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Improved DECH Technique for Cluster Head Selection Approach in WSN

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Abstract: ***Wireless network is communication network which is comprised of multiple small sensors that creates a communication link from source node to destination node. The performance of the wireless network depends upon the energy factor. The more energy consumed by the nodes, less efficient the network is and if the energy consumption of the node is lower, the network will be quite effective and efficient and have a long lifetime. Routing is a concept that is an aid for the nodes to perform data transmission. In routing the concept of clustering was introduced to improve the energy consumption of the nodes. In clustering the nodes with the similar features are bundled into a small group and then the node with highest amount of energy is elected a cluster head and represents all of the nodes of its cluster. In conventional works, energy was considered as vital factor for cluster head selection. In this paper a new proposal is represented which elects the CH on energy basis as well as a link cost function is also evaluated to select the most suitable node as cluster head. The comparison is done with DSBCA(Distributed self balanced clustering algorithm)-DECH to prove the proficiency of proposed work.***
Keywords: Wireless Sensor Network, Energy Efficiency, DECH, Link Cost Function, Energy Model, Clustering.

I. INTRODUCTION

WSN is a wireless sensor networks which works on the basis of sensed data by the sensor nodes from its surroundings. It is widely used form of communication now days. It fulfills the requirements of the[1] users such as higher data transmission rates and also reduces the mesh of wires since it is not a wired network. In WSNs the employed nodes works by consuming energy to perform various operations such as route creation, data transmission etc [2]. while initializing a network a fixed amount of energy is allotted to the nodes equally. Then nodes have to perform operations throughout the network by using this allotted energy [3]. For data transmission nodes have to create a path from source node to destination node by interconnecting adjacent nodes [4], this process is known as routing. Routing is one of the process which also requires energy consumption from the nodes because sometimes such situations could arises [5] in which adjacent nodes are located far away from a node then the sender node have to consume high amount of energy to transmit the data to the node which is located at a far distance [6]. To solve this issue the concept of clustering comes to the existence in which the nodes with similar behavior or features are collaborated into a group and in this way the whole network is divided into small clusters [7].

Then from these clusters a more suitable node is elected as a cluster head which represents all the nodes of its clusters [8]. Then the nodes of a cluster perform the communication through cluster head and CH is responsible to transfer the data packets to the sink node [9]. In this way the energy of the nodes are saved to an extinct [10]. There are large numbers of protocols that are developed to improve the clustering in a WSN[11]. Some of them are as LEACH, TEEN, DEEC, SEP, PEGASIS and HEED etc. All of the protocols are quite effective since in all of these protocols energy factor is considered for cluster head selection [12].

II. NETWORK MODEL

In this section of paper the network model for proposed work is represented. In this work we have updated the conventional cluster head selection mechanism i.e. DSBCA-DECH. In proposed work we have considered the energy model along with link cost model. For energy model the transmitting energy can be evaluated by using following equation:

$$IF\ d \leq\ d_0\ then\ \varepsilon_{TX}\ =\ (\varepsilon_{elec} * P) + (\varepsilon_{fs} * P * d^2) \quad (1)$$

$$IF\ d >\ d_0\ then\ \varepsilon_{TX}\ =\ (\varepsilon_{elec} * P) + (\varepsilon_{mp} * P * d^1) \quad (2)$$

In above equations ε_{elec} stands for amount of energy consumed for transmitting a bit/m^2 can be evaluated by using the following formula:

$$\varepsilon_{elec}\ =\ \varepsilon_{TX} + \varepsilon_{DA} \quad (3)$$

In eqn (3) ε_{DA} represents the amount of energy that is consumed for data aggregation.
For Receiving Energy the following formulation is used:

$$\varepsilon_{RX} = \varepsilon_{rx} * P \quad (4)$$

Here ε_{rx} depicts the amount of energy consumed for receiving bit/m$^{2.}$
DECH is a cluster head selection mechanism that is utilized in proposed work to calculate the link cost function for all nodes of a cluster. Then, the node with minimum link cost function is considered as a cluster head. For electing CH using link cost function following equation is used.

$$LC = max \sum_{j=1}^{n} E_R + \frac{1}{D_m} + \frac{1}{D_S} \quad (5)$$

In this equation (5), E_R stands for Residual Energy,
D_m Depicts the mean distance and
D_S Represents the distance to sink node.

