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Traffic Volume Analysis & Solutions of Dharmaraj Chowk, Akurdi, Pune

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Abstract: ***Intersection is not only the node of urban road network, but also the key point affecting the operation of the traffic of the whole region. In order to improve the traffic operation efficiency of a signalized intersection, this paper takes Dharmaraj Chowk unsignalized intersection as centre of the project on the present situation, three methods were used to optimize the signal timing of the intersection, including only designing the signal timing of the current intersection, designing the change of the signal timing of the whole line and changing the proportion of different types of drivers. The simulation is carried out by Arduino software. The results show that the traffic operation efficiency can be improved conspicuously by changing the signal timing at the current intersection. By changing the signal timing of the whole trunk line, the traffic operation efficiency can be improved obviously. By reducing the proportion of conservative drivers and increasing the proportion of progressive drivers, the traffic operation efficiency can be improved.***

Keywords: Pedestrian Survey, Traffic Survey, Traffic Problems

I. INTRODUCTION

Urban road network is composed of intersections and road sections. The intersections are the node of two or more roads in different directions. It is an indispensable part of the entire urban road network[1].The intersection is also a key point for the gathering, turning and evacuation of vehicles and pedestrians. The unreasonable design of the intersection may lead to decreased efficiency of the intersection and traffic congestion, which will have a serious impact on people's lives and work [2]. There are many ways to improve the efficiency of operations of the intersection. In order to verify its effectiveness, it often takes a long time and a wide range of traffic experiments. With the appearance and application of traffic simulation technology, the original time-consuming and costly design can be carried out under the ideal state of simulation. Although it is a little different from reality, it can explain the feasibility of the scheme to a certain extent. The importance of intersections in a road section cannot be overstated. If proper traffic control measure is not provided it led to a congestion, conflict points and bottlenecks. So, to prevent this issue, a proper traffic signal is designed which works on real-time problem detections and eliminates the wastage of green time allotted to a phase. It has been observed from the study that the Dharmaraj Chowk intersection in DY Patil road in Akurdi, Pune remains busy because of Educational Schools and Colleges located on it, due to which it has become inadequate to handle the present-day traffic. Therefore, to avoid conjunction of people and traffic increases chances of accidents and delays vehicular movement, the 4- phase traffic signal is designed. The signal timings for traffic signals are designed by following Webster's method. The design procedure discussed in this chapter include phase design, interval design, computation of saturation flow, determination of cycle time and green time, signal timing diagram. The designed traffic signal is then simulated by using Arduino Software

II. LITERATURE REVIEW

Van Aired, (1995) studied that Green shields, and Van Aerde Car-Following and Traffic Stream Models. In this investigation, the author, has relates steady-state car-following behavior to macroscopic traffic stream models has concluded that the results clearly show that Traffic move models through shooting both macroscopic and microscopic constant-state visitors behavior for a large range of roadway features and traffic requirements.

Satyanarayana, (2012) studied the effect of traffic volume, its composition and stream speed on passenger car equivalents. In this investigation, the author, has relates the safe and efficient movement of the people and goods is dependent on traffic flow, which is directly connected to the traffic characteristics. The volume, speed and density are the three important things in public transportation.

V.T Hamizh Arasan and Krishnamurthy, (2008) studied the complexity of the vehicular interaction in heterogeneous traffic. In this investigation, the author, has relates the PCU estimate, made via microscopic of simulation, for the exceptional varieties of cars of heterogeneous traffic, and has concluded that the results clearly show that the PCU price of an automobile tremendously alterations with trade in traffic quantity and width of roadway.

Ahmed Al-Kaisy, (2005) studied that developing PCE factors for heavy vehicles on freeways and multilane highways during congestion. In this investigation, the author relates to the mechanism of heavy vehicles' behavior during congestion and has concluded that the results clearly show that the effect of heavy vehicles on traffic stream behavior under free-flow condition.

