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# A Literature Review of Efficient And Reliable Communication To Reduce Broadcast Storm in Vanets

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***Abstract*— VANET has been an active field of research and development for years and related to fields like the following various existing techniques surveyed with their advantages and limitations. Several existing techniques are involved in the transmission of data among the vehicles. Networking, automobile, transportation and security, broadcasting, content prioritization, quality of service and performance, transmission power, Interference and Collision. If the overflowing is not taken up efficiently, broadcast storm problematic transpires. The components of broadcast storm are Heavy channel contention, long-lasting message collisions, and many redundant rebroadcasts. This chapter reviews various approaches and protocols in VANET along with its drawbacks and benefits.**

*Index Terms*— **broadcast storm, routing protocol, vanet**

I.

## 1.Introduction

Reliable and efficient communication approaches available in literature can be grouped into five categories as follows.

i. Broadcasting and routing protocol approach
ii. Message redundancy protocol approach
iii. Broadcast storm protocol approach
iv. VANETs mobility model approach
v. VANETs in rural and urban scenario approach

The organization of this chapter is presented. Section 2.2 relates to the broadcasting and routing protocol approach in VANET. Section 2.3 is presented the various works on redundancy protocol approach. In section 2.4 is descripted broadcast storm protocol approach. In section 2.5 is explained in VANETs mobility models. In section 2.6 are briefed of the VANET in rural and urban scenario. The observation and summary of the chapter and Conclusion is descripted in section 2.8.

## 2.BROADCASTINGPROTOCOL APPROACH

VANET broadcasting uses flooding for the distribution of data packets by flooding and vehicles rebroadcast the packets to their neighbours in the geographic area. The applications of broadcasting algorithms help minimizing overhead by reducing the occurrence of broadcast storms. In VANETs, broadcasting can also be seen as a type of controlled flooding in the network. For example, in a network that builds with a large number of nodes, the shared wireless channel gets overloaded. When incidents found, are not many attempts are made to exchange message with other nodes simultaneously Therefore, a smart forwarding strategy requires adoption for avoiding congestion in the wireless channel Moreover, safety messages are of a broadcast nature, and they should be available to all vehicles on time. Therefore, the broadcasting should minimize the number of unnecessary retransmissions to avoid overloading the channel. [1] have discussed the problem of flooding to propagate a broadcast message throughout a network. The broadcast storm refers to the problem associated with flooding. They have suggested an approach that reduces the possibility of redundancy. Data broadcasting methods can be categorized is shown in Figure 2.1.

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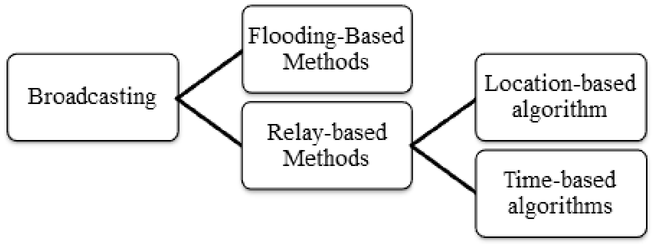


**Figure 2.1 Broadcasting Techniques**

The solution found the smallest subset of neighbours that covered all the two hop neighbours and improved running time. [2]have addressed the hidden vehicle problem in multi-hop broadcast of information in an Inter Vehicle Communication (IVC) System. The protocol has also suggested the use of repeaters at intersection to eliminate the problems caused by the shadowing large buildings in an urban environment. A number of solutions have been proposed that involve taking a proactive approach to address these problems, but these solutions are not effective in highly mobile environments.

[3]have proposed a double covered broadcast algorithm which uses broadcast redundancy to improve the delivery ratio of the broadcast messages in an environment with a high error ratio. The next forwarder for forwarding the packet was selected from the senders neighbour set. When the mobility of vehicles with network is high, there is a significant drop in the performance of the algorithm. [4] have proposed a distributed position aware smart broadcast algorithm. Each vehicle forwards the packet after a random back off time. The algorithm has made use of the Global Position System (GPS) for speeding up the propagation of a message and with good performance for the minimum connected dominating set based solutions, but showed difficulty in setting the parameters like contention window size. [5]have proposed a greedy traffic aware routing protocol based on intersection-based geographical routing protocol. It had the ability to find robust routes within city environments with a distributed traffic information system and to monitor the city traffic condition and transmitted such information to vehicles around a particular area. The researches have proposed a decentralized mechanism for the estimation of traffic density in the road side information system.

have proposed an edge-aware epidemic protocol to broadcast messages using the vehicle's geographical knowledge. When a vehicle receives a broadcast message, it founds the number of transmissions from the front and back vehicles for a specific period and decides whether vehicles will rebroadcast the message or not. It does not address the intermediate connectivity issues and provides slow speed data dissemination. [6]have discussed the broadcasting operations, challenges in mobile ad-hoc networks and the major issues in flooding like high packet collision which can cause a severe degradation in network performance.

