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Analysis of Hybrid GPSR and Location Based Routing Protocol in VANET

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***Abstract*-VANET (vehicular adhoc network) is an emerging new technology. Vanet communication has recently become an increasingly popular research topic in the area of wireless networking. A Vanet turns every participating vehicle into a wireless router or node allowing vehicles to connect and create a network. The primary goal is to increase road safety. Routing in Vanet is an important issue. In this paper various routing protocols are discussed, and out of all Position based routing protocols is found to be suitable for Vanet. GPSR is one of the most suitable position based routing protocol. This paper presents a hybrid approach PHRHLS (A Movement Prediction based Joint Routing and Hierarchal Location Based Service) coupling GPSR protocol and HLS location service with mobility algorithm.**

***Index Terms*-- VANET, Routing Protocols.**

I. INTRODUCTION

Vanet is the application of Manet. Vanet belongs to wireless communication network in which communication between vehicles takes place. In which vehicles act as nodes in the network. The communication types are Vehicle to Vehicle (V2V), Vehicle to Infrastructure (V2I) and Vehicle to
Roadside(V2R). Vanet is the most important component of intelligent transportation system (ITS) in which vehicles are equipped with some short range and some medium-range wireless communication. A Vanet turn every participating
vehicle into a wireless router or node allowing vehicles to connect and in turn create a network with a wide range. The primary Vanet goal is to increase road safety, improving transportation system and increasing vehicle safety. To achieve this vehicles act as sensors and exchange warnings that enable the drivers to react early to abnormal and potentially dangerous situations like accidents, traffic jams. Instead of safety applications it also provides comport applications to road users. For example internet access, e-commerce and multimedia applications. Through internet access users can download music, send e-mails and play games. There are various applications that were developed under collaboration of various government and car manufacturers some of them are “Advance Desire Assistance Systems (ADASE2), Crash Avoidance Matrices Partnerships (CAMP), CARTACK 2000 and “Fleet Net”.

II. COMMUNICATION TYPES

Vehicle to Vehicle (V2V) - Vehicle to Vehicle communication is suitable for short range vehicular network. It provides real time safety, fast and reliable. It does not need any roadside infrastructure. It is not very useful in case of sparsely connected network or low density vehicular network. In V2V warning messages are broadcast from vehicle to vehicle

Vehicle to Roadside (V2R) -Vehicle to Roadside provides communication between vehicles and the roadside units. It makes use of pre-existing network infrastructure such as wireless access points. In V2R warning messages are send to roadside units and then from that roadside units warning messages send to the vehicles.

Vehicle to Infrastructure (V2I) - Vehicle to infrastructure communication provides longer- range vehicular networks.

III. APPLICATIONS OF VANET

The applications where VANET is efficiently used are:

- Traffic Signal
- Vision enhancement
- Weather Conditions
- Driver Assistance
- Automatic Parking
- Safety

IV. ROUTING PROTOCOLS IN VANET

The routing protocols in VANET can be categorized into different categories such as Topology based routing, Position based routing/Geographic routing, Cluster based routing, Broadcast routing and Geocast routing.

- Topology based routing perform packet forwarding by uses the links exist in the network. The various types of topology based routing are Proactive, Reactive and Hybrid. Proactive protocols are table driven routing e.g. FSR, OLSR, and TBRPF. Reactive protocols are called on-demand routing protocols which decrease the overhead caused by proactive routing protocols. It uses the process of flooding e.g. AODV, DSR and TORA. Hybrid protocols will reduce the control overhead of proactive routing protocol and it is the combination of proactive and reactive routing protocols e.g. ZRP and HARP.

- In position based routing protocols every nodes knows its neighbor by using GPS information. It does not maintain any routing table. These protocols require knowledge about neighbor nodes and destination nodes to send packet successfully. Hello messages or beacon messages are used to update the information. A source node uses hello messages to find location of the neighbors. The position information of all nodes and vehicles are identified by location services. The various position based routing protocols are GPSR, GSR, A-STAR, GYTAR, BMFR, AMAR, BMAR.
- Cluster based routing protocols the vehicles close to each other form a cluster. There are two types of communications inter-cluster and intra-cluster. In intra-cluster vehicles communicate with every other vehicle via the direct links and in inter-cluster vehicles communicate with each other by using cluster heads.
- Broadcast routing protocols also known as flooding routing protocols which transmit the information to the maximum nodes when an accident takes place.
- Geocast routing protocols also known as the location based routing protocols which is used to send messages in the selected area called as Zone of Relevance. These protocols are separated into beacon-based and beaconless-based protocols. Beacon-based are IVG and DRG. Beaconless-based are Cached Geocast, ROVER, Abiding Geocast, DG-Castor, DTSG, Constrained Geocast, Mobicast routing.

V. RELATED WORK

In [1], authors have discussed about various applications of VANETs like intelligent transport applications, comfort applications, collision avoidance, cooperative driving, traffic improvements, payment services and location-based services all these applications help drivers, avoid congestion on road, and maintain security and any more. Then in this paper, they discussed about the pros and cons of various routing protocols.

