American-Eurasian Journal of Scientific Research 12 (4): 203-206, 2017
ISSN 1818-6785

DOI: 10.5829/idosi.aejsr.2017.203.206

Emergency Message Dissemination Using Nearest Junction Located Scheme

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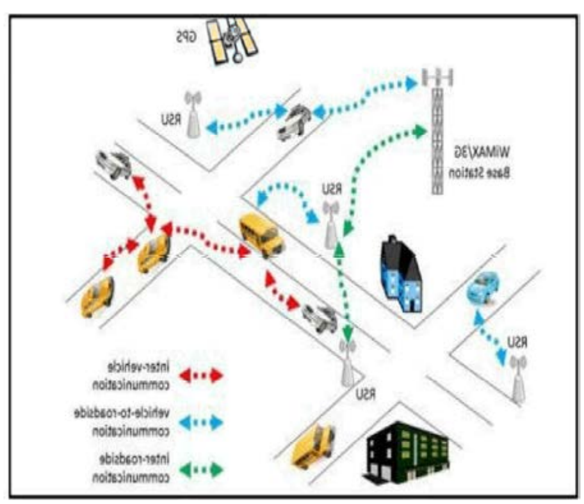
Abstract: Emergency Message disseminationisoneofthemostvitalapplicationsin ANET to avoid traffic mortalities.Toachieve cooperative driving in vehicular adhoc networks, transmission of broadcast isgenerally used for spreading safety-relatedinformationbetween vehicles. In this paper, we proposed anovel dissemination scheme called Nearest JunctionLocated(NJL)whichisfullydepend uponthetopologyofthe roadmap, allowing vehicles to rebroadcast amessage only if they are the nearest vehicle to thegeographical coordinates of any junction obtained fromthe integrated maps. We first design a novel composite relaying metric for relaying node selection, by jointly considering the geographical locations, physical layer channel conditions, moving velocities of vehicles. We further apply IEEE802.11e EDCA to guarantee QoS performance of safety related services. Finally, simulation results are proceeded to exhibit that CLBP can not only reduce the broadcast message redundancy, but also quickly and reliably emergency message disseminate in a VANET.. This methodology is to spread emergency messages in a VANET by using Multicast and broadcast modesalternatively. Simulation results show that performances are good compared to the existing protocols.

Key words: VANET・QOS・ Cross layer Broadcast Protocol・ Vehicular Ad hoc Networks

INTRODUCTION

Vehicular ad hoc Networks (VANETs) are wireless networks for communicationwhich supports cooperative driving between vehicles on the roadmap. Vehicles which acts as communication nodes, forming dynamic vehicular networks together with other related vehicles. In this work, we concentrate on traffic safety issues and efficient warning message dissemination, where the main objective is to decrease the latency and to increase the exact accuracy of the information received by nearby vehicles when a critical situation occurs. We consider that adjusting the dissemination policy to the specific environment, which accounts for the current vehicular density as well as for the scenario where the vehicles are located, can be beneficial to reduce broadcast storm related problems and to increase the efficiency of the warning message dissemination process [1]. In this paper, we suggest an adaptive algorithm that automatically chooses the best dissemination scheme to adapt the warning message delivery policy to each specific scenario. Our mechanism uses the vehicular density as input parameters and the topological characteristics of the environment where the vehicles are located, using them to decide which dissemination scheme to use. The main objective is to make the most of the message delivery effectiveness while generating a reduced number of messages and, thus, avoiding or mitigating broadcast storms. In addition, we also propose the Nearest Junction Located (NJL), our novel warning message spreading scheme specially designed to use in highly congested urban areas.



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Literature Survey: In the networking literature, we can find several works that present adaptive mechanisms specially designed to enhance message dissemination in vehicular communications. In this section, we present some of the most representative works.

Junliang Liu *et al* proposed an on-time warning delivery mechanism for VANET using IEEE 802.11p. This mechanism is based on receiver's agreement on forwarding strategies in two dimensional vehicular networks. The results of simulation show that the number of collisions is lesser and the performance of reliability and delay are higher for warning message dissemination overriding broadcast storm problem.

Celimuge Wu *et al* proposed a Backbone Broadcast (BBBR) protocol for data dissemination in VANET with dynamic backbone selection. This protocol reduces the MAC contention time at each node with high data dissemination ratio. Both theoretical and simulation results show that the throughput and delay are improved.

