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Multi-hop Receiver-Oriented Agreement Based On Acknowledgement and Positions in VANETs

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ABSTRACT: As Vehicular ad-hoc networks (VANETs) are known for highly mobile and frequently disconnected characteristics. To improve safety, a warning message in VANETs should be delivered both reliably and urgently. In the existing solution, we make consensus of receiver by assigning rank, and the best forwarder is selected by distance to the centroid of the neighbors in need of message. The proposed work aims at overcoming the above limitations. Here the best receiver is selected by the ranking based on the energy of the nodes and also the distance to the centroid of the neighbors. The proposed method has been simulated and tested and the results indicate that the proposed system shows high reliability and enhances timeliness. It also provides higher packet delivery ratio and a lower control overhead. The algorithm is also generalized for vehicles with heterogeneous transmission ranges as follows. Candidate neighbors are ranked using $d-r$ instead of d for ranking, where d is the distance to the ideal forwarding location and r is the communication range of a node.

KEYWORDS: VANET, location-assisted, routing, mobile computing.

I. INTRODUCTION

Vehicular Ad Hoc Networks are MANETs which use vehicles as mobile nodes in a mobile network. The network technology used in VANETs is Wi-Fi IEEE 802.11p for effective communication between vehicles. The VANET uses participating cars as wireless routers or nodes, allowing them to connect to each other with an approximate range of 100 to 300 metres, thus creating a network with a wide range. As vehicles move out of the network, they are dropped out and others within range of the network can join in. It includes Vehicle to Vehicle communication and Vehicle to RSU communications in Intelligent Transportation Systems. VANETs make it possible for vehicles to broadcast warnings about environmental hazards, traffic and road conditions, and local information to other vehicles. Once it is known that there is a traffic jam, or an accident, a driver may safely avoid the route and save time. The minimal configuration and quick deployment of VANETs also makes them suitable for emergency situations. VANET scenarios differ from others in three main aspects, which, taken together, pose enormous challenges for the design of timely and reliable data dissemination protocols: low packet reception rate, intermittent connectivity, and abrupt changes in neighbour density. The products of VANETs include remote keyless entry devices, personal digital assistants, laptops and mobile telephones. As mobile wireless devices and networks become interestingly important, the demand for V2V and V2R will continue to grow. They can be utilized for a broad range of safety and non-safety applications, allow for value added services such as vehicle safety, automated toll payment, traffic management, enhanced navigation, location based services such as finding the closest fuel station, restaurant or travel lodge.

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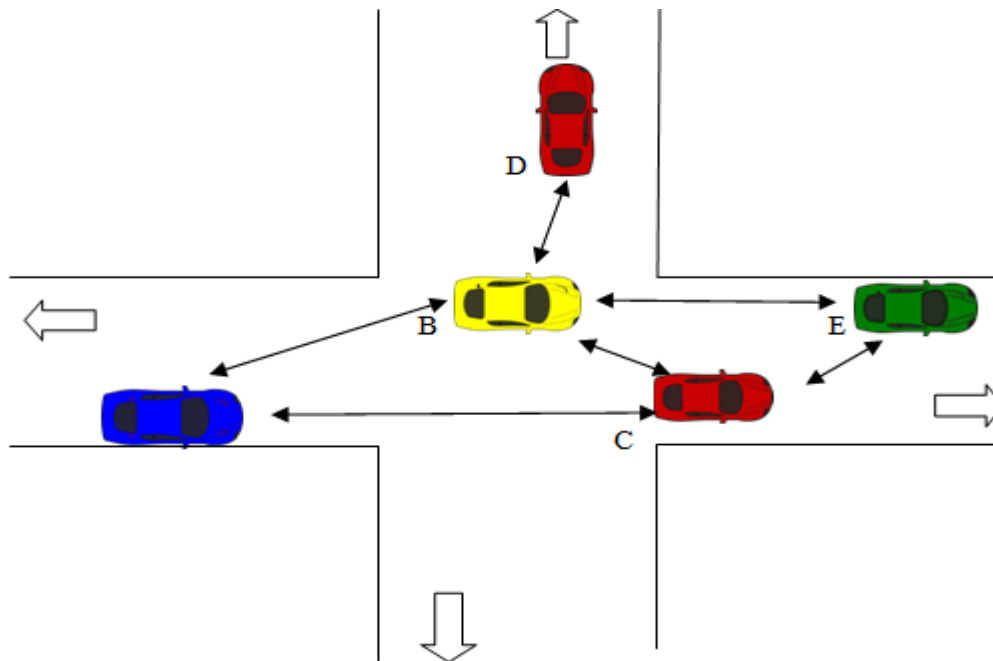


Figure1.

