Abstract: Vehicular Ad hoc Networks (VANETs) is the new wireless networking concept of the wireless ad hoc networks in the research community. Position Based Routing Protocol has been suitable for VANET because of the frequently changed networks topology and highly dynamic nature of vehicles nodes. Many Position Based Routing Protocols have been developed for routing messages in greedy forwarding way in VANET. Greedy Perimeter Stateless Routing (GPSR) is the one of the best known position-based routing protocol. Providing reliable and efficient routing in presence of relative movement motivates the introduction of movement awareness to improve performance of existing position based routing schemes in vehicular ad hoc networks. When the network is highly dynamic, few of them are efficient. In this paper we investigated about different Position Based Routing Protocols and their issues. The main aim of our study was to identify which ad hoc routing protocol has better performance in highly mobile environment of VANET.

1. Introduction:
The increasing demand of wireless communication and the need of new wireless device have tended to research on self organizing. The networks with the absence of any centralized or pre-established infrastructure are called ad hoc networks. VANET is the subclass of MANET in which vehicles act as nodes. VANET belongs to wireless communication networks area in which communication takes place through wireless links mounted on each node (vehicles). By using 802.11 WLAN technologies VANET have recently received considerable attention. High nodes mobility and unreliable channel conditions are the characteristics of VANET, but there are also some challenging issues like data dissemination, data sharing and security issues. Various routing protocols have been proposed to make routing efficient and reliable in VANET. To simulate and compare the performance of routing protocol in VANET a number of studies has been don and the simulation result shows that because of the characteristics of dynamic information exchange, fast vehicle’s movement and relative high speed of mobile nodes suffers from poor performances. So in VANET finding and maintaining routes is a very challenging task. The position – based routing protocols have been brought forward. GPSR (Greedy Perimeter Stateless Routing) is one of the best known position based routing protocols. In position based routing a source node knows the position or location of the destination node. The position information can be collected in different ways:

i. From the strength and direction of the received wireless signals.

ii. Through interfacing with satellite updating and a global positioning system (GPS) the position of the node by sending signal to this GPS device.

V2V (vehicle to vehicle) communication plays a significant role in providing a high level of safety and convenience of drivers and passengers. V2V communication is the pure ad hoc communication is used in safety warning, road obstacle warning, traffic information, intersection collision warning etc. in V2V communication each vehicle is equipped with GPS device, digital map and computing device. V2V communication uses both unicast and multicast packets forwarding technique between source vehicle and destination vehicles. So V2V communication will be necessary to extend the effective range of networked vehicles. Vehicular movements are based on the same random model with higher maximum node
speed. Increasing the number of nodes in the network and increasing mobility rate is the aim of every researcher.

This paper presents an overview of existing Position Based Routing Protocol that is based on the position prediction of neighboring and destination node. The main purpose of this paper is to identify the issues in Position Based Routing protocol and to stimulate new research directions in this area.

2. Classification Of Routing Protocol:
The routing protocols are classified as Topology Based and Position Based Routing Protocol. Topology based routing protocol is classified as:

2.1. Proactive Routing Protocol:
Proactive Protocol finds routes in advance and mostly based on shortest path algorithm. They keep information of all connected nodes in form of tables because these protocols are table based. Whenever any change occurs in network topology, every node updates its routing table. Proactive Routing protocol may not be suitable for high mobile node. In VANET, proactive routing protocol is not suitable and may fail, due to consumption of more bandwidth and large table information. E.g. Destination Sequenced Distance Vector (DSDV) protocol is more proactive protocol in which routes are discovered and stored even before they are needed.

2.2. Reactive Routing Protocol:
On Demand and Reactive Routing Protocol were designed to overcome the overhead of Proactive Routing Protocol. This is overcome by maintaining only those routes that are currently active. Reactive Routing can be classified either as Source Routing or Hop-By-Hop Routing. In Source Routing complete route information from source to destination is included in data packet. Hop-By-Hop reactive routing is better than on-demand source routing as each data packet in it contains next hop and destination address. E.g. Ad Hoc On Demand Distance vector (AODV) routing is an On Demand protocol, since no protocol information is transmitted before an application decides to send data and no data is sent until a route is formed.
2.3. Hybrid Routing:

Hybrid Routing combines the characteristics of both reactive and proactive protocol to make routing more scalable and efficient. Hybrid Routing protocol are introduced to reduce the control overhead of proactive routing protocol and decrease the route discovery delay in reactive routing protocol. The Hybrid Routing Protocol are mostly zone based, it means the number of nodes is divided into different zones to make route discovery and maintenance more reliable. E.g. the Zone Routing Protocol (ZRP). The overall characteristic of ZRP is that it reduces the network overhead that is caused by proactive routing and it also handles the network delay that is caused by reactive routing protocols and perform route discovery more efficiently.

3. Position Based Routing:

The dynamic and highly mobile nature of VANET demands such routing method that can deal with the environment of such networks. These demands to use position of nodes in order to provide successful communication from source to destination. Such method in which geographical position of nodes are used to perform data routing from source to destination is called Position Based Routing. As compared to topology based routing, in VANET position based routing uses the additional information of each participating node to applicable, that additional information is gathered through GPS device. In vehicular networks position based routing provides hop-by-hop communication. A position based routing protocol consists of many major components such as:

3.1. Beaconing:

A node forwards a packet with the current physical position and unique Id, if the node receives beacon from its neighbor’s then its update its information in the location table. Thus beaconing is used to gather information of one hop neighbor or node’s next hop neighbor.

