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Intelligent Decision Based Route Selection and Maintenance Approach Using AOMDV in VANET

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Abstract: Vehicle Ad Hoc Network (VANET) is a dynamic network with a variety of applications in intelligent transport systems. There are several routing protocols for establishing paths between sending and receiving nodes. AODV is a reactive routing protocol that broadcasts a route request to all adjacent nodes, which forward the request to their neighbors. This process helps select the path from sender to receiver. The AODV protocol is the best routing protocol when you have a large number of communicating nodes. In this study, AODV and Ant Colony Optimization (ACO) techniques are applied to transfer data. Ant colony optimization algorithm is applied considering the initial coordinates of each node. Paths established using reactive routing protocols are likely to congest the network and also consume large amounts of network bandwidth. This research is based on using a multicast approach to establish a path from source to destination to reduce the potential for network congestion. It generates the shortest route and achieves higher throughput, less packet loss, and less delay than existing protocols.
Keywords: Vehicular ad-hoc Networks, Ad-hoc routing, Routing Protocols, Back-up routes, RREQ, RREP, RERR, AOMDV with Intelligent Decision (AOMDV-ID)

I. INTRODUCTION

Vehicles can freely interact with each other in an integrated manner via DSRC. This interaction can use V-2-V, V-2-I, or hybrid communication modes [1]. The vehicle's communication configuration is highly dependent on the local environment as it uses location-based systems and advanced wireless technology. V-2-V is a major threat to developing countries due to lack of infrastructure, inadequate internet and infrastructure costs, large population centers, and increased urban property crime without RSUs installed on major thoroughfares. Essential. Several KPIs such as B. To analyze a V-2-V network or really any VANET network, we need latency, hop count, retransmission attempts, received traffic, and throughput. Your network doesn't have to achieve the best results for every KPI. Vehicles participating in VANET are equipped with wireless sensors and in-vehicle devices. These gadgets allow the vehicle and its surroundings to communicate wirelessly. Each vehicle becomes a packet sender, collector, and router, allowing the vehicle to communicate with humans over wireless media with other vehicles or RSUs within range [2]. RSUs are typically mounted throughout the truck and equipped with network devices that connect within the network architecture using IEEE 802.11p radio technology [3] and can be extended with additional network devices. In VANET, all vehicles are free to move throughout the road network and interact mainly with each other or with RSUs [4]. Vehicle motion and inter-vehicle signaling require accurately developing a realistic simulation environment within a realistic simulation time. Realistic road layouts, real-time information network requirements, and micro-mobility modeling are all required to realistically represent vehicle mobility. However, routing is a major concern due to the frequent movement of nodes when trying to implement VANET [5].

There are several routing protocols based on topology, location, cluster, geocast, broadcast, etc. to meet this demand. In this study, topology-based routing protocols, namely H. Proactive and reactive ad-hoc routing techniques and protocols (OLSR, DSDV, DSR, AODV, AOMDV, AOMDV-LR, and AOMDV-ID). Protocol performance is evaluated using traffic and network simulators. Two forms of topology-based VANET routing protocol are compared. The first is proactive and the second is reactive. As a result, the initial routing method is not supported in large networks because a table is maintained by each node to keep up-to-date information from nodes in the network. Also, the routing table becomes increasingly congested, consuming more bandwidth. The second routing is triggered by a request and is known as an on-request routing protocol, but does not require keeping the device's packet data. If the network connection is lost, the data on the network will be lost. When a vehicle wants to send an alert to a specific receiver's network, the protocol looks up the correct path and acquires additional conformance to form a relationship with the sending and receiving of the packet. The main idea of this study is to select the most effective routing algorithms for dynamic vehicle systems.

In this paper, we present a performance evaluation of topology-based his VANET characteristics related to high-density dynamic systems in vehicles. This evaluation includes the road layout design process. Urban mobility simulation is used to simulate a miniature mobility car model and create a trace file [6]. These trace files are also used as a TCL file source for the NS2 simulator to provide mobility.

