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AN EFFECTIVE MODELING TO MINIMIZE THE TRANSMISSION TIME IN VANET BY REDUCING ROUTING OVERHEAD

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ABSTRACT: *Since vehicular ad hoc network (VANET) is a new paradigm of MANET where V2V & V2I communication takes place. Finding appropriate routes is an important issue due to the large number of obstacles and high mobility. In most of the previous work, the quality of the routing protocols analyzed with the change in the topology. Howeve,r in this work we have not focus only on the change in the topology, but consideration of distance between vehicles and other RSUs is also an important aspect for the reliability and efficiency of the protocol. In the simulation using IEEE 802.11p we have set up the topology around Farid Gate (Bahawalpur) and QoS parameters (throughput, Delay, Loss, and Routing Overhead) are evaluated using Omnet++, SUMO, JOSM.*

Keywords: VANET, Routing, SUMO, Omnet++, Overhead, IEEE 802.11p, QoS.

1. INTRODUCTION

VANET appears to be a noteworthy analysis space currently days. VANET could be multihop wireless network meant to supply a several road applications like info sharing between vehicles and web can be seen in figure 1, congestion notifications, safety alerts, congestion rejection and mobile picture show. VANET has significantly necessary applications in distributed and rural areas owing to the shortage of fastened communication infrastructure, that's the rationale why routing algorithms applicable for these circumstances and therefore the style of such a routing protocol is difficult. This field deals with the matter of facultative practical networked wireless communications among vehicles, the infrastructure, and private communication devices. Varied sorts of wireless communications technologies are projected for deploying VANETs. WLAN (IEEE 802.11 based) technologies are the foremost unremarkably used for deploying VANETs. The vehicles are equipped with wireless network interfaces that use either IEEE 802.11b or IEEE 802.11g standards for access media. However, these are general purpose standards and that they don't properly the necessities of high dynamic networks like VANETs. Currently, DSRC (Dedicated Short-Range Communication), known as conjointly IEEE 802.11p, has been projected because the communications customary specifically for VANETs.

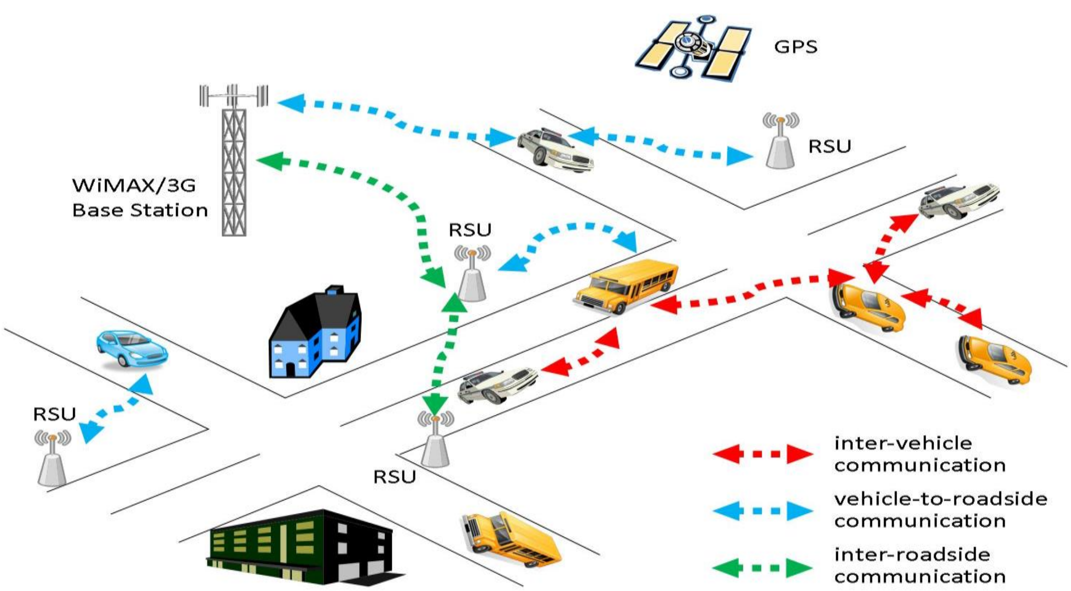

Figure 1: VANET Communication

There are main edges within the appropriate routing. First, expedient routing will merge multiple weak links in to robust link. Second, a standard routing must tradeoff between link quality & the number of progress that every transmission makes. Expedient routing exploits these occurrences to skip some hops & will increase the output at the same time. During this paper, they gift a trust model supported the concept of trust degree & apply this model to expedient routing in VANET. Our model builds a trust relationship for every node with all its neighbors & suggested trust degree. The recommendations improve the trust analysis technique for nodes.

