

Review on Various Routing Protocols in VANETS

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Abstract— Vehicular Adhoc networks (VANETS) really are an stimulating technology which innovates to allow the communication among vehicles utilizing one side as well as among cars and street area devices on the other side. VANETS provide a large quantity of programs without the help from repaired infrastructure. These programs ahead communicate in a multi-hop fashion. Planning an effective routing method for several VANET programs is extremely hard. In this review on routing protocols based on number of parameters of VANET is an essential topic in vehicle-to- vehicle (V2V) and infrastructure-to- vehicle (IVC) communication. This paper shows the overview of various routing protocols in VANETS as well as main classifications. The protocols are also compared based on their important characteristics and tabulated.

Keywords— VANETS, Routing Protocols, PBRP, TORA, PRP, DSO and HTRP

I. INTRODUCTION

There is an increasing trend of dependence on the road transport in rural as well as urban areas across the globe [1]. Road Safety and efficient traffic becomes obvious areas of concern. Further, the increase in the time spent on the roads and advent of internet and mobile telephones leads to the exploration and realization of infotainment requirements. Various supporting standards are required in order to deal with the sporadic development in academic research to meet the VANET challenges & issues. Moreover, efficient routing protocols are required to be developed for quality attainment of VANET applications services [2].

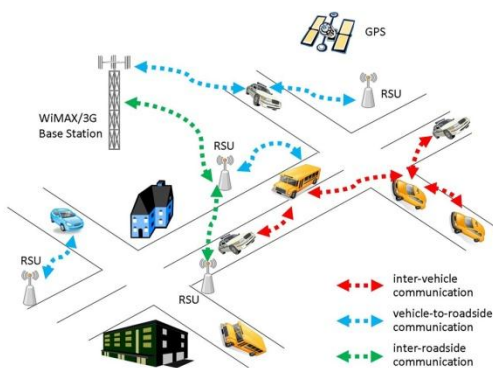


Figure 1. An Illustration of the VANETS

Vehicular Ad-hoc Networks is aimed at increasing inter-vehicular communication, so that information collected in a

vehicle can be shared with other vehicle users, with the aim of improving driving experience [3] [4].

VANET do not require any infrastructure and use On-Board Units (OBU) and Road Side Units (RSU) like traffic signals and base stations for communications. Vehicles can collect the essential information and share it with other vehicles [2]. This information can be related to the traffic jam situation, road condition detection, accident warning, tourism information, etc. [5]. The collected information would be helpful for the users to plan their route. VANETS acts as a safety aid for the driver and passengers too. If the person caught up with some abnormal situation, current positional information of the vehicle can be sent to the police station or nearby hospital.

VANETS are characterized by high node mobility, constrained movement of nodes due to road topology, highly obstructive deployment fields and a chance for heavy congregation of nodes. Firstly, vehicles are travelling at very high speeds in a highly structured topology such as roads than in a MANET. Thus the routing protocols which were designed for MANET will not be suitable for a continually changing structure such as VANET, where communication links are expected to be valid for few minutes or seconds. Another individual character of VANET is that the existing roadmaps limit the topologies available for it, when compared to MANETS. High rise buildings and houses in urban areas act as obstacles, impacting the propagation of wireless waves through reflections and refractions [5, 6]. Finally, VANETS permit a large number of vehicles to be

part of it, which makes scalability an important Quality of Service (QoS) parameter.

A. VANET Routing Protocols

VANETs are mobile, multi-hop wireless network. VANETs can operate without any pre-existing infrastructure environment. VANETs have dynamic topologies and limited and variable shared wireless channel bandwidth.

Design of dynamic routing protocols under such networks is a challenging task. Here the protocols need to be efficient and consume less overhead. It is difficult to design an efficient routing protocol for various VANET applications. So, the survey and comparison of routing protocols [9] [4] is highly important task. The routing protocols need to perform three basic functionalities viz. Route discovery, maintenance [5] [7] [9] and selection of the efficient path from the various available paths. Routing protocols are broadly classified as topology-based and position-based routing protocols, based on routing information. Under topology-based routing mechanism, the information regarding network layout of the nodes need to be available. Packet Forwarding should be possible using the available information about the nodes and links within the network. Under the position based routing mechanism [6] the location of nodes should be known for packet forwarding. The taxonomy is shown in Figure-1.2.

