# A Survey on: Routing Techniques for VANET

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*Abstract— Vehicular Ad-Hoc Networks(VANET) , are a particular kind of Mobile Ad-Hoc Networks(MANET), in which vehicles act as nodes and each vehicle is equipped with transmission capabilities which are interconnected to form a network. The topology created by vehicles is very dynamic and non- uniformly distributed.  Routing is the process of selecting best paths in networks.  Routing Protocols should be localized, loop- free, free from stale routes, must optimally use scarce resources like bandwidth, battery power etc., must able to provide a certain level of Quality Of Service( QoS).The routing  principal criterion of succesful routing in VANET is correctness but it is not only the criteron. Preference is to take the most direct , reliable , scenic and the least expensive route. The main objective of this survey paper is to study and analyse various routing techniques for VANET, and  features provided by these techniques.*

*Keywords—  Adaptive Position Update, Dead-End Reduction, Zone of Relevance, Global Positioning system, End Systems.*

## I.   INTRODUCTION

Vehicular Ad-Hoc Network (Vanet) is a wireless communication network in which communication between  the vehicles take place, and vehicles act as nodes in the network. A VANET turns every participating vehicle into a wireless router or node allowing vehicles to connect and create a network. The primary goal is to increase road safety. In VANET a vehicle can communicate to its neighbouring vehicles even in the absence of central base station. The concept of this direct communication is to send vehicle safety messages one-to-one or one-to-many vehicles via wireless connection. Such messages are usually short in length and have very short lifetime in which they must reach at the destination.
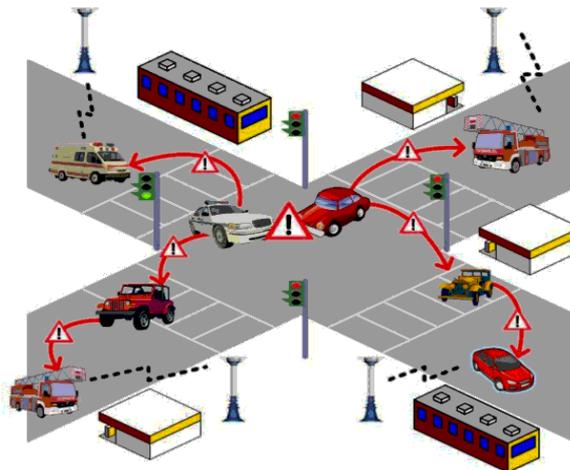


Fig 1.1: idea of VANET

VANET is an application of MANET (Mobile Ad-Hoc Network). It is the most important component of Iintelligent Ttransportation System(ITS) in which vehicles are equipped with some short range and some medium range wireless communication. VANET helps in improving transportation system and increasing vehicle safety. To achieve this vehicles act as sensors and exchange warnings that enable the drivers to react early to abnormal and potentially dangerous situations like accidents , traffic jams etc.

## II.   ROUTING PRINCIPAL OF VANET
The principal criterion of succesful routing in VANET is correctness but it is not only the criteron. Preference is to take the most direct route i.e. one that takes least time , the most reliable route i.e one that is not likely to be closed by a heavy snowfall, the most scenic route i.e. one that follows pleasant country roads rather than busy highways, the least expensive route. VANET is the open system architecture[1]. Interest in VANETs has grown over the last few years, participating in the context of emerging Intelligent Transportation System(ITS). VANETs are highly mobile wireless netwroks that are designed to support vehicular safety, traffic monitoring and other commercial aplication.
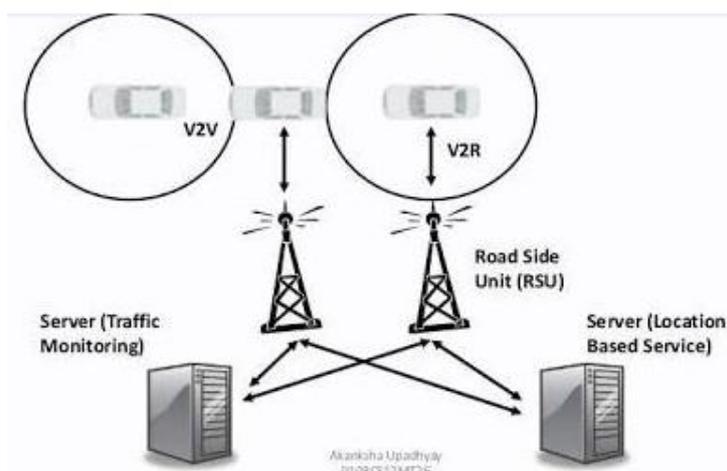
Fig 2.1: Routing Principle

## III. COMMUNICATION TYPES

The communication types are Vehicle to Vehicle (V2V) , Vehicle to Roadside (V2R) and Vehicle to Infrastructure (V2I).

