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Review of VANET Routing In Opportunistic Environment

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Abstract—Vehicular Ad hoc Network (VANET) is based on principles of Mobile Ad hoc networks (MANET). It is a spontaneous process of data exchange from one node to another node. Vehicular networks comes with new promising field in wireless technology which is used to deploy a vehicle to vehicle communication (V2V) and vehicle to infrastructure (V2I) communication between nodes. In VANET routing main drawback is packet dropping, but it will be reduce by intelligent routing which can be optimized by metaheuristics. In this thesis we proposed VANET based routing which depend on shortest path and social information, optimize by metaheuristics.

Keywords— VANET, Routing, DTN, Drop Packet.

I. INTRODUCTION

In recent times, numerous works have provided detailed study of the VANET, which takes into the consideration the realistic mobility as well as propagation model. From the couple of years, VANET has developed especially in regards of intelligent transportation systems (ITS) [1]. Though, resourceful steering in VANET is still a challenging process for lot many of the reasons such as the variations in case of vehicle thickness over the time, variations in VANET size, that may vary from hundreds to thousands of vehicles, and fading in case of wireless channel blurring because of high mobility and the natural hurdles in case of urban environments such as any building or other vehicles [6].

Now days, the multimedia content allocation in real times over Vehicular Ad hoc Networks is turning into reality and permitting travellers as well as drivers to have new encounters with on-street recordings in case of smart cities. Interactive media in VANETs is appropriate for catching and conveying weather check, observation, auto collisions, and disaster based videos in case of smart city application [10].

VANET is innovation which has been taken in huge consideration because of fast change in topology and frequent separations makes it tough to outline a productive steering convention for directing data among hubs, called vehicle to vehicle correspondence and vehicle to street side framework. It is self-sufficient and self-sorting out remote arrange for communication, where hubs in VANET include themselves as servers and additionally as clients for trading and conveying data [7].

VANET also known as ITS (Intelligent Transportation System). In vehicular ad hoc network every node is a vehicle that communicates with each other or a nearby vehicle and road side units. When communication between vehicles occur it is called vehicle to vehicle communications and when vehicle communicate with equipment\units on road side then it is known as V2I (vehicle to infrastructure) communications[9]. Vehicular Ad hoc Network is based on a principle of Mobile Ad hoc Networks. This is a spontaneous process of data exchange from one node to another node. Vehicular networks come with new promising field in wireless technology which is used to deploy a vehicle to vehicle communication and vehicle to street side framework communication between nodes [5].

VANET is based on wireless fundamental concept that is classified into different networks such as Wireless Sensor Networks (WSN), Wireless Mesh Networks (WMS) and Mobile Ad Hoc Networks (MANET). VANET is a subset of MANET having different characteristics like mobility in nodes, self-organizing, frequent data exchange [8].

Applications of VANET

To deploy VANETs, applications play an important role that is categorized on 2 classifications:

- Safety related applications
- User based applications

Users expand the security on the road and additionally classified in the subsequent method:

1. Collision avoidance: some examination state, 60%mishaps can be rid of if drivers get cautioning a large portion of a moment before crash. On the off chance that a driver gets a notice alert on time, crash will be not be there.
2. Cooperative Driving: Drivers are getting alerts for activity alike notices like varying velocity alerts. These signs can participate in continuous and safe driving.
3. Traffic Optimisation: Maximized with the use of transferring signals like jam, accidents etc. to the vehicles.

User Based Application: Supplies the customer infotainment. These are classified in the following ways:

1. Peer to peer application: They are functional to facilities like distributing songs, movies etc. between the motor vehicles in the system.
2. Global network Connectivity: User required interrelating the network for all the time.
3. Other services: utilized in other user on the basis of application alike payment examine to gather the toll assessment, to position the petroleum station, eating place etc.
4. VANET is a division of Mobile Ad hoc Network. Individual node meets with rest of the nodes specifically on multi hop. Vehicular ad hoc network delivers secure and non-secure armed forces to the drivers. Vehicular ad hoc network composed small range radios installed in vehicles, Road Side Units and middle establishment which is account able intended for individuality registration and organization. However, difficult task for vehicular ad hoc network to protect from the exploited behaviour, safety structural design have to be cautiously intended particularly when it is all over the world employed. The safety of Vehicular Ad hoc Network is most serious problems due to transferable among hubs[12].
5.

