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VANETs Using Efficient Routing Hybrid Protocol to Increase Performance in Different traffic Scenarios

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ABSTRACT

A vehicular ad hoc network (VANETs) is a upcoming technology to establish a communication between a vehicles while travelling which provide a internet connectivity. VANET provides wireless communication among vehicles and vehicle to road side equipments. The communication between vehicles is used for safety, traffic monitoring, entertainment and exchanging warning messages between vehicles. The performances of communication depend on how better the routing takes place in the network. Routing of data depends on the routing protocols being used in network. Within VANETs; vehicle mobility will cause the communication links between vehicles to frequently be broken. Such link failures increase the routing overhead and decrease network scalability. For that propose a Hybrid location-based routing protocol (HLAR). Which is generally used for repairing a link failure? HLAR is a combines feature of reactive routing with location-based geographic routing in a manner that efficiently uses all the location information available.

Keywords: Vehicular Ad Hoc Network (VANET), routing protocols, mobile ad hoc networks, AODV, geographic routing protocol.

I. INTRODUCTION

A vehicular ad hoc network (VANETs) is a sub part of MANETs (Mobile ad hoc network).It is very popular and grown in the last few years. Because of in VANETs an intelligent transportation system (ITS) is used. This helps Traffic monitoring, traffic management and vehicle tracking notification services formatting.

In VANETs routing is very challenging because vehicles are in moving so that high dynamic topology, frequent disconnected network, mobility modelling, high channel fading and varying density and size of the networks such problems are arise.

In VANETs every participating vehicle is a wireless router or node, allowing vehicles approximately 100 to 300 meters of each other to connect and, in turn, create a network with a wide range. So that which routing protocol uses is the key issues in VANETs. The routing protocols in VANETs can be classified into the following two major categories [1]:

1) topology-based routing and 2) geographic (position-based) routing. Topology-based routing protocols use the link's state information which is stored in routing table as a basis of to forward packets from source node to destination node. In VANETs the main topology-based routing protocols is a ad hoc on-demand distance vector (AODV) protocol.

AODV

Ad Hoc On Demand Distance Vector routing protocol [9] is a reactive routing protocol which establish a route when a node requires to send data packets. It has the ability of uncast & multicast routing. It uses a destination sequence number (DestSeqNum) which makes it different from other on demand routing protocols.

Pros

- An up-to-date path to the destination because of using destination sequence number.
- It reduces excessive memory requirements and the route redundancy.
- AODV responses to the link failure in the network.
- It can be applied to large scale ad hoc network.

Cons

- More time is needed for connection setup & initial communication to establish a route compared to other approaches.
- If intermediate nodes contain old entries it can lead inconsistency in the route.
- For a single route reply packet if there has multiple route reply packets this will lead to heavy control overhead.
- Because of periodic beaconing it consumes extra bandwidth. It has the best performance and lowest routing overhead among all topology based routing protocols. The common characteristic among all topology-based routing protocols is that the performance degrades as the network size increases.

Geographic Routing Protocol

The geographic (or location-based)[1] routing protocols do not exchange any link-state information and do not establish and maintain any routing tables, they should operate under a much reduced routing overhead. As such, geographic routing holds great promise for highly dynamic environments such as VANETs. In the context of VANETs, the forwarding decision by a vehicle using geographic routing is primarily based on the position of the destination vehicle and the position of all vehicles' neighbours to each others. The position of the destination is stored in the header of the packet that was transmitted by the source vehicle. The position of all vehicles' one-hop neighbours is obtained by listening to the beacon packets that are periodically sent between vehicles. Geographic routing assumes that each vehicle knows its location, e.g. through an onboard Global Positioning System (GPS). Geographic routing also assumes that the sending vehicle knows the receiving vehicle's location. This condition requires an efficient location service management system that can keep track of the locations of the vehicles within the network. It should be stated, however, that geographic routing has several issues, which has inhibited its wide adoption—most important of which is that of location error. Location errors can severely degrade performance in location-based forwarding schemes, making accurate location information a necessity for most geographic routing protocols. In addition, geographic routing fails in the presence of void regions, where a closer neighbour vehicle toward the destination cannot be found. procedures, packets often tend to travel on longer paths to their destinations or get caught in a loop and be dropped.

