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Realistic Model of Mobility based on Location and Route for VANET

Shovita Verma, Rajeev Paulus, Aditi Agrawal, Manvendr

Abstract: In this research work, we propose two realistic mobility models named as location based realistic mobility model and route based realistic mobility model. In location based realistic mobility model speed and velocity is updating and route based realistic mobility model implies how many routes are available. With these models the targeted position is set and vehicles are moving according to the same position. Hence the problem of routing is resolved which is encountered in existing realistic mobility model. For implementation of our models, we use open source software named as network simulator NS-3 and traffic simulator MOVE with SUMO. We also compare our models with the existing realistic models in terms of performance matrices: packet loss, throughput and transmission delay. Since the vehicles are moving according to targeted position, so as application aspects we predict accidents and lots of traffic and with the help of prediction we will choose some optimal solutions.

Keywords: Dsrc, Ieee 802.11p, Location Based Realistic Mobility Models, Route Based Realistic Mobility Model, Ns-3, Vanet, Wave

I. INTRODUCTION

The application of wireless technology for moving vehicles, allows the establishment of a particular class of ad hoc mobile devices networks called ad hoc vehicular networks (VANET). Use from these networks establishment of a smart transport system, which offer enormous advantages for road safety, comfort and traffic efficiency [1]. To implement vehicular networks, numerous analyses have been conducted. In spite of, the adversity and the cost of substantial execution makes simulation extensively usage to certify the proposed explanation. Mobility models are able to extensively influence the outcome of simulation [2]. Simulation technology performs an imperative responsibility in VANET research. It is essential on the way to put together a realistic model of congestion in the simulation and finding explanation to figure out the problem [3].

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***** Correspondence Author

Shovita Verma, M. tech Scholar, ECE Department SHUATS, Prayagraj, India.

Rajeev Paulus Assistant Professor, ECE Department, SHUATS, Prayagraj, India.

Aditi Agrawal Assistant Professor, ECE Department SHUATS, Prayagraj ,India

Manvendr Assistant Professor ,ECE Department SHUATS, Prayagraj, India.

Selecting a significant level of detail about the models of mobility for VANET simulation is a significant resolution. The result of simulation for unrealistic mobility model is misleading or incorrect. Diversely, the addition of details takes time to be implemented and perfected, it can increase the difficulty and also reduce the speed of the simulation and mislead the attention from the research difficulty [4].

An impose aspect in a VANET simulation study is the requirement for a mobility model that reflects, as closely as possible, the actual presence of vehicular traffic. Our research work proposed the two realistic models of mobility which are named as realistic model of mobility based on location and realistic model of mobility based on route, and these models are compared to the existing realistic mobility model. Our proposed models overcome the drawback of routing which is encountered in existing realistic mobility model.

II. DSRC/WAVE SET

DSRC (Dedicated Short Range Communications) standard uses the frequency 5.9 GHz [2] and assigned for applications related to smart transport systems.

A. DSRC

DSRC is a set which is used for vehicular security messages. The rapid exchanges of security information, joint with ability of other roaming vehicles that might invisible to drivers in the proper approach pull out the concepts of security [5]. The DSRC set supports large bandwidth and rapid link method which is a fundamental constraint in automotive operations .This standard uses the IEEE 1609 workgroup standards which are shown in figure.1. DSRC supports the use of Internet protocols known for network layer and transport layers [6].

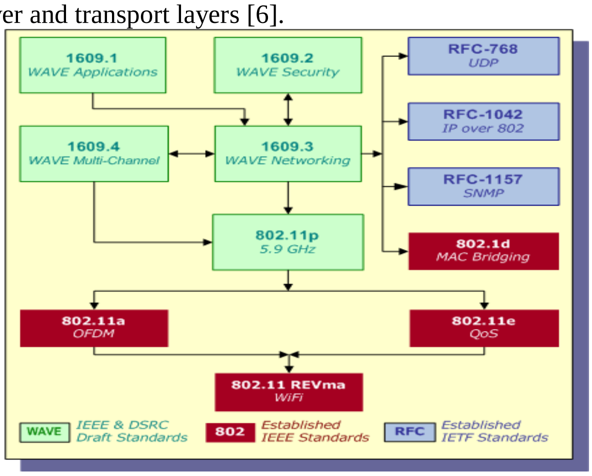

Fig.1. DSRC Standard suite [5]

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B. Wave Standard And Mac Protocol

WAVE (wireless access in vehicular environments) is an improvement to IEEE 802.11 standard to support vehicular communications that work at speeds of 200 km / h. It varies up to 1000 meters. The WAVE standard usage a concept of multichannel that can be used both for security and only infotainment messages [7].

