ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Special Issue 1, March 2017

Delay Diminution in IEEE 802.11p using Heterogeneous Vehicular Drop Boxes

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ABSTRACT: a vehicular ad-hoc network (VANETs) is egressing technology in wireless ad-hoc network. VANETs are dope out to improve the vehicular safety and manage the traffic in the urban areas by optimal link strategy which is presented in Vehicle can interplay with other vehicle for their devoir to access various services. Data Dissemination is used to relocate the data from source to destination and it is used to improve the quality of driving in term of time, distance, security, and safety. Efficient Data dissemination of messages in a Vehicular Ad Hoc Network still face many challenges in the current research scenario. It is used in vehicles to minimize end to end delay in network for the challenging issues for data dissemination in large scale with the scalability, high mobility and network heterogeneity. In this paper proposed a geocast routing to store the traffic aware information using drop boxes which is used implemented by passing and carry the messages from the network for forward framework.

KEYWORDS*:* Delay minimization , Drop Boxes, Geocast Routing , Information forwarding , MANET, VANET .

I. INTRODUCTION

VANET's are particular kind of MANET, in which vehicles act as nodes and each vehicle is equipped with transmission capabilities which are connected to form a network. VANET is a technology that uses moving cars as nodes in a network (mobile network) so each vehicle can transmit and receive other messages through a wireless network. VANET turns every participating car in to a wireless node, allowing cars approximately 100-500m of each other to connect and, in turn, constitute a network with a spacious range. As cars fall out of signal range and crumb out of the network then other car can join in by connecting vehicle to one another so that a mobile internet is created. Each vehicle communicates with the nearby vehicle in a high dynamic Ad-hoc networking environment via vehicle to vehicle communications. Periodic beaconing which allow drivers to be aware of surrounding traffic conditions by exchanging traffic related information, vehicle to vehicle communication which also support infotainment applications.

VANET COMMUNICATIONS

Vehicle To Vehicle Communication (V2V):-

V2V communication is most suited for short range vehicular networks.

Vehicle to Infrastructure (V2I) and Vehicle to Roadside communication (V2R):-

The solution for longer range of networks is provided by V2I communication.

ISSN(Online): 2320-9801
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Website: www.ijircce.com

Vol. 5, Special Issue 1, March 2017

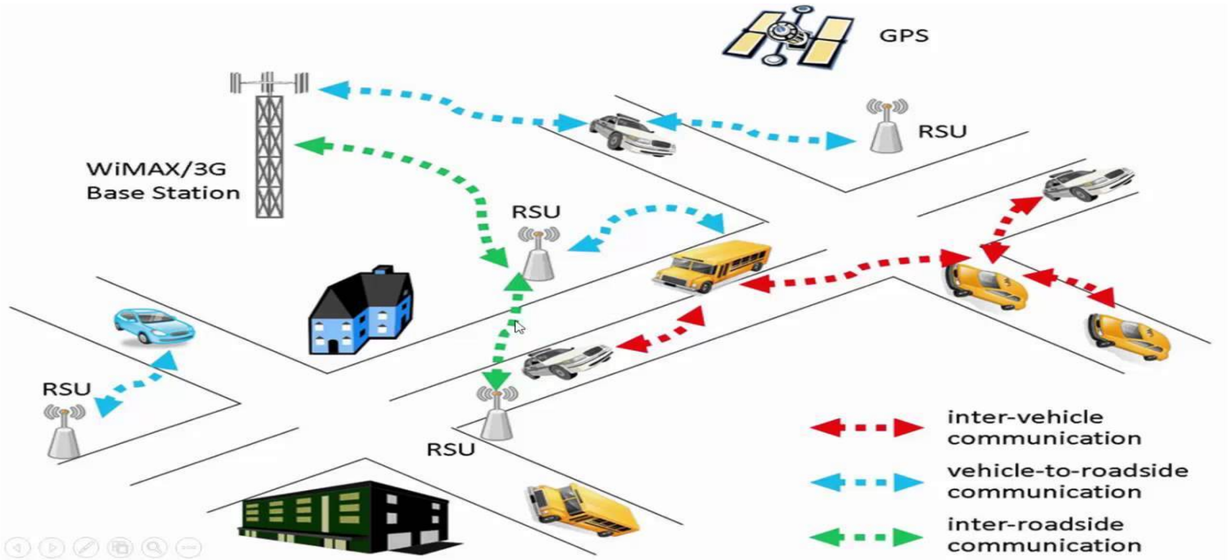

Fig.1.VANET Communication

DROP BOXES

The drop box is an immobile transceiver Road Side Unit (RSU), responsible for exchanging information with vehicles within its range. Furthermore it stores messages and removes the spare messages hence enhancing the system performance. Unlike the Base Station (BS), drop boxes are fairly cheap and easy to install/implement on the road-side. Powering the drop boxes is relatively easy; it can be attached to any other public road transportation, and powered up by battery or solar panels.

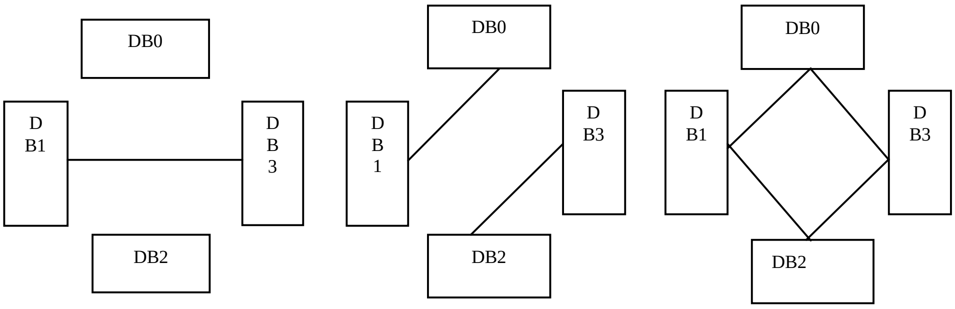

Fig.2.Different Drop Boxes Configurations

II.RELATED WORK

In this part we briefly consider some of the related work that is most relevant to our approach.Jianping He, Lin Cal, Peng Cheng, and Jianping Pan [1] have a proposed store and forward framework for VANETs with superfluous storage using “drop boxes”, which function similar to routers. That the framework can improve the connectivity, reliability, and scalability, and achieve a substantial performance gain compared with the previous solutions without drop boxes. An Optimal link approach which is independent of the message Arrival time and can be executed in disseminated manner. Zhang et al [2] used both vehicles as the message carriers in urban vehicular networks. They planned a mobility-aware Geocast algorithm (GeoMob) for urban VANETs from the DTN perspective to better deal with the high mobility and transient connectivity issues. Compared with the existing works using both buses and taxis, the main novelties of this paper include the region-based carry-and-forward network architecture design, the optimal link strategy, and the optimal routing algorithm to minimize the expected path delay. Mun J.Lok, Bilal R.Qazi and Jaafar M.H.Elmirghani

