

# A New Scalable Hybrid Routing Protocol for VANETs

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**Abstract**— A telecommunications network that facilitates computers to exchange data is primarily referred to as computer network or data network; in which network or computing devices pass data to each other along data connections. Data is transferred in the form packets. The connections between nodes are established using either cable media or wireless media. Internet is a best-known computer network. Applications such as access to the World Wide Web, shared use of application and storage servers, printers, and fax machines, and use of email and instant messaging applications are supported by computer network. The mobile wireless network, VANET are particularly designed for vehicular safety, traffic monitoring and other commercial purpose. In VANET network, communication link fails due to movements of vehicle. Which necessitates the need of a direct response from the routing protocols. In this paper we have designed routing protocol which combines AODV protocol with greedy forwarding geographic routing protocol that is mainly designed to point out the link failure within VANET. The technique incorporated here involves the added features reactive with location\_ based geographic routing for efficient use of all the location information available in the network. Our protocol is framed to overcome the information degrades of reactive routing .We have shown an analysis that our protocol is scalable and has an minimum overhead, even in the presence of high location errors. Thus providing exact location enabled solution in all VANET type environments with integrated ad hoc network, WLAN and cellular technology, etc. We can achieve intelligent inter-vehicle communications and improved road traffic safety and efficiency.

**Keywords**—Geographic Information Systems, intelligent vehicles ,VANET,AODV Protocol

## I. INTRODUCTION

A telecommunications network that facilitates computers to exchange data is primarily referred to as computer network or data network; in which network or computing devices pass data to each other along data connections. Data is transferred in the form packets. The connections between nodes are established using either cable media or wireless

media. Internet is a best-known computer network. Applications such as access to the World Wide Web, shared use of application and storage servers, printers, and fax machines, and use of email and instant messaging applications are supported by computer network

Network computer devices that originate, route and terminate the data are called network nodes. Nodes can include hosts such as personal computers, phones, servers as well as networking hardware. Two such devices are said to be networked together when one device is able to exchange information with the other device, whether or not they have a direct connection to each other network nodes

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Vehicular ad hoc network (VANET) is a vehicle to vehicle (IVC) and roadside to vehicle (RVC) communication system. VANET is a type of ad hoc network.The technology in VANET integrates WLAN/cellular and Ad Hoc networks to achieve the continuous connectivity.The ad hoc network is put forth with the novel objectives of providing safety and comfort related services to vehicle

users . Collision warning, traffic congestion alarm, lane-change warning, road blockade alarm (due to construction works etc.) are among the major safety related services addressed by VANET.As variety of services as variety of services provided by Vehicular Networks receiving a lot of attention. Vehicular Ad hoc Networks (VANET) is part of Mobile Ad Hoc Networks(MANET) i.e. In VANET, every node can move freely within the network and stay connected with each other. They can communicate with other nodes in single hop or multi hop. VANET is a distributed self-organized network formed between wireless communication devices equipped in vehicles (OBU i.e. on board unit) and any node can acts as a road side units (RSU). VANETs provide us such the infrastructure to enhance drivers and passenger's safety and comfort by developing new systems. The focus of the ITS program is on the creation of an intelligent transportation system thereby on the intelligent vehicles, intelligent infrastructure through integration with and between these two components. The overall advancement of ITS is done through investments in its major initiatives to improve safety, mobility, and productivity. Such networks is developed as part of ITS (Intelligent transportation systems) to improve the system performance. One of the main goals of ITS is to improve safety of the roads and reduce traffic congestion, waiting times, and fuel consumptions. In the other category of comfort related services, vehicle users are equipped with Internet and Multimedia connectivity .The major research challenges in the area lies in design of routing protocol, data sharing, security and privacy, network formation etc. We aim here to study the efficiency of communication network in VANET on the basis of a predictable mobility model. The routing protocols in vanets can be classified into the following two major categories: 1) Topology \_based routing and 2) Geographic ( position \_based ) routing. Topology based routing protocols use the link's state information to forwarding the packets in a network .Ad -hoc on demand distance vector (AODV) protocol has the best performance degrades as the network size increases, indicating the scalability problem.

