Minimum Delay Based Routing Protocol in Vehicular Adhoc Networks (VANETs)

Babu Ram, Neelendra Badal

Abstract*: Vehicular Ad hoc Network (VANET) is interesting area for researchers. The VANET is an onward movement technique that amalgamates a wired network for communication of vehicle to infrastructure and wireless networks for vehicle to vehicle communication for promoting a creation of new communication infrastructure. The relevant factor in any network is delay. Query delay is directly depending upon to the distance of data source vehicle and data destination vehicle; therefore, authors endeavour to decrease the distance between the data source vehicle and data destination vehicle using cache technique. The vehicles have no problem of size of memory so data replacement not matter for new data. In this paper authors propose technique that minimization of delay in V2V and V2I both communication system.

Index Terms: *access point, delay, home network, overhead.*

I. INTRODUCTION

VANETs are very interesting areas in the field of mobile computing. This network is also a specific case of mobile adhoc networks. Vehicles move with high-speed, topology change very fast, moment of vehicle in maximum cases is predictable and acceptable low delay is characteristic of vehicular adhoc networks. In VANETs used both wire and wireless technology for communication. Vehicle to vehicle communication used wireless technology and vehicle to road side communication used wire technology, also known as vehicle to infrastructure communication. The connection between road side units use wires because the bandwidth of wire technology is more than wireless technology. The higher bandwidth provides higher data transmission rate that minimizes communication delay between road side units.

On Board Units (OBUs) are equipment. It uses on vehicle side. This equipment is capable of data sending, receiving, processing, memory, sensing the environment of road, current location of the vehicle, communication range of other vehicle etc. The Road Side Units (RSUs) in VANETs used at particular fixed place nearby road. Delay is a most and important factor in vehicular adhoc networks for emergency service. Only acceptable delay is used in VANETs show authors try to minimize the delay in both communication V2V and V2I. Delay mainly depends upon communication media, distance between the source vehicle and remote vehicle, processor speed and routing protocol. Author used internet based vehicular adhoc network concept because internet service is free while cellular networks is costly and GPRS have more delay. Minimize the distance between the data source vehicle and data destination vehicle using caching in each and every vehicle, and access points. Cache invalidation scheme and query delay the least in the conditions of mobility and communication cost.V2V communications don’t have a fixed infrastructure, vehicles are connected through single hop, multihop or directly connected by road side unit. The topology of the vehicular network keeps on changing very rapidly, so call for new routes to minimize time for searching process as well as minimize the overheads concerned in route discovery and then effort route maintenance in V2V communication.

The roadside units are usually supervised by the govt. or non-public agencies. The roadside unit makes of parts are access point, the foreign agent, home agents and therefore the server. Access point affection as associating between the vehicle and data server. When vehicle connects to the data server, vehicle has to initially contact the road side access point. Home Agent work as a router, it mounts on vehicle at home network that maintains info concerning the vehicle’s current location, as identified in its care-of address. The home agent acts as conjunction with a foreign agent (FA), the foreign could be a router on the other network additionally known as visited network. Which device that enables wired communicating devices to connect to a wireless communicating device is called an access point (AP). Data server (DS) means that offer knowledge accessibility to the info keep domestically at numerous native servers. The most vital issue for message transmission in VANETs is delay. The delay is that the time that network spends in transferring a message from source to the destination vehicle. The Delay within the VANETs is proportional to the distance of data source vehicle and also data destination vehicle. For ensuring safety applications, an acceptable delay value is required. So reducing query delay is most important in VANETs. The query delay depends upon distance between sources to destination, so authors try to reduce the distance of data source vehicle and data destination vehicle using cache memory. For reducing the distance authors use the cache in the vehicle but problem is how to find whether cache is valid with minimum time delay. The cache invalidation report is an emphatic technology to keep away from the inconsistent data in the data server and vehicle's cache.

Revised Manuscript Received on December 22, 2018.

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Caching many time accessed data items in vehicles can reduce the contention of channel bandwidth, query delay and communication cost. In spite of everything cache dissolution may be a superior method to come to a decision whether the copy in the vehicle's cache is consistent with the data server. In this paper authors provide a solution for reducing the query delay and for these authors propose a communication architecture which deals with both vehicles to vehicle and vehicle to infrastructure communication.

