A Survey On Routing Protocols In VANET

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Abstract:- VANET is a special class of MANET which provides communication between moving vehicles (V2V) and between vehicle and infrastructure (V2I). VANET provides intelligent traffic system, early warning signals to vehicles which could minimize road mishaps, optimize traffic flow, improve road safety and reduce congestion and provide better in-transit communication. Performance of communication depends on the best route selection & routing of data is done by routing protocols. Analysis of routing protocols in VANET is a must to provide smart communication. The VANET challenge is to handle sporadic connectivity and sudden changes in network topology. A brief overview of routing protocols in VANET and their issues are discussed in this paper.

Keywords: - Intelligence Traffic system, Manet, Routing Protocols, Vanet,

I. INTRODUCTION

As the world is progressing at a very fast speed in almost all spheres of life & same is applicable to automobile industry. More & more facilities are provided to passengers with the aid of new technologies including safety applications. VANET is also one of them & is a new emerging technology to integrate the capabilities of new generation wireless networks to vehicles. It is a self organizing network which is a special type of MANET. Ad hoc means for a particular purpose or improvised. In absence of infrastructure, communication between mobile nodes takes place in mobile Ad hoc networks. This communication between mobile nodes may be one hop communication or multi hop communication.

VANET comprises below mentioned features:

• Dynamic topology

• Mobility models

• Infinite energy supply

• Localization functionality.

The communication protocols for MANET are more complicated than traditional networks due to the dynamically changing network topology of MANET. In a VANET, the major factor is the mobility. As the nodes are moved from one location to other, there coverage controller is changed very fast. When a mobile node moves outside its current cluster, then there is a requirement of some cluster selection mechanism so that we can elect the next head for that mobile node. This process is named as vertical handover in which network node can automatically change its connection type. As and when a computing device could connect to the Internet via two different network technologies then it is automatically connected to the available network. This shuffling from one network to the other is called vertical handover or vertical handoff which enables use of higher bandwidth and lower costs for networks like wide local area networks. It also provides coverage for cellular networks. When handoff takes place then we have to select the base station with the help of certain parameters as load value analysis, network capacity etc.

Some special features of VANET are:

➢ The mobility of vehicles is highly foreseen because there are only two moving directions for the vehicles on the same road.

➢ All communication devices have plenty of electric power provided by vehicles.

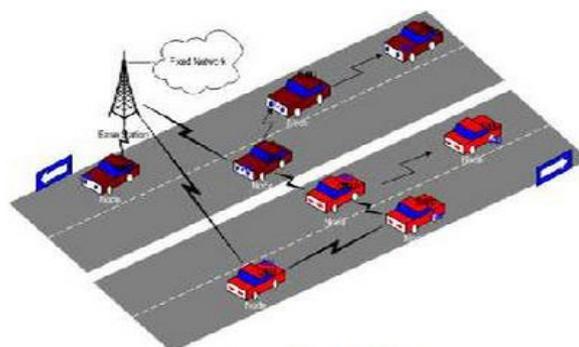➢ Broadcasting is often used to deliver messages instead of unicasting.

Fig 1 VANET SCENARIO

1.1. Communication modes:
(1) vehicle-to-infrastructure (V2I) communication.
(2) vehicle-to-vehicle (V2V) communication

V2I is based on WIFI or WIMAX while V2V is based on Dedicated Short Range Communications (DSRC). V2I communication refers to the communication between vehicle & roadside unit. It can also be used for internet access.V2V communication refers to the direct or multi hop communication among vehicles in VANET. It is efficient & cost effective due to its short range bandwidth advantage & adhoc nature.

