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Real Environment Visualization Based on Nodes Movement Pattern and Routin Protocol in MANET

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Abstract— Many Researches have been conducted on MANET related to performance measurement of various routing protocols. While measuring the performance of these protocols, during simulation an important factor to be considered is the mobility pattern of nodes in given area. Various research studies have considered a specific mobility pattern of nodes and under that pattern the performance of different protocols is measured. Still it is required to know which routing protocol perform better in different environment and different nodes mobility pattern of movement with different velocity. In MANET nodes are free to move anywhere in network and can join or leave the network arbitrarily the mobility pattern of nodes has a crucial impact on the performance of routing protocols. This study is an attempt to address this issue. In this study we have considered three different mobility models that are Group mobility model, random waypoint mobility model and pedestrian mobility model. Performance of two commonly used routing protocols DSR and AODV is studied. The performance of these protocols have been measured against some parameters, which are are Average jitter, Total packet Received, Average End-End Delay and Throughput. Results have shown that these parameters are affected by changing the mobility pattern for the same protocol, hence contributes to performance of these protocols in different mobility patterns.

Keywords— MANET (mobile ad-hoc network), DSR (Dynamic Source Routing), AODV (Ad-hoc on demand vector Routing). Mobility model, RREQ (route request), RPLY (route reply),* RW *Random Waypoint.

I. INTRODUCTION

Ad-Hoc mode wireless network is a decentralized wireless network for wireless devices allow users to communicate, cooperate, and access Internet services at anytime and anywhere. It does not rely on a pre-existing infrastructure, instead each node act as a node as well as router by forwarding data to other nodes and so the node's determination which forward data is done dynamically based on the network connectivity. Nowadays numbers of wireless ad-hoc networks are available one of the popular is MANET, also called a mobile mesh network, is a self-configuring network of mobile devices connected by wireless links. Wireless devices operate within the range of each other to discover and communicate in peer-to-peer fashion without any central access points. MANET have dynamic frequency because each node is free to move independently in any direction, and will therefore change its links to other node frequently, they also generally gather loads of nodes evolving in large areas. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. MANETs usually has a routable networking environment. There are different Routing protocols works in accordance, required whenever the source needs to transmit and delivers the packets to the destination. We are considering two routing protocol AODV and DSR .The mobility model is designed to describe the movement pattern of mobile users, and how their location, velocity and acceleration change over time. Since mobility patterns may play a significant role in determining the routing protocol performance.[4][11]

MANET includes many challenges and issues Routing is a central challenge in the design of ad-hoc networks; it is require developing dynamic routing protocols that can efficiently find routes between two communicating nodes Battery power is a limited resource, and it is expected that battery technology is not likely to progress as fast as computing and communication technologies do. Hence, how to lengthen the lifetime of batteries is an important issue. Network nodes will often be battery powered, which limits the capacity of CPU, memory and bandwidth. The network nodes are mobile; an ad-hoc network will typically have a dynamic topology which will have a profound effect on network characteristics. MANET suffer from different types of attacks at different layer which degrades its performance. Variation in speed effect the packet deliver ratio intern causes the performance of different protocols in MANET.[13]

II. LITERATURE REVIEW

Natarajan Meghanathan [1], Simulation-based analysis of the network connectivity, hop count and lifetime of the routes determined for ad hoc networks under the following four mobility models: Random Waypoint model, Gauss-Markov model, City Section model and the Manhattan model. Two kinds of routes are determined: routes with the minimum hop count and routes with the longest lifetime. Extensive simulations have been conducted for different conditions of network density and node mobility for each of the four mobility models and also for different values of the degree of randomness parameter for the Gauss-Markov mobility model. He arrive at rankings of the mobility models with respect to network connectivity, hop count of minimum hop routes, lifetime of minimum hop routes, lifetime of stable routes and the hop count of stable routes. He also observes a route lifetime–hop count tradeoff for all the four mobility models. The general trend of the results is the more realistic and constrained is a mobility model, the larger is the number of hops in the minimum hop routes and smaller is the lifetime of the stable routes determined under the mobility model.

