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# Analysis of Mobile ADHOC Network's Unipath and Multipath Routing Protocols

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***Abstract:*** - A mobile area network, also known as a MANET, is a structure that is constructed by wireless connections that connect mobile devices in order to establish a dynamic architecture. The use of routing protocols is an essential component in the process of data transmission across a network. Multipath and unipath are the two kind of routing protocols that are considered to be the most fundamental. Within the scope of this study, we investigated the effectiveness of two prevalent on-demand routing strategies, namely AOMDV and MDART, as well as AODV, which is a unipath routing protocol. These protocols were chosen because of their superior performance in comparison to their counterparts in a variety of domains, particularly in terms of reducing routing load and delay.

***Keywords:*** AOMDV, MANET, AODV, Routing Protocols, Delay

## I. INTRODUCTION

According with various types of networks, MANETs are considered to represent an accessible, quick, and economical option for deployment. These characteristics allow feasible for ad hoc network applications to be widely used across personal or local area networks as compared to only the emergency management, disaster recovery, and military domains. Since MANET is a completely separate type of network, it needs a unique set of protocols to be able to operate such a network. Routing protocols are an essential component of all networks because they allow nodes to identify and maintain routes among each other. Additionally, there are additionally distinctions between routing techniques in an Ad Hoc network, including hop-by-hop or source routing, unicast or multicast, reactive or proactive approach, single multi-path, distance vector, or link state based. The MANET is genuine. In a MANET, a wireless node may transmit data to another connected node, the source, or the destination. An intermediate wireless node serves as a router that may receive and pass data packets to a neighbor that is located near the destination node. Given its dynamic architecture, distributed communication, and changing physical channel characteristics, MANET routing is a challenging operations. Adhoc On-demand Multipath Distance Vector routing protocol [1], A modified version of the Adhoc On-demand Routing Protocol (AODV) is one of the most commonly utilized on-demand routing algorithms. For the purpose of to offer effective fault tolerance, AOMDV determines many paths connecting a source and a destination. This allows dynamic networks to come back from route failures quicker and more efficiently.

Developing a novel approach is only necessary when every other paths fail, as AOMDV can identify numerous paths in a single route discovery operation. That reduces the route discovery a latency period in addition to reducing routing overheads. Additionally, the AODV routing protocol is single path and reactive. It allows users to find and regulate routes to other users throughout the network to be needed. The adhoc on demand distance vector routing protocol enables broadcast, multicast, and unicast communications in adhoc networks. Whenever a node requests to join a multicast group or requires a route, AODV commences the route discovery procedure. Routes are maintained up up-to-date just as long as the multicast group or the source node needs them, and sequence numbers are employed to ensure sure routes never start recurring [2]. The Augmented Tree based Routing (ATR) protocol was proposed as a multipath enhancement to DART [3]. ATR replaces the DHT system via a global search table which is available to all nodes, which will have a significant impact on address

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discovery, an essential step for the whole routing protocol. Dynamic Address Routing (DART) is a shortest path routing protocol; M-DART is an enhancement on DART among DHT-based routing protocols. Multiple paths to the destination are identified by M-DART and saved in therouting table.

