GPCR MA: An Adaptive Approach Over GPCR For Vehicular Ad-hoc Network

Naziya Hussain, Dr. Priti Maheshwary, Dr. Piyush Kumar Shukla, Anoop Singh

Abstract— The term VANET developed regularly synonymous with additional broad term IVC (inter-vehicle communication), while the focus on remains feature of spontaneous networking system, less on infrastructure use such as RSUs and cellular networks. VANET conventions have high experiments because of powerfully trading topologies and symmetric connections from systems. The VANET protocols are "Greedy Perimeter Coordinator Routing", Greedy Perimeter Coordinator Routing with Movement Awareness (GPCR-MA). And include five QoS parameter performance, namely Average Delay, Average Energy Consumption, Packet Delivery Ratio, Network Overhead and Throughput, which are created and contrast with their QoS parameter execution. Toward the end of the investigation, plan a general examination for these conventions as for their QoS parameter and further comprehend the future extent of this study. Here we have taken diverse sorts of situations for simulating and analyzing the performance results. This paper indicates the comparative study of two main VANET protocols are studied and improved according to their algorithm. GPCR-MA is an improvement for the GPCR protocol that efforts on routing a vehicle affecting in the line of association of the concluding target. Based on the performance propose enhancements to GPCR-MA in order to progress performance.

Index Terms— GPCR, GPCR-MA, QoS, VANET, Routing Protocol, Movement Awareness.

1 INTRODUCTION

VANETs are a specific type of remote system made by vehicles imparting among themselves and with roadside base stations [1]. Be that as it may, all together for these advancements to make them to the organization arrange, potential security and protection issues [2, 3] must be tended to. Since protection is a twofold edge sword because of its contention with other security necessities, a contingent and trade off arrangement should be at the place keeping in mind the end goal to adjust the impact of contention. For instance, if there should arise an occurrence of Sybil assault and protection preservation, just an exchange off arrangement is conceivable to prevent the impact of the Sybil assault and monitor the restrictive security of the clients in the meantime. [4] Without tending to these issues, consumer loyalty will be a tested, which will straightforwardly influence the plausibility of these advancements.

VANETs are disseminated and self-sorted out arrange and give the office to move or convey the vehicles or node with remote specialized devices. Vehicular ad-hoc system is a part of IT'S to bring change of the conventional transport system execution and furthermore enhancing the safety of the customary transport system. ITS give the methods in which the vehicles can move onward the congestion [10-14].

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In the design of the VANET, there are numbers of vehicles, moving with one position then onto the next on their path and these vehicles can communicate from another vehicle called V2V correspondence. There are a few Road side Unit (RSUs) which are associated through web and having capacities to speak with Vehicles [15-18].

Before of GPCR, many existing protocol are counted for position based routing protocol [5], all these are extremely very much coordinated for dynamic conditions like as between vehicle correspondence on the highways, however now GPCR is a best case of the position based steering. Notwithstanding, it as of now examined for radio obstructions [6],as they are speak to for urban ranges, which have been huge for many adverse effect on the best execution of the position-based routing in the VANET System. Always it's choosing a closest neighbor's for transferring the information from source to destination. Some of the researchers are known this method as greedy forwarding method. In which every node have a prior knowledge of its current position and surrounding nodes. In preceding work [7] represent a position based algorithms. This algorithm required complete learning of city arranges topology that is given by static guide. Based on this data sending the data along a road which performed in position based way while run down of intersections which need to be crossed by data is measured by sender side grounded on static map utilizing Dijkstra most limited way calculation. In this examination paper we are speaking to the how position-based directing acquired in a city situation.

2. GPCR

GPCR vehicular routing protocol is completely based on position, which utilized a changed greedy sending with repair methodology with no require chart planarization calculation. Here some points specify which give the only data on the adjusted repair methodology.

The repair methodology which is utilized as a part of our GPCR vehicular routing that keeps away from the utilization of diagram planarization by making a directing choice in light of the lanes and intersections rather than singular hubs and their availability. As per result of repair strategy in GPCR involves two areas: (1) on each crossing point it must be picked which road data take after next. (2) Amidst crossing points an extraordinary kind of greedy is use to forward the packet towards the accompanying simulation areas. Given no outer guide is available for key experiments to perceive vehicle that convergence and to abstain from missing crossing points, while enthusiastic forward packet used. In Figure 1(a) organize is indicating where bundles forward past the crossing point to hub if standard sending were used. Whatever is left for this effort then nodes are situated on simulation area of an intersection segment of road. On an initial step we expect that every vehicle knows its positions whether it is an organizer or not.

