Priority Based Scheduling by Achieve Better Service Ratio in VANET

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Abstract—Vehicular ad-hoc network (VANET) is a part of Mobile ad-hoc network (MANET). VANET used to communicate between mobile vehicles as well as, between vehicles and Roadside Unit (RSU). They communicate using wireless medium on roads and it sake interest when vehicles increasing more and more. They communicate with each other, and communication may be emergency messages, normal messages, and/or lower priority messages. Now, VANET have issue that it has frequent disconnection issue because of high mobility. Because of that some requests could not be served on time. It affects achieving higher service ratio. There are some researches available to provide better service ratio by some scheduling policy, but they are not full proof as there is starvation problem because higher emergency request rate affect normal requests to be served. We propose a priority based scheduling algorithm to avoid starvation using aging technique along with better service ratio. Our scheduling algorithm will be capable of higher service ratio and better quality of service.

Key words—VANET, Priority, Service ratio, Scheduling, RSU.

I. INTRODUCTION

The term intelligent transportation system (ITS) refers to efforts to add information and communications technology to transport infrastructure and vehicles, in order to improve safety and reduce vehicle wear, transportation times, and fuel consumption. A vehicular ad hoc network (VANETs), a subclass of mobile Ad Hoc networks (MANETs), is a promising approach for future intelligent transportation system (ITS) [1].

The recent adoption of the various 802.11 wireless standards has caused a dramatic Increase in the number of w ireless data networks. Today, wireless LANs are highly de ployed and the cost for wireless equipment is continuing to drop in price. Currently, an 802.11adapter or access point (AP) can be purchased for next to nothing. As a result of the high acceptance of the 802.11 standards, academia and the c ommercial sector are looking for other applicable solutions f or these wireless technologies. Mobile ad hoc networks (MA NET) are one area that has recently received considerable att ention. One promising application of mobilead hoc network s is the development of vehicular ad hoc networks (VANET) [2].

Objective of VANET is to provide right information to users avoid the accidents and safe the journey VANETs are composed for a set of communicating vehicles equipped with wireless network devices that are able to interconnect each other without any preexisting infrastructure (Ad-hoc-mode). The benefit of using ad-hoc networks is it is possible to deploy these networks in areas where it isn't feasible to install the needed Infrastructure. It would be expensive and unrealistic to install access points to cover all of the roads.

VANETs consist of 2 major elements, RSU (Road Side Unit) and OBU (On Board Unit). OBU is with vehicles, means they are with higher mobility. RSU is side by road means it’s static. According to their communication path it has following architecture patterns.

A. VANET Infrastructure

1) Vehicle - to – Vehicle (V2V)
2) Vehicle - to – Infrastructure (V2I)
3) Hybrid networks (V2V & V2I)

There are some classification of VANET applications like safety, convenience and commercial. Safety applications include slow/stop vehicle advisor, co-operative collision warning, post-crash notification etc. Convenience applications include congested road notification and parking availability notification. Service announcements and advertisements covered in commercial applications [3].

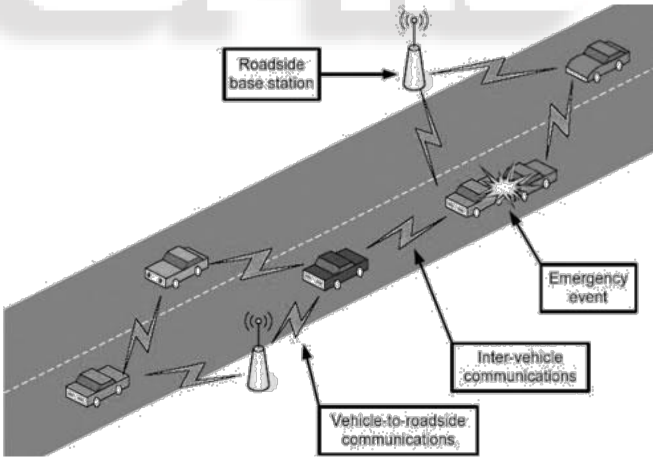

Fig. 1: VANET infrastructure

As VANET has applications and advantages, same way it has some problems also. Security concerns, frequent disconnection, fair sharing of bandwidth.

In our proposed algorithm we are planning to achieve better service ratio to deliver emergency messages. In VANET frequent disconnection, and high mobility is there so it’s much difficult to deliver message in time. Also there is priority of messages so that a low priority message never gets the chance to get delivered.

II. RELATED WORK

In VANET different type of messages are there so each having some priority and according to that it needs to be served. Also many of the messages are going to be broadcasted. Also frequent disconnection and higher mobility affects service ratio. Deal with these problems some kind of scheduling and multicast mechanisms to be used. To handle this broadcast following schemes are to be used.

In VANET there is same kind of requests can come to single RSU from multiple vehicles, so it is not preferable to serve all request at a time. If it serves all requests then network traffic increased. And also some emergency requests could not reach to RSUs, because of this service ratio will be decreased and cause hazard as emergency requests could not reach to RSU [4].

There is scheduling multi-item requests in RSU to vehicle communication can be used for better service ratio since a single broadcast used to serve more than one requests of same data item simultaneously. Each RSU store requests in local storage so that it prepare queue for same data items.Also vehicle mobility pattern canbe identified by RSU, so that overloaded RSU can transfer part of its requests to next non-overloaded RSUs according to the motion prediction of vehicles. Thisscheme is used for higher throughput. This scheme having starvation problem as some lower priority requests could not be served in time [4].

In another scheme there is scheduling based on priority and considering previous algorithm issue of starvation. From previous scheme there is not any kind of scheduling it just says that how to do multicast to serve multiple requests also transfer load from one RSU to another according to motion prediction of vehicles [5].

