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Implementation and Analysis of Stability Improvement in VANET using Virtual Carrier Sense

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Abstract: In the series of significant type of mobile ad Hoc Network, VANET has gradually in terms of gratified network services and security pouring provided to vehicular users, become an noticeable technology. However, due to raised mobility of vehicular nodes in VANET routes unavailability are created and reason for this is high data packet loss. Therefore, many researchers have paid attention on proposing or improving VANET routing protocols so that they can give routing solutions which are more capable and reliable. Moreover, it would be a great challenge to forward data resourcefully in VANETs. In this paper we enhanced the GPSR routing protocol compare with existing one. We suggest a distributed next-hop self-election mechanism for geographical forwarding by using Virtual Carrier Sense (which involves use of a special handshake). Ideally, the RTS/CTS handshake can eradicate most interference. This intended the need to research the performance of GPSR routing protocol with the help of ns2 simulation.The outcomes show that the improved GPSR routing approach researched in the paper has one step ahead performance on packet delivery ratio, Average throughput, Average delay.

Keywords: *Routing protocols; GPSR ;Virtual Carrier Sensing; Ad hoc Network; VANET.*

1. INTRODUCTION

With the vigorous development of wireless communication technologies, (VANET) Vehicular Ad hoc Network is an eye-catching matter to numerous researchers. VAENT consists of (V2I)vehicle to infrastructure communications and/or (V2V) vehicle to vehicle communications as given in “Fig. 1”. It can give a basis not only for recovering vehicle security, but also added valued network services for users throughout their journey. In the past few years there were many projects functioning on VANET [1][3]. However, due to the node’s speedily dynamic topology and high moving speed, there are still some challenges for the accomplishment of VANET. For instance, the vehicles in VANET may tend to disengage recurrently from the network, neighbouring vehicles transform frequently and do not have inbuilt relationships among them. This circumstances leads to increases delay and high packet loss. So it is a important topic to design an well-organized and reliable routing protocol so as to conquer the problems influenced by mobility over VANET.

VANET also has unique characteristics that make a distinction from variant mobile ad hoc networks; the most important characteristics are: self-organization, good mobility, road pattern restrictions, distributed communication all these Characteristics made VANETs environment a fiddly for developing well-organized routing protocols. Routing protocols have been built for VANETs situation, which can be classified in further ways, according to dissimilar aspects; like as: protocols techniques used, characteristics, routing information and so on.

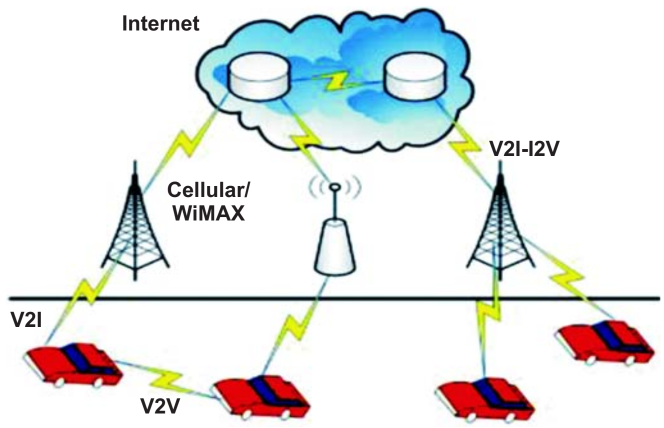

Figure 1: VANET

1.1. VANET Architecture

However, a general VANET includes moving vehicles communicating with one another as well as with certain nearby RSU. A VANET is unlike than a MANET in the sense that vehicles do not travel randomly as nodes do in MANETs, rather moving vehicles follow definite fixed paths such as highways and urban roads. While it is easy to consider VANETs as a part of MANETs, it is also main to think of VANETs as an individual research field, mainly when it comes to the design of system or network architecture.

