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The Study "Insightroads: Exploration of Data Dissemination Techniques for Ensuring Safety in Vanets"

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ABSTRACT –

Vehicle Ad Hoc Networks (VANETs) are ad hoc networks created for Intelligent Transportation Systems (ITS) in which vehicles communicate with one another to improve driving effectiveness and traffic safety without depending on a centralised infrastructure. To increase road safety, efficiency, and comfort, these networks allow vehicles to communicate data via sensors, GPS, and communication systems. By assuring accurate message transmission and lowering delivery delays, data dissemination mechanisms used in VANETs serve to further improve driver and passenger safety, productivity, and comfort. The existing literature on Vehicular Ad Hoc Networks (VANETs) includes a variety of proposed mechanisms for data dissemination. This paper aims to conduct literature review to examine the data dissemination techniques for safety applications in VANETs.

Keywords: *VANET, ITS, Data dissemination, delay tolerant, delay sensitive, safety, DSRC*

1.0 INTRODUCTION

Vehicular Ad Hoc Networks (VANETs) are interconnected collection of autonomous vehicles. Traffic congestion cost the US economy $101 billion in 2010 alone, according to scientific research from the Texas Transportation Institute. Similar to the United States, the cost of traffic congestion in Europe is $50 billion annually, or 0.5% of the GDP of the region. The technical report from the Commission for Global Road Safety also emphasizes the devastating effects of traffic accidents. It shows that at least 1.3 million people die and 50 million are injured in traffic accidents every year [1]. In order to address aforementioned problems and improve transportation safety, security, and effectiveness, researchers have been working on the development and implementation of intelligent mechanisms and technologies. This has prepared the way for the creation of new concepts such as Intelligent Transportation Systems (ITS) and a novel generation of wireless ad-hoc networks known as Vehicular Ad-hoc Networks (VANETs). The rest of the paper is organized as follows. The Introduction section is further divided into the following sub-sections -1.1 ,1.2 ,1.3 ,1.4. The sub-section 1.1 species differences between VANET and MANET, sub-section 1.2 provides communication modes and IEEE standard followed by VANET, sub-section 1.3 provides characteristics of VANETs, and 1.4 illustrates applications of VANETs. Section 2 presents different data dissemination schemes for VANETs and sub-section 2.1 describes data dissemination systems for safety applications and also provides comparison of the different methods for safety applications in VANET. Finally, the last section concludes the study.

1.1 VANET vs MANET

"VANET" refers to a subset of Mobile Ad-hoc Networks (MANETs) in which all nodes are vehicles moving at different speeds. VANET's major goal is to make it possible for automobiles to communicate with each other and with roadside infrastructure [2]. Movement, self-organization and lack of infrastructure are some of the similarities between MANET and VANET, but few of the distinctive features of VANETs are as follows:

- Unlike MANETs, nodes in VANETs don't have power and storage limitations;
- The topology of VANETs is considered highly dynamic because it is constantly changing due to the different speeds of the vehicles;
- Moving pattern of nodes is random in the MANET while vehicles in VANET tend to move in an organized fashion in VANET due to road structure, traffic rules and regulations [2].

1.2 Communication modes and Standard–

There are 3 types of communication modes in VANETs- V2V (Vehicle to Vehicle), V2I (Vehicle to Infrastructure), I2V (Infrastructure to Vehicle). Each vehicle is equipped with OBU (On-board unit) and AU (Application unit). An AU is a device that runs one or more apps while utilizing the communication capabilities of the OBU, whereas an OBU is a device in the vehicle with communication capabilities (wireless and/or wired). Both AU and OBU logically different, can coexist in the same physical unit. All modes of communication are through the IEEE standard – WAVE [3], [4]. The IEEE 802.11p communication standard is the result of work done by the 802.11 task force group. This new standard, also known as the Dedicated Short-Range Communications (DSRC) standard, is based on the 802.11a technology. One control channel (CCH) and six service channels (SCHs) make up the seven channels (10 MHz each) of the 5 GHz frequency spectrum that is used by DSRC. Wireless Access in Vehicular Environment (WAVE) developed from DSRC has significant applications in ITS, vehicle safety services, and Internet access. It supports high-speed V2V and V2I communications, utilizes Orthogonal Frequency-Division Multiplexing (OFDM) and works between 5.850 and 5.925 GHz, achieving data speeds of 6–27 Mbps and a maximum area of coverage of 1000m [5]