FanBai [2], Provided a framework to evaluate the impact of different mobility models on the performance of MANET routing protocols. They propose various protocol independent metrics to capture interesting mobility characteristics, including spatial and temporal dependence and geographic restrictions. In addition, a rich set of parameterized mobility models are introduced including Random Waypoint, Group Mobility, Freeway and Manhattan models. Based on these models several 'test-suite' scenarios are chosen carefully to span the metric space. We demonstrate the utility of their test suite by evaluating various MANET routing protocols, including DSR, AODV and DSDV. There results show that the protocol performance may vary drastically across mobility models and performance rankings of protocols may vary with the mobility models used. Finally, they attempt to decompose the routing protocols into mechanistic "building blocks" to gain a deeper insight into the performance variations across protocols in the face of mobility.

M. Sreerama Murty [3], Compare the performance of on-demand routing protocols for mobile ad-hoc networks are distributed cache updating for the (DSR) and (AODV).the simulation model of the medium access control (MAC) layer is evaluating the performance of MANET protocols. DSR and AODV protocols share similar behaviours. They evaluate the both on demand protocols DSR and AODV based on packet delivery ratio, packet delivery latency, mobility variation with total number of errors, packet and normalized routing overhead, end-to-end delay by varying in node density.

Three mobility models from random-based model group have been evaluated the performance comparing with AODV and DSR routing protocol. The Random Waypoint Model is the best model which outperforms both Random Walk Model and Random Direction Model in both scenarios. The results indicate that Random Waypoint produces the highest throughput but the throughput of the Random Walk Model and Random Direction drastically falls over a period of time.

III. MOBILITY MODELS

3.1. Random Waypoint Mobility Model

Random Waypoint model assumes that each host is initially placed at a random position within the simulation area. As the simulation progresses, each host pauses at its current location for a determinable period called the pause time. RW model assumes the possibility of setting cut-off phase, scenario duration, width and height of the area (x, y), minimum and maximum speed (Vmin and Vmax), as well as maximum pause time. RW model includes pause times between changes in direction and/or speed. Pause is used to overcome abrupt stopping and starting in the random walk model. Upon expiry of this pause, the node arbitrary selects a new location to move towards and a new speed which is uniformly randomly selected from the interval [Vmin, Vmax] in the network. The movement of each node is independent of the other nodes in the network. The node moves in a straight line (in a particular direction) to the chosen location with the chosen velocity. The selection of each target location and a velocity to move to that location is independent of the current node location and the velocity with which the node reached that location around its reference point.[1][3]

3.2. Pedestrian Mobility Model

Pedestrian mobility model mainly use for small area and areas which can be cover by walk. In this type of model destination is usually fixed .it is developed in concern to the people who are covering area by walk. It is use in awareness of persons for their own safety, help them to take proper decision and guide them. Some example of this type of model is seen while crossing road, in analyzing signal, moving in any shopping mall, bus station etc. it also help users in accessing the priority places. It has temporal dependencies between nodes. Nodes movement is in pedestrian form where speed and direction are limited. Model created with pedestrian, pedestrians move in continuous space, reacting on different kinds of obstacles and other pedestrian [12][14]

3.3. Group Mobility Model

Model represents the random motion of a group of mobile nodes and their random individual motion within the group. All group members follow a logical group centre that determines the group motion behaviour. The entity mobility models should be specified to handle the movement of the individual mobile nodes within the group. Purpose of logical group centre is to guide group of nodes continuously calculating group motion, and this way defining behaviour, speeds and directions for mobile nodes. Once the updated reference point has been updated they are combined with random motion values to represent the random motion of each [6][10]