The all-important protocol design drawback is the way to keep the cache copies valid or to invalidate them once the initial them once the initial data items are updated. Conventional cache invalidation techniques are presently supported in MANETs and cellular networks. These techniques cannot be used for VANETs owing to the first reason that VANETs deploy high speed quality in their infrastructure. What are more the techniques in MANETs square measure supported broadcast technique that will increase the overhead on the server. Also, if we tend to deploy this system then it's sure to fail as a result if once vehicle moves from one network to a different then broadcast are of no use and data would be lost.

Our paper is divided as follows, Related work is discussed in section II. In section III we have given our proposed protocol. The analysis and performance evaluation with simulation is covered in section IV. Finally, we have concluded our paper in Section V.

II. RELATED WORK

Many cache memory techniques used in vehicular adhoc networks are cognate to the cellular networks and mobile adhoc networks. Numerous drawbacks within the current VANET technology because the vehicle movements are with high speed and moving paths are fixed. The interest for this work, however, lies in proving however the web are often created appropriate for sanctioning each vehicle to vehicle and vehicle to infrastructure communicate. Authors are discussing several cache invalidation schemes have been prescribed for VANETs, MANETs and cellular networks.

Barbara and Inielinksi have projected a theme for a stateless server, where the server broadcasts the invalidation report periodically and reduces the query delay [29]. An asynchronous cache invalidation theme is projected, where the server broadcasts an IR whenever a data item is change. Location dependent cache invalidation schemes square measure projected by B. Zheng, J. Xu, and D.L. Lee, wherever every node will check the validity of cached data things while not even connecting to the server [36]. Bruno F. Guedeset et al.[1] proposed protocol for data aggregation schema that manage traffic Information for geographic area of VANETs. This scheme works on real town map and cut back quantity of generated messages within the notification time. This theme works for specific applications for traffic data systems and never use for alternative application. Yiran Wei, Changqiao Xu, Mu Wang and Jianfeng Guan have proposed [2] a protocol for Cache Management for Video Streaming in VANETs. But not use in multimedia services in VANETs system. Nicholas Loulloudes et al.[3] proposed protocol for large-scale vehicular networks under different realistic urban traffic conditions and minimizing network overhead by minimizing the total number of exchanged messages among vehicles but this scheme based on TTL cache replacement policy in urban environments. LanChao Liu, Dongliang Xie, Siyu Wang and zhen Zhanghave proposed[7] a protocol for Vehicle moving very fast so disconnection occur at each node, but this protocol solves the disconnect caused by the mobility of vehicles. Celimuge Wu, Tsutomu Yoshinaga and YushengJihave proposed [4] a protocol for minimize overhead and use for broadcast and unicast applications. Gang Denget al. [5] Projected protocol for reduces the delay and improves the caching utilization however not use in another forwarding strategy to evaluate the potential interactions between caching and completely different forwarding methods. Durga Prasada Doraet et al. [6] proposed protocol for enhances the caching methodology and minimizes packet loss. Bo Zhang and Xiaohua Jia[8] have proposed a protocol for structures for VANETs with minimize number of roadside asses points. Kaizhe Hou et al. [9] proposed protocol for packet loss rate is very high between car to car communications when using a fixed value as transmission range. Celimuge Wu et al. [10] projected protocol for common backbone vehicles for various traffic flows, a high packet delivery quantitative relation and minimize overhead and delay. Xianghui Cao et al. [11] projected protocol for improve the delay performance of VANETs rely on fifth generation device to device (D2D) technology.

The interest of this work, however, lies on proving how internet may be created appropriate for facultative each vehicle to vehicle and vehicle to infrastructure communication. Additionally, the query delay needs to be decreased in VANETs [28], we use mobile IP for protocol to reduce query delay. Instead of victimisation the broadcast techniques, associate degree on-demand technique has been temporary. By using the foreign agent query gateway, answer the queried data item and cache invalidation is required for all the agents [36, 28]. A database server is used to maintain the data and information of vehicle with data registry with attributes like data-id, vehicle's id and timestamp. After the information is updated invalidation report will be generated by the server with said attribute. In VANETs, the information is broadcasted to the vehicle in spite to the home agent, and home agent will keep the information of vehicles location data and then it will be compared with home agent registry (Rh) [36, 37].