An enhanced counter-based broadcast was used for delaying with the limitations of flooding by adjusting the threshold value and the random assessment delay using minimal neighbourhood information. [7]have analyzed the most important quality of service metrics in VANET and determined the upper performance bound for connection duration, packet delivery ratio, end-to-end delay, and jitter for unicast communication in city and urban environments. They concluded that the values of delay and jitter in VANET would be adequate for most of the applications and found the packet delivery ratio and connection duration time as not suitable for these applications. [8]have discussed the challenges of high mobility and frequent partitioning in VANET and proposed the relative position based message dissemination. Directional greedy broadcast routing approach is used for forwarding messages based on the position and direction of the vehicles. This approach considers a reasonable delay before broadcasting.

[9]have addressed the problem in communication technologies and deployed infrastructure in cooperative vehicular networks. Also an efficient road oriented dissemination protocol is proposed for inclusion of the optimized distance defer transfer module, and store and forward module. This protocol has the ability to provide a high delivery ratio only for a limited number of vehicles.[10] investigated the importance and challenges of the quality of service in VANET. They have proposed an adaptive message routing protocol that used current information about the local topology and found the route with minimum end-to-end delay while maintaining a threshold for the connectivity probability and hop count based on Genetic Algorithm. [11]have proposed a broadcast protocol which can handle acknowledgements of broadcasts messages. This protocol was based on local position information acquired via periodic beacon messages.

Beacons were used for ascertaining their belonging to a connected domain set. Vehicles in the set were used a shorter waiting period before possible retransmission. On the expiring of the waiting time, the vehicle transmitted information on whether it had at least one neighbour, which did not acknowledge the circulated message with last beacon, and started a new waiting period. [12] have proposed a geographical routing protocol for VANETs, named, intelligent routing protocol for city environments. It accessed vehicle speed, their direction, their location and also the layout of the roads like one way and double lane roads. The proposed system could route data in the network based on GPS and this solution could be used for a variety of applications like driver safety, file downloading, chatting, gaming and browsing.

[13] have proposed a broadcast street cast protocol to provide efficient broadcast service. It comprised three components: relay node selection, MRTS handshaking, and adaptive beacon control. The digital street map information and one-hop neighbour information are used for the selection of relay nodes. Street maps are used for assistance in the selection of relay nodes. Multicast request-to-send was adopted to protect wireless communications for providing high reliability. The scheme has proposed an adaptive beacon control heuristic to reduce beacon overheads. [14]proposed the position-aware reliable broadcasting protocol. It used adaptive beacons to get neighbours position and velocity. Based on this, it selected the neighbours in the preferred distance to rebroadcast the message. Immediately, the selected vehicle rebroadcast the message. If the selected vehicle did not broadcast the message, other vehicles that received the message performed this task after some waiting timeout, which was calculated taking into account the distance between the sender vehicle and the designation vehicle. Therefore, the vehicle closest to the selected vehicle rebroadcast the messages.

[15]have proposed a relay vehicle selection which studied the additional radio coverage and vehicle movement called Enhanced multipoint relay broadcast. This broadcast did not consider the fading of wireless channels. It offered a significant performance advantage over the existing alternatives through selection of better relay vehicles. [16]have proposed a scheme that used the physical dimensions of the vehicles for the selection a vehicle for the next hop. They have proposed a routing scheme based on the height of a vehicle. The Line of Sight (LOS) was conducted geometrically by drawing a line segment

between the sender and the receiver and checking for any intersection of the segment by any other vehicle. The next hop was a vehicle selected based on the vehicle's physical location and LOS between the two communicating vehicles. The tall vehicle was significantly closer to the transmitter than the short vehicle.

[17]have proposed a secure and efficient threshold based event validation protocol for MH-relevant applications. This scheme converted probabilistic counting to threshold-based validation accurately and compared the counting and the threshold. This threshold-based validation scheme provided an accurate decision. [18]have proposed a contention based broadcasting protocol to increase emergency message forwarding. The emergency message could be broadcast by the multi-hop forwarders. It forwarded emergency information to the vehicles for longer distances before reaching the danger location. [19] have proposed a novel position-based multi-hop broadcast protocol. It selected the rebroadcast vehicles based on an additional coverage area of neighbouring vehicles, within the shortest waiting time. It also adopted the implicit and explicit acknowledgement answering mechanism. [20]have discussed a centralized routing protocol called trajectory-based routing.

In this scheme, each vehicle utilized future knowledge of the trajectories of the other vehicles in the network to identify a suitable inter-vehicle route over which the packets are delivered. The vehicle trajectories were identified using a location service in the RSUs. [21] have proposed a novel multichannel Time Division Multiple Access (TDMA) MAC protocol for a VANET scenario. It involved support to efficient single and multi-hop broadcast services in the control channel by using acknowledgments. It reduced transmission collisions by assigning disjoint sets of time slots to vehicles moving in opposite directions and road side units. Addressed the challenges in routing the packet in dynamic network topology and proposed distance based routing. It adopted both position and map based routing methods and reduced the network traffic for position information about the neighbouring vehicle.

