Research Article

A Congestion Controlling Mechanism Using Smart Self Divisional Congestion Node Window (SSDCNW) And Traffic Analysis For VANET

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Abstract- Vehicular ad hoc networks are a very common area of study in which research work is carried out on different issues, such as end-to-end data routing without loss. Routing is a very tedious activity in this network because the place of vehicles is always changed location-wise. In this paper, we propose a Smart Self Divisional Congestion Node window (SSDCNW) for minimizing the congestion window size and provide the data rates of the protocol used for Jaipur and Kota city in Vanet. In WAVE/ IEEE 802.11p vehicular ad hoc networks, we studied the mechanism of transmission packets over the control channel. The findings of the simulations carried out in a practical environment justify our theoretical considerations and confirm our protocol's feasibility and effectiveness by demonstrating substantial changes in network efficiency. We analyzed the performance of the system for 2 general scenarios. With the NS-3 simulator and SUMO, we performed detailed simulation operations to find the effect of our proposed SSDCNW technique to forecast data rates and reduce and controlling the congestion level. A rise in packet processing time does not have a significant effect on network efficiency for most messages; on the contrary, it is significant for messages to arrive correctly.

Index Term— Vehicular ad hoc networks (VANETs), NS3, SUMO, SSDCNW.

I. INTRODUCTION

Vehicle protection is, beyond any doubt, an important concern in contemporary society. Almost 1.25 million persons expire per year in traffic accidents, with an average of 3287 deaths each day [1]. Different innovations have developed in the vehicle traffic industry over the years to help mitigate injuries. Since the first implementation in 2001, the Vehicle Ad Hoc Network (VANET) [2] was generally viewed by the government, the automobile industry, and academics as a promising model for the potential application [3]. To put up vehicle-to-vehicle (V2V) then vehicle-to-infrastructure (V2I) interactions for security-based purposes, a series of requirements have been introduced to date. For such vehicular communication,[4] has been suggested. The Federal Communication Commission (FCC) assigned the 75 MHz bandwidth to DSRC in the United States. Although many safety-related specifications have been established, several facets of DSRC performance criteria remain, such as determining transfer rate, transmit power control, adaptive message rate control, which is required to be methodically examined. There are major social & technological DSRC-related issues that have to be tackled before large-scale implementation. The efficient transmission of safety signals is a crucial requirement of V2V communication. Usually, these signals are transmitted to nearby vehicles using CSMA/CA-based DSRC/WAVE technologies in the media control layer. The restricted frequency space available for transmitting security messages ensures that as vehicle density grows, the shared radio channels will quickly be congested.

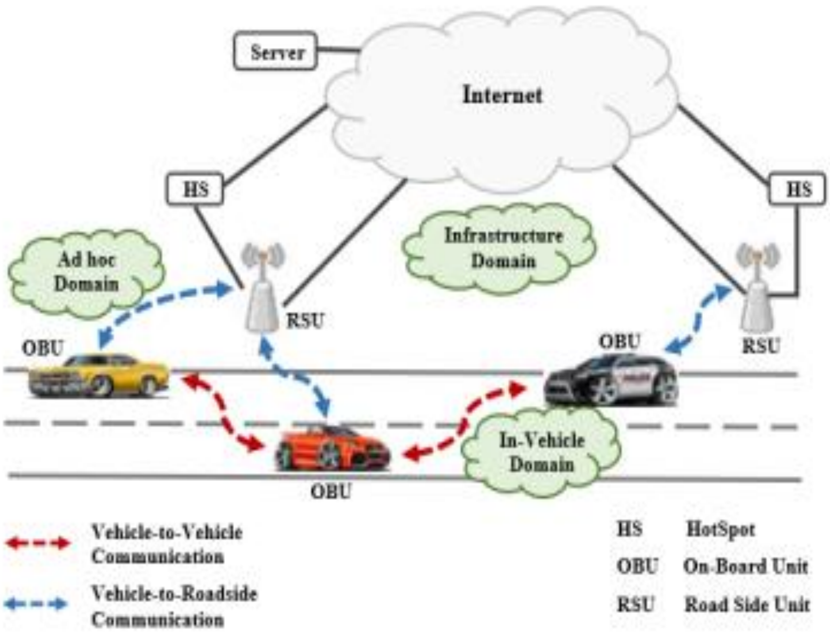

Fig. 1. Simple VANET Architecture [6]

Figure 1shows simple VANET Architecture in [6]. A key factor that contributes to the overdue or missed transmission of messages is channel congestion. For e.g., when safety signals are sent to all adjacent vehicles. In comparison, VANET congestion management is much more complex due to high node agility and channel fading restrictions.

1.1 Elementary Notions for VANets

VANets are considered to progress road safety besides traffic efficacy in vehicular surroundings. Thus, these links propose several significant topics for academic and industrial study. The meanings and basic principles of VANets are presented in this section.

1.1.1 Features of VANets

As VANets is a subclass of MANets, they receive many of the features of MANets. VANets, though, has many unique characteristics, including high node versatility, high node density, high topology shift rate, path pattern constraints, unlimited energy supply, no n/w size restrictions, & so on. [7]. Users do not have any capacity limitations when using rechargeable batteries in VANet conditions. Mobile nodes in VANets are cars that are capable of traveling at extremely high speeds (e.g. 120-140 Km/s on highways). High mobility is also one of the most important characteristics of VANets. The topology will often alter very often in VANets, so the car can travel fast, drivers can pick paths arbitrarily, and so on. Any gaps can be created between vehicles due to the complex existence of road traffic and, therefore the nodes often need to select a new data transmission path. Often, the rate of disconnection increases as the network density decreases. Any problems in the efficiency of VANets are due to the high rate of contact disconnections. Using roadside units and relay nodes, this problem can be solved. These VANet problems contribute to recent studies to preserve smooth communication and reduce the impact of VANet fading[24]. The accessibility model of VANets is limited to the highway, road, and street plans. However, to help forecast the potential driver decision and avoid relation disconnection, it is important to distinguish the location of nodes and their way of travel. Besides, the architecture of control algorithms in VANets is affected by modifying the mobility paradigm (i.e. highways or urban environments). Due to the one-dimensional movement of vehicles, the highway mobility model is simple. Such features make the construction of VANets diverse and more dynamic in urban environments [8].

1.1.1 Necessities of VANets

Specifications of VANets depend on the specifications of VANets' apps. VANets' specifications can be divided into requirements for equipment, strategic, economic, system capabilities, system performance, and standardization. The strategic criteria relate to the policies identified by commissions and govt. and to the degree

of VANet implementation. Any variables are taken into consideration in the economic criteria, for example, the required expense & time to return the financial capital examined [9].
Device performance criteria are those related to vehicle communications performance vehicle location accuracy, and network reliability, and so on[33,34]. The specifications and standards for delivering VANets in-vehicle environments are specified in the standardization requirements.

