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Comparative Study Between Archaic and Advance Technique to Evaluate the Impact of Mining Activities on Neighboring Environment

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Abstract: ***Geo-material plays significant role in the expansion of social progress, industrial growth and treasure of all nations. Rocks are one of the most accessible natural resource and one of the most important building material for urban development. It has been used from the initial spells of our progress for a multiple uses that have increased in quantity and complexity with time. Stone is a major basic raw material applied in crushed form for construction. Minerals are non-renewable in nature and also limited as well and Rocks are the assemblage of minerals. A mineral formerly extracted from the earth were leftover forever so the suitable arrangement of use for minerals including exploration and exploitation should be implemented. Compared to traditional methods, new advanced methodologies are widely used for surveying, mapping and monitoring of these natural resources. Remote Sensing and GIS/ GPS technology including drone technology has been capable as native/ global survey using aerial photo and satellite imagery for temporal study. The multi-temporal nature of satellite imagery helps to monitor present and past situation of the earth features. Thus, provides a useful information to identify land use/ land cover changes and calculate the amount of change. Satellite images are a valuable source of data for surveying, mapping, and monitoring of terrestrial resources as compared to older approaches such as topography and aerial photography. The multi-date character of space technology integrated with drone technology allows to manage/ monitor the mining activities.***
Keywords: Environment degradation, GIS, impact assessment, mining activities, remote sensing

I. INTRODUCTION

Quarrying is the practice of extracting precious stones from the ground. Dimension stone, rock salt, gravel, and other raw minerals are among the raw resources mined. Quarrying is necessary to obtain stones from the soil that cannot be industrialised through agriculture or artificially generated in a laboratory. Since prehistoric times, stone mining and crushing has been a social stroke. To remove required materials, modern stone quarrying and crushing procedures include excavating or blasting for rock shapes. Mining activities, in general, have a negative influence on land resources and/or after the mine has closed. The quarrying activities of rock forms usually have a substantial impression on the geo-environment, biotic wealth and socio-economic situation of the native residents. Its accents are the ecological concerns being threatened by the opencast mining of Jhansi. The degree of influence be subject on the approaches and attentiveness of mining operations and the geological and geomorphological situation. It passages enormous harm to local land and biotic groups [1]. It progressions huge damage to land resources of the earth surface. The un-systematic mining of minerals possess a severe risk to the surroundings, ensuing inside the discount of woodland cowl, erosion of soil in a more scale, pollutants of water, air and land and discount in biodiversity. The troubles of waste rock dumps emerge as destruction to the panorama in and around quarrying sites [2].

Remote sensing integrated with satellite sensors was used to get temporal (multi-date/time) and synoptic interpretations of the spectral behaviour of diverse environments, such as atmosphere, water quality, land degradation and soil etc. Remote sensing and GIS have been used previously to map the distribution of land resources, as well as their landscapes and geo-environments [3]–[8].

II. NOTEWORTHY CONTRIBUTIONS OF RESEARCHER'S

Jacko (1983) had given approximation of quick dust in and around mining activities. Air pollution of moveable mine plunders and dust produced from crushing units may have expressive impact to air quality in and around the mining sites [9].

According to Valdiya (1987), mining and quarrying process are basic to opening of outsized pits on the earth apparent to remove ore deposits, undressing of visible geo-materials including blasting to extract the substantial. The mark of these processes, actuality dependent on the importance of the deposited mineral and superiority of the creation, include restricted mechanization.

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These operations are the main source of impact on the environment [10].

Space Application Centre (1990), land use changes using remotely sensed satellite images is established on the evaluation of the time in sequence data. Temporal changes in superficial occurrence on earth surface can be determined and assessed digitally using visual practises [11].

Ghose (1991) found that open-cast mining, extensively predominant in the Bundelkhand region, however economical are recognised to have additional environmental concerns. In this mining a huge overload will be extract the various non-renewable deposits. This will involve diggers, loaders and transporters etc., ensuing into numerous environmental issues. Environmental influences of mining activities may be native occurrences, but several clustered mining sites situated at specific area may finally measure to various environmental issues with high scale. Giant surface mining actions in the respected area bother the land by straight extracting mine dump throughout quarrying and dumping it in neighbouring land [12].

Adyalkar (1993) stated that mining operations have been subsidised to damage of biodiversity. The overburden of mining operations are unglued and deposit in the arrangement of massive dumps on the ground far from quarrying sites [13].

