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Secure Checkpointing Approach on Ant Colony Optimization in MANET

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Mobile ad hoc network (MANET) is a collection of mobile nodes dynamically forming a temporary network without a centralized administration. Failure rate and security attack rate of processes running on mobile hosts in MANET is high due to its characteristics such as open network environment, dynamic topology due to random node movement, lack of centralized control, fixed infrastructure, stable storage etc. Existing secure checkpointing algorithm using cryptography to provide fault tolerance in failure and security attack prone mobile cellular network cannot be applied in MANET due to enhanced overhead. As an alternative solution, we have designed an ant colony based trust model to evaluate trust value of a mobile node in MANET. A trusted node, that will never be a malicious or selfish node, has low or negligible failure and security attack rate, high available battery power which indicates high availability in the network and high positive reference from other nodes. So checkpoint is secure in a trusted mobile node without additional overheads of cryptography.

Keywords:- **Mobile Adhoc Network (MANET), network, node, ant colony optimization, checkpoints etc.**

I. INTRODUCTION

Mobile ad hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any established infrastructure or centralized administration. In such an environment, it may be necessary for one mobile host to enlist the aid of other hosts in forwarding a packet to its destination, due to the limited range of each mobile host's wireless transmissions. In order to make that work, typically each node needs to act as a router to relay packets to nodes out of direct communication range. Under these circumstances, routing is much more complex than is conventional (static) networks. Many of the possible solution are determined by the characteristics of the media, the behavior of nodes and the data flow. Since research in ad hoc networking has resulted in such a large amount of routing algorithms and protocols, it has become more and more difficult to decide, which algorithm are superior to others under what conditions [6].For the successful deployment, this is an important problem, since a wrong choice may have a severe impact on the performance, and consequently on the acceptance of new technology. Also providing just any protocol is not feasible, due to the different requirements on hardware and lower network layers. Further, it would not make sense, since all devices in an area would need to agree on one method of they want to communicate.

Figure-1 shows homogeneous Mobile ad hoc network and

Figure-2 shows hetertrogeneous Mobile ad hoc network.

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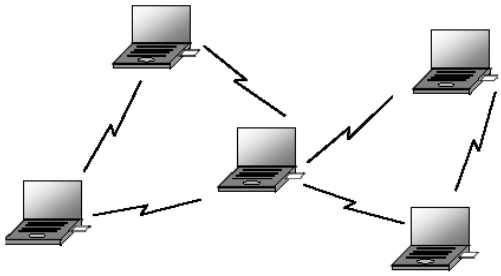

Figure-1: Homogeneous Mobile Ad-hoc Network

Since no base stations are required, ad hoc networks can be deployed quickly, without having to perform any advance planning or construction of expensive network infrastructure. Hence, such networks are ideally suited for applications where such infrastructure is either unavailable or unreliable. Typical applications include military communication networks in battlefields, emergency rescue operations, undersea operations, environmental monitoring, and space exploration. Because of its "on-the fly" deployment quality and relatively low cost of implementation, ad hoc networks are used in places where it is cheaper than its infrastructure counterparts. Examples of these applications consist of a network of laptop computers in conference rooms, network of digital electronic equipment and appliances (e.g. VCR, television, computer, printer, remote control etc) to form a home area network networks of mobile robots and wireless toys. Recently, there is a growing interest of using ad hoc networks of wireless sensors to perform unmanned distributed surveillance and tracking operations.

