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Parameters Affecting Automation Engineering Efficiency

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Abstract: Automatic mounting systems are equipped to carry out mounting operations in a set series to mount items. Four common forms of device and operating preparation challenges include: availability of equipment at workstations; single station device; integrated multi-station systems and partial automation. This paper reflects on the integrated multi-station framework used for the running efficiency of assembly operations. Normal mathematical procedures were modeled and tested using real-life industrial data for the production of high-tech goods. Sensitivity analysis is performed to determine the influence on device efficiency of process parameters. A contrast of these functions allowed users to define critical device process parameters. The outcomes relevant parameters have been found to be the most responsive in the automated method followed by cost and cycle time.
Keywords: Automated systems; high-tech assembly; output review. Operation yield.

I. INTRODUCTION

Continued research on study and design of production processes has been inspired by growing demands for efficiency, efficient distribution of capital and reducing costs. In today's automotive sector, assembly processes are a critical aspect of integrated systems.

An automation machine executes an automated assembly sequence to integrate many components into one individual. This single unit is a fundamental element that is connected to other elements. In each workstation, the elements are connected one by one and the assembly is completed gradually.

In-line assembly machine, dial-type assembly machine, carousel assembly device or single-station assembly machine may be categorized accordingly. There are four critical forms of organizational scheduling problems in automatic assembly: placement of parts in workstations; the single-station system; integrated multi-station systems; and partial automation. The thesis focuses on an automated device that is used for the operational output analysis of the assembly operations in multi-station (in series or in cells formed).

Automated lines consist usually of many workstations with unpredictable and definite operations (stochastic / probability), damaged workstation components (parts that interrupt a workstation or the entire production line), faulty operations (upstream or downstream fault), repair times (downtime restarting time) and repair (fast fixing is often required on-site). This calls for accelerated resource reprogramming, willingness to track output behavior and availability. A variety of strategies to examine the actions of the mechanism have been developed. In this area, analytical methods have been widely used to solve the traditional issue of the experiment using inductive mathematical analysis. The mathematical procedures are structured to evaluate the method. The same methodology is followed.

A. Purpose/Problem Description

The desire to achieve more with less capital and better output is intensified by the global rivalry. TPPS also acknowledges these growing pressures on businesses. As a global leader in the processing field, the TPPS recognizes the significance that its leadership status is continually enhanced and reinforced. TPPS seeks to increase its performance in automation programmes, aiming to gain productivity and recognizing the value of becoming more efficient. By reflecting on mission operations and external and internal performance factors, insights may be made about how to change. Mapping these areas of changes would enable TPPS broaden its leadership role and further give its customers value. This research paper explores innovation efficacy in the field of automation and offers observations and places for change as to where and how TPPS will boost its performance and better position itself for tomorrow 's global challenges.

B. Objectives & Goals

The goal of this analysis is to propose changes to the efficacy of TPPS. In addition, usage of literature to decide which places TPPS may enhance and identify parameters that influence the efficiency of automation engineering. The study's main purpose is defined and the following issues need to be addressed in order to determine the main target.

Performance effect metrics for programmes in automation.

1) Does the interpretation of the criteria that influence the position of the person vary?
2) To mitigate the impact of reduced efficacy of parameters, use the LEAN, CMMI, and TQM.
3) Check whether literature utility concepts can be transmitted to GP maturity ventures in the case of PMMM.
4) Test results from a benchmarking report on productivity in GP automation programmes

C. Delimitations

This research focuses on the criteria that control the performance of automation technologies. In the light of their business effects and direct or indirect business effect, actions would be analyzed. The evaluation would be focused on the evaluations are centered on the use of the criteria in the research. The project carried out at GP is of various forms. Some of the schemes are considered Greenfield ventures, where plants are built from scratch in the sense of up-to - date Brownfield and Revamping schemes. All three of these theses are addressed. The automation component is a subproject during the construction of a factory. Examples of such subprojects include process design and electrical design. However, the analysis is carried out from an automation viewpoint as this research paper focuses on parameter that affects the efficiency of automation engineering. This research would concentrate on three separate phases of the project: Definition of Features, Architecture, and Large. Three phases will include: In the sense of this paper, the conditions concerning phases such as commissioning are not mentioned.

