Journal of Theoretical and Applied Information Technology
15th May 2024. Vol.102. No 9

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

NOVEL ROUTING PROTOCOL TO OVERCOME PACKET DELAY IN MOBILE ADHOC NETWORK

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ABSTRACT

Packet delay in the wireless network leads the degrading the overall performance, many of the research work was done to overcome the packet delay in the nodes by inventing routing protocols with latest methods but the research remains the same stage. Existing routing strategy determines by using the dynamic manipulation of different parameters this is additional overhead to the routing protocol for determines the path. In this article concentrates on inventing a new routing protocol to overcome packet delay in Mobile Adhoc Network with a support of simple parameters called forwarding time of the each packet. To achieve this objective the Forward Time Based Routing Protocol (FTRP) introduces to monitoring the forwarded time of the every nodes present in the communication. The proposed forward time routing protocol was implemented with Network simulator and the simulation results are compared with existing methods of Proposed_TAODV, C-AODV, A-AODV and ML-AODV based routing protocol then the compared results are proved the packet delivery ratio is 90% to 94% and End to End Delay is 6.2% to 43.4 %. Simulation result in all the factors the proposed FTRP modes proved best result overall MANET the performance factors are excellent in 78%.
Keywords: *MANET, Attackers, Gray Hole Attackers, Forward Time Detection Technique, Forward Time*

1. INTRODUCTION

The major role of wireless based communication of Mobile Adhoc Network (MANET) [1] is providing the best routing strategy in the Network layer functionality. Since the best packet delivery to the destination produce the improvement in the performance factor. Packets performance factors are affected by delay in forwarding or by the attacker [2] present in the communication network. Many external forces are trying to crumble the MANET [2] application usage by creating the mitigation on MANET performance factor. One of the famous mitigation creations is done when the transmission of the packets via delay or dropping the packets. Traditional routing protocol are not supporting to overcome the delaying the packet as well dropping packets issues. The research need for providing the efficient packet delivery routing protocol to support packet delivery

without insisting the additional overhead to the network layers

Traditional routing approaches uses the routing protocol to enhance MANET battery performance and lowering energy consumption [3] as packet route selection is part of power transfer with topological ordering of MANET nodes is used to select routing. To handle battery power management, multiple MANET protocols [4] and numerous new categories of routing protocols [5] [6] are proposed. Several research articles have recently been published to improve the performance of the AODV protocol, including AOMDV [7], SQR-AODV [8], AODV-BR [9], AODV-RD [10], AODV-BR [11], ATOMDV [12], and AMORLM [13], which are supports for increasing battery life. MANET parameters, such as minimizing MANET overhead to support better power management, are also regarded important factors in reducing battery power consumption; many optimization strategies are based on this goal.

later, the Cluster node selection with LEACH protocol improves life time span with energy distribution [14], Fitness function in FFAOMDV to reduce power consumed [15], AI neural network based MANET to optimize MANET energy usage, which supports network efficiency and overall performance [16].After receiving signal strength indicator-based (RSSI) from the receiver strength, GPS and long-range technology demonstrated long-term MANET utilization [17]. EMBOA [18] combines butter fly optimization approaches with a low-energy machine learning methodology to improve multipath rouging. MANET security challenges, support for clustering methods to tackle battery power issues [19]. Nodes in a MANET PEO-AODV algorithm [20] offered geographic position monitoring and generated hop count parameters to meet power constraints.

MANET offers a variety of power management tactics via the routing protocol, as well as the most Advanced Fuzzy logic Algorithm [21] ,Genetic algorithm [22] ,secured routing [23] , Artificial Neural Network [24], Machine Learning[25] and cryptographic technique [26] etc, to optimize node battery power and life time. But all the methods are using some kind of manipulation on the parameter computation like shortest distance, less congestion, and minimal consumption of energy in [22] ,energy, buffer length, mobility and available bandwidth for predicting in [23] node mobility, traffic and transmission power [24] ,detection trust metric, trust score calculation, normalization metric in [27] which are dynamic nature in changing and these parameters computation takes additional overload to the routing strategy also could not support for giving the efficient packet delivery to the MANET .More research is needed to boost the MANET's routing strategy rather using of more computation parameters as well as involvement of the latest technique to give overhead to the network layer .