Figure-2: Heterogeneous Mobile Ad-hoc Network

The design of ad hoc networks faces many unique challenges. Most of these arise due to two principle reasons. The first is that all nodes in an ad hoc network, including the source node(s), the corresponding destination(s), as well as the routing nodes forwarding traffic between them, may be mobile. As the wireless transmission range is limited, the wireless link between them may be mobile. As the wireless transmission range is limited, the wireless link between a pair of neighbouring nodes breaks as soon as they move out of range. Hence, the network (wireless links between all pairs of nodes that can directly communicate with each other) can change frequently and unpredictably. This implies that the multihop path for any given pair of and destination nodes also changes with time. Mobility also causes unpredictability in the quality of an existing wireless link between neighbours. A second reason that makes design of ad hoc networks complicated is the absence of centralized control. All networking functions, such as determining the network topology, multiple accesses, and routing of data over the most appropriate multihop paths, must be performed in a distributed way. These tasks are particularly challenging due to the limited communication bandwidth available in the wireless channel

II. ANT SYSTEM

ANT Colony Optimization (ACO) was firstly put forward by Dorigo M. in the early 1990s[1], and it was designed to simulate the foraging behavior of real ant colonies. While individual ants have few capabilities, a colony can exhibit quite complex behavior, and in which the parallel computation mechanism is adopted. A schematic diagram of the natural processes that the ACO mimic is shown in Fig. 3 and Fig 4.

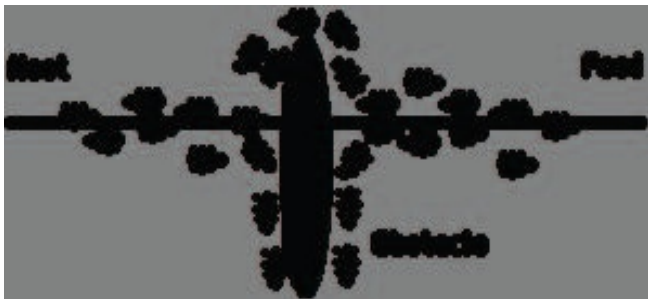

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Fig.3 Ant colony are exploring routes with different lengths

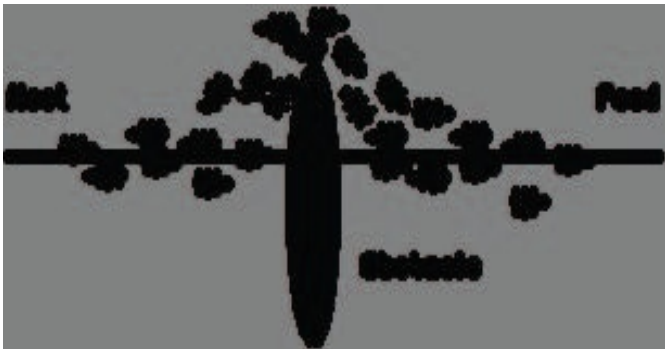

Fig.4 Schematic diagram of ant colony optimization shows that ant colony has succeeded in finding the shortest route

The principle of the phenomenon in Fig. 1 and Fig 2 is that ants can release some special substance which is named pheromone to the environment while walking [2]. It was found that the ant colony marks a path, communicates information among individuals and decides where to go mainly by the pheromone trail which has relation to the length

of the path covered by ants. Moving ants deposits a certain amount of pheromone in the environment, thus making the path by a trail of this substance. At the intersection ants encounter for the first time, they will select one path essentially at random and go forward, meanwhile, they deposit their pheromone determined by the path length. The longer the route ants gained, the smaller the amount of pheromone they deposited. Then, when ants for a second time arrive at the intersection later, each of them prefers in possibility to choose the path richer in pheromone rather than the poorer one. And so, the pheromone trail on the better paths gets stronger and stronger, and ants that choose those paths get more and more, while that of other paths fades away by iteration gradually, and ants choose them get less and less. Thus it generates a positive feedback loop and finally the entire ant colony can converge to the best route. In this process we can learn that it is very important of the pheromone trail for the path exploration of ants.

III. CHARACTERISTICS OF NETWORK

- Dynamic Topologies: Since nodes are free to move arbitrarily, the network topology may change randomly and rapidly at unpredictable times.
- Ad-hoc topology- The network should have no fixed infrastructure, with the topology of the network being defined by the positions of the mobile nodes at a particular time.
- Bandwidth constrained, variable capacity links: Wireless links have significantly lower capacity than their hardwired counterparts.
- Mobility :- The mobile nodes in the network will follow some form of synthetic or observed mobility model with direction ranging from random to predictable, and velocity ranging from static to fast moving.

