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A TECHNIQUE OF NLAODV ALGORITHM TO GET ROUTES OF NODES-LIST IN MOBILE AD-HOC NETWORK (MANET)

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ABSTRACT:

The Mobile Ad hoc Network (MANET) is a group of nodes connected to each other wirelessly without the use of a central server or a traditional network structure. In MANETs, data packets are sent through wireless channels to keep communication going. Ad hoc On Demand Distance Vector Protocol is a MANET-related reactive protocol technology that generates a route of nodes to a destination node by broadcasting packets of route request across the network. In this kind of Routing protocol, a connection loss causes the source to send control (RREQ) on the network, causing network congestion and performance deterioration. This study offers a Node List (NLAODV) Node List Ad-hoc On-Demand Distance Vector routing method that includes links and path-nodes to identify if any node on the network is involved in the route discovery process for sending control packets from wireless source node to the wireless destination node. Simulation findings reveal that the proposed NLAODV algorithm minimizes flood Packets to get the best network as it is not necessary for all nodes to be present in route discovery.

KEYWORDS: Ad hoc-MANET, Routing Protocol, AODV, Routes, NLAODV.

1. INTRODUCTION

Wireless data interchange, mostly via Mobile Ad hoc Network (MANET) may be utilized not just in locations where infrastructure is unavailable (Pughat, Bansal, and Verma 2020), but also in the creation of future communication networks. MANET's architecture is architecture-free, and communication network administration are decentralized. Each node must serve as an intermediary router for packet forwarding (Pughat, Bansal, and Verma 2020; Zeb 2020). As a result, hop-by-hop routing is the sole way to exchange packet (Zeb 2020). MANET's limited capabilities and diverse nature contribute to the design limitations for routing algorithms. Link breaks are common due to unpredictably mobile nodes (Thiagarajan and Moorthi 2017). To improve routing efficiency and reliability, and due to the rising availability of high power wireless network devices with expanded abilities, as well as the expanding availability of many platform and many functional wireless apps, networking in the wireless domain is climbing at significant levels. Furthermore, Network administration is centralized and infrastructure-based, with most communication taking place through private service providers. Where appropriate infrastructure is lacking, its establishing cost is too high. However, infrastructure installation is not feasible in every location. Mobile ad hoc networks MANET have acquired a lot of traction since they are not limited by geography. A group of mobile node devices with wireless communication capabilities may be deployed practically (Al-Khalil, Turner, and Al-Sherbaz 2015) and they are able to establish an ad hoc network among themselves within wireless network transmission range, interact with one another, and can get connection to other networks on the internet (Adil et al. 2021). As a result of its flexibility, ease, improvement in network technology, and standardization, decentralized wireless communication deployment is gaining appeal. This can also deliver internet services to locations where there is no infrastructure (Sharma, Saini, and Kumar 2018). MANET was first utilized in battles technical networks, and used packets as Radio in Networks, according to historical sources (PRNETs) (Moila and Velempini 2020). This is commonly referred to as the first-generation MANET, and it employed radio frequency technology to transport data. It was only implemented up to the network layer. Survivable Radio Networks (SURANs) used the next generation to enable switched networking for mobile battlefields (Chawda and Gorana 2015). The third generation was with the development of applications, laptop devices, and technology of sensors, and commercial networks. MANETs may be put up practically anywhere without any pre-configuration or significant administration (Deepak and Anandakumar 2019). Therefore, people have realized the optimum advantages and its ability as a result of its history extensive (Brill and Nash 2018) . In every communication network, the speed with which data is delivered to the intended receiver is critical (Sapna, Deshpande, and Ravi 2018). This is aided by appropriate routing methods. Schemes designed for architecture-based wireless node networks are incompatible with ad hoc networks, which do not need centralized management. So each mobile device must cooperate with the neighbouring nodes to get successful packet delivery (Masruroh et al. 2020), effectively operating as a router and as a group surpassing their range of transmission, with each node following a common protocol (Lalitha and Rajesh 2014). In a MANET, there are three types of protocols to find route, (i) reactive protocol or on-demand, (ii) proactive or table driven, and (iii) a hybridization of the prior to that is, hybrid. Demand-driven route identification is used in reactive protocols (Ajibesin et al. 2019; Manohari and Ray 2016).The route is only discovered when it is required, i.e. on demand and Routes are only maintained when they are required. In proactive mode, however,