1.1.2 Communication Outlines in VANets
In VANets, respectively vehicles ca
n have separate functions for carrying out vehicular communications in the network, including sender, receiver, and router. This category of communications includes OBUs to conduct the communications. SIVCs support short-range communications applications, such as the lane merging program. The MIVCs, on the other hand, are used for long-range networking systems URVCs can need additional equipment for complete coverage on all roads (in broad countries)[9]. Ultimately, HVCs are used to communicate. HVCs expand the propagation range of RVCs, thus. HVCs do not, on the other hand, guarantee connectivity in areas of low vehicle density. The coordination patterns in VANets are illustrated in Figure 1.1 [10].

1.2 Routing Protocols in VANET

Routing protocols are especially significant in ad hoc n/w since they are accountable for originating & preserving paths to enable multi-hop connections & encompass the coverage area of n/w. Also, VANET routing protocols are configured for multiple situations, taking into account the key features and limitations of vehicle networks, such as node mobility, congestion, and bandwidth. VANET has a complex topology, as we said, and the network can accommodate some type of program at runtime. The continuous study is also in growth to strengthen routing results while taking into account the limitations and difficulties of VANETs [11-12].

1.2.1 Routing Protocols (Position Based)
Depending on the environmental location of nodes, these kinds of protocols invention path to the destination. Several routing protocols that rely on positions were suggested.

Connectivity Aware Routing (CAR) [13] A novel form of beaconing machine, named adaptive beaconing, is available. The incidence of HELLO beacons in adaptive beaconing is depending on the no. of adjacent nodes. A chosen community broadcasting (PGB) method, which is an optimized broadcasting method, is used. It decreases overhead control messages by removing redundant delivery. In its route selection process, this protocol implements a location service.

Geographic source routing (GSR) protocol [14] The path from source to destination is found using a city map. In a GIS, the city map is digitized and preserved (GIS). To locate the position of the preferred contact partner, the GSR protocol usages a reactive location service (RLS). A digitized map incorporates information about a street and a road intersection. In city settings, GSR performs well, where other position-based routing protocols typically struggle. However, during the selection of the next road junctions, GSR does not include node density.

Greedy perimeter stateless routing (GPSR) [15] is a routing protocol dependent on location. In terms of the no. of nodes in the n/w & mobility rate, GPSR stores scalability by storing slight info per node. It just stores the node id & physical node location in a routing table. If any node nearer to the destination is located, then it goes back to the greedy mode. At a high degree of mobility, this protocol produces good performance [16].

A. Reactive Routing Protocols
These kinds of protocols only trigger path computation on request, but they have better efficiency than constructive protocols for routing. There are too numerous recommended reactive routing protocols.

1) **Ad hoc On-Demand Multipath Distance Vector (AOMDV) [17]** By storing different routes from Sto D, AODV overcomes the frequent route failure issue. It is a routing protocol that is reactive. Unlike AODV, it produces multiple reverse directions, generating only a single reverse path. This will stretch the protocol robustness, since if one path fails, then it is possible to route packets along another path. An updated version of AOMDV was suggested to resolve this real-time knowledge problem. The speed metric is the basis of this enhanced AOMDV.
2) **Adaptive routing protocol [18]** It is a hybrid one, a mixture of constructive and reactive routing protocols. According to node speed and mass, the spectrum of propagation varies. It measures the density of the node by taking special features into account, called the relation expiration time (LET).
3) **Ad hoc On-Demand Distance Vector (AODV) [19]** This protocol appeals to the process of path exploration only if the route to a destination is not identified. Each node upholds a routing table in this

protocol containing details about reaching the destination. By packing only following hop data rather than storing the whole path to a destination, the size of the routing table was reduced. AODV maintains a single source-to-destination path. This can, however, suffer from a problem of repeated path errors with high node mobility.

B. Proactive Routing Protocols

Through modifying routing tables regularly, diligent protocols often preserve routes from to D. The density-conscious routing protocol uses the data of available road hierarchies to route packets. High-speed road roads, medium-density roads, secondary roads, and low-density freeways are known as roads. Two directions are preserved in that. If the first path fails. The path is chosen after that. Based on real-time details, it selects the path. But it has a downside as the bandwidth usage due to checking and initial packets.

The paper is planned as follows. In Section 2; we extant the related work. Section 3 gives an overview of the Proposed methodology describes a methodology for two scenarios (Jaipur and Kota) Section 4 experiments results of the proposed SSDCNW approach. Section 5 draws some conclusions and section 6 discusses our future work.

II. Literature Survey

The contribution of various research papers is explored in this section that exhilarated our understanding of the problem definition and helpful in determining the challenges, gaps, and issues available in the field of Vehicular Ad-hoc n/w to detect collision using congestion controlling techniques in a current realistic scenario. For designing and implementing detection strategies, controlling congestion with vehicular information plays a critical role that can well detect and control congestions. Here, various studies have been done on various VANETs routing protocols, Congestion controlling methods, Congestion detection methods in this chapter. From the literature, it is evident that very little attention is given to the detection and controlling of congestions in VANETs.

S. Kumar and H. Kim (2020) An appropriate protocol for media access control (MAC) are of vital standing. A stable multichannel Time Division Multiple Access (TDMA) MAC was suggested by the current protocol, VeMAC. However, owing to high overhead, elevated entry collision, and slower collision detection, VeMAC suffers. They proposed a novel MAC protocol Hybrid Medium Access Control (BH-MAC) for VANET is called Bitmap based [20].
J. M. Lim et al. (2020) In an ever-changing VANET topology, the present VANET systems use static parameters, resulting in a lack of adaptability. Because of the rapid shift in topology and regular disturbances in VANET. To evaluate the V ANET MAC Congestion window size, the SINR adjustment is then used. In the urban map of Kuala Lumpur, Malaysia, simulation is performed on congested and non-congested traffic. The findings reveal that, in terms of packet success rate & avg. latency proposed AdMAC has greater adaptability [21].
N. Gupta and Surjeet (2019) Any of characteristic problems with almost all planned MAC protocols are ensuring the propagation of delay-intolerant time-critical safety signals, the GPS obligation, and the reliance on the leader node. The suggested framework solves these problems in this research paper with improved channel utilization and lower latency in combination with higher throughput by splitting the vehicles into 2 clusters. Therefore, they increase the use of the channel and partly guarantee in crucial time the transmission of protection signals. In cluster creation, the scheme uses the shortest MAC, CSMA/CA. There is, however, no global synchronization (GPS) for communication [22].
V. Nguyen et al. (2019) For VANETs, adaptive MAC protocols are necessary, That, according to traffic conditions, dynamically changes the interval. This paper introduces a cooperative and efficient multi-channel MAC protocol called RAM for VANETs, RSU-assisted IEEE 802.11p. An RSU is used in our proposal to measure the optimized interval of the transmission of the protection packet [23].
M. A. Karabulut et al. (2019) This paper presents a different cooperative relaying media access control (CR-MAC) protocol for ad hoc vehicle n/w (VANETs). Three data transfer modes have been obtainable to surge the output of direct transmission (DT), cooperative relaying (CR) & multi-hop relaying (MHR). The IEEE 802.11 specification defined a system for straight communication design only that is not ap appropriate [24].
Rajeswar Reddy G and Ramanathan R (2018) By differing The congestion behavior of the IEEE802.11p/1609.4-dependent Medium Access Control has been observed in urban and highway settings. The default medium access mechanism in the WAVE MAC is Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA). The parameters used to measure CSMA/CA efficiency are ag. End-to-end latency, median throughput, packet propagation ratio, packet transmission ratio [25].