This scheme suggest equation by which scheduling can be derived. But for that we have to consider different kind of requests like emergency and normal. Emergency requests can be served first but also not to ignore normal requests. They need to be served according to deadline.

It is noticeable that vehicles request different data from RSU but urgent requests should be served with higher priority. Few vehicles may ask for the same data, so there should be some mechanism to postpone some of the requests. After that requests need to be served using multicast mechanism with consideringthe deadlines. This way several requests may be served with a single multicast. Here, RSUs act as a buffer point between vehicles or act as a router for vehicles in order to access the internet. Following metrics are to be used for evaluating the scheduling [5]:

A. Service Ratio

It is defined as the ratio of thenumber of requests served before the service deadline tothe total number of arriving requests. A good schedulingscheme should serve as many requests as possible means service ratio needs to be increased [5].

B. Quality of service (QOS)

It is defined asserving of urgent and critical requests with lowest delay.In other words, quality of service will increase if any vitaland urgent data is served without delay. A goodscheduling scheme should serve urgent requests as soonas possible [5].

It proposes a scheduling scheme based on which requests are lined in two different queues [5].

1) Data-queue: if the vehicle requests normal data (e.g., downloading map), its request goes to Data-queue. These requests should not be necessarily completed. But completion of this will affect service ratio.
2) Emergency-queue: if a vehicle requests an urgent data (e.g., accident notification), its request queues in Emergency-queue. These requests must be completed at highest priority before vehicle goes out of range.

Here 3 fields should be considered for the scheduling of requests. This algorithm introduces three fields from 4-cupled request that can be used for the aim of scheduling [5]:

1) Data Size: if the vehicles can communicate with theRSU at the same data transmission rate, the data size can be taken to decide how long the service will last. Requests which need more data to be transmitted should take less priority.
2) Deadline: If a request cannot be served before itsdeadline, it has to be dropped. This affects to service ratio. Thus, the request with an earlier deadline is regarded more urgent than the request with a later deadline.
3) Data type: urgent requests need to be served sooner than normal requests. Giving higher priority to emergency requests will prevent service delay and increase quality of service.

Here, all requests will be separated in 2 queues either emergency or normal. And according to D*S/W scheme requests will be served. Take head requests from both of the queue, now calculate D*S/W value for both of the requests. Among 2 queues which have D*S/W value less considered to be first and that request will be served.

Below equation is used to calculate DSW value. Above mentioned three parameters are composed with following formula [5]:

DSW_value = (Deadline – Current Clock)*DataSize/Weight

For data queue weight will be 1 as it has lower priority and for emergency queue it will be ∞ because it has highest priority. Also needs to consider that using multicasting same requests can be suspended for some amount of time. So question arise how to define suspend time. To calculate suspend time following equation to be used.

$$T_{suspend} = T_{deadline} - T_{current} - T_{response}$$

III. PROBLEMS UNREVEALED

As seen in all above schemes that they provide us scheduling scenario along with different queues also with equations with which we can consider which request needs to be served first.

But as discussed earlier that in VANET there is high mobility, so vehicles are moving with much lesser deadline time. In such case it is not preferable that the entire time emergency requests to be served. What if any vehicle requests for normal message and its deadline is less. It's not better to ignore normal requests if RSU receive more of emergency request. Our algorithm should be mature enough to handle such a situation and provide much higher service ratio by serving all normal and emergency requests; also it should have good scheduling mechanism and priority technique.

If normal requests will ignored in case when emergency requests are more than normal requests never been served considering previous algorithms and it will lead to starvation problem.

Here, normal or lower priority request never served if more and more emergency requests will be come as weight is ∞ so that it always gets higher priority.

IV. PROPOSED ALGORITHM

We propose following algorithm to incorporate with above mentioned problems.

At RSU:

For every t sec

Call Bcast(ssid) //RSU broadcast its ssid to tell OBU about its range

Calculate_deadline = transmission range and speed //Calculate deadline of vehicles passing through

Priority

If content_type = infotainment

Set Plevel = 2 //if normal message then priority set to higher value

Else if content_type = emergency

Set Plevel = 1 //if emergency request then lower priority value

Call sort_by_priority_level //sort each request by priority

//here we incorporate aging technique to increase priority of normal message

Function sort_by_priority_level () {

//if Plevel=1 then compare its deadline with emergency message deadlines and emergency has more deadline than

Plevel = 1+1;

}

Sender Side:

Register to RSU ()

Send pack ()

Receiver Side:

Register to RSU ()

Receive pack()

Above is the pseudo code of our algorithm. In that we have not incorporate mechanism for aging method. But we plan that we can increase priority of informational or entertainment messages after certain time by mechanism using deadline. So that after certain time that message also gets high priority to request has been served.

From currently available researches we got that there is scheduling technique is available using different priority queue, weight of those queues. But as far as higher traffic concern and more request for higher priority arrived at RSU, then normal priority requests never gets the chance to be served. Even though they consider deadline but it's for the current queue only. We plan to incorporate deadline for both type of queues, means we use single scheduling scheme for all type of priorities.

Also from previous researched algorithm having problem with starvation, if continuously emergency requests come to RSU then normal requests would not be served and it affect the service ratio. And that requests will be dropped as vehicle deadline reached, this cause starvation problem. We introduce aging technique for our algorithm to deal with this.

V. CONCLUSION

As VANET is combination of RSUs and OBUs and OBUs are with high mobility, also there is problem with frequent disconnection. It directly affects the service ratio of network. Also, requests are with different priorities, in such case all requests must be served with priority and using better scheduling method, because current research could not provide better scheduling with priority and cause starvation problem. Our proposed algorithm applies scheduling mechanism in a way that it will cover priority and deadline of vehicles so that service ratio will be increased.

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