III.PROBLEM FOLMULATION

As per study of present literature the work done in the existing systems to enhance their network performance is basically that the cluster head selection approach is enhanced with adding link cost scenario. In which randomly triggered nodes initiate the clustering process in the clustering protocol. Although some of the CHS may closely have been placed and they are not optimal, the proposed approach optimally places the randomly selected closest nodes on the basis of minimum link cost.
The issue that arise in it is basically the link cost is dependent on the distance only it is shown in the mathematical modal given in the paper . But distance is not the only factor on which the performance of the network dependent except this the energy, data packets etc are also the major sections of improving network efficiency.

IV.PROPOSED WORK

As in problem it was discussed that the CH selection was the major issue in the network due to which the link cost was introduced in the present work in case of any two node been selected as Ch which are nearer to each other, but only distance factor consideration is not a point that effects on performance of the network other parameter as distance with sink and node's energy can also be considered because the main effect of this will be the energy modal that is used in the EEP are directly proportional to energy and distance both. So t here will be major effect of considering the energy factor in CH selection. Also communication will be done by changing the communication route as per traditional approach, in this work the communication will be multimode to sink.

V. METHODOLOGY

This section represents the steps in which the proposed work is implemented in MATLAB. The following is the step by step methodology for proposed work and figure 1 depicts the flow diagram for proposed work.

A. First step is to create the network by defining the initial parameters. In this the user have enter the area for network along with number of nodes in that network. Then on the basis of given value corresponding to Area and number of nodes a network is created.
B. Next step is to assign the initial energy to nodes in the network and then these nodes are deployed in the network.
C. In this step, the cluster head selection will be done by using proposed multi parameter dependent approach.
D. Then apply energy model to dissipate energy and to perform data transmission from source node to destination node.
E. Last step is to evaluate the lifetime of the network, dead nodes in the network and then perform comparison of obtained results with traditional work.

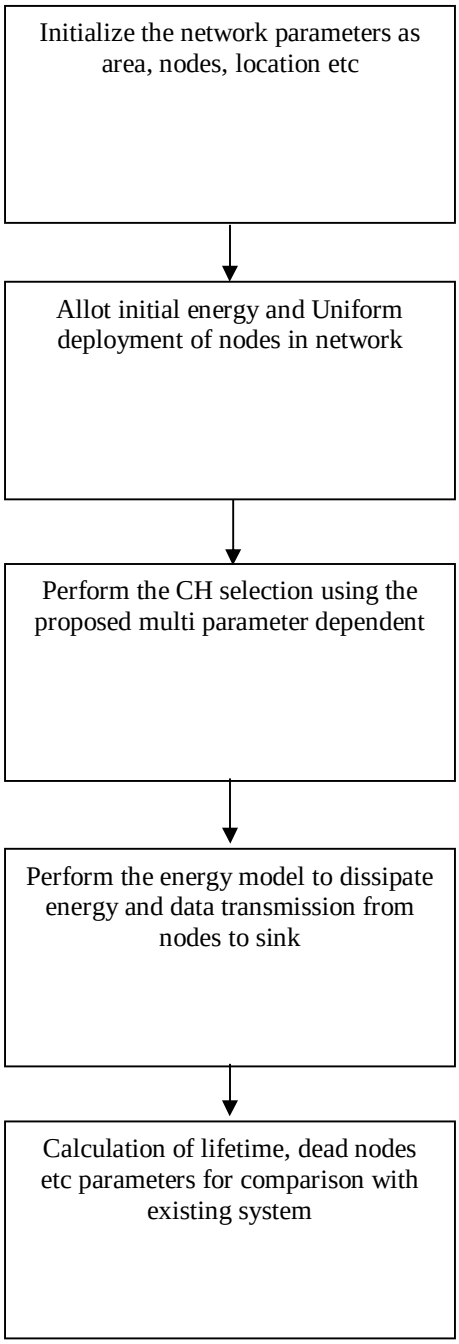

Figure 1 Block diagram of proposed work

VI RESULTS

This section represents the results in a graphical format that are received after implementing proposed work for cluster head selection in proposed work.

The figure 2 shows the cluster head formation of proposed work. The graph depicts that the nodes with a point in the circle is highlighted as these are elected as cluster head to represent the clusters.

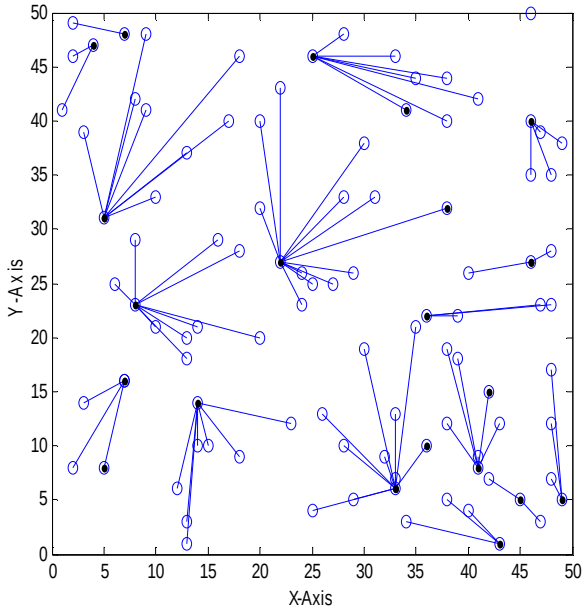

Figure 2 Cluster Formation in proposed work.

The graph of figure 3 depicts the number dead nodes in network in case of proposed work. The number of dead nodes are evaluated on the basis of number of rounds. The graph depicts that after 200 rounds all of the nodes are found dead in network in case of proposed work.

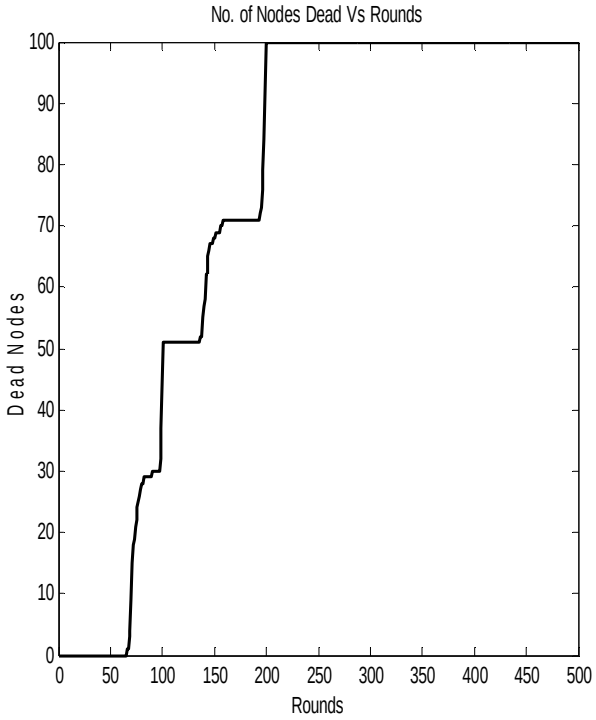

Figure3 Number of Dead Nodes in proposed work

The figure 4 shows the graph for number of alive nodes in the network in case of proposed work. The alive nodes are derived on the basis of number of rounds in the network. The graph depicts that the nodes in the network were alive till the end of 200 round.