1.3 Characteristics of VANETs – [4],[5],[6],[7]– [9]

- Unlimited transmission power: Since the node itself can supply continuous power to communication equipment, power constraints are not a barrier in vehicular networks as they are in the case of conventional ad hoc or sensor networks.
- Greater computational power: Operating vehicles can actually afford significant computing, networking, and sensing power.
- Mobility that is predictable: Unlike traditional mobile ad hoc networks, where it is difficult to forecast the nodes' motions, automobiles frequently travel in predictable patterns that are (mostly) restricted to road layouts. Map-based technology like GPS and positioning systems are frequently able to provide information on roads. The future position of a vehicle can be forecasted using the average speed, present speed, and road trajectory.
- Potentially high scale: Vehicular networks cover the entire road network and hence involve a large number of nodes, in contrast to most ad hoc networks which normally assume a constrained network size.
- High mobility: The network environment is quite dynamic, and relative vehicle speeds can range from 60 to 300 km/h.
- Network disconnection: Because vehicles are continually moving and changing their positions, the links between nodes often connect and disconnect, causing rapid topology changes.
- Heterogeneous applications: Safety applications (high priority) require a short delay and high reliability and non-safety applications require a large throughput but not a fast message delivery.
- Network density: According to the location (high traffic density in urban areas and low in rural areas, and highway), and the time of day (low traffic density during night hours, heavy traffic during morning, evening hours), network traffic density can range from high to low.

1.4 Applications of VANETs –

VANET applications can be divided into two basic categories:(i) Safety and (ii) Comfort applications.
Examples of both the categories has been illustrated through a Fig.1 [8][6], [10], [11]

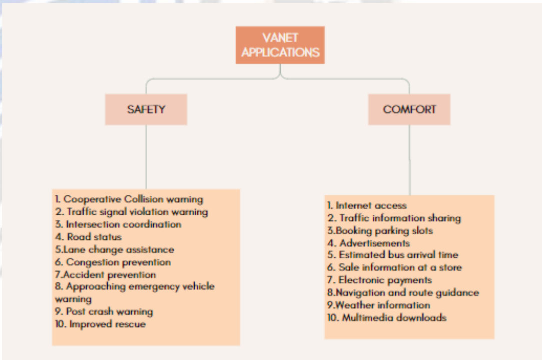

Fig.1: Applications of VANET

2.0 DATA DISSEMINATION SCHEMES.

Three models—a pull-based model, a push-based model, and a hybrid model —are primarily used for data dissemination in the two major applications of VANET, namely safety and comfort. The push-based paradigm is typically utilized for safety or delay -sensitive applications (which require fast response and high reliability), whereas the pull-based model is used for comfort or delay-tolerant applications (which don't need short delay but require high throughput). Dissemination of data occurs on demand in the pull-based but it occurs through periodic broadcast in push-based approach. Combining the pull-based and push-based models results in the hybrid model [8], [10]

[8] provide opportunities and challenges faced during data dissemination in VANET along with review on current data dissemination techniques in VANET. The authors emphasize

on the comparison of the data dissemination techniques for delay-tolerant and delay-sensitive data dissemination in VANET.

M. Chaqfeh et al. [10] present three models -push, pull, hybrid for data dissemination for VANETs along with example applications for each model. They mention current approaches to performance modeling for data dissemination along with dissemination optimization options.

A survey on broadcast message dissemination methods is presented by Julio A. Sanguesa et al. [12]. The authors primarily concentrate on single-hop and multi-hop data dissemination systems for message broadcasting. Also, Multi-hop dissemination techniques are classified as flooding, beacon, topology-based, distance-based, store-and-carry broadcast, and stochastic broadcast systems. They evaluate existing methods and compare them while maintaining the same simulation platform simulation parameters and performance metrics.

R. Gheblah et al. [11] present an extensive survey on information dissemination in Vehicular networks and in the survey the existing information dissemination systems are divided into eight new groups based on QoS, adaptive, clustering, timer, push, pull, and hybrid-based protocols. The paper also provides a comprehensive assessment of each class based on its features, advantages, and optimization goals.

Sami et al. [7] present a study that looked into numerous approaches and reviewed the literature in order to create a model for effective data dissemination in VANET. According to the authors, strict QoS requirements of the ITS safety applications is the main challenge behind developing a robust but reliable data dissemination technique. The existing Data dissemination methods are classified based on Quality of service (QoS), Delay, Probability, Push, Pull and Cluster-based data dissemination. It also provides comparison of the different data dissemination protocols.

In [13], the authors list the difficulties that VANETs face, which have an impact on the effective transfer of information between vehicles. They suggest a clustering technique to overcome these problems. In the paper, they specify that the search range that the vehicle utilizes to detect whether or not a cluster head (CH) is present is measured using a specific variable called R-of-CH (range of CH). If it discovers a CH, it associates with it and declare itself a cluster member (CM), or if it does not find a CH, it may declare itself a CH and associate with the CMs within its range. It is then the responsibility of the chosen cluster heads to spread data within their respective clusters.

In [14], the authors propose a multi-head clustering technique that forms clusters in a vehicular network using metrics that are dependent on mobility. The suggested technique assumes that each vehicle might belong to several clusters, resulting in stable clusters that are resilient in this setting.