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2. RELATED RESEACRH

A remarkable number of comprehensive research works have been done concerning vehicular adhoc network systems. Regarding routing and quality of service particular which are specifically applicable in these environments, few authors have analyzed the VANET challenges and proposed novel and different solutions. In [1] suggest a novel network coding-based cooperative ARQ method for Vehicular Networks, the proposed technique improves up to 80% the network's aggregated bandwidth by reducing the total transmissions, while the average time for transmission is significantly reduced. A. Fonseca [2] gives qualitative survey of position-based routing with consideration to the different environments. The major goal was to identify weather there is a good candidate for both environments or not. A differentiation of the environment characteristics was made and we found that urban and highway environments have different characteristics regarding the scenario, the mobility pattern and the mobility properties. A. Gorrieri [3] proposed a novel iAODV, derived from the AODV protocol by replacing the flooding mechanism used in its route discovery phase with the probabilistic forwarding mechanism denoted as IF thus reducing the control messages. M. Bakhouya [4] discussed video streaming using particular attention to errors and packet losses. A two-stage queue was proposed to perform congestion control without affecting network coding efficacy. L. Zhang [5] presents an effects of vehicle mobility in terms of inter-vehicle link available time and the average number of inter-vehicle link changes to maintain an active connectivity in VANET. The relative velocity between two adjacent vehicles is considered in the analysis. B.T. Sharef [6] gives an extensive survey on vanet about dominant parameters. C. Bian [7] identifies the challenges when applying NDN to VANETs, and proposes the corresponding solutions for a better support of content delivery required by most typical VANET applications. F. Go´mez [8] suggests proposal for TRIP (a trust and reputation infrastructure-based proposal for VANETs) as one of the first solutions to apply trust and reputation management techniques in these environments. It has been designed to be fast, light, scalable and accurate. H. Rahaman [9] provides certain techniques for implementing testable design of AND–EXOR based combinational networks are presented. For an n-input GRM/ESOP circuit with a cascaded EXOR-part, a universal test set of length (2n + 6) has been derived.

In [10-12] different authors proposes different techniques about content distribution in vanet.

In [13-19] suggest and analyze performance of vanet on different scenarios with dynamic parameters.

S. Tan [16] a trust thinking model is exhibited to evaluate reliablity. A trust based solution is proposed to choose a method with the most extreme way trust esteem among every single possible way between any two hubs in systems. Matlab is used to justify the performance of the system.

3. MODELING and ROUTING IN VANET

An ad-hoc network is actually an independent network that fills the need for the solution required for a particular problem or task. Without setting up complete network infrastructure temporary peer-to-peer connectivity is provided. Every node in this network is playing as a host and router both and also forwards packets of data to other nodes too. For this whole setup a routing protocol is required. One major approach for this is Distance-effect routing algorithm for Mobility (DREAM). DREAM uses the geographical location and distance of the nodes to send and receive data packets all over the network. For the sake of bounding flooding in a limited region and to determine the route geographical location is used. For the routing process of DREAM an intense scheme is used. Every node in the network stores the location of every other node in the network in a table that is known as location table, which is frequently flooded for the sake of updating the location of all the neighboring nodes in the network. Each location packet produced by the node contains coordinates of the node, current time and the speed with a direction. The updating prevalence depends upon the distance of nodes, as near as to source node as more as location packets sent. When a node decides to send a data packet to a particular node, firstly it checks its location table to get the geographical location of the destination node. If this search for geographical location of the destination node in the location table is successful then packet is sent to one-hop neighbors in the very direction of the destination node. But if the search for geographical location of destination node in location table fails then the protocol initiates the discovery process.

Table 1: VANET Routing Protocol Comparison

<table>
<tr><th>Protocol</th><th>Routing Strategy</th><th>Rout Selection/ Routing Metric</th><th>Scalability</th><th>Performance Attributes</th></tr>
<tr><td>ALARM</td><td>Multiple Path</td><td>Link value</td><td>High</td><td rowspan="11">I. Packet Forwarding
II. Flooding Operation
III. Path Strategy
IV. Loop Free
V. Overload
VI. Scalability
VII. Mobility Adaptive
VIII. Memory
IX. Message Delivery
X. Metrics</td></tr>
<tr><td>DREAM</td><td>Multiple Path</td><td>Hop Count</td><td>Medium</td></tr>
<tr><td>LAR</td><td>Multiple Path</td><td>Hop Count</td><td>Medium</td></tr>
<tr><td>AODV</td><td>Smooth</td><td>Hop Count</td><td>Medium</td></tr>
<tr><td>DSR</td><td>Smooth</td><td>Hop Count</td><td>Medium</td></tr>
<tr><td>ZHLS</td><td>Hierarchical</td><td>Shortest Path</td><td>Medium</td></tr>
<tr><td>GPSR</td><td>Single Path</td><td>Hop Count</td><td>High</td></tr>
<tr><td>GLS</td><td>Single Path</td><td>Hop Count</td><td>High</td></tr>
<tr><td>ZRP</td><td>Smooth</td><td>Shortest Path</td><td>Medium</td></tr>
<tr><td>DSDV</td><td>Smooth</td><td>Shortest Path</td><td>Medium</td></tr>
<tr><td>OLSR</td><td>Smooth</td><td>Shortest Path</td><td>Medium</td></tr>
</table>

