Cross-Layer Optimization Based Routing Protocol for VANET

Kavya Vidja[1], Krunal Panchal[2]

[1] P.G Student, Department of Information Technology, L.J.I.E.T, Ahmedabad, Gujarat, India
[2] Assistant Professor, PG Department, L.J.I.E.T, Ahmedabad, Gujarat, India

ABSTRACT

Vehicular Ad- hoc network is a distributed and self-organized network, have emerged as a new powerful technology to improve driving safety and traffic management. Being ad-hoc in nature, VANET is a type of networks that is created from the concept of establishing a network of cars for a specific need or situation. In VANET path stability is more important for sending a data to destination. So in this paper we are using a Received signal strength indicator parameter to calculate the stability of path. And other parameter is link congestion which is decrease the End-to-End Delay and increase the throughput. These both parameter calculate in Physical layer and our Process are work on network layer so for that we are considered Cross-layer Design in routing protocol for analysis using SUMO tool and NS2 simulation.

.**Keywords:** *VANET, Routing protocol, SUMO, ns2, Cross-layer Design*

1. INTRODUCTION

The Vehicular Ad-Hoc Network, or VANET, is a technology that uses moves cars as nodes in a network to create a mobile network. VANET turns every participating car into a wireless router or node, allowing cars approximately 100 to 300 meters of each other to connect and, in turn, create a network with a wide range. Vehicular Ad- hoc network is a distributed and self-organized network, have emerged as a new powerful technology to improve driving safety and traffic management. There exist two main forms of communication in VANETs:-Vehicle-to-Infrastructure (V2I),Vehicle-to-Vehicle (V2V) While V2I refers to communication between vehicles and road-side equipment , V2V relates to direct connectivity between vehicles without involving the intermediate infrastructure. The VANET system model is illustrated in Fig.1, which consists of three major Components:

- Trusted Authority (TA),
- Fixed RSUs

- On Board Units (OBUs) mounted on the moving vehicles

The VANET manufacturing can be fixed the unique vehicle identification number for the wireless networking. And it can derive all cities covered by the road side unit (RSU).

The local information about the physical location of nodes can be provided by the global positioning system (GPS), if vehicular nodes are equipped with a GPS receiver. Research analysis show that geographic (or location based) routing reduces the scalability problem, because geographic routing protocols do not exchange any link-state information and do not required any routing tables to maintain information. Then it reduced routing overhead.

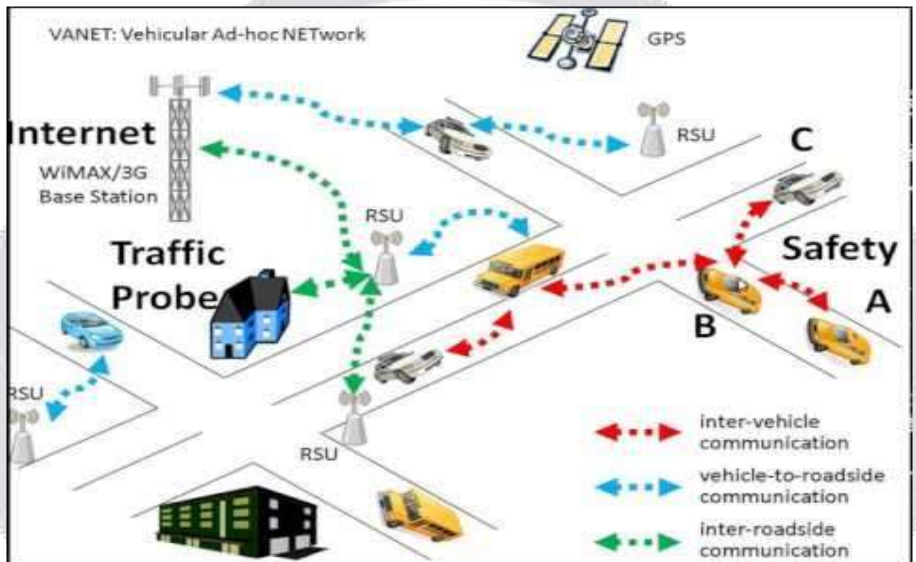

Figure .1 VANET System Model[6]

2. RELATED WORK

2.1 Jin Qian, Tao Jing, Yan Huo, Yikai Li, Wei Zhou, Zhen Li"A Next-hop Selection Scheme Providing Long Path Lifetime in VANETs"

As communication range is limited, multiple relay nodes are often required for establishing the multi-hop routing path between the source node and the destination node. Dependability of such routing path may be compromised due to different motion states of vehicles. So in this paper , we address this challenge by designing a new next-hop selection scheme named LPLS (Long Path Lifetime Scheme), in which each relay node uses the optimal stopping theory to choose a suitable next-hop node. Especially, this selection scheme can balance the tradeoff between routing path lifetime and selection efficiency.

