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Efficient and Reliable Communication to Reduce Broadcast Storm in Rural and Urban Scenario using RGHN and UGHN Protocol

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Abstract: ***In order to reduce overhead and to improve throughput an effective in Rural Group Head Node(RGHN) and Urban Group Head Node (UGHN) protocol can be implemented in the respective rural and urban scenarios. The first section deals with the efficient implementation of RGHN and UGHN protocols in VANET. In the next phase, working of RGHN in rural areas and UGHN protocol in urban areas are described and the performance analyzed. The developed protocol RGHN and UGHN needs comparison with the standard protocols under both the scenarios. The performance of the proposed protocol RGHN in rural scenario is compared with that of Dynamic Source Routing (DSR) and UGHN in urban scenario is compared with Ad-hoc On demand Distance Vector (AODV) shows the proposed technique providing a better result in terms of throughput, packet delivery ratio, delay and packet loss ratio in the network.***

Keywords: Rural group head node, urban group head node, throughput, route maintenance, route discovery.

I. INTRODUCTION

There are two discrete scenarios regarding VANET infrastructure dependent environment are urban and rural. The performance of the UGHN and RGHN in these scenarios is evaluated. In an urban scenario, the prospect of the placement of RSU or further systems enabling V2I communication is high compared to a rural scenario. Hence, the prospect of connection probability and vehicle density allowing vehicular communication in an urban scenario is good. The major key factor application is road safety which is becoming a challenging problem with steep increase in the number of vehicles day by day in both urban and rural areas. The prorogation of information among the vehicles is no easy job. Hence, RGHN and UGHN protocol are used for providing alert messages.

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The working of this RGHN and UGHN in rural and urban areas is explained in detail in this section. Bandwidth limitation, Scalability, Energy utilization, Security, Network performance etc., Several protocols have been analysed in the situation of simulation that include DSR and AODV for ensuring the concert of networks.

The GPS information is placed in a packet which has the vehicle identification number. Different scenarios like rural and urban are associated with VANET. Implementation of the broadcast protocol in these above scenarios in reproducing the same event is a highly challenging job. Each vehicle participating in VANET makes periodic reports on traffic conditions[1]. Many methods have been proposed for mitigating broadcast storm. Simple broadcast algorithms are the simplest protocol in V2V used application and are the safety alerts in the VANET networks. In the network of VANET broadcasting is done by effective tools for publication of a warning message in traffic accidents[2]. These two above works discuss the performance only in the single scenario which is not suitable for the VANET because it contains both rural and urban areas where the number of nodes changes and dynamic topology. The above mentioned issues have provided the motivation for the researcher to develop protocols RGHN and UGHN for comparison with the standard DSR and AODV protocol under the both urban and rural scenarios measured using the throughput. Hence, designing a protocol that ensures the packets for a larger number of vehicles with minimum routing overhead in the network is required. The objectives of the proposed RGHN and UGHN protocols are to design an efficient broadcast mechanism that ensures faster delivery of emergency messages in urban and rural areas.The proposed protocol consists of following phases, namely, route discovery, route request, route reply, route maintenance.To analyse the performance of the proposed protocol in terms of packet delivery ratio, packet loss ratio, control overhead, end to end delay and throughput based on varying vehicle densities. The organisation of the chapter is as follows. The literature survey of the presented work are discussed in section 2. Working of proposed RGHN in rural scenario and UGHN protocol in urban scenario is described in section 3. The performance analysis of RGHN with DSR protocols and UGHN with AODV protocols in section 4 and the Conclusion of the chapter is presented in section 5.

II. LITERATURE SURVEY

VANET as a subsidiary of Mobile Ad hoc Network (MANET). It helps the establishment of wireless message among the automobiles in the street adjacent apparatus and the vehicle[3]. Currently, Intelligent Transportation System (ITS) has the main influence on enlightening the excellence and competence of the transference system. Once exchange between extravagance and safe application of VANET is delayed vehicles make enquiry of data of any other vehicles over multi hop substructure. Despite the data affecting VANET, it suffers from recurring disruptions due to recurrent flexibility and occasionally linked network arrangement. In this broadside, training and comparison of the three routing protocols, namely, AODV, DSR and DSDV have been completed. The examination has been restrained and assessed in mutually rural and urban environments. In contrast to the negative deduction of preceding works, joining the organization correctness is enhanced in the directing procedures used. The projected system examines the vehicle thickness, data droplet, and output and end-to-end delay. Experiments on the consequences from the procedure of high through put and little packet drop DSR display better presentation likened to DSDV and AODV in rural setting and urban high density area, while AODV displays better presentation in assessment to DSR in a VANET atmosphere that is of low thickness.

