Adaptive Collision Detection and Avoidance Mechanism for Urban Traffic Management

Harjinderjeet Singh
Research Scholar (M.Tech)
BGIET, Sangrur

Manuraj Moudgil
Assistant Professor & Head IT BGIET,
Sangrur

ABSTRACT
The vehicular movement is very versatile in nature and produces a lot many movement patterns on the roads followed by the individual vehicle or group of vehicles. The vehicular networks are constructed in order to collect and share the information to and from the vehicles across the given area. The urban traffic management is the major source of the congested traffic pathways. Hence, the urban traffic requires the better management to avoid the traffic jams or snarls across the city highways. In this paper, we have proposed the method to detect and prevent the collision in the urban traffic by utilizing the distance based hurdle evaluation modules. The proposed model is equipped with several factors for the collision detection along with several movement pattern combinations. The proposed model is based upon the multiple active distance factors for the position evaluation of the other vehicular nodes or obstacles in the VANET cluster. The experimental results have been obtained in the form of various performance factors. The robust performance has been recorded for the proposed model in the form of End-to-End transmission delay, packet loss, number of hello messages on RSU and vehicles.

Keywords
Collision detection, collision avoidance, multiple active distances, Euclidean distance

1. INTRODUCTION
VANET is a vehicular ad hoc network. In VANET the cars or vehicles are moving as nodes during a network to make a mobile network. In a VANET each collaborating and involved vehicle act as a node or wireless router, and allowing them to create a wide range network between hundred to three hundred meters distance. When the automobile away from of the signal range then the automobile fall out of the network and another new upcoming auto –mobile will take part, due to the connectivity of automobile to one to another automobiles make a mobile internet. For a safety function estimated that the first system of this technology will integrate in fire and police vehicles [1].

1.1 Intelligent Transportation System (Intelligent VANETs)

1.1.1 Inter Vehicular Communication
Vehicular ad-hoc network is additionally known as intelligent transportation system (ITS). In vehicular ad-hoc network the vehicles communicate with one another known as node to node (N2N). It is also known as interring vehicular communication.

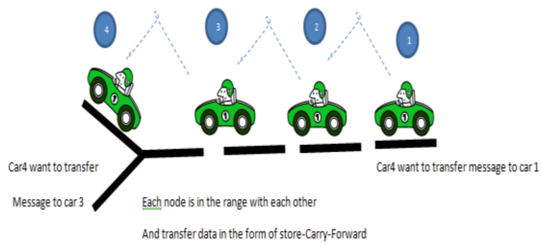

Figure 1: Inter vehicle communication [2]

It is the communication between nodes or cars. In inter node or automobile communication there two types of message forwarding techniques are used: The first one is Naïve broadcasting and second one is intelligent broadcasting. In naïve broadcasting, vehicles send broadcast messages periodically. When the message comes from a front vehicle, then the vehicle which receiving it sends its own broadcast message to vehicles behind it. The demerits of this technique are that the massive variety of message broadcasting are generated because of that the message collision or crash happens and also the message delivery rate become slow. In other word the large bandwidth is used. The other hand in intelligent broadcasting, if the vehicle finds that they receives identical message from behind, it assumes that a minimum of one vehicle within the back has received it and stop broadcasting.

1.1.2 Vehicle to Roadside Communication:
The vehicle-to-roadside communication configuration represent Single hop broadcast. In vehicle-to-roadside communication the roadside equipment or unit sends a broadcast message to all or any equipped nodes or vehicles within the surrounding location or area.

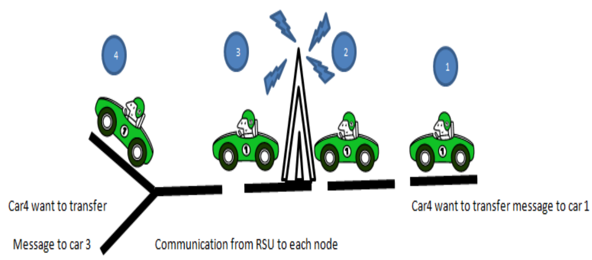

Figure 2: Vehicle to roadside communication [2]

The vehicle-to-roadside communication configuration supply large bandwidth link between vehicles and roadside units (RSU). The road side units (RSU) could also be placed each kilometer or less and road side unit also allow high data rates to be maintained in massive traffic. For example, once broadcasting dynamic speed limits, the road side instrument can verify the suitable speed according its internal traffic rules and timetable. The messages are broadcast at particular time interval by roadside unit including the speed limit and can compare any geographic or directional limits with automobile or vehicle data to work out if a limit speed warning applies to any of the vehicles within the enclosed location or area. If a driver of vehicle break the rule of the speed limit and violates it, then broadcast are going to be delivered a message to the vehicle within the type of auditory or visual warning and requesting driver that they ought to decrease their speed [2].