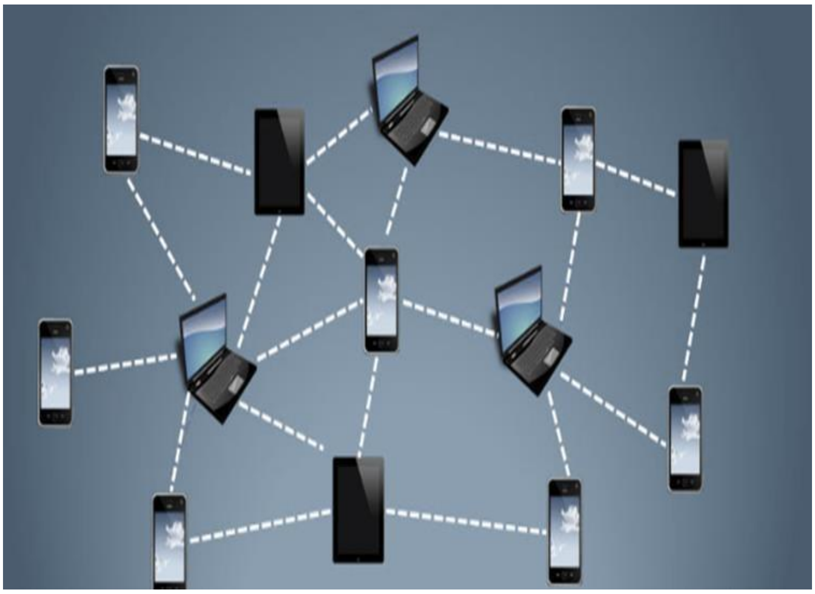


**Fig.1. Mobile Ad-hoc Network**

The widely used DHT-based shortest-path routing protocol, DART, acts as the basis for the multi-path dynamic address routing (M-DART) structure [3]. Through detecting different routes between the source and the final destination, M-DART enhances the DART protocol. M-DART might improve a tree-based address space's resistance to channel and connectivity issues. In addition, in the case of static topologies, the multi-path feature significantly improves performance based on route variation.

## II. RELATED WORK

An overview of the routing protocols which develop as AODV and DSR unipath routing's multipath extension was provided. Multipath routing protocols, that allow multiple paths (either node- or link-disjoint) from a source to a destination, minimize the frequency of route discovery, allocate network traffic between multiple nodes, and enhance the assistance level of the network, along with increased throughput, particularly more, beneficial for large networks. Numerous routing worries and difficulties are examined in addition to design issues as well as requirements for reliable and secure routing [4]. In addition, the functionality of the basic unipath routing protocols, AODV and DSR, is examined, along with the results of their simulation. The Ad-hoc on demand Distance Vector routing protocol has been proposed by C. Perkins et al. in [5], in addition to connected simulations and performance evaluation methods. We could deduce from their research that the most effective protocol for a network that has minimal routing establishment latency is AODV.

### A. Multipath Routing in ad hoc network

First, Mobile ad hoc networks (MANETs) have regulated node power, restricted channel bandwidth, and a dynamic the design. Because of these characteristics, communication throughout ad hoc networks can be complicated since the routes between source nodes and destinations could be highly unpredictable and collapse at any time. As a result, various paths can frequently be built between a source and a destination as each node in an ad hoc network can be connected dynamically in any manner. Researchers use the term multipath routing when this kind of ad hoc network function is implemented in the routing process. It is additionally feasible to obtain balanced load and route avoidance via routing traffic among multiple discontinuous routes utilizing different paths [6].

In addition, node-disjoint and link-disjoint routes are the two kinds of paths that could potentially be disjoint. Node- disjoint routes exchange no nodes except for the source and the final destination. Thus consequently, they are not connected to one another via any connections. On another hand, link-disjoint routes exchange no links. However, they might collaborate with one or more nodes[7].

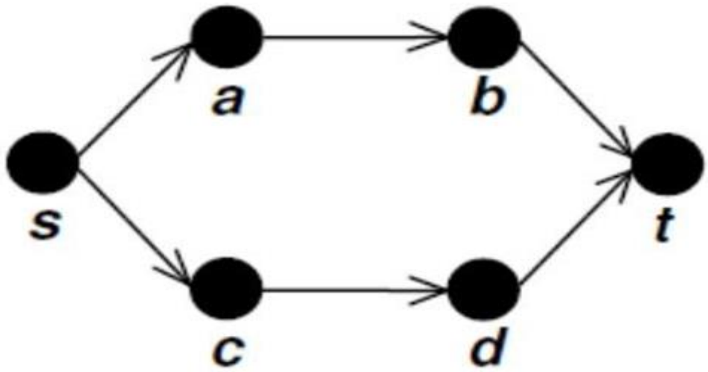



**Fig 2a. There have two node-disjoint routes from source S to the destination D.**

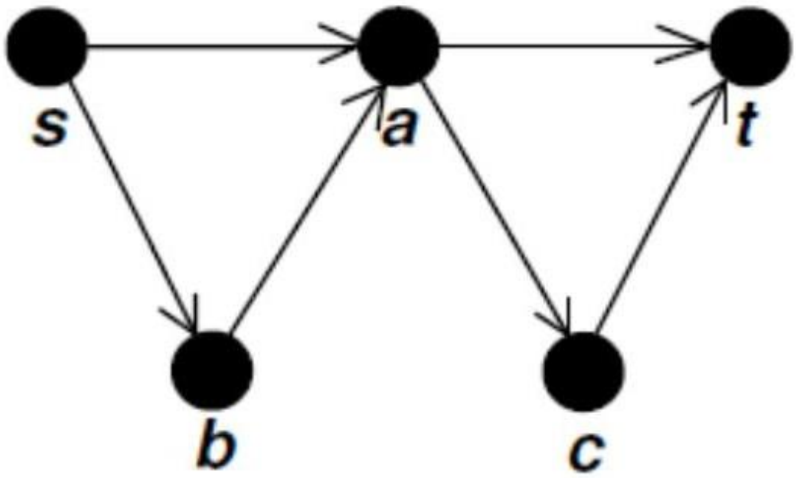



**Fig. 2b. From source S to destination D, there are actually two link-disjoint pathways. Since they share node b, taking note that they are not node- disjoint.**

These have to be as independent as possible in order to use multiple routes at once. Since routes could communicate with each other, they must not only be disjoint additionally take route coupling into considerations. When a path goes through another path's radio coverage area, route coupling develops. While there is an approach which takes advantages of this radio broadcast capability to produce backup routes, route coupling is undesirable when transferring data through multiple routes. Route coupling enables routes to interfere with each other even though the routes are link- or even node-disjoint [8].

**B. Principles of Multipath Routing Protocol Design**

Even though the multipath routing tackle has been utilized in a wide variety of applications, the recommended method's ability to provide a significant number of high- quality routes has had an important effect on the observed efficiency improvement. A wide variety of components have been included in each multipath routing protocol, which combine to present different paths and transmit network traffic through officially acknowledged routes[9]. They discuss at great detail on the components that comprise the situation up.

### C. Path Discovery

Since wireless sensor networks typically use multi-hop data forwarding techniques to transmit data, the main objective of the route discovery process is to determine a set of intermediate nodes that require to be recognized so as to create distinctive routes from the nodes that provide the data to the sink node. Multiple variables are considered in current multipath routing techniques to choose the path. All multipath routing techniques currently in use use path disjointedness as the main measure for identifying different routes from each sensor node to the sink node effectively [10]. Figure 1 reveals the variety of routes which have been identified may be broadly categorized as node-disjoint, link- disjoint, or partially disjoint routes. Whenever you involves node-disjoint routes, there is usually a node or connection that connects the routes which initially were identified. For a result, in an array of node-disjoint routes, a node or link failure primarily affects the path which includes the failed node or link.

Node-disjoint routes have been selected over link-disjoint and partially disjoint paths since they offer higher aggregated network resources. Developing an extensive variety of node-disjoint routes between sensor nodes and sink nodes is still complicated due to the sensor nodes. This is' irregular transmission [11]. In contrast, even though here isn't an interconnection between the routes, link-disjoint paths might include several of interconnected nodes. As result, if a single node fails in an ensemble of link-disjoint routes, several paths that share that failed node can turn passive.

## III. METHODOLOGY

### *A.* Adhoc On demand Distance Vector

AODV routing techniques provide multicast communication, broadcast, and unicast communication in portable ad hoc networks. AODV begins the path discovery procedure each time a source node request a route or a node want to join a multicast group. As long as the multicast group is in existence and the source node requires access, the routes remain up-to-date even though the number of sequences have already been traversed. Using AODV, the destination node's next hop path data is updated while maintained in a route table. Route Request (RREQ), Route Reply (RREP), and Route Error (RERR) In between the routing Discovery phase and the route maintenance phase, were the management messages implemented by AODV. Usually, three nodes are involved in the data flow. Subsequently comes across one of the following two categories: such as the final destination or intermediate node. Through communication, one of the nodes responds in a significant way. An initial node examines if the destination's route is already included in the route table preceding transferring packets to the destination node. It is essential to pick another route if one is readily available. In an attempt make sure that this isn't the case, the node begins a route discovery by sending an RREQ control message to every oneof its nearby nodes [12].