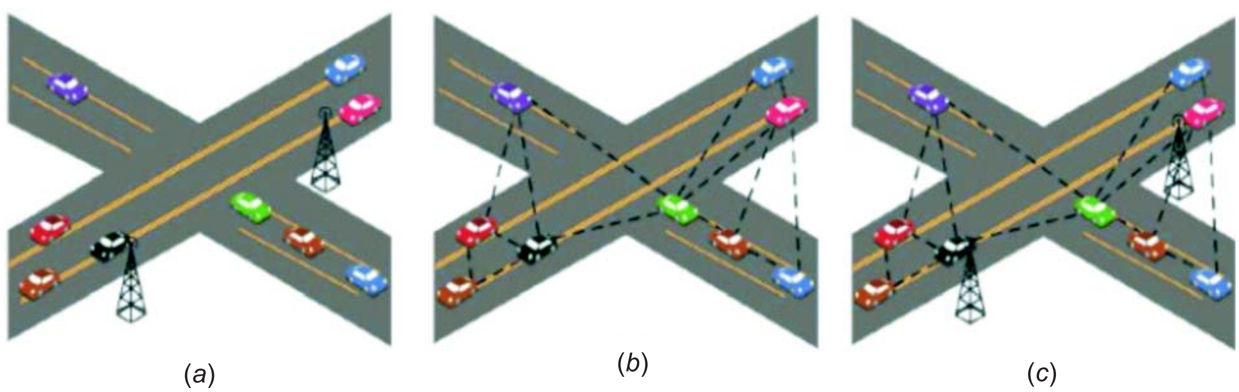

Figure 2: Network Architecture In VANET

In VANET assembly, an on board unit (OBU) in a vehicle contains of wireless receiver and transmitter. In a broad sense; we can generally define three possible communication situations for vehicles. One prospect is that all vehicles communicate with each one other through some RSU. This construction may look like wireless local area networks (WLAN). Second likelihood is where vehicles straight communicate with each other and there is no necessitate of any RSU. This can be classifying as Ad-hoc design. In third possibility, a number of the vehicles can communicate with each other openly while others may need several RSU to communicate. This can be referred as fusion state. “Fig. 2” shows these three potential.

VANET is mainly combination of an on-board unit(OBU) and more application units (AUs) [1]. A device with communication abilities located inside the vehicle is known as OBU. An AU is a device implementing applications by using OBU's communication abilities. The both units of VANET are usually attach with a wireless or wired connection. The Ad-hoc domain comprises vehicles equipped with on board units and stationary units sited along the road.

OBUs of dissimilar vehicles mould a mobile ad-hoc network (MANET). Nodes of an ad-hoc network are Stationary road side and on board unit device. RSU can be connected to a communications network, which in turn can be connected to the Internet. Road side fixed can also communicate to everyone via multi-hop or directly. Their basic role is the enhancement of road safety, by implementing unique applications and by sending, receiving, or forwarding data in the ad-hoc domain. "Fig. 3" gives overview of VANET architecture.

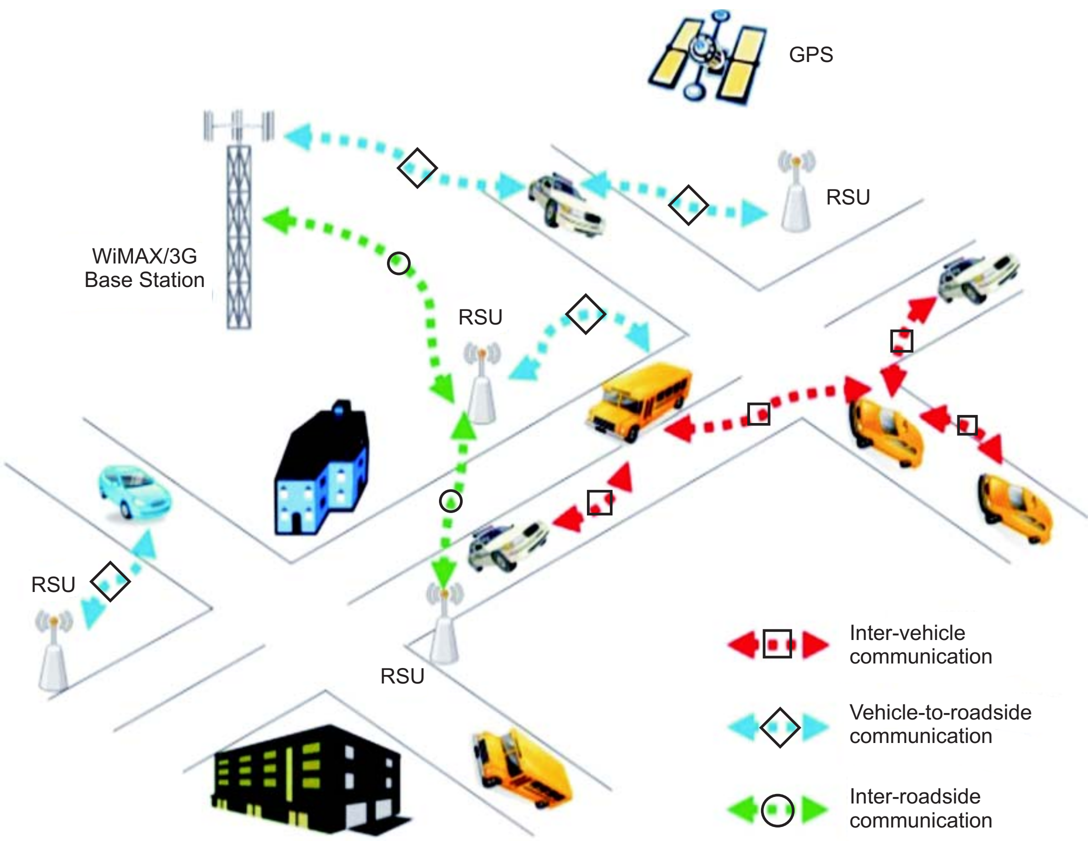

Figure 3: VANET Architecture

1.2. Routing Protocols in VANET

A number of VANET routing protocols have been planned and evaluated so far. They are mostly topology based routing (TBR) protocols and position-based routing (PBR) protocols. TBR protocols usually use a proactive or reactive scheme to establish routes. Classic proactive strategies, that are (DSDV) Destination-sequenced Distance Vector routing [5], required to be update at regular interval and constantly maintain routing tables for all nodes. And typical reactive strategies name as (AODV) Ad-hoc on-demand Distance Vector routing create routes only when they need to send packets. For PBR protocols, they do not ascertain routing tables or store routes. They make next-hop forwarding selection by taking into account position information of neighbouring and destination nodes as well as their own. In fact, PBR protocols are more proficient in VANET as shown in figure.