MAC layer 802.11p collaborates with IEEE 1609.4 which provides multi-channel operations and route routing [8].

III. SIMULATION TOOLS FOR VANETS

Before implementing VANET in the real world, it is necessary to perform a series of analysis to assessment it. These analyses can be posh and very complicated to come into all kinds of situations. In VANET, simulations are categorized into two forms which are essential for good operation i.e., network simulation and traffic simulation [2].

A. Network Simulation

Network simulation is normally inured to model computer network configurations long before they are implemented in actual world. With simulation, it is possible to contrast the performance of diverse network configurations, which makes it feasible to identify and solve concert problems. Numbers of network simulators are available, including freely available software's such as NS-2, NS-3 and commercial tools such as OPNET2 [9].

B. Traffic Simulation

Most of the practical simulation of roaming nodes and their mobility should be deduce from the tracking files accessed in actual-world measurements. Though, full manage over all facet of the circumstances can easily be achieved if traffic simulation tools generate traces of movement. [9]. The process that takes a long time, from the collection of traces, from the analysis of data to the generation and implementation of models can finally make some investigations obsolete before they end. In our research work, we use mobility model generator for vehicles i.e. MOVE via promptly generate realistic models of mobility for VANET simulations. It is built on SUMO (SUMO Simulation of Urban Mobility).The result of MOVE incorporate information on actual vehicular actions that can be used instantly through suitable simulation tools [10].

IV. RELATED WORK

Numerous works are realized to propose a mobility model, as close as conceivable to the realistic case. In [10] author introduced a VANET tool MOVE with which users immediately generate realistic models of mobility for simulations of VANET. They also evaluated and compared ad-hoc routing performance analysis for vehicular motes with MOVE. And simulation outcomes access when motes are moving in a manner of realistic model of mobility is extensively dissimilar from the generally used random waypoint model. In [11] author offered a novel path for determining a realistic flow of traffic for traffic simulators, known as Flow Generator Algorithm. In [12] author presented a realistic model of mobility for VANET, which is based on actual street map information and on modeling of vehicles roaming on streets. Their model is able to use through simulation tools for further kinds of wireless networks. In [2], the authors compared the random model of mobility with the realistic model of mobility to examine its impact on the exactness of the simulation outcome. Our proposed models are location based realistic model of mobility and route based realistic model of mobility and these two models compared with the realistic mobility model.

V. OUR PROPOSAL

In our research work we proposed two models named as Location Based Realistic Model of Mobility and Route Based Realistic Model of Mobility. These two models help to overcome the routing problem which is encounter in existing Realistic Model.

A. Location Based Realistic Model of Mobility

In this model we turned number of nodes and also the number of connection from source to destination based on the same environment but we have to modernize the location in a realistic not a random. Realistic means in a real time environment how the vehicles are moving, what is the initial point and what about the destination point and currently where about the vehicles are moving and in which direction, so thus the speed and velocity is updating i.e. location based.

B. Route Based Realistic Model of Mobility

In this model, updating the velocity and speed allocating the route so the route function should be adapted on speed and location. After updating that location, which considered the speed and velocity, it updating the sum of routes i.e. how much routes are available. Because after the mobility only we come to know how much routes are available between source vehicle to destination vehicle.

With the help of flowchart our proposed work is carried out smoothly. The flowchart is represented in figure 2.