This research work could be achieving my adding Forward time based routing protocol for selecting the path from the source node to destination. This forward time based routing is not an additional computation to the network layer which is authoring generated and recorded in the MANET nodes by the internal system. This research article is organized as follows: survey related to research work talked in chapter 2, Forward time based detection Algorithm and classification techniques discussed in chapter 3 studies, proposed research work simulation work mentioned in chapter 4, and conclusion in chapter 5.

2. LITERATURE SURVEY

Authors of Harihara Gopalan et al [21] proposes the algorithm for routing and finding the optimal path for data acceleration from the source node was named as Fuzzified Particle Swarm Optimization oriented Routing (FPSOR) algorithm for reduce the over head and data loss in MANET, this is algorithm uses the Fuzzified method to find out the fresh route for finding the best route , but finding the fresh path this algorithm need to work on energy consumption which is not perfect predictable in all the nodes .

The authors of Rao et al [22] proposed the new energy based route calculation protocol using optimized genetic algorithm named GA-AOMDV, the method of choosing the optimal path from the numerous paths in accordance with shortest distance, less congestion, and minimal consumption of energy. But all the parameter estimation for finding the optimal route is cumbersome and overload to the source node.

Patsariya & Rajavat [23] contributed the secure MANET routing called node capability based routing and Trusted node capability based routing for detecting black hole, worm hole and DOS flooding attack among the nodes. The work was implemented using NS2 and produced the improved in packet delivery ratio and throughput but this method uses the energy, buffer length, mobility and available bandwidth for predicting the secure route , these factors are varying in nature

also frequent update is needed for each new route predict .

Jayant & Ritesh Sadiwala [24] proposed the routing with energy consumption using the artificial neural network which makes decision on the node mobility, traffic and transmission power . the simulation results achieves the lift time and energy consumed and optimized energy utilization but the predicting the metric value is not feasible due to the nature of the MANET , also dynamic nature of the metric value computation is required which is impractical for all the application.

Sivapriya et al [25] invented machine learning based routing protocol for improving the QoS in MANET , the research suggested ML-AODV protocol for detecting the black hole attack and flooding attacks , the simulation results compared with the other protocols which produced better results .but this work combines the Machine learning with Artificial neural network and support vector classification in supervised method for predicting the attackers and routing, the process of classification technique is complex when a new kind of attacking nodes is predict .

Majumder et al [26] proposed the crypto-based AODV protocol for enhancing the security and efficiency in MANET with the support of cryptographic hash function and Dijkstra algorithm for mitigating the worm hole attacks. the simulation results achieves improvement in throughput, less end-to-end delay, and better data transfer success rates, even in the Wormhole attackers nodes present in the communication .But computation of Hash function and shortest path for route finding is complex work in the MAENT

Matre & Vikhar [27] authors proposed the new Trust-Aware On-Demand Distance Vector (Proposed_TAODV) protocol for MANET to provide routing strategy with the support of detection trust metric, trust score calculation, normalization metric, statically analyzing for predicting the best route. The simulation result proved comparing with the current TAODV and Dynamic Source Routing (DSR) protocols, there was an improvement in network efficiency and security, even the proposed protocol managing massive volumes of traffic, dynamic network structures, and security risks, but the selection of route involves the many metric calculation, and these metric are not fixed metric which needs more time to predict the value in dynamically.

Purushothaman et al [28] invented secured routing protocol combining the TACIT, HMAC and AES based cryptographic techniques with the fuzzy logic named as Fuzzy C-Means Clustering-based Energy-Efficient Protected Optimal Path-Routing Protocol , the proposed work has done simulation with other routing protocols in 50 nodes , which produced the better performance in OLSR routing is 72%, BTSNADS routing protocol is 82%, and DSR routing protocol is 92%, and proposed fuzzy based routing protocol performance is 97%. But this work has taken more operating cost for providing the secured protocol.