This scheme not only considers the next-hop path lifetime, but also takes into account the selection efficiency by using the optimal stopping theory.

2.2 Hung-Chin Jang, Chang-Kwei Yang "A Hybrid Architecture of Routing Protocols for VANET with Cross-Layer Design"

Among all the proposed solutions, there is no a single solution which is applicable to all kinds of road environments. In this paper, we propose a hybrid architecture with cross-layer design to provide alternative routing protocols according to different needs. The hybrid architecture is based on multiple routing-path plane, cross-layer path selection, integration of broadcast packets, and a routing module integration layer (RMIL).

The proposed architecture aims to integrate different routing mechanisms into the wireless nodes of VANET such that each packet may have more than one path to select during routing. The proposed system architecture is realized through multiple routing-path plane, cross-layer path selection, integration of broadcast packets, and a routing module integration layer.

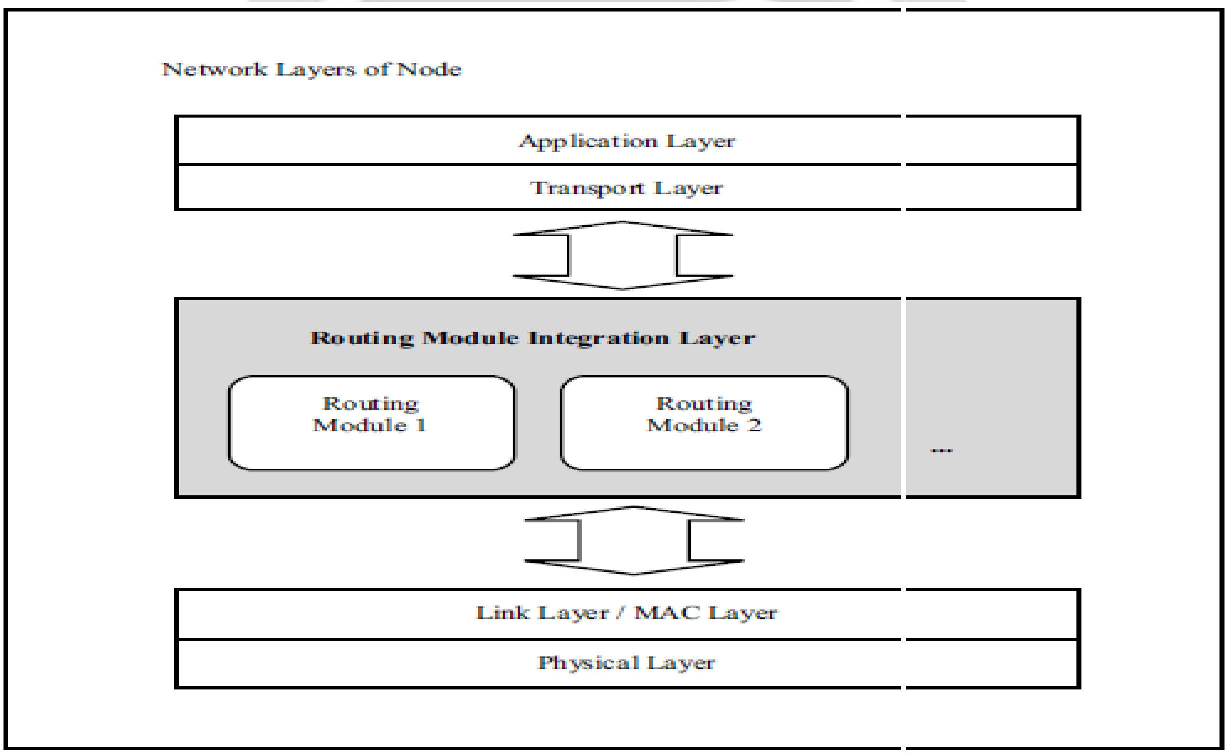

Figure 2. Architecture of Routing Module Integration Layer[2]

2.3 Sabih ur Rehman, M. Arif Khan, Tanveer A. Zia "Cross Layer Routing for VANETs"

This paper has proposed a novel routing scheme based on cross-layer approach for VANETs. The proposed protocol relies on the channel and queuing information from all neighbouring nodes of the source. Two main algorithms are presented to make routing decisions and gather information from multiple layers of VANET architecture. In contrast with other cross-layer routing schemes, the proposed scheme relies on SINR calculated by nodes under the Nakagami channel model. Using this information, the routing algorithm selects stronger routing links that reduce transmission failure and enhance system performance in terms of throughput, delay and packet delivery ratio. The paper also presents a probabilistic analysis for selecting nodes to be included/excluded in current neighbourhood set.

