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Vehicular Ad-Hoc Network Performance with Different Routing Protocol Approaches: A Review

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***Abstract*—** The basic concept in Vehicular Ad hoc Network is to integrate and fuse the mobile vehicles on road into an ad hoc network to enable communication among the vehicles on the move. The ad hoc network is infrastructure less and do not have any centralized administration. As a result, every individual node in VANETs act as a router in transmitting the packets from source towards the respective destinations. But, the delivery of packets is not always assured. Sometimes there is a possibility of high loss of packets due to adversarial conditions. Because of the high mobile nature of the nodes in VANETs, there could be frequent link failures resulting in high packet drops. In this paper the survey of different kinds of clustering algorithm have done and find best algorithm for VANET and studied different kinds of parameters.

***Keywords*—** Vehicular Ad hoc Networks (VANET), Ad-Hoc, Vehicles, Routing

I. INTRODUCTION

The ever increasing utilization of wireless networks through mobile devices has resulted in the evolution of Mobile Ad hoc Networks (MANETs) and Vehicular Ad hoc Networks (VANETs). In VANETs the mobile vehicles on road are inter-connected and are also integrated to a roadside base-unit, forming an ad hoc network. The high priority information regarding the condition of the roads, or occurrence of an accident or normal traffic messages can be transmitted to the mobile nodes through either the mobile nodes themselves or the roadside base station. Thus the vehicles are notified about the situations in a particular region and accordingly alert the other vehicles. There are 2 possible modes of communication, namely vehicle-to-vehicle or roadside base unit-to-vehicle [1]. The mobile nodes can send alert messages to the other mobile nodes along with the base station and vice versa. There could be diverse avenues of uses of the VANETs both for the safety and non-safety applications. A number of services which can be provided by VANETs include traffic management, navigation, several location-based services and some Internet based applications. In modern times, Internet has become a default standard for maximum users of vehicles. An Internet connection has become mandatory almost in several parts of the globe for easy navigation and easy maintenance of the vehicles. Wireless LAN (WLAN) is an ideally suited technology for such an environment [2,3]. But, due to the short communication paths, several access points vital to be established for trouble-free functioning of the wireless network, requiring huge infrastructural support. This becomes economically non-viable and operationally impracticable. In order to permit greater ease and mobility and diminish the possibilities of collision with several users using the same points of access, in the mode of multi-hop access is envision. This joint network integrating the infrastructure on one side and ad hoc networks on the other, are well-known as 'hybrid networks', where mobile nodes are provided gain to the infrastructure of the wired networks also. The access point which manages almost everything is the primary component in the organization of WLAN [3]. Direct inter-communication between the individual node and the access point is always required as a 'single hop'. This ad hoc manner is further intended to be integrated with a cluster of mobile nodes deprived of infrastructure, which by default make usage of the technique of 'multi-hop'. Ideal network ambience requires a continuous connection between these nodes with wireless networks using multi-hop techniques, thus gives access to established wired networks. Since the difference between these two categories of nodes in MAC layer is marginal, their integration becomes possible [5].

The plan of steering concords in WSNs is wedged by many testing aspects. Numerous routing challenges and design issues that affect routing process in WSNs are:

Network Dynamics: In maximum of the applications, it is supposed that the sensor nodes in a network are stationary.

However, some applications demand mobility of either BS's or sensor nodes. Transfer of the messages from source to destination is more challenging when the nodes are moving since maintenance of route stability and network topology becomes a major issue, along with energy, bandwidth etc. so, the sensed occurrences influenced by the application whether it is dynamic or static. for e.g., detection of moving target or observing for early fire prevention in forest, for detecting intrusion in security system, an acoustic video sensors are used. Monitoring of static events generates traffic only when reporting and dynamic events require periodic reporting [6].

Node Heterogeneity: In several studies, it is assumed that all sensor nodes are having equal capability. These are computation, communication, and power. However, according to the application, sensor nodes play different role or have different capability [8].