We have used the preferred rate of flooding under both plans (urban and rural) to minimize the preparing time that happens on handling by every vehicle which reduces the overhead as well as delay. Mac layer planning utilizing 1/R component which can be accomplished utilizing TDMA technique. The TDMA timetable prompts a fitting pipelining of the spread stream of bundles along the pair lining arrangement of RNs. We take note of that such a pipelining spatial-reuse stream over the spine hubs can be imitated by stream controlling the source (through pacing of packet transmissions into the framework at the source RSU) when utilizing a CSMA/CA based MAC convention. The broadcast capacity represents the throughput capacity rate of information delivering from the V2V & V2I that are distributed across the urban and rural scenarios within a distance of the RSU. Shannon's formula is used in AWGN channel to evaluate the achievable link capacity level. However required calculations for different parameters can be done using formula 1, 2, 3 and 4 .

$$Packets\ Delivered = \frac{Number\ of\ packets\ sent\ from\ each\ source}{Number\ of\ packets\ received\ by\ each\ destination} \quad (1)$$

$$Throughput = \frac{Successful\ transmission\ of\ all\ packets}{Time\ of\ the\ last\ packet\ sent} \quad (2)$$

$$Loss = \frac{Total\ lost\ packets}{Total\ packets\ sent\ by\ each\ source} \quad (3)$$

$$Routing\ Overhead = \frac{Total\ packets\ sent\ from\ all\ devices}{Total\ packets\ received\ at\ each\ destination} \quad (4)$$

4. SIMULATION PHASES

We developed a mobility simulator that integrates many realistic parameters of vehicular movements that we used along with different tools to illustrate the effect of overtaking on mobility. In our perspectives, we plane to make more investigations into the impact of this parameter on the performance parameters, such as the end-to end delay.

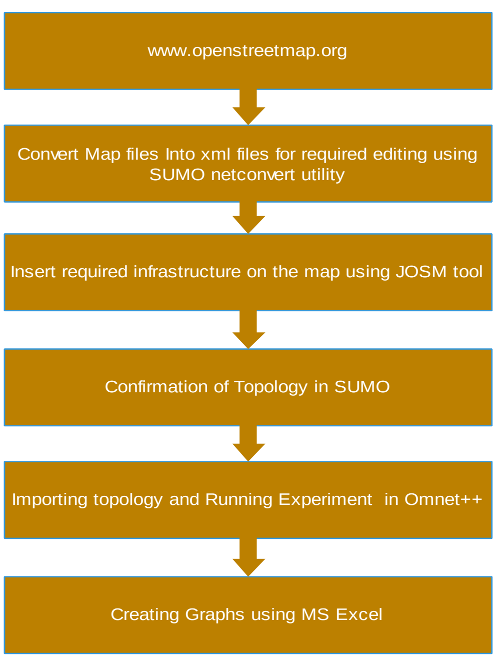

Figure 2: Experiment sequence flow

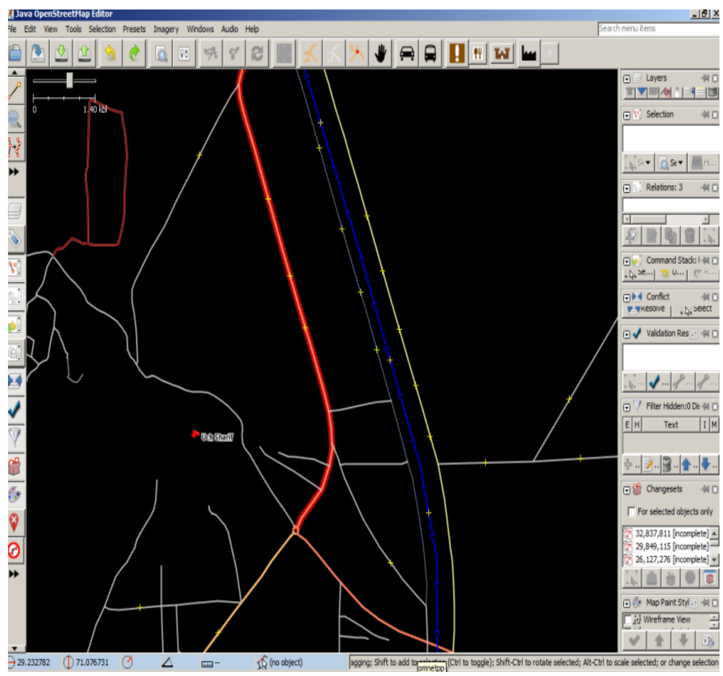

Figure 2 (a): JOSM Modeling for Uch Sharif Road-Rural

Since the experiment passes through different steps and tools as shown in figure 2, we have also describe the phases using pictorial representations in figures 2(a), 2(b), 3(a), 3(b), 4(a), 4(b) for urban and rural simulations.