To overcome this scalability problem we go for geographic (or location \_based) routing. In geographic routing the forwarding decision by a node is primarily based on the location of a packet's destination and the location of the nodes one- hop neighbors. The location of the destination is stored in the header of the packet transmitted by the source. The location of the nodes' one \_hop neighbors is obtained by listening to the beacon packets sent periodically between nodes. Geographic routing assumes each node knows its location-this can be easily achieved with the global popularity of cheap and accurate GPS units ,and that the sending node knows the receiving node's location, which requires an efficient location- service -management system that has the ability to keep track of the locations of the vehicles within the network. Since geographic routing protocols do not exchange any link state information and do not establish and maintain any routing tables (as topology-based routing does), they are promising candidate for highly dynamic environments. However, geographic routing has several

issues which inhibit wide adoption. Location errors can severely degrade its performance, making accurate location information a necessity .Also , geographic routing fails in the presence of void region-where a closer neighbor node toward the destination cannot be found .this requires a backup procedure to overcome the void region. unfortunately, with current backup procedures packets often tend to travel on a longer path to their destinations, or get caught in the loop and be dropped.Geographic routing (also called geo routing or position-based routing) is a routing principle that relies on geographic position information. It is mainly proposed for wireless networks and based on the idea that the source sends a message to the geographic location of the destination instead of using the network address. The idea of using position information for routing was first proposed in the 1980s in the area of packet radio networks and interconnection networks. Geographic routing requires that each node can determine its own location and that the source is aware of the location of the destination. With this information a message can be routed to the destination without knowledge of the network topology or a prior route discovery. There are various approaches, such as single-path, multi-path and coding-based strategies for a survey). Most single-path strategies rely on two techniques: greedy forwarding and face routing. Greedy forwarding tries to bring the message closer to the destination in each step using only local information. Thus, each node forwards the message to the neighbor that is most suitable from a local point of view. The most suitable neighbor can be the one who minimizes the distance to the destination in each step (Greedy).Alternatively, one can consider another notion of progress, namely the projected distance on the source-destination-line (MFR, NFP), or the minimum angle between neighbor and destination (Compass Routing). Not all of these strategies are loop-free, i.e. a message can circulate among nodes in a certain constellation. It is known that the basic greedy strategy and MFR are loop free, while NFP and Compass Routing are not Greedy forwarding can lead into a dead end, where there is no neighbor closer to the destination .Then, face routing helps to recover from that situation and find a path to another node, where greedy forwarding can be resumed. A recovery strategy such as face routing is necessary to assure that a message can be delivered to the destination. The combination of greedy forwarding and face routing was first proposed in 1999 under the name GFG (Greedy-Face-Greedy). It guarantees delivery in the so-called unit disk graph network model. AODV is reactive routing protocol. It is simple, efficient and effective routing protocol having wide application. The topology of the network in AODV gets change time to time so a New Scalable Hybrid Routing Protocol for VANETs dealing with same and as well as maintaining the cost, end to end, network load and packet loss is great challenge. various researches have been carried out on above factor. AODV is self starting and dynamic algorithm where the large number of nodes can participate for establishing communication and maintaining AODV network. The topology of AODV changes time to time as the nodes are not prefixed to any standard position. In AODV hello messages are used to detect and monitor links between the

nodes. An active node periodically broadcasts a hello message to all its neighboring nodes. If in the case the nodes fail to transmit hello message to neighboring node. the complete network will collapse due to link breakage. AODV uses mainly three message types route requests (RREQs), route replies (RREPs) and route error (RERRs). these message are carried through UDP and IP headers. When the source node want to send data to the destination node it send the RREQ message. This RREQ message may be received directly by the destination node or intermediate node. In AODV the destination sequence number is generated. During the period when the node request for the route discovery it is provide with destination sequence numbers. a requesting node is requiring to select the one with greatest sequence number. Then the route is made available by unicast a RREP back to the source node is from RREP back to the source node from RREQ is send. AODV mainly deals with route table. In route table the information of all the transaction between the node are kept. the routing request has following section source address, requestID, source sequence number ,destination address, destination sequence number and hop count. The route request ID gets incremented during single transaction from source node. At the destination node the request id and source address are verified. The route request with the same request id is discarded and no route reply message will generate. Every route request is TTL. Time to live and during this time period the route request can be retransmitted if reply is not received from destination node unicast the route reply message to the source node. The route reply has following section source address, destination address, destination sequence number, hop count and life time hop count different number of node utilized for data. When node involves in active transaction gets lost, a route error (RERR). The message format if route request, route reply and route error. Thus link state routing algorithms are more reliable, less bandwidth, but also more complex and compute and memory intensive. AODV mechanism to conserve more energy they reduce the average delay between the nodes communication. In VANETs, not at all solitary routing protocol will best in all scenarios, and a such, a combination method is possible to be high productive. Then, here, we will accept a combination scheme method, wherever we combine features of sensitive Routing with geo-graphical routing. Unique significant development problem of our protocol is to resourcefully create usage of all the position data presented, to decrease the routing overhead, besides to elegantly exit to sensitive routing for instance the position data reduces. Unique original significance of our protocol scheme is that our novel protocol possesses active routing approaches that are a spatial purpose of the position data worth. The leading opinion of the procedure is not to contest otherwise exchange present category protocols then, slightly, to improve then praise existing protocols as position data is completed obtainable to the nodes. It is strong that combination systems of routing events along the appearances accessible here will convert commonly organized as ITS developments it to the instance of huge position errors presented through wireless link locating in

the accurate development, wherever custom wrong proponents are unidentified. this paper is to analyses and stimulated our new protocol is to increase the performance to reduce the routing overhead. and to avoid link failure problems.