Lum K.M, (1998) studied that traffic volume and travel time. In this investigation, the author has related speed-flow relationships for radial and ring arterial roads and has concluded that the results clearly show that special reference to the characteristics with traffic flow and the recommended speed-flow models developed using travel time–density relationship.

Marwah and Bhuvanesh, (2000) studied that level of service classification for urban heterogeneous traffic. In this investigation, the author has related the traffic simulation model, model has been successfully calibrated and validated for the urban heterogeneous traffic flow conditions on the Kanpur roads and has concluded that the classification level for the urban areas especially which re heterogenous.

E. Elangovan, (2003) studied the Traffic Flow Characteristics using Probe Vehicles. In this investigation the author has relates the large-scale transport infrastructural enhancements are carried out in urban areas and has concluded that the results clearly show that the based on the average speed prevailing at work zone, capacity of the section could be estimated from established speed flow relationship.

Bhaskaran Raman, (2004) studied that Road transportation systems for developing regions. In this investigation the author has relates the Indian roadtraffic the problems, like congestion, unpredictable travel-time delays and road-accidents, are taking a serious shape and has concluded that the results clearly show that the presence of lane system, relative speed and type of vehicles, presence of freeways, orderly traffic.

III. PROBLEM STATEMENT

This study was conducted to analyse and evaluate the performance of unsignalised intersection. Akurdi is one the key urban area in PCMC because the population in the area is above 2.5 lakh. At newly renovated intersection of 'Dharmaraj chowk' near Akurdi railway station, on D.Y. Patil road which is major road that connects to the express way so the traffic is more The unsignalised intersection was identified as two way stop controlled unsignalised intersection (TWSC) where the traffic flow was controlled by stop rule. For a TWSC intersection, the stop control approach are referred to as the major road approaches

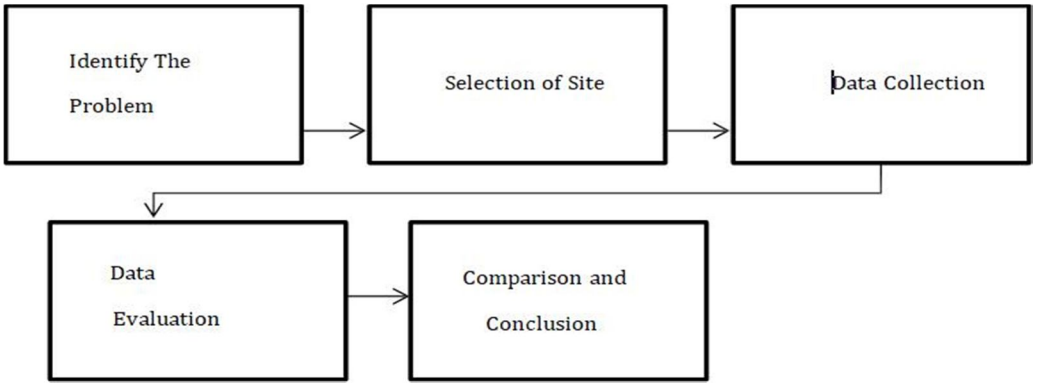
There is two under passes designed, near the intersection engineering colleges on both side of railway line are located. And, the vehicles travelling on road have no safety measures while turning on crossing intersection. And road is having bigger traffic jams and the number of conflicts is increasing day by day.

So analysis of the intersection in terms of design and other aspects is necessary to have a fluent flow of traffic, and this analysis is also important to overcome traffic accidents, conflicts by properly designing the intersection.

IV. OBJECTIVES

1) To establish the relative importance of any route or road facility.
2) To plan and design the existing and new facilities of traffic operations on the Dharmaraj Chowk
3) To decide the priority for improvement and expansion of a road and to allow the funds accordingly.
4) To make an analysis of traffic patterns and trends on the road.
5) To do the design of road intersection planning signal timings.

V. METHODOLOGY



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Traffic signals are the best way to control the congestion at intersections. Instructions are given to driver with the help of traffic lights (Red, yellow and green). Here, we use 2-methods for the design of traffic signal at non-signalized intersection.