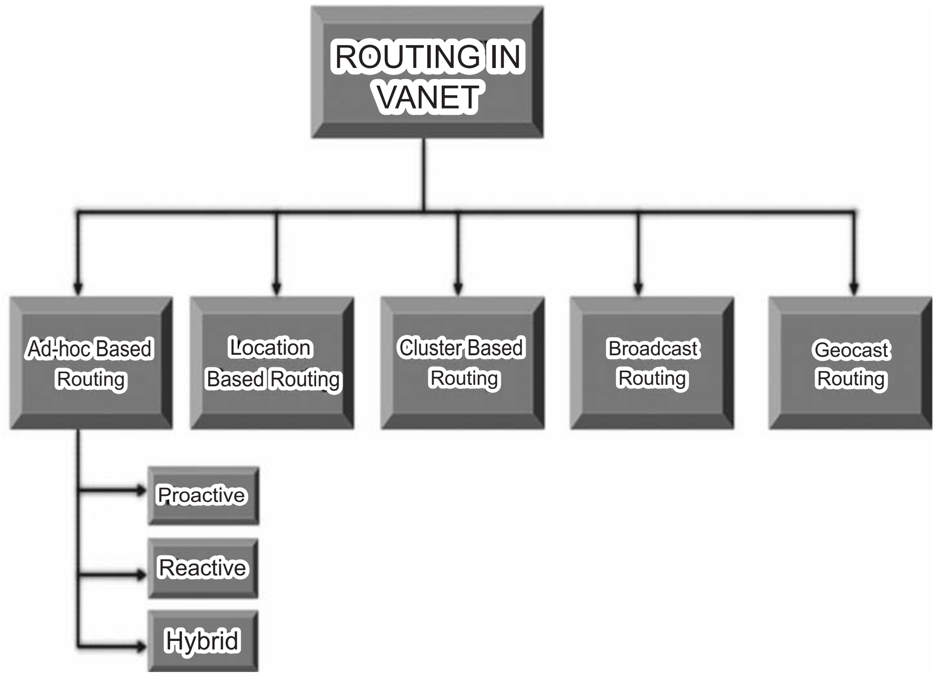

Figure 4: Routing Protocols in VANET

Our work is based on Greedy Perimeter Stateless Routing (GPSR) [9] protocol, an increasing popular PBR protocol, and an enhanced GPSR strategy is proposed. A number of studies on VANET routing performance have already been done and the simulation results gives that GPSR is suitable for highly dynamic vehicular environment due to its better packet delivery ratio and low packet delay. However, GPSR is also designed for general and best situations. Based on the original GPSR protocol, enhanced routing protocols have been put forward once for a while.

Altogether (*e.g.*, GPSR) geographic routing protocols, signals are generated or broadcast at normal intervals for maintaining a accurate neighbor list at every node. To update Position are expensive in several ways. Every updated position absorbs wireless band width, node energy, and increases the prospect of packet collision at the (medium access control) MAC layer. packet failure occurs due to Packet collisions which in turn effects the routing operations due to decreased accuracy in determining the precise local topology means a misplaced beacon broadcast is not redelivered. But at the cost of enhanced end-to-end delay a misplaced data packet does get redelivered. Without a doubt, it means cost related with transmitting beacons, so it is necessary to adjust the frequency of beacon updates to the traffic conditions and node mobility within the network, rather than implementing a static periodic update strategy. For example, if definite nodes are frequently changing their mobility features *i.e.* speed and/or heading [9] it is necessary to frequently broadcast their updated position. However, for nodes that do not demonstrate significant dynamism, periodic broadcasting of beacons is incompetent

2. RE LATED WORK

Yan-Bo Wang et. al. (2010) : The problem in Vehicular Ad-Hoc Network In novel years has received huge attention, and more VANET-associated researches have been produced. Normally speaking, the biggest distinction between traditional Ad-Hoc and VANET is the velocity of carriers for the reason that the velocity of vehicles in VANET the carriers are much elevated as compared to the carriers in customary Ad- Hoc. Also, it would be a great confront to send data resourcefully in VANETs. Thus, many researches designed have focused on the improvement of Routing Protocols. The key principle of this paper is to study Geographic Position-Based Routing Protocol, which desires Global Position System (GPS) to attain the positions of vehicles and to advance the decision-making of information delivery. Therefore, only biased topology information is essential during the decision-making of data issue for the routing protocol to have enhanced adaptability in eminent speed network topology. This paper aims to advance (GPSR) Greedy Perimeter Stateless Routing Protocol and execute our proposed method into a difficult situation like urban region. For this reason, with the conception of vector, greedy forwarding method of GPSR not only concern the distance to improve the accuracy of routing information while choosing the next bound but also, in terms of the intersection in urban section adds a analytical mode to calculate the motions of vehicles at the intersections to advance the efficiency of routing protocol.