Raghavendra Pal et al. (2018) An Activated CCHI Multichannel MAC protocol was suggested for successful propagation of safety messages in Vehicular Ad Hoc N/W. The planned protocol requires a vehicle to jerk the control channel interval (CCHI) when a safety warning arrives during SCHI by stopping the service channel interval (SCHI). By dipping resource waste and unnecessary delay induced by the set interval of CCHI and SCHI, this increases the efficiency of VANET. Also, CCHI continues to rise until not all safety signals are transmitted. This paper also suggests a simulated TDMA beaconing method to ensure the transmission of periodic status messages [26].

Y. Zhang et al. (2018) This paper suggested a novel cluster-based collision-free multichannel medium access control (CCFM-MAC) protocol to address intra-cluster & inter-cluster communication collision difficulties in vehicular ad-hoc networks. Based on communication expiration times with their neighbors, all nodes are clustered into separate clusters. To discourage inter-cluster interaction, neighboring clusters use multiple channels [27].

Z. Tianjiao and Z. Qi (2017) To solve this problem, proposed a game-based TDMA MAC protocol (GAH-MAC). In this protocol, the colliding nodes will perform games with each other when a reservation clash happens to determine whether to assign the original slot or a new one. In this way, the time slots can be fully used, and the reservation speeds can be improved without handling the base stations. The findings of the simulation show that GAH-MAC performance is superior in high-density networks, raising the success rate of reservations and increasing system capacity [28].

Tripti C et al. (2017) An asynchronous multi-channel MAC arrangement facilitating concurrent transmission on multiple service channels is introduced in this document. The suggested scheme permits certain nodes to reach the control channel dynamically & also permits them to attend to and use the control channel when not attached to the service channel [29].

Md. Kowsar Hossain et al. (2017) In overcoming this problem, a MAC protocol that makes fast reservation of packet transmission slots by vehicles wishing to transmit packets is critical. They recommended a novel dispersed ResVMAC MAC procedure for VANETs in this article. Using simulations, we show that the process outperforms [30].

V. Nguyen et al. (2016) In VANETs, RSUs, and vehicles must allocate time slots to broadcast service apps on the control channel. One of the variants of the MAC protocol called VeMAC is recommended. The VeMAC protocol will decrease the transmission collision rate and increase the control channel throughput. However, in VANETs, the VeMAC protocol did not take the unique properties of an RSU into account. In this article. RSUs manipulate the assignment of time slots in our protocol and disseminate control knowledge. Simulation findings reveal that all VeMAC and ADHOC-MAC protocols are outperformed by the RCMAC protocol in terms of the total number of frames that are successfully acquired by all nodes and the average number of access collisions before a time slot is successfully acquired by all nodes [31].

III. Proposed Methodology

In this section, we analyzed the different experimentation for VANet in both cities. In a practical simulation setting, we took careful care to carry out our test testing. For a practical mode of vehicular mobility. With the NS-3, the SUMO network emulator and helps them to share vehicle movement information at runtime.

3.1 Problem Statement

The challenge of road traffic congestion in urban areas poses itself as a very persistent problem needing solutions. Various resources are lost during a traffic jam, such as time, fuel, and many other resources. To guarantee fluidity and fast circulation, we should circulate valuable information on the state of traffic across the VANET networks. The V2V (Vehicle-to-Vehicle). Researchers concentrate on urban automobile situations that are most vulnerable to traffic accidents, leading to collisions with beacons in a series of events. In this case, the optimum speed is restricted between 2 vehicles traveling in opposite directions. The CCH channel's restricted bandwidth greatly restricts the volume of data. We give a reasonable estimate of the theoretical potential of the channel in this brief analytical analysis. Since all beacons are set in size, this power can be translated from data units to an average number of channel accesses over one so-called control channel (CCH). This latter figure is then mapped to the optimum no. of vehicles competing within until CCHI enters the channel without creating a bottleneck of the channel. This optimum no. of cars, which we will refer to as "optimal local density" in the remainder of this article, provides access to all vehicles within a given radio spectrum with a negligible crash rate. ANETs are used with different data types to relay multiple data types. The amount of traffic and the flow counts, which are the main cause of traffic jams, are among this data. The use of these will be beneficial to synchronize the flow and later solve the question. Moreover, the importance of this knowledge is expressed in the estimation of safety and protection. Vehicle networks are distinguished by their tremendous scale, especially in urban environments and in large cities. As a result, the data circulated inside is massive and 100% of it is not exploited. Exploiting this unused information will solve a variety of issues, including road traffic and avoiding others. This unstructured data cannot be handled either in terms of capacity or in terms of productivity by conventional databases. The data's potential and sophistication are exponentially growing. Therefore, to take advantage of these floating data, the need to design powerful processing instruments.

3.2 Methodology

Actually, in the problem statement, the main concern is that clustering simply defines the nodes but there is no correct implementation of the path with data transmission. It is like that we are going to road and there is a jam then nodes transmit the data such as beacon symbols which based on BSM (Basic Safety Message). When a Traffic jam has happened then it redistributes the routing table. In N nodes in which all vehicle has routing tables and in these routing tables the one node or the node which have lowest nodes. The routing table has been increasing but over messaging happens in which actual information and other messaging are processed. The channel capacity is increase due to the overall multiple transmission of messages so that the packet drops. So overall in this process we use SSDCNW in which the collision happens so we have the main aim to decrease it. Like in 10 nodes, the one in which the routing table is the lowest makes its cluster head. The SSDCNW selects it automatically meanwhile the congestion is decreased and the packet delivery ratio is high it has taken a path.

3.2.1 Real Traffic Generator (SUMO)

We moved the Jaipur City OSM file from OpenStreetMap [10] to develop and introduce VANET in urban environments and generated a real-time road traffic situation using the SUMO 0.22 simulator with real traffic. In the SUMO trace exporter, the mobility of traffic data is created, which will be spread to the NS2 simulator used as a vehicular network simulator for VANET presentation analysis. Using SUMO commands like net convert and polyconvert, we can transform the open street map OSM data into a configuration (cfg) format. To store information and parameters, these configuration files are used. To construct a network scenario for the network simulator, which in our case is NS 2, Trace files can also be created, which is a very important step. Trace files can be created in various ways, such as using the sumo trace exporter and using MOVES, etc. We choose the SUMO trace exporter because SUMO has an integrated utility to produce trace files that are in the sumo itself in the default bundle (no additional programmed components required). The sumo kit includes an exporter's directory of tools. This can be used either employing the newer Python Script command or by using standard C++ code.
The SUMO simulator is a kit for open source and real-time traffic simulation, including modules for net import and demand modeling. In networks, SUMO helps to analyses many research subjects, such as path mapping and traffic light approaches, and vehicle network simulation.