2.4 Shaik Shafi, B.N.Bhandari, D.Venkata Ratnam "An Improved Cross Layer Cooperative Routing for Vehicular Networks"

Cooperative routing has gained promising approach in Adhoc networks where nodes are assumed to be static. Recently there has been an increased heed in the cellular and vehicular Adhoc Networks (VANETs) where links between vehicles to vehicle are not fixed and inefficient. Towards this there exists only one cooperative routing scheme, Cross layer Cooperative Routing (CLCR) for route discovery on the fly similar to AODV, which requires more transmission power and energy consumption due to redundant transmission of Hello messages . Here an efficient cross layer routing mechanism is identified by the use of weighted Neighbor stability algorithm (WNS), which provides more stable, reliable routing path**.**

In this paper we have presented an improvement of Cross Layer Cooperative Routing (CLCR) protocol by proposing a new metric to evaluate routes. This metric is based on nodes weight computed by combining two parameters which are the power of node and its stability assumed to be the most important parameters in choosing routes.

2.5 G.Mary Valantina , S.Jayashri "A Novel Approach to Efficient and Reliable Routing in Vanets"

Vehicular Ad hoc Network (Vanet) is one of the emerging technology to support safety, traffic monitoring and comfort related services. Vanet is a subclass of Manet but its topology changes rapidly and network gets disconnected frequently. The prevailing routing protocol of Manet is very much applicable to Vanet. Because of its frequently disconnecting routes it is difficult to design an efficient routing protocol. Proper design of routing protocol for Vanet makes the network a successful one. In this paper we bring a concept of introducing Mesh routers in the network thereby optimal route is selected which leads to a decrease in routing overhead, packet end-to-end delay and an increase in packet delivery ratio.

