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An Overview on the Methods of Disseminating Information in VANET

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Abstract:- In the past several years, according to expansion of wireless information technology, significant research efforts are done for vehicle-to-vehicle communication of VANET. Accordingly we can use these types of networks for making connection between vehicles and thus expansion of inclusive applications for road safety. The main aim is that publishing a message efficiently done from a source to other nodes located in the same geographical area and provides suitable place for driving safer, more efficient and easier. The release of informational packages from one node that is the source of the message and indeed sense the potential event or an obvious danger in the network involve the release of informational packages in the whole network. In fact, there are no specific connection between nodes in VANET routing networks unlike the fixed network and this cause difficulty in routing work and releasing the informational packages. Hence in this article we have discussed the methods of publishing information in vehicle networks.

Keywords: ad hoc, vehicular network, information dissemination, vehicle interconnection, VANet.

1. Introduction

With expansion of wireless information technology, we have been witnessed ongoing appearance of new types of wireless networks. Vehicle ad hoc network (VANET) is one of these networks that contain wireless connection between vehicles nodes and roadside infrastructures. VANETs are decentralized and self-organizing transmissions communication networks that contain moving vehicles with high speed which are created automatically between adjacent devices without using of any kinds of infrastructures like routers and servers.

Therefore, vehicles can connect to adjacent devises named as car-to-car communication

(C2C) or even they have connection with some existing infrastructures like as roadside units [1].
In the past several years, according to expansion of wireless information technology, significant research efforts are done for vehicle-to- vehicle communication of VANET networks. Accordingly we can use these types of networks for making connection between vehicles and thus expansion of inclusive applications for road safety [2]. The main aim is that publishing a message efficiently done from a source to other nodes located in the same geographical area and provides suitable place for driving safer, more efficient and easier. This suitable place includes warning programs for alarm warning of other vehicles, weather and traffic conditions, exchanging multimedia files between vehicles (songs, movie) or section of road (TV, radio, or news) and so on [3]. For example, information about dense potential area are transferred from one vehicle to other or it is possible to inform drivers from probable accidents or traffics. Thus, drivers are informed that those ways end to a place where the accident is occurred there. Moreover, this system will able to calculate an alternative route in the case of such information as input of car navigation system in order to avoid congested areas. Respectively, one vehicle can detect possible events like as frozen rout by embedded sensors and informs other vehicles such as vehicles that move in opposite direction or those that are moving in the same rout [2].
The release of informational packages from one node that is the source of the message and indeed sense the potential event or an obvious danger in the network involve the release of informational packages in the whole network. In fact, there are no specific connection between nodes in VANET routing networks unlike the fixed network and this causes difficulty in routing work and releasing the informational packages.
Each existing vehicle in time network that receives informational packages also should sends these packages to neighboring vehicles that to this phenomenon is said message re-propagation in VANET network. Re-propagation of message has the role of repeating informational packages along the networks and each vehicles that receive and re-propagation informational .packages is named next hop node. Routing is done by sending informational packages between hops in network as long as all existing vehicles in network receive informational packages.
According to application variations in VANET and specific network characters, the designing efficient propagation protocols are challengeable work. In order to publishing information, publishing protocols play important role in communication, because most of high level programs and even protocols assume existing of propagation service. The easiest way is using the simple flooding (broadcast) for implementing a spreading mechanism. Each node in broadcast relays exactly once each message (considering that it is within the target region), thus it relays this message to the entire region. Weakness of this broadcast is that this mechanism is inefficient. According to limited bandwidth of wireless media, inefficient dissemination of information design like as broadcast results in redundancy, deal that are regarded as broadcast problems. To overcome these problems, most of the improved relay protocols have been raised by researchers.
The paper is organized as follows. In the second section we introduce and discuss a classification of different ways of relay. Then, we review modern relay mechanisms which are designed

for good performance in highly dynamic environments in the third section. Finally, some conclusions are given in forth section.

2. Probabilistic Protocols

In this scheme, one node broadcast one message with a certain probability. This probability can be fixed beforehand (static probability), or dynamic adaptation (comparative risk). In its particular case, contingency plans are very simple and stateless (without any needs to neighboring information).