3.2.2 Network Simulator

The easiest way to research connectivity online is to set up a network to perform some real experiments. Setting up a network, though, is not easy or expensive. For this purpose, for tests on just one device, a virtual n/w created by a network simulator is applied. In particular, NS2, which is free and easy to practice, is prevalent worldwide.

The Network Simulator - NS-2 and NS-3

NS-3 is a discrete simulator of events that targets networking analysis. Ns offers considerable support for TCP, routing, and multicast protocol emulation over wired besides wireless networks. Ns started in 1989 as a version of the REAL n/w simulator and has grown dramatically in the last three years. The creation is currently funded by SAMAN through DARPA and CONSER through NSF, both in cooperation with other researchers, including ACIRI. Ns has already included important contributions by other scholars, including UCB Daedelus wireless code and CMU Monarch project, and Sun Microsystems. See Version 2 update log for details of recent updates [32].

3.3 802.11p Protocol and Performance Models

Specifically, for inter-vehicle communications, the IEEE 802.11p protocol was developed so that road protection can be improved by the transmission of secure and warning messages. Alternatively, coordination functions. The control channel is responsible for the beaconing of car status (e.g., car location, pace, going, etc.) and the transmitting of safety messages (e.g., any accident ahead, sudden brake, poor road condition detected, etc.). In the CCH, broadcasting is used since these signals are meant to warn all surrounding cars. We concentrate on modeling the beacon transmitting efficiency of a vehicle in this article. Beaconing messages are produced periodically in any vehicle (node) at a rate of 10 Hz, which will be transmitted when a vehicle is operating in the CCH. Cars bid according to the CSMA/CA Congestion mechanism for the channel time. If it is not transmitted by the end of the control channel interval, the message will be lowered when new beacons are created in the next channel loop. The lowering of beacon messages, however, seldom occurs, according to previous reports. Also, when they become redundant, collision beacons may not be retransmitted.

Table 1. Assumptions concerning the protocol model.

PHY Layer	1. The channel is isotropic and homogeneous across the road. 2. The road is seen as a one-dimensional space. 3. Every node has the same transmission range R_s, & the same interference range R_I. 4. Collision happens when nodes within R_I of the receiver transmit at the same time as the sender. 5. Collision from other nodes, including hidden nodes, is the only cause of transmission failure.
MAC Layer	1. There is only a beaconing message in the system queue. 2. There is a beacon message ready to be transported at the beginning of each CCH. 3. Beacon message is not affected by channel switching; hence a beacon packet treats the channel time as infinitely long [10, 30]. 4. Beacons are generated at a rate of 10 Hz. 5. Since we are modeling a single queue scenario, the AIFS interval is neglected, which can be incorporated by adding extra states to the Markov chain. 6. Every car in the road segment is assumed to share the same MAC setting (e.g., Congestion window size, slot time, etc.).

3.4 GNU Plot

For Linux, OS/2, MS Windows, OSX, VMS, & numerous other stages, Gnuplot is a lightweight command-line oriented graphing usefulness. The source code is copyrighted but unregulated. It was originally designed to allow scientists and students to interactively visualize mathematical functions and data but has evolved to serve many non-interactive applications, such as web scripting. Third-party apps like Octave also use it as a plotting engine.

Algorithm: Proposed Algorithm

Step 1. Get a local car, bus, and truck number from the traffic model at the considered location (Jaipur and Kota);
Step 2. Set time to zero;
Step 3. Set number of cars, bus and truck in the idle state to zero;
Step 4. Generate the Jaipur and Kota traffic with the use of sumo.
Step 5. Download the generated area and convert it into an XML file
Step 6. Creation of node in XML in the format of position.
Step 7. Convert this XML file to TCL (Tool Command Language)
Step 8. Using 802.11 p Protocol Model
Step 9. Attach the TCL file to the general file of NS3 and convert this name to Jaipur scenario and Kota Scenario
Step 10. Run the code and generate the different file (log file, an XML file)
Step 11. Generate matrix calculation for both scenarios (Jaipur and Kota)
Step 12. Get SSDCNW (Smart Self Divisional Congestion Network/Node Window) and detection results.

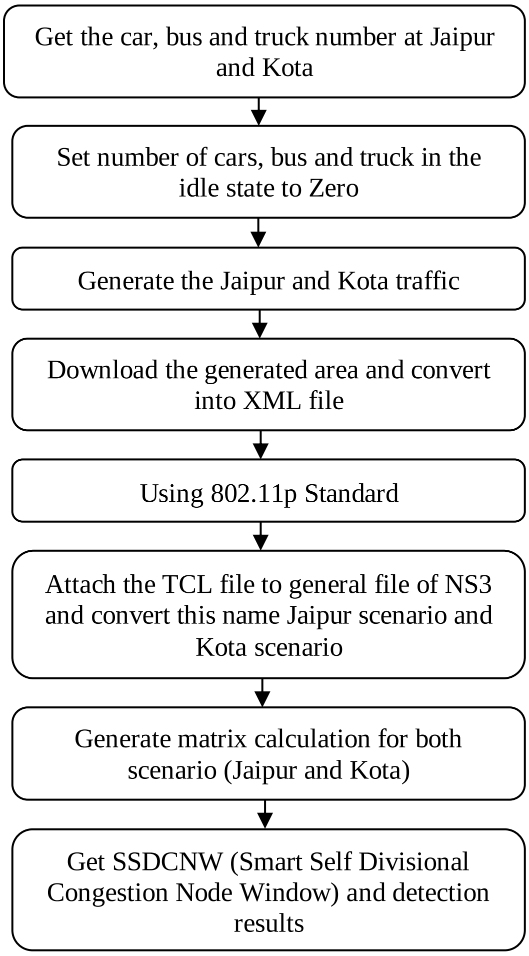

Fig. 2. Flowchart of Proposed Work

Above figure 2 shows the flow chart of the proposed methodology. When we apply methods for minimizing congestion window using the proposed SSDCNW approach, we are to detect the required scenario in which the best congestion controlling methods of networks.

The working procedure for the SSDCNW algorithm is shown in figure 3. It firstly monitors the cluster head (CH) and checks the window capacity to transmit the messages. It then checks whether such a node has received a message based on the routing table. If this node available in the routing table then assigns the node priority-wise, if not available then go back to check window capacity. Once the prioritized node is achieved, then check the node has received a critical event message or not. If it received then perform event-driven detection otherwise perform measurement-based detection.

