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A Survey on Application of Automatic Braking and Pedestrian Safety in Intelligent Transport System

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Abstract:
Pedestrian Safety is one of the most typical problems meet in many situations. The main aim is to create an empowerment not only for pedestrian safety but to keep in mind to make the driving safer especially in specific scenarios. This logic robust to, special focus on the area of pedestrian in traffic to avoidance accident using devices fitted onboard vehicles and also to enhance vehicles safety. The innovative service is the important of timely identifying the pedestrians in traffic and alerts the vehicle which is closer for Automatic Braking and also to the entire successor vehicles for reducing the consequence of crashes. So, there is a need of through study on pedestrian safety and automatic braking in Intelligence Transport System (ITS). In this paper, a detailed survey has been collected to study the importance of the problem. This survey mainly focuses on the application of evolutionary based algorithms for the pedestrian safety in ITS. At end, formulated a problem along with few directions for further research.

Keywords: *Intelligence transport system, pedestrian safety, automatic breaking, evolutionary algorithms, genetic algorithm*

1. Introduction

The main purpose of the pedestrian detection in video surveillance is for safety of the human in the world. As lots of people are killed in road accidents every day, there should be a system which can reduce the pedestrian accidents fatalities in the world. Another problem is the traffic control. Frequency of traffic accidents and traffic blocking has become a significant problem towards traffic control. So to manage traffic, efficient video surveillance system is necessary. Researches on intelligent transportation systems and algorithms for enhancing the accuracy have been proposed for improving road traffic's safety and decreases traffic blocking. Vehicle detection and human detection is one of the major problems today in the world. So for the detection purpose many different methodologies have been proposed up till now and also advanced research is going on for the betterment of the existing techniques and to get more accurate detection results. Current scenario has been improved by giving alarm to the pedestrian or the driver of the vehicle.

This technique has been implemented in VOLVO S60 car. It is having automatic pedestrian detection with full automatic braking capability. So if the driver does not respond to the alarm then the brake will be applied automatically. Object detection algorithms vary according to the application. Human detection and vehicle detection both require different approaches to get better results. As the shape, height, width, area and length are different for human as well as for vehicle. So we have to develop a system such that it can detect and recognize the object as per the application. Detection requires basic stages as follows: Pre-processing, background removal, filtering, object detection and object tracking. There are several ways to detect pedestrian or human by the shape or pattern, skin color and movement of the object. Also the light condition and environment condition affect the detection result in case of skin and motion-based detection techniques. By using combination of two or more information, we can detect pedestrians more precisely. The motion based detection is helpful in case of traffic signals as the pedestrian are crossing the road. Most of pedestrian victims are at crossroads or at traffic signals.

The rest of the paper is organized as follows, section II presents an overview to guide pedestrian away from dangerous streets and crossing points (traffic safety), Section III presents an overview to guide pedestrians in their dangerous situation and automatic braking, Section IV presents detailed literature survey in intelligence transport system, Section V presents problems and directions to initiate ideas for further research and Section VI summarize the work and quoted references are provided in the end of the paper.

2. Pedestrian away from Dangerous Streets and Crossing Points

It is possible to improve the guidance and safety of pedestrian traffic flows by the current location of pedestrians and vehicles. GIS technology is much improved for GPS to monitoring pedestrian movement on certain network or area. We can follow the following ways to safe the persons who need help at the time of crossing the road.

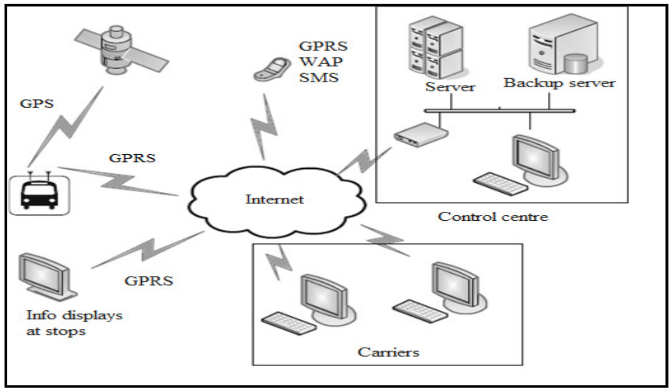

Figure 1: Components of Pedestrian Tracking System Courtesy [1]

i) Disabled persons always use wheelchairs they cannot use staircase due to their disability. They can reach their destination by means of PDA *(Personal Digital Assistants)* interface. A work presented by Simunovle, Ivan Bosnjak [1] is one of the ITS system. By voice, graphical and touch interface and by using special pens *(touch screens)* they can receive information like how to shorten the distance and time of travel and how to navigate to their destination. So the disabled pedestrians navigate to escalators, i.e. elevator shown in Figure 2.

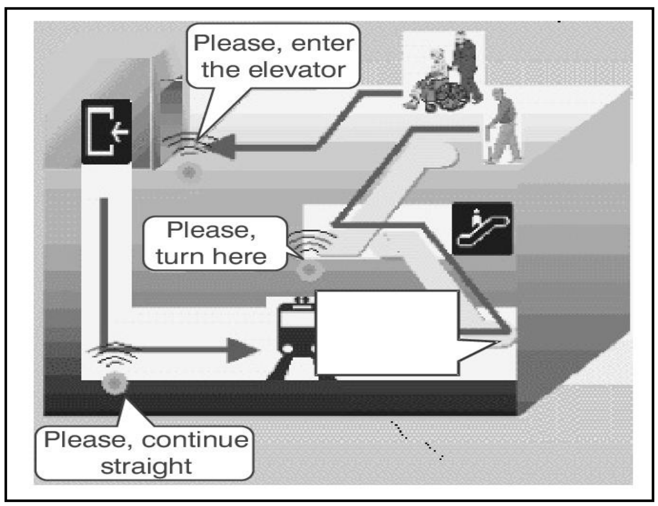

Figure 2: Pedestrian Navigation with Touch Screen Interface Courtesy [18]

ii) The Blind Pedestrians orient themselves by touch or contact and sense of hearing. They always have a stick and in some cases they bring their trained dogs for guide. They always take more time to cross the street. They feel difficulties in maintaining the direction of path at the intersection. Pedestrian navigation using RFID *(Radio Frequency Identification)* technology, ultrasound sensors and IR sensors *(infrared sensors)* - In case of the blind persons it should be precisely determined where they may walk along the road, where the road can be crossed, etc.

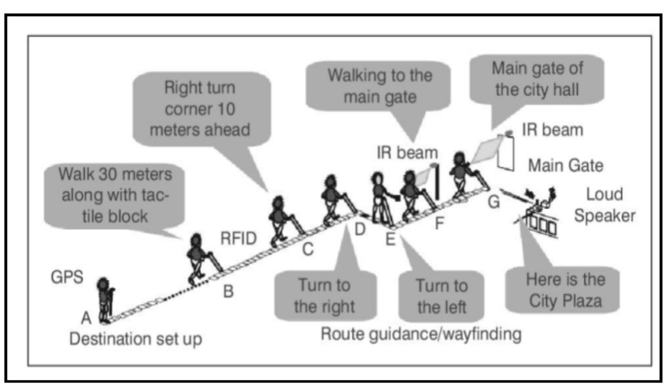

Figure 3: Pedestrian Navigation using RFID technology and IR sensors Courtesy [18]

iii) The Deaf and Dumb Pedestrian depend on large visibility indicators and an environment free of visual obstructions. The mentally retorted pedestrians have lack in observation, identification, understanding, interpretation and reaction to information. They didn't read the received information but they use pictures, shapes, symbols and colors as signs in traffic. For e.g., it is good to use a pedestrian animation on the traffic signal indicator instead of write the message "GO" in traffic signals.

Figure 4: Traffic light with a Pedestrian Animation Courtesy [18]

3. Guideline for Pedestrians in their Dangerous Situation and Automatic Braking

Giving safety involves not only for pedestrian but it is needed for vehicles also. It is necessary to give more importance to the situation where frequent vehicle – pedestrian accident are raised. In Figure 5 the drivers can easily detect the pedestrian who are in front of the vehicle we can't easily neglect it, we must focus on depending upon the situation because pedestrian movements are not to be predefined until the pedestrian went to the safer zone.

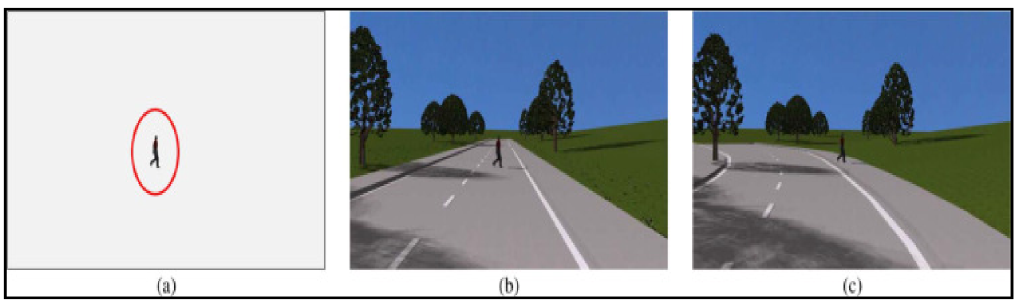

Figure 5: Pedestrian crossing in uncollision scenario courtesy [17]

The most common scenario is, when vehicle are moving on a road, the pedestrian may mix with vehicle therefore successful detection is important. We must check for the presence of pedestrian even in case of fusion with the vision. There are some situations may occur that vehicles are parked or stopped on the road or road edges, for example: zebra crossing, bus stop, vehicle breakdown, obstacles. The above mentioned vehicles blocking the visibility of pedestrians this is one of the main causes of accidents. By using Scenario-Driven Search (SDS) we can search for possible Pedestrians in the specific scenario for that particular position in addition to that localize stopped vehicles and then search for pedestrians in their close proximity or in the areas partly hidden by them. The main applications of SDS are

1. When pedestrian suddenly appearing behind an obstacle, with particularly high danger of collision - Quickly detect the pedestrian with in the short working area.
2. Detect pedestrians as soon as they appear, even when they are still partly occluded;
3. Limit the search to specific areas, which are determined by a quick preprocessing.

In Figure: 6 the first row shows some examples of situations in which the visibility of a crossing pedestrian is partly or completely occluded by stopped vehicles. The second row of Figure: 6 highlight, for each situation, the areas on which the system will perform a check for the presence of a possible pedestrian.

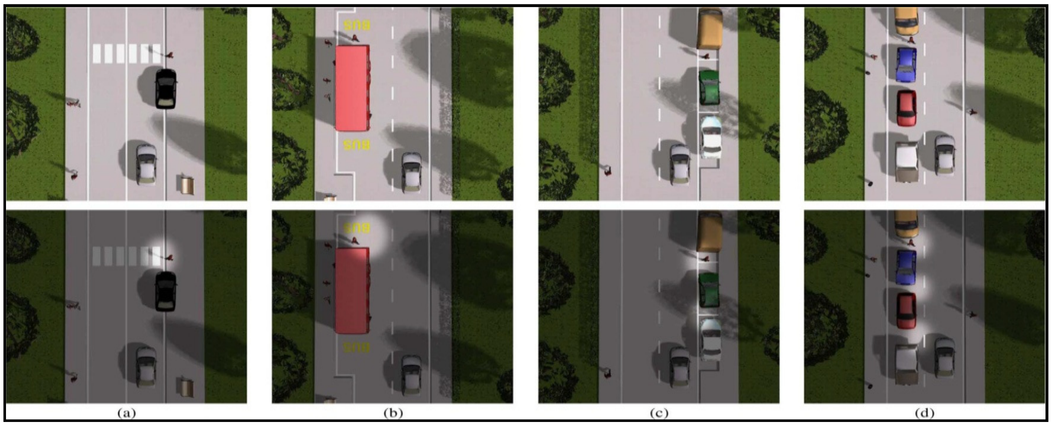

Figure 6: Vehicles blocking the visibility of Pedestrians courtesy [17]

The fusion of laser scanner is placed in the front bumper. Monocular vision and Near-Infrared (NIR) vision camera is placed inside the driving cabin near the rear-view mirror can provide a quick and robust detection in case of suddenly appearing pedestrians: The laser scanner provides a list of areas in which a pedestrian may appear, whereas the camera is able to detect the pedestrian, even when he/she is not yet visible to the laser scanner.

The following steps save the live of Pedestrian, Driver and also avoid the vehicle from crash and also shown in Figure: 7.

- A warning is sent to the driver, When the pedestrian is detected with a sufficiently high confidence level.
- When the driver not promptly reacts to the warning, to control the speed of the car. The system would issue a second level of warning by blowing the vehicle's horn. The main goal of this loud warning is to attract the attention of both the pedestrian itself and once again to the driver.
- If the Dangers level is not reduced due to a continuous action of the driver *(or the pedestrian)*, the intelligent vehicle will trigger automatic braking.

4. Literature Survey of the Paper

There have been many approaches presented for the detection of pedestrians and vehicles. A lot more research is going on for the improvement of the detection methods. Many researchers have proposed methods to detect pedestrians as well as vehicles. In [2], the authors have presented the hybrid method using advanced mean-shift algorithm to detect and track multiple objects and also to handle occlusion problem. In [3], the authors have used human skin color, shape and motion feature to detect human in dynamic scenario. The authors have used Hough transform for extracting the head position of the human. This paper shows very good detection result in different light conditions. In [4], also the color and motion statistics are used for detection of the human. In this paper, the authors have used Histogram Oriented Graph (HOG) descriptor and 4-D color histogram to detect a person.

The results are quite satisfying but if two persons wearing same color clothes, then the detection fails. In [5], Gaussian model is used for background modeling and HOG is used for feature extraction. In this paper, new method to detect head- shoulder shape of human is used. In [6], to differentiate pedestrians from other objects, the authors have considered shape analysis. Pedestrian feature like area, height, perimeter is considered for better detection of the pedestrian. Authors have used Mean-shift and particle filter combination for better real time pedestrian detection. In [7], the authors have proposed more robust algorithm for moving object detection. In this paper, automatic braking is applied if the object is detected and stopping the vehicle is possible otherwise automatic evasive steering is applied. In [8], blob based detection method is used by the author. Here the trajectory periodic motion analysis is used for human detection and tracking purpose and vertical position is used for the better prediction of the object.

In [8] Blob motion based and HOG based method results are shown but combination of both methods give more accurate result. We need to make our cities walk able for all kind of human beings, at least above a certain age. But today, many people feel that their cities are not safe, even for their adult age. An inadequate traffic planning regarding pedestrian needs can lead to an unfriendly "walking environment" with people feeling unsafe. This led to go as a real fear of walking in cities. In addition, public transportation cannot take people from door to door, so transportation system must give importance to walker or pedestrians as well. The pedestrians in traffic can be divided into the following categories:

- Slow walker pedestrian – e.g.: children, seniors, pregnant women, pedestrians with luggage and baby carriages.
- Disabled pedestrian - e.g.: physically disabled, persons with low vision, impaired hearing and mental disorders.
- Occlude Pedestrian – e.g.: parked cars on the road edge, vehicles temporarily stopped on the road, vehicles queued in a line- in front of a traffic light or zebra crossing, or simply jammed cars, Bus Stop.

We will not move towards a sustainable society unless we accept that pedestrians are people with transportation needs. We will need to make our cities walk able for pedestrians, at least those above a certain age. It is difficult to judge a pedestrian movement because each pedestrian has different behavior. Children don't know the traffic rules they show an irregular reaction so they must need an adult supervisor apart from the solution of pedestrian safety. Senior citizens have weaker response, lower eyesight and hearing and also limited attention and memory. Determining of the current location of the pedestrian is necessary because some pedestrian need

emergency assistance because of heart attack, pedestrian mugging, and even sometimes pedestrian cases injury during walk. The human behavior is the main object and it is uncertainty so we can't easily predict the movement of pedestrian.
The detection of the pedestrian more complex in occludes visibility when a vehicle stopped on the road. There are three notify functions provided for pedestrian safety they are locating, mapping (assigning position to the map), and communication. The underlying idea is to locate the stopped vehicle and then search for pedestrian in their close proximity or in the areas partly hidden by them. When a vehicle is found to be stopped, the road side edges are to be trigger to search for the pedestrian. In the case of automatic braking, the number of false detections to zero because the number of false detection is even more important than the number of correct detections. More over each traffic light affect other junction evaluation function and it is the combination of mixture of traffic flow of all junctions. Additionally, there has been a lot of work in the field of crowd estimation and people counting. Some of the earlier work in this area has relied on heavily confined environments.
For instance, Terada et al. [10] count people going through a gateway that only allows for a small number of people to go through at the same time. The stereo cameras used in this system are mounted overhead in order to avoid occlusions. Work by Velipasalar et al. [11] use a similar setup of ceiling–mounted cameras in order to avoid the problem of occlusions. The camera view is also very narrow and does not cover a large scene, unlike what we are trying to achieve. Work realized by Zhao and Nevatia [12], [13] segments and tracks humans in crowded scenes using a human model composed of ellipses corresponding to the different parts of the body. This model helps keep track of individuals and is thus capable of giving a count of people in the scene. In [14], Rabaud and Belongie describe a method of counting crowded moving objects. Their counting technique is based on clustering a set of features in a video sequence and estimating the trajectories of these different detected clusters over time. The object counting is then performed based on these trajectories. Kong et al. [15] present a viewpoint– invariant way of counting people in a crowd. The key idea in this work is to use feature histograms in conjunction with feature normalization to make the algorithm viewpoint– invariant. In [16], Kilambi et al. present a technique to count groups of pedestrians utilizing camera calibration information. They project the foreground blobs onto different planes and use an area–based heuristic to estimate the number of people in a group.

5. Problems and Directions

In traffic flow the pedestrian and the vehicle often share a common surface, which causes numerous problems to both. It is difficult to expand the existing roads and to construct a new road because of lack of space in the city areas. To overcome this all the traffic participants should be treated in the same way. Emergency response is needed at the time of facing difficulty to use in mixed traffic environment. In many traffic scenarios, we face the difficulty of Crowd Pedestrian - e.g.: Procession, Rally, Car Festival, Groom Procession, PadaYatra, Funeral, etc.
The innovative idea present here is the important of timely detection of the Crowded pedestrians in traffic and alert the vehicle which is closer and apply automatic braking wherever necessary. This can be achieved with the help of the warning message. A warning message or alarm is send to the entire successor vehicle which is in mixed traffic environment for reducing the consequence of crashes or reducing the possibility of a crash and dashes. If the crowd pedestrians keep on moving in such situation timing of green in traffic light is extended and the information is passed to the heir vehicles, so that pedestrians and automobiles can share the same space. This framework can be optimized and pedestrians are detected. The rear vehicles can be warned with the help of an evolutionary algorithm based vehicle selection.

6. Conclusion

This paper provides the brief introduction about pedestrian safety in intelligent transport system and a brief summary about a decade of developments in the field of intelligent transport system. By its new approaches and solutions ITS hold a desirable place that will provide the answer to the entire world's transportation problem. The deployment of ITS technologies has the potential to enhance safety and mobility. For this reason, the current investigation has begun with the identification of the critical scenarios user needs, in order to find the most promising ITS systems. Increase passive safety particularly in critical environment for better traffic flow.
In addition to that possibly avoid collision between vehicles–pedestrian. On the other hand, too high vehicle situational speeds have been repeatedly found to be a very important factor in fatal pedestrian collisions. It is well known that even small decreases in vehicle travelling speeds prevent a large number of pedestrian fatalities. For this reason, Intelligent Speed Adaptation as well as automated speed enforcement has significant potential to reduce the injury consequences. This paper addresses the few limitations in present ITS and also suggested few directions for further research.

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Research Article

A NOVEL CLUSTER BASED EFFICIENT BROADCASTING PROTOCOL IN VANETs

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ABSTRACT

The advancement in technology and networks has led to the introduction of safety systems with vehicles**.** Vehicular Ad Hoc Networks are one of the emerging areas for emergency situation warning since traffic safety is a concern for everyone. VANETs are Ad-Hoc vehicle networks between vehicles equipped with communication facilities. The application areas of VANETs, includes are autonomous vehicles, warning systems, collision avoidance/notification and traffic optimization. Broadcast storm arises due to frequent contention and collisions in transmission among neighboring vehicles. To limit the number of packet transmissions by Cluster Based Efficient- Broadcast (CBE-B) algorithm. The main aim is to broadcast a messages from farthest node and reduce collisions between the nodes. Due to distributed clustering this protocol can overcome challenges of data broadcast storm. Packets will be then forwarded only to selected vehicles, opportunistically elected as cluster-heads. CBE-B performances have been assessed in vehicular scenarios, mostly highway scenarios and performance are measured in terms of Packet Delivery Ratio and Throughput.

INTRODUCTION

Vehicular Ad Hoc Network (VANET) is a subset of Mobile Ad hoc Network (MANET). VANETs rely heavily on broadcast transmission. Vehicular Ad hoc Networks (VANETs) are accessed between the vehicles to communicate among themselves for safety measures. Most of recent research works have focused on analyzing VANETs as well-connected networks, providing high vehicular traffic density in low cost wireless communication. VANET consists of basic communication devices to develop peer to peer communication network. The vehicles are considered as source and destination node in VANET network. It works on developing base station to perform distribution of information over the nodes to avoid collision. The network router developed in VANET provides safety travelling in roads by broadcasting messages among the nodes. During the transmission the information of the nodes should receive at proper time without any delay.

The VANET can be used in both light and heavy weighted applications. There are some limitations using VANET mainly in high traffic collision. The broadcasting messages in traffic network causes failure of transmission which results in collision. It causes redundancy in network topologies results in collaboration of transmitting messages between the nodes of vehicle. If it cause failure, the vehicle will rebroadcast the message again n again in affected network creates more redundant messages.

The research works have focused on analyzing VANETs as well-connected networks, providing high vehicular traffic density. When a vehicle rebroadcasts a message, it is fact that neighboring vehicles have already received it and results in a large number of redundant messages. They detect the dangerous situation, they will inevitably broadcast messages relating to the same event, leading to a dramatically excessive message redundancy arises a broadcast storm problem. The design of reliable and efficient routing protocols for supporting highly diverse, and mainly intermittently connected vehicular network topologies, is still a challenge. Hybrid solutions based on both V2V, and vehicle-to-infrastructure (V2I) communications, result as a viable alternative to routing protocols that exploit the V2V paradigm only [14].

In this paper, a design of cluster-based broadcast technique for safety applications in VANETs is implemented. The approach named as Cluster Based Effective- Broadcast (CBE-B), in order to reduce the broadcast storm effect using clustering of vehicles in road. This approach is very efficient because of using limited number of vehicles to forma Cluster Head (CH). As a result, CBE-B limits the number of transmissions, broadcasting a messages with high efficiency and propagation

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speed and preserves good network performance.

The rest of this paper is organized as follows. In Section 2 summarize a various protocols and some of the research efforts directed at their evaluation. Section 3 introduced an evaluation scenario of proposed protocol and description of the algorithms under investigation, followed by the explanation. Section 4 presents the performance criteria and comparison of algorithms. Finally, Section 5 summarizes conclusions.

Related Work

Fasolo *et.al* (2006) [3] focused on a Vehicular Ad Hoc Network (VANET) that makes use of IEEE 802.11 for Inter Vehicular Communication (IVC) on distributed position based broadcast protocol Smart Broadcast (SB). The SB protocol aims to minimizing the rebroadcast delay. When the coverage areas are divided among adjacent sectors in which each nodes have the capacity to estimate their position. Mainly SB is employed to minimize the time to perform a hop, since it does not spend more time to solve the collisions. It considers a contention resolution procedure to elect the relay nodes which permits fast and reliable message propagation in a VANET.

Broadcasting is mainly employed to resolve network issues. Due to host mobility the operations such as finding a route to a particular host, paging a particular host and sending an alarm signal are executed more frequently. Broadcast storm arises due to the overlap of radio signals by flooding results in redundancy, contention, and collision. To solve tis issues Tsang *et.al* [10] proposed a several schemes to reduce redundant rebroadcasts and differentiate timing of rebroadcasts by inhibiting some hosts from rebroadcasting. Several schemes namely distance-based, location-based, probabilistic, cluster-based schemes and counter-based have been proposed to solve this problem. The location-based scheme is the best method it can eliminate most redundant rebroadcasts under all kinds of host distributions without compromising reachability.

Vegni *et.al* [11] presented a hybrid communication for vehicular networking based on network infrastructure (e.g., wireless network access points) through a vehicle-to-infrastructure protocol and traditional vehicle-to-vehicle networking. vehicular communications in short range are supported by Vehicle-To-Vehicle (V2V) protocols, considering smart vehicles equipped by on-board computers with sensors (e.g., radar, ladar, etc.) and multiple network interface cards. The optimal path selection technique is adopted by V2X, allowing protocol switching to vehicles communicating via V2V or V2I. It represents a policy to decide for the optimal vehicular communication protocol (i.e., V2V or V2I) between two end nodes to improve the network performance.

The design of a cross layered MAC and clustering solution for supporting the fast propagation of broadcast messages in a Vehicular Ad Hoc Network (VANET) is proposed by Luciano and Marco (2015) [14]. To create a dynamic virtual backbone in the vehicular network by distributed dynamic clustering algorithm. It is responsible for implementing an efficient messages propagation and forwarding broadcast messages by balancing the backbone connections as well as the cost or efficiency trade-off and the hops-reduction.

To enhance collision-free and delay-bounded transmissions for safety applications under various traffic condition Ning *et.al* [10] (2014) proposed a technique broadcasting mechanism based on MAC protocol. Dedicated Multi-channel MAC (DMMAC) adaptive broadcasting mechanism enables every vehicle in the network to have a chance to conduct collision-free and delay-bounded transmission for safety applications. In DMMAC, all vehicles are equipped with a single half-duplex radio transceiver and multiple radios implemented with current hardware may suffer from too much cross-channel interference.

Proposed Work

A Cluster Based Efficient Broadcast (CBE-B) Algorithm is expect to minimize the number of rebroadcast message by clustering the vehicles on road. This algorithm works in efficient way to elect cluster heads based on following criteria. Reliable protocols use three methods i.e.,(i) rebroadcasting, where the transmitter node retransmits the same message for many times (ii) selective ACK, where the transmitter requires ACK from a small set of the neighbors and (iii) changing parameters, where the transmitter changes transmission parameters according to the expected state of the network. The problem statement for reliable protocols is to design a protocol that can deliver a message from a single source to every node in the own transmission range with the highest possible reliability and minimum delay.

VANETs is that a vehicular network is partitioned into a number of clusters a vehicles within a partition can communicate either directly or through multiple hops among each other, but no direct connection exists between partitions, as well depicted in Fig. 1. Vehicles belonging to the same cluster can communicate each other, while due to the gaps among consecutive clusters, no inter-cluster communications are available. A particular class of routing protocols namely, the cluster-based approaches uses this assumption by exploiting clusters formation [9]. Based on geographical locations, directions of movement, speed and many other metrics, vehicles can group into different clusters.

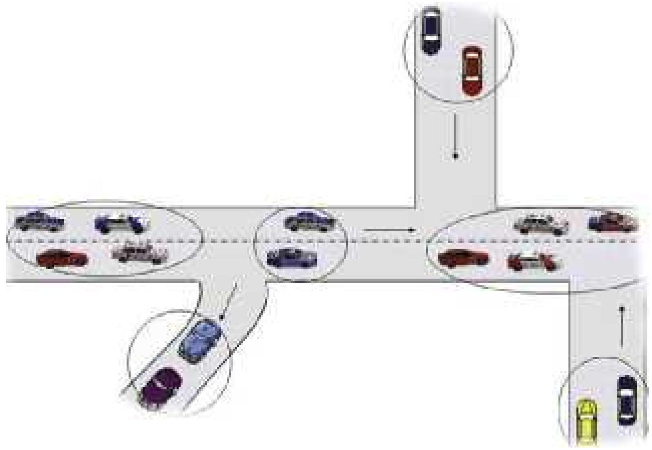

Fig 1 Schematic Diagram of Vehicle Clusters.

Cluster-Based Efficient – Broadcast

Cluster-Based Efficient Broadcast (CBE-B) algorithm offers broadcasting of messages with high efficiency and propagation speed. It mainly overcomes the limitation of existing algorithm includes broadcast storms due to collision of duplicate messages in VANET. The broadcasting of messaging in VANET network is desirable by using the proposed work with less number of transmission nodes and delay. This can be done by using three main parameters such as rebroadcast possibility (Pij), Vehicle speed (V) and receiving order of messages by nodes (MSG_No). It detects the cluster of vehicles in a fast and efficient way and elect one as CH vehicle for each cluster detected. The new cluster head is responsible to rebroadcast the messages.

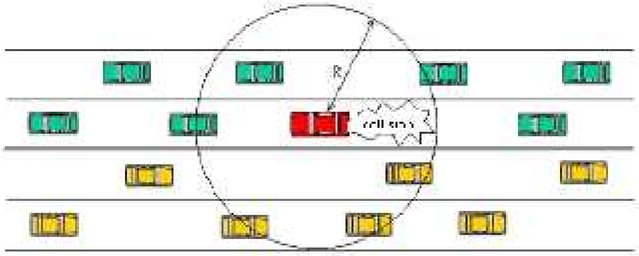

Fig 2 Message broadcast in the transmission range of crashed vehicle

Algorithm of Proposed CBE-B Protocol

Based on the above three parameters the proposed algorithm collects the information of vehicle position in GPS receiver. The bilateral roads are considered as unilateral by the algorithm to avoid collision. If the node of a vehicle is congested in collision it automatically gives message with vehicle id to the network. The figure 2 shows that message (Vehicle ID, Location).

The proposed algorithm is composed of two phases are Setup Phase and Steady-state phase as follows

Setup Phase

If the vehicle suffers due to collision acts as a base station and it automatically calculates the radius of radio range to form cluster. The broadcasting of acknowledgement message between the nodes inside the cluster is send to base station. The acknowledgement message contains nodes connecting speed, identifier and direction of moving vehicle. In which helps the direction of moving divides the vehicles into two categories whereas based on node speed the base station selects cluster header for each category the faster the vehicle is more preferred. Based on the following flowchart the working of the setup phase is given in fig 3.

Steady-State Phase

The rebroadcasting of warning messages is carried out by each cluster head and based on their vehicle speed new cluster head is determined to enhance the process quickly. There are several stages in steady state phase in each stage a new cluster head is selected. The messages are numbered in order as variables to rebroadcast and it kept fixed until next cluster is set. This phase follows some rules to select the cluster head as follows:

- The cluster head is selected by high probability even if the node is father. It is calculated by using rebroadcast parameter of $p_{i,j}$ formulated as $P_{i,j} = D_{i,j}/R$.
- The next parameter is speed of the moving node.
- Also, if the node receives less warning messages with higher probability is selected as cluster head.

The algorithm of Steady State phase is given as

Step 1 - Initialization of Cluster_Head among the nodes.
Step 2 - Broadcasting of warning messages.
Step3 -To receive acknowledgement messages (ack_msg) from cluster nodes.that contains node identifier (ID), node velocity (V), location of node (Loc), direction of movement in node (Dir_Veh).

Step 4 - Nodes those are moving in the direction of cluster head, puts into Cluster_Mems group should satisfy the following condition

For (j=1, j<=Cluster_Size;j++)
If $Dir\_Veh_i = Dir\_Veh_j$
Cluster_Members ← Veh_j;

Step 5 - Each member of the group should follow the criteria with three factors distance, speed and warning message of each nodes.

For (j=1, j<= Size (Cluster_Mems); j++)
then calculate $P_{i,j} = D_{i,j}/R$
$Result_j \leftarrow P_{i,j} * V_j * 1/MSG\_No$;

Step 6 - Create Table_Vehi is formed by current cluster head from the obtained information.

Step 7 - Selection of next Cluster Head (CH) can be obtained from the above table between nodes in the Cluster_Mems

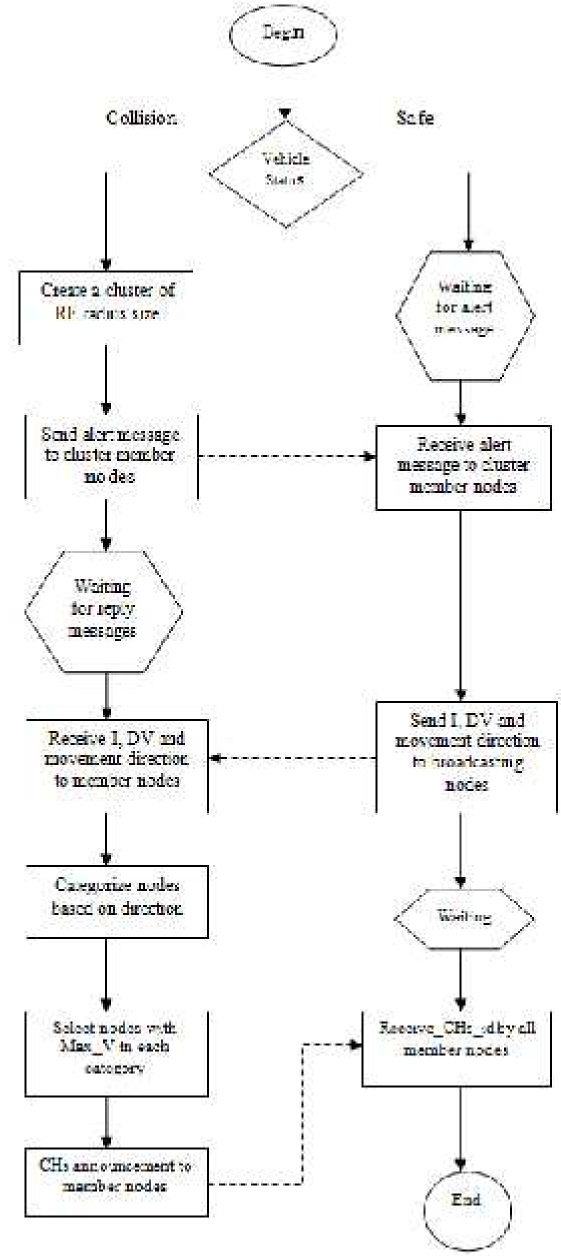

Fig 3 Flowchart of Setup Phase

In our proposed method algorithm, when a vehicle received a warning message, responses to the sender with an ACK message. If its movement direction be the same with broadcasting node, based on the next cluster head selection algorithm, it will participate in optimal cluster head selection algorithm to be the next cluster head.

EXPERIMENTAL RESULTS

Network Configuration

The proposed CBE-B algorithm has been validated in highways to avoid number of vehicles in rural areas. The simulation environment used for the proposed work is given in the following Table I. It describes the various parameters used for the simulation.

Table I Simulation Parameters and Values

Parameters	Value
Channel	Wireless channel
Antenna	Omni/Directional Antenna
MAC Protocol	IEEE 802.11
Routing Protocol	AODV
No. of Nodes	100

Performance Parameters

The performance analysis of the VANET based on Cluster based Effective Broadcast algorithm is simulated on NS2. The performance of the proposed protocol is analyzed by parameters such as throughput and Packet Delivery Ratio and compared with the existing Cisco Discovery Protocol (CDP) Protocol.

- *Throughput* - Throughput denotes that the correct cluster detection has occurred if the amount of packet exchange has increased significantly.
- *Packet Delivery Ratio* - Packet Delivery Ratio is defined as the ratio of number of packets successfully received and number of packets transmitted. It increases due to successful transmission of packets by the intermediate nodes.

Table II Performance Parameters for CBE-B Algorithm

Protocols	Throughput (%)	Packet Delivery Ratio
CBE-B	85	95.8
CDP	72	81.2

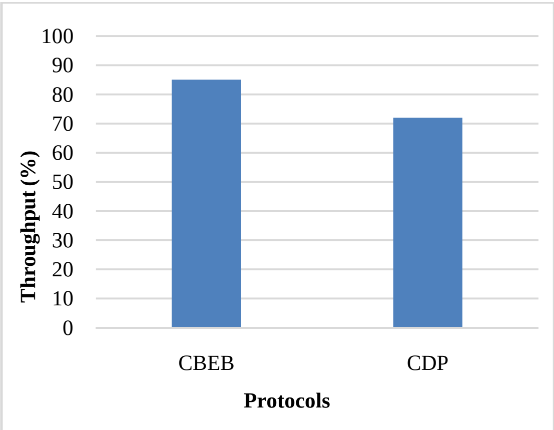

Fig 4 Throughput for CBE-B

In Fig.4 shows throughput experienced by vehicles moving in highway scenario. Throughput for proposed CBEB protocol shows higher than existing method. Fig 5 Packet Delivery Ratio for CBE-B protocol. From the results it is evident that proposed CBE-B protocol reduce the number of packet transmissions.

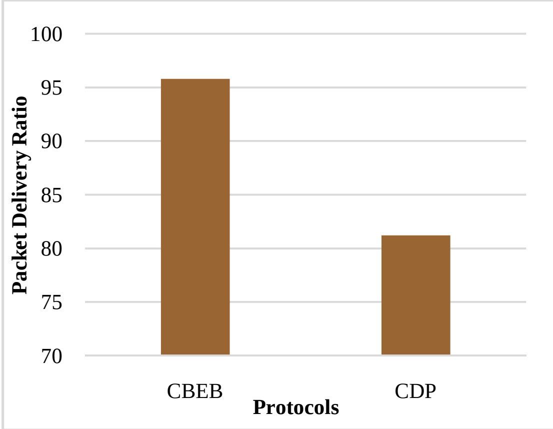

Fig 5 Packet Delivery Ratio for CBE-B

CONCLUSION

The broadcast storm is a common problem in network. To alleviate this issue a protocol is designed by selectively broadcast the message within their own transmission range that will reduce the network overload and limit the message retransmission. The cluster based routing protocols is implemented in Vehicular Ad-Hoc Network to reduce the number of packet transmissions and to align the vehicular positions by Cluster Based Effective Broadcast algorithm. In order to detect traffic congestions in a fast way and with low overhead. Only a limited number of vehicles are elected as cluster-heads to forward messages. The simulation results shows that it works efficiently by means of a faster detection of congested area.

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A Review on Plants and Food Grains Disease Detection and Quality Checking using Image Mining Techniques

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ABSTRACT :India is an agricultural country. Farmers have wide range of diversity to select suitable fruit and vegetable or food grains crop. Scientists of 21st century are exploring how genetic diversity and ecological sensitivity are necessary in solving problems such as feeding the population and fighting disease. Plants, Fruits and Food grains play important role in human life. This paper studies about the various research works done in the plant leaf based disease detection, fruits or food grains quality checking based on the image processing and image mining classifiers and techniques.

KEYWORDS : Segmentation, Feature Extraction, leaf disease detection, food grain quality

I. INTRODUCTION

Globally, it has been found that there are more than 1.7 million species of living organisms (human beings, plants and algae) on Earth, out of which, plants species plays a vital role in human life. Plants are an essential resource for human well-being and can exist everywhere. Most of the plants carry significant information for the development of human society and are considered as essential resource for human well-being. Plants are of plenty of use as they form the base for food chain and a lot of medicines are derived from plants. Plants are also vitally important for environmental protection.

Even after several innovative advancements made in the field of botany, there are still a huge number of plants that are yet to be discovered, identified and used. It is a well-known fact that unknown plants are treasures waiting to be found. Today's ethno-botanists are combining regions of the world, looking for future medicines and agricultural products.

The functional characteristics and the association of plants within ecosystems are explored by them in order to understand the need for diversity to manage the plant resources.

Research work develops the advance computing system to identify the diseases or verify the quality of fruits or grains using infected images of various leaf spots. Images are captured by digital camera mobile and processed using image growing, then the part of the leaf spot has been used for the classification purpose of the train and test. The technique evolved into the system is both image processing techniques.

Most leaf diseases or quality of grains are caused by fungi, bacteria and viruses. Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures. Bacteria are considered more primitive than fungi and generally have simpler life cycles. With new expectations, bacteria exist s single cells and increase in numbers by dividing into two cells during a process called binary fission viruses are extremely tiny particles consisting of protein and genetic material with no associated protein.

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The detection of plant leaf or fruits or grains is an very important factor to prevent serious outbreak. Automatic detection of plant disease or infected fruits or quality of grains is essential research topic. The term disease or quality is usually used only for the destruction of live plants.

Two main plant or food grains or fruits aspects of plant taxonomy that play a vital role in these endeavours are the identification and classification of plants.

- **Identification** is the determination of the identity of an unknown plant or food grains or fruits in comparison with previously collected specimen. The process of recognition connects the specimen with a botanical name. Once this connection is established, related details like name and other properties of the plant can be easily obtained.
- **Classification** is the placing of known plants or fruits or food grains into groups or categories to show some relationship. They use features that can be used to group plants or fruits for food grains into a known hierarchy.

Basic work flow of the plant disease or grains quality prediction in image processing as follows

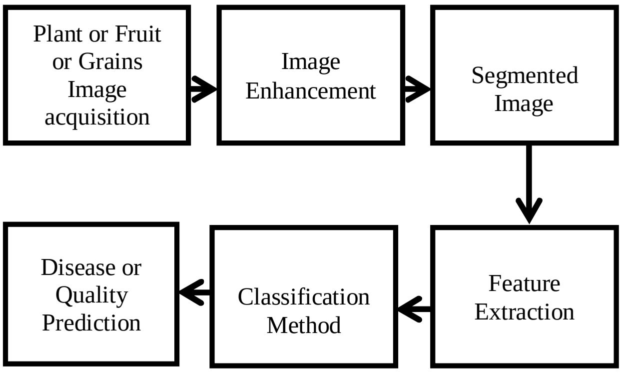

Fig.1. Overall framework

Image enhancement like noise removal, contrast enhancement, Edge detection and Segmentation, feature extraction and analyses the extracted features using classifier are the main processing tasks in the image processing to detect the diseases in leafs and food grains quality verification.

II.LITERATURE REVIEW

The papers which are used to detect the leaf disease using various methods are as follows:

P. Revathi et al [1], proposed cotton plant disease detection system using homogeneous pixel counting and edge detection technique**.** The goal of this research work is identify the disease affected part of cotton leaf sport by using the image analysis technique. This work find out the computer systems which analyse the input images using the RGB pixel counting values features used and identify disease wise and next using homogenization techniques Sobel and Canny using edge detection to identify the affected parts of the leaf spot to recognize the diseases boundary is white lighting and then result is recognition of the diseases as output.

H.Ai-Hiary et al [2] proposedthree fold method to detect leaf diseases. In the first fold identifying the infected object based upon k-means clustering; in the second fold extracting the features set of the infected objects using color co-occurrence methodology for texture analysis; and finally detecting and classifying the type of disease using NNs, moreover, the presented scheme classifies the plant leaves into infected and not-infected classes. The image is segmented using K-Means clustering technique. Otsu method is used to mark mostly green pixels. are masked as follows: if the green The pixels with zeros red, green and blue values and the pixels on the boundaries of the infected cluster were completely removed. Next in the infected cluster was then converted from RGB format to HIS format and SGDM matrices the texture statistics for each image were generated. The texture features for the segmented infected

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object in this phase are calculated. Finally, the recognition process was performed to the extracted features through a pre-trained neural network.

PiyushChaudharyet al.[3] In this paper a comparison of the effect of CIELAB, HSI and YCbCrcolor space in the process of disease spot detection is done. Median filter is used for image smoothing. Finallythreshold can be calculated by applying Otsu method on color component to detect the disease spot. Disease spots are segmented by applying Otsu threshold on “A” component of filtered LAB color space. All these color models are compared and finally “A” component of CIELAB color model is used.

S. Arivazhagan et al [4], proposed four main steps for color transformation structure for the input RG, image is created, and then the green pixels are masked and removed using specific threshold value followed by segmentation process, computing the texture features using color co-occurrence method for the useful segments, finally the extracted feature are passed through the classifier. Support vector machines are a set of related supervised learning method used for classification and regression. By this method, the plant diseases can be identified at initial stage itself and the pest control tools can be used to solve pest problems while minimizing risks to people and the environment.

ShenWeizheng [5], proposed Otsu method and sobel operator to examine the leaf disease. The process of image segmentation was analysed and leaf region was segmented by using Otsu method. In the HSI color system, H component was chosen to segment disease spot to reduce the disturbance of illumination changes and the vein. Then disease spot regions were segmented by using Sobel operator to examine disease spot edges. Finally plant diseases are graded by calculating the quotient of disease spot and leaf areas.

Mrunalini R et at [6], proposed Otsu method and K-Means clustering for feature extraction and comparison of two techniques. Both are used to identify a finite set of categories termed clusters to describe the data.

Joanna et al [7] describes the segmentation consist in image conversion to HSV color space and fuzzy c-means clustering in hue-saturation space to distinguish several pixel classes. These classes are then merged at the interactive stage into two final classes, where one of them determines the searched diseased areas.

KulkarniAnand H [8], presents a methodology for early and accurately plant diseases detection, using artificial neural network (ANN) and diverse image processing techniques. As the proposed approach is based on ANN classifier for classification and Gabor filter for feature extraction, it gives better results with a recognition rate of up to 91%. An ANN based classifier classifies different plant diseases and uses the combination of textures, color and features to recognize those diseases

Vijayaraghavan V et al [9], stated that a support vector machine is a very potential AI method and can apply extensively to solve classification problems. The SVM which is used to solve regression problems is known as support vector regression (SVR). SVR is very popular among researchers for providing generalization ability to the solution model. The manifestation of pathogens in plantations is the one of the most important cause of losses in many crops.

Bernardes [10] give the method of the automatic classification of cotton diseases based on the feature extraction of foliar symptoms from digital images. For the feature extraction this method uses the energy of the wavelet transform and a SVM for the actual classification.

N.S. Visenet al.[11] proposed algorithms to acquire and process color images of bulk grain samples of five grain types, namely oats, barley, rye, wheat, and durum wheat. The developed algorithms were used to extract over 150 color and textural features. A back propagation neural network-based classifier was developed to identify the unknown grain types. The color and textural features were presented to the neural network for training purposes. The trained network was then used to identify the unknown grain types. Classification accuracies of over 98% were obtained for all grain types. Better Accuracy was gained for these grain type samples.

Harpreet Kaur, et al.,[12] proposed a machine algorithm to grade (Premium, Grade A, Grade B and Grade C) the rice kernels using Multi-Class SVM. Maximum Variance method was applied to extract the rice kernels from background, then, after the chalk has been extracted from rice. The percentage of Head rice, broken rice and Brewers in rice samples were determined using ten geometric features. Multi-Class SVM classified the rice kernel by examining the Shape, Chalkiness and Percentage of Broken (Head Rice, Broken and Brewers) kernels. The SVM classify accurately more than 86% .Based on the results, it was concluded that the system was enough to use for classifying and grading the different varieties of rice grains based on their interior and exterior quality.

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Anami B.S, et al. [13] have developed a Neural network approach to classify single grain kernel of different grains like wheat, maize, groundnut, red gram, green gram and black gram based on color, area covered, height and width. The minimum and maximum classification accuracies are 80% and 90% respectively.

Megha R [14], proposes a model that uses color and geometrical features as attributes for classification. The grading of rice sample is done according to the size of the grain kernel and presence of impurities. A good classification accuracy is achieved using only 6 features, i.e. mean of RGB colors and 3 geometrical features. The total success rate of type identification is 98% and total success rate of quality analysis and grading of rice is 90% and 92% respectively.

III. CONCLUSION

Most of the research works based on the Otsu method for segmentation in plant leaf disease detection. Image enhancement like noise removal, contrast enhancement, Edge detection and Segmentation, feature extraction and analyses the extracted features are the main processing tasks in the image processing to detect the diseases in leafs and food grains quality verification.

Our work focus the Indian food grains like green grams, black gram and dhal varieties quality checking process based on the Thershold based segmentation and SVM classifier.

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Opportunistic Cluster based Broadcasting using Selective Reliable Broadcast in VANETs

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Abstract— Vehicular Ad hoc Network (VANET) is a subset of Mobile Ad hoc Network (MANET). VANET is a self-organized information system composed of vehicles (and possibly additional infrastructure) capable of short-range communication through the device called On Board Unit (OBU). There is a wide range of possible application areas of VANETs, including warning systems, collision avoidance/notification, autonomous vehicles, and traffic optimization. VANETs rely heavily on broadcast transmission. When a vehicle rebroadcasts a message, it is highly likely that the neighboring vehicles have already received it, and these results in a large number of redundant messages. This affects inter-vehicle communications, since redundant rebroadcasts, contention and collisions can be largely increased as the number of vehicles increases. Broadcasting packets may lead to frequent contention and collisions in transmission among neighboring vehicles this problem is referred as the broadcast storm problem. The main goal of Selective Reliable Broadcast protocol (SRB), is intended to limit the number of packet transmissions. Through an opportunistic vehicle selection, packets are retransmitted towards a next hop, in order to strongly reduce the number of forwarder vehicles, while preserving an acceptable level of QoS. SRB belongs to the class of broadcast protocols, as well as cluster-based approaches. It exploits the partitioning behavior, as typical from vehicular ad hoc networks, in order to automatically detect vehicular clusters, intended as "zones of interest". Packets will be then forwarded only to selected vehicles, opportunistically elected as cluster-heads. SRB performances have been assessed in different vehicular scenarios, mostly realistic environments, such as highway scenarios.

Keywords— Broadcast, Vehicular Ad Hoc Network (VANET), Cluster, Broadcast Storm Problem.

I. INTRODUCTION

Vehicular Ad hoc Networks (VANETs) are emerging as the preferred network design for Intelligent Transportation Systems (ITS), providing inter-vehicular short-range communications, for the support of Internet access and safety applications.

VANETs are a particular class of Mobile Ad-hoc Networks (MANETs), showing typical characteristics. Indeed, VANETs consist of mostly highly mobile nodes moving along the same or opposite directions (i.e., vehicles), forming clusters. Vehicle-to-vehicle (V2V) communications are supported due to "smart" vehicles, equipped with On-Board Unit with multi-Network Interface Cards (NICs), such as IEEE 802.11p, WiMAX, Long Term Evolution, and also Global Navigation Satellite System (GNSS) receiver. However, communications among vehicles belonging to different clusters are not always guaranteed, due to connectivity disruptions caused by quick topology network changes, different and variable vehicle speed, and sparse or totally disconnected scenarios. Moreover, also the market penetration rate can hinder inter-vehicular communications: unequipped vehicles physically occupy space and then alter the spatial distribution of equipped vehicles, and their mobility. On the other side, connectivity improves as the market penetration increases, since it directly translates in an increasing probability of finding a neighboring vehicle that forwards messages.

Inter-vehicle communications are expected to significantly improve transportation safety and mobility on the road. Several applications of inter-vehicle communications have been identified, from safety and warning applications, up to traffic control and driver assistance applications [7].

In this vision, most applications targeting VANETs rely heavily on broadcast transmissions, such as to discover neighboring vehicles, as well as to disseminate traffic-related information to all the reachable vehicles within a certain geographical area i.e., mostly in general for context-aware applications. On the other side, broadcasting packets may lead to frequent contentions and collisions, due to redundant transmissions among vehicles in dense network topologies. This problem is referred to as the broadcast storm problem. It affects inter-vehicle communications, since redundant rebroadcasts, contentions and collisions can be largely increased; when a vehicle rebroadcast a message, it is highly likely that the neighboring vehicles have already received it, and this results in a large number of redundant messages and replica.

In a traditional MANET environment, multiple solutions have been proposed in order to alleviate the broadcast storm effect, but only a few solutions have been addressed to the VANET context [3]. Most of recent research works have focused on analyzing VANETs as well-connected networks, providing high vehicular traffic density. As vehicles in close proximity detect the same dangerous situation, they will inevitably broadcast messages relating to the same event, leading to a dramatically excessive message redundancy. In such scenarios, broadcast suppression solutions have to be considered. In contrast, in low vehicular traffic density environments, with a sparse Road Side Units (RSUs) settling and a low market penetration rate, vehicular connectivity results intermittent, poor, and short-lived [17]. In this context, the design of reliable and efficient routing protocols for supporting highly diverse, and mainly intermittently connected vehicular network topologies, is still a challenge. Hybrid solutions based on both V2V, and vehicle-to-infrastructure (V2I) communications, result as a viable alternative to routing protocols that exploit the

V2V paradigm only [16].

In this paper, we present a cluster-based broadcast technique for safety applications in VANETs. Our approach is called Selective Reliable Broadcast (SRB), and relies on the opportunistic cluster selection in order to reduce the broadcast storm effect: SRB selects only one vehicle within a cluster namely, a cluster-head in order to efficiently rebroadcast emergency and control messages. SRB technique is then able to detect the well-known car platoons, which cause traffic congestions and delays, in a fast way and with low overhead, in order to eventually recommend alternative paths to other vehicles. As a result, SRB limits the number of transmissions but preserves good network performance.

II. RELATED WORK

In this section we provide an overview of previous contributions in broadcast protocols for VANETs, particularly focusing on cluster-based approaches. Within the discussion, we clarify the paper objective and then introduce our proposed approach.

Reliable protocols use three methods i.e., (i) rebroadcasting, where the transmitter node retransmits the same message for many times, (ii) selective ACK, where the transmitter requires ACK from a small set of the neighbors, and (iii) changing parameters, where the transmitter changes transmission parameters according to the expected state of the network.

The problem statement for reliable protocols is to design a protocol that can deliver a message from a single source to every node in the own transmission range with the highest possible reliability and minimum delay. Successful message dissemination in VANETs needs an efficient decision mechanism in order to maximize reliability, and keep the overhead low. The decision criterion about when and how a safety message should be delivered or repeated is an open issue.

Given the requirements of safety applications (i.e., low delay and effective reliability), and the limitations of vehicular communications (i.e., short-lived connectivity links), selective broadcast or multicast strategies seem more applicable than either unicast routing or flooding. In fact, the latter generates a high overhead without increasing the success rate substantially [4]. Several solutions have been made to introduce intelligence to the basic broadcast concept, and make it more selective and, thus, more efficient in its resource usage.

A largely common assumption in connectivity models for VANETs is that a vehicular network is partitioned into a number of clusters [12]; vehicles within a partition can communicate either directly or through multiple hops among each other, but no direct connection exists between partitions, as well depicted in Fig. 1. A particular class of routing protocols namely, the cluster-based approaches uses this assumption by exploiting clusters formation [9].

Based on geographical locations, directions of movement, speed and many other metrics, vehicles can group into different clusters. Clustering enhances effective broadcasting and relaying of messages, while reducing the overhead associated with signaling and the number of unnecessary message replica. This is due since links among vehicles within the same cluster tend to be more stable, although dynamic topology changes can occur. Leveraging on this issue, an efficient clustering should be based on adequate metrics and should take into account the frequent topology changes. The formation of clusters and the selection of the cluster-head (i.e., a vehicle leader within the cluster, responsible for intra and inter-cluster communications) are strongly affected by the high mobility dynamic cluster formation process. Ni et al. (1999) [14] consider each cluster comprised of three node types i.e., head, gateway and member. The gateway nodes are those who connect to the gateway nodes in other clusters, while the cluster-head is a node whose transmission radius can reach

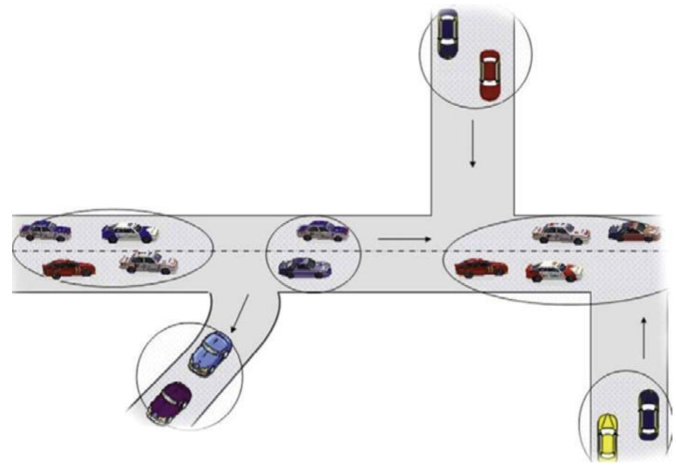

Fig.1 Schematic of several vehicle clusters. Vehicles belonging to the same cluster can communicate each other, while due to the gaps among consecutive clusters, no inter-cluster communications are available.

everyone in the same cluster. Finally, members are those who do not belong in either head or gateway group. When a gateway node receives a message from other clusters, it will rebroadcast the message that will be received, and then further retransmitted, by the cluster-head. Although this cluster architecture is correct [14], the authors did not specify the procedure for the cluster-head election.

Fasolo et al. (2006) [5] propose a Smart Broadcast protocol, which exploits vehicles' positions. The proposed technique assumes that the vehicular network is partitioned in adjacent sectors and that vehicles are able to estimate their own position and, therefore, the sector they belong to. The Smart Broadcast technique considers a contention resolution procedure to elect the relay nodes. Although this technique seems very efficient, it has not been validated in terms of network performance and system overhead. Another work that considers both information on vehicles' position, and the cluster formation, is presented by Luo et al. (2010)[13]. Their approach is a cluster-based routing protocol and the basic idea is to divide the geographic area into foursquare grids, where a vehicle is elected as the cluster-head to route data packets across nearby grids. Also, this technique needs to be validated via simulation results. Finally, in [15] propose an RSU-assisted cluster head selection, by exploiting V2I connectivity, whenever inter-vehicle communications are not available.

In all the previous works, mobility aspects have not been considered, while it is noticeable that the cluster selection process is particularly affected by vehicle mobility and cluster stability. Benslimane et al. (2011) [2] consider the cluster formation on the basis of the direction of vehicles movement, the Received Signal Strength (RSS), and the inter-vehicular distance. In this envision, the directional antenna-based Medium Access Control (MAC) protocols are exploited to accurately group vehicles on the basis of the direction of their movements and the transmission angles. Gunter et al. (2007) [6] take into account mobility during cluster collision, and a cluster-head vehicle is that one with the lowest relative mobility and closest proximity to its neighbors.

Alternatively, Kayis and Acarman (2007) [10] classify nodes into speed groups, so that nodes belonging to the same speed group will be in the same cluster. Koyamparambil Mammu et al. (2013) [11] propose a cluster-based MAC protocol able to form stable clusters, and elect stable CHs, while achieving high reliability and low delay. This is achieved by considering vehicles in the VANETs are divided into different clusters based on their position, direction of movement, lanes, and speeds. Also,[8] present a CH selection technique, based on the relative speed, and distance of cluster heads from vehicles within their neighborhood. Finally, a well-known mobility-based clustering technique is MOBIC [1], which considers an aggregate local mobility metric as the basis for cluster formation: the node with the smallest variance of relative mobility to its neighbors is elected as the cluster-head.

In this work, we present SRB, a reliable cluster-based routing protocol that is expected to minimize the number of rebroadcast messages. SRB considers the cluster selection process, and the cluster-head election, by exploiting the inter-vehicle distance and the time delay. Via simulation results, SRB results in an efficient method to detect clusters and alleviate the broadcast storm problem.

III. PROPOSED WORK

A selective reliable broadcast protocol (SRB) is expected to minimize the number of rebroadcast messages by limiting the number of packet transmission. Through an opportunistic vehicle selection, packets are retransmitted towards the next hop, in order to strongly reduce the number of forwarder vehicles. This can be done by detecting the cluster of vehicles in a fast and efficient way and elect one as CH vehicle for each cluster detected.

A. Mobility Model Generator

The most important parameters in simulating ad-hoc networks is the node mobility. It's important to use real world mobility model so that the results from the simulation correctly reflect the real-world performance of a VANET, example a vehicle node is typically constrained to streets which are separated by buildings, trees or other objects. Such obstructions often increase the average distance between nodes as compared to an open-field environment.

We will deploy a tool MOVE (Mobility Model Generator for Vehicular networks) to which will provide facility for the users to generate real world mobility models for VANET simulations. MOVE tool is built on top of an open source micro-traffic simulator SUMO (Simulation of Urban Mobility). The output of MOVE is a mobility trace file that contains information of real-world vehicle movements which can be used by NS-2 or Qualnet. MOVE provides a set of GUIs that allows the user to quickly generate real-world simulation scenarios without any simulation scripts.

MOVE consists of two main components: The Map Editor and the Vehicle Movement Editor, The Map Editor is used to create the road topology. Currently we have implemented three different ways to create the roadmap– the map can be manually created by users, generated automatically, or imported from existing real-world maps. The Vehicle Movement Editor allows user to specify the trips of vehicles and the route that each vehicle will take for one particular trip. The output of MOVE is a mobility trace, generated based on the information users input in the Map Editor and the Vehicle Movement Editor, which can be immediately used by a simulation tool such as ns-2 to simulate realistic vehicle movements.

- *MAP Editor:* In MOVE, the road map can be generated manually, automatically or imported from a real-world map. Manual generation of the map requires inputs of two types of information, nodes and edges. A" node" is one particular point on the map which can be either a junction or the dead end of the roads. Furthermore, the junction nodes can be either normal road junctions or traffic lights. The edge is the road that connects two points (nodes) on a map. The attributes associated with an edge include speed limit, number of lanes the road priority and the road length. The map can also be generated automatically without any user input. Three types of random maps are currently available: grid, spider and random networks. There are some parameters associated with different types of random maps such as number of grids and the number of spider arms and circles. Finally, one can also generate a realistic map by importing real world maps from publicly available database.

- *Vehicle Movement Editor:* The movements of vehicles can be generated automatically or manually using the Vehicle Movement Editor. The Vehicle Movement Editor allows users to specify several properties of vehicle routes including number of vehicles in a particular route, vehicle departure time, origin and destination of the vehicle, duration of the trip, vehicle speed. In addition, user can define the probability of turning to different directions at each junction (e.g. 0.5 to turn left, 0.3 to turn right and 0.2 to go straight) in the editor.

B. RTB and CTB clearance

Before sending Request-To-Broadcast (RTB) and Clear-To-Broadcast (CTB) message, network is partition into a sector through which the message is propagate along the transmission direction from the source vehicle and are identified as portion of a circle. The sector size varies as a dynamic process, iteratively hop by hop, depending on the transmission direction from each transmitting vehicle. The i_{th} sector is identified by an angle $\alpha_i(h)$, where h is the index of current hop. Initially, in the h=1 hop, there is a unique sector that includes the source vehicle's transmission range i.e., corresponding to an angle α(h)=360. On the next hops (i.e., when h=1), n sectors are identified, each one associated to the n_{th} forwarder vehicle, by the second hop (i.e., h>1) we consider that the i_{th} forwarder vehicle has an angle corresponding to its forward or backward transmission range, so that $\alpha_i(h>1)$=180. In Fig.2 depicts the sector identification in the first and second hops.

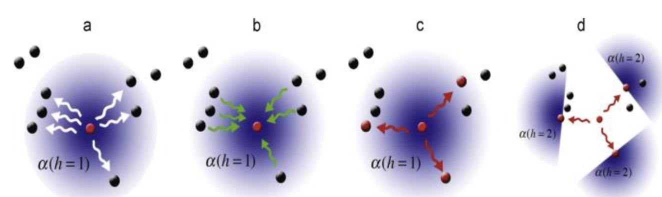

Fig.2 Sector Formation

The red and black points are respectively the source and neighboring vehicles, while the blue area represents the transmission range of one vehicle. In the first hop, during (a) RTB transmission, (b) CTB transmission, and (c) cluster-head selection, α(h=1) =360. By the second hop, (d) the message propagation is only backward or forward, and then α(h=2) =180.

SRB consider a contention procedure and cluster detection mechanism as follows

A source vehicle transmits an RTB control message to all the neighboring vehicles in the transmission range. After receiving an RTB message, the vehicle computes their distance from the source vehicle Than the vehicle sends back to the source as CTB packet, containing the vehicle ID and its distance from the source. After receiving a valid CTB packet, vehicle exit the contention phase.

C. Cluster detection and CH election

Once the source vehicle receives information on the ID and the distance from its nearby vehicles. By measuring the Direction of Arrival (DoA) of the CTB messages, the source vehicle is able to calculate all the mutual inter-vehicle distances among its nearby vehicles. If the distance between each couple of nearby vehicles is lower than a threshold value (i.e., D_{min}), the two vehicles will be considered belonging to the same cluster as shown in Fig.3 The choice of D_{min} influences the number of clusters identified: the higher the distance threshold, the higher the number of vehicles in each cluster.

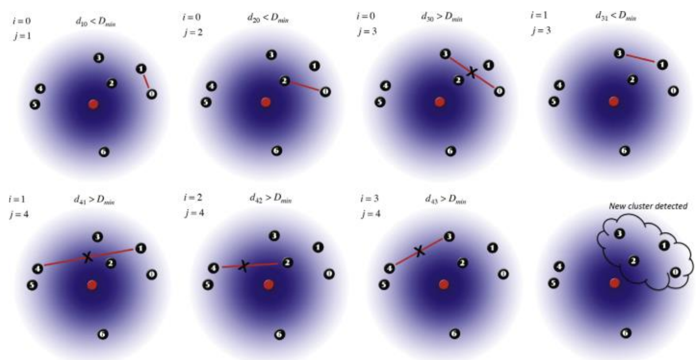

Fig.3 Cluster Detection Mechanism

After detecting multiple clusters, the source vehicle elects the furthest vehicle inside each cluster as the CH, and transmits a data message only to such vehicle. Upon receiving the data message, each CH will become the message source for the next contention phase, and the SRB method is repeated for the next hops. In Fig.4 depicts the main phases of SRB technique for a forward data transmission along the vehicular grid. Once the CH vehicles are identified, they will forward message according to SRB technique.

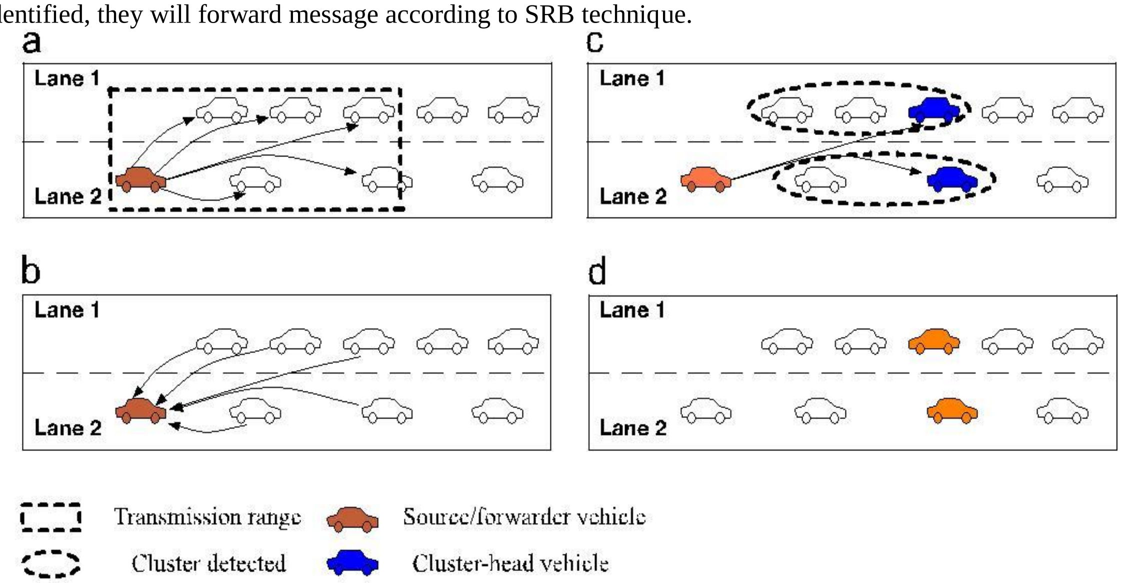

Fig.4 Main phases of SRB technique: (a) RTB transmission, (b) CTB transmission, (c) Cluster detection and CH election, and (d) message propagation.

The design and implementation of the cluster detection mechanism in the SRB algorithm follows the steps of the method Cluster Detection (), Let us define:

- **veh**, as a m _ 1 array whose elements are the vehicles' IDs reachable by the transmitter vehicle. The array is sorted according to the angles formed by the DoA of the messages sent to the transmitter;
- **sels**, as a dynamic array, initially null, whose elements are the forwarder vehicles' IDs (i.e., the selected vehicles for next hop forwarding).

During the initialization, we define three indexes i.e., i and j, used to calculate the inter-vehicle distances, and k is the index associated to the array of forwarders (i.e., **sels**). The method Cluster Detection has a 'while' command, which considers three different cases:

- Case 1: the index j is greater than the number of elements comprised in **veh**;
- Case 2: the distance between a couple of vehicles is less than D_{min} [m] i.e., the minimum distance within the cluster;
- Case 3: the distance between a couple of vehicles is greater than D_{min} [m].

The calculus of distances $v_{i,j}$ between two neighboring vehicles is done by means of the method distance (v_i, v_j), and starts for a null value of angle. This means that the first comparison will be between the vehicle with index 0 and the vehicle with index 1, where 1 and 0 are the positions of elements of the array.

IV. PERFORMANCE ANALYSIS

A. Simulation Environment

The simulation environment used for the proposed work is given in the following Table I. It describes the various parameters used for the simulation.

TABLE I
SIMULATION PARAMETERS AND VALUES

PARAMETERS	VALUE
1. Channel	Wireless channel
2. Antenna	Omni/Directional Antenna
3. MAC Protocol	IEEE 802.11
4. Routing Protocol	AODV
5. No. of Nodes	100

B. Performance Parameters

The performance analysis of the VANET based on Selective reliable broadcast is done with the help of the parameter.

- *Throughput:* Throughput denotes that the correct cluster detection has occurred if the amount of packet exchange has increased significantly. In Fig.5 shows throughput experienced by vehicles moving in highway scenario. The throughput of SRB approach increases by 15.38% when compare to CDP approach.

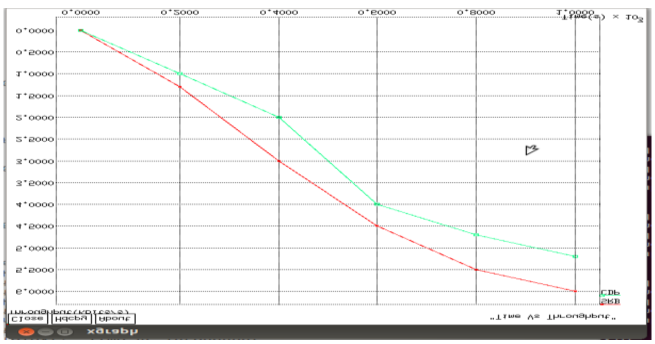

Fig.5 Throughput

- *Packet Delivery Ratio:* Packet Delivery Ratio is defined as the ratio of number of packets successfully received and number of packets transmitted. It increases due to successful transmission of packets by the intermediate nodes. In Fig. 6 shows that the SRB approach is increases by 18.75% when compared to CDP approach.

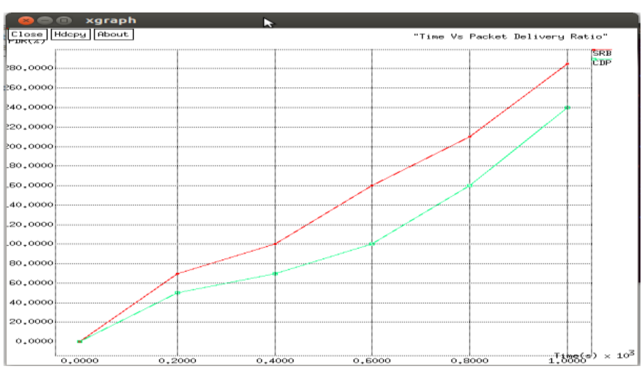

Fig.6 Packet Delivery Ratio

V. CONCLUSION AND FUTURE WORK

In SRB, aims to alleviate the broadcast storm problem by selectively broadcasting the message within their own transmission range that will reduce the network overload and limit the message duplication SRB is particularly effective for safety applications: it relies on cluster-based routing protocols, as well as exploits the vehicles positions, in order to detect traffic congestions in a faster way and with low overhead. Only a limited number of vehicles are elected as cluster-heads to forward messages. SRB has been validated through the simulation, of highway scenarios it works efficiently by means of a faster detection of congested area. In future it can be extended for urban scenarios.

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A Selective reliable communication to reduce broadcasting for cluster based VANET

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Abstract: Vehicular Ad hoc Network (VANET) is one of the subset of Mobile Ad hoc Network (MANET) and it is a self-organised system with a group of vehicles, which are capable of short-range communication using On Board Unit (OBU). This unit is comprised with the vehicles that are possible to communicate with the nearby vehicles. VANETs rely on heavy broadcast transmission due to sharing data (messages) between the nearby vehicles about the traffic, collision and so on. This redundant information spoils the nature of VANET that affects the inter-vehicular communication, rebroadcasting and information on collision. This message transmission increases largely as the number of vehicles increases. This problem is typically named as broadcast storm and it is relatively reduced through the proposed Selective Reliable Communication (SRC) Protocol. Through a reliable communication, packets are retransmitted to reduce a number of transmission in the network within the acceptable level of QoS. The proposed SRC protocol automatically detect the vehicle clusters as "Zone of Interest". Generally, the proposed protocol forwards the packets to the cluster-heads and the cluster-head forwards the packets to the cluster-members. The proposed protocol outperforms than the existing protocols in terms of Throughput, Packet Delivery Ratio (PDR) and Average delay.

Keywords: VANET; MANET; QoS; Reliable communication; cluster communication

1. Introduction

VANETs are emerging from MANET where the network is preferably design for the Intelligent Transport System (ITS) which provides an inter-vehiclular short range communication for the common support of safety applications. As rapid growth in transportation system, the traffic and other vehicle related issues were increased in the past decades. Due to this, road accidents and traffic congestions are noticed huge in the recent years. World Health Organisation (WHO) reports that the over 1 million deaths are causing every year due to vehicle accidents [1-4]. Therefore the need of road safety, traffic management information and other relevant information are to be shared with the vehicles using a defined network called VANET. Generally, VANET provide vehicle-to-vehicle (V2V) communication and Vehicle-to-infrastructure (V2I) communication to share information between vehicles [3]. VANETs is an ITS with the composed of interconnected vehicles and Road Side Units (RSU).

V2V communication is accomplished using some hardware and software equipments that are specially made for VANETS [5-7]. They are, OBU with Network Interface Cards (NIC), which can connect to IEEE 802.11p, WiMAX, Long Term Evolution (LTE), Global Navigation Satellite System (GNSS) receiver and so on. Vehicles are connected together to form a cluster that can communicate easily. However, communication between different clusters may disrupted due to some of the network topology changes, variable speed in between vehicles and in disconnected scenarios [8].

Moreover, the message transmission and duplication of messages are increased heavily and detains the performance of the network. The data transmission is carried out to discover neighboring vehicles and to transfer traffic-related information to the nearby vehicles through context-aware applications. Even though the broadcasting is achieved, it may lead to frequent contention and collision because of redundant transmission between the vehicles in a high density network [9-11]. This problem is generally referred as broadcast storm problem and it affects inter-vehicle communications with increased contention and collision through rebroadcasting of a message between the vehicles [10].

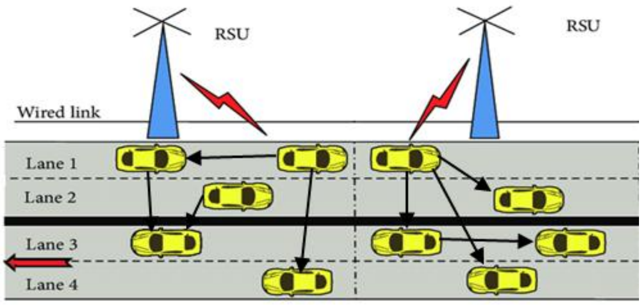

Fig. 1. VANET Architecture.

The Figure 1 shows the basic architecture of VANET. Here the vehicles receives the messages from the RSU and forwards the data to the nearby vehicles. RSUs are associated with the wired link and it forwards the data through wireless mode.

In a MANET environment, solutions are proposed to alleviate the broadcast storm affect in VANET environment. Some recent research works focused on analysing VANET as a well-connected network that provides a high traffic density. As vehicles in close area, sense the traffic situation of the same situation broadcast the message to the other vehicles, which leads to an excessive message redundancy. on the other side low vehicular density with RSU and low traffic results in low and poor network connectivity and intermittent. The design of reliable and efficient routing protocol is a challenge. Suppose a hybrid solution is an effective way to propose an alternate routing protocol to improve the V2V communication [12].

This paper presents a selective reliable communication protocol to provide a better cluster-based broadcasting technique. The paper is organised in the subsequent sections: Section II provides information about Literature review of the past works in the same area. Section III presents the problem statement and Section IV tells about the proposed SRC protocol. Section V presents simulation results and Section VI concludes the paper with conclusion and future work.

2. Related work

This section details the previous works of VANET to avoid the broadcast storm in cluster-based approaches.

Benrhaiem et al. propose multi-Hop Reliable Broadcasting (M-HRB), for wide range of VANET applications for the urban area [13]. The protocol is proposed based on local state information where the streets are divided into multiple cells. These multiple cells are formed together to form grid-like zones. A Proactive local state processing is proposed to exploit features of periodic beacons. Thus estimates the neighbour's quality and adequate forwarders are identified and achieve desirable reliability in each hop in multi-hop broadcasting. Additionally the consumption bandwidth is minimised and it improves the lifetime of the network. M-HRB attains better performance than the existing schemes in terms of reliability and bandwidth consumption. Even though it achieves better performance in terms of reliability and selection of forwarders is not reliable in MANET where the selection of forwarders is to be maintained and selected for each transmission that setbacks the performance in a network with a large number of vehicles.

Selvi & Ramakrishnan presents an efficient message prioritization technique with the scheduled partition for transferring emergency message in VANET [14]. The work focused in prioritizing the messages before beginning the transmission reduces the rebroadcasting of same messages to the same nodes. Therefore, the first priority is focused in prioritizing the transmission in VANET. To prioritize, data identification is focused in partitioning the data as normal data or emergency related data. As emergency data is high prior to reach the nodes compare to the normal data. Thus, the emergency data transmission is identified as high priority and transfer it to the nodes. Second, the emergency transmission and normal data transmission is processed using two techniques named, i) based on Similarity metrics of the SMTP and ii) based on the adaptive scheduled partitioning technique. The SMTP flows with normal data and adaptive scheduled technique follows for emergency message transmission. This schemes attains better results in data transmission yet, choosing the transmission technique and detecting the message type is a tedious process where the number of messages are huge and transmission range is high.

Pramuanyat et al., proposed a location based reliable broadcasting for VANET [15]. ITS in VANET enables a huge number of safety applications where these applications requires speed and safety transmission, reliability and restricted area dissemination for transferring high priority information to the right vehicles. The ability of location awareness is identified mostly using Global Positioning Systems (GPS), which gives inaccuracy in closed area. Therefore, the proposed work focused in reliable broadcasting protocol relies on Distributed Energy Conservation

Energy (DECA). DECA provides a better location services to identify the nodes in VANET. Thus, the accuracy of data transmission is improvised.

Oliveira et al., proposed a reliable data transmission protocol to transfer traffic safety information in VANET [16]. One of the major challenge in VANET is to design an adaptive broadcast protocol to detect the broadcast storm. This work proposed a novel Adaptive data dissemination Protocol (Addp) to handle the broadcast storm using periodical and dynamical adjustment for beacon periodicity and reducing the beacons and messages in the network. The effectiveness of the proposed protocol is evaluated and attains better performance than the other existing protocols. Even though the proposed work achieves better performance than the existing work in throughput for urban areas, the same protocol detains its level to a minimal throughput for large metro areas.

Ramalingam & Thangarajan focused in clustering based on obtained weight value and disseminating the emergency message through Selective Reliable Broadcasting (SRB) [17]. Generally, vehicles are manufactured with an onboard unit to communicate with other vehicles for overall driving experience and security. V2V and V2I communication provides vehicles with route and traffic information but the dynamic topology of VANET maintains frequent disconnection however, the proposed work guarantees efficient cluster formation and maintenance based on the proposed weighted cluster algorithm. Emergency message is disseminated based on the proposed SRB protocol. The proposed protocol achieves a better performance than the other existing protocols in terms of throughput and data transmission.

Abbasi et al., proposed a fast and reliable nultihop routing protocol called Intelligent Forwarding Protocol (IFP) in VANET for disseminating safety messages (overall safety messages) between the vehicles [18]s. In an dynamic environment many protocols are proposed to share safety messaged among vehicles. Most of the proposed work performs adequately under the limited and minimal traffic conditions. The proposed protocol exploits handshake-less communication with ACK decoupling for efficient collision resolution. IFP is theoretically modelled using simulation and real-world experiment. The message propogation delay is reduced and thus improves the Packet Delivery Ratio (PDR) of the proposed protocol.

Sattar et al., proposed reliability and energy-efficiency on safety message broadcast in VANET [19]. The model focused in reliability of flooding as an underlying data dissemination protocol to deliver time-critical safety message. The end-to-end reliability is provided through the network layer and it results insights about the flooding mechanism. Maintaining the threshold value after a certain rounds of message improves the PDR rate that results in improving the lifetime of the network. The energy-efficient protocols is a key requirement in the upcoming Internet of Vehicles (IoV) and the proposed protocol validates the improvements through simulation results with the existing schemes.

The above existing works shows that the broadcast storm is an important issue in VANET to resolve to obtain better network model. The proposed work SRC focused in minimising the broadcast storm through retransmitting the messages to the network with the acceptable level of QoS.

3. Problem Statement

The proposed SRC protocol focused in reducing the broadcast storm. Some common problems due to broadcast storm in VANET is,

- It is the accumulation of broadcast and multicast traffic.
- The switches repeatedly rebroadcast the broadcast messages and flooding in the network.
- Layer 2 header does not support a time to live (TTL).
- Whenever a frame is sent to a looped topology then it loops forever.

The proposed work focused in minimizing the number of rebroadcast through limiting the number of packet transmission. Through implementing Connected Set of Vehicles (CSV) and Eliminated Set of Vehicles (ESV) in a GPS equipped vehicles to broadcast the intensive beacon message between the nearby vehicles. The proposed SRC details in the next section.

4. Proposed SRC Protocol

The proposed work focused in SRC protocol to limits the broadcast storm. The protocol maintains the vehicles as two distinct sets named CSV and ESV. The block diagram of the SRC protocol is shows in Fig. 2.

Before the broadcasting begins, the reliability of the vehicle is checked. Based on the reliability the vehicles are classified into CSV and ESV. Through CSV the broadcasting of message transmission will successfully transmitted. Whenever the reliability of vehicles ends with ESV set, then the broadcasting is eliminated from the vehicle and transmission is stopped.

Connected Set of Vehicles

The CSV is identified based on the reliability of the vehicle. Whereas, the speed of the vehicle and timestamp is normally generated with the basic packets structure. Based on the timestamp and the basic threshold value the vehicle will be considered as CSV or not. Whenever the timestamp attains greater value then the vehicle remains in the CSV. On

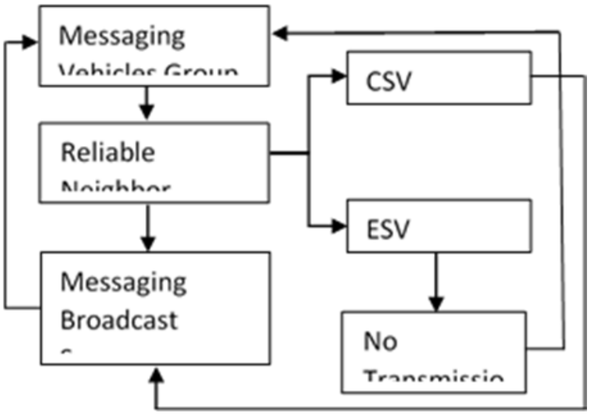

Figure 2. Block diagram of SRC Protocol

successful verification of reliability then the message transmission will be processed.

Eliminated Set of Vehicles

The ESV set generally joins after the CSV check. Whenever the vehicles fails to join into CSV then the vehicle will be automatically joins to ESV. For every messages the vehicle will be recheck its threshold value and timestamp value to group the vehicle into CSV or ESV.

Additionally the vehicles in ESV checks with distance of the vehicles and the basic threshold value of distance. Whenever the vehicle attains a less distance than the threshold distance then ofcourse those vehicles are reconsidered to join as CSV else the vehicle will remains in ESV.

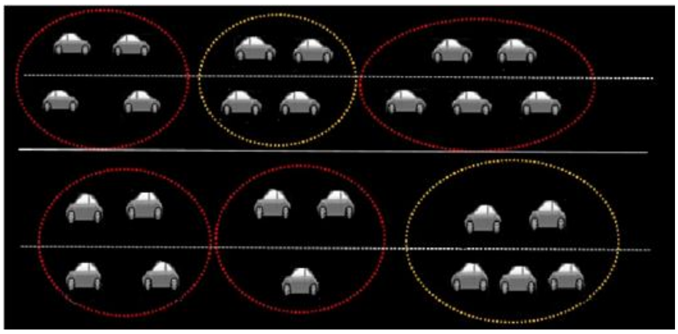

Figure 3. Proposed CSV and ESV

The Fig. 3. shows the proposed SRC protocol with CSV and ESV. the red dotted circle is a CSV and yellow dotted is mentioned as ESV. Both the sets may vary due to time, speed and other common parameters. Therefore, the data transmission will be processed before each message transmission.

