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Vehicular ad hoc networks (VANET)

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***Abstract*— A (VANET) vehicular ad hoc network is a type of network which provide vehicle to roadside and vehicle to vehicle communication through wireless connection. By making inter communication between the nodes to avoid accident and provide information of Up-to-date traffic and journey comfort .It makes sure that established routing paths do not break before the end of data transmission. This is a challenging task because the network topology is constantly changing and due to high node mobility the wireless communication links are inherently unstable. Therefore, some type of route optimization is necessary to enhance the network lifetime. The main objective of this survey paper is to study and compare various route optimization techniques.**

Index Terms **GPSR, GPCR, OLSR, VANET.**

1. Introduction

1.1 INTRODUCTION TO VANET

Vehicular ad hoc networks (VANET) represent a fastly emerging research field, it being a particularly challenging class of Mobile Ad Hoc Networks, used for communication and coordinated driving between vehicles on the road. VANET have particular features like-dispersed processing and organized networking, a large number of nodes, the scattering and the speed of these nodes, a restrained but highly variable network topology, communication surroundings and mobility patterns, signal transmissions blocked by big buildings, frequent disconnects due to the high mobility, and finally there are no remarkable power constraints[2].

VANET has many special characteristics that makes it unique from other mobile ad hoc networks; some of the most important characteristics are: distributed communication, high mobility, no restrictions of network size, self-organization, road pattern restrictions, and all these characteristics made VANETs environment a challenging for developing efficient routing protocols [8]. There are many research projects around the world which are related with VANET such as COMCAR, CarTALK 2000, CarNet DRIVE, FleetNet and NoW (Network on Wheels). The promising applications and the cost effectiveness of VANETs comprise major motivations behind increasing interest in such networks [7].

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1.2 ROUTING PRINCIPLE FOR VANET

The main criterion of successful routing in VANET is correctness but it is not the only criterion we take into account. We also prefer to take the most straight or direct route i.e. one that takes the least time , that provides the reliable route i.e. one that is not likely to be disrupt by a heavy snowfall or any other obstruction i.e. one that follows pleasant roads rather than busy one and it should be the minimal expensive route. In its most common form, optimal routing involves transmitting a packet from source to destination using the best path. What comprises the best path is quite a complicated question for example in networks, like the highway system have dynamic costs, transit restrictions, delay attributes, and residual error rates, and all of these are more or less important to find out that what requires for a particular transmission between source and destination or for a particular packet[3].

1.3 ROUTING ARCHITECTURE FOR VANET

The routing architecture in VANET is almost same as the architecture of routing in other connectionless networks. As usual, terminology and the conceptual framework of VANET are more highly elaborated than those of its roughly equivalent peers. The VANET routing architecture applies to hop-by-hop connectionless open systems routing in general.

The architecture of routing for VANET is given in figure-1

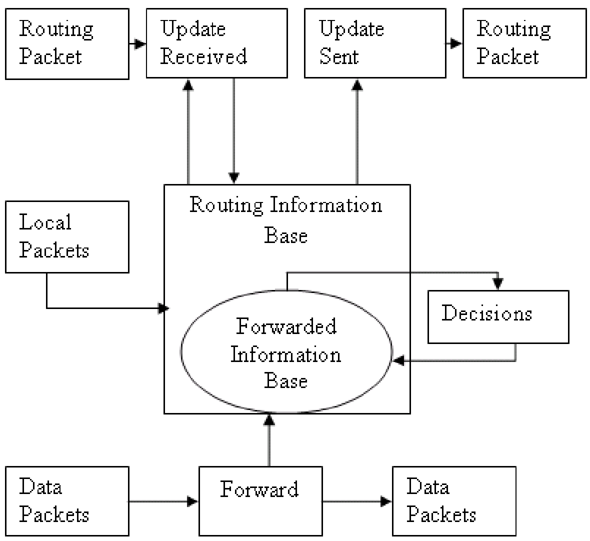

Figure [1]

1.4 ROUTING PROTOCOLS FOR VANET

1.4.1 OLSR (optimized link-state routing)

OLSR is examined as a topology-based routing protocol. Nodes that use OLSR protocol periodically broadcast their routing table to all other nodes in the network, which produces a large communication overhead. OLSR bounds the number of nodes that transmit the control messages using multipoint relays. It uses two primary control messages first one is -topology control messages and second is -the HELLO messages. Topology control messages are transmitted across the network while HELLO messages are transmitted to each one-hop neighbor. If a node does not receive any HELLO messages from one neighbor during a definite time period, then the link is considered down. The source that use this link to forward messages is not aware that the route is broken until that intermediate node broadcasts its another topology control message[4].

