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Parking Analysis and Characteristics of Sector-17 and Sector-35 in Chandigarh

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Abstract:** In the absence of adequate public transport facilities with in cities, there is rapid increase in private ownership of vehicles. Growth of population and motor vehicle coupled with socio-economic development are resulting in steep increase in transport demand leading to considerable traffic problems. In the past few years, traffic density on road especially in urban areas has grown by leaps and bounds and the well-known fact is that every vehicle requires a parking space at end of trip or at destination. The increase in demand for parking spaces due to the increase of vehicles around the world on one hand and the significant shortage of these parking spaces has created a challenging problem for parking. This demand also leads to economic, social and environmental losses. Consequently, parking space optimization and control has become a real challenge for city transportation planners and traffic authorities. Presently in many Indian cities, the systems in place today for vehicular parking areas is just the ticket system i.e. driver will buy a ticket at the entry of parking area and after that motorist have to find the vacant parking bay as guided by the attendant. Such kind of system leads to loss for both parties associated with it i.e. driver (in terms of quality of service) and parking provider (in terms of revenue generation).

I. INTRODUCTION

Sustainable economic growth in last few decades has brought about expansion of the transport sector. The share of transport sector in Gross Domestic Product (GDP) of India has increased from 6.0% to 6.5% in first decade of twenty first century. During the same time period the contribution of road transport sector in GDP has increased from 3.9% to 4.7%.

The total number of registered motor vehicles have increased from about 55 million as on 31st March, 2001 to about 142 million as on 31st March, 2011. The total registered vehicles in the country grew at a Compound Annual Growth Rate (CAGR) of 9.9% in the first decade of twenty first century. Subsequently, In today‘s fast paced working environment, people (motorists) greatly depend on auto mobiles to commute to their destinations. Automobiles include: cars, motor bikes and public vehicles to mention but insufficient. The use of these auto mobiles has gradually postured a demand for infrastructure to manage the parking. In fact, business sector and municipalities have understood that how crucial is the supply of parking for their competitive growth, especially for visitors? The improvement of the urban environment is also partially dependent on adequate parking management. Various studies have considered the problem of car parking in the city including analysis and appraisal of the parking variables that influence the behavior of motorists. The results of these studies have helped the development of varied organizational and infrastructural policies. However in Chandigarh – The City Beautiful, in most of public parking’s, the management is relying on the ticket system for managing parking areas i.e. driver (user) will have to buy a ticket at the entry of parking area and after that motorist have to locate the free parking bay on their own. This leads to losses of both parties associated with it: driver (in terms of quality of service); parking provider (in terms of inefficient land use). The General Parking Issues are:

1) Still following ticket /manual system on most of the places.
2) Lack of information:
a) Public unaware of existing parking facility.
b) Parking facility available until the visitor arrives in the LOT.
3) Underutilization of existing parking space.
4) Lack of proper signage
5) Parking /congestion in freeway and arterial roads:
a) People hunting for parking Spot during peak hours
b) Due to long queues in ticketing.

In the present study, current scenario of parking demand and supply has been accessed and attempt has been made to identify the parking problem by collecting the data from the various areas of Chandigarh. The collected data has been synthesized and analyzed to optimize the parking process by advanced technologies and management techniques.

A. *Need for Parking Study*

Parking is one of the serious problems that confront the urban planner and traffic engineer. Before any measure for the betterment of the conditions can be formulated basic data pertaining to the availability of parking space, extent of its usage and parking demand are essential. If it is proposed to implement a system of parking charges it will also be necessary to know how much to charge and what will be the effect of the pricing policy on parking. Parking survey is intended to supply all these kind of information. With the growing population of motor vehicles, the problem of parking has assumed serious proportions. A systematic study of parking characteristic and demand and regulatory measures that are possible for controlling is of great help to a traffic engineers as well as town planner. As per as survey carried out in India it is roughly estimated that out of 8760 hours in year the car runs for an average for only 400 hours leaving 8360 hours when it is parked. Increasing concentration of human activity on limited land both in terms of residential activity and commercial activity causes the parking problem. Every car owner would wish to park the car as closely as possible to his destination so as to minimize his walking distance. This result in great demand for parking space in central business district (CBD) and other areas where the activities are concentrated.