2.1 Probabilistic Dissemination Approaches

One of the probable primary methods to improve broadcast is fixed probability, which generally use defined possibility for sending messages. All of these methods have best performance if properties of network be static, homogenous and known in advance. Otherwise, their results will be in delivery ratio low or high number of non-related messages. To overcome to these problems have been expanded adaptive contingency plans.

The so-called dual-threshold plan has been introduced for improving static probability. One node sends one message with the possibility of P1, if it have more than neighboring n. if the neighboring numbers of one node be lower than this threshold so will send to it messages with higher possibility P2. Obvious advantage of this improvement is that in areas of network with low-density connectors has been avoided from failure to send messages because possibility of their send is higher than density areas.

Also the second improvement is described that it tries to determine whether a message is dying. Suppose that one neighboring node is n and possibility is P, so this node from each message should receive about n*p time from its neighboring. If this node receive one message significantly less, node sends message unless already doesn't be ready.

Also based-fighting plan is presented. When a node receives a message, accidently set a selected time lag. In the period of interruption a counter increase to receive any duplicate message. After finishing time lag these messages are sent in the events that if a counter be still lower than specific threshold.

However, all of these legislations are to improve broadcast performance, they are still faced with problems in probable network topology. For example, when one node has a lot of neighboring, result in small sending possibility in entire of this plan. However, it still can have isolated neighboring which can receive this message from that node. An example of such a situation is shown in Figure 1.

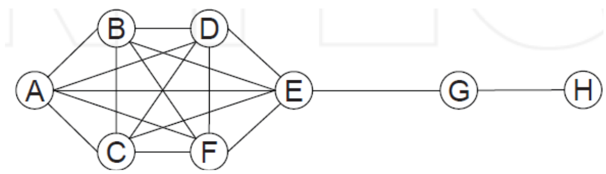

Figure 1: The sample topologies with static possible failure [4]

When node A sends one message, all nodes in its neighboring receive that. In this scenario as long as E is only node which can spread this message to node G, only node E should send it with possibility of 1. If the possibility is only based on numbers of neighboring, node E has a lower possibility because it has more neighboring. Thus, release of message with higher possibility of other nodes will be in dying mode and never won't reach to G or all nodes after that. If a part of network that connects with G is so large, the total data delivery ratio will decrease significantly. This condition can happen absolutely regular in dynamic network with specific dense [3].

2.2 Protocols based on Topology

Topology-based protocols use neighboring information for calculation of broadcast decision. This information should be exchanged periodically (by messages that called beacon) in a frequency depends to nodes speed. This causes to overhead of more information due to periodic exchanges of beacon messages but on the other hand, allows decision about broadcast to be extremely effective. In dynamic network may decrease operation of this kind of protocol with increasing in node speed due to outdated neighbor information [4].

3. Deterministic Dissemination Approach

A subset of topology-based play protocol is imposed decision protocol in which sender in message play specifies which neighbor is forced to broadcast. To this kind of protocol has been referred as definitive play approaches. Definitive approaches choose a small subset from neighbors as the sending nodes that are enough for reaching to the same destination from all nodes. Thus, one relay node is forced to get known at least the neighbors. Inasmuch as finding one optimal subset is difficult problem, used intelligent technologies is not necessarily optimal but still relay nodes are enough.

These kinds of protocols were one of the first protocols that are proposed to overcome broadcast storm problem by research community to minimize overhead play. Specifically, this protocol achieves very high efficiency that could be calculated by broadcast definitive decisions mainly due to two hop-based information in neighboring. Thus, many models of deterministic replay protocol can be found in the press. Examples of definitive approach are multipoint relaying, dominant pruning, and total dominant pruning.

Despite their efficiency, dominant play approaches have one major weakness: relay nodes represents a single points of failure. If relay cannot send a message (for example, due to losses of wireless, node failure, or lack of transmission range due to move), it is possible to decrease in total acceptance rate of this message. Thus, these kinds of protocols in dynamic environments like VANETs lack strength and they have a poor run. Therefore, for safety of important operational programs cannot be used in VANET but in the same time efficient play methods are needed.

