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A Clustering & Systematic Scheduling Approach for Data Dissemination in VANET

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Abstract: VANETs are an important part of intelligent transport systems. This can be seen as a network of vehicles that communicate autonomously and unequally. The dynamic topology of vehicles leads to an unexpected change in the network topology, as it poses a significant challenge for VANET information dissemination, which is efficient and scalable. The probabilistic clustering and clustering strategy provides a breakdown of the synchronization between space, time, and communication entities, as it adapts better to the VANET-like environment, but increases the load on the network by grouping the same amount together times in the directory network. In this article, we propose our systematic grouping or clustering and programming approach for the spreading of information in VANET. In our approach, we assume a stable VANET network, consisting of static information stations and moving vehicles, with the vehicle choosing its cluster leader or head, who is responsible for its downlink communication, with each group's vehicle planning algorithm. . The support will be communicated and the cluster manager will decide on the programming mode and the node that will transmit this programming to the cluster. The results of the simulation show that our approach works well with an increasing number of vehicles, which reflects its applicability.

Keywords: VANET, RSU, AP, OBU, CBP, CSS

I. INTRODUCTION

VANET are attracting increasing attention from the scientific community because of its growing importance in the construction of intelligent transport systems. VANET characteristics, such as high mobility, network sections, interrupted communications and interference in the urban environment, complex routing Because of these characteristics VANET network routing protocol performance deteriorates. Routing based on the location considered the most significant in the VANET approach. An overview of the most important protocols for communication between vehicles in the urban environment, also discuss functionality for exchange of information between the vehicle units. [1].

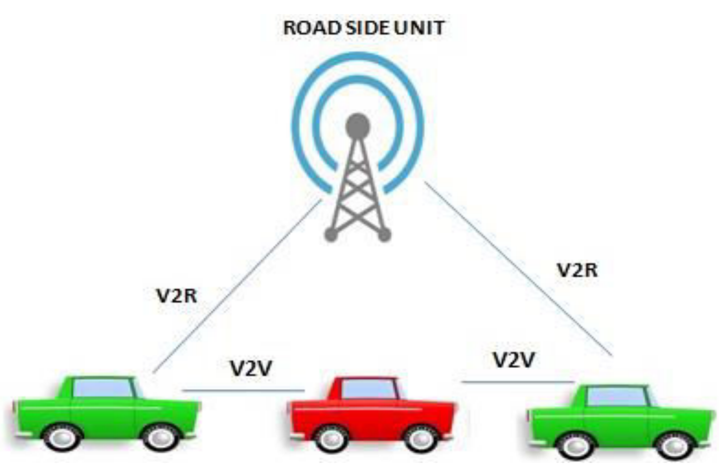

Fig. 1.1 VANET Communication Mode

VANET has its own internal characteristics, which is a hard task to design a stable and reliable data transmission scheme. First, the speed of the nodes, the rapid changes in the topology, the segmentation of the link or the network fragments are often found in the environment of the vehicles, this will greatly affect the transmission of packages. Second,

As a decentralized self-organized network, VANET lacks a centralized administrator to manage bandwidth allocation and dispute resolution operations. Although due to the limit of the range of the wireless radio, it is necessary to forward the data packet in multiple jump modes between two distant nodes, which generates a problem of scalability. In addition, a broadcast storm can occur when large numbers of nodes together restart the data packet in the same surrounding area, causing serious data redundancy, packet collision, and limited channel resources [2].

In this document, we propose a hybrid method to disseminate structured data so that any information on the network can be extended to the network without compromising route load and delay. Use this method on each vehicle's On-Board Unit (OBU), in which OBU elect their cluster head and then only communicate with cluster head or info-stations. Communication paradigm which is used in our approach is systematic scheduling. The technique is localized, requires only a small overhead, and does not have special requirements such as special hardware etc. The technique was tested through simulations for different distributions of vehicles in dynamic connectivity models. Under all the evaluated scenarios, the technique demonstrates excellent dissemination. The results of the proposed approach are batter then the previous approaches in order to reduce routing load as well as decreasing a delay time of a packet in a network.