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ISSN (Print): 2320-9798

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Website: www.ijircce.com

Vol. 5, Special Issue 1, March 2017

[3] focused in this RDS-based and multi hop routing in a 3*3km Manhattan Grid with variable incursion ratio were studied with the effectiveness of traffic density. Different configurations of drop boxes were introduced and some very useful communication scenarios were evaluated. However,RDS-based routing suffers from higher end to end delays while flooding and higher packet delivery ratio are the main challenges in multi hop routing. Therefore, we intend to introduce a location based routing algorithm that can significantly reduce flooding while improving the packet dropping probability and the average end to end delay. Wenrui Zhao, Yang Chen, Mostafa Ammar, Mark Corner, Brian Levine and Ellen Zegura [4] have proposed the use of throw boxes to enhance network capacity in mobile Delay Tolerant Networks. By relaying data, throw boxes increase the broadcast opportunities and throughput between nodes. We presented a framework to systematically study the issues of deployment and routing and we developed algorithms for various deployment and routing approaches. In This paper focused on evaluated different routing and deployment approaches using ns2 simulations. Throw boxes are very effective in improving throughput and delay, especially when node movement is regular or multi-path routing is used. As compared to multi-path routing, single path routing is less effective in using throw boxes because data forwarding is limited along a single path. Due to the poor utilization of network resources, epidemic routing achieves the least improvement when using throw boxes.

II. SYSTEM DESCRIPTION

A. SCENARIO AND ASSUMPTIONS

Scenario and Assumptions consider the Geocast problem where a message is stored and forwarded by cooperative vehicles toward its destination with the assistance of drop boxes. Note that a vehicle will travel according to its travel plan determined by the driver and rail user(s) and the road and traffic condition, and the message is simply piggybacked on the vehicle. We assume that the travel plan is known to the OBU, the travel destination and route calculated by the GPS routing unit can be sent to the OBU.The destination is a known location, or within a certain known target region. If the latter, the message will be carried to the target region to reach all vehicles in the destination. To address the network scalability issue, we first divide the whole VANET area into regions, and select a hot-spot in each region with a large traffic volume, such as major bus exchanges, shopping centers, airports, central business districts, etc. A drop box is installed at each selected hot-spot. The drop box can be hosted in an idle vehicle’s OBU and the content can be handed over to another idle vehicle if the current one needs to leave, or be hosted in a stationary road-side unit. These drop boxes may not have an Internet connection, or, even if a limited Internet access is available, we do not use it for data dissemination to save the cost. For example, the drop box can be a storage device in a bus which is parked in a hot-spot location, without Internet access. The drop boxes in the VANET function similar to the routers in the Internet but with larger storage. We assume that when a vehicle is within the drop box’s coverage, the travel plan of the vehicle will be reported to the Drop box. Also, it will transfer the data it carries to the drop box if the message needs to be carried by another vehicle. The drop box then stores the message until it finds a suitable Vehicle and transfers the message to it. It is noted that since the transmission range of the drop-box is limited, the drop box can only relay the message to those vehicles within its coverage for the next carrier. Hence, depending on the transmission range of the drop-box, only a portion of taxies may pass the coverage area of the drop-box. This is essentially a thinning process. We can handle the thinning process by multiplying the vehicle arrival rate by a ratio (the arrival rate in the area covered by the drop-box over the arrival rate in the whole region). The flow diagram will clearly explain the proposed system in the graphical way.

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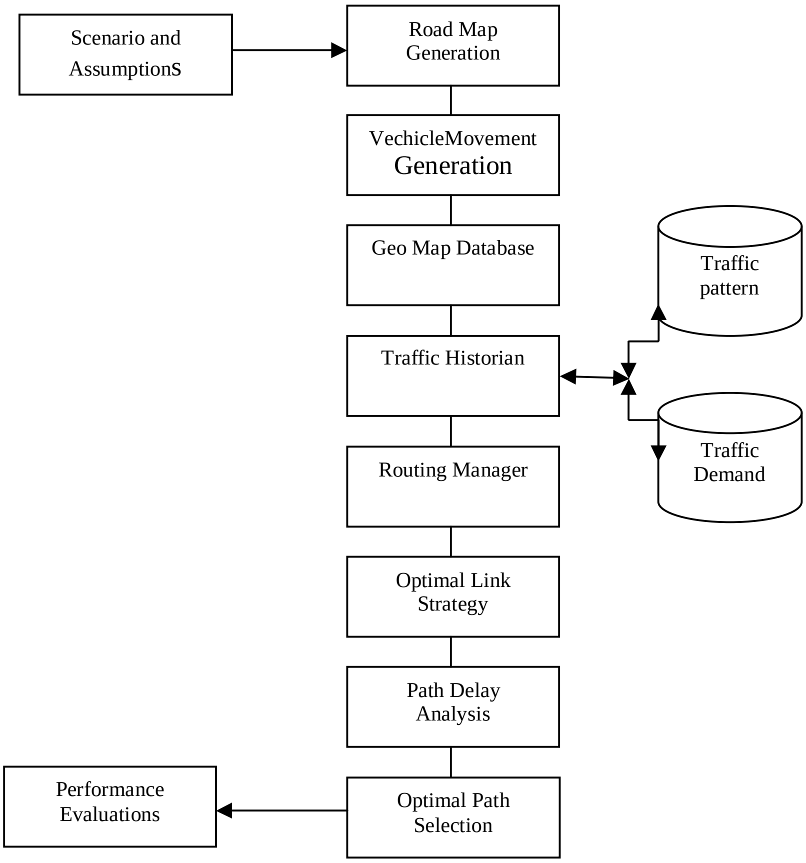

Fig.3. System Architecture

B.ROAD MAP GENERATION

Initially Road map is created with number of nodes as vechicles, for each node in the topology. Map inserted into the Open Street Map (OSM). If you want any area based on road map are collected and downloaded via Open Street Map. The Open Street Map incorporated Location detail and width and length of the road map. Network simulation setup has been created.Vechicle ad-hoc network is formed by vechicles.Then the vehicles share ciao message and its information with its neighbor. Communication between various nodes takes place based on the neighbor table information.These street map should manage different densities of intersections, contain multiple lanes information, different categories of street and speed limitations.

