A proportional analysis of dissimilar Mobility Models in Ad- hoc Sensor Network over DSR Protocol

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ABSTRACT

With the current advances like wireless networks is becoming most useful technology is increasing popularity. Simulation is the technique which is used for evaluation of wireless networks. There is numerous number of Network Simulator's available. Here we are using NS2 simulation tool is used to find that which mobility model is best for real-life Scenarios. The Mobility model gives information like movement of nodes and how it works with the protocol and connectivity of nodes in an excellent manner. In this paper we are analyzing the mobility model which is best in incorporate more Realistic mobility model. We are taken four different mobility model in different models like entity models (Manhattan model and gauss markov model) and group mobility model (Reference Point Group Model) and Random Waypoint mobility model. Random waypoint is used as a default mobility model in many network simulations. Our comparative analysis for the mobility models which is existing mobility models are discussed on a variety of simulation settings and parameters to find these results are as follows Control Overhead, Generated packets and Received packets.

Keywords

Mobility models, DSR protocol, RWP, MM, Gauss-markov, RPGM, Manhattan, Ad-hoc Sensor Network, Simulation

1. INTRODUCTION

Ad-hoc Wireless Sensor Networks: It is an emerging recent interested topic in wireless ad-hoc networks and in particularly wireless sensor networks as a Research topic. It is a wireless, self-organizing, sensing, processing, and communication systems formed by co-operating sensor nodes within communication range of each other that forms temporary network. In this their topology is dynamic, decentralized, ever changing and the sensor nodes may move around arbitrarily. The progress in computational and communicational technology is an emerging field based on low cost and also for reliability. They have great long-term economic potential, ability to transform our lives; it gives new technological and conceptual optimized problems. Some, such as location, deployment, and tracking some environment, are fundamental issues and then, in that many applications rely on them for needed information.

Important characteristics of AWSN are:

- Mobility of nodes
- Node failures
- Scalability
- Dynamic network topology
- Communication failures
- Heterogeneity of nodes
- Large scale of deployment

Mobility model is the model which gives the movement of nodes is found to have significant impact on analysis of results. The movement patterns have an influence the topology of network. Due to this reason, many different mobility models are proposed in last decade.

The rest of the paper is organized as follows: Section 2 describes related works with regards to studying the performance of different mobility models using routing Protocol. Section 3 overview of DSR routing protocol and discussion of the mobility models like Random Way point, Reference Point Group Mobility Model, Manhattan and the Gauss-Markov mobility models. Section 4 illustrates the simulation results and compares the mobility models with respect to the results obtained for the Control overhead, Packets generated, and Received Packets. Section 6 conclusion and Future work of this paper.

2. RELATED WORKS

A brief survey of performance metrics, mobility metrics and routing in WSNs is presented in this section. WSN have been an extensively studied area of research, [1] examines the area in detail giving a review of the architecture ranging from management, communication, coordination, and current and potential applications. Broch et al., [11] evaluates that on-demand protocol such as Dynamic Source Routing and AODV perform better than table-driven ones such as Destination Sequenced Distance Vector (DSDV) routing protocol at high mobility rates, while DSDV perform quite well at low mobility rates. High mobility and its effects on the network operation have also been explored recently in WSN. In [14], the author compares the performance of proactive Destination Sequenced Distance Vector (DSDV) Protocols under the Different Mobility Models. Random mobility has been studied for improving data capacity [3], [4] and networking performance [1]. However, in such cases the latency of data transfer cannot be bounded deterministically, and delivery itself is in jeopardy if the data is cleared from the sensor node buffer.

3. DYNAMIC SOURCE ROUTING (DSR) PROTOCOL:

DSR is specifically designed for multi-hop ad hoc networks. The difference in DSR and other routing protocols is that it

uses source routing supplied by packet's originator to determine packet's path through the network instead of independent hop-by-hop routing decisions made by each node [8].
The packet in source routing which is going to be routed through the network carries the complete ordered list of nodes in its header through which the packet will pass. Fresh routing information [9] is not needed to be maintained in intermediate nodes in design of source routing, since all the routing decisions are contained in the packet by themselves.

4. DISCUSSION OF MOBILITY MODELS (MM):

In this section we are going to present about the mobility models studied in this paper as follows [14]. These models are in builded in Bonn motion tool.