B. *Regional Practice*

So much work has been done to improve the Process of Parking all around the world. But what about Chandigarh? Or Where Chandigarh is standing? The kind of system that we have in place today can be elaborated with the following sub-headings:

1) *Searching Time:* Blind searching is the only choice left with users when no parking information is offered. Motorists search parking spaces randomly within parking area or at certain distance to their terminus. The search ends only when the motorist will get a free space for parking otherwise, the driver will continuously searching in the neighboring parking areas until he/she finds space.
2) *Hunting for Space:* This mechanism represents the current state of parking system in Chandigarh. During the peak hours the possibilities of free parking lot are less however the demand from the users is higher lead to struggle for few parking spaces available. This phenomenon is called ―multiple-car-chasing-single-space‖, which may cause severe congestion.
3) *Long Queues:* Queues of vehicles at the entry gate waiting for their entry during peak hours is one of the chief factors for increasing the time of parking.

II. LITERATURE REVIEW

1) *Gillen (1977) [1];* examined the effects of a change in parking fee on mode choice in urban areas. Unlike the two previous studies discussed, this study focused on household decisions based on income class. The study had three goals: to characterize the parking cost variable in order to incorporate it into the mode choice model, to "calculate the microelasticity of mode choice with respect to parking costs," and to estimate the effect that changes in the individual characteristics have on the modal choices of the population as a whole.
2) *Mufti et.al. (1977) [2];* designed the optimal location for a fringe parking facility and the number of spaces to have at the facility. This study was completed in conjunction with a 1974 Delaware Valley Regional Planning Commission (DVRPC) study of 20 potential fringe parking sites at rail stations that had been identified by such characteristics as land availability, highway accessibility, rail ridership and parking demand. Author investigated the relation between the number of parking spaces available and the number of trips to and from the town centre. He found a close correlation between availability of parking spaces and the number of trips in Danish and American towns.
3) *Willson and Shoup (1990), [4];* the authors found that employer-paid parking "strongly works at cross purposes with public policies designed to reduce traffic congestion, energy consumption, and air pollution." Employer-paid parking encourages employees to drive solo while discouraging ridesharing, carpooling and transit usage. The effects of employer-paid parking extend to increasing air pollution, traffic congestion and gas consumption. Author used three different methods to analyze previously completed studies to measure the effect of employer parking subsidies on commuter mode choice. The first method to measure the effects of employer-paid parking was a mode share comparison between employees whose employers pay for parking and those employees whose employers do not pay for parking. The second method determined the number of automobiles used per every 100 employees. The third and final method were a calculation of the "parking price elasticity of demand for solo driving." This method showed the change in the percentage of solo drivers with respect to a one percent change in the cost of parking.
4) *Axhausen and Polak (1991) [5];* stated preferences data to model travelers response to changes in parking attributes and show that journey purposes has a strong impact on the value of time and consequent parking choices. Presents various data collection methods that are used to gather information on parking spaces. He also discusses the role of technology in the advancement of

these methods as well as the availability of data to assess the use and impacts of parking spaces. Author analyzed a 1998 Chicago Transit Authority (CTA) park-and-ride user survey to determine the characteristics of a park-and-ride facility that make it attractive to current users and could make it attractive to future users. The results of this study allowed CTA to determine parking locations that were candidates for capacity or service expansion

5) *Williams (1992) [6];* studied parking in the Washington, D.C metropolitan area to determine the relationship between employee parking costs and modal choice. The six month study consisted of collecting parking fee data from both private and public parking facilities, surveying private employers to gather a picture of the number of employers offering parking subsidies and the amount of those subsidies, and finally estimating the number of cars parking by using the regional travel model.

III. METHODOLOGY

For study, areas having shopping cum offices complexes in different sectors of Chandigarh were considered, in order to check how far the provided parking facilities in these areas fulfil or meet the parking demand and up to what extent they can accommodate the giant increase in the number of vehicles. The surveys were conducted in normal week days and the timing of the survey was kept from 10:00 am to 10:00 pm (except two locations, presented in respective tables). In Survey only two-wheelers and four–wheelers had been taken in consideration because the contribution of the rest of the vehicles in parking areas was less than one percent (<1%).

