A REVIEW ON ROUTING PROTOCOLS IN VANET

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Abstract

VANET is a technology which is used to move cars as joint in network to make a transportable network. Principles of MANET are applied in domain of vehicles, they form VANETs. A form of mobile ad hoc network, to provide communications among nearby vehicles and between vehicles. It includes V2V communication and V2R communications. The Main purpose of Vehicular ad hoc network is to improving security on the road and increase traveler safety. Design of an efficient routing protocol has taken significant attention. In this article, we discuss about the VANETs and survey recent routing protocols. There are six categories of routing protocols topology-based , position-based routing , Geocast routing, Cluster based routing , Broadcast routing protocol and infrastructure based protocols.

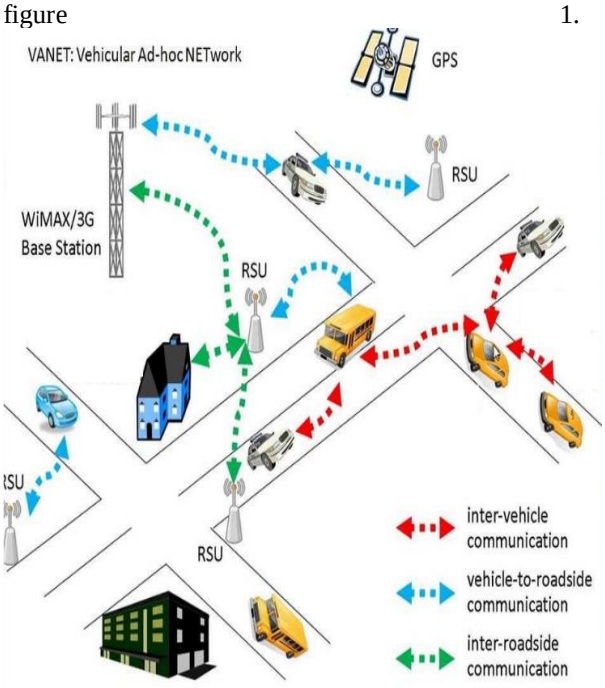
Keywords: VANET, MANET, Communication, Protocols, Routing

1.INTRODUCTION

VANETs are distributed, self-organized communication networks formed by vehicles. Vehicular ad-hoc networks (VANETs) offer a vast number of applications without any support from fixed infrastructure[2]. Vehicular Ad-Hoc Networks, (VANET), are a particular kind of Mobile Ad Hoc Network, in which vehicles act as nodes and each vehicle is equipped with transmission capabilities which are interconnected to form a network. VANET support applications like safety applications, mobile commerce and any type of congestion, driving hazards, accidents, traffic jams. For better communication among these vehicles, an efficient routing protocol withstanding the dynamic topology of the vehicles plays a vital role[3]. In VANET technology vehicles are equipped with wireless connectivity and a GPS device[18]. A VANET is a wireless network that is formed between vehicles on an as-needed basis.

1.1 *Architecture Of VANET*

Mainly two type of communication taken place in VANET, V2V (Vehicle to Vehicle) and V2I (Vehicle to Infrastructure), here infrastructure is mainly in form of Road Side Unit (RSU). This communication achieved from WAVE as a wireless medium. The main components are RSU (Road Side Unit), OBU (On Board Unit) and AU (Application Unit). OBU is a device that use services which provided by RSU.Set of sensors also mounted on the vehicles for collection of various data and that data transmitted to other vehicle or RSU using WAVE[17]. RSU is equipped with device for short range communication using IEEE 802.11p radio protocol technology. On-Board Unit (**OBU**) for highways, and realizes vehicle-to-vehicle (V2V) communication. The AU is the device equipped within the vehicle that uses the applications provided by the provider using the communication capabilities of the OBU.The Architecture of VANET is shown in figure 1.



1.2 *Characteristics Of VANET*

Due to some unique characteristics VANET attract more Attention of Industry and research [6].