Primary focus of the paper is study of clustering protocols that not only minimize the number of cluster heads but also maintain the stability of the cluster-based topology with the least amount of overhead [15]

2.1 Data dissemination systems for safety applications

Strategy 1: Most of the broadcast approaches for safety applications don't focus on bi-directional and multi-directional dissemination of emergency messages rather only emphasize on directional broadcast in highway scenarios. Hence [16], proposes Urban Multi-hop broadcast protocol (UMBP) to be used in vehicular ad hoc networks (VANETs) for supporting safety-related applications that require low latency, high reliability, scalability, and other quality-of-service (QoS) requirements.

In the urban setting, a traffic accident may happen on a road or at an intersection area, which initiates an emergency message. If the source node is located on a straight road, the emergency message is bi-directionally broadcast to nearby nodes at the first hop, and a single relay node is chosen in either direction of the source node to forward the message. However, if the source node is in an intersection region, then the message has to be broadcast in multiple directions and one relaying node is chosen to convey the message in each road branch. The message is directionally disseminated from the second hop, and only one relay node is chosen in the direction of message propagation, with the exception that the forwarding node locates in intersection area.

The following three steps make up the new method that UMBP devises to accomplish effective bi-directional broadcast at the first hop: The emergency message is broadcast directly from the source node, candidates for forwarding nodes are chosen in each direction using the black burst mechanism, and candidates for forwarding nodes in each direction compete by sending an enhanced RTS (eRTS). This approach enables the emergency message to seamlessly cover the target area. Results from simulation (in NS-2) show that the protocol is effective in rapidly disseminating emergency messages while also reducing redundancy and increasing message reliability.

Strategy 2: In [17], situation -adaptive beaconing approach that is dynamically adjusting the frequency of the beacon while ensuring accuracy, has been suggested for inter-vehicle communication. Two types of rate adaptation schemes are discussed - those that depend on the movement of the vehicle itself (Velocity, acceleration, yaw rate, special vehicle) and those that depend on the movement of nearby vehicles or the road traffic condition (Vehicle density, Close by vehicles, crossing vehicles, high relative speed).

The speed of a vehicle is the first factor which affects beacon frequency. Beacon rate should be increased for higher velocities of vehicles and also internal sensors of the vehicle could cause a higher beacon rate in case of acceleration, deceleration. Emergency or special vehicles have increased beacon rate as their position information must immediately and accurately reach the other vehicles to make a way for it. If the vehicle density is high, the beacon rate should be decreased to proactively reduce the offered load. Vehicles that are in close proximity to one another or vehicles crossing their ways demand a higher beacon rate.

[18] describes the G-SRMB protocol, an extension to the SRMB protocol that incorporates geographic information to improve the reliability of broadcasting in safety applications. In the G-SRMB protocol, each vehicle selects a set of 1-hop neighbours as forwarding nodes or Multipoint relays (MPR) within a certain distance range, which is determined based on geographic information (e.g., GPS coordinates). When a vehicle wants to broadcast a message, it first determines which of its neighbours are within the desired broadcasting range and then uses the SRMB protocol to broadcast the message to those neighbours.
When a vehicle receives a packet from neighbour and then determines that it is a MPR of the source node, then it checks if the distance between both the nodes is less than or equal to minimum broadcast distance (the shortest distance that the data dissemination should cover to meet the needs of safety applications) and also checks the dissemination direction (the direction in which data has to be disseminated), then it selects its own set of MPR and broadcasts the data, otherwise it sends an empty packet acknowledging the last transmission. The number of redundant transmissions is considerably reduced or decreased using this method and it also the needs of emergency messaging in terms of end-to-end delay and reliability.

[19] proposes street- based broadcast scheme incorporating a "smart relay" mechanism to improve message delivery rates in urban areas. When a vehicle senses an accident, it becomes the source node for periodically broadcasting an emergency packet. When a vehicle receives an emergency broadcast packet, it records the most recent emergency broadcast packets and decides whether or not to rebroadcast the packet and also discards any redundant ones. It then checks if all its 1-hop neighbours that are on the same street as this node have received it. If so, it need not re-broadcast the packet, otherwise it checks it is the farthest node from the sender node on the current street, then it becomes the sender node and re-broadcasts the packet.
Street-based broadcasting can get around the intersection and shadowing issues. To address connection hole issues as well, a smart relay is introduced. In this method, each vehicle has two tables- neighbour table (stores ID and location of 1-hop neighbours) and emergency table (stores recent emergency messages received). When the vehicle doesn't meet a new neighbour ,it periodically broadcasts basic hello message, but when it meets a new neighbour, it updates the broadcast with extended hello message. When receiving extended hello message from a neighbour, emergency lists in both the vehicles are compared and if any emergency message is missing in the neighbour, the vehicle re-broadcasts the missing message.