Characteristics of VANET

Vehicular Ad hoc Network has novel qualities that make VANET not the same as that of MANET. VANET characteristics can be summarized as:

- High dynamic topology [14]: The topology changes in light of hubs moving at high velocity. Assume two hubs are having velocity of 20m/sec and range which is radio range among them is 160 m. At that point connection between two hubs will be there for 160/20= 8 sec.

- Frequent disconnections in network [21]: Due to profoundly dynamic topology, continuous detachment is there between two vehicles when they are trading data. This detachment happens mostly in sparse system.

- Portability: It relies on upon moving environment, street type, the velocity of vehicles, driving conduct of drivers etc.

- Battery consumption and capacity limit: In cutting edge vehicles battery consumption and capacity is boundless. Subsequently it is having enough figuring power that is inaccessible in case of Mobile Ad hoc Network. It is useful for communication in effective way and settling on steering choices [18].

- Correspondence environment: Environment for communication between hubs is distinctive in case of sparse and dense systems. In case of dense system building, trees and different items act as impediments but in sparse system like highway these things are not there. So the directing methodologies of sparse and dense system will be quite different[15].

- Collaboration with on board sensors: Present position and the movement of hubs can undoubtedly be detected by locally available sensors like GPS gadget. Which is helping in case of effective correspondence?

- Node distribution pattern: Node distribution pattern is non-homogenous along the road segment such as traffic control and available speed limits [17].

Advantages of VANET

Following are the advantages in case of Vehicular Ad hoc Network:

- Safety Of Public

- Managing the traffic

- Coordinating and Assisting traffic

- Information Support system for travellers
- Measurement and reduction of air pollutants

Disadvantages of VANET

Following are disadvantages in case of Vehicular Ad hoc Network:

- Route discovery flooding on initial phase
- Bandwidth wastage
- Delay
- Increase in system congestion
- External source for target location
- Bad performance in case of large distance among source and destination

Challenges in VANET

- Network Management: Because of high versatility, the topology of systm and condition of channel change quickly, difficult to set and keep it as quickly as the topology changed.
- Congestion and collision Control: System which is unbounded in nature measure additionally builds up a test. The load of traffic is less in rural area and on night in even in urban ranges. Due to which, partitions in network occur frequently while in day slot load is very high and collision occurs due to congestion in the network.
- Environmental Impact: VANETs make use the electromagnetic waves, may get affected due to environment while communication.
- Security: Security of road safety messages being provided by VANETs should be there as they are life critical.
- MAC Design: VANET make use of shared media while communicating hence MAC design is a main problem.
- Social and Economic Issues: It's a difficult to convince anyone to build a system that will convey traffic signal information as there are chances that consumers are not going to accept the type of monitoring.

II. LITERATURE REVIEW

Xinming Zhang, et. al. (2015) [1]**,** "A Street-centric Opportunistic Routing Protocol Based on Link Correlation for Urban VANETs," In this paper link model has been constructed with a Wiener procedure so as to analyze the availability of link that is taking into consideration the states which are stable as well as unstable as per conduct of vehicles. It presents a keen idea known as the Link correlation that talks about the impact of various connection mixes in system arrangement to transmit a parcel with lower asset utilization and high good put. In view of above idea opportunistic metric for routing, the normal transmission charges over a multi-hop path (ETCoP) executed with the link model that act as a guidance for selecting relaying hub in case of intra streets. Metric can likewise help in following road determination at a crossing point. At last, street-centric opportunistic routing protocol based on ETCop for VANETs (SRPE). Simulation demonstrates that SRPE beats the traditional conventions in context of data delivery ratio, normal delay and system yield.

K. W. Wong Gary et. al. (2015) [2] "Performance Evaluation of Social Relation Opportunistic Routing in Dynamic Social Networks", this paper social relation opportunistic steering algorithm is used for mobile social networks and defines the social relation and profiles among the hubs. SROR algorithm is used to resolve the routing issues by searching and forwarding the packet to node. Social computing has adapted to solve the networking protocol design such as routing and scheduling. In this paper aim is to provide the more accurate and extensive performance evaluation results with quality of service metrics. These approaches are much capable than the traditional opportunistic steering protocols, social properties provide more stable over the unstable dynamic characteristics. Social characteristics of nodes, routing protocol can efficiently predict and deal with the dynamics of networks.