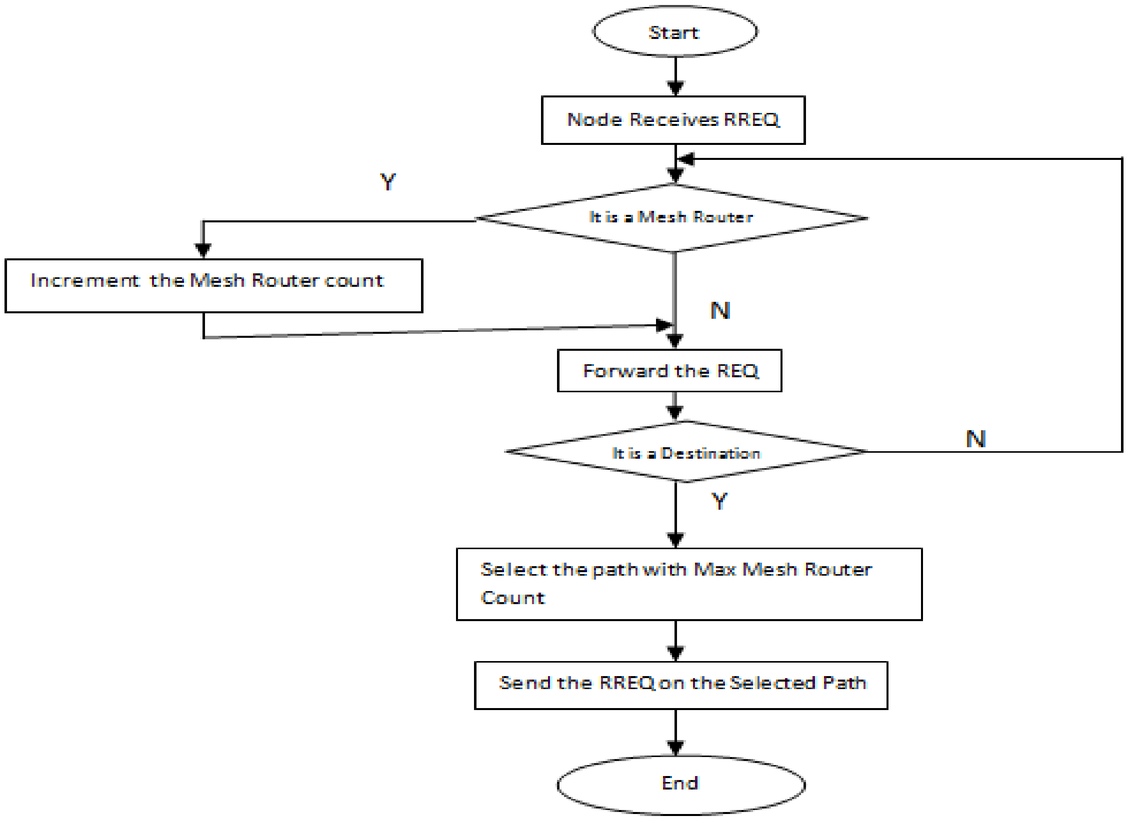

Figure 3: Flowchart of EV-AODV[5]

3. PROPOSED SYSTEM

Basically in VANET Source node, Destination node and many other nodes are there . Those are create a route to reach the destination.

First of all source node sending a route request to neighbor node and neighbor node send its on neighbor node. Like this create a route and send a route request and reach the destination.

Sometimes request massage are not reach the destination or say packet is lost for those issues are solve using Routing protocol.

So in our proposed system first source node or sender node scan the neighbor node using transmission range for sending a route request message. when we finding neighbor node than we are finding signal strength using received signal strength integrator and link congestion of node. Received signal strength integrator is known as node mobility . So node mobility is calculate instance of distance means if distance is small than power is high and if distance is high than power is low. Now Link congestion is calculate using queue length of link . Link congestion = Queue Length/Max(Queue length).

Now using Node mobility and Link congestion finding a Weighted factor (wf).

In Weighted factor we are using two constant α and β . The value of α and β first take a initially. Based on local route repair β will be adaptive so using Queue length /max queue length and finding its percentage . Now α + β = 1 so α = 1- β.

Than this weighted factor value store in array . Taking a condition while < node_info_vector > != NULL if this condition is true than finding minimum value in the array and it is a our relay id and send request to relay id . This procedure will continue when the reach the destination . If the condition is false than discard the packet.