In [2], authors compared various position based routing protocols namely GPSR, GSR, A-STAR, GYTAR, BMFR, AMAR, BMAR. Position based routing protocols uses the GPS information to choose the next forwarding hops. These protocols require knowledge about neighbor nodes and destination nodes to send the packet successfully. Hello messages or beacon messages are used to update the information. A source node uses hello messages to find location of the neighbors. The position information of all nodes and vehicles are identified by location services. In this paper, they simulated protocols GyTAR, EBGR, B-MFR on two parameter end-to-end delay and packet delivery ratio.

In [3], authors compared performance parameters of three different VANET routing protocols that is AODV, DSDV, and DSR. In adhoc on demand distance vector routing protocol it establish a route when data packets send by the node it maintains routing table and within certain time period if node is not used then it is deleted from the table. In destination sequenced distance vector it uses the bellman ford algorithm in this every node maintains a routing table it uses two types of route update packets full dump and incremental packets. In dynamic source routing the source node send RREQ packets with the help of other nodes to destination and when packet reaches destination then it sends RREP packet to destination. Then in this, they compared all these protocols on various parameters which show no protocol performs well.

In [4], the authors proposed the two combinations one is the GPSR with the grid location service (GLS) called HRGLS hybrid routing and grid location service and the other one is GPSR with hierarchical location service called HRHLS hybrid routing and hierarchical location service. In this paper for routing the packets GPSR used the location information, to find the exact destination position the packet is send to the old destination position and from that old position local location request send to get back the exact position. In this the HLS and GLS algorithms are altered by HRHLS and HRGLS in which old position is used to forward data packet then intermediate node send location request to find the new destination.

In [5], authors discussed proposed the routing technique which is amalgamation of geographic routing protocol greedy perimeter stateless routing and Hierarchical location service. The routing packets are handled by the GPSR protocol and hierarchical location service is used to find the destination position. The problem arises in this is location overhead when the source and destination are far away so the combination of the GPSR protocol and HLS service will reduce the overhead and improve the network performances

In [6], the authors proposed a hybrid approach which is the combination of the GPSR protocol and the HLS location based service. In movement prediction based joint routing and location based service with the help of predictable position route to the destination is found. To attain the predictable destination position cell with the help of intermediate nodes it uses the old route but it has a drawback that if intermediate node have been moved or changing their speed then it cannot take use the old route to reach the estimated cell for broadcasting and whenever packet reaches at the intermediate nodes these nodes has to check the route to the destination causes slow data transfer problem. They also explained the proposed changes in the algorithms in this two algorithms are used firstly Location based service HLS in which two operations are used Poslookup and Predictpos Secondly GPSR protocol in which the two operations are GPSRemit and forward packet. The problem can be resolved by choosing the vehicles with relative speed to the source node as intermediate nodes. The comparison of all existing routing protocols is done in table 1 below.

VI. PROBLEM DEFINITION

In vehicular ad hoc networks, the vehicles communicate with each other using dedicated short range communication (DSRC). The information that is exchanged between the vehicles is usually related to traffic monitoring services, tourist guiding information and natural hazards etc. The vehicles move at random speeds as compared to the nodes

in mobile ad hoc networks where mobility of nodes is usually less. The information must be passed to the destination vehicle accurately without affecting it i.e. that should not depend upon the speed of the vehicles. Whenever the destination vehicle moves from one place to another, the source vehicle has to broadcast the route request messages in order to find a route to the destination. So there arises a need for the routing protocol that must be designed for the vehicular ad hoc networks in such a way that routing overhead is minimized. In the base paper they proposed a method in order to find a route between source and destination vehicle using hybrid routing and hierarchical location service which makes use of the greedy perimeter stateless routing along with location services and mobility prediction. According to PHRHLS, whenever the source node has to send data to the destination vehicle the GPSR protocol will ask the location services in order to find the fresh route to the destination. It estimates the new location of the destination using velocity and movement angle i.e. the direction of the vehicle. So the source forwards the data message to the nodes that has previous route to the destination and when data reaches the intermediate node which is located near the estimated position of the destination then route request message is broadcasted to find exact position of the destination. The shortcoming in this approach is that intermediate vehicular nodes might have changed the speed i.e. may become slower or faster. So forwarding the data through the intermediate node prior to broadcasting the route request message might cause problem if intermediate nodes have varied their speed parameter so the following objectives must meet to overcome the problem of slow data transfer.