This research aims to improve the overall performance of VANET networks by improving PDR, increasing throughput, and reducing overhead. The proposed protocol is mainly implemented using simulation methods as steps in the Urban Mobility Simulation Generator (NS2).

The reason I use his NS2 is because it includes features such as state of charge limits, number of lanes, intersections, traffic lights, and cars with unique characteristics such as vehicle length and idling characteristics. is. NS2 also allows you to assign vehicles to specific users or randomly generated routes.

All vehicles arrive and depart on time, and XML format is used for all user input. You can also visualize the developed route topology using the NS2 GUI mode. One of the main contributions of this paper is the comparison of features using a mobility simulator under a traffic simulator based on the parameters throughput, OH, PDR and protocols AOMDV, AOMDV-LR, AOMDV-ID, AODV, and OLSR. Creating results, DSR and DSDV are available.

II. RELATED WORK

These routing technologies use network connectivity information to perform packet forwarding. These are further divided into two categories: proactive routing protocols and reactive routing protocols.

Proactive-based routing protocol means that routing information such as the [7] next forwarding hop is stored in the process regardless of carrier up. The advantage of the proactive protocol is that it does not require a network connection as the journey to the destination is maintained during that time. However, the actual application delay is minimal. Tables are built and managed within nodes. Each table entry therefore specifies the next jump address on the way to a particular destination. It also preserves unused data paths, reducing channel capacity. OLSR and DSDV are examples of proactive protocols.

1) *OLSR:* A proactive system built on top of the link state algorithm. A periodic exchange of messages is used to keep each node up-to-date with network topology information. It is advancement over pure link-state protocols, compressing the amount of data delivered in messages and minimizing the potential data transfer required to flood the network with those signals. To accomplish this, the protocol uses a multipoint relay mechanism to flood data packets efficiently and cheaply. It provides the most efficient route in terms of number of hops that are readily available. This protocol works best on large and congested MANETs. Here are some of the benefits of using the OLSR optimization protocol: Instead of announcing all links, the OLSR optimization protocol uses a multicast relay picker to declare only a subset of links, reducing the number of control packets. It reduces flooding of control traffic by propagating messages throughout the network through only a few selected nodes called multipoint relays. A node's broadcast message is only retransmitted by this multipoint relay. In flooding or broadcasting schemes, this strategy dramatically reduces the probability of data transmission [8].
2) *DSDV:* Routing is a modified table-driven routing system using the Bellman-Ford algorithm based on MANET. The main contribution of this method is that it should solve the circulation problem. Each entry in the routing table has a destination address that is set even if there is no connection. Otherwise, a strange system is available. The sender should send the next update using the target number provided by the generator. Full dumps are sent infrequently and small incremental updates are sent more frequently to propagate routing information between nodes [9]. A reactive-based routing protocol, whenever one node needs to communicate with another node, it creates a route. Track currently active connections and free up the network [10]. During the route discovery phase of reactive routing, the network is flooded with path discovery request packets 8. It ends when a route is found and AODV, DSR, AOMDV, AODV-LR, and AOMDV-ID are part of it.

a) AODV

An on-demand protocol that initiates path finding only when the sender wants to send a packet to another node. A route request packet (RREQ) is delivered to its neighbors to complete the route discovery operation. The main goals of the protocol are:

- Send discovery packets only when absolutely necessary.
- Discuss the difference between local connection management (neighbor identification) and general topology maintenance.
- Changes in local connectivity must be propagated to neighboring nodes.