This RREQ message needs to be transmitted sent to all the neighbors that have a node between there. This message will proceed through the last node before it end the entire process. The destination is currently generating another RREP control message at the specified location. Therefore, after providing the RREQ, the source node waiting for RREPs to be received. Shortly after detecting the attack, a malicious node sends an accepted RREP packet containing ahop count number to a source node. [13].

In this scenario, all of the data packets which the source node originally intended for a real destination will be transmitted to the malicious node. An unauthorized nodes were probably to have been able to forward any packets to the location they were designed for. That may result to the source and destination nodes remaining connected with each other. The present research proposes the colony of ant optimization method as a solution to this issue. Here, the main objective of this ant algorithm is to constantly develop routes in an attempt to simultaneously improve the capacity ratio and packet overhead and reduce total latency and packet loss.

### *B.* Route maintenance

Once there's an issue maintaining the connection between two neighbors, the source node transmits a route error packet. In accordance with the data mentioned above, this packet now initiates a new route discovery with the objective at developing a new path between the next nodes. It will confirm the pheromone's concentration level while searching seeking a different data transfer technique when its value is low additionally. Data packets are used to maintain the route after these pheromone tracks have been generated for the source and destination nodes utilizing FWANT and BWANT. The concentration these pheromones increases every time a node transmits a packet throughout the communication link. When the BWANT visits a node, it improves the probability that the particular connection will be accepted as the next hop in the network, referred to as positive reinforcement. One the other hand, it reduces the probability that other links will receive the choice, which is negative reinforcement. Consequently, traffic flows along both routes and the best path remains freeof congestion.

### *C.* Optimization monitoring Ant Communities

Ant colony optimization-enabling meta-heuristics constitute an individual class of ant algorithms. Multi-agent systems, or "ant algorithms," include agents that show different actions like the ones shown by ants. Ant Colony Optimization's components were meta-heuristic as they comprise of various kinds of ant algorithms. Ant colony optimization represents one of the most effective methods for determining which direction is best for them. ACO depends on the subconscious interactions throughout a colony using fundamental agents referred to as artificial ants.

An ant produces an element known as a pheromone as it approaches closest to a food source as it possible. As more and more ants travel together the trail, their pheromone concentration increases. The path with the greatest concentration of pheromone is consequently the most beneficial.

An Ant Colony Optimization based routing conduct (ACO) provides a reactive on-demand the solution for MANETs. An ACO's primary goals are to minimize overhead and balance the pressure during routing. Figure 2 shows the ant colony's route from its place of origin to its destination.

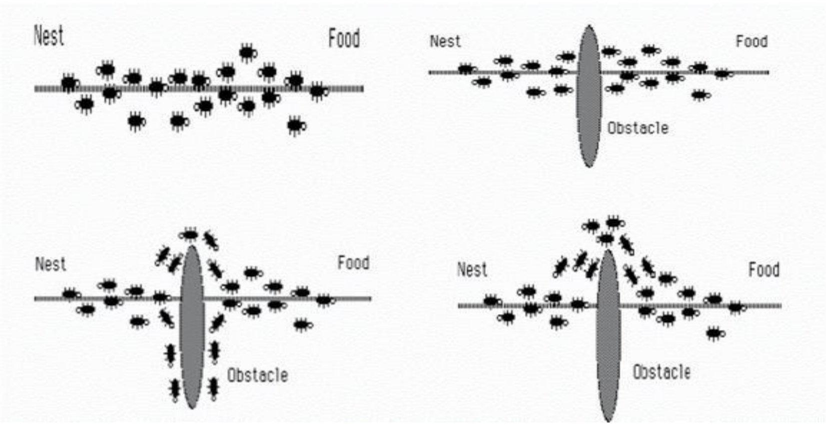
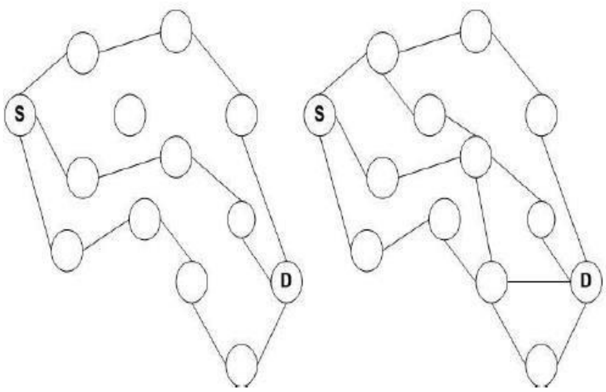