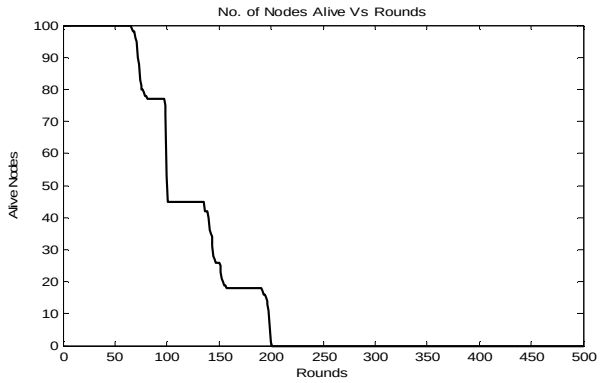

Figure4 Number of Alive nodes in network

The first dead node in the network in case of proposed work is detected after round 60 as shown in graph (figure5). The term first dead node depicts the interval at which the any of the node in the network gets exhausted and left with 0 dB of energy.

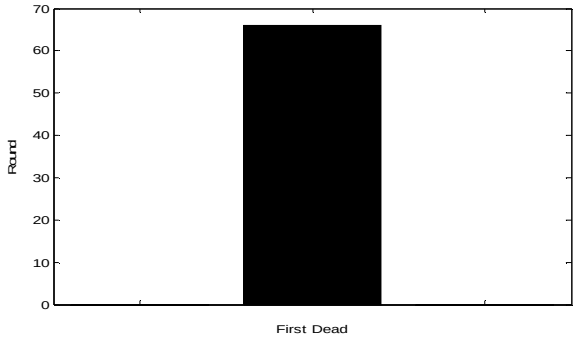

Figure5 first dead node in network

Figure 6 shows the comparison of proposed work and DSBCA-DECH on the basis of number of dead nodes in the network. The dead nodes are evaluated on the basis of rounds in the network. The x axis in the graph calibrates the data in the form of number of rounds and y axis calibrated the number dead nodes in the network. The graph proves that the proposed work is better than the conventional since in proposed work, all nodes are found dead after 200 rounds whereas in DSBCA-DECH all nodes are found dead after 50 rounds. Hence it is proved that proposed network can survive for longer as compare to DSBCA-DECH.

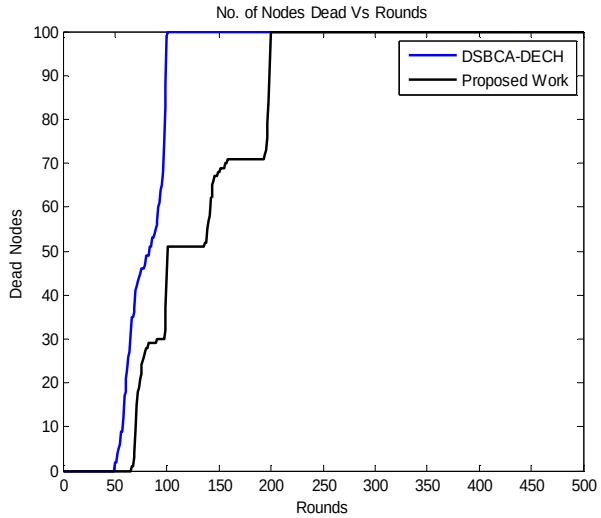

Figure6 Comparison of proposed and DSBCA-DECH with respect to dead nodes in the network

Total Number of alive nodes in case of proposed work are depicted in figure 3 and figure7 presents a comparison among proposed and DSBCA-DECH for alive nodes. The graph observed that in case of DSBCA-DECH last alive node is found at 100 round whereas in proposed work it is found at 200 rounds. Therefore in proposed network most number of nodes remains alive for 200 rounds which is a good practice for efficient network