DSR also supports internetworking between different types of wireless networks, allowing a source route to be composed of hops over a combination of any types of networks available [4,19]. For example, some nodes in the ad hoc network may have only short-range radios, while other nodes have both short-range and long-range radios; a combination of these nodes can be considered by DSR as a single ad hoc network[11]. In addition, the routing of DSR has been integrated into standard Internet routing, where a node connected to the Internet also participates in the ad hoc network routing protocols; and has been integrated into Mobile IP routing, where such a gateway node also serves the role of a Mobile IP foreign agent [5,20].

The urban-rural edge that has typically been considered from the opinion of assessment of cities with altered sectorial benefits and actual slight from rural viewpoints[6]. Yet, these types of parts are essential for deliberation from both points of view and from wide-ranging methods that could reproduce their difficulty[12]. Thus the effort is concerned with the style of a proportional examination of two main methods to commence with the rural-urban border in a Latin-American setting: one pending from cities and further from geography, where both have maintainable comprise and a regional viewpoint of growth. The examination has gone into explanation, financial, social, ecological and political-institutional problems, in addition to urban-rural connections. Results underscore some aids to such methods for modelling and repetition of the preparation and organization of these places, such as the cost of a multifaceted schemes view, preparation in dissimilar three-dimensional scales and time situations, the region as a provision of socio-economic and ecological procedures and the part of resident performers in this alteration[13,18]. To conclude, rural growth has been rising as a developing arena where average and small size settlements show a significant role in connecting construction with local and worldwide markets and applying rural-urban relations in urban organizations. The distance based scheme to store the data and forward the other node[14]. The advantage of the protocol is highly reachability and the performance metrics are delay, message overhead, collision ratio and efficiency[7,17]. The location and speed based scheme to store the data and forward the mobility based clustering exchange the data to other node. The advantage of the protocol is cluster stability and the performance metrics are cluster duration, message overhead, change rate and efficiency[8,16]. A brand new approach referred to as Dynamic Broadcast storm Mitigation Algorithm (DBSMA) which may be used to resist the broadcast storm problem in a Vehicular Network (VN)[9,15].

III. RGHN AND UGHN PROTOCOL

RGHN protocol is implemented in three stages. The first stage, involves sending emergency message to rural scenario in the vehicle. It is the route for ensuring reliable transmission of the messages. Finally, the messages are sent and maintain the broadcast to the neighbour. Similarly, the proposed UGHN protocol is developed in three stages, namely, grid scenario, route request and route reply. Figure 3.1 is the block diagram of RGHN and UGHN protocol.

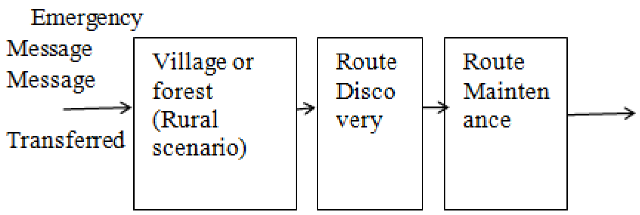

Figure 3.1 Block diagram of RGHN protocol

The various stages of RGHN and UGHN protocol are discussed in detail in the following sections. In rural areas, the availability of vehicle is small. Hence, the implementation of such a protocol is a challenging job. The estimation of the RGHN protocol can work a rural scenario. The RGHN protocol is composed of two mechanisms that work together to allow the discovery and maintenance of source routes in the ad hoc network.

3.1 RGHN protocol

In rural areas, the availability a small less number of vehicles. Hence, the implementation of such a protocol is a challenging job. The estimation of the RGHN protocol working in this rural scenario.The RGHN protocol is composed of two mechanisms that work to allow the discovery and maintenance of source routes in the ad hoc network.

3.2 Route Discovery in RGHN Protocol

Route discovery is the mechanism by which a node S wishing to send a packet to a destination node D obtains a source route to D. Route discovery is used only when S attempts sending a packet to D with no prior knowledge of a route to D. Third is shown in Figure 5.2.

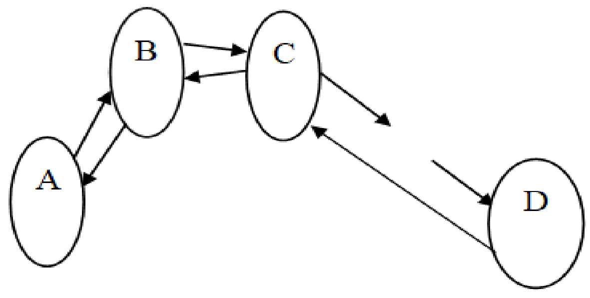

Figure 3.2 Route Discovery in RGHN protocol

Route discovery is the mechanism which node S provides node S the ability to detect , while using a source route to D, if the network topology has changed such that it can no longer use its route to D due to link along the route working no longer. When route maintenance indicates a source route broken, scan attempt to use any other route happens to know D, or can invoke route discovery again to find a new route is in Figure 3.2.

