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A trusted model using improved-AODV in MANETS with packet loss reduction mechanism

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ABSTRACT

A MANET is a self-configured network which do not need any special infrastructure, as the nodes are versatile, topology of network changes frequently that prompts connection failures. Because of its special characteristics like dynamic topology, hop-by-hop communications and easy and quick setup, MANET faced lots of challenges allegorically routing, security and clustering. The security challenges arise due to MANET's self configuration and self-maintenance capabilities. In this paper Ad hoc On Demand Distance Vector algorithm is discussed which is helpful for routing and a new Improved-Ad hoc On Demand Distance Vector Routing algorithm is proposed which establishes routing based on trust on the nodes in MANET.AODV is responsive passage revelation convention where a mobile node of MANET gets associated with gateway. I-AODV is used for identifying node routing behavior and recognizing the route failures, for example, data droppings, black hole and worm hole assaults in MANET.I-AODV also uses the Intrusion Detection framework on trust based routing. Each send or received message takes specific measure of energy from the node. So node's collective energy level based on bit by bit will get reduced each time while it sends or receivesdata packets. Along these lines node will stop to be present and packets originating from the source will be dropped since one of the node on the present route is never again working. These packet loss occasions are watched and limited in this paper. In this manuscript after completing routing using I-AODV protocol with trust dependency Multi-Ack scheme is used for packet loss reduction. The proposed method utilizing the NS2 simulator test system. The consequences of this work is precisely assessing and executing routing convention in a specially appointed condition with efficient routing and reducing packet loss ratio.

1. INTRODUCTION

Wireless Communication is one of the rising innovations which enable clients to get to data and benefits electronically, in spite of their geological position. Wireless communication can be named: Infrastuctured organized and Infrastructureless system. Versatile Adhoc organization is an exceptional sort of infrastructureless system. It is an accumulation of portable nodes that move arbitrarily and powerfully [1]. The portable nodes with wireless radio interface are associated by wireless connections. With the dynamic nature of MANET the system topology changes quickly and continuously thus the effective routing conventions plays essential parts in taking care of it. They ought to be skilled to guarantee the transportation of packets securely to their destinations. MANETs are additionally fit for dealing with topology changes and breakdowns in nodes through system reconfiguration. The versatile adhoc systems are extremely adaptable and reasonable for a few kinds of uses, as they permit the foundation of temporary communication with no pre introduced infrastructure [2].

Each node can take an interest in the role of exchanging the packets. The nodes keep up association through sending packets to particular nodes inside its range. The wireless connection qualities are time-changing in nature: There are transmission obstructions like blurring, route failure, obstacle and impedance that adds to the mis-conduct of wireless channels. The obligation of wireless transmission is opposed by different elements. Packet Loss happens from blunders in transmission – MANETs experience higher packet loss due to factors like unauthorized nodes that impacts network performance, wireless channel issues, obstruction, and link breakage in routes.

Routing Failure is another significant reason for the packet loss in AODV and degrades the system performance. The system is comprising of various host, one is source and another is destination, and the nodes those are in the middle of these two nodes is called halfway nodes. There is a dynamic node which is incharge of the directing data. New routes required if source node, destination node or any one middle node moves or change from its position [6].

The routing mechanisms is done based on the Trust levels of a node which involves in communication. Unlike AODV, the proposed method does not send RREQ message to all the nodes in the MANET. In proposed scheme RREQ message is send to trusted nodes in the group.

1.1 Trust and its properties in manet

Trust, is a directional connection between two elements and assumes a noteworthy part in building a relationship between nodes in a system [3]. In trust the nodes will implement the principles characterized in the network by administrator and that the participation of the group will be represented by obviously characterized imperatives. Trust is characterized as a firm faith in the functionality of a node to act reliably, safely, and dependably inside a predefined setting. Trusted framework is characterized as a substance whose security components are segregated from unapproved clients; the framework can be distinguished, content controlled and secure, and overseen by an able specialist. As for unarranged systems, this basically suggests each sharing node has the important security parts that offer the security administrations which can't be superseded in an unapproved way. Every node would then be able to be trusted to perform organizing related administrations as well as end framework administrations. For a node to be trusted node it has to follow the below characteristics.