2. LITERATURE REVIEW

Razzaque Mohammad Abdur et al. (2014) have proposed the Mobility Pattern Based Misbehavior Detection to Avoid Collision in Vehicular Adhoc Networks [3]. According to the paper misbehavior detection scheme (MDS) and corresponding framework based on the mobility patterns analysis of the automobiles in the vicinity of concerned automobiles. Initial simulation results demonstrate the potential of the proposed MDS and framework in message's correctness detection, hence its corresponding applications in collision avoidance.

Zhang Linjuan et al. (2013) have proposed a multilevel information fusion approach for road congestion detection in VANETs [4]. According to the paper, the authors have proposed a multilevel information fusion approach by combining the fuzzy clustering based feature level information fusion (FCMA) and the modified Dempster–Shafer evidence reasoning-based decision level information fusion (D-SEMA). The FCMA can extract the key features from atomic messages, thereby greatly reducing the network traffic load. Furthermore, the D-SEMA mechanism is used to judge whether the road congestion event occurs.

Ghaleb F. etal. proposed (2013) "Security and Privacy Enhancement in VANETs Using Mobility Pattern"[5]. According to the paper in a VANET a mobility pattern based mistreatment detection approach. The offender is often categorized as outsider and insider. Outsider is a type of interrupter goal to intercept, wrong use or interrupt of the communications link between VANET's nodes. Insider, on other hand could be a legitimate node would possibly intentionally or unintentionally create unauthorized or undesirable acts (Mistreatment), like update or change, fabricate, drop the messages additionally to, and impersonate different node identities.

Prasad O. et al. Proposed (2012) "Cross Layer Optimization of VANET Routing with Multi-Objective Decision Making"[6]. According to the paper Vehicular Ad-hoc Network (VANET) and alternative mobile ad-hoc (MANET) network has completely different characteristics from each other. Because of the dynamic position of the automobile the routing becomes a complicated issue because they behave as routers and radio links are connected with purchasers. First he suggest CO-GPSR (Cooperative GPSR), updating of older GPSR (Greedy Perimeter Stateless Routing) that uses relay nodes that exploit radio path diversity during a vehicular network to upgrade routing performance. Then he formulates a Multi-objective decision making issue to pick optimum packet relaying nodes to upgrade the routing performance additional.

Dias .A.J. et al. proposed (2011) "Test bed-based Performance Evaluation of Routing Protocols for Vehicular Delay-Tolerant Networks" [7]. According to the paper on VDTNs the test bed performance valuation of DTN-based routing protocols is used. The target have judge and perceive however common routing ways go through in distributed or divided opportunistic transport network situations. The paper is representing Spray and Wait protocol. In networking the physical process of moving of vehicle or automobile and opportunistic connectivity to vehicle data between disconnected elements is the idea of this protocol. According to suggested protocol the buffer size is decreased as a result of this protocol accomplished the flooding sending single copy of message however affected from long delivery delay.

3. OBJECTIVES

1. To design the mechanism for detection of point of collision.
2. To design the mechanism for the collision prediction using the movement analysis of vehicle node.
3. To design the mechanism to avoid the prediction collision by altering the movement vehicular.
4. To implement the security mechanism in Network Simulator 2 (NS2).
5. To obtain and analyze the results.

4. METHODOLOGY

1. We will start our research project by conducting a detailed literature review on the prankster attack in case of selfish driver in VANETs to know the problem in detail.
2. A detailed security mechanism would be designed to prevent the prankster attack in VANETs.
3. The simulation would be implemented using Network Simulator (NS2).
4. The obtained results would be examined and compared with the existing security mechanism to address the similar issues.
5. Waterfall development method is ideal for projects with clear task formalization and fixed scope of work like this research work, i.e. for small and medium-size projects.
6. Waterfall methodology comprises the following steps: working out system requirements and drawing up.

