A Comprehensive Survey On Various Routing Protocols In Vanet

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Abstract: With the sharp and constant increase of aoutomative market, traffic accidents, finding a parking lot in a new city and traffic jams are becoming the serious issues that put emphasis on the evolution of Vehicular Ad hoc Networks(VANET). As a result of which VANETs receive the considerable attention of the scientific community. Moreover, communication between vehicles is used for safety, comfort and for entertainment as well. The routing in VANET is an important task for the reliable communication between the vehicles, number of routing protocols has been defined for this purpose. However, VANET researchers cannot able to evaluate the performance of their proposed protocols without any evaluation tool. So, various VANET simulators has been provided in order to help the active researchers to evaluate the performance of different routing protocols , thus they can be able to suggest most appropriate routing protocol for the given scenario. In this paper different routing protocols for VANET has been surveyed, in order to identify the most appropriate Ad-hoc routing protocol for the overall performance in highly mobile environment of VANET. From the literature survey done here, it is found that it is hard to provide a universal routing protocol that can work in diverse nature of vehicular environment.

Keywords: VANET, GUI, packet drop, throughput NCTUNs.

I. INTRODUCTION:

With the continuous increase in the number of vehicle on roads, people[1] are facing serious problem of traffic congestion, which give rise to Vehicular Ad-hoc Networks System in which each vehicle can communicate with other vehicles using dedicated short radio signals DSRC (5.9 GHz) (DSRC) standard that employs the IEEE 802.11p[2] for wireless communication, this communication is an Ad Hoc communication that means each connected node can move freely, no wires required, or no centralized device is required. The scenario of VANET required Road Side Unit (RSU) and On Bard Unit(OBU). RSUs are installed on both sides of roads at several km apart (usually after every 1 km apart). These road side units works as a router between the vehicles on the road and connected to other network devices. OBUs are installed on each and every vehicle. which is responsible for the communication between the vehicle and RSU via DSRC radio signals as shown in figure below.

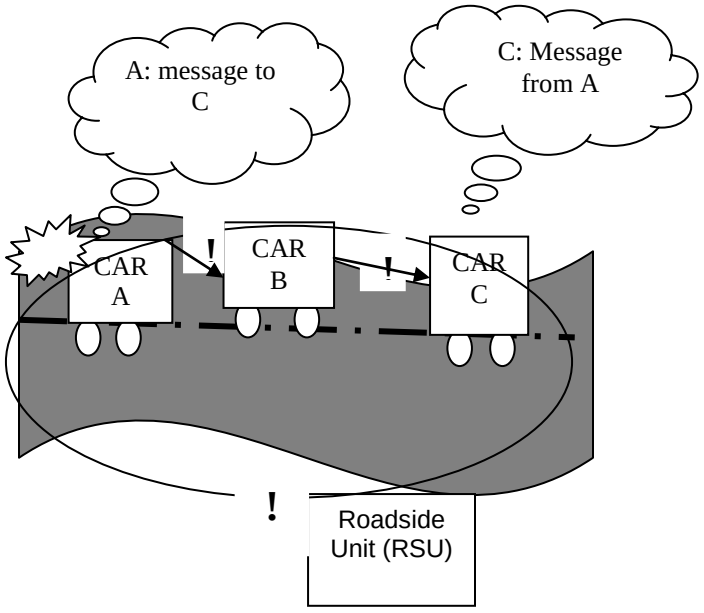

Figure I : Scenario of VANET.

In the above figure circle defines the range of RSU. If CAR A suffers from an accident , it will convey information to the cars behind it with the help of RSU. Another device called TPD (Tamper Proof Device)[3], which holds all the information about the vehicle like keys, drivers identity, trip details, speed, routing information etc. VANET provides applications[3] includes safety, comfort and multimedia applications. Safety applications include alerting the driver to slow down its speed by conveying information about the occurring of accident, condition of road, road turn, traffic light etc. Comfort application includes the online information about the parking lot, petrol stations, map while entering a new city. It also includes toll payment by recharging the OBU installed in every car, while passing the car through toll tax station, the amount of tax can be automatically deducted. Thus, it can save time and traffic congestion can be minimized. Entertainment applications include downloading of songs, sharing video's between cars etc.

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II. REQUIREMENT OF ROUTING PROTOCOLS IN VANET

VANET routing is challenging since it is fundamentally different from conventional ad hoc networks; the vehicles move fast, and the network topology changes rapidly causing intermittent link connectivity. The routing protocol should be such that works based on the real-time road vehicle density in order to provide fast and reliable communications so that it adapts to the dynamic vehicular city environment. VANET differs from MANET by its highly dynamic topology. Because of the dynamic nature of the mobile nodes in the network, finding and maintaining routes is very challenging in VANETs. Routing in VANETs (with pure ad hoc architectures) has been studied and many different protocols were proposed. We classify them into two main categories as follows: topology-based and geographic-based which can be further classified into various routing protocols as shown below:

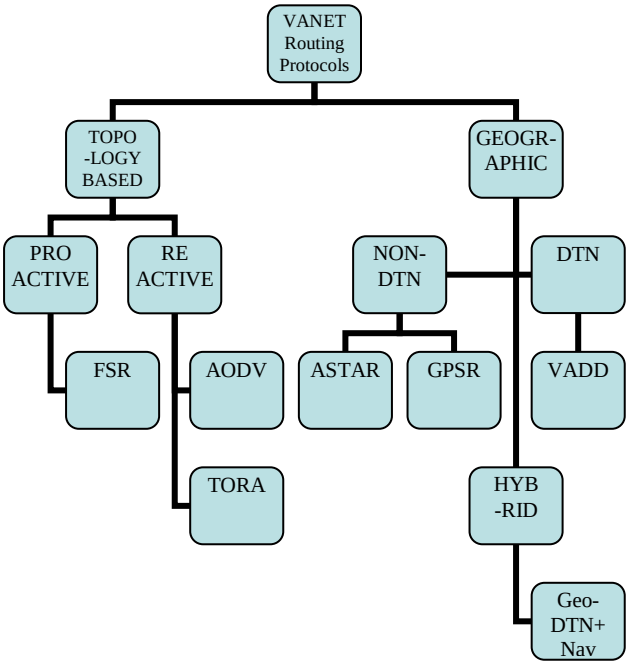

Figure 2: Taxonomy of VANET routing protocols.

i. Topology based Routing Protocol

This type of routing considers the selection of route for sending the information between sender and receiver. It can be further divided into proactive (table driven) and reactive (on-demand) routing.

a. Proactive routing Protocol

This type of routing protocol maintain current list of destinations and their routes by periodically[4] sharing the routing tables. As, the routing table is shared on periodic basis even if link changes does not takes place so, problem of heavy bandwidth consumption its major drawback. But, its advantage is the availability of link instantaneously as the route is already maintained in the background . It also provides low latency for real-time application.

b. Reactive (On Demand)

Reactive routing finds the route only when it is necessary by the flooding of RRP (Route Request Packets).It maintains only the routes that are currently in use, thereby reducing the bandwidth consumption problem as in case of proactive routing.

ii. Geographic or Postion based Routing Protocol

This type of routing protocol depends upon the geographic locality or the position of the nodes which can be known by periodic beacon messages or with the help of GPS (Global Positioning System)[5] which can be installed on the top of the vehicle and current information regarding the street can be viewed , this feature is used by Google driver less cars. But this type of service (GPS) is absent in tunnel as the satellite signal is absent there. Tn this type of routing any node can communicate with another node by knowing its position and position of the destination node on the network without having the information of route between source and destination.It can be further divided into delay tolerant network(DTN) and non-delay tolerant network(NON-DTN).

a. Delay Tolerant Network

It uses packet store and forward strategy. In case of traffic environment[6], when a node can't able to connect with other nodes, it stores the packet and forwarding is done on the basis of certain metric. As because of storing the packet delay occurs to reach to its destination. Thus, it is known as delay tolerant network.

b. Non- Delay Tolerant Network

It uses packet carry and forwarding strategy[7]. In this case packets are forwarded without any delay, as there is high end to end connectivity between source and destination. This type of routing is basically meant for city scenario where high connectivity between the vehicles is required. The selection of routing protocol for a given scenario is done on the basis of several metrics as below:

i) Packet Drop

It is defined as the total no. of packets that do not reached to the destination successfully.

ii) Throughput

It can be defined as the ratio of total no. of received packets at the destination to the total simulation time. On the classification of VANET routing protocols as above, various sub- routing protocols has been studied and from the literature survey it has been found that routing protocols are selected based upon the scenario. For Example:- For the city scenario ASTAR[8] routing protocol is best as, it uses nodes position and street information for finding the route, Thus, it works well in the presence of several radio obstacles. However, for the highway scenario where direct reliable communication between the nodes is desired GPSR[9] is more efficient.

III. ISSUES & CHALLENGES OF VARIOUS ROUTING PROTOCOLS.

In this section based on the literature survey , various VANET routing protocols are studied and are compared based on important parameters and tabulated below.

Table I: Comparison of various VANET routing protocols

PROTOCOLS → / **PARAMETERS** ↓	Topology based		Geographic		
Subtype	Proactive	Reactive	DTN	Non-DTN	Hybrid
Examples	FSR	AODV /TORA	VADD	ASTAR/ GPSR	Geo-DTN+Nav
Overhead	All Link States	Path States	Beacons	Beacons	Beacons
Mobility Model	IDM on Manhatton Grid.	IDM on Manhatton Grid	Unknown. Geopps:MTS	M Grid Mobility	Vanet Mobisim
Propagation Model	Unknown	TORA:Unknown AODV: Road Blocking, Probabilistic Shadowing.	Unknown. Geopps: None.	ASTAR:Road Blocking GPSR: Probabilistic Shadowing	Road Blocking.
Forwarding Strategy	Multihop	Multihop	Optimum Forwarding.	Store and Forward	Greedy Forwarding
Recovery Strategy	Store and Forward	Store and Forward	Carry and Forward	Store and Forward	Recompute Anchors
Mechanism	It is based on Link State routing, It collects information from neighbours and prepare its routing tables.	TORA is used for creation, maintainence and deletion of route. In AODV discovery cycle is used for route Finding,Route maintaining	Carry and forward by using predictable vehicle mobility.	ASTAR:It uses of street map information in our routing scheme for anchor path computation. GPSR: It uses the positions of routers and a packet's destination to make packet forwarding decision.	It proposes virtual navigation interface to determine routing mode and forwarder. It can switch from Non-DTN to DTN network.
Remarks	Routing over head is reduced. Consumed Bandwidth is also reduced.	TORA: Multiple paths created. Perform well in dense networks, reduce network overhead. AODV: Upto date path to destination because of sequence no. , less memory requirement, applicable to large scale adhoc networks.	.It is suitable for multi-hop data delivery.	ASTAR:Path selection ensures high connectivity though its packet drop ratio is lower than GPSR and AODV. GPSR: GPSR can use local topology information to find correct new routes quickly, forwarding packet decisions are made dynamically.	It can recognize partition in the network.
Challenges.	Insufficient information for route discovery. Less knowledge about distant nodes.	TORA:It is not scalable. AODV: Periodic beaconing consumes extra bandwidth.	Large Delay	A-STAR:Problems in finding routes because of connectivity problem on some prtions of streets. GPSR:Information in the packet header of intermediate node is never updated.	Latency time is increasing. Packet Delivery ratio is decreased.

It has been observed that the performance evaluation of various routing protocols is difficult because of non existence of infrastructure of VANET, there is a need of suitable network simulator to evaluate the performance of routing protocol. In order to identify routing protocol for the evaluation of VANET. A summary of all the network simulators has been provided as below:

IV. VANET SIMULATORS

Various simulators[10] for the simulation has been provided. The summary of all the VANET network simulators with their features and characterstics is given in a tabulated form as below:- Table II shows a comparison of some popular VANET simulators

Table II. Comparison of VANET Simulators

	NCTUns	TraNS	GrooveNet
VANET IEEE 802.11p	yes	yes	Yes
Traffic generator Software	NCTUns	SUMO	GrooveNet
Open source	Ver 7 is not	yes	yes
GUI	yes	yes	yes
Continuous development	yes	yes	yes
Ease of use	Easy	moderate	hard
Examples	yes	yes	yes
Ease of setup	hard	moderate	moderate
Programming Language	C++	java	C++

From the table above NCTUns is most widely used by the active VANET researchers because it is user friendly software.

V. OPEN ISSUES & FUTURE SCOPE

This paper discusses various routing protocols of VANET. Designing an efficient routing protocol for all VANET applications is very hard. Hence a survey of different VANET protocols, comparing the various features is absolutely essential to come up with new proposals for VANET. The performance of VANET routing protocols depend on various parameters like mobility model, driving environment and many more. The selection of a single routing protocol is hard in VANET because the protocol performance depends on vehicle speed, driving environment etc that may vary from one environment of network to another. The open issues has been concluded by various researchers are listed below.

- **i)** For the operation of VANETS alternative sources of energy can be used like solar energy to operate RSU's and the mechanical energy of the vehicles can be converted into electrical form an preserved as a backup for worst weather condition.
- **ii)** Secure routing is one of the challenging areas. Due to the unsecure and ad hoc nature of VANET, makes it prone to several security attacks that may lead to devastating consequences. So security attacks should be investigated with respect to different attacks in VANET.
- **iii)** New algorithms should be proposed to provide reliable QoS for safety and comfort applications in VANET.
- **iv)** New Algorithms should be found which can make various protocols scalable and can provide improved path connectivity and delay issues.
- **v)** Different routing protocols should be suggested according to the environment, the protocols should work efficiently even in dense network.
- **vi)** A single heterogeneous routing protocol should be developed having all the desired properties such as vehicle speed and driving environment which can be implemented in every environment .

VI. CONCLUSION

The main goal of this paper is to identify different issues in ad hoc routing protocols and to evaluate these routing protocols against each other in VANET. It can be used as reference for the active researchers in this field. In this paper literature survey on routing protocols ranging from traditional ad hoc based routing protocols to recently proposed position based routing protocol for VANET has been examined. It has been found that how different routing protocol suffers from the highly mobile nature of VANET. The selection of a single routing protocol is hard in VANET because the protocol performance depends on vehicle speed, driving environment etc that may vary from one environment of network to another. This paper will help to know about what are the various issues for using different protocols. The performance issues regarding path connectivity and time delay should be improved. It is hoped that this paper will provide guidelines for active researchers working on routing protocols in the VANET.

VII. ACKNOWLEDGEMENT

I would like to thanks my guide DR. Jyoteesh Malhotra HOD of ECE Department GNDU RC Jalandhar who support me and provide guidance to me at each and every step.

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