Energy consumption: Sensor nodes consume up their limited amount of energy and performs the computations. Later, it transmitting information in a wireless environment. Sensor node lifespan is strongly reliant on the battery capacity. Each node performs a double role one is data sender and second is data router in multi hop network. The depletion of energy of a specific node may lead to malfunctioning and it is also responsible for substantial topological changes and sometimes, it is necessary to reroute packets and reorganized the network [9].

Quality of Service: In some applications, quality of the data delivered might be more important. In such cases, the delivery of data within the specified time is very essential or otherwise the data will be deemed useless. In time constrained applications, confined latency for data delivery is another condition. In general, many applications of WSN demand preservation of energy rather than the data quality sent, for extending the network lifetime. As the energy gets indulgence in sensor nodes, the data quality is compromised to obtain the reduction in energy indulgence in the nodes [9].

Deployment of Nodes: In WSNs, node deployment can be done according to the applications. So, the performance measures of the routing protocol is affected. The deployment can be predetermined otherwise random in nature. In pre-determined deployment, the locations of the sensors are pre-determined and data travels through preset paths. However, in random deployment, the locations of the sensor are not known. Nodes are dispersed in an ad-hoc manner. If the result of distribution of nodes is not even, it is essential to use optimal clustering to permit connectivity and permit energy efficient network operation with routing through multi-hop communication [10].

Fault Tolerance: Sometimes sensor nodes may fail due to energy depletion, physical harm or due to interference in environment. The failure of such sensor nodes may lead to overall malfunction of the sensor network. At the time of node or link failures, routing protocols must configure to re-establish new links and routes to send the information to base stations without any disruption. This may need active adjustment of transmission power and data rates on the existing links to lessen energy consumption, or reroute packets through regions of the network where more energy is available. So, the system is compelled to find new routes frequently [13].

Scalability: The network contains many sensor nodes in terms of hundreds or thousands or more. Thus, the system should be capable to handle any number of sensor nodes. Also, the sensor network routing protocols must be scalable enough to react when any dynamic changes occurs in the environment.

II. RELATED WORK

Parmar et al. (2013, [1]), Vehicular Ad-hoc Network (VANET) is another system innovation where the autos are utilized as portable hubs to frame a correspondence organize. In VANET, directing conventions have a critical job since they decide the method for sending and getting parcels between versatile hubs. They inspect and investigate the execution of Ad-hoc On-Demand (AODV), Dynamic Source Steering (DSR) and Destination-Sequenced Distance Vector (DSDV) steering conventions over Constant Bit Rate (CBR) traffic information type utilizing various speeds and number of hubs. The execution estimations; Packet Delivery Ratio, Average Start to finish Delay and Average Throughput are inspected with respect to speed and number of hubs. The target of examination is to discover the best directing convention which can be additionally utilized for upgrading security. Outcomes shows that, AODV plays out the best role among of the three assessed conventions.

Emad Alizadeh et al. (2018, [2]), The fundamental difficulties looked by between vehicle systems which as of late has expanded significantly is the self-design. So for improving the self-setup, it is required to have structure with a productive directing convention. The Ad hoc On-Demand Distance Vector (AODV) steering convention is a standout amongst the most generally utilized directing concords in Vehicular Ad hoc network (VANET). Since the most limited way between the source and goal isn't known as the best course constantly. In this, they utilized VIKOR that is a Multi-Criteria Decision-Making (MCDM) technique to pick the best course from the accessible courses.

H. Bello-Salau et al. (2019, [3]), productive directing calculations are fundamental to ensure solid correspondence in Vehicular Ad-hoc Systems (VANETs). They present a twofold methodology involving the structure of another

course metric for VANET correspondence, which considers significant parameters, for example, signal quality; transmit power, recurrence and the way misfortune. They describes an enhanced hereditary calculation based course improvement procedure (IGAROT) that ensures better steering in VANETs. They utilized IGAROT to decide ideal courses required to impart street irregularities adequately between vehicles in VANETs. The presentation of proposed calculation was contrasted and the outstanding traditional Hereditary Algorithm (GA) course improvement system under same re-enactment conditions. Further advantages of our framework may incorporate the brief notice of street support offices concerning enduring street conditions by means of vehicle to foundation correspondence.