Here are some of AODV's features:
- Nodes store only the routes they need.
- Less need for shipping
- Reduce storage requirements and unnecessary duplication.
- Faster response to active route connection errors.
- It uses target sequence number [11] to keep the path free of loops and is scalable to a large number of nodes.

b) DSR

A routing protocol that runs on demand. It is a low power, high speed, multi-hop VANET routing protocol. This allows networks to self-organize and adapt without the need for additional monitoring devices or management. It consists of two basic techniques that work together to allow ad-hoc networks to find and maintain source routes [12].

c) Ad Hoc On-Demand Multipath Distance Vector (AOMDV)

Similar to AODV routing protocol, AOMDV multipath routing protocol also has three categories of packets [13]. The first is a Route Request (RREQ) packet, the second is a Route Reply (RREP) packet, and the last is a Route Error (RERR) packet. Transmission and reception of these three types of packets realize selection and maintenance of transmission paths in network topology[14]. The route discovery process of the AOMDV protocol is divided into two parts: forward routing path setup and reverse routing path setup. Reverse routes are recognized in RREQ packets. When the in-between node receives the RREQ packet broadcasted by the originating node or the preceding node, the reverse route from the node to the originating node or the preceding node is recognized accordingly; the forward route is recognized through the RREP when the route is established, the destination node act in response to the arriving RREQ packet, sends the RREP packet to the preceding node, and at that instance the forward route from the preceding node to the target node is recognized whether the originating node can find a most modern route is resolute by the RREP packet to the originating node. After the routing table is maintained, each node in the route desires to perform some routing preservation and supervision tasks to attain hop-by-hop transmission and multi-hop communication. In the preservation procedure of the routing table, in addition to deleting unacceptable and needless node routes, when a link interruption is identified, if a node did not obtain the Hello packet in the analogous period, the preceding node will send it to the more preceding node RERR package. In the routing table of every RERR packet, the IP address of the target node that cannot be reached because of link disruption is stored. Likewise each node retains a preceding node list to assist complete the procedure of the RERR packet reaching the originating node efficiently. When a VANET network sends out packet transmissions, some nodes are repeatedly selected as intermediate nodes due to locality and various other reasons. As a result, additional information is available on these nodes for copying and forwarding, resulting in high load for long periods of time [15] [16]. Node congestion is very severe and at the same time causes information overflow and loss, with dangerous effects on routines throughout the network.

d) Ad Hoc On-Demand Multi-Path Distance Vector with Local Repair (AOMDV-LR)

AOMDV works well except for the lack of local repair. Use a backup route for future transmissions in the event of a failure. If no backup route is available, restart route discovery from source to destination. This reduces throughput and increases end-to-end latency [17]. In AOMDV-LR, an intermediate node on the active path attempts to discover a new path to the destination in the event of a link failure and no alternate route exists. Both proactive and reactive routing are used in AOMDV-LR within a local area to reduce the route invention delay in the network. Like the proactive steps, it looks for alternate routes from the routing table. In addition to the reactive method, if an alternate route is not available, it will probe routes as needed. Nodes are invented to disappear from the network if they haven't received packets from a large number of originating nodes for a period of time. If a node discovers that a successor node is not available, the ancestor node, instead of sending a REER packet to the sending node, will attempt to repair the broken link itself or, if no alternative route exists, to the destination node. Try to find another route. Origin node.

Fewer data packets are lost when the previous node tries to re-establish a broken connection on its own, allowing the route to be restored with little overhead. Also, the originating node does not participate in any other route discovery process. AOMDV-LR helps increase the amount of data packets reaching their destination. As networks grow in size, the end-to-end path distances of these routes increase, and if no alternative route is available, AODMV-LR will revert to all previously failed nodes that are closer to the destination than the source node. Start a local repair. H. Low-overhead roots are expected to be repaired quickly, as not only ancestor nodes contribute to local repair, but all previous nodes contribute to local repair. Because the ratio of the number of control packets RREQ, RREP, and RERR is compressed, the control overhead of the protocol is also compressed. Local route recovery compresses end-to-end delay because the originating node does not care about route knowledge [18].

e) AOMDV Protocol with Intelligent Decision Making (AOMDV-ID)