- High Mobility of nodes
- Unlimited transmission power
- Network topology and connectivity
- Rapidly changing network topology
- Unbounded network size
- Frequent changing information
- Wireless Communication
- Variable network density
- Crucial effect of security and privacy
- Potential Support from infrastructure
- Real time , time sensitive , Data exchange

2.ROUTING PROTOCOLS IN VANET

Routing is the process of selecting a path for traffic in a network, or between or across multiple networks. Routing is usually performed by a dedicated device called a router. The communication between vehicles in VANET technology performed by routing protocol.The efficiency of communication between vehicles based on routing protocol [10].Routing decisions do not have to be predetermined and static it should be dynamic because based on conditions we can make adjustment.Theimportance of routing protocols is to select an optimal path with minimum cost. Vehicular ad-hoc routing is classified as Unicast, Multicast and Broadcast routing. Unicast routing in VANETs is to transmit data from a single source to a single destination via wireless technology. In multicast routing protocols, data travel from a single source to multiple destinations. Broadcasting is the simultaneous transmission of the same message to multiple recipients.

2.1 *Classification of Routing Protocol in VANET*

The routing protocol can be classified into 6 categories [2]. The types of VANET routing protocols are

- ✓ Topology Based
- ✓ Position Based
- ✓ Geocast
- ✓ Cluster
- ✓ Broadcast
- ✓ Infrastructure

2.1.1 *Topology Based Protocols*

Topology Based Routing Protocols in VANET are based on three ways: Reactive or on Demand protocol, Proactive or table driven protocol and Hybrid protocol.Table 1 shows the types of topological based protocols

Table 1.Topology Based Protocols

Proactive	Reactive	Hybrid
FSR	AODV	ZRP
OLSR	DSR	HARP
TBRPF	TORV	
WRP	PGB	
CGSR	CBRP	
DSDV	ABR	
GSR	SSR	
IARP	LAR	

2.1.1.1 *Proactive Protocol*

Proactive protocol is called on-demand routing protocol .There is no need to maintain routing information where there is no communication[20] .This Protocol can updates routing table proactively , before route really needs to be know.Proactive protocol can frequently update the routing table information , gives more overhead to network traffic.

FSR-Fisheye State Routing

Fisheye State Routing is a proactive protocol which maintains a topology map at each node and immediate link state update of neighbor node. The aim of protocol is to reduce updates overhead in large ad-hoc network.

OLSR-Optimized Link State Routing Protocol

OLSR is table-driven, pro-active protocol, each node in the network selects a set of neighbor nodes called as multipoint relay which retransmits its packets [4].

TBRPF-Topology Dissemination Based on Reverse-Path Forwarding

TBRPF is a proactive protocol which transmits large amount of routing data and provides hop-by hop routing. TBRPF has two modes: full topology (FT) and partial topology (PT).

WRP-Wireless Routing Protocol

The Wireless Routing Protocol is a unicast ,table-based protocol maintaining routing information among all nodes in the network. This protocol is based on the distributed Bellman-Ford algorithm. The

main advantage of WRP is that it reduces the number of routing loops.

CGSR-Clusterhead Gateway Switch Routing

CGSR is a proactive, table-driven routing protocol,each predefined number of nodes are formed into a cluster controlled by a cluster head, which is assigned using a distributed clustering algorithm.

DSDV-Destination Sequenced Distance Vector Routing

DSDV is a table-driven routing protocol [7] based on the Bellman- Ford algorithm. It eliminates route looping, increases convergence speed, and reduces control message overhead.It was developed by P. Bhagwat and C. Perkins in 1994.

GSR-Global State Routing

Global State Routing is a proactive routing protocol based on link state routing in which each node floods the link-state information to every node in the network. Global State Routing is similar to DSDV[10].

IARP-Intra Zone Routing Protocol

IARP is a limited scope proactive routing protocol used to improve the performance of existing globally reactive routing protocols. With each node monitoring changes in its surrounding r-hop neighborhood.

2.1.1.2 Reactive Protocol

Reactive Protocol is called table driven protocol and each node maintains the routing information [20].This type of Protocol can updates routes only when data is to be transferred[12].

AODV-Adhoc on Demand Distance Vector

AODV is a packet routing protocol, which routing works by using Route Request message and Route Reply Message.AODV is a Demand Driven Protocol. The route discovery mechanism is invoked only if a route to a destination is not known

DSR-Dynamic Source Routing

The Dynamic Source Routing (DSR) protocol presented in [1] which utilize source routing & maintain active routes. It has two phases route discovery & route maintenance.

TORA-Temporally Ordered Routing Protocol

TORA is an on-demand routing protocol. This protocol can limit control message propagation in the highly dynamic environment. Each node has to explicitly initiate a query when it needs to send data to a particular destination.

PGB-Preferred Group Broadcasting

PGB is a broadcasting mechanism which aims to reduce broadcast overhead associated with AODV's route discovery. Receivers can determine whether they are in the preferred group and which one in the group to broadcastdependson received signal of the broadcast [4].

CBRP- Cluster Based Routing Protocol

CBRP is a reactive , distributed, scalable protocol. This protocol can use clustering approach to minimize on-demand route discovery traffic and can use "local repair" to reduce route delay and new route discovery traffic [11].

ABR -Associativity Based Routing

ABR selects routes based on their stability and is an on-demand reactive routing protocol similar to Dynamic Source Routing (DSR) and Ad-Hoc On-Demand Distance Vector Routing (AODV). Route Discovery,RouteReconstruction,Route Deletion are three phases involved in ABR.

SSR-Signal Stability Routing

SSR is a version of Associativity-Based Routing.In this type , routes can select based on the signal strength between nodes[11].The Signal strength criteria allow the protocols to differentiate strong and weak channels.

LAR-Location Aided Routing

LAR is on demand routing protocol like AODV and DSR. It utilizes location information of mobile nodes to decrease the routing overhead. LAR uses flooding like DSR to discover the route but flooding is restricted to a certain areacalled "requestzone". It uses location information to flood a route request packet for destination in requestzone instead of in the entire ad hoc network.

2.1.1.3 Hybrid Protocol

Hybrid routing protocols use can use features of both reactive and proactive protocols.This protocol can use more accurate metrics to determine the best paths to destination networks[5].

ZRP-Zone Routing Protocol

ZRP taking advantage of pro-active protocol to discover neighborhood node and using a reactive protocol for communication between these neighborhoods.ZRP consists of 3 sub protocols IARP,IEAP,BRP.

HARP-Hybrid Adhoc Routing Protocol

HARP which is used to establish the stable path in VANET .Instead of node based routing using Zone level routing. The Zone level routing is performed on 2 levels.First level is intra-zone forwarding and another one is inter-zone routing.

2.1.2 Position Based Protocols

Position based routing protocols gathered nodes knowledge through the GPS system, which is based on location services. Position-based protocols do not maintain routing table, do not require link state information.Table 2 shown Non DTN and DTN Position based protocols.

Table2. Position based protocols

NON DTN		**DTN**
GPSR	AMAR	VADD
GRANT	EBGR	GEOPPS
PRB-DV	ROMSGP	
GPSRJ	TO-GO	
CAR	CBF	
GSR	RDGR	
A-STAR	GPGR	
STBR	STAR	
GYTAR	SAR	
LOUVRE	ARBR	
DIR	MORA	
B-MFR	VGPR	
	DTSG	

2.1.2.1 Non DTN

The Non-DTN Routing Protocols are also known as Min delay protocols. Main focus of this protocol is to minimize the packet delivery time from source to destination.**[14]**

GPSR-Greedy Perimeter Stateless Routing

GPSR selects node closer to the destination using beacon. A node needs to know only one hop neighbor information. It uses greedy forwarding algorithm for packet transmission. If it fails then perimeter forwarding mechanism is used to select a node for packet transmission.

GRANT -Greedy Routing with Abstract Neighbors Table

GRANT divides the whole plane into small areas and has only one representative neighbor per area. When its receive a beacon a node that called as broadcasting node, compute the area along with its neighbors and distinguish them from different hope from current node. In this every node knows its x hop neighborhood. Using this information every node can find better route and avoid local maximum[13].

GPCR-Greedy Perimeter Coordinator Routing

GPCR use the street map which is naturally forms a planar graph. In this planar graph nodes would forward the packet along to the road as far as they can go in both greedy or perimeter mode, but they have to stop at junction. Here all the decisions are made on the junctions and the packets are forward to junction to junction along to the roads. It use two heuristics to find whether a node is at a junction. The first heuristic is determined by the beacon messages. The second heuristic is derived from a correlation coefficient that relates a node to its neighbors and find out their linear relationship.

GpsrJ

GpsrJ minimize the packet forwarding node through removing the unnecessary stops at junctions without changing the maps. It considers the two-hop neighbor beaconing to choose the next road segment at junction which is taken by its neighboring node. A node considers its two hope neighbor and predicts the next forwarding node. If the next forwarding neighbor node is in different direction then the packet forward to the junction node. And if it is on the same direction then it bypass the junction and forward to its furthest neighboring node.