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it is required to keep routing information in routing tables at all times (Manohari and Ray 2016). Tables are updated to guarantee consistency. Hybrid treatments provide a benefit by combining the advantages of both proactive an reactive routing protocols (Ema et al. 2020). In addition, not every MANET circumstance requires the use of the same protocol. Ad-Hoc On-Demand Distance Vector Routing (AODV), another reactive routing protocol, establishes backward and forward paths for each device in the route (Stancescu and Luca 2013). Rather than considering links of a route or all intermediary nodes, the proposed hybrid protocol examines selected nodes on the network and the connections combined for building the rout between specified source nodes and destination nodes. As a consequence, not only does it improve data packet routing, but it also increases the Quality of the Service. Therefore, this study presents the NLAODV Node List Ad hoc On-Demand Distance Vector routing technique for determining whether a node in a network participates in route discovery or remains silent. The proposed method reduces network congestion and improves performance. When it is compared to the reactive protocol AODV, the findings reveal that the proposed NLAODV performs better.

This paper includes the following. Section 2 provides related works. Section 3 presents the proposed NLAODV protocol. The simulation techniques and result justifications are presented in section 4. Finally, section 5 gives the main conclusions of the paper.

2. RELATED WORK

Each node in AODV must maintain a table routing that includes neighbors' information. Each of the nodes will be assigned a sequence number of every node and a broadcast id. If any source node is connected with a destination node, it increases its broadcast_id and sends request control packet to its neighbors to establish the path (Park, Kim, and Jang 2013). In AODV, finding a route is done by sending request control packets on the network by the source node to the first nodes. The information will then be received and processed by the neighboring nodes. When a request packet is received at first time, all nodes search in routing databases for a feasible route. If the path is present, the nodes transmit an RREP packet to their neighbors. The RREQ control packets, that do not reach at first, will be discarded by the nodes and the node sends a Route Reply Error Packet (RREP) back to the source (Ad and Networks 2016). Congestion develops up in the network as AODV floods the whole network with route request packets for route discovery. The crisis starts once there is a loss in connection or a path failure. A node that loses the connection sends a Route Error Packet (RERR) to a source node. The source node restarts route discovery after receiving an RERR packet by sending RREQ control packets on the network. As the time it takes to send packets grows longer and the quantity of packets delivered falls, performance reduces. To address this issue, In a MANET, AODV utilizes RREQ and RREP control packets to get the route or path, but rather than adding intermediate nodes in RREQ, it progressively generates backward paths as RREQ forwards via nodes on network and generate forward connections when RREP is delivered to the source node by the destination and other nodes. The intermediary nodes maintain a route by building backward and forward links between them, and packet is delivered from the source node to the destination node via these paths. Many routes are generated by RREQ in the protocol of AODV, but only a single path, via RREP is eventually established and the other paths are timed out and cancelled by themselves because of RREP packet loss (Mathurkar and Dorge 2020; Satav and Jawandhiya 2018). The benefits of AODV include a reduction in packet header length due to information on the route which is preserved across intermediate nodes, and packets follow the sequence of the forward paths of the nodes and arrive at their destination node. The undesirable feature is unused paths terminate even if the topology remains unchanged.

In recent years, various multipath routing approaches based on AODV to optimize protocol have been developed:

In Ahn et al. (2010), Lal, Laxmi, and Gaur (2012) and Pathak and Kumar (2017), The AOMDV protocol creates network loop-free link discontinuous pathways. Unlike standard AODV, which discards duplicates when mobile node receives the RREQ packet from the source node, the AOMDV protocol maintains all RREQ packets. As a result, each node keeps a first hop list in which information from an extra field called first hop in the RREQ packet is used to identify the source nodes neighbors. The RREQ packet is deleted if the first hop of the receiving RREQ packet is repeated from its own initial hop list. For each destination, AOMDV has the overhead of keeping several next hops and hop counts, as well as the initial hop list. AODVM may not build other routes based on the path over which the RREP packets are transmitted if it overhears the neighbor's packets.

The redundant RREQ packets are not discarded by intermediate nodes in the AODVM protocol. However, all the received RREQ packets are recorded in the routing table by intermediary nodes. Since nodes cannot engage in more than a route, if a node overhears one of its neighbors broadcasting an RREP packet, it excludes that neighbor from its routing database (Yang et al. 2012).