3.3 Route Maintenance in RGHN protocol

Route Maintenance is used only when S actually sends packets to D. The route maintenance is in Figure 3.3.

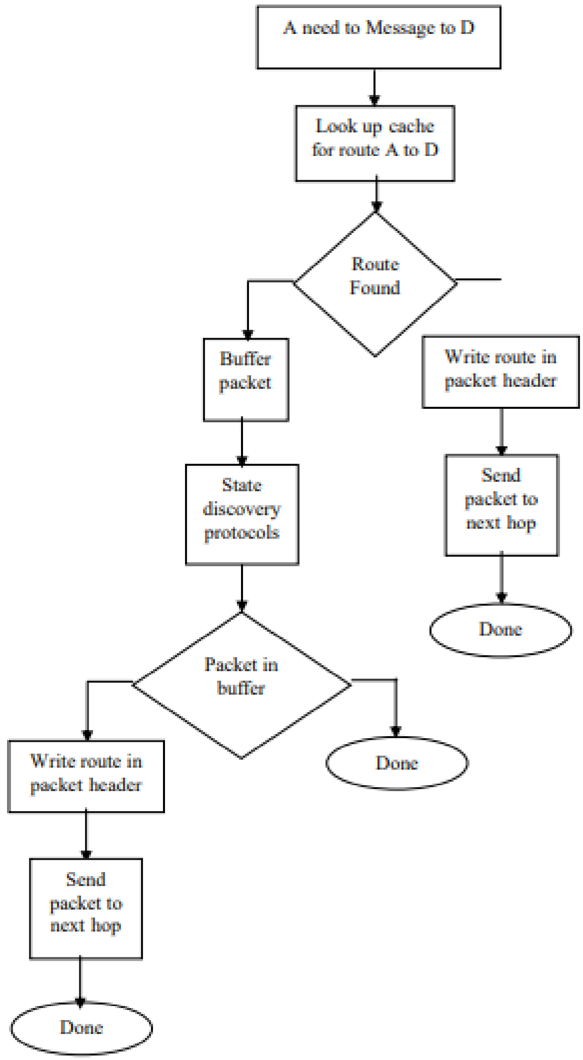

Figure 3.3 Route Maintenance in RGHN protocol

Figure 3.3 shows route maintenance and route discovery both operate entirely on demand. In particular, RGHN requires no periodic packets of any kind at any level within the network. It does not use any periodic routing advertisement, link status sensing or neighbour detection packets, and does not rely on these functions from any underlying protocols in the network.

This entirely on-demand behaviour and lack of periodic activity allow the number of overhead packets caused by RGHN to scale all the way down to zero, when all nodes are approximately stationary with respect to each other and all routes needed for current communication have already been discovered. As nodes begin to move more or as communication patterns change, the routing packet overhead of RGHN automatically scales to only that needed to track the routes currently in use. In response to single Route Discovery (as well as through routing information from other packets overheard), a node may learn and cache multiple routes to any destination.

The overall workflow of the RGHN is in Figure 3.3. The rural scenario has major challenges like a small number of mobile nodes and detects obstacles. In this proposed methodology, the scenario created has a small number of nodes in the village and/or forest area. In the scenario the researcher's proposed RGHN protocol is deployed for the evaluation of the performance of the RGHN with respect to various parameters.The RGHN protocol is mainly employed for the promoting road safety**.**

3.3.4 UGHN protocol

Each vehicle consists of a system that continuously collects information on GPS. The GPS information is placed in a packet which has the vehicle identification number. Different scenarios like rural and urban are available for VANET.

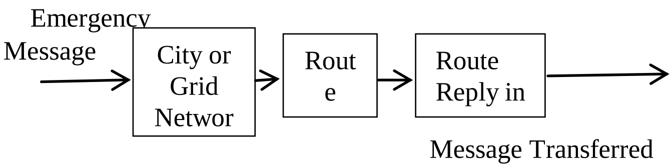

Figure 3.4 Block diagram of UGHN protocol

Implementing the broadcast protocol in these above scenarios will be a greater challenge. The developed protocols UGHN need comparison with the standard protocol under the urban scenario measured using the throughput to design an efficient broadcast mechanism that ensures faster delivery of emergency messages in urban area. However, this AODV approach has some limitations which could be overcome by the use of the proposed UGHN protocol thereby and implementing them in urban scenario, the benefit of AODV is that it produces no further road traffic for transmission over the existing links. Likewise, routing of distance vector is modest, and does not need much retention or intention. Nevertheless, AODV requires additional time to create a link, and the preliminary communication to begin path behaviour in comparison with some other approaches.

