A survey, Performance Analysis of ISR, TASR, VBRP Geographical Routing Protocol for Vehicular Ad –Hoc Networks

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Abstract

Vehicular ad hoc network is a technology concept (VANET) it uses the characteristics of MANET and it became the viable and valuable for the wide variety of novel applications, such as road safety, security, multimedia content sharing etc. In VANET V2V (Vehicular to Vehicular) and V2I (Vehicular to Infrastructure) communication are possible. So we need to find out the feasible and optimal routing protocol. In this research the main focus is to analyse the performance of ISR, TASR, VBRP protocols and finally the simulation results show the performance of the protocols.

Conclusions: In this article, VANET's are the main components of communication framework for Intelligent transportation system therefore, the heavy research is still going on in both industry and academic institutions .and its expected that vehicles will be equipped with most advanced onboard units, multiple communication technologies and sensor platforms, and it's also guide and provide useful information to driver for vehicle to vehicle communications.

In this article, we analyze the existing routing protocols with all metrics, the existing routing protocols have suffered in terms of dis connectivity, delay, lower throughput, packet loss, delivery issues in rural and urban areas due to heavy traffic, unpredictable networks, dynamic nature of networks and high mobility of nodes. after performing various critical analysis, its found that the ISR performs good and ISR based simulation gives better results in Packet delivery ratio, End to End delay, Data throughput and Speed of Vehicle analysis, In future gathering all various metrics of VANET routing protocols and conduct a meta-analysis of VANET performance.

Keywords: routing protocols, intelligent transportation systems, VANETs, vehicle routing, ISR, TASR, VBRP

Introduction

At present automobiles is the most form of transport used by the millions of peoples. When the parallel growing of the transport system, we need to allow the vehicles-to-vehicles communication, with primary objective of providing safety and entertainment to their users,

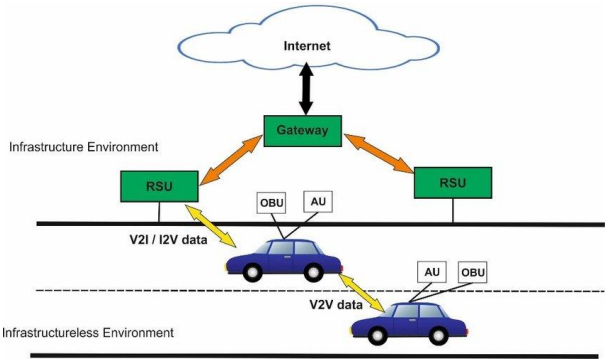
the main focus of this various protocols discussed here is to choose the optimal road routing path with minimum traffic and accident-free zones.

Apart from these this will help to raise the vehicle efficiency and contribute with the reduction of environmental pollution, vehicle to vehicle and vehicle to road side communication it will bring advantage to the user and also allow the user to access and share the video, music or even give interaction with information points existing on roads.

A single solution is deploying the Vehicular Adhoc Network (VANET), an VANET can be created and deployed anytime and anywhere without the need of infrastructure (except RSU in VANET). In VANET the element are tiny, small dynamic, portable and all are equipped with battery powered. And they communicate with each other through radio frequency signal.

Safety in driving ia a highly important thing to consider that is expected to be developed into a technology that can be utilized into a real life. One of the latest and current technology it can support safety in driving is VANET (Vehicular adhoc network). VANET are created applying the principles of MANET.at the present time car's and other private vehicles are used daily by many peoples. The biggest problem regarding them is safety. Vehicle to Vehicle and Vehicle to Roadside communications architecture can co-exists in VANET's. These types of Communications allow vehicles to share different kinds of information. The ultimate goal is to provide an accident free environment and move towards implementation of the zero- accident car by the help of VANET.

VANET Architecture



ON Board Unit (OBU)

Its present in vehicle, the inter communications between vehicle are done in this unit, its responsible for all networking and routing function

Application Unit (AU)

Its present in vehicle, it's a dedicated unit for safety applications, it decides what to do and how to disseminate information between vehicles.

Road Side Unit (RSU)

Its present in road side. The main functions is extending the communications range of the adhoc network, running safety applications and providing internet connectivity to OBUs.

One of the biggest challenges in VANET is when the number of dense nodes with high node speed causes dynamic topology changes. It causes the need for testing of several routing protocols to overcome these challenges.

