A Review on Routing Protocol in Vehicular Ad-hoc Network

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Abstract- *Nowadays, a tremendous evolution of advanced technologies and sophisticated solutions applied to intelligent transport systems (ITS) has been observed. For instance, Internet of Vehicle (IoV) allowing both appealing infotainment systems and traffic management applications which require internet access is a core component of future ITS. In VANET, each vehicle acting as the network node communicates with another vehicle and constitutes a large ad-hoc network. Considering a huge number of vehicles the market and benefit of VANET would increase exponentially in the future. Here presents the literature study to routing protocol in vehicular ad-hoc network.*

Keywords:- Intelligent transport systems, Mobile Ad-hoc Network, Vehicular Ad-hoc Network, Global Positioning System.

INRODUCTION

Recent advances in communications technologies allow a wide range of different types of networks to deploy in diverse environments to be developed and implemented. I take into consideration an increase in energy efficiency, lower latency, and smooth connectivity [2]. One of these networks that have received a lot of attention in recent years is the vehicular ad-hoc network (VANET). VANET is a part or branch of MANETS built to achieve transportation protection, reliability, health, death, and efficiency by integrating with current technologies, each node of a vehicle operating in VANET as considered a vector.

A VANET is a specialized type of Mobile Ad-hoc Network (MANET), through which vehicular communication can take place in urban and highway scenarios. Many applications such as security, information services, accident alarm, road safety and traffic managements are associated with VANETs. The speed of the vehicle is the major factor which affects the communication process due to which rapid changes in network topology occur, so the selection of the intermediate vehicle is very crucial. A typical VANET scenario where communication can take place between vehicle-to vehicle (V-2-V), vehicle-to-infrastructure (V-2-I) and hybrid (either V-2-V or V-2-I) [3]. In a VANET, routing protocols are generalized in five categories: Ad-hoc based, cluster-based, position-based, broadcast-based, and geocast-based routing. Position-based routing protocols use geographical coordinates from the Global Positioning System (GPS). They also use digital maps to obtain road information. Low overhead and its effectiveness for rapidly moving nodes are the key advantages of location-based routing protocols. Geocast-based routing protocols basically limit the area of transmission in a specific portion by identifying the next hop using the node's position.

Although Vehicular Ad-hoc Networks (VANET) are derived from Mobile Ad-hoc Networks (MANET) and have similar characteristics like lack of pre-determined infrastructure, self-organization of network and low-bandwidth radio channels, but due to extensive mobility in VANET and thereby dynamically varying network topology, the network solutions for MANET including routing protocols prove ineffective for

VANETs [11]. This leads to degradation of network performance with low communication throughputs, poor route convergence and importantly intermittent connection disruptions [5].

The pivotal requirement for the achievement of VANET applications is the availability of one robust routing protocol for messages dissemination. In order to enable geographically separated vehicles to link together, VANET adopts multi-hop wireless communication by relying on intermediate vehicles for data transmission to extend the coverage of vehicular communications and internet-based services. For more reliable and sustainable connectivity, automotive manufacturers employ cellular network for inter-vehicle internet access. However, in the high-density traffic area, and with respect to the explosive growth of mobile data traffic, the centric cellular networks cannot afford the high communication overhead. It is measured that the current mobile data demand will increase over 10 times and the monthly mobile data traffic will exceed 77 exabytes by 2022. Hence, a hybrid network of VANET and cellular network can be deployed to both effectively support VANET users with low-cost internet-based services and greatly mitigate the cellular network overload [4].

The high-speed mobility of road traffic vehicles and heterogeneous road layouts cause rapid changes in vehicles density and intermittent inter-vehicular communications. Moreover, the existence of obstacles, such as large vehicles and building, can hugely influence the radio signal and disrupt inter-vehicular data transmission, even when vehicles are within the communication range. For the purpose of mitigating the influence of highly dynamic topologies and guaranteeing inter-vehicular connections, one of the most challenging tasks to address unique characteristics in VANET is the design and implementation of communication routing protocols.

Most of the existing routing protocols hardly take both of aforementioned two factors into consideration. VANET is slightly different from Mobile Ad-hoc Network(MANET) by its characteristics, requirements, architecture, challenges and applications. Therefore, conventional routing protocols used in MANET cannot be used directly in the field of VANET because of unwarranted performance. Massive works have been done to solve routing issues in VANET, such as position-based routing (PBR) protocols, cluster-based routing protocols and regional-multicast routing protocols.

The layered architecture for VANET is based on the published materials for ITS standards [5] by IEEE. Initially, IEEE 1609 standards were introduced that defined the Wireless Access in Vehicular Environment (WAVE) architecture. WAVE 1609 addressed the requirements of determining architecture, standards, interfaces and protocols necessary to develop wireless communication in VANET including V2V and V2I wireless communications. Thereafter, IEEE 802.11 protocols were extended with addition of IEEE 802.11p which is compliant with DSRC and enhances vehicular communication capabilities.