Random waypoint model (RWP):

In this model nodes are assumed to be placed randomly in the simulation Area. The movement of each node is independent of other nodes [14]. The nodes are chosen as random target location to move. In this model nodes are distributed randomly over a convex Area [12].

Manhattan model (MHN):

In this model it is assume the region is divided into grid and then the square blocks of identical block length. The nodes movement is decided from one street at one time [14]. To start with this equal chance is given to every node. After a node is selected in initial location, a node begins to move in same direction and reaches in other street intersections, then the subsequent street in which it moves to chosen probabilistically.

Reference Point Group Mobility (RPGM): It is group mobility model. It is a Spatial Dependencies mobility model. The RPGM mobility model works as follows: Nodes move as a group with each group having a group leader (a logical centre for the group) whose movement determines the group's mobility pattern.

Gauss-markov mobility model (GM):

The nodes are placed as randomly and it works as independently. It is a Temporal Dependencies mobility model. In this model initially, the nodes are placed at random locations in the network. The movement of a node is independent of the other nodes in the network [14]. Each node i have assigned a mean speed, i S, and mean direction, i of movement. For every constant time period, a node the speed and direction of movement based on the speed and direction during the previous time period, along with a certain degree of randomness incorporated in the calculation.

5. SIMULATION RESULTS:

To assess the performance of DSR protocol with different mobility model .we have implemented them within the version 2.24 of the ns2 [17] network simulator. The performance analysis for these simulations was conducted by using the discrete-event simulator, NS2. The simulator was used to simulate the mobility environment and the Open System Interconnections (OSI) layers utilized in wireless simulation. The gateway selection function uses in all cases the criterion of minimum distance to the gateway, in order to get a fair comparison between the approaches. The periodic advertisements sent out by the gateways are issued every 2 seconds. We have set up a scenario consisting of 50 to 250 mobile nodes using 802.11b at 2 Mb/s with a radio range of 300 m. The size of area is 1000*1000m^2. Ten active UDP sources have been simulated, sending out a constant bit rate of 20Kb/s using 512 bytes/packet.

Movement patterns have been generated using the Bonn Motion [10, 11] tool, creating scenarios with the Random Waypoint, Gauss–Markov and Manhattan mobility models, Reference point group mobility model. Random Waypoint is the most widely used mobility model in MANET research because of its simplicity. Nodes select a random speed and destination around the simulation area and move toward that destination. Then they stop for a given pause time and repeat the process. The Gauss–Markov model makes nodes movements to be based on previous ones, so that there are not strong changes of speed and direction. Finally, Manhattan Grid models the simulation area as a city section which is only crossed by vertical and horizontal streets. Nodes are only allowed to move through these streets.

All simulations have been run during 300seconds, with speeds randomly chosen between 0 m/s and (2, 4, 6, 8, 10) m/s as a Speed Variations in all mobility models. In this subsection we focus on the following as control overhead, dropped Packets and Received Packets as a metric during the simulation in order to evaluate the performance of the different mobility models.

5.1 Control Overhead (CO): The control overhead is defined as the total number of control packets exchanged successfully.

Table1 and Fig 1*:* CO in 50 nodes

MM	Node 50- Control Overhead					
SPEED	0	2	4	6	8	10
GM	29	239	521	669	2526	4338
MHN	40	1672	3457	3652	3495	8539
RPGM	1672	1063	1553	1999	3094	5402
RWP	41	149	978	1452	2763	2709