3.1. Dissemination of Information in VANET based on a Tree Topology

Patricia Ruiz and et.al (2012), in source [6], present one tree topology-based release approach in network for process of dissemination of information in vehicle network. Indeed, establishing a spanning tree in network is known strategy for providing communication and navigation algorithm in wired networks. Moreover, they have been used recently in delay suffering ad hoc networks (DTN). According to high speed of vehicles and topology change, the appropriateness of using a spanning tree in VANETs can be raised as the basic question. Thus, at this research, a comparison is been discussed between needed sources for keeping tree topology in one moving ad hoc network (MANET) or in one VANET, because as previously mentioned, widely used and accepted in the network monitoring.

In this study, a pilot study has been developed which in it has been presented an efficient release algorithm named as BODYF. BODYF is designed to coping with more swinging networks like VANET. In this network, outgoing of BODYF is comparable with pervious release algorithms. Beside the suitable operation of BODYF, one of the important character of it is no need to any parameter in spite of existing release of original algorithm in press which needs to adjust parameters for different scenario which are used in them.

3.2. Collecting Vital Data based on Regression Analysis and Dissemination in Vehicle Network

M.S. Kakkasageri and et.al [10] in source are proposed one operating distance cognitive-based approach as node cluster for collecting vital data and dissemination in VANETs by using regression mechanism. Collecting data in vehicle ad hoc network space (VANET) with efficient technique is for efficient use of communicational sources. In dense traffic scenario of VANET, collecting data which is for showing different numbers of almost same vital data in the form of refined important message is needed for reducing bandwidth. The factor of vital data based on regression analysis approach aggregates important collected information and minimizes dissemination of unbiased and additional data. The proposed plan in this study works under vehicle cluster by using collection of fixed and dynamic factors. The proposed plan includes following stages:

- Validation and filtering of collected vital information
- Production of beliefs based on valid and filtered vital information
- Cumulative belief in its development using regression
- Revision to increase the quality of assembly
- Final revision of beliefs according to cumulative information
- Dissemination of collected information to neighboring cluster

The proposed scheme is validated by simulation from the perspective of acquisition delay of vital information, late rally, end-to-end delay, dissemination delay and using of bandwidth.

In this method exciting vehicles in road network are clustered according to their intervals in different cluster. Vehicles within each cluster have a less distance with each other. Whereas vehicles within different cluster have more distance. For each cluster choose one cluster as head cluster. Head cluster vehicle has almost same distance from all vehicles within cluster. In the other words, vehicle which is located in the approximate center point of each cluster is chosen as head cluster vehicle in each cluster. When a critical message feel by a network of road within the vehicle, that vehicle sends message at first stage to vehicle of head cluster that is located within that, then head cluster vehicle sends message to other head cluster vehicle in other clusters. Head cluster vehicles of clustered receives that message and sends it to own head cluster vehicle. In this way, all vehicles within road network get up felted critical message by one vehicle [10].

4. Protocols based on Location/Distance

By using position information, in some cases broadcast decisions can be calculated more accurately. For example, broadcast possibility can be set based on distance to sender or based on position can choose relay in VANET.

4.1 Traffic View Approach

Traffic view is a system to release traffic information and visualize in vehicular temporary ad hoc network. Aim of traffic view is providing continues updates for vehicles about traffic condition that help to drivers in route planning and also driving in adverse weather condition in low vision [8]. The participated vehicles are equipped with a computing device, a short-range wireless interface and GPS receiver. Optionally, on-board diagnostic interface system (OBD) can be used for gaining electronic and mechanic data from embedded sensors in vehicles. GPS receivers provide location, speed, current time and direction of vehicles. Vehicles collect and release information of its own or other vehicles in peer-to-peer model. Collected information is stored in background of local database. A record is vehicle profile which contains its location in terms of latitude, current speed vehicle, direction, and stamped time of the record time which is created for the first time, and create receiving time of this record. Embedded LCD touch screen on vehicles show detailed map with real time traffic condition in different road and also show dynamic information about other vehicles like its location [8].

4.2 Published Data in Traffic View

As described in the previous chapter, each vehicle in traffic view calculates the relative position on the road from other vehicles which are moving along the road without regarding topology. Thus, without loss of generality, assume vehicles move in two-way road with multiple lines in any direction which is shown in Figure 2.

Assume that direction of vehicle on the road is toward east which is shown in lower part of the road in Figure 2 or toward the west which is shown in higher part of the road. The average speed for the east and west are SE and SW. All receive or sending transmission are in suitable direction with the R communication range. Each vehicle in traffic view is concerned about information of way ahead. In order to do this work, information should release to the back due to direction of vehicle (release in opposite direction). It's assumed that vehicle release data packages periodically in every B second [8].

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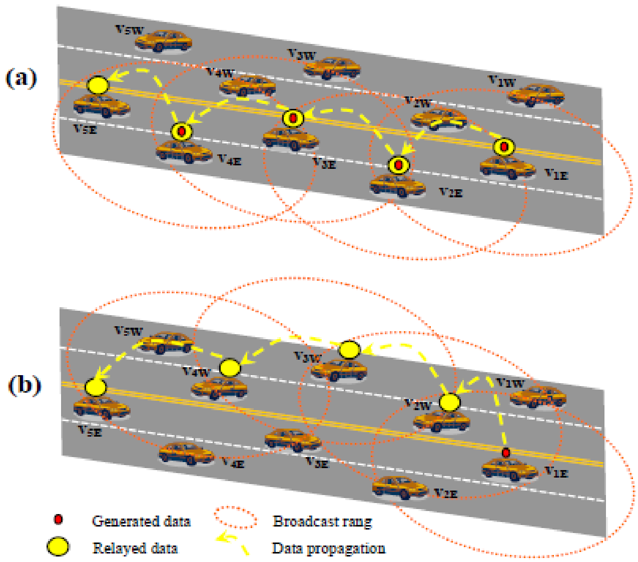

Figure 2: Dissemination models: (a) model with same destination, (b) model with opposition destination [8]

4.3 Local Decision Protocols

In local decision protocols, node decides itself to accept message broadcast or not. This is imposed the opposite of decision, this is from the characteristic of protocol especially in dynamic environment like VANET because this broadcast method can decide locally, as a result the transmitter has been decomposed from receiver and the result is a more robust protocol.

4.4 Adaptive Methods for Disseminating Information on VANET Networks

M. Bakhouya and et.al in source [5] are proposed one decentralized and adaptive approach for dissemination of information based on local neighboring information. In this method, each node can adjust their own local parameters dynamically by using of all adjacent nodes. In this study, a plan based on counting a fixed threshold are used to prevent nodes from the broadcast of messages. For example, if a node is heard one message more than D times, it is unlikely message is replayed because of the area covered by the waiver. Thus it is necessary to have a mechanism to adjust D threshold for the balance between broadcast storage and accessibility. It is worth noting that recent studies showed that broadcast a message after hearing k time when is k>t, has no benefit because it is expected additional coverage area is lower than 00.5%.

Adaptive methods for disseminating information allow nodes to broadcast efficiently incoming messages. This method allows nodes choose suitable operation (choose broadcast or remove) in distributed manner (for example, without helps of central controller) [5].

4.5 Protocols based on the Delays in Relay

This category of protocols before the broadcast of a message introduce one delay that is defined by delay function (accidently or according to some node properties like distance from transmitter). Delay relay is useful when nodes attend to communicational channels and collect information about broadcast from other nodes. According to that broadcast decision can be done more efficiently.

4.6 Dynamic Delay Broadcast Method (DDB)

From sample of Protocols based on the delays in relay can cite dynamic delay broadcast protocols which is introduced by Heissenbuttel and et.al (2006). This mechanism is considered in order to improve broadcast performance as orthogonal to other methods. Thus, it can integrate with other mechanisms and as a result, it cannot be considered separately in this work.