Skidmore et al. (1997) concentrated mainly on remote sensing and GIS knowledge used for sustainable management of land use features. Data received from radar, hyperspectral and high spatial resolution data is expounded. Diverse sensors give exceptional data for several land resources. UV radiation, Infrared Radiation and Microwave which are visible light produces False Colour Composite (FCC) imageries. They can deliver information even when there were nearly confines sun spots, night darkness and cloud cover etc. Numerous remote sensing and GIS applications/ actions can simply overlap these imageries in the form of multiple stratums/ layers explaining appropriate facts for protection and management of different land resources [14].

According to Jones (1997), the application of geo-informatics tools in environmental research, is consequently a proper tool for producing maps for land resource statistics and disaster planning and management [15].

Burrough (2000) stated that remotely sensed data which simplifies the analysis of changing pattern of land resources at native, national and universal measures. Therefore providing a prospect for a quick and precise admittance to information that is desirable to measure such changes in land resources [16].

Campbell (2002) and Curran (1992) considered that remotely capturing of emitted energy, sensors (scanners, radar, camera, lasers and radiometers) are used to capture responses created on numerous appearances of the earth surface, as well as natural and manmade activities after which the noted remarks are transmitting to receiving place for further treating, interpretation and examining. In interpreting the captured remarks, an explainer uses the component such as size, shape, tone, pattern, shadow, texture and relationship to develop statics about the several features present on the earth surface [17], [18].

Kariuki (2002) emphasized that mining operations consist of digging in the surface of the earth for the drive of manipulating the mineral prosperity. It could be for the development of local economic/ industrial growth [19].

Liu et al. (2002) analysed that “remote sensing is an aerospace technology that uses electromagnetic energy to capture data from the Earth's surface and its surrounding atmosphere by remote sensing systems”. The ERDAS Imagine, ArcGIS software is used to improve a LULC classification and LULC change exposure using multi-date satellite imageries. The created LULC classification were associated with LULC produced using ArcGIS, to pick which technique delivers enhanced LULC arrangement. Classification technique using image processing was similarly used and important land resource features (agriculture, built-up, forest area, waterbodies and wastelands etc.) take out on the root of pixel discrepancy and relate the effects with the outcome derived next on-screen digitization [20].

Campbell (2002) noticed that remote sensing as the exercise of arising evidence about the appropriate land use/ land cover features using remotely sensed dataset acquired from an above viewpoint with the help of electromagnetic energy [17].

According to Williams and Peter (2002), an environment was the amalgamation of all physical, biological and societal influences that action on a living and its survival and development. Environment is separated into physical (lifeless belongings i.e., land, water and air), biological (life belongings i.e., plants, animals and human) and social (produced by man using social and cultural activities i.e., historical, political, traditional, commercial, ethical traits of environment) [21].

Das and Nizamuddin (2002) considered that the hyperspectral sensor data have effectively applied to map the lithological actions, inorganic richness and processing practise for identifying specific excavations and spectral signature and spectral blend modelling techniques applied for aiming bauxite and laterite pledges [22].

Gupta (2005) emphasised that the application of geomatics tools in the field of geo-environmental research has exceptional benefits for the reason that of its temporal/ multispectral manner and synoptic coverage. The innovation of high resolution data with its multi-temporal nature is an outstanding tool to study the environmental influences in line for mining operations. To observer the changes in land resources due to surface mining operations, remote sensing and GIS practices have effectively realistic [23].

Kumar et al. (2013) report that geo-informatics tools play an essential character in mineral exploration, infrastructure planning and management, water, agriculture, geology, forestry, ocean, disaster mitigation and management, environmental mapping etc. Geo-informatics tools has fully-fledged as a most important tool for gathering statistics on related feature present on the earth surface since historic time. In the present time, data received from space born platform with high resolution (both spectral and spatial) are accessible to numerous determination. Geo-spatial technology has also paid meaningfully in the direction of progressive actions in India. The application of geo-informatics tools in environment related issues i.e., geo-environment and hydro-environment management etc. which might be recognisable from air/ space born platform [24].