Sangeetha et al [29] invented the new hybrid routing protocol strategy for the MANET, which combines the features of Digital Certificate authority and SHA-3 for robust route failure detection with the support of secret key forming. The result supports to reduce the number of failed nodes in the communications but the security in usage of the secret key is not public.

Advin Manhar and Dr. Deepak Dembla [30] authors invented Improved Hybrid Routing Protocol for creating the route path between the nodes. IHRP combines the different routing protocols like DMR, AOMDV, OLSR, AODV routing protocols to build the IHRP routing protocol and makes the route path based on the situation. The simulation results shown the better comparing with the existing routing protocol but the selection of routing protocol for a route selection and packet forwarding is puzzling task to the nodes .

Ryu et al [31] proposed the reputation based routing protocol based on the Q-Learning which uses the reinforcement learning in game theory. Finding the reputation nodes process which exclude the attackers and intruders nodes, simulation research of the proposed routing protocol overcomes the black hole attack scenario and the gray hole attack and produced the better in packet loss ratio, end-to-end delay computation, energy efficiency .But the adaptation of Game theory and Reinforcement learning methods in to Q-Learning is needed a trained data set, a new attacker node could not be predicted.

From the literature survey the prediction of route discovery for routing protocol with secure communication uses the modern techniques like fuzzy based methods , genetic algorithm, artificial neural network, machine learning , and traditional techniques cryptographic, hybrid routing , Situation based routing all these uses some metric to evaluate the route decision , but the evaluation of these metric is a fruitless to the route strategy in network layers functionality which consumes MANET energy to process the metrics . This article focuses

on the simple parameter called forward time of the nodes which is not calculated in every movement, for making the route path in the communication. This work will achieve the best routing process and also improve the routing protocol performance in the MANET.

3. DESIGNING FORWARD TIME BASED ROUTING PROTOCOL

To provide the efficient packet forwarding to reach to the destination, the best Routing strategy is necessary. From the literature survey, the existing routing strategy follows in the MANET nodes which use the energy based routing, clustering based routing, power optimization strategy, topology based routing and modern technique usages of machine learning, Artificial Intelligence etc, but all the methods are using some kind of manipulation on the parameter computation like shortest distance, less congestion, and minimal consumption of energy in [22] ,energy, buffer length, mobility and available bandwidth for predicting in [23] node mobility, traffic and transmission power [24] ,detection trust metric, trust score calculation, normalization metric in [27] which are dynamic nature in changing and these parameters computation takes additional overload to the routing strategy also could not support for giving the efficient packet delivery to the MANET.

This research article proposed the new kind of routing strategy which is based on the only one parameter which not calculated dynamically and available in internal nodes called forwarding time of the nodes. Idea behind the work is all the nodes internal forward time is monitored by the routing protocol for selecting the route path, if the nodes performs the forwarding the packet within the threshold of the node, these nodes are selected for the intermediate node route to the destination rather concentrating on the shortest path or other routing factors.

MANET is a Graph which has vertices and Edges are connected in undirected graph.

Let us Assume Graph G (V, E),

Vertices represent the total number of nodes are in the MANET.

Let's say V= {n1, n2, n3….Nn}

Edges are connecting n number of nodes

The transmission range of N nodes are two dimensions metric of N

Let Assume Source node S wants to send Data P to the Destination node D.

The data is collection of packets named as Pi = {P1, P2, and P3…..Pm}.

Every packet passes several intermediate nodes to reach to the destination.

Let have Collection of intermediate nodes from S to D = {I1, I2, I3 ...In}

Forward time detection technique used for monitor the every node activity forwarded time. This estimated forwarded time only support for intermediate node route selection not. Every node forwarded time is calculated from the equation Eq 1.

$$\text{Forward Time } Ft = \sum tt\ Pi \quad (1)$$

Where $1 \leq i \leq n$

Where tt represents the transmission time of all packets in the MANET Pi of each node.

