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A Review on Social Based Routing Schemes in Vanets

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***Abstract*— In last few years VANET has become a remarkable field for research analysis and development. VANET provide us with the new ideology to enhance driver and passenger's safety and comfort level. Due to quickly evolving topology, deterrents and constrained portability in VANET, there is a need of wise and productive guiding conventions which guarantees enhanced proficiency as far as limiting delays, increment throughput and steady quality. Although there are lots of routing schemes in VANET but neither they consider the social characteristics of fixed-line VANET nor the social relations among passengers while message forwarding. But in social based routing scheme all these factors are taken into account which helps in the perfection of routing efficiency and effectiveness. Keeping in view of the above, this paper provides a detailed description of various routing protocols involved in social based routing scheme in VANETs with the aim of comparing all of them and selecting an appropriate protocol depending upon its applicability. An audit of latest conventions is displayed by utilizing its parameters.**

***Index Terms*— About four key words or phrases in alphabetical order, separated by commas.**

I. INTRODUCTION

VANET is a network in which each moving car is taken as a node. Every vehicle in this network acts as remote switch or hub. Each vehicle is able to interact with each other within the range of 100 to 300 meters of each other, which makes a wide range of network. Whenever any vehicle drops out of this range, any other vehicle can join the network and interact with so that a versatile network is made [1]. Vehicular Ad Hoc Network (VANET) is a form of Mobile Ad Hoc Networks (MANET). Both are wireless networks which are featured as self-managed and autonomous ad-hoc networks. The main difference between a VANET and a MANET is that there is no infrastructure available in MANET and nodes can move randomly in a network while in VANET access points can be placed as Road Side Units which allows vehicles to avail the services from the infrastructure [7].

There are 2 types of communication i.e. **Vehicle To Vehicle (V2V):** It provides interaction within vehicles in ad hoc approach. In V2V, a vehicle can accept broadcast and exchange helpful traffic news i.e., traffic conditions and road accidents in particular area or with other vehicles. In V2V communication internet connectivity is needed which allows sharing the traffic related information among moving vehicles [11]. **Vehicle to Infrastructure (V2I):** the information will be broadcast between the nodes (i.e. vehicle) and infrastructure (also known as ITS), to discuss about valuable information such as road conditions and safety events which have been taken into account. In this V2I, a vehicle (node) launches a connection between RSU and contact with external networks which is internet. In this communication vehicles can communicate with roadside units deployed at fixed distances at the side of the road. There is no need of internet connectivity for the communication between vehicles [11].

The architecture of VANET consists of 3 different domains. These are as follows:

In-vehicle domain: In this domain, each vehicle consists of an on-board unit (OBU) and one or more application units (AU). AU is used to execute certain set of applications by utilizing the communication capability of the OBU. For the purpose of road safety, the OBU of each vehicle is equipped with a short range wireless communication device.

Ad hoc domain: In ad hoc domain, each vehicle is equipped with On-Board Units and Road Side Units, which in turn forms the VANET.

Infrastructure domain: In this domain, for the purpose of accessing safety and non-safety applications, each vehicle is equipped with RSUs and wireless hotspots (HT). In order to access the internet services, RSUs are deployed by road administrators or other public authorities and hotspots are set up in a less controlled environment.

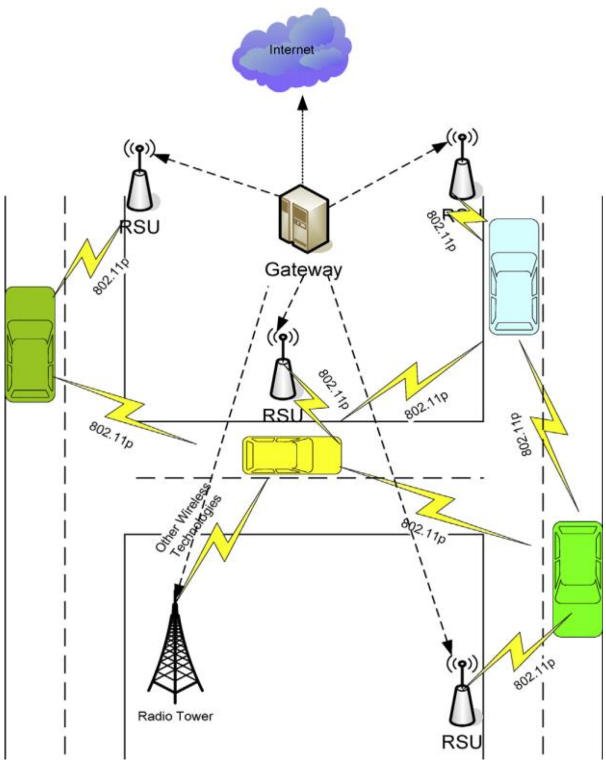

Fig 1. Example of VANET network [4]

