iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: IX Month of publication: September 2023

DOI: https://doi.org/10.22214/ijraset.2023.55841

Secured Clustering Multilevel Underwater Acoustic Networks with Dynamic Routing Discovery (SCDRD) Protocol

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Abstract: Due to multiple rising automated industry and combat field applications, researchers have developed a growing interest in the area of Underwater Acoustic Sensor Networks (UASNs) over the previous decade. Extending the lifetime of the energy and the consumption of energy in UASNs are enormous challenges. One of the primary difficulties in UASNs is the development of energy-saving routing mechanisms. In recent days the security of the data collected is the main concern because of widely accessible wireless sensors, because these low-power devices are incompatible with complicated encryption methods. As a result, for multi-hop Underwater Acoustic Sensor Networks (UASNs) with non-replenish able energy resources, lifetime optimization and security are two opposing design concerns. This work introduces an Efficient Energy Clustering with Dynamic Routing Discovery protocol (SCDRD protocol), which addresses two competing difficulties by taking into account several characteristics such as probability random walking and the energy balance control mechanism. The suggested protocol detects that energy consumption in the existing network topology is disproportional to energy deployment, which has an impact on the lifetime of wireless sensor networks. Through a quantitative security analysis, this work proposes a non-uniform efficient deployment technique to handle existing energy resource optimization problems and addresses the security location privacy concern. In all circumstances, the proposed Protocol produces the efficient trade-off between the energy balance and the routing mechanisms, allowing sensor networks to last substantially longer. In addition, the deployment of energy in the non-uniform manner results in the increased network's lifetime and overall packets sent. The results of proposed work is compared with existing cost-aware routing protocols and outperform the existing protocol with respect to various performance parameters like energy, throughput and delivery ratio.
Keywords: Dynamic Routing Discovery, Underwater Acoustic Sensor Networks, Energy Aware, protocol,Lifetime Optimization, Energy Consumption

I. INTRODUCTION

The Wireless Sensor Network (UASNS) is made up of multiple sensors put in various geographic locations across several networks. Some of theunknown places where the size and energy of thenetwork become crucial elements to decide are amongthe key applications that use sensors. Due to their location and other obstacles, it is also impossible to replenish the energy of sensor nodes. The increase of various networks and networking technologies has resulted in the development of innovative Wireless networks. These networks are comprised of various distributed networks that are mainly used to monitor the health of the sensor nodes based on the mobility, motion and the temperature. These networks acquired popularity in a variety of industries, and are today utilized in a variety of most popular applications such as automation of the home, monitoring the performance of various fields such as agriculture, robotic and health. Underwater Acoustic Sensor Networks (UASNS) has considered wired networks as the core area for the data of wired network security systems that require a minimum number of days and are pricey. Basic characteristics of Underwater Acoustic Sensor Networks are low utilization of the network, cost of the network and compact size of the sensor nodes, all of which may be defined by scaling down and combining.

These characteristics demonstrate that the wireless nodes have very much less control over the system complexity and the computation, helps in providing the necessity for the use of non-computationally verified applications. Thousands of physical address sensor nodes have been transformed, reduced in cost, and distributed in geological regions and for mostapplications thanks to advancements in wirelesscommunication and hardware. Using a replacement battery to restore energy is tricky.

The Wireless Sensor Network (UASNS) offers a greater range of audit visualization, editing concept development, automated audits, and agriculture awareness applications. By minimizing the size of the various multi-functional sensor nodes are used, the remote-moving hardware-capable devices and interchange design can increase the efficiency of the productivity. Most of the existing models today strive to identify proper path between source-sink to optimize the power capacity that enhances throughput.

In any event, if the idea of controlling energy expertise is implemented, the emergence of sensor networks will be doubled, because it does more than merely look for lesser energy path from source to the destination ofvarious sensor nodes. Modulation of the entire system's residual power distribution is also possible.