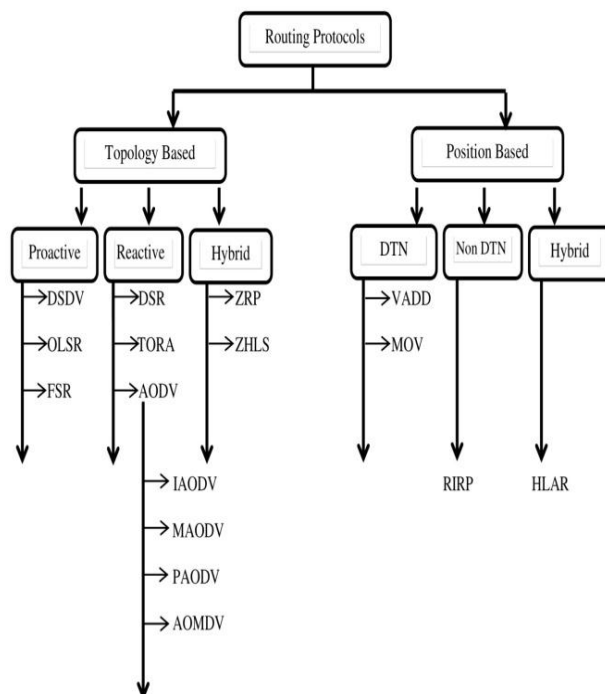


Figure 2. Taxonomy of Routing Protocols

1) Position-Based Routing Protocols [PBRP]

To change the default, adjust the template as follows. “Position-based routing protocol is normally dependent on the location or position of the data during the execution of the routing mechanism. Every node recognizes geographical position [8] of its own as well as its neighbouring nodes”. The transmitting node sends data packet information to the receiving node using the location of the packets.

2) Topology-based Routing Protocols

In this type of routing protocols the routing tables are maintained for storing the link information which is the base of packet forwarding from transmitting node to destination node. “Topological based protocols are further categorized into two types [6], [8] viz proactive and reactive routing protocols”.

General Limitations of Topological-based Protocols for VANET

Topology-based routing protocols have following limitations [7] in case of vehicular ad-hoc networks:

- Topology routing protocols are less scalable.
- Topology routing protocols have high route finding latency.
- The paths which are not used but stored in routing tables unreasonably occupy existing bandwidth.
- These protocols find their suitability with slow to moderate mobility environment [9] and medium size networks.

a) *Proactive Routing Protocols [PRP]*: “Proactive routing protocols are also called as table-driven protocols. These protocols are also addressed as proactive protocols because they already maintain the routing table information [38] for the subsequent reference”. PRPs permit each network node for maintaining a routing table for the route information storage to all other nodes. Each subsequent hop node is also preserved in the table entry which comes in the path from source node to destination node for finding out [4] which route has to be selected.

b) *Reactive Routing Protocols [On Demand]*: Reactive routing Protocol (RRP) is a bandwidth-efficient (beaconless) on-demand Reactive routing protocol. “In this protocol the initiator node starts the route searching process whenever it is required to send the data packets towards a target node.

c) *Dynamic Source Routing (DSR) Protocol*: “Dynamic Source routing protocol is a reactive protocol which ensures the packet delivery successfully even if the network changes happen. In this type of the protocol each network node is required [49] to maintain a route cache”. This is a multi-hop routing protocol. DSR decrements the network traffic by decrementing the

periodic messages. The two processes provided by DSR [5] are route discovery mechanism and route maintenance process.

Advantages of DSR

- Source routing: no special strategy required [5] to reduce loops.
- Useful when route breaks.
- Simple to program
- Good visibility in case of low [5] network scenario.