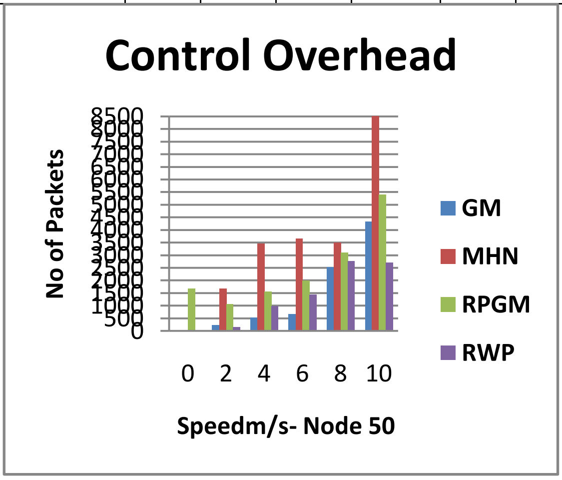
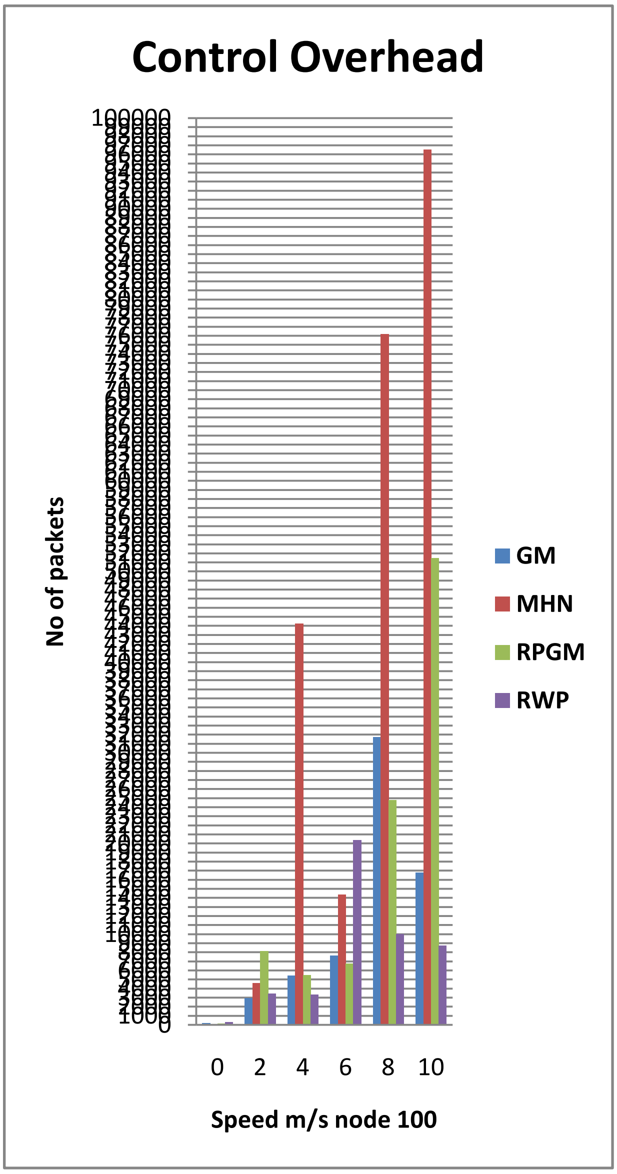


Table 1: Control Overhead (CO) in the 50 nodes using different Mobility model with different Speed (maximum speed = 10 m/s).In Table 1 and fig 1 represents the Control Overhead in accordance with Speed. By using 50 nodes, the performance of Manhattan model gives better CO results. At 0 Speed RPGM is giving 1672 packets as high packets, and for Speed 2, 4, 6, 8, 10 Manhattan models giving high

transmission of packets successfully and also it differs with other models.

Table 2 and Fig 2: CO in 50 nodes

MM	Node 100- Control Overhead					
SPEED	0	2	4	6	8	10
GM	194	2957	5445	7615	31735	16753
MHN	56	4613	44260	14367	76152	96524
RPGM	131	8134	5519	6761	24786	51439
RWP	310	3459	3318	20392	10036	8742



performance of Manhattan model gives better CO results. At 0 Speed Gauss-Markov is giving 194 packets as high packets and at Speed 2,RPGM model exchange 8134 packets and at speed 4,6,8,10and 44260,14367,76152,96524 respectively here Manhattan models giving high transmission of packets successfully and also it differs with other models.

Table 3 and fig 3: CO in 150 nodes

MM	Node 150- Control Overhead					
SPEED	0	2	4	6	8	10
GM	209	3281	86693	150910	206736	232365
MHN	495	92196	134530	176392	249500	291639
RPGM	578	4091	4392	152096	254690	255382
RWP	24303	125818	46024	115598	213215	276664