3.3.5 UGHN in VANET

The UGHN protocols implemented in the urban areas are those in which the grid networks are formed for the transmission of messages among the vehicles. From the grid station, the messages are sent before the start of communication. On receipt of the confirmation, alert broadcast of information starts. This may reduce the heavy traffic flow that is a feature in urban areas. A respective vehicle involves a scheme that uninterruptedly gathers the GPS data. The GPS data is positioned in a package which has the vehicle ID number. Diverse situations urban and rural are accessible for VANET. Execution of the broadcast procedure in these above situations is a better proposition. This unit answers the encounters tackled by VANETs in urban surroundings. Packet delivery in rural areas does not depend on VANET, as the fixed substrate is small or nil, sometimes. Mobile systems are known for high flexibility and little node thickness in rural areas. These structures of the rural areas are completely inconsistent in nature where there is a view of the urban scenario. Recurrent alteration in network topology based mostly on the subsection of the city and the activities of vehicle are limited on the roadsides. In this, the working of UGHN protocol in urban areas is depicted as a flow chart provided below. A grid is constructed which, in turn, interconnects all vehicles that are in contact with these nodes. In the urban atmosphere, the traffic is heavy which, in turn, causes some congestion and a threat of accidents. Vehicle to vehicle communication plays a significant part in the transmission of some alert or warning messages among the vehicles. There have been several routing protocols employed in the transmission of messages among vehicles.

However, there were also some downsides in these traditional routing protocols. Therefore, a UGHN protocol is implemented in urban areas for overcoming these limitations. A grid network is designed from which the nodes are separated for the transmission of warning messages among the vehicles to alert them. The performance is estimated and compared with the existing approach. A broadcast storm may cause redundancy of broadcast, collision of packets, contention in a severe manner, incompetent usage of processing power and bandwidth and service disturbance due to of high dispute in the channel. Nodes in MANETs determine the routes obviously by merging RREQ (Route Request) packet over and done with the network. The node obtains the RREQ packets for the initial time, rebroadcasting the packet, (or) answers to the basis, if it has the way to the end point (or) is the terminus of the RREQ package. Transmission squall arises, if the updating is not completed effectively.

The method of increasing ring exploration is cast-off to switch the transmission area to inside a insufficient stages away from the basis. In this method, the nodes hoard the directing admission for lengthier phases for speeding up the acceleration procedure and also answer in support of the end point node (Gratuitous Route Reply). Subsequently it can do a directing table by snooping on the deliberation of other nodes. All these performances reduce broadcast idleness, but they might reduce network connectivity and extend the route detection development.

The downside of transmission storm in MANETs is the dispute interruption which may protract path attainment, and interrupt continuing broadcasts which are unwanted. In VANETs, the propagation of communications inside a convinced area is utilized for security and safety associated requests. Traffic communication should be in system for an extended period of time.

So, the Road Side Unit (RSU) that transmits the messages would occasionally rebroadcast road traffic communication to the vehicles to retain activity for longer phases. As the road traffic thickness and occurrence at which RSU show the messages as high, broadcast storm happens in VANETs. This would, in short, lead to consumption of bandwidth, dispensation time and augmented average admission delay. A larger problematic feature is disturbance i.e., other imperative security communications might become lost (or) deferred all through the transmission storm.

3.4 Simulation Results and discussion

The proposed RGHN and DSR protocol have been only many real world VANET protocol experiments. Therefore, researchers are mostly using various VANET simulators for the evaluation of protocols. VANET simulation tools are the easiest, fastest and most the efficient way to evaluate VANET protocols. The latest approach is to use VANET simulation tools with bidirectional coupling of road traffic micro-simulation and network simulation. Although, some of them can provide a high degree of realism, there are still numerous factors from real world environment that can influence the mobility and network traffic. Getting realistic VANET protocol evaluations requires conduct of real world experiments. Therefore, the researcher has proposed a method for easier and cheaper real world VANET experiments. The method is based on the use of smart phones for communication between vehicles. Mobile application and central server architecture are described. The simulation parameters for implementing RGHN protocol are listed in Table 3.4.1.

Table 3.4.1 Simulation Parameters of RGHN Protocol

No. of vehicles	12
Speed	5,10,15,20,25 and 30 sec
Area coverage	2500×1000m
Direction	Bidirectional movement
Simulation Time	25s
Traffic lane	Two lane roads
Features of vehicles	GPS enabled vehicles
Nodes	Small number of nodes

IV. RESULTS AND DISCUSSIONS OF RGHN PROTOCOL

The performance analysis of the proposed RGHN is estimated in terms of packet loss ratio, packet delivery ratio, throughput, and delay. The packet delivery ratios of RGHN and DSR protocols under varying vehicle densities is given in Figure 1.