Strategy 5: Motivation in [20] was to develop a scalable information dissemination technique that can effectively operate with high reliability and minimal delay in a variety of network conditions. According to their severity, safety messages are split into three groups (class-one, class-two and class-three) and given three separate priorities.
The highest priority or class-one messages (emergency warning messages like vehicle accidents, dangerous road conditions) are sent using one-hop, multicycle broadcasting, followed by class-two messages which are long-range emergency notification messages (like post-accident notification) sent using multi-hop one cycle broadcasting, then are the class-three beacon messages (or periodic safety messages) sent using one-hop one cycle broadcast. Emergency broadcast messages are sent along with a long-range multifrequency busy tone, which is used to remove hidden terminals.
When a vehicle transmits an emergency packet (class-one or class-two message), one or more nearby nodes that have successfully received the packet are chosen to relay the message. For relaying the message, a candidate node with a greater directional distance from the sender is preferred in order to potentially reach the larger area where the nodes missed the broadcast message. Redundant relaying nodes are configured to handle potential failures of multi-hop message delivery in order to ensure reliable broadcast.

Strategy 6: In [21], a trinary partitioned black-burst-based multi-hop broadcast protocol (3P3B) for dissemination of emergency messages is proposed. Mini-DIFS (Mini distributed interframe space), trinary partitioning, and collision handling followed by data transmission make up the three phases of the protocol.
Mini-DIFS is a channel access method which enables time-critical messages to access a channel more quickly and with less contention. The messages only hold out on accessing the channel for a fraction of the DIFS period rather than the entire DIFS period. As a result, the mini-DIFS gives high priority to emergency messages. When the mini-DIFS timer expires, the sender sends an RTB (Request-to-broadcast) packet and waits for the CTB (Clear-to-broadcast) packet from the next-hop forwarder. The hidden terminal and broadcast storm issues are resolved using the RTB/CTB. A black-burst message, or the jamming signal, is simultaneously transmitted by any vehicles within the sender's communication range that receive the RTB message. The sender assumes there is at least one potential forwarder when it receives the black-burst

message. Trinary partitioning will now begin. Otherwise, the sender deduces that there isn't a candidate forwarder. As a result, the sender waits for a set amount of time before restarting the mini-DIFS procedure.

Three iterations are used in trinary partitioning. In the first iteration, potential forwarders divide the sender's communication range into three partitions (inner, middle, and outer partitions). Using the location data, the possible forwarders then identify the partition that belong to them. All potential forwarders will carry out the following tasks during a single iteration of the trinary partitioning process.

1) The possible forwarders who are all located on the outer partition will all simultaneously broadcast a black burst only during the first time slot, proving that they are the most qualified candidates for forwarding in this iteration.

2) If the potential forwarders in the middle partition do not hear a black burst during the 1st time slot, they broadcast black burst during the 2nd time slot, otherwise they will leave the trinary partitioning because they believe the outer partition has better forwarders. The same is repeated by the forwarders in the inner partition.

After the 1st iteration, in the 2nd and the 3rd iteration, vehicles in the selected partition are divided further into three sub partitions and the same process is repeated for the new formed partitions. Following the third trinary partitioning iteration, the candidate forwarders in the chosen partition will select their back-off times at random from the available contention windows. The candidate forwarder whose back off expires first will be selected and will broadcast a CTB packet. Collided messages are then retransmitted in the collision handling and data transmission phase to increase Packet delivery ratio.

Strategy 7: In vehicular ad hoc networks (VANETs), safety messages have to be disseminated to ensure that as many vehicles as possible are receiving it but care must be taken to mitigate the broadcast storm problem. In [22] , the enhanced Street Broadcast Reduction (eSBR), a unique VANET-based technique for reducing broadcast storms in real urban environment which uses street map and location information is introduced.

There are two operating modes for vehicles: warning and normal. Vehicles in warning mode periodically transmit warning messages to other vehicles to let them know their status. At the MAC layer, these communications are given the highest priority. In addition to periodically sending beacons with information about their positions, speeds, and other characteristics, normal mode vehicles also permit the dissemination of these warning packets. Beacons have a lower priority than warning messages and are not transmitted by other vehicles. Each vehicle is only allowed to propagate warning messages once for each sequence number, i.e., older messages are discarded.Every vehicle periodically repeats warning or beacon messages with varying periods. Each vehicle maintains a list of messages and when a new message is received, the vehicle checks to see if the message has already been received. If not, then it is rebroadcast to the nearby vehicles only when the receiver is on a separate street from the sender or the distance between the sender and receiver is more than a distance threshold D. Two vehicles are considered to be in different streets if both are actually on different roads or the receiver is close to an intersection even though it is on the same street. If the message is a beacon, it is simply ignored because the algorithm doesn't propagate beacons.

Strategy 8: In order to shorten the time needed for dissemination and maximize the number of vehicles getting the traffic warning information, warning messages must be distributed fast and intelligently. M. Fogue et al. propose PAWDS, Profile - driven Adaptive Warning Dissemination System in [23] to enhance the process of disseminating warning messages in multi-hop wireless networks and in real urban settings.