Neeraj Sharma et. al. (2013) : VANET**(**Vehicular Ad Hoc Network) is an emanating new technology to accomplish the communication between the vehicle, it is the confined derivation of pure multi hop ad hoc networking and are previously going through the industrial prototyping; the dreamed idea of general purpose VANET is still away from the fact. Vehicular communication has become most recent topics of discussion from last few years. The vision for VANETs is commercial comfort applications and road safety enabled by short-lived wireless technology. Many routing protocol have designed for such manner of networks, most of them try to manipulate the data, which may be accessible at the vehicle by the time a routing judgment must be made. In this paper the author has evaluate the AODV& GPSR routing protocol and also conclude them

Quanjun Chen et. al. (2013) : For making forwarding decisions, in geographic routing, nodes require to keep up up-to-date positions of their proximate neighbors. Intermittent transmission of beacon packets that restrain the geographic location coordinates of the nodes is a common technique used by utmost geographic routing protocols to maintain neighbor positions. Author demonstrates and contends that from both routing performance and renew cost points of view, periodic beaconing regardless of the node traffic and mobility patterns in the network is not appealing. He also suggest the (APU) Adaptive Position Update scheme for geographic routing, which dynamically arranges the occurrence of position update based on the movement dynamics of the nodes. APU's simple principles are: 1) nodes whose mobility are harder to presage revise their locations more regularly and 2) nodes closer to forwarding paths reinstate their positions more frequently. Theoretical analysis, is validated by NS2 simulations of a geographic routing protocol, GPSR,(Greedy Perimeter Stateless Routing Protocol, shows that APU can considerably diminish the update cost and rectify the routing performance in terms of packet average end-to-end delay and delivery ratio in disparity with periodic beaconing and other projected updating approach.

Sakshi Marwah et. al. (2014) : VANET Vehicular Ad Hoc Networks is one of the exclusive subclass of Mobile ad hoc networks which show a dissimilar method for intelligent transport scheme. The routing protocol has two main categories of position-based and topology-based routing. In position-based, every node is perceptive of the positions of straight neighbors by regularly sending out airframe messages that shows the present position of the node. Additionally, with the idea of transmitting a packet from a source to a destination node, the sender needs data on the existing geographic place of the destination node. This research changes the GPSR protocol by inclusive the learning phase. The learning stage is utilized to decide the cost of the edge. . In position-based, each node is perceptive of the positions of straight neighbours by regularly sending out airframe messages that shows the present position of the node. This research changes the GPSR protocol by inclusive the learning period. The learning phase is utilized to decide the cost of the edge.

Chih-Hsun Chou et. al. (2008) : In this the author presents a scheme that minimizes the risk of an information packet encountering a dead-end condition as it is forwarded to its terminal. Under the system, the mobile nodes intermittently circulate beacon messages to replace adjacent node information to detect dead ends along their intended transmission paths. During forwarding, the transmitting nodes use this data to avoid releasing data packets to any broadcasts known to be suffering a dead-end condition. The dead-end reduction (DR) strategy and other two baseline algorithms were estimated using the ns2 simulator. The simulation and analytical results reveal that the DR strategy significantly lessens the number of dead-end situations. As a result, average path length and the PDR (packet delivery ratio) were both improved compared with the standard (GPSR) greedy perimeter stateless routing scheme. Furthermore, the additional control overhead induced by the dead-end reduction strategy was less than 10% collated with the GPSR scheme.

3. PROPOSED WORK

In this paper we proposed a Virtual Carrier Sensing Technique (VCS) to improve the stability in GPSR protocol. To avoid packet collision at MAC layer that cause packet breakdown or collapse at the node we use Virtual Carrier Sensing Mechanism. The virtual carrier sensing mechanism uses a network allocation vector (NAV), the RTS/CTS mechanism use in wireless network protocol and a Threshold to control the packet flow. The absolute result of sending packet will depend upon virtual carrier sense mechanism. It performs at the MAC (Medium Access Control) sub layer does not sense the carrier directly. To propose a distributed next-hop self-election mechanism for geographical forwarding by using Virtual Carrier Sense (which involves use of a special handshake). preferably, the RTS/CTS handshake can eliminate most interference. It often uses RTS (request to send) and CTS (clear to send) control frames to forecast the channel's status based on the sequence of received frames For example, IEEE 802.11 MAC uses RTS and CTS for virtual CS.

Assumptions :

1. A flow can obtain the needed congestion feedback information from just links all along its own path.
2. Multi-channel transmission support simultaneously.

The algorithm of the procedure is as follows:

Step 1 : Generate the Network scenario using NS2

Step 2 : Start with some initial elements like no. Of nodes, neighboring nodes

Step 3: Initialize with n no. of nodes.

Step 4: Implement the virtual carrier sensing technique

Step 5: Introduce new fields RTS/CTS header to transform the 802.11 MAC to carry multi-channel and flow information

Step 6: Preserve for every node a table to record the status of each flow and the packet number.

Step 7: If the packet number exceeds a threshold, the node would decline to receive the packets of this flow by sending CTS-Block.

Step 8: Until the packet number is fewer than the threshold, the flow would be in progress again by sending CTS-Resume to the prior node.

4. SIMULATION RESULTS

In this particular part we will observe the Performance of GPSR Protocol on ns 2.34 simulator. A network of 150 nodes is deployed in an area of 1200m*1200m. The main Parameters are described in Table 1.

