iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 5 **Issue:** IV **Month of publication:** April 2017

**DOI:**

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)

# Trip Attraction Models for Shopping Malls: A Case Study

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***Abstract:*** ***Trip attraction is an important parameter in planning of transportation facilities. It aims at forecasting total number of trips generated or attracted towards zones of study area. It is important for the traffic engineer and urban planner to consider the impact of trip attraction at commercial complex, shopping malls and residential areas. This paper aims to build a suitable trip attraction model for selected malls at Vadodara city.***
***Keywords: Trip attraction, TransCAD, Correlation, Multicollinearity, Regression analysis, Trip attraction rate***

## I. INTRODUCTION

The major problem that developing countries are facing today is Urbanisation. As a result of urbanisation the standard of living of people have also improved. Shopping malls have played a major role in this process. People have shifted towards the mall culture instead of shopping from individual stores or retail outlets. The trip attraction rate of shopping mall depends upon the following such as time of the day, day of the week and facilities provided by the mall. Location of malls impact existing traffic operations on urban road network. Evaluation of impact on traffic is supported by trip attraction models.

## II. NEED OF THE STUDY

The development of various commercial recreational malls have resulted into problems such as parking, traffic congestion due to more number of trips attracted to the mall. Hence the increased trips are considered for providing efficient facilities. Estimation of increased trips due to location and attributes of mall is very important in understanding traffic impact.

## III. OBJECTIVES

*A. The Objectives of Study are*

*1)* To develop questionnaire and methodology which can be followed for other similar cases.
*2)* To develop attraction rates and trip attraction model.

The scope of study is limited to the selected malls in Vadodara city.

## IV. LITERATURE REVIEW

*A. Walejo(2012)*

Determined trip attraction at the market land use and developed an attraction model at Dinoyo market area. Model formulation was done using correlation and regression analysis.

*B. Udin (2004)*

Examined trip attraction rate of shopping centre at dhanmondi area in Dhaka city. He used trip rate analysis instead of regression analysis because of small sample size.

*C. Innes (1990)*

He determined various factors affecting shopper's destination choice and it included store hours operation, accessibility to the shopping centers and quality of goods offered.

*D. K.Mert Cubuku (2001)*

It attempted to answer two question 1. Factors that affect the shopping trips and 2. Did the demand of internet and online shopping has any effect on shopping trips. The dependent variable considered were number of trips and independent variables were related to

shopping factors.

## V. METHODOLOGY

Study area was delineated. The zoning of study area is divided into 13 wards in order to simplify travel pattern. Primary data of the study area and malls were collected from municipal corporation and mall owners. The primary data which gives socio economic character of traveller was collected using well designed questionnaire. Survey was done starting from opening of the mall to the closure of the mall in order to determine the total number of trips attracted towards each mall from different wards of the city. The data was complied in MS Excel sheet.