- Must be active in the network for a particular period of time.
- Must not misbehave i.e, not causing any packet failure or data modification or illegal actions.
- Must not leave the network without handling its data to its neighbors.
- Must be active in routing table updates and packet forwarding without any delay.

Furthermore, trust administration has various importance in a few higher subjective procedures like interruption recognition, validation, get to administration, key administrationfor powerful routing. The dynamic nature and qualities of MANETs end in vulnerability and wholeness of the trust.

2. RELATED WORK

Bing Wu et al. [1] proposed a system inside which novel secure routing convention for MANET was designed. In this procedure the idea of a trust model to defend directing practices inside the system layer of MANETs was utilized. Aldar C-F et al. [2] anticipated a path known as Ariadne inside which includes assaults against directing in surprising networks, and that we blessing the look and execution investigation of another safe on-request Ad-hoc arrange routing convention.

Aziz, B, et al. [3] anticipated the authentic Routing or Ad-hoc Neworks(ARAN) secure directing convention that is Associate in Nursing on-request routing convention that relies upon the work of computerized endorsement to distinguishes and shields every single known assault. R. Anderson et al. [4] contempt a Destination Sequenced Distance Vector manage as a variation of separation vector directing procedure by that versatile node agreeable to make Ad-hoc arranges for littler populace of portable nodes.

Valle, G et al. [5] convention is given that relegates a trust cost for each node. Nodes territory unit permitted to take part in directing upheld them confide in values. Lou, W et al. [8] arranged Associate in Nursing methodology of the presence of understood interruption deterrent instruments, like cryptography or authentication, will downsize dangers against MANETs, like noxious information modification, that expects to reduce learning respectability and privacy.

Murthy, C, et al. [9] have proposed a technique that is intended to guarantee break even with interest among individuals from the specially appointed gathering, and that gives every node the expert to issue authentications [8]. Burnett, S. et al. [12] have proposed a safe specially appointed directing convention in view of mystery sharing; shockingly, this convention depends on incorrect suppositions, e.g., that every node can't imitate the MAC address of different nodes.

Menezes, A et al. [14] performed tests for execution correlation of both proactive and responsive routing conventions. In their reenactment, a system size of 50 nodes with fluctuating stop times and different development designs were picked. The reenactment was finished with ns-2 test system.

Jin-Hee Cho et al. [16] exhibit their perceptions with respect to the execution correlation of the routing conventions for variable piece rate (VBR) in portable promotion hoc systems (MANETs). They perform broad recreations, utilizing NS-2 test system [13]. Their investigations have demonstrated that responsive conventions perform superior to proactive conventions.

J. W. Wilson et al. [17] assess the execution of directing convention with differing system size and recreation time. They utilize 10 nodes for recreation time up to 200 seconds. They utilize NS-2.34 as test system. AODV perform better in term of bundle conveyance proportion in expanded activity stack and mobility. They utilize Qualnet 5.0.2 test system.

Wei, W et al. [18] Proposed Blocking ERS (Expanding Ring Search) to decrease the control packet overhead. The premise of the approach is that route seek system isn't continued from its source node however each time a communicate is required [6]. A steering convention brought QoS Mobile Routing over Ad hoc On-request Distance Vector steering (QMRB-AODV) [7] builds a routing comprising of nodes that are rich in assets. These back nodes are dependable to route bundles to end nodes.

3. PROPOSED WORK

The I-AODV expects to distinguish and detach the assaults, for example, link failures, node failures, and a gap in a MANET [9]. With the guide of an Intrusion Detection System IDS and a trust-based routing, the assault recognizable proof and failures are done in two periods of routing, for example, route exposure stage and information sending stage. Without route directing and randomnode choosing, AODV can assemble just an exceptionally restricted measure of routing data. Specifically, route learning is constrained just to the wellspring of any directing packets being sent. AODV depend on a routing revelation flow all the more frequently, which may convey a critical system overhead. On-request routing conventions at a point there is a need of correspondence amongst source and destination. AODV and I-AODV are the unipath and multipath directing convention separately. AODV is

receptive entryway disclosure measure where a MANET gets associated with a portal just when it is required.