1) *Webster's Method:* Webster's method is a rational approach for signal design. The design is simple and is totally based on formula laid down by webster. In this method, the total cycle of the signal is determined which forms a total least delay occurring at signal.
2) *IRC Method:* The design of traffic signal according to IRC method by adopting maximum P.C.U on the intersection in each direction. Thus, traffic signal system should be introduced at the intersection with total cycle time of 140 seconds.

The signal design procedure involves six major steps. They include:

a) Phase Design
b) Determination of Amber Time and Clearance time
c) Determination of cycle length
d) Apportioning of Green Time
e) Pedestrian Crossing Requirements
f) Performance evaluation of the design obtained in the previous steps

➢ *Design Procedure for webster's Method*

- Normal Flow of Vehicles on Road, Denoted by q.
- Saturation Flow of Vehicles on Road, denoted by S.
- Critical Flow Ratio of Vehicles on Road, denoted by Y and Y= q/S.
- Total Lost Time L= 2n+R (n- number of Phase, R- All Red Time for Pedestrian, 12 Seconds.)
- Optimum Cycle time, Co= 1.5L+5/1-Y (seconds)
- Effective Green Time Per Cycle= Co-L
- Effective Green Time for Phase 1= Y1/Y (Co-L)
- Effective Green Time for Phase 2= Y2/Y (Co-L)
- Effective Green Time for Phase 3= Y3/Y (Co-L)

➢ *Design Procedure for Traffic Signal by IRC Method ❖ Width of Road ❖ Pedestrian walking speed= 1.2 m/s.*

- Step-1 Pedestrian Crossing Time= (width of road/1.2) +7
- Step-2 Minimum Green Time for Traffic= (Pedestrian Crossing Time* Normal Flow) /Minimum Normal flow on Road.
- Step-3 Revised Green Time for Traffic Signal = (Adding 2.0 seconds each towards Clearance Amber and 2.0 seconds Inter green Period for each Phase)
- Step-4 Check for optimum signal cycle by Webster's Method- Co= 1.5L+5/1-Y (seconds)

A. Geometric Study Of Intersection

In this we have studied the geometry of intersection. Such as width of lane, width of footpath, study of island, sight distance and AMF.

$$AMF = \frac{1.55L_c + \frac{80.2}{R} - .012S}{1.55L_c}$$

where

AMF = Accident modification factor, a multiplier that describes how many more crashes are likely to occur on the curve compared to a straight road
L_c = Length of the horizontal curve in miles.
R = Radius of the curve in feet.
S = 1 if spiral transition curves are present
= 0 if spiral transition curves are absent

1) *Traffic Volume Study at Intersection:* To study count of vehicles passing through the intersection at particular points, on specific day, at specific time.
2) *Conflict Point Analysis:* Based on the traffic flow and the geometry of intersection conflict point can be decided.
3) *Comparison with Standard Values Given by IRC:* Based on the survey conducted values obtained will be considered with the standard values of design given by IRC.
4) *Design Analysis:* Analysis of design of intersection and its properties.

VI. TRAFFIC STUDY

After the geometric study our next step was the traffic flow study of intersection so we decided a day and did the traffic study on specific day at peak hours and normal hours. We counted the vehicles on each lane at particular point and categorised them as car, motor, bus, bike, LCV, HGV and other.

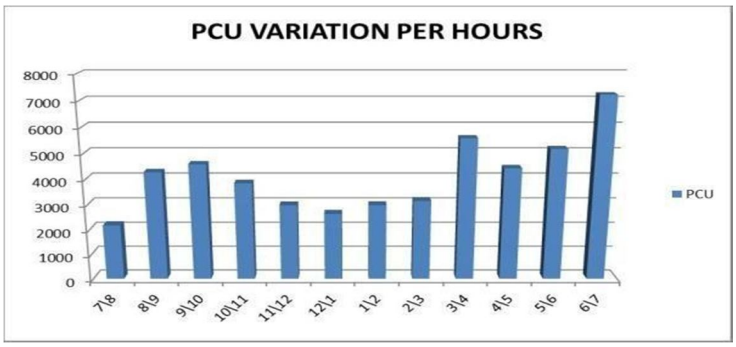
VII. PEDESTRIAN SURVEY

We performed pedestrians' survey in 2 shifts that is morning peak hours and evening peak hours, as there are engineering colleges on both sides of the tunnel pedestrians are more mostly the college students so there safety is a major issue so this survey becomes very important.