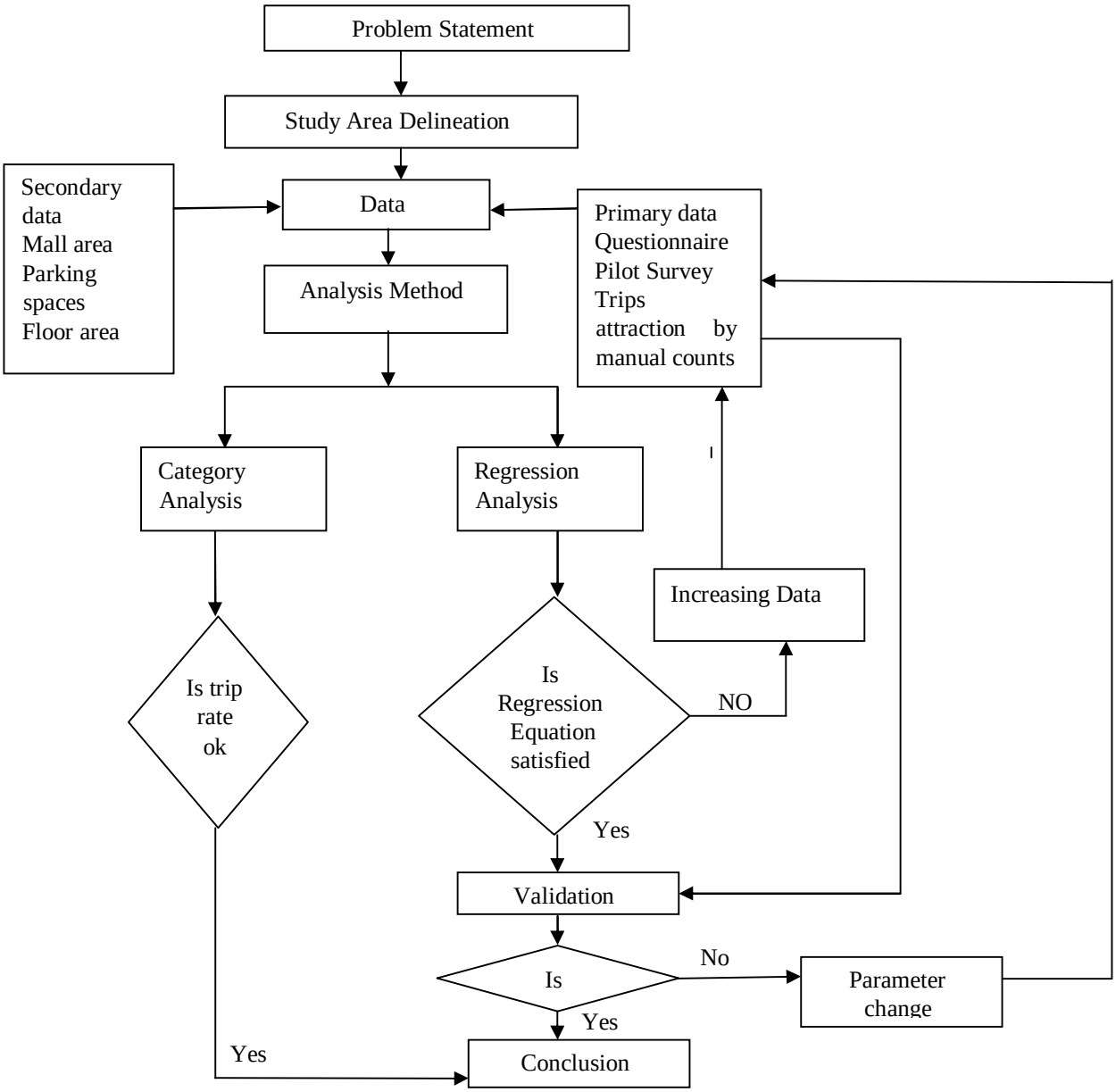


Fig-1 Methodology chart

## VI. STUDY AREA

The position of selected malls were plotted using TransCAD software as shown in the figure-2