IV. LITERATURE REVIEW

In Year 2003, Mohammad Towhidul Islam performed a work," A Parallel Ant Colony Optimization Algorithm for All-Pair Routing in MANETs". In this paper, Author design an on-demand routing algorithm called source update for MANETs using a meta-heuristic based on the ant colony optimization (ACO) search technique. Author develop a mechanism to detect cycles, parallelize this algorithm on a distributed memory machine using MPI, and study the performance of the parallel algorithm.

In Year 2003, Seemanti Saha performed a work," A NOVEL SWARM INTELLIGENCE BASED ROUTING SCHEME FOR MANET USING WEIGHTED PHEROMONE PATHS". In this paper, Author present a novel routing scheme in MANET based on Ant Colony Optimization (ACO) algorithm that is probabilistic in nature and inspired by the foraging behavior of the real ants. In the proposed algorithm, nonlinear weights for the deposited pheromone at the intermediate nodes are obtained by incorporating some aspects of queuing delay analysis while calculating the total path delay.

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In Year 2008, Sabari.A performed a work," Ant Based Multicast Routing Algorithm with Multiple Constraints for Mobile Adhoc Networks". This paper presents a design on Ant-Colony Based Multicast Routing (AMR) algorithm for MANETs, to solve the Traffic Engineering Multicast problem that optimizes several objectives simultaneously. The algorithm calculates one more additional constraint in the cost metric, which is the product of average-delay and the maximum depth of the multicast tree and try to minimize this combined cost metric.

In Year 2008, Niaz Morshed Chowdhury performed a work," A new adaptive routing approach based on Ant Colony Optimization (ACO) for Ad hoc Wireless Networks". This paper proposed the basic deign of the algorithm that works based on the principle of Ant Colony Optimization (A CO). This is a probabilistic adaptive technique that changes its routes with the change of network topology over the period of time by learning its environment. It identifies appropriate paths with the feedback of previously travelled packets and maintains routing table accordingly.

In Year 2009, Rahim Rashidi performed a work," Trust Routing Protocol based on Congestion control in MANET". The trust models presented before have three main properties of the trust agent, reputation agent and combiner agent. Since the congestion control agent is crucial in the trust protocols, this article presents a developed trust protocol based on congestion control. In the presented model, the congestion control section guarantees the stability of network and does the distribution of the load on the most highly trust nodes.

In Year 2010, Xibin Zhao performed a work," Availability Based Trust Model of Clusters for MANET". Based on the analysis of availability related factors in MANET, Author present an availability based trust model in this paper. Furthermore, a cluster based trust model (ABTMC Availability Based Trust Model of Clusters) is presented with the consideration with the resource constrain of node, dynamic topology, and the unbalance of computing capability and resource capability among MANET nodes.

V. EXISTING METHODOLOGY

A mobile network is a dynamic reconfigurable network with heavy traffic over the network. In such network the optimization of QOS is always the basic need of the network. Checkpoints Oriented routing algorithm is suggested in this work. As the name suggest, during the long distance communication if some failure occur, the complete communication will be performed again. In such case, to avoid the recommunication, a check point based approach is suggested in this work. The work is divided in two main stages, in first stage, ACO will be implemented to identify the optimized route over the network. The route identification will be based on different parametric analysis such as PDR ratio of nodes, response time analysis etc. Once the route will be identified, the next work is to identify the critical location where the route diversion is possible. On these diversion points the checkpoints will be defined. As the communication will be performed, these checkpoints will perform the communication analysis like an agent. If some attack or the data loss occur, the check points are responsible to call the ACO routing again to generate the new path from that checkpoint onwards. As the work is checkpointing based so that no need to regenerate the whole route again. In this proposed work we are providing Checkpoints improved ACO routing algorithm to handle the link failure by and providing the substitute path. These substitute links are estimated initially by the help of some Checkpoints link. The Checkpoints link is place in between the route dynamically such that it will enhance the QOS over the network.