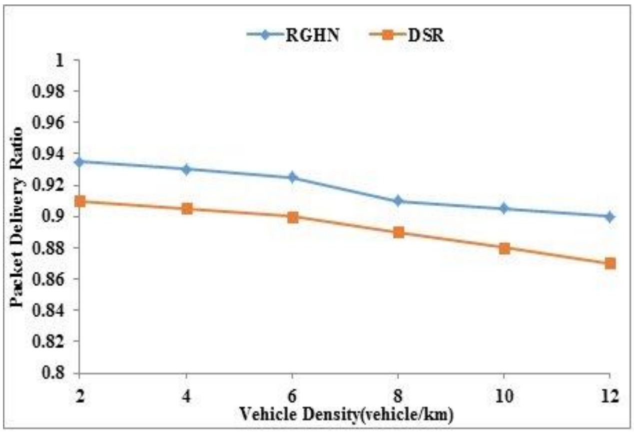

Figure 1.Packet delivery ratio of RGHN and DSR protocol varying vehicle densities

The packet delivery ratios of the proposed RGHN and the existing DSR have been presented in Figure 5.5(a). The ratio of PDR is estimated in terms of density which is measured in terms of vehicle/km. The proposed method yields values from 0.8 to 0.95 and the density values from 10 to 60. This Proposed technique provides a better packet delivery ratio in comparison with the existing technique.

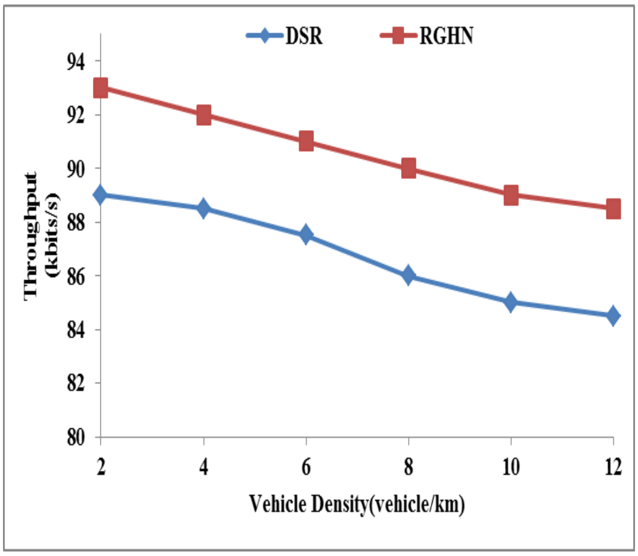

Figure 2.Throughput of RGHN and DSR protocol under varying the vehicle densities

The throughput of the proposed RGHN and existing DSR are presented in Figure 2. The ratio of PDR is estimated in terms of density which is measured in terms of vehicle/km. The proposed method yields values from 88 to 94 and density values from 10 to 60. This proposed GHN technique provides a better throughput in comparison with the existing DSR technique.The results show the ability of the RGHN algorithm to reduce broadcast storm by more than 14 percent compared to the existing algorithm. The delay rate is estimated in terms of density which is measured in terms of kilobits /sec. The proposed method yields values from 20.1 to 25 and the density values from 10 to 60.

This is proof of the researcher's proposed technique enabling a reduced delay compared to the existing technique. The end to end figures of delay of RGHN and DSR protocols under varying vehicle densities are shown in Figure .

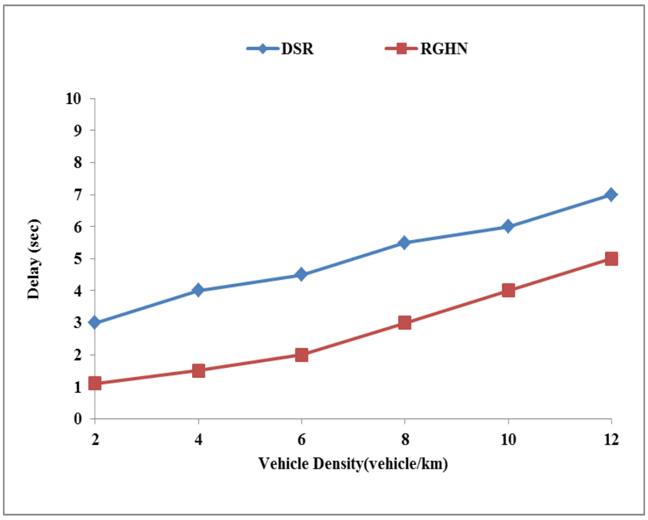

Figure 3 End to End Delay of RGHN and DSR protocol under varying vehicle densities

The delay figures of RGHN and DSR protocol under varying vehicle densities are shown in Figure 3. The packet loss ratio is estimated in terms of density measured in terms of vehicle/km. The proposed method yields a value from 9 to 16 and the density values from 2 to 12. The packet loss ratio figures of RGHN and DSR protocol under varying vehicle densities are given in Figure 4.