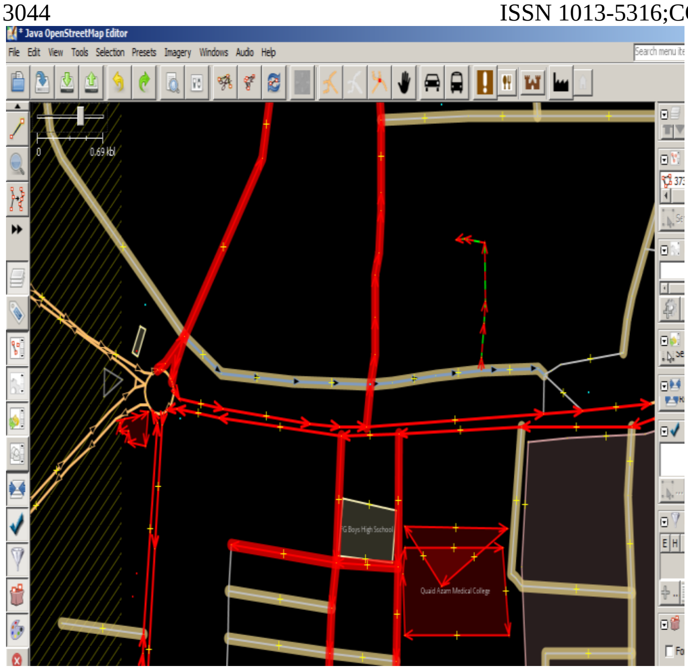

Figure 2 (b): JOSM Modeling for Farid Gate/Circular Road Bahawalpur-Urban

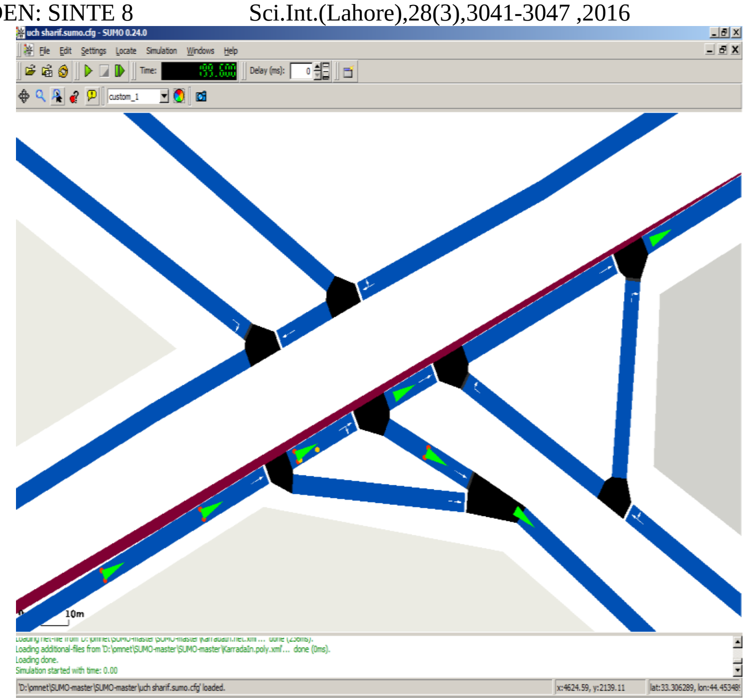

Figure 3 (a): SUMO View for Uch Sharif Road-Rural

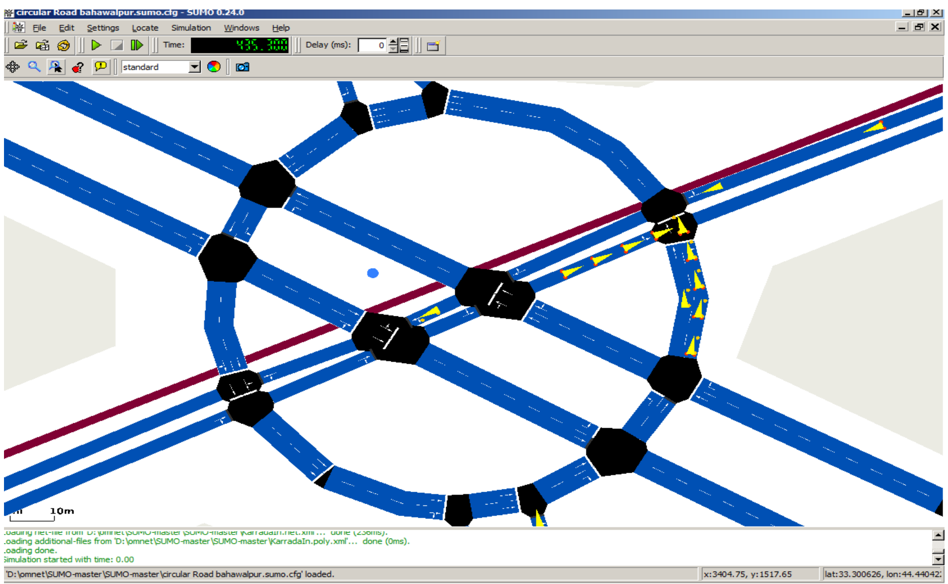

Figure 3 (b): SUMO View for Farid Gate/Circular Road Bahawalpur-Urban

Simulation setup for the proposed model is explained using flow chart in figure 2. Required map files (osm) extracted from openstreetmap.org, convert these files into xml files using SUMO *netconvert* utility, afterwards JOSM editor is used for desired editing in the map files. Network and scenario files imported into SUMO tool to confirm the movement of vehicles as required. Finally these files imported into Omnet++ to simulate and verify the desired model. Further parameters configured in Omnet++ are as follows in table 2.

5. RESULTS & DISCUSSION

Case 1: Packet Delivered case for Rural & Urban Scenarios

Since with the increase in the number of vehicles a source can detect many paths to the destination in case of mobility. In our simulation initially source starts in a V2V manner, while after few seconds due to mobility path changes. We have focus on the distance and try to select minimum hops for communication to take place