The above figure shows the Vehicle C as farthest forwarder of A does not cover vehicle D on another road. Receiver-oriented decisions may allow vehicle B to retransmit before C and cover D and E, or additionally after C's retransmission to cover D.

To send message from a source node to all other nodes in a network, Broadcasting is the message delivery task. Many important VANET services, ranging from safety applications to location-based advertisement, rely on the reliability and efficiency of underlying broadcast protocols. Applications have different requirements on broadcast protocol design. Location-based advertisement emphasizes reliability in order to achieve higher coverage of vehicles, while warning delivery, which broadcasts emergent information to approaching vehicles, requires both low propagation delay and reliability. The proposed broadcasting scheme based on best Receiver, which is a fully distributed and effective warning delivery algorithm suitable for VANETs with all mobility and density scenarios. Ranking is the key idea behind our proposed work. Receiving node retransmits immediately if it considers itself as the best forwarder. We adopt flexible receiver consensus, which can be applied in 1-D, 2-D or even 3-D scenarios, rather than selecting best forwarders by the sender. Once a node receives a broadcast message, based on its local knowledge, it ranks the potential (and known) forwarders according to their geographical locations. Ranking is based on distance to an ideal forwarder, located at the centroid of (remaining) neighbouring vehicles and energy of the vehicles believed to need the message. Each node considers itself as a potential forwarder picks up a time slot according to its ranking. Time delays are calculated, and all the known candidates are ranked by these timers resulting in zero delay. The best forwarder retransmits immediately after it receives the packet, while other nodes would take action if better ones fail to fulfil their duties. Otherwise they will update the reception information and reassess the need for further retransmissions. Rapid and reliable receiver for on time warning delivery in vehicular adhoc networks exhibits its basic advantages and great potentials in assuring reliability and timeliness. To the best of our knowledge, this is the first broadcast protocol in VANETs solving broadcast storm and aiming at perfect timeliness in 1D, 2D and 3D scenarios. Previous works are only for sender oriented approaches. It is the first and best receiver oriented approach with instant retransmission without any time delay.



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II. RELATED WORK

1. Vehicle-to-vehicle wireless communication protocols for enhancing highway traffic safety.

In vehicle to vehicle wireless communication protocol presents an overview of recently developing vehicular communication technology particularly describing Vehicle to Vehicle (V2V) communication using IEEE and ASTM adopted Dedicated Short Range Communication (DSRC) Standard. And in vehicle to vehicle wireless communication protocol, also discusses some of the application requirements and congestion control policies. Lastly, a real life implementation of V2V and DSRC standard that support it are analyzed.[1]

2. Broadcast storm mitigation techniques in vehicular adhoc networks.

In this article, Author explore how serious the broadcast storm problem is in VANETs using a case study of a four-lane highway scenario. Propose three lightweight broadcast techniques that can provide 100 percent reachability in a well-connected network and up to approximately 70 percent reduction in broadcast redundancy and packet loss ratio on a well connected vehicular network The proposed schemes are distributed and rely on GPS information (or received signal strength when a vehicle cannot receive a GPS signal), but do not require any other prior knowledge about network topology.[2]

3. GPS-based message broadcast for adaptive inter-vehicle communications.

To achieve many ITS applications, the ability to exchange messages between vehicles is necessary. This is generally required as inter vehicle communication (IVC). IVC can be considered as a special case of adhoc networks, where nodes only move along predefined road paths. Author propose new broadcast protocols that make use of global positioning system (GPS) information to enhance the performance of broadcast service in IVC. The ability to efficiently broadcast messages is necessary for any communications in IVC (e.g, updating routing tables, etc). Author propose two algorithms that effectively reduce the number of re-broadcast messages without affecting the number of hosts (vehicles) that receive the broadcast.[4]

4. Opportunistic broadcast of emergency messages in vehicular ad hoc networks.[5]

In this paper, author propose an opportunistic broadcast protocol (OppCast) that aims at simultaneously achieving high WM packet reception ratio (PRR) and fast multi-hop message propagation while minimizing the number of transmissions. A double-phase broadcast strategy is proposed to achieve fast message propagation in one phase and to ensure high PRR in the other. Opp Cast exploits opportunistic forwarding in each transmission to enhance the WM reception reliability and to reduce the hop delay, and to carry out reliable and efficient broadcast coordination; Author propose the use of explicit broadcast acknowledgements (BACKs) which effectively reduces the number of redundant transmissions. Opp Cast is also extended to handle sparse and disconnected VANETs, where the protocol adaptively switches between fast opportunistic forwarding and the store-carry-and-forward paradigm.

III. PROPOSED ALGORITHM

A. Receiver Consensus Algorithm:

```
ReC at each node for a message m Initialize P,N,R are empty
Event beacon received from neighbour n update CDS status if ACK(m) attached in beacon
then
add n to R and remove n from P,N
if broadcast of m is scheduled and N=null
then
Cancel scheduled broadcast
else
add n to N and remove n from P if broadcast of m is not scheduled then perform ideal_location_ranking

Event message received from neighbour s or generated by this node s=c
```