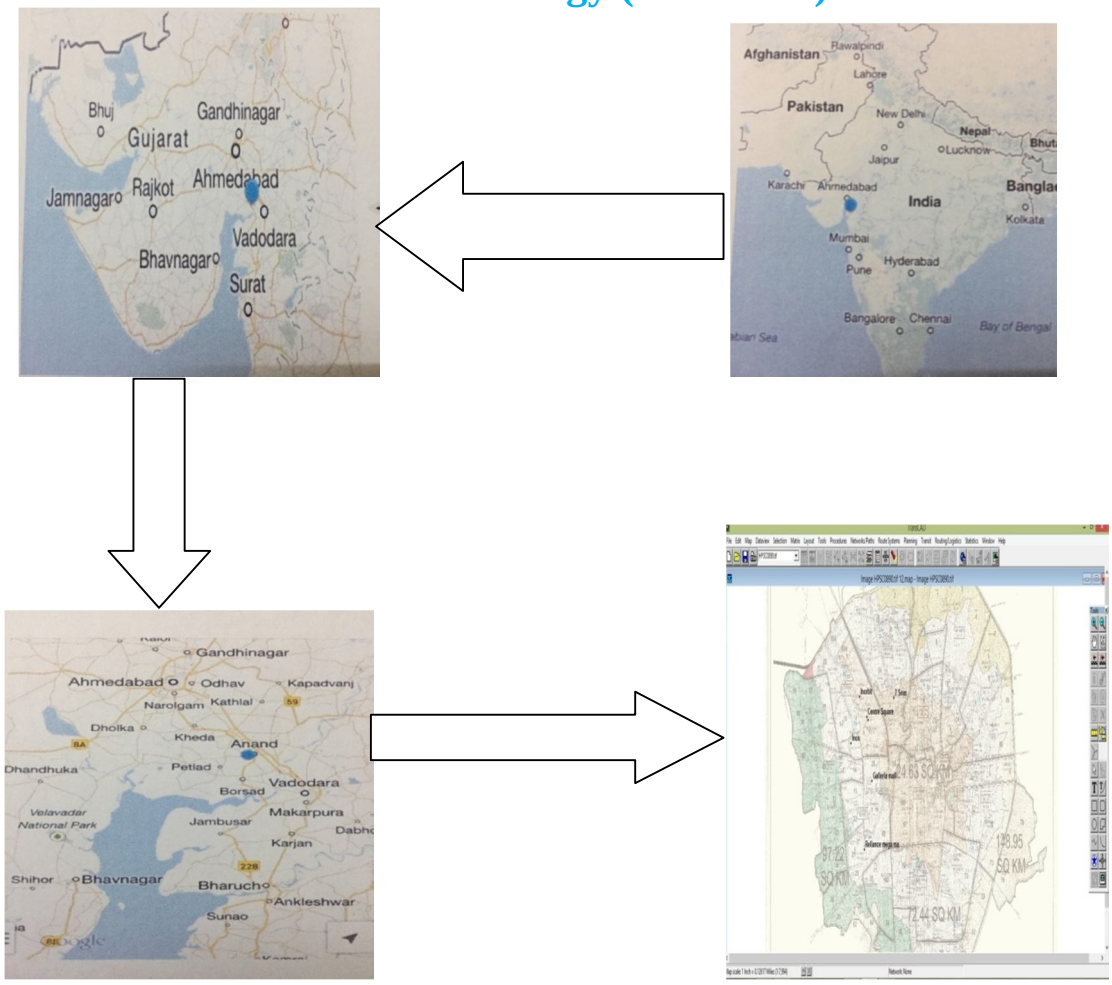


Figure-2 Layout Map

The details of selected shopping malls are shown in the following table1

Table-1 Mall Details

| Name of Malls | Location | Parking space 2w | Parking space 4w | Floor area Lacs sqft | Restaurant Floor area sqft |
|---|---|---|---|---|---|
| Inorbit Mall | Gorwa | 380 | 150 | 4.05 | 87000 |
| Centre square Mall | Genda Circle Alkapuri | 370 | 50 | 1.5 | 13000 |
| Vadodara central | Genda Circle Alkapuri | 330 | 70 | 1.6 | 4000 |
| 7 Seas Mall | Fathegunj | 400 | 110 | 1.85 | 47000 |
| Reliance Mega Mall | Old Padra Road | 450 | 100 | 1.97 | 30000 |
| Galleria Mall | Akota | 350 | 40 | 1.75 | 6000 |
| Inox | Race Course | 300 | 50 | 1.45 | 2500 |

## VII. DATA ANALYSIS

### A. *To find the Peak Period at Malls*

Hourly trip attraction survey was carried out at each mall to determine the peak period. The data collected is shown in the following

table.

Table-2 Hourly Trip Attraction

| Name of malls | 10-11am | 11-12am | 12-1pm | 1-2pm | 2-3pm | 3-4pm | 4-5pm | 5-6pm | 6-7pm | 7-8pm | 8-9pm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7seas | 162 | 212 | 222 | 269 | 411 | 453 | 483 | 575 | 745 | 797 | 540 |
| Vadodara central | 72 | 134 | 215 | 317 | 373 | 325 | 350 | 475 | 545 | 440 | 275 |
| Centre square | 56 | 174 | 243 | 197 | 155 | 312 | 295 | 345 | 425 | 373 | 250 |
| Reliance mega mall | 79 | 127 | 153 | 177 | 159 | 197 | 166 | 352 | 369 | 275 | 243 |
| Galleria mall | 105 | 179 | 205 | 243 | 151 | 167 | 347 | 392 | 453 | 551 | 558 |
| Inox | 83 | 175 | 159 | 236 | 197 | 263 | 256 | 230 | 357 | 383 | 405 |
| Inorbit | 897 | 653 | 743 | 549 | 693 | 804 | 885 | 975 | 1575 | 1793 | 1675 |

The hourly trips of different malls were plotted using TransCAD software in order to determine peak hour of each mall.