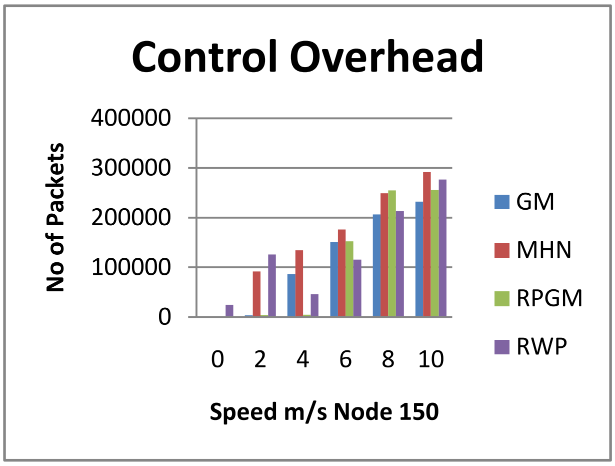


Table 3: Control Overhead (CO) in the 150 nodes using different Mobility model with different Speed (maximum speed = 10 m/s).In **Table 3** and **fig 3** represents the Control Overhead in accordance with Speed. By using 150 nodes, the performance of Manhattan model gives better CO results. At 0, 2 Speed RWP is giving 24303,125818 respectively packets as high packets and at Speed 4, Manhattan model exchange 134530 packets and at speed 6,10and 176392,291639 respectively here Manhattan models giving high transmission of packets successfully and at Speed 8, RPGM model exchange 254690 packets also it differs with other models.

Table 4 and fig 5: CO in 200 nodes

MM	Node 200- Control Overhead					
SPEED	0	2	4	6	8	10
GM	61527	187830	288050	417917	495131	607848
MHN	36434	146496	285299	387865	503112	548114
RPGM	71180	303741	473917	514712	599167	740247
RWP	316	304784	439703	510587	628702	557924

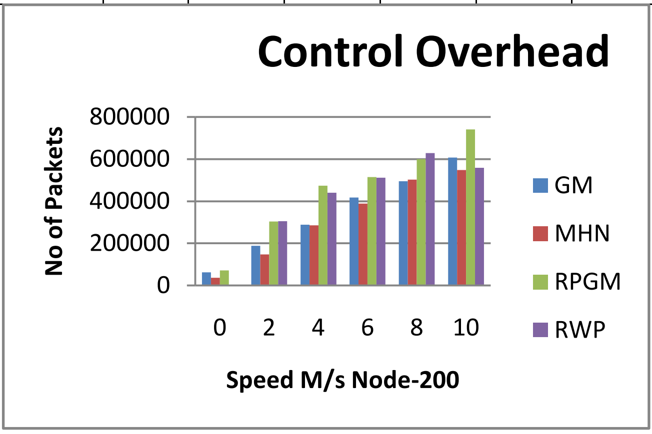


Table 4: Control Overhead (CO) in the 200 nodes using different Mobility model with different Speed (maximum speed = 10 m/s). In Table 4 and fig 4 represents the Control Overhead in accordance with Speed. By using 200 nodes, the performance of RPGM model gives better CO results. At 0, Speed RPGM is giving 71180 respectively packets as high packets and at Speed 2, RWP model exchange 304784 packets and at speed 4,6 packets exchanged 473917,514712 respectively and at Speed 8,RWP model exchange 628702 packets and at Speed 10, RPGM models giving high transmission of 740247 packets successfully also it differs with other models.

MM	Node 250- Control Overhead					
SPEED	0	2	4	6	8	10
GM	110227	256195	402368	569872	697692	917620
MHN	80626	254251	437812	630242	861533	948529
RPGM	80942	571094	721552	819003	928271	1104614
RWP	119300	511612	569203	863995	973823	1236021