C.VECHICLE MOVEMENT GENERATION

The activities of the vehicles can be generated automatically or manually using the vehicle Movement Editor. The vehicles Movement Editor allows users to specify several properties of vehicles routes including number of vehicles in a particular route, vehicles exodus time, origin and destination of the vehicle, duration of the trip, vehicle speed (acceleration, deceleration, and maximam speed), etc.The user can define the probability of turning to different directions at each intersection in the editor.

D.GEO MAP DATABASE

A Geo Map Database represents a road network along with associated features. Geo Map provides choose various models of a road network as a basis to formulate a database. Commonly, such a model comprises basic elements (nodes, links and areas) of the road system and properties of those elements (location coordinates, shape, addresses, road class, speed range, etc.,).The basic elements are referred to as facial facade and properties as attributes. Other

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information associated with the road network is also included, including points of interest, building shapes, and political boundaries. Each node represents with a map graph represents a point location of the surface of the Earth and is represented by a pair of coordinates. Each link represents a stretch of road between two nodes, and is represented by line segment. A Geo Map Database provides generally collect, aggregate and supply data in a well-defined and documented file format. A small number of record types are used to represent the various types of data. Each record type consists of a sequence of fields, which are either predetermined length or delimated by a punctuation character such as a comma.

E. TRAFFIC HISTORIAN

The purpose of traffic management is to differentiate among various types of traffic and give higher level of service to high priority traffic at the cost of lower priority traffic. To achieve this, precedence queuing can be used which we extended with hop-constrained queue inouts and real time neighbor aware rate control policies. The priority queuing used and modified the interface queue sub layer of NS-2 to implement priority queuing mechanism. The traffic historian maintained the traffic related information such as, traffic types, traffic location, and traffic time. Route maintenance is used to update existing routes to proactively adapt to the movements of the source and destination over time as well as to repair busted paths. Since sources and destination are moving vehicles, the route created during the route invention phase is not expected to remain constant.

TABLE 1
Simulation parameters setup

Network Simulator	NS2
Traffic Simulator	SUMO
Number of vehicles	50
Vehicular area	14 km^2
Transmission range	50m
Simulation time	1000s
Vehicle and RSU MAC	IEEE802.11p
RSU range	[1000,2000]m
Propagation model	Free Space
Data packet size	6 Mbit/s

F.ROUTING MANAGER

Routing is a vast concept used in the VANET Environment. In the VANET, the nodes are prone to undergo change in their positions. Hence the source should be continuously tracking their positions by implementing the AODV(Ad hoc On-Demand Distance Vector) protocol in the simulation scenario it transmits the first part of the data through the below allowed trail. After few seconds the nodes move to new positions. The every node is maintenance of these routes which is equally important. The source has to continuously observe the position of the nodes to make sure that the data is being carried through the path to the destination scarce loss. In any crate, if the position of the nodes change and the source doesn't make a note of it then the packets will be lost and eventually have to be resent. The path selection maintenance and data transmission are consecutive processes. Hence the paths allocated priory is used for data transmission. The first route are allocated previously is now used for data transmission and data is transferred through this highlighted path. The second path selected is now used for data transmission.

G.OPTIMAL LINK STRATEGY

The optimal solution needs to address two issues. First, given a path, what is the optimal link strategy in terms of how long the message should wait for a vehicles to be carried to the next hop.second,how to find the optimal path from the source to the destination with the minimal expected delay. In many applications of VANETs, cars exchange road condition information in order to predict travel time and prevent congestion and accidents. We consider the scenario that vehicles aim to inform the following vehicle of preceding road conditions for travel time prediction, and to warn

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following vehicles to slow down in case of any accidents, thus, the direction of packet transmission is opposite to that of vehicular traffic flow as described. Each Node is assumed to have a maximum communication range R and know the positions of those vehicles' with R.One simple way for a vehicle to know its position is to use GPS.We assume that this information piggybacked on data packets. Please note the requirement of knowing neighbors' positions is for the transmitter to determine the relay node in the routing strategies considered in this paper, the computation of protocol performance from vehicular density knowledge does not necessarily require such information. A source node will choose one of the nodes as relay within the maximum transmission range according to one of the three routing strategies described below and transmit a packet with the identity of the relay and the identity of the final destination in the packet header. A node receiving this packet will this packet will only process the packet if it is identified as a relay, all other nodes will discard the packet.

G. PATH DELAY ANALYSIS

Delay and throughput are most important parameter to be considered for vehicular traffic. In this section, we present the theoretical results on the delay of a given path, which are necessary for the design of the optimal routing algorithm. From the discussion in the last section, for a given path, there are two per-hop optimal strategies, i.e., s1 and s2, so we need to consider two cases. First, when all nodes along the path take s1, the expected delay for each link is independent of each other, and we call this the fully random case. Second and more difficult, when part of the nodes along the path take s2, the expected delays for these hops depend on the previous hops and the arrival times of the message at these nodes, and we call it the mixed case. Note the case that all nodes in the path taking s1 are a special case of the mixed case, so we skip it here due to the space limit. Fully random case we consider the fully random case first.

H.OPTIMAL PATH SELECTION

In this paper focused a traffic aware approach for routing in graded network using Dijkstra's algorithm. Dijkstra's has been used as a good search process for optimality exploitation and exploration. The paper shows how Dijkstra's approach has been utilized for determining the optimal path based on bandwidth availability of the link and how it outperformed non graded network while deriving the optimal route. The selection of the nodes is based on the direction of the goal node also. This would help in narrowing down the number of nodes participating in routing. Here an agent system governs the collection of QoS (Quality of Service) parameters of the nodes. Also a quadrant is synthesized with centre as the source node based on the information of which quadrant the intention belongs, a search is performed. Among the many searches observed by the onlooker bees the best path is selected based on which onlooker bee comes back to source with information of the optimal route.