Pedestrians are unsafe while crossing the intersection, insufficient width of footpath on both lanes of road, required more time for crossing. A questionnaire-based survey was carried out for suggestions and short comes for pedestrian crossing at junction. Based on surveys, and analysing with Road Safety Audit and IRC recommendation. Table no 1 show the values of PCU with standard as per road design. Table clearly shows the traffic on road is about thrice the capacity of design. The pedestrians route are insufficient need to be widen.

VIII. OBTAINED DATA

Count Hrs	Cars	Bikes	Trucks	3 Wheelers	Busses	Cycles
9am - 10am	35	68	18	21	4	12
12pm- 1pm	42	76	15	25	5	6
3pm-4pm	28	51	8	19	2	0
5pm- 6pm	34	71	11	22	7	5
8pm-9pm	38	62	4	15	2	0
10pm-11pm	25	51	0	11	0	0



A. Checklist For Existing Roads

1) Are the prevailing speed levels within desirable limits
2) Are there signs of other conflict situations and minor accident.
3) Are medians and islands of adequate width for the likely users.
4) Are there signs of pedestrian traffic in places that seem hazardous to pedestrian.
5) Do road users park in ways that could Constitute hazards.
6) Does there appear to be need for more or better crossing facilities for pedestrian
7) Is sufficient warning provided in advance of breaks in service roads and openings in medians for traffic using multilane highway
8) Does there appear to be need for more or better facilities for cyclist.

IX. TRAFFIC SIGNAL DESIGN ON DHARMARAJ CHOWK

A. Overview

The conflicts arising from movements of traffic in different directions is solved by time sharing of the principle. The advantages of traffic signal includes an orderly movement of traffic, an increased capacity of the intersection and requires only simple geometric design. However the disadvantages of the signalized intersection are it affects larger stopped delays, and the design requires complex considerations. Although the overall delay may be lesser than a rotary for a high volume, a user is more concerned about the stopped delay.

B. Phase Design

The signal design procedure involves six major steps. They include the (1) phase design, (2) determination of amber time and clearance time, (3) determination of cycle length, (4)apportioning of green time, (5) pedestrian crossing requirements, and (6) the performance evaluation of the above design. The objective of phase design is to separate the conflicting movements in an intersection into various phases, so that movements in a phase should have no conflicts. If all the movements are to be separated with no conflicts, then a large number of phases are required. In such a situation, the objective is to design phases with minimum conflicts or with less severe conflicts.

This is often guided by the geometry of the intersection, flow pattern especially the turning movements, the relative magnitudes of flow. Therefore, a trial and error procedure is often adopted. However, phase design is very important because it affects the further design steps. Further, it is easier to change the cycle time and green time when flow pattern changes, where as a drastic change in the flow pattern may cause considerable confusion to the drivers. To illustrate various phase plan options, consider a four legged intersection with through traffic and right turns.

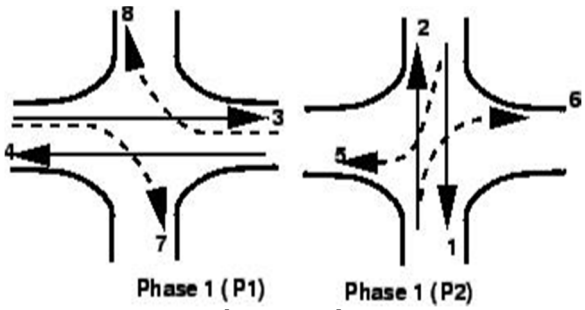
For Dharmaraj Chowk we are proposing 2 types of phase designs which we believe is suitable for the intersection

C. Two-Phase Signals

Two phase system is usually adopted if through traffic is significant compared to the turning movements. Non-conflicting through traffic 1 and 2 are grouped in the second phase.