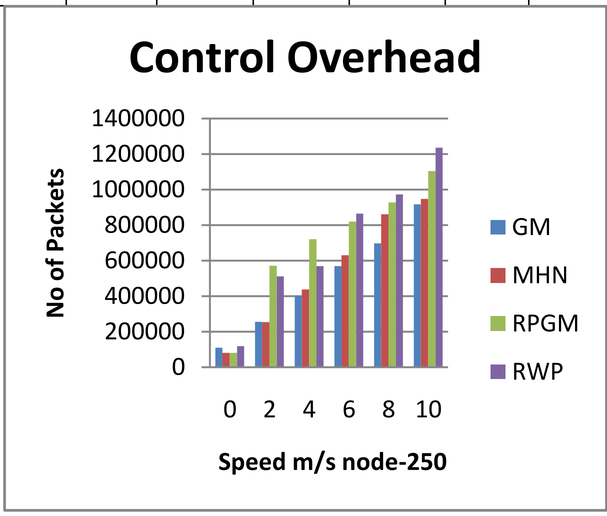


Table 4: Control Overhead (CO) in the 250 nodes using different Mobility model with different Speed (maximum speed = 10 m/s). In Table 5 and fig 5 represents the Control Overhead in accordance with Speed. By using 250 nodes, the performance of RWP model gives better CO results. At 0 Speed, RWP is giving 119300 packets are exchanged successfully and at Speed 2,4, RPGM model exchange 571094,721552 packets respectively and at 6 Speed RWP model exchange 863995 packets which giving high transmission of packets successfully and at Speed 8,10, RPGM model exchange 973823,1236021 packets respectively also it differs with other models.

Overview of Control Overhead (CO): This Control overhead (CO) estimate gives us an idea about how successful the protocol is in exchanging packets to the application layer. A high value indicates that most of the packets are being exchanged to the higher layers and is a good indicator of the DSR protocol performance and Different Mobility models. Among different mobility models Manhattan model and RPGM models exchanging the packets overall performance is good among the other models which we selected the models from group and random models.

2. Generated Packets (GP): It is defined as Number of Packets Generated Successfully.

Nodes	No. of Packets
50	3480
100	5798
150	9272
200	11586
250	13898

The above mentioned table gives generated packets for nodes 50 -250 Received Packets (RP) in the 50 nodes using different Mobility model with different Speed (maximum speed = 10 m/s at time intervals of 2 m/s).At Node 50,100,150,200,250 the result of generated packets are same in all mobility models which we are compared.

3. Received Packets (RP)**:** It is defined as number of packets received to the destination successfully.

Table 6 and fig 6: RP in 50 nodes

MM	**Node 50- Received Packets**					
SPEED	**0**	**2**	**4**	**6**	**8**	**10**
GM	**3480**	**3469**	**3434**	**3429**	**3353**	**3289**
MHN	**3480**	**2000**	**3036**	**2946**	**3081**	**2902**
RPGM	**2000**	**2789**	**1731**	**3081**	**1630**	**1565**
RWP	**3480**	**3465**	**3433**	**3368**	**3235**	**3306**

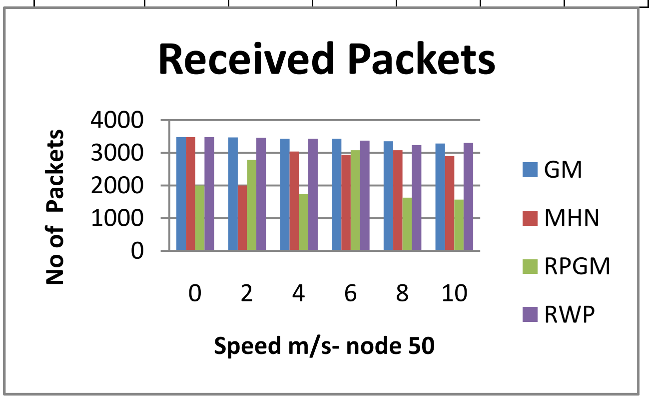


Table 6: Received Packets (RP) in the 50 nodes using different Mobility model with different Speed (maximum speed = 10 m/s). In **Table 6** and **fig 6** represents the Received Packets in accordance with Speed. By using 50 nodes, the performance of RWP, Gauss-Markov model gives better RP results. At 0 Speed, RWP, Gauss-Markov and Manhattan is giving 3480 packets are Received to Destination successfully and at Speed 2,4, Gauss-Markov model receive 3469,3434 packets respectively and at 6 Speed Gauss-Markov model receive 3429 packets successfully and at Speed 8,10, Gauss-Markov model receive 3353,3289 packets respectively also it differs with other models. In overall node 50 RPGM model is very less packets are received among the other models.

