iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4220

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

Preparation of Safe Site Zonation Map of Karul Ghat by using RS and GIS

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Abstract: ***Many rainfall-induced landslides transform into debris flows (fast-moving slurries of water, soil and rock) as they travel down steep slopes, especially those that enter stream channels where they may mix with additional water and sediment. In the present report, an attempt has been made to study the detail preparation of safe site zonation map of KARUL GHAT have study. For detailed study, we used SRTM data for preparing digital elevation model (DEM), and geographical information system (GIS) was used in evaluation of linear, areal and relief aspects of morphometric parameters. Watershed boundary, slope, hill shade, stream ordering have prepared using spatial analysis Tools and contour, aspect, have prepared using Surface Tool in QGIS 3.2.3 BONN software. Different types of maps i.e. digital elevation model, contour map, slope map, etc., have prepared by using QGIS software. Based on that analysis we prepare safe site zone in the study area.***
Keywords: Landslide, QGIS, Safe site zonation map, Contour map, Digital elevation model.

I. INTRODUCTION

Landslide is one of the major natural and geological hazards occurring all over the world every year. In the recent past, various landslide events have taken place in several regions in India. It generates lots of fatalities and financial losses than any other type of natural disasters. About more than 12% of the land area in the country is susceptible to landslide and more than 300 die every year worldwide due to a landslide. With recent developments of satellite image with high resolution, image analysis techniques and geographical information system (GIS) for spatial data analysis, a variety of application using Remote Sensing and GIS as tools are emerging. The Landslide phenomenon is not only limited to land or sliding but it also includes all kind of mass movements towards the slopes under influence of gravity. Due to a sudden landslide on roads transportation and the factors related to it gets badly affected. Nowadays, using Remote Sensing and GIS techniques we can predict the possible areas where landslide may occur in future. Geographic Information System by which we can observe various features of the ground surface. GIS technologies facilitate the management of different typology of analogical data, maintaining a proper cartographic representation and allowing the combination of analogue and vector data in order to create useful hazard management maps. These different information, included in the GIS geodatabase maintain their geometric consistency, allowing rapid query and calculation using the stored data. Karul Ghat starts at Karul Check Post and finishes 800 meter ahead of Kolhapur border in Gaganbawda. The 9 Km portion of this Ghat falls in Sindhudurg. Sudden twists and deadly turns in here make journey thrilling and risky at the same time. Sindhudurg and Kolhapur shares good trade relations for which maximum transport takes place through Karul Ghat. Gradually number of heavy vehicles travelling from this route increased and due to lack of restrictions and regulations these vehicles deteriorated corners of high cliffs here. In Karul Ghat, landslides are recurrent phenomena causing victims and significant economic damage to infrastructures, loss of productive soils and pasture lands. Annually, during the rainy seasons. Not less than crores of rupees are spent till date on safety fencing, support walls, parapets etc.The Karul Ghat regions are affected by natural hazards, among which landslides represent the primary cause of death. Landslide inventory maps are prepared for multiple scopes, including: (i) documenting to study the evolution of landscapes dominated by mass-wasting processes, (ii) as a preliminary step toward landslide susceptibility, hazard, and risk assessment, (iii) to investigate the distribution, types, and patterns of landslides in relation to morphological and geological characteristics and (iv) the extent of landslide phenomena in areas ranging from small to large watersheds and from regions to states or nations. The present study reveals that necessity of landslide hazard zonation and safe site zonation mapping with the help of field study as well as Remote Sensing and GIS.

II. STUDY AREA

The present study reveals that the study of Karul Ghat which is the mainly hilly area. From this area, NH17 passes. By using Remote Sensing and GIS software we are going to show safe site Zonation Map of Karul Ghat. It is helpful for future planning as well as to prevent loss occurring due to a landslide in that area (Figure 1).