CAR-The Connectivity-Aware Routing

This protocol included with four parts destination location and path discovery, data packet forwarding along the found path, path maintenance with the help of guards,and error recovery. CAR protocol combine locating destinations with finding connected paths between source and destination as a substitute of using the popular location service like RLS. The beaconing period is dynamically changed according to the number of the registered nearby neighbors so the mechanism can adapt to the changing traffic conditions.[19]

GSR-Geographic Source Routing

This protocol applies a greedy forwarding approach.GSR aims to calculate the shortest route between origin and destination .It helps to drivers understand the current traffic conditions in order to avoid congestion and make optimal routing plans. The protocol works until that packet eventually reaches the destination node.

A-STAR-Anchor-based Street-and TrafficAware Routing

This protocol contains packet header.In this address of header is given to all other nodes that packet travels.This is called Anchor Based Routing .This method employed in GSR Protocol.A-STAR can perform anchor-based routing . STAR is the inclusion of traffic density information to weigh the streets of the scenario. This contribution modifies the behavior when computing the route of junctions that a packet must go through.

STBR-Street Topology Based Routing

In STBR, routing of packed based on their geographic distance to the street where the destination is on. This protocol differs from GSR and A-STAR because routes are computed through Dijkstra shortest path. This protocol used for long distance unicast communication, it traverse least spanning multiple junctions.

GyTAR-Greedy Traffic Aware Routing protocol

GyTAR also known as Improved Greedy Traffic Aware Routing Protocol.This protocol is intersection-based geographic routing protocol which use new parameter traffic density to find robust routes. These protocols have two parts junctions's selection and Forwarding data between two junctions.

LOUVRE-The Landmark Overlays for Urban Vehicular Routing Environments

LOUVRE uses peer to peer density.This protocol first find the road length and radio range .after finding radion range it determine the roads that do not have density over the threshold. LOUVRE observe all overlay link and calculate all vehicles on each overlay link, it does not matter what the geographical position of the vehicle on that overlay link, After that decide a vehicular density threshold.

DIR-Diagonal Intersection-based Routing

The DIR protocol is a geographic based routing protocol. According to the geographic routing protocol, source vehicle sends data packet toward the firstdiagonal intersection, and then the second diagonal intersection, and so on, until toward the last diagonal intersection, and then reach to the destination vehicle. The protocol creates a sequence of diagonal intersection between sender node and target node.

BMFR-Border-node based Most Forward within Radius

BMFR is a new position based Protocol.This protocol uses a special node called as border node. This Border nodes present at the edge of the radio transmission range of a node. Border node avoiding use of interior node for utilization of bandwidth. This protocol consists of two steps: neighbor innovation and border node selection method. [18]

AMAR-Adaptive Movement Aware Routing

This protocol follows a greedy forwarding method.This protocol is used for select the next hop from the source.This protocol overcome the drawbacks of AMAR Protocol which can add information about vehicle movement. The protocol uses parameters of speed and direction to select the border node out of the two conflicting nodes.

EBGR-Edge Node Based Greedy Routing

The EBGR is designed for sending messages from any node to any other node (unicast) or from one node to all other nodes (broadcast) in ad hoc network. The goal of the EBGR algorithm are to optimize the packet behavior for ad hoc networks with high mobility and to deliver messages with high reliability. The EBGR protocol uses three methods: neighbor node selection, node direction identification, and edge node selection method[17].

ROMSGP-Receive on Most Stable Group-Path

The ROMSGP was introduces for metropolitan environment in order to enhance routing consistency. In this protocol, vehicles are divided into four groups according to their velocity headings. If two vehicles belong with the same group, so the protocol considers stable one and if the vehicles are not belonging to same group, it considers as unsteady.In ROMSGP routing process, where vehicles are divided by vector base grouping technique and into four groups.

TO-GO -Topology-assist Geo-Opportunistic Routing

TO-GO is a geographic routing protocol. It selects the best target forwarder from the forwarding set

between the sender and the target node. It not uses previous approaches where a forwarding region is defined between the current sender and the destination. The simulation result of TO-GO is divided in to two parts error-free channel scenario, error-prone channel scenario .

CBF-Contention-Based Forwarding

CBF is position based routing protocol. Its works based on forwarding algorithm.CBF does not require any proactive transmission like beacon messages. Instead of that data packets are forwarded to their direct neighbors and the neighbor itself can decide whether to forward it to the other node or no.