VI. SOURCES OF DATA

To work with mobile network we need to define a mobile network with n number of nodes. For this we need to collect the information about the network scenario. The scenario includes the information like

- No of Nodes
- Mobility
- Channel Type
- Propagation

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- Transmission Speed
- Packet Size

To represent all these parameters we need to collect relevant senarios. We can collect these scenarios either from some existing literature Surveys or by studying the network definition from the ieee itself.

VII. PROPOSED WORK

Our aim is to ensure secure routing of checkpoints through trusted nodes only at the time of recovery. This can be fulfilled if following objectives are met: i) To find a path, from 'checkpoint node' to 'recovery node', consists of only trusted nodes. ii) If multiple paths exist, the path with minimum number of nodes and higher pheromone concentration value will be selected. Based on ACO, such a path can be found. Pheromone deposit of a trusted node is positive and these nodes are included in pheromone list which is maintained per node in the network. For checkpoint forwarding a node will select next node from its pheromone list.

VII. RESEARH METHODOLOGY

The proposed work is about to optimize the mobile network. using checkpointing. The protocol defined here is a stability oriented protocol. But it will not work efficiently in case of some dynamic change in the network. The proposed work is about to provide an optimization in QOS in case of broken link. In this work we have improve the ACO routing by generating the optimized path initially. Once the path generated, the next work is to setup the check points over the route and finally identify the bad link and generate the substitute path. To optimize the compromising path Checkpoints links are also included dynamically. The methodology of the proposed work is given as