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1) Study area : Karul Ghat (Kolhapur district, Maharashtra)
2) Longitude : 73.795 E to 73.837 E
3) Latitude : 16.518N to 16.549 N
4) Area :9.71Sq.km

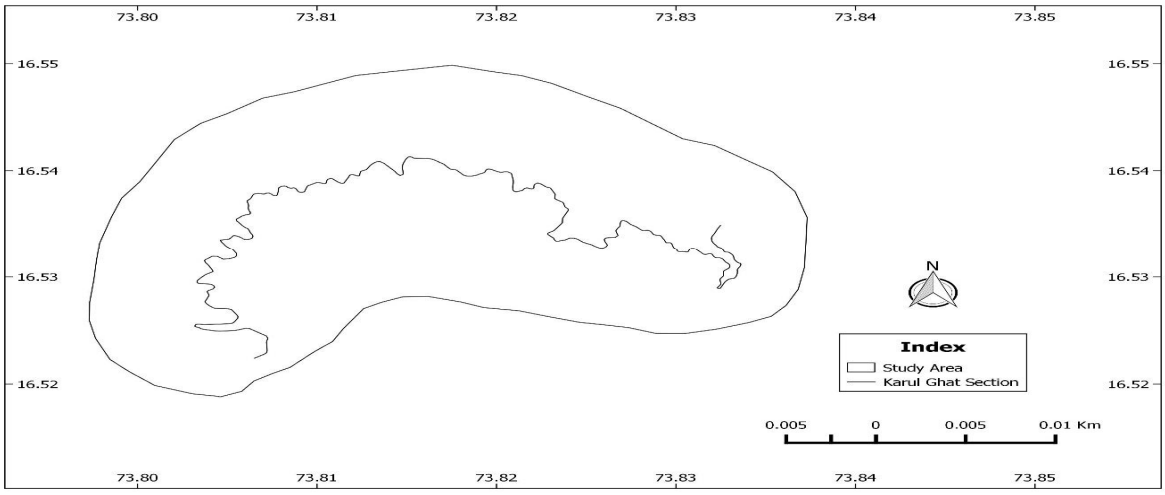

Fig. 1 Study area

III. METHODOLOGY

A. Study basics of remote sensing and GIS.
B. Collect maps of study area including spatial data.
C. Interpretation of spatial data.
D. Preparation of safe site zonation map of study area.

IV. RESULT AND DISCUSION

1) *All Digital Elevation Model (DEM):* There is no universal usage of the terms digital elevation model (DEM), digital terrain model (DTM) and digital surface model (DSM) in scientific literature. In most cases the term digital surface model represents the earth's surface and includes all objects on it. In contrast to a DSM, the digital terrain model (DTM) represents the bare ground surface without any objects like plants and buildings (see the figure on the right) DEM is often used as a generic term for DSMs and DTMs, only representing height information without any further definition about the surface (Figure 2).

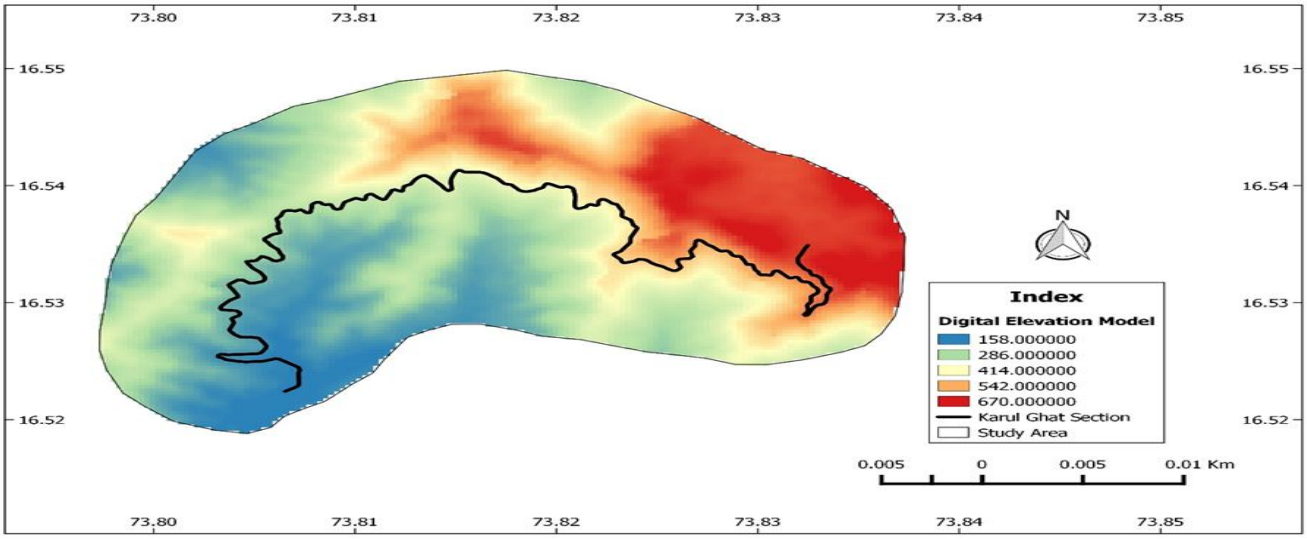

Fig. 2 Digital elevation model.