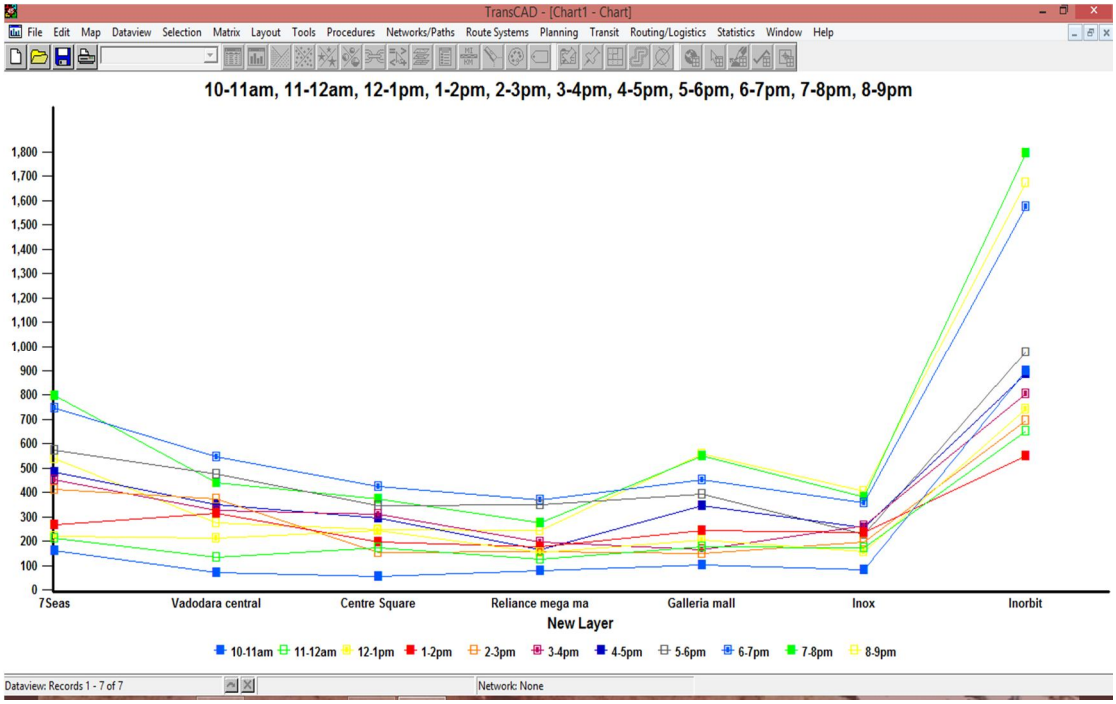


Figure-2 Hourly trip attraction chart

From the above chart it can be said that the peak period for each mall is from 5pm-9pm during weekdays.

*B. Trip Attraction Rate*

After esmitating peak hour, Trip attraction rate was calculated relating peak hour trip with attributes of shopping mall. The rip attraction rate was determined using the following equations

*1)* Trips per 1000 sqft per hour = (Peak hour person trips/floor area)*1000
*2)* Trips per hour per shop = (Peak hour person trip/total number of shops)
*3)* Trips per entry gate per hour = (Peak hour person trip/number of entry gate)
*4)* Trips per 1000 sqft per hour = (Peak hour person trips/ restaurant floor area)*1000

Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Table-3 Calculation of Peak hour person trip attraction (trips/1000sqft/hour)

| Name of mall | Peak hour trip | Floor area Lacs sqft | Trip attraction rate |
|---|---|---|---|
| 7 Seas | 664.25 | 1.85 | 3.59 |
| Vadodara Central | 452.5 | 1.6 | 2.82 |
| Centre Square | 359.5 | 1.5 | 2.39 |
| Reliance mega mall | 309.75 | 1.97 | 1.57 |
| Galleria Mall | 488.5 | 1.75 | 2.79 |
| Inox | 343.75 | 1.45 | 2.37 |
| Inorbit | 1504.5 | 4.05 | 3.71 |