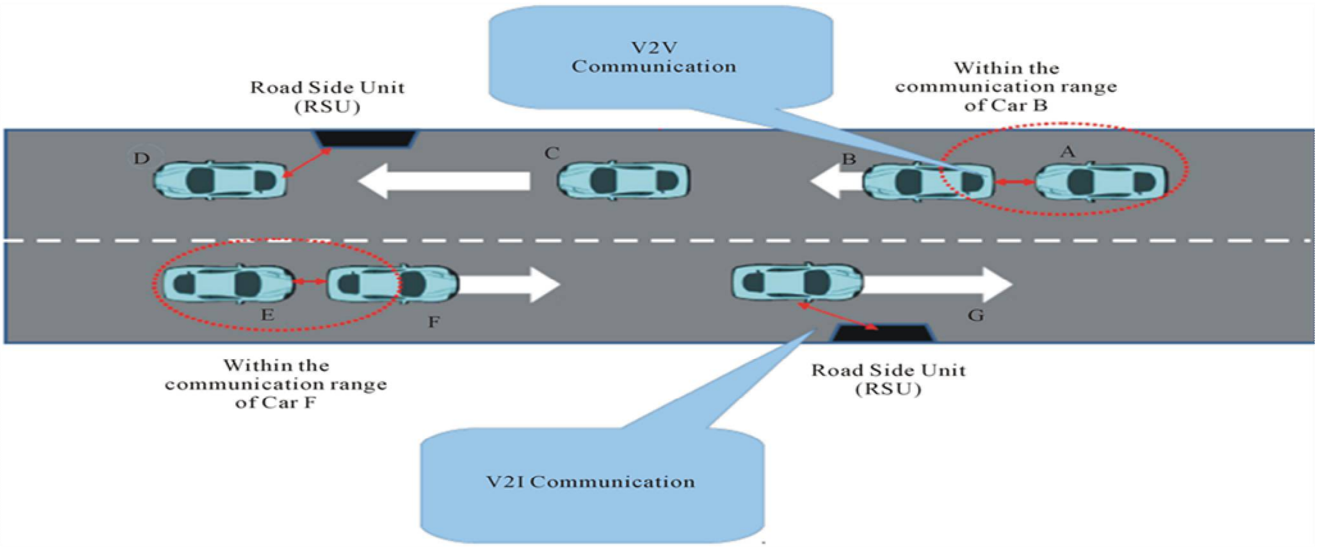

Fig.4. Vehicles Communication in Delay Based

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Dijsktra Algorithm for Optimal path selected

Dijkstra algorithm is the algorithm that used to select the shortest path between two nodes in the network using graph mode that content nodes and edges. In this algorithm assigned zero to the source node and infinity to the others nodes. It starts from the source and selects the minimum link's value and update the cost of the node that found in the second for this link. The new cost to this node is found by adding the cost for the source node and the link's value.

PSEUDO CODE FOR DIJIKSTRA'S ALGORITHM:-

1. Function Dijsktra (Graph, Source);
2. Create vertex set Q
3. For each vertex v in Graph
4. Dist[v]←INFINITY
5. Prev[v]←UNDEFINED
6. Add v to Q
7. Dist[source]←0
8. While Q is not empty
9. u←vertex in Q with min dist[u]
10. remove u from Q
11. for each neighbor v of u
12. alt←dist[u]+length(u,v)
13. if alt←dist[v];
14. dist[v]←alt
15. prev[v]←u
16. return dist[],prev[]

IV.IMPLEMENTATION

The implementation of this paper work is first to create the road map and topology mapping node with the network simulator. 1.Topology Generations in SUMO
2. Path Delay Analysis
3. Implementing Traffic Aware A* Algorithm
4. Comparison between the Estimated Values

1. Topology Generations in SUMO

1.1 Node Creation in NS2

Creation of nodes is base for VANET and transfer of packets between nodes. Using TCL script to verify the nodes. It is used with AODV protocol .using this we can calculate the collision rate, delay, energy spent and throughput ratio. When a node is created, it is automatically assigned an address and an address and a default routing module.

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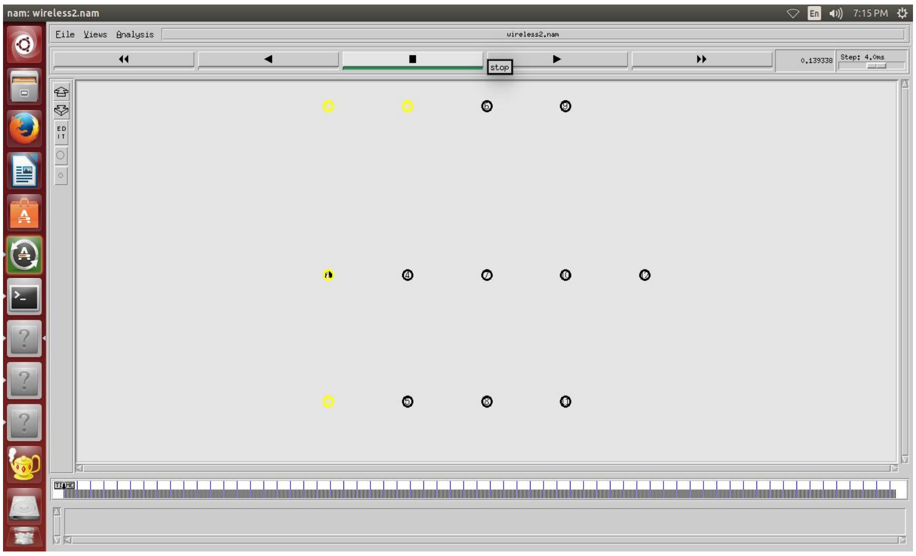

