ISSN: 2581-3404 (Online)
International Journal of Innovative Research in Technology and Management, Vol-4, Issue-5, 2020.

Routing Protocol in Vehicular Ad-hoc Network: Survey and Discussions

Pratima Kumari[1], Prof. Rajni Kori[2]

[1]M. Tech. Scholar, Department of CSE, LNCTE, Bhopal (India)

[2]Assistant Professor, Department of CSE, LNCTE, Bhopal (India)

ABSTRACT

The growing amount of vehicles on roadway is the key motivating the establishing of the road safety with comfort and undisturbed traffic flowing. Vehicular ad-hoc network is a trending wireless methodology that enables an unwired connection between the automobiles to have a highly secured driving with comfort. In this study we provide a survey for vehicular ad-hoc network, with including types of communication, routing protocols etc. and also provide directions for future research and development.

Keywords:- Intelligent transportation system, Vehicular ad-hoc network, Wireless communication, Wireless Access in Vehicular Environment.

INRODUCTION

The rapid growth in the transportation system increases eminence traffic on the streets. In consequence of this, plenty of road accidents and traffic congestion has been noticed in recent times. In a report by the world health organization (WHO) affirms that road traffic accidents touched 1.35 million deaths per year. Thus, the vehicular ad hoc networks (VANETs) aims to enhance road safety, information dissemination and traffic management applications. Through VANETs, we can provide vehicle-to-vehicle (V2V) communication, which can avoid a crash and hazardous condition by propagating alert messages to other vehicles in the network [2].

A Mobile Adhoc Network (MANET) scheme in which automobiles form the mobile nodes is termed as Vehicular Adhoc Network (VANET). Instead of moving in random, the highly mobile nodes of VANET have a unique feature of following pre-structured routes. Vehicles communicate with Base Station, Road-Side-Units (RSUs), as well as with each other. The VANET based automobiles perform Wireless Access in Vehicular Environment (WAVE) using ratio transceivers, Global Positioning System (GPS) based localization, sensor and processing unit equipped On-Board Units (OBUs), and make use of various such cutting-edge technologies to form an Intelligent Transportation System (ITS) [4].

Vehicular Ad-hoc network are a part of mobile Ad-hoc network where the vehicle take the place of mobile node or the data points. These vehicular wireless communication allows an instantaneous information exchange between the vehicles by the electronic circuitries that support the communication. The electronics circuitries found inside the vehicle and the sides of the roadway help the vehicular communication to take place between the vehicles and to extend the communication from vehicle to its road side electronic circuitry. The communication extended between the vehicles are known as vehicle to vehicle communication and that which is extended between the vehicle and the road side circuitry is called vehicle to infrastructure communication.

The vehicular Ad-hoc network similar to the mobile ad-hoc network is formed by the instantaneously available vehicles without any frame work. They possess the same properties of mobile ad-hoc network that they are patterned on their own, and can perform the restoration of their lost network and rearrange them and protect them on their own. The vehicle communication is entailed in great degree for the roadways that suffer from heavy traffic and increased number of fatality rates. The communication enables the operator of the car to have knowledge of the vehicle coming on the opposite side, the traffic, damages caused in the roadway taken, and the best roadway to be taken and even more [3].

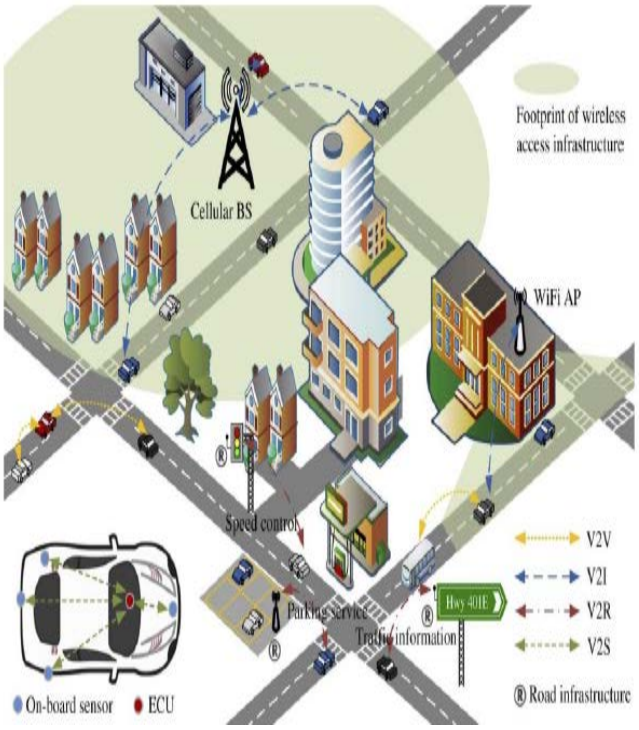

Figure 1: VANET Architecture [4].