According to the approach, depending on the profile of the roadmap and the vehicle density, the appropriate dissemination scheme is selected. The specified operation modes are:

• Full dissemination: Vehicle can send a lot of messages and no danger of broadcast storm issues because of low density vehicles.

• Standard dissemination: vehicles attempt to strike a balance between the quantity of informed vehicles and the quantity of messages received.

• Reduced dissemination: Due to the area's high vehicle density, which may easily cause broadcast storm issues, vehicles send few messages.

The simulation results show that in simple profile cities (where streets and junctions are low), when the density of the vehicles is low, standard dissemination is more suitable and in high density scenarios, reduced dissemination is more appropriate. The best strategy for regular cities is to use the full dissemination scheme while there aren't many vehicles and the standard mode when their density rises. In complex profile cities, full dissemination scheme performs well in low density areas and standard dissemination is more fit in high density areas.

Strategy 9: In [24] , binary-partition-assisted multi-hop broadcast (BPAB) protocol is proposed to deal with the problem of emergency message distribution in VANETs. The paper's major objective is to decrease broadcast delay, which is crucial for safety applications in both city and highway contexts.

When a dangerous event is identified, a node begins transmitting emergency messages. This source node sends out a request-to-broadcast (RTB) packet before sending out the message. The RTB packet header includes a timestamp, a flag, the location of the source, the direction in which the message is propagating. The RTB sender's node ID, is contained in the CTB packet header. When a RTB packet is received, only nodes that follow the source node in the direction of message propagation take part in the binary partitioned relay node selection process. All participants start sending black-burst transmissions at the beginning of the binary partition procedure, to enable the source to be aware of their presence or absence. Two phases follow the black burst event: the binary partition phase and the contention phase. The main purpose of binary partition phase is to obtain the thinnest possible strip containing the candidate relay nodes. The algorithm performs binary partitioning to divide a segmentt (coverage area of the source) into two subsegments (Near segment –segment near to the source and Far segment –far to the source) of equal width. A certain number of iterations are performed, and each iteration includes exactly one binary partition.Out of the two subsegments, the effective subsegment is chosen and sent as input to the following partition phase for additional analysis, while the other subsegment is removed from consideration in the future.

Once the farthest segment has been determined by the binary partition phase over N iterations, a relay node within that segment is randomly selected. To achieve this task, nodes in the farthest segment select a random backoff time from the back-off window. The relay node transmits the CTB packet to the source and is the node whose back-off timer expires first. The contending nodes, if any, leave the random contention phase after hearing a CTB packet with the same source's destination. The source node delivers the broadcast message after a brief interframe space following receipt of a valid CTB packet, which is subsequently relayed by the selected relay node in the following hop.

Strategy 10: A new approach TLO (The Last One) is proposed to mitigate the broadcast storm problem and improve the performance of safety applications in [25]. The algorithm is simple and relies on the assumptions that each vehicle has a GPS and that changes in relative velocities and distances between cars occur slowly. When there is an accident, the vehicle that suffered damage broadcasts an alert message to warn the vehicles behind it. Not all vehicles that get an alert message will re-broadcast it right away. Only the vehicle chosen by the algorithm as TLO (last vehicle, farthest from the accident area and of which all nodes are aware of) will rebroadcast the message to other vehicles, and other vehicles will wait for a threshold amount of time before deciding whether to rebroadcast.

When the threshold interval period expires, the other nodes will determine that there is either no relay node behind them or there is a problem if they have not received the same alert message from the chosen TLO. To locate the next last node, TLO is performed again and the next node selected as TLO will re-broadcast the safety messages. This is done over and over until the broadcast is successful. The method reduces the broadcast storm issue and works well when GPS data is accurate, but it can suffer from errors if GPS data is inaccurate between 0 and 20 meters.

Strategy 11: The majority of the services via vehicular networks that are envisioned must transmit information to every car in a specific area and most of the broadcasting techniques don’t deal with the problem of intermittent connectivity. In [26], protocol called Acknowledged parameter less broadcast in static to highly mobile (AckPBSM) is proposed (extension of PBSM) that works in a variety of traffic situations and vehicle scenarios. The PBSM protocol works on two techniques –CDS (connected dominating set) and neighbour elimination scheme (NES). A connected dominant set (or connected sub-graph) of a graph G is a set D of vertices where each vertex in G is either present in D or is a neighbour of some vertex in D. The data gathered during the periodic beacon exchange phase is used by the protocol to build a CDS delivery backbone. This data is needed to establish whether the vehicle is a member of the CDS after each beacon exchange.When NES is employed, a broadcast message is not immediately forwarded after being received. Instead, the node establishes a waiting timeout and keeps an eye on its neighbours. Only if the node still has uncovered neighbours after the timeout ends is the message retransmitted.