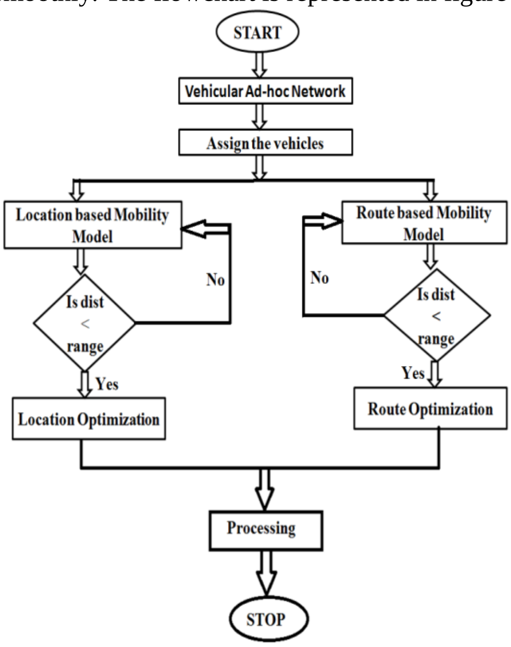

Fig.2. Flowchart

C. ALGORITHM

An algorithm is also proposed to transmit the packet from. S (source node) to the D (destination node).

Input: N number of vehicles.

Select source node S, destination node D and routing table from S to D.

Set k=1,path[j]; k is the constant value

Set j=1,Neighbor=0; j is the number of id

WHILE (Src!=D) do Src is the source node

Send route request RREQ[i] from source node S to its neighbor node and wait for route reply RREP[i].

IF(E[i] > = L[i])then //Location based routing E[i] is the initial energy

Neighbor++,Fid++; Fid is the forwarder id

ELSE

Discard the packet.

Add Energy from S to D in Route[j] and fid++;

END WHILE

Output: Packet transmission from source node S to destination vehicle D.

D. Performance Metrics

Throughput: Average number of successfully packets which is delivered on the communication network is defined as throughput [13]. It is calculated as [14]

Throughput = Total Number of delivered packets * packet size*8 bit / total duration of simulation. (1)

Delay Calculation: Time which is required for the messages to be passed among nodes in a network. It actually refers the time taken of a packet of data to go from one node to other node [15]. This comprises all possible delays.

It is calculated as:

□□□ − □□ −□□□ □□□□□ = (1/N) ∑ □ □=1 (□P□ − □P□) □ (2)

Where □P□ = Time at which nth data packet is sent

□P□ = Time at which nth data packet is received

N = Number of data packets received

Packet loss: Packet loss is calculated as percentage of lost packets corresponding to the packets sent. It is calculated as [14].

Packet Loss Ratio (%) = (1- received packet/sent packet) *100 (3)

VI.SIMULATION RESULTS

Simulation is categorized in two scenarios. In scenario I performance matrices dealing with number of nodes, while in scenario II performance matrices dealing with number of connections. We mainly worked on the three performance matrices i.e. throughput, packet loss and transmission delay which I already discussed in above section. Table 1 shows the simulation parameters.

Table- I: Simulation Parameters

PARAMETERS	CONFIGURATION
Simulation Tool	NS-3
VANET Tool	Move With Sumo
Graph Evaluation	Gnuplot
Packet Size	1024Kb
Simulation Time	15 sec
Number Of Nodes	10,20,30,40,50,60
Number Of Connections	5,10,20,40,60
Mac Protocol	802.11p
Mobility Model	Realistic Model/Location based realistic model/ Route based realistic model

A. Scenario. I

This scenario explained the performance of three metrics: packet loss, throughput and transmission delay regulated by the node density.

Figure.3 represents the performance of packet loss with node density. In Realistic model, packet lost is explicitly large, whereas in location based and route based realistic mobility model, packet loss is reduced to a minimum, which provides a better improvement to the realistic mobility model.

