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REVIEW ARTICLE

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REVIEW ON VARIOUS ROUTING PROTOCOLS IN VANETS

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Abstract: Vehicular Ad Hoc Networks (VANETs) are categorized as a particular application of mobile ad hoc networks (MANETs) that assure the new potential to enhance traffic effectiveness, street security driving convenience. By giving the safety as well as non-safety applications as well as discussing the helpful data by the way of vehicle to vehicle (V2V) or vehicle to roadside (V2R) transmissions to prevent incidents as well as give consistent data to travellers, this type of problems attempts significant interest of researchers in that area. VANET as well as MANET having various frequent features but VANET vary with applications or programs, architecture, difficulties as well as information dissemination. The survey of routing protocols in vanets is important and necessary issue for smart ITS. The objective of this paper is to discuss the important characteristics of VANET such as challenges, routing, applications as well as glimpse of routing protocols in a comparative mode

Keywords: Vanets (Vehicular Adhoc Networks), Applications of Vanets, Data Dissemination, and Routing Protocols

I. INTRODUCTION

In this time private vehicles as well as transport vehicles such as car, scooter, motorcycles, truck, buses that are general utilized by incredible number of people. The significant issue is the quantity of sufferers rising because of the highway accidents that will be brought due to more utilization of transport [1], according to the World Health Organization, number of people expire every year across the world due to vehicle collisions on the highway, about 50 thousands of people indignant in vehicular incidents[6] , therefore researchers of computer networking area planned a notion of wireless networks called VANETs that are categorized as a specific form of MANETs. With the emergence of MANETs, researchers conceptualized the scheme of connecting vehicles giving growth to VANETs that are the important topic of engineers working to turn cars into intelligent technology which commune for security as well as comfort purposes. It is independent as well as self-organizing wireless communication network, where nodes in VANET occupy themselves as servers or clients for exchanging as well as sharing data. A VANET is created by vehicles which can be built with wireless communication devices, positioning systems, as well as digital maps. In VANETs, a packet could be relayed from a car to another by the way of direct forwarding or carry as well as forwarding. VANETs also permit vehicles for connecting to RSUs that are linked to the Internet as well as are often interconnected with one another with a mesh network. VANET may be the powerful technology which could give reliable vehicle to vehicle (V2V) as well as vehicle to roadside infrastructure (V2I) communication [1]. VANETs are self configuring network where nodes are vehicle and WIFI technologies are accustomed to establish these networks [2] [5]. VANETs contain On Board Units (OBUs) and Roadside Units (RSUs).

II. TECHNOLOGY FOR VANETS

VANET works on the dedicated short range communication (DSRC) that can be an IEEE 802.11p standard adapted from IEEE 802.11a standard protocol employed for short range wireless communication, the IEEE known as Wireless Access in Vehicular Environment (WAVE) as well as standardizes the complete transmission stack by the 1609 group of standards. DSRC is really a 75MHz licensed spectrum that employed on 5.9GHz Radio Signal Frequency as well as Supports information rate a lot additional than 27mbps, the transmission area is estimated of 300 to 1000 meters as well as supports an environment where vehicles moving at speed as high as 200kmph [1, 15]. IEEE 802.21 Media Independent Handover Standard reduces delays in diverse networks and provides better services and continuous connections to moving nodes by new and growing technologies like LTE-Advanced, WiMAX rel 2 and IEEE802.11ac standard which provides high data rates, reduce noise ratio, decreases energy consumption in moving vehicles in highly mobile networks.

III. CHARACTERISTICS OF VANETS

VANET has some unique characteristics which will make it distinctive from MANET in addition to challenging for designing VANET applications.

a) High dynamic topology: The topology of VANET changes because of the movement of vehicles at high speed. Suppose two vehicles are moving at the speed of 20m/sec and the radio range between them is 160 m. the link between the two vehicles will last 160/20 = 8 sec.

b) Frequent disconnected network**:** From the highly dynamic topology results we observe that frequent disconnection occur between two vehicles when they are exchanging information. This disconnection will occur mostly in sparse network.

c) Mobility Modeling: The mobility pattern of vehicles depends upon traffic environment, roads structure, the speed of vehicles, driver's driving behavior and etc**.**

d) Battery and storage capacity: In modern vehicles battery and storage is unlimited. Thus it's enough computing power which will be unavailable in MANET. It's great for effective communication & making routing decisions.

e) Communication environment: The communication environment between vehicles is significantly different in sparse network & dense network. In dense network building, trees & other objects behave as obstacles and in sparse network like high-way this things are absent. And so the routing approach of sparse & dense network is likely to be different.

f) Interaction with onboard sensors: The present position & the movement of nodes can certainly be sensed by onboard sensors like GPS device. It will help for effective communication & routing decisions.

IV. APPLICATIONS OF VANETS

a) Non-safety Applications

Comfort as well as Entertainment applications are associated to the group of applications; ease to travelers comfort is the main objective. This type of applications give services such as traffic data, shortest route to destination by the way of GPS system, atmospheric situation, nearby hotel, restaurant for fatigue, closest service centre, gas/petrol station for the required necessities of the vehicle. Internet provides access when linking through the infrastructural network which enables to play games online as well as routing decisions, as well as also provides further surfing on the internet.

b) Safety Applications

Safety applications offers caution as well as safety messages to drivers or passengers of the moving vehicles that have been in the transmission selection of the RSU as well as another vehicle, to be able to avoid road accidents as well as enhancing the street safety. VANET supplies a broad variety of safety applications, has been represented as follows:

- Public Safety: This application objective to offer medical ailment to the passengers endured in shortest time span, it specify urgent situation to attain the incident spot when feasible by minimizing their journey time. This type of application utilizes I2V, V2V transmission for disseminating the event-driven communication underneath the dedicated communication selection of 300-1000m.
- Utilizing SOS services is a great solution to communicate the data about accident to the nearby infrastructure, also directly by the driver or the machine or by utilizing V2V communication.
- When emergency vehicle is on the road to approach the destination, this application supplies a clear road using V2V communication. These messages sustain the speed, direction as well as lane data alongside path of the emergency vehicle.
- Sign Extension: This application offers alert messages to the drivers about the trail signs, in order to prevent the road accidents. Sign extension application utilizing 1 HZ frequency as well as I2V communication to disseminate the periodic messages in 100-500 meters of transmission range.
- Curve speed warning messages utilizing the RSU's to supply the data about the curves as well as the necessary speed of the automobile on the curve.
- Wrong side driving messages, low bridge warning messages, pedestrian crossing as well as work zone alert messages to alert the automobile driver about their direction and the height of the bridge.

V. INFORMATION GATHERING AND DISSEMINATING:

This application employs with the frequency of 2-50 HZ, using V2V, I2V transmission for disseminating the periodic and event driven messages.

a) Road Condition Warning: Definitive goal with this application is to offer the status of the trail to the drivers in order to avoid accidents.

- Vehicles collecting information from other moving vehicles using V2V communication about the trail conditions with the aid of sensors, then In-vehicle domain processing the info and AU offers the warning message to the drivers of the automobile about the trail status.
- RSU's gathering the useful information and disseminate to other vehicles about the unsafe conditions and poor conditions of the road. To ensure that to prevent the accidents by giving the warning messages and suggestions to modify the speed and required road safety conditions.

b) Collision Avoidance: This application provides how you can prevent the accidents as a result of collision; following are some cases and conditions:

- Warning messages about the intersections on the roads, this application offers the neighbor vehicles position, speed and distance from the automobile and suggests the speed adjustments to negotiate with the intersection or curve on your way to prevent the collision.
- RSU gets information from vehicles or infrastructure and disseminates the pre-accident warning messages to other vehicles using multi-hop technique with V2V communication, which include the speed, direction and position of the vehicles, in order to avoid road accidents.

VI. DATA DISSEMINATION IN VANETS

The thought of data dissemination is wide and useful in VANETs. We generally reference it as means of spreading data or information over distributed wireless networks, which is really a superset of VANETs. The info dissemination approaches in this network might be classified on the foundation of:

a) V2I /I2V dissemination

- Push based: In push based data dissemination, the info may be efficiently delivered from moving

vehicles or fixed base station (RSU) to a different vehicle. This is justified with traffic condition, e-advertisement etc.

- Pull based: Pull based data dissemination is the kind where any vehicle is enabled to query details about specific location or target. This really is one type of request and response model. In this sort, enquiry about parking lot, nearby coffee house etc. will be the cases.

b) V2V dissemination

- Flooding: In flooding broadcast the info is established and received in vicinity. Generally every node participates in dissemination. This flooding approach is wonderful for delay sensitive application and also greatly suited to sparse networks during low traffic conditions.
- Relaying: The relaying form of data dissemination in the network, the relay node is selected (next hop) where relay node forwards the info to another hop and so on. The key advantageous asset of this method can it be reduces congestion and it's scalable to dense networks. This really is generally preferred for congested networks.