PRB-DV -Position based routing with distance vector

It uses AODV routing to recover from local maxima. When the packet reaches to the local maxima it will broadcast a request packet. The request packet contains the node position and destination location. There is no evaluation done comparing packet delivery and overhead in PRB-DV and GPSR thus performance is inconclusive.

RDGR -Reliable Directional Greedy Routing

RDGR is a position based Non DTN routing Protocol.This protocol can select the next node by using e position, speed, direction.Through GPS It obtains position, speed and direction of its neighboring nodes . It uses combination metrics of distance, velocity, direction and link stability to decide about to which neighbour the given packet should be forwarded.

GPGR -Grid-based Predictive Geographical Routing

The protocol GPGR was based on grid predictive approach. The protocol considers the road topology information, which offers through static street map. Then starts the process of packet forwarding with the help of vehicle position, movement, and velocity and road topology information between vehicles. This approach improves the routing in inter vehicular communication (IVC).

STAR-Spatial and Traffic Aware Routing

The STAR protocol was works based on position. When a node wants to send the packet to its neighbor and neighbor node does not exist then the local maximum arises. In this type of scenario, the STAR protocol forwards the packet only for those streets, where vehicular traffic exists. STAR protocol organizes for lower and higher layers. In the lower layer, the information is exchanging about network status and at the higher layer, information uses for computation of paths[6].

SAR-Spatially Aware Packet Routing

The SAR protocol searches a substitute path from the local maximum location and restores the original route with the new route shows the SAR function, where two vehicles nodes S and D communicate with each other, and use geographic forwarding. The source node S forwards the data to destination node D. The node A is neighbor node of node S, which is nearer to the target node than B. This approach gives the impression that local decision is most advantageous without considering spatial environment.

ARBR - Associativity-Based Routing

This protocol defines a routing metric named as degree of association stability. That is free from loops, deadlock, and packet duplicates. ABR has three phases route discovery phase,Route reconstruction phase, Route Deletion Phase.

MORA-Movement-Based Routing

MORA works effectively in car-to-car communications and networking has lead to the definition of the concept of VANET as an infrastructure-free ad-hoc networking solution in the automotive scenario. The requirement for providing reliable and efficient routing schemes in presence of relative movement motivates the proposal of MORA, a movement-based routing algorithm for VANETs.

VGPR-Vertex-Based predictive Greedy Routing

VGPR is a multi-hop vehicle-to-infrastructure routing protocol for urban environment. This protocol estimatea sequence of valid junctions from a source node to fixed infrastructure and then, transmit message to the fixed infrastructure through the sequence of junctions. VGPR calculating both sequence of valid junctions and greedy forwarding by using position, velocity and direction of vehicles

DTSG- Dynamic Time-Stable Geocast Routing

DTSG is reactive position based protocol.This can adjust the protocol based on network density and the vehicles speed for better performance. DTSG has two phases: pre-stable and stable period. Pre-stable phase helps the message to be disseminated within the

region, and stable-period intermediate node uses store and forward method for a predefined time within the region.

2.1.2.2 DTN

DTN protocol can communicate when communication issues exist in VANET.

VADD-Vehicle assisted Data Delivery

VADD Can be used to enhance the routing in frequently disconnected networks. It is based on forward strategy. In VADD a vehicle can make a choice at an intersection and chooses the path of packet forwarding that has negligible delay. This protocols consists of three packet modes Intersection, Straight and Destination.

GeOpps -Geographical opportunistic routing

GeOpps protocols used for navigation system to select the vehicle travelling closer to the packet nearest destination.GeOpps calculates the distance between the destination and the nearest point of the vehicles path and estimates the arrival time of a packet at the destination. During the forwarding of packets if any node has minimum arrival time the packet will be forwarded to that node.

2.1.3 GeoCast Protocol

Geocast protocol can deliverythe information to a group of destinations in **a** network identified by their geographical locations.Types of Geo Cast Protocol shown in Table 3

Table 3.GEO CAST Protocol
ROVER
IVG
DG-CAS
DRGM
STMG
DRGH

ROVER - Robust Vehicular Routing (ROVER)

ROVER is a reliable geographical multicast protocol. Here only control packets are broadcasted in the network and the data packets are unicasted. The main objective of the protocol is to send a message to all other vehicles within a specified Zone of Relevance (ZOR). The ZOR is defined as a rectangle specified by its corner coordinates.