The time taken for a packet reach to the destination is computed with the principle of time of flight. A threshold value δ is determined, when the Forwarded time below the threshold value them conclude the nodes is normal, otherwise classify the nodes not suitable for the intermediate node selection. The distance between the sources to destination is calculated using time of flight. This is done with the support of beacon signal generation for route Request (RREQ) and Route Reply (RREP). Two category of beacon signal named as Beacon signal arrival time B_{at}, Beacon signal Transmission time $B_{tt.}$ the difference between this two times is called distance from Source to Destination d using the Eq2.

$$d = (Bat - B_{tt}) \quad (2)$$

Normal Node where $Ft \leq$ threshold value δ

Not suitable Node where $Ft >$ threshold value δ

FORWARD TIME BASED ROUTE SELECTION ALGORITHM: I

The routing algorithm for selecting the route path from the Source node S to the Destination node D is working based on the on internal node forward time . The algorithm steps for selecting the route from the source to destination nodes as follows

Journal of Theoretical and Applied Information Technology
15th May 2024. Vol.102. No 9

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

1. Let S be the source node and D be the destination node
2. Using AODV routing algorithm determines the path between the source to destination using RREQ and RREP procedure.
3. Collect the All the intermediate nodes and forward time and time of flight using the forward to the Forward time detection classification.
4. Node verifies the forward time of all the intermediate nodes before confirming the route to transfer the packet
5. If forward time of all intermediate nodes less than the threshold value, then the route is selected otherwise new route is finding to transmit the packet.

Route selection (S, Intermediate nodes, D)

{
//Here the route selection is based all the nodes Forward time less than the threshold value
Label:
If (Forward time of all nodes from S to D < Threshold Value)
{
Route from S to D is selected for the packet transmission
return (S, Intermediate nodes, D)
Break;
}
Else
Find alternative route from S to D
Go to label
}

For an example from the Fig.1, S is the source node and wants to communicate with the Destination node D, send RREQ signal by stating the destination D address. All the nodes send the route reply along with the Forward time with threshold values lesser or greater.

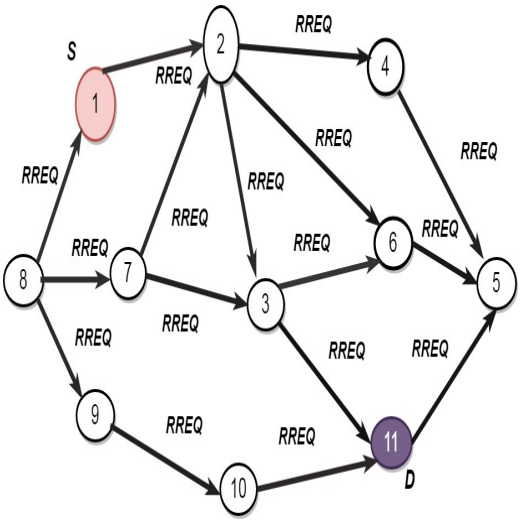

Fig. 1 Request Route from S node to D Node

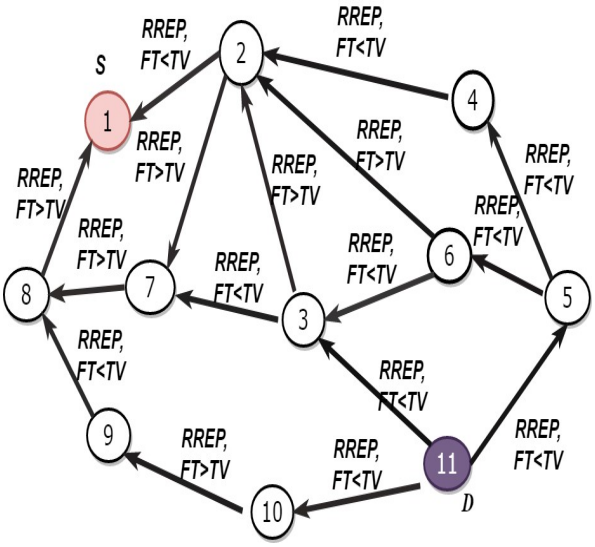

Fig. 2 Reply Route from Destination Node to Source Node along with Forward time

All the nodes forward time is compared with the threshold values, from the Fig 2, nodes 3, 8, 3, 6 threshold values are greater than the Forward time , so the path routing path from the path 1 to path 6 , except the path 1 remaining all other paths are not having the Forward time less that threshold values. Finally the path 1 is selected for the packet transmission from S to D as shown in the Fig.4.