In PBSM, each vehicle S maintains two lists of nearby vehicles in relation to the message being disseminated and local 1-hop knowledge: R and N, holding neighbours that have already received (or have not yet received, respectively) the message. If the list N is not empty, S retransmits the message after a delay timeout. Every message and beacon exchange received updates both lists R and N, which could result in additional retransmissions if N once more becomes nonempty. Nodes that are part of CDS have shorter waiting timeouts than nodes that are not. The primary innovation in AckPBSM is the way the algorithm has been changed to handle acknowledgements of broadcast messages, which are piggybacked in periodic beacons. However, since broadcast messages are acknowledged, new discovered neighbours which previously received the message do not cause new retransmissions. Through acknowledgments, the two goals achieved are to decrease redundancy and increase reliability in the event of communication losses. Table 1 provides comparison of the data dissemination methods for safety applications in VANET.

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Table 1: Comparison of data dissemination methods for safety applications in VANET

Paper	Motivation	Year	Performance Metric	Model for performance analysis	Simulator /Simulation results	Future scope
Y. Bi et al. [16]	Urban multi-hop broadcast protocol (UMBP) to disseminate emergency messages	2015	• One-hop delay • Message propagation speed • Reception rate	Manhattan Mobility Model.	NS-2. Results show that the protocol Disseminates emergency messages faster and also successfully reduce message redundancy and enhance message reliability	Modify the protocol to support more complicated road structure in ITS.
R. K. Schmidt et al. [17]	Cooperative awareness by periodic single-hop broadcast messages (beacons) for safety communication	2010	Low resource usage High information accuracy	Mathematical model	The offered load is managed by dynamically altering the beacon frequency to the current traffic scenario while preserving the necessary accuracy.	To combine research on smart communication with different network loads and ensure that safety applications specify their accuracy standards for specific circumstances.
M. Koubek et al. [18]	Reliable multi-hop broadcasting for safety applications	2010	• Minimum broadcast distance • Dissemination direction	Radio propagation model	OPNET, SUMO . The protocol achieved 100% Delivery Ratio, maintained a very low End-to-End Delay, and also reduced the amount of redundant transmissions	Including roadside units with a backend connection to a centralized network to support vehicle-to-infrastructure communications for safety applications.
C. Y. Yang et al. [19]	Street based broadcast scheme for	2010	• Average delay time	VanetMobiSim	NS-2. It addresses the intersection	The broadcast strategy can be further altered to distinguish between

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	urban scenarios		• Average retransmission time • Delivery ratio		problem and increases delivery ratio with low delay time.	emergency messages with differing priorities and security concerns like integrity and non-repudiation can also be considered.
X. Ma et al. [20]	DSRC control channel design using a distributive cross-layer approach with three levels of safety services.	2012	• Packet reception ratio • Packet transmission delay	-	NS-2, Matlab. Higher multihop broadcast efficiency and more robust, reliable and scalable to the density of the vehicles	Development of a novel adaptive IEEE 802.11p protocol that can modify network parameters depending on the volume of traffic and other network circumstances for improved performance
C. Suthaputchakun et al. [21]	Multi-hop broadcast protocol which reduces contention period jitter and is independent of density of vehicles.	2014	• Average one-hop delay • One hop message progress • Dissemination speed. • average hop count • end-to-end delay, and • PDR (Packet delivery ratio)	40-km long highway	OMNET++ Performs better than existing protocols in terms of average delay, Data dissemination speed and average PDR.	-
F. J. Martinez et al. [22]	To solve the broadcast storm problem in real urban scenarios, a new scheme is proposed - Enhanced Street Broadcast Reduction (eSBR)	2010	• Percentage of blind vehicles • Warning notification time • No. of packets received per vehicle.	Real Building and Distance Attenuation Model (RBDAM) model	NS-2 /SUMO	Need to use real maps whenever possible.
M. Fogue et al . [23]	To improve alert/ warning message dissemination in real urban scenario - Profile-driven Adaptive	2013	• Warning notification time (WNT) • Percentage of blind vehicles (BV), • No. of messages received per vehicle (MR)	• Downtown Model, • Krauss Mobility model	NS-2 /SUMO	To alter the proposed scheme to adjust the time between messages based on the time elapsed since the last dangerous situation was detected

	Warning Dissemination Scheme (PAWDS) is proposed					
J. Sahoo et al. [24]	To reduce broadcast delay for safety applications - binary-partition-assisted broadcast (BPAB) protocol is proposed.	2011	• MAC-Layer Slots • One-Hop Message Progress (%) • Message Dissemination Speed • Packet Delivery Ratio (%)	• Freeway and Manhattan mobility model	NS-2	-
Kanitsom et al. [25]	To decrease broadcast storm problem, end-to-end delay and enhance performance of safety applications	2008	• Time from accident vehicle to last vehicle. • The number of collision time that occur in the situation	Uniform speed model	GrooveNet network virtualization platform	Proposed work should use correct GPS information.
Francisco J. Ros et al. [26]	To propose a broadcast protocol appropriate for a varied range of vehicular and traffic conditions.	2009	• Reliability • Number of transmissions per transmitting vehicle	Two-ray-ground propagation model,	NS-2 /SUMO. Protocol beats competing methods while achieving excellent reliability and lowering the number of retransmissions.	The protocol's level of compatibility with DSRC to be addressed