IV. ROUTING PROTOCOLS

4.1. AODV

AODV protocol is a reactive routing protocol for ad hoc and mobile networks that maintains routes only between nodes which need to communicate. The routing messages do not contain information about the whole route path, but only about the source and the destination. Therefore, routing messages do not have an increasing size. It uses destination sequence numbers to specify how fresh a route is, which is used to grant loop freedom. Whenever a node needs to send a packet to a destination for which it has no 'fresh enough' route it broadcasts a RREQ message to its neighbours. Each node that receives the broadcast sets up a reverse route towards the originator of the RREQ, unless it has a fresher one. When the intended destination or an intermediate node that has a 'fresh enough' route to the destination) receives the RREQ, it replies by sending a Route RREP. It is important to note that the only mutable information in a RREQ and in a RREP is the hop count. The RREP is uncast back to the originator of the RREQ .At each intermediate node, a route to the destination is set again, unless the node has a 'fresher' route than the one specified in the RREP. In the case that the RREQ is replied to by an intermediate node and if the RREQ had set this option, the intermediate node also sends a RREP to the destination. In this way, it can be granted that the route path is being set up bi-directionally. In the case that a node receives a new route and the node already has a route 'as fresh' as the received one, the shortest one will be updated [3][11]

4.2. DSR

The DSR protocol is an on-demand routing protocol based on source routing. In the source routing technique, a sender determines the exact sequence of nodes through which to propagate a packet. The list of intermediate nodes for routing is explicitly contained in the packet's header. In DSR, every mobile node in the network needs to maintain a route cache where it caches source routes that it has learned. When a host wants to send a packet to some other host, it first checks its route cache for a source route to the destination. In the case a route is found, the sender uses this route to propagate the packet. Otherwise the source node initiates the route discovery process. For route discovery, the source node starts by broadcasting a route request packet that can be received by all neighbour nodes within its wireless transmission range. The route request contains the address of the destination host, referred to as the target of the route discovery, the source's address, a route record field and a unique identification number. At the end, the source host should receive a route reply packet containing a list of network nodes through which it should propagate the packets, supposed the route discovery process was successful.[2][11]

V. METRICS

5.1 Throughput

Throughput is the average number of successfully delivered data packets on a communication network or network node. In other words throughput describes as the total number of received packets at the destination out of total transmitted packets. Throughput is calculated in bytes/sec or data packets per second. Mathematically throughput is shown as follow

$$\text{Throughput (bytes/sec)} = \frac{\text{Total number of received packets at destination* packet size}}{\text{Simulation time}}$$

5.2 Average end-end delay

End-to-end delay indicates how long it took for a packet to travel from the source to the application layer of the destination. It represents the average data delay an application or a user experiences when transmitting data.

5.3 Packet delivery ratio

Packet delivery ratio is calculated by dividing the number of packets received by the destination through the number of packets originated by the application layer of the source (i.e. CBR source). It specifies the packet loss rate, which limits the maximum throughput of the network. The better the delivery ratio, the more complete and correct is the routing protocol.

5.4 Jitter

Jitter is often used as a measure of the variability over time of the packet latency across a network. A network with constant latency has no variation. Packet jitter is expressed as an average of the deviation from the network mean latency. However, for this use, the term is imprecise [11][13]

VI. SIMULATION SETUP

This simulation is using three mobility models that will be tested on AODV and DSR routing protocols. The simulation period for each scenario is conduct in 900 seconds and the simulated Mobility network area is 1500 m x 1500 m square. The scenario is to evaluate the mobility models in different node speed; 3, 7 and 10 mps with fixed the number of node to 100 nodes and sources are 40. Comparison of performance of AODV and DSR routing protocols in Random waypoint mobility model, Pedestrian mobility model and Group mobility model is done through metrics Average jitter, Total packet received, Average end- end delay and Throughput to gain a good result and performance differences for each mobility model.

VII. EXPERIMENTAL RESULTS

The simulation results are focusing in analysing the performance on jitter, throughput, total Packet received and average end-end delay. The results also compared with different mobility model that we had chosen. The result are based on the speed, scenario that we will decided to shows the performance for every mobility model that had been selected.