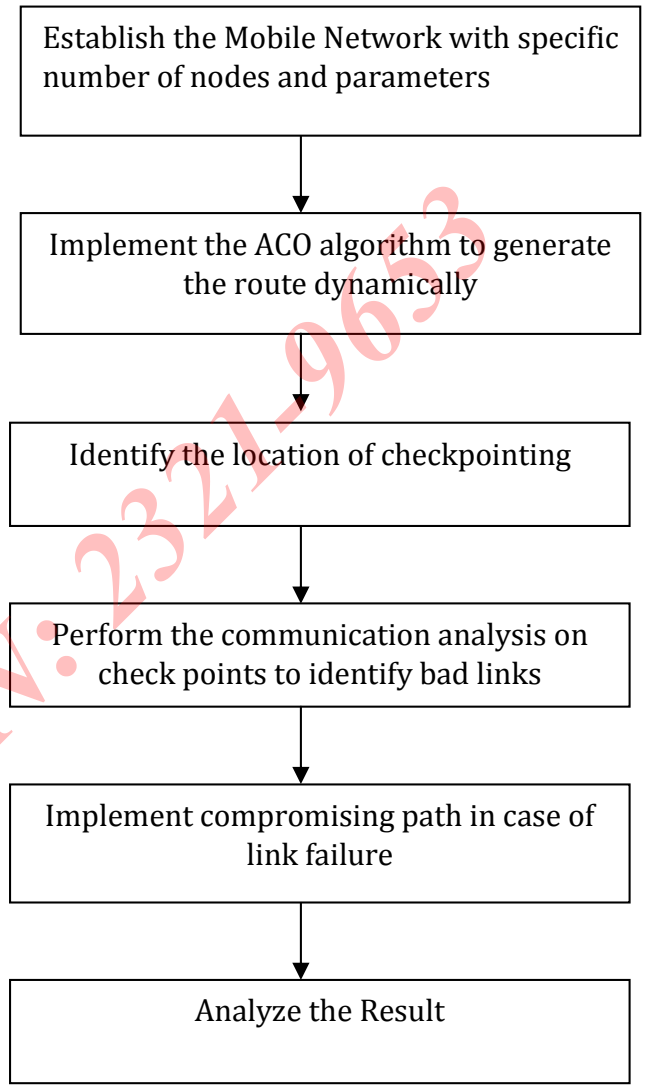

Figure 5 . Path Generation

VIII. CONCLUSION

This paper presents a secure checkpointing approach by selecting cluster head and gateway nodes using ACO based trust model. We use ACO technique to detect availability of nodes, and whether a node is selfish or malicious. MANET is used in military communication and operations, automated battlefields, disaster management, m-commerce applications, safety critical systems e.g. coordination and supervision of mining activities, air traffic control, automated and mobile healthcare system and so on. So, when an application fails, it must have to recover from latest process state to ensure quick recovery, no wastage of computation and no redundant executions. An efficient fault tolerant algorithm makes a failed system to be available quickly so that the system can be accessed by its target users as and when they require. Trusted checkpointing will find its application more and more in such systems with the advancement of technology and evolution of service oriented systems.

IX. REFRENCES

[1] Mohammad Towhidul Islam," A Parallel Ant Colony Optimization Algorithm for All-Pair Routing in MANETs", Proceedings of the International Parallel and Distributed rocessing Symposium (IPDPS'03) 0-7695-1926-1/03@ 2003 IEEE

[2] Seemanti Saha," A NOVEL SWARM INTELLIGENCE BASED ROUTING SCHEME FOR MANET USING WEIGHTED PHEROMONE PATHS".

[3] Sabari.A," Ant Based Multicast Routing Algorithm with Multiple Constraints for Mobile Adhoc Networks", 2008 International Conference on Security Technology 978-0-7695-3486-2/08 © 2008 IEEE

[4] Niaz Morshed Chowdhury," A new adaptive routing approach based on Ant Colony Optimization (ACO) for Ad hoc Wireless Networks", Proceedings of International Workshop on Internet and Distributed Computing Systems (lDCS' 08) 1-4244-2136-7/08©2008 IEEE

[5] Rahim Rashidi," Trust Routing Protocol based on Congestion control in MANET", 978-1-4244-4740-4/09©2009 IEEE

[6] Xibin Zhao," Availability Based Trust Model of Clusters for MANET", 978-1-4244-6487-6/10©2010 IEEE

[7] Hui Xia," A Subjective Trust Management Model with Multiple Decision Factors for

MANET based on AHP and Fuzzy Logic Rules", 2011 IEEE/ACM International Conference on Green Computing and Communications 978-0-7695-4466-3/11© 2011 IEEE

[8] Mohammad Ghulam Rahman," A Trust Based MANET Routing Protocol", 2011 17th Asia-Pacific Conference on Communications (APCC) 978-1-4577-0390-4/11 ©2011 IEEE

[9] Alexandre Massayuki Okazaki," Ant-based Dynamic Hop Optimization Protocol:

A Routing Algorithm for Mobile Wireless Sensor Networks", Joint Workshop of SCPA 2011 and SaCoNAS 2011 , 978-1-4673-0040-7/11©2011 IEEE

[10] U.Venkanna," BLACK HOLE ATTACK AND THEIR COUNTER MEASURE BASED ON TRUST MANAGEMENT IN MANET: A SURVEY", Proc. of1nt. Con/, on Advances in Recent Technologies in Communication and Computing 2011

[11] Parmeet Kaur Jaggi," Preventing Useless Checkpoints in MANETs", 2012 2nd IEEE International Conference on Parallel, Distributed and Grid Computing 978-1-4673-2925-5/12 ©2012 IEEE

[12] D. Karthikeyan," Ant based Intelligent Routing Protocol for MANET", Proceedings of the 2013 International Conference on Pattern Recognition, Informatics and Mobile Engineering (PRIME) 978-1-4673-5845-3/13©2013 IEEE

[13] Sudarshan D Shirkande," ACO Based Routing Algorithms for Ad-hoc Network (WSN,MANETs):A Survey", 2013 International Conference on Communication Systems and Network Technologies 978-0-7695-4958-3/13 © 2013 IEEE

[14] B.Nancharaiah," MANET link Performance using Ant Colony Optimization and Particle Swarm Optimization Algorithms", International conference on Communication and Signal Processing, 978-1-4673-4866-9/13 ©2013 IEEE