Even though there is various efficient energy routing protocols designed they failed to determine the shortest energy path between source and sink. In the proposed work an efficient dynamic routing protocol is designed to determine the shortest path from single source node to the destination without affecting the network power distribution.

This Main contribution of this work is to:

1) To decide the appropriateness of secure routing conventions for wireless sensor network arrangements with regards to energy-efficientinformation dissemination techniques at multilevel networks for sensors organizations.
2) To determine the problem of reducing energy consumption and increasing energy efficiency and to decide the ideal activity framework for the wireless sensor network base station.
3) Provide higher network capacity and decrease the total energy consumption.
4) Designing a new algorithm to enhance security and retrieve the information available at sink.

As discussion in the introduction section, the work presents an efficient energy clustering protocol at multilevel networks with Dynamic Routing Discovery protocol (SCDRD Protocol). In which each of the sensor nodes will maintain proper energy levels, As a result of this work two efficient algorithms have been proposed one for forwarding messages: shortest pathand second for secure forwarding using random walk mechanism. The section 2 describes various research works done so far, Section 3 presents the proposed methodology and Section 4 describes the results and Discussion of the work carried out.

II. LITERATURE REVIEW

In this section we discuss on the various research workscarried out so far in Underwater Acoustic Sensor Networks on the cost-aware Secure Routing Protocol Design**.**

Di Tang et.al. [1] Presents how to monitor the surveillance network by combining multimodal sensor data. It primarily focuses on information procurement for multi-domain data acquisition. It also provides a plan for identifying needless and dangerous situations inthe environment. This methodology helps streamline monitoring tasks in airports and other security-sensitive facilities because it is totally automated.

The author describes a method for acquiring essential data using information such as sound. The proposed framework for progressive preparation engineering recognizes a large number of preset patterns and discovers frequent practices.

Y. Li et.al [2] presents and evaluation mechanism of Multi Hop Wireless Networks utilizing Extremely Opportunistic Routing (ExOR). This ExOR sends the signal for each node using node grouping technique, then this will accept the decision taken from eachnode for sorting the messages of all the nodes.

The proposed ExOR determines which of the evident bulk nodes that are effectively routed the ones are closest to the objective. The node closest to you communicates with the rest of the network using a suitable computation, the ExOR architecture tries to pick a sending node after transmission. Once the package is received by the node, this will remember for the parcel the basic workload representing the need request in which the possible recipients must advance the package. Based on common assessments of node transport rates, the node processes the schedule.

[3] Y. Li et.al discusses how to monitor and control capacity in Wireless Integrated Network Sensor for a variety of application used in the real time for various purposed such as healthcare, agriculture, safety, biological and security related aspects. The main drawback of this work they concentrated only on the power consumption of the sensor nodes.

The rapid expansion of integrated circuits has enabledthe development of a wide number of complex technologies that connect the physical world to networks, as well as the increasing development of the low-cost sensor nodes and the processors. It will also extend from close to far, with applications ranging from medical to security to factoryautomation to environmental monitoring and condition-based support.

[4] B. Karp et.al examined statistics of most forward within range in One Dimensional Ad Hoc Networks (MFR). The analysis of a wireless network has revealed that routing-related characteristics have a significant impact on the network's performance. Power consumption, multi-hop communication delay, and position evaluation are all factors that influence routing designs. Statistical measures of the most forward within range routing network were investigated in this paper.

[5] Y. Xu et.al.discusses how to use QoS to achieve geographic optimal routing in Underwater Acoustic Sensor Networks in this work. One of the most important evaluations in the UASNS is QoS routing. Most vital monitoring and surveillance systems rely on fast data delivery as one of the most important aspects. In the case of geographic opportunistic routing (GOR) for QoS provisioning in UASNs with both start-to- finish dependability and delay constraints.

UASNS-designed robust QoS Awareness GOR protocol optimized for performance latency UASNs to optimize QoS EQGOR, effectively pick and priorities preset forwarding candidates. The amount of energy used and the length of time it takes are two factors to consider. In a UASNS, using a multipath guiding technique to ensure reliability and latency QoS restrictions may be impractical.

