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A Survey on Various Data Dissemination Approaches in Vehicular Ad Hoc Network

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Abstract

Objectives: The main objective of this work is to survey various techniques used in the field of data dissemination in Vehicular Ad hoc NETwork (VANET).
Methods: There are different approaches used to improve data dissemination in vehicular ad-hoc network. Such approaches are context-aware information dissemination, Space-time network coding, geo-based Named data networking forwarding strategy, Route-based data pre-fetch model and etc.
Findings: VANET has become more popular in the areas of vehicular transportation systems. Data dissemination which is the base of communication plays a major role in VANET system. Various data dissemination technologies were developed for avoiding the issues such as data routing, vehicle mobility and network security. This paper provides brief explanation about several data dissemination techniques and compares their performance based on the output parameters, merits and demerits. Comparison result shows that, the prefetching based data dissemination technique outperforms than other techniques.
Application/ Improvements: the result of this work shows that prefetching based data dissemination technique provides better result than the other dissemination techniques.

Keywords: VANET, data dissemination, data routing, vehicle mobility, network security

1. Introduction

VANET is considered as the multi-hop ad-hoc network in which vehicles can communicate among themselves through wireless technology [1]. Vehicles in VANET are equipped with On-Board Units (OBUs), such as positioning systems, computing resources, sensing devices and wireless communication devices. It should be noted that, vehicles does not communicate with Road Side Units (RSUs) that has fixed infrastructure and present along the road sides. There are two classifications of communication namely Vehicle to Vehicle (V2V) communication and Vehicle with Roadside infrastructure (V2R) communication. V2V is the distributed and self organized network whereas V2R is interconnected to the backbone network [2].

The primary issue in this VANET is data dissemination. There were several data dissemination techniques[3] such as cluster based message dissemination, demand-based location dependent data dissemination and unicast pull based approach for data dissemination have been developed. In cluster based message dissemination approach, cluster head initially sends an alert message to other clusters. Then the node that receives the alert message informed all other nodes. However, this approach resulted in maximum overhead. In demand-based location dependent data dissemination, a framework was proposed in which schemes were developed for aggregating the demands of drivers, to understand data dissemination condition and scheme for choosing data to be forwarded based on the aggregated demands and data dissemination condition. However, framework was not so elaborated. In unicast pull based data dissemination approach, authentic vehicles were identified and utilized for disseminating the data. By using this approach, congestion occurred in channels was reduced by removing periodic dissemination of beacon messages. But it takes more time for computation. This paper will provide additional explanation about techniques that were utilized for data dissemination in VANET

In [4] developed a new data dissemination technique for distributing data in Vehicular Ad hoc NETwork (VANET). Vehicle to Vehicle (V2V) scenario was adapted in this technique. The proposed dissemination technique mainly concerned with the way of connectivity between vehicles and the way of removing the congestion from the channel for packet forwarding. Each vehicle is associated with digital map for providing complete explanation about the road network. Vehicles presented in the VANET estimates its initial position by utilizing Global Positioning System (GPS) and found the location in the digital map. After the location identification, packets were ready to transfer from the source to destination. This method increases the data delivery ratio, reduces the packet drop. Bit it faces intermittent node failure.

In [5] proposed the reliable scheme for data dissemination in VANET. This proposed dissemination scheme was designed based on the modified link topology and connectivity of the VANET. Dynamic prediction was utilized in this scheme for enhancing the reliability of data dissemination among vehicles. In addition with this reliability improvement, assisted nodes that are arranged at the intersection of coordinates should be considered for enhancing both efficiency of data dissemination and network connectivity. This method maximizes the delivery reliability and reduces the delay. However, it does not save bandwidth.

In [6] recognized the problem of inter-vehicle data dissemination in VANET by utilizing network coding. Initially, Probability Mass Functions (PMFs) at the time of completion of dissemination were derived for analyzing the performance of data dissemination with random broadcast and with network coding. Then, in case of one dimensional infinite lattice network, network coding was directly applied for estimating steady state data dissemination velocity. Performance results of network coding related to random broadcast and perfect feedback was calculated in the presence of Rayleigh fading wireless links. This method was a Good predictor of dissemination velocity and dissemination completion time. But network coding will not suitable for large data size.

In [7] presented the effective data dissemination technique in which each Road Side Unit (RSU) broadcasted the messages based on time, policy or network-specific criteria. Vehicles that were reaching RSU received the broadcasted message from RSU and decoded it using rateless coding. In order to improve the decoding distance, rateless coding was incorporated with Store-Carry-Forward (SCF) technique. Here, the limitations of buffer capacity were overcome by using buffer management mechanism. At last, patterns of message dissemination were estimated around each RSU. This method minimizes the system complexity and overhead using rateless coding. However, coding was inefficient.