2) *Contour Map of study Area:* We prepared contour map of study area with help of raster analysis of QGIS software contour interval of this map is 25m. Highest contour is 675m and lowest contour is 150m (Figure 3).

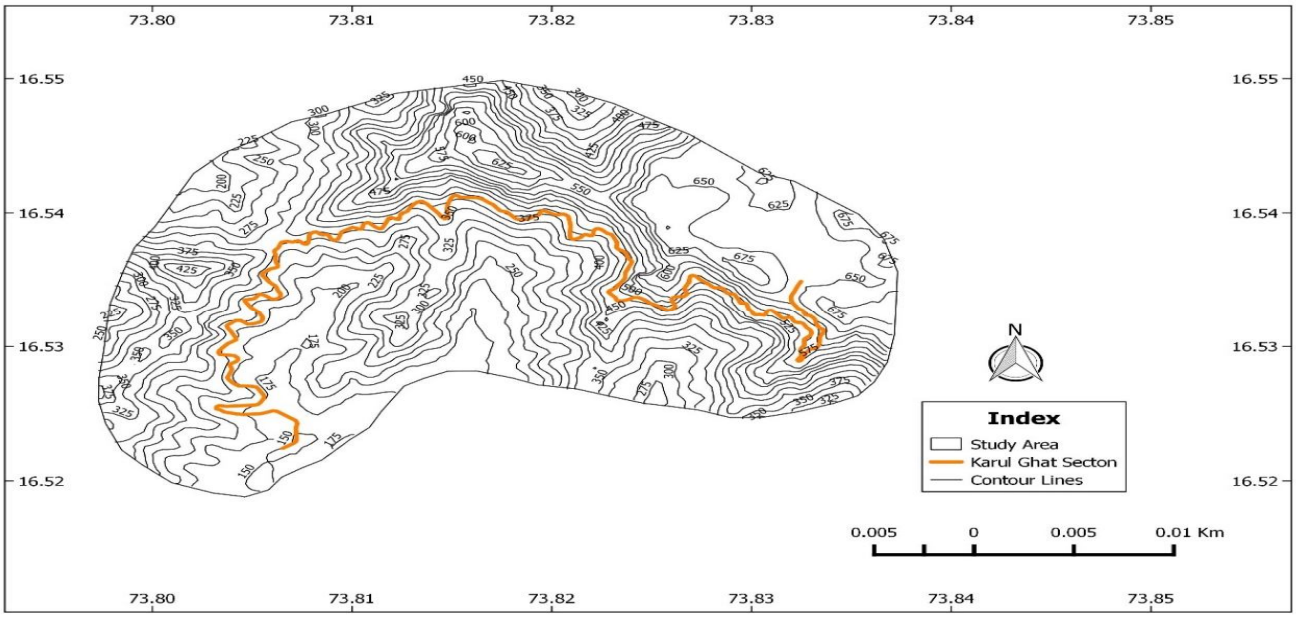

Fig. 3 Contour Map.

3) *Slope Map:* We prepared slope map of study area in Grass 6.4.4 of QGIS software. Maximum area of karul ghat is covered by very steeply sloping also some area of karul ghat section is coming under the steeply sloping. the along road stretch area of karul ghat is extremely sloping in nature (Figure 4).