Table-4 Calculation of Peak hour person trip attraction (trips/total number of shops)

| Name of mall | Peak hour trip | Number of shops | Trip attraction rate |
|---|---|---|---|
| 7 Seas | 664.25 | 20 | 32.21 |
| Vadodara Central | 452.5 | 15 | 30.16 |
| Centre Square | 359.5 | 28 | 12.83 |
| Reliance mega mall | 309.75 | 15 | 20.65 |
| Galleria Mall | 488.5 | 1 | 488.5 |
| Inox | 343.75 | 5 | 68.75 |
| Inorbit | 1504.5 | 88 | 17.09 |

Table-5 Calculation of Peak hour person trip attraction (trips/ number of entry)

| Name of mall | Peak hour trip | Number of entry | Trip attraction rate |
|---|---|---|---|
| 7 Seas | 664.25 | 2 | 322.12 |
| Vadodara Central | 452.5 | 1 | 452.5 |
| Centre Square | 359.5 | 2 | 179.75 |
| Reliance mega mall | 309.75 | 1 | 309.73 |
| Galleria Mall | 488.5 | 2 | 244.25 |
| Inox | 343.75 | 1 | 343.75 |
| Inorbit | 1504.5 | 2 | 752.25 |

Table-6 Calculation of Peak hour person trip attraction (trips/restaurant floor area)

| Name of mall | Peak hour trip | Restaurant Floor area sqft | Trip attraction rate |
|---|---|---|---|
| 7 Seas | 664.25 | 47000 | 14.13 |
| Vadodara Central | 452.5 | 4000 | 113.125 |
| Centre Square | 359.5 | 13000 | 27.65 |
| Reliance mega mall | 309.75 | 30000 | 10.325 |
| Galleria Mall | 488.5 | 6000 | 81.41 |
| Inox | 343.75 | 2500 | 137.5 |
| Inorbit | 1504.5 | 87000 | 17.29 |

## VIII. MODEL FORMULATION

For model formulation correlation and regression analysis were performed using Microsoft excel.

### A. Correlation Analysis

A correlation coefficient indicates linear relationship between two variables. The value of coefficient ranges between 0 and 1 where 0 indicates no relationship and 1 indicates perfect correlation.

### B. Multicollinearity

Correlation matrix is used to detect collinearity. It is said that multicollinearity is present if the value of coeeficient is larger than 0.4. The correlation matrix is as shown below. As most of the variable are correlated they are not considered for regression analysis.

Table-7 Correlation matrix

| | *2W* | *4W* | *RFA* | *FA* |
|---|---|---|---|---|
| 2W | 1 | | | |
| 4W | 0.424199 | 1 | | |
| RFA | 0.480998 | 0.959454 | 1 | |
| FA | 0.274512 | 0.85766 | 0.912271 | 1 |

### C. Regression Analysis

The best model obtained after correlation analysis is regression model. The independent variable considered are parking space for 2-wheelers and floor area of mall.

The regression equation is as follows

Trips attracted = 167.17 + (-1.0774 2wheeler parking space) + (0.0031floor area of mall)

where,

y= trips attracted to the malls

$x_2$= Parking space for 2 wheeler

$x_4$= Floor area of mall.

The first term in the equation 161.17 is a constant represents the predicted criterion value when both predictors equal zero. The values -1.0774 and 0.0031 represent weight or regression coefficient of selected independent variables parking space for 2 wheeler and floor area of mall.

Table-8 Regression Statistics

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.970115402 |
| R Square | 0.941123892 |
| Adjusted R Square | 0.911685838 |
| Standard Error | 84.27368997 |
| Observations | 7 |

R square is a statistical measure of how close the data are to the fitted regression line. It is also known as the coefficient of determination. R square always ranges between 0 and 100%. 0% indicates that the model explains none of the variability of the response around its mean where as 100% indicates that the model explain all the variability of the data around its mean. In general, higher the R square better is the model fit.