In summary, the on top of techniques cannot maintain the right cache invalidation and mobile adhoc networks (MANETs) cache invalidation on techniques cannot be directly applied to VANETs as a result of vehicle have high speed quality and query delay square measure primary concern. We tend to propose conceptually a routing protocol for VANETs for minimizing of Query Delay further as cache invalidation.

III. PROPOSED SOLUTION

In VANETs, the server does not maintain the location management. Therefore, we have proposed to utilize a state-full server so as to search out problem to the issues.

The state-full server has been deployed considering their practicalities that state-full server will bear in mind the vehicle data no matter the time it's requested. This paper assumes that the data will solely be updated by the server; the vehicle solely reads the data. Within vehicular adhoc networks, most likelihood is that the vehicles move in same direction or wrong way. Just about, within the road one-half vehicles move within the same direction. If vehicles move within the same direction then mobility impact reduces and vehicle to vehicle communication time is additionally redoubled, therefore this paper proposes a communication design that deals with each vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communication. With the assistance of V2V communication, the requested data may be received from the native cache in vehicle or remote cache in different vehicles additionally as via associate access point connectively to the internet. Data server does not maintain the vehicle location management. Vehicle's location is managed by home agent and foreign agent. When vehicle enter the foreign network, it sends its location update to the home agent. Every foreign agent has several access points (AP). If foreign agent receives a packet from totally different access point that is beneath an equivalent network, then it doesn't send the packet to the home agent, it solely send it once vehicle moves to a different network. Now we present our proposed protocol to reduce query latency delay throughout cache invalidation (RQLDCI) in vehicular ad hoc networks is given bellow.

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Algorithm: RQLDCI

1. ***if*** ($V_{x, y}$) {vehicle V_y requests the data item d_x }
{
2. ***if*** (data d_x is not found in V_y cache)
{Vehicle V_y send the query request to adjacent vehicles and server.
3. ***if** (*adjacent vehicle does not found the data (d_x))
{
It forwards the request to adjacent vehicle when hop limit is not exceeds.}
4. ***else***
{
Data is found the adjacent vehicle then this vehicle sent to the GFA for data validation
5. ***if***
{
Data is valid then send to the corresponding vehicle.
}
6. ***else***
{
Data is not valid then data is not sending to vehicle.
}
}
}
If vehicle found the data from the neighbour vehicle then store in cache and forward the acknowledgement to server and server stop the sending the data.
}
7. ***else*** (data d_x is found in V_y cache)
{Vehicle sent to data id GFA for data validation.
8. ***if*** (data is valid)
{
Send the positive acknowledgement
}
9. ***else***
{
Send the query request to the server.
}
}
}

Algorithm Description

When a vehicle (V_y) request data item (d_x) that is found within the vehicle cache, then vehicle sends the requested packet which has vehicle's id, data-id and vehicle home address to the GFA that checks for the cache validation. The GFA compares the id of query data with the registry. If data is valid it sends the acknowledgement to vehicle otherwise GFA sends this query packet to the server. The server's packet has three attributes vehicle's id, home network id, access point id with GFA id. The server also keeps the path information of the received packet and requested packet is incorporate with this data within the received packet and it will be sent back to the GFA. Server keeps all the information related to vehicles in the same network, if it will move from the same network all data will be updated in the server's registry to give the answer and then there's no downside, it will get positive response and, if the vehicle moves to other network then GFA won't send packet and server will receives the negative acknowledgement (NACK). Home network (HN) keeps the information of vehicles current location and maintains all data of current network then packet will be delivered to the new GFA. The complete algorithm is discussed Figure 2 shows the method with comparison, Where Vy (Vehicle) request data item (dx) and generates two types of request one is vehicle to vehicle communication and other one is vehicle to infrastructure that contains vehicle-id, access point with its own id and passes on the query packet to the GFA, all steps are covered in algorithm . The GFA once more adds its own id into received packet and this whole packet is shipped to the server. Thus, the packet received by the server would have attributes particularly vehicle's id, home network id, access point id and the GFA id. The server would even be ready to acknowledge the path of the incoming data request. The server would look for data requested and incorporate this data within the received packet.