D. Deliverables

This research has been written in conjunction with TPPS and some deliverables are also required. The findings are to be the foundation for the analysis conclusion but are also to form a reference point for the way GP and the author will settle about whether the question of preference has been effectively pursued:

1) Overview of lessons gained, Repeatability and performance review. And how well they report the performance parameters.
2) A project performance appraisal process.
3) Assumptions about the efficiency-affecting criteria.
4) Overview of the interviews highlighting the most important efficiency-reducing challenges. Improvement recommendations obtained during interviews.
5) Recommendations for reducing the influence of efficacy metrics on performance.
6) Thoughts and recommendations about how GP can be more effective, not only by utilizing guidelines, but also by incorporating ideas and procedures in the literature.
7) The findings in the form of a study would be issued.
8) Observations and results on TPPS and LTH will be discussed.

The aim is to provide Tetra Pak, to provide a research report on project effectiveness and to finalize the education of the writers in electrical engineering when their projects are complete.

II. RESEARCH METHODOLOGY

Höst, Regnell and Runesson (2006) claim that the approach for a study is the option of modus operandi and does not define them in depth, but that it describes the path from the ultimate aim to an improved understanding of the topic. Denscombe (2009) states that pragmatic decisions must be created, yet there is no ideal process, and each decision has its difficulty and advantages. It is just a case of picking those that provide the most value for the subject of preference. The first is to know what not to do, secondly, to recognize your decisions and eventually the value of common information. Bryman (2009) notes that one should concentrate on three aspects. Both these concepts provide various viewpoints on the research approach; to simplify it can suggest that the option of technique determines the direction to take and what paths to avoid.

Typically, the sample technique concentrates on a study field's breadth rather than range. The analysis contains both data collection methods and a lengthy and systematic report (Denscombe, 2009). On the other side, Bryman (2009) rejects the word survey and uses the phrase "cross-sectional research," which suggests that surveys are sometimes mistaken as collecting data through questionnaires. The cross-sectional analysis is described by Bryman as the compilation of data from more than one case (sometimes far more than one), at a certain point in time, with the aim of generating a set of quantification and qualitative data relating to two or more variables (often often more than two) that are analyzed for the identification of models concerning various relation forms.

Where and how data is accessible and even the general purpose of the analysis depends on the test nature of the experiment. In addition to Denscombe (2009), Höst et al. (2006) identifies it as the "purpose and aim of the analysis," and explains it as the process of gathering and constructing scientific evidence. It is described by Bryman (2009) as the technique for data collection. The writers

have the same opinion of what studies are available. In practice, observational data are obtained through archive information, interviews, findings and analyses. It is a common way to evaluate phenomena, especially when it is hard to differentiate between its context and its atmosphere (Yin 1994 in Höst et al. 2006).
Action analysis has four characteristics: it is functional, it happens through a transition, it is a cyclical operation, and the investigator engages in the operation. The scientist helps in the project and generates evidence and tracks the effects of the improvements made. Höst et al (2006) suggests that the approach to action analysis is a way to change and to track the effects of the transition. Somekh (see Denscombe, 1995) suggests that action-related analysis is the combination between study processes and intervention systems, such that action is taken and the consequences between improvements are studied. Denscombe (2009) notes that the researchers' involvement in the method is the most defining feature in the intervention study.