VANETs can support a number of applications, namely infotainment, safety, etc. Currently, there is a need to support vehicular communication for applications such as safety messaging, traffic and congestion monitoring and Internet access. One of the most promising applications of VANETs are safety applications. Approaching emergency-vehicle warning, post-crash warning, accident reporting, blind merge warning, and pre-crash sensing, among others, are effective applications for improving road safety. Safety applications usually rely on broadcast-based protocols. These protocols have the task of disseminating emergence messages quickly and efficiently through the network. Hence, a key research problem here is how to design a scalable information dissemination method that can efficiently work with high reliability and short delay under different network conditions [8].

Compared with the static or low-speed moving nodes in the traditional wireless network, the VANET node moves faster and unpredictably, which leads to frequent changes of network topology. Besides, owing to the unique features of VANET itself, such as its dynamism, complexity, and uncertainty, the difficulty of routing protocol design in VANET is increased still further. On the other hand, the VANET routing protocol is more vulnerable to threats due to the lack of infrastructure and the self-organization of the network. Malicious vehicles may incorrectly forward and even drop packets, or divert packets towards the wrong relay nodes, preventing data from reaching their destination nodes. Furthermore, vehicles colluding in the network may also falsely improve their reputation, or maliciously slander trusted vehicles, thereby interfering with the assessment of node trustworthiness [5].

II V2X COMMUNICATION TECHNOLOGIES

There are two potential communication technologies that enable V2X. The first one is known as Dedicated Short Range Communication (DSRC), which is based on IEEE 802.11p and was standardized in 2012, In DSRC, vehicles transmit messages known as Common Awareness Messages (CAM) and Basic Safety Messages (BSMs) with a latency of less than 100 ms. DSRC is a slight modification of IEEE 802.11 protocol, and it can be easily used to deploy VANETs. The second is based on Long-Term Evolution (LTE)

cellular communications and known as cellular-V2X or in short C-V2X, which was released by the 3rd Generation Partnership Project (3GPP) in 2016, On the other hand LTE is highly reliable, and have higher bandwidth, and requires modifications before its deployment in the V2X system. According to the latest 3GPP technical specifications of LTE V2X, the physical link of LTE (Sidelink) is introduced, which is different from the traditional LTE uplink and downlink network traffic. Both DSRC and C-V2X support V2V and V2I communications. However, C-V2X also supports wide area communications called Vehicle-to- Network (V2N), enabled by 5th Generation (5G) services [12].

IV RELATED WORK

In this section, we will explore some of the most important works that have been proposed in the literature. The challenges of network routing protocols in VANETs have been attracting more research efforts, and a number of routing protocols have been proposed to determine the route based on the route lifetime.

[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 proposed a cosine similarity based selective broadcast routing protocol, also known as CSBR, which leverages non-linear cluster formation ability using cosine similarity index. Distinct clusters and the coordinating vehicles assist each other in finding the most suitable path to reach the destination. Additionally, a probabilistic forwarding approach is used to disseminate routing messages further in the network. The outcomes exhibit that the proposed scheme improved 5-10% packet delivery fraction (PDF), minimizes average delay approximately 25%, up to 10% low communication overhead, improved throughput upto 5-10%, and less neighbour discovery messages overhead compared to the existing broadcast routing protocols in VANETs. [3] The proposed algorithm, in this on the fly network would make it even more promising as it provides a non-breakable communication with high stability. The performance evaluation based on the grounds of delay incurred, throughput, packet delivery ratio and network life span proves the MFML algorithm in the on –the-fly network to be reliable and efficient. The vehicular network that are used for preventing of the unwanted sudden incidents and providing better comfort ability by giving information regarding the congested roads and the safe roads to be taken is a trending entailment for the cities experiencing heavy traffic. [5] They propose a novel trust-based multicast routing protocol (TMR) to defend against multiple attacks and improve the routing efficiency. In the proposed trust model, direct trust is calculated based on Bayesian theory and indirect trust is computed according to evaluation credibility and activity. The fuzzy logic theory is used to fuzzily the direct and indirect trust values, and then the total trust value of the node is obtained by defuzzification. With the help of the obtained trust values, malicious vehicle nodes are eliminated in the processes of route establishment and route maintenance, and finally, the network establishes trusted and efficient routes for data delivery. Comprehensive simulation experiments show that our new protocol can effectively improve the transmission rate of data packets at the expense of a slight increase in end-to-end delay and control overhead. [6] In the available studies, Smart-phone or portable GPS apparatuses are used as the source of the extraction vehicle's kinematic characteristics, which are not dependable for the tracking and classification of vehicles in real time.

