International Journal of Modern Engineering Research (IJMER)
www.ijmer.com Vol.2, Issue.2, Mar-Apr 2012 pp-062-066 ISSN: 2249-6645

ANALYSIS OF SAFETY MEASURES AND QUALITY ROUTING IN VANETS

Vedha Vinodha.D*, Mrs.V.Seethalakshmi**

*II M.E CS, Sri Shakthi Institute of Engineering and Technology, Coimbatore
**Assistant professor ECE Dept, Sri Shakthi Institute of Engineering and Technology, Coimbatore

Abstract- Vehicle to vehicle communication (V2V) systems, where vehicles exchange information's with each other, become an important need in order to decrease traffic accidents and improve capacity of highways traffic and also road side infrastructure (V2I) communication from transportation operation center. The security could indeed be increased if the communication between the vehicles is established and maintained, this enables the driver of a car to be aware at an early time of the emergency breaking of the preceding vehicle and so eventually avoid a collision. Two efficient algorithms are proposed. Distributed-fair power adjustment for vehicular environments (D-FPAV) is a transmit power control approach for periodic messages based on a strict fairness criterion that can maximize the minimum value over all transmission power levels assigned to nodes that form the vehicular network under a given constraint on the Maximum Beaconing Load. Emergency message dissemination for vehicular environments (EMDV), for fast and effective multihop information dissemination of event-driven messages with respect to both probability of reception and latency. Synergy is gained when using both protocols together because D-FPAV can ensure the channel load is kept at a level where EMDV can successfully operate with the help of nearby base station. Analysis and Simulation is carried using NS-2.

Keywords- Active safety, contention, fairness, information dissemination, power control, vehicle-to-vehicle communication.

1 INTRODUCTION

DIRECT vehicle-to-vehicle communication plays an important role for improving road safety based on radio technologies. Many organizations worldwide are funding national and international initiatives that are devoted to vehicular networks, such as the Internet ITS Consortium [1] in Japan, the Vehicle Infrastructure Integration (VII) Initiative [2] in the U.S., the Car2Car Communication Consortium (C2CCC) [3] in Europe, and the Network on Wheels (NoW) Project [4] in Germany. Currently, the IEEE 802.11p Working Group [5] is developing a standard. The effort is assisted by initiatives from various parts of the globe. There are two types of messages in safety-related communication that can be identified: 1) periodic and 2) event driven. Periodic messages which refers the vehicle's position, speed, etc can be used by safety applications to detect potentially dangerous situations. A distributed fair power adjustment for vehicular environments (D-FPAV) that controls the beaconing load under a strict fairness criterion is used for safety reasons. D-FPAV gives more priority for event-driven over periodic messages. A contention-based strategy called emergency message dissemination for vehicular environments (EMDV) for event driven messages ensures a fast effective dissemination of alerts in a target geographical area along with D-FPAV.

2.CHALLENGES IN SAFETY MEASURES

Safety applications can be achieved by two types of messages: 1) periodic and 2) event driven. Periodic status messages are mainly used to exchange state information to the sending vehicle, like position, direction, speed, etc. Through this beaconing activity, safety applications acquire an accurate knowledge of the surroundings and therefore smart cars are used as shown in Fig. 1.The main factor related to this beaconing activity is to control the channel load to avoid channel congestion. Beacon messages decreases when generation rate of the probability of successful reception of each of them is increased. When transmission power is increased for greater distance it leads to congested wireless medium, and also leads to packet collisions.

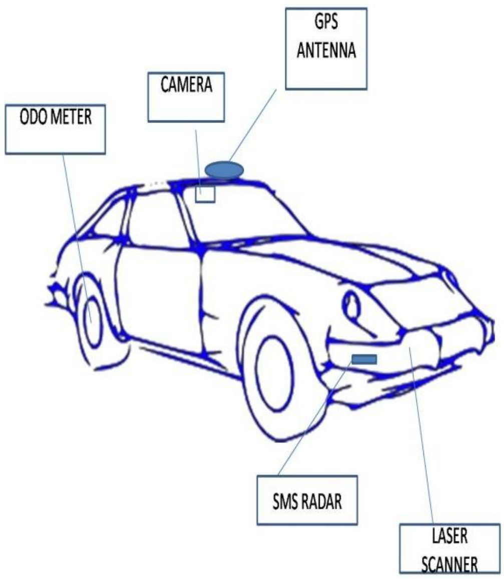

Fig. 1 Smart Cars

The packet generation rate should be at the minimum to adjust the transmission power of beacons in case of congestion. This mechanism should keep the load on the wireless medium below a certain level, called the maximum beaconing load (MBL). Fig. 2 shows the reception probability between periodic and event driven messages. The desired performance can be achieved at close distances as periodic messages experience a high reception probability, and event-driven emergency messages achieve an enhanced performance at reducing dissemination delay and improving reliability in high channel load conditions.

