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Improving AODV Routing in Vehicular Ad Hoc Networks

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ABSTRACT: Vehicular Ad hoc Network (VANET) is a new method of interaction which involves interaction among vehicles running at high velocities on the roads. Vehicular Ad-hoc Network (VANET) is a most vital class of mobile ad-hoc network (MANET) that makes capable roadside vehicles to intelligently communicate with outside infrastructure and with each other anywhere anytime in the worldwide network. A new routing protocol for VANET is introduced in this paper; the suggested Active Route timeout established Ad-hoc on demand Distance Vector (AODV) is called E-AODV; it utilizes the hello interval and Active Route timeouts parameters to choose the best routing route. This paper compares the suggested E-AODV performance with respect to average delay, average throughput and average network load. Results show that performance of E-AODV is much better as compared to normal AODV.

KEYWORDS*:* AODV, EAODV, MANET, VANET.

I. INTRODUCTION

The Vehicular Ad hoc Network (VANET) is a family of mobile ad hoc network (MANET) that provides traffic and car safety applications VANET is the important technique that can offer reliable vehicle to roadside infrastructure (V2I) and vehicle to vehicle (V2V) interaction as depicted in fig. 1. [1]. VANETs are self organized network where mobile nodes are vehicle and for demonstrating these networks WIFI technologies are employed [3] [7]. VANETs are composed of Roadside Units (RSUs) and On Board Units (OBUs). OBUs are set up on the vehicle to offer the wireless interaction facility with other vehicles or RSUs and RSUs are communication units positioned along the road. RSUs are linked with and truth authority (TA) and application server [4]. VANETs issues are road safety, traffic management, authentication and information inaccessibility. For instance, to minimize the roadside accident vehicle should change their position information and speed at the time of driving. Life critical information authentication is very significant for this, which Assure that any obtained information is send authenticated user and has not been altered [4]. The VANET routing protocols are separated into three major categories:-

• **Proactive Routing Protocol-**Here the mobile nodes interchange routing information periodically and manage the network configuration information in routing table. These types of protocols are also known as table driven routing protocol [5].

• **Reactive Routing Protocol-** Here there is no interchange of routing information in a periodic way like proactive routing protocols. Here a essential route is established when needed. [These protocols are also known as on demand routing protocol [5].

• **Hybrid Routing Protocol-** It combines the characteristics of both proactive and reactive routing protocols and A table driven method is utilized inside the routing zone of every node while an on demand method is applied for the nodes that are not inside the routing zone [10].

The Transmission control protocol (TCP) is one of the most popularly used transport layer protocol on the internet in present time. TCP ensure reliable data transfer over unreliable networks. This protocol performs three important tasks a) Connection Termination b) Data Transfer c) Connection Establishment. Significant problems of TCP degradation in mobile networks are high bit error rate, exposed, mobility, and hidden node problem and Scalability etc. Presently, conventional wired network are being replaced with wireless networks. The main causes may be the decreasing cost of wireless devices and the tremendous technical enhancement in the wireless communication area. Still, there remains a significant challenge to give QoS solutions and maintain end-to-end Quality of Service with user mobility. Mostly founded routing protocols are designed either to decrease the network data traffic or to decrease the mean hops for

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supplying a packet. [1]. Some protocols that are Ad-hoc On demand Distance Vector (AODV), On-demand Multicast Routing Protocol (ODMRP) and Dynamic Source Routing (DSR) are originated without considering QoS explicitly. When QoS is taken in account, some protocols can be unsatisfactory or impractical because of the deficiency of resources and the unlimited calculation overhead. QoS routing generally includes two tasks: assembling and holding up-to-date status information about the network and discovering executable routes for a connection depending on its QoS needs. [5] To provide support to QoS, a service can be depicted by a accumulation of measurable pre defined service needs i.e. minimum delay, maximum delay variance, maximum bandwidth, and maximum packet drop rate. AODV [2] is an on-demand routing protocol that build routes only when needed. It uses successions numbers to assure the originality of routes. To discover a route to a destination, a source node using AODV circulates a route request (RREQ) packet based on constant Time to Live (TTL) value. The RREQ packets have the current sequence number, node's IP address, broadcast ID and recent sequence number for the destination node which is known to the source node. The destination node on reception of RREQ sends a unique route reply (RREP) packet with the reverse route constructed at the intermediate nodes on the route discovery process. In situation breakage of link or invalid TTL value a route error packet (RERR) is delivered to the destination and source nodes. Because of used of sequence numbers, the source nodes are all time able to discover new valid routes.