In vehicle to vehicle communication, requested packet which is send to neighbour's vehicle have the vehicle's id and data-id, If data is not found in neighbour's vehicle then it is send to other neighbour vehicle until the limit of hop count is not reached. The hope count value is depending upon transmission range of vehicle and vehicle's velocity. If data is found within the neighbour vehicle's cache, then this vehicle sends request packet for validation to the GFA through the access point. If cached copy is valid, then vehicle forwards the data to related vehicle. If data is not valid then vehicle does not forward the data. If vehicle received the data from the neighbour vehicle, then it sends information to server by AP and GFA for stopping the transmission of data.

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From the above method query delay and maintenance of cache invalidation may be reduced. The new proposed cache invalidation scheme (RQLDCI) provides higher performance and fewer overhead.

IV. ANALYSIS AND PERFORMANCE EVALUATION

In this section, we have a tendency to analyze the performance of the proposed schemes. In VANET (VANETs), most chances are that the vehicles move in same direction or opposite direction. If vehicles move in the same direction then mobility impact would reduce and vehicle to vehicle communication time is also increased. Assume that T is diameter of the communication range of vehicle to vehicle and d is distance between two vehicle V_1 and V_2, vehicle communicate with each other if $d \leq T$.

Case -1 when vehicles move in same direction with velocity v_1 and v_2, and then initial communication time is $|T/(v_1-v_2)|$.

Case -2 when vehicle move in opposite direction with velocity v_1 and v_2, and then initial communication time is $|T/(v_1+v_2)|$.

For example v_1=70km/h and v_2=50km/h and T=250 meter. Then first case communication time is 45 sec and second case communication time is only 7.5 sec. In the first case reduces the mobility effect because communication time is large. We assume that probability of data found in vehicle's cache is *p* and probability of data found in remote vehicle's cache is *f*. To calculate the query delay, 3-cases got to consider:

1. The requested data item is within the vehicle's cache.
2. The requested data item is found within the remote vehicle's (Vi) cache. 2 sub cases area unit possible:
   a. A valid data item is kept in remote vehicle (Vi).
   b. The data item in remote vehicle's cache is not valid.
3. Data is not found in local or remote vehicle's cache.

TABLE 1. Used Parameter

Parameter	Description
D	All super set of data
d_x	Is the basic unit of an update or a query operation, wherever $1 \leq x \leq d$
N	Total number of vehicles
$V_{x,y}$	Vehicle V_y request data item d_x
IR	Invalidation Report
IR(s)	Invalidation report generated by server, IR(s) ε (id(d_x), id($V_{x,y}$))
IR(h)	Invalidation report generated by home agent(HA),IR(h) €(id(d_x),id($V_{x,y}$),id(GFA))
Rs	The server maintains data regarding that data item accessed by that vehicle and conjointly maintains the vehicle home network address.
Rh	The home agent (HA) maintains location information about which vehicle is currently roaming under which GFA
T	T is diameter of the communication range of vehicle to vehicle.
L	L is diameter of the RSU communication range
v_i	The velacity of vehicle V_I

The various parameters used for performance evaluations of the algorithm are given Table 1. To evaluate the performance of the projected scheme we've developed a simulation model.

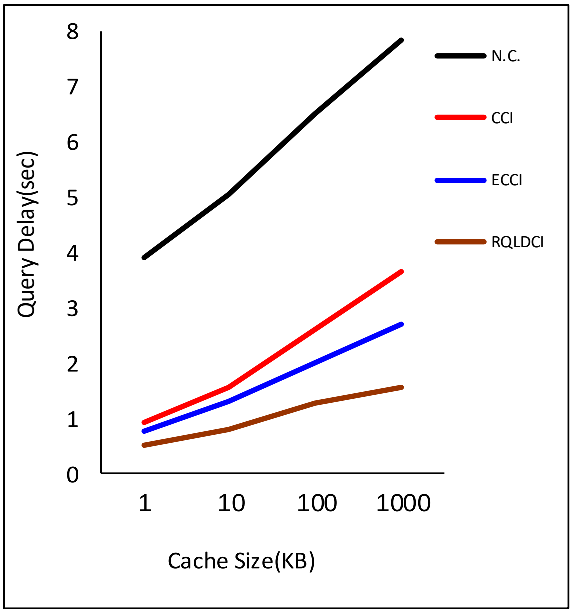

Fig.1. Query delay vs. cache data size

We assume every AP features a diameter (T) of 750 (m) and every GFA consists of five APs. Initially, the vehicles are randomly placed within the area and speed (v_i) of vehicle is sixty km/h. Query data (d_x) item size varies from one to five hundred Kbytes and it's assumed that bandwidth of wired network and wireless network is 1000