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Juan Luo et. al. (2015) [3] "Opportunistic routing algorithm for relay node selection in wireless sensor networks", Wireless Sensor Networks having a wide range of applications in areas such as monitoring of traffic, care in medical terms, the robotic examination. In this paper, main concentration is on minimizing vitality utilization and expanding system lifetime for information transfer in one-dimensional (1-D) line arrange. Broad recreations and genuine test bed comes about demonstrate that the proposed arrangement ENS_OR can essentially enhance the system execution on vitality sparing and remote availability in examination with other existing WSN steering plans.

Mingjun Xiao et. al. (2014) [4] "Community-aware opportunistic routing in mobile social networks", Mobile Interpersonal Organizations are a sort of postpone tolerant system that comprises of loads of versatile hubs with the social attributes. As of late, numerous social-mindful calculations have been proposed to address steering issues in MSNs. Nonetheless, these calculations have a tendency to forward messages to the hubs with locally ideal social qualities, and consequently can't accomplish the ideal execution. This paper, propose a conveyed ideal Community-Aware Opportunistic Routing algorithm. Principle commitments are that it has proposed a community model of home-aware, where by it turn an MSN into a system that lone incorporates group homes. CAOR can compute the minimum expected conveyance postponements of hubs through turn around Dijkstra algorithm and achieve the ideal astute steering execution. In spite the number of groups is far not exactly the quantity of hubs in size, the computational charges and support charges of contact data are enormously reduced. Optimal route performance is the biggest advantage of the CAOR algorithm.

Xuebin Ma et. al. (2014) [5] "An overlapping community detection algorithm for opportunistic networks", in this paper community structure are designed to understand networks, which can likewise profit productive steering conventions and QoS plans outlining. For an Opportunistic Network which comprises of various types of versatile hubs, its topology changes after some time. Accordingly the community detection turns out to be more troublesome than static circumstances. Besides the covering group identification is a more mind boggling issue. This paper dissects the time changing topology of Opportunistic Networks and the covering group structures of human. Community detection algorithm applied on social science, complex networks and graph theory. The algorithm is highly reliable and flexible in nature for overlapping community detection in case of the opportunistic networks.

Mingjun Xiao et. al.(2015) [6] "Deadline-sensitive opportunistic utility-based routing in cyclic mobile social networks", This paper, brings out utility-based directing into cyclic MSNs, has proposed a deadline touchy utility-based steering model. A cyclic Mobile Social Network is another sort of postpones tolerant system, in which the mobile clients occasionally move around, and get in touch with each other through their conveyed short-remove specialized gadgets. This paper introduce a deadline sensitive utility model into MSN routing. Under this model, proposed a single-copy routing algorithm DOUR (deadline sensitive opportunistic utility based routing model), and a multi-copy routing algorithm m-DOUR can achieve a maximum utility for each message delivery. Both provide a good balance between the advantages, delay and cost for every message conveyance.

Jie Luo et. al. (2010) [7] "A mobile infrastructure based VANET routing protocol in the urban environment", This paper, first dissect the novel components of urban VANET that hubs have diverse sorts, and move alike bunches because of the impact of activity lights. Along these lines, the idea of utilizing transports as the versatile foundation to enhance the system availability is proposed. We likewise build up a novel steering convention named Mobile Infrastructure Based VANET Steering convention. This convention made complete utilization of the transports, making it a key segment in course opting and bundle sending. It is a location based steering convention. MIBR attains the highest data delivery ratio. MIBR protocol improves the network connectivity by escalating the transmission range.

Mohammad Al-Rabayah and Robert Malaney (2012) [8] "A new scalable hybrid routing protocol for VANETs", this paper, new kind of hybrid location based steering convention has been proposed that is especially intended to address issue. This new convention consolidates components of the reactive steering with location based on the geographic directing in a way that effectively utilizes all area data accessible. The convention is intended to effortlessly exit to the reactive steering as the area data degrades. We show through examination and simulation that our convention is versatile and has ideal overhead, even within sight of high area blunders. Their convention gives an improved but realistic area empowered arrangement that can be conveyed in all VANET situations.