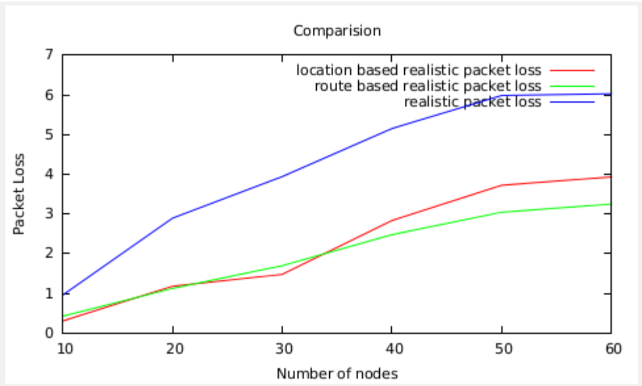

Fig.3. Packet Loss for the scenario I

Figure.4 represents the performance of throughput with the density of the network. With a larger number of nodes, throughput decrease in the realistic model of mobility. But in location based and route based realistic mobility model, it provides higher throughput than that of realistic model of mobility and hence its performance become better.

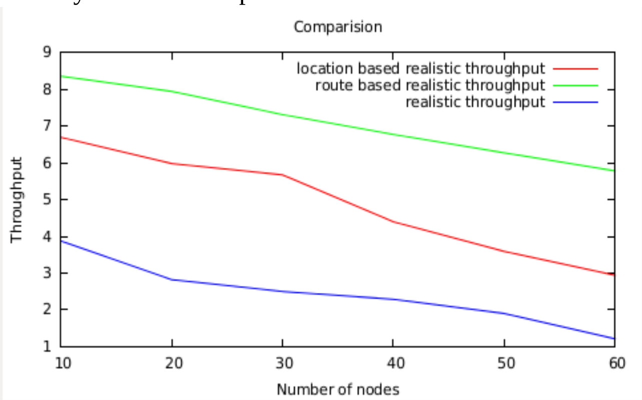

Fig.4. Throughput for the scenario I

Figure.5. represents the deviation of transmission delay by way of node density.

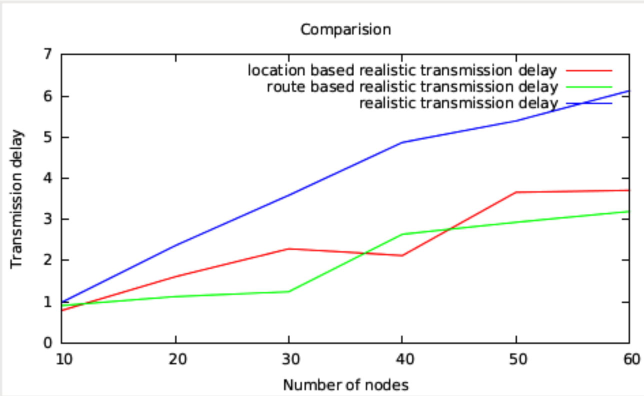

Fig.5. Transmission Delay for scenario I

In realistic model the transmission delay is high, but in case of location based and route based realistic model this parameter decreases and better result is achieved. The outcomes obtained from the realistic model of mobility based on location and route is a better strength for simulation in VANET.

TABLE - II: Packet loss of Scenario I

No. of nodes	Location based realistic packet loss	Route based realistic packet loss	Realistic packet loss
10	0.30255	0.4214	0.955
20	1.1781	1.1221	2.8992
30	1.4772	1.6964	3.942
40	2.8341	2.4789	5.153
50	3.7241	3.0446	5.988
60	3.934	3.2492	6.032

TABLE - III : Throughput of Scenario I

No. of nodes	Location based realistic throughput	Route based realistic throughput	Realistic throughput
10	6.6978	8.3633	3.873
20	5.9842	7.9479	2.819
30	5.6742	7.3169	2.4987
40	4.3971	6.7758	2.2873
50	3.5889	6.2748	1.8993
60	2.9372	5.7835	1.2081

TABLE – IV: Transmission delay of Scenario I

No. of nodes	Location based realistic transmission delay	Route based realistic transmission delay	Realistic transmission delay
10	0.7873	0.9061	0.9846
20	1.6074	1.125	2.3628
30	2.2868	1.2428	3.5875
40	2.1221	2.6399	4.8734
50	3.6598	2.9309	5.3958
60	9.7082	3.1949	6.128

B. Scenario.II

The three performance matrices that depend on number of connection are modified by keeping a steady number of nodes. Figure.6. represents the performance of packet loss by way of number of connections. In realistic model the packet loss is more in comparison to the location based realistic model and route based realistic model.