3.1 AODV protocol

The Ad hoc On-Demand Distance Vector (AODV) calculation empowers dynamic, multi-hop, self-beginning routing between taking an interest node that needs to make and keep up a specially appointed system. AODV grants versatile nodes to react rapidly to interface breakages or some other changes in organizing topology precisely**.** Keeping up group numbers-Each route in routing table keeps up the present data about the destination succession number.

This is known as "destination succession number"[1]. Destination succession number is refreshed when a node gets late data about the grouping number from RREQ, RREP, or RERR messages. Destination node augments its own arrangement number in two conditions either when a node starts another route discovery or when the destination node sends a RREP message. AODV is a responsive routing convention, and it deals with the routing table. Routing table incorporates destination IP address, destination succession number, node Count, next node and lifetime. Generating Route Requests and route answers When a node needs a route to destination then it communicates RREQ packets.

The Destination Sequence Number field in the RREQ message is the last known destination grouping number for this destination. The Originator Sequence Number [1] in the RREQ message is the node's own particular arrangement number, which is expanded before embeddings in a RREQ. Regularly the RREQ ID field is augmented by one from the last RREQ ID. Each node keeps up just a single RREQ ID. The Hop Count field is set to zero. Bidirectional Communication is available. In the event that RREP couldn't be received until Net traversal time at that point sends another RREQ, having increased RREQ Id. Subsequent to doing greatest RREQ retries, the route is proclaimed inaccessible.

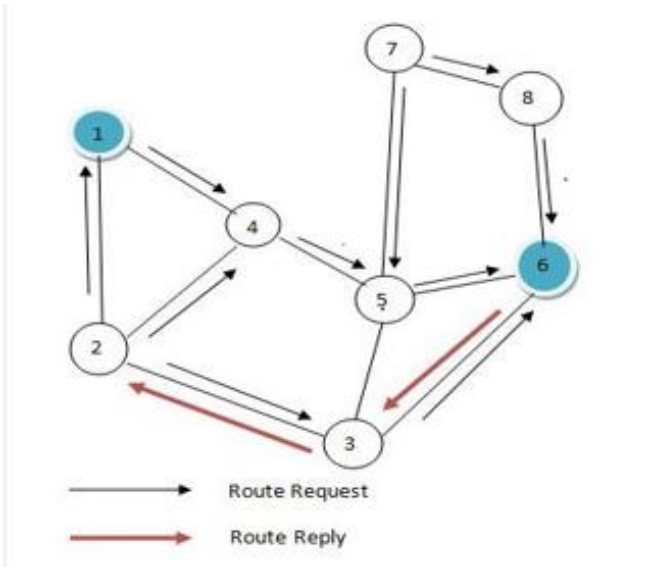

Figure 1. Path establishment in AODV routing protocol

At the point when middle of the road node gets RREQ, it makes or updates route to past bounce, check past subtle elements. It then additions the bounce check by 1. And afterward the invert way is kept up. A node creates a RREP if it is possible that it is itself the destination or it knows a dynamic route upto the destination. Figure-1 explains the path finding process clearly.

Route Error Messages-When node X can't forward packet P (from node S to node D) on connect (X,Y), it produces a RERR message. Destination group number for D is augmented by node X. The RERR incorporates the increased succession number N. At the point when received by nodes it begins another route disclosure for D utilizing destination grouping number more than N. On accepting route, ask for destination grouping number, node D will set its succession number to N.

3.2 I-AODV (improved-AODV protocol)

In AODV, when a route is required from source to destination, at that point source begins a route revelation process by flooding a RREQ for destination. With the assistance of arrangement numbers, RREQs are interestingly recognized so copy RREQs can be distinguished and disposed of. At the point when a non-copy RREQ is received then middle node records forwards and scan for a hard route section to the destination in routing table.

On the off chance that hard route is available then the node sends a RREP to the source yet in the event that new route is absent, it rebroadcasts the RREQ. The directing data is refreshed by a node just if a RREP contains either a bigger destination grouping number than past one or a route with less hop count found.

I-AODV routing process with the assistance of IDS and trust-based directing, the assault recognizable proof and disengagement in I-AODV are completed in two periods of routing, for example, route exposure stage and information sending stage.