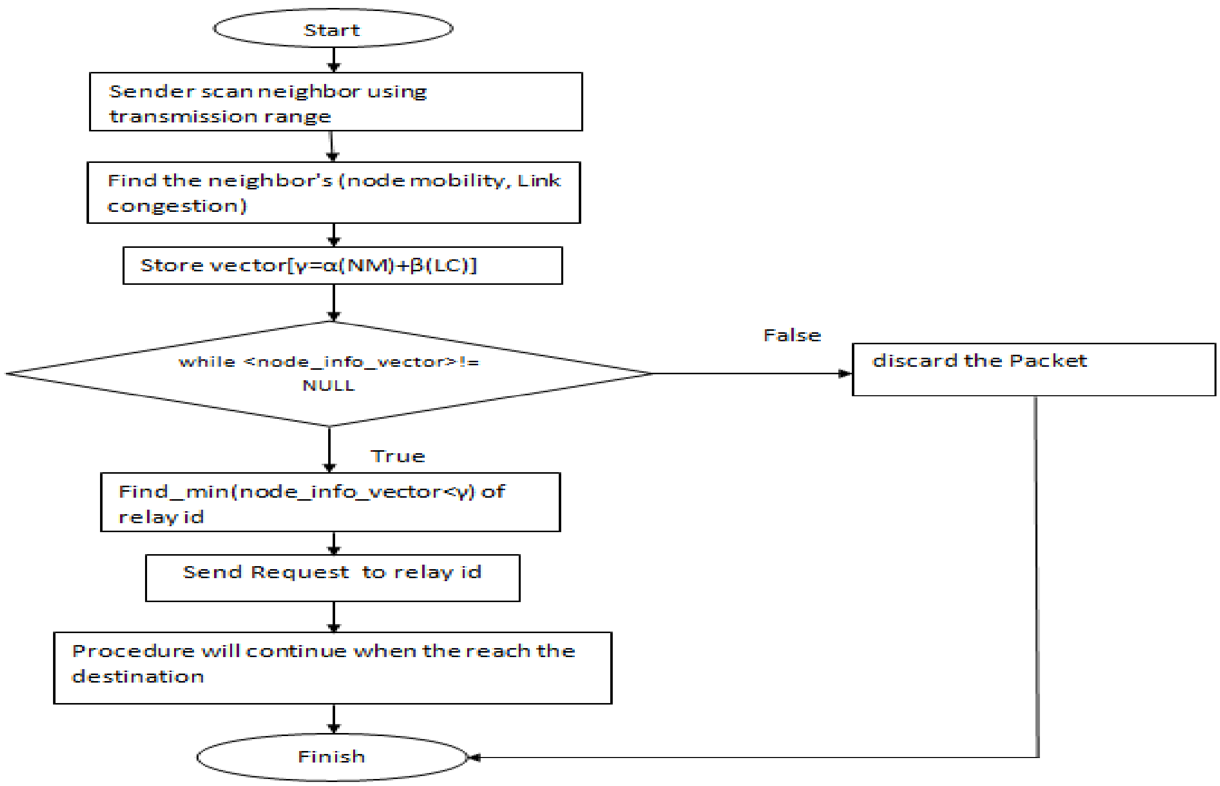

Figure 4 : Proposed model

4 EVALUTION PARAMETER

End to End Delay (EED):-

EED is the sum of buffering time, queuing time, MAC layer retransmission time of packets and delay in propagation.

Mathematically,

End-to-End delay = S/N

Where,

S = Sum of time spent to deliver packets for each destination, and

N = Number of packets received by all the destination nodes.

Throughput:-

It is defined the total number of packets delivered over the total simulation time.

Throughput = Na/Tb

Where,

Na = Total number of packets delivered

Tb = Total simulation time

Packet Delivery Ratio(PDR) :-

Packet delivery ratio (PDR) = Sa/Sb

Where,

Sa = Sum of the data packets received by each destination

Sb = Sum of the data packets generated by each CBR source

5. SIMULATION RESULT

This chapter contains the details about simulation results of existing system and proposed system. For the simulation purpose the NS-2 simulator has been used and for plotting graphs Microsoft excel has been used. The second tool used for mobility generation is VANETMOBISIM.

Simulation Parameter	**Value**
Number of nodes	100
Network size	652*752
Simulation time	200(sec)
Type of channel	Wireless channel

Radio Propagation Model	Two-Ray Ground
Network Interface type	Wireless Phy
MAC type	802.11
Interface Queue type	Droptail Queue
Interface Queue length	500
Node size	30
Antenna type	Omni Antenna

