SURVEY ON ROUTING PROTOCOL IN VEHICULAR AD HOC NETWORK

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***Abstract* – VANET is an emerging technology to achieve inter-vehicle communications, for improving the road safety, alerts messages, accessing and sharing the information and entertainments. Vehicular Ad hoc Network (VANET), a subclass of mobile ad hoc networks (MANETs), is a promising approach for the intelligent transportation system (ITS). The design of routing protocols in VANETs is important and necessary issue for support the smart ITS. Although rich literature in ad hoc networks exists, the scale, availability of realistic traffic data and vehicle equipments motivate researchers to study the unique characteristics of VANET. The aim to survey the paper and compare literature on the characterization and existing routing protocol of VANET.**

Keywords - Routing protocols; VANET.

I. INTRODUCTION

In VANETs, vehicles can communicate each other (V2V, Vehicle-to-Vehicle communications) additionally they will connect to an infrastructure (V2I, Vehicle-to-Infrastructure) to urge some service. This infrastructure is found on the roads. Network nodes in VANETs are highly mobile, so the topology is changing. Consequently, the communication link condition between two vehicles suffers from quick variation, and it is susceptible to disconnection owing to the vehicular movements. As luck would have it, their quality may be certain on the road as a result of it is subjected to the traffic networks and its regulation. VANETs have normally higher procedure capability and better transmission power than MANETs.

The characteristics of the network can affect the routing strategy. There are existing protocols designed for the characteristics of MANET, but further studies are required to evaluate the suitability of existing protocols for VANET. Existing routing protocols are generally categorized in *topological-based* and *position-based* routing. Topological based routing makes use of global path information and link information to forward packets. Position-based routing does not keep global network information but requires information on physical locations of the node.

A routing protocol governs the approach that two communication entities exchange information. They includes the procedure in initiate a route, by taking the action for routing failure or maintaining the route. This section describes recent unicast routing protocols proposed in the literature wherever single data packet is transported to the destination node with none duplication due to the overhead concern. Some numbers of routing protocols have been introduced in MANETs but have been used for comparison purposes to suit VANETs distinctive characteristics. Owing to the plethora of MANET routing protocols and surveys written on them, we will solely limit our attention to MANET routing protocols used in the VANET context.

II. LITERATURE SURVEY

Maram Bani Younes at[1] Introduced intelligent path recommendation protocol(ICOD), aim of this protocol to find best path towards each destination in grid based layout area. It can be handle centralized behavior problem. Three different variants are focused in ICOD congestion avoidance, economical, and context aware. Congestion avoidance variant recommends the least congestion path towards the destination. Economical variant recommends the best economical path, fuel consumption and gas emission parameters of each path. Context aware variant consider the road segments and condition of the road analyzing the

desire path. ICOD protocol and different variants are using in same distributed manner and reducing centralized behavior problem, making the fast communication between the vehicles. This paper implemented by NS2, it shown to exhibit a good performance and ability to recommend the best path with decreases the delay of each vehicles. Path recommendation protocol introduced to find the best path based on distributed manner which can be consider road side unit(RSU). RSU present at each road intersection based on grid based layout. It can be solving the congestion problem.

Sheng-Shih Wang, Yi-Shiun Lin at[2] Passive clustering mechanism can be used in this paper for constructing the stable and reliable cluster structure during the route discovery phase. When compared with the traditional clustering mechanisms, PC mechanism is validated and more efficient rather than others. Each candidate nodes self determines its own priority and proposed multi metric election strategy based on metric such as node degree, expected link lifetime. It not only increases the probability of route discovery and also selectedsuitable nodes to create the cluster structure. Cluster structure used to improve the packet delivery ratio and achieves the higher network throughput due to its performance for stable, reliable, and durable routing path. Passive clustering aided mechanism, to construct a reliable and stable cluster structure enhancing the routing performance in VANETs.
First declaration wins mechanism based on the contention. When cluster the nodes, head of the node dominate the other nodes within its communication range. Gateway Selection Heuristic mechanism determines the minimal number of gateway node maintain the connectivity between cluster. Route metrics, Node degree, Expected transmission count, Link lifetime these to construct an efficient structure for reliable and durable routing.