Table 1
Simulation Parameters

Parameters	*Value*
Channel Type	Wireless Channel
Simulation Area	1200m*1200m
MAC Type	802.11
Simulation Time	1000 seconds
Transmission Range	250 m
Routing protocol	GPSR
Number of Nodes	150

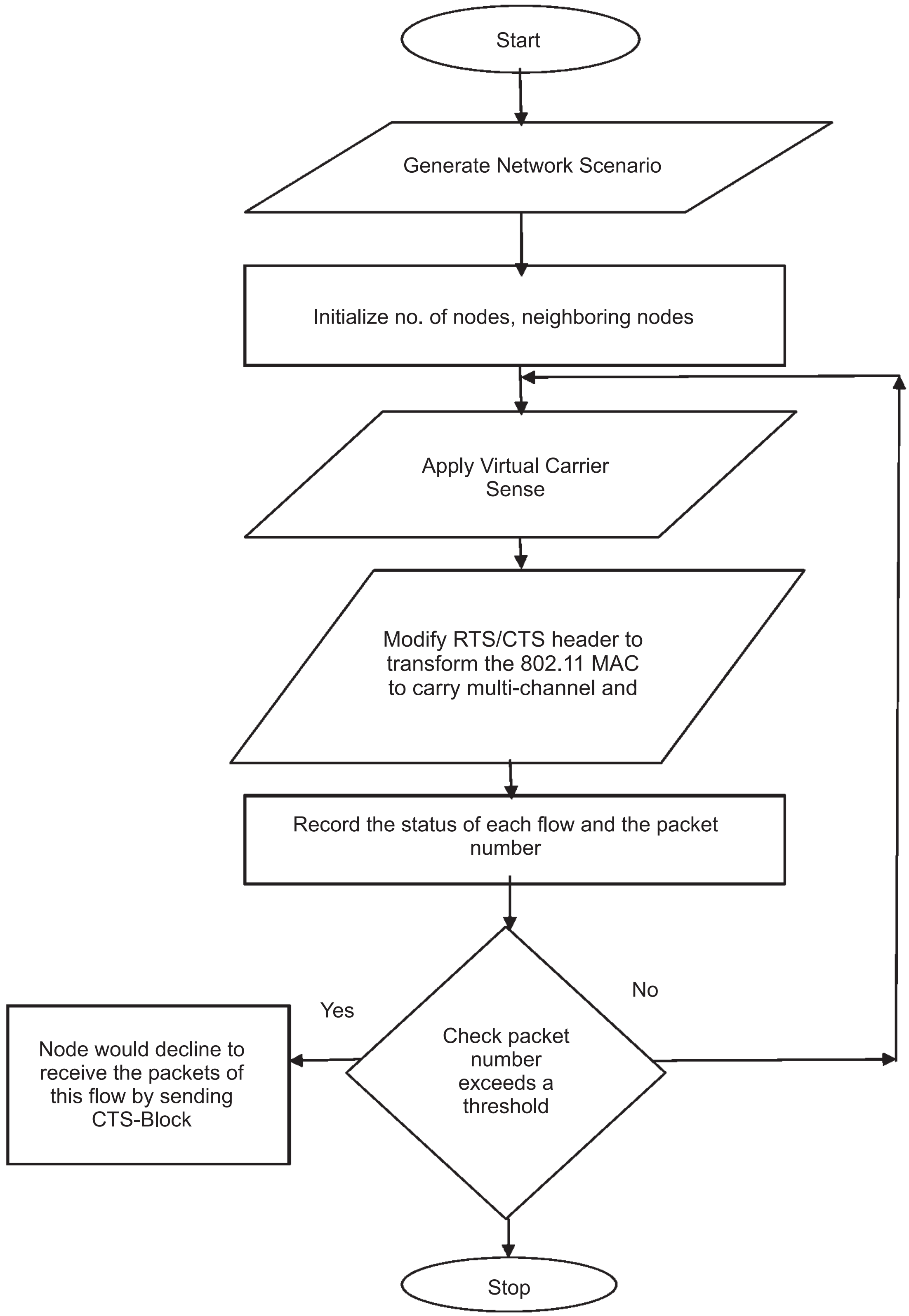

Figure 5: Flowchart of Algorithm

1. **In scenario 1 :** Transmission range is varied from 20m to 100m as shown in figure 5 to figure 8. Number of nodes for scenario 1 is 100.

```
Total Runtime=  73.9
Load=  0.0063
Total Packets Sent=       116
Total Packets Recdeived=       116
Total Packets Dropped=        0
Average Delay=      0.0153
Maximum Delay=      0.0803
Minimum Delay=      0.0019
```

Figure 5: Simulation for transmission Range 100 Node 20m

```
Total Runtime=  74.0
Load=  0.0061
Total Packets Sent=       112
Total Packets Recdeived=       112
Total Packets Dropped=        0
Average Delay=      0.0135
Maximum Delay=      0.0744
Minimum Delay=      0.0018
```