Pros and Cons

- Route discovery & management is not required.
- Scalability.
- Suitable for high node mobility pattern.
- It requires position determining services.
- GPS device doesn't work in tunnel because satellite signal is absent there.

In VANETs, no single routing protocol will good in all scenarios (i.e. in highway and city scenarios) so that a hybrid approach is used. Therefore, here, HLAR is a hybrid design; it is combine features of reactive routing (AODV) with geographic routing.

In HLAR instead of AODV, AODV-ETX used which is used to repair a link failure when link failure occurred for transferring the data from source to destination.

II. LITERATURE SURVEY

[1] In 2013 Marwa Altayeb and Imad Mahgoub [1], author discusses all the routing protocol used in VANETs also discusses working, characteristic and subtypes of all the protocols.

Pros and cons: During this paper author summarizes the characteristics of all routing protocols that have either been used or designed specifically for VANETs and also gives the description of whether the given protocol is topology base or position base. In topology base how the packets are transmitted. Which transmission strategy used in transmission strategies protocol?

[2] In 1999 C. Perkins and E. Royer [11], author presents Ad-hoc On Demand Distance Vector Routing (AODV), protocol.

Pros and cons: AODV is an on demand distance vector routing protocol within which routes area are established on demand menace whenever necessary and messages are passes from source to destination using RREQ message and destination send RREP message to source when message reach to the destination AODV offers low network overhead by reducing messages flooding in the network. So reducing the requirement of memory size by minimizing the routing tables which keep only entries for recent active routes, also keeps next hop for a route rather than the whole route.

It also provides dynamically updates for adapting the route conditions and eliminates looping in routes; by using destination sequence numbers. So AODV is flexible to highly dynamic network topology and large-scale network.

However, it causes large delays in a route discovery, also route failure may require a new route discovery which produces additional delays that decrease the data transmission rate and increase the network overhead.

[3] In 2013 Mr. Nikhil D. Karande, Ms. Kushal, K. Kulkarni [3], author trying to analyse the performance of AODV protocol with respect to various routing parameters and show the result using different simulator.

Pros and cons: The performance of AODV is analyse using parameter like Throughput, Packet size, Packet drops, End to End delay etc in three different scenarios of node density. The performance of the proposed protocol has been studied using simulation tools mainly Network Simulator (NS) and MOVE (Mobility model generator for Vehicular networks) over SUMO (Simulation of Urban Mobility).

[4] In 2013 Mangavaram .D and Vishnupriya.R [7], discusses a Dedicated Short Range Communications (DSRC) is a key enabling technology for VANET applications and HLAR and MAC protocol for VANETs.

Pros and cons: Giving diagrammatical representation of DSRC Channel assigns by FCC, also the application and layered view of vehicular network. A secure MAC protocol for VANETs has different message priorities for different types of applications to access DSRC channels.

[5] In 2013 Jacek Rak [5], author investigated the issue of end-to-end multipath transmission availability in V2V networks. Special focus was put on achieving continuity of transmission in the presence of inter-vehicle link failures being result of vehicles mobility.

Pros and cons: Author gives the protection against link failures with respect to three introduced classes of AODV of service availability, namely: bronze, silver, and gold, and to increase the communication path lifetime.

III. IMPLIMETION DETAILS

HLAR (hybrid location-based protocol) is a combination of AODV protocol with a greedy-forwarding geographic routing protocol. In HLAR, instead of AODV, AODV augmented with the expected transmission count (ETX) is used to find the best quality route (instead of the minimum hop count). In AODV, intermediate vehicles report the broken routes to their source vehicles. The AODV-ETX has additional functionality where intermediate vehicles are allowed to locally repair broken routes (a local repair save the time and cost less power consumption to re-establishing a new source-to-destination route).

For implementing HLAR we are create nodes as a vehicle in VANET, And every node are act as neighbour node for each other. The nodes are source node, intermediate neighbour nodes and destination node. Every vehicle has desired path and that moves in that path. Source vehicle broadcast the beacons (emergency message) to nearest neighbouring vehicles, and neighbouring vehicles to next neighbouring vehicles. Applying this procedure message is reach to the destination vehicle. It is show in the figure 1.