Ms. Divya Rathi et al. (2017, [4]), in astute transportation frameworks, the cooperation among vehicles and the street side units is basic to carry these frameworks to acknowledgment. The developing Vehicular Ad Hoc Network (VANET) is ending up increasingly more significant as it gives insightful transportation application, comfort, security, stimulation. So to give stable courses and to get great execution in VANET, there is a necessity of appropriate steering conventions must be structured. In this work, they are working with the very outstanding impromptu on-request remove vector (AODV) directing concord. The current Routing convention AODV-L which depends on the Link lapse time is reached out to propose a progressively dependable AODV-AD which rest on multichannel Macintosh convention.

Alexandros Ladas et al. (2016, [5]), In this, Multipath-ChaMeLeon (MCML) is used which is an extension of the ChaMeLeon (CML) steering convention. CML is a cross breed and versatile convention intended for Versatile Ad-Hoc Networks (MANETs), supporting crisis interchanges. M-CML obtains the qualities of the proactive Upgraded Link State Protocol (OLSR) and extends it to execute a multipath steering approach reliant on the Expected Transmission Count (ETX). The gained outcomes demonstrate that M-CML steering approach joined with a shrewd connection metric, for example, the ETX decreases the impacts of connection hazards what's more, improves the system execution as far as flexibility what's more, adaptability.

Wendi Rabiner Heinzelman et al. (2000, [6]), remote circulated micro sensor frameworks will empower the solid observing of an assortment of situations for both common and military applications. They take a look at correspondence conventions, which can have noteworthy effect on the general vitality scattering of these systems. Reproductions demonstrate that LEACH can accomplish as distant as a factor of 8 decrease in vitality dispersal contrasted and traditional directing conventions. Likewise, LEACH can convey vitality dispersal equitably all through the sensors, multiplying the helpful framework lifetime for the systems we reproduced.

Nejla Ghaboosi et al. (2007, [7]), the approach of different constant mixed media applications in rapid systems makes a requirement for quality of administration (QoS) based multicast directing. Two significant QoS measures are the transmission capacity imperative also, the start to finish defer limitation. Different calculations have done to explain the transmission capacity delay constrained least-cost multicast directing issue dependent on Tabu Search (TS), tending to issues of the chose starting arrangement and move type as two noteworthy structure hinders in momentary memory form of Tabu Search and longer-term memory with related increase and expansion systems as cutting edge Tabu Search strategies.

Abdelmorhit El Rhazi et al. (2009, [8]), the fundamental test in remote sensor arrange sending relates to enhancing vitality utilization when gathering information from sensor hubs. This paper explain another unified bunching strategy for an information gathering system in remote sensor systems, which depends on system vitality maps and Quality-of-Service (QoS) necessity. The bunching issue is demonstrated as a hyper graph parcelling and its goals depends on a tabu inquiry heuristic. The methodology characterizes moves utilizing biggest size inner circles in an achievability group diagram. Contrasted with different techniques (CPLEX-based strategy, disseminated strategy, re-enacted toughening based technique), the outcomes demonstrate that our tabu inquiry based methodology returns superb arrangements as far as group cost and execution time. Subsequently, this methodology is appropriate for taking care of system extensibility in an agreeable way.