Generally, the cluster detection is formulated based on the basic architecture of the VANET. Here the SRC adds cluster detection method to form a better cluster under the three different cases:

- Case – 1: the defined index *j* is greater than the reachable transmitter vehicle ID. (*j* – as median vehicle)
- Case – 2: distance between the couple of minimum distance vehicle within the cluster.
- Case – 3: distance between the couple of maximum distance vehicle within the cluster.

Through the above cluster detection mechanism the better cluster formation is identified. Additionally, the clusters are formed with the proposed SRC protocol to broadcast a message in a better VANET environment.

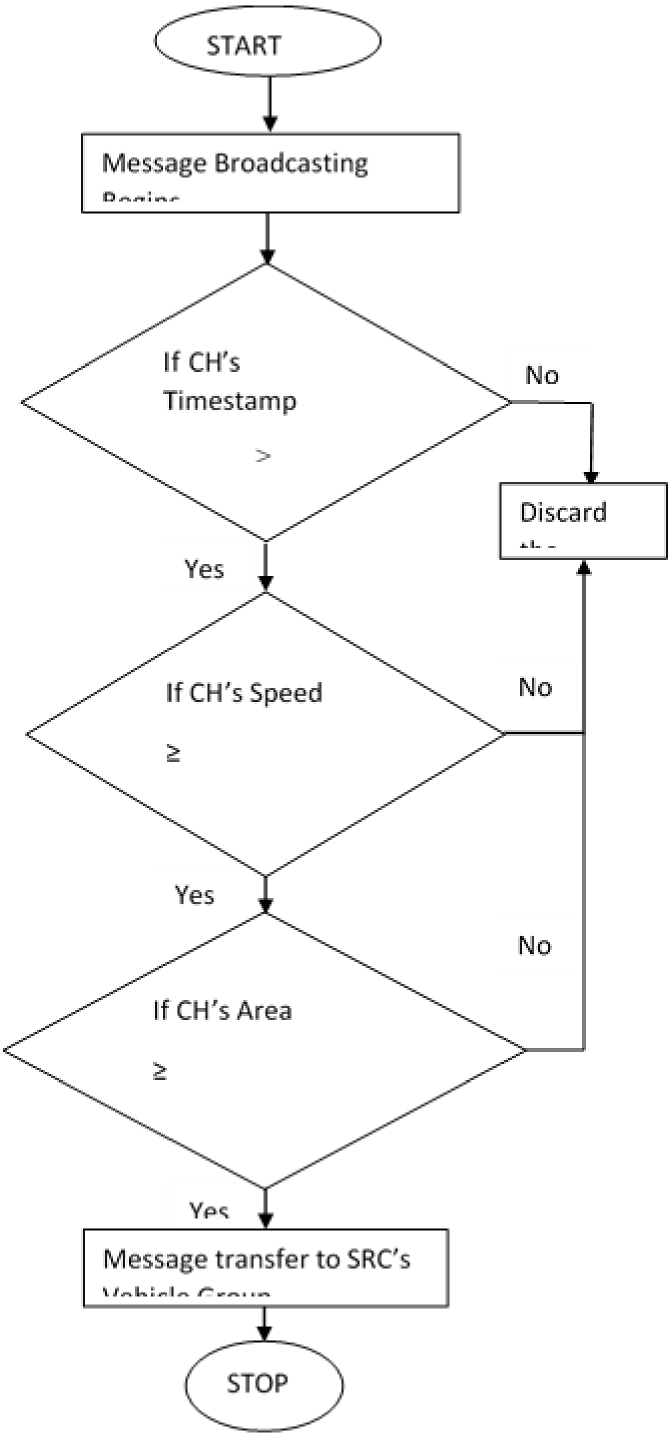

Fig. 4. Flow of SRC Protocol

The Figure 4 presents the flow of SRC protocol. The CH forwards the data to the CM as Zone of Interest.

5. Simulation Results

This section presents the performance of SRC protocol is implemented using NS2.34. The performance of the proposed protocol is compared with the existing schemes ROAC-B, EWCA and CDP. The various parameters used for the proposed simulation is detailed in Table I.

TABLE I. SIMULATION PARAMETERS

Parameters	**Value**
Channel	Wireless Channel
Antenna	Omni/Directional Antenna
MAC Protocol	IEEE 802.11
Routing Protocol	Proposed SRC
No. of Nodes	100
Transmission Rate	250 Kbps
Area Coverage	1000 x 1000m
Direction	Bidirectional
Simulation Time	500 Sec

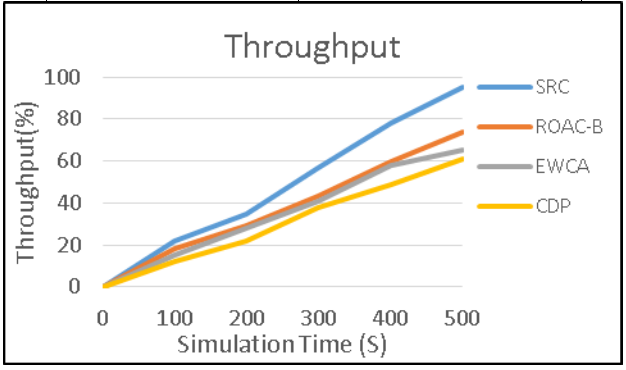

Fig. 5. Throughput

Figure 5 compares the proposed SRC protocol with the existing schemes. SRC achieves 95% of throughput than ROAC-B (74%), EWCA (65%) and CDP (61%).

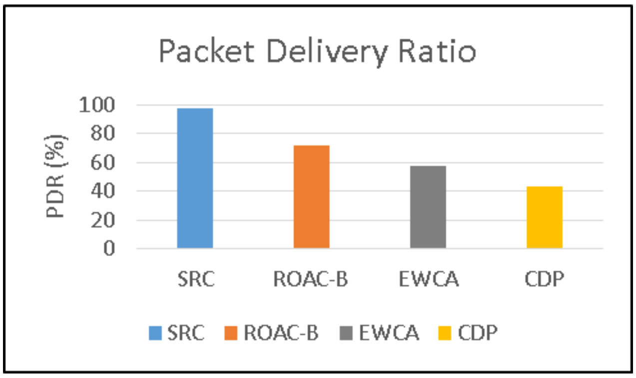

Fig. 6. Packet Delivery Ratio

Figure 6 shows the PDR (%) between proposed SRC with the other existing schemes. SRC maintains 98% of PDR whereas ROAC-B maintains 72%, EWCA retains 58% and CDP comes with 43%. It shows that the SRC maintains a better PDR than the existing schemes.

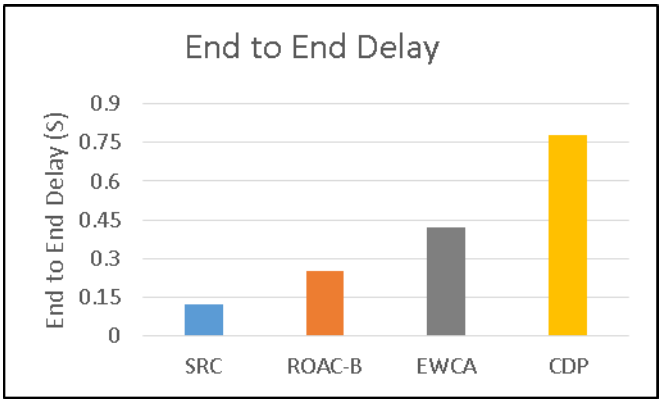

Fig. 7. End to End Delay

The Figure 7 presents End to End Delay between the proposed SRC and the other existing works. The proposed SRC maintains a less delay as 0.12 Sec compared to ROAC-B 0.25 Sec, EWCA with 0.42 Sec and CDP maintains 0.78 Sec.

The above figures 5, 6 & 7 proves that the proposed SRC maintains a better performance than the above-mentioned existing schemes.

6. Conclusion & Future Work

The VANET is an emerging network where the vehicles are transmitting the data about the traffic situation and other relevant information to the nearby vehicles. Even though the VANET is efficient in communicating and transferring the data, the broadcast storm occurs often to detains the performance of the network. To overcome the broadcast storm, there are number of effective protocols are defined. Since, the broadcast storm is not eradicated in the network. Therefore, the proposed SRC protocols found an effective technique to retransmit the data to the Zone of Interest to eradicate the storm and the performance of the SRC proves the broadcast storm is vanished in the VANET. In future, to improve the security in preserving the data transmission can be included with the SRC to implement the same protocol in the Internet of Vehicles (IoV)..

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Efficient and Reliable Cluster Head Selection Mechanism to broadcast collision information in Vehicular Ad-hoc Network

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Abstract-

Recent technology developments and researches in all aspects on information technology makes the Vehicular Adhoc Network (VANET) to develop the communication terminologies for their own network to perform effective communication. Some of the common areas of VANET considered for research such as routing, security, message broadcasting and so on have been improved to communicate and transmit the packets in a prominent manner. Therefore, the architecture of the VANET is remodified as per the three common scenarios such as purely ad hoc, cellular and hybrid. As the topology of the VANET keeps changing due to node mobility, hence the routing becomes more vital and needs an effective approach to transmit data between source and destination node. Additionally, VANET comprises of number of routing protocols to overcome such issues and one of the powerful and efficient clustering based multipath routing protocol named AOMDV is considered. This paper proposed a novel scheme of electing better and most efficient cluster head among the nodes according to the distance between cluster & members and number of hops for data transmission using the proposed AOMDV protocol. Experimental result shows the effectiveness of the proposed scheme with the existing models based on throughput and delivery ratio of packets (PDR).

Keywords: *VANET, AOMDV, Cluster Head, Cluster Member, Throughput*

INTRODUCTION

The number of revolutionary vehicle safety-oriented technologies such as the ABS, seatbelts, airbags, rear view cameras, Electronic Stability Control (ESC) is that alarmingly amid road accidents. Governments, the manufacturing industries and academia have been widely viewed as promising concepts of a future implementation of the Intelligent Transport System, thereby achieving security and efficiency on almost crowded motorways, for the direct interchange of kinematic data between cars via ad hoc network environments, called vehicular ad hoc network (VANET). The VANET is a MANET subset, with mobile nodes. Inter vehicle communication (IVC) offer four major advantages compared to MANET and other cellular systems: wide coverage area, relatively low latency due to direct wireless communication, little to no power problem to service charges (Eze et al.,2014).

In order to create a smart transport system, VANET integrate with the few elements of ad-hoc wired based and wireless networking by communicating between vehicle-to-vehicle and roadside systems. VANET's main aim is to ensure health and protection for people, through information on accidents, instability on traffic information in engaging with road drivers. Every node or vehicle has a VANET system that immediately shape an Adhoc network and can transmit the messages requested through the wireless network. A vehicle could communicate directly with other vehicles known as V2V communications, or a vehicle could communicate with an provided infrastructure such a Road Side Unit (RSU) known as V2I (Vehicle-to-Infrastructure (Lakshmi et al., 2012).

In today's world, there are many significant VANET applications. Such uses range from critical medical care to comfort and leisure. A VANET must meet the needs of ever evolving users, and should comply with the available technology requirements and architectures.

Some of the key applications (Saibh ur Rehman et al., 2013) of VANET can be summarized as follows,

1. Road Traffic Safety
2. Traffic Engineering or Efficiency
3. Comfort and Quality of Road Travel
4. Dynamic Topology
5. Frequent Disconnections
6. Predictable Mobility Patterns
7. Use of Other Technology
8. Stringent Delay Constraints

Proper routing is one of the key issues in VANET research. The maintenance and road exploration of route for transmitting messages in multi-hop networks in VANET is difficult due to the nature of the mobile ad hoc nodes. Most routing protocols are currently available and used under different road conditions ((Hartenstein & Laberteaux, 2009), (Chekima et al., 2015)). VANETs have several different characteristics than MANETs, such as road pattern limitations, no network size limits, dynamic topology, movement models and limitless energy supply. All these features made it impossible for the VANET community to establish successful routing protocols. The key aspect is the mobile nodes that travel rapidly (Dinesh & Deshmukh, 2014).

Some of the common parameters of VANET is described in the below table I.

TABLE I PARAMETERS OF VANET

SNO	Parameter	Description
1	High Mobility	Usually in VANET the nodes are moving at high speed. This makes harder to predict a node's position and protecting the privacy.
2	Rapid topology changes	Due to high node mobility and random speed of vehicles, the position of node changes frequently. Therefore, the network topology in VANET tends to change its topology frequently.
3	Unbounded network size	VANET may implemented in a city, several cities or for the whole country. Then the network size is geographically unbounded.
4	Frequent exchange of information	The ad hoc nature of VANET motivates the nodes to gather information from the other vehicles and road side units. Hence the information exchange among nodes become frequent.
5	Wireless communication	Design of VANET is meant for the wireless environment. Nodes are connected and exchange their information via wireless. Therefore, some security measure must be considered in communication for safe and secure transmission.
6	Time critical	The information in VANET must be delivered to the nodes with in time limit so that a decision can be made by the node and perform action accordingly.
7	Energy sufficient	The VANET nodes have no issue of energy and computation resources. This allows VANET usage of demanding techniques such as RSA, ECDSA implementation and also provides unlimited transmission power

Some of the common issues in VANET is detailed in Figure 1.

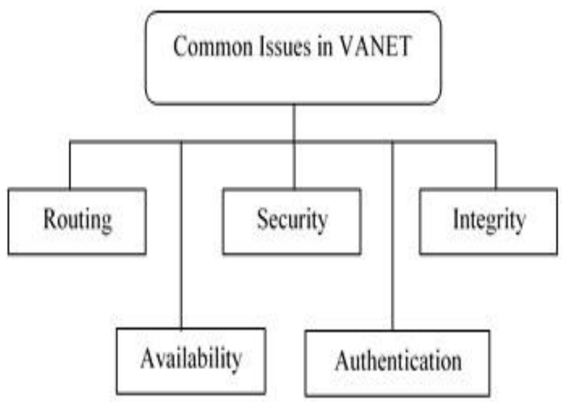


Fig. 1. Common issues in VANET.

Some key factors of VANET which considered in this paper is Routing issues in VANET occurs due to the high topological network (Routing issue) and VANET is the key component in the transport system. Due to the volume of the road traffic, it affects the safety of an individual, therefore, this issue should be eradicated (Security issue) (Samara et al., 2010). Considering the possibilities mentioned above, avoidance of the upcoming transport accident is an open problem with the alarming traffic flow on highways, towns and metropolitan regions. Various road safety solutions include traffic control and channeling, using technology such as warning systems, digital maps, and so forth were developed. Collision alert devices also introduced as an important part of the active protection of vehicles. VANET systems using inter-vehicular communication (IVC) to avoid accidents and the Intelligent Transport Network (ITS) can be incorporated.

Generally, the message from vehicles contains about time, space and agents details with the original message where the source and destination is going to receive and share. This message's validity is according to the relevance and road condition. Therefore, the message validity has also plays a vital role. Sometimes the irrelevant messages may transfer from any vehicle to the other where it may cause some consequences too. In

VANET, the message consists of live information therefore whenever the condition changes the vehicles must capture the status and to update the older content to the latest before transmitting it to the other vehicles. Suppose road accident in a certain area before an hour may create a worst traffic but there may no traffic jam right away. Consequently the data verification also plays a vital role in VANET. In such situation VANET is in demand whenever a better improvements in market.

Section II details the existing works on cluster head selection and collision broadcast on VANET. The problem statement is presented in section III and the proposed work is detailed in Section IV. Section V shows the simulation results of the proposed work and Section VI concludes paper.

LITERATURE REVIEW

(Haider et al 2020) presented a collison avoidance scheme in bi-directional traffic scenarios. The author proposed a modified K-medoid algorithm for estimating the collision probability with the expected state of nodes. The novel benign factor is implemented with adaptive deceleration for collision avoidance. In addition, the scheme mitigates inter-cluster and intra-cluster collisions to minimize congestion in communication and latency in transmission. The proposed work performs better warning in a situation when the probability level exceeds the predefined threshold value. Additionally, the encapsulated safe speed ensures the collision avoidance from the upcoming threat. This scheme performs efficiently in terms of stability in between and inside the cluster and collision avoidance.

(Srivastava et al., 2020) proposed a probabilistic broadcasting mechanism using fuzzy-based for information dissemination in VANET. Due to insignificance resource consumption, VANET becomes network crowded and rise network storm often. However, to avoid such insignificances beaconless approach is proposed and control packet flow and minimise the collision and packet drop rate. The goal of this work is to minimal broadcast between vehicles to achieve better packet delivery ratio through broadcast suppression technique to utilising the vehicle's buffer efficiently. The proposed work outperformed in terms of average delay and minimal rebroadcasting compared with other techniques.Increased interest in ad hoc vehicle networks has led to huge investments over the last decade. VANET (Vehicle Ad-hoc Network) is a modern technology field that is commonly used in self-contained systems. Due to rapid changes in topology and frequent disconnections, an effective routing protocol is difficult to conceive. Several VANET routing protocols have recently been proposed. Most approaches have ignored parameters such as environmental changes that affect the performance of real VANET applications. Environmental changes in VANET can have an impact on efficiency and output. In paper (Oranj et al., 2016) proposed an ant-colony optimization routing algorithm and a DYMO (Dynamic MANET on-demand) protocol to respond to environmental change. Ant Colony Optimization Algorithm is a probabilistic technique commonly used to locate graphical paths. In this document, two parameters were considered for assessing the paths identified: the delay time and (ii) the reliability of the path. Ns-2 was used to implement the proposed algorithm and to monitor its performance through a variety of environmental changes. The results showed that the proposed ant colony routing algorithm is better than other well-known methods, such as Ad Hoc on Demand Distance Vector (AODV).

The Ad Hoc Vehicle Network (VANET) is a network with high mobility nodes or vehicles. Many techniques have been proposed to improve VANET communication efficiency; one of these techniques is vehicle node clustering. In the clustering process, cluster nodes (CNs) and cluster heads (CHs) are selected or selected. The longer cluster life and the less efficient networking of VANETs contributes to the number of CHs. (Adil, 2016) proposes a new clustering algorithm based on ACONET Ant Colony Optimization (ACO) called VANET. This algorithm creates optimized clusters for robust VANET communication. The transmission range, direction, node speed and load balancing factor (LBF) parameters are considered for optimized clustering. ACONET is empirically compared to state-of-the-art methods, including Multi-Objective Particle Swarm Optimization (MOPSO) and Clustering Techniques for Comprehensive Learning Particle Swarm Optimization (CLPSO). In addition to the efficiency of the algorithms, a wide variety of tests are carried out through the difference in grid size, the transmission variety of nodes and the total number of network nodes. The results indicate that ACONET significantly outperformed the competitors.

Intelligent Transportation Systems (ITS) applications have been first implemented in Vehicle Ad-Hoc VANET, with the main objective of providing network vehicles and providing useful information about the status of road traffic. In addition, several papers have been written with ITS enhancements. VANET must be able to interact, regardless of traffic density and vehicle position, in any setting. The use of the cluster algorithm in VANET is successful since the algorithm makes the network more stable and scalable. Nonetheless, due to the high mobility of the nodes, stable clusters are difficult to obtain. Many parcels are lost and road repairs or warnings of failure, with low delivery ratios and long transmission delays, trigger overhead rises. The work of (Marzak et al., 2015) proposes a model that uses the YATES algorithm to calculate the value of stable nodes. This process aims to resolve the stability of the clusters.

The ad hoc vehicle network (VANET) is an ad hoc mobile network subset. VANET has become an active research sector aimed at improving vehicle and road safety, improving traffic quality and improving drivers and passengers' comfort. Owing to high mobility and dynamism, the routing of messages to their final destination in VANETs is a difficult task. These problems can be tackled by clustering techniques. Clustering is a mechanism of vehicle grouping based on some predefined metrics, such as vehicle density, speed and geographical position. Vehicle ad hoc network clustering (VANET) is a dynamic topology control mechanism. Many of the clustering algorithms from VANET are based on ad hoc mobile networks (MANETs). VANET nodes are, however, distinguished by their high mobility and the presence of VANET nodes in the same geographical proximity does not mean that they have the same mobility patterns. Therefore, the VANET clustering schemes will consider the speed and velocity of nodes to create a stable clustering structure. (Malathi & Sreenath, 2017) introduce a new clustering technique suitable for the VANET environment in order to improve the stability of the network cluster. Distance and speed are used as a parameter in this technique to build a relatively stable cluster structure. Additionally, a super cluster-head selection algorithm is proposed.

PROBLEM STATEMENT

Generally, VANET considers all vehicles as a node and each node can communicate with others wirelessly. Additionally, it turns all vehicles as wireless router or a node to communicate each other within 100-300 meter range. The primary objective of the network is to transmit current road status and information about obstacles with location information from each vehicle to others to provide a better road safety. Clustering in other networks such as WSN, MANET is an easy task compared to VANET because of the node’s speed, transmission of data, location information and so on. However, clustering is in need to overcome redundancy of sending same packets to the vehicles in a range. Clustering can possible in VANET by making a vehicle as cluster head which receives the current road scenario and it forwards the same data to the nearby vehicles within a range. The cluster head should continuously update its location to the member nodes; therefore, the redundancy of data is increased significantly in the network that increases the false information transmission. Sometimes, the same message is also transmitted from more than one vehicle in the same cluster, which gives data redundancy. The accident vehicle forwards about the accident and vehicle information to the bi-directional vehicles without any delay and still the accident vehicle is stopped manually. Henceforth, the data redundancy is occurred most of situation in VANET and needs an effective cluster head selection mechanism to improvise the network as set down in this paper.

PROPOSED METHODOLOGY

Vehicle ad hoc networks (VANETs) are created using the Mobile Ad Hoc Network Principles (MANETs) by spontaneously creating a wireless data-exchange network in the vehicle domain. Vehicle ad hoc network clustering is one of the strategies used to transfer data within a cluster from one node to the next. Managed systems for the clustering of adjacent vehicles are critical to the achievement of secure and effective safety communications. Among unlimited vehicles (Offor, 2012),

1. With radio frequency communications, so many vehicles can interface.
2. Such messages can be dispersed anywhere by crippling the network grid.

Traditional cluster strategies in nodes of VANETs may not be successful in forming efficient cluster groups and organizing cluster vehicles. More organizational strategies need to be developed with the VANET setting in mind. The cluster layout should be based on the space-time stability of ad-hoc networks consisting of mobile nodes.

Cluster Components: The solution consists of three parts, the cluster header, the cluster gateway and the cluster member.

Cluster Head:-This is the local cluster leader who arranges the transmission and transmission of the data.

Gateway Cluster:-A non-cluster header node that accesses the adjacent node and transfers data between clusters.

Cluster member:-This is generally referred to as the ordinary cluster node that participates in the same cluster without any interlinking of neighboring clusters (Saravanan et al., 2018).

Gateway is a node that connects the two network clusters, the gateway node is specific to the two separate clusters that are shown in Figure 2 in order to transfer information from one node to another. Preferred node-based routing in node creation. In a cluster, a cluster of nodes identified as part of a cluster and a node is configured to transmit the packet as a cluster header to the other cluster. This helps to ensure high scalability in large networks, but there is a risk that highly mobile nodes may be delayed (Jiang et al., 2016).

Vehicles will be grouped into various clusters based on geographical positions, motion directions, speed and many other metrics. Vehicle Clusters will be presented in Figure 3.

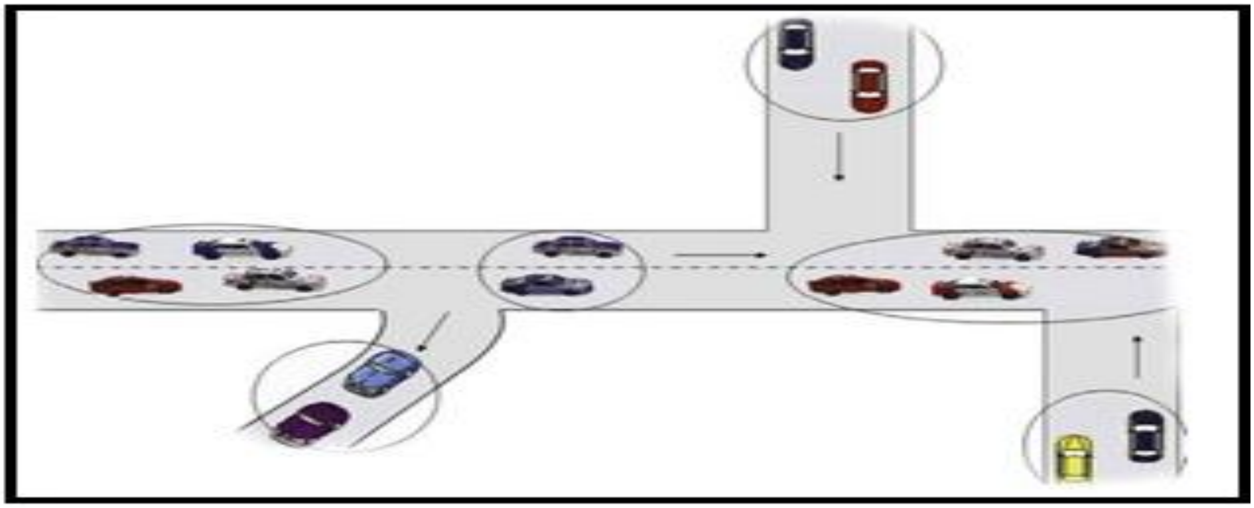


Fig.2 Schematic Diagram of Vehicle Clusters

In this paper, proposed a high-grade algorithm for the selection of CH under the MAC protocol. The VANET routing protocol focuses on location-based, data-centric and application-dependent. The primary research the cluster routing protocol in VANETS and examine the advantages and drawbacks of the current protocol belonging to VANETS. Based on the problems in the original protocol, the selection of cluster heads, special node processing, and inter cluster routing problems respectively, and then proposed improved Cluster Head Selection Mechanism.

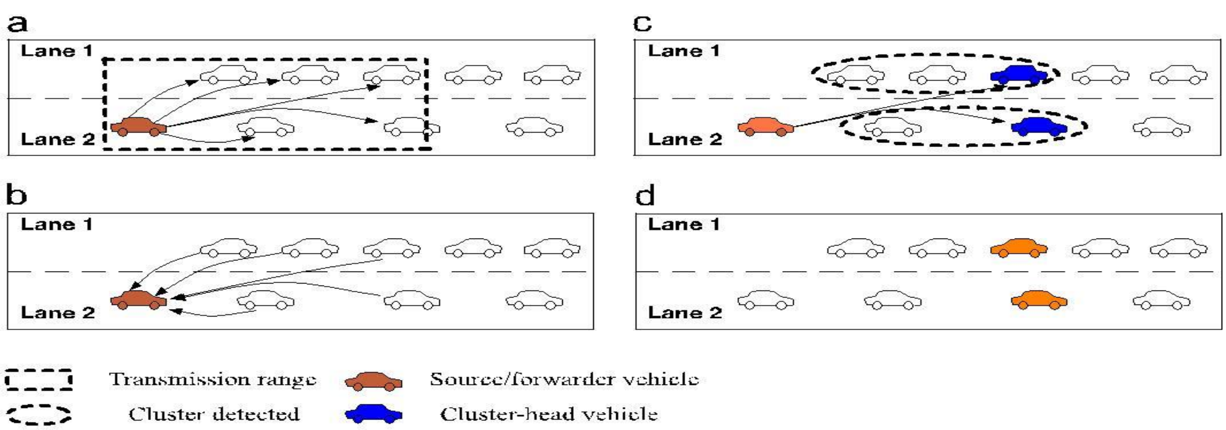


Fig. 3. VANET Clustering Scheme

EXISTING ISSUES IN CLUSTER HEAD SELECTION MECHANISM

Some of the common existing issues in the mechanism of cluster head selection are detailed here.

- Choosing better and needed CH among nodes is a vital issue.
- Keeps on evolving changes between the CH nodes and member nodes.
- Selection of CH based on more number of data delivered or received.
- location access and location based information sharing cannot determine a better CH selection.
- Interchange of state between stable and election state.
- Partitioning of cluster based on location and cluster based vehicles determination.
- Determining single point-to-point route and need of necessary transmission power.
- In a situation such a CH becomes dead then the network doesn't elect another CH still the message transmission ends (upto initial allocated time).
- Ratio of number of CH nodes, addition of new nodes and deletion of existing death nodes needs further topological changes.