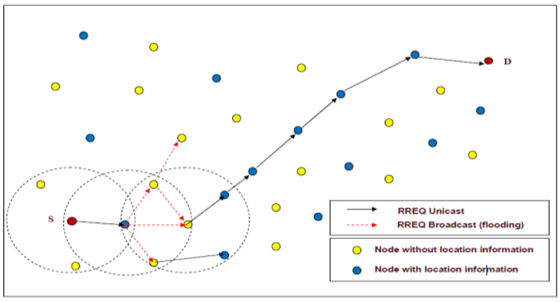

Figure 1: Shows how RREQ packets are transfer from souse S to destination D. There was a expected zone and circle shows the how broadcast the beacon.

Consider source node S wants to send the beacons to destination node D. Assume that S knows the location of D at time. We supposed to get expected zone by sending acknowledgement beacons from destination. As node is free to move in any direction, the expected region will be a circular area. When the destination will be in expected zone source will send the beacons to destination through intermediate nodes. As destination node will be out of zone remaining beacons will persist till the destination returns into expected zone. As destination comes in zone remaining beacons will be send and data delivered to destination.

For transferring message if any link failure occurred menace there is no vehicle in the zone of message transferring vehicle then there link failure occurred of that vehicle. HLAR protocol locally repairs that link failure without informing to the source vehicle. i e message transferring vehicle search nearest neighbouring vehicle and repair link. In such a way message is transfer to the destination vehicle.

3.1 Algorithm

Step1: Initialize the timer and generate the beacon (small data units) Packets.

Step2: produce node table (in node table vehicle ID and location coordinates of the neighbouring vehicles present.

Step3: Check if the source has route to the destination? (In which source check self node table if any nearer vehicles present towards the destination.)

Step4: Check the node table and routing table? (Every neighbouring vehicles of source check self node table and routing table if any nearer vehicles present towards the destination.)

Step5: if no route found source create RREQ message and flood RREQ message towards the destination and update neighbour node table and self node table according to vehicles comes in the zone.

Step6: Check any error. (Check any link failure occurred menace no beacon packet transmitted between the two vehicles towards the destination.

Step7: Inform source to repair (link failure) or locally repair (Find out another neighbour vehicle).

Step8: Forward the RREQ message to neighbouring vehicles until it reaches the destination.
Step9: If destination gets RREQ message then destination vehicles send RREP (route reply message to the source.)

Step10: When RREP received to the source? Menace message successfully transfer to the destination.

Step11: Again update the routing table and node table of all the nodes according to the vehicles in the road.

3.2 Propose Model

The propose model of the HLAR protocol is shown in the figure 2. Model shows how beacons are transfer from different units. The steps of the model are follows.

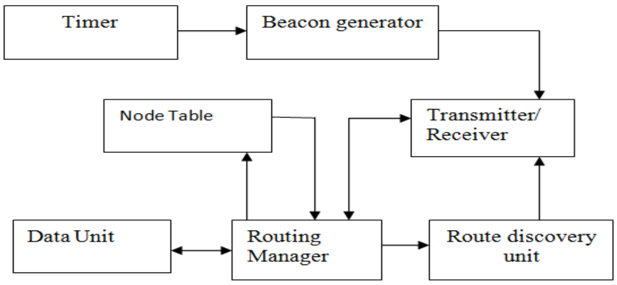

Figure 2: Shows the architecture of HLAR protocol.

1. First set timer and generate beacon
2. Create the node table file: - Create the node table according to the vehicles present.
3. Route discovery: - Route discovery unit discover the route for generating following two messages.
   Route request:-If no route found then source send RREQ message to all intermediate node. Route reply:- If RREQ message reach to the destination then destination send RREP message to the source vehicle.
4. Route Manager:-update the routing table according to the vehicle comes to each other's.
5. Data Unit:-Supply the storage data about node to the Route manager