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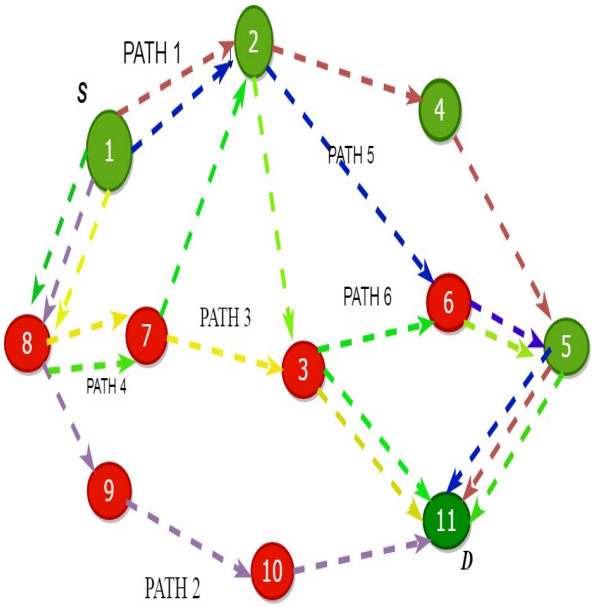

Fig. 3 Possible Path from Source to Destination There are six path are received for the S to D

transformation as shown in the Fig. 3.

Path 1 - node 1 →2 → 4→5→11
Path 2 - 1→8→9→10→11
Path 3 1→8→7→3→11
Path 4 1→8→7→2→3→11
Path 5 - 1 →2 →6→ 5 →11
Path 6 →1→8→7→2→3→6→5→11

Forward time based routing algorithm stages define in the ALGORITHM I and working flow chart shown in the Fig.5. First few stages the route selection is done using the traditional routing technique of route request and reply. This algorithm uses on demand AODV protocol for finding the best path since it is on demand does not require any route overhead. After the different route is selected along with the calculation of Forward time for the entire intermediate route (which include the source node as well as destination node) and call the classification technique to select the path which all the intermediate nodes are forward time is less than the Threshold value otherwise the path is rejected even any one of the intermediate nodes does not meet the condition.