II ROUTING PROTOCOLS OF VANET

Broadly speaking, existing VANET routing protocols can be systematically classified into two main categories: (i) V2V and (ii) V2I respectively. There are mainly four types of V2V routing protocols: topology-based routing protocol, position-based routing protocol, cluster-based routing association, and regional multicast routing protocol as shown in below figure. It uses connection information within the network to transfer data packets from the source to the destination.

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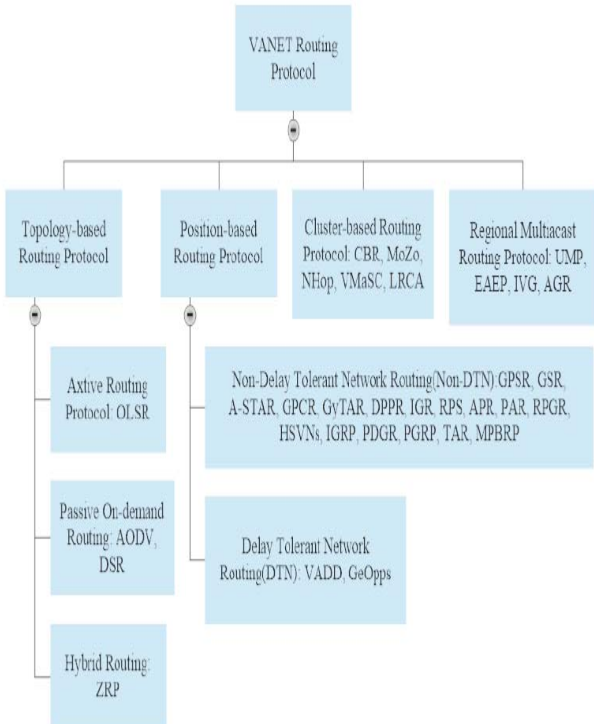

Fig 1: Types of Classification of VANET protocols [6].

Topological routing forward data through existing links in the network, which includes active routing, passive on-demand routing and hybrid routing driven by routing table. Unlike other networks, vehicles' high mobility and frequent change of communication links between vehicles make the traditional topology-based routing protocols, such as OLSR (active routing), AODV (passive on-demand routing), DSR (passive on-demand routing) and ZRP (hybrid routing), fail in VANET because they flood the packets with extensive path finding and maintain control messages, which caused increased routing load and network security problems.

III RELATED WORK

During the research, we noticed that there are many previous works in the literature, but we will look at the most important ones that have compared and analyzed the performance of routing protocols based on topology. Nonetheless, the researcher and the recipient feel the need for a lot of qualitative comparisons in addition to a lot of performance assessment studies and work that helps assess the performance of these protocols in the VANET environment under NS-2.

[1] In this paper, they proposed a new algorithm for quickly discovering neighbor node in such a dynamic environment. The proposed rapid discovery algorithm is based on a novel mobility prediction model using Kalman filter theory, where each vehicular node has a prediction model to predict its own and its neighbors' mobility. This is achieved by considering the nodes' temporal and spatial movement features. The prediction algorithm is reinforced with threshold triggered location broadcast messages, which will update the prediction model parameters, and improve the efficiency of neighbor discovery algorithm. Through extensive simulations, the accuracy, robustness, and efficiency properties of their proposed algorithm are demonstrated.

[2] In this paper they choose AODV protocol, DSDV protocol, and DSR protocol with five different nodes density. For each protocol, as regards specific parameters like (throughput, packet delivery ratio, and end- to- end delay). On simulators that allow users to build real-time navigation models of simulations using VANET. Tools (SUMO, MOVE, and NS-2) were used for this paper, then graphs were plotted for evaluation using Trace-graph. The results showed the DSR is much higher than AODV and DSDV, In terms of throughput. While DSDV is the best choice because of the low average end to end delay. From the above, we conclude that each strategy has its own negative and positive aspects that make it ideally suited to a particular scenario than other scenarios.

[3] A Vehicular Ad-hoc Network (VANET) is a subclass of wireless ad-hoc networks, widely used in on-road vehicles and roadside equipment, having applications in various areas including passenger safety, smart traffic solutions, and connectivity on vehicles The VANET is the

backbone of the Intelligent Transport System (ITS) that establishes connectivity between vehicles through a wireless medium. When it comes to the communication between high-speed vehicles there is the challenge of dynamic mobility. In order to provide a higher Packet Delivery Ratio (PDR) and increase the throughput, a new routing protocol called Dynamic Trilateral Enrolment (DyTE) is introduced which chooses a dynamic trilateral zone to find the destination vehicle by allowing only relevant nodes to participate in the communication process using the location coordinates of the source and destination nodes. The proposed routing protocol is compared with Ad-hoc On-demand Distance Vector (AODV), Ad-hoc On-demand Multipath Distance Vector (AOMDV), and Dynamic Source Routing (DSR), and the results show a remarkable improvement in reducing the Network Routing Load (NRL) and in increasing the PDR and throughput of the network.