1.2 Handoff in VANET:
Most basic definition of handover is when a phone call in progress is redirected from its current cell that is considered as source, to a new cell considered as target. Handoffs can be classified in several ways as discussed below: Hard and Soft Handoff: Hard handover is one in which the channel in source cell is released & only then the channel in target cell is engaged. This is considered as break-before make. Soft handover is one in which the channel in the source cell is retained and used for a while parallel with the channel in target cell. It is also considered as make-before-break. Handoff is classified as either horizontal or vertical depending on the type of network technologies involved. Horizontal or intra-system handoff occurs when the MS switches between different BSs or APs of the same access network. On the other hand, vertical handoff or inter-system handoff involves two different network interfaces representing different wireless access networks or technologies depicts the two types of handoffs in heterogeneous wireless networks where horizontal handoff occurs between two WLANs, and vertical handoff occurs between a WLAN and a CDMA network. Mobile controlled, Mobile assisted, and Network controlled Handoff: This is classified on the basis of entity, access network, that makes the handoff decision. Mobile-assisted handoff is the combination of mobile-controlled and network controlled handoff where the MS makes the handoff decisions in cooperation with the access network.

1.3. Applications:
VANET communication provides a numerous of application in present computing environment which are mainly classified in two classes as:
1) Safety oriented applications

2) Value added applications
3) Comfort applications.

Safety oriented applications are generally broadcast type. It comprises emergency warning, stopped vehicle warning, lane changing warning, road conditions warning etc. while value added applications will be mobile commerce, entertainment, multimedia, streaming etc. Comfort applications improves passenger's comfort & traffic efficiency such as traffic information system, weather information, nearest gas station, best restaurant etc.

Below is a list of applications [11]:

Vision enhancement: In this drivers are given a clear view of vehicles or obstacles in foggy weather also. In Cooperative driving driver is the main lead in this application. Examples are lane changing, curve warning etc. by the help of which we can prevent accidents.

Traffic optimization: In this application vehicles could detect if there is any road jam & due to which speed of vehicle is too slow. As the information is received , an alarm signal is broadcast to vehicle & all others can have an option to opt other route.

Location based services: In this vehicle can find the location of nearest petrol station , railway station, hotel etc. Payment services: This application is suitable for toll collection without waiting in line.

Automatic parking: It is an application in which a vehicle can park itself without the driver intervention. For this to make possible a vehicle needs accurate distance estimators and a localization system with sub meter precision.

So VANET provides life critical safety applications, electronic toll collection and many more . Applications of VANET are divided in two categories: 1) Safety applications(broadcast type) 2) Non safety applications(just depend on request-response).There are certain parameters of message for which checking is required ,such as authentication, message integrity, reliability, confidentiality etc [11].

II) ROUTING IN VANET:
Routing is the process of selecting best paths in a network along which we can send our message from source to its destination, act performed by router. Each intermediary device performs routing by passing along the message to next node over network. Routing tables are used to analyze the best path Two major categories of routing protocols are topology based and position based [5].

II. OVERVIEW
2.1 Overview of Routing Protocols
In VANET, the routing protocols are categorized into five Categories which are as [1]:
  ➢ Topology based
  ➢   Position based Broadcast
  ➢ Cluster based
  ➢ Geo cast based

2.1.1 Topology based routing protocols
For packet forwarding in topology based routing protocol, links information that exist in the network is used to perform packet forwarding from source to destination. It is further divided into two classes as:
1. Proactive routing protocols
2. Reactive routing protocols

2.1.1.1 Proactive routing protocols:
In this type of routing all the necessary information for routing is maintained in background irrespective of communication requests. Packets are constantly broad casted among nodes to maintain path & then routing table

is maintained within a node which indicates next hop towards destination. Advantage of this type of routing is that no route discovery is required because the destination route is stored in background. Disadvantages of this routing are that it provides low latency for real time applications reduction in the available bandwidth. The different type of proactive type routing protocols are Fisheye state routing, link state routing. In FSR, the route information is collected from the neighbour nodes & then table is maintained.

Advantages of FSR are:
➢ FSR reduces consumed bandwidth as it exchanges partial routing update information with neighbors only.
➢ Reduce routing overhead.
➢ Routing table will not change even if there is any link failure because it doesn't trigger any control message for link failure.

