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Percentage Reduction of Defects in Trim Line

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***Abstract:** This project report is a detailed study of various techniques, procedures & efforts that are employed in improving productivity by identifying problems and then developing suitable solutions. This report consists of many small projects which in turn lead to better productivity. Being in the Maintenance department various issues faced in the TCF Assembly Shop which reduce the productivity have to be tackled. Thus improvements are made in a systematic manner and suggestions regarding each issue have been mentioned in this report. Few of the suggestions have been implemented and has seen good results. Thus overall objective was to reduce worker's fatigue, improve quality and have higher customer satisfaction. Each aspect has been covered in one of the multiple projects in this report. Thorough study of the existing processes has been done and modifications based on the observations have been made. Many issues have been tackled like operator's fatigue reduction, reduced wear of machine parts, proper classifications wherever required. The problems are tackled by following few basic steps like observation, collecting data, and study of the problem, cause identification, providing suggestions and then implementing those suggestions. The report includes various personal suggestions.*
***Keywords:** Trim line, Quality control, Kaizen, Ishikawa diagram. Employee Management*.

I. INTRODUCTION

E8-trim line is located at E sector. These sectors consist of various small sections starting from E1-E10. Different works are distributed in these areas.

Fig No 1 Trim Line

E block consist of Press metal sheet working, winger body making where work is done by automated robots jigs and fixtures are used for wielding the body parts together and it carried further with help of conveyer belt. The next area consists of E8-trim line shop where all the trims are fitted to the cabins. The process consists of help of man as well of machine and the coordination between them is important for a good quality work output. The trim line is supervised by the 4 in line Auditors and 2 high post supervisors and over all attention to the shop is done by plant manager. The total no of manpower in E block is 400-500 people where some of them are labour, some auditors, supervisors & managers. The cabins are made itself in the E block. The production of cabins is done in E-10 shop where the parts that are cut by the press machine are transferred into the E-10 shop and then these

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parts are bent to required shape with the help of heavy machines and use of manpower with the help of fixtures. In this trim line the actual work is to fit the cabins and its all interior parts. In trim line there are 10 stations. On each station different parts of cabins are fitted. This station is arranged on the basis of preference of work. This station consists of work like fitment of the wind shied, mirrors, cables, and all the other interior parts. The actual work on this trim line is done by 92 employees. Each employee is assigned with different type of work. In these employees there is a junior supervisor on each station work on that station as well as supervise the other employee on his station. There are four different stages on trim line each stage is assigned with senior supervisor. The junior supervisor of each station has to report to this senior supervisor. Four auditors are assigned at the last stage of the line, where this auditor check for quality of the work done on each station. This auditor fills the check sheet for each cabin. This auditor has to report to the manager of line at the end of shift. Auditors have rights to stop the line when there is a serious issue related to the line. The manufactured cabins are further sent to the D-block where the chassis of the truck as well as the engine fitment is done.

A. Assembly Line

A typical vehicle assembly line consists of many workstations, where the components are assembled sequentially in a fixed pattern repeatedly and continuously as shown in There is a fixed precedence between these stations. Workers move with the moving conveyor to complete the task of that stage and reposition themselves to their initial position to work on the subsequent vehicle which might have arrived at the upstream stage. There are three main assembly lines viz. Trim, Chassis and Finish. Progress of each vehicle can be tracked by means of its Vehicle Identification Number and a small radio frequency transponder attached to the chassis. Layout of the assembly line at plant. Trim lines consist of 19 stations numbered from B-1to B-19. While work is being carried out at Trim line, simultaneously chassis is loaded on chassis line consisting of workstations numbered from 18-19. Finish line starts from station 7 till 3. Parallel workstations viz. 10,11,12,13,14,15,16,17, Windshield and Electricals are called as Feeder stations. Lines were studied in terms of layout, automation level, inventory, cycle time, resources, material handling, ergonomics, etc.