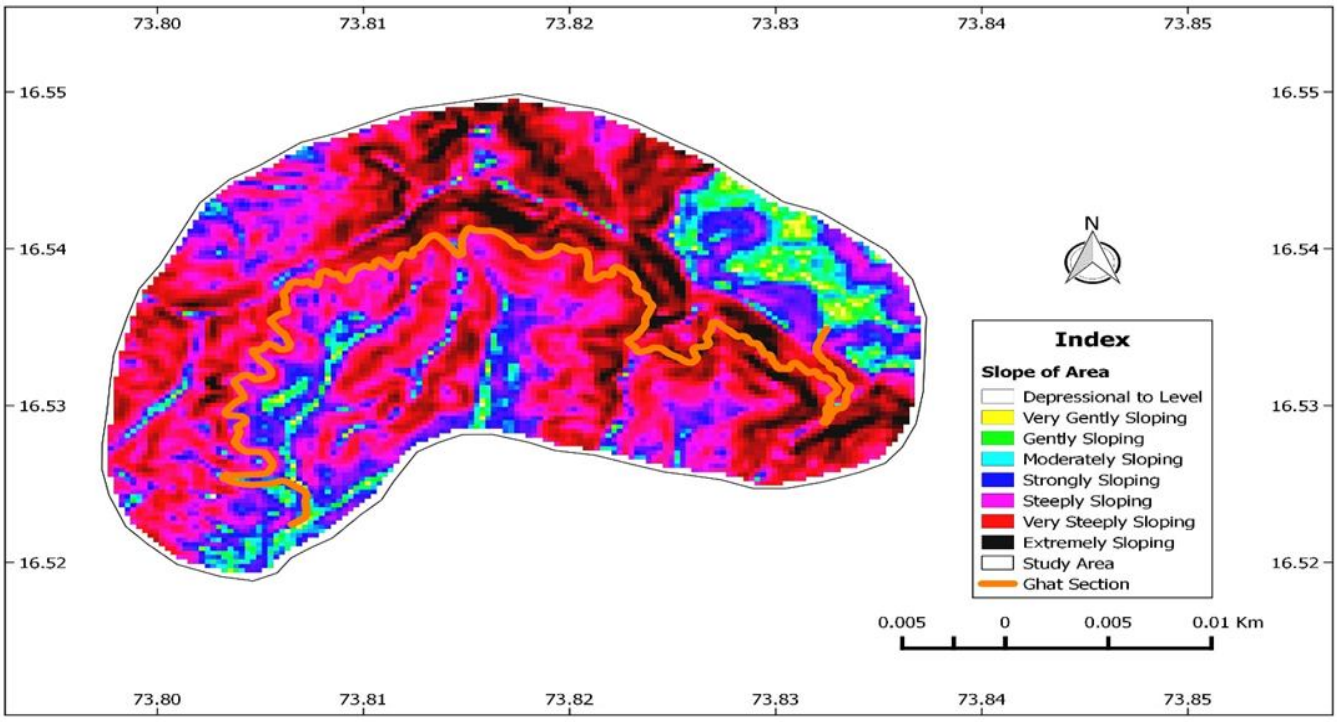

Fig. 4 Slope Map.

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4) *Lineaments of Area:* We prepared lineaments map of area in GRASS 6.4.4 of QGIS software. lineaments map indicates structural weak zones of area. Natural water channels is formed along these weak zones due to these possibility of landslide is more in that area (Figure 5).