Figure 6: Simulation for transmission Range 100 Node 40m

```
Total Runtime=  73.5
Load=  0.0062
Total Packets Sent=       113
Total Packets Recdeived=       112
Total Packets Dropped=        1
Average Delay=      0.0088
Maximum Delay=      0.0368
Minimum Delay=      0.0018
```

Figure 7: Simulation for transmission Range 100 Node 50m

```
Total Runtime=  38.8
Load=  0.0059
Total Packets Sent=       57
Total Packets Recdeived=       57
Total Packets Dropped=        0
Average Delay=      0.0054
Maximum Delay=      0.0315
Minimum Delay=      0.0018
```

Figure 8: Simulation for transmission Range 100 Node 100m

Table 2
Performance Metrics for Nodes 100

Transmission Range	*Load*	*Total Packets sent*	*Total Packets Received*	*Total Packets Dropped*	*Avg Delay*	*Max. Delay*	*Min. Delay*
20 m	0.0063	116	116	0	0.0153	0.0803	0.0019
40 m	0.0061	112	112	0	0.0135	0.0744	0.0018
50 m	0.0062	113	112	1	0.0088	0.0368	0.0018
100 m	0.0059	57	57	0	0.005 4	0.0315	0.0018

Table 2 shows Packets dropped and Average delay for scenario 1 by varying the transmission range from 20m to 100m.

2. **In scenario 2** transmission range is varied from 20m to 100m as shown in figure 9 to figure 12. Number of nodes for scenario 1 is 150.