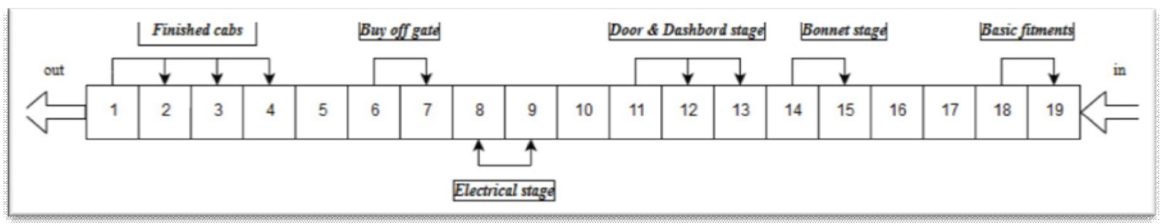

Fig No 2 Layout of Assembly Line

The layout of trim assembly line is shown in above figure. The trim line consist of total 19 stations and work is distributed among this station. Cabins are painted and are stored in the ware house after drying then painted cabins then after are brought and then lifted with help of pulley and then dropped into the carrier carts that have shapes made like fixture to support the cabins without damaging them. The carts have wheel attached to them so they can be easily maneuverer. These carts are then attached to the conveyer belt which helps the carrier cart to move forward in the assembly line. Small trolley with wheels are also attached to conveyers. Small parts such as bushes, bolts, small locks, harnesses are placed into the small conveyer by other worker and then those trolley are attached to conveyer and parts are fitted this trolley also helps the worker to keep unwanted parts or rejected part or faulty parting it saves time for the worker as he does not have to go back to collect parts he needs.

II. LITERATURE REVIEW

A. Luis Mendes

Employees' involvement and quality improvement in manufacturing small and medium enterprise (SME):
A comparative analysis the research focused specific human resource management (HRM) issues, driven at raising employees' awareness, and fostering employees' full involvement in quality programs. Moreover, the research tested if general HRM initiatives directed at quality improvement, and quality training programs, in particular, assume different preponderances in small and medium enterprise (SME), according to firms' size. For this purpose, a survey was mailed to a random sample of Portuguese SME. From the sample, around 16% of questionnaires were completed and returned. The results suggest clear concerns from SME in raising employees' awareness about the importance of quality improvement issues and fostering employees'

involvement in quality improvement programs. Furthermore, regarding quality improvement, differences in attitude towards HRM initiatives, in general, and training, in particular, are attributed to organizational size.

Ms. Pallavi P. Kulkarni -A Literature Review on Training & Development and Quality of Work Life

In this competitive world, training plays an important role in the competent and challenging format of business. Training is the nerve that suffices the need of fluent and smooth functioning of work which helps in enhancing the quality of work life of employees and organizational development too. Development is a process that leads to qualitative as well as quantitative advancements in the organization, especially at the managerial level, it is less considered with physical skills and is more concerned with knowledge, values, attitudes and behaviour in addition to specific skills. Hence, development can be said as a continuous process whereas training has specific areas and objectives. So, every organization needs to study the role, importance and advantages of training and its positive impact on development for the growth of the organization. Quality of work life is a process in which the organization recognizes their responsibility for excellence of organizational performance as well as employee skills. Training implies constructive development in such organizational motives for optimum enhancement of quality of work life of the employees. These type of training and development programs help in improving the employee behaviour and attitude towards the job and also uplift their morale. Thus, employee training and development programs are important aspects which are needed to be studied and focused on. This paper focuses and analyses the literature findings on importance of training and development and its relation with the employees' quality of work life.

Arun B. Rane, Vivek K. Sunnapwar -Assembly line performance & Modelling-

Automobile sector forms the backbone of manufacturing sector. Vehicle assembly line is important section in automobile plant where repetitive tasks are performed one after another at different workstations. In this thesis, a methodology is proposed to reduce cycle time and time loss due to important factors like equipment failure, shortage of inventory, absenteeism, set-up, material handling, rejection and fatigue to improve output within given cost constraints. Various relationships between these factors, corresponding cost and output are established by scientific approach. This methodology is validated in three different vehicle assembly plants. Proposed methodology may help practitioners to optimize the assembly line using lean techniques.

Gidey E*, Jilcha K, Beshah B and Kitaw-The Plan-Do- Check-Act Cycle of Value Addition

Value addition has only been measured as the difference between output and input prices and the critical roles of all functions in the process of value addition were not clearly known. Moreover, some core functions that inherently exist in the process of value addition were ignored until recently. The process of value addition and enhancement is continuous in its approach. Despite the fact that the value addition process is a continuous process, only its absolute measures were used for evaluating the intensity of value addition. Usually, value addition to a product was considered to happen only in the shop floor. In reality however, value addition is not only the responsibility of manufacturing function; rather, other functions before and after manufacturing also add significant tangible or intangible value to a product. The continuous characteristics of the value addition process can be visualized and evaluated in terms of the PDCA continuous process cycle so that value addition can be enhanced in a continuous basis. The PDCA cycle is a renowned continuous quality improvement approach and has been widely used by many successful companies as a strategic weapon for enhancing organizational performance. Hence, this paper roots its core idea towards the conceptual design of continuous value addition process using the PDCA cycle.

III. METHODOLOGY

A. Ishikawa Diagram

It is also known as cause and effect diagram or fishbone diagram with the help of fishbone diagram the main or root cause of a problem can be found by understanding the working area. The trim shop consists of man, material, machine, environment interaction it is important to find the main problems that lead to increase in defects. These problems are found out by fish bone diagram

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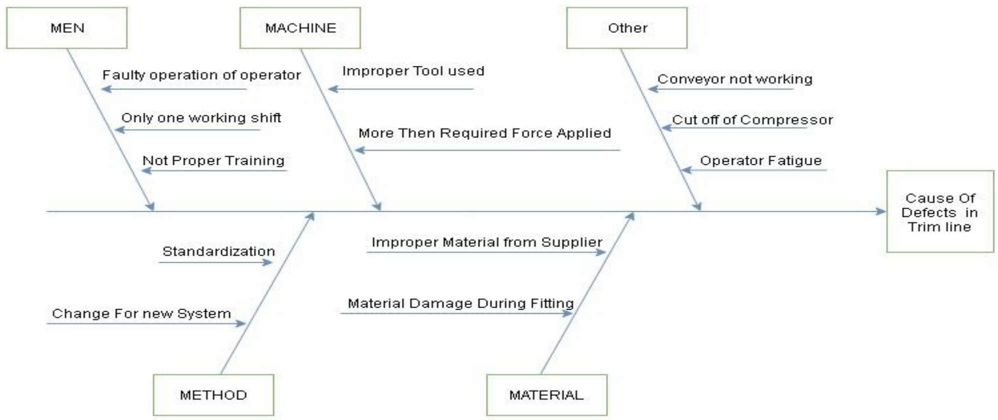

Fig No 3 Ishikawa Diagram

B. PDCA

(plan–do–check–act or plan–do–check–adjust) is an iterative four-step management method used in business for the control and continual improvement of processes and products. I also known as the Deming circle/cycle/wheel, the Shewhart cycle, the control circle/cycle, or plan–do–study–act (PDSA). Another version of this PDCA cycle is OPDCA. The added "O" stands for observation or as some versions say: "Observe the current condition." This emphasis on observation and current condition has currency with the literature on lean manufacturing and the Toyota Production System.[5]

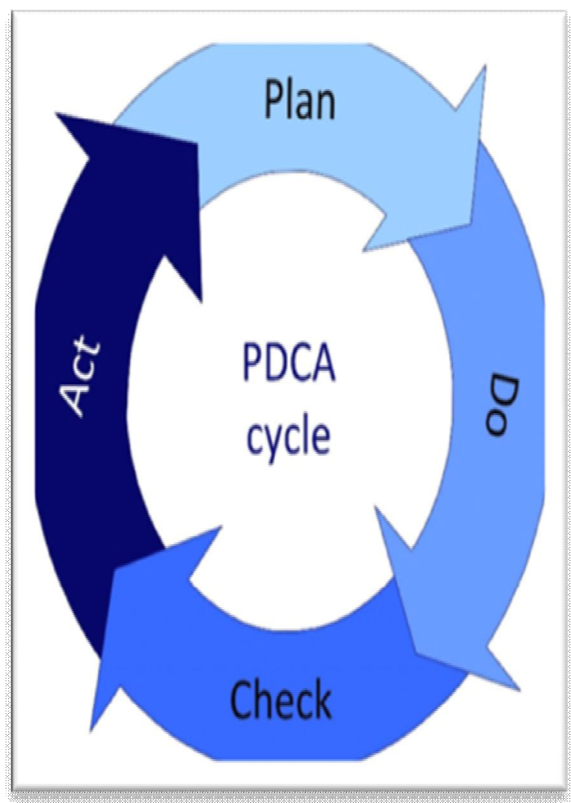

Fig No 4 PDCA Cycle

1) *Plan:* The planning phase involves assessing a current process, or a new process, and figuring out how it can be improved upon. Knowing what types of outputs that are desired helps to develop a plan to fix the process. It is often easier to plan smaller changes during this phase of the plan so that they can be easily monitored and the outputs are more predictable[5]

2) *DO:* The do phase allows the plan from the previous step to be enacted. Small changes are usually tested, and data is gathered to see how effective the change is. [5
3) *Check:* During the check phase, the data and results gathered from the do phase are evaluated. Data is compared to the expected outcomes to see any similarities and differences. The testing process is also evaluated to see if there were any changes from the original test created during the planning phase. If the data is placed in a chart it can make it easier to see any trends if the PDCA cycle is conducted multiple times. This helps to see what changes work better than others, and if said changes can be improved as well. [5
4) *Act:* If the check phase shows that the plan phase which was implemented in do phase is an improvement to the prior standard, then that becomes the new standard for how the organization should act going forward Instead, if the check phase shows that the plan phase which was implemented in do phase is not an improvement, then the existing standard will remain in place. In either case, if the check phase showed something different than expected, then there is some more learning to be done and that will suggest potential future PDCA cycles. Note that some who teach PDCA assert that the act phase involves making adjustments or corrective actions, but generally it would be counter to PDCA thinking to propose and decide upon alternative changes without using a proper plan phase, or to make them the new standard without going through do and check steps.[5]

IV. SELECTION OF DEFECTS

The total number of cabins produced per day is 98 in working shift of 8 hours so it is important to detect defects and if corrective actions are not taken then it can lead to decrease the quality of cabins produce and may lead to customer dissatisfaction. There are work sheet present in each cabin that gives us the total information of parts used the batch of parts used in the making of cabins, the workers that work on the cabin all the information is obtained from the worksheet.

A. Per day a batch of 30 cabins are observed and all the defects occurring are noted down
B. A list of defects is made
C. The frequency of defects is found out by observing cabins with the help of remark on work sheet by auditor.
D. The unique vin and biw number gives us the information of parts used by particular batch.
E. The defects are sorted on depending upon the frequency of the defects.
F. Demerit Score & Preference Ranking.

1) *Defects Selected For Improvement :* The defects selected for improvement based on Demerit score and frequency of defects per day.

Table I Defects Selected For Improvement

Sr no.	Defects	Demerit Score	Frequency/day from 90 cabs
1	Deflector bolt loose	50	30
2	CP flap stud striking bezel	50	80
3	Fuse box cover loose	50	65
4	Vibration of Tool box	15	38
5	Flushness of right door	15	60
6	Combi grommet N/F	15	45
7	Flap not locking	50	80

V. PROBLEM STATEMENT

A. Finding the cause of defects selected
B. Eliminating the defects
C. Increasing the quality of production

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VI. DEFECTS AND CAUSES

Table Ii Defects And Causes

Sr no	Image	Defect	Cause
1		Deflector bolt loose	• Operator laps • Not enough torque when bolted • Mismatch of holes
2		CP flap stud striking bezel	• Improper dimension of bonnet flap • Large size of stud
3		Fuse box cover loose	• Supplier issue. • Operator laps.