without disruption. In figure 4(a) & figure 4(b) we can see that Packets delivered in proposed mechanism is increasing as the number of vehicles increasing. Thus proves that the distance technique is much better that just focusing on the change in the topology as other protocols do. Calculation is done using the formula 1.

Table 2: Experimental Configuration

Sr. #	Attribute/Parameter	Metric/Cost/Value
1	Data Link Layer Protocol	IEEE 802.11p
2	Routing Protocols	DREAM, DBR-LS
3	Coverage Area	1000m x 1000m
4	Transmitter with Range	Omni (200 meter)
5	Minimum Vehicle Speed	2m/s (Rural) 5m/s Urban
6	Maximum Vehicle Speed	15m/s (Rural) 25m/s (Urban)
7	Number of vehicles	10 (Rural) 20 (Urban)
8	Multimedia Contents	CBR
9	MSS Size	512 Bytes
10	Queue Mechanism	Drop Tail
11	Medium	Wireless
12	Bandwidth	2 Mbps
13	Experimental Time	250 seconds
14	Experimental Tools	Omnet++ (4.6) SUMO JOSM

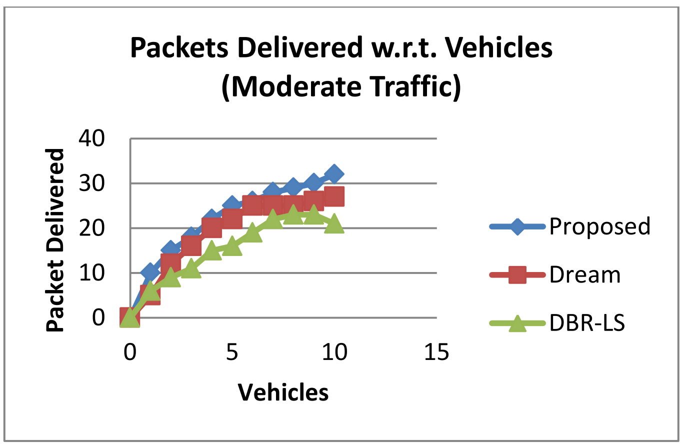

Figure 4(a): Packets Delivery Analysis (Farid Gate/Circular Road Bahawalpur-Urban)

It can also be analyze that for congested traffic on roads the maximum peak value for goes to 22 packets for each vehicle for the proposed mechanism.

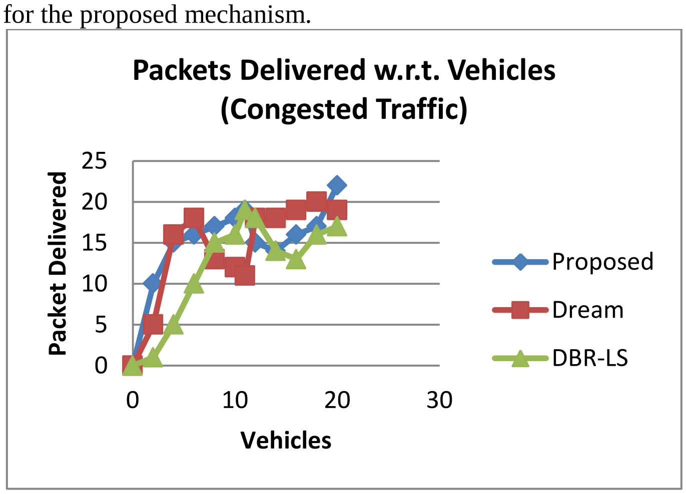

Figure 4(b): Packets Delivery Analysis (Uch Sharif Road-Rural)

Case 2: Throughput & Goodput cases for Rural & Urban Scenarios

Since packets delivered and throughputs are two different concepts exactly while transmitting data from one point to another point. Throughput and PD performance measures go hand in hand. Throughput is a measure of how fast one can actually send data through a network. So we have analyzed and evaluate both parameters separately. For example if a link bandwidth is 1Mbps and the end devices due to congestion can handle only 300kpbs, which means we cannot send more than 300kpbs through the link. The potential bandwidth is 1Mbps but actual rate at which one can send data is 300kbps. The throughput is 1/3 the bandwidth. This is one way of defining throughput which can be calculated using the formula 2, while goodput/routing overhead is calculated using formula 4, and can be analyzed through figure 5(a), figure 5(b), figure 6(a), and figure 6(b).

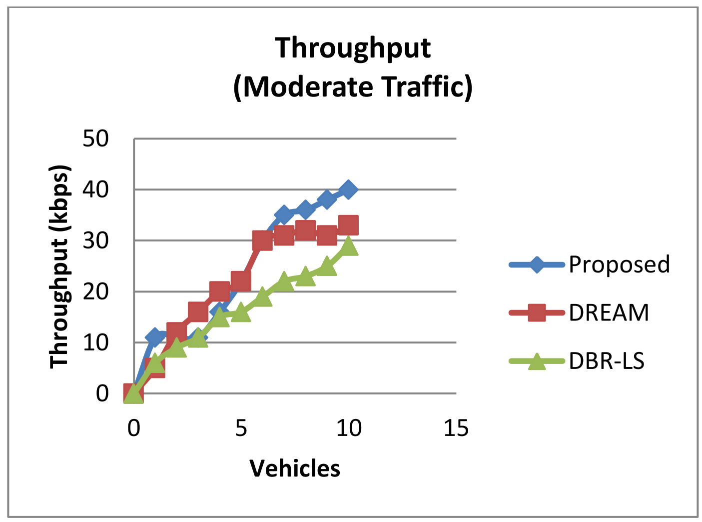

Figure 5(a): Throughput Analysis (*Uch Sharif Road-Rural*)

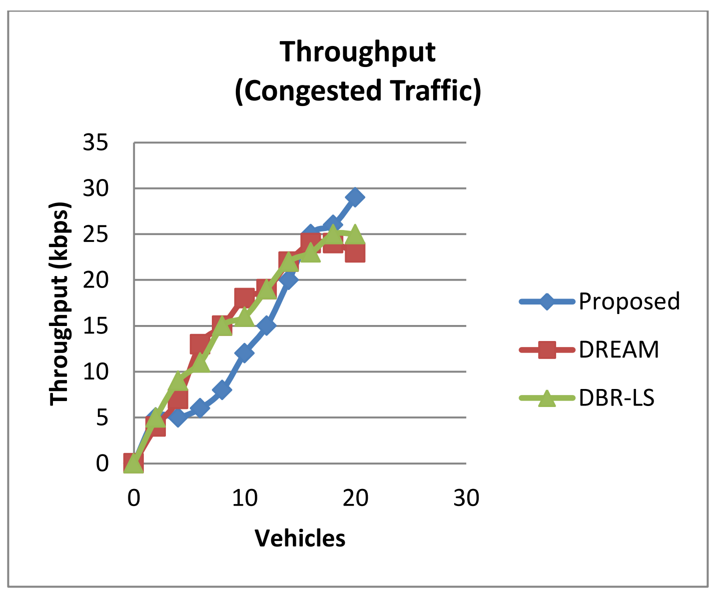

Figure 5(b): Throughput Analysis (*Farid Gate/Circular Road Bahawalpur-Urban*

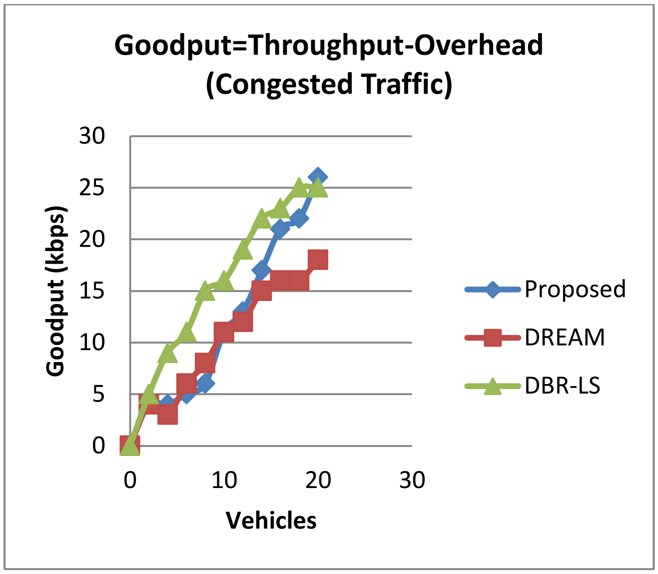

Figure 6(a): Goodput Analysis (Farid Gate/Circular Road Bahawalpur-Urban)

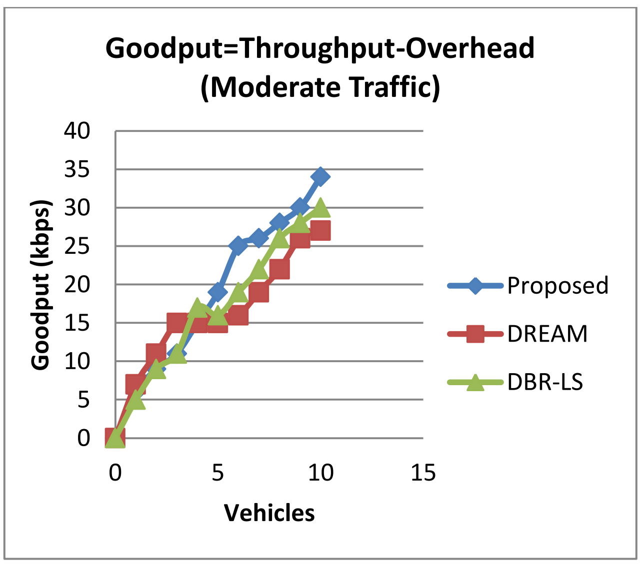

Figure 6(b): Goodput Analysis (*Uch Sharif Road-Rural*)

Case 3: Packet Loss case for Rural & Urban Scenarios

From the results we can see that loss in moderate traffic is less as compare to congested traffic, which also proves the packet delivery results. Since the increase in the broadcast for hunting required destination for each source collision may take place which leads to packet loss, on the contrary increase in the vehicles also gives many paths to communicate V2V, but loss is not due to the increase in vehicles but increase in the number of flooding during mobility. Even after reducing the routing overhead problem, the probability of reducing loss in heavy flooding is nominal. Loss is calculated using formula 3 which can be analyzed in figure 7(a) and figure 7(b).

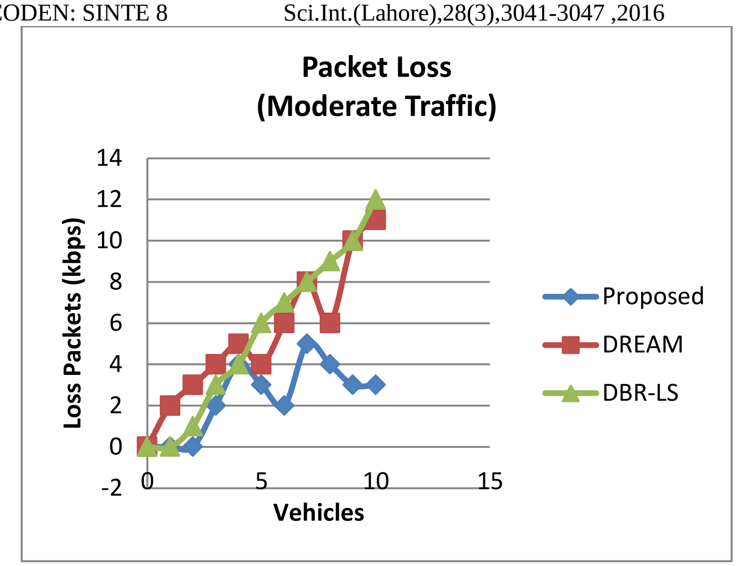

Figure 7(a): Packet Loss Analysis (*Uch Sharif Road-Rural*)