5. RESULTS AND DISCUSSION

The results from the simulation has been obtained in the form of various performance parameters which includes the End-to-end delay, Packet Loss, No. of Hello Messages (HM) at RSU, No. of HM transmitted when 100% vehicles are in hazard zone and Throughput. Packet loss increases the retransmissions and hence the network load increases which ultimately gives a rise to end to end delay. The proposed work has been entirely based upon the detection and updating of the hurdles in the vehicle paths which are responsible for flooding data and delivering wrong information and the membership of nodes within the VANET cluster. For the updates, the vehicles flood the data in the cluster, due to which the network load increases than the normal situations. The aim of this research is to lower the data volume during the detection and updating periods in comparison with the existing schemes. The proposed model has been designed with the communication efficiency, which controls the data volumes during the proposed work simulation.

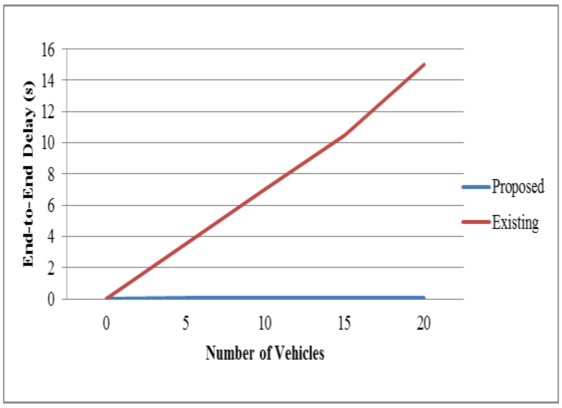

Figure 3: End-to-End Delay

The transmission delay is the parameter which indicates the total time taken by a packet to travel across the transmission link. The delay is added at the maximum rate of 0.064 microseconds in the given simulation, which indicates the ideal data transfer across the given simulation. The transmission delay indicates the network latency caused due to the load across the path. The above graph indicates the comparison with the existing model results which have a maximum delay of 15. So, delay is reduced a lot and network performance is far much better than the existing scheme.

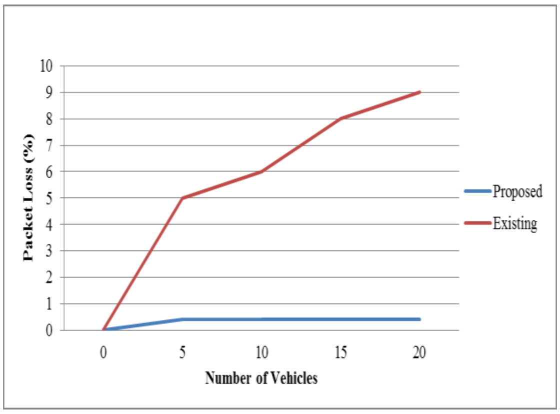

Figure 4: Packet Loss

The data loss is the parameters indicator of the loss of the packets due to the traffic flow overheads or the bottlenecks. The proposed model records the constant delay after the network convergence period. The packet loss has been recorded at less than 0.4 %, which is considerably very low. The low packet loss indicates the effectiveness of the proposed model in comparison with the existing model which has a variable packet loss at a maximum rate of 9 which is very high in comparison.

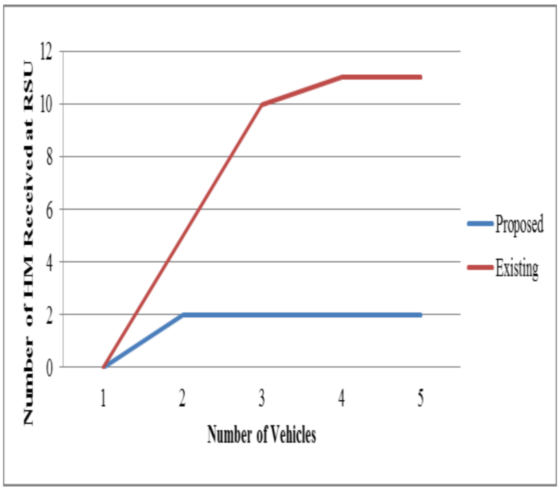

Figure 5: Number of HM Received at RSU

Number of HM received at RSU is the total number of Hello Messages received at RSUs for making connections with nodes which includes a new connection and connection after any disconnection. Thus, high network performance is obtained as the total load for connectivity at RSUs is 2 messages only.