IVG-Inter-Vehicle Geo-cast Routing Protocol

This protocol adopt a mechanism which is timer based for message forwarding and also adopt periodic broadcast i.e. used for reduced network fragmentation. In this protocol, a busted vehicle disseminate an alert message to all vehicles in the group and the neighbor which received alert message analyze its applicability based on their location informing to the risk area.

DG-CASTOR -Direction-Based Geo-cast Routing Protocol for Query Dissemination

DG-CASTOR is used to estimate the neighbors, which neighbors have same ability to communicate with sender in given period of time. It is especially designed for commercial purpose in VANETs. The main aim of DG-CASTOR is to build an essential commonality that is based on future location prediction of moving nodes in the network.

DRG-Distributed Robust Geo-cast Routing Protocol

DRG protocol works in manner if a vehicle receives geo-cast message then it checks its relevance according to its location and it found that the vehicle belongs to the ZOF then it either forward the message or drop the message and DRG does not require any exchange of periodic beacons messages[16]

DRGM-Distributed Robust Geo-cast Multicast Routing Protocol

The distributed robust geo-cast multicast routing protocol is targeted to deliver packets to vehicles located in a specific geographical region. Zone Of Relevance (ZOR) and Zone Of Forwarding (ZOF) are defined for each geo-cast message. Each node within the ZOR is targeted to receive the packet. Whereas each node in the ZOF forward the geo-cast messages to nodes in the ZOR. Periodic retransmission handles the disconnected topology problem.

STMG-Spatio-temporary Multicast/Geocast Routing Protocol

The spatio-temporary multicast/geo-cast routing protocol uses 'time' as an additional parameter for geo-cast transmission. It delivers information to all nodes within a specific geographical region, at a particular point in time. Emergency alerts that are time sensitive, e.g. road block etc. can use this concept for efficient handling of data.

2.1.4 Cluster Protocol

Cluster Based Protocol divides the nodes of

the ad hoc network into a number of overlapping or disjoint clusters.Table 4 shown types of cluster based protocols.

Table 4. CLUSTER
HCB
CBLR
CBR
CBDRP
LORA-CBF
COIN
CBRP

HCB-Hierarchical Cluster Based Routing

HCB is a novel based Cluster routing protocol . HCB uses the two layer communication architecture. In Layer-1 the nodes have single radio network and through multi-hop path nodes are communicate with each other. In Layer-2 base station helps to communicate among nodes in the network.

CBLR-Cluster Based Location Routing

CBLR is a cluster based ,reactive and on demand routing protocol. In this protocol, each cluster head contains its own routing table. Each cluster header maintains a table contains the addresses and geographic locations of the cluster members and gateways nodes. Cluster header also keep the information about all neighboring clusters in the Cluster Neighbor Table. When the packet transmit between source and destination in the network then the source node firstly send the packet to the nearest neighbor of the destination if it is in same direction/cluster. If the destination is not in same cluster then the packet stores in the buffer then the Location Request (LREQ) packet broadcasting and start the timer.

CBR-Cluster Based Routing

CBR is a routing protocol .It based on the position and cluster where the geographical area of the cluster is divided into rectangular grids with the help ofgeographical information each node send packet to the next node. If there is any vehicle present in the grid is chosen as a cluster header then it widely disseminated a LEAD message to its neighbors and whenever header leave the chosen grid, it will disseminate LEAVE messagencontaining its grid position.Discover the route in thenetwork is not needed do the routing overhead is very less.[18]

CBDRP-Cluster-Based Directional Routing Protocol

It divides the vehicles into clusters and vehicles which are moving in same direction form a cluster. The source sends the message to its cluster header and then it forwards the message to header which is in the same cluster with the destination. At last the destination header sends the message to the destination. The cluster header selection and maintenance is same like CBR but it considers velocity and direction of a vehicle.[19]

LORA-CBF -Location Routing Algorithm with Cluster Based Flooding

In LORA_CBF, each node can become the cluster-head, gateway or cluster member. For each cluster, there is one cluster-head. The node which connects two clusters are called gateway. The cluster-head maintains information about its members and gateways. The packet forwarding is same the greedy routing. Only cluster head and gateways can send out the location request (LREQ) packets when the location of the destination is not available as well as the phase of the Location Reply (LREP) messages. The proposed LORA-CBF shows highly heterogeneous performance results.