The trust acquired from IDS is connected in the directing basic leadership about spreading RREQ packet of the source and choosing the trust based node for information forwarding [6]. In Trust Based Route Discovery Process initially, every node allocates the NODE-ID in an incentive as 'one' to its neighboring nodes. As indicated by the routing exercises of these nodes, the IDS measure the first trust esteem and illuminates the system layer.

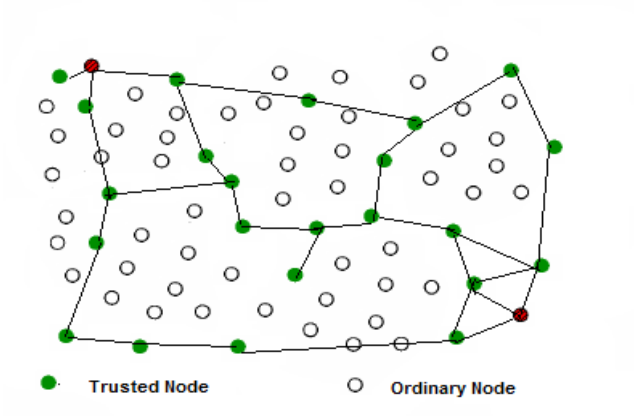

Figure 2. Routing process in I-AODV

In the proposed I-AODV method even if a MANET is formed the RREQ message will not be send to all the member nodes. After forming the MANET the nodes should be registered as trustednodes. A node can be registered as the trusted node if it satisfies the above said conditions in section

1.1. After registration only trusted nodes are involved in communication and routing is done only between these nodes.

The route revelation process is conveyed out based on the trust an incentive to remove the packet dropping action. Figure-2 illustrates the routing process in I-AODV process Preceding rebroadcasting the RREQ message to the neighbors, each node checks for the trust estimation of the source that has communicated the RREQ packet. In the event that the trust esteem is lesser than the limit, at that point the RREQ packet from the compared source is dropped to delay the action of the assailant.

3.3 Network reproduction

Reproduction is managed utilizing NS2. In view of the connection and route lifetime, no route overhead was considered in our reproduction. In 500 X 500 zone, portable nodes exist. Square territory is utilized to expand normal bounce length of a route with relatively little nodes. Each portable node is moving in view of the portability information records that were created by versatility generator module. Various 50 nodes are made. The transmission extend is settled at 100 meters. 100 nodes have destinations and take a stab at discovering routes to their destination nodes. Greatest speed of node is set to 20 m/sec. The nodes are doled out with an initial position. All nodes don't quit moving and the recreation second is 500 seconds. Table 1 illustrates the parameters used in the simulator and figure3 and figure4 explains the network formation and route discovery in I-AODV protocol.

Table 1. Simulation parameters

Parameter	Values
Coverage area	500m×500m
Simulation Time	500s
No.of nodes	50
Traffic type	UDP-CBR
Packet Size	512 bytes
Maximum Speed	20 m/s
Routing Protocol	AODV
Mobility Model	Random Way Point