Ling-Jyh Chen et. al. (2006) [9] "A hybrid routing approach for opportunistic networks", this paper, hybrid scheme has been proposed, named H-EC, to manage a large variety of opportunity system cases. H-EC intends to completely consolidate robustness of erasure code based steering techniques, while preservation of the replication technique advantages in terms of

performance. Then assess H-EC against other similar methodologies as far as delivery ratio and latency, and find that H-EC offer robustness in worst case delay evaluation cases while achieving good evaluation in small delay evaluation scenarios.

Bijan Paul, et. al. (2011) [10] "VANET Routing Protocols: Pros and Cons", this paper presents the advantages and disadvantages of Vehicular Ad hoc Network steering conventions for inter vehicle correspondence. The current directing conventions for VANET are not productive to meet each activity situations. In this way plan of a productive steering convention has taken huge consideration. In this way, it is exceptionally required to recognize advantages and disadvantages of directing conventions that can be utilized for future changes of any new steering convention. Because of quick changes in topology and visit separation makes it tough to plan a productive directing convention for the steering information among vehicles known as vehicle to vehicle correspondence and vehicle to street side framework.

Mario De Felice et. al. (2015) [11] "A distributed beaconless routing protocol for real-time video dissemination in multimedia VANETs", This paper introduces an application system that can handle multi-hop, multi-way, and element situations, the Distributed Beaconless Dissemination, that improves the scattering of live video streams on media interstate Vehicular Ad hoc Network. DBD utilizes a backbone based way to deal with make and maintain constant and quality routes through video delivery in opportunistic Vehicle to Vehicle situations. It additionally enhances the execution of the IEEE 802.11p MAC layer, by providing solution to the Spurious For-warding (SF) issue, while expanding the data delivery proportion and decreasing the sending delay. Performance assessment demonstrate the advantages of Distributed Beaconless Dissemination contrasted with existing work for sending recordings over Vehicular Ad hoc Network, where primary target and subjective QoE results are being measured.

Neha Garg and Puneet Rani (2015) [12] "An improved AODV routing protocol for VANET (Vehicular Ad hoc Network)", This paper has enhanced the evaluation of Ad-hoc on Demand Distance Vector steering convention by using few parameters such as time outs in case of active routes and interval of hello to opt the best way for steering and is comparing the proposed AODV evaluation with Normal AODV in context of varying evaluation metrics i.e. average good put, average delay and average system load. Simulation show that proposed AODV steering convention has better performance in comparison to normal AODV.

Farahnaz Naeimipoor et. al. (2012) [13] "Performance evaluation of video dissemination protocols over Vehicular Networks", This work considers the infrastructure less situation of Vehicular Ad hoc Networks. The spread of video substance over VANETs is to a great degree testing essentially because of the system's dynamic topology and stringent prerequisites of video streaming. This paper concentrates the primary methodologies pointed towards a compelling and proficient result for video dispersal over Vehicular Ad hoc Networks. Work depicts in detail the procedure of video scattering over VANETs and presents an exhaustive assessment of existing arrangements.

Cristiano Rezende et. al. (2012) [14] "VIRTUS: A resilient location-aware video unicast scheme for vehicular networks", Video streaming abilities in Vehicular systems are urgent to the advancement of profitable administrations. Nonetheless, VANET is a challenging domain to this sort of correspondence because of the scattering and development of vehicles. This work, introduce an achievable answer for this issue. The Video Reactive Tracking-based UnicaSt convention is an accepting based arrangement that uses vehicles' present and future area for a choice strategy of handing-off hubs. It satisfies video streaming prerequisites without bringing about into an over the top no of transmissions.

Chander Prabha et. al. (2016) [15] "Optimising social information by game theory and ant colony method to enhance routing protocol in opportunistic networks", The proposed convention is analyzed completely by means of examination and reproduction keeping in mind the end goal to survey their execution in correlation with other social based steering conventions in opportunistic network under different parameters settings. The information misfortune and detachment of nodes are visit in opportunistic system. The social data assumes an essential part in lessening the information misfortune since it relies on upon the network of hubs. The proper determination of next jump in view of social data is basic for enhancing the execution of directing in opportunistic stems. Frequent disconnection issue is avoided by enhancing the social data with ACO technique which relies on upon the topology of opportunistic network.

Shehu Jabaka Muhammad et. al. (2015) [16] "Network Coding for Reliable Safety Message Communication in Vehicular Ad-Hoc Networks : A Review", This paper audits a portion of the applications of system coding for dependable reliable message correspondence in VANETs, grouping them in view of the transmission introduction and revealing the increase acknowledged when the technique is utilized. A summary table introducing the relative investigation of the conventions is given. At present, data dispersal in the practical communication networks is accomplished by steering. Be that as it may, organize coding can be considered as the cheerful speculation of steering that can possibly arrange evolving circumstances. Regardless of the presence of various reviews on the applicability of system coding to broadcasting interchanges for MANET.

Mohammad Jalil Piran et. al. (2011) [17] "Vehicular Ad Hoc and Sensor Networks; Principles and Challenges", In this paper they have explained main fundamentals and challenges of VASNET. The proposed approach VASNET is specifically for highway traffic. VASNET is a self-manageable Ad Hoc and sensor network consist of a large number of sensor nodes. In VASNET there are two sorts of sensor nodes, some are implant on the vehicles-vehicular nodes- and others are established in fixed distances excepting the highway road, known as Road Side Sensor nodes. The vehicular nodes are used to sense the velocity of the vehicle

for illustration. Authors have some Base Stations which may be stationary or mobile. VASNET supplies capabilities for wireless communication among vehicular nodes and stationary nodes, to enlarge security and contentment for vehicles on the highway roads.

Sabih ur Rehman et. al. (2013) [18] "Vehicular Ad Hoc Networks (VANETs) - An Overview and Challenges", The author presents the cutting edge of Vehicular Ad hoc Network and suggest similar problems. System design, signal modeling and the propagation structure mobility modelling steering convention and network security are explained in details. Main outcomes of the paper are an well-organised and steady Vehicular Ad hoc Network is one which persuade factors such as QoS, minimum latency, low BER and high PDR.

Ozan Tonguz et. al. (2007) [19] "Broadcasting in VANET", In this paper author identifies three distinct systems that needs to be work upon in vehicular broadcast protocols such as dense, sparse and regular traffic regime. They construct upon their formerly anticipated steering solutions for every system and they show the broadcast alert can be propagated systematically. The planned design of the Distributed Vehicular Broadcast convention unites the use of several steering solutions they have proposed earlier.

Shouzhi Xu et. al. (2013) [20] "QoS evaluation of VANET routing protocols", The principle objective of paper to examine the fundamental quality criteria in steering conventions with a coordinated Vehicular Ad hoc test bed. Topology-based directing conventions are inspected. To consider Quality of service execution of various conventions, assessing models of edge misfortune proportion, PSNR and network likelihood are represented. Three normal directing conventions: Destination source distance vector, Ad hoc on demand and GPSR are choosed to affirm the Quality of service as indicated by the insights consequence of video transmission over VANET testbed. Quality of service execution is broke down under a few states of various separation of directing information transmission and vehicles' arriving rate. Test comes about demonstrate that Pro-dynamic convention is not appropriate for high mobility Vehicular networks, and Position-based hybrid convention is more reasonable for video transmission over Vehicular networks than Re-dynamic convention.

Kevin C. Lee and Mario Gerla (2010) [21] "Opportunistic vehicular routing", In opportunistic system there is no predefined administer for picking the following hub to goal (as it is the situation in ordinary plans, for example, OLSR, DSR or even Geo-Routing).Rather, a middle of the road hub in transit acts in an unrehearsed manner and takes a choice that is construct exclusively in light of current conditions. A prevalent case of opportunistic steering is the "delay tolerant" sending to "data mules" when an immediate way to goal does not exist. Conventional steering for this situation would simply "drop" the packet. With opportunistic steering, a node follows the available information and it seeks the best neighbour to carry the information to the destination.

CONCLUSIONS

Quality of service according to the statistics outcome of video transmission over Vehicular testbed. Quality of service performance is investigated under various sets of distinct distance of transmitting data transmission and arriving rate of vehicles. Experimental outcome shows that Pro-active protocol is not appropriate for high mobility Vehicular networks, and Position-based hybrid protocol is much convenient for transmission of video over Vehicular networks than Re-active protocol. Comparing with prior work the result depicts that model is better and more organized for interpretation.

