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Efficient Multi-hop Communication using Dual Mode Transfer Algorithm for Vehicular Ad-hoc Networks

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Abstract--*Vehicular Ad-hoc Networks (VANETs) are made exclusive for vehicular communications in which each node makes a bidirectional connectivity with other nodes. VANET has attracted more researchers and has unlocked a track to cultivate few applications like propagation of travel warnings, alerts, traffic status, and user defined applications. VANETs have some unique features like dynamic network structure, node mobility, low processing speed and low memory. These features need a special attention, while designing a protocol to VANETs. Our work proposes a new protocol for inter vehicular multi-hop communications to achieve a minimum latency in delivering messages and balancing the overhead in a network channel. Two different messages are transmitted dynamically using a dual mode transfer (DMT) algorithm to minimize the reception delay at the receiver. Receiver node uses a classifier to reorder the messages and select the relevant messages. It eliminates the reproduction of redundant messages and reduces a network channel overhead. The proposed algorithm is designed to work in stressful road environment and it significantly reduces the latency in delivering the messages.*

Keywords : *Safety- Critical Application (SCA), Region based Clustering Mechanism,(RCM ITS System, VANET, Traffic congestion, jamming*

I. INTRODUCTION

VANET is a special form of Ad-hoc Network. It is designed to help better to the drivers and passengers. Each node in a vehicle can send, receive and forward the data. Single node deserves broadcast rather than unicast and multicast. During broadcast, each node must ensure a little delay in reception. In some uncertainty, wireless communication is not reliable. A typical wireless communication may disturbed by several reasons. It could be channel fading, packet collisions, bad weather, communication obstacles etc. To ensure a minimum delay, considering Backbone vehicle is one new solution proposed by Celimuge Wu, Xianfu Chen, Yusheng Ji, Satoshi Ohzahata and Toshihiko Kato, "Efficient Broadcasting in VANETs Using Dynamic Backbone and Network Coding", IEEE Transactions on Wireless Communications, Vol. 14, No. 11, November 2015. In this existing work, the major consideration goes to reducing total number of messages propagated among the nodes. Backbone vehicles alone forward a message. Other ordinary vehicles can only receive a message. It cannot forward the receiving data. VANET is Multihop Data Dissemination Protocols we propose three graph-based metrics to gauge the redundancy of In such a network, each vehicle is equipped with communication for wireless and an on-board GPS device. Data forwarding is then performed collaboratively and collision among vehicles in a multihop relaying manner. One of the most important applications for VANET is the distribution of active to send the messages to safe improve driver safety, namely Safety-Critical Application (SCA) that requires minimum time and idle reliable message dissemination. Information about SCA is changed so a the drivers about the car accident and to perform control actions in coordinated systems. Other applications are also permitted for shortest the deployment cost of VANET and for speed up it is adoption period.

II. MATERIAL AND METHODS

The MAC protocols for radio channel access among vehicles are effective under light traffic load. The existing method is highly reliable and tends to reduce the number of data propagated in a wireless channel.This existing work can significantly reduces the reception time among the receivers. The problem here is types of data is not defined and considered. Types of messages in VANET is usually divided into four types. They are Type 1, Type 2, Type 3 and Type 4. Type 1 message: Information messages – These can accept delay and weakly important. These messages are not closely related with vehicle safety. Type 2 message: Safety messages – These messages are highly connected with safety and so a high priority is given. Delay or loss is unbearable. Type 3 message: Individual drive control message – It is unique and special message that may focus on a specific vehicle driver or controller to regularize safe and efficient driving.Type 4 message: Group drive control message – It is a group message that may intended for a group of vehicles.