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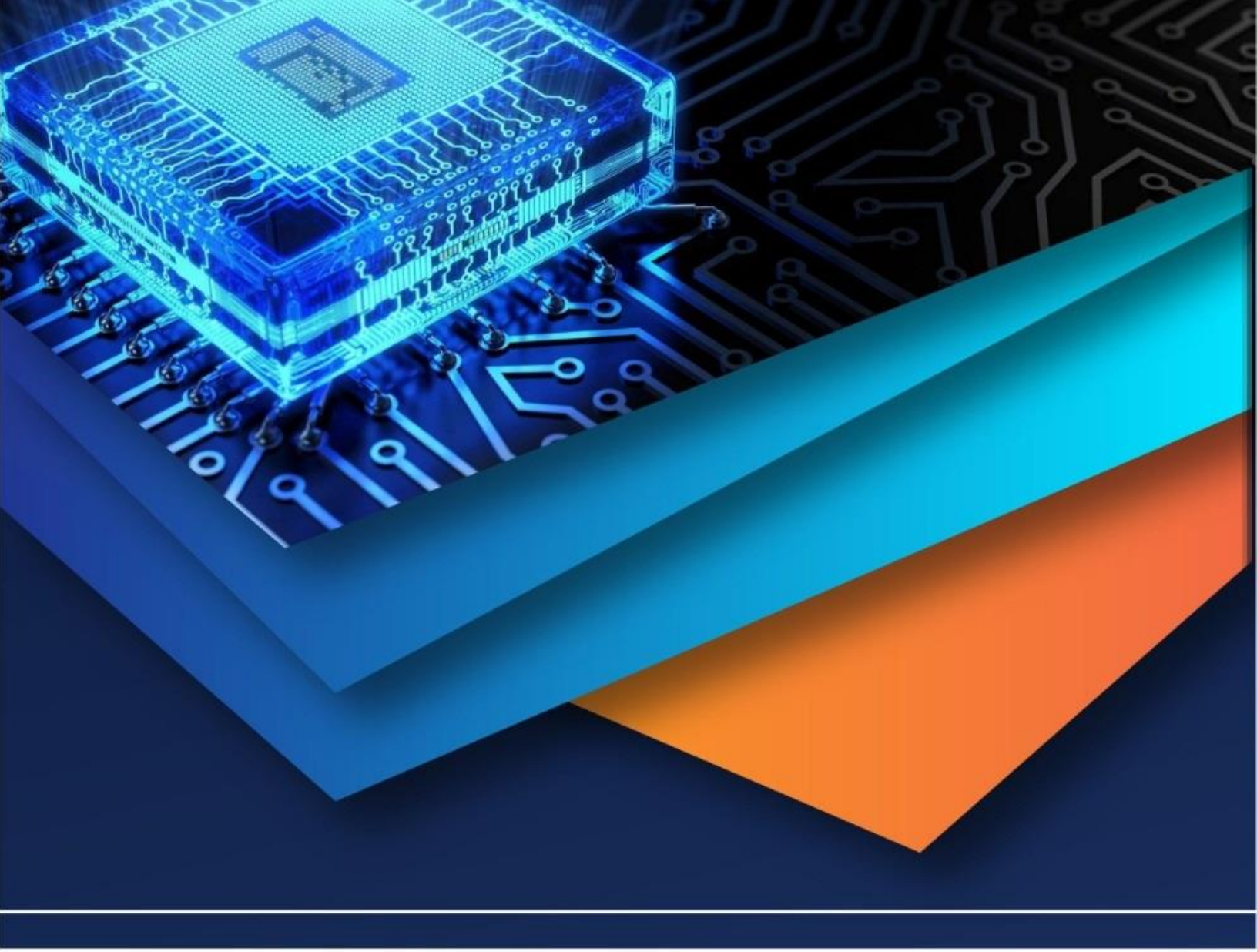

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