Fig.5.Node Creation in NS2

Fig.6. Creating the Stationary Node in Ns2

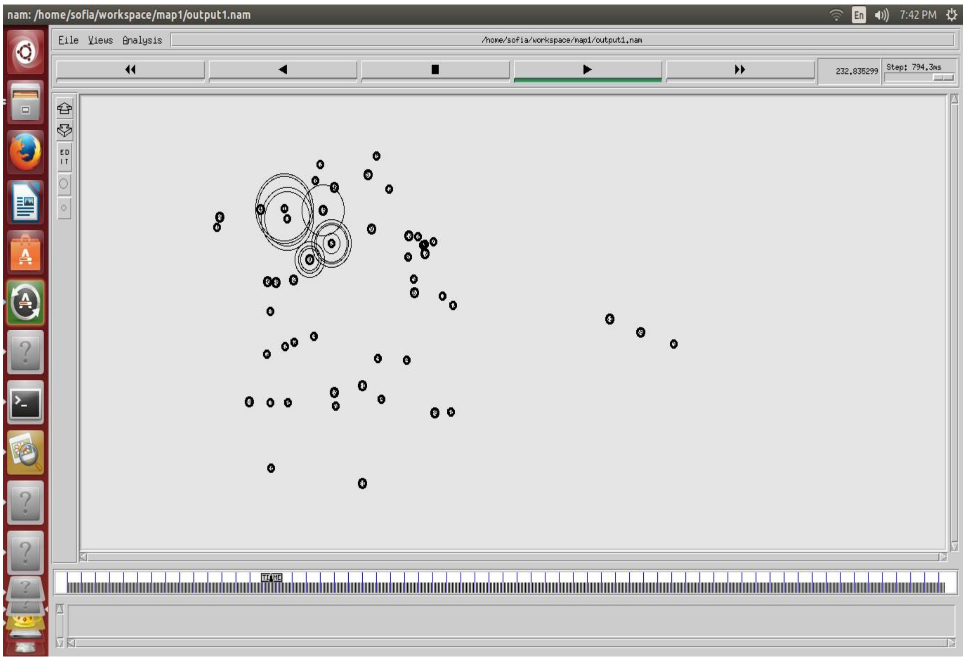

Fig.7.Communication Establish between the nodes

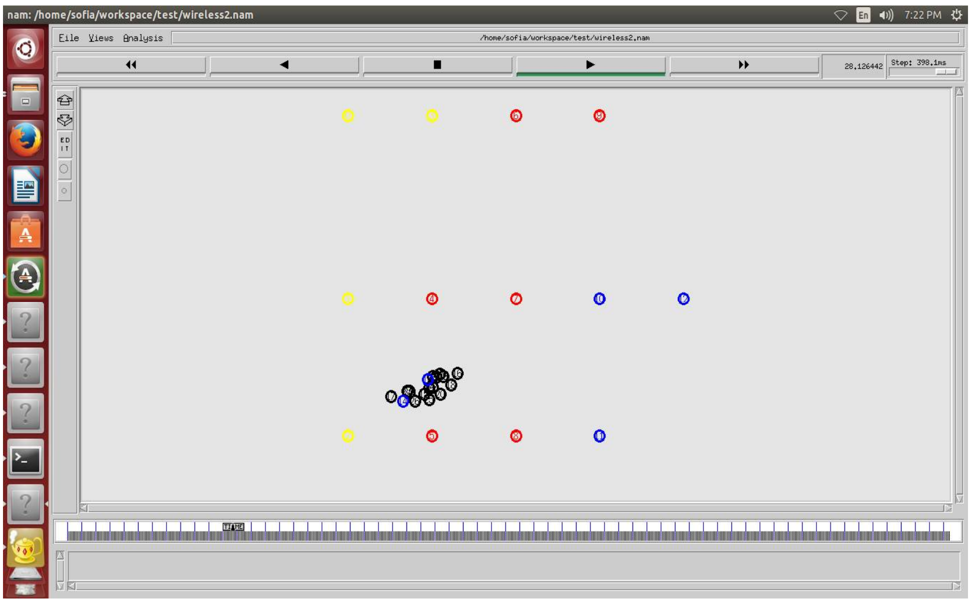

Fig.8.Data Transmission Between the nodes

1.2 Map Creation and Vehicles Movement Generated in SUMO

The Map Editor is used to create the road network and currently our implementation provides three different ways to create the road map. The map can be manually created by the user, generated involuntarily or imported from existing real world maps such as publicly available TIGER (Topologically Integrated Geographic Encoding and Referencing) database.

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1.2.1 Map Generation in SUMO

In SUMO, the road map can be generated manually, automatically or imported from a real world map. Manual generation of the map requires inputs of two types of information, nodes and edges. A node is one particular point on the map which can be either a junction or the lifeless end of the roads. Furthermore, the junction nodes can be either normal road junctions or traffic lights. The edge is the road that connects two points (nodes) on a map. The attributes associated with an edge include speed limit, number of lanes, the road priority and the road length.

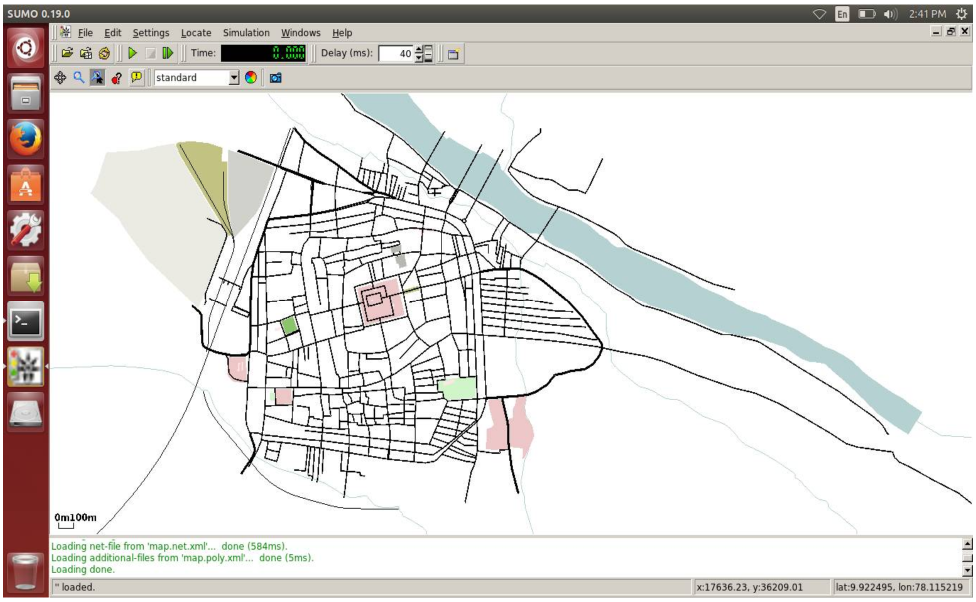

Fig.9. Road Map generation using the Map Editor

We are currently in the process of integrating Google Earth into SUMO. OSM is a tool that enables its user to view the satellite image map of any place on earth. One of the functionality that OSM provides is called "place mark" which allows the user to put a mark on any location of the Open Street map. Each place mark contains the longitude and latitude information of the selected locations and can be saved into a file in XML format. Hence, one can define the node location on the Open Street map and then extract the node information by processing the saved XML file. This allows SUMO users to generate a map for any real-world road on earth for their simulations. The road map can also be generated automatically without any user input. Three types of random maps are presently available: grid, spider and random networks. There are some parameters associated with different types of random maps such as number of grids and the number of spider arms and circles. Finally, one can also create a realistic map by importing real world maps from publicly available database.

1.2.2 Vehicle Movement Editor

The movements of vehicles can be created automatically or manually using the Vehicle Movement Editor. The Vehicle Movement Editor allows users to specify several properties of vehicle routes including the number of vehicles in a particular path, vehicle departure time, origin and destination of the vehicle, duration of the trip, vehicle speed (including acceleration, deceleration and maximum speed), etc. In addition, a SUMO user can define the probability of turning to different directions at each junction in the editor. Figure 10 shows a snapshot of the Vehicle Movement Editor. On-Board Unit communication has recently become an increasingly popular research topic. A new pattern of Networks in Motion is quickly attracting interest from the research community and is also being viewed as a doable commercial solution for extending Internet services to public transport passengers. SUMO allows users to enter the bus time table to simulate the movements of public transport. We model the taxi as one type of vehicle which has similar

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parameters, such as speeds, routes, etc, associated with it as other vehicles. In addition, one needs to define the departure times of the first and the last taxi and the taxi inter-arrival time to simulate the bus time table.