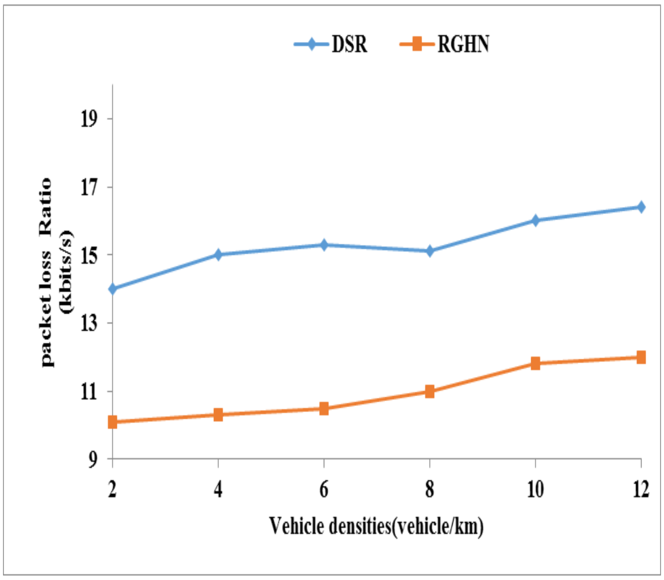

Figure 4.Packet loss Ratio of RGHN and DSR protocol under varying vehicle densities

The RGHN protocol has the ability to identify the location based coverage area in the networks effectively. As a result, the packet loss ratio of RGHN protocol is 23 percent lower than DSR protocol. When the speed of the vehicles increases, the packet loss ratio decreases. This is due to the cross layer check performed by DSR protocol. Hence, the RGHN protocol provides reliability from the vehicles effectively. As a result, the packet loss ratio of RGHN protocol is lower than DSR protocol.

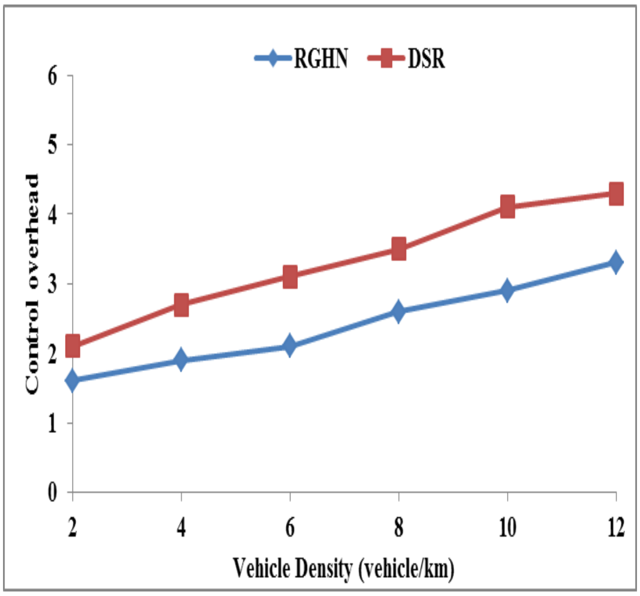

Figure 5. Control overhead of RGHN and DSR protocol under varying vehicle densities

Figure 5 shows the overhead of RGHN protocol as 22 percent which is lower than that of the DSR protocol. However, the speed increases from 5m/s to 30 m/s when route changes are made more frequently and route discovery mechanism is initiated in DSR protocol. The results, shows that RGHN protocol having lower overhead due to its use of GPS based location services, control overhead of reestablishing the path when it is distributed due to high mobility of vehicles.

4.5. Results and Discussions of UGHN protocol

The performance analysis of the proposed UGHN in urban areas is estimated in terms of packet loss ratio, packet delivery ratio, throughput, and delay. The simulation parameters for implementing UGHN protocol are listed in Table 4.5.1

Table 4.5.1 Simulation parameters of UGHN protocol

No. of vehicles	60
Speed	5,10,15,20,25 and 30 sec
Area coverage	2500×1000m
Direction	Bidirectional movement
Simulation Time	25s
Traffic lane	Two lane roads
Features of vehicles	GPS enabled vehicles
Nodes	Small number of nodes

The packet delivery ratios of the proposed RGHN and existing AODV are presented in Figure 6. The ratio of PDR is estimated in terms of density which is measured in terms of vehicle/km. The proposed method yields values from 88 to 95 and the density values from 10 to 60. This clearly shows the proposed technique providing a better packet delivery ratio in comparison with the existing technique which is in figure 6.