In [8] proposed Tailor-p and Tailor-f algorithms for data dissemination. In Tailor-p algorithm, Adapted Bipartite-based heuristics (ABS) was developed for minimizing the topology-aware intersection selection issue. Here, geographic area was converted into the bipartite graph to obtain exact solution. Then, obtained graph was again converted into original planar graph and tuned the solutions for solving the issue of general geographic area. In Tailor-f algorithm, greedy heuristics was utilized to overcome the issue of Traffic Correlation (TC) by achieving best heuristics as approximate solutions. Both Tailor-p and Tailor-f algorithms were developed for installing Access Points (AP) using less number of intersections and finally used for disseminating the data. Tailor-p has low overhead and less computation time. Greedy heuristics may reduce the reliability of VANET due to packet loss and delay.

In [9] developed a decentralized Context Aware Information Dissemination (CAID) approach for information dissemination in which concept of Ants' pheromones spreading principles was adapted. By using this proposed approach, if any unusual event was detected, then the safety message was generated for alerting other vehicles and RSUs. Based on the principle of ant communication, relevance value of safety messages that contains information about severity and event types is considered as pheromone. Here, the relevance value minimized with respect to the time and distance till the elimination of safety message from the system. In this method, there was no need to predefine the geographical area. But it was not applicable for congestion avoidance.

In [10] proposed the scheduling based data dissemination strategy for avoiding the problem of collision. For designing this strategy, data dissemination scheduling framework was developed. In addition with this framework, Space–Time Network Coding (STNC) was utilized for enhancing the efficiency of data dissemination. STNC provides low detection complexity. STNC was mainly used for transmitting data. In this method, coding coefficients for the coded packet were generated based on the code-division multiple-access protocol. Then the output signal was determined using matched filtering method. This will reduce the dissemination delay. There was no collision transmission, reduces the dissemination delay. STNC does not provide effective coding gain and it will not always give better results

In [11] modelled the two-way road network [12] for disseminating the data in two directions by using network coding. In this model, encountering phase and separated phase were developed for analysing dissemination. In encountering phase, overlap between the broadcasting coverage areas of two disseminators was occurred and the vehicles from two directions received the packets concurrently from those two disseminators. Then, probability mass functions of dissemination completion time were finally determined. In separated phase, there was no overlapping of broadcasting coverage areas. The effect caused due to the opposite direction on the dissemination velocity was measured using dissemination velocity, dissemination slope and cache capacity. It effectively supports the two way communication. However, it was difficult to process the large size of data.

In [13] presented the geo-based Named Data Networking (NDN) forwarding strategy for effective data dissemination. Geo-based forwarding strategy makes use of geo-based routing and data dissemination mechanisms to improve the efficiency and reliability for packet delivery. Caching strategy with random caching strategy and density aware strategy were developed in order to remove the redundancy of cache and finally enhance the performance of data dissemination. This method improves the ratio of network success, minimizes the cache redundancy. But, safety and security are considered by NDN strategy.

In [14] designed the vehicle route-based data prefetch framework for data dissemination in Vehicular Cloud Systems (VCS). In this approach, data dissemination was done by adapting greedy algorithm for achieving best optimal solution. Optimal solution was obtained by approximation bound determination of greedy algorithm. MAB-based online learning algorithm was utilized to learn the unknown network connectivity success rate at and finally estimated the optimal binary decision matrix. This leads to effective data dissemination with less computational complexity. However, when data storage capacity increases, costs was also increases.

2. Comparison Tabulation

Ref. No.	Techniques Used	Output Parameters	Merits	Demerits
4	Reliable Route based Data Dissemination Technique (RRDD)	Data delivery Ratio : 0.97 Delay: 1000 bytes: 25 sec 2000 bytes: 35 sec 3000 bytes: 43 sec 4000 bytes: 65 sec	Increases the data delivery ratio, reduces the packet drop	intermittent node failure
5	Reliable data dissemination protocol, Dynamic Prediction Scheme	Data dissemination rate: 0.53 Delay: 600 metres: 0.2 sec 1800 metres: 0.6 sec 3000 metres: 3.5 sec	Maximizes the delivery reliability and reduces the delay	no bandwidth saving
6	Network coding (NC) with data dissemination	completion time: 18000 slots	Good predictor of dissemination velocity and dissemination completion time	NC will not suitable for large data size.
7	Data dissemination with rateless coding	Number of detected packets at distance: 1 km : 800 2 km : 600 3 km : 400 4 km : 300	Minimizes the system complexity and overhead using rateless coding	coding inefficiency
8	Tailor-p with adapted bipartite-based heuristics and Tailor-f with greedy heuristics	NYC selection: Tailor-p : 3.1 Tailor-f : 2.9 zurich selection: Tailor-p : 2.6 Tailor-f : 2.5 Baar selection: Tailor-p : 2.4 Tailor-f : 2.4	Tailor-p has low overhead and less computation time	Greedy heuristics may reduce the reliability of VANET due to packet loss and delay
9	CAID, Ant colony	Average relevance sparse network: 0.8 dense network : 0.77 sparse network: 0.2 Dense network : 0.18	No need to predefine the geographical area	Not applicable for congestion avoidance
10	STNC, scheduling approach	dissemination delay sparse: 1.9 ms sparse urban: 0.5 ms dense: 0.5 ms dense urban: 0.3 ms	There is no collision transmission, reduces the dissemination delay	STNC does not provide effective coding gain and it will not always give better results
11	Network coding based data dissemination	Completion time: n=2: 12000 slots n=3: 11200 slots n=4: 10200 slots n=5: 10000 slots	effectively supports the two way communication	difficult to process the large size of data
12	Caching strategy, NDN strategy	Delay in dense: 2.02 seconds Delay in sparse: 11.5 seconds	Improve the ratio of network success, minimizes the cache redundancy	safety and security are considered by NDN strategy
13	Greedy Algorithm, MAB-based online learning algorithm	Mean dissemination success probability: 0.85	less computational complexity	when data storage capacity increases, costs is also increases