If a section of the main route is broken in the AODV-BR protocol, nodes send error packets to adjacent nodes. When neighbor nodes get an error packet, they create an alternative route based on the previously overheard RREP messages. AODVM may not build other routes based on the path over which the RREP packets are transmitted if it overhears the neighbor's packets. Furthermore, AODV-BR is not a multipath routing protocol in the strictest sense, because it only uses neighbor nodes surrounding the main routes to preserve by pass routes when the main route is broken (Ahn et al. 2010; Kushwaha and Gupta 2014).

MP-AODV is a node-disjoint multipath enhancement for AODV presented by the authors. For each source-destination combination, MP-AODV finds two routes: a major route and a secondary route. Two RREQ messages, one for each route, are used to find the routes. This strategy has two flaws: (i) MP-AODV has a greater overhead than standard AODV since it requires one RREQ flooding for one path and extra RREPs for node-disjoint pathways; (ii) the suggested technique does not locate all potential node-disjoint paths between the source and destination (Ahn et al. 2010).

Multipath forms of AODV protocols are also available in AODVM and AODVM-PES. These algorithms, unlike the methods outlined above, identify numerous pathways that are link disjoint instead of node disjoint. All of these approaches begin data transmission only once all multiple pathways have been found. This causes a delay in data transfer at first (Lal, Laxmi and Gaur 2012).

Stable On-Demand Multipath Routing (SOMR) constructs numerous node-disjoint pathways to the destination using the DSR source routing technique included into the AODV route discovery process. The protocol is intended to increase reliability while lowering route discovery time and routing overheads. A node disjoint multipath routing approach (NDMP-AODV) is developed, which modifies the AODV route discovery mechanism to build multiple node disjoint pathways. It prohibits intermediate nodes from sending unnecessary route answers and requires each node to keep an extra data structure that holds information about observed control packets. With little routing overhead, it delivers low end-to-end delay and a high packet delivery ratio (Arya and Gandhi 2014).

A multipath routing protocol (MP-AODV) is presented in which two node-disjoint pathways to destination are maintained at all times at source nodes. Every node in MP-AODV maintains a seen table, which contains information about seen control packets for a certain route discovery. The observed table helps find node disjoint routes by filtering repeated RREQ packets. When compared to typical routing algorithms, MP-AODV delivers greater packet delivery rates with less routing overhead in the event of link failure (Arya and Gandhi 2014).

Pathak and Kumar (2017) proposed a novel load-balanced multipath QoS routing. This paper makes two key proposals. The first is a load balancing method that evenly distributes traffic among active routes, while the second is a route discovery process based on QoS parameters like latency and throughput. To begin, they suggested LB-AOMDV, a novel multipath routing protocol with a new statistic, the buffer size of less crowded paths. Then they incorporate QoS into their LB-AOMDV protocol proposal, which includes latency and throughput characteristics. It uses the RREQ message to communicate the necessary information in order to meet the QoS standards. The new protocol QLB-AOMDV allows for a restricted QoS from source to destination.

Pathak and Kumar (2017) provided an overview of the most modern MANET multipath routing techniques. Multipath routing can increase network performance in terms of latency, throughput, dependability, and longevity, according to the protocols studied. However, finding a single or combination of procedures that can increase all of these performance factors is difficult. The choice of a multipath routing protocol is determined by the application and trade-offs involved. Energy efficiency, minimal overhead, dependability, and scalability are some of the goals here.

Atto, Mstafa, and Alkhayyat's (2020) article presents a new approach for determining alternate routes for every node engaged in the active route over a single hope for Image and video transmission Over Mobile Video Sensor Networks transmission. The hello messages from current route nodes are used to generate these routes. When nodes respond to a RREP message from a source node, they broadcast hello messages to all of their neighbors in a single hop. This is critical for providing a local connection among the entire network. Hello message headers are expanded to incorporate extra information, such as the path from each node in the planned route to the target destination. When each active node replays RREP in this situation, it sends a hello message to all of its accessible neighbors. When neighbors get these greetings, they update their routing tables to include a legitimate path to the destination.

Many issues with preceding multipath routing methods are addressed by our suggested NLAODV routing protocol. NLAODV always has alternative routes for current flows, which dramatically minimizes latency. Our technique lowers the quantity of RREQ messages in the network by flooding a single RREQ message with all possible node disjoint paths between the source and the destination.