**Fig.3. Handling with an ant colony for obstacle**

### *D.* Ad hoc Multipath Distance Vector on-demand(AOMDV)

AOMDV is a combination among the numerous routes that produce AODV. To prevent loops, AOMDV is a representational multipath routing protocol which is compatible with AODV. For this purpose, load balancing, resource traffic dispersion, multipath routing with fault tolerance among an ensemble of irregular routes, and improved aggregate bandwidth may each be employed. Different routes which prevent overlapping are a better alternatives because they have a smaller probability for both immediate and related failure. The ability might be helpful in an adversarial environment where malicious behavior might result in additional connection failure.[10]. Finding an inconsistent path in source routing is very easy since each node maintains all route data for each and every path; however, hop-by-hop routing, or AOMDV, is considered to have been more efficient in terms of producing less overhead. There's a significant relationship among the total amount of nodes in the network and the number of routes in each source and destination. AOMDV operates excellently in highly complicated and dense networks.




(a) (b)

**Fig.4. AOMDV Multi-path**

### *E.* Reliable and Energy-Aware Multipath Routing

This protocol enables reliable transmission of data from each source node to the sink node while reducing requirements for resource economy in wireless sensor networks. Once it concludes properly, the sink node conducts the routing method for this protocol depending on the previous mentioned protocols [11]. Whenever there appears to be an active path connecting to a source node, a sink node starts a service-path discovery process by flooding a service-path request message in response to obtaining an interest message from the source node. The receiver node verifies the known path by transmitting a service-path reservation message to the sink node following obtaining the service-path request message at the correct source node (via the reverse path). A certain percentage of a node's available battery capacity is made available for data transmission via this route when it converts into a service-path reservation message which flows from the source node to the sink node. The sink node's service-path reservation signal indicates the end of the service-path development process is completed. The source node is able to transmit the contents of its data packets to the sink node in the desired direction through the path that was previously developed. The sink node starts a backup path discovery process that creates a backup path towards the same source node once the service-path is established. The procedure starts by flood the backup path discovery message [14]. Following this process, the second path discovery message which the intermediary nodes themselves received is detected by other nodes which are not members of the recently found service-route. A node-disjoint path is generated for the purpose to provide fault tolerance in the instance of a service-path failure. The main drawback of the alternative path routing method is this, though this sort of protocol transfers data securely and energy-efficiently, its end-to-end capacity remains limited by the availability of just one path. In addition, this approach takes into account if wireless interference and insecure connections has an impact on the total amount of energy needed to transport data efficiently.

### *F.* Multipath Dynamic Source Routing

The multipath enhancement to the DSR routing system is expressed by the Multipath Dynamic Source Routing . The MDSR needs to supply details regarding the flooding problem. Since the query flooding look at uses an important percentage of the network's capacity, it produces an excessive amount of additional packets. The destination node replies to every RREQ signal in the DSR protocol, but to a specific number of RREQ packets, that included data, in the MDSR protocol. This implies that the destination node will only respond to RREQs that are link-disjointed from the main source route (i.e., the shortest path route) after collecting all of the RREQ responses. Each route has been saved by the source. If the shortest distance is broken, the shortest alternate route among all those remaining in the cache of paths is used. Nodes attempt another route if their primary route is also down, and so on, until all of the routes that are remaining in the cache have been utilized.