## II. EXISTING SYSTEM

Topology based these routing protocols use links information that exists in the network to perform packet forwarding. They are further divided into Proactive, Reactive. The proactive routing means that the routing information, like next forwarding hop is maintained in the back ground irrespective of communication requests. The advantage of proactive routing protocol is that there is no route discovery since the destination route is stored in the background, but the disadvantage of this protocol is that it provides low latency for real time application. The various types of proactive routing. Position based routing consists of class of routing algorithm. They share the property of using geographic positioning information in order to select the next forwarding hops. Position based routing is broadly divided in two types: Position based greedy V2V protocols, Delay Tolerant Protocols. Disadvantage is increase in the routing overhead in vanets, degradation in network scalability and link failure problem.

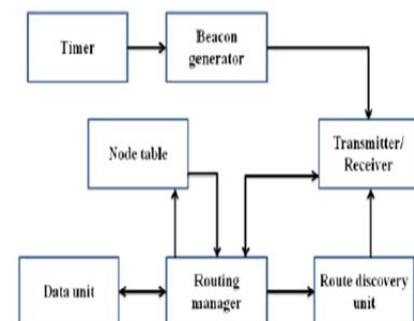
## III. PROPOSED METHOD

### *HLAR Protocol*

A hybrid location-based ad hoc routing (HLAR) protocol, which was particularly designed with optimal scalability performance. It combines a modified AODV protocol with a greedy-forwarding geographic routing protocol. HLAR have features of reactive routing with location-based geographic routing. Our proposed protocol is to efficiently make use of all the location information available, to minimize the routing overhead, and to gracefully exit to reactive routing as the location information degrades. In proposed system each node will have the following two separate tables, which were locally constructed from the beacon packets:

- 1) A neighbour table, which will be used to perform geographic routing
- 2) An ETX\_table, which will be used to construct the AODV route (the AODV routing table) upon request to obtain optimal scalability performance.

### *HLAR Architecture*



In the above Figure the timer is a specialized type of clock for measuring time intervals. Each node transmits data packets which are generated in a particular time interval. The timer is set for a certain time period so that the periodic update of the vehicle or node's location parameters are done. Beacon generator is one of the management frames in IEEE 802.11p. After receiving the beacon frame all the stations change their local clocks to this time. This helps with synchronization. This is the time interval between beacon transmissions. The time at which a node (AP or station when in Ad-hoc) must send a beacon is known as Target Beacon Transmission Time (TBTT). Beacon interval expressed in Time Unit (TU). It is a configurable parameter in the AP and typically configured as 100 TU. Capability information field spans to 16 bits and contains information about capability of the device/network. Type of network such as Ad-Hoc or Infrastructure network is signalled in this field. Apart from this information, it announces the support for polling, encryption details also.

An Omni direction antenna is used both for transmitting and receiving. Since the mobility of the nodes is in all directions and the transmission of the data packets will be in all directions. Since the main characteristics of Omni directional antenna is that the transmission and reception does not have any particular angle so it is used. The transmission range used is 150-250 meters. The node table has the information about the neighboring vehicles such as,

1. Neighbor vehicle ID
2. Current location of the vehicle
3. Destination vehicle ID

The data unit has the data that is to be transmitted from the source vehicle or node to the destination vehicle or node. The data packets that are transmitted from the transmitter reach the routing manager and it does the operation of comparing the node table and the data packet transmitted. It compares and gives the information to the Route discovery unit.

#### MODULES

Creating Neighbor Vehicle Information:

Vehicles need to locally broadcast small beacon packets periodically. These periodic beacon packets include the vehicle's ID and the current location coordinates. These beacon packets also allow vehicles to build their neighbor information table.

*Route Discovery:*

If the source vehicle has no route to the destination vehicle, then the source vehicle initiates the route discovery in an on-demand fashion. After generating RREQ, the node looks up its own neighbor table to find if it has any closer neighbor vehicle toward the destination vehicle. If a closer neighbor vehicle is available, the RREQ packet is forwarded to that vehicle. If no closer neighbor vehicle is present, then the RREQ packet is flooded to all neighbor vehicles. A destination vehicle replies to a received RREQ packet with a route reply (RREP) packet in only the following three cases:

1. If the RREQ packet is the first to be received from this source vehicle.
2. If the RREQ packet contains a higher source sequence number than the RREQ packet previously responded to by the destination vehicle.
3. If the RREQ packet contains the same source sequence number as the RREQ packet previously responded to by the destination vehicle, but the new packet indicates that a better quality route is available.