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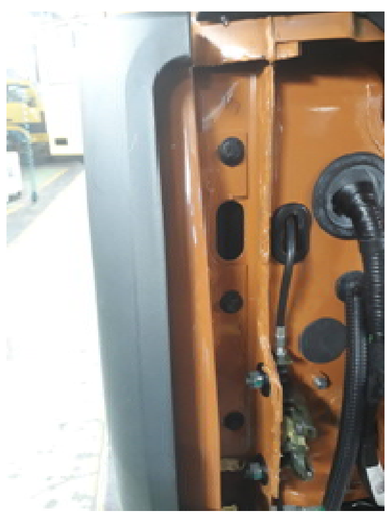
4		Vibration of Tool box	• Loose fitting. • Less support to box. • Less number bolts used than actual required. • Absence of Cushioning
5		Flushness of right door	• Deflector bolts not properly bolted
6		Combi grommet N/F	• Operator laps

7	 	Flap not locking	• Locking mechanism not properly fitted. • Welding not properly done. • Misalignment of striker and cone

VII. SOLUTION TO DEFECTS

The cause of defects is found out by ishikawa diagram (fish bone diagram). With the help of fishbone diagram we can target the root cause of the defects and corrects action can be taken.

Table Iii Solution To Defects

Sr no	Defects	Image	Corrective action
1	Deflector bolt loose		• Mismatch of holes due to plastic moulding part. Studs is weak which tends to break when tried to fitted tightly so it is kept loose by worker. • Supplier is contacted to overcome this problem a faulty deflector is rejected.

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2	CP flap stud striking bezel		• The stud length was reduced to adequate length • The supplier started providing the correct size of stud.
3	Fuse box cover loose		• The knob is already supplied loose by the supplier which is not fitted by labour. • Supplier is educated with issue and asks for improvements. • The fitter in this stage is educated to fit the knob in case of loose knob.
4	Vibration of Tool box		• Solution is found out by adding foam at bottom of folded sides • The knob is fitted more tightly so there is no freedom given to the tool box.

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5	Flushness of right door		• The problem was solved by fixing the deflector bolt issue and alignment of doors
6	Combi grommet N/F		• By changing the station of grommet fitment it is fitted during fitment of indicator stock • By changing the fitment station of the grommet, it was compulsory to fit the grommet along with the steering wheel and the indicator lever.
7	Flap not locking		• There is fault in the welding section of the block • In experiment the lower frame of the cabin lowered with 5 mm. the cone position was also changed and it shifted to the right side by 3 mm. in this experiment the several parameters are checked like force required to lock the bonnet, gaps in all side of the bonnet

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VIII. RESULT

The total number of defects are observed and noted down for total 90 cabins per day for a month.
The Average value is calculated at end of each month and the defects are found

Table Iv Average Defects At End Of Each Month

Sr no	Defects	Sept	Oct	Nov
1	Deflector bolt loose	30	10	7
2	CP flap stud striking bezel	80	80	10
3	Fuse box cover loose	65	42	8
4	Vibration of Tool box	38	20	5
5	Flushness of right door	60	38	5
6	Combi grommet N/F	45	28	7
7	Flap not locking	80	52	14