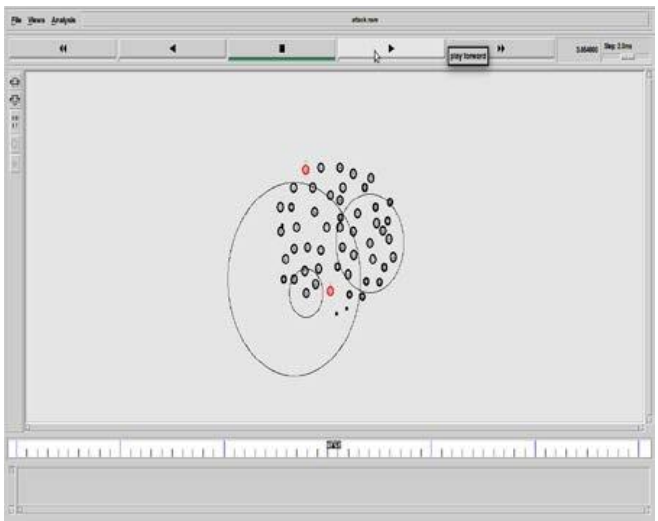

Figure 3. Network formation

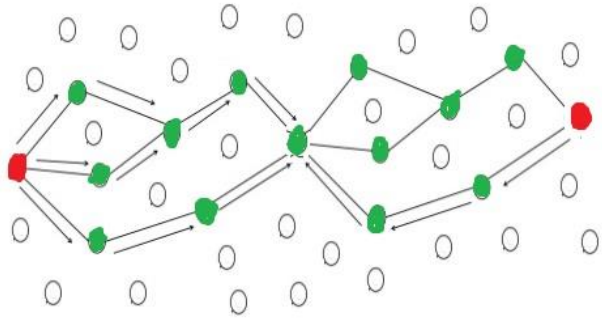

Figure 4. Routing using I-AODV

3.4 Routing operations in I-AODV

In this novel approach three new fields has been piggybacked into every node's unique routing table viz., positive occasions, negative occasions and response. Positive occasions are the strong correspondence times concerning two nodes. In advance of specified negative occasions are the regrettable correspondence between any two elements. Figure-5 explains the structure of the trusted node routing table.Response expresses the node's conviction towards another node's reliability as characterized previously. These three fields are thought to be the primary elements when performing put stock in routing in MANET.

DESTINATION IP	DESTINATION SEQUENCE	HOP COUNT	LIFE TIME	POSITIVE OCCASIONS	NEGATIVE OCCASIONS	RESPONSE
192.168.1.152	1	1	5	1	0	1
192.116.8.58	4	2	4	1	0	1
192.168.5.50	2	2	5	1	0	1
196.185.9.256	3	1	5	1	0	1

Figure 5. Trusted routing table

3.5 Trust judging rules

The pre-offered trust show is an addition of the standard disclosure in display in subjective rationale. In our trust model, reaction is a 3-dimensional metric and is characterized as takes after:

Definition 1

Let T(M,N)=[n(M,N),f (M,N),U(M,N)] mean node M's response about node N's reliability in a MANET, where the main, second and third part compare to conviction, un trust and vulnerability separately where M and N are the trusted nodes and f is failure and n is the total nodes in MANET.

The entirety up of each of the three esteems is constantly one. These three components ought to have the capacity to satisfy n(M,N)+f(M,N)+U(M,N) = 1. In this definition, conviction relates to the likelihood of a node N can be trusted by a node M, and mistrust compares to the likelihood of N can't be trusted by node M. At that point vulnerability fills the void without both conviction and doubt, and aggregate of these three components is dependably 1. The confined judging rules are clearly stated in figure-6.

A node in MANET will gather and safeguard all the positive and negative confirmations concerning alternate nodes reliability in MANET, With these amassed

confirmations we can store the assumption esteem by abusing the accompanying mapping condition.

Definition 2

Let T(M,N) = n(M,N)+f(M,N)+U(M,N) be node M's conclusion about node N's reliability in a MANET, and let p and n1 individually be the positive and negative confirmations gathered by node An about node B's dependability, at that point T(M,N) can be expressed as a component of p and n1 as per:

n(M,N) = p/(p+n1+2)

f(M,N) = n1/(p+n1+2)

u(M,N) = 2/(p +n1+2)

Where p is certain packet transmission from M to N, n1 is negative parcket transmission from M to N i.e, the packets that are not in any way, shape or form conveyed to the exact destination.

1) If node M's response towards node N's dependability, the principal segment conviction of supposition T(M,N) is bigger than 0.5, M will trust N and keep on performing directing identified with N.
2) In node M's conclusion towards node N's reliability, in the event that the second segment doubt of response T(M,N) is bigger than 0.5, M won't confide in N and will decline to performing routing identified with N. As needs be the route passage for N in M's routing table will be crippled and erased after specific time.
3) In node M's conclusion towards node N's dependability, if the third part vulnerability of assessment T(M,N) is bigger than 0.5, M will ask for N's computerized signature at whatever point has cooperation (or relationship) with N.
4) In node M's assessment towards node N's reliability, if the three segments of supposition T(M,N) are for the most part littler than or equivalent to 0.5, M will ask for N's computerized signature at whatever point has cooperation with N.
5) If node N has no route section in node's routing table's supposition about N is initialized as (0,0,1).