REFERENCES

[1] Zhang Xinming et. al. (2015) "A Street-centric Opportunistic Routing Protocol Based on Link Correlation for Urban VANETs", vol. XX, no. XX, pp. 1–14.

[2] Wong Gary K. W. et. al. (2015) "Performance Evaluation of Social Relation Opportunistic Routing in Dynamic Social Networks", pp. 874–878.

[3] Luo Juan et. al. (2015) "Opportunistic routing algorithm for relay node selection in wireless sensor networks", IEEE Transactions on Industrial Informatics, vol. 11, no. 1, pp. 112–121.

[4] Xiao Mingjun et. al. (2014) "Community-aware opportunistic routing in mobile social networks", IEEE Transactions on Computers, vol. 63, no. 7, pp. 1682–1695.

[5] Ma Xuebin et. al. (2014) "An overlapping community detection algorithm for opportunistic networks", IEEE Computers, Communications and IT Applications Conference, pp. 110–115.

[6] Xiao Mingjun et. al.(2015) "Deadline-sensitive opportunistic utility-based routing in cyclic mobile social networks", 12th Annual IEEE International Conference on Sensing, Communication, and Networking (SECON 2015), pp. 301–309.

[7] Luo Jie et. al. (2010) "A mobile infrastructure based VANET routing protocol in the urban environment", WRI International Conference on Communications and Mobile Computing, vol. 3, pp. 432–437.

[8] Al-Rabayah Mohammad and Malaney Robert (2012) "A new scalable hybrid routing protocol for VANETs", IEEE Transactions on Vehicular Technology, vol. 61, no. 6, pp. 2625–2635.

[9] Chen Ling-Jyh et. al. (2006) "A hybrid routing approach for opportunistic networks", Proceedings of the SIGCOMM workshop on Challenged networks - CHANTS' 06, pp. 213–220.

[10] Paul Bijan et. al. (2011) "VANET Routing Protocols: Pros and Cons", International Journal of Computer Applications, vol. 20, no. 3, pp. 28–34.
[11] Felice Mario De et. al. (2015) "A distributed beaconless routing protocol for real-time video dissemination in multimedia VANETs", Computer Communications, vol. 58, pp. 40–52.
[12] Garg Neha and Rani Puneet (2015) "An improved AODV routing protocol for VANET (Vehicular Ad-hoc Network)", vol. 4, no. 6, pp. 1885–1890.
[13] Naeimipoor Farahnaz et. al. (2012) "Performance evaluation of video dissemination protocols over Vehicular Networks", Proceedings - Conference on Local Computer Networks, pp. 694–701.
[14] Rezende Cristiano et. al. (2012) "VIRTUS: A resilient location-aware video unicast scheme for vehicular networks", IEEE International Conference on Communications, pp. 698–702.
[15] Prabha Chander et. al. (2016) "Optimising social information by game theory and ant colony method to enhance routing protocol in opportunistic networks", Perspectives in Science, pp. 658–660.
[16] Muhammad Shehu Jabaka et. al. (2015) "Network Coding for Reliable Safety Message Communication in Vehicular Ad-Hoc Networks: A Review", Conference on Future Generation on Communication Technologies (FGCT 2015), pp. 125–130.
[17] Piran Mohammad Jalil et. al. (2011) "Vehicular Ad Hoc and Sensor Networks; Principles and Challenges", International Journal of Ad hoc, Sensor & Ubiquitous Computing (IJASUC), vol. 2, no. 2, pp. 38–49.
[18] Rehman Sabih ur et. al. (2013) "Vehicular Ad-Hoc Networks (VANETs) - An Overview and Challenges", Journal of Wireless Networking and Communications, vol. 3, no. 3, pp. 29–38.
[19] Tonguz Ozan et. al. (2007) "Broadcasting in VANET", IEEE.
[20] Xu Shouzhi et. al. (2013) "QoS evaluation of VANET routing protocols," Journal of Networks, vol. 8, no. 1, pp. 132–139.
[21] Lee Kevin C. and Gerla Mario (2010) "Opportunistic vehicular routing", European Wireless Conference (EW 2010),pp.873–880.