7.1 Average Jitter

7.1.1 Group Mobility Model

Average Jitter of AODV Routing Protocol is increases with increase in speed 3 mps to 7 mps and again decreases at speed 10 mps. In DSR routing protocol, Average jitter is increase with speed from 3 mps to 7 mps and goes on increase to 10 mps. Given graph shows that Average Jitter of AODV Routing Protocol is less and DSR's Jitter is high, so AODV Routing Protocol is better than DSR routing protocol

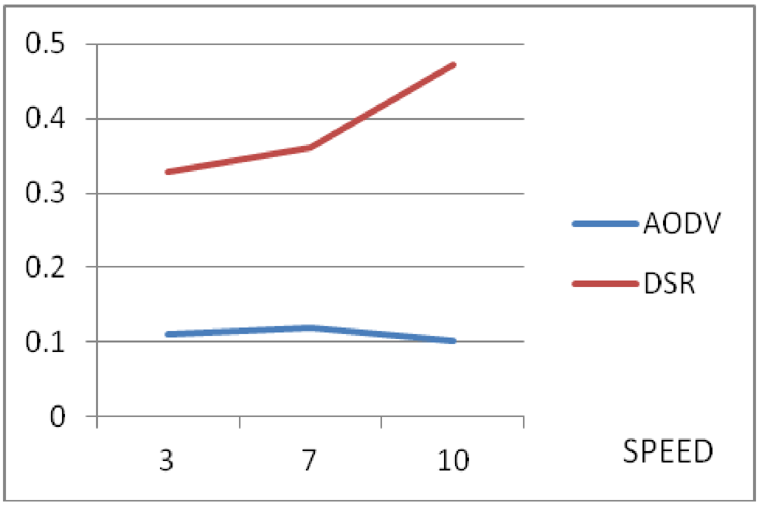

Fig.7.1 Group mobility model average jitter

7.1.2 Random Waypoint Mobility Model

Average jitter value of AODV Routing Protocol is increase from speed from 3 to 7 mps and goes on increase with increase in speed to10 mps. DSR Routing Protocol Average jitter value is also increase from speed 3 to 7 mps and on further increasing the speed to 10 mps it is increased. From graph we can say that DSR Routing Protocol has the highest value so AODV Routing Protocol is better than DSR.

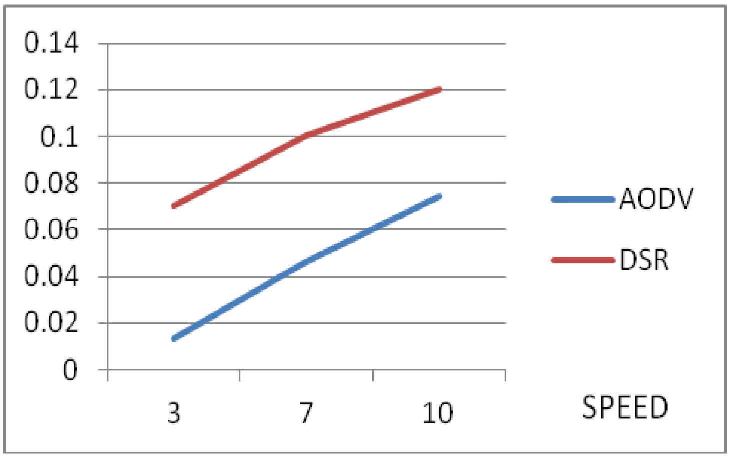

Fig.7.1.1 Random waypoint mobility model average jitter

7.1.3 Pedestrian Mobility Model

In AODV Routing Protocol with increase in speed from 3 to 7 mps Average jitter value increase a little and remain constant at speed 10 mps. Average jitter of DSR Routing Protocol is constant in speeds 3 mps and 7 mps but increased a little at speed 10 mps. Overall we can say that AODV Routing Protocol has the least value so it is better among other two routing protocol