1. Vehicle to Vehicle (V2V) - It is suitable for short range vehicular network. It provides real time safety , fast and reliable. It does not need any road side infrastructure. In V2V warning messages are broadcasted from vehicle to vehicle.
2. Vehicle to Roadside (V2R) – It provides communication between vehicles and the roadside units. It makes use of pre existing network infrastructure such as wireless acess points. In V2R warning messages are send to roadside units and then from that roadside units warning messages are send to the vehicles.
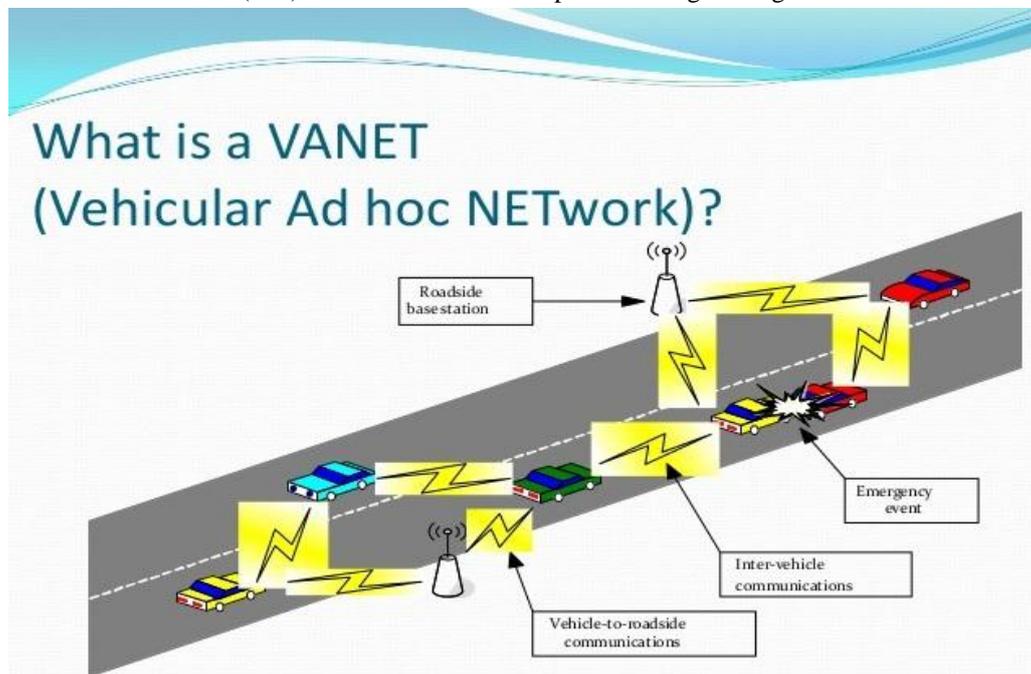3. Vehicle to Infrastructure (V2I) – This communication provides longer- range vehicular networks.


Fig 3.1: VANET

## IV. ASSUMPTIONS FOR ROUTING IN VANET

1. No power concerns with regarding to routing in VANET.
2. In VANET the mobility is more structured as compared to MANET.
3. Nodes have very high speed.
4. Road network information is available.
5. Geographic position is available

## V. ROUTING ARCHITECTURE OF VANET

The VANET routing architecture applies to hop-by-hop connectionless open systems routing in general. The routing architecture for VANET is given in figure-4. The VANET routing scheme consists of:

• A set of routing protocols that allow end systems and intermediate systems to collect and distribute the information necessary to determine routes.

- A routing information base containing this information, from which routes between end systems can be computed i.e. directory information base, the routing information base is an abstraction and it doesn't exist as a single entity. The routing information base can be thought of as the collective (distributed) information of an entire subsystem concerning the routing relevant connectivity among the components of that subsystem.
- A routing algorithm that uses the information contained in the routing information base to derive routes between end systems.