For whatever length of time that there are no qualified neighbors which are facilitators the hub with the biggest separation to the sending hub is picked. In the event that organizers are qualified then one facilitator is arbitrarily picked as next bounce. With this approach parcels won't be sent crosswise over intersections. Figure 1(a) demonstrates a case of how the following jump is chosen on a road. Hub a gets a packet from hub b, since situated on a road and not on an intersection road it must to forward a packet along the road. Initially qualified neighbors are resolved. At that point it is checked whether no less than one of them is an organizer. As in this case there are three facilitator hubs that qualify as a next bounce one of these organizer hubs is picked arbitrarily and the parcel will be sent to this facilitator.

We are indicating in this portion, how a vehicle are exchanging the information each other. In this case node send the information from source to destination which arranged on a street and not belong to crossing point of packet which is for forward along with street towards the supplementary junction. To get this transmission information of node preferences those neighbors that around build up the line between the sending node's indication and the sending hub. Out of these qualified neighbors one must be picked as the accompanying next move of the next vehicles. At the point, when, no qualified neighbors which are facilitators the node with the greatest separation to the sending node is picked, with this approach packet won't be sent crosswise over junctions.

In the event that forwarder node is situated on a crossing point then hub needs to figure out which road packet must to take after next. The road network of city viewed as a planar chart and right-hand lead [9, 5] is connected. In figure (b) packet on goal D achieves a neighborhood ideal at source vehicle S. The forwarder of the packet is then changed to the repair procedure and it is protocol along the road until the point that it hits the principal organizer vehicle. Vehicle node C1 gets the data that needs to choose the road packet must be taken after. Utilizing the right-hand run it picks the road that next one counter-clock shrewd from the road packet has touched base on. In this manner vehicle I will be sent the forwarder vehicle. The data will be sent along the road until the point that the following convergence is come to. At the point when the forwarder vehicle at the organizer C2 this vehicle needs to choose again the following road that is taken and chooses to forward the vehicle to vehicle L. Based on distance till destination is reduced as compared to the establishment of repair policy at source node(S). Hence forth vehicle policy mode is switched again to greedy.

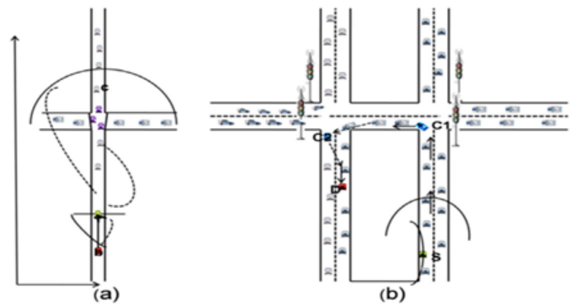

Fig 1: The Graphical illustration of discovery the forwarding node policy. In this figure, have two graphical representation left side (figure 1(a)) is avoid a missing junction by discovering the Coordinator nodes and right side (figure 1(b)) is complete based on the repair strategy