II. VANET CHARACTERISTIC

VANET can be viewed as a subset Mobile Ad Hoc Networks (MANETs) and component ITS systems still need to be addressed in a VANET different areas of research, especially in light of the security allocation of resources. Unique features VANET It include [3]:

➢ **High mobility:** nodes in VANET usually they are moving at high speed unit movement restricted roads and design topology.

➢ **Rapid change in the network topology**: because the high mobility of the node, network topology, as a rule, VANET frequently changes.

➢ **Unlimited size of the network:** on VANET may include vehicles in several cities, or even countries. So VANET network should not depend on the number of nodes.

➢ **Anonymous name:** most of the applications VANET require identification of vehicles in a specific region, and not the specific vehicle so Anonymous name system should be carried out to protect privacy driver.

➢ **The exchange of confidential data to the delay:** in VANET message transmission network must be free transfer delay, because the application needs to messages related to safety fast delivery.

III. LITERATURE REVIEW

We studied various research paper and journal and find-out some research work carried out by various researchers in the field of Wireless network, Vehicular ad-hoc network and Data Dissemination. All methodology and process are not described here. But some related work in the field of VANET and techniques for dissemination are discussed by the name of authors and their respective published year.

In this document [4], a congestion control approach has been proposed for security applications. The basic idea of the scheme is to identify congestion and manipulate the Queues transmission of MAC for IEEE 802.11p using event-activated detection and measurement to ensure security messages sent through the control channel. When high-priority security messaging is recognized to ensure the quality of service of security applications, event-activated congestion detection begins receptively, while measurement-based congestion detection measures channel utilization and Compare with defined. Spectrum. However, the efficient transmission of security messages is not guaranteed in the neighborhood context and the effective exchange of bandwidth is not taken into account. Mohammed Salah Busida suggested this approach in 2010.

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In this work [5], the author presents the system of diffusion and aggregation of traffic information, which is appropriate for the urban environment and is based on the ad hoc network of vehicles to improve traffic conditions. In the proposed approach, road units can create, collect and disseminate road messages. Use of mutual support of the vehicle and communication between vehicles these messages can help drivers choose better routes and prepare for road incidents. It reduces the number of traffic accidents and is useful to avoid traffic jams. But the author of this article did not demonstrate the impact of the attack because it was a traffic jam because it is a difficult problem that is the main cause of the crowd. Feng Zhang suggested this approach in 2010.

In the article [6], the author presents a secure MAC protocol for VANET with different messaging preferences for different types of applications that use DSRC channels. DSRC is an important technology for VANET services and applications. Before implementing VANET, several problems must be resolved. These challenges include the design of security mechanisms to protect VANETs from misuse; And through the design of effective media access control (MAC) protocols, so that security-related messages and other application messages can be transmitted reliably and timely through VANET. He also stated that the occasional network connection of vehicles is an important component of the Intelligent Transportation System (ITS). The main benefit of ad hoc network communication in vehicles is active safety systems that improve passenger safety by exchanging warning messages between vehicles. Private services and other applications can also reduce costs and encourage the adoption and implementation of VANET. The proposed MAC protocol can provide secure communication while maintaining reliability and latency requirements for DSRC security related applications for VANET. Nader Moeri suggested this approach in 2010.

In the article [7], the author presents a protocol of adaptive transmission assisted by nodes (SADV) capable of increasing the distribution ratios for densities of medium and low vehicles at intersections. However, in a real-time scenario, the density of vehicles at intersections is higher than on roads. The proposed method is intended to increase the dissemination of data when vehicle densities are higher at the intersection and on the road. High mobility and scalability are two important aspects of reliable data delivery in an ad hoc vehicle network (VANET). Since vehicles are often supposed to go to intersections, the routing protocol most often triggers an expensive route discovery process. The author presents a mobile cluster assisted routing for evolving networks. It has been observed that the mobile cluster considerably improves the connection time and, therefore, the package delivery report. Naveen, K. In 2011, this approach was suggested.