2. Path Delay Analysis

It is common in Vehicular ad-hoc network that the nodes move within a certain transmission range, therefore network performance directly depends on the number of hops with average delay in a VANET. Latency is one of the key parameter to be considered for vehicular network traffic. It is defined as the time taken for a packet to be transmitted across a network from source to destination. Throughout of the network is universally proportional to the average delay between source and destination.

CALCULATION:

Delay=Starting Time-Ending Time

Throughput=Number of Packet Send-Number of Packet Received

Consuming Energy=Initial Energy-Final Energy

Total Energy=Total Consume Energy(less)

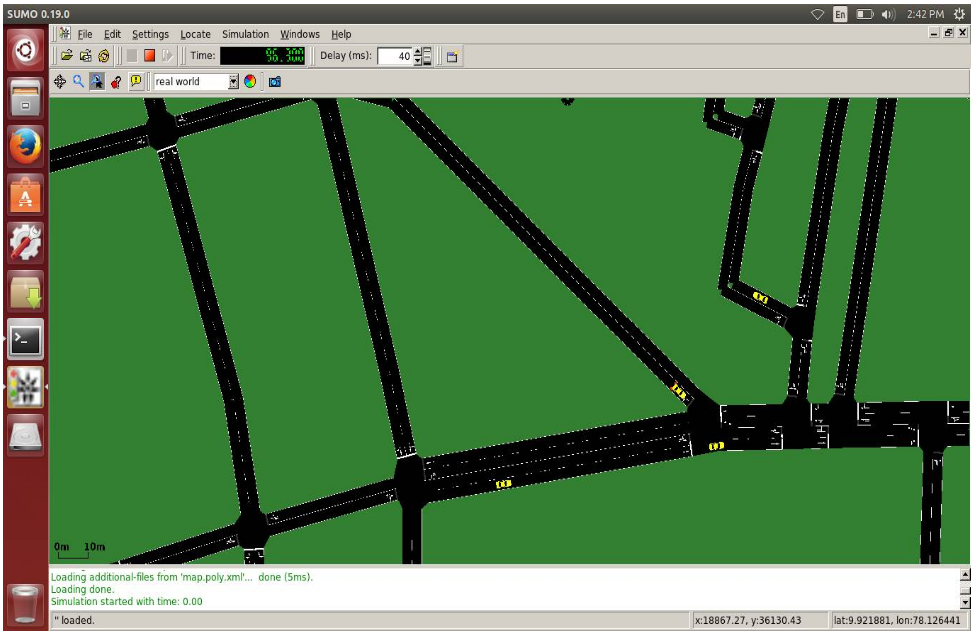

Figure.10. Vehicles Movement Generator in SUMO

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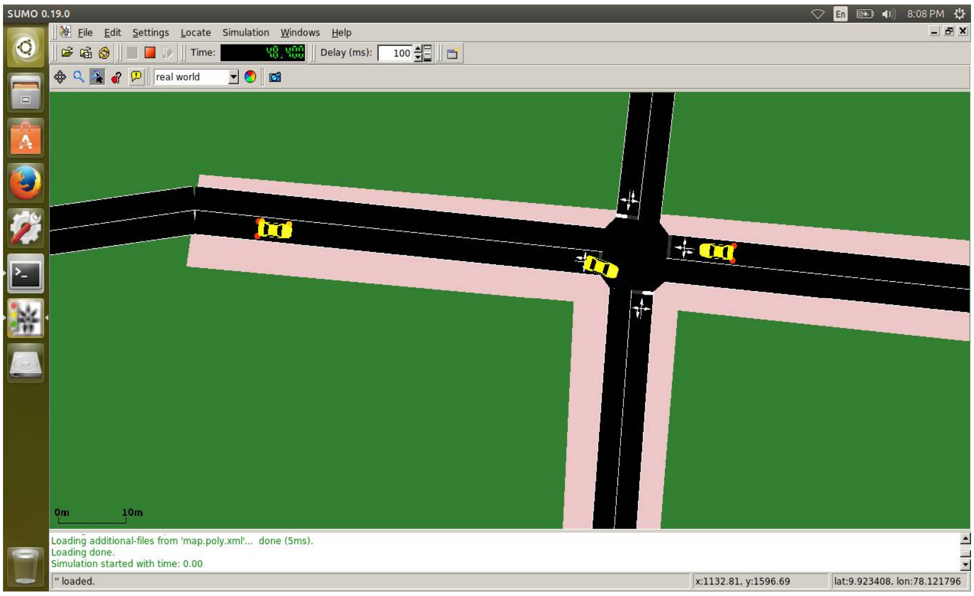

Figure.11.Vechicle Moving in Predefined Path

3. Implementing Traffic Aware A Algorithm*

TAA*algorithm is a best first graph search algorithm that finds a least cost path from a given initial node to one goal node. That is widely used in path finding and graph traversal. It is based on the generic search algorithm which can be used find solutions for several problems. It has using two types of the list one is open list another one is closed list. The open list contains all the nodes in the map that have not been explored yet. The closed list contains of all nodes that have been totally explored.

PSEUDO CODE FOR TAA ALGORITHM:*

1. Let's P is the source node
2. Assign g, h and f values to P (Attributes g, h, and f)
3. Add the source node to the open list
4. Repeat the following steps
    1. If it is on the closed list ignore it
    2. If it is not on the open list add it to open list
    3. Make the current node the present of this node
    4. Record the g, h and f value of this node
    5. If it is on the open list already
    6. Check to see if this is a better path
    7. If so change its parent to the current node
    8. Recalculate the g and f value
5. Tracing backwards from the destination node to the source node that is the path

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Time slots for packet transmission	Delay rate
2	116.38
4	517.95
6	1253.72
8	1968.21
10	2300.81

TABLE 2:- DELAY RATE FOR PACKET TRANSMISSION

Time slots for packet transmission	Energy spent
2	16.30
4	16.78
6	17.31
8	17.84
10	18.38

TABLE 3:- COLLISION RATE FOR PACKET TRANSMISSION

Time slots for packet transmission	Throughput
2	37.60
4	122.01
6	151.91
8	165.81
10	174.07

TABLE 4:- THROUGHPUT FOR PACKET TRANSMISSION

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V. PERFORMANCE ANALYSIS

The main goal is to find the shortest distance from source to target node by comparative study of algorithms. This will give us the best available path or route to reach at destination so that the problems of latency can be reduced. In this paper we have to check following parameters:-

1) Optimal path: Road Side Unit (RSU) should provide user information about safer and more relaxed driving route. Based on this metric, route planning algorithm aims to find a vehicle route satisfying driver's preference the most.