[5] The paper discussed unique characteristics of Vehicular Ad-Hoc Networks (VANET) including high vehicular mobility and frequently changing dynamic network topology as the distinguishing parameters from other Ad-hoc Networks. These unique features along with exponentially growing number of vehicles pose a huge limitation for the layered architecture to ensure stable and reliable V2V, V2I wireless communications. The primary challenges in VANET have been identified as Routing, Handoff Management and Spectrum Utilization which are inefficiently being addressed by layered architecture. Therefore, stringent Quality of Service (QoS) requirements of safety-critical and non-safety critical application services are challenging to be fulfilled. Due to encapsulation of protocol layers, each layer optimizes its own services with no consideration to system performance as a whole.

[6] This paper proposed Adaptive Congestion Aware Routing Protocol (ACARP) for VANET using the dynamical artificial intelligence (AI) technique. In ACARP, the adaptive congestion detection algorithm is designed using the type-2 fuzzy logic AI technique. The fuzzy model builds to detect the congestion around each vehicle using three fuzzy-inputs such as bandwidth occupation, link quality, and moving speed. Using three parameters, the fuzzy rules are designed in the first phase. In the second phase, the inferences model introduced where the fuzzy decision has been made. In the last phase, defuzzifuzification is applied and the congestion probability estimated in the range of 0-1 for each vehicle.

[7] This paper imparts information about VANETs technology by addressing their architecture, the various types of cross layer design methods, their associated problems, and potential solutions in the cross layer network. The paper addresses the numerous issues associated with cross-layer design in VANETs and some of the methods suggested in various journals. Each layer must be interpreted precisely in order to create a cross layer design. It is necessary to consider how information flows between layers and how information from one layer can be useful to another. It has been demonstrated that cross-layer architecture is critical for optimizing the overall routing mechanism's performance. Consequently, enhancement in connectivity of both vehicle-to-vehicle and vehicle-to-infrastructure connectivity can be achieved with the passage of time. Additionally, considerable debate has taken place about cross layer design, but no formal structured design exists. Various methods are taken depending on the requirements.

[8] In this paper, author use the evolving graph theory to model the VANET communication graph on a highway. The extended evolving graph helps capture the evolving characteristics of the vehicular network topology and determines the reliable routes preemptively. This paper is the first to propose an evolving graph-based reliable routing scheme for VANETs to facilitate quality-of-service (QoS) support in the routing process. A new algorithm is developed to find the most reliable route in the VANET evolving graph from the source to the destination. They demonstrate, through the simulation results, that their proposed

scheme significantly outperforms the related protocols in the literature.

[10] The main features of vehicular adhoc networks pertaining to the city environment like high mobility, network segmentation, sporadic interconnections, and impediments are the key challenges for the development of an effective routing protocol. These features of the urban environment have a great impact on the performance of a routing protocol. This study presents a brief survey on the most substantial position-based routing schemes premeditated for urban inter-vehicular communication scenarios. These protocols are provided with their operational techniques for exchanging messages between vehicles. A comparative analysis is also provided, which is based on various important factors such as the mechanisms of intersection selection, forwarding strategies, vehicular traffic density, local maximum conquering methods, mobility of vehicular nodes, and secure message exchange.

IV PROBLEM IDENTIFICATION

VANETs deployment having several challenges that needs to be conquering by appropriate routing methodology. The challenges are congestion in the network, severe mobility, high computational efforts, and data loss [6]. VANETs give Web network to vehicles while moving, so travellers can download music, send messages, book eateries, or potentially mess around. Because of the vehicle's fast movement, vehicular networks are described by quick geography changes that lead to serious congestions in the network. Furthermore, thus it makes the planning of effective steering convention for the vehicular climate troublesome. Planning versatile congestion mindful directing conventions to such quickly changing network geographies is exceptionally basic to numerous vehicular security applications such as neglecting to course impact evasion messages to their expected vehicles can deliver these messages to be pointless. The directing assumes a significant function in the wellbeing uses of VANET for moving the information between end-clients.

It noticed that designing routing protocol for VANET is challenging due to:-

- Dynamic topology changes due to high mobility.
- Frequent link disconnections due to the mobility speed.
- Flexibility to select alternate routes for data transmission.
- Capability to tolerate faults such as link breakages and nodes' positions.
- Automatic mitigation of RSU failures without compromising the QoS of VANET communication.

V CONCLUSION

Vehicular Ad-hoc Networks (VANET) have gained intensive research interests from both industry and academia over the years. VANET emerged as a paradigm in Intelligent Transportation System (ITS) in the wake of growing concern for safety on the roads and has consistently evolved since then to enable safety-critical and infotainment application services.

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