Several multipath routing protocols have been proposed for efficient data transmission between participating nodes. Ad Hoc On-Demand Multipath Distance Vector Routing Protocol (AOMDV) is one of the most widely used reactive protocols for multipath routing in VANET [19]. AOMDV works well, but lacks intelligent decision- making capabilities such as choosing immediate routes per source without discovering new routes, or alternative routes after intermediate nodes during outages. , resulting in lower throughput and reduced end-to-end - increased latency [20]. To overcome this problem, we present the AOMDV protocol with intelligent decision function (AOMDV-ID). AOMDV-ID works as a hybrid protocol (proactive and reactive). As a proactive protocol, it maintains reachability information up to two hop counts. As a reactive log source node, it checks the routing table for direct connections to destinations and collects routing information from V2V and V2RSU to destinations. If the route is found, it will start sending the AOMDV ID. As soon as route discovery begins, newly discovered routes are compared with static routes for timestamps. A shorter timestamp is chosen for further transmission. After the errors are subtracted, each intermediate node starts transmitting on alternate routes of the static information collected by V2V and V2RSU, acts as a source node for route discovery without affecting the source node, and reduces routing delays. Keep it to a minimum. Intelligent Multipath Ad hoc On-Demand Distance Vector (AOMDV-ID) is a multipath routing protocol designed to make intelligent decisions to select the fastest route and initiate instant data transfer. Many configuration parameters used by AOMDV-ID are based on AODV and AOMDV. Smart decision-making allows data to be transferred instantly without waiting for the route finding process. As the size of the network grows, these routes are more likely to fail. AODMV-ID initiates intelligent decisions on all predecessor failure nodes that are closer to the destination than the source node. H. Not only do ancestor nodes participate in the intelligent decision-making process, but all ancestor nodes participate, so alternate route availability is expected to be found quickly with less overhead. Because the ratio of the number of control messages RREQ, RREP, and RERR is compressed, the control overhead of the protocol is also compressed. With intelligent decision, the source node does not care about minimum hop distance route discovery and route rediscovery on failure, reducing end-to-end delay [21].

III. METHODOLOGY

The goal of this paintings is to determine the dynamic machine efficiency of VANET dual carriageway routing protocol situations and to pick the nice VANET routing protocols for the dynamic vehicle gadget. DSDV, OLSR (proactive), AODV, AOMDV, AOMDV-LR AOMDV-id and DSR are routing protocols which might be tested (reactive). The preliminary level of our methodology is to apply network simulation with the NS-2 simulator to explore what a dedicated community is and the way it differs from a traditional network. the second one phase includes gaining knowledge of approximately MANET, a specialized wi-fi network, and engaging in studies on its capabilities and routing protocols. The TCL record is created using NS2. The purpose for choosing the NS2 is that it is a tour model this is affordable, small and mild. users also can create their very own avenue topologies and import fully prepared map codecs from a huge range of cities around the world. It also permits the utility of speed limits, as well as the identification of visitors lanes, intersections and lights. NS2 additionally offers vehicles the capability to assign identified customers or random routes. After the units are entire, the NS2 GUI mode is used to show all of the preceding steps. once you recognize MANET, operating with VANET could be easy in the 0.33 step. within the fourth and very last level of our technique, we use a network simulator called NS-2 to find the effects of the proposed routing protocols. Experiments are analyzed using two routing strategies for one of a kind eventualities, and then the most excellent routing protocol is chosen for the given situation. DSDV, AODV, AOMDV, AOMDV-LR, AOMDV-id and DSR, OLSR are the protocols with a view to be studied on this studies. To validate the VANET simulation, NS-2 community simulators were used for the dual carriageway scenario. Throughput, packet transport price, and EED postpone are used to evaluate overall performance. The output is stored to a trace report and displayed the usage of a C++ script. finally, the outcomes are calculated the use of an Excel report and the gnu plot is done the usage of NS-2 csv documents.