COIN -Clustering for Open IVC Network Routing Protocol

COIN Is a cluster based protocol because it uses clustering mechanism for improving network scalability. It divides the network into different cluster. In COIN, the selection of cluster is depending on the three different parameters: movements of nodes, position of nodes, and behavior of nodes. In this protocol, each cluster has a specific time that called time to live and it is used to reduce control overhead. The mobility of nodes should be low due to that nodes can communicate with each other for long time.

CBRP - Cluster based routing protocols

This protocol is proposed for a highway scenario in which vehicles are divided into clusters and a vehicle node is selected as a head of cluster. The cluster-based routing protocol (CBRP) was introduced by Jiang. In CBRP the nodes of a wireless network are divided into several disjoint or overlapping clusters. Each cluster select one node as cluster head . These special nodes are responsible for the routing process. Neighbors of cluster heads cannot be cluster heads as

well. But cluster heads are able to communicate with each other by using gateway nodes[18].

2.1.5 BroadCast Protocol

These protocols are multihop and reliable boardcastprotocols.Table 5 shows Broadcast protocols.

Table 5.BROADCAST
EAEP
DVCAST
SRB
PBSM
UMB
V-TRADE
BROADCOMM
PGB

EAEP- Edge-aware epidemic protocol

EAEP reduces control packet overhead by eliminating exchange of additional packets for message transfer between different clusters of vehicles.

DV-CAST-Distributed vehicular broadcast protocol

DV-CAST protocol categories the vehicles into three types depending on the local connectivity.Well connected, sparsely connected, totally disconnected neighborhood. This protocol causes high control overhead and delay in end to end data transfer[17].

SRB-Secure Ring Broadcasting

SRD minimize number of retransmission. This protocol can classify nodes into three types inner nodes, outer nodes and secure ring nodes.

PBSM-Parameter less broadcasting in static to highly mobile wireless ad Hoc

In PBSM , nodes does not need to know neighbor information .To eliminate redundancy PBSM use connected dominating sets. R and NR list is maintained by each vehicle which helps to detect neighbors. This list finds that which neighbor already received and which did not receive the packet.

UMB-Urban Multihop Broadcast Protocol

UMD protocol is used to solve interference, packet collision and hidden nodes during message multi hop broadcast. Here sender nodes can select the further node in broadcast direction for forwarding packet.UMB Protocol successfully performs at higher packets load. Drawback of UMB is waste of bandwidth.

V-TRADE-Vector Based Tracing Detection

The basic idea of V-TRADE protocol is based on Zone RoutingProtocol.This protocol classifies the neignborsinto different groups.Classification depends on position and movement information. V-TRADE improves the bandwidth utilization. For selecting the next forwarding node in every hop routing overheads occur is drawback of V-TRADE.

BROADCOMM

BROADCOMM is used for highway network which is divided into virtual cells. This cells move like vehicles. The nodes organized into two level of hierarchy.All the nodes in a cell are included in level one.Cell reflectors are represented. BROADCOMM performs better for simple highway structure which contains smaller number of nodes.

PGB - Preferred group broadcast

PGB is a solution to prevent broadcast storm problem from route request broadcasting. Each node can sense the level of signal strength. PGB Reduce numbers of RREQ broadcasting.PGB is not reliable broadcasting protocol.

2.1.6 *Infrastructure Protocols*

TABLE7. INFRASTRUCTURE
SADV
RAR

RAR-RoadsideAidedRouting

The RAR is a routing framework for VANETs. It uses the concept of road sectoring using RSUs. Routes are formed using RSUs as well as mobile nodes. In the absence of large scale deployment of RSUs, the performance of these frameworks or routing protocolsis notveryefficient

SADV-Static-node Assisted Adaptive Data Protocol

SADV protocol is effective in reducing the data-delivery delay. SADV is a static-node assisted adaptive data-dissemination protocol for vehicular networks. The protocol allowed each node to calculate the time needed to deliver a message with the aid of GPS system and digital map. The SADV introduced three modules: Static Node Assisted

Routing (SNAR), Link Delay Update (LDU), and Multi-Path Data Dissemination (MPDD).

3.CONCLUSION

In thispaper,Architecture of VANNET and various types of routing protocols are discussed . The type of topology based protocol and sub-types are discussed and also subtype of position based protocols are discussed. Further work we can evaluate performance of routing protocol in VANET based on some performance metric.

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