Hamed Orojloo et al. (2015, [9]), in this paper, a Tabu hunt based directing calculation is proposed to effectively decide an ideal way from a source to a goal in remote sensor systems (WSNs). In this the Tabu quest strategy is misused for steering in WSNs from another perspective. In this calculation (TSRA), another move and neighborhood search strategy is intended to incorporate vitality utilization and bounce checks into directing decision. The proposed calculation is contrasted and a fragment of the insect settlement advancement based directing calculations, for example, conventional subterranean insect province calculation for vitality and way mindful insect settlement calculation for steering of remote sensor systems, in term of directing cost, vitality utilization and organize lifetime.

Dhanush yadav M et al. (2017, [10]), in this era the quantity of vehicles is growing and because of this there is plot of blockage on streets. Just as many parcels moving through a VANET systems are expanding. Shortest Path Tree helps in route discovery and Minimum Spanning Tree

provide the series of steps which can improve the bundle conveyance proportion. Anyway the calculations experience the bad effects of unpredictability, postponement and bounces. The role of in-charge on 2 unique areas/streets is played by Hand-off hub. The discovery of transfer hubs will utilize Expected Transmission which is a dreary procedure. Subsequently a calculation is required which can carry the parcels quicker towards the goal before the vehicles changes to an alternate area.

Shrikant Mane et al. (2017, [11]), this paper emphasizes on importance of the routing protocol compatibility with 3D road scenarios like viaducts, flyovers & road ramps. Performance variation of greedy forwarding techniques designed with 2D co-ordinates and 3D co-ordinates are analyse which describes the effect of compatibility issue. They mention these strategies as 2D greedy forwarding and 3D greedy forwarding. On the completion, they conduct the comparison between performance of 2D greedy algorithm and 3D greedy algorithm on NS2 platform. The results are shown in graphical manner. 3D greedy forwarding is more suitable with 3D road structures than traditional greedy forwarding working with 2D co-ordinates.

Taqwa O. Fahad et al. (2018, [12]), vehicular specially selected system (VANET) steering conventions have been drawing in a significant consideration of both research and modern networks, because of their critical job in keen transportation framework applications. The present paper receives an improved coordinated multicast, multi-criteria, versatile course lifetime as a directing concord for VANETs. Whereby just an ideal subset of neighbor vehicles is picked to transfer course ask for (RREQ) messages dependent on separation, heading, speed, and future bearing data in a consolidated sender-recipient way. Among those chose ideal ways for course disclosure, the best course with most minimal cost will be picked for sending information bundles for a predetermined term allocated relying upon the got expense and number of middle vehicles of that course.

Kalupahana Liyanage Kushan Sudheera et al. (2019, [13]) had dynamic idea of vehicular systems forces a ton of difficulties in multi-hop information transmission as connections are helpless in their reality due to related portability of vehicles. With the as of late developed programming characterized vehicular system (SDVN) worldview, connect steadiness can be better examined relating to the accessibility of worldwide system data. Therefore, they present a streamlining based novel bundle directing plan using a source steering based stream instantiation (FI) task for SDVN. The directing system intently breaks down the solidness of connections in choosing the courses and the issue is detailed as a base expense capacitated stream issue.

III. COMPARATIVE STUDY

Table 1 represents the summary of few of the work accomplished in the field of ad hoc network.

Table 1: Comparison of routing protocol

Title	Authors/ Publication	Tool Used	Algorithm Used	Parameters	Scope
Implementing and analyzing routing protocols for self-organized vehicular ad hoc network	Parmar, Prof. S. K. Hadia and Prof. A. M. Shah, 2013	NS-2	IGAROT clusters chromosome	4.24%, 75.7% and 420% increment for low, medium and high car density scenario	Vehicular Ad hoc Network
Improving Routing in Vehicular Ad-hoc Network with VIKOR Algorithm	Emad Alizadeh, Khalilollah Raeisi Lejjy and Esmaeil Amiri, 2018	MATLAB	VIKOR algorithm	Delay = 0.135, Throughput = 640 kbps for 30 Vehicles	Intelligent transportation systems
An optimized routing algorithm for vehicle ad-hoc networks	H. Bello-Salau, A.M. Aibinu, Z. Wang, J.J. Dukiya, 2019	NS-2	Compare AODV, DSR, DSDV using Constant Bit Rate(CBR) connections	For AODV PDR=1, for DSDV, DSR PDR=0.8017	Vehicular Ad-hoc Network
Performance Evaluation of AODV Routing Protocol in VANET with NS2	Ms. Divya Rathi and Mrs. R. R. Welekar, 2017	NS-3	Source routing based flow instantiation (FI) operation for SDVN	Packet Overhead = 590, Latency = 700 for Number of hop 6	Road safety, Traffic information
Multipath Routing Approach to Enhance Resiliency and	Alexandros Ladas, Nikolaos Pavlatos,	SUMO and OMNeT++	Fuzzy Inference Controller	PDR = 97.6%, Throughput 1600	Transportation system