III. LITERATURE REVIEW:

A. Overview of The Mechanism And Mathematical Model

The motions of the components by many cells are modelled as the device flows as an entity (part). The incoming components enter the device, remain at the queue until the services are accessible and are interrupted by the respective step loading period. The quick reworking period is further postponed (if necessary) and rework is reviewed. If swift reworking at the respective stage is not necessary, it will proceed to the next station according to the product form. After all services operations are done, the components leave the structures as 'healthy bits' if no rework is needed. With its related probability there are three incidents of concern, i.e. the part launched on the base plate is faulty or the station's jam. In this case the fraction defect probability of station (Dri) pieces are determined by the chance that the station jams (jmi) with a fault. The second case contains the faulty portion which is not likely to trigger station jams of (1-jmi) Dri, which case three includes components that do not have defective parts comparable to (1- Dri). The variables of interest in the above-mentioned scenarios therefore reflect the fraction defect ratios (Dri) and defects which cause the station to jam (jmi) and production line downtime.
These variables (but not limited to) are significant in their responses: output speeds, performance-related parameters, productivity and cost per unit. The following flow map describes the rationale of the model and component flow data seen in figure 1. The machine routines that control the processes are modelled in certain scope software while evaluating the output of an automated assembly machine.

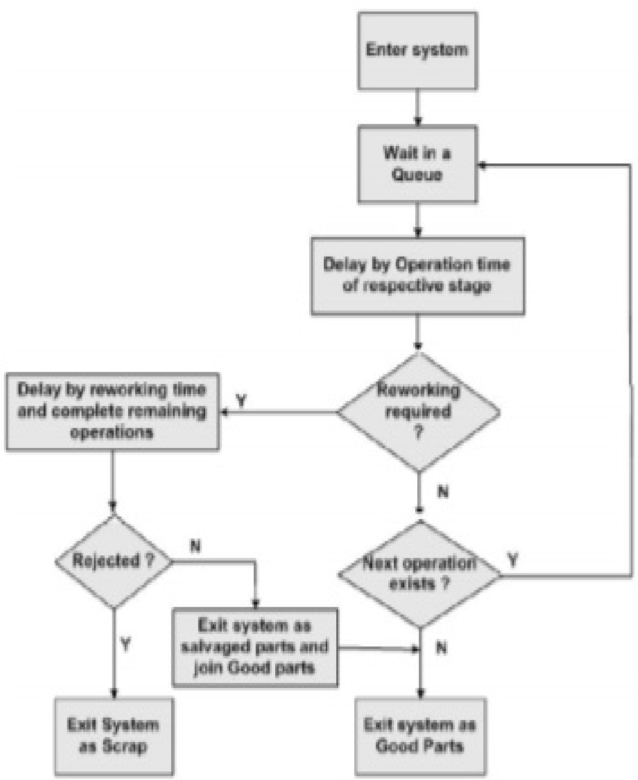

Figure 1: Details regarding the distribution of components in the device

The lists of abbreviations used are given below:
Abbreviations
1) Dri = Fraction defect rate
2) jmi = Defect that cause the station to jam
3) Pyp = Proportion of good assemblies or yield
4) PDp = Proportion of assemblies containing at least one defective component
5) Fd = Frequency of downtime occurrence per cycle
6) Tpt = Average actual production time
7) Tcyc = Ideal cycle time
8) Tavd = Average downtime per occurrence
9) Rpt = Production rate Theoretical
10) Rap= Production rate of acceptable products (units/min)
11) Eup = Efficiency of the Up-time Production line
12) Casy = Operating cost of the assembly system
13) Cmt = Cost of materials
14) Ctl = Cost of tooling
15) Cpg = Cost per good assembly L
16) Eff = Line Efficiency
17) Dper = Percentage of time assembly line is down for repair

The likelihood for the three potential events is equivalent for n workstation mounting unit, as stated in the paragraph above.

$$\prod_{i=1}^{n}\left[jm_i Dr_i + (1-jm_i)Dr_i + (1-Dr_i)\right] = 1 \quad (1)$$

Pyp is the proportion of the appropriate product which leaves the line, and the term is probable that a faulty part will not be included in station i (2).

$$P_{yp} = \prod_{i=1}^{n}(1 - Dr_i + jm_i Dr_i) \quad (2)$$

In this situation as Pip reflects the proportion of healthy components, so at least one faulty PDp part comprises the proportion of assemblies.