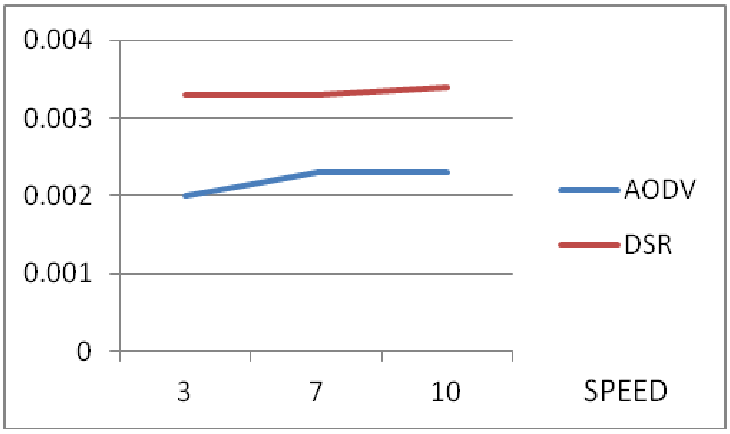

Fig.7.1.3 Pedestrian mobility model average jitter

7.2 Total Packet Received

7.2.1 Group Mobility Model

Total packets received by AODV Routing Protocol are reduced with increase in speed and again increases on further increasing the speed. DSR Routing Protocol received packets are increased when speed is increase to 7 mps but decreases on speed 10 mps. Overall DSR Routing Protocol receive highest total packets.

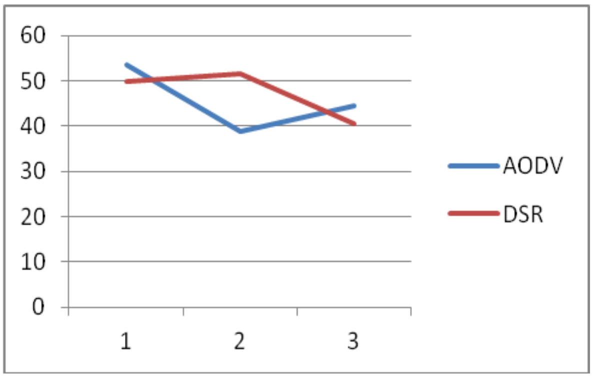

Fig.7.1 Group mobility model total packet received

7.2.2 Random Waypoint Mobility Model

In AODV Routing Protocol with increase in speed from 3 to 7 mps total packets received value is increase and decrease at speed 10 mps. DSR Routing Protocol total packet received value is increase at speed 7 mps and goes on increase at speed 10 mps .

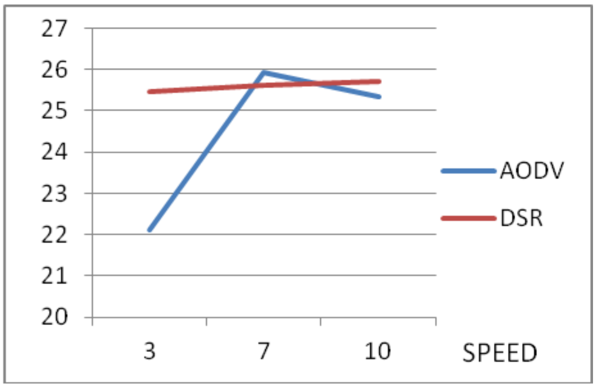

Fig.7.2.2 Random waypoint mobility model total packet received

7.2.3. Pedestrian Mobility Model

AODV Routing Protocol is having constant value when speed is increase from 3 to 7 mps and remains constant on further increase in speed. DSR Routing Protocol values are also constant in all the three speeds 3, 7 and 10 mps. Both routing protocols have same value of total packet received parameter.

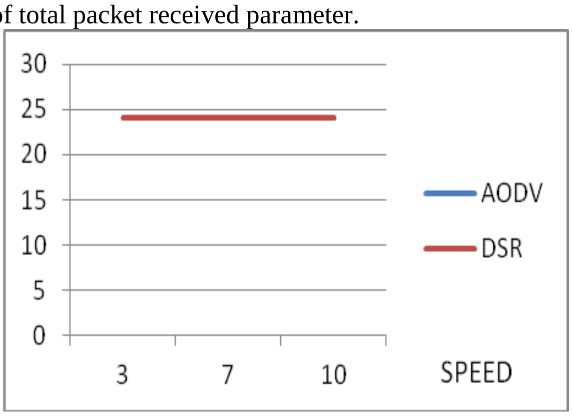

Fig.7.2.3 Pedestrian mobility model total packet received

7.3. Average End-End Delay

7.3.1 Group Mobility Model

Average end- end delay of AODV Routing Protocol is increase with increase in speed from 3 mps to 7 mps and goes on increase at speed 10 mps. In case of DSR, also Average end-end delay is increases with increase in speed and highest at speed 10. AODV's is lowest among AODV Routing Protocol and DSR Routing Protocol, so we can say that AODV Routing Protocol is better.