However, in the first phase flow 7 and 8 offer some conflicts and are called permitted right turns. Needless to say that such phasing is possible only if the turning movements are relatively low. On the other hand, if the turning movements are significant ,then a four phase system is usually adopted.

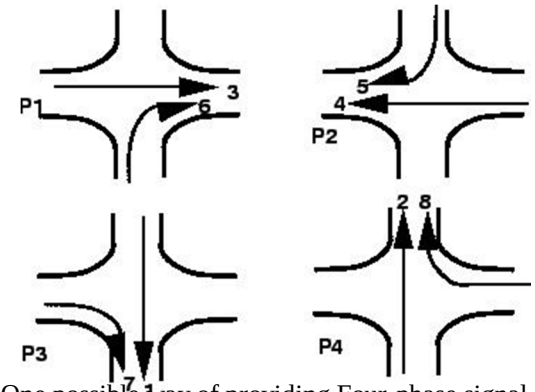
through traffic 3 and 4 are grouped in a single phase and non-conflicting



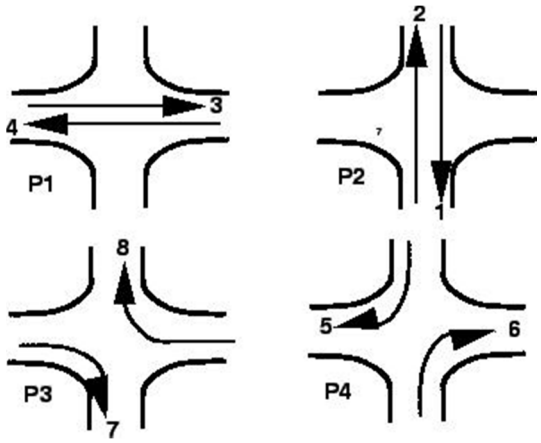
Two-Phase signal

D. Four-Phase Signals

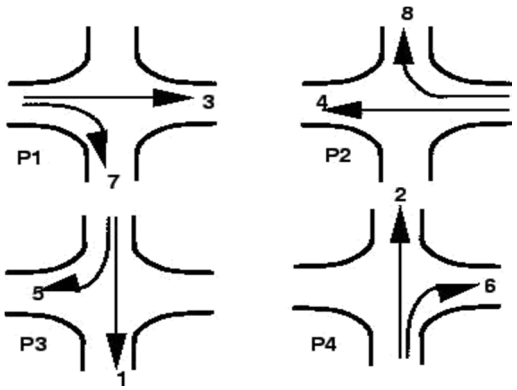
There are at least three possible phasing options. For example, figure shows the most simple and trivial phase plan. where, flow from each approach is put into a single phase avoiding all conflicts. This type of phase plan is ideally suited in urban areas where the turning movements are comparable with through movements and when through traffic and turning traffic need to share same lane. This phase plan could be very inefficient when turning movements are relatively low. The non-conflicting right turn flows 7 and 8 are grouped into a third phase. Similarly flows 5 and 6 are grouped into fourth phase. This type of phasing is very efficient when the intersection geometry permits to have at least one lane for each movement, and the through traffic volume is significantly high. Figure shows yet another phase plan. However, this is rarely used in practice.



One possible way of providing Four-phase signal



Second possible way of providing Four-phase signal



Third possible way of providing Four-phase signal

E. Interval Design

There are two intervals, namely the change interval and clearance interval, normally provided in a traffic signal. The change interval or yellow time is provided after green time for movement. The purpose is to warn a driver approaching the intersection during the end of a green time about the coming of a red signal. They normally have a value of 3 to 6 seconds.