Disadvantages of DSR

- Because of many route replies coming due to nodes replying with the help of local cache increases contention.
- There is possibility that the route flooding requests may possibly reach almost all nodes in the network, which can create too much overhead.
- Because of source routing, there are chances of linear growth of packet header size with route length.

d) *Temporally Ordered Routing Algorithm (TORA) Protocol*: “TORA is categorized in the distributed routing protocol which uses the phenomenon of multi-hop routes during routing mechanism. The communication overhead to adapt with frequent network changes [5] is reduced in this protocol”. This protocol does not comprise shortest path algorithm implementation. Temporally Ordered Routing Algorithm Protocol follows the link reversal algorithm which is creating a directed acyclic graph towards the destination. “TORA has main advantages that it provides a route towards each node of the network topology which ultimately reduces the control message broadcast. The scope of control messaging is localized to a very small set of nodes [2] [4] near a topological change”. High dynamic VANET conditions may lead to overhead or traffic during route maintenance among network nodes.

Advantages

- Directed Acyclic graph are created [52] when necessary.
- It can execute successfully in dense network.
- It helps in reducing network overhead as all intermediate nodes do not require broadcasting the message.

Disadvantage

- Less scalable.

- It is not used as AODV and DSR perform well than TORA for wireless networks.

e) *Hybrid Topological Routing Protocols [HTRP]*: “This protocol is referred as the combination of the proactive and reactive protocols which is mostly applicable for the networks where the number of nodes is less. The power requirement of hybrid protocols [8] is observed as medium”. Reactive routing protocols are applied for global network level whereas proactive protocols are being deployed at local adjacent nodes at local level. Zone Routing Protocol (ZRP) is a type of HTRP.

f) *Hybrid Position-based Routing*: “Hybrid routing is one of the position-based routing which results in the reduction of control overhead or traffic. Hybrid routing does not need maintaining the table as they use the location information about the [3] adjacent nodes and destination node. This feature makes position-based routing much scalable”. There are some limitations which control the use of position-based routing. Researchers have developed a hybrid schemes by combining the characteristics of more than one routing protocols. “The new protocol combines [6] features of reactive routing with location-based geographic routing in a way which efficiently uses all the location information available”. The combination of two position-based routing protocols like DTN and Non-DTN routing protocols is one of the examples.

As a last paragraph of the introduction should provide organization of the paper (Rest of the paper is organized as follows, Section I contains the introduction of the VANET's, Section II contain the related work of VANET's, Section III contain the comparison table of various routing protocol, Section IV concludes research work with future directions).

II. RELATED WORK

Ruikar et al. [2013] (4) have studies printed annually by Transportation Research Wing of the Ministry of Road Transportation & Highways and National Crimes Files Office of Ministry of House Affairs, Government of India explain national mathematical tendencies and normalized indications of street incidents, accidents & fatalities. This information highlights tendencies, indications, interstate reviews and the most recent traits of street traffic incidents in India. While the official street traffic fatality information may be near the real quantity, the harm information are disgusting underestimates. Depending on bib-lio metric analysis, India led only 0.7 per cent papers on street traffic accidents and had less than one article on street traffic accidents per 1,000 street traffic connected deaths. To work, plans on harm prevention and security should be predicated on regional evidence and research. Health professionals and

their skilled bodies across large disciplines have to get an initiative for the exact same with effective commitment. Saleet et al. [2011] (5) have shown a class of redirecting methods for vehicular advertising hoc systems (VANETs) called the Intersection-based Geographical Routing Protocol (IGRP), which outperforms existing redirecting systems in town environments. IGRP is based on a fruitful collection of path intersections by which a package should move to achieve the gateway to the Internet. The choice is created in ways that assures, with high likelihood, network connectivity among the trail intersections while satisfying quality-of-service (QoS) limitations on tolerable wait, bandwidth consumption, and problem rate. Shen et al. [2014] (6) have discussed this details distribution is actually an alternative request to the vehicle network. Current details distribution programmers' are usually designed on a few random-access projects, which end up in a bound to happen crash problem. To pay this condition, within this report the fresh details distribution tactic provides fashioned in the preparation perspective. The details distribution preparation design might be proposed. While in the recommended design, the chief problem is actually just how to help allocate a indication possibility to nodes by using highest distribution application also to pun intended, the crash problem. The fresh along with sensible communicate assortment tactic has additionally recommended along with follow a space-time multilevel programming (STNC) by using minimal discovery complication along with space-time range attain to help improve distribution efficiency. Sherif M. et al. [2015] (1) have illustrated the data of car points submission is definitely important for pricing the possibilities of connection with motor vehicle advert hoc networks. Their submission associated with autos in a ln provides regarded bearing in mind in which step by step autos ought to have a minimum amount protected length in between them. It really is revealed the profile associated with protected length raises the deal in between autos theoretical space submission as well as empirical information with one ln traffic. Minimum amount length is affecting your connection chances see how to avoid targeted traffic situations additionally be studied. Their points submission associated with one ln readers are additionally revealed from the free of charge circulation situations is superior made utilizing a moved dramatical unit which in turn considers their protected length in between vehicles. Sichitiu et al. [2008] (7) have proposed Inter-vehicle conversation (IVC) systems (i.e., systems not depending on roadside infrastructure) have the possible to radically enhance the security, effectiveness, and comfort of daily path travel. Their main gain is that they avoid the need for costly infrastructure; their major problem could be the comparatively complicated marketing practices and the need for significant penetration before their applications can become effective. In this short article they presented several major classes of applications and the types of companies they require from an main network. Then they check out analyze