The primary path can be observed by the relationship sequence L1-L2- - - Lk. Every node in the primary path Ni includes an alternate route Pi that connects it to the destination. When it failures, the source S uses the main path to send data packets to the destination node D.[12]. Considering that the connection Li is broken, node ni would respond by replacing a different route over the portion of the route Li - Lk which has not been used in the data packet header. Whenever Pi collapses an error packet shall be sent backwards up to node ni-1, causing it to curb the error packet and route data packets to its own fallback route. Pi-1 through the same change to the original route in the packet header.

*G. Braided Multipath Routing Protocol*

This unique multipath routing technological advances was designed to provide wireless sensor networks fault-tolerant routing. This approach generates numerous partially disconnected routes utilizing a method similar to directed diffusion. Figure 3 shows a standard version of the established routes. This protocol creates partially disjoint routes through the use of multiple types of path reinforcement signals for themselves. The sinking node transmits a primary path reinforcement communication to its best adjacent to node in the same direction of the source node to initiate the route developing procedure. For example, node D obtains the main path reinforcement message via the sink node in Figure 3. For the signal for it to reach the source node, an intermediate node sends an essential reinforcement message to the node that is best nearest to it for the following hop[13]. These procedures continued until the main route reinforcement message reach the source node.

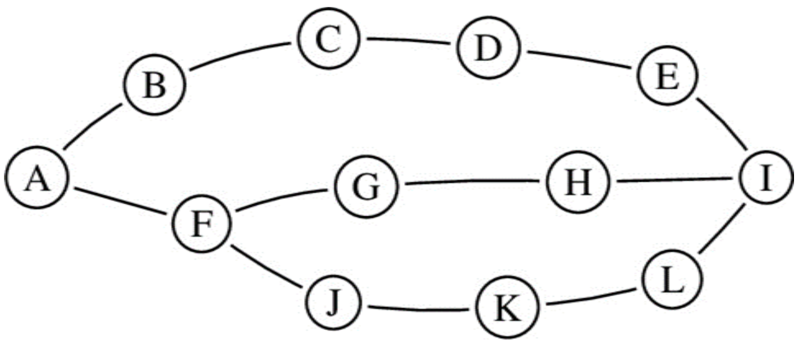



**Fig.5. Braided multiple paths**

## IV. RESULTS

### *A.* Average Throughput

This feature shows the time it usually takes a packet to travel from its origin to its destination. What concerns was the quantity of time it generally takes for a packet to travel from its source node of origin to its destination node of receipt. T is the throughput's initial point.

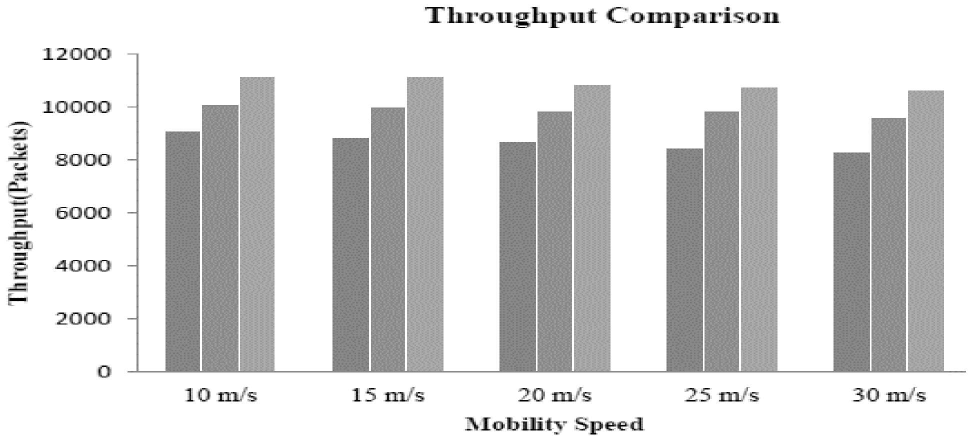



**Fig.6. Throughput Proposed AOMDV method**

The performance findings from the study for throughput when the nodes travel at a mobility rate ranging from 10 m/s to 30 m/s throughout the terrain range are shown in Table 1. The trial's results show how much higher the ACO-EAODV method is than conventional methods. If the mobile nodes travel at 10 m/s, the throughput can reach 10624 packets at the highest speed and 11136 packets at the smallest rate when traveling at 30 m/s.