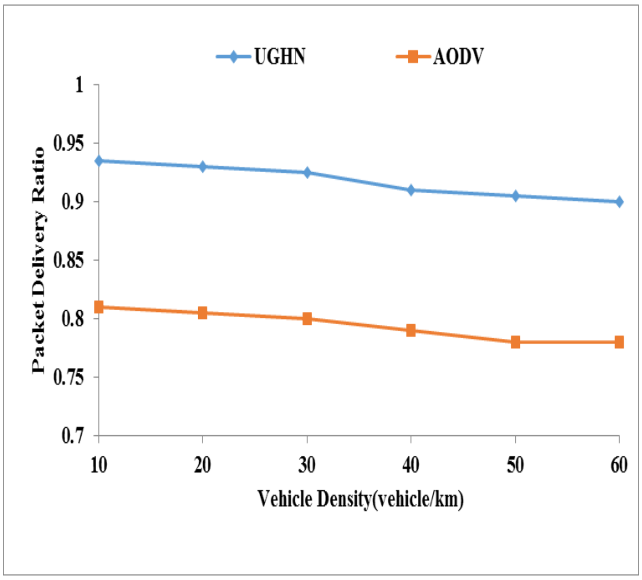

Figure 6.Packet delivery ratio of UGHN and AODV protocols under varying vehicle densities

The results show the ability of the GHN algorithm to reduce the broadcast storm by more than 14 percent in comparison with of the existing algorithm. The algorithm also proves vital when a larger number of vehicles are used and also with features. The throughput of UGHN and AODV protocols under varying vehicle densities are given in Figure 7.

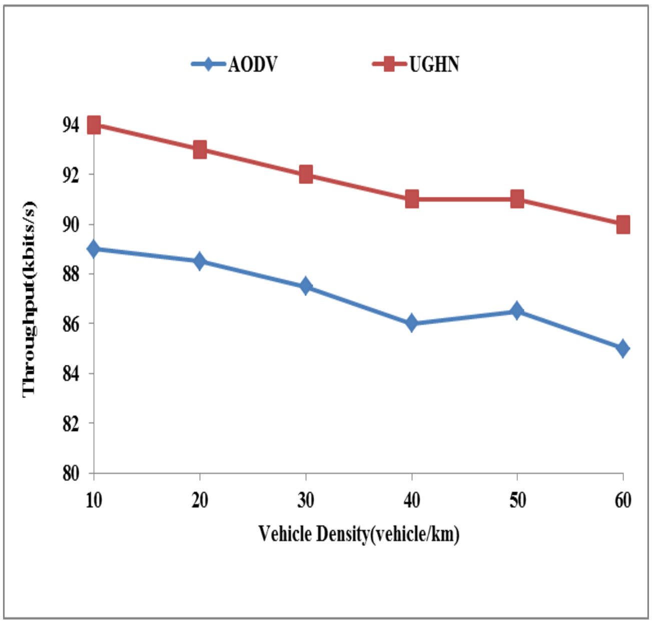

Figure 7.Throughput of UGHN and AODV protocols under varying vehicle densities

The throughputs of the proposed UGHN and existing AODV are presented in Figure 7. The throughput rate is estimated in terms of density which is measured in terms of kbps. The proposed method yields values from 89 to 94 kbits/s and the density values from 10 to 60 vehicle. This is clear of the proposed UGHN technique providing a better throughput compare to the existing technique. The packet delivery ratio of UGHN and AODV protocols under varying vehicle density is in Figure 8.

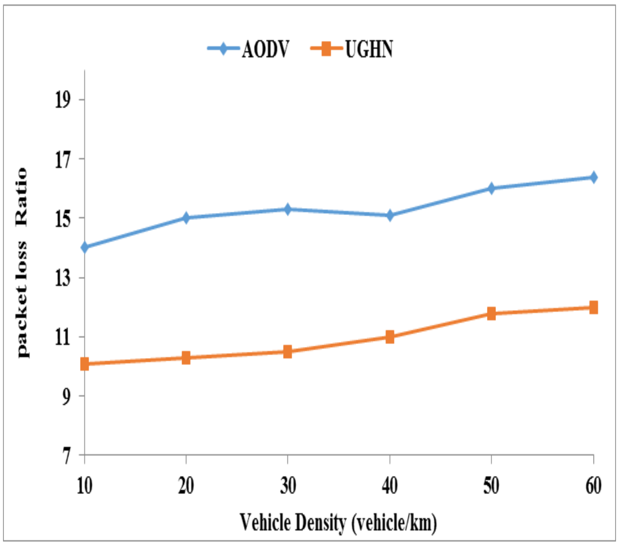

Figure 8Packet loss ratio of UGHN and AODV protocols under varying vehicle densities

The ratio of packet loss ratio is estimated in terms of density which is measured in terms of kbps. The proposed method yields values from 10 to 17 and the density values from 10 to 60. This is clear proof the proposed technique providing a reduced packet loss in comparison with the existing AODV technique. The packet loss ratio of UGHN and AODV protocols under varying vehicle densities are shown in Figure 9.