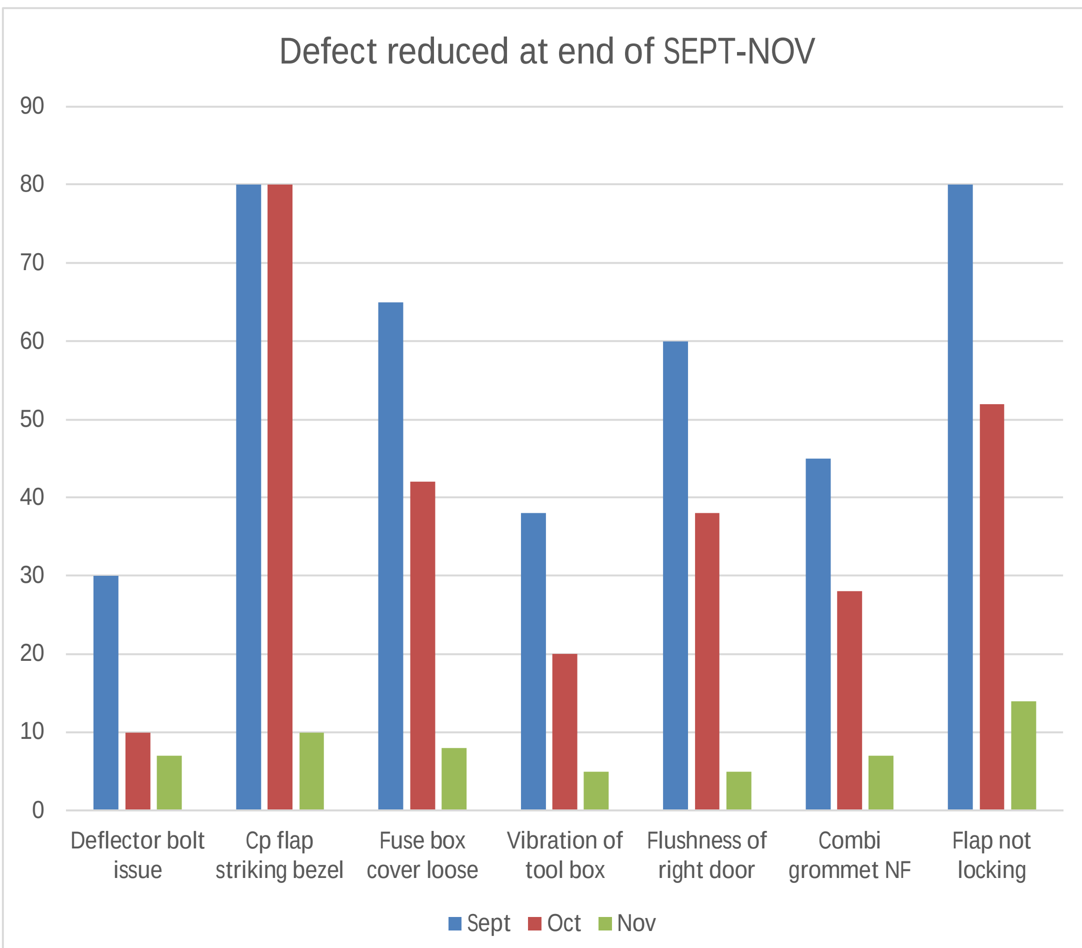

Fig no 5 Graphical Representation of defects

TABLE V
PERCENTAGE REDUCTION OF DEFECTS W.R.T SEPT

Defects	Frequency	Percent defects	Frequency	Percent defects	Frequency	Percent defects
month	Sept	Sept	Oct	Oct	Nov	Nov
Combi grommet	45	100%	28	62%	5	11.11%
CP flap not ok	80	100%	40	50%	15	18.75%
Fuse box cove loose	65	100%	43	66.15%	8	12.30%
Deflector bolt loose	30	100%	10	33.33%	7	23.33%
Tool box knob loose	38	100%	20	52.63%	3	7.89%
Stud striking bezel	80	100%	80	100%	20	25%
Door flushness	60	100%	31	51.66%	4	6.66%

IX. CONCLUSION

The subject quality control has given us some of the best techniques to control the product quality. Some techniques like PDCA and kaizen are used in this project to maintain the product quality which is beneficial for the organization. By standardizing the work method time reduced to manufacture the cab by some amount. The work in rework area is minimized.The rework area in which the damaged and the cab which has more defects are separated of and the works on that cabin are done by the expert worker. The more cabins separated out in rework area reduces the daily production. The target of the line per shift is to produce 90 cabs. Due to defects generated and the improper way of working as well as the faulty or improper goods were supplied by the supplier reduces the production of the line. By the use of techniques which are mentioned about were the most helpful tools in reducing the defects. The proper use of these techniques is done to fulfil the quality of the product. By continuous improvement in the design and educating the worker of the organization with the proper way of doing work the defects minimized.The frequencies of the defects were reduced on large quantity which is beneficial to organization. The production of the line has been increased and the quality of the product also increased.