The design consideration is that a driver approaching the intersection with design speed should be able to stop at the stop line of the intersection before the start of red time. Institute of transportation engineers (ITE) has recommended a methodology for computing the appropriate length of change interval which is as follows:

$$y = t + \frac{v_{85}}{2a + 19.6g}$$

where is y the length of yellow interval in seconds, t is the reaction time of the driver, v_{85} is the 85 th percentile speed of approaching vehicles in m/s, a is the deceleration rate of vehicles in m/s^2 , g is the grade of approach expressed as a decimal. Change interval can also be approximately computed as $y = \frac{SSD}{v}$, where

SSD is the stopping sight distance and v is the speed of the vehicle. The clearance interval is provided after yellow interval and as mentioned earlier, it is used to clear off the vehicles in the intersection. Clearance interval is optional in a signal design. It depends on the geometry of the intersection. If the intersection is small, then there is no need of clearance interval whereas for very large intersections, it may be provided.

F. Cycle Time

Cycle time is the time taken by a signal to complete one full cycle of iterations. i.e. one complete rotation through all signal indications. The way in which the vehicles depart from an intersection when the green signal is initiated will be discussed now. As the signal is initiated, the time interval between two vehicles, referred as headway, crossing the curb line is noted. The first headway is the time interval between the initiation of the green signal and the instant vehicle crossing the curb line. The first headway will be relatively longer since it includes the reaction time of the driver and the time necessary to accelerate. The second headway will be comparatively lower because the second driver can overlap his/her reaction time with that of the first driver's. After few vehicles, the headway will become constant.

X. RESULTS

A. Problems

While observing the site, we came to know the following problems:

1) Wrong position of stop bars.
2) No provision of signal.
3) Lack of pedestrian signals.
4) Absence of outer radium marking.

B. Shortfalls

1) As per PCU counts, road is insufficient for present traffic.
2) On street parking leads to congestion for vehicles to travel on road.
3) Insufficient Informatory signs at Intersection which causes vehicles collision.

C. Suggestions

1) Signal system should be provided for free flow of traffic
2) The requirement of all informatory signs should be fulfilled at the intersection.
3) Grade separator on road coming from Gurudwara should be made.
4) For future traffic flow the road may require underpass at intersection for road.

XI. DISCUSSION

Congestion occurs due to four basic reasons for instance environment, mechanical, human, and infrastructure. Quantitative and qualitative both types of congestion indices have been discussed, suggested by the afore-mentioned researchers. Various congestion data collection methods have been explained which will be useful in the selection of a suitable technique for Indian conditions. Congestion measurement criteria can be adopted based on available budget by adopting speed based or LOS based matrices.

Ridesharing emerges an important role with high efficiency in the use of existing assets such as personal vehicles. Recently the role of this increase most of the popular cities. Ridesharing is a new point-to-point transport model, and has seven features:

(1) dynamic pricing, (2) dynamic routing, (3) smart dispatching, (4) customer network effect, (5) demand pooling, (6) feedback collection, and management system and (7) flexible supply base. From ridesharing, we can find four advantages that can automatically reduce traffic congestion by 17%-31% and optimize infrastructure investment (1) Accelerating public transportation, (2) Providing alternatives to car ownership, (3) Supplementing incomes, (4) Optimising infrastructure timing and location. Delhi will be launching a mobile application based on a new high-tech system linked to smart cameras deployed at traffic signals to help ease the chaotic roads (not required to manage traffic physically by Traffic cops). Signals will change to red or green in real-time based on traffic volume and not at fixed intervals. The system is being adapted based on studies of international countries' best practices in cities such as Sydney, Singapore, and Amsterdam. A similar system based on real-time traffic is functional at Closure Home, Coimbatore, Tamil Nadu, India.

XII. CONCLUSIONS

1) Installation of Traffic signal at the intersection helps ease out the congestion at peak hours
2) Installation of traffic signal helps in the flow of traffic without any collisions like pedestrian accidents or right-angle collision of two vehicles
3) Traffic signs are seen at all times in all weather conditions at day and night
4) Traffic handled the traffic at regular intervals without any interruptions
5) This project is proposed to developed less traffic jam at intersection.
6) Main conclusion of our Research is that Intersections are well signalized for better movement of vehicles at Intersections.