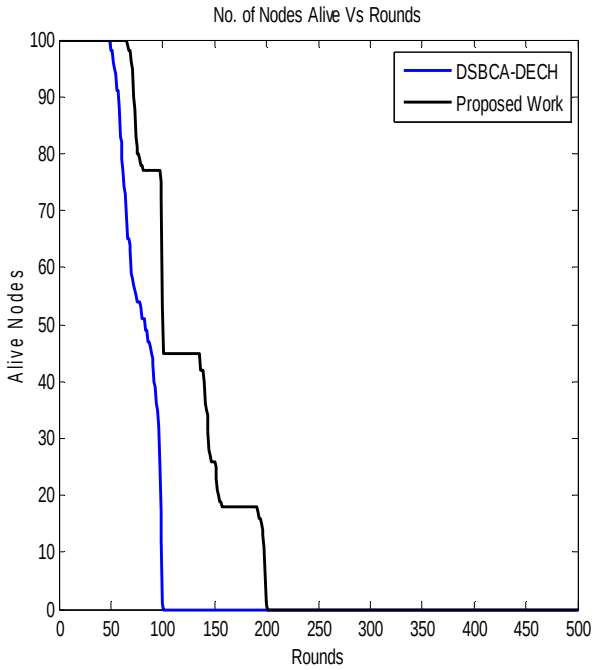

Figure 7 Comparison of proposed and DSBCA-DECH on the basis of alive nodes in the network

The graph of figure8 represents a contrast among proposed work and DSBCA-DECH on the behalf of first dead node found in network. The bar graph defines that in proposed work first dead node is located after 60 rounds whereas in case f DSBCA-DECH it is located at early stage of the communication i.e. at 50 rounds. Hence this graph proves that the proposed work have better performance as compare to the DSBCA-DECH protocol.

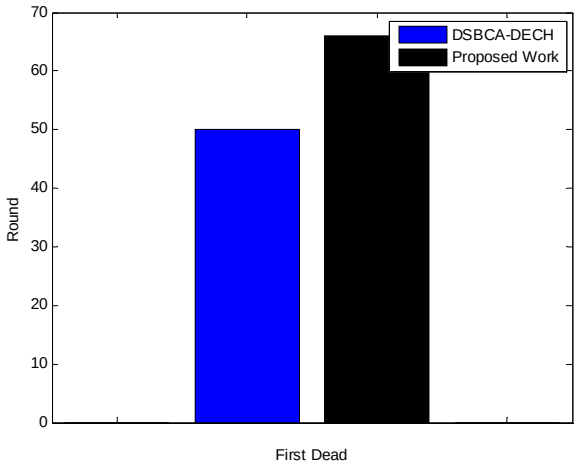

Figure8 Comparison of proposed and DSBCA-DECH on the basis of first dead node in the network

The table1 depicts the performance parameters along with their exact values obtained in proposed work. The table depicts the first dead node and last dead node in proposed and DSBCA-DECH techniques. From the data given in the table it is concluded that the proposed work outnumbered the DSBCA-DECH.

Table 1 Performance parameters

S. NO.	Parameters	Proposed Work	DSBCA-DECH
1.	First Dead Node	At 67 round	At 50 round
2.	Last Dead Node	After 200 rounds	After 100 rounds

VI. CONCLUSION AND FUTURESCOPE

Energy is an essential factor to consider while performing cluster head selection in wireless sensor networks. This study develops an novel mechanism which collaborates the energy model with link cost function to evaluate the capability of the nodes to become a cluster head. The node with minimum link cost is elected as cluster head. And at last it is concluded that the proposed work is quite efficient and reliable as compare to the DSBCA-DECH protocol for cluster head election.

In future, further enhancements can be done by improving the process of cluster head election. The improvements can be done by considering some advance cluster head selection protocols by collaborating them with soft computing techniques.