Belief	Unbelief	Uncertainty	Action
		>0.5	Request and Verify Digital signature
	>0.5		Distrust a node for an expire time
>0.5			Trust node and continue routing
<=0.5	<=0.5	<=0.5	Request and Verify Digital signature

Figure 6. Confide in judging rules

In our proposed system we have upgraded the routing convention by also computing the trust, unbelief and vulnerability esteems before creating the path, which improves the current convention. We have planned a model that distinguishes the malicious nodes that drops packets while sending and computed the packet loss proportion and end to end delay. The figured esteem is lower than as of now existed defer an incentive with no malevolent node conduct in the system. These qualities are made dependable in Improved- AODV.

4. IMPLEMENTATION OF TRUST BASED ROUTING

Initially the trust of the node can be computed utilizing strong trusted and slightest trusted. To begin with the system arrangement of the node occur. Figure-7 clearly explains the trust based routing mechanisms. At that point comes route foundation of each node should be possible. While setting up the route, the trust esteem ought to be ascertained. For that we ought to get the data in table data.

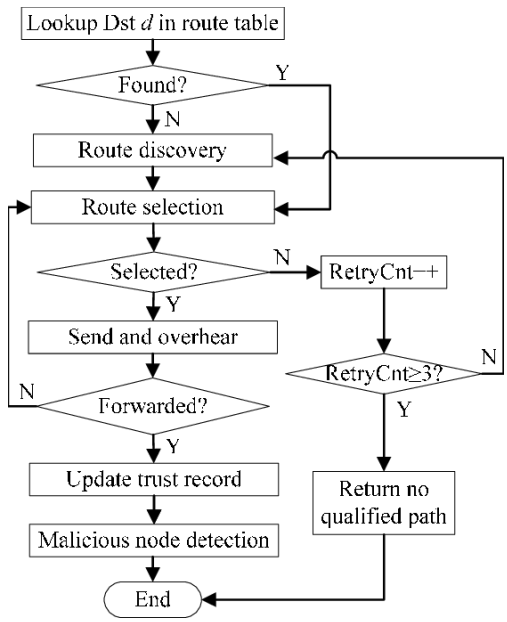

Figure 7. Trust based routing

```
#Filename: trust_routing.tcl

#Model Attacker
$ns at 0.0 "[$node_($i) set ragent_] malicious"

#Compute trust and select router based on threshold
set trust($i) [expr $forwarded($i) / $received($i)]
if {$trust($i) > 0.8} {
set router $i
}
```

Figure 8. Coding for trust table

The trust table data may contain three nodes as strongly trusted, trusted and minimum trusted. In the event that the conclusion is equivalent to data of node, at that point the way as response and play out the accompanying routing. On the off chance that the condition is not genuine at that point check whether response is equivalent to trusted esteem then these nodes give 50%positive assessment and

fix the way as trusted. The code for trust table is depicted in figure-8. On the off chance that the node is less trusted at that point dispose of the route and start new path. In the flowchart, trust esteem can be computed as explained previously.

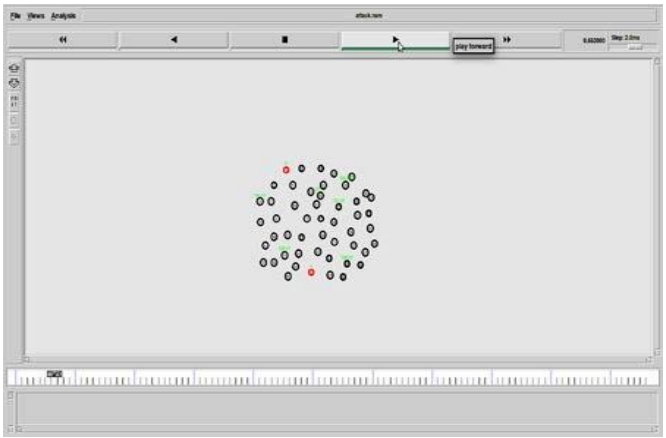

Figure 9. Identification of trusted nodes

In Figure 9 the red colored nodes are source and destination and green colored nodes are trusted nodes and the remaining nodes are ordinary nodes in the MANET which needs to be authenticated.