3.0 CONCLUSION –

Due to its greater mobility, dynamic connectivity, and decentralised administration, VANET has garnered the interest of researchers more than other networks. Due to VANET's low degree of connectivity, the majority of conventional data dissemination methods are ineffective. A overview of VANET-related topics is covered in this paper, with a focus on intelligent transport systems, mobile ad hoc networks, the VANET standard, and VANET characteristics, VANET and MANET differences, communication standards, various data dissemination schemes from survey papers, data dissemination schemes for safety applications, and their comparison with regard to performance metric, model used for performance analysis, simulator used, simulation results, and future scope.

REFERENCES -

[1] K. Gonzalez, D. Njoroge, K. Professor, G. Saillant, and D. Ward, "Commission for Global Road Safety (2009). Make roads safe, a decade of action for road safety.," 2009. Accessed: Jun. 22, 2023. [Online]. Available: http://www.makeroadssafe.org/publications/Documents/decade_of_action_report_lr. pdf.

[2] Naveen Chilamkurti, Sherali Zeadally, and Hakima Chaouchi, *Next Generation Wireless Technologies*

4G and Beyond. London: Springer, 2013. [Online]. Available: www.springer.com/series/4198

[3] Hassnaa Mustafa and Yan Zhang, *Vehicular Networks Techniques , Standards and Applications*. United States of America: Taylor and Francis Group, 2009.

[4] T. Yeferny and S. Hamad, "Vehicular Ad-hoc Networks: Architecture, Applications and Challenges," *IJCSNS International Journal of Computer Science and Network Security*, vol. 20, no. 2, Mar. 2020.

[5] Y. L. Morgan, "Notes on DSRC & WAVE standards suite: Its architecture, design, and characteristics," *IEEE Communications Surveys and Tutorials*, vol. 12, no. 4, pp. 504–518, Dec. 2010, doi: 10.1109/SURV.2010.033010.00024.

[6] S. Al-Sultan, M. M. Al-Doori, A. H. Al-Bayatti, and H. Zedan, "A comprehensive survey on vehicular Ad Hoc network," *Journal of Network and Computer Applications*, vol. 37, no. 1. Academic Press, pp. 380–392, 2014. doi: 10.1016/j.jnca.2013.02.036.

[7] Sami Abduljabbar Rashid, lukman Audah, Mustafa Maad Hamdi, and Sameer Alani, "An Overview on Quality of Service and Data Dissemination in VANETs," in *2nd International Congress on Human-Computer Interaction, Optimization and Robotic Applications (HORA), Ankara, Turkey*, , Ankara, Turkey: IEEE, 2020, pp. 1–5. doi: 10.1109/HORA49412.2020.9152828.

[8] H. Shahwani, S. Attique Shah, M. Ashraf, M. Akram, J. (Paul) Jeong, and J. Shin, "A comprehensive survey on data dissemination in Vehicular Ad Hoc Networks," *Vehicular Communications*, vol. 34. Elsevier Inc., Apr. 01, 2022. doi: 10.1016/j.vehcom.2021.100420.

[9] M. A. Al-Shareeda, M. A. Alazzawi, M. Anbar, S. Manickam, and A. K. Al-Ani, "A Comprehensive Survey on Vehicular Ad Hoc Networks (VANETs)," in *2021 International Conference on Advanced Computer Applications, ACA 2021*, Institute of Electrical and Electronics Engineers Inc., 2021, pp. 156–160. doi: 10.1109/ACA52198.2021.9626779.

[10] M. Chaqfeh, A. Lakas, and I. Jawhar, "A survey on data dissemination in vehicular ad hoc networks," *Vehicular Communications*, vol. 1, no. 4. Elsevier Inc., pp. 214–225, 2014. doi: 10.1016/j.vehcom.2014.09.001.

[11] R. Ghebleh, "A comparative classification of information dissemination approaches in vehicular ad hoc networks from distinctive viewpoints: A survey," *Computer Networks*, vol. 131. Elsevier B.V., pp. 15–37, Feb. 11, 2018. doi: 10.1016/j.comnet.2017.12.003.

[12] J. A. Sanguesa, M. Fogue, P. Garrido, F. J. Martinez, J. C. Cano, and C. T. Calafate, "A Survey and Comparative Study of Broadcast Warning Message Dissemination Schemes for VANETs," *Mobile Information Systems*, vol. 2016. Hindawi Limited, 2016. doi: 10.1155/2016/8714142.