## IX. CONCLUSION

This study developed a suitable trip attraction model using regression analysis in order to forecast future trips attracted to the shopping malls.

This study gives an idea about factors affecting trip attraction towards the shopping mall.

The model will be beneficial in finding out the impact of the future trips that would be attracted to the malls on the traffic so that proper planning of transportation facilities and services can be effectively done by the urban planners.

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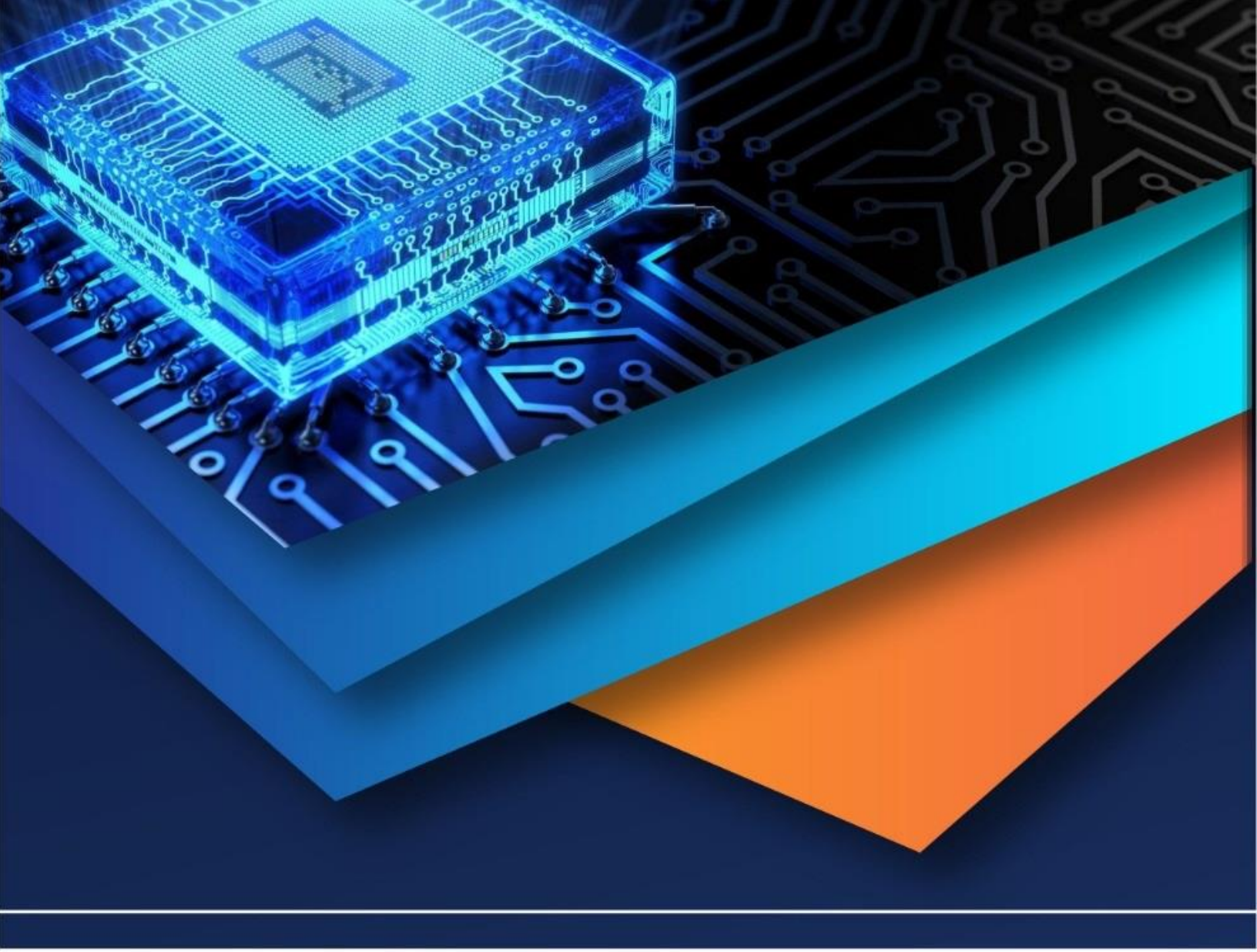

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