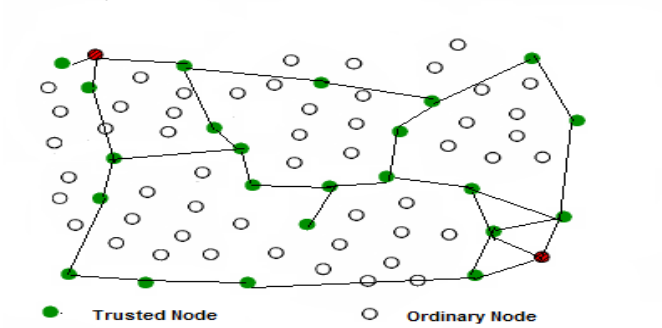

Figure 10. Constructing optimal path from source to destination via trustednodes

Before building the way from source to destination it is devoir to make certain the nodes that are going to share in the routing procedure are profoundly trusted in nodes. The route is solidly settled just if every one of the nodes are exceptionally trusted or nodes that meets the limit esteem. Figure-9 and Figure-10 illustrates the process of identifying highly trusted nodes and a path discovery process from source to destination respectively. In the event that slightest trusted nodes are situated inside the prescribed route, at that point the route is disregarded and the procedure is started again until the point that the route is ideal. In this degree, since just trusted nodes are conceded to share in the routing procedure the route will dependably stay immaculate where noxious nodes are totally detached from the routing procedure.

5. PACKET LOSS REDUCTION USING MULTI-ACK SCHEME

In MANET node is imparting by utilizing sending and accepting of packets. Each time a node sends or gets something it really utilizes some energy from node. In such way a node's energy will be done and this node will vanish soon. Subsequently one of the routing nodes will not discover it to forward packets. In this way, route breakage will happen clearly and a few packets will be lost since source will not know the off state of this node and source node will keep sending bundles utilizing this broken route.

Every one of the bundles that has drop because of the portability, blockage, transmission mistake and the assault is known as the packet loss. Consequently,

Packet Loss =Sent packet – Received packet.

MANET experienced some different difficult issues like black hole attack, malignant attack and worm hole attack that are excessively in charge of the packet drop. A few nodes deliberately drop the packet, these nodes are called malicious nodes. Indeed, even after the ideal choice of the course, organize can't perform well due to the bundle drop [5]. Nodes are in charge of packet drop in two ways [4].

- Nodes are disposing the packets because of deficient assets.
- Nodes are disposing the packets with no reason (noxious node).

To reduce the packet drops which occurs because of several factors a new Multi-Ack scheme is proposed which in turn verifies the node authenticity and trust. In this proposed model initially the network is established which comprises of only trusted nodes and then after successful routing the source will send ACK signal to the next hop in routing table. If the node is ready then it will send return OKACK to its origin and then the sender starts sending the data packets. Once the node receives the packet then again it sends DR (data received) message, so that sending packet process stops in this stage. This process continues until all the data packets are successfully transmitted to destination. The below code explains the process of Multi-Ack mode.

Pseudo Code

1. Transmit bundles from source to destination.
2. for each node on the continuous route do
   Check Trust Enable (TE) value
   if (TE==1) then
   Send ACK to next node in routing table.
   if (ACK==received)
   {

Send OKACK message back
Send data packet to next node
Send DR message back to the sender indicating the data packet is received.
}
else
{
In the event that (Critical Energy Level of a Node N!=TE) At that point Node N will create a Warning Message to the source. Here Node N is any node on the continuous course.
}

3. In the event that a Warning Message from any directing host is gotten,
   At that point
   i) Source won't send a solitary packet in this present route.

ii) It will dispose the present route from its store.
iii) In the event that any messages should be transmitted to destination

At that point
Source will utilize another route from its reserve paths.
else
Source will forward packets on the present route.