2) Travel distance: Finding the shortest path means searching the path from the origin location to the destination through which the vehicle travels the shortest distance.

3) Travel cost: The travel cost defines the total cost from source to destination. Suppose cost unit is Rs 2 per kilometer. Cost= Distance x Cost unit

4) Elapsed time: The travel time is another criterion for route planning algorithm. The fastest route is the path through which the vehicle can reach its destination with within minimum travel time.

5) Overheads: transparency consists of extra computations that are to be performed to get the results. A* gives better results than Dijikstra's.

6) Scalability: Another factor is scalability. The scalability of an algorithm reflects the decrease of performance when the size of the road network gets larger.

7) Quality of the best route: This is used to compare the different best routes in order to determine which algorithm is calculating the contiguous solution to the optimal route.

8) Negative Edges: Dijkstra's does not work on negative values but A* work on negative values.

9) Delay: The time taken by A* is small as compare to Dijkstra's algorithm.

VI. COMPARISON BETWEEN DIJKASTRA AND A*

TABLE 5
Difference between Dijkstra's and A* algorithm

Parameter	**Dijkastra**	**A***
Time Complexity	The time complexity is O (n2).	Time complexity is O(n log n), n is the no. of nodes.
Negative edges	No	Yes
Heuristics Function	f(n)=g(n), g(n)represents the cost of the path from the starting point to the vertex n. Dijkstra's Algorithm is the worst case of A star Algorithm.	Heuristic Function, f(n)=g(n)+h(n), g(n) represents the cost of the path from the starting point To the vertex n. h(n) represents the heuristic estimated cost from vertex n to the g.
Search Algorithm	Greedy Best First Search	Best First Search

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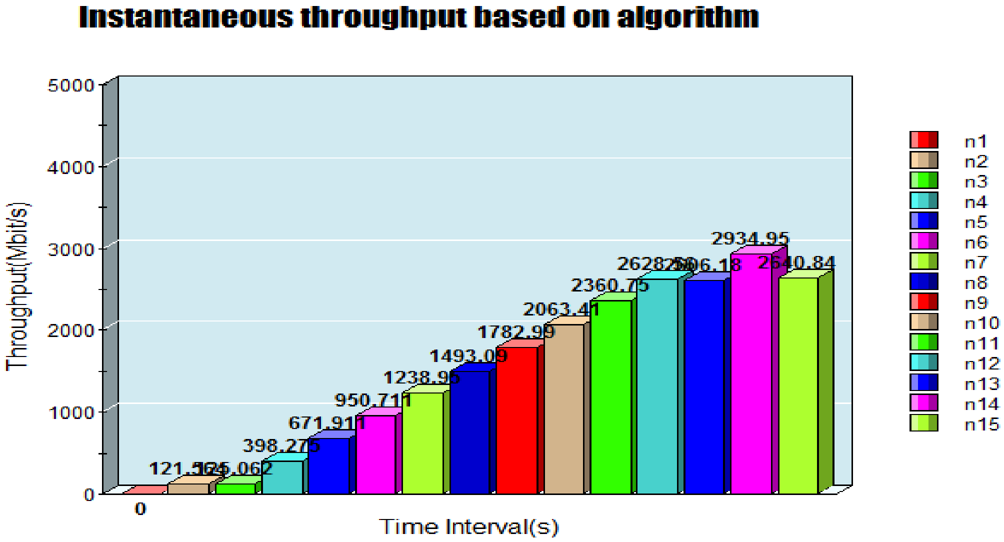

Fig.13.Nodes Throughput

The experiment is performed by taking 50 nodes. The results show that the A* gives better results as compared to the Dijkstra to reach at destination. By Dijkstra algorithm the distance covered by a vehicle is smaller as compare to A* and time it takes to reach at destination is also less as compare to Dijkstra. A* works on negative as well as positive edges but Dijkstra only work for positive edges. A* requires O (|V|·|E|) time, while Dijkstra requires O (|E| + |V|log|V|) time, we have concentrated on finding shortest path in small time. The table illustrates the performance of A* and Dijkstra algorithms. As a result best available path is found in less time the end-to-end delay is the time taken for a data packet to reach the destination node and the average delay is calculated by taking the average of delays for every data packet transmitted.