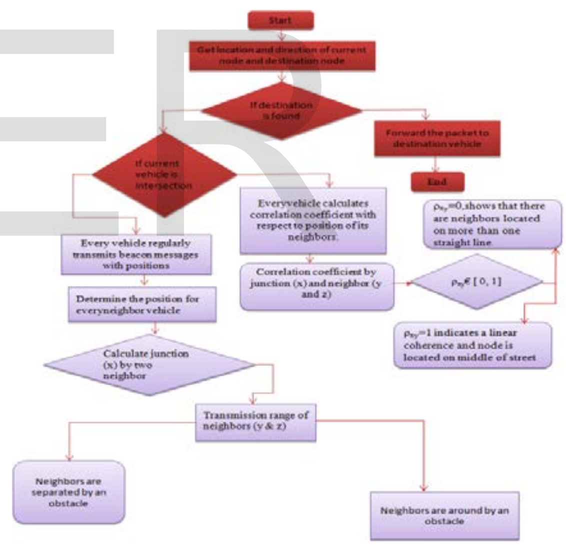

Fig 2: Flowchart of GPCR

2.1 Detecting junctions: In this following session process of detecting junction are presented with the help of two alternate methods. 1) This approach presented every vehicle frequently transmit beacon messages with position of that vehicle forwarding beacon and the position of each & every neighbors of its After detecting the beacon messages of vehicle has the complete information for every neighbor: vehicles position and the existence of neighbor's neighbors. Suppose vehicle x is then measured to be located in a network junction, if it has two neighbors vehicle y & z and its transmission range to every other but cannot list every other as neighbors vehicle. This approach indicates that those neighbors vehicle are separated by an obstacle and that vehicle x is able to forward messages across the obstacle. 2) In which approach does not require to vehicle forward any special beacon messages. Every vehicles calculates the correlation coefficient with respect to their position of its neighbors. The correlation coefficient of vehicle is defined as:

$$\rho_{xy} == \left|\frac{\sigma_{xy}}{\sigma_x \sigma_y}\right| = \left|\frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{(\sum_{i=1}^{n}(x_i-\bar{x})^2)(\sum_{i=1}^{n}(y_i-\bar{y})^2)}}\right| \text{ With } \rho_{xy} € [0, 1].$$

A correlation coefficient of vehicles is 1shows a linear consistency and it is found when vehicle is located in middle of road.

A correlation coefficient of vehicles is 0 indicate in which are neighbors vehicles are located on more than one straight line. After adjusting a threshold €vehicle can measured the correlation coefficient of vehicle and assume with$\rho_{xy} \geq €$ that it is located on a road network and $\rho_{xy} \geq €$ with that it is located within the area of a node junction. The flowchart of GPCR is presented in figure (2).

Algorithm

- Input: ID of source vehicle S and Destination vehicle D
- Outputs: route from source vehicle to destination vehicle
- Begin
- if (ID D = ID N)
- Forward packet to D;
- Else
- Node's coordination for source= [X1min , X1max , X2min, X2max];
- Node's coordination for destination = [X1min , X1max , X2min, X2max];
- Calculate direction of both source and destination
- If broadcast RREQ to D based on vehicle's coordination
- Activate (BROADCAST_TIMER);
- (Sforwarding_packet = D received_packet)
- End
- else
- if (D forwarding_road_segment = D current_road_segment)
- each vehicle regularly forward the beacon packet with positions
- calculate position = [X1min , X1max , X2min, X2max];
- calculate intersection vehicle and transmission range
- forward to the N intersection_vehicle;
- forward the packet directly to its farthest N neighboring_vehicle;
- forward packet to destination vehicle;
- while (forwarding vehicle is not destination vehicle)
- go back to intersection vehicle
- else
- Each vehicle (x) calculates the correlation coefficient with respect to the position of its neighbors (y and z)
- $\rho_{xy} == \left|\frac{\sigma_{xy}}{\sigma_x \sigma_y}\right| = \left|\frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{(\sum_{i=1}^{n}(x_i-\bar{x})^2)(\sum_{i=1}^{n}(y_i-\bar{y})^2)}}\right|$

  Where n=number of vehicle, i=1,2,3,4……….n
- ρ_{xy}€ [0, 1]
- If ρ_{xy}=0
- shows that there are neighbors located on more than one straight line
- end
- If ρ_{xy}=1
- indicates a linear coherence and vehicle is located on middle of street
- end

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2.2 Issues in GPCR

GPCR vehicular routing protocol having certain drawbacks over GPCR-MA. In which if any vehicle located on the junction no matter inside or outside of the network, it is a coordinator but in GPCR-MA, it's checked the vehicle position, transmission range and area of that intersection vehicle. In the following GPCR present two alternative approaches, In first approach, vehicle node continuously send beacon messages with proper, this approach can be lost due to obstacle or weak signal during the message transmission and but second approach correlation coefficient with respect to the position. The second approach correlation coefficient with their position of its neighbors not having perfect correlation to detect the junction. Beacon messages is affected by very high and very low mobility and coordinator may not able quantify next hop the vehicular networks in the greedy forwarding measures and edges to the data packet loss.

The using of Planarzed graphs in GPCR having repair policy when greedy forwarding not get. If no vehicle on the junction then coordinator vehicles is chosen randomly in GPCR.