End systems (ES) and intermediate systems (IS) use routing protocols to distribute some or all of the information stored in their locally maintained routing information base. ES and IS send and receive these routing updates, and use the information that they contain and information that may be available from the local environment, such as information entered manually by an operator to modify their routing information base. The routing information base consists of a table of entries that identify a destination. The following illustrates the decomposition of the VANET routing function.
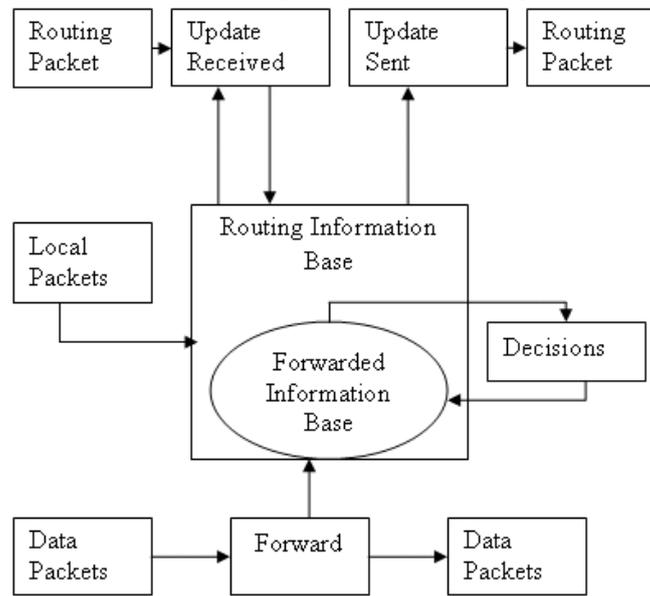


Fig 4.1: Architecture of VANET

## VI. RELATED WORK

The various approaches and techniques used in VANET are described below:

### A. Road-Based using vehicular Traffic Routing Protocol

RBVT protocols leverages real time vehicular traffic information to create road based paths consisting of successions of road intersections that have high probability, network connectivity among them. The two protocols namely reactive protocol RBVT-R and a proactive protocol RBVT-P are introduced and compared them with protocols representative of mobile ad-hoc networks and VANETs. Simulation results in urban settings show that RBVT-R performs best in term of average delivery rate, with up to a 40% increase compared with some existing protocols. In terms of average delay, RBVT-P performs best with as much as an 85% decrease compared with the other protocols[2].
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### B. Intersection-Based Geographical Routing Protocol

Hanan Saleet, worked on Intersection-Based Geographical Routing Protocol for VANETs in order to improve Quality of service [3]. IGRP is based on an effective selection of road intersections through which a packet must pass to reach the gateway to the Internet. The selection is made in a way that assures, with high probability, network connectivity among the road intersections while satisfying quality-of-service (QoS). Geographical forwarding is used to transfer packets between any two intersections on the path, decreasing the path's sensitivity to individual node movements[3].
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### C. Cluster-Based Routing Protocol

Cluster Based Routing help in transmitting packets in network even with low vehicle density. If the network has less vehicle then it becomes more challenging to send packet from source to destination. Cluster Based Routing is a method to solve the issue of low communication in scarce network. There is a hybrid network whick includes both static and dynamic nodes. Static and dynamic cluster heads are reponsible for cordination among the nodes within their clusters and between the clusters. In [4] clustering was proposed as a useful tool for locating the destinations. In VANET , every node can act as a source. Each vehicle should store the information related to the cluster within the tranmission range of source node. In this model a fixed no. of dynamic and static sources are known to every vehicle of system. In the integrated approach the information pertaining to traffic is maintained in both sources, lesser in dynamic and longer duration in static source. If the distance between two cluster head is found to be less that the threshold, the cluster with fewer members is dismissed to reduce communication overheads and its members join other clusters [5] [6].

## D. Routing Techniques for VANET.

The various routing techniques used in VANET or V2V communication are Geographic Source Routing, Data Dissemination Routing, Greedy Perimeter Stateless Routing, On-Demand Routing Protocol, Greedy Forwading Techniques, Fish-eye State Routing, Geo-cast Routing, Position Based Routing, Dynamic MANET on Demand. Geographic Source routing is a position based routing with topology information. Geographical routing states that each node knows its own location by using the global positioning system (GPS) or some other indirect, localization technique [15]. Greedy perimeter stateless routing protocol specifies the geographic forwarding strategy and assumes the existence of a location. GPSR data forwarding algorithm consist the two component i.e. greedy forwarding and perimeter routing. On-demand routing protocols for ad hoc networks, in which a node attempts to discover a route to some destination only when it has a packet to send to that destination. Geo-cast routing is basically a location based multicast routing. Its objective is to deliver the packet from source node to all other nodes within a specified geographical region Zone of Relevance (ZOR) [7].