Izhak Rubin *et al* proposed a system for critical public safety message broadcasting. In this system, the RSU in highway broadcasts critical safety messages to the vehicles in its vicinity and to the vehicles over the vicinity using VBN. The authors used vehicular Carrier Sense Multiple Access/ Collision Avoidance (CSMA/CA) access scheme and spatial reuse Time Division Multiple Access (TDMA) to emulate the system. This system forwards the messages with high throughput and low end-to-end delay.

Muhammad Awais Javed *et al* proposed a multi-hop broadcast protocol for emergency warning notification in highway VANET. This paper attempts to overcome broadcast storm, severe interference and hidden node problems. The results of simulation show that this protocol performs better in terms of number of multi-hop transmissions and dissemination delay.

Izhak Rubin *et al* proposed a Lane Based Election (LBE) algorithm for the relay node selection by using VBN structure in highway VANET. This paper focuses on optimal selection of the relay nodes. This paper also proposes Group Based Election (GBE) algorithm which is used in case the lane residence information is not employed. The simulation results on analytical expressions show that these algorithms perform better for more number of lanes with varied vehicle densities.

Xing Fan *et al* proposed a multi-hop broadcast scheme with RSU assistance. This scheme ensures in instant emergency message propagation. The authors express that the throughput and network utilization are better in this scheme irrespective of the number of vehicles.

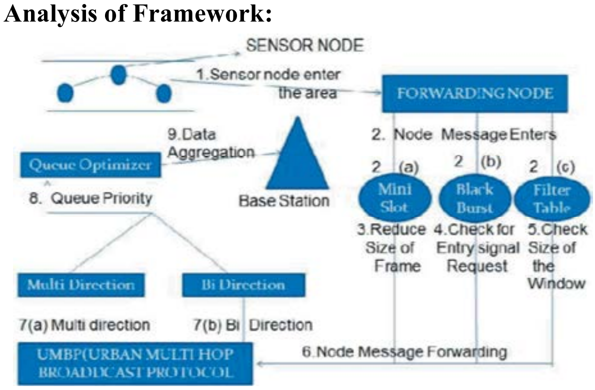
Francesca Cuomo *et al* proposed a protocol for dissemination scheme by using VANET structure called VBN for achieving high throughput. The authors presented both analytical and simulation analysis by using IEEE 802.11p CSMA/CA MAC protocol[6]. The protocol achieves high throughput and low end-to-end delay. This approach is done for a linear highway and it needs to be extended for two-dimensional highway systems.

It is learned from the above works that (i) Multi-hop broadcasting with relay nodes in VBN structure in highway VANET will improve dissemination performance of time critical emergency warning messages. (ii) Extending the coverage area of RSU improves notification percentage and end-to-end delay. (iii) By extending the coverage area, the number of RSUs required is minimized. (iv) Reliability of EWM broadcasting is improved. (v) Reception of EWM by farthest vehicles is assured.

Problem Statement: The problem statement for reliable protocols is to design a protocol that can deliver a message from a single source to every node in the own transmission range with the highest possible reliability and minimum delay. Successful message dissemination in VANETs needs an efficient decision mechanism to maximize reliability and keep the overhead low. The decision criterion about when and how a safety message should be delivered or repeated is an open issue.

Given the requirements of safety applications (i.e., low delay and effective reliability) and the limitations of vehicular communications (i.e., short-lived connectivity links), selective broadcast or multicast strategies seem more applicable than either unicast routing or flooding. In fact, the latter generates a high overhead without increasing the success rate substantially. Several solutions have been made to introduce intelligence to the basic broadcast concept and make it more selective and, thus, more efficient in its resource usage.

Analysis of Framework:



Sensor node enters the area to forward nodes. It includes the node creation in the network. Node configuration essentially consists of defining the different node characteristics before creating them. They may consist of the type of addressing structure used in the simulation, defining the network components for mobile nodes, turning on or off the trace options at Agent/Router/MAC levels, selecting the type of ad-hoc routing protocol for wireless nodes or defining their energy model[3]. An efficient forwarding node selection scheme is presented to quickly select a remote neighboring node by utilizing iterative partition, mini-slot, black-burst and asynchronous contention mechanisms, which greatly lowers emergency message transmission delay and reduces message redundancy[4]. At the first hop, the emergency message is bi-directionally broadcast to neighboring nodes if the source node locates on a straight road and a single relaying node is selected to forward the message in either direction of the source node.