[7] N. Bulusu et.al discusses real-time implementations of the harmonization protocol-based clustering to create energy-efficient wireless sensor networks. UASNS employs optimization techniques to aid in the creation of a centralized cluster-based protocol. For many real- time applications, the harmony search algorithm (HAS) is employed in UASNS. In UASNs, it's crucial to keep intra-cluster spacing between cluster heads (CH) and group individuals to a minimum and to maximize energy distribution.

Through many works carried out based on the Energy- Balanced Routing Protocol (EBRP) they fail to provide much efficient and proper routing strategies, Hence our research work aims to address these issues. This research works an efficient energy clustering protocol atmultilevel networks with Dynamic Routing Discovery protocol (SCDRD Protocol by addressing various issuesfound in the literature review.

III. PROPOSED METHODOLOGY

This work presents an efficient energy clustering protocol at multilevel networks with Dynamic Routing Discovery protocol (SCDRD Protocol is mainly designed on a power rating model to control power measurement and route safety at UASNS at the same time. Each sensor is required to maintain grid power levels in its immediate vicinity. This function focuseson two messaging system systems: the shortest route and secure sending using random navigation. The main aim this work is to high energy levels is used for message forwarding. The degree of energy balance control is enforced as criteria to accomplish balanced energy balance control.

1) Reduce the energy consumption among thevarious sensor nodes.
2) Increase proportion of message conveyance
3) Minimize the time delay.
4) Improve the security among the nodes

A. The System Architecture

The architectural design in Figure 3.1 depicts the proposed Framework for common mobility data interms of one –Dimensional line process where the sensor node is sent to the path, without use of any other force, and depicted the same in the standard development framework.

In UASNs, raising the energy of the main node increases the routing length, which can efficiently regulate the energy consumption of each node by lowering the energy levels below Node B.

For node B, the set of all surrounding grids is defined as, and the grid I's remaining available energy is specified as, I Nb. The following is how the SCDRD selection path algorithm works:

Without the use of administrative force, the majority of the present standard development data collecting framework was completed. With the demands for numerous advancements that are acceptable in the city of understanding, the cost- effective upgrade solution for obtaining intelligent movement data should be explored.

$$\epsilon_{\infty} = \frac{1}{Nb}\sum_{i=Nb} \epsilon\, ri \text{--------} (1)$$

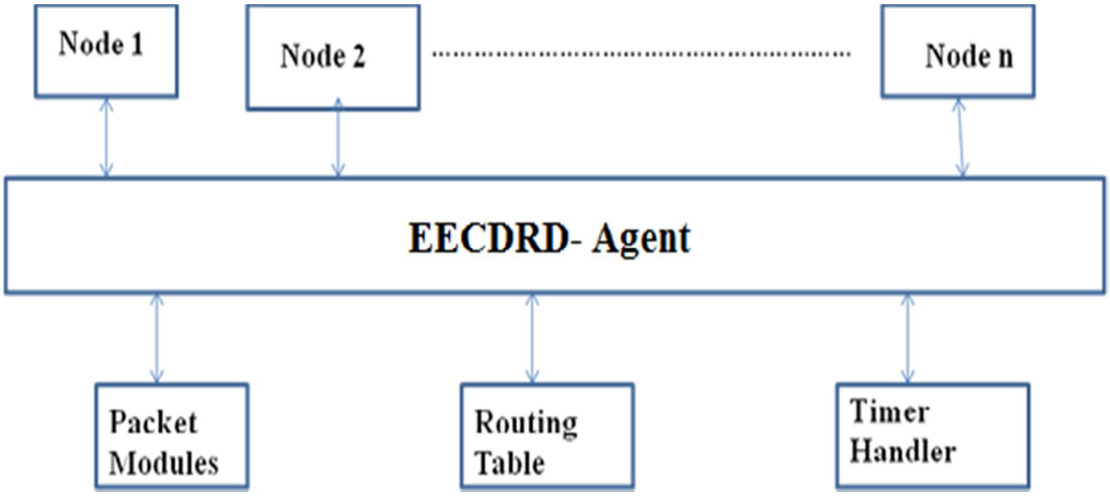

Figure 3.1: System architecture for ProposedSCDRD Protocol

The node of the sensor will provide the data collected to transfer of the node and delivers to sink node. One or more jumps out, and the sync node eventually generates and sends full development data to the motion management focus. In a UASNS-based information technology (IT) framework, great versatility can be leveraged to extend the life of a 1-D line system that demands energy savings.