James Bernsen, D.Manivannan at[3] Reliable Inter –Vehicular Routing (RIVER) protocol is an efficient routing protocol for VANETs. This protocol represents surrounding street layout where the vertices of the graph are pointed in street curve. RIVER utilizes an undirected graph will be represented. RIVER performs period of time, active traffic observance and uses these information and alternative information gathere d through passive mechanisms to assign reliability rating to every street edge. Control messages to identify node's neighbors, determine the dependability of street edges, and to share street edge dependability data with alternative nodes. Known edge list- The known-edge list identifies edges by their end point geolocations and communicates responsibility data about every edge. Weighted routers- Every RIVER routing packet contains a listing of anchor points for the route, known by their geolocation. Any two consecutive route anchor points within the list represent an edge within the street graph of the sender node and has an edge weight related to it.

Jung-Shian Li at[4] Link quality changing constantly in vehicular ad hoc network. Many routing algorithm for discovering available transmission paths have been proposed, it is almost impossible to find a reliable end-to-end path in VANET environments since transmission failures occur so frequently. Proposes an application layer forwarding protocol designated as Intelligent Adjustment Forwarding (IAF), in which a segment-to- segment transmission paradigm is used to enhance the data delivery performance. Transmitting data in networks, end-to-end connections are not easily established, and even when they are properly established, they are easily broken. By implementing a store-and-forward capability at each hop in the transmission path, the BP protocol ensures the reliability of each connection between the source and the destination. Ns2 (network simulation 2) simulations was performed to compare the routing performance of IAF with that of the BP protocol and an existing VANET forwarding scheme, namely existing VANET approach. Delay tolerant network (DTN) to beat the inherent issues of DTN networks, such as intermittent property, variable or long delays, and then forth, the communications are usually handled using some kind of information bundling protocol. BP protocol causes several web services to fail since such services typically use the communications protocol transmission protocol which utilizes an end-to-end communication paradigm. The Intelligent Adjustment Forwarding (IAF) algorithm performing an intelligent routing discovery process to establish a transmission path to the destination.

Antonio Fonseca, Teresa Vazao at[5] The protocols based on the vehicles positions were found to be the most adequate to VANETs due to their

resilience to handling the nodes position variation. Topology -based protocols are compared to position-based protocols and to the latter are identified the different used strategies and their performances are qualitatively evaluated relatively to different metric. The different position-based routing proposals are described including a pseudo-code specification is made based on different perspectives. Geographic Source Routing (GSR) chooses a road path to the destination using Dijkstra shortest path algorithm with the GPS map information. The Anchor-based Street Traffic Aware Routing (A-STAR) relies on the calculation of a full path to forward data although using a different approach than GSR. The Greedy Perimeter Coordinator Routing (GPCR) solves the problem caused by the obstacles in the junctions. Greedy Perimeter Stateless Routing (GPSR) does not calculate any path from source to destination.

Carlos J. Bernardos at[6] They analyzed the provision of increased communications between vehicles. It's expected that vehicles can have Communication devices. The main contribution of this paper consists in a route optimization solution for mobile networks – based on the use of mixed ad hoc and infrastructure communications – that enables intervehicle Communications to be improved in terms of bandwidth and delay. OPNET simulation tool used in this paper. NEMO is a home network connected to the Internet. NEMO is away from home, packets addressed to the Mobile Network Nodes will still be routed to the Home Network.

Samira Harrabia at[7] This paper introduces a multi-agent system approach to solve the problems of route instability, low delivery ratio, high transmission delay and improve Vehicular ad-hoc network routing. routing management system requires network operations distribution because every node also acts as a router. An agent technology solution is proposed to perceive the environment and collect context information that will be used to optimize communication, reduce network traffic and find the best routes. The topology based routing protocols use links information that exists in the network to perform packet forwarding. They are further divided into reactive, proactive and hybrid protocols. Position based routing protocols consists of class of routing algorithm.

Yong Xiang at[8] Proposed GeoSVR, a geographic stateless routing combined with node location and digital map. GeoSVR enhances forwarding path to solve local maximum and sparse connectivity problem, and the restricted forwarding algorithm overcomes unreliable wireless channel issues. GeoSVR. The optimal forwarding path used in GeoSVR solved the issues of the local maximum and sparse connectivity by estimating the vehicle density given road type. Restricted forwarding algorithm was proposed to find the next hop in a restricted range to reduce packet loss caused by unreliable wireless channel. The proposed routing is evaluated in synthetic scenario and the results indicated that GeoSVR was able to provide high packet delivery ratio with low latency. We implemented the proposed routing in a real world test bed and deployed it along an urban road for performance evaluation. GeoSVR is a novel stateless VANET routing combined with node location and digital map. Two core algorithms comprise GeoSVR: optimal forwarding path algorithm and restricted forwarding algorithm.