Study Area

Total 7 Locations from 2 different sector were considered for study. Based on land use, they cover the tourist spots, commercial hubs, bank Squares and CBA‘s as well. The detail is tabulated below in table – 3.1 and there layouts and sectioning used for evaluating the capacity of parking area are presented in figure – 3.1 to figure 3.15.

Detail of 7 - locations used for study

S.No.	Study Area/ Location	Land Mark	Sector
1	17C	Sector – 18 lights	Sector – 17
2	17D	B.S. Blue ice (Opp. MCC)	
3	17D	B.S. Neelam	
4	17C	B.S. Kapsons	
5	17B	Bank Sq.	
6	35B	Zone – 1 India Bulls	Sector – 35
7	35C	Zone – 2 Nik Bakers	

Capacity of Parking Areas

S.No.	Sectors	Study Area/ Location	Land Mark	Capacity		
				Four-wheelers	Two-wheelers	In terms of PCU’s
1	Sector - 17	17C	Sector – 18 lights	409	423	621
2		17D	B.S. Blue ice (Opp. MCC)	186	317	345
3		17D	B.S. Neelam	210	728	574
4		17C	B.S. Kapsons	409	249	534
5		17B	Bank Sq.	531	227	645
6	Sector – 35	35B	Zone – 1 India Bulls	380	1153	957
7		35C	Zone – 2 Nik Bakers	448	1348	1122

A. Parking Summary According to Physical Survey

Survey Summary Sheets is prepared summarizing the number of vehicles 'Entering' Parking (under 'IN 'column), vehicle 'leaving' parking (under 'OUT' column) and the resulting accumulation at the end of each 60 minute (one hour) interval. Accumulation at any time is calculated by subtracting 'OUT' and adding 'IN' to the accumulation numeral for the pervious interval, details are tabulated as

Parking Accumulation Summary Sheet for Sub Area – 1 (Sector - 17)

Duration - 12 hours			Day - average of 7 – days			
Parking interval- 1 hr.			Location – 17C (18 sec lgts.)			
Time (in hours)	Inflow		Outflow		Accumulation per hour	
	Car	Two - wheeler	Car	Two – wheeler	Car	Two – wheeler
Before 10:00 am	21	32	0	0	21	32
10:00-11:00 am	97	142	21	70	76	73
11:00-12:00 pm	122	148	115	115	6	33
12:00-1:00 pm	131	146	109	141	23	5
1:00-2:00 pm	146	134	125	137	20	-3
2:00-3:00 pm	135	135	142	134	-8	1
3:00-4:00 pm	134	129	145	121	-11	8
4:00-5:00 pm	134	121	139	120	-5	0
5:00-6:00 pm	136	125	118	126	18	-1
6:00-7:00 pm	149	145	119	112	30	33
7:00-8:00 pm	135	145	136	147	-2	-1
8:00-9:00 pm	25	24	116	123	-91	-99
9:00-10:00 pm	12	22	55	70	-43	-49

Parking Accumulation Summary Sheet for Sub Area – 2 (Sector - 17)

Duration - 12 hours			Day - average of 7- days			
Parking interval- 1 hr.			Location – 17D (opp. MCC)			
Time (in hours)	Inflow		Outflow		Accumulation per hour	
	Car	Two – wheeler	Car	Two - wheeler	Car	Two – wheeler
Before 10:00 am	21	26	0	0	21	26
10:00-11:00 am	122	130	27	36	95	94
11:00-12:00 pm	134	150	78	71	55	80
12:00-1:00 pm	132	142	85	87	47	55
1:00-2:00 pm	131	140	94	94	37	46
2:00-3:00 pm	132	125	108	129	25	-3
3:00-4:00 pm	100	142	77	106	23	36
4:00-5:00 pm	122	104	127	103	-4	0
5:00-6:00 pm	126	139	145	169	-19	-30
6:00-7:00 pm	126	133	154	135	-28	-2
7:00-8:00 pm	101	113	155	189	-54	-76
8:00-9:00 pm	47	61	148	184	-102	-123
9:00-10:00 pm	17	23	71	82	-54	-60