1.4.2 GPSR (Greedy perimeter state-less routing)

GPSR presumes that each node in the network has a local table in which all neighboring nodes are recorded by name and position. The record of the local table is soft stated and upgraded after the related timer expires, where signals or beacons broadcast information of the new neighbors. GPSR also presumes that each source with the help of a location service node knows the location of the destination. GPSR has two working approaches: 1) Greedy forwarding mode and 2) Perimeter mode. Greedy forwarding is the default mode, where the packet is transmitted to the node that is geographically closer to the destination [4].

Pros-To forward the packet a node needs to remember only one hop neighbor location.

-It dynamically made decisions for forwarding packet.

Cons-For high mobility characteristics of node, sending nodes ‘neighbor table contains stale information of neighbors’ position.

-Though in the packet header of intermediate node is never update in which the destination node is moving its information [7].

1.4.3 GPCR (Greedy perimeter coordinator routing)

GPCR allocates the routing decision to the nodes located at the street junctions or intersections, and at the same time, it uses the greedy forwarding approach to route the message between the street intersections. Like GPSR, it also for routing the messages does not make use of road maps; therefore, it may result in loops and introduce many hops in the route [4].

Pros-The packet delivery ratio of GPCR increases which is managed by GPSRJ+.

- Iin the recovery mode of GPSR The number of hops is reduced by 200%.

- An expensive planarization strategy is not required in GPSRJ+.

Cons- for the delay sensitive applications it is not appropriate.

- It did not apply on realistic city map that are not necessarily grids.

- It has used simple line trajectory [7].

1.4.4 MURU

The Multihop Routing protocol used for VANETs used in urban areas (MURU) presumes that each node has a static street map and with the help of a location service the source node gets the information about the location of destinations. To find a route, the source node calculates the shortest mean path to the destination based on location of both the source and the destination and this static street map, MURU offer routes that minimize the hop count, it also presents the degree called 'expected disconnection degree (EDD) to evaluate the quality of the routes. The EDD of a given route gives the possibility that this route will fail during a given time interval. MURU uses the EDD to construct a best path or an optimal path based on anticipated speed, location, and the geometry of road[4].

1.4.5 Source-Tree Adaptive Routing (STAR)

(STAR) Source-Tree Adaptive Routing is link State protocol. By eliminating periodic updates, It reduces overhead on the network but it needs large memory and processing because it has to maintain large trees for whole network. this protocol can be suitable for large scale networks. Each node maintains a source tree. Each node builds a partial topology graph using sumtotal of neighbor information learnt using an underlying neighbor discovery protocol and [7].

1.5 NEED OF GPS

The growing demand of positioning devices for eg GPS and other localization schemes, geographic routing protocols are becoming an appealing choice for use in mobile ad hoc networks [5]. The geographic routing mechanism assumes that each mobile node can establish its location by means of a Global Positioning System (GPS) or some other localization technique [1]. The key principle used in these protocols includes selecting the next routing hop from among the geographically close nodes neighbors to the destination. Since the forwarding decision is based totally on local information, it prevents the requirement to create and maintain routes for each destination. Due to these characteristics, position-based routing protocols are particularly robust and are highly scalable to constant changes in the network topology[5]. To identify every node in the system, each node is assigned a unique permanent identity. Furthermore, each node is equipped with a GPS receiver such that it can obtain its location information,i.e., its coordinates and velocity [1].

LITERATURE SURVEY

Chih-Hsun Chou et al.[1] The dead-end reduction (DR) scheme and another two baseline algorithms were evaluated using ns2 simulator. The analytical and simulation results show that the DR scheme significantly reduces the number of dead-end occurrences. As a result, the packet delivery (conveyance) ratio and average path length were improved compared with the standard greedy perimeter stateless routing (GPSR) scheme. Moreover, the supplemental control overhead induced by the DR scheme was less than 10% when compared with the GPSR scheme.