III. INTELLIGENT TRANSPORTATION SYSTEM (ITSs)

In intelligent transportation system, the role of sender, receiver and router takes on each vehicle. On Board Unit (OBU) shows the short range wireless ad hoc networks to be formed. For communication Road Side Unit (RSUs) and vehicles should be equipped with sort of ratio interface. In ITS vehicles received location predication for Global Positioning System (GPS) or a Differential Global Positioning system (DGPS) provided by ITS. Fixed RSUs, to communicate and connected to the backbone network. For example, the whole road network throughout evenly distributed to Road Side Unit required by some protocols. Some require road side units only at intersections and other require road side units only at region borders. Access the vehicles intermittently and exists on infrastructure are assumed for safety purpose, it should be unrealistic to require that the vehicles always access to roadside units. Inter vehicles, vehicle to roadside, and routing based communications depend on very accurate and collect up to date information about the surrounding environment, which requires the uses to exchange

information by accurate positioning systems and smart communication protocols.

IV. ARCHITECTURE OF THE VEHICULAR NETWORK

The architecture of VANETs has in three main categories:Inter-vehicle communication: This is also known as vehicle-to-vehicle (V2V) communication on ad hoc networking. In this category, without the infrastructure support the vehicles communicate with each other. Any valuable data collected from sensors on a vehicle is sent to near vehicles. Vehicle-to-road side communication: This is also known as vehicle-to-infrastructure (V2I) communication. During this class the vehicles will use cellular gate ways and wireless local area network access points to connect to the Internet and facilitate vehicular applications. Inter-road side communication: This is also known as hybrid vehicles-to-roadside communication. Vehicles will use infrastructure to communicate with each other and share the information received from infrastructure with other vehicles in an exceeding peer-to-peer mode through ad hoc communication.

V. SPECIAL CHARACTERISTICS OF VANET

The feature of VANET similar the operation technology of MANET in the sense that the method of self-organization, low bandwidth and shared radio transmission criteria stay same. But the key hindrance in operation of VANET comes from the high speed and uncertain mobility of the mobile nodes (vehicles) along the paths. Moreover, VANETs have unique features over MANETs as follows: Higher transmission power and storage: The network nodes (vehicles) in VANETs are usually equipped with higher power and storage than those in MANETs. Higher computational capability: Operating vehicles can afford, communication and sensing capabilities than MANETs. Predictable Mobility: Unlike MANETs, the network nodes moved over on a VANET can be predicted because they move on a road network. then the future position of the vehicle can be predicted based on the current velocity and road trajectory.

VI. ROUTING PROTOCOLS OF VANET

The growth of the vehicles is equipped with wireless transceivers help to communicate with other vehicles, to form a class of wireless networks, known as vehicular ad hoc networks. To increase the safety of drivers and to provide the comfortable driving environment, messages need to be sent to vehicles for different purposes through the inter vehicle communications. Unicast routing vehicles to construct a source to destination routing in a VANET as