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```
add s to R and remove s from P,N
add nodes in N within communication range of s to P
and remove from N
add other neighbouring nodes of c which are not in R to N
if c=s then
Forward message
else
if N is not empty then
perform ideal_location_ranking
else
cancel scheduled broadcast
function ideal_location_ranking:
I is centroid of nodes in N
rank nodes in P and R based on distance to I and current CDS at c if c's ranking is 1 then
Forward message in the next 1-th slot
else
r is c's ranking schedule the broadcast at the r-th timeslot
Event beacon not received from n for a while remove n from N and from local neighbour set
Event message m received by RSU x transmit m to neighbouring RSUs.
```

IV. PROPOSED SYSTEM

The proposed system uses Receiver Consensus which is a receiver oriented protocol for message delivery. All vehicles are assumed to be GPS-enabled for location information. Each vehicle in the system follows DSRC/WAVE standard, in which it periodically broadcasts beacon message containing basic information including geographic position.

MODULE

1. Beacons Module
2. Neighbor Elimination and Status Updates Module
3. Location Based Ranking Module
4. RSU to RSU communication Module

1. Beacons Module:

This module defines about how each vehicle using the ReC strategy, sends broadcast beacons containing basic information including its geographic position. It follows the DSRC/WAVE standard with IEEE802.11p connectivity. Each vehicle broadcasts periodic beacons to show its existence in the mobile network. These beacons are captured by other vehicles within the broadcast range and they add that vehicle into their Connected Dominating Set.

2. Neighbor Elimination and Status Updates Module:

For every message m broadcasted in the mobile network, each node divides its neighbor nodes into three sets, based on their reception status: R for affirmatively received, P for potentially received and N for not received. Each receiving node computes every neighbors distance to the sender. Neighbors whose distance to the sender is less than sender's communication radius, are moved to P and marked as potentially received. Each warning message has a duration and upon expiration of the message, its acknowledgement will not be attached in future beacons. When N becomes empty, transmission is cancelled immediately.

Every node updates the three sets as follows.

- a). When a node A broadcasts a message m , it moves all the nodes within its communication radius into set P, and moves itself to R.
- b) A beacon is received from a node B, and if there is no acknowledgement attached to it, node B is moved to set N. If there is an ACK(m) attached to it, it is moved to R. B can also be a newly discovered node.
- c) If there is no beacon received from a neighbor in the CDS for a period of time, it might have moved away from the vehicle and it is removed from the local neighbor list and also from the three sets.

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3. Location Based Ranking:

Neighbors in N or P are ranked in order of the distance to the ideal location. The node then picks up the r-th upcoming slot, based on its rank r. If it ranks itself first, it retransmits immediately. All nodes in N are moved to P after retransmission. Neighbors' reception status and ranking are updated upon the detection of successive broadcasts. The ideal location for next hop forwarder is the centroid I, which is the point having average coordinate values of nodes in N. The smaller the distance to the centroid I, the greater the ranking. In case there are ties in the ranking, the node with greater distance to the sender is given a higher rank. All candidate nodes that are in CDS are ranked before all nodes that are not in the CDS. If an RSU is found in the CDS, it is ranked first to forward the message.

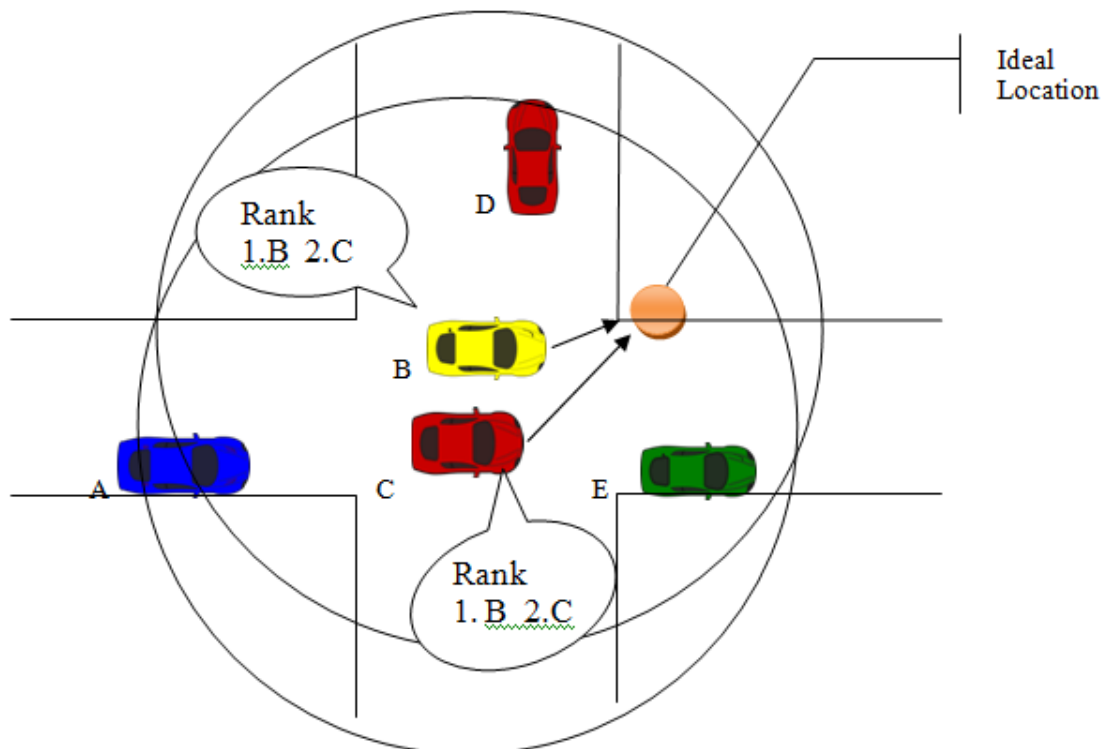


Figure 2. Ranking example

The “ideal” location for the next hop forwarder is the centroids I of all nodes in N (the point having average coordinate values of “not received” neighbors).

5. Collision Detection Module:

This module describes how collisions are handled in the mobile network. Whenever conflicts occur between two nodes in the network layer, the nodes with conflict enter into MAC layer competition like 802.11 with high probability of starting their retransmission at different mini-slots. When they are neighbors, retransmission by one of them will prevent retransmission by the others. RSU to RSU Communication Module: Whenever a Road Side Unite receives a message to be broadcasted; it also sends the message to neighboring RSU using wired communication lines. This improves the reception rate of the message as well as reduces the time taken by the nodes in the mobile network to receive the message across different blocks.



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V.CONCLUSION AND FUTURE WORK

The proposed design is rapid and reliable receiver to address both reliability and delivery latency in VANETs warning delivery. Nodes make consensus based on their local knowledge. Such mechanism provides a prospective direction of forwarder coordination. Geographical information is used to select an ideal location for forwarding, and neighbors are ranked and assigned priority to broadcast accordingly, based on their distance to the ideal location and energy of nodes respectively. This protocol can work in 3D scenario. It is possible if 3D location information is provided.

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