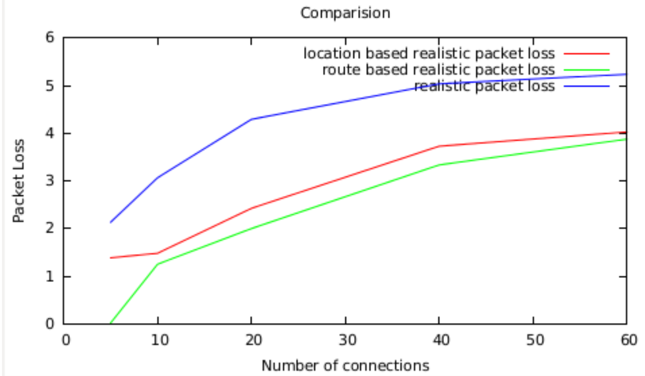

Fig.6. Packet loss for scenario II

Figure.7.shows the performance of throughput.

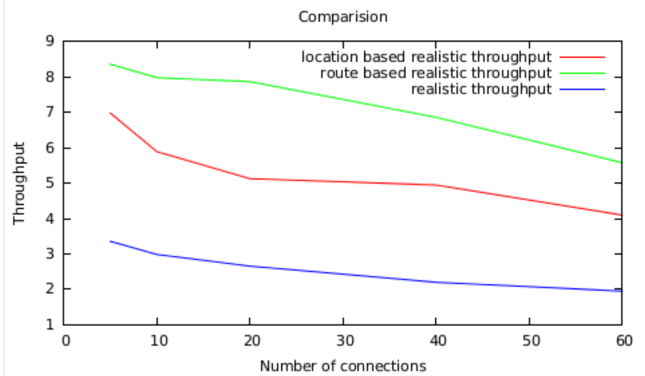

Fig.7.Throughput for scenario II

Throughput and the number of connection has an converse relationship with each other. In realistic model of mobility the throughput is less on comparison of location and route based realistic mobility model.

Figure.8.represents the transmission delay variation by way of number of connections. In realistic model, transmission delay is more in comparison to the location and route based realistic mobility model.

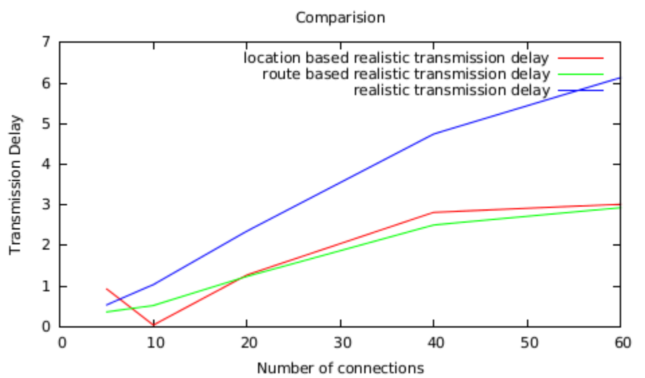

Fig.8. Transmission delay for scenario II

The same consequence derives from the scenario I. So our proposed mobility model provides the enhanced result of realistic model of mobility with the higher throughput along with the minimum packet loss and transmission delay.

TABLE -V: Packet loss of Scenario II

No. of connection	Location based realistic packet loss	Route based realistic packet loss	Realistic packet loss
5	1.3852	0.0180	2.133
10	1.4798	1.2511	3.066
20	2.4241	1.9987	4.295
40	3.7293	3.3361	5.04
60	4.0292	3.8783	5.24

TABLE - VI : Throughput of Scenario II

No. of connections	Location based realistic throughput	Route based realistic throughput	Realistic throughput
5	6.9843	8.3633	3.54
10	5.8923	7.9848	2.984
20	5.1259	7.8699	2.653
40	4.9465	6.8623	2.198
60	4.0978	5.5792	1.948