3.2 Forwarding and Recovery Strategy:

Forwarding and Recovery Strategy are used to forward data from source to destination node. Position Based Routing Protocol used three types of forwarding VANET:

i. Restricted Directional Flooding
ii. Hierarchal Forwarding

iii. Greedy Forwarding

4. Position Based Routing Protocol

In this section we discussed various position based routing protocol used in VANET. In VANET each vehicle wishes to know its own position as well as its neighbor vehicle position, because position is one of the most important data for vehicles. A routing protocol which uses the position information is known as the position based routing protocol. Position based routing protocol need the information about the physical location of participating vehicles be available. A sender requests the position of a neighbor node by means of a location service. Since the vehicular nodes are known to move along establish paths, position based routing protocols are more suitable for VANET. So there is no overhead when tracing a route because routing tables are not used in these protocols.

4.1. Greedy Perimeter Stateless Routing:

Greedy Perimeter Stateless Routing (GPSR) is one of the best known Position Based Routing Protocol. Greedy Perimeter stateless Routing algorithm consists two methods for forwarding packets: greedy forwarding and perimeter forwarding.

4.2. Greedy Forwarding:

A node which forwards a packet to the neighbor that is closer to the packet destination is called greedy forwarding.
Figure 1: Greedy Forwarding

The Greedy Forwarding algorithm looks at the Euclidean distances from each to the packet destination and picks the one with smallest distance. After finding the closest neighbor the packet is forwards to that network. The main drawback of Greedy Forwarding is that if none of the neighbors are closer to packet destination than it, then the algorithm returns failure.

Figure 2: Greedy Forwarding failure

The major advantage of Greedy forwarding is that it holds current physical position of forwarding node, thus by using this strategy total distance to destination becomes less and packets can be transmitted in short time period.

4.3. Perimeter forwarding:

Where greedy forwarding fails Perimeter Forwarding is used. Its means when there is no closest neighbor to the destination is available then Perimeter Forwarding is used.

Figure 3: Perimeter Forwarding.
In this figure x is the node where Greedy Forwarding failed. To forwards the packet algorithm uses right hand rule. According to this rule each node involved to forward packet around the void region and each edge that is traversed are called Perimeter.

4.4. GPSR Performance problem in VANET:

This section reviews performance related problem of GPSR. When evaluating GPSR in VANETs, we observe that inconsistency of neighbor table’s information leads to many problems and low throughput. Outdated information in the neighbor tables can be healed with the more frequent beaconing; this would certainly increase the congestion and the potential for collisions. We may add information about the node’s speed and direction to improve the accuracy of neighbor tables. The neighbor table is not up-to-date always, so the selected neighbor may not be optimal or even may not be a neighbor any more.

Besides GPSR has several characteristics, but there are also several drawbacks:

i. Greedy Forwarding is unsuitable for the vehicular network where the nodes are highly mobile and the node may not be able to maintain it next hop neighbors information as the other node may gone out of range due to high mobility. This can lead to data packet loss.

ii. The beacon may lost due to bad signal or channel destruction. This problem can lead to removal of neighbor information from location table.

Both the recovery strategies of GPSR i.e Perimeter mode and GSR i.e Switch back to greedy are insufficient in city environment. So, there is a need of such routing algorithms, which merges position information with the road topological structure in order to make possible vehicular communication in presence of radio obstacle. Presently many researchers are engaged to solve the problems occurred in forwarding algorithms that fulfill the various requirements, and numerous algorithms related to finding routes and forwarding packet have been proposed.

4.5. Geographic Source Routing (GSR):

GSR routing was proposed to deal with challenges faced by GPSR in city environment. In GSR position based routing is used that support the city map. GSR use reactive location
service to find the physical location for node. GSR combines both geographic routing and road topology knowledge to ensure promising routing in the presence of radio obstacle. In city area these are some problems occurs:

i. Network Disconnection: Due to buildings and trees in city area Greedy position-based routing and its recovery mechanisms to not fully applicable. Nodes that directly connect in free space cannot communicate in city area due to radio obstacles.

ii. Too many hops: In city area, planarized connectivity graph for vehicles along a single street essentially lead to a graph where a vehicle no longer send packets to the neighbor with the largest forward progress. In city area, planarized connectivity graph can increase delay due to large number of nodes.

iii. Routing loops: Routing loop can be occurred in packets while using perimeter method due to mobility. In city area when there are many nodes participating in the communication at the same time there are more chances of routing loops.

iv. Incorrect route selection: Perimeter routing method can select a long route using a right hand rule. The possibility of selecting and longer than necessary route is increased when there is more than one route available. High mobility and too many hops in city area may lead to incorrect route selection.

For local recovery GSR uses “switch back to greedy” method. Both the recovery strategies of GPSR i.e Perimeter mode and GSR i.e Switch back to greedy are insufficient in city environment.

5. Discussions:

In this paper the Problems of Position based routing protocol is mainly presented. This paper outlined the various routing protocol of VANET. Designing an efficient routing protocol for all VANET applications is very difficult. GPSR is reliable for direct communication among nodes. Furthermore, all position based routing protocols cannot deal with all various environments of VANET. The performance of VANET routing protocols depends on various parameter like driving environment, mobility model etc. From the survey it is clear that position based protocol are more reliable for most of the applications in VANET.
References:


