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VARIOUS ENERGY EFFICIENT ROUTING PROTOCOL FOR VANET: A REVIEW

Namrata Suri
Department of CSE
RIET, Phagwara,
Punjab, India

Er. Harshdeep Trehan
Department of CSE
RIET, Phagwara,
Punjab, India
(Assistant Professor)

Er. Varinderjit Kaur
Department of CSE
RIET, Phagwara,
Punjab, India
(Head of Department)

Dr. Naveen Dhillon
Department of CSE
RIET, Phagwara,
Punjab, India
(Principal)

***Abstract*— Vehicular Ad-hoc Networks (VANETs) address a rapidly growing, particularly troublesome class of Mobile Ad Hoc Networks (MANETs). The communication between vehicle to vehicle, vehicle to roadside unit done through remote communication. System fractures and regular topology changes (Mobility of the hubs) and restricted scope of Wi-Fi, are issues in VANET, that emerge because of nonattendance of focal administrator substance. In light of these reasons, steering the messages inside the system is troublesome assignment. Thus, provisioning a skilled steering methodology is imperative for the organization of VANETs. Various quality parameters are considered till now like, Energy efficiency, Delay, Packet delivery ratio, Network Latency, throughput for number of routing protocols. In this paper, a survey of various routing protocols has been done and analysed the advantages and disadvantages of each.**

Keywords— **Particle swarm optimization (PSO), road side units (RSUs), vehicular ad-hoc network (VANET),Vehicle-to-Vehicle (V2V), vehicle-to-infrastructure (V2I), mobile ad-hoc network (MANET), Dedicated Short Range Communications (DSRC).**

I. INTRODUCTION

The nonstop improvements in Information and communication innovation have come about into the new advancements in car industry. In the last few decades, mobile communications have potentially influenced the human lifestyle providing an ability to exchange information, anywhere at any instant. The current major challenge recognized in automotive industry and by governments is the issue of traffic safety. Thus in such manner, Inter-vehicle communication (IVC) has ascended as an intriguing subject of innovative work including the blend of the advancements in remote and mobile ad-hoc networks, worldwide situating frameworks and sensor advances. The concept of incorporating wireless communications in vehicles was introduced in 80s but the recent attention given by the governments and national traffic administrations to establish the wireless spectrum for vehicular communications and to adopt the standards such as Dedicated Short Range Communications (DSRC) has provided a real drive in the arena of IVC.

VANETs are an extension of the mobile ad hoc networks (MANETs) constituting smart vehicles equipped with on-board units (OBUs) serving as mobile nodes, road-side units (RSUs) located in the critical points of the road serving as the information infrastructure and a Trust Authority (TA). OBUs and RSUs consist of in built sensory, data processing, and wireless communication modules which support the communication between the vehicles street side framework units done over single or numerous hops to share critical data about the driving status details of vehicles and the driving environment changes.

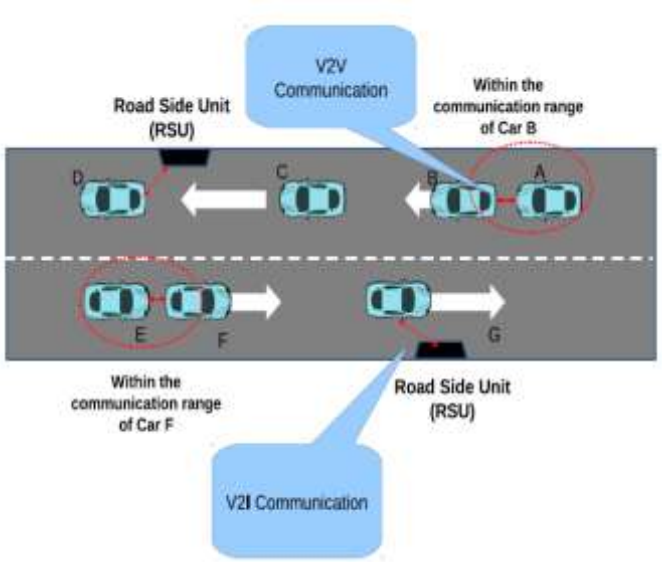

Fig 1: Vehicular Ad-hoc Network

VANET can be characterized into two types: vehicle-to-infrastructure (V2I) or vehicle to RSU (V2R) and vehicle-to-vehicle (V2V) or inter vehicle communication (IVC). Vehicle-to-Vehicle (V2V) communication incorporates the direct vehicular communication without depending on a settled base backing and is for the most part utilized for wellbeing, security, and dispersal applications. Vehicle-to-Infrastructure

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(V2I) system communication permits a vehicle to speak with the roadside framework for the most part for data and information gathering applications.

The procedure of how to locate the most powerful route to the craved destination shifts relying upon the mechanism used in that protocol. To develop an Efficient routing protocol in VANET, staying up with the latest data about other surrounding hubs is thought to be a basic procedure.

As said some time recently, VANET is a center exploration theme for some scientists and engineers, particularly when trying to outline a proficient routing protocol to convey messages to the destination with more energy efficiency, less time delay, higher throughput and packet delivery ratio and with a decent level of unwavering quality in connected environments.

The rest of the paper is organized as follows: Section II briefly summarizes the relevant work and provides an insight into the work done by specialists in this particular area. Section III the objectives and drawbacks of past related work. Section IV Concludes the paper.

II. RELATED WORK

With the rising advancement in information technology and communication, the idea of a vehicle communication system has gotten tremendous consideration everywhere throughout the world. It is a present rising trend to make the vehicles and streets very much prepared and productive to build up a more secure, more effective, urban mindful transportation foundation. An essential configuration part of VANET is to build up an effective, fast routing protocol. Endless research has been led here.

Debasis Das, Rajiv Misra (2014) examined an inter-vehicle communication (IVC) systems which has the potential to increase the safety, efficiency and comfort of everyday road travel in VANETs. They proposed a efficient Vehicle-to-Vehicle (V2V) communication protocol for avoid the collisions in VANETs. This protocol reduces the number of road accidents by providing early warnings messages and it also reduces the latency in delivering emergency warnings messages in various road situations in VANETs. They have given simulations results for the proposed protocol reducing latency in delivering emergency warnings messages and efficient bandwidth usage in stressful road scenarios in VANETs because they use the vehicle-to-vehicle communication concept.

Kamini, Rakesh Kumar (2010) examined a Vehicular Ad-hoc Network (VANET) which represents a challenging class of mobile ad-hoc networks that enables vehicles to intelligently communicate with each other and with roadside infrastructure. VANET poses number of challenges in terms of Quality of Service (QoS) and its performance. Quality of Service depends on numerous parameters such as bandwidth, packet delivery ratio, data latency, delay variance etc. They have discussed various issues associated with data latency, efficient bandwidth utilization and packet delivery ratio in VANETs. Moreover, challenges in providing security, reliability and confidentiality of the disseminated data are elaborated. Finally, various applications of VANETs in current computing scenario are also presented.

R. Bhakthavathsalam, Starakjeet Nayak, Murthy G Srikumar (2009) examined that the Vehicular ad hoc network (VANET) applications are principally categorized into safety and commercial applications. Efficient traffic management for routing an emergency vehicle is of paramount importance in safety applications of VANETs. In the first case, a typical example of a high dense urban scenario is considered to demonstrate the role of penetration ratio for achieving reduced travel time between source and destination points. The major requirement for testing these VANET applications is a realistic simulation approach which would justify the results prior to actual deployment. A Traffic Simulator coupled with a Network Simulator using a feedback loop feature is apt for realistic simulation of VANETs. Thus, they develop the safety application using traffic control interface (TraCI), which couples SUMO (traffic simulator) and NS2 (network simulator). Likewise, the mean throughput is one of the necessary performance measures for commercial applications of VANETs. In the next case, commercial applications have been considered wherein the data is transferred amongst vehicles (V2V) and between roadside infrastructure and vehicles (I2V), for which the throughput is assessed.

Sebastian Ebers, Stefan Fischer (2014) examined the applications for Vehicular Ad-Hoc Networks (VANETs) simulations as a widely used alternative to potentially costly and complex field tests. For authentic results, simulations of realistic vehicular movement and communication environment are mandatory. Usually, a traffic simulator and a network simulator are used for the first and second requirement, respectively. Some VANET simulators combine independent simulators of both domains while others implement the necessary functionality themselves. However, due to different scopes of functionality, available protocols, etc., the choice of a VANET simulator has an impact on the result. Unfortunately, VANET applications are typically implemented based on a certain VANET simulator's API. Thus, applications have to be adapted when switching between simulators. To solve this problem, They developed a framework which allows for executing VANET applications in different environments without modification. They further defined a VANET API which aims at enabling portability for VANET applications. Hence, applications can be implemented independently of the used VANET simulator and can be even run on real hardware unmodified.

Phongsathorn Boonnithiphat, Yuthapong Somchit (2015) examined that the VANET has been developed for vehicle-to-vehicle communication (V2V). There is MI-VANET protocol that is developed for packet forwarding using only buses. It has high successful packet delivery rates. However, its performance degrades when the number of buses is low. Therefore, they proposes a new hybrid protocol called

Hybrid VANET protocol. The protocol finds routes to forward packets considering both buses and cars. Packets are mainly transmitted by buses. If buses are not available, cars are used to assist packet forwarding. The protocol combines with two methods which are routing method and forwarding method. In the performance evaluation, the experimental results show that our proposed protocol has higher successful packet delivery ratio and has less packet delays than MI-VANET.

Jan Janech, Anton Lieskovsky, Emil Krsak (2012) examined that the High vehicle mobility and frequent topology changes of VANET have negative influence on performance of data distribution in such network. If cars are not connected through VANET, they are not able to access data owned by each other. Data availability in VANET is therefore lower than in standard wired networks. Most of the solutions of data distribution in VANET are focused on the packet routing. On the other hand, their solution is using database replication as the method for the distribution of a data in VANET network. They are looking at VANET as distributed database system. Replication of data in such a distributed database system can be used to reduce the impact of intermittent node connectivity in VANET and to improve access of a node to data. To solve this problem they have designed a special query language suitable for distributed database systems in VANET. They have also designed replication algorithms for data distribution at each node in VANET. .

Ian Ku, You Lu, Mario Gerla, Rafael L. Gomes (2014) examined that the Vehicular Ad Hoc Networks have in recent years been viewed as one of the enabling technologies to provide a wide variety of services, such as vehicle road safety, enhanced traffic and travel efficiency, and convenience and comfort for passengers and drivers. However, current VANET architectures lack in flexibility and make the deployment of services/protocols in large-scale a hard task. They demonstrate how Software-Defined Networking (SDN), an emerging network paradigm, can be used to provide the flexibility and programmability to networks and introduces new services and features to today's VANETs. They take the concept of SDN, which has mainly been designed for wired infrastructures, especially in the data center space, and propose SDN-based VANET architecture and its operational mode to adapt SDN to VANET environments. They also discuss benefits of a Software-Defined VANET and the services that can be provided. They demonstrate in simulation the feasibility of a Software-Defined VANET by comparing SDN-based routing with traditional MANET/VANET routing protocols. They also show in simulation fallback mechanisms that must be provided to apply the SDN concept into mobile wireless scenarios, and demonstrate one of the possible services that can be provided by a Software-Defined VANET.

Hongyu Tu1, Lei Peng, Huiyun Li, Falin Liu (2014) examined the vehicular ad-hoc network (VANET) is an essential technology that enables the deployment of the intelligent transportation system (ITS), which improves the traffic safety and efficiency. For the efficient message delivery in VANET, it is desirable to provide a reliable and stable VANET routing protocol. However, VANET routing is challenging since the VANET is fundamentally different from conventional wireless ad hoc networks; vehicles move fast, and the network topology changes rapidly, causing intermittent and dynamic link connectivity. They introduced the traditional GPSR routing for VANET and the disadvantages are listed. Meanwhile, based on the locations information, an improved routing protocol is proposed to form a new protocol called GPSR-MV that has taken the nodes' fast moving and forwarding efficiency into account. Furthermore, combining with the simplified perimeter forwarding, the final new protocol called GSPR-MV is proposed. They compare our proposed mechanism with the well-known GPSR via NS-2 based simulations and show that their mechanism outperforms GPSR in terms of both delivery success rate and transmission delay.

Mohamed Hadded, Rachid Zagrouba , Anis Laouiti, Paul Muhlethaler (2015) examined Vehicular Ad Hoc networks as a major component recently used in the development of ITS. VANETs have a highly dynamic and portioned network topology due to the constant and rapid movement of vehicles. Currently, clustering algorithms are widely used as the control schemes to make VANET topology less dynamic for Medium Access Control (MAC), routing and security protocols. An efficient clustering algorithm must take into account all the necessary information related to node mobility. They proposed an Adaptive Weighted Clustering Protocol, specially designed for vehicular networks, which takes the highway ID, direction of vehicles, position, speed and the number of neighboring vehicles into account in order to enhance the stability of the network topology. However, the multiple control parameters of our AWCP, make parameter tuning a nontrivial problem. In order to optimize the protocol, they define a multi-objective problem whose inputs are the AWCP's parameters and whose objectives are: providing stable cluster structures, maximizing data delivery rate, and reducing the clustering overhead. They address this multi-objective problem with the Non-dominated Sorted Genetic Algorithm version 2 (NSGA-II). They evaluate and compare its performance with other multi-objective optimization techniques: Multi-objective Particle Swarm Optimization (MOPSO) and Multi-objective Differential Evolution (MODE). The experiments reveal that NSGA-II improves the results of MOPSO and MODE in terms of spacing, spread, ratio of non-dominated solutions, and inverse generational distance, which are the performance metrics used for comparison.

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III. COMPARISION TABLE

S.No.	Name	Author	Objectives	Drawbacks
1	Efficient vehicle to vehicle communication protocol for VANETs.	Debasis Das, Rajiv Misra	1. Identifying requirements for Vehicle to Vehicle(V2V) collision avoidance mechanism in VANETs. 2. Achieving congestion control at the emergency situations in VANET.	1. More complex algorithm. 2. More number of messages generated which will further leads to more error.
2	VANET Parameters and Applications: A Review.	Kamini, Rakesh Kumar	1. Explained few QoS parameters such as data latency, efficient bandwidth utilization and packet delivery ratio of VANETs, which affects the performance of network communication. 2. Discussed various issues associated with data latency, efficient bandwidth utilization and packet delivery ratio in VANETs.	1. There are still quite a few parameters that have not been carefully investigated yet like network fragmentation, delay constrained routing, efficient resource utilization, and delay tolerant network.
3	Expediency of penetration ratio and evaluation of mean throughput for safety and commercial applications in VANETs.	R. Bhakthavathsalam, Starakjeet Nayak, Murthy G Srikumar	1. To develop a safety application and simulate it by exploiting the real time coupling between traffic and network simulator to achieve realistic results. 2. The evaluation of Mean throughput with respect to the number of vehicles is carried out, as throughput is crucial for such applications.	1. As the number of vehicles increase, the mean throughput reduces due to increased number of collisions.
4	Poster: Adapter Framework for VANET Simulators.	Sebastian Ebers, Stefan Fischer	1. Developed a framework which allows for executing VANET applications in different environments without modification. 2. Defined a VANET API which aims at enabling portability for VANET applications.	1. The communication between the modules of framework introduces an overhead.
5	Development of Hybrid VANET Routing Protocol Between Buses and Cars.	Phongsathorn Boonnithiphat, Yuthapong Somchit	1. Increase an efficiency of the packet transmission in VANET. 2. Calculates the routes to forward packets by considering densities of	1. Performance of the proposed protocol with more complicated maps should be decreased.

			each type of vehicles.	
6	Comparation of strategies for data replication in VANET environment.	Jan Janech, Anton Lieskovsky, Emil Krsak	1. Designed a special query language suitable for distributed database systems in VANET. 2. Designed replication algorithms for data distribution at each node in VANET.	1. It achieved very poor results in the terms of network load.
7	Towards Software-Defined VANET: Architecture and Services.	Ian Ku, You Lu, Mario Gerla, Rafael L. Gomes	1. Provide the flexibility and programmability to networks and introduces new services and features to today's VANETs. 2. Demonstrate one of the possible services that can be provided by a Software-Defined VANET.	1. Architecture still requires. infrastructure support 2. Problem in safety and surveillance services.
8	GSPR-MV: a Routing Protocol Based on Motion Vector for VANET.	Hongyu Tu1, Lei Peng, Huiyun Li, Falin Liu	1. Increased nodes speed so as they move fast and forwarding efficiency into account. 2. To ensure the reliability of the neighboring nodes' routing table.	1. Requires improvement in incorporate more realistic factors into routing protocol of VANET, such as road restraints, traffic rules, prediction based on traffic density and so on.

IV. CONCLUSION

Vehicular ad hoc networks are a key technology for the future development of vehicular communications systems. However, the routing of packets through the VANET is very complex due to the high mobility of the vehicles and the fast changing network topologies. In this paper, there is a study and analysis of various existing packet transmission schemes in VANETs is done. In future, OLSR PROTOCOL with ENHANCED GENETIC ALGORITHM will be implemented in order to reduce the Energy consumption and Delay.

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