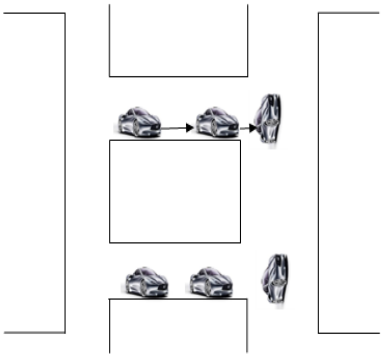

Fig:1. a) Unicast Routing

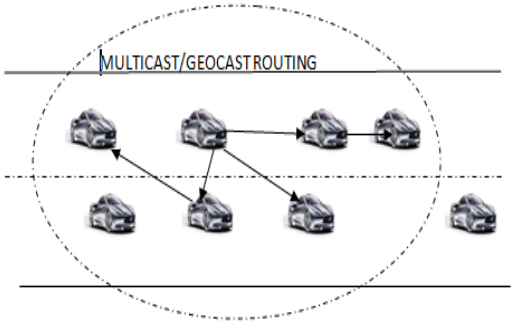

Fig:2 b) Multicast and Geocast routing

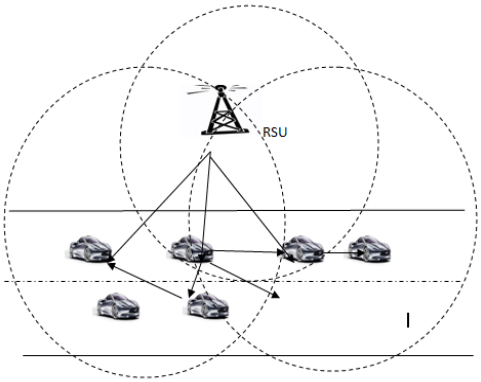

Fig 3 c) Broadcast routing

Multicast is defining to delivering multicast packets to all multicast members from a single packet by multihop communication. Geocast routing works to deliver the geocastpacket sent to a specific geographic region. Geocast packet, forward and receive the specific geographical region where should be vehicle located, otherwise the packet should be dropped as the broadcast protocol is utilized to send the broadcast messages to all other vehicles in the network. Many results on MANETs proposed for unicast, multicast, geocast and broadcast protocols. VANETs are fundamentally different to MANETs, such as rapid changed topology and other special mobility pattern. This key differentiation has an existing routing protocol for MANETs; it cannot be directly applied to VANETs. The recent survey for VANET routing mechanisms, that shows the survey structured into three categories are unicast, multicast geocast and broadcast approaches.

A. UNICAST ROUTING PROTOCOL

This section introduces the Unicast routing protocols in VANETs. To transmit data from a single source to a single destination through wireless multi-hop transmission techniques and also carry and forward techniques. As soon as possible routing path should be relay data from source to destination in the wireless multi-hop transmission techniques. In the carry and forward techniques, as long as possible source vehicle carries data to reduce the number of data packets. The carry and forward technique makes delivery delay time cost is normally longer than wireless multi-hop transmission technique. Min-delay routing protocol and delay bounded routing protocol are two categories of routing protocol design. The aims of min-delay routing protocol to minimize the delivery delay time from source to destination. Delay-bounded routing protocol to maintain a low level of channel utilized within the delivery delay-time. This section describe the existing unicast routing protocols in VANETs as follows.

a. Min-Delay Routing Protocol

The main goal of min delay routing protocols is to transmit data packets to destination as soon as possible. The shortest routing path is adopted and major concern is transmission delay time. However, the shortest path is not the quickest path with the minimum delay time in VANETs. The shortest path should be found in a low density area, packets does not transmit by the multi-hop forwarding since that there's no neighboring vehicle can forward packets. Carry-and-forward scheme should be delivered the packets. The delay time is highly growing if the multi-hop should not be utilized. This effort will be finding a routing path with multi-hop forwarding. The min-delay routing protocols are examined as follows.

b. Greedy perimeter coordinator routing protocol

GPCR (greedy perimeter coordinator routing) which is a position based routing for urban environment. Highly dynamic environments are suited by GPCR protocol such as inter-vehicle communication on the highway or city. Restricted greedy forwarding procedure for GPCR traverses the junctions and the repair strategy which is based on the topology of streets and junctions are adjusts the routing path. After vehicle A received the packets, vehicle A detects destination. Vehicle A then moves packets backward vehicle B, then the packet is forwarded

B. MULTICAST AND GEOCAST ROUTING PROTOCOL

Multicast and geocast routing are the important routing operations in VANETs. The challenges is given how to develop the multicast geocast protocol placed over VANETs with the highly changeable topology. Some of the results have taken the recently investigated the multicast and geocast protocols in VANETs. Multicast and geocast protocol and spatio temporary multicast/geocast routing protocols are classified in existing results.

a. Distributed Robust Geocast Multicast Routing Protocol

Distributed robust geocast multicast routing protocol are proposed this protocol for inter vehicle communication. The vehicles, where to be located in specific geographic region, deliver the packets by distributed robust geocast routing protocol. When the vehicle receives packets or depended on its current location. The vehicles receive the packet within specific region otherwise this vehicle drops packets. In geographic region which vehicle should receive the geocast messages are called zone of forwarding (ZOF). To increase the reliability of receiving messages under frequently changeable topology, when forward the goecast messages to other vehicles in the ZOR (zone of relevance). ZOF usually surrounds ZOR to ensure the geocast messages should be delivered to vehicle inside ZOR. To overcome the network fragmentation is proposed by a periodic retransmission mechanism.

b. Multicast Protocol in Ad Hoc Networks Inter-Vehicle Geocast

Multicast protocol in ad hoc networks inter-vehicle geocast proposed by multicast protocol called Inter Vehicle Geocast (IVG) protocol. If any danger is occurred, IVG protocol is used to inform all the vehicles in a highway; such as an accident. In term of driving direction and positioning of vehicles are determined in risk area. Vehicles located in the risk area from a multicast group. The location, speed and direction of vehicles are temporarily and dynamically defined by the multicast group. IVG protocol is used to periodic broadcasts to overcome temporary network fragmentation for delivering the information to multicast members. The re-broadcast period can be calculated based on the maximum vehicle speed. IVG protocol helps to reduce the hops of delivering messages in use of deferring time. a vehicle which has some distance to source vehicle waits for less deferring time to re-broadcast

c. Spatio temporary Multicast/Geocast Routing Protocol

The spatio temporary multicast/geocast routing protocol is very interest routing problem. The problem occurred ordinary multicast and geocast routing protocol, the spatio temporary multicast and geocast routing protocol should take time factor into account. Spatio temporary multicast and geocast routing are distinctive new form feature. Protocol used to deliver the information to all node and particulat region of space at a particular point in time. Spatio temporary multicast called as mobicast, protocol support the application which require spatio temporary coordination in VANETs..