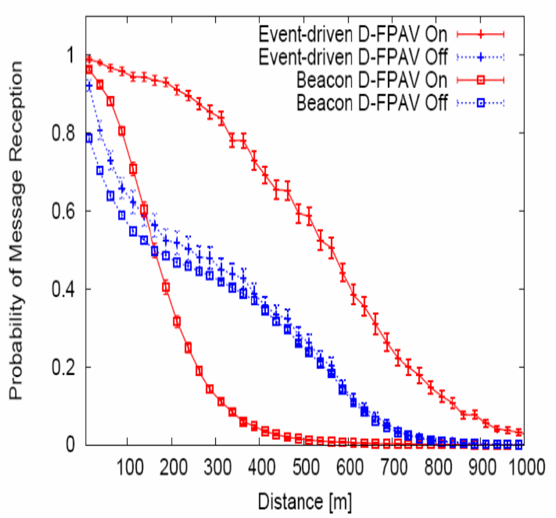

Fig. 2 Reception Probability between Periodic and Event Driven Messages

3 CONGESTION CONTROL

The D-FPAV algorithm to achieve the following design goals makes use of transmit power control.

1) Congestion control. Limit the load on the medium produced by periodic beacon exchange.
2) Fairness. Maximize the minimum transmit power value over all transmission power levels assigned to nodes that form the vehicular network under Constraint 1.
3) Prioritization. Give event-driven emergency messages higher priority compared to the priority of periodic beacons.

The congestion control requirement (Constraint 1) is applied only to beacon messages to control the channel bandwidth assigned to periodic safety-related messages.Prioritization is achieved through the EDCA mechanism by Constraint 3 available in the IEEE 802.11p and by always sending an event-driven emergency message using the maximum possible transmit power.

D-FPAV is based on the following factors:

1) Executing the FPAV algorithm at each node with the information gathered from received beacons;
2) Exchanging the locally computed transmit power control values among surrounding vehicles; and
3) Selecting the minimum power level among the one locally computed and those computed by the surrounding vehicles.

Algorithm D-FPAV: (algorithm for node u_i)

INPUT: geographical positions of all nodes in $CS_{MAX}(i)$

OUTPUT: a power setting $PA(i)$ for node u_i, such that the resulting power assignment is an optimal solution to BMMTxP

1. Based on the geographical positions of all nodes in $CS_{MAX}(i)$, use FPAV to compute the maximum common transmit power level P_i s.t. the MBL threshold is not violated at any node in $CS_{MAX}(i)$

2a. Disseminate P_i to all nodes in $CS_{MAX}(i)$

2b. Collect the power level values computed by nodes u_j such that $u_i \in CS_{MAX}(j)$ and store the received values in P_j

3. Assign the final power level:
$PA(i) = \min\left\{P_i, \min_{j:u_i \in CS_{MAX}(j)}\{P_j\}\right\}$

Fig. 3 DFPAV Algorithm

The D-FPAV algorithm(conventional) is summarized in Fig. 3 [7]. A perfect information accuracy from *all* nodes inside CS*MAX*(*i*) is required to *guarantee* strict fairness, achieving such a perfect knowledge is very difficult in a fully distributed fast-moving scenario as given by vehicular ad hoc networks. D-FPAV is expected to operate in situations in which nodes have incomplete knowledge about the environment .

4 EMERGENCY RESPONSE

The second main goal is the dissemination of event-driven messages within a geographical area as in Fig.4.A certain vehicle issues a hazard warning message (also called emergency message in the following) in case a dangerous situation is detected (e.g., obstacle on the road, airbag explosion, malfunctioning of the braking system, and so on). This emergency message should be propagated backward on the road as quickly and reliably as possible, in order to enable the drivers of approaching vehicles to undertake adequate countermeasure in Fig.5.

An effective strategy that offers short delay is required to deliver a message that contains information about an existing threat.