IV. PERFORMANCE SIMULATION AND MODELING

The exchange of messages between connected nodes is simulated using a community simulator. vehicles and RSUs are frequently implicated in the case of a VANET, and wireless communications are the maximum commonplace mode of communique. other critical metrics have to in the end be included inside the simulation as well as all factors of the records transmission (as an example, the complete protocol stack, signal to noise ratio, packet blunders quotes). each the community additives and events are described inside the community version. additives encompass nodes, routers, switches, and connections. records transmissions and packet screw ups are two examples of activities. A network simulator's output commonly consists of network degree facts, link metrics, and device metrics for a unique simulation state of affairs. every event in the simulation is recorded in a trace record.

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Discrete-occasion simulation is used by the general public of network simulators. there is a listing of "pending occasions." maintained in this approach, that's then treated at every step. some events can lead to the emergence of new ones. the advent of a packet at a node, for example, might also reason a new packet to be despatched. OPNET, NS3 and NS2 are some of the maximum substantially used VANET simulators. community simulator through NS-2: it's miles used to put in force routing and examine the overall performance of different set of nodes. it's far an open-source community simulation tool. this is written in C++ and also can write scripts in C++ and python. consumer can simulate simple and complex networking scenario. The minimal necessities of NS-2 are to have C++ and python is set up inside the system. sudo apt-get installation g++ python3 It makes use of a python tool referred to as bake to download and deploy NS-3 and after installation person could run an example using . /waf –run examples/tutorial/first NS-2 simulator's general computation is less than NS-2 and memory allocation is also exact. it may prevent from pointless parameters to be saved. For gnu plotting .csv files are extra suitable and for network animation.

Simulation configuration: VANET output is examined throughout five set of situations to train a community. The output is then copied to an excel record to calculate performance metrics (parameters). common Throughput, PDR, OH are used to assess the performance of OLSR, AODV, DSDV, and DSR. The simulation parameters and their specification are given in table 1.

Table 1. Simulation Parameters for

S.No.	Parameters	Values
1	Area size	2000 m x 2000
2	Number of nodes	5–25
3	Node mobility speed	0.9–1.1 v
4	Propagation range	250 m
5	Mobility model	Random way
6	Data rate	5 Kbps
7	Simulation time	1000 s
8	Pause time	0
9	No. of experiments	Five times

V. ANALYSIS AND RESULT

Simulator Setup TR, PDR, and OH are 3 ordinary performance measures used to evaluate the above-mentioned protocols' performance. So, in this segment, researchers will study five extraordinary scenarios to peer how node density and mobility affect dynamic system of VANET routing protocol overall performance. This element discusses simulation and result analysis utilising 3 performance metrics (throughput, PDR, and OH) and five diverse set of densities (20, 30, 40, 50, and 60) with using network simulator (NS-2). Throughput Ratio as the variety of nodes between the supply and the vacation spot grows so does the complexity of the machine and throughput also lower or drops. it's measured in kbps. for that reason, each time a packet from the second one node arrives on the 1/3 node, the primary node is not able to send the subsequent packet until more packets from the second node arrive, and so on. The DSR has a greater overall performance than the AODV, OLSR, and DSDV protocols when compared to all routing protocols. among the 2 reactive routing protocols, DSDV and AODV, it has been located that AODV outperforms DSDV. DSDV makes use of ordinary on-call for routing and vacation spot collection numbers, while AODV leverages source routing, which allows AODV packets to arrive at their vacation spot faster and with better throughput. As a end result, AODV can achieve better throughput than DSDV. however, because the nodes grow, DSR is anticipated to outperform OLSR, DSDV, and AODV. because the quantity of nodes will increase because the packet drop reduces, ensuing in better throughput. The throughput value will be 0 if no protocol is chosen. BSM_PDR This experiment's network performance is classed the usage of five awesome kinds of simulations. It shows the packet transmission ratio for five one-of-a-kind nodes the usage of the OLSR, AODV, AOMDV, AOMDV-LR, AOMDV-identity, DSR, and DSDV protocols. The higher the PDR, the more specific and appropriate the routing protocol might be. when all protocols had been compared, it was determined that AOMDV-D executed higher than the rest, whilst DSR had a zero percent PDR on the grounds that DSR does now not manage BSM packets. Overhead The decrease the OH, the higher the networks overall performance. From effects it is indicated that DSR is having high OH in 20,30,forty,50 set of nodes however step by step it's miles decreasing from 20 set of nodes to 60 set of nodes. end is that after nodes will boom then overhead value would be lowering. If the nodes are high then DSR might carry out better.