Table 7and fig 7: RP in 100 nodes

MM	**Node 100- Received Packets**					
SPEED	**0**	**2**	**4**	**6**	**8**	**10**
GM	**5789**	**5736**	**5657**	**5642**	**4590**	**5511**
MHN	**5798**	**5657**	**3512**	**4905**	**2431**	**1716**
RPGM	**5790**	**5287**	**5603**	**5471**	**3539**	**3101**
RWP	**5787**	**5477**	**5690**	**4487**	**5433**	**5463**

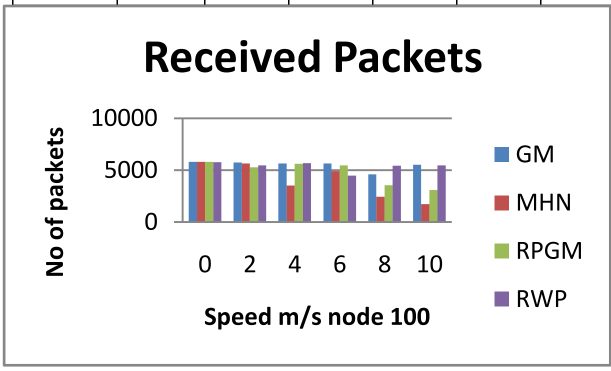


Table 7: Received Packets (RP) in the 100 nodes using different Mobility model with different Speed (maximum speed = 10 m/s). In **Table 7** and **fig 7** represents the Received Packets in accordance with Speed. By using 100 nodes, the performance of RWP, Gauss-Markov model gives better RP results. At 0,2 Speed, Manhattan is giving 5798,5657 packets are Received to Destination successfully and at Speed 4, RWP model receive 5690 packets respectively and at 6 Speed Gauss-Markov model receive 5642 packets successfully and at Speed 8, RWP model receive 5433 packets and at Speed 10,Gauss-Markov Model receive 5511 packets successfully and also it differs with other models. In overall node 100, the performance of RPGM model is very fewer packets are received among the other models.

Table 8 and fig 8: RP in 150 nodes

MM	Node 150- Received Packets					
SPEED	0	2	4	6	8	10
GM	9269	9208	3798	2646	1824	2150
MHN	9253	1575	2845	421	1093	325
RPGM	9262	9118	9085	2609	2130	902
RWP	6427	1412	6255	3827	2314	1206

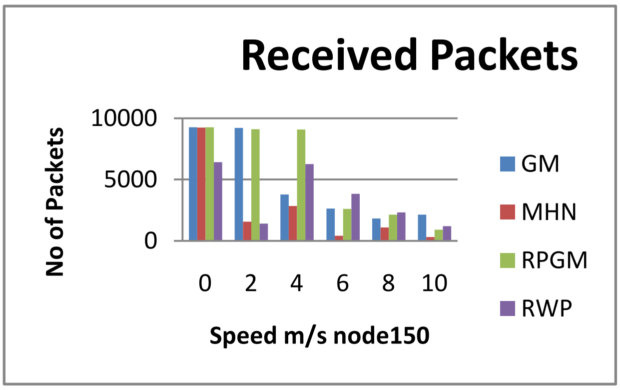


Table 8: Received Packets (RP) in the 150 nodes using different Mobility model with different Speed (maximum speed = 10 m/s). In **Table 8** and **fig 8** represents the Received Packets in accordance with Speed. By using 150 nodes, the performance of Gauss-Markov model and RPGM gives better RP results. At 0,2 Speed, Gauss-Markov Model is giving packets are Received to Destination successfully and at Speed 4, RPGM model receive 9085 packets Received and at 6 Speed Gauss-Markov model receive 2646 packets successfully and at Speed 8, RWP model receive 2314 packets and at Speed 10,Gauss-Markov Model receive 2150 packets successfully and also it differs with other models. In overall node 150, the performance of Manhattan model is very fewer packets are received among the other models.

Table 9: RP in 200 nodes

MM	Node 200- Received Packets					
SPEED	0	2	4	6	8	10
GM	2763	320	241	122	299	136
MHN	5273	1292	742	221	377	590
RPGM	1316	848	421	180	89	30
RWP	11572	1802	425	465	344	1438