Scalability in Ad-hoc Networks	Nuwan Weerasinghe and Christos Politis, IEEE 2016			packet/sec	
Energy-Efficient Communication Protocol for Wireless Microsensor Networks	Wendi Rabiner Heinzelman, Anantha Chandrakasan, and Hari Balakrishnan, 2000	MATLAB	Low-Energy Adaptive Clustering Hierarchy	Factor of 8 reduction in energy dissipation	Wireless distributed micro-sensor systems
Tabu search based algorithms for bandwidth-delay-constrained least-cost multicast routing	Nejla Ghaboosi, Abolfazl T. Haghighat, 2007	MATLAB	TS-based algorithms	To reduce the total cost of the system	Real-time multimedia application
A Tabu Search Algorithm for Cluster Building in Wireless Sensor Networks	Abdelmorhit El Rhazi and Samuel Pierre, 2009	NS-2	Tabu Search Algorithm for Cluster Building	Execution Time = 2.2 sec, Solution cost = 800	Wireless Sensor Network
A Tabu search based routing algorithm for wireless sensor networks	Hamed Orojloo, Abolfazl T. Haghighat, 2015	NS-3	Source routing based flow instantiation (FI) operation for SDVN	Packet Overhead = 590, Latency = 700 for Number of hop 6	Road safety, Traffic information
Delay and hop sensitive routing protocol for Vehicular Ad Hoc Networks	Dhanush yadav M and Flory Francis, 2017	NS-2	GAROT clusters chromosome	4.24%, 75.7% and 420% increment for low, medium and high car density scenarios	Vehicular Ad-hoc Network
Investigation of Greedy Forwarding Strategies for Three Dimensional Vehicular ADHOC Networks	Shrikant Mane and R. Ramanathan, 2017	MATLAB	Greedy algorithm	End to end delay is low in 3D Greedy forwarding strategy	Intelligent transportation systems
Multi-objective Optimized Routing Protocol for VANETs	Taqwa O. Fahad and Abduladhem A. Ali, 2018	SUMO and OMNeT++	Fuzzy Inference Controller	PDR = 97.6%, Throughput = 1600 packet/sec	Transportation system
Link Stability Based Optimized Routing Framework for Software Defined Vehicular Networks	Kalupahana Liyanage Kushan Sudheera, and Peter Han Joo Chong, IEEE 2019	NS-3	Source routing based flow instantiation (FI) operation for SDVN	Packet Overhead = 590, Latency = 700 for Number of hop 6	Road safety, Traffic information

IV. CONCLUSION AND FUTURE SCOPE

It is concluding that fuzzy inference system (FIS) based dynamic cluster algorithm is best compared to other algorithm. In general, the active participating nodes in the VANET environment spontaneously broadcast the respective messages to all the available nodes in the proximity and within the range of its network connectivity. The messages are sensitive with respect to time and delay. So, in this paper, survey of several approaches have been done. Further work of this paper, the simulation of FIS based dynamic cluster algorithm have to perform using MATLAB and calculate different kinds of parameter i.e. packet delivery ratio, dead node, energy consumption and cost of system.

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