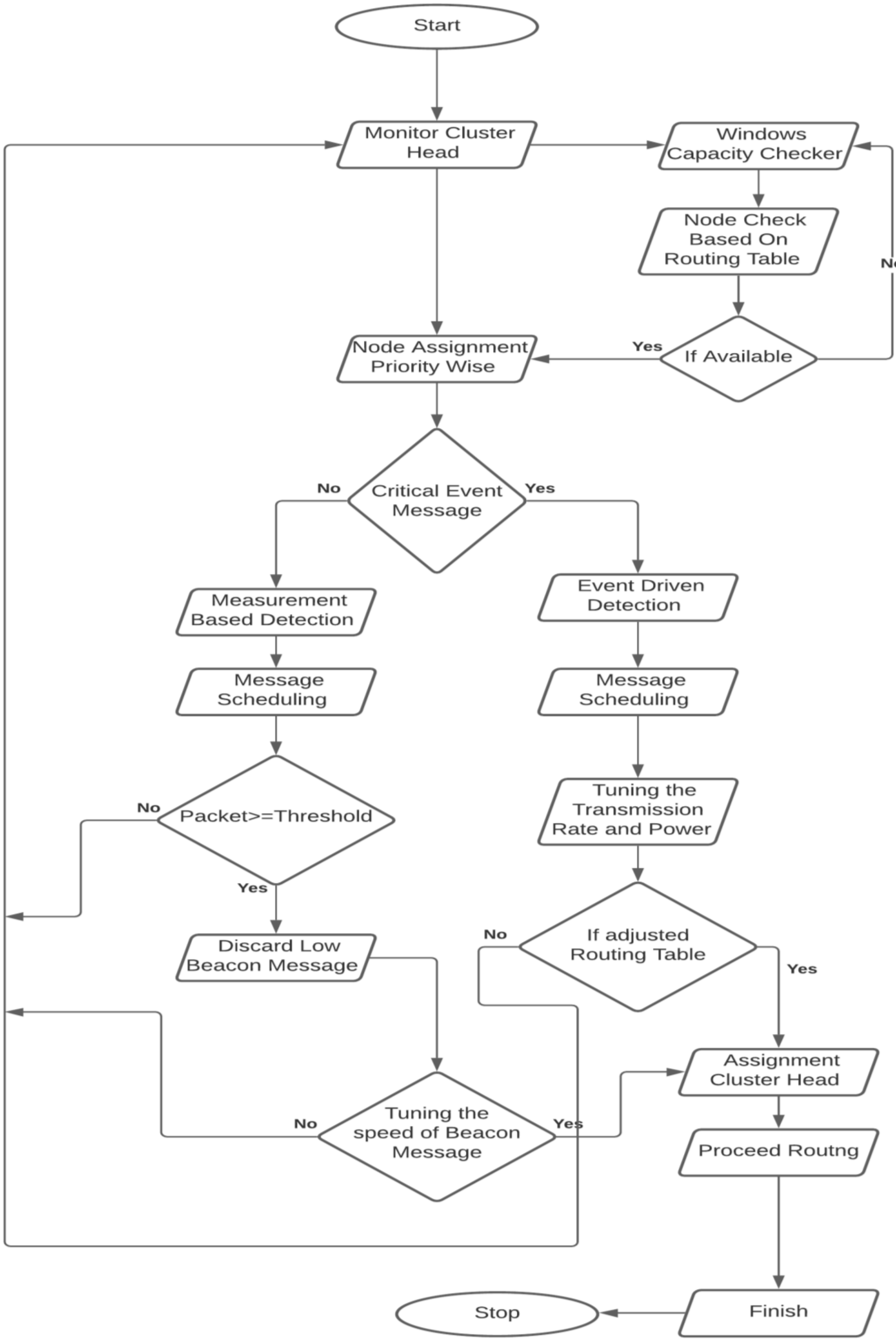

Fig. 3. Flowchart of SSDCNW algorithm working procedure

In event-driven detection, perform a message scheduling process to tune the transmission rate and power. After this update the routing table on these tuned parameters. If the routing table is adjusted then assign a new CH and proceed with the routing accordingly and complete the process, otherwise process from starting phase.

In measurement-based detection, perform message scheduling and check the number of packets. If packet size is not greater than or equals to specified threshold value then go back to the initial phase, otherwise discard the low beacon message and tune the speed of the beacon message. on these tuned parameters. If beacon message speed has tuned then assign new CH and proceed with the routing accordingly and complete the process, otherwise process from starting phase. Once the process has been completed then it stops working.

Pseudocode for SSDCNW Algorithm

Input:

```
        CH: cluster _head
        MCH: monitor _cluster _head
        CWC: check_ windows _capacity
        CNBORT: check _node _based _on_ routing_ table
        ANPW: assign _node _priority _wise
        CEM: critical _event _message
        EDD: event _driven _detection
        SM: schedule_ message
        TRx: transmission _rate
        TPx : transmission _power
        RTA: routing _table _adjusted
        RTmax: routing _table _max
        RTmin: routing _table _min
        NTR: node _routing _table
        ACH: assign _cluster _head
        MBD: measurement _based  _detection

1.  At the event of congestion:
2.  Each node does for CH:
3.  MCH
      (RTmin==NTR)
        ANPW
      (RTmax==NTR)
       Go to Step 4
4.  CWC
    (RTmin==NTR)
        ANPW
    (RTmax==NTR)
       Go to step 5
5.  CNBORT
     If (available ==1) then
         Go to Step 6
      End if
         Go to Step 4
6.  ANPW
7.  Generate
8.  CEM
    If (CEM == 1) then
         EDD
           SM
           Tune (TRx  && TPx)
               If (R TA ==1) then
                     ACH
                     Proceed Routing
                     Go to step 9
               End if
                     Go to step 3
    End if
         MBD
         Message Scheduling
         If (Packet>=Threshold)
               Discard Low Beacon Message
                  If (speed of Beacon Message tuned) then
```

Go to Assignment Cluster Head
Proceed Routing
Go to step 9
End if
Go to step 3
End if
Go to step 3
9. Exit

IV. EXPERIMENT AND DISCUSSION

In this section, we have experimented with the proposed approach using two (Jaipur and Kota) scenarios. To determine the success of our protocol, the metrics we choose are the rate of accidents and the busy percentage. If 2 or more vehicles emit their beacons within the range of each other at the same time mark, a collision is recovered from the simulation area.

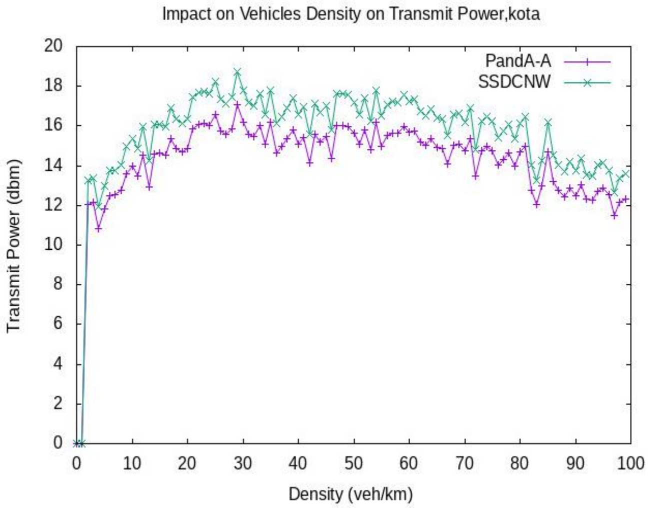

Fig. 4.1 Graph of Impact on Expected Density(veh/km) to transmitting power(dBm) of Kota

The above graph shows that the consequences reveal that the analytical model proposed is very similar to the Python-based simulation results. Besides, on the control channel, we can see the broadcast efficiency of IEEE 802.11p. The risk of collision also upsurges as the no. of nodes in Jaipur increases in the scheme. The graph applied between simulation time and the coverage received from projected wave packets means that this is demonstrated by the assumption that when there are more bytes to relay.