VII. OVERVIEW OF ROUTING PROTOCOLS

In VANET, the routing protocols are classified into five categories: Topology based routing protocol, Position based routing protocol, Cluster based routing protocol, Geocast routing protocol and Broadcast routing protocol. These protocols are characterized on the foundation of area/application where they're most suitable [1].

A. Topology Based Routing:

Protocols these routing protocols use links information that exists in the network to do packet forwarding. They're further split into Proactive and Reactive.

B. Proactive routing protocols:

The proactive routing ensures that the routing information, like next forwarding hop is maintained in the backdrop aside from communication requests. The benefit of proactive routing protocol is that there's no route discovery considering that the destination route is stored in the backdrop; however the disadvantage with this protocol is so it provides low latency for real-time application. A dining table is constructed and maintained in just a node. To ensure that, each entry in the table indicates another hop node towards a specific destination. In addition, it contributes to the maintenance of unused data paths that cause the lowering of the available bandwidth. The various forms of proactive routing protocols are: LSR, FSR.

a) Fisheye State Routing:

FSR is really a proactive or table driven routing protocol where the data of each and every node collects from the neighboring nodes. Then calculate the routing table. It's on the basis of the link state routing & a noticeable difference of Global State Routing.

Features of FSR:

- FSR reduces significantly the consumed bandwidth because it exchanges partial routing update information with neighbors only.
- Reduce routing overhead.
- Changing in the routing table won't occur even when there is any link failure since it doesn't trigger any control message for link failure

C. Reactive/Ad Hoc Based Routing:

Reactive routing opens the route only if it is required for a n ode to keep in touch with each other. It maintains only the routes that are still used; consequently it reduces the burden in the network. Reactive routing contains route discovery phase in that the query packets are flooded in to the network for the trail search and this phase completes when route is found. T he various forms of reactive routing protocols are AODV, PGB, DSR and TORA.

a) Ad Hoc On Demand Distance Vector routing protocol:

It is really a reactive routing protocol which set up a route whenever a node requires sending data packets. It's the power of unicast & multicast routing. It works on the destination sequence number (DestSeqNum) rendering it distinctive from other on demand routing protocols.

Features of AODV:

- An up-to-date road to the destination as a result of using destination sequence number.
- It reduces excessive memory requirements and the route redundancy.
- AODV responses to the web link failure in the network.
- It could be put on large scale adhoc network.

D. Position Based Routing Protocols:

Position based routing contains class of routing algorithm. They share the property of using geographic positioning information to be able to select other forwarding hops. The packet is send without the map knowledge to usually the one hop neighbor, which will be closest to destination. Position based routing is beneficial since no global route from source node to destination node must be created and maintained. Position based routing is broadly divided in two types: Position based greedy V2V protocols, Delay Tolerant Protocols.

a) Position Based Greedy V2V Protocols:

In greedy strategy and intermediate node in the route forward message to the farthest neighbor in the direction of the following destination. Greedy approach requires that intermediate node should possessed position of itself, position of its neighbor and destination position. The target of the protocols would be to transmit data packets to destination when possible that's why they are also referred to as min delay routing protocols. Various kinds of position based greedy V2V protocols are GPCR, CAR and DIR.

b) Greedy Perimeter Coordinator Routing (GPCR):

It is really a position-based routing protocol uses greedy algorithms to forward packet predicated on a pre-selected path which includes been designed to manage the challenges of city scenarios. No global or external information like static map doesn't require in GPCR.

Benefits of GPCR:

- Doesn't require any global or external information.
- For representing the planar graph it uses the underlying roads although it is on the basis of the GPSR.

- It does not have any as usual a planarization problem like unidirectional links, planar sub-graphs & etc

c). Delay Tolerant Protocols:

In urban scenario where vehicle are densely packed locating a node to transport a note is no problem in rural highway situation or in cities during the night fewer vehicles are running and establishing end to get rid of route is difficult. So such cases certain consideration must be provided with in sparse networks. The different kinds of Delay Tolerant Protocols are MOVE, VADD, and SADV.

d) ***Vehicle-assisted data delivery routing protocol:***

VADD protocol adopted the notion of carry-and-forward for data delivery from the moving vehicle to a fixed destination. The most crucial issue is to choose a forwarding path with the tiniest packet delivery delay.

Benefits of VADD:

- Comparing with GPSR (with buffer), epidemic routing and DSR, VADD performs high delivery ratio.
- It's ideal for multi-hop data delivery.