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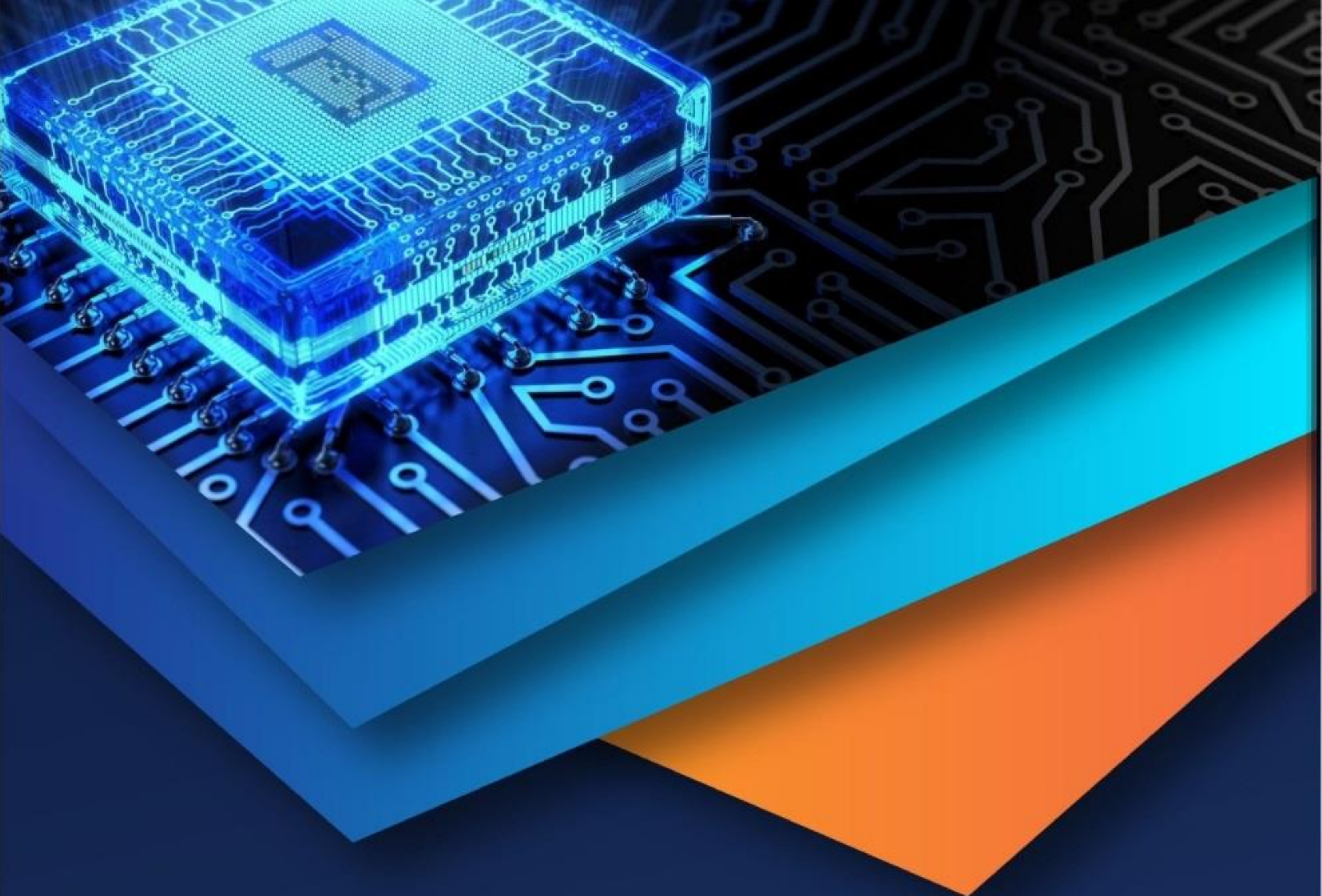

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