The proposed methodology focused in solving such issues mentioned above through multipath routing and modified CH election.

PROPOSED CLUSTER HEAD SELECTION MECHANISM

Based on the problems identified in the original protocol, the revised protocol called the Enhanced Head Selection Mechanism is proposed in this paper and is shown in Fig.3. After the first round, the BS based on its distance from the BS, the number of times to be chosen, chooses the next CH and the number of adjacent nodes, and alternate CH nodes and more logical and rational multi-hop inter-cluster routing are established.

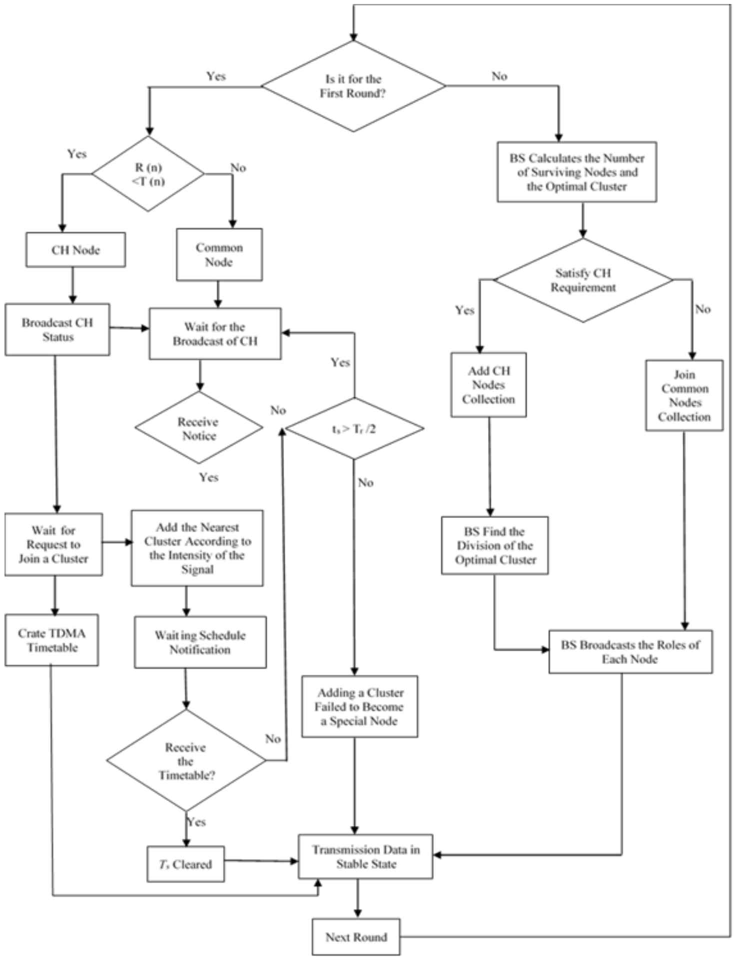


Fig. 3. Flow of Improved Cluster Head Selection Mechanism

The proposed algorithm is detailed in Figure 4.

1 **Initialisation:** *V = set of vehicles*
2 No_V *= Number of vehicles in cluster*
3 S_i *= Speed of vehicle in V*
4 S_{avg} *= average speed of all vehicles*
5 (x_i,y_i) *= current coordinates of the vehicle*
6 w_1 *= distance*
7 w_2 *= number of messages received*
8 w_3 *= percentage of Packet Loss (* $0 \leq W_1, W_2, W_3 \leq 1$ *and* $W_1 + W2 + W3 = 1$*).*
9 *velocity of a vehicle* V_i^m *calculated using*
V_i^m *= velocity of a vehicle i in the cluster m*

$$\Delta V = \frac{\sum i \in V^m \left|V_i^m - V_j^m\right|}{Nov \times w_1(w_2 - w_3)}$$

10 Utility function of CH in m

$$U_i^m = \frac{Nov^m, S_{avg}}{1 + e^{-S\left(\frac{S_{avg} \times w_2}{V_{(x_i,y)} \times w_2}\right)}}$$

11 Average Utility function is identified

$$\Delta V_i^{m,n} = S_i \Delta S_{avg} w_2 + S_i \Delta Nov w_2$$

12 If $\Delta V_i^{m,n} \leq 0$ Then
13 CH election is followed as default
14 Else
15 CH is elected based on proposed V_i^m

PERFORMANCE ANALYSIS

SIMULATION ENVIRONMENT

Table II below displays the simulation model used for the proposed analysis. It describes the different simulation parameters.

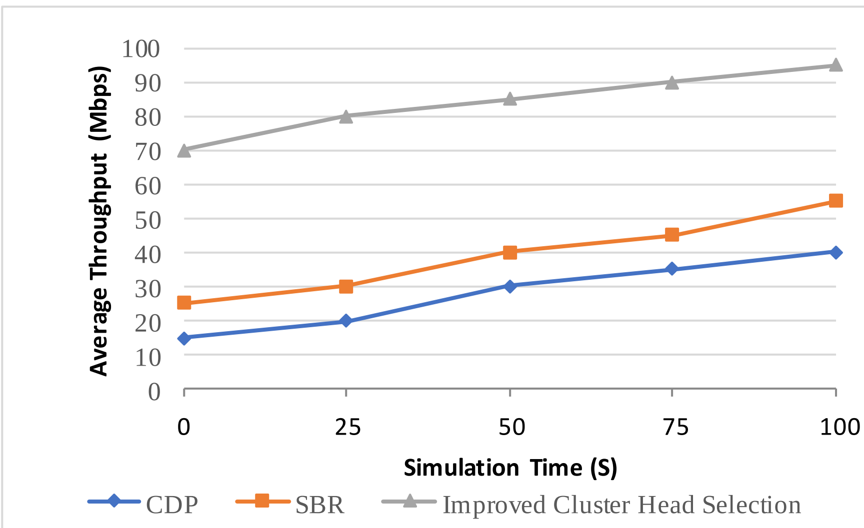
TABLE II SIMULATION PARAMETERS AND VALUES

PARAMETERS	VALUE
Channel	Wireless channel
Antenna	Omni/Directional Antenna
MAC Protocol	IEEE 802.11
Routing Protocol	AOMDV

No. of Nodes	100
Simulator	NS 2.35
Simulation Time	600 Sec
Protocol	AOMDV
Traffic Status	Continuous arrival

PERFORMANCE PARAMETERS

The VANET output analysis is performed using the parameter dependent on the limited accurate



transmission.

Fig. 4 Comparison of Throughput

Throughput: The throughput shows the correct cluster detection occurred when the packet exchange rate was significantly increased. Figure 4 shows the performance of vehicles on the motorway scenario. Compared to the SBR method, the efficiency of the proposed method increases by 50%.

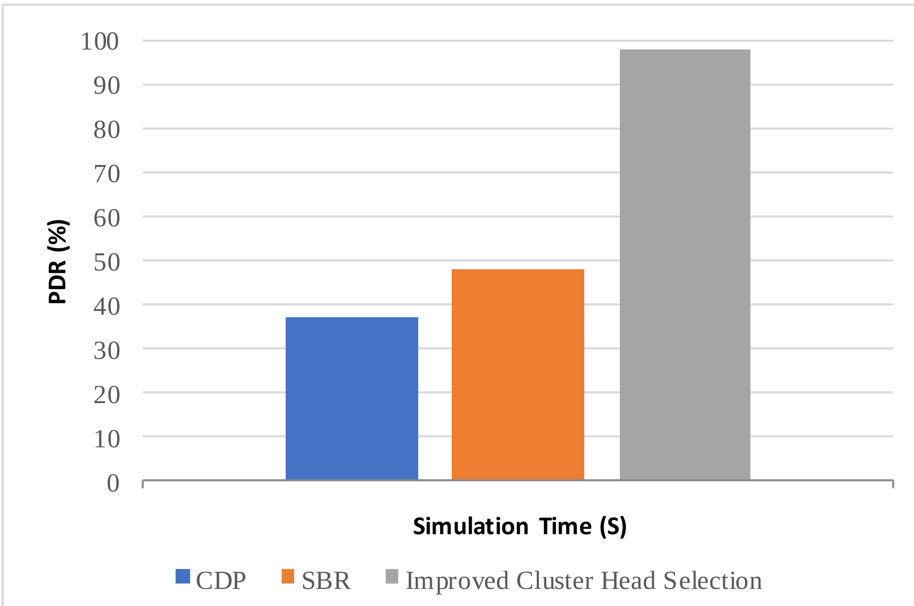


Fig. 5. Comparison of Packet Delivery Ratio

Packet Delivery Ratio: Packet delivery ratio is defined as the number of received packets and the number of transmitted packets. This increases since packets are transmitted efficiently to intermediate nodes. It is in Figure 5 indicates that the solution proposed is 50% higher than the SBR solution.

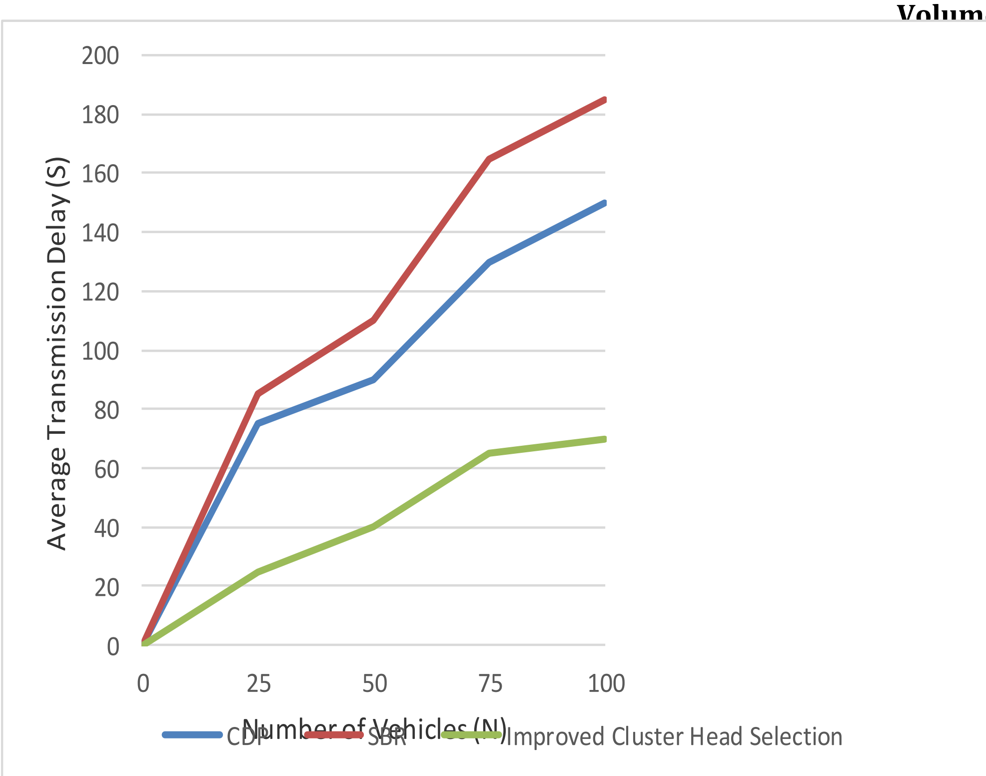


Fig. 6. Comparison of Average transmission delay

Average Transmission Delay: Average transmission delay is defined as an average of delay in seconds between source and destination vehicles . It is in Figure 6 indicates that the solution proposed is 35% lesser delay than the SBR solution.

CONCLUSIONS

1. The VANET clustering algorithm works by combining mobile nodes with groups called clusters. According to a set of rules, and the choice of a node called the Cluster Header (CH) between the cluster and the remaining network is the same as the wireless infrastructure access point. Depending on the specification, the basic functions of the cluster head vary as does the mechanism by which it is selected. The clustering algorithm used to connect cluster nodes must ideally be robust for node instability and unpredictable changes in the topology of the network and the cluster and ensure stable VANET-back communication.

2. Cluster Heads are chosen and play a key role in VANETS cooperation. This paper introduces a new approach for the collection of VANETS clusters. The proposed Head Selection Mechanism for Clusters will be based on the number and the distance between the heads of the clusters and the members. As all mobile nodes are in VANET, this article considers the vehicle speed and vehicle location when the cluster head is selected. Output analysis is performed on the basis of the packet's throughput and delivery ratio. The findings show that the suggested solution provides a substantially higher percentage of improvements in both parameters.

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Proficient Clustering based Broadcasting for VANET using LEACH and AOMDV Protocol

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Abstract— Recently, Vehicular Ad Hoc Network (VANET) applications have increased enormously. Due to the ad hoc nature and ease of installation, more applications are developed. In addition, the utilization of VANET improves the need for security, energy efficiency, and other parameters needed to enhance the competence of network lifetime. This paper PC-LEADV (Proficient Clustering – LEACH and AOMDV) focuses on improving the energy efficiency of the VANET through LEACH protocol. Additionally, VANET comprises several routing protocols to overcome such issues, and one of the powerful and efficient clustering-based multipath routing protocols, AOMDV, is considered. This proposed work attempts cluster formation and Cluster Head (CH) election through energy-efficient parameters such as distance and residual energy. The proficiency of the proposed work achieves better compared with previous results.

Keywords—*network lifetime, cluster head election, cluster formation, energy efficiency, residual energy*

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I. Introduction

Daily the Vehicular Ad Hoc Network (VANET) applications are increasing as VANET can reach the geographical areas where humans or others cannot go, improving the need for VANET. Some widely used areas are military, medical, and so on [1].

VANET consists of tiny nodes with a small processor, RAM and small non-rechargeable battery. The sensors are deployed in any geographical area to acquire the data from the environment and forward the collected information to the sink node or base station (BS). Humans can use the collected data for different processes [1,2]. The deployed sensors still sense the battery drains and die in the deployed environment.

VANET protocol stack architecture consists of physical, data link, network, transport, and application layers. The routing protocols of VANET are generally classified into three primary types plane routing, grade routing and position routing. Research on potential collaboration in data gathering and processing in sensor nodes was conducted in past years. It results in innovative techniques to eliminate the energy inefficiency required to maintain the network's lifetime. In addition, the protocol stack should facilitate routing protocols of VANET for energy-efficient route discovery and data relay from source to sink node [2]. Fig.1 presents the architecture of VANET.

Routing is a challenging task compared to mobile ad hoc or cellular networks. The global addressing model does not apply to VANET due to the huge number of member nodes. ID maintenance is also a high-issue task for a mobile environment [3]. Thus, traditional IP-based communication cannot be possible for VANET. The self-organizing nature of VANET is the best affordable feature of VANET still, it requires a battery for each formation.

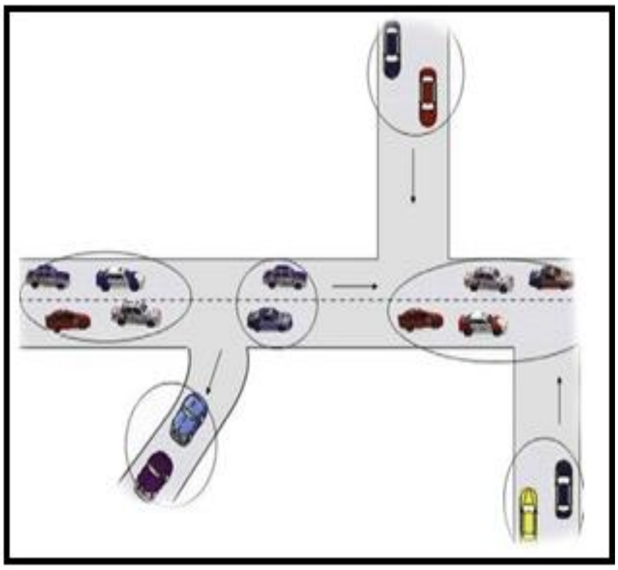

Figure 1. Schematic Diagram of Vehicle Clusters

To create an intelligent transport system, VANET integrates with the few elements of ad-hoc wired-based and wireless networking by communicating between vehicle-to-vehicle and roadside systems. VANET's main aim is to ensure health and protection for people through information on accidents and traffic information in engaging with road drivers. Every node or vehicle has a VANET system that immediately shapes an Adhoc network and can transmit the messages requested through the wireless network. A vehicle could communicate directly with other vehicles, known as V2V communications, or a vehicle could display with a provided infrastructure such as a Road Side Unit (RSU) known as V2I (Vehicle-to-Infrastructure [2].

In today's world, there are many significant VANET applications. Such uses range from critical medical care to comfort and leisure. A VANET must meet the needs of ever-evolving users and comply with the available technology requirements and architectures.

Proper routing is one of the critical issues in VANET research. The maintenance and road exploration of the route for transmitting messages in multi-hop networks in VANET is difficult due to the nature of the mobile ad hoc nodes. Most routing protocols are available and used under different road conditions [4, 5]. VANETs have several distinct characteristics to MANETs, such as road pattern limitations, no network size limits, dynamic topology, movement models and limitless energy supply. All these features made it impossible for the VANET community to establish successful routing protocols. The critical aspect is the mobile nodes that travel rapidly [6].

Due to such differences, many new algorithms were proposed. To minimize the energy consumption, many routing techniques were proposed. The proposed work also focuses on achieving the energy efficiency of VANET.

A. LEACH Protocol

Low Energy Adaptive Clustering Hierarchy (LEACH) protocol is introduced by Heinzelman et al.

This protocol is one of the foremost protocols used to elect the CH for each round using its threshold function $T(n)$ in Eq. 1.

$$T(n) = \begin{cases} \dfrac{p}{\left(1 - p \times \left(r \bmod \left(\frac{1}{p}\right)\right)\right)}, & if\ n \in G \\ 0, & otherwise \end{cases} \quad (1)$$

Where p denotes the probability of the nodes to become CH, r denotes the round which is ended, G denotes the set of nodes which not act as CH in the last $1/p$ rounds [7].

LEACH follows a simple process for the election of CH. Each node is assigned a numerical value between 0 – 1 (Zero – One). After this process, the assigned value is checked with the threshold value, and the node which holds a lesser value than the threshold value is elected as CH for that round. This is a continuous process for each round. In this election, the node which holds lesser energy, the node far away from BS, and the node not maintaining the centrality in a cluster may become CH which leads to a decrease in the efficiency of the network. To avoid such flaws, the proposed scheme follows the election of CH with the modified threshold function [6,7].

The proposed PC-LEADV focus in selecting CH based on distance and residual energy of node. Distance is considered as distance between neighbors and distance between BS.

Section II related works discuss the latest research works of different authors. Section III presents PC-LEADV in detail, and experimental results are discussed in Section IV. Finally, Section V concludes with a conclusion.

II. RELATED WORKS

In [1] proposed, a mechanism called message passing in VANET through LEACH protocol. The work focused on the delivery of data from source to BS. Passing message (sensed data) through a definite route is the idea of the proposed work. This work needs a high packet delivery ratio, achieved through forming an effective routing technique. The proposed cluster formation technique focused on developing the cluster by electing a CH node based on a distance metric. Distance is considered between the node and neighbor node. Therefore, the cluster formed with highly reachable neighbours, and the data transmission begins in the proposed work. The pitfall of this scheme is that the cluster formation with a highly reachable neighbor is a good technique but the residual energy of the node is not at all considered. The node without energy is simply useless while transmitting the data.

In [2], proposed energy efficient improved SEP (Stable Election Protocol) protocol for VANET. The proposed work enhances the energy efficiency of the network by selecting the proficient routing path to deliver the sensed data. SEP focus on finding the shortest path from source to BS and neighbor nodes. The sensor nodes are stable in this format, so selecting an appropriate route for data transmission is easy. This scheme focused on the route discovery process for each communication in a stable configuration. This reduces the network's lifetime due to the loss of energy for route discovery.

In [3] delivers an energy utilization model for VANET. Using Particle Swarm Optimization (PSO) with Simulated Annealing (SA) produced the best chain formation technique for cluster formation. The unequal energy consumption is reduced through sub-optimal cluster formation. CH communicates through a multipath fading technique to the far distance node. It eliminates the communication overhead in the network. The residual energy of the node is not considered while transmitting data, and the distance between the source node and BS is also not mentioned.

In [4] proposed, an efficient clustering through Improved LEACH. The research focused on electing the CH, which holds higher residual energy than the other node. This leads to electing the best CH for the cluster, but still, the communication between the nodes is not considered in this scheme. This feature leads to less packet delivery ratio. The basic need of VANET is to collect data from the environment, which is affected highly by less packet delivery ratio.

In [5] proposed improved Bat Algorithm (BA) for LEACH protocol for effective data transmission. This algorithm forwards the data through a unique faster shortest path communication between the source node and destination to reach BS as early as possible. In addition, the proposed model achieves a higher data delivery ratio than the other models. The network's lifetime remains unstable due to the inefficient CH election process.

III. PROPOSED WORK

The proposed PC-LEADV focused in two major processes. They are,

- Energy efficient CH election & cluster formation
- Higher packet delivery ratio

Traditional cluster strategies in nodes of VANETs may not successfully form efficient cluster groups and organize cluster vehicles. More organizational processes need to be developed with the VANET setting in mind. The cluster layout should be based on the space-time stability of ad-hoc networks consisting of mobile nodes.

Cluster Components: The solution consists of three parts, the cluster header, the cluster gateway and the cluster member.

Cluster Head:-This is the local cluster leader who arranges the transmission and transmission of the data.

Gateway Cluster:-A non-cluster header node that accesses the adjacent node and transfers data between clusters.

A cluster member:-This is generally referred to as the ordinary cluster node that participates in the same cluster without any interlinking of neighboring clusters [8-10].

The PC-LEADV achieves the above processes by setting up two parameters distance and residual energy.

The residual energy of the node is the first parameter of the proposed scheme, where energy is the primary constraint in electing CH. The effectiveness of clustering formation is measured based on the network's performance, which is mainly retained in energy of the node [11]. The sensor node consumes energy in sensing the data and forwards it to CH. Elected CH delivers the data to the nearby CH or BS. The electing CH must have high energy because it has to aggregate the data and forward it to BS, whereas the nodes only have to deliver the sensed data. This shows that the residual energy is one of the primary constraints in electing CH. The basic formulae for finding the residual energy in Eq.2.

$$Resi_{egy} = \frac{EGY_{current}}{EGY_{maximum}} \quad (2)$$

Where $EGY_{current}$ specifies the current volume of the residual energy and $EGY_{maximum}$ specifies the maximum energy of a node means the energy of a node when it is fully charged. The above formula denotes that the node with high residual energy will be selected as CH.

The distance between neighbor nodes is obtained using Eq. 3.

$$distance_{neigh} = 1 - \left[\frac{\sum_{i=1}^{N} distance_i}{N\ X\ distance_{max}}\right] \quad (3)$$

Where $distance_{neigh}$ denotes the distance between the neighbors, $distacne_i$ denotes the distance of node i and $distance_{max}$ denotes the maximum distance of a node, and N indicates the number of neighbor nodes.

The CH must communicate with BS often because the CH must collect the data from the member nodes and forward it to BS. This transmission consumes the energy of CH. Therefore, the node to act as CH is to calculate the distance between the CH and BS. Less distance will improve the performance [12]. The distance is calculated as in Eq.(4).

$$BS_{dist} = \frac{Distance_{BS}}{Distance_{far}} \quad (4)$$

Where, Dis_{BS} denotes distance to BS and Dis_{far} denotes the distance of a node which is far away from the network.

This paper proposed a high-grade algorithm for the selection of CH under the MAC protocol. The VANET routing protocol focuses on location-based, data-centric and application-dependent. The primary research is on the cluster routing protocol in VANETS and examines the advantages and drawbacks of the current protocol belonging to VANETS. Based on the problems in the original protocol, the selection of cluster heads, special node processing, and inter-cluster routing problems, respectively, proposed an improved Cluster Head Selection Mechanism [13]. The proposed algorithm is detailed in Fig. 2.

Finally, Eq.2, Eq. 3 and Eq.4 are combined with Eq. 1 to elect the best CH for each round.

1 **Initialisation:** *V = set of vehicles*

2 *No_V = number of vehicles in cluster*

3 *S_i = Speed of vehicle in V*

4 *S_{avg} = average speed of all vehicles*

5 *(x_i, y_i) = current coordinates of the vehicle*

6 *w_1 = distance*

7 *w_2 = number of messages received*

8 *w_3 = percentage of Packet Loss ($0 \le W_1, W_2, W_3 \le 1$ and $W_1+W2+W3=1$).*

9 $Resi_{egy} = \frac{EGY_{current}}{EGY_{maximum}}$

10 $distance_{neigh} = 1 - \left[\frac{\sum_{i=1}^{N} distance_i}{N\ X\ distance_{max}}\right]$

11 $BS_{dist} = \frac{Distance_{BS}}{Distance_{far}}$

12 $CH_{elec} = \left\{\frac{EGY_{current}}{EGY_{maximum}} + \left[1 - \left[\frac{\sum_{i=1}^{N} distance_i}{N\ X\ distance_{max}}\right]\right] + \frac{Distance_{BS}}{Distance_{far}}\right\}$

13 CH is elected

14 Else

15 CH is elected based on proposed V_i^m

16 *velocity of a vehicle* V_i^m *calculated using*

V_i^m= *velocity of a vehicle i in the cluster m*

$$\Delta V = \frac{\sum i \in V^m \left|V_i^m - V_j^m\right|}{Nov \times w_1(w_2 - w_3)}$$

17 Utility function of CH in m

$$U_i^m = \frac{Nov^m, S_{avg}}{1 + e^{-S\left(\frac{S_{avg} \times w_2}{V_{(x_i, y)} \times w_2}\right)}}$$

18 Average Utility function is identified

$$\Delta V_i^{m,n} = S_i \Delta S_{avg} w_2 + S_i \Delta Nov w_2$$

19 *CH is elected*

Figure. 2 Proposed algorithm

IV. EXPERIMENTAL RESULTS

The results are obtained by running the simulation NS2, with 100 nodes from 0 – 99 and specifying the100th node as BS with a simulator time of 3600 seconds.

Table II below displays the simulation model used for the proposed analysis. It describes the different simulation parameters.

TABLE II SIMULATION PARAMETERS AND VALUES

PARAMETERS	*VALUE*
Channel	Wireless channel
Antenna	Omni/Directional Antenna
MAC Protocol	IEEE 802.11
Routing Protocol	AOMDV
No. of Nodes	100
Simulator	NS 2.35
Simulation Time	600 Sec
Protocol	AOMDV
Traffic Status	Continuous arrival

Fig. 3 shows the packet delivery ratio of the network.

Packet Delivery Ratio: Packet Delivery Ratio is defined as the number of packets successfully received and the number of packets transmitted. It increases due to the successful transmission of packets by the intermediate nodes. Fig. 3 shows that the proposed approach increases by 56% compared to previous methods.

Fig. 3 shows the packet delivery ratio of the network.

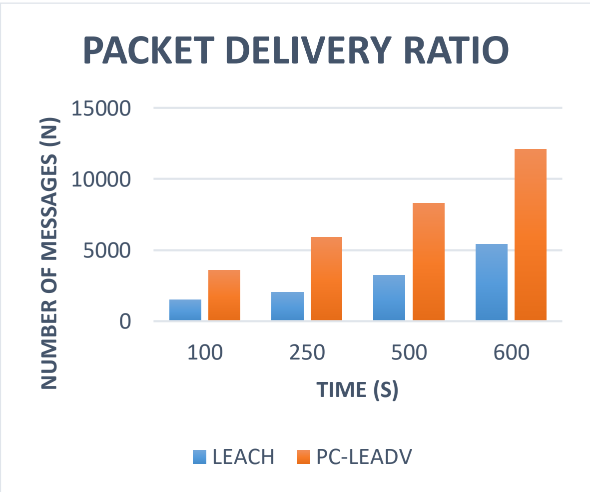

Figure. 3 Packet Delivery Ratio

Remaining energy consumption: The energy consumption is the best parameter to determine the proficiency of the proposed and existing works. The proposed work attains 44% lesser energy consumption than the existing schemes.

Fig. 4 shows the average remaining energy.