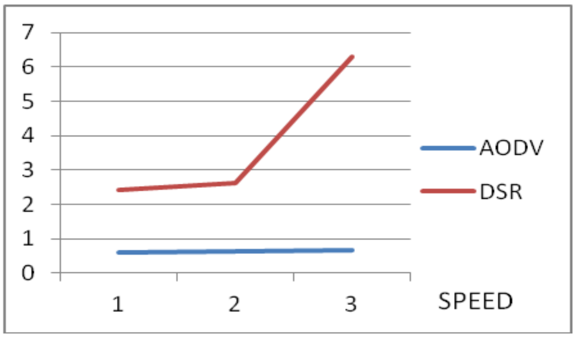

Fig.7.3.1 Group mobility model average end- end delay

7.3.2. Random Waypoint Mobility Model

AODV Routing Protocol average end to end delay is increase from speed 3 to 7 mps, on more increasing the speed to 10 mps delay increases again. Delay of DSR Routing Protocol is increase with increase in speed and remains constant on again increasing the speed to 10 from 7 mps. From above graph we can say that AODV routing protocol produce lowest Average delay so it is better in this configuration.

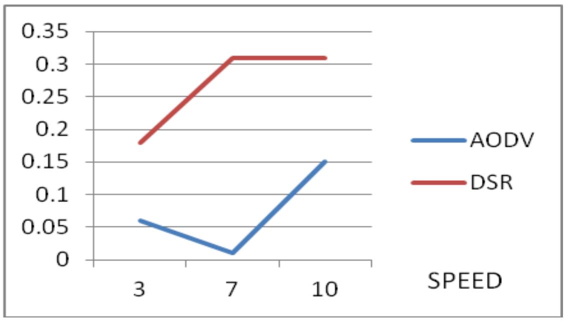

Fig.7.3.2. Random waypoint mobility model average end-end delay

7.3.3 Pedestrian Mobility Model

Average end to end delay of AODV is reduced from speed 3 to 7 mps, on increasing speed to 10 mps delay increase again same as in speed 3 mps. delay of DSR is decrease with increase in speed and goes on decrease on again increasing the speed to 10 from 7 mps. From graph we can say that AODV routing protocol produce lowest delay so it is good under this configuration.

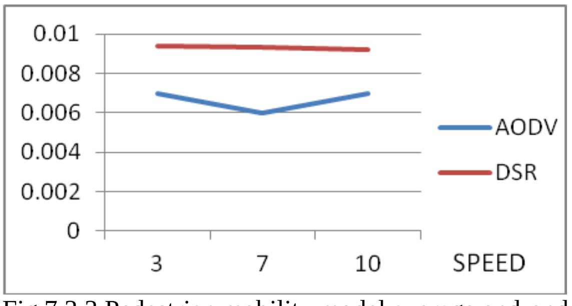

Fig.7.3.3 Pedestrian mobility model average end-end delay

7.4. Throughput

7.4.1 Group Mobility Model

Throughput of AODV is decreases with increase in speed and goes on decrease from speed 3 mps to 10 mps. DSR's throughput is also goes decrease form 3 mps to 10 mps. Overall we can say that DSR's throughput is high so it is better than AODV.