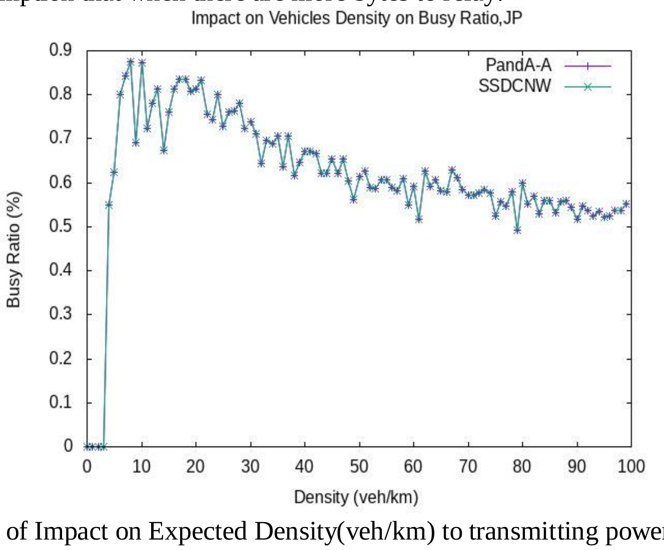

Fig. 4.2 Graph of Impact on Expected Density(veh/km) to transmitting power(dBm) of Jaipur

The above graph shows, the results It indicates that the analytical model presented is very similar to the findings of the python simulation. Also, we can get the efficiency of broadcast in IEEE 802.11p on the control channel. As the no. of Kota nodes grows in the scheme, the likelihood of collisions also increases. This is demonstrated by the fact that when there are more bytes to send, it can take longer to complete the transfer, which can cause losses due to channel switching or secret terminal switching. The graph applied between simulation time and predicted wave packets received coverage received.

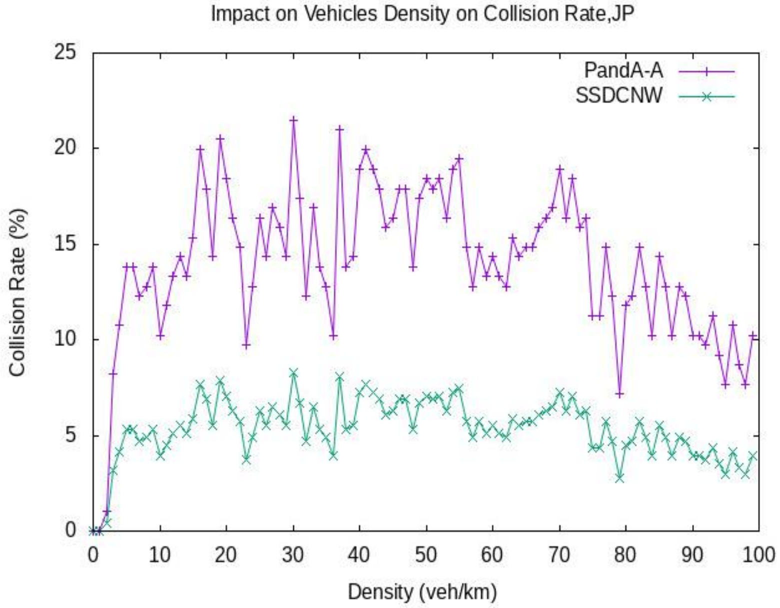

Fig.4.3 Graph of Impact on Vehicle Density on collision rate of Jaipur

The above figure shows the packets of wave in Jaipur in which as the distance of message upsurges, the quantity of period i.e., the delay is also increased. The delay is the same for certain packet lengths, which surges as the packet duration increases until the delay is the same again for the last two packet spans. This shows that the delay will remain the same where the packet size varies in small length, but when it differs in large packet size, Jaipur causes a major gap in delay.

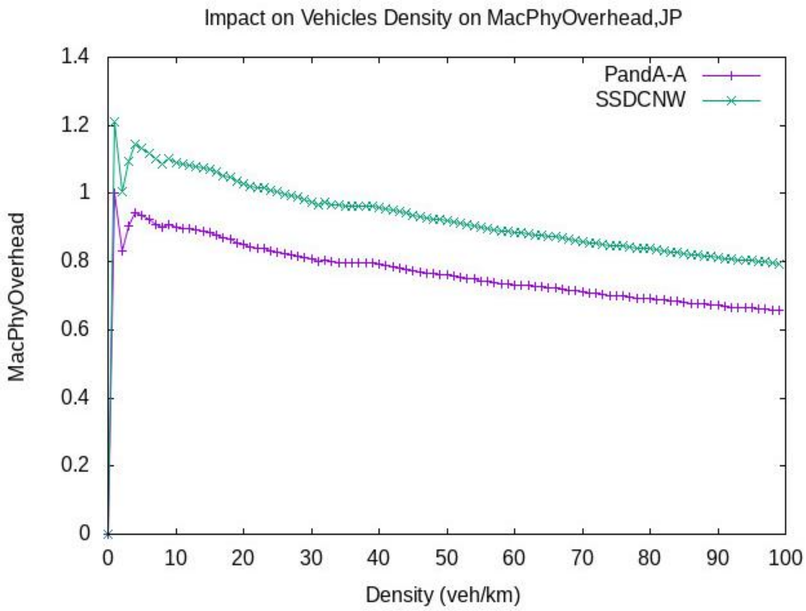

Fig.4.4 Graph of Impact on Vehicle Density on MacPhy Overhead of Jaipur

The above figure shows the packets of wave in Kota in which the amount of time, i.e., delay, is also increased as the message length increases. The delay is the same for certain packet lengths, then it increases as the packet length increases. The delay is the same again for the last two packet lengths. This shows that the delay will remain the same where the packet size varies in small length, but when it differs in large packet size, Jaipur causes a major gap in delay.