## 3.Routing Protocol Approach

In the routing protocol, the network is divided into several groups of nodes, each is called a cluster. One cluster has the ability to communicate with another cluster through a cluster head. Members of a cluster forward the packet to the cluster header and then the cluster header forwards the packet to another cluster header. A node common to any two clusters known as a gateway node receives a packet from one cluster header and sends it to another cluster header. The cluster based routing is well suited for large networks as it provides good scalability. In VANET, it generates packet delays and increases routing overhead due to the high mobility of vehicles. The various cluster-based routing protocols are discussed in following sections. The Cluster head Gateway Switch Routing (CGSR) [22]protocol is entirely different from the previous protocol in the case of message forwarding and organization of the network.

CGSR is used in clusters communication network instead of a "flat" network. Clusters are formed using the election of a cluster head election procedure. Frequent changes in cluster head are avoided by using Least Cluster Change (LCC) algorithm. The cluster head is changed when two cluster heads come together in contact with each other or move away from the transmission range of all other cluster heads. Location Routing Algorithm (LRA) with Cluster-Based Flooding (LORA-CBF). [23] is a location-

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based routing algorithm with cluster-based forwarding of packets in vehicle to vehicle communication. Four stages are considered in this algorithm: the first stage is Cluster formation, the second stage is Location discovery (Location Request (LREQ) and Location Reply (LREP)), the third stage is Routing of data packets and the final stage is Maintenance of location information. The cluster is formed among the group of nodes in a network. The cluster head is selected within the cluster maintaining the cluster table. The cluster table contains information relating to geographical locations of members of the nodes and gateway nodes of the cluster. The routes are discovered using LREQ and LREP for forwarding the data packets. Maintenance of location information is easily achieved by cluster tables.

Novel Cluster-Based Protocol (NCBP) for topology discovery [24] in VANET is a position based routing protocol. This algorithm works on the basis of both vehicle connectivity and vehicle mobility. It provides for a quick convergence approach with load balancing, thereby improving the efficiency and scalability of VANETs. It also reduces control overhead with a variable mobility of vehicle. Passive Clustering Aided Routing Protocol (PassCAR) [25]is one of the cluster based routing protocols. PassCAR is used for improving routing performance in a one-way multi-lane highway environment.

During the route discovery phase, it finds participating nodes suitable for constructing a stable and reliable cluster topology. Each node in PassCAR is self-determined of its own priority to enable a node competing for a participant. The self-deterministic approach is a multi-metric election strategy is based on node degree, expected transmission count, and link lifetime. [26] have proposed an algorithm that used the information on the vehicle headings for calculation of possible link breakage prior to its occurrence. Vehicles are grouped according to their speed and the proposed scheme searched for a more stable route that included other vehicles from the same group, when a vehicle shifted to a different group and the route involving the vehicle was about to break. [27] have proposed a movement prediction based routing algorithm for predicting the future position of a vehicle and a search for a stable route. It analysed the location, direction, and velocity information of each vehicle and selected the route that was the most stable when considering the movement conditions of the intermediate vehicles with respect to the source and destination vehicles.

[28] have proposed a prediction based routing protocol for VANETs designed for the mobile gateway scenario and took advantage of the predictable mobility pattern of vehicles on highways. It predicted route lifetimes based on the range of communication, vehicles location, and corresponding velocities. It allowed the processing of multiple routing requests to check all the available routes to the destination and finalize the route that had the maximum predicted route lifetime. [29] have proposed a velocity-aided routing protocol that determined packet-forwarding scheme based on the relative velocity between the forwarding and the destination vehicles. The area for packet forwarding was determined by calculating the future route of the destination vehicle based on its location information and velocity. [30]have proposed a heuristic clustering technique for multi-hop routing in VANET. It used the geographic position of vehicles and the vehicles traffic information for building the cluster structure and also presented the stability of the proposed cluster structure, and communication overhead for maintaining the structure and connectivity in an application context. [31]have proposed a cluster formation technique using the affinity propagation

method for passing messages from one vehicle to another. It used two input functions, namely, similarity and responsibility. Each vehicle transmits responsibility and availability messages to its neighbours, and then makes an independent decision on clustering. When a vehicle's self-responsibility and self-availability become positive, that vehicle become a cluster-head for every clustering interval period. [32] have proposed a weighted clustering algorithm, which used parameters like ideal degree; transmission power, mobility and battery power of a mobile node are used for cluster formation. Cluster head election procedure was executed only when the existing cluster head left the path instead of periodic election. This on-demand execution aimed to maintain the stability of the network, thus lowering the computation and communication costs associated with it.

[33]have introduced distributed grid based robust clustering protocol for mobile wireless networks. They have proposed an algorithm based on grid based robust clustering and completely distributed without centralized authority and each vehicle independently made its decisions based only on location information. [34] have proposed an acknowledgment-based broadcast protocol for reliable message dissemination suitable for a wide range of vehicular networks. It employed local information obtained through periodic beacon messages, containing acknowledgments of the circulated broadcast messages. Vehicles were grouped into a connected dominating set based on local information. Vehicles in this set wanted for a particular time interval before retransmission. With the expiry of time, one of the selected vehicles retransmitted the message.

[35] have proposed the cluster based topology discovery algorithm to avail the advantage of k-hop cluster architecture to improve the network topology scalability. It also introduced the inter-cluster link expiration time to improve cluster stability with a capability of balance traffic loads and tolerate false routes. [36] have suggested another Clustering technique which is based purely on density and helps forming a stable cluster in this unstable network. In this method, clustering is done on several clustering metrics like connectivity level, link quality, relative node position and node reputation. The clustering metric is implemented in three phases. In the first phase, the node estimates its connectivity level which provides the information on whether the node belongs to a denser or sparser part of network. The second phase selects stable links and, in the last phase, the nodes reputation is determined from the communication history after which it is transformed into cluster member. The Algorithms were implemented in a multithreaded way, which comprises of three main threads responsible for the synchronized implementation of the algorithm. A real time simulation was performed using JiST/SWANS network simulator along with VANET Mobi-Sim where the cluster stability observed clusters of higher stability did change their cluster membership quite often. [37]approve a VANET clustering scheme uses Affinity Propagation to form clusters from a communications perspective and in a distributed manner. The mobile nodes use affinity propagation cooperatively to elect the most advantageous cluster head where the ultimate aim is to create a small number of clusters with high stability which is measured in terms of cluster head duration, cluster member duration and average rate of cluster head change. Cluster stability is determined using the similarity function. Message passing is achieved in two different ways: segregated and aggregated. [38] have proposed proactive routing

resources that the help directing data, similar next promoting hop is preserved in the related regardless of message requirements. The benefit of proactive routing procedure is that there is no path detection. Meanwhile, the end point path is kept in the contextual area, but the shortcoming of this procedure is the delivery of a low potential for actual time submission. A table is created and preserved inside a node. Subsequently that, each admission designates the subsequent hop node in the direction of a convinced end point. It also relates to the conservation of unexploited data track, which sources the decrease in the accessible bandwidth. The several kinds of proactive routing proprieties are: FSR, LSR.

## 4.MESSAGE REDUNDANCY PROTOCOL APPROACH

Security of VANETs is essential for meeting critical life threatening situations. It is necessary to ensure that vital information is not inserted or modified by a malicious person. The system should have the ability to determine the responsibility of drivers while maintaining their privacy. These problems in VANET are difficult to solve due to the speed of the vehicles, geographic position, network size, and the connectivity between the vehicles. [39]have addressed the challenges seen in the sharing of the limited wireless channel capacity for the exchange of safety-related information in VANET and the issue of broadcasting safety messages in a densely populated network. A fair power adjustment algorithm has also proposed the power control algorithm that found the optimal transmission range of a vehicle. [40] have proposed a scheme that secures geographic position-based routing. It focused on the scheme in the Car to Car Communication Consortium, with the proposal of a security mechanism to protect the position-based routing functionality and services like beaconing, multi-hop forwarding, and geo-location discovery for the enhancement of the network robustness. It has also proposed defence mechanisms for checks for mitigating false position injection.

[41] have classified a variety of applications into logical groups for getting a more concise picture of the applications and categorize envisioned applications from various sources and to classify the unique network characteristics of vehicular ad hoc networks. It also proposed five distinct communication patterns that formed the basis of almost all VANET applications. This pattern reflected the close coupling between applications and communication in VANETs shifting the focus to a more integrated system architecture. [42] have discussed a critical security threat in VANET particularly when an attacker disseminates false information to disrupt the behaviour of other drivers. They have also proposed the notion of proof-of-relevance which offered proof of the event report being authentically relevant to the event it has reported. It is accomplished by collecting authentic consensus, which is a digital signature on the event from witness vehicles in a cooperative way. Reports with less than threshold signatures were discarded.

[43] have discussed security challenges and requirements in VANET applications, security management, key management, secure routing and network coding. They proposed a secure and application oriented network protocol for both security requirements of the communications and the requirements of potential VANET applications and services. The proposed structure consisted of application aware control scheme and a unified routing scheme. [44] have proposed a distributed vehicle behaviour analysis and evaluation scheme. Each vehicle was assigned a trustworthiness value which could be exchanged among all the vehicles, building up good reputation. Based on this

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information, vehicles were classified into trustworthy, untrustworthy or neutral. [45]have proposed an efficient distributed certificate service model for Vehicular Ad hoc Networks.

It provided flexible interoperability for certificate service in heterogeneous administrative authorities and updated its certificate from the available infrastructure roadside units in regular intervals. This model has introduced an aggregate batch of vehicles with high probability. The results indicated the ability to achieve high reliability and short key dissemination time with low complexity. [46]have introduced the privacy preserving broadcast Message authentication protocol. The proposed protocol was based on the concept of a timed efficient stream loss tolerant authentication scheme, where the released key was disclosed after several intervals of time. It used two levels of hash chains for key generation, the high level and low level hash chain. The high level hash chain was used for the generation of seeds for the low-level hash chain. The low level hash chain was intended for authenticating the broadcast messages. The proposed protocol helped avoiding certain message losses.

[47]have proposed three graph-based metrics for the measurement of the redundancy of dissemination protocols and applied these metrics to baseline geo cast protocol, and aggregation protocols using extensive simulations. VANET uses multi-hop broadcasting for the dissemination of real time traffic information. An emergency situation is conveyed to the surrounding vehicles on its occurrence as early as possible. Priority is given to emergency messages. [48] have proposed a communication protocol for cooperative collision warning. The emergency warning protocol used congestion control policies, service differentiation mechanisms and methods for emergency message dissemination. Congestion control was achieved using a rate adjustment algorithm. This protocol reduced the amount of congestion in the network and also the number of redundant emergency warning messages.[49] have proposed an algorithm for the hierarchical aggregation of observations in dissemination-based traffic systems with duplicate insensitive. It was based on a probabilistic data representation. It selected one of the aggregates for further use while the rest was discarded. [50]have discussed the problem of services that can provide car drivers time-sensitive information about traffic conditions and roadside facilities. They have proposed the Vehicular Information Transfer Protocol (VITP), to support a distributed service in Vehicular Ad-hoc Networks and introduced the concept of the vehicular ad-hoc server, which was established on-demand as an ad-hoc collection of VITP peers that collaborate to resolve incoming VITP requests.

The vehicular information transfer protocol had the expressive power to define location-aware queries seeking and integrating information from vehicle sensors and roadside facilities, taking advantage of on-board GPS navigation systems. [51]have discussed a new message priority scheme, which was assigned on the basis of message urgency associated with different quality of service in terms of average delay and normalized throughput. It investigated the use of IEEE 802.11e to provide priority-based service differentiation, with application of a repetitive transmission mechanism that provided proportional reliability differentiation for each prioritized message.

[52]have proposed a novel position-based directional vehicular routing scheme for sending packets to destinations through an efficient and stable route. It was a multihop routing scheme, which selected the next-hop from vehicles travelling in the same direction as the forwarding

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vehicle based on their angular directions relative to the destination, the neighbour vehicles' position and velocity vectors. [53]have discussed the challenges in VANET and inter vehicle communication. In the dynamic environment of VANET, increase in the number of redundant broadcast messages triggered an increase in resource utilization, which indirectly reduced the network performance. The proposed algorithm used counter-based protocol for information dissemination. This scheme helped the vehicles in deciding on whether to rebroadcast or discard the received messages based on threshold values.

[54]have discussed taking up the authentication of safety messages and its challenge in a high density traffic scenario. A solution to the vehicular message authentication in dense traffic conditions using a prioritized verification strategy was proposed. It used the physical parameters of the neighbouring vehicles to assign different priority scores for the safety messages. In a heavy traffic condition when the resources are scarce, a verifier randomly authenticated the selected received messages according to their priorities. [55]have proposed a metric to investigate the degree of redundancy in different types of information dissemination protocols. They have presented extensions of the metrics and performed extensive simulations to show the ability to achieve sufficient data redundancy for consistency checking the cost of higher bandwidth usage and smaller information dissemination areas or reduced information utility. [56]have indicated a new scheduling algorithm to satisfy the quality of service levels for different classes of applications based on the requirements. Applications of VANET were classified into different safety perspective and used a greedy algorithm to ensure the traffics of high priority application in safety serving at the appropriate time.

## 5.BROADCAST STORM REDUCING PROTOCOL APPROACH

The impact of broadcast storm problem finds mention in several papers. But not all of the proposed solutions provide consequences to remedy this problem. The Broadcast Storm Problem may produce a high message overhead, broadcast collision, dissemination postpone, etc. Emergency safety motive requires the message to exceed with none interruption inside the short time period. Emergency protection message dissemination is a time critical occasion, so it is highly crucial to investigate the time parameter even as disseminating the emergency message. Because most of the proposed algorithms had been analyzed for single directional message dissemination schemes, [57]have prompted the suggestion of a brand new Broadcast Storm Suppression Algorithm (BSSA) in a multi directional dual carriageway community scenario. The principal goal in this paper was to suggest a new BSSA that would dynamically adapt the vehicle's location based on the adaptive localization technique to broadcast the emergency safety message based totally on the methodology named as a Selective Epidemic Broadcast (SEB) algorithm. The SEB algorithm reduces the published Broadcast Storm Problem with selecting the automobiles that have dispatched the passive acknowledgment best. The passive acknowledgment suggests the car which wants to communicate with the source vehicle that initiated the transmission.

[58] have proposed a brand new approach referred to as Dynamic Broadcast storm Mitigation Algorithm (DBSMA) which may be used to resist the broadcast storm problem in a Vehicular Network (VN). A DBSMA idea was defined, the development and derivation steps described and offered. The DBSMA performance

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turned into evaluated towards the DCC and the Hi-cast techniques and its outperformance was observed and verified in all situations of mobility conditions. The end result from numerous figures confirmed the potentiality of DBSMA to overcome the effect of broadcast storm via presenting a higher than a hundred and fifty percentage superior efficiency towards the Hi-cast method at lower velocity. Another advantage of the DBSMA is that it is far simple to compute and to implement.

The implementation of the broadcast message in VANET can also be the reason for several troubles consisting of broadcast storm problem in a dense area network and reliability of broadcast transmission. Thus there are numerous publications published dealing with the accomplishment over those issues. The priority based broadcast scheme can be used for mitigating the storm. In [59] have proposed the categorization of nodes into multiple instructions which constitute the priority of messages and schedule the messages on the basis precedence. The emergency message has the highest priority. As a result, the node may be granted with a small waiting time, with ability to access the channel as fast as possible. However, in traffic accident scenario, the traffic can be ruled with an emergency message, so the concern precedence categorization will now not affect a whole lot in suppressing the printed typhoon.

[60]have proposed a DLAR protocol which is an improvement of the LAR protocol that makes use of vicinity facts to minimize the routing overhead of the ad-hoc network. The ideas of DLAR are based entirely on the following principles. First, all the ones nodes on the same routing path which have the same shifting course and much less pace distinction preserve the path with higher solidity (longer connection time). The second idea is the application of AODV as a route discovery mechanism on top of LAR and picks the next relay node on the basis of the transferring course of the supply node. The third concept is the appointment of the AODV nearby repair mechanism for RREQ message to find the vacation spot node on the disconnected function. The fourth concept is to the restriction of the scope of RREQ broadcast region (request zone) to avoid broadcast storm through decreasing RREQ packet quantity.

[61]have proposed broadcast routing which is generally utilized for information dissemination relating to weather conditions, emergency and warning alerts and road conditions. In this routing method, the packet is sent to all other vehicles in the network using flooding. When message the needs dissemination beyond the radio transmission range, a multihop mechanism is utilized. Thus, in a pure broadcast implementation, all receiving vehicles simply rebroadcast the received messages resulting in a broadcast storm problem. The broadcast storm problem occurs when multiple nodes attempt simulations transmission, causing packet collision and extra delay at Medium Access Control (MAC) layer. A broadcast message is sent only once by using a time to live parameter for avoiding message duplication. But there is degradation in the performance of this routing scheme with the increase in network size. Therefore, designing a broadcast protocol for VANET requires consideration of two major problems, namely, the broadcast storm problem and the disconnected network problem. The disconnected network problem occurs when the number of nodes in the area is not sufficient to help disseminate the broadcast message. The broadcast routing suggested for VANETs defines the following three schemes such as the broadcast problem, [62]Vehicular Broadcast Protocol for Vehicular Ad

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Hoc Networks (DV-CAST) and Broadcast method for V2V communication. The urban multi-hop broadcast (UMB) protocol is an 802.11-based solution targeted at reducing the broadcast storm and hidden node problems while maximizing the reliability.

[63]point out the broadcast storm is minimized only by allowing the farthest vehicle which receives a message to forward it. For this, after successfully receiving a message, vehicles issue a black-burst jamming signal whose duration is directly proportional to the distance between the transmitter and the receiver. When the signal transmission ends, the vehicle listens to the medium to as certain if other neighbours transmitting a black-burst. If not, that vehicle is the farthest one from the transmitter and forwards the message. The hidden node problem is addressed through addition of a Request-To-Broadcast (RTB) and Clear-To-Broadcast (CTB) exchange, similar to the case of unicast messages. In addition, reliability is expected to be improved via acknowledgment messages (ACKs, also like unicast). The protocol is designed for dense urban scenarios, with intersections and streets in several directions.

Along each street, directional broadcasts take place in the direction of the message propagation. UMB assumes that a repeater is deployed at each intersection, thus initiating directional broadcasts along each of the converging streets. There is also a version of the protocol which substitutes repeaters for regular vehicles which cross the intersection, thereby eliminating the need of infrastructure. [64]have proposed a mechanism for dynamic control of the communication range by adjusting the transmission power for mitigation of the effects of the broadcast storm. They have discussed multi-hop broadcasting specially in a shockwave scenario which separates the traffic into two streams with different densities and speeds. When the first vehicle of the following stream meets the last vehicle of the leading stream, it senses the danger and immediately sends a broadcast message to all nearby vehicles as caution to reduce speed.

[65]have proposed The Last One (TLO) broadcast method to reduce end-to end delay and broadcast storm problem, and the broadcast storm problem using probability to choose the vehicle for the rebroadcast of an alert message. When a vehicle receives a broadcast message for the first time, the vehicle rebroadcasts the alert message with random probability. This method helps reducing the number of rebroadcasting vehicles and, thereby the broadcast storm problem. This method could not fully ensure avoiding broadcast storm. It just reduced the chances of its occurrence. But this algorithm suffered when GPS provided incorrect information between 1-20 meters. [66]have indicated two possible solutions for mitigating the effects of the "broadcast storm problem", which are to reduce the possibility of rebroadcasts or to differentiate the timing of rebroadcasts. There are five possible schemes proposed by the author to alleviate the broadcast storm problem. First, a probabilistic scheme aims at limiting the number of rebroadcasts.

When a node receives a broadcast for the first time, the message is rebroadcast with a probability P. Second, Counter-based broadcast is used for preventing the rebroadcast of a message when the Expected Additional Coverage (EAC) is low. The authors showed that, when $k \geq 4$ there was a drastic decrease in the additional coverage of a rebroadcast. A counter was used for keeping track of the number of times that a message is heard being rebroadcast before a node has a chance to rebroadcast the message. The counter base

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scheme prohibited the rebroadcast when $c \geq C$, with c the being the number of times a broadcast was heard and C the counter threshold. Third, the distance-based scheme rebroadcast a message depending on the distance between the sender and receiver. The variable Dmin was used for recording the distance between the sender and receiver of a broadcast. When Dmin was less than the D threshold value, the broadcast was prohibited from being relayed.

In this scheme, the distance between the sender and receiver was calculated based on the transmitted and received power. Fourth, location-based scheme allowed calculation of the coverage area with more precision than in the previous schemes. A GPS device is used to record the points used in the broadcast. When the additional coverage of a message was greater than a predetermined threshold, the message was rebroadcast. One possible solution was the calculation of the additional coverage area based on convex polygons. The last scheme was the cluster-based scheme, where the network is partitioned into clusters.

## 6.VANETS MOBILITY MODELS APPROACH

In vehicular networks, moving vehicles showed follow the mobility pattern constraints of the road. Unlike, in MANET, the vehicles may not change direction while movement in a road change of direction is permitted only in the intersections of road. Different mobility models are designed in vehicular networks for producing mobility traces that find use in routing protocols during simulation. The different types of mobility models are described in the following sections. The Freeway Mobility Model (FMM) [67] is well suited for highways environment suggested by considering vehicles moving on freeways. The map given in FMM has several freeways with multiple lanes. The movement of vehicles is restricted to their respective lanes. The velocity of a vehicle depends on that of the forwarding vehicles due to the maintenance of security distance are between vehicles. Each vehicle starts moving in the beginning of its lane and ends at the same lane when it reaches the end point. It is again placed randomly on a selected this process is repeated.

The Manhattan Mobility Model (MMM) is an urban environment-based mobility model. This mobility model uses a grid topology. Hence, vehicles move in a horizontal or a vertical direction on the road map. In MMM, a vehicle can reach any of the intersections and be allowed to take the diversion either to left or right or continue in the same direction with a certain probability. In this model, there is no control mechanism at junction, thus this model is unrealistic.

The City Section Mobility Model (CSMM) [68] is a grid road topology in a city environment. In CSM, the travel behaviour of vehicles on a is severely restricted. CSM is a hybrid model between Manhattan and Random Way Point (RWP) [69]mobility models. CSM follows the principles of RWP, where vehicles select any direction at an intersection and move towards the destination. Security distance is maintained between vehicles to avoid collisions.

Stop Sign Model (SSM) is a city based mobility model. In the city environment, every intersection has a stop signal at an intersection. The vehicles that reach the intersection stop for a specific duration. In this model, vehicles travel one by one in a single lane maintaining security distance between them. Overtaking of vehicles is not permitted, unless it is a multi-lane road. The vehicles are not coordinated at intersections due to

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movement in different directions. The Probabilistic Traffic Sign Model (PTSM) [70] is an improvement in the city based mobility model. In PTSM, waiting time of the vehicles in a queue is probabilistically calculated. When a vehicle reaches an intersection, it stops at the red signal with a probability ρ and it crosses the intersection when the signal turns green with a probability (1 – ρ). For any vehicle that arrives near the intersection of a non-empty queue, waiting time is calculated as remaining from the previous node plus one second. When the signal turns green, the vehicles begin to cross the intersection in the duration of one second. Similar to SSM, the vehicles are not coordinated at intersections due to their movement in different directions.

Traffic Light Model (TLM) is an improvement in both SSM and PTSM. In TLM, the vehicles are coordinated at intersections and vehicles travel in single lanes and multi-lanes. The information relating to the position of intersections is provided by the map which is installed in every vehicle in a network. When signal light turns green, vehicles in the single pair of opposing lanes cross the intersection simultaneously. The vehicles can turn left or right, based on free turning rule but reach the head of queue concept. After a certain period of time, vehicles in different pairs of opposing lanes start crossing the intersection when the signal turns green. In TLM, two actions, namely, acceleration and deceleration are performed by vehicles. In acceleration, vehicles cannot increase the speed immediately from the rest stage. Similarly, stoppage of vehicles when they approach the red signal is known as deceleration.

## 7.VANET IN RURAL AND URBAN SCENARIO

[71] point art to VANET as a subsidiary of Mobile Ad hoc Network (MANET). It helps the establishment of wireless message among the automobiles in the street adjacent apparatus and the vehicle. Currently, Intelligent Transportation System (ITS) has the main influence on enlightening the excellence and competence of the transference system. Once exchange between extravagance and safe application of VANET is delayed vehicles make enquiry of data of any other vehicles over multi hop substructure. Despite the data affecting VANET, it suffers from recurring disruptions due to recurrent flexibility and occasionally linked network arrangement. In this broadside, training and comparison of the three routing protocols, namely, AODV, DSR and DSDV have been completed. The examination has been restrained and assessed in mutually rural and urban environments. In contrast to the negative deduction of preceding works, joining the organization correctness is enhanced in the directing procedures used. The projected system examines the vehicle thickness, data droplet, and output and end-to-end delay. Experiments on the consequences from the procedure of high through put and little packet drop DSR display better presentation likened to DSDV and AODV in rural setting and urban high density area, while AODV displays better presentation in assessment to DSR in a VANET atmosphere that is of low thickness.

Broadcast is an effective way to disseminate information for cooperative routing protocols in ad-hoc wireless networks. An emergency intimation broadcast protocol which provides safety-related information in VANET to ensure faster message delivery. The neighbours are initialized and a common range is created for testing. Based on the distance between the source and the destination, beacon message is created with indication of the emergency condition. Source node

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broadcasts emergency message to its neighbours in the network.

DSR also supports internetworking between different types of wireless networks, allowing a source route to be composed of hops over a combination of any types of networks available [72]. For example, some nodes in the ad hoc network may have only short-range radios, while other nodes have both short-range and long-range radios; a combination of these nodes can be considered by DSR as a single ad hoc network. In addition, the routing of DSR has been integrated into standard Internet routing, where a node connected to the Internet also participates in the ad hoc network routing protocols; and has been integrated into Mobile IP routing, where such a gateway node also serves the role of a Mobile IP foreign agent Perkins [73].

[74] have proposed the urban-rural edge that has typically been considered from the opinion of assessment of cities with altered sectorial benefits and actual slight from rural viewpoints. Yet, these types of parts are essential for deliberation from both points of view and from wide-ranging methods that could reproduce their difficulty. Thus the effort is concerned with the style of a proportional examination of two main methods to commence with the rural-urban border in a Latin-American setting: one pending from cities and further from geography, where both have maintainable comprise and a regional viewpoint of growth. The examination has gone into explanation, financial, social, ecological and political-institutional problems, in addition to urban-rural connections. Results underscore some aids to such methods for modelling and repetition of the preparation and organization of these places, such as the cost of a multifaceted schemes view, preparation in dissimilar three-dimensional scales and time situations, the region as a provision of socio-economic and ecological procedures and the part of resident performers in this alteration. To conclude, rural growth has been rising as a developing arena where average and small size settlements show a significant role in connecting construction with local and worldwide markets and applying rural-urban relations in urban organizations.

## 8.Conclusion:

The huge impact of VANET in fields like networking, automobile, transportation and security. Has triggered research works on this subject. This chapter has summarized the various exiting VANET works on the areas of broadcasting, routing approach, security, content prioritization, V2V dissemination, VANET in urban and rural environments and the different kinds VANET mobility models. Several routing protocols with their merits and drawbacks have been seen.

| Literature | Approach(es) | Strength(s) | Weakness(es) |
|---|---|---|---|
| Khan and Cho[74] | Distance based scheme. The distance inversely proportional to the initial waiting time. | Bandwidth utilize effectively, less delay time, highly reachability. | The receiving packet time is monitoring.it is waste of time and also reduce the efficiency. |
| Aadil et al.[75] | Speed based selection. The data packet forwarded | Cluster based performance. The stable clustering, | Weights factoring assigned by each parameters. |

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| | | | |
|---|---|---|---|
| | using colony optimization. | optimization cluster member per cluster. | |
| Nguyen et al.,[76] | The data packet store-and-carry forwarder the neighbor vehicle. | High efficiency and reachability | It is higher collision ratio during more vehicle density. |
| John sospeter et .al.,[77] | Effective and efficient adaptive probability data dissemination(EEAPD) protocol ,delay schemes and probability | The rebroadcast the emergency message based on probability decision. | It increase redundancy ratio and reduce the throughput of the real time environment. |
| Wenjie wang et. al.,[78] | A local information sensing based scheme for safety message. | Selecting minimum number of gateways based on the set cover. The high level of transmission reliability. | High bandwidth consumption. |

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