III. COMPARATIVE STUDIES TO FIND THE IMPACT OF MINING ACTIVITIES ON NEIGHBORING ENVIRONMENT

A. In India

1) Work Done Using Archaic Methods

The mining operations have engaged immense attacks throughout the century paying important infrastructure growth and levitation the existing criteria for human. Though, they have as well transported in their come round, falling apart and filth of natural assets, natural contamination, fitness hazard and socio-environmental variabilities. Bundelkhand region, inhabiting almost 71818 sq. km in the central plains of India, is recognized for its ironic deposits of granite, salt peter, sand, diasporas, pyrophyllite, moram etc. Presently, there are around 325 active mining sites in Jhansi district. Dust generation, deforestation, air/ water/ noise contamination and reserve reduction are collective threats connected with surface mining extensively predominant in Bundelkhand region. The base line socio-economic situation and environmental inferiority in this region effects on the environment changes in land resources and work-related health belongings of mine workers etc. [25].

The quarrying and crushing actions were successful in Bundelkhand and Gwalior regions, to mistreatment of the Rocks, which were un-cropped harvests of landscape, when they are shattered, cannot be developed like vegetation. These assets have noteworthy prominence for the growth of built-up, socio-economic affluence of any country. Observance it in vision, the essential for a judicious expansion and mistreatment of these assets are necessary without environmental encroachments. Mostly, diverse surface mining of Granite are passed out by several organizations on minor to huge measure, for the fabrication of, building stone, decorative stone and dimensional stone etc. The study found that at many seats environmental lose was observed throughout the ground truthing, because of mining actions, exposed to deterioration of the natural assets, soil/ atmospheric contamination and the destruction of visual prettiness of the land. Health risk and socio-economic impressions were the mutual threats as linked with the mining actions in Bundelkhand and Gwalior regions. There were no solid and strong endowment to look after the environmental humiliation caused by mining operation underneath analysis. An attempt has been made by the author first time to recapitulate the mining situation in the regions to evaluate the ecological hazard and how these events were seriously disturbing the environment [26].

Singh et al. (2013) emphasized that cement was measured as essential construction ingredients everywhere in the world. It is essentially castoff for the creation of concrete. Concrete is a combination of inactive mineral collections *i.e.*, crushed stones, gravel, sand and cement. The building material is account as a geographic plenty of raw geo-materials in all over the world. India is the next leading creator of cement on the Earth after China. In complete, India's productions 251.2MT/y of cement. The mining operations are done using the open mining procedure finished by blasting, drilling and using heavyweight motor vehicle (bulldozers and junkyard trucks etc.) [27].

2) Work Done Using Remote Sensing & GIS

The preparation of the LULC maps by conventional methods is very time taking and costly. Besides, field survey/ ground truthing may be tedious in around extents. Also, as revealed previous, the changing in LULC need a regular updating of the present LULC of the respected area. Remote sensing technique delivers multi-temporal and multi-spectral synoptic exposures for any concerned area. The space technology delivers an enduring and reliable record of the LULC outlines at any specific time which can be re-used for re-confirmation and re-examination. Digital data gives an incredible sinuousness to find the goal. Moreover, GIS offers the capability to assimilate multi-disciplinary data for devoted explanations in an informal and rational way. This cohesive method demonstrated to be timesaving and cost-effective method. In this study area, Jharia Coal Field (JCF), where wide and express subversive and surface mining was running on uninterruptedly so land use studies are of vital position. The remote sensing and Geographical Information System practices used for identification of land use features on satellite images and improve produces and identification of temporal changes in land use classes. The numerous land resources, predictable from space-born platform and ground investigations, are built-up, vegetation, wasteland, river and water tank etc.

Various image processing actions have been used up on satellite images to monitor the land use arrangements. It has been establish that Landsat thematic mapper with suitable band combination deliver very valuable statistics for land use study. Temporal variations in land use have been followed in the JCF since 1975, 1990 and 1994 and have investigated earlier by the author for the evaluation of change matrix. The generation of statistic in a number of steps including image processing have been carried out. It is concluded that widespread mining, formation of transport setups, degraded vegetation cover and socio-economic growth have adapted the face of the JCF using satellite images [28].

Raghavendra and Nijagunappa (2010) noted that apprehensions around the impact of quarrying was barely new. Criticisms about quarrying activities were voiced before 1890s. The concretive problems such as damage to landscapes, visual intrusion, smoke, traffic, dust/ noise effluence and loss of geo-materials have not transformed over time. Quarrying was precious part of indigenous legacy, but most of the individuals well attentive of the destructive impact of un-planned quarrying. To determined delicate and definite areas that urgently requirement of planning for sustainable resources and environmental management. A combo of Remote Sensing and GIS technology were used in this situation. The Shahabad Basin was identified and investigated using Landsat images. The Shahabad area was the largest and most inhabited of all the industrial sites in the Kagina River basin, according to the findings. Using Landsat imagery, the Shahabad region was further investigated to identify the growth of urban areas over the period of 16 years. Finally, assessments of the current environmental situation were made. This study not only demonstrated the significance of implementing environmental legislation, but also how to effectively control pollution [29].