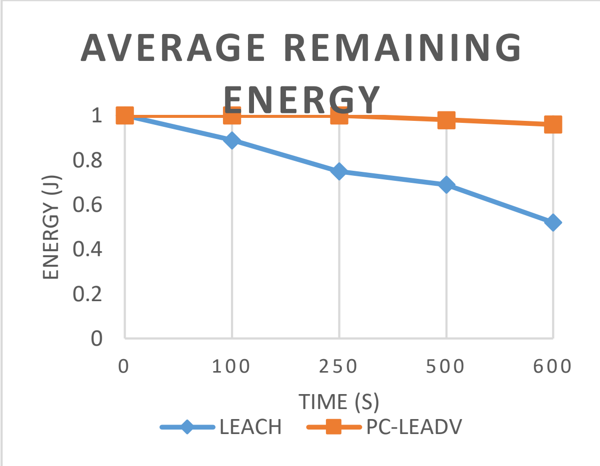

Figure.4 Average remaining energy

In the Proposed scheme, PC-LEADV performs better in maintaining better-remaining energy, packet delivery ratio and a good number of nodes alive than the existing approaches, thus proving PC-LEADV obtains energy efficiency. The network becomes stable compared to the existing models for a certain period. Finally, the energy efficiency enhances the lifetime of the VANET.

Fig. 5 shows the total number of alive nodes for the simulation time. The proposed work PC-LEADV maintains 44% of better proficiency than the LEACH protocol and supports a maximum of 95 alive nodes.

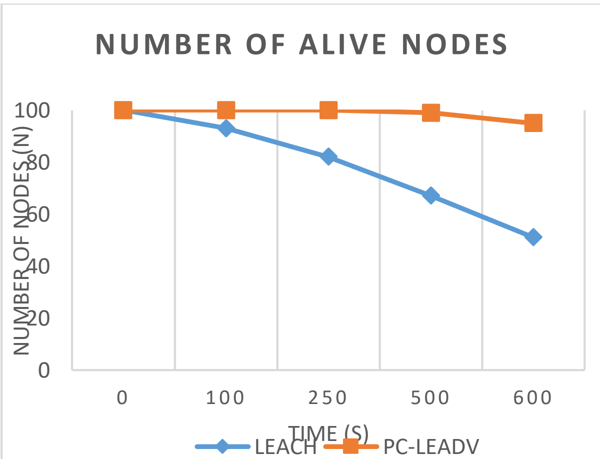

Figure. 5 Number of Alive Nodes

V. CONCLUSION

The VANET clustering algorithm works by combining mobile nodes with groups called clusters. According to a set of rules, the choice of a node called the Cluster Header (CH) between the cluster and the remaining network is the same as the wireless infrastructure access point. Depending on the specification, the basic functions of the cluster head vary as does the mechanism by which it is selected. The clustering algorithm used to connect cluster nodes must ideally be robust for node instability and unpredictable changes in the topology of the network and the cluster and ensure stable VANET-back communication.VANETs are utilized to sense the data from various areas humans cannot reach. Thus, VANETs need energy-efficient models to survive. The proposed scheme PC-LEADV provides a better model for an energy-efficient network. This model elects CH based on residual energy, the distance between CH and BS, and the distance between node and members. The simulation result shows that the proposed methodology is better than the existing methods.

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AN OVERVIEW OF CLOUD COMPUTING FOR THE ADVANCEMENT OF THE E-LEARNING PROCESS

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ABSTRACT
As an aid in the teaching-learning process, online communications systems are used to facilitate e-learning, a form of virtualized computing and distant learning. The rise of E-learning platforms emerged drastically in the past two years. Data mining for education information processing uses facts generated from internet databases to enhance the educational learning paradigm for educational purposes when the learning process is computerized. Cloud computing is a suitable platform for supporting e-learning solutions. It can be automatically altered by providing a scalable solution for transforming computer resource consumption in the long run. It also makes things simpler to use data mining techniques in a distributed environment when interacting with massive e-learning datasets. A summary of the current state of cloud computing is provided in the study and examples of infrastructure explicitly designed for such a system. In addition, it also discusses examples of cloud computing and e-learning methodologies.

Keywords: *E-Learning, Cloud Computing, Virtual Learning, SaaS, PaaS, IaaS*

1. INTRODUCTION

E-Learning emerged due to the widespread use of the internet and other digital communication systems and distance education [11]. It makes use of multiple formats and functions that might best aid classroom instruction. These include Virtual instruction, emails and web links, discussion boards, and other learning platforms, among other things. As a result of the online integration of students, content producers, and professionals, the learning experience is better handled. Learning with web-based tools has many benefits, the most prominent of which are the tasks' consistency and recurrence, adaptability, accessibility, and easier access [16]. E-learning or virtual teaching platforms are becoming increasingly popular in information technology (IT), particularly after the outbreak of Covid-19 and digital advancement. Different educational levels have associated efforts, such as Massive Open Online Courses (MOOCs), Blackboard, Desire to Learn (D2L), and the Virtual Learning Center at various universities, implemented as E-learning format globally [21,22]. Compared to the conventional attendance class, virtual programs, fully endorsed by the e-learning paradigm, have an obvious optimal learning environment, a notably greater frequency for those who can acquire their material online [6, 13,20]. These proportions have a lot of consequences; for example, the infrastructure requirements to provide a concurrent service for that many learners far surpass the capability of traditional web application users. Moreover, the need for instructional resources often fluctuates rapidly and dynamically, with significant activity spikes. To respond to requests without affecting other system services, a much more advanced infrastructure will be needed than what is normally required for the learning institution to function normally during these periods. Providing services based on usage and only paying as the pay-per-use policy for resources that are used is an option. Cloud computing technology provides the solution to these problems. Cloud computing was first proposed to reduce computational costs while enhancing system reliability and availability [1, 30]. These goals have since evolved into those of cloud computing. Nevertheless, there is a distinction between the two regarding how the tasks are calculated in each setting [40]. In terms of technical resources, a computing grid is more stable, and it is primarily designed to maximize the performance of a computer system. On the other side, Cloud computing aims to provide transparent mobility while allowing users to acquire various services rather than familiar with the basic infrastructure. It does not have a limited range of services, including hosting services and word processing [37]. It's important to note that one of the foundations of cloud computing is Service Oriented Architecture (SOA). There are many dispersed organizational computing barriers that this type of technology is intended to help programmers to transcend, such as application integration, concurrency control, and security protocols, as well as numerous differentsystems and protocols and the use of hardware and software to which we might have direct exposure, and existing data systems [24, 39]. All of a cloud platform's functions are made accessible in a way that hides the location and other technical aspects of the computing infrastructure from users [45]. In comparison to other competing technologies, the advantages of this new computing paradigm are plain to see. Users don't have to invest money on new hardware to use the application because cloud software vendors attempt to deliver comparable or better capabilities and functions than if the applications were loaded locally on end-user machines [28]. This storage capacity and computing initiatives help corporations to get their software fully operational faster, with a lesser provision of services from the IT division because it instantaneously intends the business needs by interactively assigning IT assets (servers) based on the computation complexity in virtual environments[14]. Massive e-learning environments, such as those discussed earlier, also produce large archives of student participation with peers and teachers. Significant data is stored in these systems that haven't been explicitly declared. You'll need to use data mining algorithms [25]. Educational datamining (EDM) is a technique that helps both instructors and learners enhance teaching and learning in this situation [2]. The creation of novel strategies for examining the data created by the aforementioned current education system activity is the focus of this discipline. This method's ultimate goal is to understand student performance better and create protocols and resources that will make learning more engaging and easier. There are computer-based tutoring systems that are specifically developed to assist in the teaching and learning process and directly link to this approach. These are sophisticated programs that support students learning by monitoring their performance and providing them with feedback. An instructional model interacts with the EDM process, which extends and refines the knowledge it has. Considering the size and capacity expansion of computer capabilities (solid space, ram, and CPUs), cloud hosting is a sequence for adopting data mining algorithms and implementing them towards every database [15, 42]. Several more data mining methods, on the other hand, aren't very scalable.

This is a topic that is becoming extremely relevant, and scholars and businesses alike are taking notice.

Due to the Covid-19 pandemic educational institutions around the globe moving to either use blended learning or fully E-learning. The major challenge is to deliver secure and adequate resources to support the E-learning process. This research aims to review cloud computing services for E-learning to enable the educator to utilize the benefits of cloud services such as scalability, flexibility, and security to support and enhance the E-learning process. The remainder of this paper is organized as follows. Section 2 introduces the fundamental notions of cloud computing, section 3 discusses E-learning tasks and cloud computing, section 4 describes the perspective challenges of e- learning and cloud computing. Finally, section 5concludes the paper.

2. FUNDAMENTAL NOTIONS OF CLOUDCOMPUTING

All the analysis in the preceding sections are the review of the cloud computing. The review is based on the qualitative analysis, which allows researchers to present the notion in elaborative way. A literature review examines publications, academic papers, and any other source materialspertaining to a particular issue, area of investigation, or concept, and provides an overview, synopsis, and analysis of a research subject in order to address the research. Cloud computing is an emerging approach in which different resources and services such as data storage, servers, databases, networking, and software are delivered via the web. This brings us to the conception of SOA [36], a framework for integration consisting of a combination of a rational and technology framework to assist and incorporate all range of facilities. In essence, service in the context of cloud computing is a function that has been wrapped in a somewhat form that it could be mechanized and delivered to customers in a standardized and structured way. Any element, from those adjacent to equipment, such as storage capacity or processing time, to software elements targeted at verifying a user or handling mail, database administration, or regulating the use of the operating system, can be regarded as a service.

Essentially, the cloud computing philosophy suggests a shift in how challenges are tackled through technology [38]. Using and combining services is the basis for application
design. Instead of relying on the concept of processor algorithms, as with more conventional methods, such as distributed systems, the provision of functioning depends on the use and integration of services. In other words, this has benefits in terms of adaptability, dependability, scalability, and so on. For illustration, more instances of a specific service could be launched so that the application's response time stays appropriate for consumers during a spike of resource requirements due to a rise in customers or a rise in computational load.

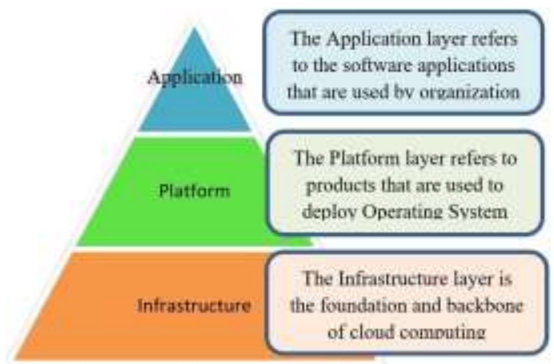
As a consequence of a decline in demand, available resources should be made available. Everything is done sensibly to the customer. Among the most notable cloud computing are its minimal connection, high degree of interoperability, and protocols that separate the provider's execution and environment [41]. It's not uncommon for an SOA to divide its operations into levels or layers (rather than in precise boundaries). Some components make usage services rendered by lower tiers to allow other capabilities to higher ones. Aside from that, these divisions could have multiple corporate frameworks, architectural designs, and so on. According to the type of arrangement being offered, there are generally three basic types of layers together, which form what is described as According to the kind of arrangement being offered. There are generally three basic types of coatings together, which include what is described as a cloud-based storage system that provides data storage depending on "files" or "blocks." Cloud computing is a collection of registers, columns, or entities that offer services and complete execution services are available by a compute cloud. Mega projects benefiting from the cloud computing model [35]. Many scientific and business applications are well-known burdened by heavy computational requirements. A constant data flow necessitates an elevated communication link since it involves handling enormous amounts of data contained in stable systems, which indicates a high amount of storage space.

Service-oriented systems can be grouped into a variety of areas. The complexity degree that these systems provide to the system user is a commonly used parameter for grouping them. As illustrated in Figure 1, this method frequently distinguishes between three distinct levels.

Infrastructure as a Service (IaaS) provides infrastructure, i.e., data centers, network technology, memory, or computing, and essential components like computer systems and abstraction of hardware elements [26]. If we compare the IaaS to a mono computer platform, the software and computer program together represent the IaaS. The operating system manages the system resources and makes them accessible. Rather than purchasing and establishing its entire computing infrastructure, the IaaS customer leases computational capabilities from the IaaS provider. Since services are typically priced based on actual usage, the customer only charges for whatever they consume. Because of cloud computing's dynamic scalability, they utilize (and spend for) fewer resources when the workload is light. Where there is a more critical requirement for help, IaaS can make them available to meet the demands of that specific customer. Most service agreements specify a maximum value that a customer may not go beyond. As an example, scholars and practitioners in the scientific community are prototypical IaaS customers. These clients can design experiments and interpret information to the degree that would not be feasible without the IaaS and the large amount of infrastructure it provides as a service. Amazon's Elastic Computer Cloud is one of the most popular IaaS suppliers today (EC2). Other notable IaaS providers include RackSpace, Google Compute Engine, and Windows Azure.

Figure 1: Layers of Cloud computing Source [7]

The second level, namely Platform as a service (PaaS), is a provider-provided infrastructure that includes an integrated software package with everything a development hub to construct apps at the design and delivery stages [27, 31]. PaaS providers don't offer infrastructure explicitly, but utilizing IaaS services provides developers with the tools they have to have an indirect connection to the IaaS infrastructure and, therefore, the architecture they require [31]. The PaaS could be regarded as a software layer,' allowing elements for apps and apps altogether to be produced on top of the PaaS. An interconnected developer setup or a collection of stand-alone tools will help engineers work on software glitches throughout the entire software development lifecycle. This includes everything from analyzing and modeling a challenge to designing a remedy to testing and deploying it. Similar to this, a computer language that uses several operating mechanism compilers and modules makes it possible to



deploy the same application on numerous systems without having to rewrite any code. Major examples of PaaS-cloud computing services market players include “Google App Engine”, “Amazon Web Services”, “Heroku”, “OpenShift- Red Hat” etc.

Software as a Service (SaaS) is the highest level in the pioneering use of cloud services when internet usage was growing in prominence [32]. Originating in the host functions of the Platform as a service, some organizations provided to everyone the applications appeared as customer interaction managements from these applications [28]. There are now numerous options available, both for businesses and private individuals as well as for education. Even though these services are delivered over the internet, which allows for geographic versatility, the direct sharing of data in this manner does not ensure its confidentiality. That's why VPNs are frequently used, as they enable data to be sent over the internet in an encoded file, keeping user and SaaS data safe and secure.

3. E-LEARNING TASKS AND CLOUD COMPUTING

E-learning systems advent expand at an exponential rate due to the suspension of on- campus classes, tremendous expansion in the number of students, instructional content, services available, and materials made accessible [21,23]. It's essential to select a platform that can scale to meet demand while still keeping expenses in check while optimizing resource processing, storing, and communication requirements. Cloud computing is what's happening here in the shape of delivery and retrieval of information and content. In contrast to previous 'traditional' learning environments, defining the promise of SaaS applications for resilient and comprehensive distance learning may help us comprehend the advantages of cloud computing mostly on a technological and pedagogical level. Throughout terms of achieving a beneficial system for online tools and interactive services, such as teaching materials, recordings, educational materials, peer instruction, and so on, we ought to offer the 'road' for supporting migrationto such a model.

Many educational institutions are now using cloud technology, and it's evident that it has a promising future in [19]. In many countries, namelythe UK, initiatives like JISC (2012) are in place to include an education cloud with the required tools to manage data and store the data [33]. Education SaaS refers to a cloud-based e-learning system that allows users to gain the benefit of cloud computing. Due to its modest hardware requirements, it can be swiftly deployed by the end-user. Moreover, it relieves the supplier of system service and maintenance responsibility, permitting the manufacturer to focus on the most critical business while receiving free automatic updates and providing essential resources via Web 2.0.

E-learning system architecture and cloud computing systems as part of consistency, harmony, effective resource use, and the long-term stability of the e-learning ecology from a technological standpoint in education [10]. In [29], the authors summarized the repercussions and ramifications of developing e-learning solutions in the cloud computing system. At the onset, there is a greater demand for web development abilities because the application may be accessed from anywhere, at any time. As a result, the subscriber has saved money by not paying for software, deployment, or server management. As a result, the institution will spend less money overall, have afaster deployment, and need fewer IT workers. Thiswill be equally handy for the situations like Coivd-
19 where the moment is restricted [16]. It is appropriate for the program type education sector topay for content peruse, making it available to more sophisticated programs and required applications. Numerous educational establishments can use a SaaS server. Scalability is built-in to the system because it is hosted on a cloud server. Thesoftware's performance will not deteriorate asstudent usage increases. To acquire the confidence of consumers and a comprehensive providing users system software, the SaaS provider needs a sophisticated level of security. The consumer data is dispersed throughout various services and therefore must be consolidated in obtaining a comprehensive picture of the business, resulting in an increased need for platforms and data integrators for education. The advantages of a cloud-based curriculum have previously been studied from a technological standpoint by specific authors. While affordability is the most frequently cited concern, other considerations include those highlighted for cloud use throughout the practice [33, 39, 40, 41]. It is not necessary to back up and move data between devices using a hard drive. Creating a reservoir of information means that students can keep it for as long as they desire, and it will continue to grow with them. Recovering after a crash seems to be almost entirely superfluous in this situation. There's essentially no information lost if the user machine fails. While working from numerous locations, students can access their files and modify them using virtualized programs that have also helped institutions implement E-Learning recently and notably during the lockdown. It offers academic organizations a minimal cost-effective alternativefor their academics, staff, and students.

Data access monitoring is made simpler bythe notion that just one location must be controlled rather than hundreds of computers dispersed across a larger region. Furthermore, because the cloud has a single database for all users, cybersecurity modifications can be efficiently evaluated and deployed [8]. Subsequently, even though more efforts are required to determine how cloud-related pedagogies or assessments of learning purposes [11], from a scholarly perspective, one of the advantages of the cloud is its ease of access [16], as it is mainly created to permit users to collaborate from anywhere at any given time. It can reach more learners outside the traditional teaching environment and meet their requirements. It canprovide more meaningful information to a broader spectrum of students in a more comprehensive range of contexts [10]. Figure 2, shows the dimensions of cloud computing in its association to E-Learning.

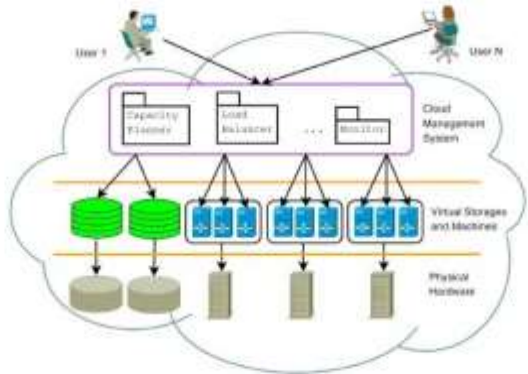
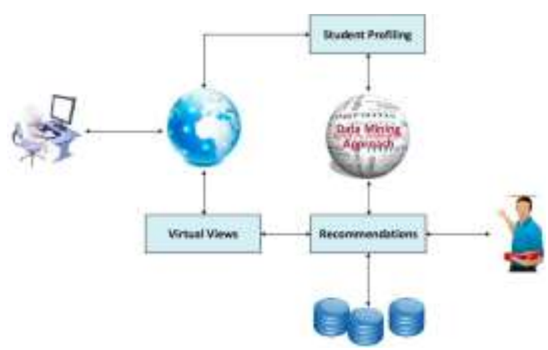


Figure 2: A glimpse of Cloud computing for E-Learning.
Source [12]

It's easy to see in Figure 2 that most cloud e-learning techniques use three fundamental layers: a virtualized platform on top and a cloud management system and services layer underneath that. Two computer pools are used for teaching: a C pool with a thin client and a server pool running the hypervisor, with the private cloud architecture created using vSphere. It is possible to observe and manage all of the virtual infrastructure's hosts and services instantaneously using a web browser. Things like efficiency and configuration can be monitored along with saving alarm information and permission settings.

To allow multiple operating systems, a single hardware host hypervisor is essential. A hypervisor prevents virtual machines from interfering with one another by allocating resources to each element as they are required. In this case, a hypervisor that runs directly on the underlying hardware is the better option. This layer, which serves as an interface to the outside world, provides the PaaS and SaaS cloud users' needs. The instructional coordinators build the virtual PCs, choosing the baseline images and installing the software they've chosen afterward [27]. Thus, standardized web technologies



are generated for specific course projects, and learners may connect to the respective VM using the remote network. Figure 3. shows the personalized virtual model for E-Learning.

Figure 3: Personalized E-learning Architecture. Source [17]

The integration of cloud technology and e- learning has received more attention from the institutions due to its high demand to continue education. Almost all the institutions of schooling deemed it to be an operative and suitable alternative for e-Learning. Nevertheless, an absence of research may provide a theoretical foundation from which a methodology could be constructed. The flexibility implicit in the cloud strategy, on the other hand, could've been highlighted as a considerable advantage in producing an analytical framework and creating successful teaching techniques [34]. The drawback in this field is that few studies provide a strategic or tactical of the subject.

Conversely, the overall characteristics of the cloud are associated with social engagement and collaboratively learning pursuit in the literature [28]. In [9], the authors investigate students' views of excellence and responsibility about various kinds of interaction within Google Docs. Instructional methods that use technology to alter and improve students' collective experience when producing a joint assignment. Additionally, various cloud- related studies may be found for measuring the results of online models to conventional approaches[43].

4. PERSPECTIVE CHALLENGES E- LEARNING AND CLOUD COMPUTING

E-learning may benefit greatly from today's cloud computing, applications, and capabilities as a lucrative industry [4,13]. A cloud-based e-learning system can provide significant assistance in overcoming the shortcomings of conventional local physical labs and computing platforms. Nevertheless, fundamental problems and barriers must be solved before the cloud can be widely used and adopted to facilitate and promote e-learning.

It is essential that instructors and students undergo a learning curve and that academic institutions give IT support to make good use of cloud computing for e-learning and teaching [18, 33]. Use third-party solutions or current public or commercial cloud resources or services however you like. Along with training, the instructor should be well-versed in cloud capabilities and consult with the university's IT department to establish the best cloud model for the class's requirements. The instructor must be taught how to set up and assign cloud resources and manage student accounts. Students must also be coached and instructed on how to access and use the cloud-based course resources. Depending on the course design and requirements, the learning curve for instructors and students might be steep or easy. Faculty in fields like computer science and related courses may have an easier time learning about and using the cloud than faculty in other areas.

A cloud-based system integrates the inherent advantages of cloud technology, such as cost savings, fault tolerance, and enhanced accessibility and remote connectivity into e-learning. Cloud technology benefits can be maximized with proper pre-implementation planning [3, 4, 5]. Businesses can utilize any options listed below to move from their present e-learning system to cloud-based e- learning. The process of converting an e-learning program involves several steps, including installing the operating system and middleware and implementing the server and client modules. A migration feasibility study must include user needs, existing IT infrastructure availability, and a cost/benefit analysis [44]. A system's monetary cost can be kept to a low by optimally mapping existing resources to the cloud tiered architecture using virtualization to reduce resource under-utilization.

Even though connectivity and speed have improved dramatically over the previous decade to an acceptable level worldwide, a slow internet connection can significantly impede cloud-based education and e-learning. The situation is exacerbated even further when data and services are accessed from non-regional cloud datacenters. Due to this problem, users and students of cloud-based e-learning systems may be subjected to excessive delays. The cloud may not be the appropriate Platform for teaching specific topics and disciplines if students need to use specialist software or equipment and resources in physical labs [33]. Digital forensics, mainboards, physical network devices, and robotics can be considered equipment if they require a hardware dongle. It is possible to use the cloud in part for this purpose, although it may not be possible in all cases. The use of cloud power must be thoroughly investigated and studied for such topics. Tools that closely imitate the hardware environment may hold the key to this problem's resolution. Using resources and software from both on- and off-cloud should be part of the hybrid cloud concept.

5. CONCLUSION

The overview presented in the analysis assert that using cloud services in E-learning is a nice alternative because it allows teachers to leverage cloud adaptability, flexibility, and security to represent the main framework of E-learning — instruction providing access anywhere, at any time, and from any gadget. When an efficient learning environment with specialized content is easily adaptable to today's educational paradigm, we can fully utilize the opportunities it presents. Increased storage, computation, and network connectivity are a few advantages of integrating an e-learning system into the cloud. Software and hardware savings should be prioritized. In contrast, it has a more incredible selection of educational programs at a lesser license cost. However, the replacement rate for student computers is reduced due to the longer machine life. These savings are boosted by the decrease in IT personnel costs associated with computer lab maintenance and software updates.

Today's e-learning services and systems fall short when it comes to customizing and personalizing learning for each user. Students obtain generic e-learning that is not personalized to their needs as a result of this practice. New research and development are required for cloud-based personalized learning to be used and developed across many topic areas. In most modern systems, the interaction between professors and students is critical to increasing the quality of the learning experience for each individual. Integrating cloud- based e-learning services, such as video conferencing or instant messaging, should be possible with online and real-time training. Modern cloud-based e-learning systems make up for these shortcomings by using email, voice-over-IP, and apps like Skype. For the great majority of cloud- hosted services, this is still a concern. There are numerous factors to consider when estimating the size of a problem. Cloud service providers have made significant investments in cloud infrastructure and platforms in response to client concerns about security and privacy. Furthermore, country restrictions are essential since some countries demand that data be kept within their borders, making data storage remotely or outside the country a criminal offense. According to the current research, academics have an abundance of data at their disposal to aid in the development of cloud- based e-learning frameworks and implementations. a quantitative evaluation of the impact on numerous parameters such as access speed, influence on educational quality, and return of migrating to a cloud e-learning environment will be a future inquiry.

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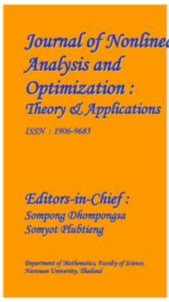

MITIGATING BROADCAST STORM IN VANETS THROUGH KEY-BASED MESSAGE TRANSMISSION

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Abstract

Vehicular Ad Hoc Networks (VANETs) use low-cost wireless communication technologies to relay traffic information to nearby vehicles. One of the main objectives of Intelligent Transportation Systems (ITS) is to disseminate road information to vehicles promptly to reduce the risk of accidents. When a vehicle receives information from its neighbor, it becomes part of the VANET, helping to control and forward the received information to other nearby vehicles. This paper proposes a design to mitigate broadcast storms, named Key-Based Message Broadcast for VANET (KMB-V). This method forms small clusters of vehicles, each with a Cluster Head (CH), and utilizes a unique key for message transmission to avoid broadcast storms. The proposed approach demonstrates superior performance in terms of Packet Delivery Ratio (PDR), network lifespan, and throughput compared to previous methods.

Keywords

VANET, ITS, Broadcast Storm, key-bases message broadcast, PDR

Introduction

Vehicular Ad Hoc Networks (VANETs), a subset of Mobile Ad hoc Networks (MANETs), heavily rely on broadcasting transmissions for communication. These networks facilitate the exchange of traffic information among neighboring vehicles through affordable wireless communication technologies. VANETs employ a peer-to-peer network infrastructure, known as Intelligent Transport Systems (ITS), to enable data transmission between vehicles. The primary objective of ITS is to enhance safety for drivers, passengers, and vehicles by promptly sharing road information to mitigate the risk of accidents [1].

In VANETs, when a vehicle receives communication from its neighboring vehicle, it becomes an integral part of the network, responsible for controlling and forwarding the received information to other nearby vehicles. VANETs consist of mobile nodes equipped with sensors, as well as Road-Side Units (RSUs) designed to access data from vehicles and relay it to passing vehicles through wireless intercommunication [2].The architecture of VANETs encompasses On-Board Units (OBUs) facilitating Vehicle-to-Vehicle (V2V) communication, as well as communication with fixed street units known as RSUs, termed Vehicular-to-Infrastructure (V2I). In certain scenarios, both V2V and V2I transactions are combined to form a hybrid architecture [3].

Three distinct types of communication are prevalent in VANETs, namely V2V transactions, V2I transactions, and hybrid transactions combining both V2V and V2I communication modes.

Vehicle-to-Vehicle Communication (V2V)

Vehicle-to-Vehicle Communication (V2V) facilitates direct communication between vehicles, enabling them to exchange crucial data such as speed, position, and traffic information without the need for any intermediary medium. The primary objective of this communication is to enhance safety on roads by enabling vehicles to share real-time information and thereby avoid potential accidents.

This system operates through On-Board Units (OBUs), which serve as the communication interface for transmitting and receiving data between vehicles [3].

Vehicle-to-Infrastructure Communication (V2I)

In this communication framework, vehicles are enabled to exchange information with Roadside Units (RSUs). This interaction is bidirectional, allowing both the vehicle and the RSU to share relevant data between them. Acting as a reliable information hub, the RSU disseminates collected data to vehicles as they enter its radio range. Furthermore, the RSU plays a pivotal role in suggesting both security and non-security functionalities for the on-board units (OBUs) installed in vehicles [2],[3].