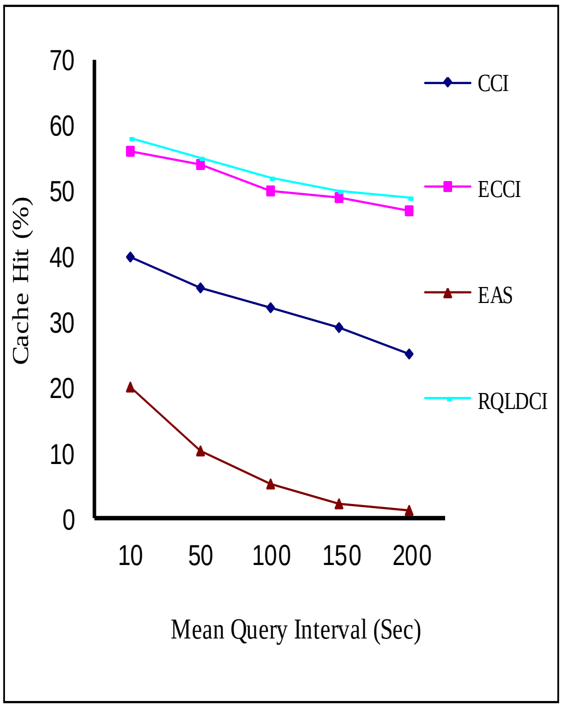

Fig.2.Cache hit vs. query request interval

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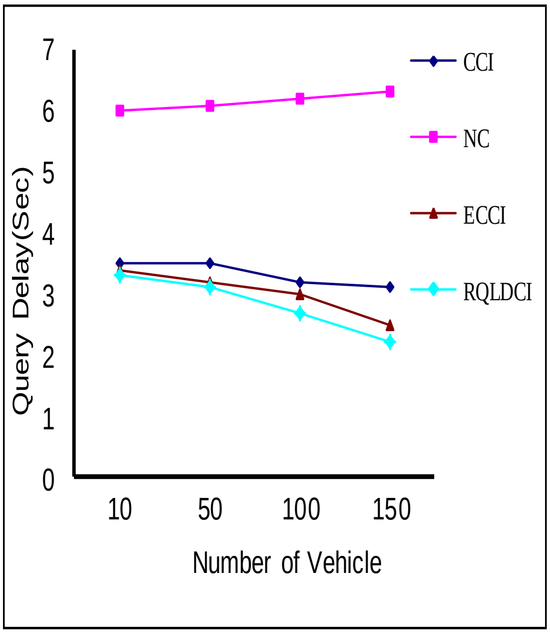

Fig.3.Query delay vs. number of vehicles

MBPS and 2 MBPS severally. We evaluate the query to find the query delay to operate the data size. The non-caching (NC) scheme takes the upper query delay in comparison to cooperative and enhance cooperative caching (ECCI) scheme. Fig.1 shows that the newly proposed protocol (RQLDCI) performs on the others protocol and achieves lowest query delay for all data sizes. Fig. 2 shows the impact of mean query generation time on system performance. Once query interval is large, the many cache data are not useful because data is invalid. Therefore, the cache hit ratio is very low. Cache may not found the valid data item so query request is sent to server. Therefore, the cache hit magnitude relation is extremely low. Cache might not found the valid data item therefore query request is shipped to server. Fig. 2 show the query delay of latest protocol (RQLDCI) is lowest. Fig. 3 shows the impact of query delay as operate of variety of vehicle. Once additional number of vehicles in the system, remote cache hit magnitude relation is high. Since query delay is scale low. The new proposed cache invalidation scheme (RQLDCI) provides higher performances and fewer overhead.

V. CONCLUSION

In this paper, we have a tendency to embrace each vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communication and The newly proposed scheme for determination the query delay has been reduced with cache invalidation problem related to VANETs and also data consistency has been successfully maintain. The newly proposed scheme reduce query delay through cache invalidation (RQLDCI) performs higher than others protocol and achieves lowest query delay for all data sizes. The network traffic and therefore the overhead on the server are reduced. The systems overall performance therefore will increase and it is more additional capable of providing services not solely quickly however conjointly effectively.

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