Algorithm:

Algorithm for Optimal Broadcast Selection 1 forall b 2 B do
2 Pinf (b) = Inf10(b) • 0.5 + Inf30(b) • 0.3 + Inf120(b) • 0.2;
3 maxinf = max(Pinf (b)) 8 b 2 B
4 C = {}
5 forall b 2 B do
6 if (maxinf - Pinf (b)) <10% then C = C [{b}
/* Step 2: Minimize received messages */ 7 minrecv = min(Mrecv(b)) 8 b 2 C 8 forall b 2 C do
9 devinf (b) = maxinf - Pinf (b)
devrecv(b) =
Mrecv(b) - minrecv
minrecv 10
/* Step 3: Selection of the optimal broadcast
scheme */
Optimalbcast = argmin
b2C
(devinf (b) • K + devrecv(b)) 8 b 2 B 11

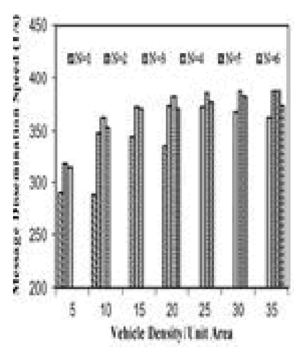
Expectedoutcome: The most important metric to be considered when designing a warning message dissemination scheme for VANETs is the percentage of notified vehicles. We performed several experiments using roadmaps with different features and varying the density of vehicles. It is noticeable how the topology of the area and the number of vehicles are determinant factors affecting the performance of the broadcast scheme.

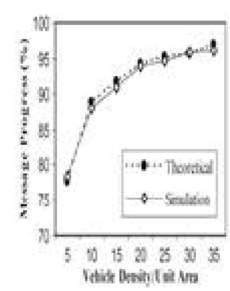
Table 1: Simulation Parameters

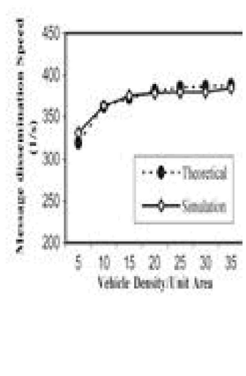
Parameters	Values
number of vehicles per km2	[25, 50, 100, 150, 200 and
number of collided vehicles	250]
roadmap size 2000m × 2000m	3
warning message size	256B
beacon message size	512B
warning messages priority	AC3
beacon priority	AC1
interval between messages	1 second
MAC/PHY	802.11p
radio propagation model	RAV[7]
mobility model	Krauss[5]
channel bandwidth	6Mbps
max. transmission range	400m
dmin (used in distance-based, eSBR and eMDR schemes))	200m

The dissemination process develops faster in every situation when the vehicle density increases. The parameters used for the simulation of the scheme are tabulated in Table-1.

The simulator was also modified to make use of our Real Attenuation and Visibility (RAV) scheme, which proved to increase the level of realism in VANET simulations using real urban roadmaps in the presence of obstacles. As for vehicular mobility, it has been obtained with CityMob for Roadmaps (C4R), a mobility generator able to import maps directly from OpenStreetMap and make them available for being used by the ns-2 simulator. With regard to data traffic, vehicles operate in two modes:(a) warning mode and (b) normal mode.







CONCLUSION

In this paper, we proposed a quantitative algorithm that allows selecting the optimal broadcast scheme in a VANET scenario depending on two different metrics: (i) the percentage of informed vehicles, a particularly determinant factor in warning message dissemination, and (ii) the number of messages received by each vehicle, an important factor which indicates the channel contention and the possibility of broadcast storms during the dissemination of alert messages. In addition, we presented a new broadcast scheme called Nearest Junction Located (NJL), which was specially designed for scenarios presenting high vehicular densities or simple topologies, where broadcast storms are prone to occur. The NJL scheme is designed to reduce the number of messages received per vehicle without noticeably affecting the percentage of informed vehicles. We showed how our broadcast selection algorithm can select the optimal scheme in almost all the scenarios tested.

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