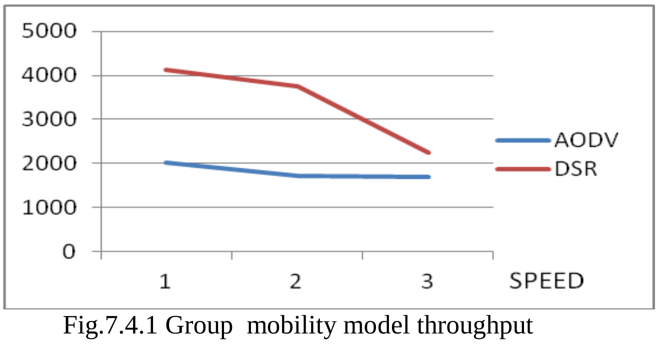

Fig.7.4.1 Group mobility model throughput

7.4.1 Random Waypoint Mobility Model

Throughput of AODV Routing Protocol is decrease with increase in speed from 3 to 7 mps and again increases when speed is increase to 10 mps. Throughput of DSR is reduced when speed is increased to 7 mps but again increases when speed is 10 mps but not more than the value at speed 3 mps. From graph we can say that DSR's throughput is highest among them.

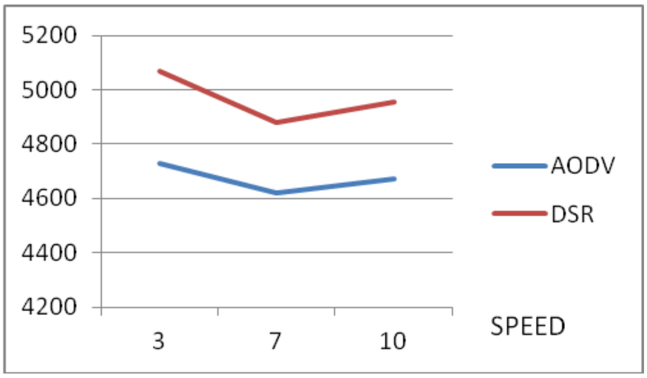

Fig.7.4.2 Random waypoint mobility model throughput

7.4.3. Pedestrian Mobility Model

At speed 3mps throughput of AODV Routing Protocol is same as in speed 7 and 10 mps it is constant in all speed. Throughput of DSR in all the three speed is also same does not affect by change in speed.. From above graph we can say that AODV Routing Protocol and DSR Routing Protocol are equal.

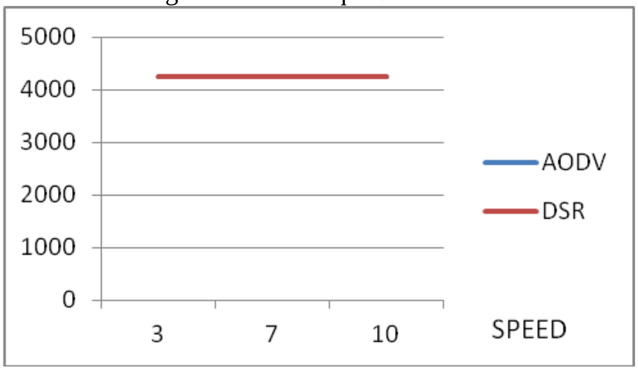

Fig.7.4.3 Pedestrian mobility model throughput

IV. CONCLUSIONS

Routing protocols performance is evaluated in different Mobility models, comparing of AODV Routing Protocol and DSR routing protocol is done in three Mobility model. Since, the previous research has done a lot on doing research with random mobility model. So we have compared the routing protocols performance in different environment where nodes move in pedestrian, random and in group form. AODV Routing Protocol performance is better than DSR in Random waypoint mobility model whereas in Group mobility model AODV's Average Jitter and Average end-end delay is lower and DSR total packet received and throughput is better. In Pedestrian mobility model Average jitter and Average end-end delay of AODV is lower than DSR routing protocol, Total packet received and Throughput of AODV Routing Protocol and DSR Routing Protocol are nearly equal so we can say that AODV and DSR routing protocol perform almost equal in pedestrian mobility model. If we compare the Mobility models; group mobility model's has highest total packet received value, Random waypoint has highest throughput, and pedestrian mobility model has lowest Average jitter and Average end to end delay. Implementation of comparing scenario is done in different mobility models to suite with current environment.

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