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Enhanced Receiver Consensus Message Passing TechniqueForVANETS Using RSU

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Abstact

Vehicular Ad hoc Networks are Mobile Networks with vehicles as nodes which communicate between each other to share information among other nodes in the network. In VANETs, it is important to deliver messages swiftly and reliably in order to improve safety of vehicles. Broadcasting becomes vulnerable to unreliability, and unicasting is prone to propagation delay. In Receiver Consensus, RSUs(Road Side Units) are not used as a part of the mobile network for information sharing. We propose an enhanced Receiver Consensus technique which exploits the wired communication established between neighboring RSUs for inter-block dissemination of emergency messages and the use of RSUs for a wider range of broadcasting in a single time slot. Each forwarding candidate ranks itself based on the distance to the ideal forwarding location with the closest candidate transmitting first. The forwarding candidate is selected using a collision handling technique to avoid multiple broadcasts at the same time.

Keywords*: VANETS, RSU, Nodes, Vehicular Ad hoc networks*

1. INTRODUCTION

1.1 GENERAL

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 neighbor 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.

1.2 OBJECTIVE

The process of including RSUs in the existing protocol to improve the overall performance of the algorithm, and to increase the number of nodes receiving the message by adding wired communication lines to adjacent RSUs and transmitting the message.

1.3 EXISTING SYSTEM

A warning delivery system, which determines forwarders according to Receiver Consensus algorithm. It is parameter-less, fitting all mobility and density conditions, and applicable to 1D, 2D and 3D scenarios. It is assumed that all vehicles are GPS-enabled. It follows DSRC/WAVE standard, where each vehicle periodically broadcasts a beacon containing basic information including geographic position. Nodes send the beacons in rounds to avoid collision. Each round is divided into time slots where each time slot suffices to fit the warning message. The algorithm consists of two components: Location-based ranking and acknowledgement-based neighbor elimination. Location-based ranking enables fast propagation without unnecessary waiting time latency at every hop, and the latter guarantees reliability while reducing the number of retransmissions considerably. Both the components' receivers utilize local knowledge to achieve consensus on forwarding strategies.

1.4 DISADVANTAGES OF EXISTING SYSTEM

- RSUs are not considered in the infrastructure to provision warning delivery**.**
- Messages are not transmitted directly to another geographic location by any means for a more widespread message delivery area.

2. RELATED WORK

M. T. Sun*et al.*,proposed two protocols namely TRADE and DDT.

TRADE is a sender oriented protocol. A car that retransmits will piggyback the ID of the furthest neighbor, which upon receiving the message, will be the next to retransmit it. i.e. If a sender A selects its furthest neighbor to C to retransmit, but the intended neighbor may be disconnected at the time of message transmission, and the flooding process would stop prematurely. Another issue is that messages cannot be disseminated in two directions with this technique.

DDT is a beacon-less receiver oriented next hop selection strategy. A transmitting vehicle appends its location with the message. Receiving vehicles do not retransmit for a back-off time that is inversely proportional to their distances from the transmitting vehicle. Candidate neighbors set timers proportional to 1-d/R, where d is the distance from the sender, and R is the transmission range which is assumed to be the same for all vehicles. Neighbors may continue competing using the same timer value if they do not hear the transmission, which also causes additional transmissions.

3. PROBLEM DEFINITION

The Receiver consensus protocol addresses both reliability and delivery latency in VANETs. However messages cannot be transmitted to far away vehicles immediately without going through vehicles in that specific path. Thus in this paper, a proposal to include RSUs into the infrastructure to provide wider range of coverage per transmission and also reaching out to far away vehicles using wired communication between neighbouring RSUs is made.

4. 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 a beacon message containing basic information including geographic position.

In addition, the use of RSUs for message passing where ever possible is introduced to further improve the performance of the existing system. Messages receiver by the RSU is also transmitted to neighbouring RSUs through wired communication for reliable message delivery to vehicles in neighbouring blocks. As ReC is the first receiver-oriented approach with instant transmission, the addition of RSU communications in the infrastructure should speed up the process even further.

4.1 METHODOLOGIES

Methodologies include modules which describe how each vehicle is introduced into the mobile system using beacons, identified based on the information provided in the beacons, ranked for forwarding based on its location and eliminated from the system when moving out of range in addition to RSU to RSU communication.

4.1.1 MODULE NAMES

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

4.1.2 MODULE EXPLANATION

Beaconing 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.

Neighbour Elimination and Status Updates Module:

For every message m broadcasted in the mobile network, each node divides its neighbour 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 neighbours distance to the sender. Neighbours 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.

- 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.
- 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.
- If there is no beacon received from a neighbour in the CDS for a period of time, it might have moved away from the vehicle and it is removed from the local neighbour list and also from the three sets.
-

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. Neighbours' 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.

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 neighbouring 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.

4.2ALGORITHM

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

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        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
                performideal_location_ranking

Event message received from neighbour s or generated by this node s=c
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
                performideal_location_ranking
        else
                cancel scheduled broadcast

functionideal_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
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TABLE 1: COMPARISON BETWEEN EXISTING SYSTEM AND PROPOSED SYSTEM

EXISTING SYSTEM	PROPOSED SYSTEM
Flooding process stops prematurely due to disconnectivity.	Connectivity to nearby nodes is maintained using CDS concepts.
Some protocols do not supports message transmission in multiple directions.	Receiver consensus is applicable to 1D, 2D and 3D scenarios.
Lack of acknowledgments leading to message storming or disconnection.	Acknowledgment based neighbour elimination algorithm is used.

4.3 ADVANTAGES OF PROPOSED SYSTEM

- The considerably higher transmission range of RSUs should allow them to cover an increased number of vehicles in a single transmission.
- Wired communication between neighbouring RSUs improves reliable transmission of the message between different blocks.

5.CONCLUSION

The inclusion of Road Side Units into the Receiver Consensus protocol and implementing wired communication between neighbouring RSUs improves the overall reception rate of a given message reaching nodes at different geological blocks with increased reliability.

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