[13] S. T. Hasson and A. T. Abbas, "A Clustering Approach to Model the Data Dissemination in VANETs," in *1st Babylon International Conference on Information Technology and Science 2021, BICITS 2021*, Institute of Electrical and Electronics Engineers Inc., 2021, pp. 337–342. doi: 10.1109/BICITS51482.2021.9509890.

[14] S. Vergis, G. Tsoumanis, and K. Oikonomou, "A Proposed Multi-Head Clustering Algorithm for VANET Environments," in *6th South-East Europe Design Automation, Computer Engineering, Computer Networks and Social Media Conference, SEEDA-CECNSM 2021*, Institute of Electrical and Electronics Engineers Inc., 2021. doi: 10.1109/SEEDA-CECNSM53056.2021.9566263.

[15] Rajendra S. Hande and Dr. Akkalakshmi Muddana, "Comprehensive Survey on Clustering-Based Efficient Data Dissemination Algorithms for VANET," in *International conference on Signal Processing, Communication, Power and Embedded System (SCOPES)-Paralakhemundi, India, 2016*, pp. 629–632. doi: 10.1109/SCOPES.2016.7955516.

[16] Yuanguo Bi, Hangguan Shan, Xuemin (Sherman) Shen, Ning Wang, and Hai Zhao, "A multi-hop broadcast protocol for emergency message dissemination in urban vehicular ad hoc networks," *IEEE Transactions on Intelligent Transportation Systems*, vol. 17, no. 3, pp. 736–750, Mar. 2015, doi: 10.1109/TITS.2015.2481486.

[17] R. K. Schmidt, T. Leinmüller, D. Automotive, E. Schoch, and F. Kargl, "Exploration of Adaptive Beaconing for Efficient Intervehicle Safety Communication," *IEEE Netw*, vol. 24, no. 1, pp. 14–19, Feb. 2010, doi: 10.1109/MNET.2010.5395778.

[18] M. Koubek, S. Rea, and D. Pesch, "Reliable broadcasting for active safety applications in vehicular highway networks," in *IEEE Vehicular*

Technology Conference, 2010. doi: 10.1109/VETECS.2010.5494194.

[19] C. Y. Yang and S. C. Lo, "Street broadcast with smart relay for emergency messages in VANET," in *24th IEEE International Conference on Advanced Information Networking and Applications Workshops, WAINA 2010*, 2010, pp. 323–328. doi: 10.1109/WAINA.2010.31.

[20] X. Ma, J. Zhang, X. Yin, and K. S. Trivedi, "Design and analysis of a robust broadcast scheme for VANET safety-related services," *IEEE Trans Veh Technol*, vol. 61, no. 1, pp. 46–61, Jan. 2012, doi: 10.1109/TVT.2011.2177675.

[21] C. Suthaputchakun, M. Dianati, and Z. Sun, "Trinary partitioned black-burst-based broadcast protocol for time-critical emergency message dissemination in VANETs," *IEEE Trans Veh Technol*, vol. 63, no. 6, pp. 2926–2940, 2014, doi: 10.1109/TVT.2013.2293020.

[22] F. J. Martinez, M. Fogue, M. Coll, J.-C. Cano, C. T. Calafate, and P. Manzoni, "Evaluating the Impact of a Novel Warning Message Dissemination Scheme for VANETs Using Real City Maps," pp. 265–276, 2010, doi: 10.1007/978-3-642-12963-6_21ï.

[23] M. Fogue, P. Garrido, F. J. Martinez, J. C. Cano, C. T. Calafate, and P. Manzoni, "An adaptive system based on roadmap profiling to enhance warning message dissemination in vanets," *IEEE/ACM Transactions on Networking*, vol. 21, no. 3, pp. 883–895, 2013, doi: 10.1109/TNET.2012.2212206.

[24] J. Sahoo, E. H. K. Wu, P. K. Sahu, and M. Gerla, "Binary-partition-assisted MAC-layer broadcast for emergency message dissemination in VANETs," *IEEE Transactions on Intelligent Transportation Systems*, vol. 12, no. 3, pp. 757–770, Sep. 2011, doi: 10.1109/TITS.2011.2159003.

[25] Kanitsom Suriyapaibonwattana and Chotipat Pomavalai, "An Effective Safety Alert Broadcast Algorithm for VANET," in *International Symposium on Communications and Information Technologies, Vientiane, Laos, 2008,* IEEE Xplore, pp. 247-250,. doi: 10.1109/ISCIT.2008.4700192.

[26] Francisco J. Ros, Pedro M. Ruiz, and Ivan Stojmenovic, "Reliable and Efficient Broadcasting in Vehicular Ad Hoc Networks," in *VTC Spring 2009 - IEEE 69th Vehicular Technology Conference, Barcelona, Spain, 2009,* IEEE, pp. 1–5. doi: 10.1109/VETECS.2009.5073834.