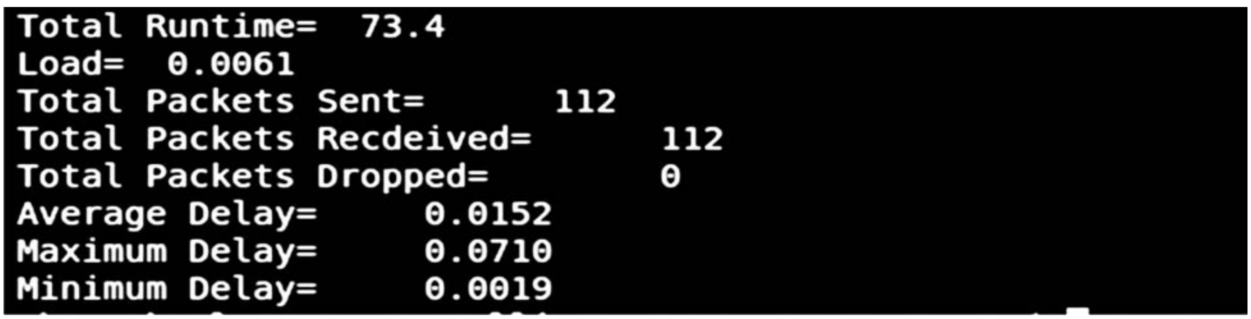

Figure 9: Simulation for transmission Range 150 Node 20m

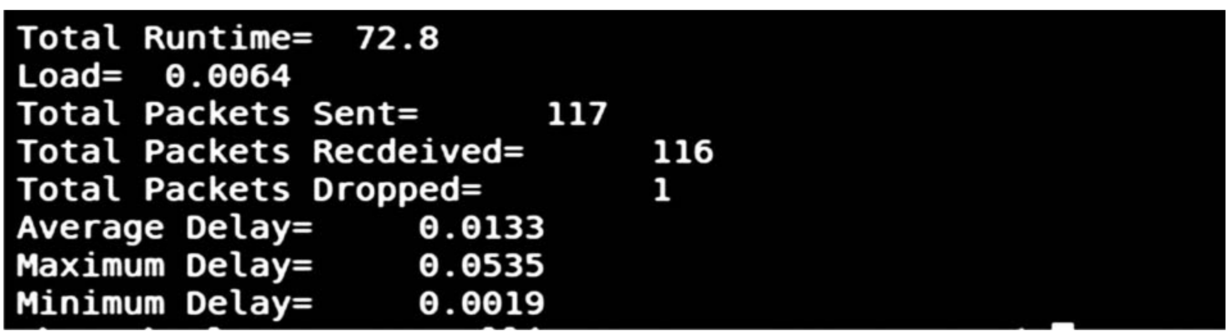

Figure 10: Simulation for transmission Range 150 Node 40m

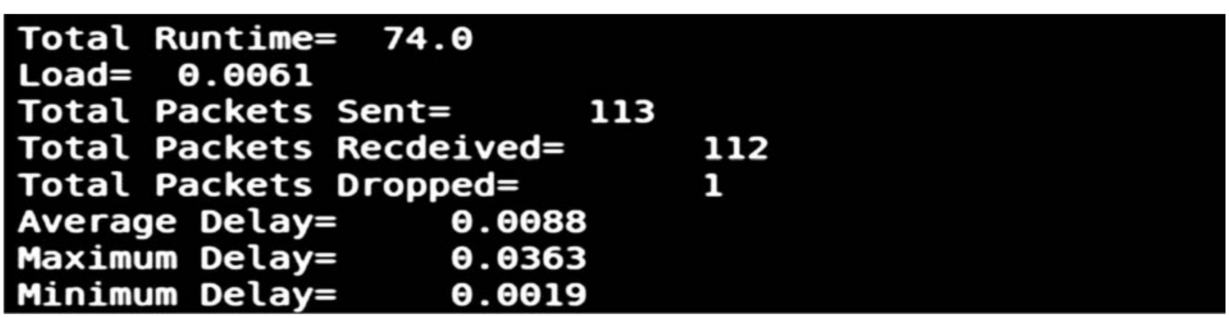

Figure 11: Simulation for transmission Range 150 Node 50m

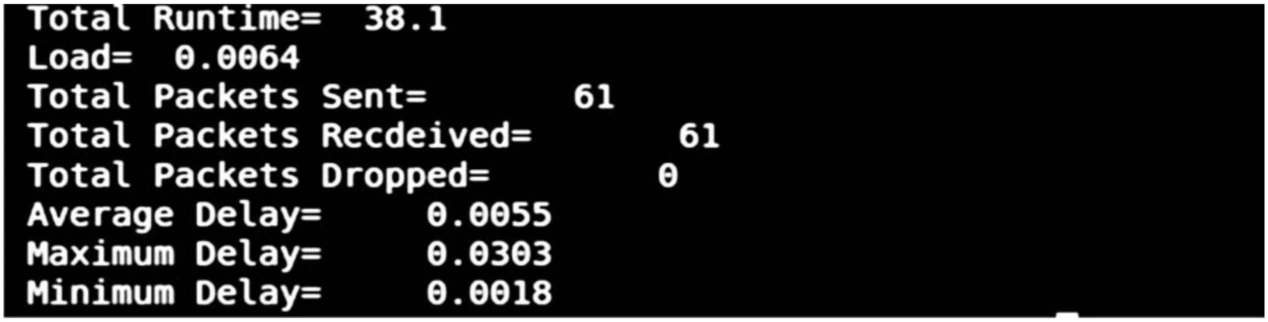

Figure 12: Simulation for transmission Range 150 node 100m

Table 3
Performance Metrics for Nodes 150

Transmission Range	*Load*	*Total Packets sent*	*Total Packets Received*	*Total Packets Dropped*	*Avg Delay*	*Max. Delay*	*Min. Delay*
20 m	0.0061	112	112	0	0.0152	0.0710	0.0019
40 m	0.0064	117	116	1	0.0133	0.0535	0.0019
50 m	0.0061	113	112	1	0.0088	0.0363	0.0019
100 m	0.0064	61	61	0	0.0055	0.0303	0.0018

Table 3 shows Packets dropped and Average delay for scenario 1 by varying the transmission range from 20m to 100m.

Table 4
Summary Performance Metrics for Nodes 100 And 150

Trans-mission Range	*Load (100 m)*	*Load (150 m)*	*Total Packets Dropped (100 m)*	*Total Packets Dropped (150 m)*	*Average Delay (100 m)*	*Average Delay (150m)*	*Max. Delay (100 m)*	*Max. Delay (150m)*	*Min. Delay (100 m)*	*Min. Delay (150 m)*
20 m	0.0063	0.0061	0	0	0.0153	0.0152	0.0803	0.0710	0.0019	0.0019
40 m	0.0061	0.0064	0	1	0.0135	0.0133	0.0744	0.0535	0.0018	0.0019
50 m	0.0062	0.0061	1	1	0.0088	0.0088	0.0368	0.0363	0.0018	0.0019
100 m	0.0059	0.0064	0	0	0.0054	0.0055	0.0315	0.0303	0.0018	0.0018

Table 4 shows Packets dropped and Average delay for scenario 1 and scenario 2 by varying the transmission range from 20m to 100m.

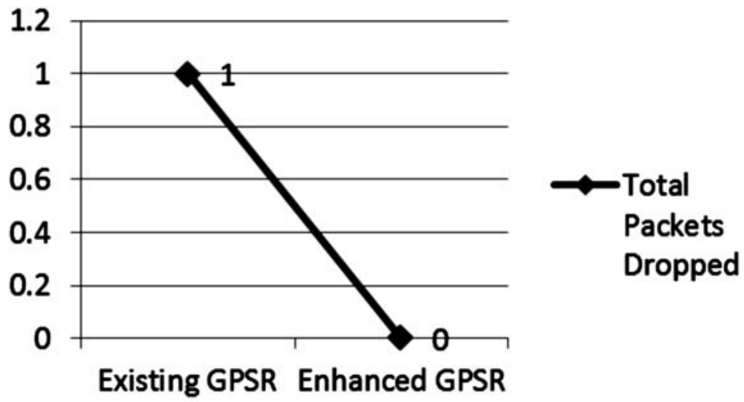

Figure 13: Total Packets Dropped

The above "Fig. 13" depicts the graphical view of comparing of total packets dropped in Existing GPSR and Enhanced GPSR.