3. PROPOSAL OF NLAODV PROTOCOL

The proposal of NLAODV finds a path using route discovery by adding node list which is the previous address, next address, the final address and employing time to live (TTL) element to RREQ. The hop range, before a RREQ packet may be broadcasted, is determined by the TTL factor. The source node uses node list and sets the TTL result in the RREQ control packet to beginning TTL at first, and the RREQ control packets are transmitted within the range of hops that is correspondent to the TTL. When a source does not receive an RREP control packet by the destination during the route discovery, the destination node is not in the range of hop. The source node will increase the TTL value in order to broaden its search area and rebroadcast the RREQ control packets in the extra range. The source node increments TTL until finding the route to the destination node, then the source node will receive an RREP control packet. The process value of nodes is used to determine a path during route discovery. The NLAODV procedure includes the following steps:

- The starting process value will be 1, indicating that every node in the wireless network will engage in rebroadcasting RREQ control packets at first step.
- When the previous, next, and final fields of the source node's RREQ address are all zero, these fields can be utilized in all intermediate nodes to eliminate loops when compared to the node-list of all intermediate paths from the source node to the destination node.
- if a node receives an RREQ packet it will check node List in RREQ if it is the first RREQ then the current node will process RREQ by inserting Route list from RREQ to Routing Table then move the content of the next field to the previous, move the final field content to the next field and append node ID to the final field then sending the control packet to its node neighbors. When an RREQ control packet broadcasts by a middle node, the node's process value changes to 1, indicating that it has already engaged in the route discovery. If a node is out of the source node's TTL hop. That node's process value is set to 0 because it does not present a route discovery.

When any node gets an RREQ control packet and the next or previous address of RREQ control packet has the same node's ID, the process value of the node is already 1 to avoiding loop so the RREQ will be dropped. This signals that neighbors have taken part in finding a route by rebroadcasting the RREQ control packet supplied by the node receiving packet, and will not process in route discovery for the second time.

When node “10” sends a packet to node “11”, the previous address is 7, the next address is 8, and the final address is “10” as it is shown in “Fig.1”. When node “11”, which is node “10's” neighbor, delivers this packet back to node “10”, the packet's previous address is 8, the next address becomes “10”, which is the same as node “10's” address, and the final address is 11. As a result, node “10's” process value is reset to “1”, indicating that it can be present in route discovery.

- As a result, anytime the source updates the TTL value and rebroadcast RREQ control packets. All nodes with a process value of “1” can be present in route discovery; otherwise, the node will not be presented in route discovery.
- If process is “0”, the RREQ is not forward by a node. The process value of the nodes will be altered depending on the NLAODV when node S creates control request packets to reach D.

If a control packet of the same address is received then the list node address in the control packets is examined, and the node determines whether the process value will be “0” or discard the RREQ control packet depending on the results. If the RREQ control packet is not processed recently, its process value will be examined. The process value is then set depending on the TTL result and the final address value. Nodes with a process value can be present in route discovery, while nodes with a process value of “0” cannot be present.

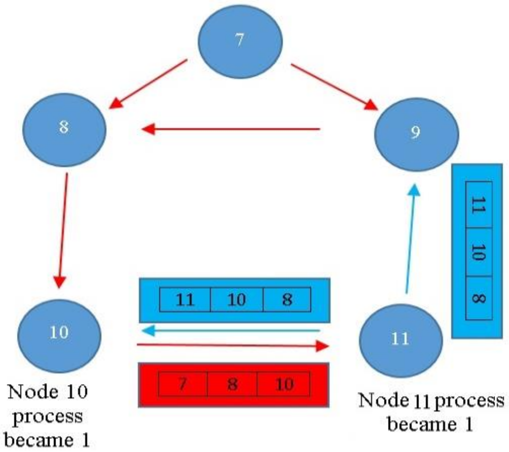

Fig 1. Node Id in the packet

The implementation of NLAODV:

```
At Source Node:
RREQ Source_ID = Index
RREQ node_list = 0
Broadcast RREQ()
Receving RREQ:
    If Source_ID ≠ Index Then
        If lookup RREQ_node_list ≠ Index  Then
            If Process_Value =0Then
                If lookup RREQ_Node_List ≠ Routing_Table_List_ID  Then
                Insert_RREQ_node_list  // insert the Reverse_route to Routing Table of Node
                RREQ_Previous_add  = RREQ_ Next_add
                RREQ_Next_add = RREQ_Final_add
                RREQ_Final_add = Index
                Routing_Table_hop = RREQ_hop +1
                RREQ_TTL = -1
                Process_Value =1
                    If lookup Destination _ID = Index Then
                    RREP_Previous_add  =  RREQ_ Next_add
                    RREP _Next_add = RREQ_Final_add
                    RREP_Final_add = Index
                    Broadcast RREP()
                    End if
                    Else
                    Broadcast RREQ()
                End if
            End if
        End if
    End if
    Else Drop RREQ ()
Receving RREP:
    If Destination_ID ≠ Index Then
        If lookup Routing_Table_List_ID = RREP_Node_List Then
        Insert_RREP_node_list  // insert the Forward_route to Routing Table of Node
        RREP_Previous_add  = RREP_ Next_add
        RREP _Next_add = RREP_Final_add
        RREP_Final_add = Index
        Process_Value =1
        Broadcast RREP()
        End if
    End if
```