VI. PROPOSED DESIGN

The whole network will be arranged into particular cells. It is assumed that vehicles in a particular cell will have access to road side unit. The road side units will track the velocity of the vehicles moving in its range. Since the vehicles move at greater speeds in vehicular ad hoc networks, the link breakage in such conditions is frequent. In order to reduce the network overhead caused by the link breakage, we use the concept of the selecting the path from source to destination vehicle consisting of the nodes which are moving relatively at the same speed as the source vehicle so that the link breakage can be reduced. Every time the source node has to send data to the destination vehicle, it will send query message to the road side unit along with its speed. The road side unit on receiving the query will reply back to source vehicle with vehicles moving at relatively same speed as the source vehicle. The source vehicle will send data to the destination using the information provided by the road side units. If the destination position is known the steps to be followed are shown in figure 1. . If the destination position is not known the steps to be followed are shown in figure 2.

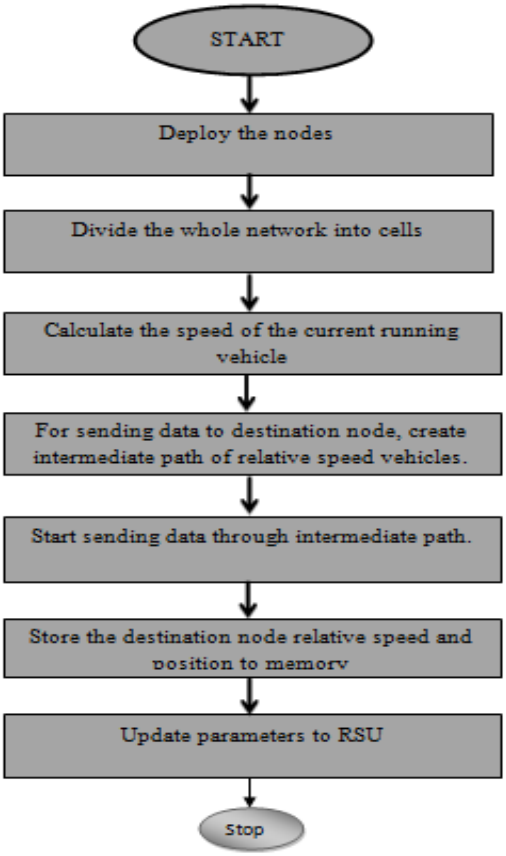

Figure 1: Steps followed if destination is known

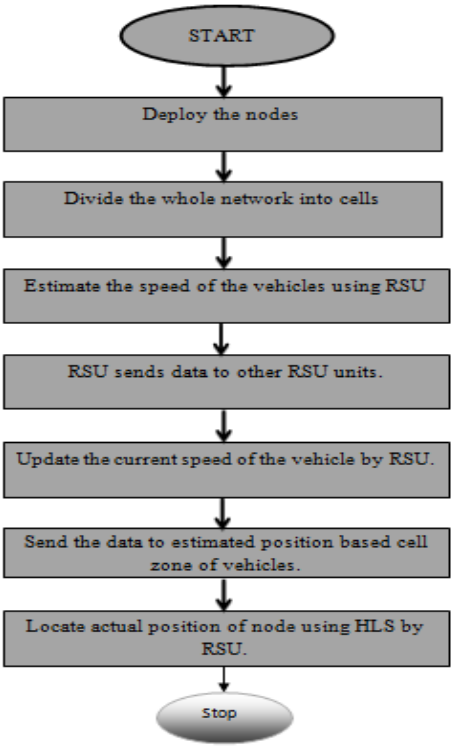

Figure 2: Steps followed if destination is not known

Protocols	Proactive Protocols	Reactive Protocols	Position Based Protocols	Cluster Based Protocols	Broadcast Based Protocols	Geocast Based Protocols
Forwarding Method	Wireless Multihop	Wireless Multihop	Heuristic Method	Wireless Multihop	Wireless Multihop	Wireless Multihop
Virtual Infrastructure Requirement	No	No	No	Yes	No	No
Recovery strategy	Multihop Forwarding	Carry and Forward	Carry and Forward	Carry and Forward	Carry and Forward	Flooding
Digital map requirement	No	No	No	Yes	No	No
Realistic traffic flow	Yes	Yes	Yes	No	No	Yes
Scenario	Urban	Urban	Urban	Urban	Highway	Highway
Pros	Route discovery not required, very low latency	Memory requirement less, saves bandwidth	Lowest overhead, more suitable for distributed nodes, provides good performance	Good scalability	Minimize overhead, packet transmission reliable	Reduced overhead and congestion, reliable packet delivery
Cons	Needs GPS	No response on link failure	High latency	Delay in highly dynamic network	Consume large amount of bandwidth	Packet transmission delay
Examples	DSDV, OLSR	AODV, DSR	GPSR, GSR, BMFR	HCB, CBLR	DECA, POCA	IVG, ROVER

Table 1: Comparison of Various Routing Protocols

VIII. CONCLUSION

The proposed system provides more efficient path for broadcasting the route request message as compared to the existing system. To reduce the overhead caused by link breakage we take relative speed of vehicles with respect to source node as the intermediate nodes and find the path from source to destination. This will give the more reliable path as compared to previous one. This will increase the packet delivery ratio and reduce the average latency when compared with the existing system. This proposed approach gives better performances.

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