$$P_{Dp} = 1 - P_{yp} = 1 - \prod_{i=1}^{n}(1 - Dr_i + jm_i Dr_i) \quad (3)$$

The Pyp yield is one of the essential assembly machine efficiency parameters. A major drawback in machines output shall take into account the proportion in assemblies possessing one or more faulty components PDp. If any station jam contributes to system inaction, Fd can be calculated by taking the amount of station jams predicted per loop.

$$F_d = \sum_{i=1}^{n} p_i = \sum_{i=1}^{n} jm_i Dr_i \quad (4)$$

The total average output time is estimated per assembly.

$$T_{p_t} = T_{cyc} + \sum_{i=1}^{n} jm_i Dr_i T_{avd} \quad (5)$$

The Tcyc is the optimal assembly machine period, including indexing or transition time. The time for completion of the computer is the maximum. The output rate is equal with the total real processing time;

$$R_{pt} = \frac{1}{T_{pt}} \quad (6)$$

In order to provide quantities of a suitable product which do not include defects, the output rate should be changed. This is essentially the yield pip multiplied by Rpt:

$$R_{pt} = P_{yp} R_{pt} = \frac{P_{yp}}{T_{pt}} = \frac{\prod_{i=1}^{n}(1 - Dr_i + jm_i Dr_i)}{T_{p_t}} \quad (7)$$

The line productivity is measured as the association between the optimal cycle period and the average output period.

$$E_{up} = \frac{R_{pt}}{R_c} = \frac{T_{cyc}}{T_{p_t}} \quad (8)$$

Where Tpt is computed from Equation 5 and the inaccessibility function is:

$$D_{Per} = 1 - E_{up} \quad (9)$$

The prices per manufactured unit may take into consideration the efficiency of the production.

$$C_{pg} = \frac{C_{m_t} + C_{asy} T_{p_t} + C_{tl}}{P_{yp}} \quad (10)$$

Other than above, some researchers established modeling methods based on queue specialization in order to classify the output of the production line. As was the case with the literature assembly queuing systems [5] were explored in which a fork-joint queue in an open framework was tested. Rao and Suri [6] and Krishnamurti et al [7] consider a fork joint queue as well, and then the device is locked. The Gold [8] upstream and downstream market viewpoint is viewed for an appropriate overview of an assembly structures and a suggestion has been made for research for the simulation and application strategy [9, 10]. However, no comparison takes into consideration general inter arrival and assembly periods, and some of them look only at two-part assembly systems. The next segment discusses the assembly system's model comport ability study and the findings and assumptions.

B. Project Comportment and Review

Designing of experiments essentially involves selection of performance measures, factors that would have to be varied, and the levels of each of these factors that we want to investigate. The performance indicators related to the automated assembly lines are cost, quality and throughput as discussed with the company's management. It was decided that by using the routines and modeling the real world system according to the existing scenario (it is for this reason that subscript (i) is used for generic assembly system in the mathematical routines as given above). It is followed by carrying out sensitivity analysis to identify the most important input parameter affecting the system. The parameters of interest are defect rate, station jamming when malfunction occurs, and cycle time and down time percentage. The in-depth study and discussion it comes out that, the company's operations and scheduling was affected by these parameters and a large number of back locks occurred. To cope with this situation, series of experiments with existing base case have been designed. The base value which company currently operating is explained in subsequent paragraph. There were a series of eight stations arranged in series in the form of cell to assembly an electronic part used in automatic product. The station cycle time was 12 seconds and the parts were added in each station with an average defect rate of 0.01 and it was recorded that the station jamming time for all of the stations observed was 0.5.