The Pseudo NLAODV Protocol

4. SIMULATION

The simulations are conducted using the Network Simulator 2 (NS2) program. “Table 1” shows the parameters that were utilized to create the simulation environment.

NLAODV employed randomly constructed networks upon which algorithms were performed to conduct the simulation studies. This assures that the simulation results are unaffected by the topological features of any given network. We compare NLADOV's performance to that of other well-known routing protocols such as AODV in terms of cost to control information, average link-connect time, path success rate, and packet transfer feature. A network of mobile nodes was randomly distributed inside a 1400m by 1400m space in our scenario. The simulation is run for a total of 100 seconds.

Table 1. NLAODV parameters

Parameters	Value
Simulator	NS2
Channel Type Wireless Channel	Wireless Channel
MAC Layer Protocol	IEEE 802.11
Number of Nodes	30,70,100 Nodes
Simulation Time	100 Second
Data Packet Size	512 Bytes
Traffic Type	Constant Bit Rate (CBR)
Simulation Area	1400*1400
Routing Protocols	AODV, NLAODV

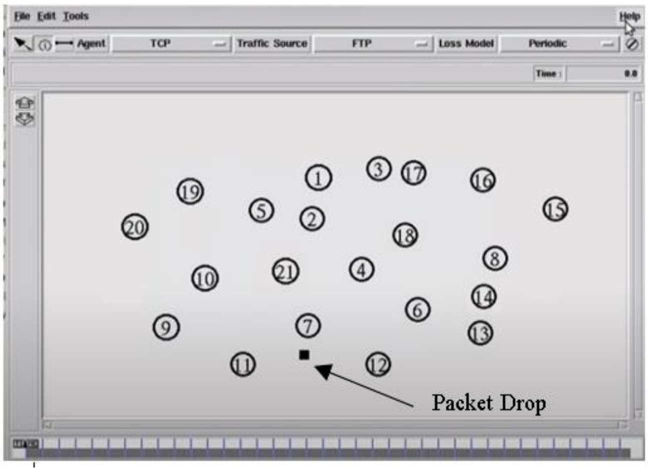

Fig2. Network Animator

5. RESULTS

We analyzed the wireless mesh network performance using various parameters by implementing ns-2 (network simulator 2) to measure the various parameter in different scenario using AWK script file. AWK utility shall interpret each input record as a sequence of files the AWK utility shall denote the first field in a record $1- the second $2 and so on. In this project the AWK language has been used to read the data from the trace file to calculate and evaluate the parameters for a number of nodes (30,70,100).

5.1 Packet Loss

Packet loss occurs when a packet is sent by the sender but does not arrive at the destination node. It is a comparison of the basic and modified protocols. As demonstrated in the graph, the updated technique has reduced packet loss. In every node, NLAODV checks the control packet and routing table to avoid regenerating packets and reduce the probability of packet collision. Whereas in AODV, every node tries to discover a single path by regenerating and broadcasting a packet to all neighbor nodes. In addition to that, NLAODV avoids using the previously Nodes by checking the node list to get a less-trafficked path.

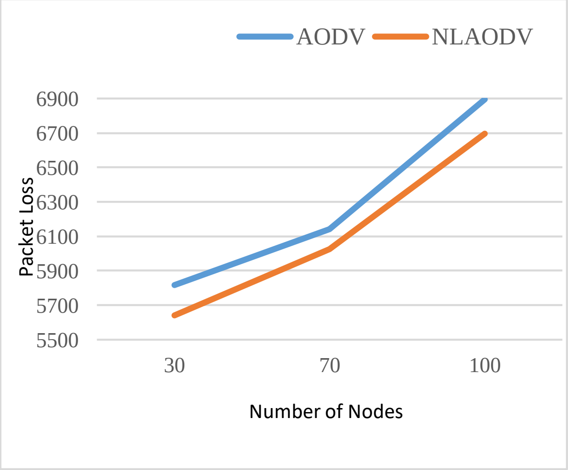

Fig 3. Packet Loss

5.2 Packet Delivery Ratio

Packet Delivery Ratio is the number of control packets received by nodes over the total packets transmitted in the network. Packet delivery between the source and destination shows better effectiveness by using the proposed NLADOV than AODV. Packet loss is decreased by employing the node list function to avoid packet collision.