5. Combined Broadcast Protocols

As we can be seen, adaptive propagation methods achieve high efficiency but they lack substance. On the other hand, probabilistic methods have better behavior in presence of wireless damages and node failures but also have other limited disadvantages. For example, sending probable approval about the real situation is challenging task and it is not enough unresolved with simple smart technology. Thus, recently it has been proposed new methods of possible broadcast which is combination of the power of both protocols that at the moment has become a very consistent way with condition of network. This kind of protocols are named combined broadcast approaches [7].

5.1 Smart Possible Method

Smart possible protocol is one of the first combined broadcast methods. In smart possible protocol, each node in network use from neighboring information by hearing the message to construction dependency graph. According to dependency graph, the possibility of efficient sending is calculated at each node to ensure a sustainable directed graph, the authors assume that there is only one inventive sending node in entire network. This assumption may be useful in some scenarios, but it is not applicable especially in the case of VANETs. As a result, as shown protocol performance reduce greatly in such environment.

To overcome these problems, a new combined probability distribution method is introduced that is called position-based probability(PBG) in which neighboring information of 1- hop along with positional information of neighboring vehicles are used for creation of local dependency directed graph. According to efficient sending possible dependency of this graph can be calculated compatible with the current situational network. PBG is designed just in one direction to release information. For example, for a highway traffic scenario all vehicles that are closing to highway should be informed about traffic. So, messages release just in one driving direction. As a result, it is created just one dependency graph which this protocol is introduced as 1 version of a table PBG.

Moreover, two more improvements are introduced about PBG protocol: one is network dense-based reducing possibility, and the other is re-mechanism mechanism. First mechanism reduce sending possibility in dense networks, as a result overhead diffusion reduce. At that time achieves to acceptance rate similar to the original protocol. The second improvement has the aim of preventing the loss of message. This shows the common problem in wireless networks that is called hidden station problem. Since MAC layer uses broadcast frames, methods like CTS/RTS cannot be used to prevent such problem especially in very dense networks, hidden station problem has significant impact on the performance of the protocol. In such cases, package loss rate increases and the application's level needs for the delivery ratio cannot be met more. To overcome to this problem, second improvement attempts to determine whether a message is dying or not.

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General probable protocol also is introduced that is similar to PBG. In this protocol that is called advanced adaptive gossip protocol use from two-hop neighborhood information for calculating probabilities of similar sending PBG. Thus, no location information is not required, that is possible to be imprecise or even be in some cases not available. Moreover, this protocol is not limited to road topology and is developed by a mechanism of avoid from losing one message, which is similar to second development PBG. By using this format the protocol became much stronger and thus it is called strong AAG or RAAG. In this study security beneficial properties have been discussed according to RAAG [7].

6. Comparison of Investigated Approaches

In this section we compare investigated methods from classification perspective as well as the criteria for coverage of network nodes. Table 1 shows the distribution of the investigated methods in classification. Table 2 shows coverage percent of investigated methods at road network.

Table 1: Distribution of investigated methods in classification

	probabilistic protocols	protocols based on topology	protocols based on location/distance	local decision protocols	Protocols based on the delays in relay	Combined broadcast protocols
probabilistic dissemination approach	*					
Deterministic dissemination approach		*				
tree topology		*				
collecting vital data based on regression analysis		*				
Traffic view			*			
Adaptive methods				*		
Dynamic delay broadcast (DDB)					*	
Smart probabilistic						*

Table 2: Compare investigated methods in terms of evaluation criteria

	Network Coverage	Delay
probabilistic dissemination approach	99.5%	1.72 s
Deterministic dissemination approach	99%	4.2s
tree topology	90%	0.4 s

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collecting vital data based on regression analysis	96%	0.25 s
Traffic view	80%	205 s

3.3. Conclusion

Disseminating information in VANET vehicle network according to dynamic nature and speed of moving car has become a research challenge, which has attracted many researcher in this field. Disseminating information may not reach to destination because of change intervals and the routing process is interrupted between cars. Also, disseminating information broadcast by vehicles that result in release of information in vehicles should travel suitable process for covering all exciting vehicles. Thus, in this study investigated exciting protocol for release of message and samples of disseminating of information methods in vehicles network VANET. Results of comparison show that investigated methods cover acceptable percentage of exciting vehicles in network with little delay of sending message.

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