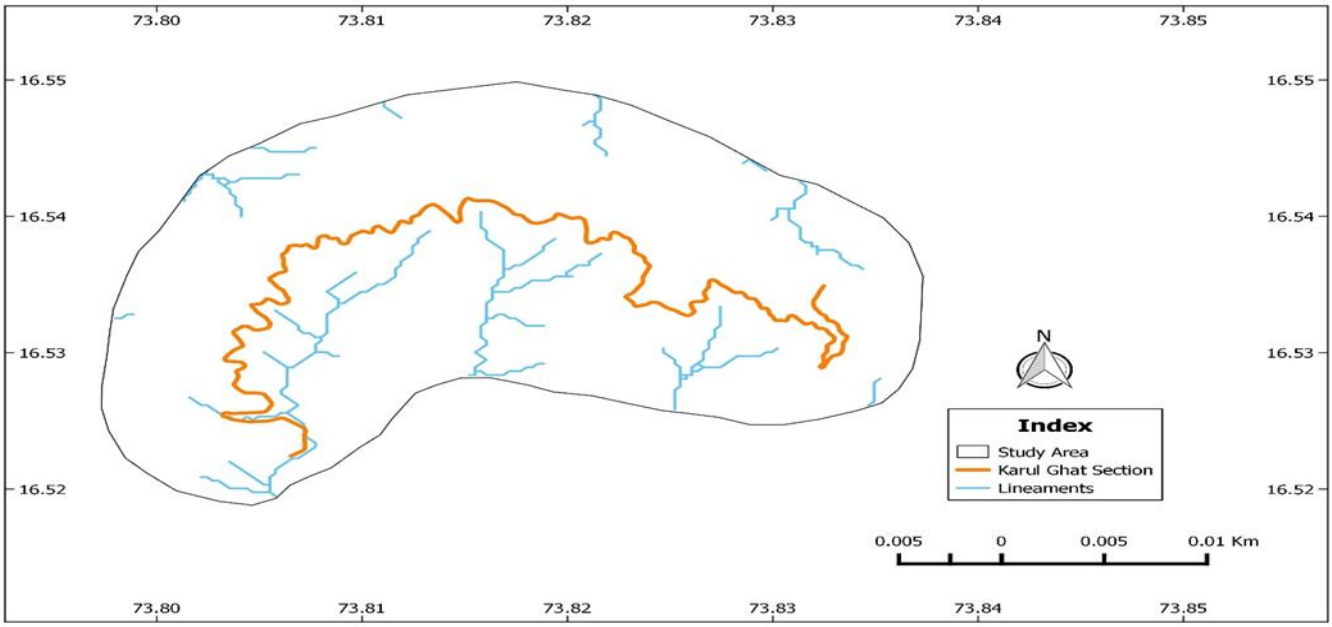

Fig. 5 Lineaments map.

V. CONCLUSIONS

We prepared landslide safe site zonation map of study area with help of raster analysis in QGIS software. In map red colour indicates very high severity of risk similarly dark green colour indicates very low risk. It is prepared to assist mitigation planners in wake of landslide trigger. In the present study remote sensing and field data has been used to prepare safe site zone of study area. Remote sensing data is further used to delineate drainage pattern, photo lineaments, structural features, lithological features area by applying digital image processing techniques Geological features are analysed using criteria such as colour, tones, topography and stream drainage pattern from the imageries. Digital elevation model data is used to generate primary topographic attributes namely and slope.

Purpale colour indicates unsafe area and green colour indicates safe area also yellow colour indicates valunerable. It is very much usefull for future planning, locating accidental prone area, security room as well as in heavy rainfall we can use that area as a stoping or parking point (Figure 6).

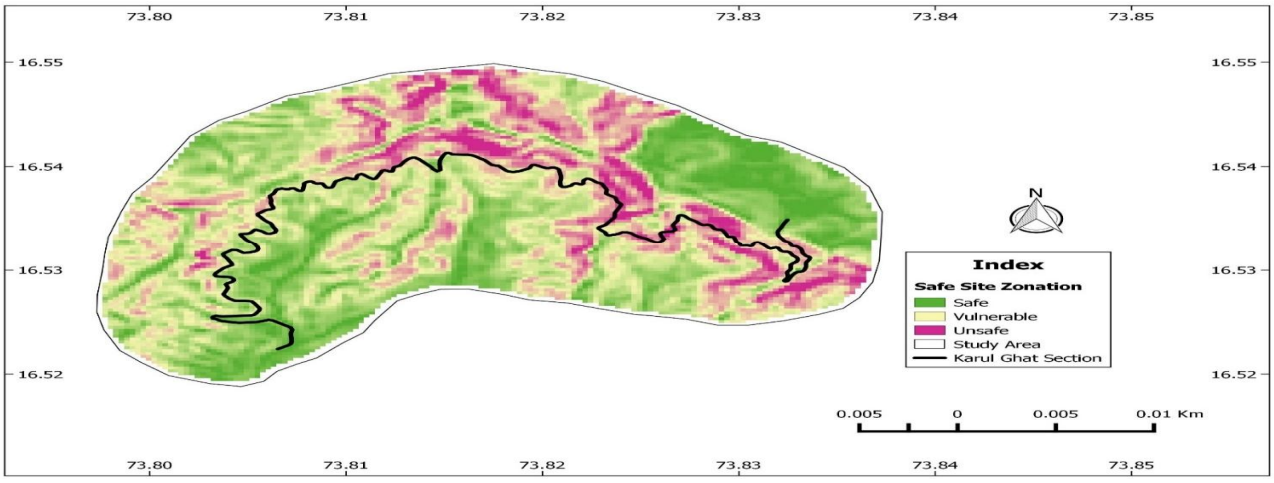

Fig. 6 Safe site zonation map.

VI. ACKNOWLEDGMENT

We take this opportunity to express our profound gratitude and deep regards to our guide Prof. A.A. Lole for his exemplary guidance, monitoring and constant encouragement throughout the course of this project. The blessings, help and guidance given by him from time to time shall carry us a long way in the journey of life on which we are about to embark. It is because of him that we could synchronize our efforts in covering the manifold features of this project work. We are greatly indebted to him for piloting us whenever we faced difficulties.