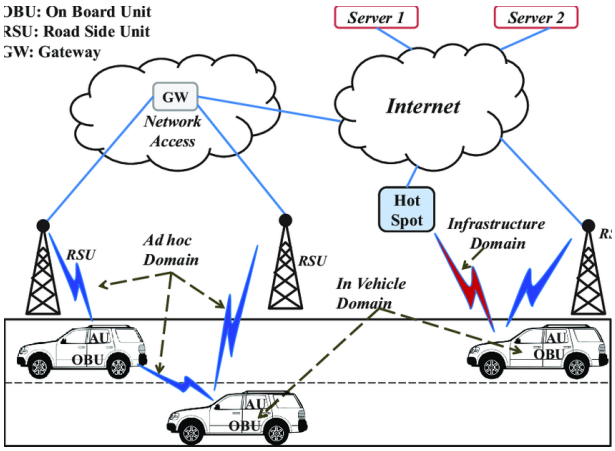
In this case, test was conducted to determine the comparison between the Improved Road Segment Routing (ISR), Traffic aware segment-based routing (TASR) and virtual backbone routing protocol (VBRP) which all these are geo-based routing protocol. I conducted the experiment using two different communication models (V2V) Vehicle to Vehicle and (V2I) Vehicle to Infrastructure, the various parameters will be considered

I. LITERATURE REVIEW

A. VANET

Vehicular Ad hoc Network (VANET) as a technology evolution of Mobile Ad hoc network (MANET), where in VANET communication can be done between two or more vehicles and this communication is referred to as Vehicle to Vehicle (V2V) or Vehicle to Infrastructure (V2I)

Communication domain



In Vehicle domain

This domain consists of an OBU and one or multiple AUs.

Adhoc Domain

Two types of communication are available in the adhoc domain.

1. Vehicle communicates with other vehicle.

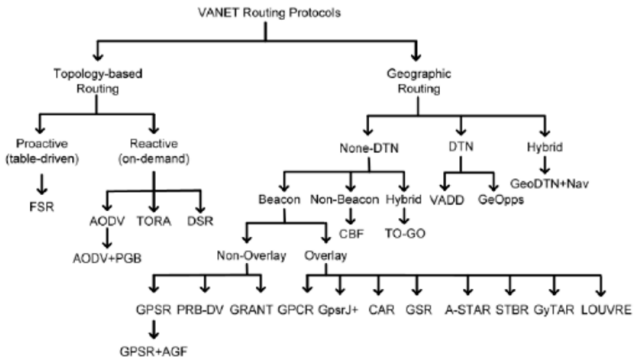
2. Vehicle communicates with an RSU.

Infrastructure Domain

The RSU can connect to the infrastructural network or to the internet allowing accessing the infrastructural network.

B. Routing Protocol

The design of routing protocol is one of the most challenging tasks in realizing VANETs; it results in network disconnections and packet dropping issues in information dissemination. We need an efficient routing protocol. The routing protocol provides on optimal network communication route and builds a path between two nodes. Optimal is meant in terms of distance means providing a network communication route to the shortest destination for the destination node to reach messages.



The main purpose of the routing protocol is to provide optimal network communication routes between the sending and receiving nodes to produce parameters values such as throughput and end to end delay values that are good.

Major routing protocols used in VANET are

1. Topology based routing protocols.

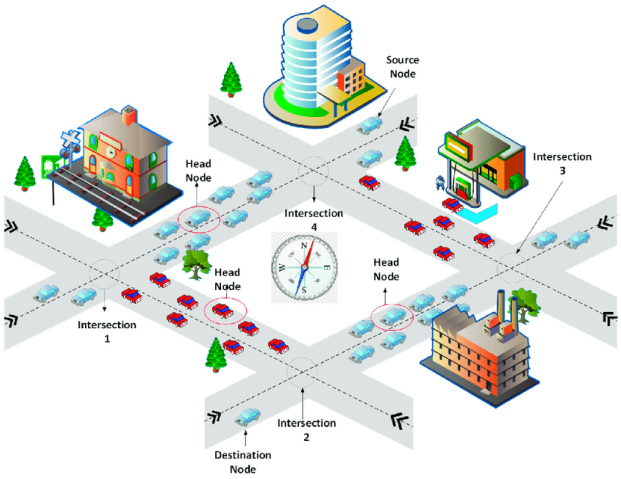
2. Geographical routing protocols.