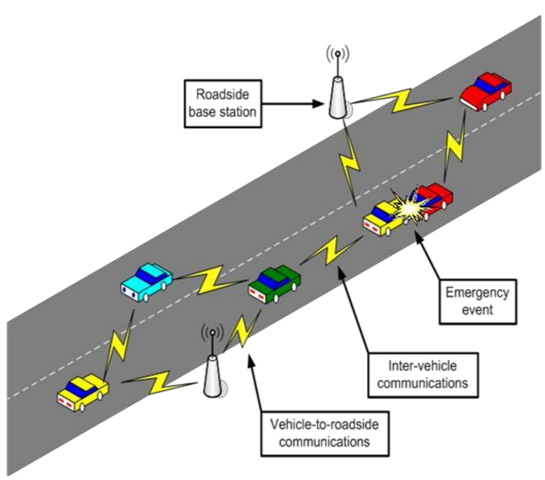

Fig. 1 Vehicular Ad-hoc Network

The paper is an extension of our previous conference paper. In this paper, we improved by taking channel constitution into account for the backbone selection. We explain the backbone selection algorithm for street scenarios and some of the special scenarios, and discuss the backbone maintenance overhead. We also present new theoretical analysis and more realistic simulation results that have not been reported previously. we give a brief outline of related work. we give a detailed description of the proposed protocol.

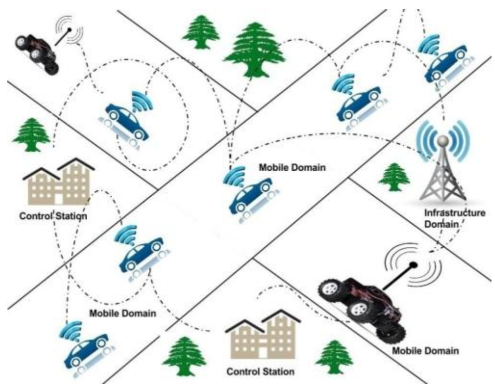

Fig. 2 System Architecture

A. RESULTS

In the receiver-oriented protocols, upon a packet reception, each node determines whether to forward or not by using an autonomous approach. Wisitpongphan and Tonguz [1] have proposed three receiver-based broadcast schemes which allo-cate different forwarding priorities to vehicles depending on certain probability, inter-vehicle distance and the combination of the probability and distance respectively. In general, a node with a larger inter-vehicle distance is preferred in order to provide a faster multi-hop dissemination. In recent years, routing of MANET has been inspirational for developing new communications and designing mathematical model for the ad hoc networks. The main goal of unicast routing protocol in VANETs is to transmit data from a single source to a single destination either using multi-hop or carry-and-forward (delay tolerant) techniques.In the multi-hop forwarding, the intermediate nodes in a routing path should relay data as soon as possible from source to destination. Thus multi-hop technology enables a minimum end-to-end delay.In the carry-and-forward technique, source node carries data as long as possible to reduce the number of data packets. The delivery delay-time cost by carry-and-forward technique is normally slower than multi-hop transmission technique. Among the various radio propagation models, Nakagami is the best suited one because of its closer representation of the wireless communication channel. They proposed Bidirectional coupled simulation approach of mobility model which will help to form realistic scenario in VANET. The system model assumed in this research for removing congestion is as follows. The VANET is formed of N vehicles equipped with an air interface with a road and supervision system. In order to achieve a large information range, a combination of broadcast data transmissions and a store-and-forward approach is used: The roads on the map are divided into segments of a standardized length (e.g. 250 m). Vehicles act as sensors and measure the conditions at their current road segment.

A VANET supervision system propagates one data value and a time-stamp per section. Supervision system transmits the currently available information in form of broadcast packets containing the information for multiple road segments. Per node, one or multiple applications can be active. Applications are assumed to be independent of each other. Therefore, data values sensed by different applications are uncorrelated. Data packets are stored in a packet queue at the network layer before transmission.

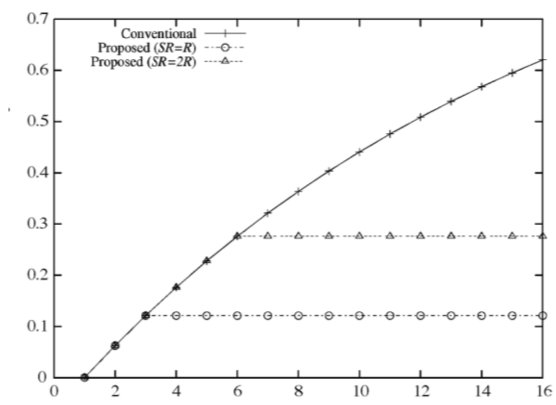

Fig. 3 Collision probability for various numbers of nodes in the sensing range

The collision probability for various numbers of nodes in the sensing range. Due to the backbone based forwarding mechanism, the proposed protocol can control the collision probability at a very low level.

The proposed protocol shows the best performance due to the efficient backbone node selection algorithm which takes link quality and vehicle mobility into account. Weighted p-persistence scheme is inefficient due to the packet collisions incurred from the redundant transmissions. The retransmissions contribute to the better performance of EMPR as compared with Weighted p-persistence scheme. The network coding approach shows a significant improvement over “Proposed without NC.” This benefit comes from both intra-flow and inter-flow network coding. The intra-flow network coding can provide a high packet reception probability at a receiver node. The inter-flow network coding can achieve lower collision probability by reducing the number of required transmissions, which makes the NACK approach (for the non-backbone node) possible, resulting in 100% packet dissemination ratio. MAC layer acknowledgment for a broadcast frame, packet loss at the relay node could happen. Therefore, we have to design a mechanism to improve the reliability. Since there are multiple intended receivers for broadcast applications, the aim of the protocol is to disseminate data packets to all these receivers. In the proposed protocol, the sender node processes network coding based on a batch of m packets. In this paper, m is set to 2 by default, and we explain the proposed protocol by using 2 instead of m for the sake of simplicity. The source node uses network coding to encode two consecutive native packets to get two encoded packets, and transmits the encoded packets.

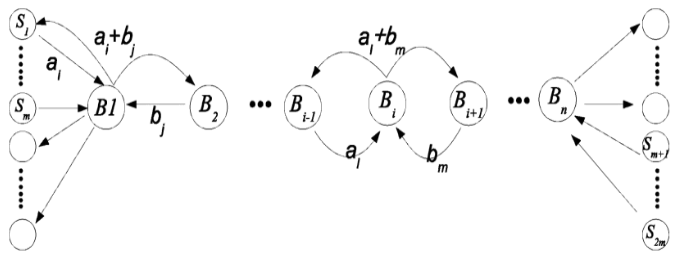

Fig. 4. Inter-flow network coding at backbone vehicles.

Unicast routing protocols in VANETs is to transmit data from a single source to a single destination either using multi-hop or carry-and-forward (delay tolerant) techniques. In the multi-hop forwarding, the intermediate nodes in a routing path should relay data as soon as possible from source to destination. Thus multi-hop technology enables a minimum end-to-end delay. In the carry-and-forward technique, source node carries data as long as possible to reduce the number of data packets. The delivery delay-time cost by carry-and-forward technique is normally slower than multi-hop transmission technique. Minimum-delay routing protocol - Minimum-delay routing protocol has the intention to diminish the delivery delay- time from source to destination.Ex: GPSR: Greedy perimeter stateless routing, GPCR: Greedy perimeter coordinator routing protocol, GSR: Geographical source routing protocol, VADD: Vehicle-assisted data delivery routing protocol. Delay bounded routing protocol - Delay-bounded routing protocol tries to maintain a low level utilization of channel within the constrained delivery delay-time.Multicast and geocast routing are the most opted routing techniques in VANETs. One of the design challenges is how to develop the efficient multicast/geocast protocol over VANETs with the highly dynamic network topology. According to the property of geographic region, existing results can be classified into simple multicast/geocast protocol and station temporary multicast/geocast routing protocols. IVG: Multicast protocol in ad hoc networks inter-vehicle geocast: It follows the concept of simple multicast/geocast and the primary concern of an IVG protocol is to notify all the vehicles on the way if any danger occurs. The danger area is determined in terms of driving direction and current positioning of vehicles. Vehicles located in the danger area form a cluster called multicast group.

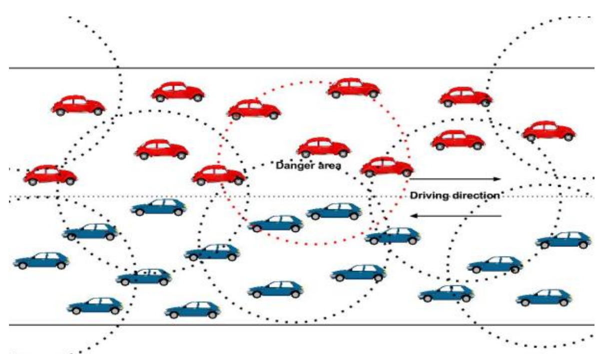

Fig .5 Mmulticast/geocast protocol

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Distributed robust geocast multicast routing protocol: The goal of multicast routing protocol is to deliver data packets to vehicles that are located in a specified static region. The imposed condition is that, a vehicle should take packets if it is present in an intended geographic location. Otherwise the vehicle drops packets. The zone of relevance (ZOR) and zone of forwarding (ZOF) are the two independent geographic regions specified by this protocol.ZOR is a geographic region which identifies vehicles based on region of relevance for receiving the packets. ZOF is another geographical region which identifies vehicles based on region and can only forward the received packets to other vehicles located in ZOR.It is worthy to listen that, ZOF usually surrounds ZOR to ensure an effective communication between inter-vehicles

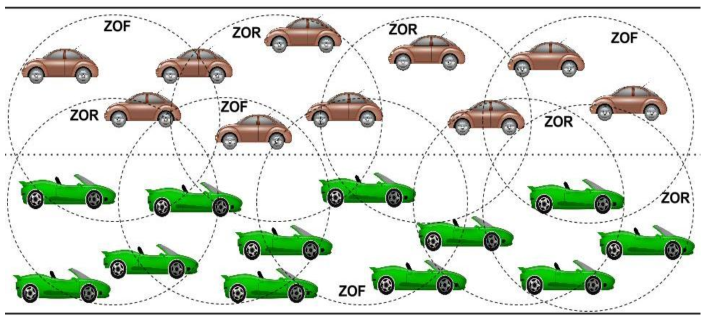

Fig.6 Spatiotemporary multicast/geocast routing protocol

Broadcast is an important and last type of routing for a vehicle to disseminate a broadcast message to all the others in a VANET. They are two types Broadcast storm problem in ad hoc wireless networks , DV-CAST.A border node based routing protocol for partially connected vehicular Ad Hoc Networks. Road layout design with the required lanes. Design of vehicle mobility model for both rural and urban environment ,congestion control mechanism in a wireless channel. Recording and analyzing the results. Compare the results using some standard parameters.

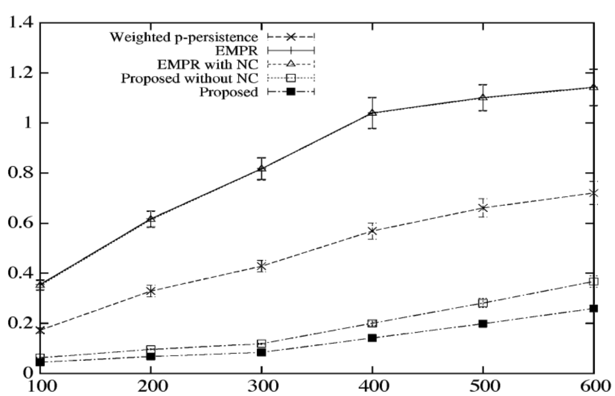

Fig. 7 End-to-end delay for various numbers of nodes in Freeway scenario.