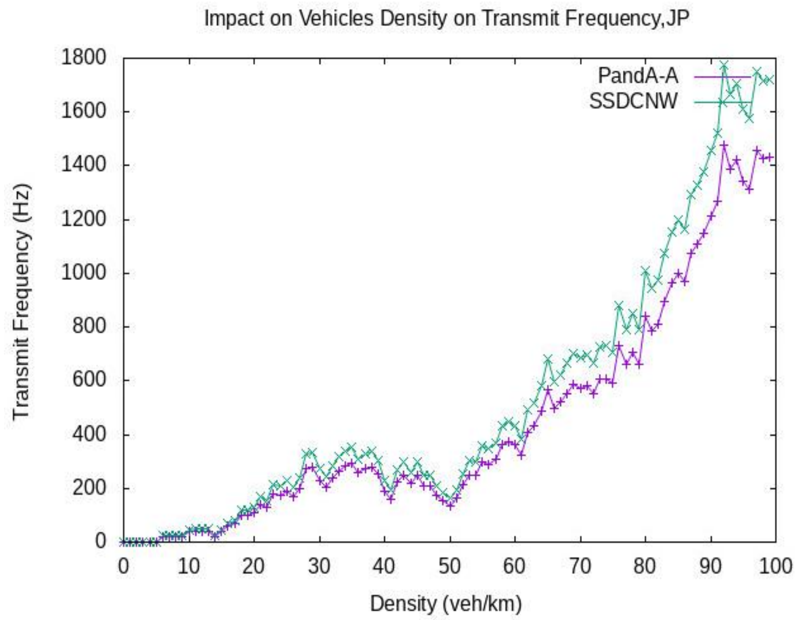

Fig.4.5 Graph of Impact on Vehicle Density on Transmit Frequency of Jaipur

The above graph shows the Mac Phy Layer Overhead for Jaipur and Kota. The physical and electrical characteristics of Jaipur and Kota are described by the PHY sheet. It is in charge of controlling the hardware that modulates the RF bits and demodulates them. Sending and receiving RF frames is the responsibility of the MAC layer. The graph shows the overhead vs simulation time mechanism of Jaipur and Kota.

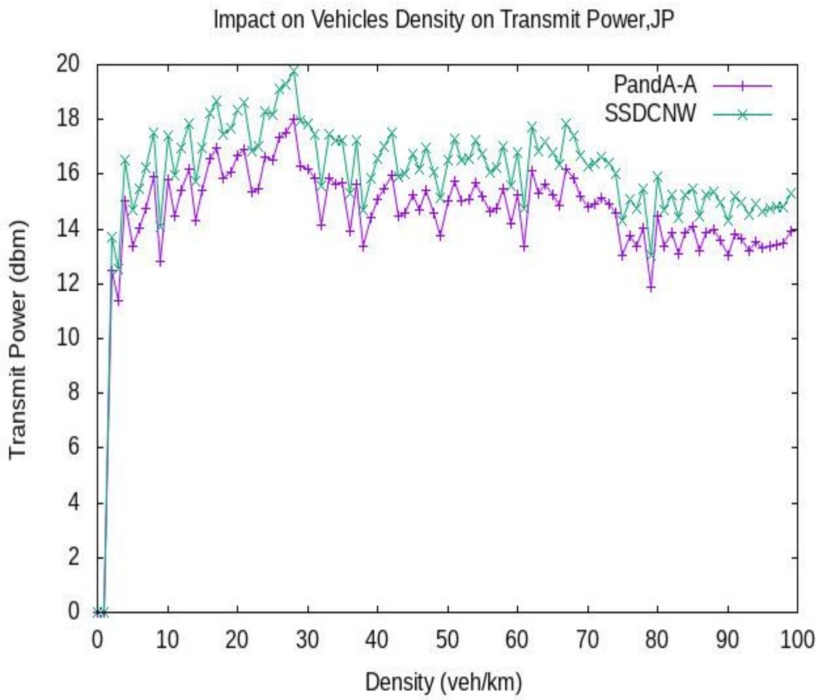

Fig.4.6 Graph of Impact on Vehicle Density on Transmit Power of Jaipur

The above graph shows the Bar Chart of MAC PHY-oh and GoodPut. To test the efficiency of our proposed system, we conduct simulations using ns-3. 802.11p Innovations for MAC/PHY. Two input parameters (average decent performance and overhead MAC/PHY) were used to produce one output parameter. it has been observed that at constant overhead when average goodput is increased, transmission power is required more, but as average goodput is required more, transmission power also varies up and down.

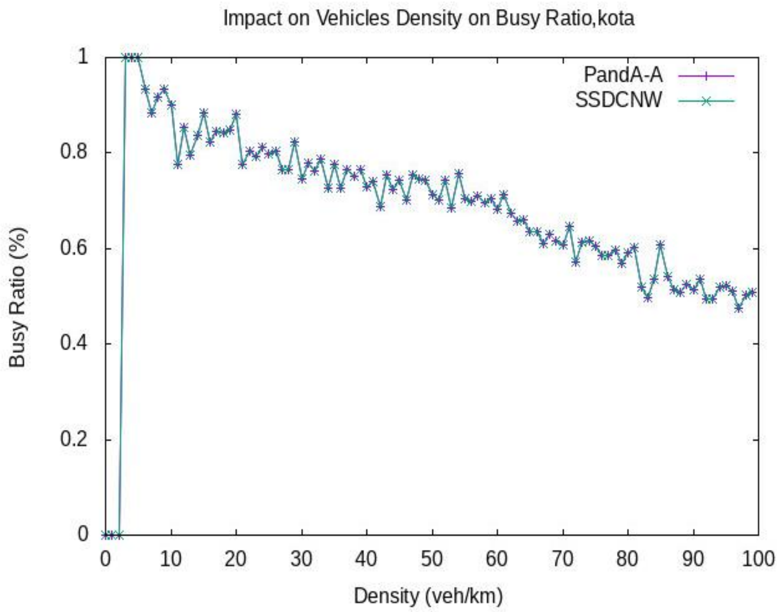

Fig.4.7 Graph of Impact on Vehicle Density on Busy Ratio of Kota

The above graph shows the Packet Received in Jaipur and Kota. With various beacon sizes, the proposed solution was contrasted with the traditional approach. To specifically illustrate the results of considering the beacon size and adaptive redundancy in terms of package obtained in Jaipur and Kota.