In case of DSDV it is shown that because the nodes are growing so the price of overhead might also increase. but in case of OLSR and AOMDV-LR if the nodes are increasing the fee of overhead as soon as increases however later it starts offevolved decreasing. while no protocol is chosen in that case fee of overhead might be equal in all the cases. So, eventually it is concluded that for lower fee of nodes DSDV could work higher whereas for higher cost of nodes DSR will function a better option. dialogue In few research works special mobility simulator and network simulator are used and in comparison on the premise of various routing protocols (AODV, AOMDV, AOMDV-LR, AOMDV-id and DSR protocols) utilising PDR, common EED, Throughput Ratio as performance metrices. The situations are used to base the research findings on this paper. OLSR, AODV, DSDV, AOMDV, AOMDV-LR, AOMDV-identity and DSR have been tested in phrases of (throughput ratio, PDR, and overhead) utilizing (AODV, AOMDV, AOMDV-LR, AOMDV-identity, DSDV, OLSR, and DSR) and there are five distinct set of nodes (20, 30, 40, 50, and 60), using simulation on NS3. This look at appeared into the impact of the vehicle's node density component on routing protocol overall performance and the dominance turned into utilized to attract graphs and set performance criterion tests. due to the findings, it become determined that DSR performs extensively higher than the protocols AODV, AOMDV, AOMDV-LR, AOMDV-id, OLSR, and DSDV in phrases of throughput. So, whilst there are 60 nodes, in phrases of overhead, the DSR protocol is the most efficient. even as AOMDV-identification is better than different protocols, while case of PDR in particular on the set of node degree (30). this means that any approach or protocol used can be evaluated in exceptional situations, relying on the nature of the assignment.

VI. CONCLUSION AND FUTURE SCOPE

The goal of this examine is to determine the maximum suitable and green routing techniques in a excessive-traffic density area of vehicle dynamic device. This paper offers a practical assessment of the VANET topology's residences in phrases of time for high-density traffic situations of vehicle dynamic machine. huge simulations on a highway site visitors situation are used to check the dynamic system of VANET routing algorithms. Investigations and interpretation of overall performance of AODV, AOMDV, AOMDV-LR, AOMDV-id, OLSR, DSDV, and DSR is analyzed on diverse overall performance metrics (Overhead, PDR, and Throughput). Simulation effects concluded that usual DSR perform better amongst AODV, OLSR, DSDV, DSR in case of Overhead when quantity of nodes are excessive but if nodes are low then DSDV carry out better and in case of throughput DSR perform better among all. however in case of percent of BSM_PDR AOMDV-identification will perform higher among all. As a end result, the reactive routing protocol (DSR, AODV, AOMDV, AOMDV-LR, AOMDV-identity) outperforms all of the overall performance metrics examined on this examine. based totally on the outcomes of this have a look at, other routing protocols with extra performance metrics must be explored for in addition performance evaluation within the future. The work's flaw is that it is feasible that the same routing protocols may produce poor effects in other city visitors areas. Routing protocols for dynamic device of VANETs ought to have been examined on a ordinary basis for automobile conversation and automobile, passenger, and motive force safety. As a end result, extraordinary routing protocols need to be studied as well. more routing protocols with one of a kind performance metrics may be simulated and tested in the future the use of various densities of nodes or cars. thru analysing the dynamic overall performance of a car machine for various nodes it is concluded that DSR, AODV, AOMDV, AOMDV-LR, AOMDV-identity carried out amongst all of the routing protocol mentioned for contrast. it'll offer secure and reliable routing protocol for the automobile gadget dynamic network for further research.