To deal with the limitation of the available VC methods, potential global methods to identify physical and kinematic characteristics in real time states are investigated. Vehicular Ad Hoc Networks (VANETs) are networks of intelligent interconnected vehicles that can provide traffic parameters such as type, velocity, direction, and position of each vehicle in a real time manner. In this study, VANETs are introduced for VC and their capabilities, which can be used for the above purpose, are presented from the available literature. [7] The main aim of the paper is to discuss about the routing based on link stability and to increase the coverage area of the cluster to improve the mobility characteristics and the energy efficiency of the VANET. The summarized studies about both the category are discussed in order to improve the link stability, energy efficiency, network lifetime, data aggregation, Quality of service, load balancing and multipath. A systematic comprehensive survey has been conducted for link stability and energy efficient clustering based routing protocols reported from 2012 to 2018. By the help of the survey, a technical direction is provided to the researchers about the pros and cons of the earlier studies. [8] This work lays out a decentralized stochastic solution for the data dissemination problem through two game-theoretical mechanisms. Given the non-stationarity induced by a highly dynamic topology, diverse network densities, and intermittent connectivity, a solution for the formulated game requires an adaptive procedure able to exploit the environment changes. Extensive simulations reveal that our proposal excels in terms of number of transmissions, lower end-to-end delay and reduced overhead while maintaining high delivery ratio, compared to other proposals. [10] In this paper they will focus only on the multicast that is referring to a process of sending information from one node (called source vehicle) to a group of nodes that found in different locations (called destination vehicles). The purpose of this paper is to study the existing multicast routing protocols in VANET and produce good survey about them and determine the advantages and disadvantages of each one as well as classify them into different categories based on some effected parameters such as quality of service, vehicle trajectory and etc. After analyzing these routing protocols we concluded that there is persistent need to produce efficient multicast routing protocol in this network to decrease the resource consumption and improve the overall performance. [11] Their schemes are designed to enhance the communication in highway scenarios for the comfort applications. They predict the most stable route by selecting the route that has the longest lifetime. They are based on the prediction of the link lifetime and the route lifetime taking into account the variation of velocity. Our schemes increase the route duration, the percentage of packets delivery, the throughput and decrease the number of route failures during data packet transmission.

[12] This article presents a comparative survey on the related AI algorithms applied to the Vehicle-to-Everything paradigm. We have presented various AI techniques. AI-driven algorithms for V2X applications have shown improved performance over traditional algorithms. In general, all optimization problems face uncertainty in the intensions of the surrounding participants. Different branches of AI can help each other to bring out an optimum solution that would not cause or generate problems in the domain they are not intended for. The AI algorithms in most cases require higher computational resources. These resources may not require to be inside the vehicle. Thanks to V2X, MEC and VEC technology, the computation burden of AI can be offloaded to the edge computation servers in the nearby road side infrastructure. The future V2X applications will get great benefits from the emerging field of edge computing.

Ref. No.	Title	Author Name, Year of Publication	Technology Used	Used Parameters
[1]	"Kalman Prediction based Neighbor Discovery and its Effect on Routing Protocol in Vehicular Ad Hoc Networks"	Chunfeng Liu, Gang Zhang, Weisi Guo, Ran He,Jan, IEEE, 2019.	Rapid discovery algorithm is based on a novel mobility prediction model	Number of hello message and packet delivery ratio.
[2]	"CSBR: A Cosine Similarity Based Selective Broadcast Routing Protocol for Vehicular Ad-Hoc Networks"	Ankur Nahar, Himani Sikarwar, Debasis Das, IFIP, 2020.	Cosine similarity based selective broadcast routing protocol (CSBR).	Packet delivery fraction, Average delay, Low Communication overhead and throughput.
[3]	"Performance Evaluation of Flying Wireless Network with VANET Routing Protocol"	Dr. N. Bhalaji, Journal of ISMAC, 2019.	Model free machine learning algorithm	Network lifespan and Average delay.
[4]	"A Stochastic Mobile Data Traffic Model for Vehicular Ad Hoc Networks"	Dr. S. Smys, Dr. Jennifer S. Raj, 2019.	Enhanced Ad Hoc on Demand Distance Vector (EADOV) Routing Protocol.	Throughput, Packet delivery ratio and Delay.
[5]	"Towards a Novel Trust-Based Multicast Routing for VANETs"	Hui Xia, San-shun Zhang,Ben-xia Li, Li Li, Xiang-guo Cheng, Hindawi, 2018.	Multicast trust-based ad- hoc on-demand distance vector (MTAODV) routing protocol.	Transmission rate of data packets, end-to-end delay and Control overhead.