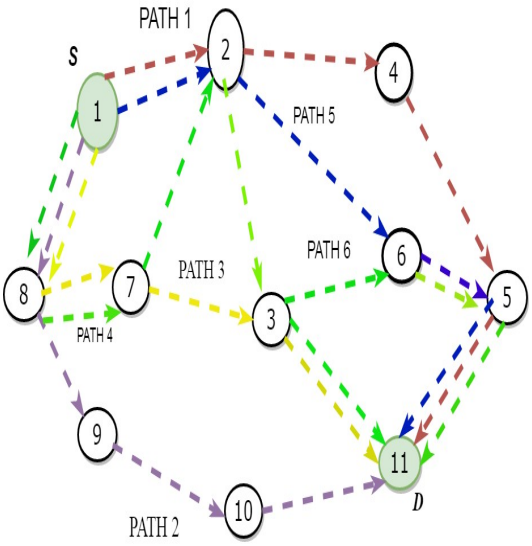

Fig. 4 Selected path which has Forward time < Threshold Value

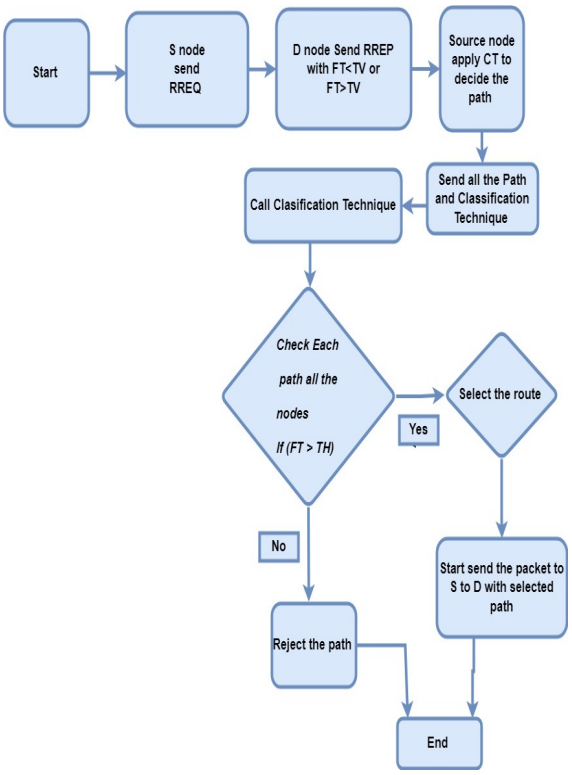

Fig. 5 Route selection based on Forward time with Classification Technique

4. SIMULATION RESULT

Simulation of Forward Time Based routing protocol for making efficient packet

communication is named as FTRP (Forward Time Based Routing Protocol) model which is simulated using Network simulator 2.34 and TABLE.I given for metric value defined used for simulation. Defined Network area is 300 m* 300m and nodes are varying ranges from 50, 100, and 150. Simulation time 150 sec and random mobility among the nodes are set .Speed of the mobility node is maximum 25 ms, and protocol used for route selection is AODV.

Initially, the proposed work will be work by setting the source node and destination node .when the simulation starts running the Route Request is send from the source to reach to destination, destination node send route reply. Based on the selection path, this makes the route path between the sources to the destination. Threshold value defined for the transmission and forwarding is 0.01ms. AODV protocol with Forward time detection named as FTRP and normal existing AODV protocol of Proposed_TAODV [24], C-AODV [25], A-AODV [27] and ML-AODV [23] based routing protocol values are taken for the performance comparison. Packet delivery ratio and End to End delay metric are taken for the nodes performance comparison since these factors are related to packet transmission.

TABLE I METRIC VALUE USED FOR SIMULATION

Parameter	***Value***
Network simulator	*NS 2.34*
Protocol selected	*AODV*
Number of nodes	*50,100,150,200*
Simulation time	*150 sec*
Model of mobility	*Random*
Speed of node	*0-25 m/s*
Network area	*300m * 300 m*
Initial sending Data packets	*10,20,30,40,50*
Traffic	*Constant Bit rate*

A. Packet Delivery Ratio

The Packet Delivery Ratio is a ration between the numbers of packet received from the sender with number of packet send as shown from the Eq 3,

$$PDR = \frac{Total\ number\ of\ Data\ packet\ received}{Total\ numebr\ of\ Data\ Packet\ Send} \times 100 \quad (3)$$

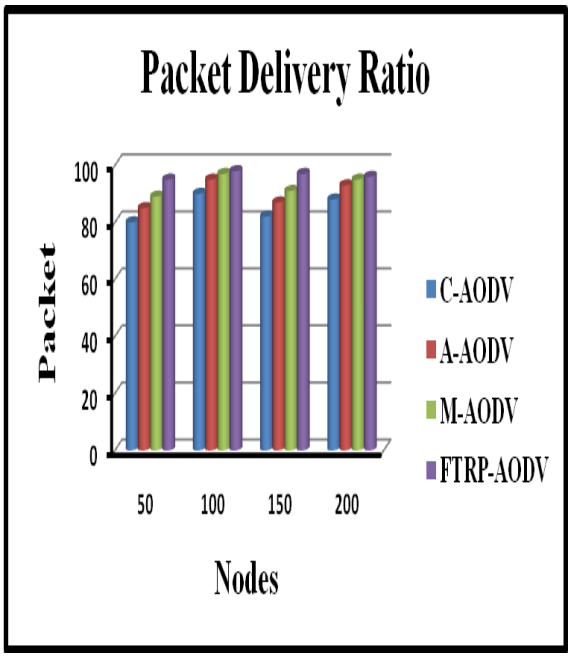

Fig. 6 Packet Delivery Ratio

Initially the packet are started send is set from 10,and slowly increasing by 20,30,40,50, The dropped packet are in the comparison chart shown in the Fig. 6 , in which the proposed FTRP model packet delivery ratio is high ranging from 90 % to 94% where as traditional A-AODV, C_AODV, M-AODV are Packet Delivery ratio between 80% to 88% .