3.3 Flowchart

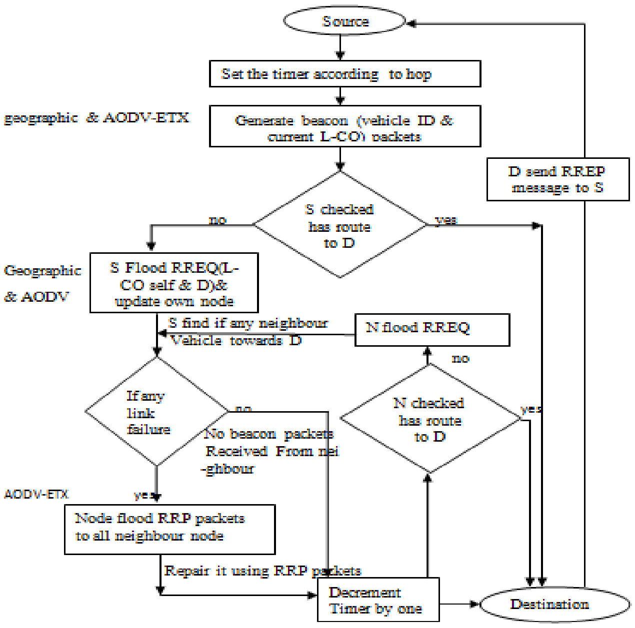

Figure 3: Flowchart of working of HLAR protocol and in which stapes which protocol works.

3.4 Flowchart Description

According to the system implementation

1. Create the node table file.

Vehicles those are in the VANETs environments are broadcast tiny beacon packets periodically. These broadcasted periodic beacon packets contain the vehicle's ID and current location coordinates. These periodic beacon packets help other every neighbour vehicle to make their neighbour information table.

2. Beacon message generation & Route discovery

If the source vehicle has no route to the destination vehicle, then source vehicle initiates the route discovery in Associate in nursing on-demand fashion. After generating RREQ, node looks up its own neighbour table to search out if any route toward the destination vehicle. If it found any closer neighbour vehicle, the RREQ packet is forwarded to that vehicle. If no closer neighbour vehicle is present then RREQ packet is flooded to any or all neighbour vehicles.

3. Repair link failure

If link broken or failure occurred then vehicles that participate in broken link locally repair and data is transmitted towards destination or if it is not repair then participle vehicles inform the source vehicles.

4. Hybrid model routing

The hybrid model routing protocols combines feature of proactive and reactive protocol. In these routing protocols the routing is at first established with some proactively prospected routes so serves the demand from additionally activated nodes through reactive flooding.

IV. RESULT

1) The actual implementation of HLAR in Urban scenarios is shown in the following fig.

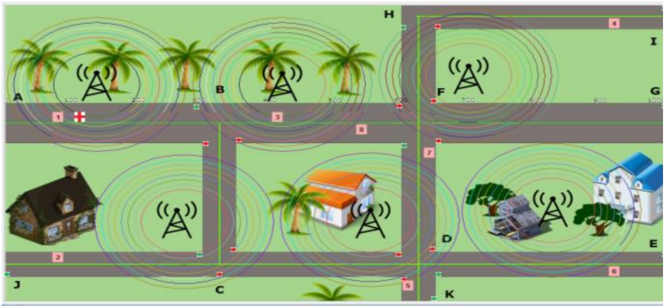

Figure.4.1: Frame for urban scenarios

This fig shows the urban scenarios frame. In which 1,2,3… nodes are nothing but vehicle and all the nodes are in moving in their desired path. Towers are transferring the waves in the desired zone. In the signals there are red and green light showing the traffic signals. In urban scenarios there are so many disturbances for passing the signals such as buildings, trees, traffic etc. Source vehicle transfer the emergency message to the destination vehicle. The result of urban scenarios is shown in the following graphs.

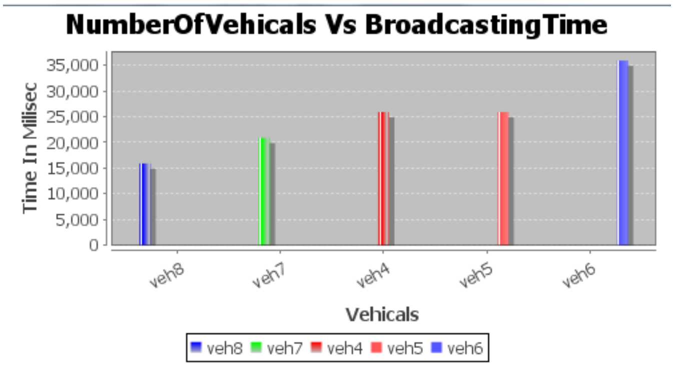

Figure 4.1.1: Urban scenarios number of vehicles Vs Broadcasting Time result

This graph shows the result of vehicles broadcasting a message in millisecond. When source broadcast emergency message hear five neighbouring vehicles are broadcasting a message in millisecond towards the destination.