3. Proposed Work: GPCR with Movement Awareness(GPCR-MA)

GPCR-MA The portability aware augmentation of GPCR convention, called Greedy Perimeter Coordinator Routing with Movement Awareness (GPCR-MA), draws out the arrangement of parameters utilized for a steering choice with the walled in area of (i) speed (ii) bearing of the vehicle. Speed is measured in m/s, and in view of the separation and time while course depends on edge amongst vehicle and section associating with the goal. These Nodes included such parameters like intermittent area of the parcels, which in our execution compares to an overhead and bundle convey proportion of which added to the GPCR header. Other way, speed and heading can't be passed on plainly however it inferred by neighboring hubs utilizing hub's directions. It ought to be featured that GPCR-MA usefulness is kept completely relentless with the first GPCR detail – including "facilitator" property where each hub arrange with their neighboring neighbors. The flowchart of the proposed GPCR-MA convention is spoken to in (figure 3). GPCR-MA improvements are the following [8]:

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Procedure 1: route discovery [8]

- Input: ID of source node S and Destination node D
- Outputs: optimal route from source to destination
- Begin
- if (ID D = ID N)
- Forward packet to D;
- Else
- Vehicle's coordination = [X1min , X1max , X2min, X2max];
- Calculate direction of both source and destination broadcast RREQ to D based on vehicle's coordination
- Activate (BROADCAST_TIMER);
- Calculate route probability of connectivity and packet delay;
- if (p max – p other > E)
- return route with the probability of connectivity pmax;
- else
- delete routes with the probability of connectivity p other < p max – p threshold;
- return route with packet delay d min;
- end if
- end if
- End of Route Discovery

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Procedure 2: Next-Route Position [8]

- Inputs: speed and angle of the neighbor's
- Outputs: The optimal next-position of forwarding vehicle
- begin
- do
- if (D forwarding_road_segment = D current_road_segment)
- else
- forward to the N intersection_vehicle;
- else
- forward the packet directly to its farthest N neighboring_vehicle;
- while (forwarding vehicle is not destination vehicle);
- forward packet to destination vehicle;
- end if
- end if
- end while
- End of Next-Route Position

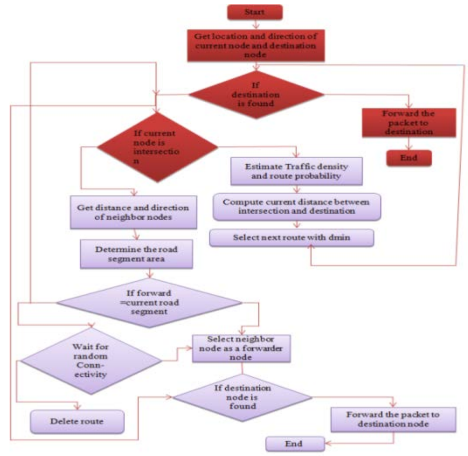

Fig 3: Flowchart of proposed work GPCR-MA[8].

In the GPCR and GPCR-MA are ascertaining the vehicle hub position in arrange and Pythagorean Theorem is utilized to decide the separation amongst source and neighbor hub in condition (1), where the places of source and neighbor are (x_1, y_1) and (x_2, y_2)

$$Distance = \sqrt{\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}} \qquad (1)$$

4. Simulation Assumptions

- ➢ Here create a road topology with the help of node in ns2.35.
- ➢ Every hub keeps up a neighbouring rundown in view of the most recent data got after a specific time. Data messages are sent to every one-jump neighbour. On the off chance that a hub does not get messages from one neighbour amid a specific day and age, at that point the connection is considered down.
- ➢ For course estimation a diagram G (V, E) hypothesis is accustomed to comprising of a street crossing points or intersections v ∈ V and street sections e ∈ E here each fragments are associated with the convergences.