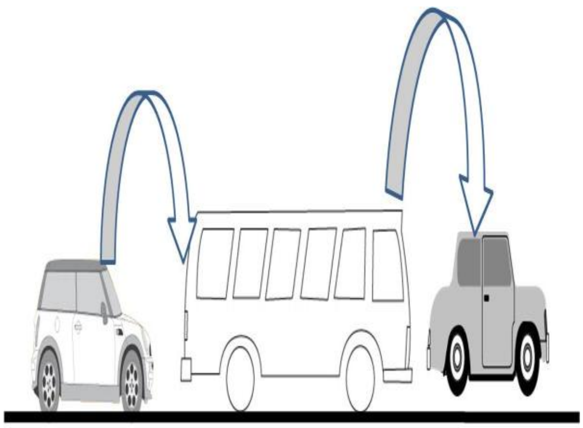

Fig.4 Car2Car Communications

This dissemination strategy is to select the appropriate nodes to efficiently forward the message in the direction of dissemination to cover the dissemination area. The proposed strategy deals with uncertainties that result from node mobility, fading phenomena, and packet collisions. In order to cover the destination area, some intermediate nodes (forwarders) will be selected by the contention mechanism to forward the message in the direction of dissemination.

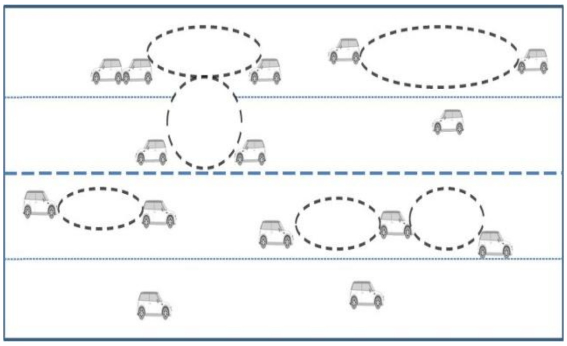

Fig. 5 Relevant area for dissemination of emergency information after an accident detection in a highway.

Cars in the opposite direction are also included. A wireless channel is utilized for periodic beacon exchange. Thus, relatively busy medium can be encountered by event-driven emergency messages in dense vehicular traffic situations.

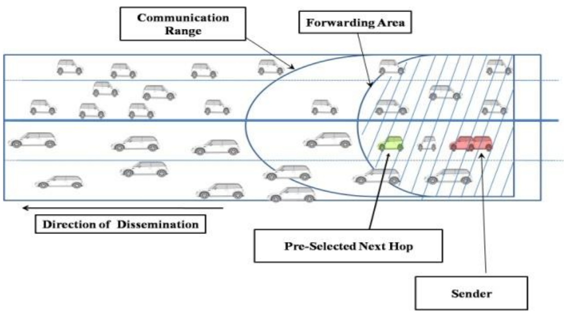

Fig. 6. Sender perspective when utilizing the EMDV protocol.

EMDV is based on the following three design principles.

1) A contention scheme is used message to deal with uncertainties like node mobility, fading phenomena, and collisions after the broadcast transmission.
2) To minimize the delay, the contention strategy is complemented with the selection of one specific forwarder made at transmission time, referred to as the next hop which immediately forwards the message.
3) The reliability of the dissemination process is increased by the following factors:

a)Assuming a forwarding range shorter than the communication range and b) a controlled message retransmission scheme within the dissemination area.

Fig. 6 shows a sketch of conventional figure of a sender perspective, which must preselect a next hop among known nodes and then broadcast the message [9]. The forwarding area identifies the area where the next forwarders can be located. EMDV is composed of four main procedures, as shown by the conventional pseudocode description of the protocol as shown in Fig.7 [8]. A node that transmits an emergency message invokes the *PrepareMessage()* procedure. This procedure first checks whether the message has already been transmitted for the maximum number of times (*maxMessages*) within the node's forwarding area. If not, the *FindNextHop()* procedure is invoked to determine the message's destination node.

Once the message has been transmitted, the message counter is increased, and a contention period is started to verify that at least one neighbor forwards the message. The *FindNextHop()* procedure essentially scans the neighbor table of the sender to find (if any) the neighbor in the sender's forwarding area with the highest progress in the direction of dissemination. If no neighbor in the dissemination direction can be found or if the sender's forwarding area is at the border of the dissemination area, no specific forwarder is selected, and *NextHop* is set to *broadcastAddress*.

The *ReceiveMessage()* procedure is invoked when a node receives an emergency message and first ensures that the node lies inside the dissemination area to proceed. Then, it is checked whether the received message has been sent by a node that is farther in the direction of dissemination and lies inside its own *forwardingArea*. In this case, the message can be considered to be a sort of "implicit ack" of message forwarding, and the corresponding message counter is increased so that contention for forwarding the message can be canceled if enough "implicit acks" have already been received.