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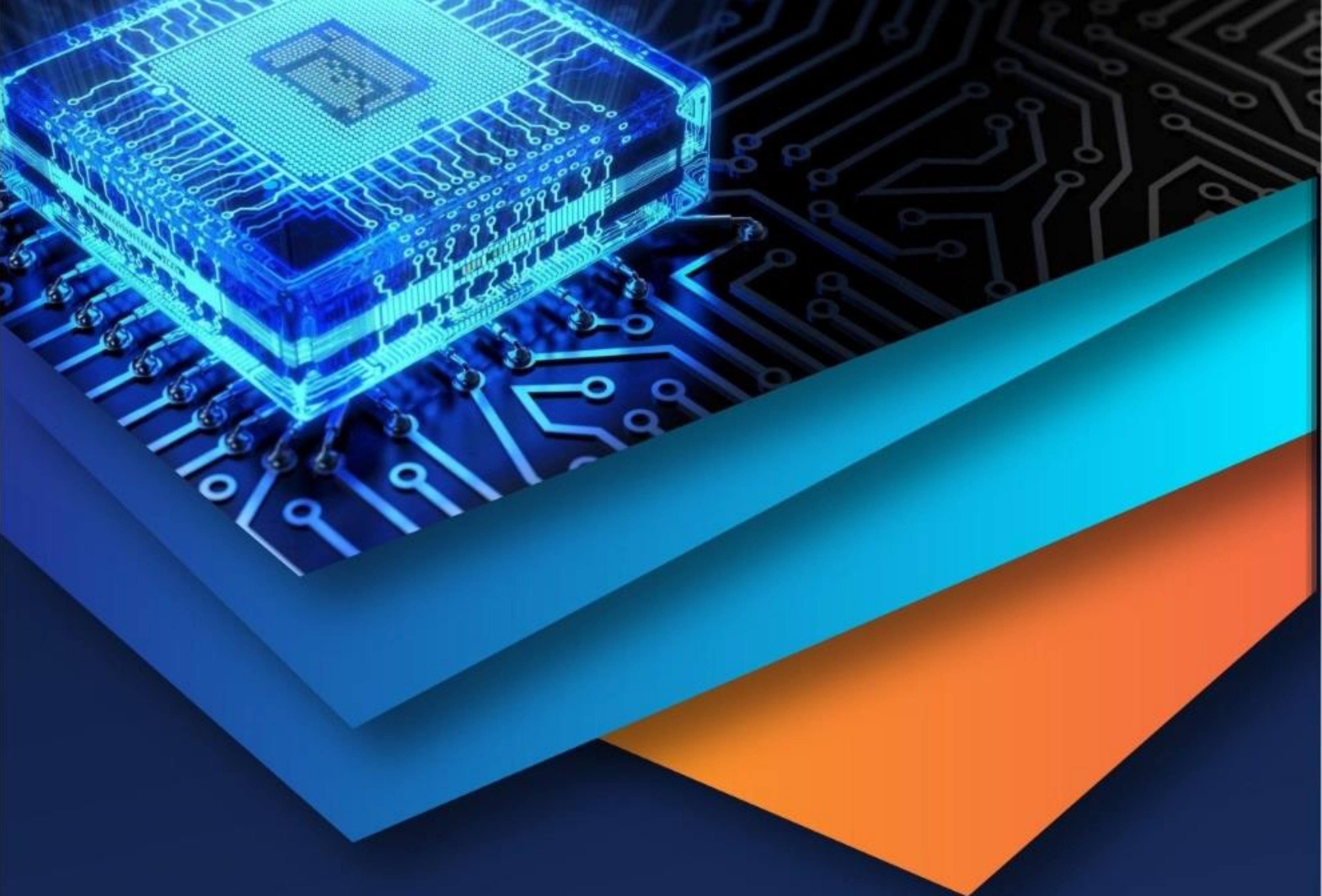

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