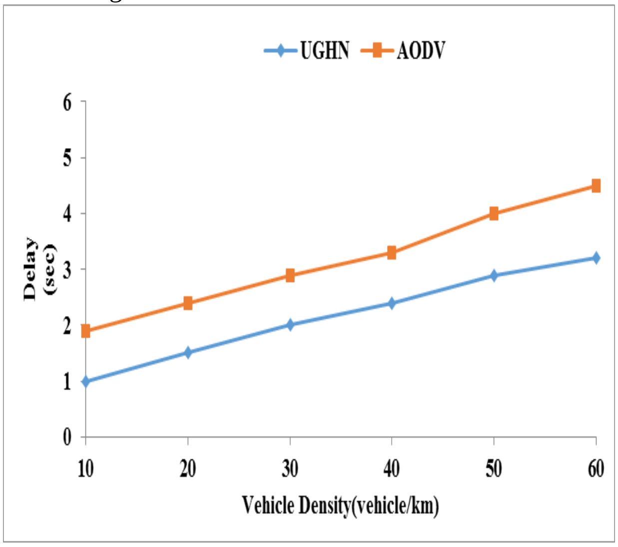

Figure 9.Delay of UGHN and AODV protocols under varying the vehicle densities

Figure 9 indicates the delay of UGHN protocol as 8 percent lower than AODV protocol. UGHN protocol has the ability to avoid congestion and collision in the transmission. Implementing of UGHN protocol, leads to the simulation results showing its incurring a lower average delay when compared to AODV protocol in the network. The control over head for of nodes vehicles of varying numbers like from 10 to 60 for which, the delay values of UGHN from 1 to 10 is estimated. The throughput value is computed in terms the of number of packets per second.

The control overheads of UGHN and AODV protocols under varying vehicle densities are given in Figure 10.

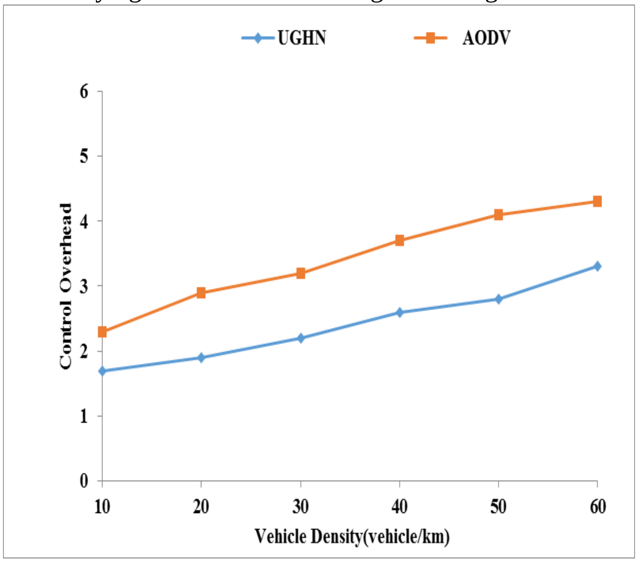

Figure 10.Control overhead of UGHN and AODV protocols under varying vehicle densities

Figure 5.6 (e) shows the control overhead of UGHN protocol as 2 percent lower than AODV protocol. However, the speed increases from 5m/s to 30 m/s, route changes are made more frequently and route discovery mechanism is initiated in AODV protocol. The results show lower overhead in UGHN protocol due to its use of GPS based location services, control overhead of reestablishing the path when it is distributed due to high mobility of vehicles.

V. CONCLUSION

In this paper, a GHN protocol has been proposed which has three stages for improving the broadcast level in VANET. It consists of two new protocol called as RGHN and UGHN. This chapter has also dealt with the performance of the have been described in detail RGHN and UGHN in rural and urban areas where the availability of road side unit is rare or hardly found. Thus, the efficiency of the transmission of message among the vehicle increases through use of a group head node in rural scenarios. The algorithm has been improved by further increasing the different parameters of vehicles by increasing the simulation throughput value, the number of vehicles in the broadcast and by reducing the transmission packet loss. The working of RGHN algorithm in rural areas and UGHN algorithm in urban area has been made effective by proving the efficiency of the protocol performance. The outcome of the system proves to be more efficient in terms of data, throughput packet delivery ratio, and packet loss ratio than the DSR and AODV.

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