Table 5.1 Simulation Parameters

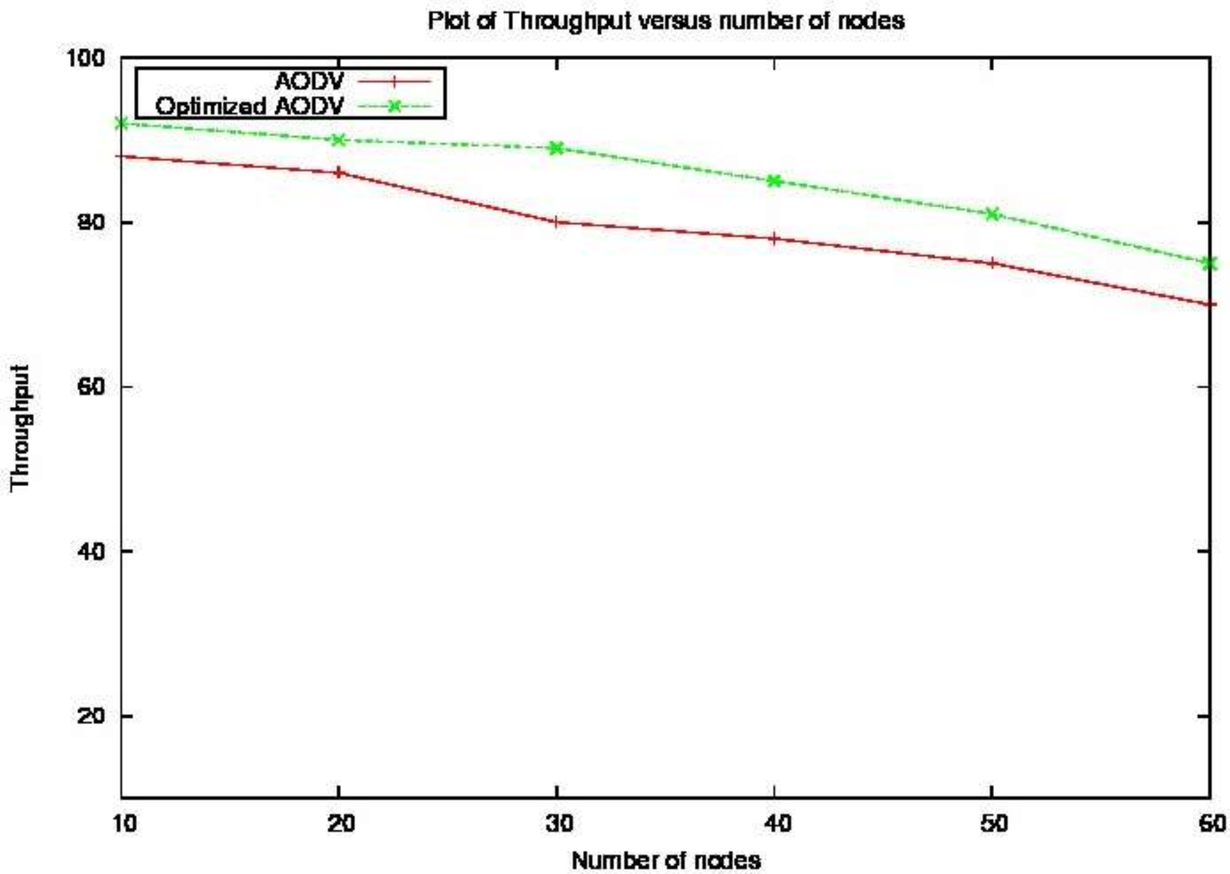

Figure 5.1 Plot of throughput versus number of nodes

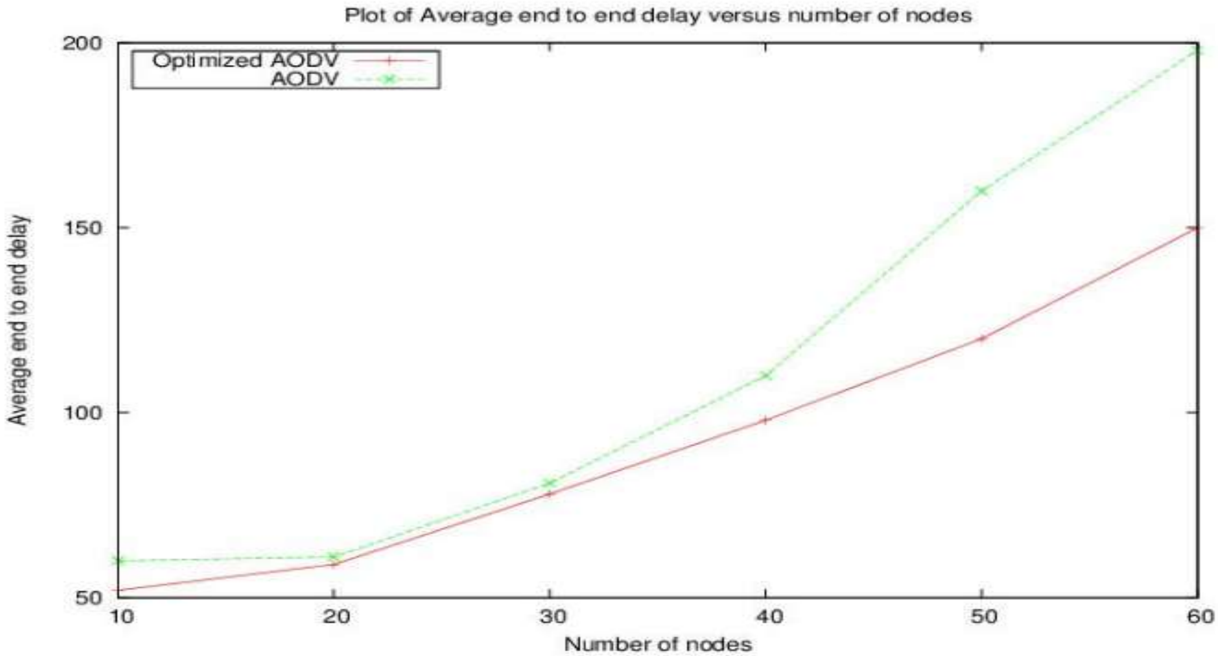

Figure 5.2 Plot Average end to end versus number of nodes

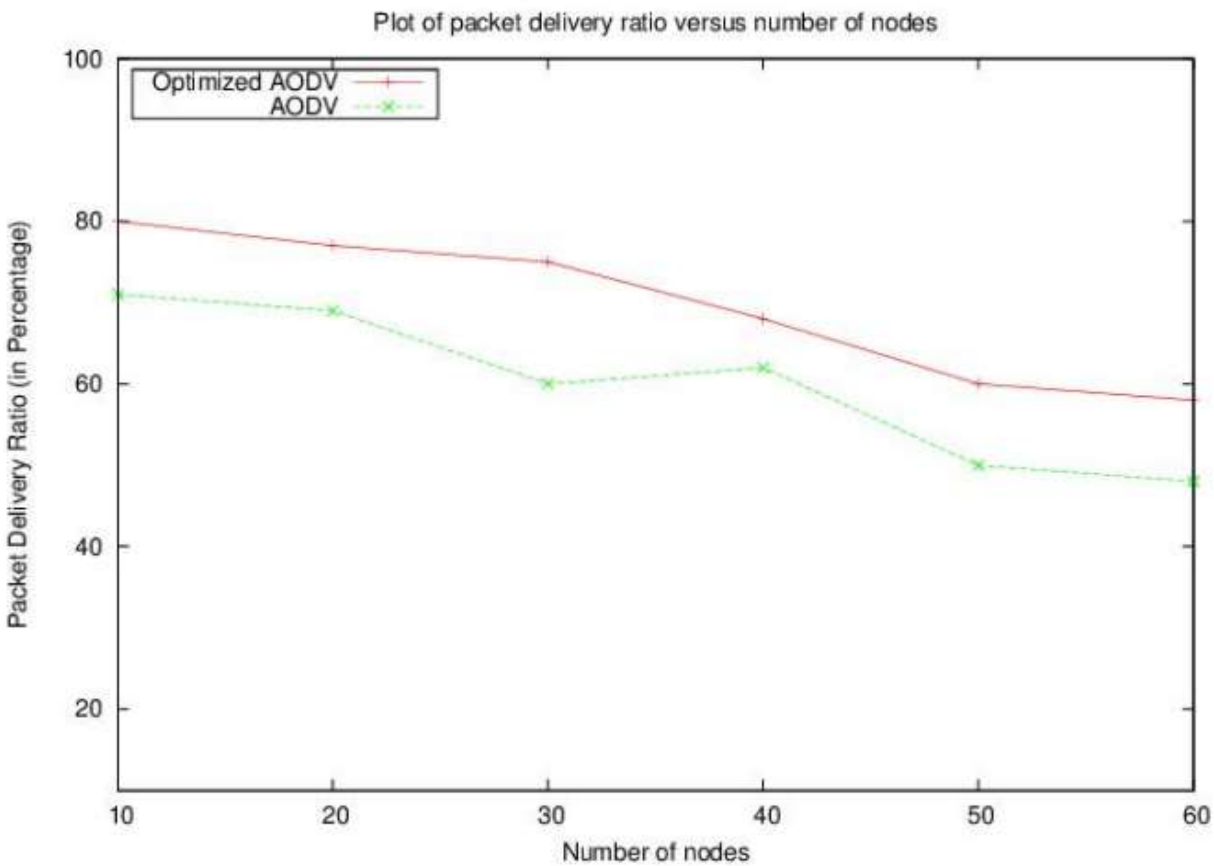

Figure 5.3 Plot of packet delivery ratio versus number of nodes

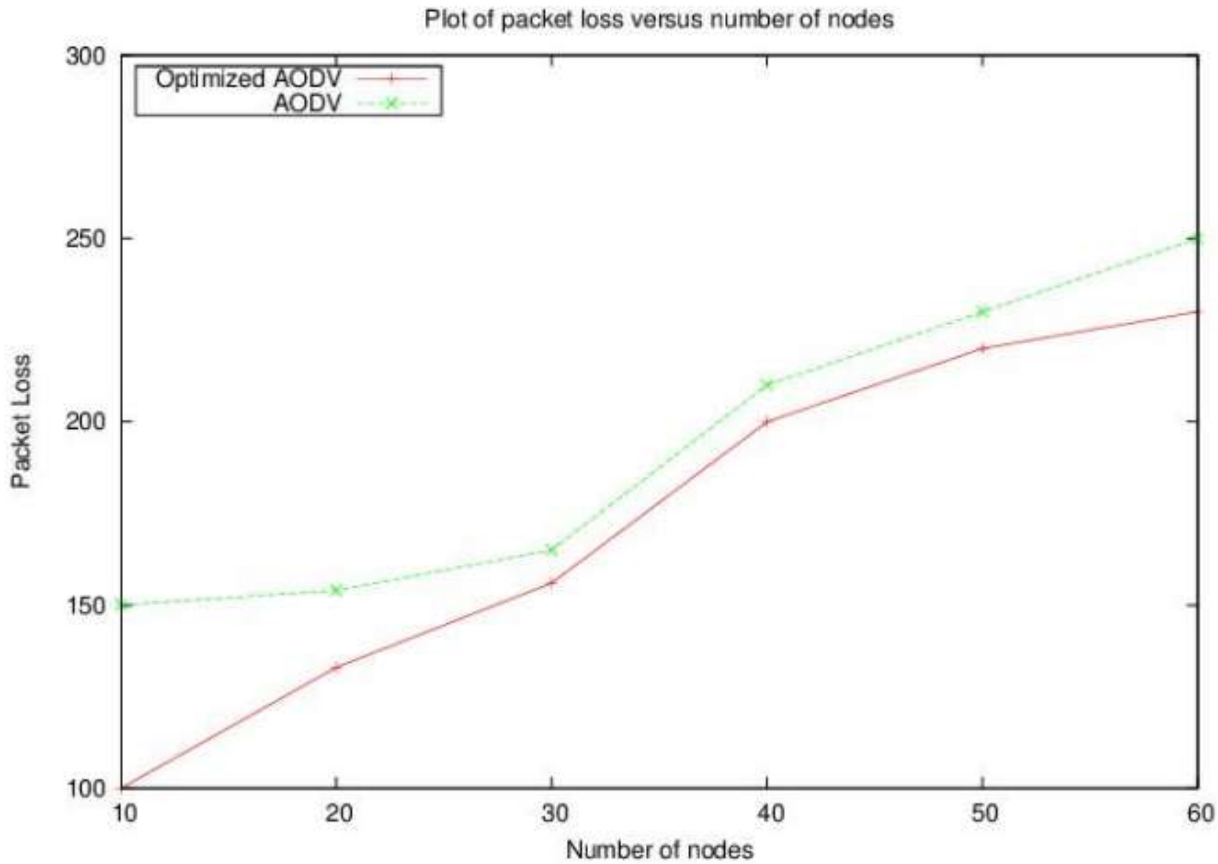

Figure 5.4 Plot of loss packet versus number of nodes

6. CONCLUSIONS

Improve the driving safety and traffic management we are using a VANET and VANET is technology. Because of traffic, constraint roads and very high speed of vehicles routing is an issue in VANET. In exiting system end-to-end delay is increase. So we are using Receive