B. Energy Balance Control

In the proposed SCDRD protocol, each node's energy level is used to pick surrounding nodes. To balance the energy and consumption of additional energy by the nodes at various levels, the grid with

The energy level of each node is used to select neighboring nodes in the proposed SCDRD protocol. The grid with high energy levels is utilized for message forwarding to balance the energy and consumption of more energy by the nodes at different levels. To achievebalanced energy balance control, the degree of energy balance control is enforced as a parameter.

It was also demonstrated in UASNs that increasing the energy of the main node increases the length of the route and manages the energy consumption in an effective manner, each node by lowering the energylevels below Node B.

For node B, the set of all surrounding grids is defined as, and the grid I's remaining available energy isspecified as, I Nb. The following is how the SCDRD selection path algorithm works:

C. Secure Routing Strategy

The proposal demonstrates the information transmitted by the steering system. When steering, this is a directingapproach that can provide both quirkiness and security. The steering path is less predictable than anticipated. The two-message protocol follows to different options: first is based on framework determination, and second isarbitrary matrix based. The relative areas of the grids determine the next node in the deterministic steering technique. Messages are forwarded to nearest grid. The next hop grid for message forwarding is chosen at random under the safe steering circumstance.

Each communication includes a security level of [0, 1], which regulates the spread of these two calculations. Wherever the sensor node wants to send a communication message it will choose an arbitrary from [0 to1] as the initial path, then it will choose the next hop using the shortest path technique.

The computation of this method is mostly determined by the security level [0, 1], which defines how each communication is conveyed. Whenever the node wantto communicate it starts with the arbitrary value [0,1].If $\gamma>\beta$ is true, each node decides the hop grid based onthe path routing protocol, otherwise, a random algorithm is mainly used to chose the grid of next hop.

D. SCDRD Algorithm

SCDRD algorithm includes routing security. Safety routing increases the cost of extra routing due to the extended routing route.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IX Sep 2023- Available at www.ijraset.com

The Algorithm is follows:

Step 1: Start
Step 2: At source node, create DATA packets:

Given the value of 'alpha'

Set the value of 'beta' for every node:

Calculate threshold Energy = alpha * average Energy;

Step 3: Chose a random number for the value of 'gamma'

if (gamma > beta) then

Select a grid whose RT.i.averageEnergy is more and greater than threshold energy

Select a shortest node to the sink node from selected grid

Send the packet to the selected node.

else

Choose a random node from the neighbor node set and send to it.

End

The likelihood of the next framework hop to glance over an irregular walk increased as b increased. As a result, the steering path is more erratic. Particularly when b value is less than alpha value an Irregular walk becomes the primary directing mechanism for the next bounce network to be chosen. Because SCDRD blends irregular walks with shortest routing, existing research [19], [20] suggests that messagesmay not be transmitted when the base b=1 wherever the data is transmitted from source to destination.
Messages will be forwarded from the source node to the sync node if the shortest routing is defined. Regardless, the steering approach will be more strong and unconventional. Along these lines, it is becoming increasingly difficult for an adversary to intercept a message or generate a traffic congestion. As a result, in dangerous situations, the conveyance proportion can be increased. Course separation is increased with the security level b while providing directing wellbeing.

IV. PERFORMANCE ANALYSIS

Network Simulator 2 [ns-2] is used to perform the performance analysis. The GNU plot utility is used to plot the results.