If the aforementioned conditions are not satisfied and the receiving node is located inside the *forwardingArea* of the sender, the dissemination criteria are used to determine whether immediate or contended forwarding will be performed: If the receiving node is indicated as the intended forwarder in the *NextHop* field, then the message is forwarded with no contention by invoking the *PrepareMessage()* procedure; otherwise, a contention period is started by invoking the *PrepareContention()* procedure.

Finally, the protocol has to be adjusted with respect to two specific situations. First, the contention period after delivering the message to lower layers (*PrepareMessage()*) must take into account the time that the message needs to access the channel and transmission. The contention time is set to *maxContentionTime* + *maxChannelAccessTime* when *flag* = *sent*. Second, nodes located within *forwardingRange* from the border of the *disseminationArea* will act a little differently, because the message must not travel farther distances than *borderDisseminationArea*. Therefore, the following cases hold:

1) They will not select a nextHop; instead, the broadcastAddress will be utilized, and

2) they will increment countMessages when receiving a message from any node that is also located within forwardingRange of borderDisseminationArea instead of only counting the ones that come from their forwardingArea.

```
Procedure: PrepareMessage( )
    if countMessages < maxMessages then
      nextHop ← FindNextHop( )
      TransmitEMDVMessage( nextHop )
      countMessages ++
      PrepareContention( sent )

Procedure: FindNextHop( )
    nextHop ← broadcastAddress
    if borderDisseminationArea ∈ myForwardingArea then
      return nextHop
    progress ← 0
    for each neighbor ∈ myNeighborTable do
      if neighborPosition ∈ myForwardingArea and
         neighborProgress > progress
      then
         progress ← neighborProgress
         nextHop ← neighborAddress
    return nextHop

Procedure: ReceiveMessage( )
    if myPosition ∈ disseminationArea then
      if senderPosition ∈ myForwardingArea or
         borderDisseminationArea
              ∈ myForwardingArea ∩ senderForwardingArea
      then
         countMessages ++
      if countMessages ≥ maxMessages then
         CancelContention( )
      else if messageDestinationAddress = myAddress then
         if contending then
           CancelContention( )
         PrepareMessage( )
      else if myPosition ∈ senderForwardingArea and
         not contending
      then
         PrepareContention( received )

Procedure: PrepareContention( flag )
    if flag = sent then
      time ← maxContentionTime + maxChannelAccessTime
    else time ← maxContentionTime × (1 − myProgress/forwardingRange)
    contending ← true
    Contend( time )
```

Fig. 7 EMDV protocol for emergency message dissemination.

5 RESULTS AND DISCUSSION

5.1 D-FPAV Performance and EMDV Performance

To evaluate D-FPAV performance, two main simulation setups are consider: 1) D-FPAV On and 2) D-FPAV Off as shown in Fig. 8.

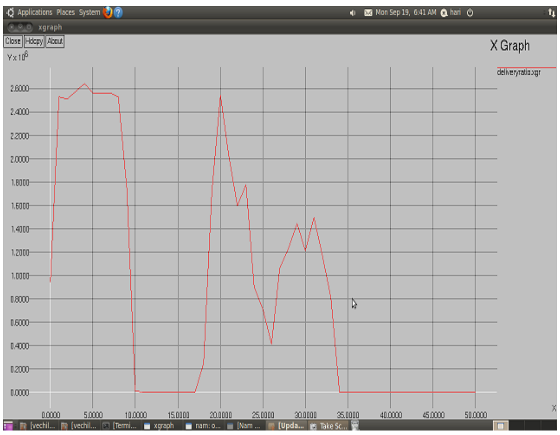

Fig.8 DFPAV-ON/OFF

The main metrics considered to evaluate D-FPAV's performance are given as follows: 1) the probability of successful reception of a beacon message with respect to the distance and 2) the average channel access time (CAT). The CAT is computed for all nodes and it is used to achieve fairness. The probability of reception is used to prioritize a safety-related message which is obtained by ensuring a high probability of correctly receiving beacons at close distances from the sender. It also increases the probability of successful reception of event-driven messages at all distances.