Josiane Nzouonta et al. [2] presents a class of routing protocols named road-based vehicular traffic (RBVT) routing, which outstrip already existing routing protocols in city-based vehicular ad hoc networks (VANETs). RBVT protocols provides real-time vehicular traffic information to form road-based paths that includes series of road intersections that have network connectivity between them. Geographical forwarding strategy is used to transmit packets between intersections on the path which reduces the sensitivity of path to individual node movements. For the networks which are dense with high contention, we optimize the forwarding strategy using distributed receiver-based election of next hops that rely on a multi criterion prioritization function that considers non –uniform radio propagation into consideration. We designed and implemented two RBVT protocols named reactive protocol RBVT-R and a proactive protocol RBVT-P and then authors compared these protocols with protocols representative of mobile ad hoc networks(MANET) and (VANETs). Simulation results in urban areas reveal that RBVT-R performs very good in terms of average delivery rate, that increases 40% when relate with some existing protocols. In te average delay also, RBVT-P performs best, with an 85% decrease compared with the other protocols.

Mr. Yugal Kumar et al. [3] Now a days, one of the most tempting research topics in Intelligent Traffic Control domain is Inter-vehicle communication. In V2V communication or we can say VANET i.e. vehicular ad-hoc network in which a vehicle can communicate to its nearby vehicles even in the absence of a central Base Station. This idea of direct or (undeviate) communication is to send safety messages to one or many vehicles via wireless connection. Such messages are generally consice in length and have very little lifespan in which they should arrive at the destination point. Inter-vehicle communication system is an ad-hoc network having high mobility and changing number of nodes, where mobile nodes dynamically create short term networks and transfer these messages from one to one node or to others by using multiple hops due to restriction of limited range. The routing in vehicular Ad hoc Networks (VANET) has drawn an attention of many people during the previous years. So in this paper the authors are concentrating on the routing concept for the VANET i.e. different principles for routing, decomposition of the routing function and necessity. The data delivery via Vehicular Ad-hoc Networks is challenging since it have to efficiently handle rapid topology changes and an exploded network.

HananSaleet et al. [4] presents different routing protocols for vehicular ad hoc networks (VANETs) that is called as Intersection Geographical Routing Protocol (IGRP), that outstrip existing routing schemes in city environments. IGRP rely on an effective selection of road intersections through which a packet must transmit to reach the gateway to the Internet. The choice is made in a way that assures, high possibilities of net-work connectivity among the road intersections and also satisfies quality-of-service (QoS) constraints on delay upto tolerable limit, bandwidth usage and error rate. Geographical forwarding is used to pass packets between any of the two intersections on the path, reducing the sensitivity of path to individual node movements. To achieve this, the authors mathematically compose the QoS routing as a constrained optimization problem. Particularly, analytical expressions for the connectivity possibility, end-to-end delay, hop count, and bit error rate of a route in a two-way road situation are derived. Then, authors proposed a genetic algorithm that is used to solve the optimization problem. Analytical and simulation results show that the given proposed approach gives optimal or near-optimal solutions and upgrades VANET performance when compared with several existing routing protocols, for e.g. GPSR ,GPCR and OLSR.

Quanjun Chen et al. [5] proposed the Adaptive Position Update (APU) strategy for geographical routing, which vigorously adjusts the frequency of position updates are based on the mobility dynamics of the nodes and the forwarding patterns within the network. APU is based on two simple principles i.e 1) nodes whose movements are difficult to predict update their positions more often (and vice versa) and 2) nodes closer to the forwarding paths will update their positions more oftenly (and vice versa). Our theoretical analysis, which is confirmed by NS2 simulations of a known geographical routing protocol named as Greedy Perimeter Stateless Routing Protocol (GPSR), unveil that APU can appreciably reduce the update cost and can improve the routing performance in terms of packet delivery(conveyance) ratio and average end-to-end delay in contrast with periodic beaconing and other newly proposed updating schemes. The advantages of APU are further affirmed by undertaking considerations in authentic network scenarios, which account for localization error, authentic radio propagation, and sparse network.