C. TOPOLOGY-BASED ROUTING PROTOCOLS

These routing protocols use links' information that exists in the network to perform packet forwarding. They can further be divided into proactive (table-driven) and reactive (on-demand) routing.

a. Proactive (table-driven)

Proactive routing carries the definite feature: Proactive routing carries the distinct feature: the routing information like following forwarding hop is maintained within the background regardless of communication requests. control packets are constantly roadcast and flooded among nodes to keep up the path or the link states between any pair of nodes though some of paths are never used. A table construct within a node specified every entry within the table indicates following hop node toward an exact destination. The advantage of the proactive routing protocols is that there's no route discovery since route to the destination is maintained within the background is usually offered upon operation. Despite its sensible property of providing low latency for time period applications, the maintenance of unused path which occupied a part of the available bandwidth VANETs.

b. Reactive (On Demand)

It is necessary for a node to communicate with another node only when the reactive routing opens a route. Routes currently in use reducing the burden on the network. It maintains only routes, query packets are flooded into the network in route discovery phase. The phase completes once a route is found.

D. AODV

Ad-hoc on demand distance vector protocol is also known as reactive protocol which sending the data packets by nodes required. In AODV protocol, the route will be built for node needs to send the packet and could not updated until the route breaks or times out.

a. Geographic Based Routing Protocols

This routing technique is used to aware the position of vehicles by sending information that will be indicates the current position of the vehicle. This can identify the destination of vehicle. But it does not exchange any information to neighbor vehicles.

*DTN***:** DTN stands for delay tolerant network and also known as disruption tolerant network uses carry and forward technique to overcome the loss of data in the network. By using this technique if node not to connect with the other node, the packet and forward will be stored. When node connect with the other node.

BEACON: BEACON, indicator to provide the information and used to transmit a message to neighbor node. Remove the receiving node from neighbor table and it can be informed the positions and presence of node.

OVERLAY: Overlay is a network every node is connected by virtual or logical links which is built on top of an existing network.

VADD: VADD stands for vehicle-Assisted Data Delivery. This technique will be based on the carry and forward approach by using the vehicle mobility. VAAD protocol and H-VAAD are shows the better performance. It can be suitable for multi-hop data delivery.

GeOpps: It stands for Geographical Opportunistic Routing. This protocol suggested route and utilized the navigation sysytem for vehicles to forwarding nodes which closer to the nodes. Compare the routing protocols are Location-Based Greedy routing and MoVe routing algorithm GeOpps has high delivery ratio. During this process, the node which has minimum arrival time the packet will be forward to that node.

GPSR: It stands for Greedy Perimeter Stateless Routing. The packet will be travel which through the destination node and closer to the selected node. If the node fails to select the node and using the perimeter forwarding to select the node. To forward the packets needs only one hop neighbor location.

GPCR: Greedy Perimeter Coordinator Routing is position based routing protocol. It ha some advantage from natural planer graph without using any external information such as static street map.

*GyTAR***:** GyTAR stands for Greedy Traffic Aware Routing Protocol. I t reduces the end-toend delay and messages.

*GSR***:** GSR stands for Geographic Source Routing is based on the Vehicular ad-hoc network. This will be developed from the combination of position based routing protocol and topological routing protocol. This protocol provides the routing procedure and selects the best route for sending the source node to destination node.

A-STAR: Anchor –Based Street and Traffic Aware Routing (A-STAR) is related to GSR. A-STAR is traffic aware, traffic on the road which determines the anchor point of the road. It can be considering the shortest path. This route based on the maps such as statistically rated maps and dynamically rated map. The different between these maps are accuracy of road traffic.

CONCLUSION

In summary, VANET routing has open issues whether there is tools for evaluating these protocols. VANET routing are research direction is advancing and matured level will be high many technologies are need to become mature so the validity much can be given to the benefits of these routing protocols. By comparing the protocol and using the advantages are help to find the efficient routing protocols.

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