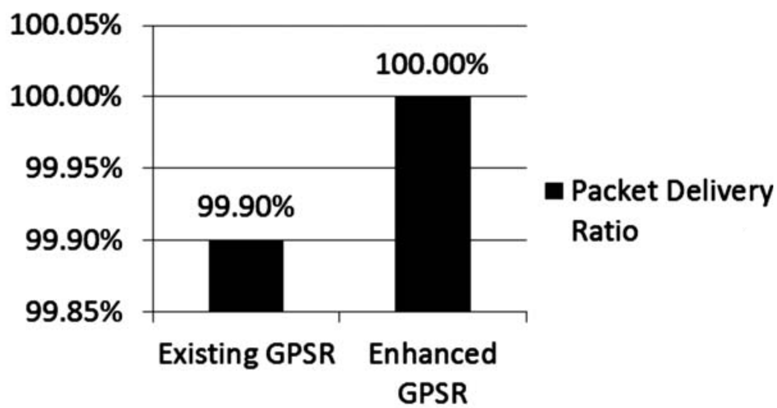

Figure 14: Packet Delivery Ratio

The above "Fig. 14" shows the graphical analysis of comparing the Existing GPSR and Enhanced GPSR packet delivery ratio. As the protocol will achieve enhanced when the value of packet delivery ratio is more and in above graph the PDR value is more as compared to existing.

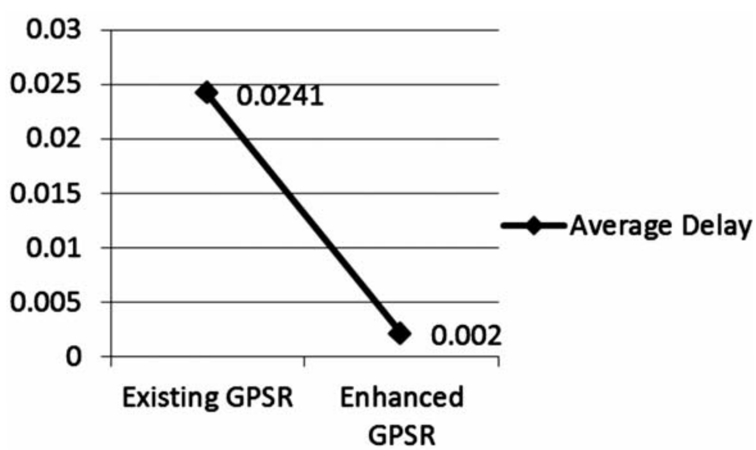

Figure 15: Average Delay

The "Fig. 15" depicts the graphical view of comparing of average delays of simple Existing GPSR and Enhanced GPSR.

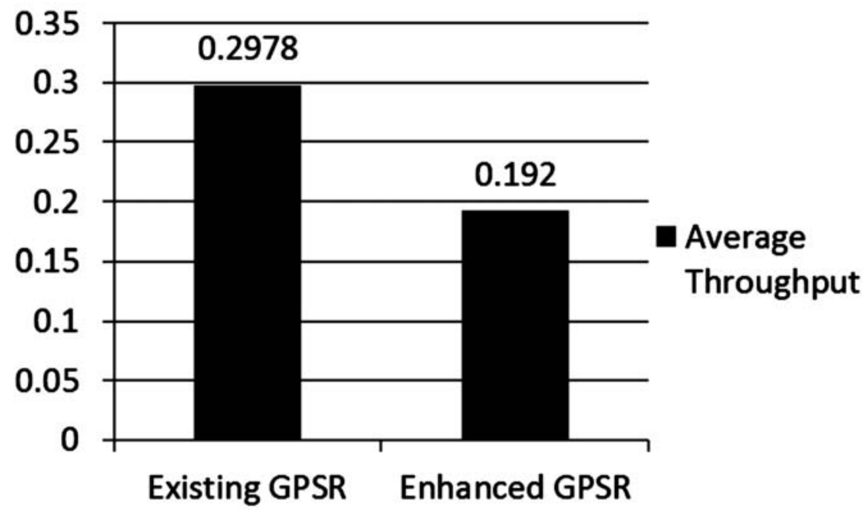

Figure 16: Average Throughput

The "Fig. 16" depicts the graphical view of comparing of average throughput of simple Existing GPSR and Enhanced GPSR.

We will compare the existing GPSR protocol with the improved or enhanced GPSR protocol using our proposed technique. From comparative analysis it is clearly shown that by implementing our proposed technique *i.e*. Virtual Carrier Sensing, there is significant improvement in the results as shown in table below.

Table 5
Performance metrics

Performance Metrics	*Existing GPSR*	*Enhanced GPSR*
Total Packets Sent	112	384
Total Packets Received	111	384
Total Packets Dropped	1	0
Packet Delivery Ratio	99.90%	100%
Average Delay	0.0241	0.0020
Average Throughput	0.2978	0.1920

5. CONCLUSION AND FUTURE WORK

The Performance of VANET(Vehicular Ad-Hoc Network) is enhanced by the Proposed mechanism *i.e*. based on virtual carrier sensing in terms of decreasing average delay and the average throughput, increasing packet delivery ratio and decreasing the total packets dropped during the execution. The proposed mechanism first deliver the packets efficiently and the performance metrics such as average throughput, packets dropped, average delay, packet delivery ratio is evaluated and then compare them with proposed technique. The calculation of work is done in NS2 and the simulation results indicated that the Proposed mechanism has better performance and provide a significant increase in terms of PDR and decrease in Packets dropped and increase in average delay and throughput.

In future, the work can be extending to improve the lifespan of network and improving the "Average Throughput" metrics at certain level in the proposed system.

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