3. Cluster based routing protocols

C. ISR (Improved Road Segment Routing)

The ISR Protocol uses segments to perform the routing in the urban VANET Environment. Routing protocol is based on routing parameters including vehicular nodes position information, direction , traffic density and link quality between the communicating nodes in the network.

Each segment contains head node (HN), in which it imitates the routing to all other nodes, When the source node finds the destination out of its direct communication range, the protocol divides the forwarding path into small road segments with the help of the location information of vehicle and the road map information of the nearby area each vehicle is considered to be equppied with OBU and a digital road map of the nearby area, here segments are identified by the no of intersections.



ISR –Head node selection method.

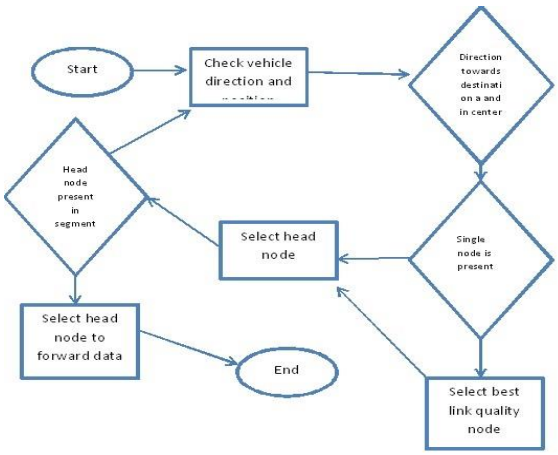
Head node (HN) is a node used for forwarding messages. the HN selection process starts for every segment after completion of segment formation, each vehicle nodes shares the information of its own position, direction and link quality of its neighbor node within the segment, the protocol checks the position and direction of each neighboring vehicle for selecting the HN.

Score function for the HN Prioritization

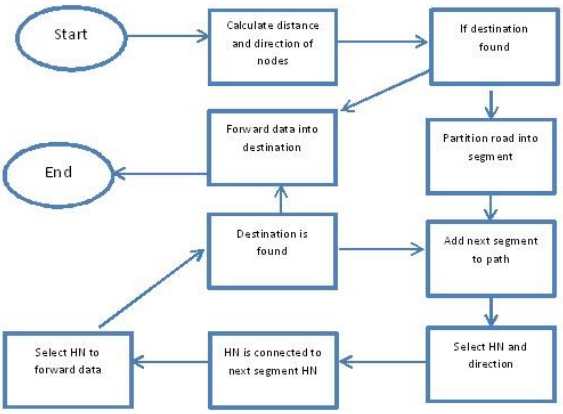
1. The first metric is position

2. The next routing metric is the direction towards the destination.

3. The third metric is link quality when there is a tie in the direction oriented score segment.

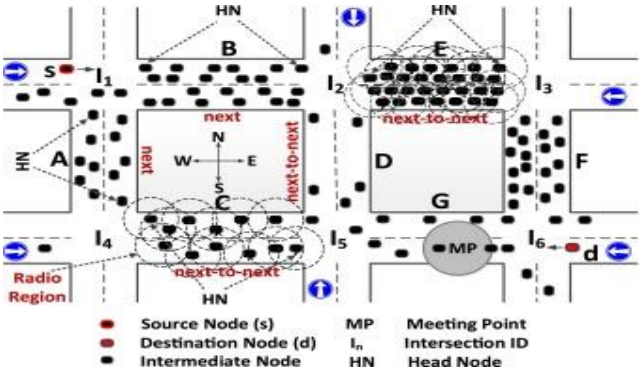


ISR Routing Process



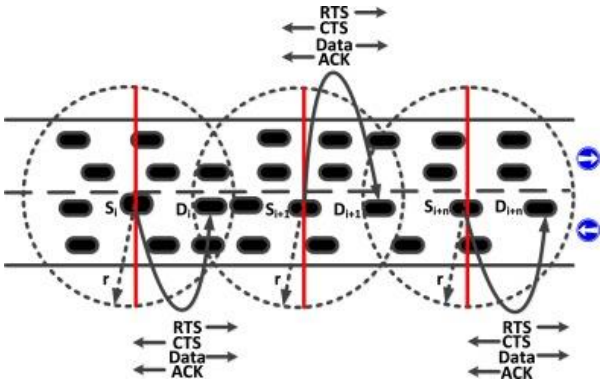
D. TASR (Traffic aware segment based routing)

TASR relies on traffics density on the road segment, TASR consider not only the next segment but also the succeeding segment, in other words TASR employs a look-ahead depth of two segments for data packet routing. Segments are formed depending upon intersections; there are two head nodes in each segment, which are present on the opposite end of segments.