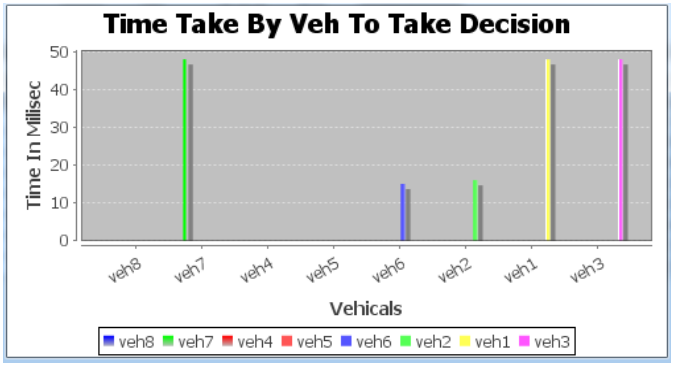

Figure.4.1.2: Urban scenarios Time Taken by Veh to Take Decision

In this urban scenarios graph show how many millisecond taken by neighbouring vehicles to take a decision to broadcast a message to other neighbouring vehicles. Some vehicles are neutral because they are out of the zone in which message is passed.

2) The actual implementation of HLAR in Highway scenarios is shown in the following fig.

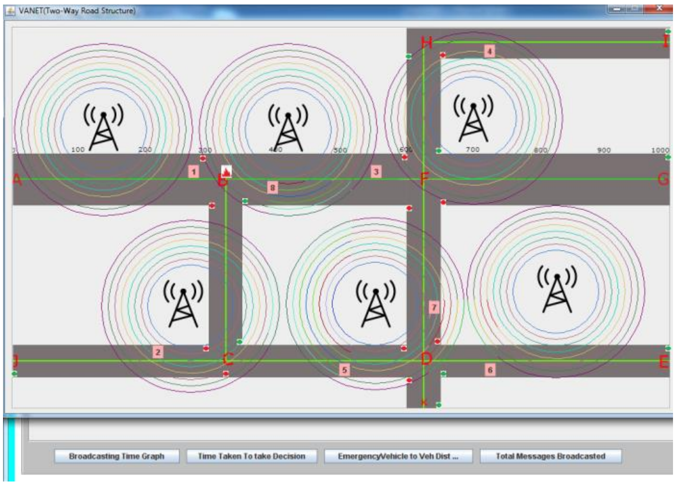

Figure.4.2: Highway Scenarios Frame

This fig shows the highway scenarios graphical user interface. In which 1,2,3… nodes are nothing but vehicles moving in a desired path. Towers are transferring the waves of signals in a particular zone. In the signals there are red and green light showing the traffic signals. In Highway scenarios there are no disturbance for passing the message because in which roads are straight and no buildings, trees, traffic etc in the way. Source vehicle transfer the emergency message to the destination vehicle through the neighbouring vehicles. The highway scenarios result shown in the following figure.

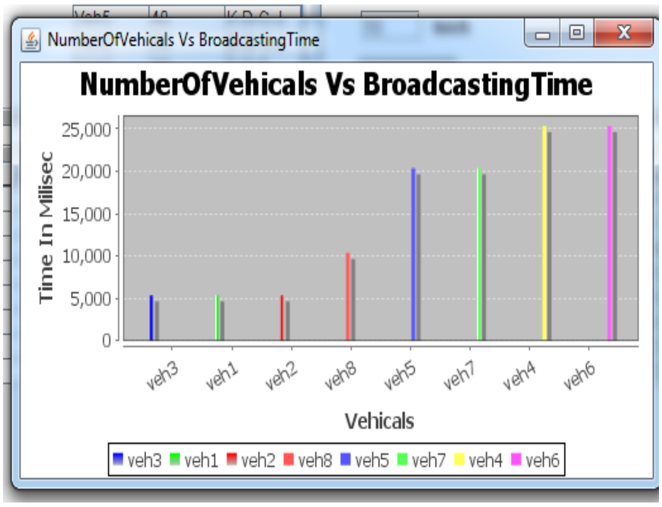

Fig.4.2.1: Highway Scenarios number of vehicles Vs Broadcasting Time result

In the above graph shows the result of the number of vehicles take a time to broadcasting a message in millisecond. Hear all the eight vehicles are broadcast a message towards the destination. Those vehicles are nearer to source are take less time to broadcast a message and those are away from source are take more time to broadcast a message.