II. LITERATURE SURVEY

In [11], authors suggested a Robust AODV protocol in which the active route is managed by updating active route information locally to 1-hop neighbouring nodes, multiple backup paths are constructed and the highest priority backup path is shifted to become the new active path when the current active route fails or when it has less priority. Managing the active path by updating active routing information locally permits path to adapt to configuration variations, builds them robust against mobility, and makes capable them to arrive local optimum. The adaptation to mobility is especially obvious when the source or destination node keeps accelerating. In Robust AODV, the overhead is less as compared to proactive routing protocols because only the active path is managed and the path update message is only flooded to 1-hop neighbouring nodes locally. Its overhead is almost not influenced by speed while the normal AODV overhead increases with increasing in the speed. The enhancing AODV Routing Protocol with Priority and Power Efficiency (AODV-PP) [12] has a ability to find battery of intermediary nodes along with the application priority as it choose a node with a high left energy to enhance the lifetime of the node. The Modified Reverse Ad Hoc On Demand Distance Vector (MRAODV) routing algorithm [13] introduces an Algorithm to choose maximum appropriate route between source node and destination node based on stability of nodes, energy of nodes and hop-count of routes. In Optimized AODV (OAODV) routing protocol [14], the node does not send RREQ unless there is appropriate energy (battery lifespan), and until the node density in its environment beyond a special threshold.

III. SIMULATION SETUP

In this work we utilized OPNET simulator 14.5for simulation objective. A campus of network was simulated for simulation purpose within a simulation area of 1500 m x 1500 m. The mobile nodes were scattered within this simulation area. Mobility model employed is random waypoint model with 50 meters mobility; the reactive ad-hoc routing AODV and EAODV protocol performance is measured by implementing various scenarios. The buffer size of data is adjusted to 1024 Kbps for every mobile workstation at 54Mbps data rate with DCF MAC Protocol implementation and OFDM 802.11g PHY layer. The traffic runs in a random way between various Voice applications workstations located at different distances. We consider the different network size based on the number of nodes. There will be increment in power consumption as the number of nodes is increasing in a VANET, So by modifying the value of Hello Loss, Active Route Time and Hello Interval we build a scenario (EAODV) and compare with the normal scenario (AODV). The for simulation parameter scenarios is defined in Table I.

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Table 1: Simulation Parameters

Examined Protocols	AODV ,	E-AODV
Number of Nodes	100,150,200, and 250	100,150,200, and 250
Types of Nodes	Mobile	Mobile
Simulation Area	1500*1500 m	1500*1500meters
Simulation Time	1200 seconds	1200 seconds
Mobility	varying(10-50) m/s	varying(10-50) m/s
Pause Time	200 seconds	200 seconds
Performance Parameters	Throughput	Throughput
Traffic type	FTP	FTP
Active Route Timeout(sec)	4	30
Hello interval(sec)	1,2	3,4
Hello Loss	3	5
Timeout Buffer	2	6
Physical Characteristics	IEEE 802.11g (OFDM)	IEEE 802.11g (OFDM)
Data Rates(bps)	54 Mbps	54 Mbps
Transmit Power	0.005	0.005
RTS Threshold	256	256
Packet-Reception Threshold	95	95
Long Retry Limit	4	4
Max Receive Lifetime(seconds)	0.5	0.5
Buffer Size(bits)	25600	25600
Mobility model used	Random waypoint	Random waypoint
Data Type	Constant Bit Rate (CBR)	Constant Bit Rate (CBR)
Packet Size	512 bytes	512 bytes