Disadvantages are:
➢ It provides poor performance in small ad hoc networks.
➢ Have knowledge only about neighbor nodes & don't have knowledge about distant nodes.
➢ With the increase in network size the storage complexity and the processing overhead of routing table also increase.

2.1.1.2 Reactive routing protocols:
It is also considered as on demand routing protocol. It only opens the routes when it is necessary for a node to communicate with each other. It only maintains the routes that are currently needed. So it reduces network load. It consist of route discovery phase in which the query packets are flooded into the network for route discovery & when the rotes found then this phase completes. The various type of reactive routing protocols are PGB, AODV, DSR etc. [3]

Pros
➢ For updating routing table, flooding is used.
➢ It is done on demand.
➢ Saves bandwidth.
Cons
➢ Latency is high for route finding.
➢ Excessive flooding in the network causes disruption of nodes communication.

DSR (Dynamic source routing) has two phases as route discovery & route maintenance.
AODV [3] (Ad Hoc on Demand Distance Vector) is a routing protocol which establishes a route when a node requires sending data. It uses both unicasting & multicasting. A destination sequence number is used which makes it different from others.

Pros
➢ Up-to-date path from source to destination because it uses destination sequence number.
➢ Less memory requirement & route redundancy.
➢ It responses at the time of link failure in network.
Cons
➢ Takes more time while setting up of connection.
➢ Requirement of extra bandwidth.

2.1.2 Position based routing:
This type of routing consist of a class of routing algorithms. In this protocol the nodes uses the global positioning information in order to select the next forwarding hops. The packet is sent to the neighbor hop which is closest to destination. It is beneficial as no global route is created or maintained form source to destination node. It is broadly divided into two types as position based greedy v2v protocol & delay torent protocol. In Position based greedy v2v protocol, we select the farthest node in route of destination. It requires that the intermediate node should have the position of itself, position of its neighbor & position of destination.The goal of this type of protocols is to transmit data from source to destination as soon as possible. That is why this type of protocols are also considered as min delay protocols. Various types are GSR (geographic source routing), SAR, CAR (connectivity aware routing protocols) etc.

2.1.3 Broadcast routing: Broadcast routing is mainly used for safety applications such as for sharing weather, traffic, emergency, road conditions among vehicles & delivering advertisements & announcements. Message is sent to the vehicles beyond the transmission range via broadcasting. In broadcasting same message is sent to all nodes in network. The delivery of packets is ensured at the cost of wastage of bandwidth of network therefore it is better to use in VANET in case of a small number of nodes. Various broadcast routing protocols are DV-CAST, UMB etc.

2.1.4 Cluster based routing: Cluster based routing is preferred in case of clusters [2]. In this case the complete geographical area is divided into squares [4]. In the cluster a node is considered as cluster head & the head will broadcast the message to all the nodes that comes in that cluster. Virtual network infrastrucure is a must to be created through the clustring of nodes to provide scalability. The various cluster based protocols are COIN & LORA_CBF.

2.1.5 Geo Cast Routing: It is basically a location based multicast routing. Its main aim is to deliver the packets within a specified geographical region (Zone of relevance ZOR). Vehicles that are outside the ZOR are not alerted. It just define a zone in which is sends the message in order to reduce overhead & congestion. Unicast routing can be used in case of destination zone. The various geo cast routing protocols are IVG, DG-CASTOR etc.

Following table shows the comparative study of various routing protocols:

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

Fig 3 Comparison of various protocols

III. CONCLUSION

This paper presents a state of the art survey on routing protocols in vehicular ad hoc network which is a promising technology for intelligent transportation system (ITS). In this paper the application & challenges of vehicular ad hoc network are presented. By studying different routing protocol in VANET we have seen that further performance evaluation is required to verify performance of a routing protocol with other routing protocols based on various traffic scenarios. From here we conclude that geo cast routing is used for comfort applications. Network bandwidth is mainly reserved for safety application & comfort messages are usually delay tolerant. In the last table shows the comparative study of all the protocols.

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