Hybrid Architecture

This architectural model combines Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication. It enables vehicles to communicate with both Roadside Units (RSUs) and nearby vehicles for the exchange of information. This setup supports both single-hop and multiple-hop communication, accommodating high node mobility and facilitating rapid network topology adjustments within a limited mobility design. Additionally, it operates under the assumption of an infinite power supply. The effectiveness of Vehicular Ad-Hoc Networks (VANETs) is contingent upon the transmission of messages among vehicles, a process influenced by the high mobility of nodes, which necessitates frequent routing and topology modifications [3]. For a visual representation of this simplified VANET architecture, refer to Figure 1.

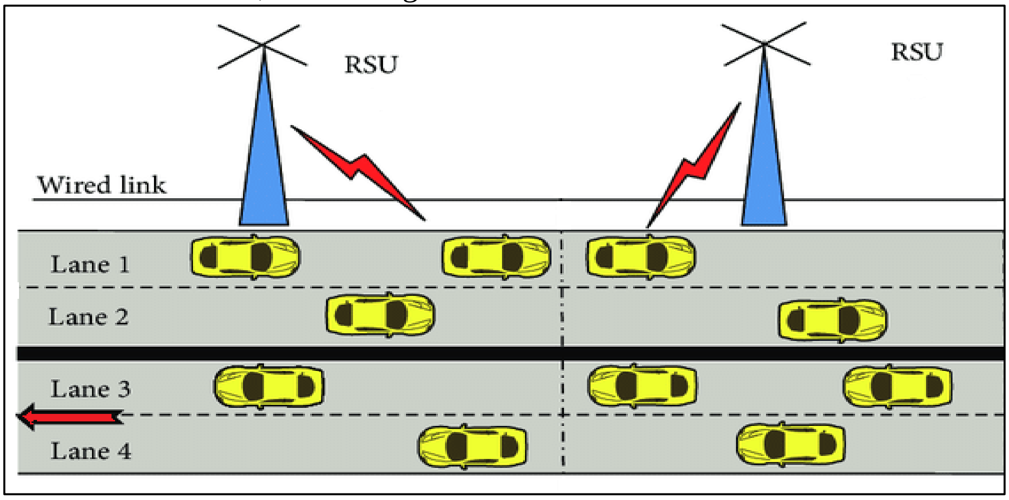


Figure 1: Simple Architecture for VANET

Some research efforts have concentrated on examining the robust connectivity inherent in Vehicular Ad-Hoc Networks (VANETs), particularly in regions characterized by high vehicular traffic density. However, the reception of redundant messages from both vehicles and Roadside Units (RSUs) often results in resource wastage, encompassing costs and time (Source: [4]). The proliferation of redundant messages can instigate a broadcasting storm, a hazardous scenario for VANETs, which imperils the network's design and reliability. To address this challenge, a novel design is proposed in this paper, termed Key-Based Message Broadcast for VANET (KMB-V), aiming to mitigate the broadcasting storm phenomenon.

This KMB-V approach involves the formation of clusters comprising a minimal number of nodes (vehicles) with designated Cluster Heads (CHs). By constraining the number of transmissions, this KMB-V method establishes a highly efficient broadcasting mechanism and resulting in enhanced propagation speed and overall network performance (Source: [5]). The subsequent section of this research is structured as follows: Section 2, Related Work, provides an overview of various protocols and prior investigations. Section 3 delineates an evaluation scenario for the proposed protocol and outlines the algorithms under assessment, along with their explanations. Section 4 conducts a comparative evaluation of the proposed methodology's performance. Finally, Section 5 presents the conclusions drawn from the study.

Related Work

The author [6] details the intra-cluster routing protocol, which is a hybrid protocol that partition a massive network into a tiny cluster. The CHs are elected through usual technique and it is responsible for communication between the cluster members and nearby CHs. The high responsibility of the CH is to find out the optimal route to reach each cluster members. Generally, cluster decreases the control overhead and it expands the size of the network.

In paper [7] suggested a cluster-based directional routing algorithm for public transportation. Constrained variables such as direction, location, and acceleration have been calculated and considered in deciding on CH. The proposed protocol in [8] relies on movement as a parameter and attempts to maintain the CHs as a constant object. This reduces communication overhead and the MAC layer argument while maintaining an excellent Packet Delivery Ratio (PDR). To select CH, the greedy traffic-aware routing protocol (GYTAR) and a crossroad-based routing protocol are proposed.

Similarly the [9] proposed Greedy Perimeter Coordinator Routing (GPCR) convey a tiny packet of information using a direct route to a destination in an intersection. The researchers also discuss the volume and load conscious VANET protocols that outperform the other protocols. When compared to GYTAR and AODV, the idea for IRTIV is a position-based routing protocol that tries to minimize end-to-end delay. It determines the immediate rate of vehicular traffic and the related path to the target.

In [10], the author presented a Beacon Less Routing algorithm for Vehicular Environment (BRAVE) to reduce overhead communication when broadcasting. In [11], CHEF guarantees that the nodes are optimized and that sufficient energy levels are selected for CH. CH proposed a collecting approach that proposes and enhances fuzzy logic rules over time. This CHEF follows four fuzzy rules that are primarily focused on the Base Station (BS), the module's remaining energy, and node awareness with local distance.

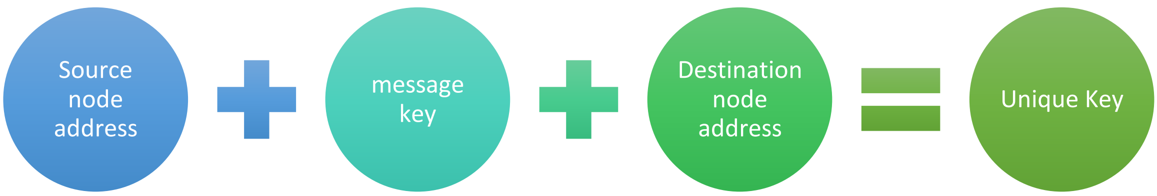
Proposed Work

The proposed work key-based message broadcast for VANET (KMB-V) generates a unique key for each message transmission to avoid message-broadcasting storm whereas the message must be deliver to the all possible vehicles with high reliability and minimum delay.

Key-Based Message Broadcast for VANET (KMB-V)

The key-based message broadcast for VANET (KMB-V) proposes an algorithm to overcome the network from broadcast storm through sharing a unique key for each message transmission. The key consists of three identification alphanumeric unique numbers for each transmission. Figure 2 presents a unique key structure.

Figure 2: Proposed Unique Key Structure



Source node address is the address of a source vehicle (8 bit), which is going to transmit the data to the destination vehicle or to RSU. Message key consists of 8 bit key combination from the original message and destination node address is the address of the destination vehicle (8 bit).

Generally, each node (vehicle) forwards a hello packet to its CH to join into the cluster. While sending the hello packet itself, the unique node address is generated and forwarded to the concern node. Likewise, for each RSU, the node generates a special address to identify the RSU.

Figure 3: Unique Key Message Format

Figure 3 presents the unique key message format for each data transmission. Instead of sending the same messages repeatedly, this unique format easily identifies that the message is received already and alerts the sender that message was received early. When a sender receives alert from most of the node then, the receiver stops forwarding the message to other nodes. Figure 4 shows the working structure of the proposed work.

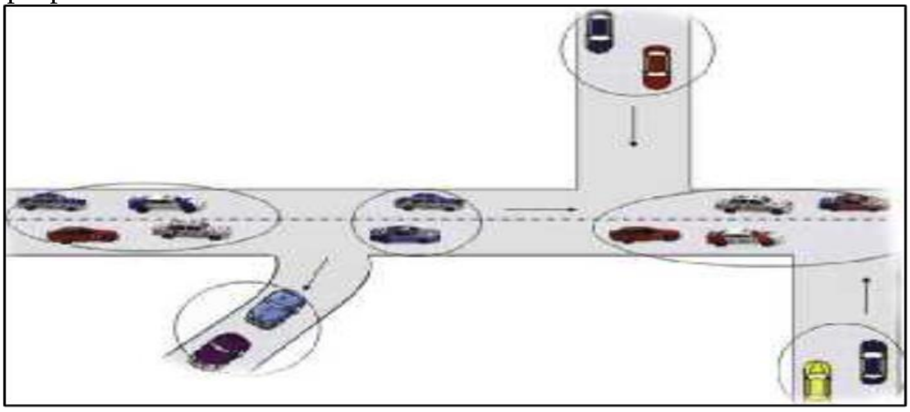


Figure 4: Working structure of the proposed work

This proposed work follows traditional LEACH (Low Energy Adaptive Clustering Hierarchy) to elect CH. The CH election is processed in two phases namely Set-up Phase and Steady Phase. Setup phase elects CH based on the chosen value between 0 (Zero) to 1 (one). In next phase, which is steady phase the CH election is based on the performance metrics such as distance between nodes, distance to RSU, number of transmitted vehicles of a node and so on. Therefore, the broadcasting storm detains the performance of the network and as well, it reduces the lifetime of the network to some extent. The algorithm is proposed in steady phase to elect better CH based on the unique key data transmission,

Algorithm

Key-based Message Broadcast Algorithm

Step – 1: Unique value between 0 to 1 is assigned to all node through LEACH's dynamic value allocation as in setup phase.

Step – 2: Threshold value is identified using

$$T(n) = \frac{P}{1-P\times(r \bmod \frac{1}{P})} \quad \forall n \in G$$

Step – 3: Node that holds nearer or equal value to the threshold value is elected CH for the initial round

Step – 4: Initialize the CH and send message to nearer vehicles to form cluster

Step – 5: Cluster members forwards the unique node address to each other to forward/receive Messages between the vehicles.

Step – 6: Once the node addresses are transmitted, the key generation will be processed.

$$key = Source_{addr} + \frac{original_{msg}}{Key_{gen}} + destination_{addr}$$

Where, $Source_{addr}$ is source address of the node and $destination_{addr}$ is destination address of the node. $original_{msg}$ is original safety event message content of (254 bytes) and Key_{gen} is the key generation process consist of 254 bytes alphanumeric keys that generate a unique key of size 8 bit (1 byte by 254 bytes message content/254 alphanumeric keys)

Step – 7: Start message transmission by transmitting unique key to all nearby nodes

Step – 8: Destination node checks the unique key with received key to identify the uniqueness of the key.

Step – 9: IF key is unique, the destination node sends the ACK (acknowledgement) and the original message will be forwarded

ELSE key is not unique then the destination node sends an alert message stating that the message is already received to the sender. Whenever, the alert message is received, the transmission of the particular message is stopped.

Step – 10: Stop the process

Figure 5: Key-based message broadcast algorithm

The algorithm outlined in Figure 5 illustrates the process of message transmission among vehicles. Upon forwarding or receiving node addresses from nearby vehicles, the message exchange ensues. Subsequently, once nearby addresses are gathered, nodes harboring messages for the clusters dispatch them. In response, cluster heads (CH) and other cluster nodes issue acknowledgments (ACKs) upon receipt of new messages, whereas already received messages trigger alert messages back to the sender. Upon receiving a sufficient number of alert messages (60% or more), the sender ceases forwarding the original message to the recipient, redirecting it instead to nodes that haven't sent alerts. This measure helps avert broadcasting storms by eliminating redundant message transmissions.

Results and Discussion

The proposed work focuses in minimizing the broadcast storm in VANET that improves the network lifetime, packet delivery ratio, and Throughput. Table I displays different simulation parameters used in the proposed work.

Table I: Simulation Parameters of the proposed work

PARAMETERS	VALUE
Channel	Wireless channel
Antenna	Omni/Directional Antenna
MAC Protocol	IEEE 802.11
Routing Protocol	LEACH
No. of Nodes	100
Simulator	NS 2.35
Simulation Time	3600 Sec
Protocol	KMB-V LEACH
Traffic Status	Continuous arrival

The proposed work is compared with the existing schemes to identify the performance of the proposed KMB-V LEACH in network lifetime, Packet Delivery Ratio (PDR), and Throughput. Network lifetime is an essential factor for a network to continue the purpose of developing such network without any pitfalls.

However, the improvement in lifetime definitely improves the performance of the PDR. The better selection of correct nodes as CH in terms improves the purpose of this network, in such a way the proposed work concentrates in improving the correct selection of CH and member nodes for betterment of the network.

The Figure 5 shows the network lifetime of the proposed and existing schemes.

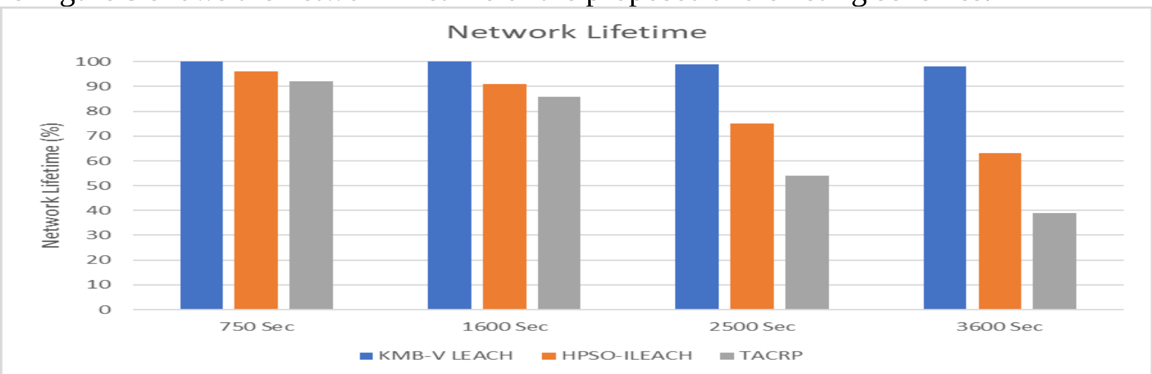


Figure 5: Network Lifetime

The proposed KMB-V LEACH attains a maximum of 96 % lifetime after 3600 Sec of simulation, whereas the existing schemes HPSO-ILEACH [10] and TACRP [11] maintains 54% and 32 % respectively.

The Figure 6 presents throughput between the proposed and existing schemes as well.

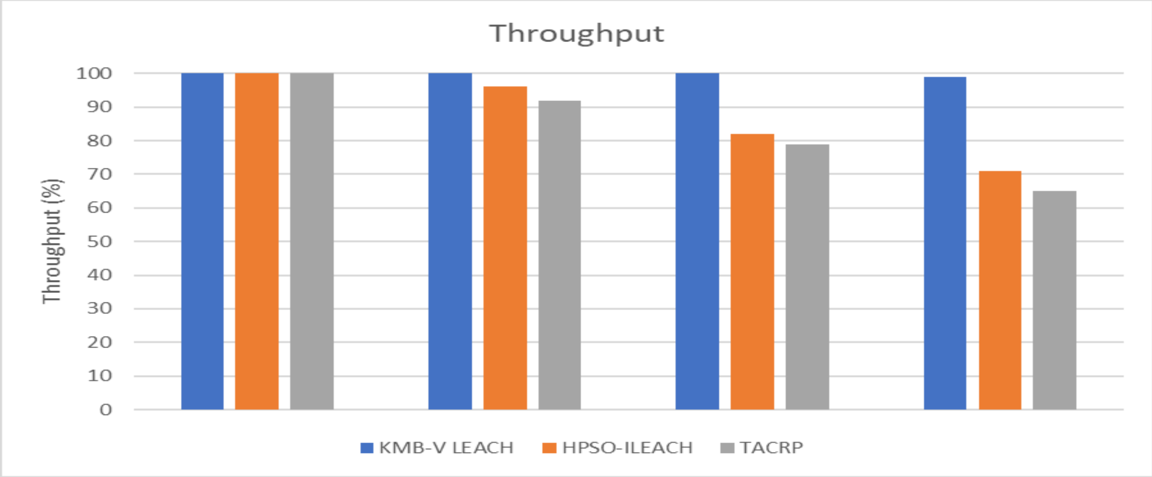


Figure 6 Throughput

Throughput is to measures the correct selection of CH, member nodes, transmission of correct message after key transmission and so on. This parameter identifies that the proposed KMB-V LEACH maintains 98% of throughput stating that for every 100 connectivity 98 connections were connected successfully and transmitted new information or correctly identified as older one. However, the existing schemes throughput is reduced to 52% (HPSO-ILEACH) and 35 % (TACRP). The lesser throughput percentage states that lesser connectivity, lesser message transmission and higher old message key transmission and so on.

Figure 7 shows the Packet Delivery Ratio between the schemes.

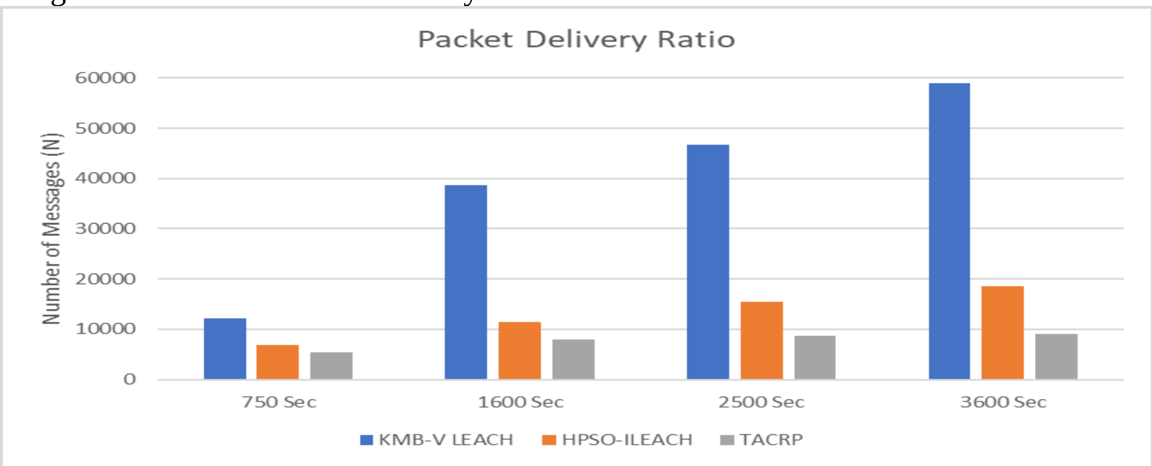


Figure 7: Packet Delivery Ratio

The PDR of proposed work is 31% higher than the HPSO-ILEACH protocol and slight higher to TACRP protocol. The proposed work outperforms due to unique key formation that avoids broadcast storm as well as improves the lifetime, throughput and PDR ratio to the betterment of the VANET.

Conclusion

Vehicular Ad Hoc Networks (VANETs) play a crucial role in disseminating real-time road and passenger safety information efficiently. However, the swift transmission of data can lead to inefficiencies due to broadcast storms, where messages are forwarded repeatedly. To mitigate this issue, the proposed solution emphasizes the generation of unique keys for each message transmission. These keys are forwarded along with the message to destination nodes, allowing them to identify whether the message has already been transmitted.

If the message is detected as already received, the destination node sends an alert message to prevent redundant broadcasting. When a sender node accumulates 60% or more alert messages, the original message is discarded from the transmission list. This approach demonstrates superior performance across parameters such as Packet Delivery Ratio (PDR), network longevity, and throughput compared to existing methodologies. Looking ahead, integrating key transmission with security features holds promise for detecting and mitigating malicious nodes within VANETs.

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PORTIONING CLUSTER RELIABLE BROADCAST (PCRB) THROUGH INDEX BASED MESSAGE -TRANSMISSION (IBM-T) TO AVOID COLLISION IN VANET

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Abstract: Vehicular Ad-hoc Networks (VANETs) perform a power position in improving various aspects of international transportation. VANETs support the exchange of safety-critical information among vehicles, help to avoid collision and increase overall road scenario. One popular method for increasing the effectiveness of data distribution in VANETs is cluster-based routing. VANET depend on robust broadcast transmissions because they exchange information (such as messages) among the close vehicles regarding traffic conditions, accidents, and similar events. This continuous message broadcast result in redundant data and cause broadcast storm and result in collision in VANET. The proposed work named Portioning Cluster Reliable Broadcast (PCRB) and Index Based Message-Transmission (IBM–T) reduce the broadcast storm though grouping the vehicle by messages and by index the message that transmit before message transmission The proposed work improve better performance like PDR and throughput parameters.

Keywords: VANET, Broadcast Storm, Portioning Cluster Reliable Broadcast (PCRB), Index Based Message-Broadcast (IBM–B), PDR

I. INTRODUCTION:

VANET is a kind of network specifically designed for establishing communication between Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I). Vehicles share and transmit information about their location, path, and speed, which improves road safety. This can help prevent accidents and improve traffic management. VANETs can help in optimizing traffic flow, reducing congestion, and improving route planning by means of facilitating better communication between vehicles and infrastructure [1]. On-Board Units (OBUs) are installed in VANET vehicles which manage communication, navigation, and other tasks. The Infrastructure is established with Roadside Units (RSUs) that are fixed along roads and highways, providing connectivity and data exchange points [2].

The Communication types of VANET are divided into the following: *Vehicle-to-Vehicle (V2V):* Vehicles can communicate directly to exchange data, including location, speed, and direction. *Vehicle-to-Infrastructure (V2I):* Vehicles communicate with RSU (Road Side Unit) to share information about traffic signals, road closed and various information regarding road environment. *Vehicle-to-Network (V2N):* Interaction between vehicles and broader networks, enabling access to cloud-based services and traffic management systems [3]. Ensuring the communication at correct time to vehicle is crucial because of randomly changing of nodes with high speed velocity. Managing network performance and transmission of message is a challenge if the number of vehicles increases [4]. The design of VANET is shown in Fig 1:

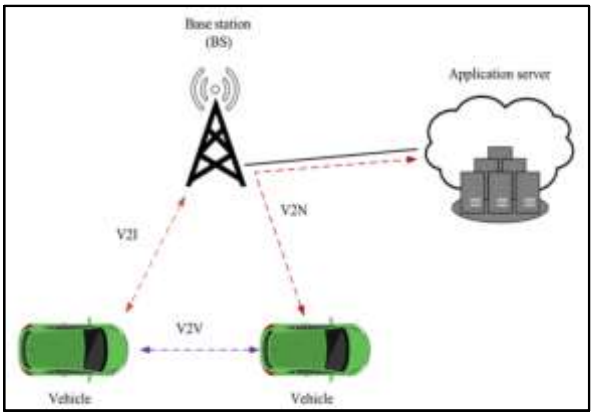

Fig 1: The Design of VANET

Due to vast network topology clustering vehicles in VANETs is important because it enhances communication efficiency, scalability, data management, and network stability. Cluster organizing vehicles into groups that can more effectively interact. Cluster reduces the network overload and distributing the message and managing network resources, such as bandwidth and energy, more effectively. Clustering the Vehicles within range exchange information directly, reducing the need for long-range communication and thereby minimizing delays and congestion in the network. Instead of each vehicle communicating directly with every other vehicle, they can communicate with them, which then communication with other clusters. This reduces the number of messages and bandwidth required [5]. This paper present Portioning Cluster Reliable Broadcast (PCRB) for better cluster-based broadcasting technique using Index Based Message-Transmission (IBM–T) for improved message transmission. This paper is divided into sections: Section II illustrations literature review about related work of the past works in the same area. Section III tells about the proposed PCRC protocol using IBM-T data transmission and Section IV presents the result of the proposed work and in Section V this paper concludes with future work.

II. RELATED WORK

The earlier work of VANET to control the broadcast storm associated with cluster-based technique is discussed in this section

The author [6] **Huang et al.,** proposed that there are two methods of facilitating communication between VANET and the backbone infrastructure, RSU. The first involves direct utilization of the RSU by the vehicle to establish an internet connection. Alternatively, the second approach entails the formation of clusters by vehicles, which allows for intra-cluster communication in order to exchange information**.**

Robust Mobility Aware Clustering (RMAC) present by **Zareei et al.** it defines the characteristics of CH that Selects the most suitable CHs by considering metrics related to the mobility of nodes, including speed, location, and direction of travel [7].

Almalag et al. [8] Time Division Multiple Access (TDMA) slot reservation strategies, which leverage the clustering of vehicles, facilitate one-hop communication within each cluster, thereby negating the necessity for the discovery of neighboring nodes. Ensuring the stability of the cluster relies heavily on the careful selection of a cluster head node.

Distributed and Mobility aware Cluster-based MAC protocol (DMMAC) presented by **Gupta et al.** [9] guarantees the robustness of its cluster members by accurately forecasting their future velocity and location. The main difficulty with TDMA lies in its requirement for precise synchronization and thorough pre-planning of geographical areas for TDMA slots. The protocol could be enhanced by taking into account the time spent by potential cluster members on the road before they are permitted to become part of a cluster group.

The Hierarchical Clustering Algorithm (HCA) is designed by **Nazhad et al.** [10] to prioritize rapid establishment of network topologies and efficient scheduling to ensure the prompt transmission of urgent messages within a Vehicular Ad-Hoc Network (VANET). This algorithm operates as a randomized hierarchical cluster, featuring two primary nodes and a central hub. Consequently, the algorithm restricts the maximum number of potential connections.

The issue of safety message authentication in a high-density traffic scenario was covered by **El Sayed et al.** (2020) [11]. Additionally, it proposed a prioritised verification strategy as a means of resolving vehicular message authentication issues in high traffic situations. Based on the physical characteristics of the nearby vehicles, priority scores were assigned to the safety messages [12].

III. PROPOSED WORK

Index Based Message-Transmission (IBM-T)

In order to prevent rebroadcast of message, each message transmission in Index Based Message-Transmission (IBM-T) is assigned a specific key. The packets are delivered to entirely possible vehicles with high dependability and little latency. The network is prevented from broadcast storms by the proposed IBM-T, which involves sharing a distinct key for each message transmission. The following Fig 2 explains specific index message transmission contains of three identification alphanumeric specific numbers for each broadcast.

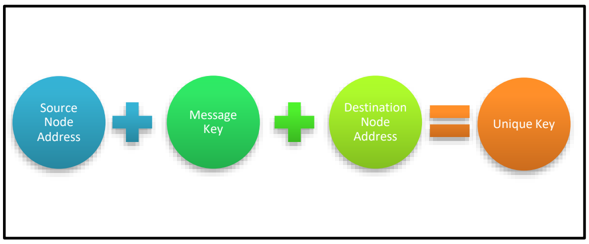

Fig 2: Specific Index Based Message-Transmission

The address of the destination vehicle (8 bits) represents the destination node address, whereas the 8-bit key combination from the original message aids as the message key. The destination nodes and RSU receives the data from the source node address that contains the address of a source vehicle (8 bits).

Every node communicates with its Cluster Head (CH) by sending a hello packet to join the cluster. In the process of sending the hello packet, the node generates its specific address, which is then transmitted to the concerned node. Similarly, for every RSU, it generates a unique address that helps identify the RSU.

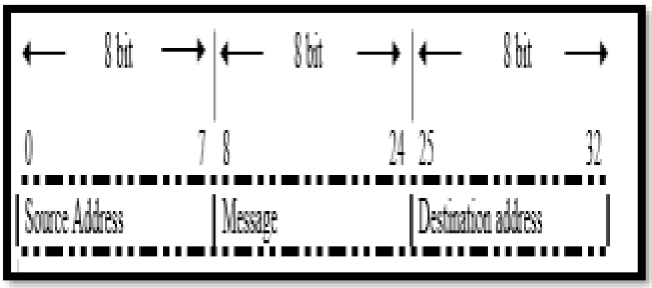

Fig 3: Index Message Format

For every data transmission, a different index message format is shown in Fig 3. Instead of sending the same messages over and over, this special format lets the sender know that their message has already been received and makes it obvious that it was received early. The following Fig 4 shows the algorithm of IBM-T.

Index Based Message-Transmission (IBM-T) Algorithm:

Step – 1: Unique value between 0 to 1 is assigned to all node through LEACH’s dynamic value allocation as in setup phase.

Step – 2: Threshold value is identified using

$$T(n) = \frac{P}{1 - P \times (r \bmod \frac{1}{P})} \quad \forall n \in G$$

Step – 3: Node that holds nearer or equal value to the threshold value is chosen CH for the first round

Step – 4: Initialize the CH and send message to nearer vehicles to form cluster

Step – 5: Cluster members forwards the unique node address to each other to forward/receive messages between the vehicles.