E. ***Cluster Based Routing:***

Cluster based routing is preferred in clusters. Several nodes identify themselves to be an integral part of cluster and a n ode is designated as cluster head will broadcast the packet to cluster. Good scalability may be provided for big networks but network delays and overhead are incurred when forming clusters in highly mobile VANET. In cluster based routing virtual network infrastructure must certainly be created through the clustering of nodes to be able to provide scalability. T he various Clusters based routing protocols are COIN and LORA_CBF.

a) Cluster-based directional routing protocol (CBDRP) :

It separates the vehicles into clusters alongside those vehicles that are intending to follow a same road to form a cluster. The sender transmits data to the cluster header and further it transmits the information to header which are incorporated with identical cluster alongside the locations. Finally this location header transmits data towards the location. This cluster header choice and preservation may be exact as CBR nonetheless they look at speed and path of a car.

F. ***Broadcast Routing Broadcast:***

In this routing is often found in VANET for sharing, traffic, weather and emergency, road conditions among vehicles and delivering advertisements and announcements. The different Broadcast routing protocols are BROADCOMM, UMB, VTRADE, and DV-CAST.

a) Distributed vehicular broadcast protocol (DVCAST)

It utilizes nearby topology details by utilizing the regular hello announcements for transmitting the data. Every car depends on a flag parameter for evaluating either the packet is obsolete or not. This sort of protocol splits the cars in a number of ways based on the nearby connections and remains connected, sparsely connected, completely deterred neighborhood. In well-connected area utilizes determination plan.

G. ***Geo Cast Routing****:*

Geo cast routing is actually a spot based multicast routing. Its objective is to provide the packet from source node to all or any other nodes in just a specified geographical region (Zone of Relevance ZOR). In Geo cast routing vehicles beyond your ZOR aren't alerted to prevent unnecessary hasty reaction. Geo cast is recognized as as a multicast service in just a specific geographic region. It normally defines a forwarding zone where it directs the flooding of packets to be able to reduce message overhead and network congestion brought on by simply flooding packets everywhere. In the destination zone, unicast routing may be used to forward the packet. One pitfall of Geo cast is network partitioning and also unfavorable neighbors, which can hinder the correct forwarding of messages. The different Geo cast routing protocols are IVG, DG-CASTOR and DRG.

a) Dynamic time stable geocast routing (DTSG):

The principal goal with this protocol would be to work despite short density networks. It directly adjusts the protocol with respect to the network density and the vehicles speeds designed for better performance. This describes different stages: pre-stable and stable period. Pre-stable stage allows this content being disseminated inside the location and stable-period directly node utilizes save in addition to send process for described periods in the area. Additionally this attempts for stability among packet transmitting rate and system cost.

VIII. RELATED WORK

Dubey, B. et al. [1] displayed knowledge conversation in VANETs and numerous Difficulties and Purposes were studied.A essential function of knowledge conversation in VANETs was learned since it influences people's living or demise decisions. Chen, N, et al. [3] learned which increased the caution concept dissemination process. Regarding past proposals, the planned system runs on the mapping approach centered on changing the dissemination technique in accordance with the traits of the road region where in fact the cars are going, and the occurrence of cars in the mark scenario. Kumar, Kiminas, et al. [4] outline a few of the VANET study difficulties that also have to be resolved allow the huge arrangement and widespead usage of scalable, trusted, effective, and protected VANET architectures, methods, systems, and services. Zeadally, S, et al. [5] process FairAD is shown for VANETs that directs knowledge power pretty around cars while adaptively managing the system load. The process depends just on regional information to accomplish equity with ideas of Nash Bargaining from sport principle which can be their limitation. Schwartz, Kiminas et al. [6] shown transmitted algorithm ideal for a wide selection of vehicular circumstances, which just utilizes regional data purchased via periodic beacon communications, comprising acknowledgments of the circulated transmitted communications was studies. Each car chooses if it goes to an attached owning collection (CDS). Cars in the CDS make use of a smaller waiting time before probable retransmission. Ros, F. T, et al. [7] study of numerous knowledge dissemination methods utilized in VANETs was studied. In vehicular offer hoc sites knowledge move is usually finished with the aid of multihop conversation in that the top speed cars are working as the info carrier. Djahel, S, et al. [8] learned to handle that problem a story geographical Information Dissemination for Attentive Data (GEDDAI) was planned, which removes the transmitted surprise and increases the ability of doing knowledge dissemination across areas of relevance with reduced cost, small setbacks and large coverage. Villas, L. A et al. [9] investigated outside peer-to-peer material circulation