Dual Mode Transfer using forwarding algorithm, the proposed protocol can significantly reduce MAC layer contention time at each node, resulting in low end-to-end delay (as we can see from "Proposed without NC”). The delay increases slightly with the node density due to hello messages. By employing the joint network coding approach, the proposed protocol can efficiently reduce the number of data (re)transmissions which can further reduce the end-to-end delay. The advantage of the network coding becomes more notable when the number of nodes increases. This is mainly because the proposed protocol can reduce the number of trans-missions significantly by using the inter-flow network coding.

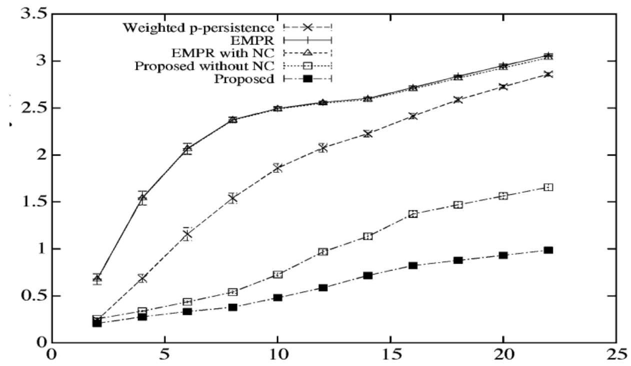

Fig. 8. End-to-end delay for various numbers of source nodes in Street scenario.

The advantage is very significant when the number of source nodes is large. This is because that protocol overhead has a significant effect on the end-to-end delay when the data rate is high. Most prioritized one is minimum delay in reception. Eliminate redundant data / messages. Make a consistent way to transport other messages. Address an irrelevant message. A solution must fit for both rural and urban areas. An exclusive application is undesirable.

III DISCUSSION

Knowledge about the In the Freeway simulation, we used a freeway which had two lanes in each direction We evaluated the protocol’s performance in various velocities and various node densities. The number of source nodes was set to 2 (the two nodes were neighbors) in order to simulate a condition of two collided vehicles send data messages at the same time. In the street scenarios the maximal vehicle velocity was 70 km/h. The street consisted of 5 horizontal streets and 5 vertical streets and every street had one lane in each direction. The distance between any two neighboring intersections was 400 m. We generated scenarios with various numbers of broadcast source nodes (traffic flows). We proposed an efficient multi-hop broadcast protocol which employs backbone based forwarding and network coding. The protocol generates a dynamic vehicle backbone by taking into account vehicle movement and link quality based on a fuzzy logic algorithm. By using the backbone, the number of sender nodes is significantly reduced, resulting in a shorter MAC layer contention time at each node. The protocol also uses a joint inter-flow and intra-flow network coding approach. By using the inter-flow network coding, the protocol can significantly reduce the number of transmissions. The intra-flow network coding can improve the packet dissemination ratio with low overhead. Therefore, the proposed protocol can pro-vide a lightweight and reliable solution for data dissemination in VANETs. Theoretical analysis and simulation results con-firmed the advantage of the proposed protocol over existing alternatives.

This study focused congestion based safety message. The message is caused by the traffic of the same priority, typically the warning messages of safety applications from different transmitters. Furthermore, in real life various responses from drivers will happen to related to traffic conditions. The purpose of this survey is to study the different proposals that strongly removing the possibility of congestion in network. The road map divided into a number of segments and assigning a fixed transmission period to each segment for particular interval by that the possibility of bandwidth consumption are reduced.

IV CONCLUSION

We proposed vehicles are provided time slots in the transmission period of their respective segments so that the collision of information are avoids. The Supervision system scheduling ensures that all vehicles in a segment must receive and transmit their information in network in different time slots. The possibility of congestion free network are reduces the overhead and delay in network. This study focused congestion based safety message. The message is caused by the traffic of the same priority, typically the warning messages of safety applications from different transmitters.

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