Whenever, there is a jam due to malfunctioning parts, the line stops and causes station to jam and the average downtime is 2.5 min. The cost of operating the assembly machine is approximately Rs. 3500 per hour (this included cost of all of the resources engaged for the assembling of the part i.e. components added to the base part). It is required to analyze the system with the input parameters as mentioned in the previous section and the output responses important for the company. Yield of the parts, percentage of good parts in terms of production rate, the efficiency of the line and cost per part are the responses declared important. The effects of various parameters are shown in figure 2 (as a sample, all graphs cannot be shown because of lack of space). The list of experiments with their base values used is given in following table:

Experiment Type (Sample)	Base Value
Effect of changing the average fraction defect rate	0.2 to 0.5 min with a step size of 0.01
Effect of changing the Prob of jamming of the station	0.1 to 0.35 with a step size of 0.1
Effect of changing the cycle time	0.1 min to 1.05 min with a step size of 0.5
Effect of changing the down time of the station	2.5 to 5 min with a step size of 0.1

Table 1 : Examination of Adaptation (base values).

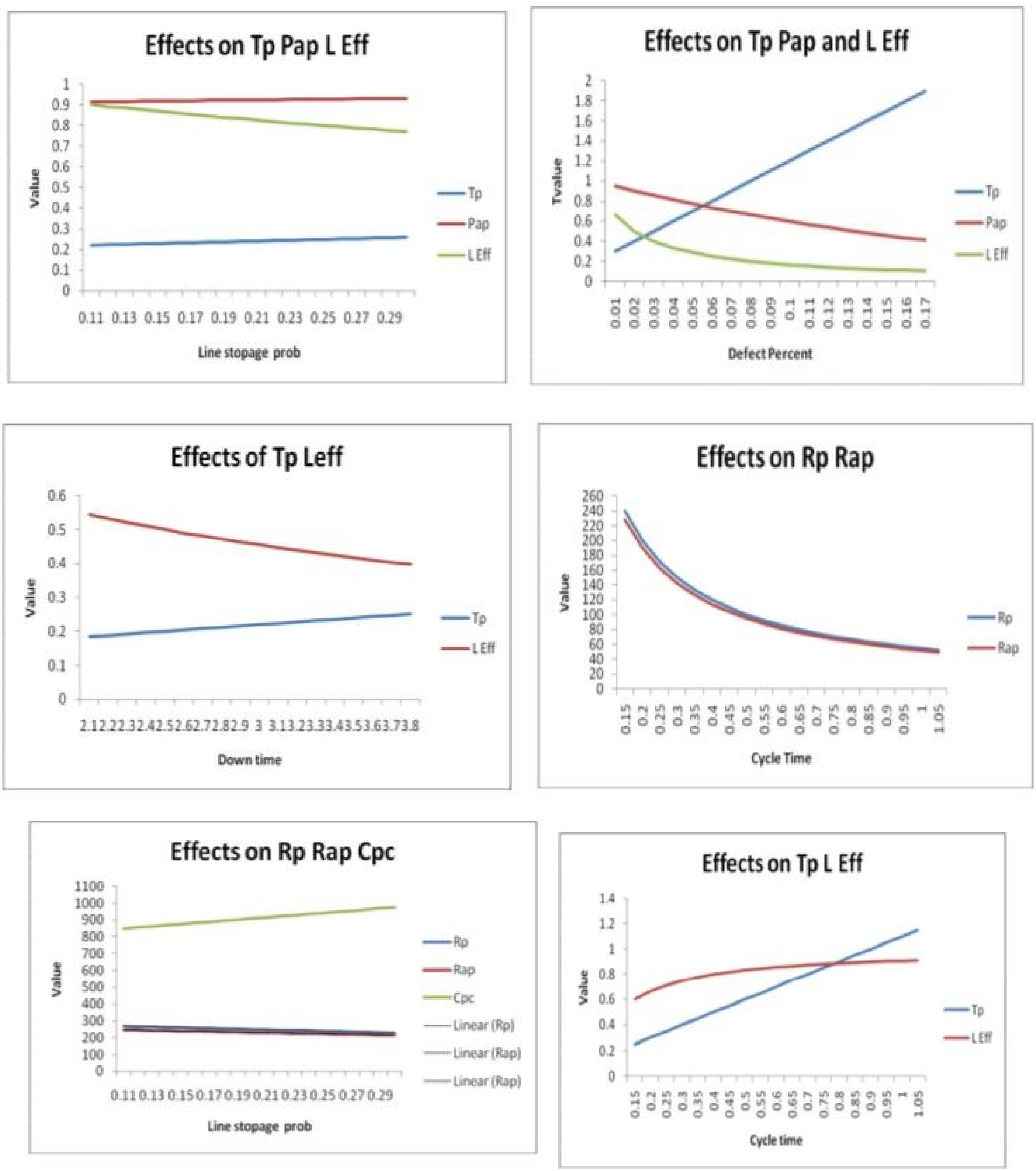

Figure 2: Related method feature effects (sample chart).

IV. CONCLUSION

Many parameters have been found to be critical and influence the device. The fault rate was calculated using a simple value of 0.2 min as the fault rate improved, allowing the device output level to get worse and impacted many of the performance metrics, i.e. a decrease in the production pace, the major impact on process yields, decreased production line reliability and increased costs per device. With jamming of the plant utilizing the original or basic value of 0.1, since it rises from this amount, the output of products has very little impact, but the output rate and the line productivity are the most critical parameters affected. As the goal of an automated system is to maintain the line of output and not to adjust all the station times. The line had 0.2-minute equilibrium and by vitiating to 1.05 minutes, the cost per cycle, the output pace, was greatly reduced, but the quality performance of the item is very poor. Compared to the other parameters, the impact of down line influence on automated device output is less apparent.

The Case Company is advised to concentrate on the fraction defect rate as among other parameters the most relevant. This may be accomplished by adequately educating the production line workers, by accurately fitting equipment, etc. There must be an operator's pool (semi-qualified and highly skilled) to ensure the experienced operator completes his job as a new item appears on the manufacturing line to pass it to semi-qualified employees. The semi-trained employees would also not perform any errors that impede both development and yield. In relation to station jamming, storage buffer on the line should be given in order to avoid the whole line from stopping when a sudden jam happens. The upstream stations continue their output during this time. It has been found that the most important parameters that influence the device and that the downtimes are the yield valued parameters. It supports our conviction that, the first time, the pieces are correct and healthy.