## E. Dead-End Reduction (DR) mechanism

DR(Dead-End Reduction) mechanism is a scheme that decreases the risk of a data packet encountering a dead- end situation. As it is forwarded to its destination. Under the scheme, the mobile nodes periodically broadcast beacon messages to exchange neighbouring node information to detect dead ends along thier intended transmission paths. During forwading the relaying nodes use this information to avoid delivery data packets to relays known to be suffering a dead-end situation[8]. **Adaptive-Position Update Strategy** identified the need to adapt the beacon update policy employed in geographical routing protocols to the node mobility dynamics and the traffic load. Adaptive Position Update (APU) strategy for geographic routing , which dynamically adjusts the frequency of position updates based on the mobility dynamics of the nodes and the forwarding patterns in the networks APU is based on two simple principles :1) nodes whose movements are harder to predict update their positions more frequently and vice versa and 2) nodes closer to forwading paths update their positions more frequently and vice versa [9].

## VII.   SUMMARY OF ROUTING TECHNIQUES IN VANET

**Summary Of Various Routing Protocols.**

In the following Table, contains all routing protocol  technique methods that are explained previously

| METHOD | AUTHOR AND YEAR | FEATURES |
|---|---|---|
| Greedy Perimeter Stateless Routing (GPSR) | Yugal (2011), Yanmin (2013), Shalley (2015), Neha (2015) | In this the data packets are not sent to a special receiver but to the coordinates.The packages should be relayed to the node that's geographically closest to the coordinates. This assumes that every node knows its own position. |
| On-Demand Routing | Yugal (2011) | In these protocols a node attempts to discover a route to some destination only when it has a packet to send to the destination. |
| Geo-Cast Routing | Yugal (2011) | Geocast routing protocols follow the principle of routing data packets from a single source vehicle to all vehicles belonging to the destination area called zone of relevance(ZOR). |
| Intersection-Based Geographical Routing (IGRP) | Hanan (2011) | IGRP is based on an effective selection of road intersections through which a packet must pass to reach the gateway to the Internet. The selection is made in a way that guarantees, with high probability, network connectivity among the road intersections while satisfying quality-of-service (QoS). |
| Road-Based Using Vehicular Traffic Routing (RBVT) | Josiane (2009) | RBVT protocols leverages real time vehicular traffic information to create road based paths consisting of successions of road intersections that have high probability, network connectivity among them. The two protocols namely reactive protocol RBVT-R and a proactive protocol RBVT-P are introduced  and compared them with protocols representative of mobile ad-hoc networks and VANETs. |
| Cluster-Based Routing | Siddhant (2013) | The vehicles sharing similar characterstics, such as performing in the same direction with more or less same velocity, can form a cluster and elect a cluster-head  which manages the cluster and is incharge  of  inter  cluster  communication.intra  cluster communications are cluster-head free and perform using direct links. |
| Position-Based Routing, Geographic Based Routing | Neha (2015) | In this vehicle's geographical information is used in the relay selection process that each vehicle has the mean to know its geographical position. The knowledge of the whole route is unnecessary to deliver the data packets. |

## VIII. CONCLUSIONS

In this paper, the various routing techniques used in VANET (V2V), are discussed. **Greedy Perimeter Stateless Routing (GPSR)** allows nodes to figure out who are closest neighbours that are also close to the final destination, tho which the information is supposed to travel to. **On-Demand Routing protocols** obtains the necessary path when it is required , by using a connection establishment process. These protocols find route by flooding the network with Route Request packets. Their disadvantage is their high latency in route finding and excessive flooding can lead to network clogging. The vehicles sharing similar characterstics, such as performing in the same direction with more or less same velocity can use **cluster based protocols. Geo-Cast Routing** routes data packets fron one single vehicle to all the vehicles belonging to ZOR. It is a type of multicast routing, and is used in geographic messaging , geographic advertising, presence discovery of a service in a limited geographic area (ZOR). **Intersection-Based Geographical Routing (IGRP)** selects the route in a way that guarantees, with high probability, network connectivity among the road intersections while satisfying quality-of-service (QoS).

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