According to Chitade et al. (2010), any region's entire growth and success are dependent on industrialisation/ urbanization. Along with development, it has a negative influence on the environment such as air/ water pollution and other issues. The Wardha basin in the Chandrapur District, Maharashtra is rich in high-quality coal deposits. Due to the exploitation of coal mines and the resulting negative influence on the environment, this region of Chandrapur district has seen a lot of changes in land resources. They detect changes using geo-spatial tools/ techniques. Changes in land resources were found using satellite images (Landsat-TM images for 1990; Cartosat - I images for 2010). The aforementioned satellite images were corrected and georeferenced using GPS data collected from field survey. The GPS was also used to provide ground validation for the assessment of accuracy of digitally classified land resources. ERDAS Imagine software was used to perform image processing. The impact of coal mining on land usage has been addressed in a number of ways. Conventional approaches make it difficult to create an environmental geo-database for transport out regional environmental influence assessments and understanding de-forestation in the spatial/ temporal province. Remote sensing data has effectively filled this gap today. The concluding remarks of this study was focused on water bodies. It appear to have grown from 151.898 to 321.568, however it was discovered that the change occurred by the extraction of large quantities of material beneath the earth's surface which was scattered unevenly and became polluted [30].

Mondal et al. (2014) found that in every operating region, the impact of quarrying and crushing activities on the nearby air/ water and land forms can be severe. Environmental degradation can range from small soil and water pollution to the harmful impacts of air-borne contaminants on larger ecosystems. All of which require a well-designed geospatial database. The quantification of land cover changes over long time periods demands a user-friendly and cost-effective technique for monitoring these environmental consequences. It is now mandatory to utilize remote sensing techniques to monitor these environmental risks in and around the mining zones on a regular basis. The study area is situated in Joda Block of the Keonjhar District, Orissa. Results showed that in 1975, the overall forest cover was 65 percent, but presently (in 2001) only 45 percent of the land is covered in forest, as well as increasing mining activities. Another section of the route revealed that pollution had accelerated to the point that the surrounding region was dusty. As a result, the environment was heavily contaminated and unfit for human occupancy. Malaria and other vector-borne diseases had spread over the area [31].

According to Borana (2014), across the globe, the environment has become a key issue for human existence. Intellectuals, educators and environmentalists now express their concerns on a variety of venues in order to improve society. To understand the type and severity of these hazardous episodes, a systematic and interdisciplinary strategy to mapping, monitoring, and regulating the harm produced by mining activities is required. According to the findings, unscientific and non-mechanized practices used in opencast mines posture a risk to the environment, human life and the destruction of land. Ground truth data was also used to verify the results. Significant changes were discovered in mining areas and other LULC features accordingly change categories such as no change, positive change and negative change [32].

B. In Foreign Countries

1) Work Done Using Archaic Methods

Mensah et al. (2015) found that in most international countries, mineral mining contributes greatly to socio-economic growth.

Ghana is World's second gold producer, contributing for around 5.7 percent of the country's GDP. In Ghana's mining industry, both modest and massive mining exist, with differing environmental consequences. The mining activities in Prestea (placed at 5.43274 latitude and 2.14284 longitude) in the country's western area were the subject of this study. During the fieldwork between May and August of 2014, the research approach utilized in this study was a fully qualitative field survey research strategy, with data acquired mostly using qualitative approaches. Primary and secondary data were used as data sources. Participants were observed in-depth interviews utilizing an observation guide were conducted using a worksheet of inquiries, and environmental evaluations of several mining sites in Prestea were conducted. The communities and/or respondents for the interviews were chosen using a random sample approach. An acute examination of collected works on the environmental implications of mining, as well as appraisal of pertinent legislation and guidelines presently in effect, were utilized as secondary data in this study. The study revealed that mining operations, particularly illicit small-scale mining, degrade natural resources such as water, soil, the landscape, flora, and the ecosystem. Land in mine-affected regions has been scrubbed clean, making it more vulnerable to rapid depletion of agricultural viability. Increased deforestation for mining sites, among other things, seems to have had a negative impact on hydrological regimes. Important soil organisms were wiped off, and soil physical aggregates were diluted [33].