Step – 6: Once the node addresses are transmitted, the key generation will be processed.

$$Index\ = Source_{addr} + \frac{original_{msg}}{Key_{gen}} + destination_{addr}$$

Where, $Source_{addr}$ is source address of the node and $destination_{addr}$ is destination address of the node. $original_{msg}$ is original safety event message content of (254 bytes) and Key_{gen} is the Index generation process consist of 254 bytes alphanumeric keys that generate a unique Index of size 8 bit (1 byte by 254 bytes message content/254 alphanumeric keys)

Step – 7: Start message transmission by transmitting unique key to all nearby nodes

Step – 8: Destination node checks the unique key with received key to identify the uniqueness of the Index.

Step – 9: IF index is unique, the destination node sends the ACK (acknowledgement) and the original message will be forwarded.

ELSE index is not unique then the destination node sends an alert message stating that the message is already received to the sender. Whenever, the alert message is received, the transmission of the particular message is stopped.

Step – 10: Stop the process

Fig 4: Index Based Message-Transmission (IBM-T) Algorithm

Portioning Cluster Reliable Broadcast (PCRB):

After the messages are keyed by Based Message-Transmission (IBM-T) the vehicles are grouped by Portioning Cluster Reliable Broadcast (PCRB) protocol. PCRB reduces the amount of packets that are transmitted for rebroadcast messages. In order to substantially decrease the number of forwarder vehicles, packets are re-sent towards the next hop utilizing a method of dynamic vehicle selection.

The proposed protocol possibly reduces retransmission by identifying vehicle clusters quickly and effectively. Additionally, choosing one to be the CH vehicle for every cluster is identified, and the PCRC protocol mainly focuses on to limit the broadcast storm. The PCRC protocol divided the vehicle into two groups, LSV (Linked Set of Vehicle) and RSV (Remove Set of Vehicle), according to the message transmission and it’s explained in Fig 5.

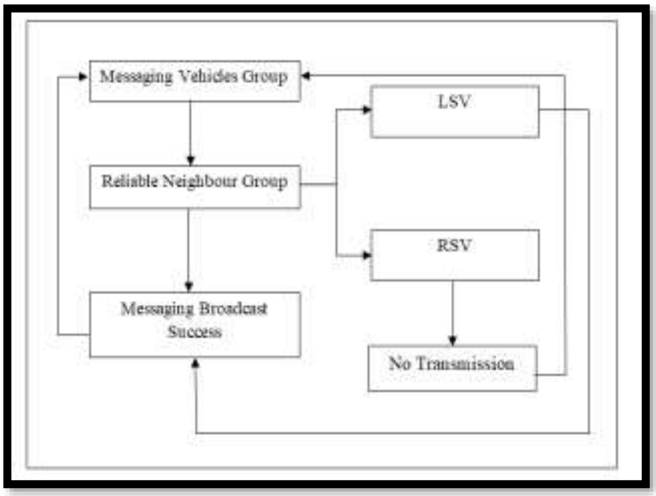

Fig 5: Block Diagram of PCRB

Vehicles are categorized as either RSV or LSV according to how reliable they are. The reliability of the vehicle is confirmed prior to the start of broadcasting. LSV will enable the successful broadcasting of the message transmission. A vehicle's broadcasting is turned off and transmission is halted when its dependability with RSV is jeopardized. The complete infrastructure is established within this segment, facilitating communication between vehicles and between vehicles and infrastructure. To cover the vehicles, the RSUs are fixed on the roads. The RSU gathers data from the roads during this time and sends it to the server.

The vehicle's dependability is used to determine the LSV. On the other hand, the timestamp and vehicle speed are often generated using the fundamental packet format. The classification of the vehicle as an LSV will depend on the timestamp and the established threshold value. The vehicle remains in the CSV as long as the timestamp continues to rise. The message transfer will be handled after the reliability has been successfully verified.

Usually, the LSV check is followed by the RSV set joining. The car will automatically join the RSV whenever it is unable to join the LSV. For the purpose of classifying the vehicle as either an LSV or RSV, it will review its threshold and timestamp values with each message received.

Furthermore, the cars in the RSV are checked for distance and the fundamental threshold value of distance. Naturally, cars that go less than the threshold distance are given another look at joining as LSV; otherwise, they stay in RSV. The following Fig 6 shows the vehicle portioning into LSV and RSV. An LSV is indicated by a red dotted circle, and an RSV is shown by a yellow dotted circle, because of shared elements such as speed and time. Thus, before to each message transfer, the data transmission will be examined.

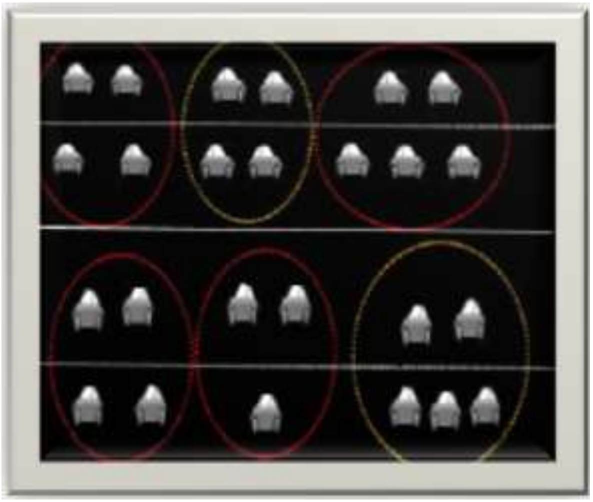

Fig 6: PCRB – LSV and RSV

The Algorithm for Portioning Cluster Reliable Broadcast (PCRB) is given below:

- Step – 1: The designated index j is greater than the ID of the reachable transmitter vehicle, with j identified as the median vehicle.
- Step – 2: The gap between the two nearest vehicles in the cluster.
- Step – 3: The gap between the two vehicles that is furthermost apart within the cluster.

IV. RESULT OF THE PROPOSED WORK

The objective of this proposed work is to mitigate broadcast storms in Vehicle Ad Hoc Networks (VANET) by enhancing throughput, improving packet delivery ratios, and extending the overall lifespan of the network. The various simulation settings utilized in the suggested work are shown in Table I. The performance of the proposed PCRB is evaluated by comparing it with existing methods using metrics such as packet delivery ratio (PDR) and throughput. For a network to continue serving its intended purpose of developing without encountering any problems, network lifetime is crucial. The PDR performs better, though, thanks to the lifetime improvement. Improved CH node selection advances the goals of the network; consequently, the suggested work focuses on enhancing member node and CH selection for network enhancement. The proposed and current methods' network lifetimes are displayed in Fig. 7.

TABLE I: **SIMULATION PARAMETERS**

Parameters	Value
Channel	Wireless Channel
Antenna	Omni/Directional Antenna
MAC Protocol	IEEE 802.11
Routing Protocol	Proposed PCRB
No. of Nodes	100
Transmission Rate	250 Kbps
Area Coverage	1000 x 1000m
Direction	Bidirectional
Simulation Time	500 Sec

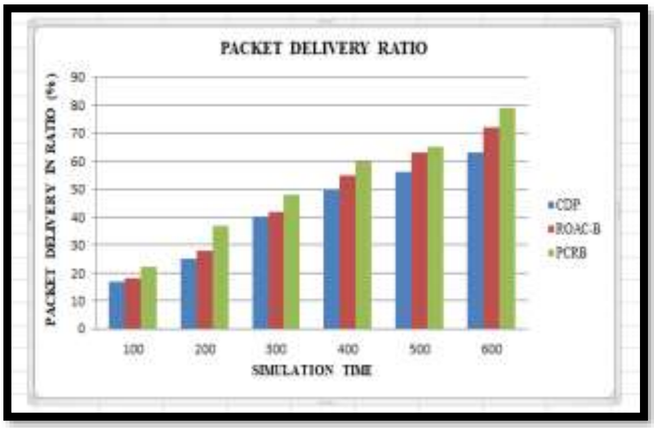

FIG 7: PCRB PACKET DELIVERY RATIO

Figure 7 explains PDR (in percentage) comparison results, existing algorithms CDP achieve 63%, and ROAC-B achieves 72%. The PCRB Protocol being proposed shows a 79% of quantity of data packets delivered by the source and the number of packets that reach their destinations.

The proposed PCRB Protocol has a 79% ratio between the number of data packets supplied by the source and the number of packets received by the destinations. This shows proposed PCRBs PDR is higher than the existing system. The proposed PCRB is significantly higher than 16% and 7% of existing CDP and ROAC-B results.

V. CONCLUSION AND FUTURE WORK

The VANET is a newly developed network in which cars communicate with other nearby vehicles about pertinent information including traffic conditions.

Although VANET does a great job of communicating and transferring data, it often experiences broadcast storms that can disrupt the network's performance. Several useful protocols have been defined in order to combat the broadcast storm. Considering that the network has not completely eliminated from the broadcast storm.

To address the storm, the proposed PCRB protocols identified an effective approach for retransmitting data to the area of interest, demonstrating superior performance compared to current protocols. In the future, the Internet of Vehicles (IoV) can use the same protocol, which includes the PCRB, to improve security in data transmission.

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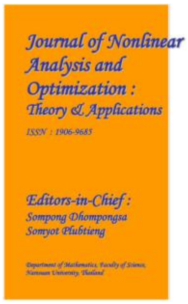

A NOVEL DRIVER SAFETY USING VANET TO CONTROL BROADCAST STORM BASED ON EFFECTIVE CLUSTER-BASED REBROADCASTING (ECR-B)

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Abstract:
The development of networks and technology has prompted the integration of safety systems into automobiles. Vehicular Ad-hoc Networks (VANET) is unique among the mounting area to alert dangerous situations among roads, as road safety is a concern for everyone. VANET connecting vehicles to broadcasting messages with one another for safety purposes. VANET broadcast messages in dense area; therefore it can lead to message retransmission, transmission failures, which in turn can cause collisions. The rebroadcast of messages led to broadcast storm. The main aim is to reduce the redundant data transmission by sending the packets to the appropriate node. By clustering the vehicle according to Zone Routing Protocol (ZRP), the proposed Effective Cluster based Re-Broadcasting (ECR-B) ensures the best throughput and packet delivery ratio by sending packets to every node within its transmission range.

Keywords:
VANET, Broadcast Storm, ZRP, PDR.

I. INTRODUCTION

A VANET is a kind of MANET designed to facilitate short-range communication between automobiles for the mutual support of safety applications. The transportation system's fast development has led to an increase in traffic and auto accidents. Consequently, a unique network known as VANET is used to communicate with the vehicles regarding traffic management, road safety and other necessary information. In VANET, vehicles are node connected together to communicate each other and form a network it is referred to as Vehicle to Infrastructure (V2I). Vehicle-to-infrastructure technology records information about the state of the roads, including traffic jams, weather alerts, bridge clearance levels, traffic light status, and other relevant data. The purpose of the data transmission between nodes is to identify nearby vehicles and give them information about traffic. The following figure shows the V2V and V2I communication of VANET.

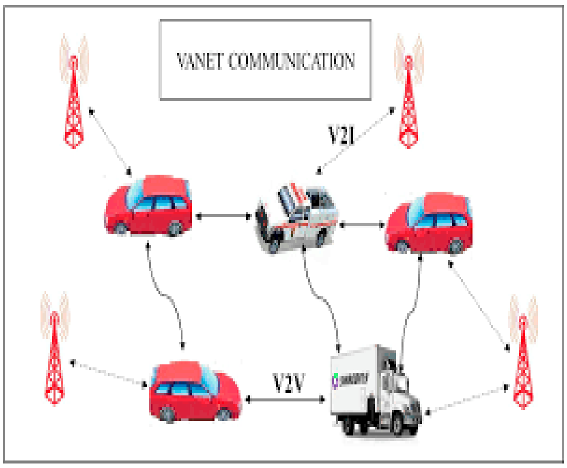

Fig 1: V2V and V2I communication of VANET

The nodes in VANET create a cluster that facilitates easy communication. Nevertheless, various network architecture modifications, varying vehicle speeds and unconnected conditions can cause communication break between different clusters. Even if the broadcasting is accomplished, the message related to same event between the nodes in a high density network may create frequent contention and collisions. Additionally, there is a significant rise in transmission of message repetition between nodes, which obstructs the network's performance.

There are a lot of repetitive messages send in VANET because it's true that when a car transmits a message, other cars have previously received it. This redundant message causes a major problem and it is mainly referred to as broadcast storm. This broadcast storm problem effect inter-vehicle communication and also the performance of the network. Therefore, designing a reliable and efficient routing protocol to support highly diverse node structure and to control redundant message rebroadcast for this irregularly connected vehicular network topologies remains a challenge.

The aim of this proposed work Effective Cluster based Re-Broadcasting (ECR-B) to control the impact of broadcast storms by clustering vehicles on the road. The suggested work maintains good network performance by minimize the count of packets while transmit informations with great efficiency and propagation speed. The Proposed work is divided in to following sections. Section II demonstrate the study of related work, Section III illustrate the work of Zone Routing Protocol (ZRP) in addition to this section also shows how Effective Cluster based Re-Broadcasting (ECR-B) reduce the broadcast storm. Section IV explains the performance and result of the ECR-B and the conclusion with future work is followed in Section V.

II. LITERATURE REVIEW

This section reviews different studies and methods aimed at reducing the broadcast storm problem. It mentions several clustering methods; each one focused on issues and which causes problem in VANET. In addition to that the authors submit various solutions are also proposed for the issues. The goal is to discuss the recommended clustering techniques and explain how this work is different and works well than other methods to avoid the broadcast storm and other problems, it looks at how well the current traffic signal controller works and its weaknesses in vehicle-to-vehicle communication.

The suggested work submitted by the author Luhach & Gao by combines different routing methods to make communication faster and easier. Two methods were used: Hybrid Routing with Grid Location Service (HRGLS) and Hybrid Routing with Hierarchical Location Service (HRHLS).The tests showed good results in how many packets were delivered, the speed of communication, and the amount of control messages needed [1].

Tsado et al. proposed Location aided Routing Protocol (LARP) for Latency in packet delivery that led to collision in VANET [2]. The suggested protocol achieved high reliability and maximizes the throughput in data transmission multi-hop manner. In this LARP protocol only response time is considered for the performance evaluation but not by request time.

Clustering aims to divide a network into smaller groups that exhibit similar traits. Communication between the Vehicle Ad Hoc Network (VANET) and the backbone infrastructure, specifically the Roadside Unit (RSU), can occur in two primary ways. In the first method, vehicles connect directly to the internet via the RSU. Alternatively, in the second method, vehicles establish clusters and engage in intra-cluster communication to share information [3].

Zareei et al. describe a method called Robust Mobility Aware Clustering (RMAC) that helps find nearby nodes and choose the best Cluster Heads (CHs) based on how fast they move, where they are, and which way they are going. RMAC works independently of other technologies and helps with routing in networks by forming groups based on location. It addresses the issue of cluster members being too far from the CH by creating 1-hop clusters for better communication. This clustering method should work together with geographic routing methods [4].

VANET nodes changes its position time by time, finding a way to send messages to a destination, the speed of vehicles, and managing them directly is very important in vehicle networks. However, keeping a connection between vehicles is hard because they move around a lot [5].

Almalag et al. contribute a new way for vehicles to share time slots for communication called Time Division Multiple Access (TDMA) based on vehicle groups. This method allows vehicles in a group to talk to each other without needing to find nearby vehicles first. A leader for the group, called a cluster-head, is chosen to keep the group stable. When picking this leader, the lane position of the leader is taken into account. The lane and direction most of the group members are traveling in also affect who becomes the leader. The TDMA Cluster-based MAC protocol (TC-MAC) lets vehicles send non-safety messages while mainly focusing on important safety messages. With the TDMA method, vehicles can listen to control and service channels at the same time. However, this method only works for single-hop communication and is not suitable for fast-changing multi-hop vehicle networks [6].

Hierarchical Clustering Algorithm (HCA) present by Nazhad et al, focuses on fast topology control and scheduling for the timely delivery of time-sensitive messages in VANET. HCA is a randomised hierarchical cluster with two utmost nodes and the CH. Thus, the maximum number of possible hops is limited to four. This size-limited cluster formation allows message transmission without needing GPS to identify the cluster members since four hops are considered reasonably local to transmit safety-critical messages. Scheduling of messages within a cluster is controlled by CH [7].

Roy and Das used fixed tools, like roadside units, to collect information from cars and to help when data packets are lost. They tested their method by looking at how vehicles move on a highway [8]. A unique protocol presented by Esmaeily Fard and colleagues indicates that a non-cluster head (non-CH) node is not required to transmit its message to a designated cluster head (CH). Instead, when a non-CH node communicates with a CH, the CH collects and consolidates beacons from its surrounding area. The problem with this protocol is that it can create duplicate beacons because of the overlaps between clusters [9].

Wang et al. created a Wireless Computing System (WCS) to make data transmission faster and use less energy. It gets real-time feedback by collecting and managing data with a log computing node. The WCS cuts down on the number of connections needed to save power, even when some connections are added back. There is a delay in transmission, but it is within an acceptable range [10]. After the study of related work, an idea for the broadcasting method is formed, to picking up the right node to help with broadcasting along to that to choose a relay node shows where the emergency message is sent to or sent from again.

III. PROPOSED WORK

The routing protocol in a Vehicular Ad Hoc Network (VANET) shows a deserve role in overseeing the movement of data packets between nodes within the network. It determines the appropriate node responsible for forwarding packets to their intended destination. Consequently, the effectiveness of the routing protocol is vital in VANET. This entails the incorporation of innovative criteria to identify the optimal node, thereby enhancing the routing process and improving overall performance.

1. Effective Cluster based Re-Broadcasting (ECR-B):

VANETs are vehicular networks that are divided into numerous clusters. Vehicles can be organized into various clusters based on position, speed and direction of moving vehicle and other factors. Vehicles inside a partition can interact with all other nodes. While there are gaps between succeeding clusters, which prevent inter-cluster communications. Fig 2 shows the formation of cluster in VANET.

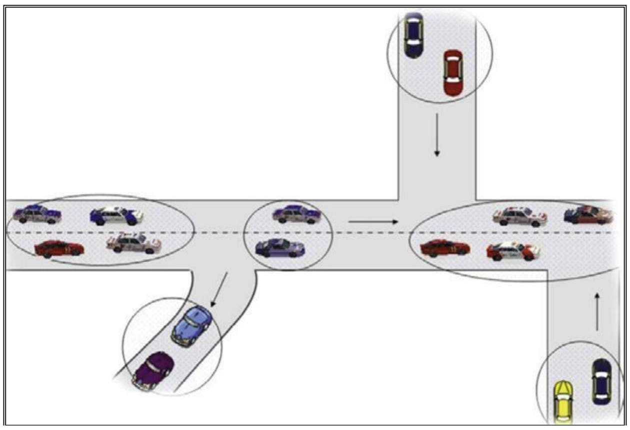

Fig 2: Formation of Cluster

The Effective Cluster based Re-Broadcasting (ECR-B) protocol is expected to reduce the amount of rebroadcast messages by grouping the vehicles (nodes) on the route. The Fig 3 shows the Cluster based broadcasting technique that reveals vehicles in the same cluster communicate with Cluster Head only and they not allowed communicating with each other. Similarly, the Cluster Head (CH) can't directly communication with other intra-cluster node. The Cluster Head is the only nodes that communicate with other intra-Cluster Head (CH) nodes.

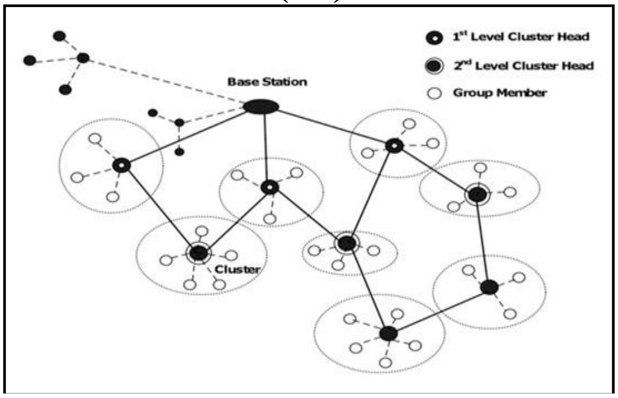

Fig 3: Cluster Based Broadcasting Technique

The following criteria are used by this approach to elect Cluster Head (CH) in an efficient manner. Three techniques are used by reliable protocols: (i) rebroadcasting, in which the source node repeatedly broadcasts the similar information (ii) ACK, in which the sender only needs the acknowledgement from a intra group of the nodes (iii) changing parameters, in which the sender modifies the transmission parameters based on the network's predicted state. The Node Grouping Phase and CH Election Phase are the two phases that make up the suggested work.

a) Node Grouping Phase:

It is desirable to broadcast messages in the VANET network using the suggested technique, which requires fewer transmission nodes and less delay. The suggested method gathers the vehicle's location using the GPS receiver, based on the three points mentioned below. Vehicle fast (V), Hierarchy of messages from various nodes (MSG_No), and rebroadcast possibility (Pij) and transmit the message to CH. It quickly and effectively locates vehicle clusters and selects one to serve as the CH vehicle for each cluster. Rebroadcasting of message responsibility is done by the new cluster head to avoid broadcast storm. Fig 4 shows if a node is involved in a collision it will immediately send a message to the network with its Vehicle ID and location to its Cluster Head and this proposed work treats the two-sided roadways as one-sided in order to prevent collisions and for ease broadcasting.

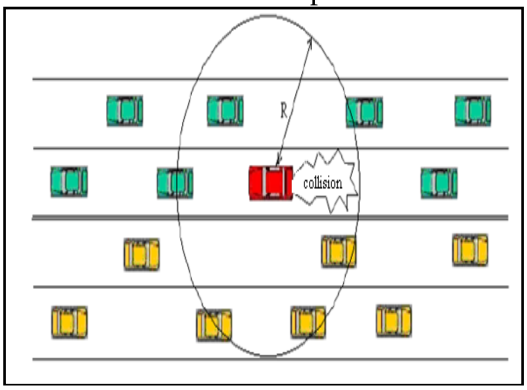

Fig 4: Node in Collision

b) CH Election Phase:

Each cluster head is responsible for rebroadcasting warning messages a novel cluster head is nominated to improve the process based on the comparison of vehicle speed of the existing cluster head. This phase consists of, a new cluster head is chosen at each level, in order to rebroadcast, the messages are numbered in order and this order is maintained until the next cluster is created. The basic rules and algorithm for CH election are given below:

- Even if the node is father, there is a great possibility that the cluster head will be chosen. The rebroadcast parameter of pi, j, which is defined as Pi, j = Di, j/ R, is used to compute it.
- The moving node's speed is the next parameter.

- Additionally, the node is more likely to be chosen as the cluster head if it receives fewer warning signals.

Step 1 - Initialization of Cluster_Head among the nodes.
Step 2 - Broadcasting of warning messages.
Step3 -To receive acknowledgement messages (ack_msg) from cluster nodes.that contains node identifier (ID), node velocity (V), location of node (Loc), direction of movement in node (Dir_Veh).
Step 4 - Nodes those are moving in the direction of cluster head, puts into Cluster_Mems group should satisfy the following condition

For (j=1, j<=Cluster_Size;j++)
If $Dir\_Veh_i = Dir\_Veh$
$Cluster\_Members \leftarrow Veh_j$;

Step 5 - Each member of the group should follow the criteria with three factors distance, speed and warning message of each nodes.

For (j=1, j<= Size (Cluster_Mems); j++
$P_{i,j} = D_{i,j} / R$
$Result_j \leftarrow P_{i,j} * V_j * 1 / MSG\_No$;

Step 6 - Create Table_Vehi is formed by current cluster head from the obtained information.
Step 7 - Selection of next Cluster Head (CH) can be obtained from the above table between nodes in the Cluster_Member
Step 8 - Stop the Process.

2. Zone Routing Protocol (ZRP) :

The cluster region is partitioned into two separate zones by the Zone Routing Protocol. First one is Zone of Interest (ZOI) and another one is Zone of Forwarding (ZOF). The distinction is that it exclusively makes use of the network's energy-efficient nodes. The Base Station is then in charge of cluster formation when the network first starts. The main goal of facilitating communication between the Cluster Head and Cluster Member within the same cluster can only be achieved once the cluster member node receives the Zone of Interest (ZOI) message. Once the Cluster Head (CH) is elected, CH broadcasts hello messages that include the cluster_id along with its location to form a cluster.

When the vehicle obtains a distance that is under the defined threshold (10 m) and the time stamp of the message, those vehicles sent request message to join the cluster by Zone of Interest (ZOI) messages to Cluster Head. The ZOI message have Acknowledgement message (ACK) that contains vehicle ID, location, direction message to CH. After receiving ZOI message from the node CH continue broadcast the messages to the cluster members through Zone of Forwarding (ZOF) message. Due to rapid changing environment the cluster creation and Cluster Head selection procedure is again done by ECR-B. The following Figure 5 shows the flowchart for ZOR.

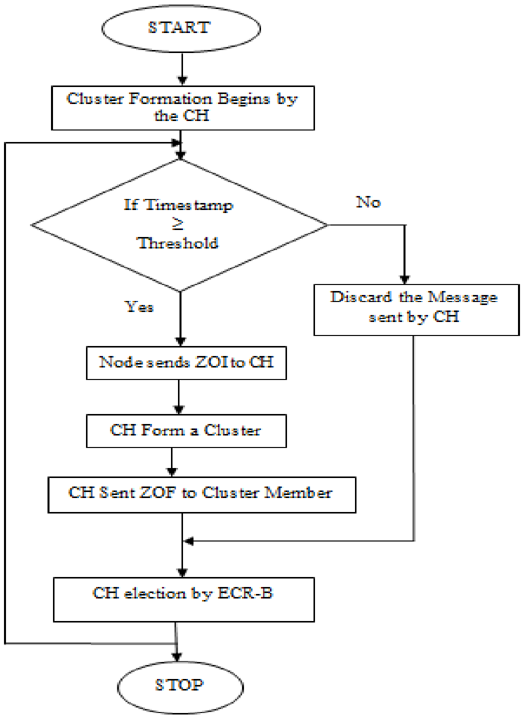

Fig 5: The Flowchart for ZOR

IV. PERFORMANCE AND RESULT

This division displays the performance of the ECR-B protocol when implemented with NS3. The efficiency of the suggested protocol is matched with the existing CDP and ROAC-B. A detailed analysis of all the parameters used in the suggested simulation can be found in Table I.

Table 1: Simulation Parameters

Parameters	Value
Channel	Wireless Channel
Antenna	Omni/Directional Antenna
MAC Protocol	IEEE 802.11
Routing Protocol	Proposed ECR-B
No. of Nodes	100
Transmission Rate	250 Kbps
Area Coverage	1000 x 1000m
Direction	Bidirectional
Simulation Time	500 Sec

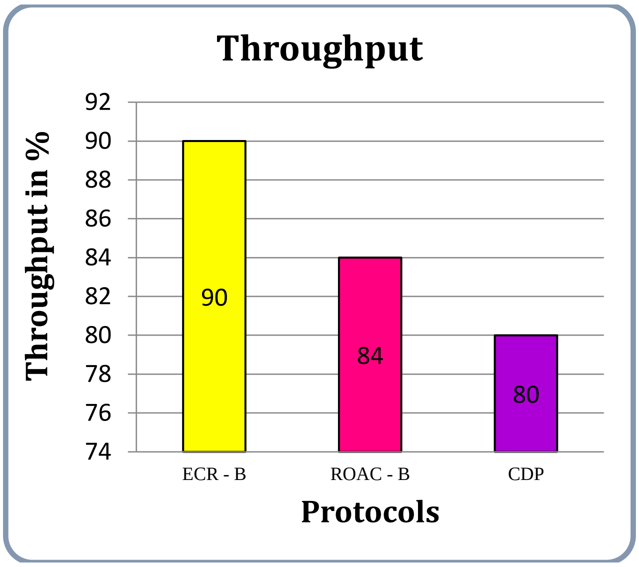

Fig 6: Throughput Comparison

Figure 6 analyse the proposed ECR-B protocol with the existing protocol. The result of the comparison state that the proposed ECR-B achieve 90% of throughput compare to existing ROAC-B (84%) and CDP (80%) protocol.

V. CONCLUSION

One ubiquitous issue in networks is the broadcast storm. A protocol that limits message retransmission and reduces network overload is created to address this problem by electively broadcasting messages within a transmission range.

Many efficient protocols have been defined to conflict the broadcast storm. Since the network has not completely eliminated the broadcast storm. As a result, the suggested SRC protocols discovered a useful method for retransmitting the packets to the Zone of Interest in order to destroy the storm, and the ECR-B performance indicates that the broadcast storm has disappeared from the VANET. In the future, the ECR-B can enable in the Internet of Vehicles (IoV) to improve security in preserving data transmission.

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