**Table 1. Throughput Analysis Regarding The Aco-Eaodv Method Considering Development**

| Mobility Speed (m/s) | Throughput (Packet) | | |
|---|---|---|---|
| | AOMDV | MDSR | AODV |
| 12 | 9084 | 10115 | 11138 |
| 16 | 8838 | 9986 | 11137 |
| 22 | 8708 | 9876 | 10886 |
| 28 | 8452 | 9866 | 10754 |
| 32 | 8322 | 9605 | 10626 |

### *B.* Packet Delivery Ratio (PDR)

Many MANET protocols utilize the packet delivery ratio (PDR) for a signal to choose the most effective transmission rate, power, or route. offers, as the total amount of nodes rises, greater velocity than both AOMDV, shown in Figure 5. This specific model in particular. Delay improves significantly with AOMDV. This is because of the reality that the need for new route discovery decreases when different choices are accessible in the instance of a route failure [14]. With less route discoveries, the multipath protocol reduces the detrimental impact of route discovery latency on the total delay.

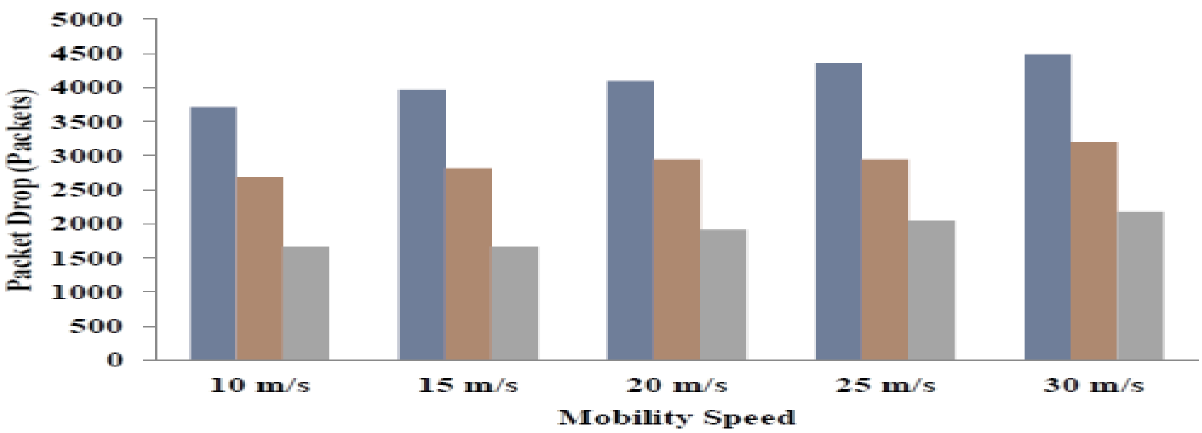



**Fig.7. Packets Drop Analysis AOMDV Method**

## V. CONCLUSION

As a way to maintain track of every possible destinations' routes, proactive protocols in MANETs need nodes. Since the route has been established, it can be used immediately in case a packet has to be forwarded. All nodes around the network obtain updates throughout any changes in topology. The network continues to become significantly better when it comes of performance. The present research examined how effectively the AODV and AOMDV routing algorithms worked for MANETs under different simulation situations, cbr rates, and packet sizes. They analyzed end-to-end latency as well as drop count, PDF, and throughput. AODV is the more effective protocol in terms of throughput, PDR, and Drop count, though AOMDV performs better in terms of a latency period under various conditions, according to simulation results. Consequently, comparing to single path routing, multipath routing is frequently better during periodsof significant traffic.

In addition, on-demand routing protocols with multipath capabilities have been more capable of handling mobility- induced route failures in mobile ad hoc networks than their single path alternatives. Another potential objective in the future could be to conduct a more thorough examination of the performance of these two routing protocols, involving account additional variables and unfamiliar simulation circumstances employing more effective measures.

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