Imasiku (2008) stressed that emerging nations also include mining and will keep to offer technological improvement and employment. In certain Southern African countries, intensive mineral extraction has provided 90 percent of all external exchange income, 60 percent of GDP, 50 percent of general government revenue, and 30 percent of total employment. In the same way, nominal mineral extraction gives a source of income for persons located in remote and semi-urban areas of Africa [34].

2) Work Done Using Remote Sensing & GIS

Saroglu et al. (2005) evaluated that in the northern portion of Istanbul, quarries were discovered and examined for modification utilizing rectification, classification and presentation to produce dataset in order to accurately accomplish the goal. Furthermore, ground truth data and topographic maps were used to support all procedures in the technique. The quarry area was assessed in 1987 and 2001, and the extent and direction of growth were established using GIS overlay analysis. SPOT 5 images and field data were used to verify potential quarry regions generated from Landsat TM imagery. Finally, using suitable visualization techniques, thematic maps of these places were created and it was exposed that the area of stone quarries was 39339ha in 1987 but had significantly expanded to 108045ha in 2001. In 14 years, the forest area declined from 716103 ha to 647838 ha. This indicates that from 1987 to 2001, the forest area declined by around 8% [35].

Jones (2006) estimated that The increase of gravel mining areas in the Presumpscot River watershed in Southern Maine, ODI (Ortho-rectified Digitized Images) and digital terrain roads, town border, water and tax map data, and ODI (Ortho-rectified Digitized Images) and digital terrain roads was documented from 1998 to 2001 using ArcGIS software. The pit expansion was computed by manual digitizing the boundaries of places where the soils had been bothered to reveal mining elements, as seen on the 1998. The pit outlines on the satellite image of 2001 and 2004 were compared to these regions. From 461.49 acres in 1998 to 653.24 acres in 2004, the total area of all approved and non-licensed pits within the watershed rose by 47 percent. Between 1998 and 2004, the 34 permitted sites grew by 49 acres, from 117.49 acres to 161.29 acres, a 37 percent increase. Per pit, the average increase was 3.8 acres. Gorham, Maine, has 18 percent of the watershed and 21 approved mines, according to a more thorough investigation. After Windham, Maine, which has 22 percent of the watershed but just 13 pits, this is the second-largest coverage area. For mining, Gorham has three zoning classifications: (1) approved mineral extraction, (2) permissible with special exemption authorization, and (3) prohibited. After combining zones 1 and 2 and eliminating water and road regions, as well as their mining hindrances of 100 and 250 feet, the total acreage of prospective mining area (5500 acres; 23 percent) inside Gorham is acceptable to be planned. In 1998, Gorham had roughly 215 acres of mining activity, which had grown to 278 acres by 2001. This expansion occurred in both permitted and unlicensed mining enterprises. Over the last three years, licensed sites have grown by 22.7 percent, while non-licensed pits have grown by 22.6 percent [36].

Koruyan (2012) has projected that remote sensing technology has been everywhere for a long time, it has been only recently utilized to monitor mining operations. According to recent research, remote sensing may also be used to manage and organize some parts of a mining operation. The author investigated the areal growth of marble quarries and the associated vegetation in the Mugla region of Turkey over 10-year.

The investigation included images procured by the ASTER Level 3A 01 and Landsat 5&7 between 2001 and 2009. The normalized difference vegetation index was used to calculate changes in natural vegetation caused by marble quarry. Subsequent an increase in mining actions, the research found that vegetation cover fell by 1% from 2001 to 2009 [37].

IV. CONCLUSIONS

Prehistoric men employed rock as the fundamental construction material of the earth's crust. Minerals and rock resources are essential for any country's socio-economic development and treasures. Stone is one of the most readily available natural resources on the planet, as well as one of our society's most important building materials. They are required for fundamental human requirements. It has been employed for a multitude of purposes since the dawn of civilization, with the quantity and complexity of those uses increasing as time and technology progressed. Stone is now a crucial raw material for building, agriculture, and other sectors that employ complicated chemical and metallurgical processes in its crushed state. Minerals are finite and non-renewable in nature, whereas rocks are mineral aggregates. A mineral is lost forever once it is extracted from the land, hence the right pattern of geo-materials mining and its optimal use must be followed.