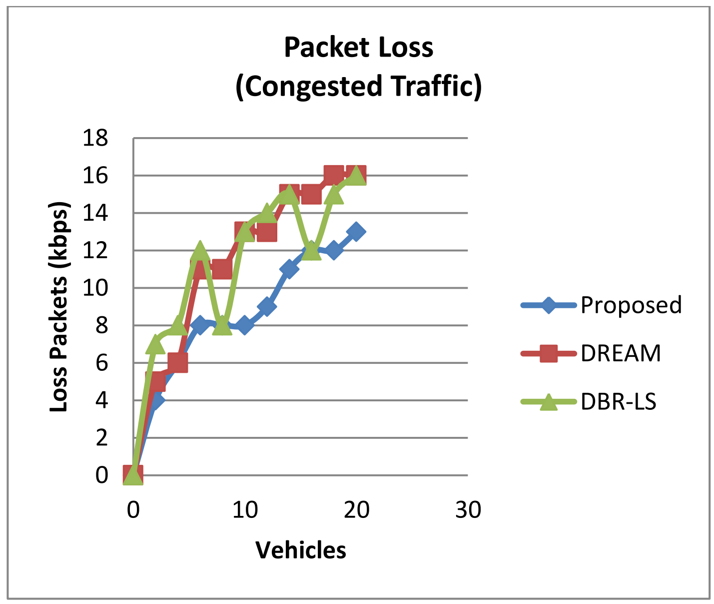

Figure 7(b): Packet Loss Analysis (*Farid Gate/Circular Road Bahawalpur-Urban)*

6. CONCLUSION & FUTURE WORK

From the results we have observed that during mobility topological change is not sufficient to decide the routing path because of dramatic change of location vehicles. However, focusing on distance (Position based routing) helps vehicles to deduce the path in an efficient manner. The relative speed between two adjacent vehicles is considered and we have experimented this model both in urban & rural areas with dense and moderate traffic respectively.

Although the methodical procedures are more complex, especially for haphazard moving, but they are able to effectively describe the vehicle mobility behavior. In future, we will perform widely simulation and rigorous analysis to verify the performance of under real environment. Further, we will put together this scheme with network coding and QoS assurance for further study.

REFERENCES

[1] A. Antonopoulos et al. Network coding- based cooperative ARQ scheme for VANETs. *Journal of Network and Computer Applications* (2013); **36**:1001–1007.

[2] A. Fonseca, T. Vazao. Applicability of position-based routing for VANET in highways and urban environment. *Journal of Network and Computer Applications* (2013); **36**:961–973.

[3] A. Gorrieri, G. Ferrari . Irresponsible AODV routing. Vehicular Communications (2015); **2**: 47–57.

[4] M. Bakhouya et al. An adaptive approach for information dissemination in vehicular Ad hoc Networks. *Journal of Network and Computer Applications* (2011);**34**:1971–1978.

[5] L. Zhang et al. Mobility analysis in vehicular ad hoc network (VANET). *Journal of Network and Computer Applications* (2013);**36**:1050–1056.

[6] B.T. Sharef et al. Vehicular communication ad hoc routing protocols: A survey. *Journal of Network and Computer Applications* (2014); **40**: 363– 396.

[7] C. Bian et al. Boosting named data networking for data dissemination in urban VANET scenarios. *Vehicular Communications* (2015); **2**:195–207.

[8] F. Go´mez Ma´rmol, G. Martı´nez Pe´rez. TRIP, a trust and reputation infrastructure-based proposal for vehicular ad hoc networks. *Journal of Network and Computer Applications* (2012); **35**:934–94

[9] H. Rahaman et al. Testable design of AND–EXOR logic networks with universal test sets. *Computers and Electrical Engineering* (2009); **35**:644–658.

[10] M. Gerla et al. Content distribution in VANETs. Vehicular Communications (2014);**1**:3–12.

[11] N. Mirjazaee, N. Moghim. An opportunistic routing based on symmetrical traffic distribution in vehicular networks. *Computers and Electrical Engineering* **47** (2015) 1–12.

[12] Y. Liu et al. The insight s of message delivery delay in VANETs with a bidirectional traffic model. *Journal of Network and Computer Applications* (2013); **36**:1287–1294.

[13] O.M.H. Rehman et al. Forward link quality estimation in VANETs for sender-oriented alert messages broadcast. *Journal of Network and Computer Applications* (2015);**58**: 23–41.

[14] P. Salvo et al. Investigating VANET dissemination protocols performance under high throughput conditions. *Vehicular Communications* (2015); **2**:185–194.

[15] W. Abdou et al. Using an evolutionary algorithm to optimize the broadcasting methods in mobile ad hoc networks. *Journal of Network and Computer Applications* (2011);**34**:1794–1804.

[16] S. Tan et al. Trust based routing mechanism for securing OSLR-based MANET. *Ad Hoc Networks* (2015); **30**:84–98.

[17] Fatima Saeed, Dost Muhammad Khan, Najia Saher, Faisal Shahzad, Noman Ammer, "A Novel Framework for Interactive Mobile Applications", Sci.Int. (Lahore), 26(5), pp.: 2089-2095, 2014, ISSN 1013-5316; CODEN: SINTE 8 300, ISI Indexed.

[18] Dost Muhammad Khan, Faisal Shahzad, Najia Saher, Nawaz Mohamudally, "A Relative Study of Load Balancing and Management Techniques in a Distributed System: IUB Case Study", Sci. Int. (Lahore), 27(4), pp.: 3171-3177, 2015, ISSN 1013-5316; CODEN: SINTE 8 300, ISI Indexed.

[19] Dost Muhammad Khan, Najia Saher, Faisal Shahzad, Nawaz Mohamudally, "The Integration of Networking and Computerization towards e-Education and e-Learning at the Higher Education and Research Institutions of Pakistan", INTERNATIONAL JOURNAL OF COMPUTER SCIENCE ISSUES (IJCSI), Volume 9, Issue 2, 2012 pp.: 546-551.