Above tabulation shows the comparison result of various techniques used for data dissemination in VANET. Dissemination delay in [4], [5], [10] and [12] is represented in terms of seconds, milliseconds and it is compared among the sparse highway, sparse urban, dense highway and in dense urban network. Average relevance in [7] is given in two distance conditions. One is for 0-100 m distance and other is for 400-500 m distance. Completion time of dissemination in [6], [8] and [11] is given in terms of slots.

3. Conclusion

This paper provides brief description about various techniques that were developed for effective data dissemination in vehicular ad hoc network. The mentioned techniques are compared based on the dissemination delay, computing time, dissemination completion time, average relevance, merits and demerits. The comparison result shows that, despite of increase in costs, prefetching based data dissemination technique provides better dissemination result than other dissemination techniques.

4. References

1. C. Pop, R. I. Ciobanu, R. C. Marin, C. Dobre, C. X. Mavromoustakis, G. Mastorakis, J. J. Rodrigues. Data Dissemination in Vehicular Networks Using Context Spaces. In *IEEE Globecom Workshops (GC Wkshps),* IEEE, 2015, December, 1-7.
2. X. Li, H. Li. A survey on data dissemination in VANETs. *Chinese Science Bulletin*, 2014; 59(32), 4190-4200.
3. Mondal, S. Mitra. Secure data dissemination in VANET-a pull based approach. In *IEEE International Conference on Communication, Networks and Satellite (COMNESTAT).* IEEE. 2015, December. 60-67.
4. B. Dubey, N. Chauhan, S.Pant. RRDD: Reliable route based data dissemination technique in vanets. In *Communication Systems and Network Technologies (CSNT). International Conference on* IEEE. 2011 June; 148-151.
5. X. Bai, M. Gong, Z. Gao, S.Li. Reliable and efficient data dissemination protocol in vanets. In *Wireless Communications, Networking and Mobile Computing (WiCOM),* 8th International Conference on IEEE, September 2012; 1-4.
6. F. Ye, S. Roy, H. Wang. Efficient data dissemination in vehicular ad hoc networks. *IEEE Journal on Selected Areas in Communications*. 2012; 30(4), 769-779.
7. M. A. Salkuyeh, F. Hendessi, T. A. Gulliver. Data dissemination with rateless coding in a grid vehicular topology. *EURASIP Journal on Wireless Communications and Networking*. 2013; 1, 1-14.
8. T. Yan, W. Zhang, G. Wang, Y. Zhang. Access points planning in urban area for data dissemination to drivers. *IEEE Transactions on Vehicular Technology*. 2014; 63(1), 390-402.
9. S. Medetov, M. Bakhouya, J. Gaber, K. Zinedine, M. Wack, P. Lorenz. A decentralized approach for information dissemination in Vehicular Ad hoc Networks. *Journal of Network and Computer Applications*. 2014; 46, 154-165.
10. X. Shen, X. Cheng, L. Yang, R. Zhang, B. Jiao. Data dissemination in VANETs: A scheduling approach. *IEEE Transactions on Intelligent Transportation Systems*. 2014; 15(5), 2213-2223.
11. F. Liu, Z. Chen, B. Xia. Data Dissemination With Network Coding in Two-Way Vehicle-to-Vehicle Networks. *IEEE Transactions on Vehicular Technology*. 2016; 65(4), 2445-2456.
12. P.Karmuhil, LathaParthiban. An Automatic road network extraction from satellite images using Modified SOFM approach. *Indian Journal of Innovations and Developments*. 2016; 5(4), 1-6.
13. C. Bian, T. Zhao, X. Li, W. Yan. Boosting named data networking for data dissemination in urban VANET scenarios. *Vehicular Communications*. 2015; 2(4), 195-207.
14. R. Kim, H. Lim, B. Krishnamachari. Prefetching-based data dissemination in vehicular cloud systems. *IEEE Transactions on Vehicular Technology*. 2016; 65(1), 292-306.

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