Since 1972, most nations have had access to satellite images. The dynamic properties of landscape environments may be monitored and significant changes in ground cover can be detected thanks to the nature of various dates of satellite photos. GIS is an arrangement for capturing, storing, verifying, integrating, manipulating, analyzing and visualizing geographically referenced data on Earth. A GIS, according to the preceding definitions, is a computer-based system for storing, analyzing and visualizing geographical data. GIS stands for Geographic Information System and it is a computer-based system that works with geographic data. The use of a geo-informatics tool in mining research, such as land ownership and mineral reclamation, exploration management and the location of the mine. Using hyperspectral data, several main granites and later colonization in the mining region were easily detected. Satellite images are a valuable source of data for surveying, mapping, and monitoring of terrestrial resources and computability when compared to older approaches such as topography and aerial photography. The multi-date character of space technology enables management of active features available on the surface of the earth, allowing for the detection of significant changes in land resources and the calculation of exchange rates.

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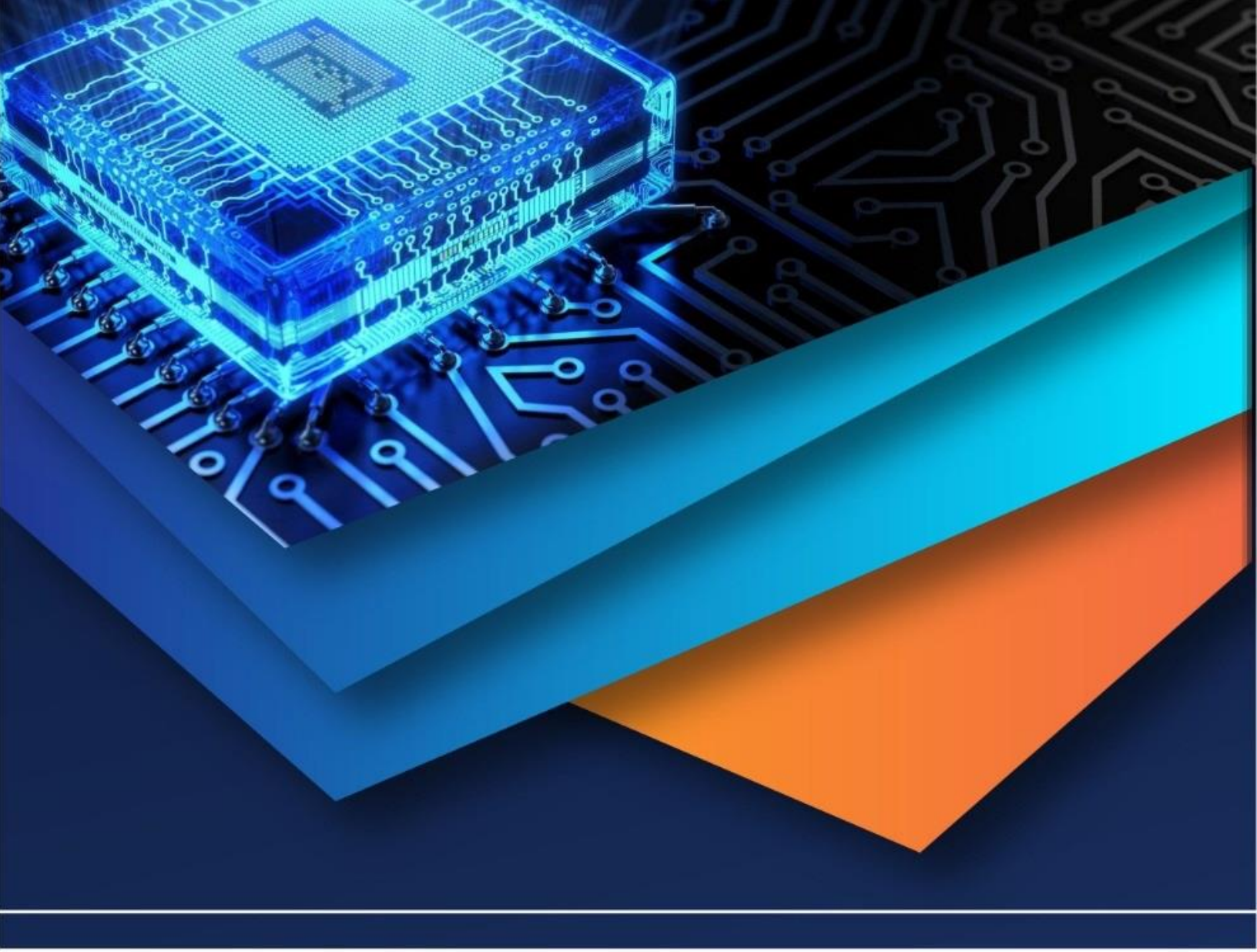
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