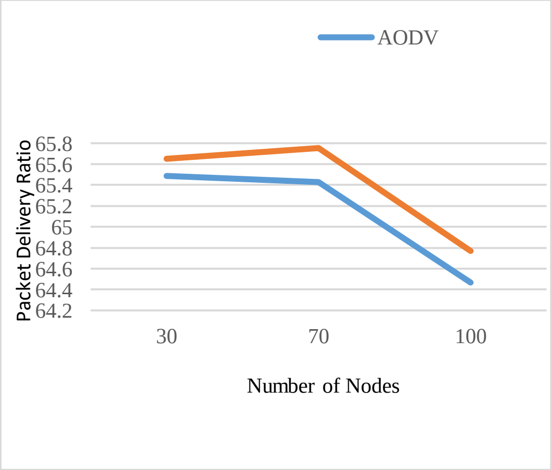

Fig 4. Packet Delivery Ratio

5.3 Average End to End Delay

All the packets were successfully sent from the source to the destination with no delays. There's a chance that certain packets will cause a delay. This statistic is important for estimating the overall transmission latency from both ends. AODV has a higher delay as compared to NLAODV by reducing the attempts of rediscovering the path by assigning a list of ID nodes in every routing table of the nodes to get routes, while AODV, requires rediscovery of a new path when it fails.

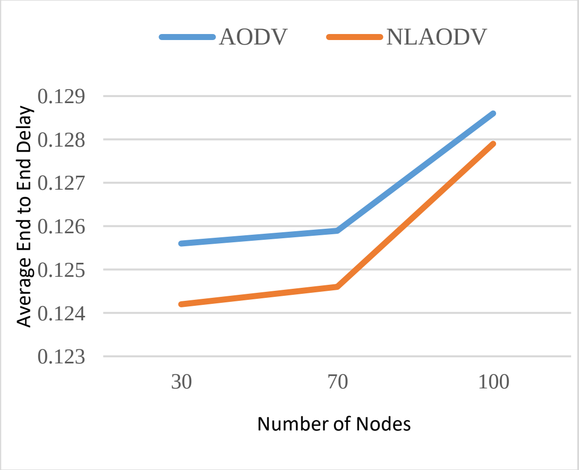

Fig 5. Average End to End Delay

5.4 Throughput

The rate over the number of control packets that are delivered successfully to the Destination is defined as throughput. Throughput is normally expressed as terms of bits per second (bps). It is one of the results for indicating the network performance. High throughput can indicate low packet loss while Low throughput can indicate high packet loss. In the proposal NLAODV, throughput is increased when compared to AODV as it uses routes when the path fails rather than using a single path as in AODV.

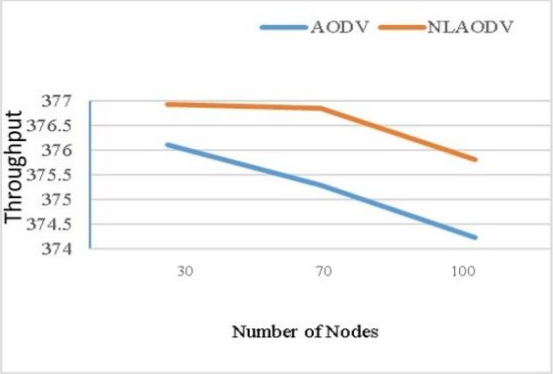

Fig 6.Throughput

6. CONCLUSION

This study focuses on AODV routing protocol congestion reduction owing to failure in connection and rebroadcasting RREQ control packets. This was accomplished by including a route discovery path into the proposed AODV protocol, rather than flooding the whole network to router discovery by control packets at all the time. When comparing NLAODV to AODV, the performance study shows that the NLAODV has the greatest accuracy value, indicating that it is more efficient and reliable. The authors expect to demonstrate in the future that the suggested

NLAODV routing protocol architecture may benefit a wide range of real-world MANET

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