signal strength indicator, Link Congestion parameter to calculate the Packet Delivery Fraction, Average End-to-End delay , Packet loss, Throughput using Cross Layer Design. Simulation result show that proposed system Optimization-AODV is better performance than the existing AODV routing protocol. So over all proposed system gives increase packet delivery fraction and decrease the packet loss, end-to-end delay.

.

7. REFERENCES

[1] Jin Qian, Tao Jing, Yan Huo, Yikai Li, Wei Zhou, Zhen Li"**A Next-hop Selection Scheme Providing Long Path Lifetime in VANETs"** DOI 978-1-4673-6782-0/15 © IEEE 2015 pp 1929-1933

[2] Hung-Chin Jang, Chang-Kwei Yang **"A Hybrid Architecture of Routing Protocols for VANET with Cross-Layer Design"** DOI 10.1109/IS3C.2012.27 © 2012 IEEE pp 68-71
[3] Sabih ur Rehman, M. Arif Khan, Tanveer A. Zia **"Cross Layer Routing for VANETs"** DOI 10.1109/WoWMoM.2014.6919006 ©2014 IEEE pp 1-5
[4] Shaik Shafi, B.N.Bhandari, D.Venkata Ratnam **"An Improved Cross Layer Cooperative Routing for Vehicular Networks"** DOI 978-1-4673-8819-8/**16/** ©2016 IEEE pp 1-4
[5] G.Mary Valantina , S.Jayashri "**A Novel Approach to Efficient and Reliable Routing in Vanets"** DOI 978-1-4799-2259-14/ © 2014 IEEE pp 14-17
[6] Leandro Aparecido Villas **" Data Dissemination in Vehicular Networks: Challenges, Solutions, and Future Perspectives"** 978-1-4799-8784-9/15/©2015 IEEE DOI 10.1109/NTMS.2015.7266482 pp 1-5.