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Characteristics of VANET

- **Hard Delay Constraints:** For the safety application of VANET, timely delivery of message to relevant nodes is the main concern. Any important data simply cannot be compromised for any delay. Therefore, it is not necessary for VANET to overcome the issues of high delay constraints instead of giving high data rates [7].
- **Interaction with onboard Sensors:** For effective routing and communication purposes, onboard sensors help in finding the location of the node in the network and the movement nature of the vehicle [9].
- **Rapidly Changing Network Topology:** The network topology in VANET tends to change frequently because the nodes in the network are highly mobile. [10].
- **Time-Sensitive Data Exchange:** In order to provide safety to the vehicles, it is required that the data packets should be transmitted in a timely manner. The security schemes should be such that cannot harm the network performance of VANETs [7].
- **Potential Support from Infrastructure:** In VANET, the potential support from infrastructure will always be taken as an advantage in future. This helps in making better protocols and better [11].
- **High Mobility:** In VANET, the high speed of the vehicles makes it difficult to predict the position of a vehicle and to provide security to the vehicle [9].
- **Unbounded Network Size:** VANET is a network which can be deployed for one or more cities, so the size of network is not fixed. Hence the network size is unbounded [11].
- **Time Critical Environment:** In VANET, the safety related messages must be delivered to the relevant node in a short span of time. This is important so that the message receiving vehicle can make a decision on time and can react accordingly [10].
- **Frequent exchange of Information:** The major concern of VANET is to provide road safety and for this the information regarding traffic conditions needs to be exchange frequently among nodes. This information should be broadcasted to alert the vehicles for any kind of danger [9].

Applications of VANET

Commercial Oriented: The Commercial applications can be grouped as:

- **Remote Vehicle Personalization/Diagnostics:** It helps in downloading of customized vehicle settings or transferring of vehicle diagnostics from/to foundation.
- **Internet Access:** Vehicles can get to web through RSU if RSU is filling in as a switch [11].

Comfort Applications: Comfort application essentially bargains in movement administration with an objective to upgrade activity productivity by enhancing the level of comfort for drivers. Comfort applications can be classified as:

- **Route Diversions:** Route and trek arranging can be presented in defense of street clogs.
- **Parking Availability:** Notifications in regards to the accessibility of stopping in the metropolitan urban communities serves to discover the accessibility of openings in parking garages in a certain land territory [10].

Safety Applications: Safety applications incorporate observing of the encompassing street, approaching vehicles, surface of the street, street bends and so forth. The Road safety applications can be classified as:

- **Real-time traffic:** The Road Side Units are stored with the traffic information and this information can be accessed from anywhere and at any time when required. This is done take care of the issues like traffic jams and to make a distance from blockages like mischance.
- **Co-operative Message Transfer:** In this the vehicles when slowed or stopped will broadcast a message to other vehicles to act accordingly. Such information exchange also helps in maintaining distance from other vehicles to avoid accidents [11].

Social Based Routing in VANET

There are lots of routing schemes in VANET. Some are for fixed-line VANET and some for Non-fixed-line VANET. But all of these schemes neither take into account the characteristics of fixed-line transportation VANET, like the encounter regularity of vehicle nor the social relations among passengers in case of message forwarding. But social based routing scheme take all of these factors into account to improve the routing efficiency and effectiveness. Hence the social concept can be used in VANET for solving the routing issues.

In social based routing scheme, firstly the passengers or nodes are divided into communities by using the Improved k-Clique Community Detection algorithm (IKC). In IKC, community is made of the passengers that carry similar social attributes and which can frequently encounter with each other. These passengers are more likely to communicate with each other during travelling. Once a community is made, the passenger nodes inside the community are linked with each other more strongly as compare to outside the community. After making a community, the next step is to find out which message needs to be forwarded first. This is done using a Social-based Message Buffering scheme (SMB). For this, each message is provided with a priority to be calculated. Priority is calculated on the basis of the intimacy of the message issuer and the message forwarder and the contribution of message forwarder. When the priority of each message is calculated, the message with highest priority is chosen to be forwarded first. After SMB, forwarding node needs to be found out to which the message needs to be forward. In order to find out the forwarding node, a Bilateral Forwarder Determination method (BFD) method is used. BFD is done by using two methods i.e. Intra-Community Forwarder Determination (ICFD) and intEr-Community Forwarder Determination (ECFD) method [17].

Benefits of Social based routing

- The efficacy of routing mechanism in VANET can be enhanced by recognizing the social behavior of people which become quite easy during travelling as people with unlike nature and financial status comes in contact.
- By identifying crowd’s social traits (e.g., tie strength), the node can upgrade routing by delivering the message to the

most often encountered vehicles instead of producing traffic in the network by forwarding the message in duplicity.

- Social relation is a prominent factor affecting the most suitable design of routing scheme for fixed line VANET as for most of the people it is a stagnant characteristic which results in predictable routing information and decrease in number of overhead.

II. LITERATURE REVIEW

As per previous studies, social characteristics of protocols have been considered as a prominent factor in optimizing the design of various routing algorithms. In [1], *Friendship Based Routing* proves to be effective than the existing algorithms by forwarding fewer messages, as demonstrated by simulations. In [12], BUBBLE named algorithm is designed to optimize the delivery performance. This is done using two metrics named as centrality and community. After this, BUBBLE is being compared with a history-based PROPHET and SimBet algorithm which results in improving the performance of message forwarding. In [8], a fuzzy-assisted social-based routing (FAST) protocol is introduced. FAST makes use of human's social behavior to improve the routing decisions. In order to transfer data from source to destination, previous traffic related information is used. As per the simulations, FAST results in 32% high delivery ratio, 80% low delays 50% low hop counts. In [16], the main purpose is to deliver the message to nodes in a network according to their social behavior. The social based routing algorithm is proposed for this purpose. The simulations results of this scheme are specially designed for measurements in DTN scenarios and compared with popular solutions.

In [2], in order to make routing decisions, awareness of energy is used as the basic feature. It is said that the use of social characteristics among nodes leads to the depletion of energy resources and the reason being that the nodes are temporary and there are no suitable routing decisions. The approach used in this paper enhances the delivery process as well as the energy consumption between the nodes is also balanced. In [5], a protocol named as Social Opportunistic Networks Routing (SONR) is introduced which is used to calculate probability of transition between nodes and for this Markov's chain is used as a mobility model. In order to see the simulation results, a comparison is done between 3 protocols i.e. Spray, Wait and Epidemic protocol. As the simulation results shows, SONR proves to be better in case of delivery ratio, delivery latency and network overhead. In [6], a protocol named as social contribution-based routing protocol (SCR) is proposed. The main considerations of this protocol are the probability of delivering the message to the destination and how much the node contributes socially to forward the message. These two factors help in making the selfish nodes more cooperative. If the probability of delivering the message is high and the social contribution is low of any node, then that node is considered to be the best possible next candidate for delivery. The simulation results on the basis of this idea prove to be effective and efficient. In [13], a solitary duplicate anycast routing methodology is proposed in which the present forwarder advances the message to an experience hub with a higher Anycast Social Distance Metric (ASDM). ASDM depends on the multi-jump social separations to anycast gather individuals. It adjusts the exchange off between a short way to the nearest, single gathering part and a more drawn out way to the region where numerous other gathering individuals dwell. It advances both the proficiency and heartiness of message conveyance. From the simulation results it is demonstrated that ASDM accomplishes a high delivery ratio, low delay, and low transmission cost contrasted with other anycast methodologies. In [18], a social prominence based routing algorithm is proposed, named SPBR. It considers the between contact time and multi-hop neighbor data. As a matter of first importance a technique is acquainted which precisely recognize the nature of connection between nodes. At that point a social prevalence is proposed to assess the social intensity of node in the system. SPBR settles on the directing choices dependent on the popularity, driving message nearer to goals with low routing nodes and system assets. Reenactment results demonstrates that the proposed calculation essentially enhances the routing contrasted with Epidemic, Prophet and First Contact (FC), particularly SPBR is bring down by about 55.1% in overhead proportion and higher by about 22.2% in delivery rate than Epidemic when there are 40 nodes in the systems. In [14], a socially mindful routing technique is suggested that advances both fairness and throughput. To accomplish outstanding task at hand decency, a node is chosen based on multi-hop delivery likelihood and its line length. Besides, to accomplish throughput decency, we sort arriving messages into various destination based lines. Messages are then booked after a two-level sending technique that streamlines throughput reasonableness utilizing round-robin and delivery proportion utilizing priority scheduling. In [15], a half and half directing convention called EpSoc is proposed which uses the Epidemic forwarding for routing system and adventures a critical social element, that is, degree centrality. Two systems are utilized in EpSoc. Messages' TTL is balanced dependent on the degree centrality of hubs, and the message blocking component is utilized to control replication. Simulation results demonstrate that EpSoc expands the delivery proportion and reductions the overhead proportion, the average latency, and the counts of hop consider contrasted with Epidemic and Bubble Rap.

III. GAPS IN LITERATURE

While social based steering conventions for DTNs absolutely have points of interest over different conventions, there are still a few holes that should consider under research for far better outcomes. A portion of these holes which can be tended to incorporate LIMITED BUFFER SPACE, ENERGY EFFICIENCY and PROTOCOL ADAPTABILITY. With the end goal to address the issue of constrained buffer space, a few conventions have coordinated to support the systems that enable the node to drop messages in specific situations. This is an issue that must keep on being routed to suit the shifting uses DTNs may serve. Tending to energy utilization is a heading that ought to be investigated later on both as an approach to dodge nodes dropping out of the network and as an approach to decrease the measure of energy the framework employments. Also, the last issue of protocol adaptability implies how conventions dependent on social elements can be connected to less human-subordinate conditions.

IV. LITERATURE REVIEW FINDINGS

PROTOCOL	TYPE	SIMULATOR	MOBILITY MODEL	FORWARDING STRATEGY	SOCIAL METRICS	DELAY	DELEVERY RATIO	DELIVERY LATENCY	PROS	CONS
SONR	Proactive	ONE	Markov's chain	Opportunistic	Community detection and degree centrality	Low	High	Low	The message forwarding performance is improved.	Not able to focus on deploying mobile devices in real Societies.
BUBBLE RAP	Reactive	NS-2	Random Way Point	Greedy	Centrality and community	Medium	High	Low	Lower resource utilization	The size of the data set used is limited
ANYCAST (ASDM)	Proactive	NS 3.19	Free Way	Multi-Hop	Frequency, intimacy, closeness, longevity, reciprocity	Low	High	Low	Optimizes efficiency and robustness of message Delivery.	It is less robust
EpSoc	Reactive	ONE	Opportunistic and flooding	Hybrid	Similarity, Centrality and flooding	Low	High	Low	EpSoc decreases the overhead better than epidemic.	The message blocking strategy forwardings.
Friendship Based Routing	Proactive	ONE	Random Way Point	Opportunistic	Community and Friendship	High	Low	Low	It use not only direct relation of the nodes but also indirect ones.	It do not make use of the transitive friendship behaviors of different nodes.
FAST	Reactive	ONE	Random Way Point	Directional	Friendship	Low	High	Low	FAST makes dynamic routes .	Computation overhead is high.
SPBR	Reactive	ONE	Real trace and Synthetic mobility model	Flooding	Degree centrality, Betweeness centrality, closeness centrality	Low	High	Low	Leads the message closer to destinations with low hops resources.	Do not concentrate on social community .
SCPR	Proactive	NS-2 or OPNET	Random waypoint + random model + community based model	Hybrid	Encounter frequency, regularity of encounters, freshness of encounter	Low	High	Low	capable of integrating the merits of the Epidemic, Prophet and SimBet protocols.	Message delivery ratio of SCPR is low
CGrant	Reactive	ONE	Hybrid	Store-Carry-Forward	Frequency of encounters, duration of encounters, degree centrality, relationship degree	High	High	Low	Characterized the utility of each node as a message forwarder by considering a set of social-aware metrics.	The adaptive capabilities of CGrAnt to point-to-multipoint communications.
SCR	Proactive	ONE	Random mobility model	Bilateral Forwarder Determination Method	Community Detection	Low	High	Low	Social contribution is used to stimulate selfish nodes .	There is no anonymity to protect node's privacy.

V. CONCLUSION

Vehicular ad-hoc networks are composed of mobile wireless devices which mean they do not have sustained connectivity throughout the network. In order to overcome delays in the network, many routing protocols have been proposed that utilize social features to make more efficient routing decisions. In this paper, a survey has been done for various routing protocols with social characteristics, which proves that social based routing protocols are more promising than other protocols as they take the advantages of relatively stable characteristics (social properties) efficiently to predict and deal with the dynamics of DTNs and also improves the performance of the network.

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