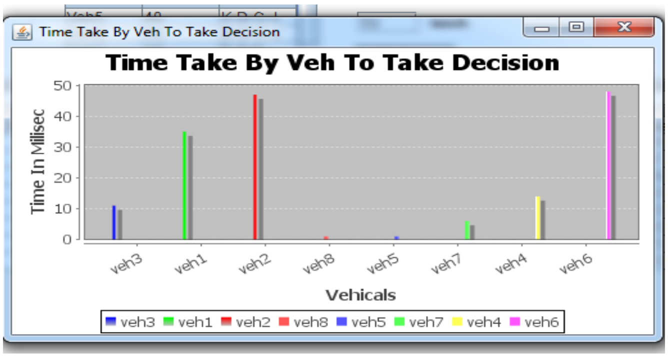

Figure 4.2.3: Highway Scenarios Time Take by Veh to Take Decision

This graph shows time taken by the vehicles to take a decision for broadcasting a message in millisecond. Some vehicles take low time and some vehicle take large amount of time.

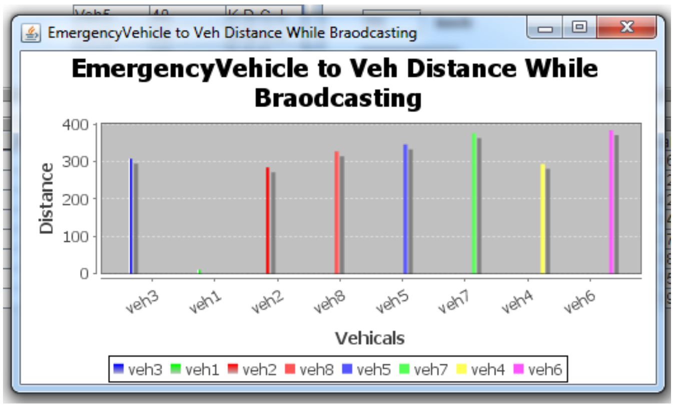

Figure 4.2.4: Highway Scenarios Emergency Vehicle to Veh Distance While Broadcasting

This graph shows the distance between Emergency vehicles (such as ambulance, police car) to another vehicle distance while broadcasting a message. Some vehicles have low distance and some vehicles have high distance from vehicle to emergency vehicles.

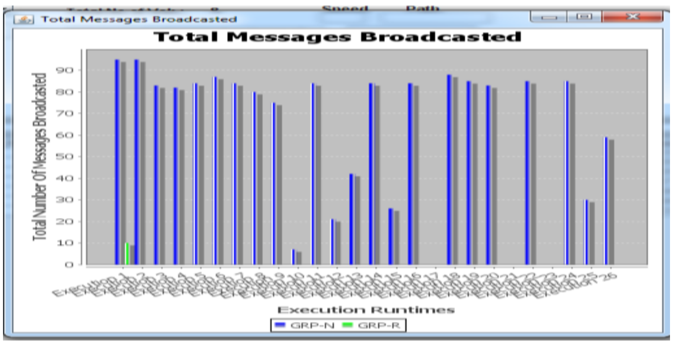

Figure.4.2.5: Highway Scenarios Total Message Broadcasted

This graph shows the result of total messages broadcasted by vehicles in every execution.

V. CONCLUSION

In this study, a new hybrid location based protocol (HLAR) which is the combined feature of reactive routing with geographic routing. In the reactive routing AODV-ETX is used instead of AODV. In HLAR routing overhead can be reduce as compared to standard reactive and geographic routing protocol. While transferring data in the networks link failure or location error occurred. HLAR simply locally repair a broken route instead of just reporting to the source using AODV-ETX and find the location using geographic location based protocol. Thus HLAR effectively obtains optimal scalability performance.

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