V. ACKNOWLEDGEMENTS

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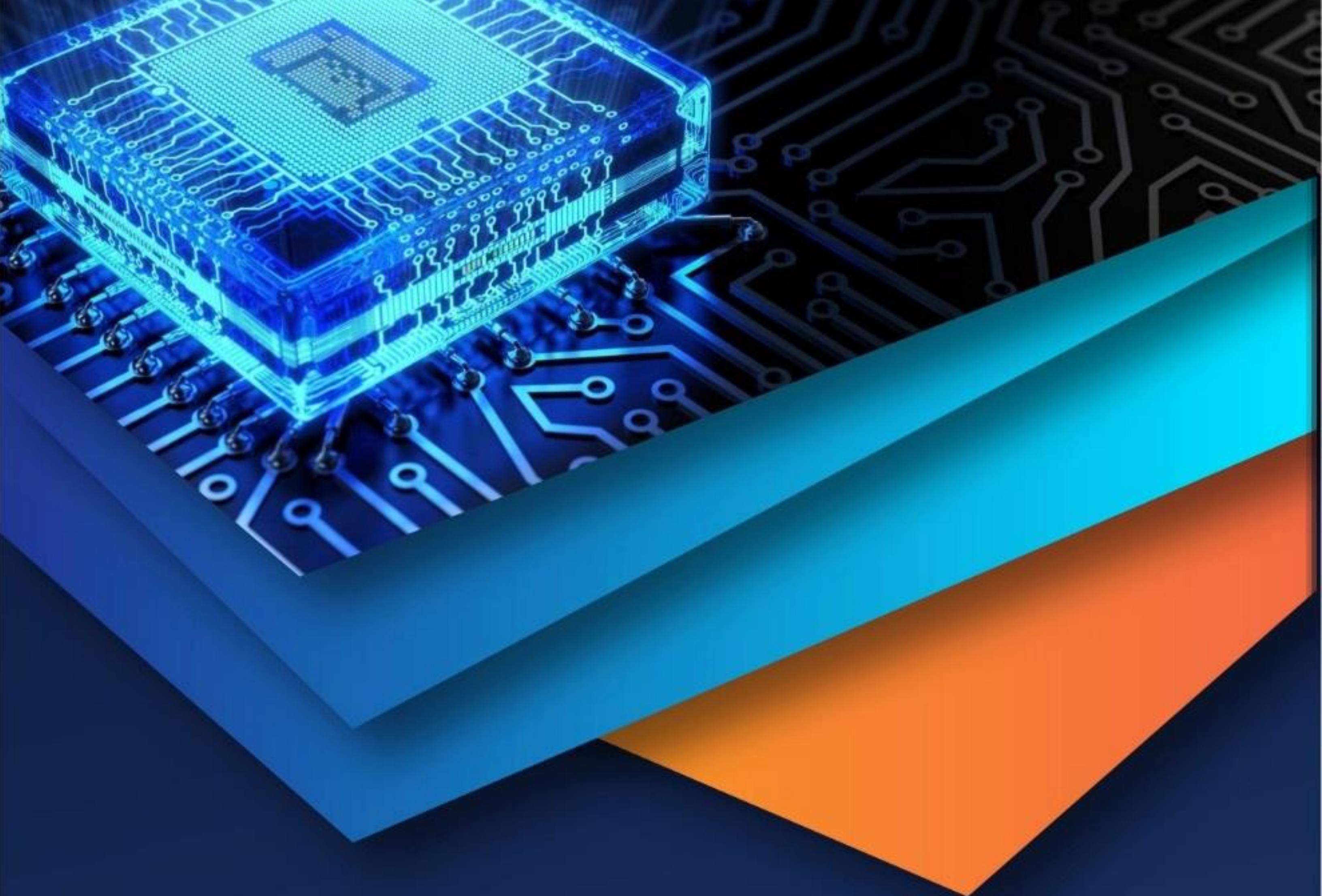
REFERENCES

[1] Automation, Production Systems and Computer Integrated Manufacturing, M. P. Groover, Prentice Hall, 2nd Edition, 2003.
[2] Tang, Chen and Ji, (2005), 'Operational tactics and tenets of a new manufacturing paradigm instant customerisation', International Journal of Production Research, vol. 43, No.14, 2873-2894
[3] Banks, J., Carson, S, J., Nelson, L, B., and Nicol, N, David (2002), Discrete Event System Simulation. 3d, ed., Pearson Education Asia.
[4] Boothroyd, G., P. Dewhurst, and W. Knight, Product Design for Manufacture and Assembly, Marcel Dekker, Inc., New York, 1994.
[5] N. Hemachandra and S.K. Eedupuganti (2003) Performance Analysis and Buffer Allocations in some Open Assembly Systems. Computers and Operations Research 30, 695-704.
[6] P.C. Rao and R. Suri (1994) Approximate Queuing Network Models for Closed Fabrication/Assembly Systems Part 1: Single Level Systems. Production and Operations Management 3(4), 244-275.
[7] Krishnamurthy, R. Suri and M. Vernon (2004) Analysis of a Fork/Join Synchronization Station with Inputs from Coaxial Servers in a Closed Queuing Network Annals of Operations Research 125, 69-94.
[8] Hermann Gold (1998) A Markovian Single Server with Upstream Job and Downstream Demand Arrival Stream. Queuing Systems 30, 435-455.
[9] Aftab. A. Haider, M. Jahanzaib, Khalid Akhtar, "Experimental Comparison of one-Piece Flow Production: A Simulation Based Approach", European Journal of Scientific Research, May 2007.
[10] M. Jahanzaib., Khalid Akhtar, "Technology Driven Strategy Using Machine Automation Cost in Discrete Parts Manufacturing", Kuwait Journal of Science and Engineering (KJSE), vol: 34 issue 2B, pp.207-224, Dec-2007.



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