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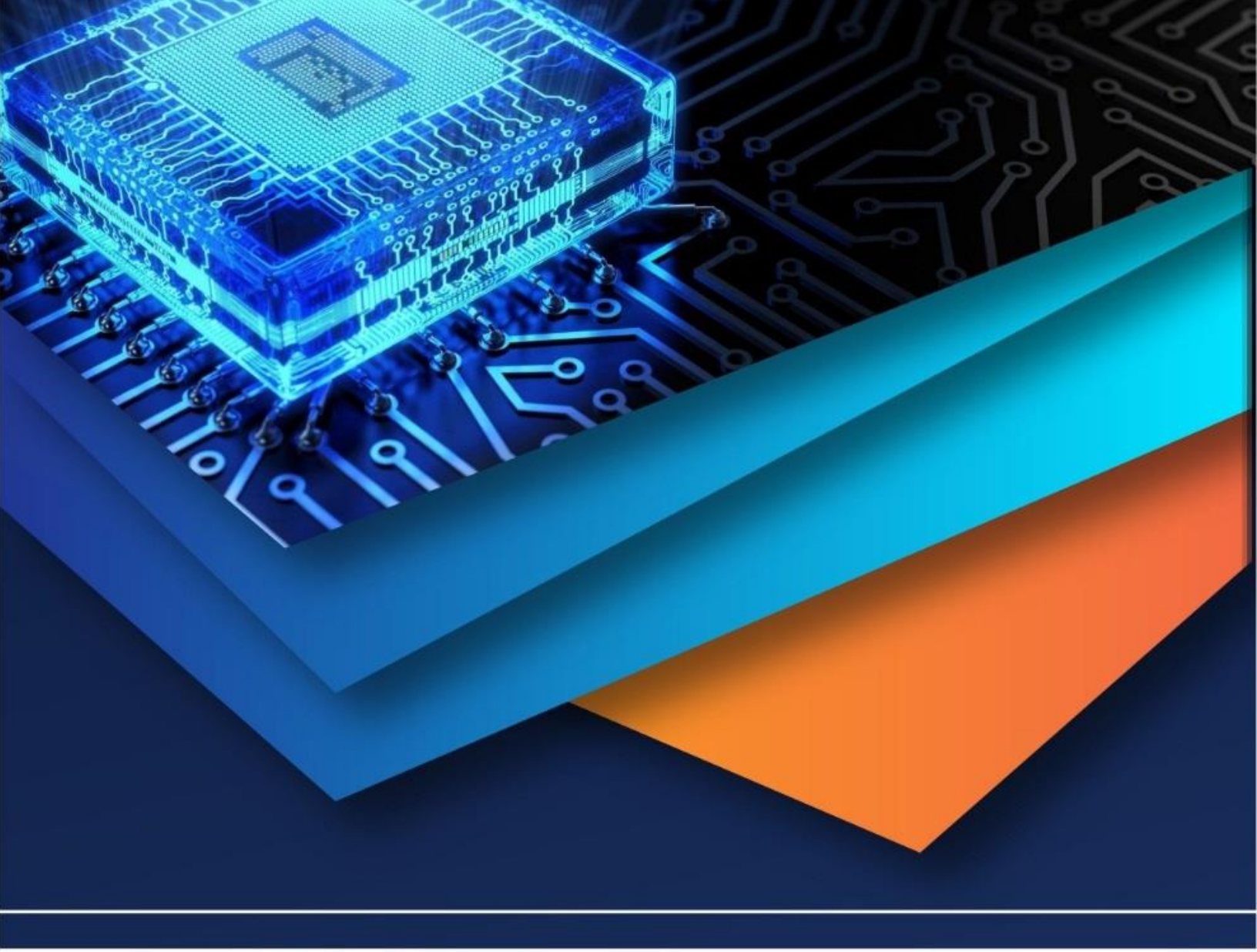

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