A. Energy of the Network

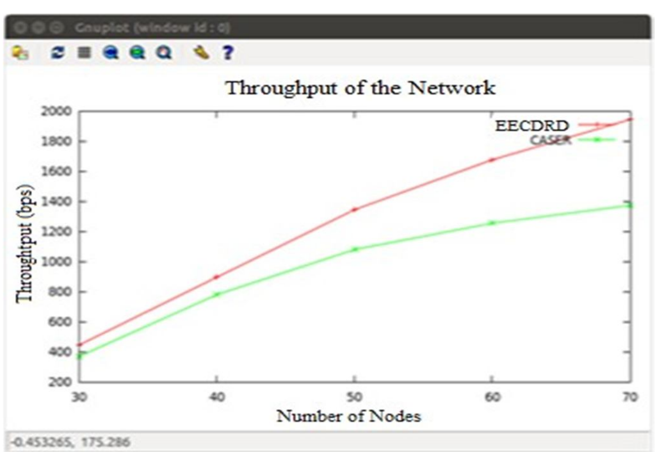

Figure 4.1: Number of nodes vs. Throughput

The graph in Fig. 4.1 is plotted using the results of the network's energy in relation to the number of nodes.

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The results are compared to those obtained using the CASER technique [1]. When compared to CASER, where a neighbour node selection strategy is used, the suggested protocol saves energy by adding morenumber of nodes for the transmission, which adds to thenetwork's overhead.

Figure 4.2 Number of nodes vs. PDR

Figure 4.2 describes the number of nodes vs. PDR, where the PDR is the ratio of various number of packets received from the sink to source node. The results of the packet delivery ratio vs. the number of nodes are shown in Figure 4.2. The results describes the proposed protocol has more PDR than the CASERbecause routing ensures that packets arrive at their destination. If the channel is busy, the proposed protocol uses internal queue management to store packets to be transmitted later. As a result, delivery outcomes will be improved.

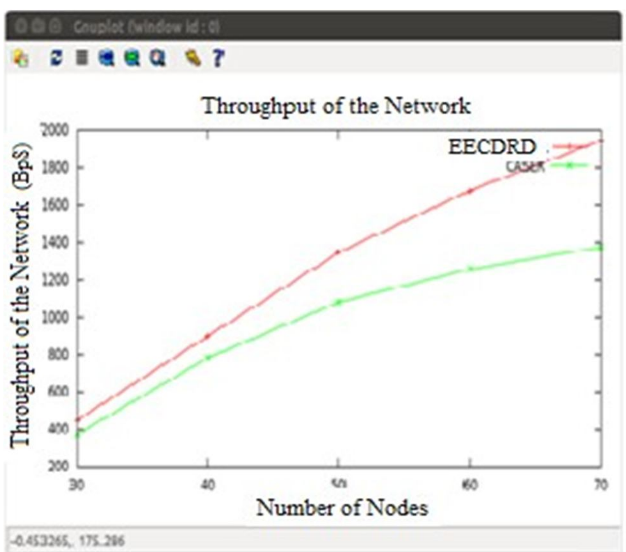

Fig 4.3 Throughput v/s Number of nodes

Fig 4.3 shows the consequences of throughput v/snumber of nodes within the organization.

Due to the energy efficiency and unpredictability produced by introducing security, better packet delivery is achieved as adversaries are unable to manipulate the data. As a result, when compared to the CASER methodology, the results reveal improved performance.

V. CONCLUSION

This work presents an efficient energy clusteringprotocol at multilevel networks with Dynamic Routing Discovery protocol SCDRD Protocol for UASNs that balances energy usage in a non-uniform energy deployment manner to increase the network's lifespan. Multiple routing is possible using the proposed protocol's message forwarding mechanism, which extends the packet's lifespan and enhances security. According to theoretical analysis and simulation results,the proposed SCDRD has a good routing performance in terms of packet delivery ratio, throughput, routing path security and energy balancing. In the future, this work could be developed to compare with the current Leech protocol in order to improve network node performance characteristics.