TABLE - VII: Transmission Delay of Scenario II

No. of conncetions	Location based realistic transmission delay	Route based realistic transmission delay	Realistic transmiss ion delay
5	0.927	0.3632	0.534
10	0.0385	0.5185	1.034
20	1.2716	1.2353	2.3528
40	2.8161	2.5048	4.747
60	3.0166	2.9319	6.1374

C. Simulation Setup for Vanet tool

In our work, we use MOVE with SUMO for representing the road in real time scenario. With the support of NS-3 we only deals with vehicles which is represented in form of nodes. But with the traffic simulator it is easy to create the real view as in this vehicles are present. Following figure.9 explains itself the traffic scenario. In the region where the green light is blow, the vehicles passes and where the red light blow, vehicles stopped.

We generate this scenario with the help of MOVE. In MOVE, we generate the mobility model and with the support of configuration we able to see the real view in the SUMO.

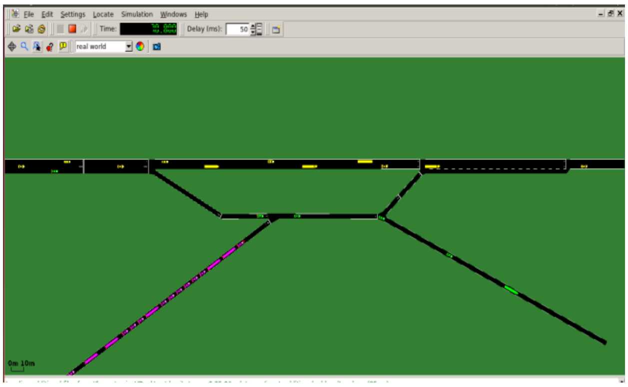

Fig.9. Real view scenario of road

VII. CONCLUSION

We proposed two realistic mobility models named as location based realistic mobility model and route based realistic mobility model. These models eliminate the problem of routing which is encountered in the existing realistic mobility model. Our proposed model enhances the performance matrices such as packet loss, throughput and transmission delay. On comparison to the existing realistic mobility model our model offered a minimization in packet loss and transmission delay and maximization in throughput.

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AUTHORS PROFILE

Shovita Verma is a M.Tech student in Electronics and Communication Engineering from SHUATS, Prayagraj. She received her Bachelor's degree hons from Ambalika Institute Of Management and Technology (AKTU) in 2017.She is a member of International Association of Engineers, The Society of Digital Information and Wireless Communications (SDIWC) and student member of IEEE. Her current research interests are Ad hoc network and Wireless Communication.

Dr. Rajeev Paulus received his Doctorate degree in Electronic and Communication Engineering from SHIATS, Allahabad and M.Tech. degree from the Department of Electrical Engineering, MNNIT, Allahabad. He received his Bachelor's degree in Electronic Engineering from University of Pune. He has been working in the Department of Electronic and Communication Engineering, as an Assistant Professor in Sam Higginbotom Institute of Agriculture, Technology and Sciences. He has published number of Research Paper in National, International Journals and Conferences. His specializations include Wireless Communication and Networks. His current research interests are Data Communication Networking, Optical Communication and Network, Network Management, 4G, IoT, M2M Communication Sensor and Adhoc-Network. He is Life member of ISTE and member of IEEE.

Aditi Agrawal is currently working as Assistant Professor in Electronics and Communication Engineering Department in SHUATS, Prayagraj and has a teaching experience of 8 years. She is currently pursuing Ph. D in ECE from the same University. She received her M. Tech degree in Wireless Communication Engineering from SHIATS-DU, Allahabad, India in 2012. She completed her B.E in ECE in the year 2002 from AK Garg Engineering College, Ghaziabad. Her specialization includes wireless communication and networks, sensor and ad-hoc networks and Fuzzy logic controllers. She has publications in national and International journals. She is a student member of IEEE.

Er. Manvendr Completed his B.Tech. in Electronics & Communication Engineering with 65.44% in the year 2009 from Hindustan College of Science & Technology (Uttar pradesh Technical University Lucknow) Farah,Mathura (U.P.) & Completed M. Tech in Electronics & Communication Engineering (Communication System Engineering) with CGPA of 9.37 in the year 2012 form SHIATS - DU, Allahabad.