B. End to End Delay

End to End delay estimated as the time difference between packet send from the source to packet arrival at destination. Packet send from the sender side delay is 0ms but there is varies delay at the destination node which is shown in the Fig.7 shows the comparison chart of delay between the traditional AODV and Proposed FTRP-AODV model where the proposed model delay is less varies from 0.2% to 0.4 % comparing with the existing routing protocol A-AODV, C_AODV, M-AODV.

C. Throughput

Throughput is defined at successful packet send from the sender to the receiver which is measure in bps. With efficient utilization of wireless bandwidth and minimum interference makes the FTRP-AODV protocol better throughput is 80 % excellent compared with the existing

routing protocol A-AODV, C_AODV, M-AODV which is depicted in the Fig.8.

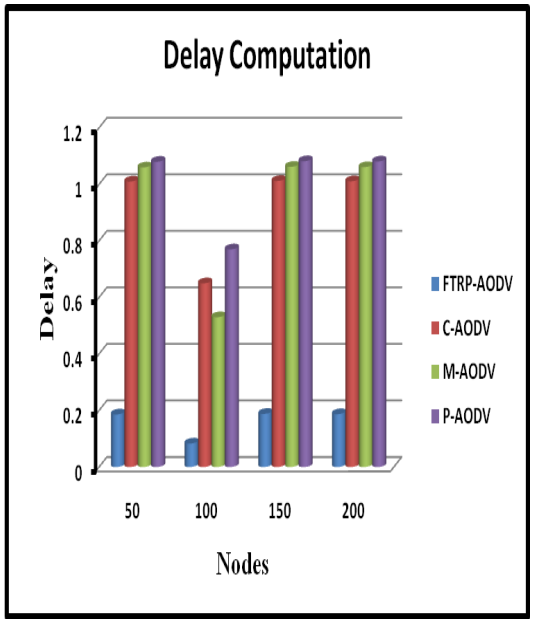

Fig.7 End to End Delay

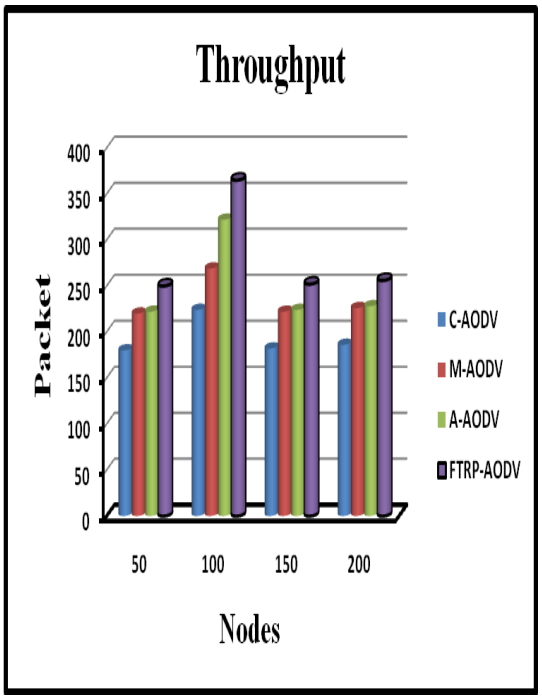

Fig 8. Throughput

5. CONCLUSION

This article focuses on routing protocol for making efficient communication of the MANET AODV routing. This is achieved by introducing the Forward time Based routing protocol and classification technique based on the threshold value to find out the best route. Simulation of the proposed work done with NS2.34 and the revealed result are computed with the metric of packet delivery ratio is 90% to 94% , End to End Delay is 0.2% to 0.4 % and throughput 80% compared with the C-AODV,A-AODV and ML-AODV existing routing protocol. Simulation result in all the factors the proposed FTRP-AODV modes proved best result overall MANET performance factors are excellent in 78%. In feature this research work could be carried out to indentify the black hole and white hole attackers using the forward time of the MANET nodes.

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