5. Performance Metrics

a. Average delay

Average delay communicated with normal time which information packet go in transmission from source vehicle to goal however since all deferrals started by buffering, lining and spread postponements. Thus, delay somewhat depends on packet transmission. When distance increased between transmissions, probability of drop packet is also increased. Mathematically formula of average delay (D) and total number of packets delivery successfully (n) in this scenario shown in equation (2).

$$Average\ end2end\ delay = \frac{\sum_{i=1}^{n}(Received\ Packet\ Time - Send\ Packet\ Time) * 1000(ms)}{Total\ Number\ of\ Packets\ Delivery\ Successfully}$$
(2)

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b. Average Energy Consumption

The Average spent energy is calculated by total number of energy is consumed for transmitted and received packets during the simulation in the networks. The total energy depletion is the summation of spend energy of overall nodes in the network, where the spend energy of node is the summation of energy spend for communication, packet transmit (Pt), received packet (Pr), and idle packet (Pi).

c. Average routing overhead load

The normal directing overhead load communicated the aggregate total number of overhead routing data transmitted from all source vehicles inside the whole system over given simulation time.

d. Average network throughput

The average throughput expressed total amount of the packets data which positively inwards towards destination as per given simulation time. The mathematical calculation of throughput shows, here PacketSizeis size of packet of ith packet reaching to destination, PacketArrival is the time when last packet arrived and PacketStart is the time when firstpacket arrived to destination.

$$Throughput = \frac{PacketSize}{(PacketArrival - PacketStart)} \quad (3)$$

e. Packet Delivery Ratio (PDR)

It is the ratio all packet positively reached at destination nodes source nodes. Network presentation is high, when data delivery ratio is high in the network. The mathematically calculation of packet delivery ratio shown in equation (4)

$$\text{Packet Delivery Ratio} = \frac{\sum \text{No.of data received by destination side}}{\sum \text{No.of data send by source side}} \quad (4)$$

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6. Results Analysis

The performance of GPCR and GPCR-MA are shown with the help of network simulator. Here used a real road network topology. The development consists of 10, 20, 30, 40 and 50 vehicles (nodes) on streets. The undertaking of presented nodes was produced with VANET simulator [5]. For the evaluation considered two protocols of the vehicular networks- GPCR, GPCR-MA Protocol is designed for qualified study based on QoS performance parameter. The RWP mobility model is used for random movement of the vehicle mobile nodes. Simulation parameter tables I are mention here.

Table I
Simulation Table with parameters values

PARAMETERS	VALUES
Operating System	Linux (Ubuntu 12.04)
NS-2 version	NS-2.35 for IEEE 802.11Ext
No. of vehicles	0, 10, 20, 30, 40, 50
Number of road segments	4
Speed of vehicles	20 m/s
Mobility Model	RWP
Packet Size	512
Traffic Type	UDP/CBR
Simulation Time	0, 10, 20, 30, 40, 50 Second
Antenna Type	Omni-Antenna
Transmission Range	1000*1000 m
Routing Protocol	GPCR, GPCR-MA

Several simulations scenarios on the different approaches were done. As detecting junctions by calculating the distance from the sending packet node to the receiver node. Here represent three different comparison scenarios of the present work.

Results-2: Comparison of GPCR and GPCR-MA Protocol based with respect to the variation of node.

Table II
GPCR-MA and GPCR vehicular routing performance comparison with respect to variation of node

No. of Node	Average Delay		Average Energy Consumption		Average-Throughput		Packet Delivery Ratio	
	GPCR	GPCR-MA	GPCR	GPCR-MA	GPCR	GPCR-MA	GPCR	GPCR-MA
0	0	0	0	0	0	0	0	0
10	5.56	0	3.522	0	41.05	44.75	51	71.96
20	8.46	4.46	6.26	7.16	4.83	48.53	52.36	72.57
30	16.76	6.76	7.53	6.33	55.25	61.25	59.96	72.96
40	18.95	13.95	8.21	6.11	60.98	62.98	65.57	75.57
50	25.67	20.67	9.48	6	66.67	76.67	66.11	76.11

Here, all vehicle nodes were examine using GPCR and GPCR-MA routing protocol with the help of CBR traffic application. The CBR application is were checked by different performance metrics parameters.