*Local Repair:* Vehicle mobility will cause the communication links between vehicles to frequently be broken. A local repair will, in general, also cost less power consumption relative to re-establishing a new source-to-destination route. Intermediate vehicles that participate in exchanging data traffic are allowed to locally repair broken routes through a route repair (RRP) packet instead of just reporting a broken route to its source vehicle.

A. *Road Side Unit*: The signal within the range of its communication link is failure so, we avoid that failure using RSU. It's a dedicated short range communication, avoid link failure problem and prevent accident. Using RSU avoid collision and vehicle to vehicle infrastructure.

B. *Vehicle to vehicle communication*: Vehicle to Vehicle communication method is the greatest suitable for short range vehicular networks. It is Fast and Reliable and provides real time safety. It does not need any roadside infrastructure. V2V does not have the problem of Vehicle Shadowing in which a smaller vehicle is shadowed by a larger vehicle preventing it to communicate with the Roadside infrastructure. Challenges:

(i) In V2V the connectivity between the vehicles may not be there all the time since the vehicles are moving at different velocities due to which there might be quick network topology changes.

(ii) The anonymity problem: The addresses of vehicles on highways are unknown to each other.

(iii) Periodic broadcasts from each vehicle may inform direct neighbors about its address, but the address-position map will inevitably change frequently due to relative movements among vehicles.

(iv) It is the receiver's responsibility to decide the relevance of emergency messages and decide on appropriate actions.

(v) Location based broadcast and multicast are the proper communication methods for collision avoidance in V2V Communication.

(vi) Without any roadside infrastructure, multi hop forwarding must be enabled to propagate the messages or signals.

(vii) Hence, V2V communication is not very useful in case of Sparsely connected or low density vehicular networks.

(viii) Stringent delay requirement: A rear end collision occurs when the Available Maneuvering Time (AMT) is less than the Needed Maneuvering Time (NMT). NMT is

dominated by the driver's perception response time, which is determined by many factors, and therefore difficult to change. To prevent a rear-end collision, a vehicle must receive the Message or Signal sufficiently prior to the lead vehicle's initiation of deceleration to provide more AMT.

### C. Vehicle to Infrastructure

- (i) Vehicle to Infrastructure provides solution to longer range vehicular networks.
- (ii) It makes use of preexisting network infrastructure such as wireless access points (Road-Side Units, RSUs).
- (iii) Communications between vehicles and RSUs are supported by Vehicle-to-Infrastructure(V2I) protocol and Vehicle-to-Roadside (V2R) protocol.
- (iv) The Roadside infrastructure involves additional installation costs.

### D. Third Generation

In modest potential terms, 3G is totally around speed. It permits you to send and receive big quantities of data using a cell phone. In fact, several refer to 3G as WIRELESS BROADBAND as it allows very fast browsing speeds. While approximations differ, most predictors agree that 3G will deliver speeds in range of 144KBps to 2.4MBps a staggering increase from the current speeds.

## IV. CONCLUSION

In this paper, a new hybrid location-based ad hoc routing protocol(HLAR)is presented, which combines features of reactive routing with location-based geographic routing. The analysis presented have shown a significant reduction in the routing overhead can be achieved in HLAR compared to standard reactive and geographic routing. We also have shown how our main conclusions hold, even in the presence of location errors. HLAR is simple to deploy and yet effectively obtains optimal scalability performance ,thus making it an ideal candidate for the routing protocol in emerging VANETs. This is helpful for routing protocols in emerging VANETS to improve ITS which is need of today.

## V. FUTURE WORK

VANET have received increased attention since the last few years as the potential technology to enhance active and preventive safety in the road, as well as travel comfort. Several unexpected disastrous situations are encountered in the road daily, many of which may lead to congestion and safety hazards. The quality of driving can be improved significantly in terms of time, distance, and safety. If the vehicles are provided with information about such incidents or traffic conditions in advance .Searching and maintaining an effective route for transporting data information is one of the main challenges in Vehicular ad hoc network, security and privacy are indispensable in vehicular communications for successful acceptance and deployment of such a technology. The vehicular safety application should be thoroughly tested before it is deployed in a real world to use .The future perspectives for VANET security protocols should include: firstly a major challenge in protocol design

in VANET is to improve reliability of Protocols and to reduce delivery delay time and the number of packet retransmission. And secondly to design and implement the protocols for rural environments as well.

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