Cycle Time.
(2) Shift Schedule

Robotic cell no.	**Stage name**	**Cycle time**						**Total cycle time**
		Slider/ turn table	**Ganrty pick & place**	**Tip dressing time (secs)**	**Spot time (secs)**	**Loading/ unloading time**	**Cycle time**	
M1	Stage 1: Floor tacking spots	55	0		260	60	320	320
CELL 01	Stage 2: Ladder geo spoting	57	30	20	176	110	233	470
	Stage 3: Ladder to floor	39	60	20	197	150	236	

	joining							
CELL 03	Stage 4: Ladder floor to side scutle joining	57	60	20	406	150	463	510
CELL 04	Stage 6: Ladder to floor joining	57	60	20	422	150	479	514
	Tail gate fitting & manual BKT	0	0		0	60	60	

Table no. 1: Time cycle for old assembly line

Robotic cell no.	**Stage name**	**Cycle time**						**Total cycle time**
		Slider/ turn table	**Ganrty pick & place**	**Tip dressing time (secs)**	**Spot time (secs)**	**Loading/ unloading time**	**Cycle time**	
M1 & 2	Stage 1: Floor tacking spots	0	0	0	238	60	238	
CELL 01	Stage 2: Ladder formation & geo spoting	80	120	40	702	220	818	458
CELL 02	Stage 3: Ladder to floor joining	0	120	40	777	80	1001	502
CELL 04	Stage 5A: Floor MBR joining & Stage 5B: Ladder to front panel joining	120	180	60	1185	450	1359	516
CELL 05	Stage 06: Ladder to floor joining	80	120	40	728	300	844	484
	MIG welding stage	0				60	60	
	Tail gate fitting & manual BKT	0				60	60	
	Inspection stage	0				60	60	

Table no. 2: Time cycle for new assembly line

VI RESULT AND DISCUSSION

SHIFT SCHEDULE					
NO. OF SHIFT	**TOTAL SHIFT TIME (MINS)**	**LUNCH/DINNER,TEA TIME**	**ACTUAL WOKING TIME(MINS)**	**EFFECTIVE TIME(MINS)**	**PRODUCTION PER SHIFT**
1st shift	510	60	450	378	43
2nd shift	510	60	450	378	43
3rd shift	420	30	390	327	24
TOTAL			1290	1083	110
EFFECTIVE TIME(SEC)				64980	
EFFICIENCY		84%	TACT TIME(SEC)	590.72	591
PRODUCTION PER SHIFT 110 NO.S					

TABLE 3: PRODUCTION PER SHIFT 110nos.

SHIFT SCHEDULE					
NO. OF SHIFT	**TOTAL SHIFT TIME (MINS)**	**LUNCH/DINNER,TEA TIME & PREVENTIVE MAINTAINANCE**	**ACTUAL WOKING TIME(MINS)**	**EFFECTIVE TIME(MINS)**	**PRODUCTION PER SHIFT**
1st shift	510	60	450	405	47.1
2nd shift	510	60	450	405	47.1
3rd shift	420	30	390	351	40.8
TOTAL			1290	1161	135
EFFECTIVE TIME(SEC)				69660	
EFFICIENCY		90%	TACT TIME(SEC)	516.00	516
PRODUCTION PER DAY 135 NO.S					

TABLE 4: PRODUCTION PER SHIFT 135nos.

VII CONCLUSION

For we have successfully reduced the cycle time by 74 sec and has achieved semi-automation as well as increased productivity of load body of heavy vehicle by 25 nos & efficiency increased by 6%.

VIII FUTURE SCOPE

1) Flexibility and adaptability assessment capabilities in order to account for them in the decision making process and further improve the plant's responsiveness.

2) Synergy-collaboration between humans and robots in order for the benefits deriving from the human workers (decision making and intuition) to be combined with those from robots (speed, strength and accuracy).
3) Implementation of advanced joining technologies offering improved quality, productivity and safety.

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