HN contains segment information which include segment ID, transmission time, accessible transmission range and overall vehicular density on the segment, the HN choose the N2N segment on a metric called estimated connectivity degree (ECD), each intermediate node contains information of its neighbour nodes.

TASR protocol develops routes making use of a (RREQ, RREP), send data and receive acknowledgement (Data/ Ack) having received a RREQ packets, the receiver conditionally return RREP, Else the RREQ packet accordingly is rebroadcasted, the data from source to destination is transmitted utilizing geographical forwarding, a feedback message in the form of route error (RERR) is delivered back to the source node if the communication link breaks, Request to Send and Clear to send message are also used for communication,



E. VBRP(virtual backbone routing

The VBRP protocol utilizes RSU to assist in routing decision, in this protocol the transmission is dependent on backbone nodes on link stability and node stability, however this protocol adopts RSU for routing decision making.

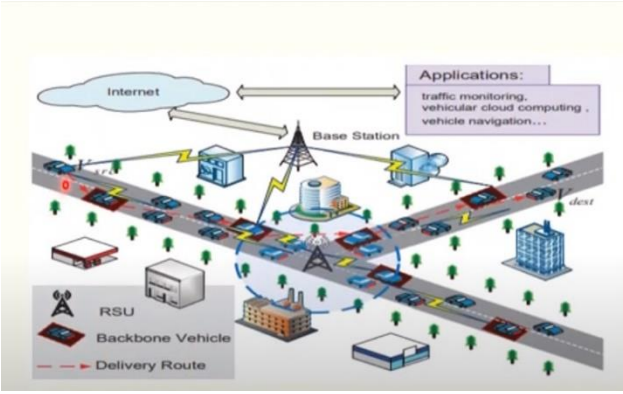
Data Forwarding

1. Packet forwarding with road segments.

In this protocol transmission mainly relies on backbone nodes, when a backbone node receives a packet in a road segment, it transmits the packet to its neighbour node towards the end side of the road, the packet is transmitted through the backbone node until it reaches the intersection.

2. Forwarding path selection at intersections.

When a packet arrives at an intersection, it searches the next routing path with the help of RSU at the junction, to forward the data, the RSU makes decision by estimating the performance of each node road segment connected to the intersection.



Methods

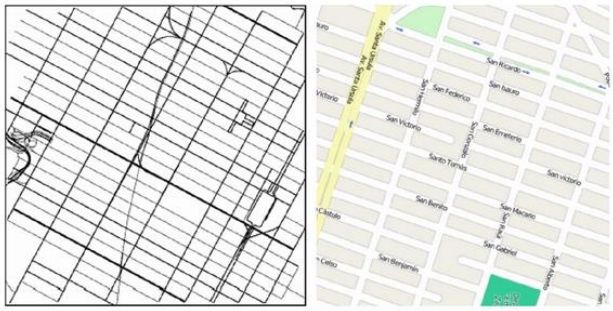
Methods of research

The next step was designing a simulation scenario. In this study, the authors conducted a simulation experiment by applying two types of communication vehicular to vehicular (V2V) and vehicular to infrastructure (V2I). the speed of vehicular nodes was set by 10-100 km/h with rectangular area by 2 by 2 km. A Chicago city map with 370 road segments and 124 intersections was used. The radio range was set to 300 m and the packet size was set to 512

bytes with 2 mb/s data rate. The time for simulation was set to 500s for each round.

A. Simulations designs

The simualtion was carried out by Sumo-move: simualtion for urban mobility model generator for VANETs.