In the article [8], the author proposes a new energy management system using kinetic energy limits. The proposed approach begins with a first step, which consists of a sensor the network of the network will be organized in virtual and a cluster head will be selected in each cell. In the second step, the data propagation process begins to transmit the detected data from the sensor node to the sump. The results of their simulations show that the proposed approach consumes less energy and has a longer life than previous protocols. Badache, N., S. Moussaoui, Z. Doukha suggested this approach in 2011.

In article [9], the author proposes a new data distribution scheme based on probabilistic clustering and dissemination (CPB). First, a clustering algorithm is presented according to the driving direction of the vehicles, which allows the vehicles to exchange their data in a grouped manner with the corresponding duration. In the built grouping structure, a probabilistic transfer is presented to transmit data between vehicles. Each group member transmits the received package to their group leader with the probability that it is associated with the number of times a single package has been received during an interval. Upon receiving the sent packet, the header of the selected cluster continues to transmit it in the transmission direction. LeiLiu suggested this approach in 2018.

In this task (VANET), a new routing protocol based on a two-level cluster [2] for an ad hoc vehicle network is a subset of MANET (Mobile Ad Hoc) networks. These networks do not have a specific structure in which the nodes that constitute the network are moving vehicles. Therefore, routing is necessary for the propagation of data in these networks. The problem of the failure of links between vehicles is one of the main challenges of these networks. In this article, a reliable two-layer cluster the algorithm is introduced in the VANET to reduce the problem of link failure. The use of a two-layer path maintains the path and facilitates the possibility of self-organization when the topology does not have a stable form. In the first level of the new method, the greedy algorithm is used to select the strongest link and, in the second level, to select the best route. Speed, direction, ST and location are effective parameters included in this new algorithm. The proposed protocol, simulated by NS-2.35, improves network parameters, such as delays and end-to-end packet delivery reports, compared to two similar measured protocols. The comparison with previous protocols showed an improvement in the performance of the new method to increase the package delivery ratio and finally the delay.

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IV. PROPOSED WORK & RESULT ANALYSIS

Justification of Need: Before introducing the new mechanism, it is necessary to present an introduction to the previous communication approach. Each VANET vehicle is equipped with OBU and uses DSRC channels for communication. The OBU in the vehicle is an intelligent device with sensor, modem, processing unit and storage capacity [5]. Vehicles can also communicate with other vehicles and basic facilities (access points). When access points are available, vehicles send their information about the accident, collision and other information, and the access point sends this information to the other vehicle that goes to that vehicle [10]. In some places where access points are not available (such as roads or rural areas), vehicles inform each other. Several methods have been implemented to organize this communication in an orderly manner, C.P.B. (Grouping and probabilistic dissemination) [9] is one of them. This method has some disadvantages, because as traffic increases, the delay time also increases.

4.1 Clustering & Probabilistic Broadcasting:

A clustering algorithm is first presented according to the driving directions of vehicles, by which vehicles could exchange their data in a clustered way with sufficient connection duration. In the constructed clustering structure, a probabilistic forwarding is presented to disseminate data among vehicles. Each cluster member forwards the received packet to its cluster head with a calculated probability which is associated with the number of times the same packet is received during one interval. When receiving the sent packet, the elected cluster header continues to disseminate it toward the transmission direction. But this method has some limitations which are as follows:

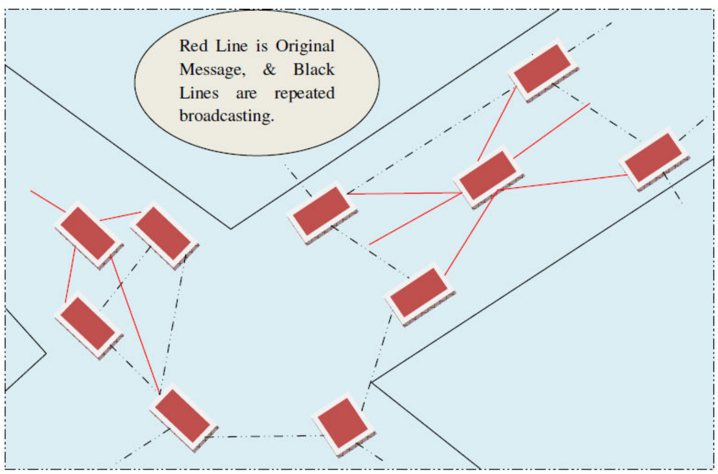

Figure 4.1 Data traffic load on a vehicle OBU using Clustering & Probabilistic Broadcasting method

1. For several applications with different QoS requirements, the data is merged, then the cluster header transfer and the direct transfer by the cluster member must be considered together. For example, an accident notification requires fast long-distance delivery, even when the channel is congested and discards several packages. In contrast, infotainment information can be used first by the head of the cluster and then sent to the next hop, greatly improving the competition of the channel and the use of the spectrum.

2. Density-based probabilistic transfer can actually reveal the effect of traffic intensity on network performance. The determination of probability remains an open question to overcome density limits to determine to what extent, which may require the help of traffic engineering theory.

3. A realistic interference model can further detect the effect of traffic intensity on network performance with hidden and exposed terminals.

4.2 Algorithm

The network node of the network must select the primary node of the cluster, capable of performing the appropriate. It works on behalf of the initial node. Cluster Header This is the last cluster option for other nodes. The type of communication strategy used in this method is the selective programming of migration, internal and external, but the responsibility for communication lies with all group leaders or CH HEAD. The procedure is the next:

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➢ **Choosing a cluster header:** To find a cluster header, the vehicle sends a welcome packet (speed, last station pass and connection link) to the network at regular intervals and awaits your response. When the answer is provided, the OBU counts the answer number these responses refer to the connection link. These packets are placed in a queue, where the corresponding information sends information to the following table, and the OBU compares it with the information of its last information station. Now this OBU compares this line with your connection. After comparing whether two or more values correspond to these values, they return to the next matrix, this time using the comparison based on their speed. If the speed of the on board unit is higher than that of the other, determine done. Otherwise, wait for the cluster head warning. Assume that the vehicle connection link is "X", the vehicle speed is "Y" and the last information station is "Z". The procedure is the next:

Step.1 Broadcast integration packages (speed and endpoint information) in the network
Step.2 put packet in a queue a [Zi]
Step.3 If (Z = a [Zi])
Step.4 Put packet in a queue b [Xi]
Step.5 if (X >= b [Xi])
Step.6 if (X= b [Xi])
Step.7 Put above packet data in a queue c [Yi]
Step.8 If (Y <= c [Yi])
Step.9 broadcast its address as Cluster Head.
Step.10 Else
Step.11 Discard Packets
Step.12 Else
Step.13 Wait for Cluster Head notification.
Step.14 Else
Step.15 Broadcast its address as Cluster Head.
Step.16 Else
Step.17 Wait for Cluster Head notification

➢ **Input Module:** When any data packet comes to onboard unit of vehicle it checks its source address if this address is same as the cluster head address then onboard unit check what kind of data is it publication, subscription or forwarding and match this data with its tables if value is true discard regarding entry from table else follow regarding procedure for dissemination.

i) Extract input data id (vehicle id, control information, data)
ii) Match input data id with cluster id
iii) If (cluster id = input id)
iv) Discard related entry from regarding tables
v) Else
vi) Put entry in regarding table
vii) Follow regarding procedure for dissemination