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IV. RESULT ANALYSIS

Parking Statistics such as*parking accumulation, parking volume, parking load, average parking duration, average turnover and parking index*for the present study are calculated in the following

Parking Accumulation Summary Sheet for Location – 1 (Sector - 17)

Duration - 12 hours							Day - average of 7 – days					
Parking interval- 1 hr.							Location – 17C (18 sec lgts)					
(1) Time (in hours)	(2) Cumulative accumulation (veh. Per hour)		(3) Parking volume (veh per hour)		(4) Parking load (veh. Hours)		(5) Average parking duration (in hours)		(6) Parking turnover (veh. per bay per hour)		(7) Parking index (percentage)	
	Car	Two wheeler	Car	Two wheeler	Car	Two wheeler	Car	Two wheeler	Car	Two wheeler	Car	Two wheeler
Before 10:00 am	21	32	21	32	21	32	1.00	1.00	0.17	0.25	14.80	20.02
10:00-11:00 am	97	105	95	142	97	105	1.02	0.74	2.24	2.50	69.48	64.90
11:00-12:00 pm	103	138	122	148	103	138	0.85	0.93	3.38	6.22	74.10	85.27
12:00-1:00 pm	126	143	131	146	126	143	0.96	0.98	9.88	7.74	90.44	88.36
1:00-2:00 pm	146	140	146	134	146	140	1.00	1.04	-21.23	6.10	104.93	86.42
2:00-3:00 pm	138	141	135	135	138	141	1.03	1.04	188.6	6.38	99.49	86.95
3:00-4:00 pm	127	149	134	129	127	149	0.95	1.16	11.29	9.69	91.47	91.80
4:00-5:00 pm	123	149	134	121	123	149	0.91	1.23	8.16	9.40	88.18	92.06
5:00-6:00 pm	141	148	136	125	141	148	1.03	1.19	-68.21	9.22	101.44	91.62
6:00-7:00 pm	171	181	149	145	171	181	1.15	1.25	-4.71	-7.57	122.71	111.82
7:00-8:00 pm	169	180	135	145	169	180	1.25	1.24	-4.51	-8.21	121.48	110.93
8:00-9:00 pm	78	81	25	24	78	81	3.10	3.36	0.41	0.29	55.81	49.74
9:00-10:00 pm	34	32	12	22	34	32	2.87	1.48	0.11	0.17	24.77	19.75
Total	1472	1619	1374	1449	1472	1619	17.12	16.64	125.58	42.18	1059.10	999.65
Average	113	125	106	111	113	125	1.32	1.28	9.66	3.24	81.47	76.90

Parking Accumulation Summary Sheet for Location – 2 (Sector - 17)

Duration - 12 hours							Day - average of 7 – days					
Parking interval- 1 hr.							Location – 17C (18 sec lgts)					
(1) Time (in hours)	(2) Cumulative accumulation (veh. Per hour)		(3) Parking volume (veh per hour)		(4) Parking load (veh. Hours)		(5) Average parking duration (in hours)		(6) Parking turnover (veh. per bay per hour)		(7) Parking index (percentage)	
	Car	Two wheeler	Car	Two wheeler	Car	Two wheeler	Car	Two wheeler	Car	Two wheeler	Car	Two wheeler
Before 10:00 am	21	26	21	26	21	26	1.0	1.00	0.1	0.1	11.4	8.3
10:00-11:00 am	116	120	122	130	116	120	1.0	0.93	1.8	0.7	62.5	37.9
11:00-12:00 pm	172	200	134	150	172	200	1.3	1.33	9.3	1.3	92.2	63.0
12:00-1:00 pm	219	255	132	142	219	255	1.7	1.79	-4.0	2.3	117.7	80.4
1:00-2:00 pm	256	301	131	140	256	301	2.0	2.15	-1.9	8.5	137.6	94.8
2:00-3:00 pm	280	297	132	125	280	297	2.1	2.37	-1.4	6.4	150.8	93.8
3:00-4:00 pm	304	333	100	142	304	333	3.0	2.35	-0.8	-8.9	163.4	105.0
4:00-5:00 pm	300	333	122	104	300	333	2.4	3.21	-1.1	-6.3	161.1	105.2
5:00-6:00 pm	281	304	126	139	281	304	2.2	2.19	-1.3	10.6	150.9	95.9
6:00-7:00 pm	252	302	126	133	252	302	2.0	2.27	-1.9	9.0	135.6	95.3
7:00-8:00 pm	198	226	101	113	198	226	2.0	2.01	-8.3	1.2	106.5	71.3
8:00-9:00 pm	96	103	47	61	96	103	2.1	1.69	0.5	0.3	51.8	32.4
9:00-10:00 pm	43	43	17	23	43	43	2.5	1.91	0.1	0.1	23.0	13.6
Total	2538	2843	1310	1428	2538	2843	25	25	-8.9	25.1	1364.5	897.0
Average	195	219	101	110	195	219	2	2	-0.7	1.9	105.0	69.0