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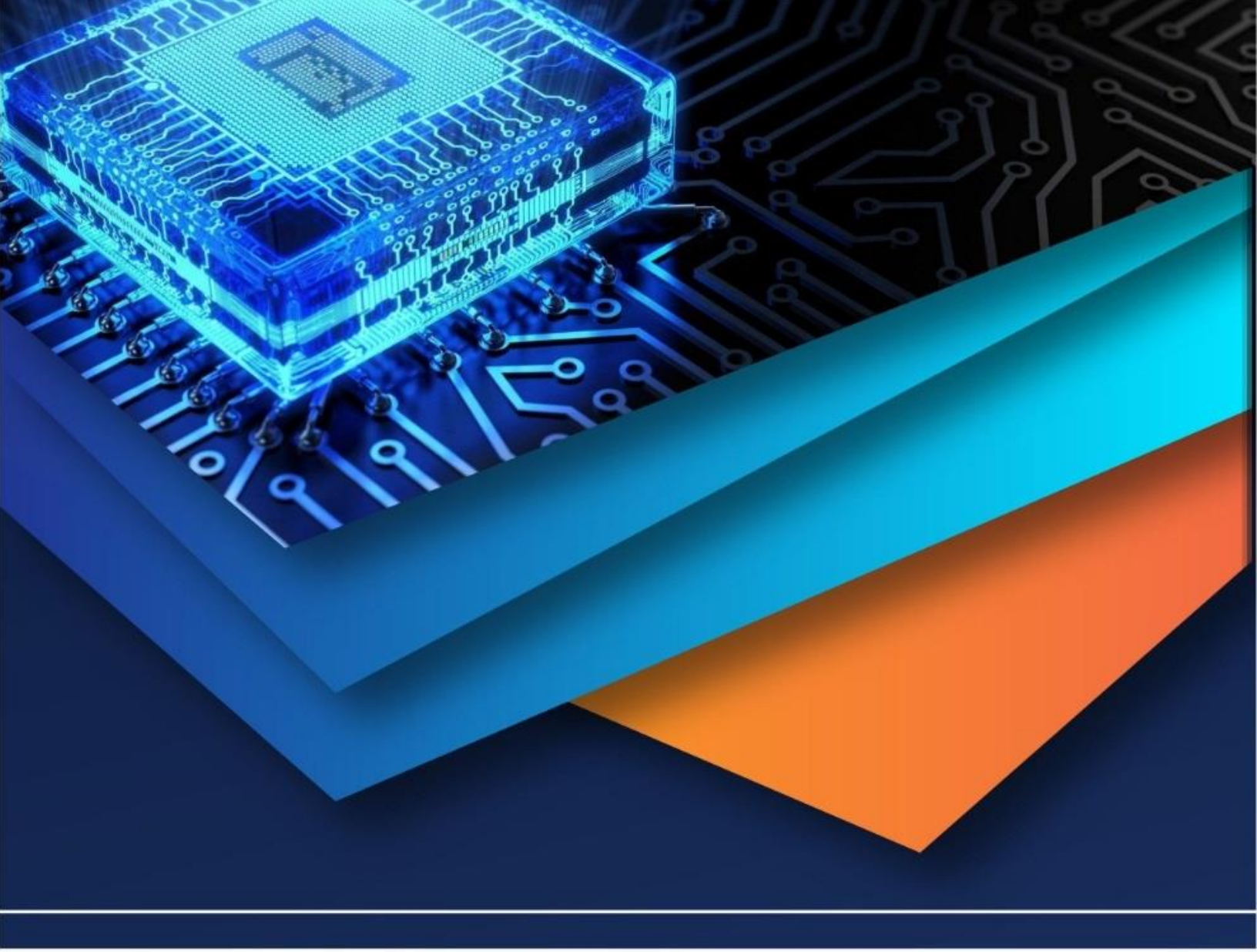

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