Simulation parameters

S.No	Parameters	specification
1	Simulation model	SUMO-Move
2	Simulation time	500s
3	MAC Layer	IEEE 802.11p
4	Propagation model	Nakagami fading
5	Traffic model	CBR
6	Performance parameters	end to end ,packet delivery,data throughput
7	Antenna mode	Omni directional
8	Node amount	100-350
9	Node speed	40,100
10	TTL	10 hops
11	MAC channel bandwidth	3 mbps
12	Packet size	512bytes

The above table shows the simualtion parameters that is used in all scenario of ISR,TASR and VBRP rotuing protocol , here we use Qos parameters like end to end , packet delivery ratio and data througput , in this research data throughput serves the speed of data transfering in units per second , packet deliver ratio also measures the speed of deliver packet from source to

destination , finally end to end serves the average time it take to tansfer data packet from source node to reach the destination node.In this scenario we use IEEE 802.11p , IEEE 802.11p is the updated version of IEEE 802.11b standard, that works on data link and physical layers and enables communication between high speed vehicles.in this scenario we use simualtion propagation model –nakagami fading propagation model is to determine the fading features of wireless channels among vehicular nodes nakagami fading occurs for multipath scattering with relatively large delay –time spreads with different clusters of reflected waves.

Results

B. Simulation results

After successfully performed the experiment, the next step is to analyze the results got from each simulation scenario based on the parameters applied we have to show the observation.

In this section, the simulation results are discussed in terms of packet delivery ratio, end to end delay with maximum number of nodes in the network, with varying speed of the nodes. The PDR is telling about the ratio of the data packets successfully received at the destination over a total number of packets was sent from the source node. The end-to-end delay tells about the how much time it takes to send packet from source node to destination node. HOP link failure tells about disconnection of message during transmission from one node to another node during forwarding path. The data throughput is defined as the amount of data successfully transferred from source to destination at a time

C. Figures

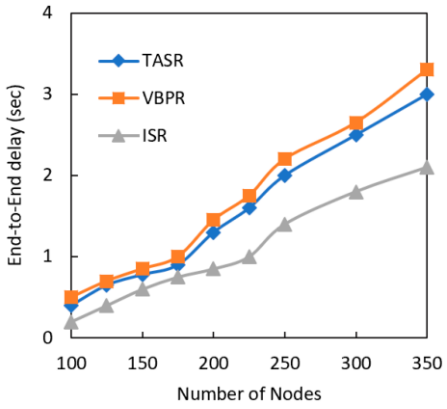
1. Total nodes analysis

In this simulation results we increasing number of vechicle nodes to analyze the various parameters and we compared with ISR, TASR and VBRP

Packet delivery ratio

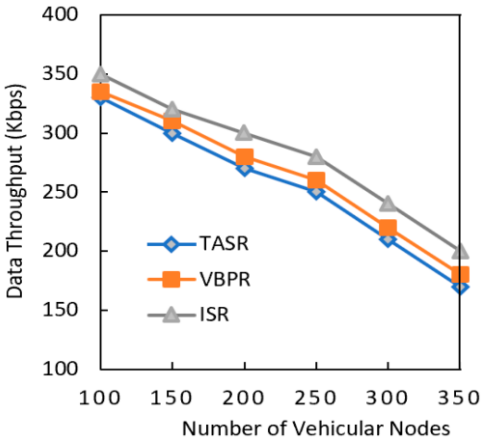
PDR Comparison shows the different number of vehicle nodes in the network. It shows the ISR continuously ahead during the data delivery due to the increasing connectivity portability in dense network.

a) End to End delay



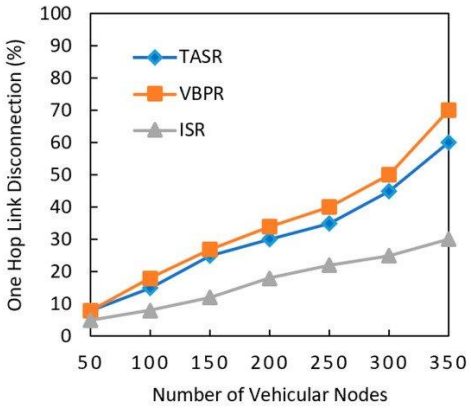
The delay of all the protocols significantly increased with larger network size. This result is also that VBRP had more delay than TASR and ISR , however it results into longer delay due to the information processing at each node in forwarding vehicles.

c) Data throughput



Another parameters was data throughput that all protocols constantly decreased due to routing metric calculation, because of involving number of nodes in the network in this scenarios the TASR goes down deeply is decreased the throughput because the protocol initiated the decision based on the distance , direction and signal strength.