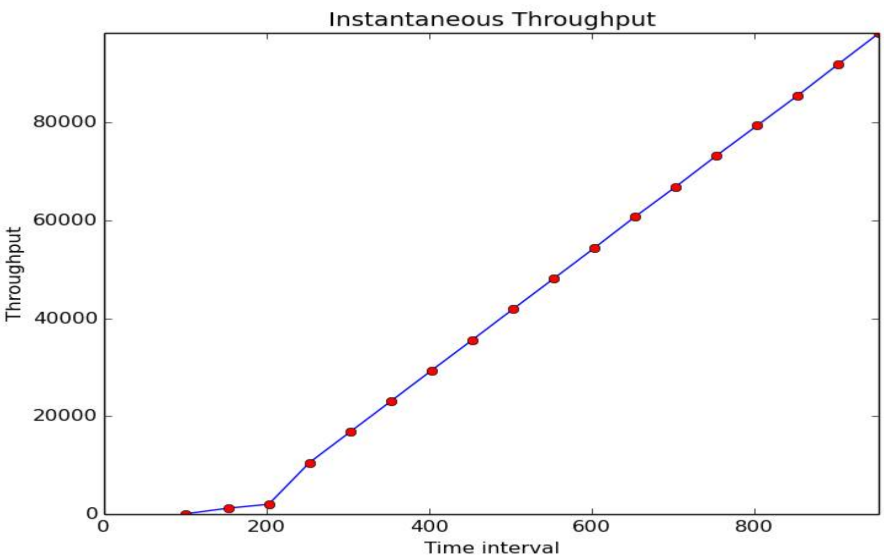

Fig.14. Average Delay analysis of AODV

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

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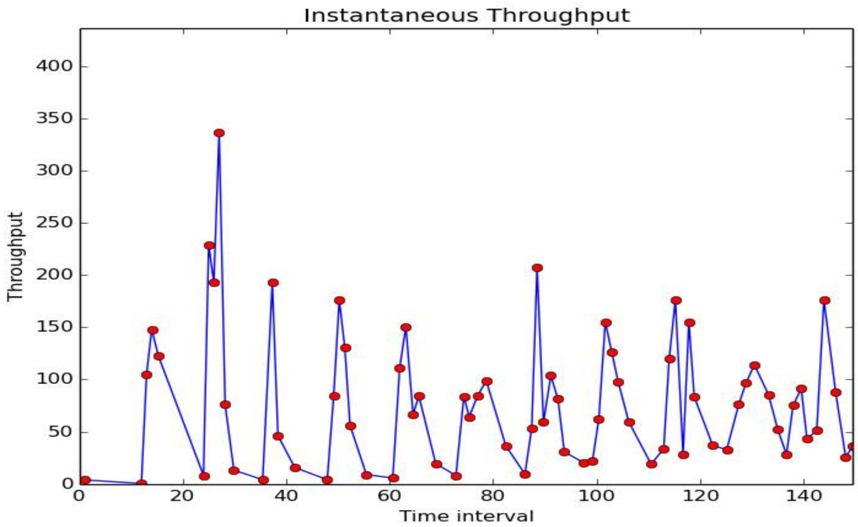
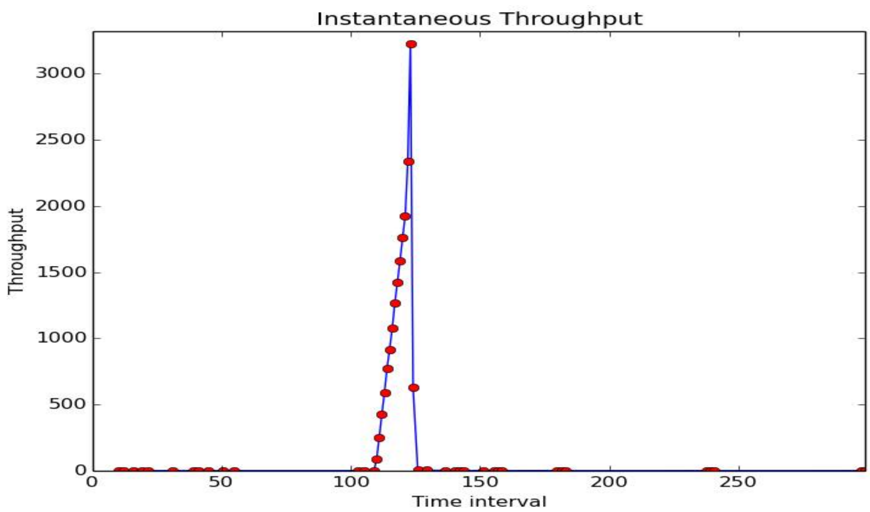
Vol. 5, Special Issue 1, March 2017



Scenario 1: Fig.15. Average throughput of AODV

Scenario 1: It is a measure of the amount of data transmitted from the source to the target in a unit period of time (seconds). The throughput is measured in total bits received per second. The throughput of all nodes in the simulation is normally increased as the simulation increases.

Scenario 2: It is a measure of the amount of data transmitted from the source to the target in a unit period of time (seconds). The throughput is measured in total bits received per second. The throughput of all nodes in the simulation is normally increased as the simulation increases.



Scenario 2:Fig.16. Average throughput of AODV

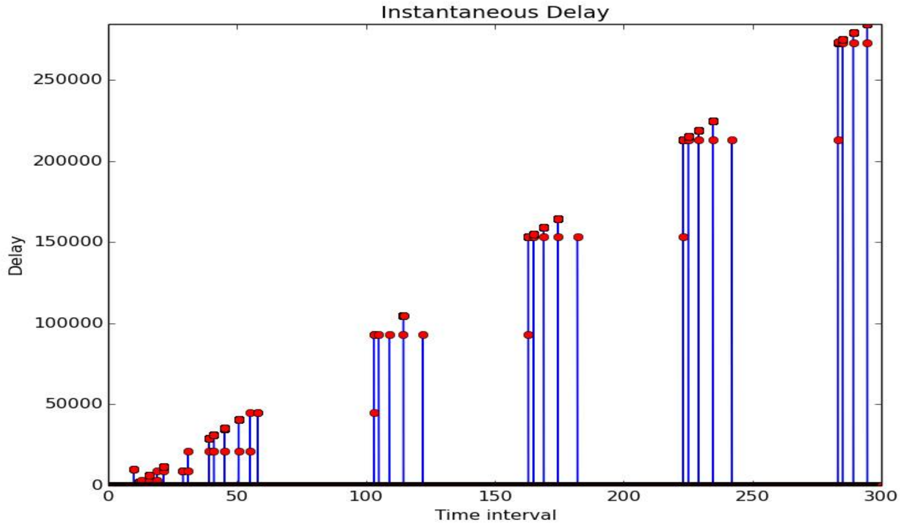
ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Special Issue 1, March 2017



Scenario3:Fig.17. Average Delay of AODV

VII .CONCLUSION AND FUTURE WORK

In this paper, focused how to minimize the expected end-to-end delay in a large-scale VANET with both V2V and V2I.store-and-forward framework, by introducing drop boxes which function similarly to routers with extra storage. The optimal link strategy which is independent of the message arrival time and can be executed in a distributed manner. We derived the expected path delay, considering the dependency of the delay components along each path and proposed the optimal routing solution to minimize the path delay. Dijkstra's Algorithm is essentially the same as A* Algorithm, except there is no heuristic (H is always 0), because it has no heuristic, it searches by expanding out equally in every direction, but A* scan the area only in the direction of destination. As you might imagine, because of this Dijkstra's usually ends up exploring a much larger area before the target is found. This generally makes it slower than A*. But both have their importance of its own, for example A* is mostly used when we know both the source and destination and Dijkstra’s is used when we don't know where our target. It may know where several resource areas are, but it wants to go to the contiguous one. Here, is A* better than Dijkstra's because we don't know which one is closest. Our only alternative is to repeatedly use A* to find the distance to each one, and then choose that path. A* is both complete (finds a path if one exists) and optimal (always finds the shortest path) if you use an Admissible heuristic function. If your function is not admissible off - all bets are off. In future we can build the Geocast routing protocol based vehicle movement and implemented priority based vehicles, non priority based vehicles movement. Additionally implemented the Hybrid cloud based VANET for the Data Dissemination.

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ISSN(Online): 2320-9801
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International Journal of Innovative Research in Computer and Communication Engineering

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