4.3 Proposed Scheduling Framework

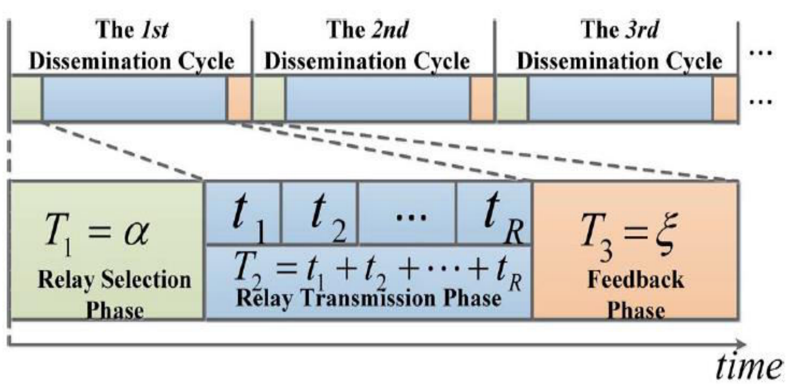

Figure 4.3.1 Proposed data dissemination framework inside the cluster

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The planning is carried out periodically by the head of the cluster and the interval between two successive programming intervals is represented as a data propagation cycle. The proposed planning framework for data propagation is illustrated in fig. a data propagation cycle is divided into three phases.

Algorithm 1: The proposed suboptimal relay selection scheme for the rth ($r = 1, 2, \ldots, R$) relay transmission frame

1. **Initialize** the candidate relay node set $\Lambda = \{\mathbf{RSU} \cup \mathbf{U}\}$, in which all the nodes in the network are included.
   Initialize the number of selected relay nodes $L_r = 0$ and the selected relay node set $\Omega_r = \varnothing$.
2. **While** $\Lambda \neq \varnothing$
3. $L_r = L_r + 1$
4. Select the nodes from the set Λ with the max utility, which is denoted as $R^*_{L_r}$, i.e.,
   $$\Phi^{t_r, R^*_{L_r}} = \max_{R_x \in \Lambda} \Phi^{t_r, R_x}$$
5. Add the node $R^*_{L_r}$ to the set Ω_r, i.e.,
   $$\Omega_r \leftarrow \Omega_r \cup \left\{ R^*_{L_r} \right\}$$
6. Update the set Λ by deleting the nodes which have common neighboring nodes with $R^*_{L_r}$, i.e.,
   $$\Lambda \leftarrow \Lambda - \left\{ \tilde{R} \middle| \mathcal{N}^r_{\tilde{R}} \cap \mathcal{N}^r_{R^*_{L_r}} \neq \emptyset \right\}$$
7. **End While**
8. **Output** the result set Ω_r.

- **Relay Selection Phase T1:** selecting suitable relay nodes for the transmission There are R transmission frames, i.e., {t1, t2. ….tR} included in phase. The Cluster Head transmission frame tr, r = 1, 2. . . R.
- **Relay Transmission Phase T2:** results given in the relay selection phase. According to t1 to tR, nodes in set Ω1 relay data first, and nodes in set of a transmission frame is denoted as
- **Feedback Phase T3:** Each vehicle updates its current status to its connected RSU for the scheduling to the next data dissemination.