d) One hop disconnection

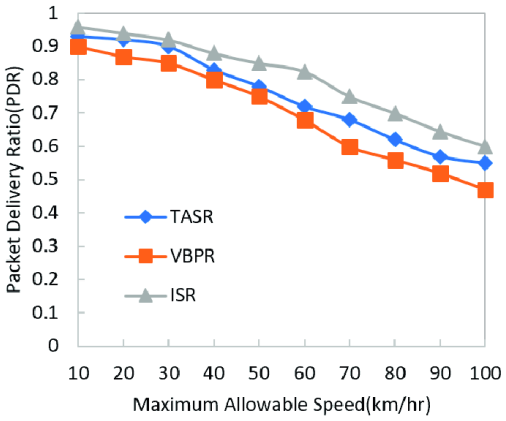


Another parameter analyzed performance metric was one hop link connection, once we increase the number of nodes, the hop disconnection also increased from this scenario we observed that ISR gives better results than the other two protocols.

2. Speed of Vehicle Analysis

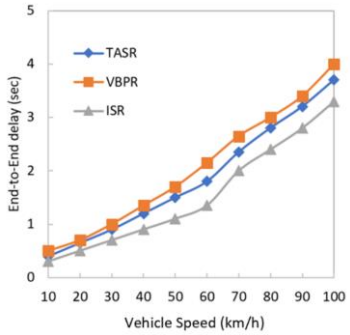
In this section the analysis of results based on speed of the vehicle, in terms of the packet delivery ratio, end to end delay, data throughput and one hop disconnections.

a) Packet Delivery ratio



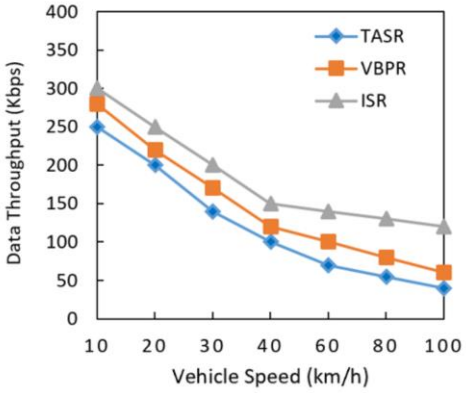
By seeing this scenario due to increase of speed of the vehicle it decreases the PDR in the network of all the protocols. But ISR gives better performance due to non-presence of beacon message in the whole network. the high speed also one of the reason the staleness of neighbour node information. at the speed of 30 to 35km/h, both ISR and TASR gives the same performance and sometime later the speed increases at 50 to 60 km/h , ISR had better results than other two protocols and it gradually decrease the performance once the speed was increased.

b) End to End Delay



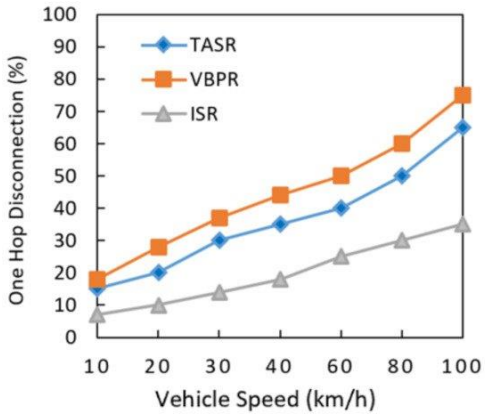
By seeing this scenario the ISR had a lower delay than the TASR and VBRP, during the speed of 30 to 35 km/h the delay was higher due to the high velocity of nodes , at the speed of 40 to 50 km/h ISR gives better delay performance compared to other two protocols.

c) Data throughput

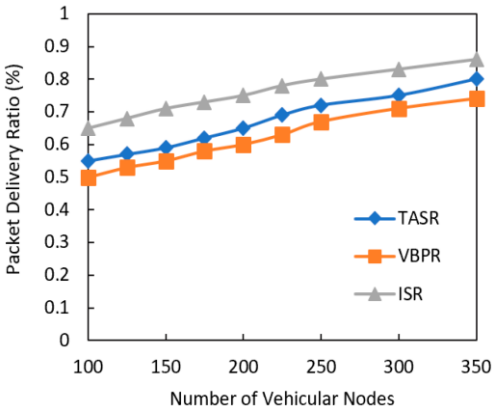


In this scenario data throughput was analysed, ISR protocols decrease due to its routing metric calculation , TASR is steeply decreased due to its routing metric calculation , comparatively ISR gives better results.

d) One hop disconnection



In this scenario clearly discussed that one hop disconnection of ISR was nominal as compared with other two protocol it is also understand that once the vehicles speed increased one hop disconnection also increased.



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