We also take this opportunity to express a deep sense of gratitude to Prof. S.B. Kore , for his cordial support, valuable information and guidance. Which helped us in completing this project through various stages.

We are obliged to all staff members of Department of Civil Engineering, for the valuable information provided by them in their respective fields. We are grateful for their co-operation without which this entire manuscript couldn't be completed in time.

Once again we are thankful to all those who directly or indirectly helped us in completing this project and making it a knowledgeable experience.

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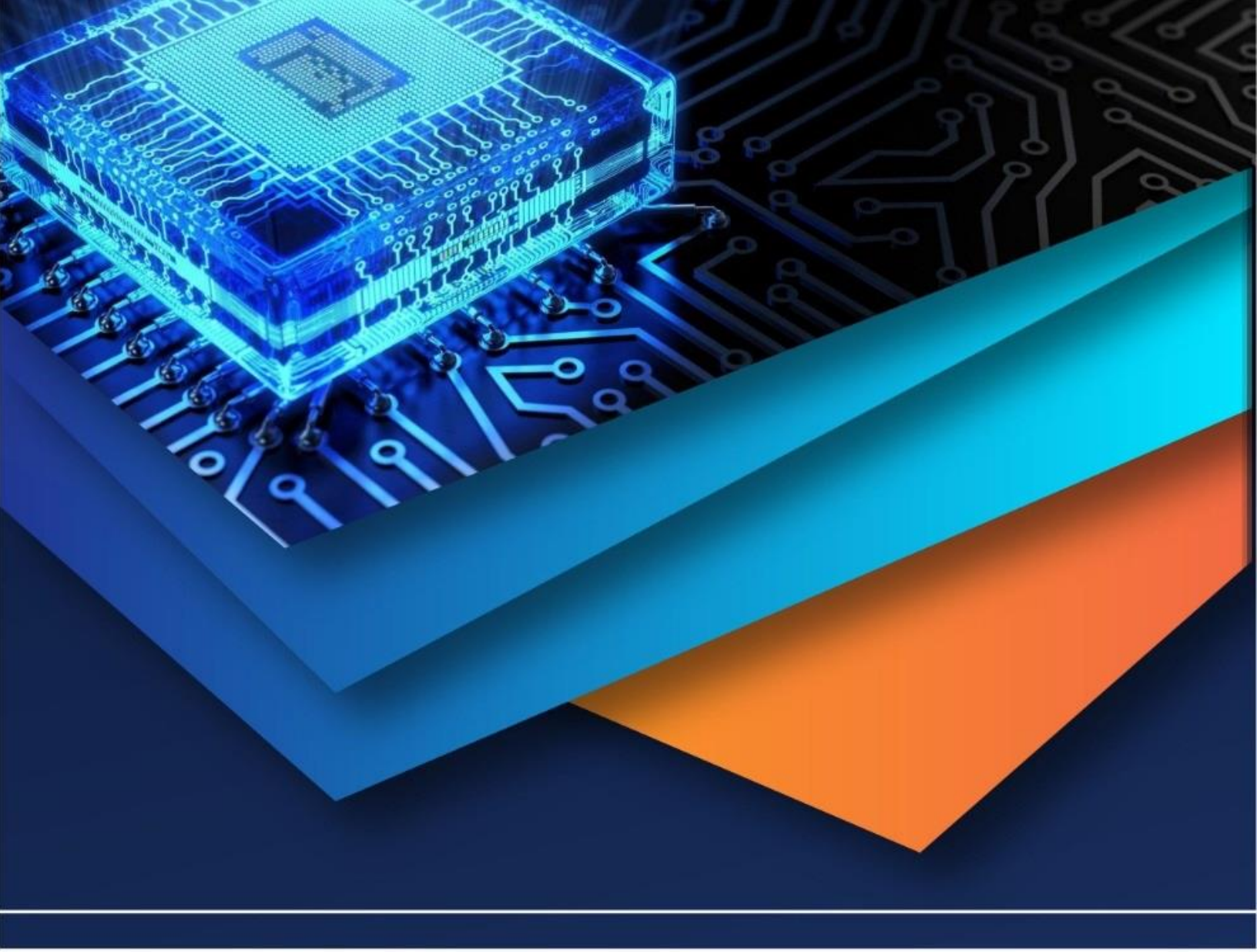

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