IV. AD HOC ON DEMAND DISTANCE VECTOR ROUTING PROTOCOL WITH GENETIC ALGORITHM (G-AODV) STEPS

This paper are focusing on Genetic Algorithm with Conventional Ad Hoc on Demand Distance Vector Routing Protocol (AODV) in order to reduce network load on the network and to uphold the throughput of the existing protocol, as routing protocols make an significant task for improving QoS in Mobile Ad hoc Network**.** Genetic Algorithm states that: If there are n nodes, and the cost between each pair of these nodes is given, find the shortest corridor where each chromosome is defined as the inimitable path of nodes i.e source to destination. In this affirmed problem number of nodes and cost between the nodes are given we have to determine the possible shortest path from source to destination by evaluating fitness function of each chromosome.

Step-1:- Initialization of Route Discovery

(i) If source node doesn't know about route to destination node

(ii) Then Apply Genetic Algorithm

1. [Start] Firstly produce arbitrary population of *n* chromosomes by using Dijkstra's Algorithm.

2. [Fitness] estimate the fitness f(x) of each chromosome x in the population.

3. If it gives necessary clarification then stop it, if not then replicate the subsequent steps until the new population is complete

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- **[Selection]** choose two parent chromosomes from a population according to their fitness (the large fitness, the better chance to be selected)
- **[Crossover]** cross over the parents to form a new offspring (children). If no crossover was performed, offspring is an exact copy of parents.
- **[Mutation]** mutate new offspring at each locus (position in chromosome).
- **[Accepting]** Place new offspring in a new population

4. [Replace] utilize fresh generated population for a further run of algorithm
5.[Test] If the end condition is satisfied, **stop**, and return the best solution in current population
6. [Loop] Go to step **2**
(iii) end

Step-2:- Initialization of Route Reply

1. It saves received **(RREQ) shortest** path in its cache until the end of RREQ TTL (Time To Live).
2. When the RREQ TTL has been finished, the destination adds all received RREQ in genetic approach and finds the two best routes from source to destination.
3. Finally, the destination knob creates a Route Reply packet, adds these two routes in it and sends the RREP packet for the source knob.

V. SIMULATION RESULTS

To measure the AODV and EAODV performance in several scenarios we have defined the several routing and QOS parameters i.e. throughput. it describes the throughput comparison between AODV and EAODV at various numbers of nodes. EAODV has more throughputs in comparison to AODV to find out the path. The figure 6.1 Improved and Normal throughput for 100 Nodes.

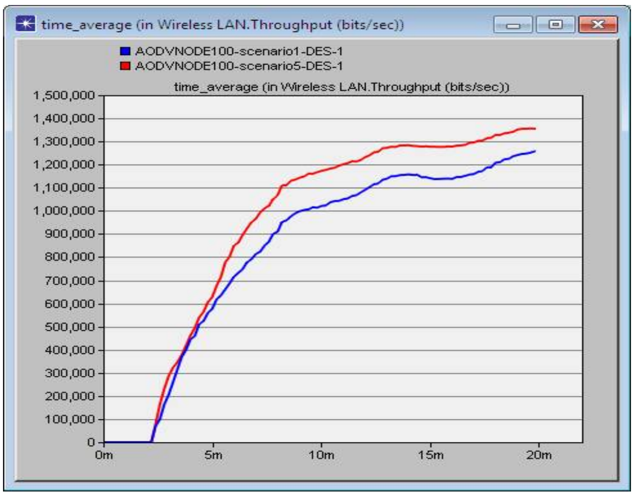

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Fig: 1 Improved and Normal throughput for 100 Nodes

Figure 2 In scenario of 150 nodes the EAODV has better throughput. The throughput value increases with increasing in the number of nodes. Figure 6.3 scenario of 200 nodes the EAODV has better throughput. fig. 6.4 scenario of 250 nodes the EAODV has better throughput as compare to AODV.