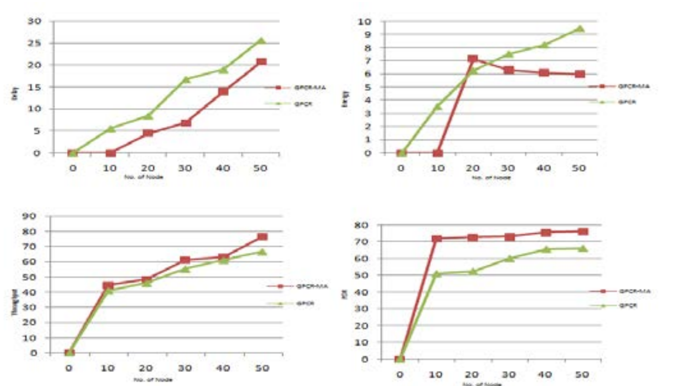

Fig 4: Comparison of the Delay, Energy, Throughput and PDR between GPCR and GPCR-MA based on the No. of Node.

(Figure 4 and Table II) indicating the Performance of GPCR and GPCR-MA with respect to network density load. GPCR and GPCR-MA increases but less value with compare to GPCR-MA protocol. When number of vehicle nodes is increasing then delay is also increasing of both routing protocol, the overall performance of delay is varies with the number of nodes, but GPCR-MA performance is better that GPCR. The GPCR energy consumption increased with respect with variation of vehicle node, but GPCR-MA routing protocol is consumed less energy during the transmission. The GPCR-MA and GPCR almost same with the variation of vehicle nodes but GPCR -MA better than GPCR (Figure 4). The performance of GPCR-MA is better than GPCR. With the variation of vehicle nodes GPCR routing protocol having worst performance.

Results-3: Comparison of GPCR and GPCR-MA Protocol based with respect to simulation time.

Table III:
GPCR-MA and GPCR vehicular routing performance comparison with respect to simulation time.

Simulation Time	Average Delay		Average Energy Consumption		Average-Throughput		Packet Delivery Ratio	
	GPCR	GPCR-MA	GPCR	GPCR-MA	GPCR	GPCR -MA	GPCR	GPCR -MA
0	0	0	0	0	0	0	0	0
10	1.98	0	1.501	1.001	32.44	32.44	70.74	70.54
20	3.82	1.82	1.333	1.133	40.38	49.38	75.89	75.89
30	8.64	5.64	2.687	2.387	59.7	62.7	69.26	70.26
40	20.52	7.20	5.578	3.578	60.12	6312	67.87	6887
50	29.42	9.42	6.768	3.768	72.87	76.87	68.87	68.87

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(Figure 5& Table III) indicating GPCR-MA serves the best performance as compare to the GPCR protocols. The GPCR-MA protocol showed the less delay with the variation of simulation time as compared to GPCR protocol. GPCR-MA protocol outperforms as compared to GPCR protocols in all conditions.

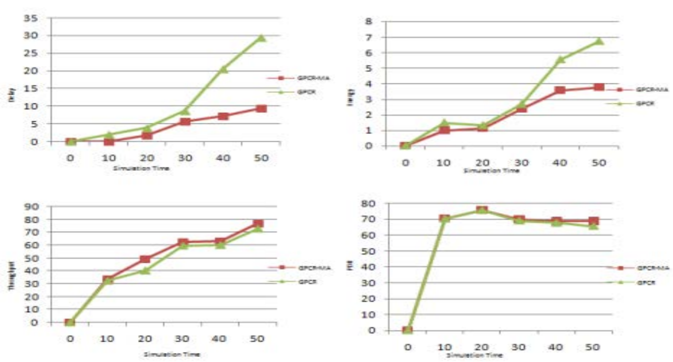

Fig 5: Comparison of the Delay, Energy, Throughput and PDR between GPCR and GPCR-MA based on the simulation time

4 Conclusion

GPCR-MA VANET routing protocol shows best performance over all the QoS performance parameter with the different scenario and it have ability to continue their linking by episodic transfer of information packet need for the network. GPCR-MA accomplishes PDR, delay and network overheads of GPCR outperform in case of throughput. With the variation of pause time, GPCR-MA overtakes in all case of QoS performance parameter which is presented and we can say overall GPCR-MA is best as compared to GPCR. After explained the entire results scenario, it's clear result towards the performance of GPCR is better than other VANET routing protocols. In case of advanced node mobility, GPCR is worst routing protocol in case of PDR and energy consumption but it's almost similar for throughput and network overhead. For the real time traffic proposed protocol is mostly used over GPCR. So final conclusion, from the mention research work the overall results of GPCR-MA is best for VANET traffic.

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