current marketing practices in a bottom-up style, from the physical to the transfer layers in addition to analysis frequent performance evaluation methods for IVC systems. Soldo et al. [2011] (8) have built and contributed an important number of traffic in the near future. An issue, hardly addressed to date, is how exactly to spread video streaming traffic in one supply to any or all nodes in an downtown vehicular network. This problem significantly is different from prior work with broadcast and multicast in advertising hoc systems due to the very powerful topology of vehicular systems and the rigid wait requirements of streaming applications. Steven J et al. [2008] (3) have proposed the newest technologies to become listed on the fray is cellular WiMax, a version of traditional WiMax (worldwide interoperability for microwave access), which permits high-speed fixed wireless communications. Mobile WiMax advocates trust their strategy can compete with mobile, Wi-Fi, and last-mile Internet-access technologies such as DSL and cable. Toor et al. [2008] (9) have shown a thorough study on the state-of-the-art pertaining to car offer hoc networks. They started by getting through examining the potential apps to use around VANETs, specifically, security along with customer apps, by pinpointing its requirements. Next, all of us label the actual answers consist of inside the materials in accordance with their whereabouts in view technique interconnection personal reference unit and romance so that you can security as well as customer applications. They all examine its positive aspects along with mistakes and supply your recommendations for a more rewarding approach. They illustrate the actual different ways employed to emulate along with study consist of solutions. Ultimately, all of them end having recommendations for an overall structure in which can build the actual cause an operating VANET. Toutouh et al. [2012](10) have mentioned that recent improvements in wireless technologies have provided increase to the emergence of vehicular offer hoc systems (VANETs). Such systems, the restricted protection of WiFi and the high mobility of the nodes make frequent topology improvements and network fragmentations. That report handles the optimal parameter setting of the enhanced link state routing (OLSR), which is really a well-known cellular offer hoc network routing project, by defining an optimization problem. This way, some representative meta heuristic algorithms are studied in that report to find automatically optimum options of the routing protocol. Additionally, a set of practical VANET cases have already been defined to accurately evaluate the performance of the network under our computerized OLSR. In the tests, OLSR options lead to better quality of support (QoS) than the normal request for comments along with many human authorities, rendering it amenable for usage in VANET configurations. Wang, Z & Hassan, et al. [2008] (11) have proposed the web connectivity involving car posting hoc cpa affiliate networks (VANETS) may have your particular submission habits, generally based mostly in addition to non-