6. EXECUTION ANALYSIS

Trust based Routing algorithm produces better packet delivery ratio and throughput than the current conventional techniques. The outcomes are examined beneath. Packet drop due to acting up nodes, movement or clog is evaluated amid runtime as appeared in the below figure.

```
$ns at 0.0 "[$node_($attacker) set ragent_] malicious"
set udp [new Agent/UDP]
$ns attach-agent $node_($source) $udp
set cbr [new Application/Traffic/CBR]
$cbr set packetSize_ 1024
$cbr set interval_ 0.1
$cbr attach-agent $udp
set null [new Agent/Null]
$ns attach-agent $node_($destination) $null
$ns connect $udp $null
$ns at 1.0 "$cbr start"
$ns at 40.0 "$cbr stop"
```

Figure 11. To estimate the run time packet drop due to malicious node

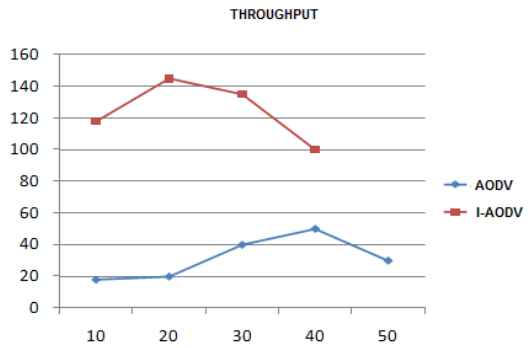

Figure 12. Variation of throughput with time

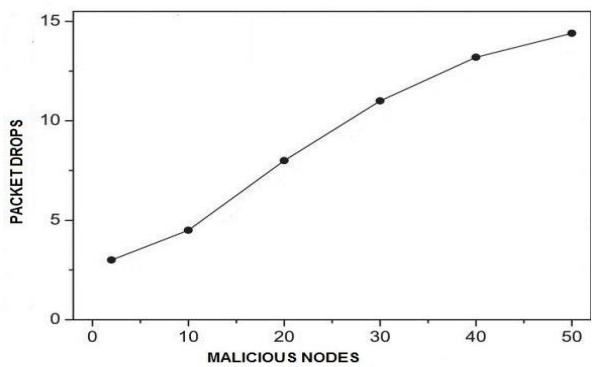

Figure 13. Packer drops vs malicious nodes

In the proposed method the throughput greatly varies when compared to existing method. The proposed I-AODV method exhibits better throughput than the existing AODV.

The above figure-13 clearly explains the raise of packet drops when there is a raise in malicious node existence in the MANET.

The proposed I-AODV methods performs better in delivering the packets to the destination without any packet loss and within a stipulated time.

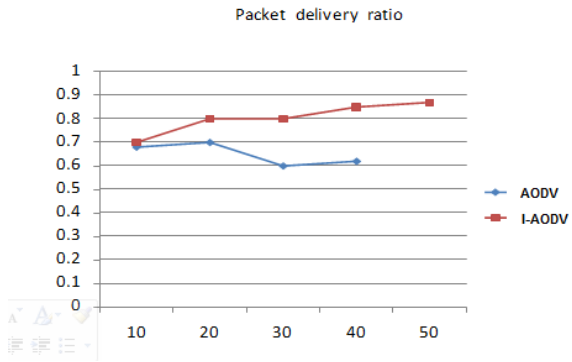

Figure 14. The relative decrease in packet delivery rate in I-AODV

7. CONCLUSION

MANET is an accumulation of portable nodes that are equipped for imparting each other by means of a remote connection. MANET can frame at wherever necessary without any fixed infrastructure. There are sure parameters those are identified with the execution of the MANET i.e. routing, throughput, packet drop, delay and so forth. In this Paper, the trusted nodes which are thought to be the trusted system has been recognized and a trusted route is set up in the wake of figuring the routing regard and the way is registered utilizing I-AODV routing convention that secludes the noxious nodes from the routing procedure. This winds up in expanded dependability Packet conveyance in MANET along these lines expanding the nature of administration and throughput in the system. This is on the grounds that I-AODV convention registers the trust estimations of every node and permits just the trusted nodes to get associated with the routing procedure. Our future work is to execute I-AODV convention for exchange conflicts in MANET. Although I-AODV brings about all the more routing overheads and packet delivery delays due its alternate route disclosure process, it is especially productive if there should arise an occurrence of packet conveyance for a similar reason. I-AODV ends up being more proficient than AODV as it gives better throughput. At long last the conclusion is that when using I-AODV as a superior on-request routing convention than AODV the proposed method gives better insights for routing, packet conveyance and throughput.

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