Fig 9: RP in 200 nodes

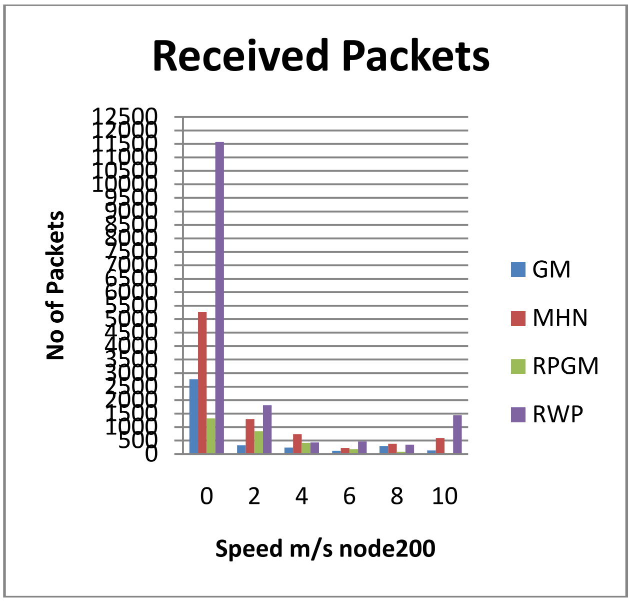
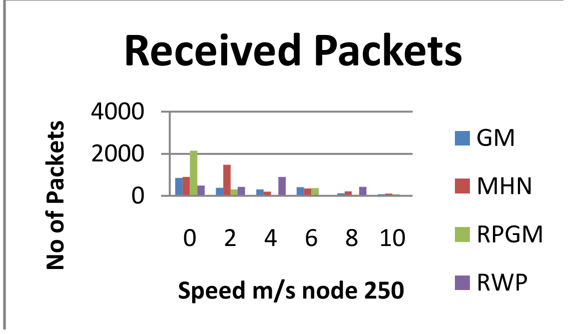


Table 9: Received Packets (RP) in the 200 nodes using different Mobility model with different Speed (maximum speed = 10 m/s). In **Table 9** and **fig 9** represents the Received Packets in accordance with Speed. By using 200 nodes, the performance of Gauss-Markov model and RPGM gives better RP results. At 0, 2,6,10 Speed, RWP Model is giving 11572, 1802, 465 1438 packets respectively and at Speed 4, 8 Manhattan model receive 742,377 packets respectively Received and also it differs with other models. In overall node 200, the performance of Gauss-markov model is very fewer packets are received among the other models.

Table 10: Received Packets (RP) in the 250 nodes using different Mobility model with different Speed (maximum

MM	Node 250- Received Packets					
SPEED	0	2	4	6	8	10
GM	856	377	303	408	129	81
MHN	903	1479	194	352	219	99
RPGM	2149	308	30	367	51	75
RWP	483	423	900	20	428	21



In **Table 10** and **fig 10** represents the Received Packets in accordance with Speed. By using 250 nodes, the performance of Manhattan model and RPGM gives better RP results. At 2, 10 Speed, Manhattan Model is giving 1479, 99 packets respectively and at Speed 0, through RPGM model 2149 packets Received successfully and at Speed 4, 8, through RWP model 900,428 packets receive successfully and also it differs with other models. In overall node 250, the performance of RWP model is very fewer packets are received among the other models.

Overview of Received Packets (RP): This Received Packets estimate gives us an idea about how successful the Received packets by using of the DSR protocol and Different Mobility models. Among different mobility models Manhattan model and RWP models received packets is good with generated Packets which we selected the models from group and random models. When the network is small then the Received packets is 95% and above. When the network is high (i.e. Nodes high) the performance of Received Packets is low.

7. CONCLUSION AND FUTURE WORK

In this paper, main aim is to prove that the analyzing behavior of different mobility models over DSR Routing protocol gives more different behavioral. The mobility model extremely affects the performance results of a Routing protocol in realistic environment. The behavior of the mobility models with DSR protocol have been compared and observed the high variance in results.

We have used NS2 simulation tool for analyzing with Control overhead, Generated Packets and Received Packets. Our findings show that this model fails to provide that existing Mobility models give high variance in Result. The Mobility models which we taken for analysis has same generated packets when the number of mobile nodes and Speed varies. The overall performance of Control Overhead (CO) the models Manhattan model and RPGM models exchanging the packets overall performance is good among the other models which we selected the models from group and random models. The overall performance of Received Packets (RP) is that the models when the network is small then the Received packets is 95% and above. When the network is high (i.e. Nodes high) the performance of Received Packets is low.

We are going to compare Obstacle Mobility Model with same nodes and Speed as future; by finding the defects and behaviors based on this a new method using graph-theory based model is found for best mobility results.

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