uniform, involving cars in the travelling network. Around these studies, they all bring in a different composition to get computing you're on the web connectivity in the VANET to get on going submission habits involving conversation nodes using a set in the travelling network. This sort of submission habits could be predicted via targeted visitors densities received via picture alarms as well as other detectors. As soon as conversation nodes stick to homogeneous Poisson distributions, they all attained a different closed-form treatment for on the web connectivity; while submission habits involving conversation nodes tend to be distributed by spatial revival methods, they all obtained the approx. closed-form treatment for your on the web connectivity; then when conversation nodes stick to non-homogeneous Poisson distributions, they all suggested any recursive label of connectivity. For your shock-wave targeted visitors, they all displayed their steadiness involving diagnostic final results together with those people simulated together with ns-2, any conversation simulator. While using created styles, we talk about your influences upon on the web connectivity involving road-side programs and various submission habits involving vehicles. Supplied ongoing targeted visitors circumstances, on the web connectivity style may possibly help to get creating redirecting methods throughout VANETS in addition to applying vehicle-infrastructure plug-in systems. Wisitpongphan et al. [2007] (12) have proposed vehicular ad hoc network (VANET) may well showcase the illness tendencies, i.e., your system can certainly be either thoroughly related or perhaps sparsely related with respect to the period or perhaps out there vaginal penetration fee on the mobile transmission devices. With this newspaper, most people work with empirical auto targeted visitors facts tested about 1-80 road throughout Los Angeles in order to develop an all-inclusive diagnostic design to review your turned off

system trend as well as its system characteristics. These traits reveal the important thing the navigation efficiency achievement connected with curiosity about turned off VANETs, just like the ordinary time frame delivered to propagate your small fortune in order to turn off nodes (i.e., your re-healing time). Each of our outcomes reveal that, with respect to the sparsely connected with automobiles or perhaps this market vaginal penetration fee connected with cars and trucks making use of Devoted Limited Array Communicating (DSRC) technologies, your system re-healing time frame may differ coming from a couple of seconds to many minutes. The following means that, with regard to road wellbeing apps, a whole new advert hoc the navigation standard protocol might be desired seeing that the common advert hoc the navigation standards for example Vibrant Origin The navigation (DSR) plus Advertising Hoc On-Demand Range Vector The navigation (AODV) won't assist these kinds of prolonged re-healing times. Moreover, your designed diagnostic design as well as its forecasts deliver priceless information in the VANET the navigation efficiency inside the turned off system regime. Yang et al. [2013] (13) have discussed that "VANET is one of the capable wireless communication technologies which can help in improvement of highway safety and information services. In this paper, the authors proposed application oriented secure network design framework. The authors also highlight various supporting tools like security management, secure routing etc. to design VANET framework. The paper briefly describes the importance of an Internet Access application. At MAC layer, DSRC channel excluding control channel can be used for Internet access. It is possible that the future vehicles may be equipped with the capability so that the routes on the vehicles can get connected with the Internet facility".

III. COMPARISON TABLE

The table below gives the comparison between the various routing protocols:

Table 1. Comparison table of various Routing Protocol

Routing Protocols	Proactive Topology Based Protocols	Reactive Topology Based Protocols	Position Based Routing Protocols	Cluster Based Routing Protocols	Geocast Based Routing Protocols	Broadcast Based Routing Protocols	Infrastructure Based Routing Protocols
Prior Forwarding Method	Wireless Multihop Forwarding	Wireless Multihop Forwarding	Heuristic Method	Wireless Multihop Forwarding	Wireless Multihop Forwarding	Wireless Multihop Forwarding	Multihop Forwarding
Digital Map Requirement	No	No	No	Yes	No	No	Yes
Virtual Infrastructure Requirement	No	No	No	Yes	No	No	Yes
Realistic Traffic Flow	Yes	Yes	Yes	No	Yes	Yes	Yes
Recovery Strategy	Multihop Forwarding	Carry & Forward	Carry & Forward	Carry & Forward	Flooding	Carry & Forward	Carry & Forward
Scenario	Urban	Urban	Urban	Urban	Highway	Highway	Urban

IV. CONCLUSION AND FUTURE SCOPE

Routing is a significant part in vehicle-to-vehicle (V2V) and infrastructure-to-vehicle (I2V) communication. That report examines numerous redirecting standards of VANET. Developing an effective redirecting method for several VANET purposes is quite hard. Hence study of various VANET standards, researching the different characteristics is totally important to develop new proposals for VANET. The efficiency of VANET routing protocols be determined by numerous variables like Prior forwarding method, digital map requirement, virtual infrastructure requirement, realistic traffic flow, recovery strategy and scenario. in this paper represents the study and contrast of various routing protocols in VANETS.

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