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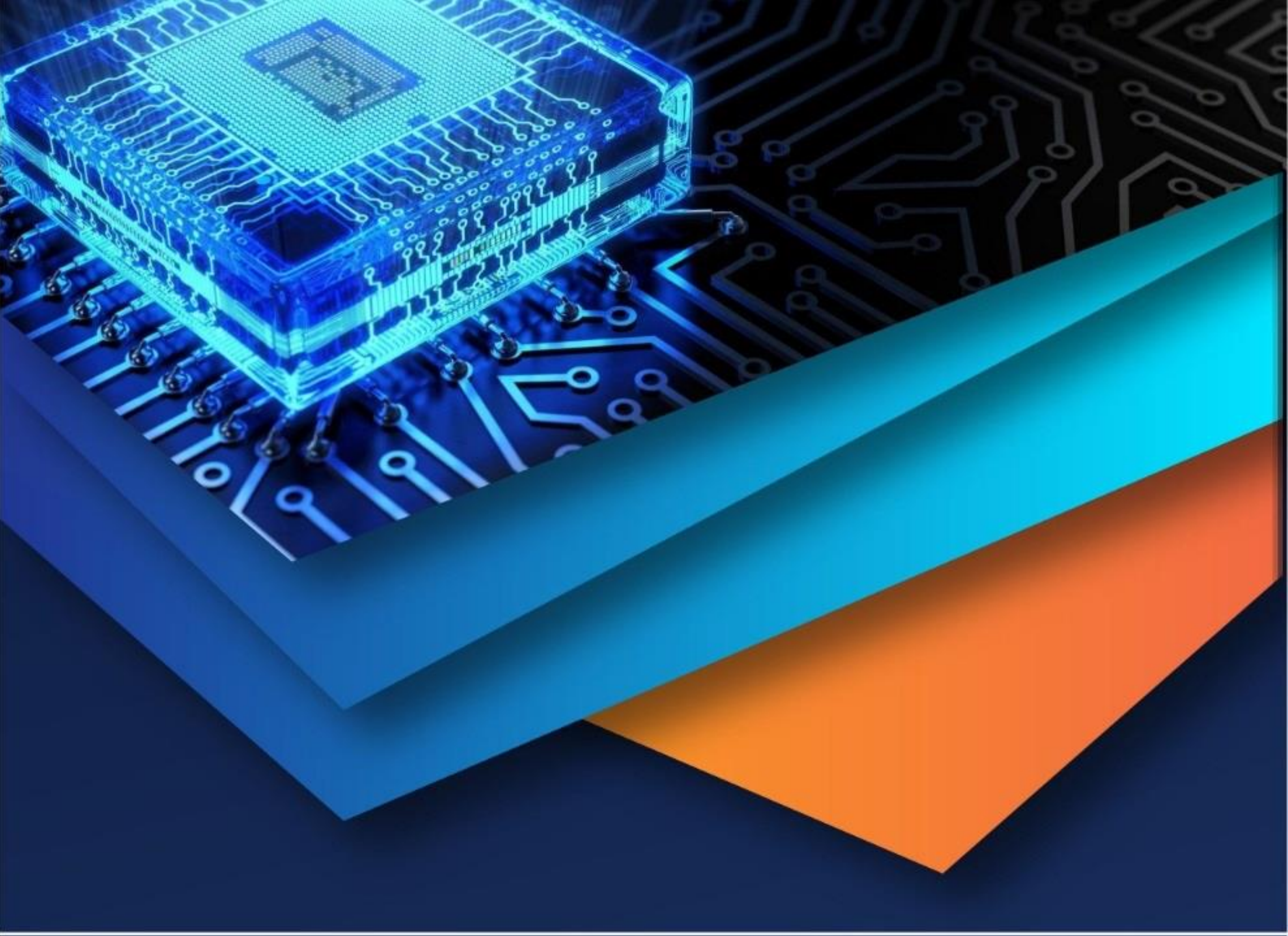

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