Table 1: Comparative discussion for the vehicular ad-hoc network and their techniques.

V CONCLUSION AND FUTURE SCOPE

Vehicular network or as it is called VANET is witnessing increasing attention from a large number of the vehicle manufacturers, the academic community and governments, which want to exchange information efficiently among vehicles or between vehicles and roadside unit (RSU) that distribute along the road to help the drivers to access to information anytime and anywhere quickly. In this paper vehicular ad-hoc network and their description was present, in future we implement a model for the efficiently and reliable communication among the vehicles and improve the quality of services in a network.

REFERENCES:

[1] Chunfeng Liu, Gang Zhang, Weisi Guo, Ran He, "Kalman Prediction based Neighbor Discovery and its Effect on Routing Protocol in Vehicular Ad Hoc Networks", IEEE Transactions on Intelligent Transportation Systems, January 2019, pp. 1-11.

[2] Ankur Nahar, Himani Sikarwar, Debasis Das, "CSBR: A Cosine Similarity Based Selective Broadcast Routing Protocol for Vehicular Ad-Hoc Networks", IFIP, 2020, pp. 404-413.

[3] Dr. N. Bhalaji, " Performance Evaluation of Flying Wireless Network with VANET Routing Protocol", Journal of ISMAC, 2019, pp. 56-71.

[4] Dr. S. Smys, Dr. Jennifer S. Raj, "A Stochastic Mobile Data Traffic Model for Vehicular Ad Hoc Networks", Journal of Ubiquitous Computing and Communication Technologies, 2019, pp. 55-63.

[5] Hui Xia, San-shun Zhang,Ben-xia Li, Li Li, Xiang-guo Cheng, "Towards a Novel Trust-Based Multicast Routing for VANETs", Hindawi Security and Communication Networks, 2018, pp. 1-13.

[6] Hoofar Shokravi, Hooman Shokravi, Norhisham Bakhary, Mahshid Heidarrezaei, Seyed Saeid Rahimian Koloor, Michal Petru, "A Review on Vehicle Classification and Potential Use of Smart Vehicle-Assisted Techniques", Sensors 2020, pp. 1-30.

[7] Sami Abduljabbar Rashid, Lukman Audah, Mustafa Maad Hamdi, Sameer Alani, "Prediction Based Efficient Multi-hop Clustering Approach with Adaptive Relay Node Selection for VANET", Journal of Communications, 2020, pp. 332-343.

[8] Cristhian Iza-Paredes, Ahmad Mohamad Mezher, Monica Aguilar Igartua and Jordi Forne , "Game-Theoretical Design of an Adaptive Distributed Dissemination Protocol for VANETs ", 2018, pp. 1-31.

[9] Zeeshan Shafiq, Mohammad Haseeb Zafar, Abdul Baseer Qazi, "QoS in Vehicular Ad Hoc Networks – A Survey", JICTRA 2018, pp. 48-59.

[10] Ahmed Jawad Kadhim, Seyed Amin Hosseini Seno, "Recent Multicast Routing Protocols in VANET: Classification and Comparison", Journal of University of Babylon, Engineering Sciences, 2018, pp. 371-382.

[11] Mohamed Nabil, Abdelmajid Hajami, Abdelkrim Haqiq, "Predicting the longest route lifetime as the most stable route between two vehicles in VANET", International Journal of Computer Information Systems and Industrial Management Applications, 2018, pp. 125-133.

[12] Wang Tong, Azhar Hussain, Wang Xi Bo, Sabita Maharjan, "Artificial Intelligence for Vehicle-to-Everything: A Survey", IEEE Access, 2019, pp. 10823-10843.