A. *Present System for Demand Management*

As numbers of vehicles parked in parking area are much higher than their maximum capacity. The excessive vehicles are parked in a lane called *Neutral Lane*. Actually neutral lane is a lane in centre of parking areas side by side to mark parking lots in which the vehicle stands in neutral gear without pulling the hand brake. These lanes can be two or more depending on the availability of space. Fig.1 shows the factual condition of parking sub-areas. In the photo L and photo R extreme left and right lanes are marked or fixed parking lot area where as the centre lane of vehicles is neutral lane; which was the passage area for the vehicles coming in and going out from parking area. Whenever any vehicle which was parked in actual/marked parking lot desire to leave, then a user will have to call supervisor of the parking area. The supervisor will push or pull the vehicle parked in neutral lane to provide passage space for correctly parked vehicle. This process is inconvenient, time consuming, poor aesthetics, adversely affects environment and frustrating for both the drivers which are coming in or going out.

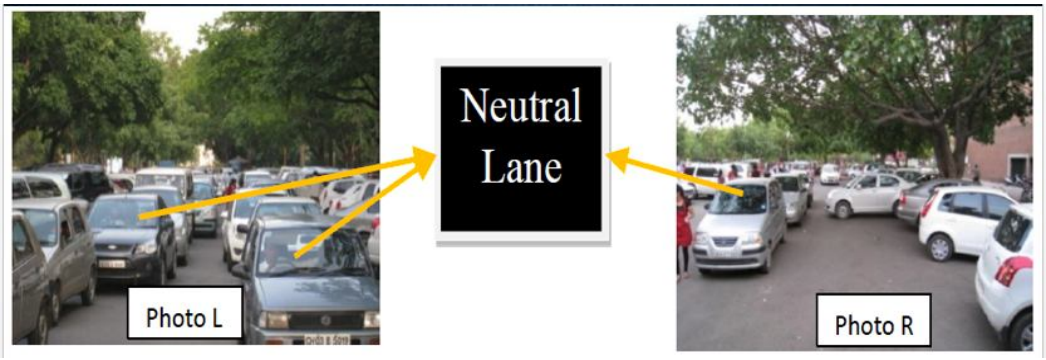

Fig. – 1: Real Photograph Showing Present System for Demand Management

B. *Management Techniques*

The term management techniques refers to strategies and agendas, which helps in efficient usage of parking resources. Gaps in public transport facility, population enhancement plus hike in incomes have resulted in escalation of motor vehicles on road. However the supply of parking to accumulate road traffic is a balancing act; i.e. if the supply is surplus, consequences are underutilization of valuable land, so disconnected development pattern; whereas if there is shortage of supply then results will be the spill-over to adjoining areas leading to traffic congestion on the roads.

V. CONCLUSION

In Chandigarh, majority of the parking facilities are common/public, controlled by administration and private owners have not made suitable arrangements for their own parking. The outcome of the supply and demand studies has revealed that in almost all the activity/work centres of the city, ad-hoc parking overspill often takes place along sections of road, residential streets, foot paths and green verges of the roads which causes frequent traffic congestions on the outer periphery of the parking areas. Similarly, within the parking area, the excessive vehicles are parked in a lane called *Neutral Lane* and neutral lane is a lane between the marked parking lots of the parking areas, where the vehicle stands in neutral gear, without pulling the hand brake. So that there will be a flexibility to push and pull the vehicle in case of emergency. These lanes can be two or more depending on the availability of space.

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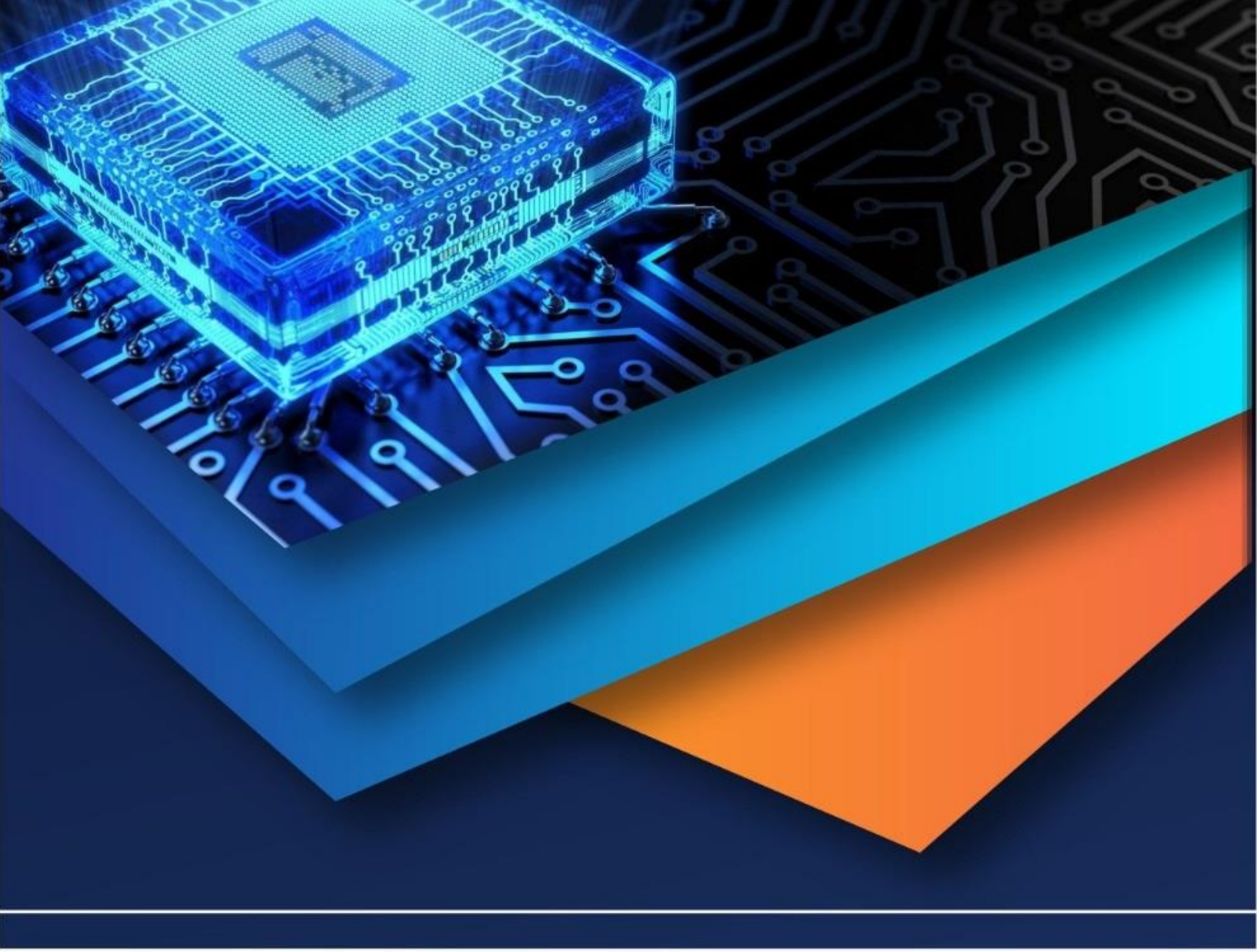

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