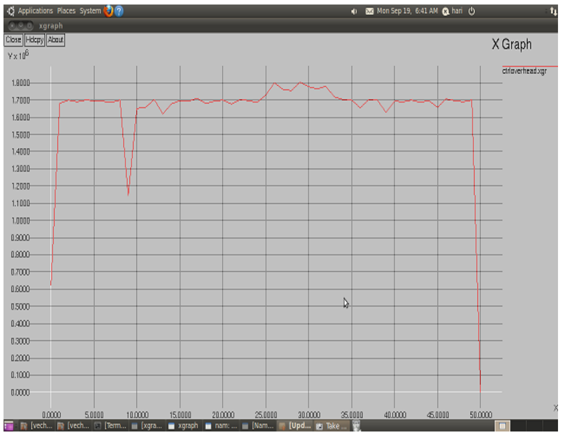

Fig.9 EMDV-ON/OFF

The performance of the EMDV protocol is shown in Fig.9. With a lower MBL, the EMDV protocol achieves a more efficient performance due to the lower channel load.

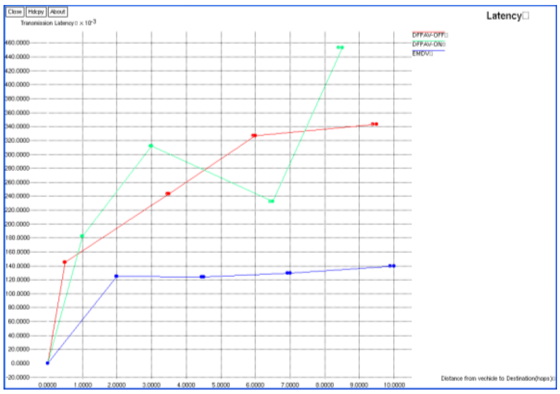

Fig.10 Comparison of Latency

Latency time (L) is defined as the time needed to propagate generated data between two vehicles positioned D meters from each other and the comparison graph is shown in Figure 10.

6 CONCLUSION

In this paper, a new efficient system for safety measures in VANETs.The vehicular networks which uses the IEEE 802.11p and active-safety communication will consist of two types of messages: 1) periodic beacon messages and 2) event-driven emergence messages. The

channel saturation can "easily" occur due to the load caused by beacon message transmissions. Simply increasing the rate or power will just make the channel conditions worse. In these conditions, both types of messages might not be received where they are needed.D-FPAV is a transmit power control approach based on a strict fairness criterion that can maximize the minimum value over all transmission power levels. The EMDV approach provides for robust and effective information dissemination of emergency information with help of nearby base station. For EMDV, the idea of contention-based forwarding that can very well deal with the unreliability of the channel and with node mobility is used. The emergency dissemination model is evaluated using latency time metric.
For the reduction of the dissemination delay, use of beacon information and forwarding techniques in combination with the contention-based approach is used. Efficient Performance is obtained when using both protocols together. The performance of the proposed protocols has been analyzed via ns2 tool. As future work, the selection criteria that decides whether a car should participate in broadcasting or not will be considered. These criteria will depend on several factors such as traffic density and car speeds.

REFERENCES

[1] Internet ITS Consortium. [Online]. Available: http://www.Internetits.org

[2] Vehicle Infrastructure Integration (VII)Project. [Online]. Available: http://www.its.dot.gov/vii/

[3] Car2Car Communication Consortium. [Online]. Available: http://www.car-to-car.org/

[4] The NOW: Network on Wheels Project. [Online]. Available: http://www.network-on-wheels.de

[5] IEEE P802.11p/D0.21, Draft Amendment forWireless Access in Vehicular Environments (WAVE), Jan. 2006.

[6] Network Simulator ns-2. [Online]. Available: http://www.isi.edu/nsnam/ns/.

[7] M. Torrent-Moreno, P. Santi, and H. Hartenstein, "Distributed fair transmit power assignment for vehicular ad hoc networks," in Proc. 3rd Annu. IEEE Conf. Sens., Mesh Ad Hoc Commun. Netw. SECON, Reston, VA, Sep. 2006, vol. 2, pp. 479–488.

[8] Torrent-Moreno, M, Mittag, J., Santi, P. Hartenstein,"Vehicle-to-Vehicle Communication: Fair Transmit Power Control for Safety-Critical Information",in IEEE Transaction on Vehicular Technology,Vol 58,No.7,Sep 2009.

[9] M . Torrent - Moreno, " Intervehicle comm.-unications: Assessing information dissemination under safety constraints," in Proc. 4th IEEE/IFIP Conf.WONS, Obergurgl, Austria, Jan. 2007, pp. 59–64.