Siddhant Jaiswal et al.[6] Interest in vehicular ad hoc networks (VANETs) has emerged over the previous few years, mainly in the context of intelligent transportation systems i.e (ITS) . Vehicular ad hoc networks (VANETs) are mobile wireless networks that are intended to support vehicular safety, traffic monitoring, and other materialistic applications. However, efficient routing in VANETs remains a challenge for so many reasons, e.g., the changing vehicle density over time, the size of VANETs that ranges from (hundreds or thousands of vehicles), and wireless channel fading due to high motion of vehicles and natural obstructions in urban environments (for e.g., big buildings, trees, and other vehicles).Within VANETs, vehicle mobility will create the communication links between vehicles to frequently be broken. Routing has an important role in VANET. If the network has very less number of vehicles then it becomes more difficult to send a packet from source to destination. In this context efficient routing plays a crucial role. With competent routing technic we can provide communication in network even if the vehicle network density is low. We provide a routing algorithm that works on a hybrid scenario, i.e. it includes both static and dynamic infrastructure. The perspective used is Cluster based routing which will help in passing packets even in a network with low vehicle density

BijanPaul VANET et al [7] (Vehicular Ad-hoc Network) is a new technology which has taken enormous attention in the recent years. Due to fast topology changing and regular disconnection makes it difficult to design aneffective routing protocol vehicles, called V2V or vehicle to vehicle communication and vehicle to road side infrastructure, called V2I for routing data among. The present routing protocols for VANET are not effective enough to meet every traffic scenarios. Thus need of an efficient routing protocol design has taken attention. So, it is very necessary to find out the pros and cons of routing protocols so that these can be used for further improvement or development of any new routing protocol. This paper gives the pros and cons of VANET routing protocols for inter vehicle communication.

UditAgarwal et al.[8] Vehicular ad hoc networks (VANETs) are a subclass of mobile ad hoc networks (MANETs). It is a new difficult network environment that pursues the concept of ubiquitous computing for future. VANETs involve lots of options for new range of applications which will not only make the travel safer but will be fun as well. Destination Reaching or getting help would be much easier. The concept of VANETs is very easy .So VANET is a hopeful approach for the intelligent transportation system (ITS). To make a design of routing protocols in VANETs is important and necessary point for support the smart ITS. MANET routing protocol is not appropriate for VANET because for MANET routing protocol it is difficult to find stable paths routs in VANET environments. This paper gives the applications of different routing protocols for vehicular ad hoc networks and their advantages , disadvantages.

TABLE

Technology Used	Protocol Used	Reference No	Parameters	Year	Findings
Dead End Reduction Scheme	GPSR	1	a. Impact of Node Mobility. b. Impact of Node Density. c. Impact of the Position Error.	2008	1. Reduces the no. of dead-end d occurrences. 2. Improves packet delivery ratio and average path length.
Road-based vehicular traffic (RBVT) routing	RBVT-R RBVTP	2	a. Average b. Delivery c. Ratio. d. Average e. Delay. f. Average g. Path h. Length. i. Impact j. Of the k. Number offlows . l. Overhead.	2009	1.RBVT-R(reactive) performs best in terms of average delivery rate up to a 40% increase compared to existing protocols 2. RBVT-P(proactive) perform

					s best in terms of average delay, with as much as 85% decrease compared to other protocols.
Vehicle to Vehicle (V2V)communication	GPSR GPCR OLSR	3	Routing, GPS, VANET, MANET	2011	1. Vehicle can communicate to its neighbor vehicles even in the absence of a central Base Station.
Intersection-based Geographical Routing Protocol (IGRP)	DYMO	4	a. end-to-end delay. b. connectivity probability. c.bandwidth usage. d.BER	2011	1. Decreases end to end delay with increase in network density.
Adaptive Position Up-date strategy (APU)	Geographic routing protocols	5	a.Impact of AER on the Performance of APU. b.Impact of Localization Errors, Fading Channel, and Node Density on Beaconing Schemes. c. Impact of Node Mobility on Beaconing Schemes. d.Impact of Node Mobility on Beaconing Schemes.	2013	1.Achieve better packet delivery ratio, and also average end-to-end delay and energy consumption.

CONCLUSION

In this paper we have discussed the routing concept and different routing technique which are used in VANETs. Routing is the backbone of any network. So the major challenge in protocol design in VANET is to improve reliability of Protocols and to reduce delayed delivery time and the retransmission of number of packet. Dead End Reduction Scheme which reduces the no. of dead-end occurrences and improves packet delivery ratio and average path.Road-based vehicular traffic (RBVT) routing, it performs best in terms of average delivery rate up to a 40% increase compared to other protocols. Vehicle to Vehicle (V2V)communication is also one of the techniques ,Vehicle can communicate to its neighboring vehicles even in the absence of a central Base Station. Intersection-based Geographical Routing Protocol (IGRP) decreases end to end delay with increase in network density. Adaptive Position Up-date strategy (APU) also used by many reasearchers to attain better packet delivery ratio, average end-to-end delay and energy consumption.

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