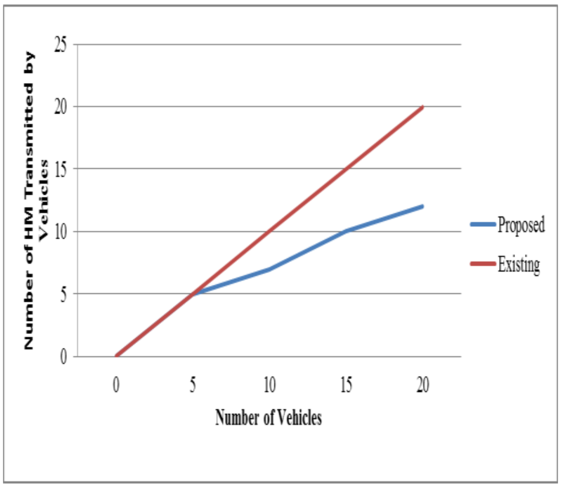

Figure 6: Number of HM Transmitted by Vehicles when 100% Vehicles are in Hazard Zone

Number of HM transmitted by vehicles to each other or to the RSUs when all the vehicles are in hazard zone and needs timely delivery of messages is reduced from 20 (existing) to 12 (proposed) which increases the reliability and decreases the network load for a better performance in real time scenarios. The table given below contains comparison values between the existing and proposed schemes against the parameters of End-to-End Delay, Packet Loss, Number of HM received at RSU Number of HM transmitted by vehicles when 100% vehicles are in hazard zone:

Table 1: Comparison Values of Various Parameters with the Existing Model

Sr. No .	End-to-End Delay		Packet Loss	
	Existing	Proposed	Existing	Proposed
1	0	0	0	0

2	3.5	0.054043652	5	0.4
3	7	0.057930573	6	0.4
4	10.5	0.058366259	8	0.4
5	15	0.064048666	9	0.4

Table 2: Comparison Values of Various Parameters with the Existing Model

Sr. No	No. of HM Received at RSU		No. of HM transmitted by vehicles when 100% vehicles are in hazard Zone	
	Existing	Proposed	Existing	Proposed
1	0	0	0	0
2	5	2	5	5
3	10	2	10	7
4	11	2	15	10
5	11	2	20	12

6. CONCLUSIONS

The proposed model has been designed to deploy the collision-free environment in the vehicular ad-hoc networks (VANETs). The proposed model has been designed for the detection of the hurdles produced by the variety of reasons such as mud slides, tree falling, hill sliding, traffic jams or collisions occurred due to node failure and attacks. The proposed model uses the stationary hurdles tracing with long range decreasing distance with 100-meter prevention perimeter. The backup path is calculated once the hurdle is detected to avoid the hurdle area over the roads. The distance of 100-meter has been also utilized as the preventive measure for the purpose of collision detection to avoid the area of collision over the road. Also, the proposed model has been empowered for the long range connectivity with the area of blank RSU connectivity by enabling the node-to-node and node-to-RSU model. The vehicular node connects itself with the neighboring node while the RSU is not in range with the assurance of the vehicular node it is being connected with some of the RSU. The proposed model has been evaluated on the basis of various performance parameters. The proposed model has performed better than the existing models. The experimental results have proved its efficiency which is obtained by AODV and EDHRP. With the help of EDHRP, network overhead is highly reduced and high reliability is achieved.

7. FUTURE SCOPE

The proposed model can be enhanced in many ways. The proposed model can be improved by using the location based distributed hash tables to manage the local connectivity in the continuous connectivity scenario. The region-wise non-overlapping blocks based distributed hash tables can be utilized for the regular connectivity as well as the backup path information. Also the swarm intelligent solution can be employed for the bio-inspired intelligent and complex solution calculation for the smoother vehicular movement. The proposed model can be enhanced for the security of the extended transmission range links through the one-hop nodes. Also the more bypass routing methods can be applied to the real time VANET application of the proposed model to create a highly robust and flexible security and movement management model.

8. REFERENCES

[1] Farkho Alisherov "The Security in the Vehicular Ad Hoc Network (VANET) Using Expedite Message Authentication Protocol (EMAP)"Asia-pacific Journal of Multimedia Services Convergence with Art, Humanities and Sociology,Vol.1, No.2, pp. 101-108,2011.

[2] Ravinder Singh et al. "Vehicular Ad-hoc Network: A Review" Int. Journal for Advance Research In engineering and Technology, ISSN 2320-6802, Vol. 2, Issue 7 July- 2014

[3] Mohammad Abdur Razzaque et al. "Mobility Pattern Based Misbehavior Detection to Avoid Collision in Vehicular Adhoc Networks" Springer International Publishing Switzerland, pp. 300–303, 2014.