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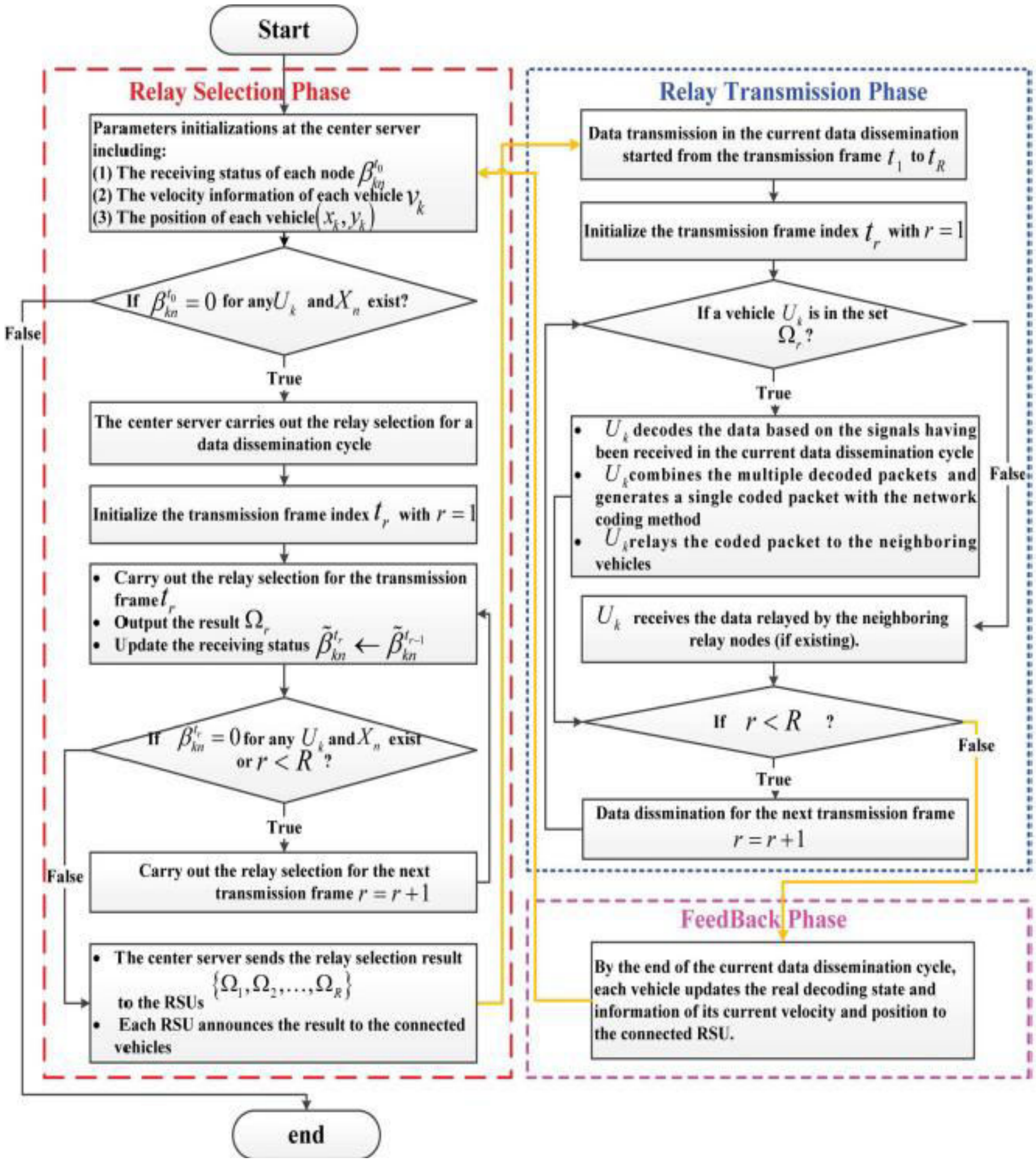

Figure 4.3.2 Overall diagram of the proposed data dissemination strategy

V. SIMULATION PARAMETER & RESULTS ANALYSIS

Parameter	Default values
Simulation region	1000m * 1000m
Simulation point in time	300 minutes
quantity of vehicles	60
message range	400m
Node Speed	60km/hr
Visualization device	NAM
MAC layer	IEEE 802.11 p

The performance of our approach is measured by the package delivery rate, end to end session delay. There are two different approaches for which we measure the delivery rates of packages. These are two approaches:

1) Clustering and probabilistic broadcasting.
2) Clustering and systematic Scheduling. The simulation graphs are as follows:

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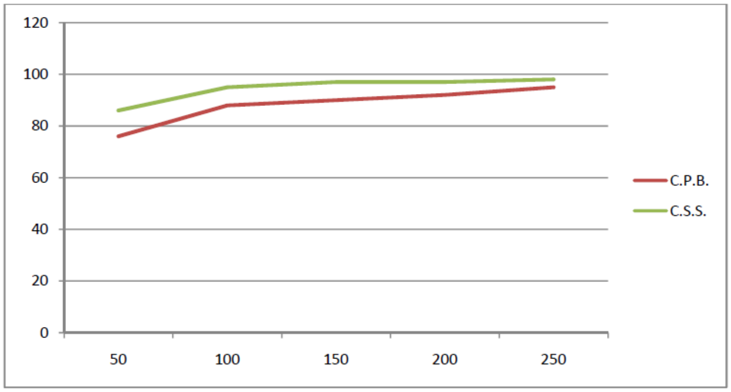

Figure 5.1.1 Graph-Packet delivery ratio of "C.P.B." & "C.S.S."

Figure 5.1.1 shows the green line that shows the managed Clustering & Systematic Scheduling approach (C.S.S) in VANET and the red line shows the Probabilistic Broadcasting (C.P.B.). The horizontal plane represents the time in seconds and the vertical plane shows the distribution of the packages as a percentage.

Table 5.1.1 Table for Packet Delivery Ratio

TIME	C.P.B.	C.S.S.
50	76	86
100	88	95
150	90	97
200	92	97
250	95	98

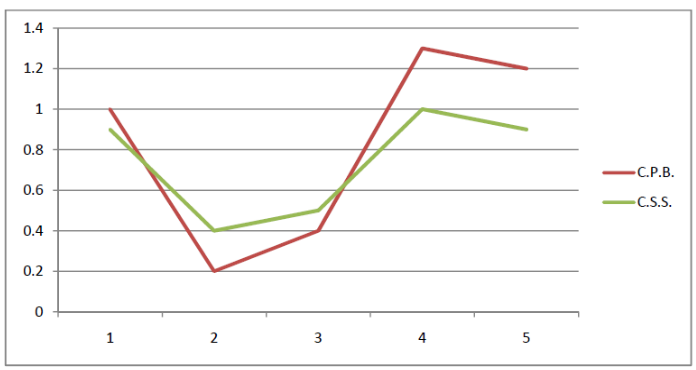

Figure 5.1.2 End to End Delay graphs, shows comparability of "C.P.B." & "C.S.S."

The Figure 5.1.2 illustrates Green line shows that Clustering & Systematic Scheduling approach (C.S.S.) in VANET (End to End Delay) & red line shows Clustering & Probabilistic Broadcasting (End to End Delay). Horizontal plane represents number of nodes and vertical plane represents time in seconds.

Table 5.1.2 End to End Delay

Number of Nodes	C.P.B.	C.S.S.
15	1	0.9
25	0.2	0.4
35	0.4	0.5
45	1.3	1
55	1.2	0.9

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Table 5.1.3 Overall Analysis Table

	C.P.B.	C.S.S.
Send	9564	9564
Receive	9124	9110
Routing Packets	2109	1499
PDF	95.25	95.40
NRL	0.23	0.16
Actual Performance	99.74%	99.82%

VI. CONCLUSION

We have proposed a hybrid structured data propagation technique, according to which any information on a network must be distributed on the network without increasing the routing load or delaying time. This method is used in the vehicle unit (OBU) of each vehicle, in which the OBU selects its cluster or group head and communicates only with the CH or information stations. The model system used in our approach is planned. This technique is viable, requires a lot of overhead and does not require special hardware configurations. This technique has been tested dynamically simulating the distribution of different vehicles connectivity model. In all the scenarios evaluated, the technique has an excellent diffusion. The outcome of the planned approach are achieved, as compare to previous approach we aims to reduce the routing load, as well as the delay time of a packet in a network.

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