applying V2V offer hoc communications to complement straight vehicular knowledge acquire from mobile and path part infrastructures. Just one supply dissemination situation with a great scheduler was learned to know the restricts (upper bound) of the advantages of system coding. Wang, H. et al. [10] planned an method which could somewhat reduce steadily the MAC coating competition time at each node while sustaining a top box dissemination ratio. The process decides backbone cars by contemplating car freedom, how many friend cars going in the exact same way and aerial height. Maia. H, et al. [11] peer-to-peer (P2P) supportive caching system was planned to decrease force on the infrastructure, traffic data among cars is distributed in a P2P fashion utilizing a Markov cycle product with three states. The substitute of active knowledge to allow for recently appeared knowledge is accomplished in a probabilistic fashion Fogue, Michael, et al. [12] learned that includes three stages the following; goal assignment to the communications to be given /forwarded in accordance with two various metrics, obstruction recognition stage, and eventually send energy and beacon sign charge change to aid crisis communications distribute within VANETs. That guarantees that probably the most important and closest problems are promoted before the further and less harming events. Medetov, S, et al. [13] story versatile program which allows each car to instantly embrace probably the most appropriate dissemination system to be able to match the caution concept supply plan to each unique condition was studied. Farooq, M. U, et al. [14] learned a bee-inspired algorithm for data dissemination in VANETs was learned wherever baby bees conversation together just in bee hives was taken as base for communication. The planned algorithm exploits bee conversation rules allowing cars talking with each other. Sanguesa, J. A, et al. [16] knowledge dissemination methods were learned and there benefits and limits were also studied. Our major intention is to supply a construction for knowledge dissemination in Vehicular ad-hoc sites such that it can be quite a variable enough to adjust to different vehicular traffic problems common worldwide.

IX. COMPARISON OF VARIOUS ROUTING PROTOCOLS

Protocols	Proactive Protocols	Reactive Protocols	Position based Greedy Protocols	Delay Bounded Protocols	Cluster Based Protocols	Broadcast Protocols	Geo cast Protocols
Prior Forwarding Method	Wireless multi hop Forwarding	Wireless multi hop Forwarding	Heuristic method	Carry & Forward	Wireless Multi hop Forwarding	Wireless multi hop Forwarding	Wireless multi hop Forwarding
Digital Map Requirement	No	No	No	No	Yes	No	No
Virtual Infrastructure Requirement	No	No	No	No	Yes	No	No
Realistic Traffic Flow	Yes	Yes	Yes	No	No	Yes	Yes
Recovery Strategy	Multi Hop Forwarding	Carry & Forward	Carry & Forward	Multi Hop Forwarding	Carry & Forward	Carry & Forward	Flooding
Scenario	Urban	Urban	Urban	Sparse	Urban	Highway	Highway

The future perspectives for VANET routing protocols should include following:

1. 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.
2. Driver behaviour should be considered for designing of delay bounded routing protocols since carry and forward is the mainly approach to deliver packets.
3. Geo cast routing for comfort applications should also considered. Comfort messages are usually tolerant of delay, Network bandwidth is generally reserved for emergency messages. It is worth to develop an efficient geo cast routing protocol for comfort applications with delay tolerant capabilities with low bandwidth utilization.

X. PROBLEM FORMULATION

1. VANETs are the infrastructure based ad hoc networks that rely heavily on road side infrastructures for communications. Variation in speed and non-availability of line of sight makes it difficult to provide efficient transmission between the vehicles. Existing framework has limited scope and provides provision for data dissemination to a limited extent. Thus, a framework is required which can improve the current scenario of data dissemination over VANETs.
2. Other main issue is scalability of existing frameworks. A highly dynamic environment requires a scalable framework which can gross the transmission even with varying traffic scenarios. Thus, scalability is another issue regarding the VANETs.

XI. CONCLUSION

This paper represents the outline of current problems as well as focused on applications also and the significance of safety as well as non-safety applications in VANETs, recent problems as well as issues is represented to boost enhancement in technology as well as prevail over these pitfalls from VANET. The comparison has been drawn between the various routing protocols undertaking different challenges and metrics like prior forwarding method, digital map requirement, virtual infrastructure requirement, realistic traffic flow, recovery strategy and scenario. Security in VANET as well as data dissemination along with sender's protection safety applications should be improved in future as these are the current issues in latest times.

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