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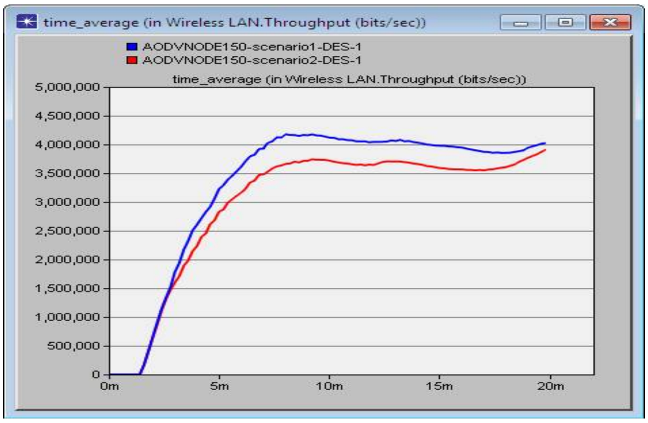

Fig: 2 Improved and Normal throughput for 150 Nodes

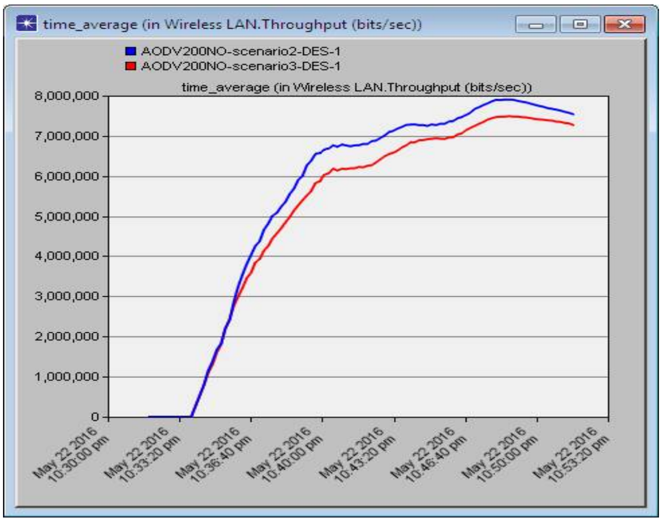

Fig: 3 Improved and Normal throughput for 200 Nodes

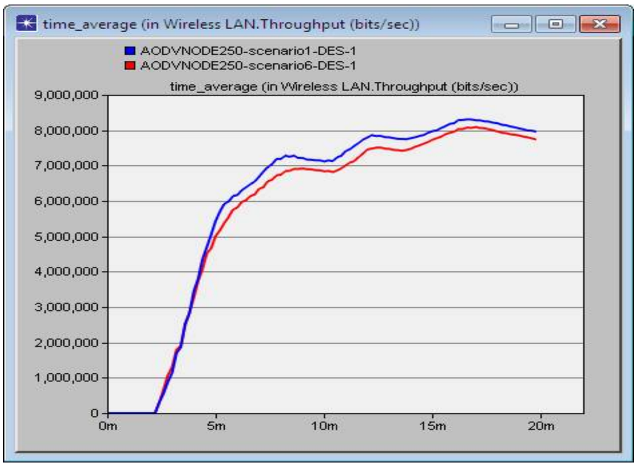

Fig: 4 Improved and Normal throughput for 250 Nodes

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VI. CONCLUSION

The simulation work of VANET network is modelled by utilizing the OPNET 14.5 modeller and examined for AODV and EAODV routing protocol. We employed some mechanisms to enhance the AODV protocol performance by changing the parameters values i.e. Active Route timeout and Hello Interval and build E-AODV routing protocol. We employed this changed AODV (E-AODV) to different numbers of nodes i.e. 100, 150, 200 and 250. And observed that this is efficient in all the scenarios. It is observed that E-AODV has better Routing results and Quality of service as compared to AODV protocol. In future, we will further enhance the AODV protocol performance at very large scale.

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