[4] Linjuan Zhanga et al. "A multilevel information fusion approach for road congestion detection in VANETs" Mathematical and Computer Modelling, pp 1206-1221, 2013.

[5] Ghaleb et al. "Security and privacy enhancement in Vanet's using mobility pattern." IEEE, ISSN: 2165-8528, pp. 184 – 189,2013.

[6] Prasad et al. "Cross layer optimization of VANET routing with Multi-objective decision making." Telecommunication Networks and Applications Conference (ATNAC) IEEE, pp. 1-6., 2012.

[7] João A. Dias et al. "Testbed-based Performance Evaluation of Routing Protocols for Vehicular Delay-Tolerant Networks" IEEEE, 2011.

[8] J. Deeksha et al. "Hardware Implementation of Collision Avoidance in inter-Vehicular Adhoc Network Using Zigbee and Stellaris ARM Cortex-M4"Int. Journal of engineering and application, ISSN : 2248-9622, Vol. 3, Issue 5, pp. 1564-1568, Sep-Oct 2013.

[9] Muhammad A. Javed et al. "An Efficient Data Dissemination Scheme for Warning Messages in Vehicular Ad Hoc Networks" IGI Global, 2013.

[10] Namrata Singh et al. "Avoiding Prankster Attack in Case of Selfish DriverUsing the Location Aware FixedNodes - A Review" International Journal of Engineering Trends and Technology (IJETT),Vol. 12, Number 7, Jun 2014.

[11] Namarata Singh et al. "Roadside Traffic Management Unit to Mitigate Prankster Attack in VANET Cluster" International Journal of Science and Research (IJSR), ISSN: 2319-7064,Vol. 3, Issue 9, September 2014.

[12] Chia-Chen Hung et al. "Mobility Pattern Aware Routing for Heterogeneous Vehicular Network" IEEE, 2008.

[13] Needhi Lathar et al. "Intelligent Hazard Routing for VANETs With Point of Interest Evolution Technique" International Journal of Computer Science and Mobile Computing, Vol. 4, Issue. 7, pg.116 – 121, July 2015.

[14] PriyankaSoni et al. "A Review of Impact of Sybil Attack in VANET's" International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 5, Issue 5, May 2015.

[15] Kavita Sharma et al. "Energy Efficient Power Aware Multipath Dynamic Source Routing–A Survey" International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 5, May 2013.

[16] Ajay Dahiya et al. "TCP Analysis under Various Mobile Adhoc Networks" IJMIE, Vol. 2, Issue 3, March 2012.

[17] Pratibha R et al. "Intelligent Traffic System for VANET-Enabled Vehicle Platoon" IJEDR, ISSN: 2321-9939, Vol. 3, Issue 2, 2015.

[18] Marcelo G. Rubinstein et al. "A Survey on Wireless Ad Hoc Networks" Springer US, 2006.

[19] Nancy Rai et al. "VANET Routing with Cognitive Radio Network over High Density Road" International Journal of Advanced Research in Computer Science and Software Engineering, Volume 5, Issue 9, September 2015.

[20] Sherali Zeasally et al. "Vehicular ad hoc networks (VANETS): status, results and challenges" Springer,2010.

[21] Manjunath P S et al. "A Review on Security and Challenges for Vehicular Ad Hoc Networks" International Journal of Emerging Technology and Advanced Engineering, Vol. 4, Issue 5, May 2014.

[22] Deepti et al. "REVIEW PAPER ON SECURE VEHICULAR COMMUNICATION International Journal of Scientific Research Engineering & Technology (IJSRET), ISSN 2278 – 0882, Vol. 4, Issue 5, May 2015.

[23] Tashakkori Hashemi et al. "Load balanced vanet routing in city environments."Vehicular Technology Conference (VTC Spring) IEEE,pp. 1-6., 2012.

[24] Ghassan Samara et al. "Security Analysis of Vehicular Ad Hoc Networks (VANET)." Network Applications Protocols and Services (NETAPPS) IEEE, pp. 55-60., 2010.

[25] Yi Qian et al. "Performance evaluation of a secure MAC protocol for vehicular networks." Military Communications Conference IEEE, pp. 1-6, 2008.

[26] Harjinderjeet Singh et al. "Collision Avoidance Mechanism Using Multi-Layered Collision Detection Model For Vehicular Network" IJCST, Volume 3, Issue 4, Jul-Aug 2015.