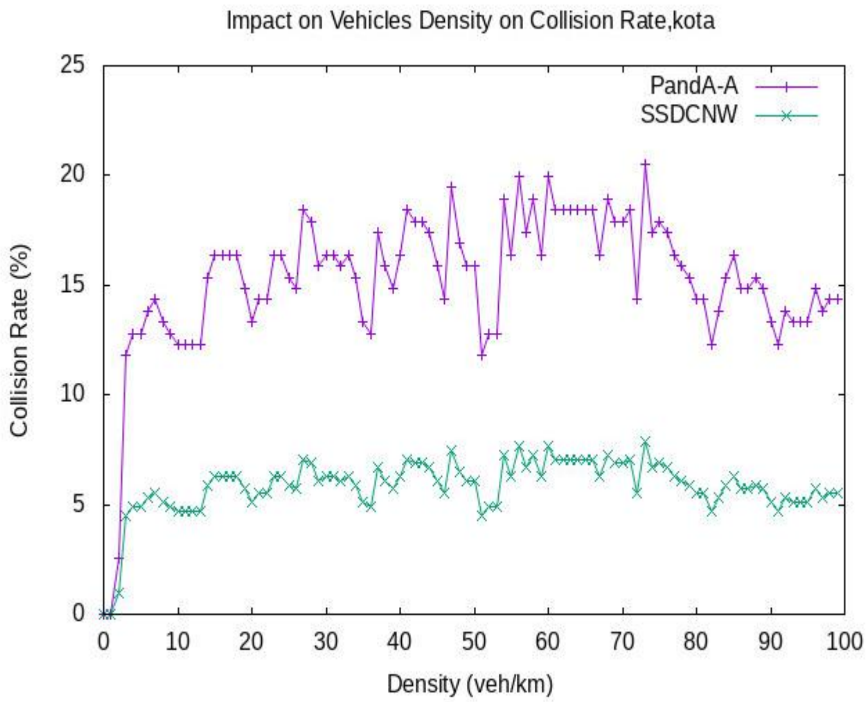

Fig.4.8 Graph of Impact on Vehicle Density on Collision Rate of Kota

The above graph shows the Receive Rate in Jaipur and Kota. The number of packets per node transmitted on a route, irrespective of broadcast or unicast. Any alternatives are open. Per node, the total no. of routing packets will be sent. The cumulative no. of routing bytes per node got. The number of routing packets, counted by the series number, means end-to-end, not determined by the base node.

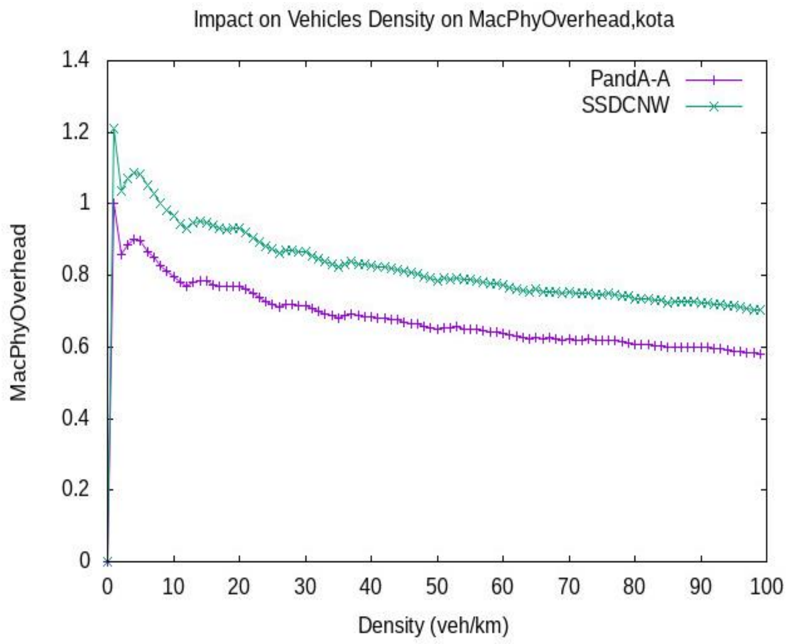

Fig.4.9 Graph of Proposed SSDCNW for Graph of Impact on Vehicle Density on MacPhy Overhead of Kota

The above graph shows the proposed SSDCNW for congestion control in Jaipur and Kota. We proposed this approach for minimizes the congestion in both cities.

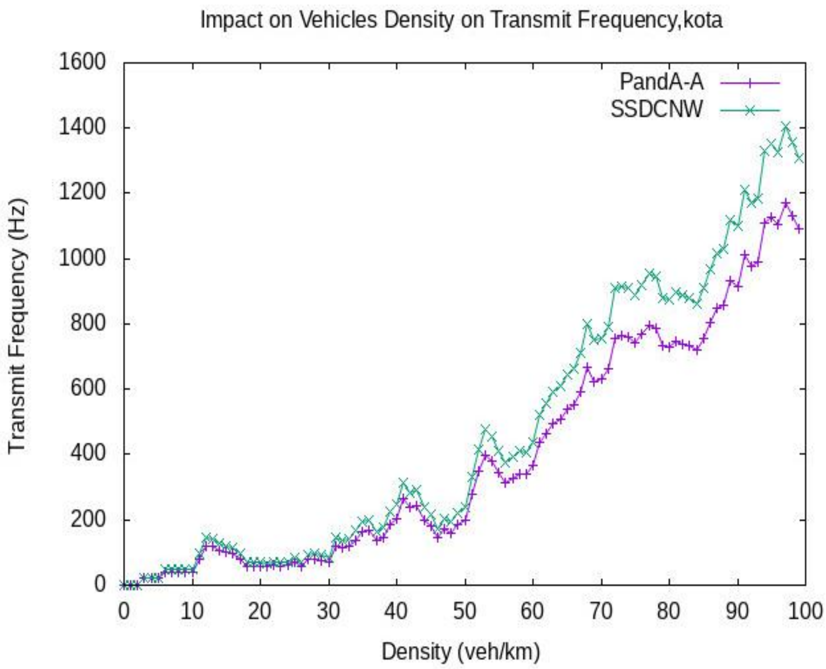

Fig.4.10 Graph of Proposed SSDCNW for Graph of Impact on Vehicle Density on MacPhy Overhead of Kota

In this graph is exponentially increase which defines that congestion window has decrease and SSDCNW graph has improved.

V. CONCLUSION

In this paper, we propose Smart Self Divisional Congestion Node Window (SSDCNW) for minimizing the congestion window size and provide the data rates of the protocol used for Jaipur and Kota city in Vanet. In IEEE 802.11p/WAVE vehicular ad hoc n/w, we studied the mechanism of transmission packets over the control channel. The assumptions completed in such a model, however, reflect its key downside as its indifferences some major phenomena in-vehicle networks. This is a clear statement because one would predict the hidden terminal hypothesis to occur very often in situations such as those we examined in this work in a specific scenario. For two general situations, we evaluated the system's performance. With the NS-3 simulator and sumo, we performed detailed simulation campaigns to find the effect of our proposed SSDCNW technique to forecast data rates and reduce and monitor the scale of congestion. A rise in packet processing time does not have a significant effect on network efficiency for most of the communications; on the contrary, it is very significant for messages to arrive correctly. Nonetheless, the packet received time for protection and important communications and thus the error rate is of considerable significance. The results of this paper will allow the research group to move forward one step and develop a better considerate of the mechanics of rate and power adaptation and pave the method for more creative ways to regulate the load of the channel in VANETs.

VI. FUTURE SCOPE

This methodology allows the research community of vehicular networks to develop a better understanding of why a local density forecast in such an n/w is needed and will open up novel research opportunities by generating new obstacles for VANET's research area. MAC/PHY overhead and goodput are evaluated to transmission powers (5dB-35dB). As transmission power will be high; MAC/PHY overhead will be high. The received rate is evaluated to the transmission rate. We can use other efficiencies for minimizing the size of the congestion window.

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