VANET:Moving Zone Based Routing Protocol

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Abstract : Vehicle – to – Vehicle communication is more emerging wireless communication application area networks. VAET is the most difficult and flexible communication network architecture. The application of VAET is to give better safety environment when vehicles are moving with high speed on the highways. In VAET each node is in dynamic nature, due to this nature finding an optimal position of the node and efficient communication way is a most challenging task. Routing protocols are significance functional parameter of the VAET, where the application of particular routing method is responsible of vehicular communication. The proposed paper is mainly concentrated on position based path estimation routing method. A distance based method of routing algorithm is used to find the efficient path in the nodes so that every node can get a flexible communication path between the nodes. The expected possible outcome simulation explains that application on Moving object Zone (MoZo) based routing protocol present a better packet delivery ratio.

Keywords*: Vehicular Ad – hoc network (VAET), GPS calculator, Spiracle Co-ordinator, Vehicular moving Zone, MoZo Routing Protocol.*

I. INTRODUCTION

Advanced in wireless communication technology leads to the number of applications area. Recently ad hoc networks or wireless ad hoc networks are emerging wireless communication technologies. It includes 2 different types of communication modules i.e. Mobile ad-hoc network (MANET) and Vehicular ad-hoc network (VANET). VANET is a sub section of MANET used to give an efficient communication between the movable nodes. Recently wireless communication getting an immense significance in vehicular equipment to provides efficient information about the path information, traffic density in particular path etc between the nodes. VANET is a low range communication technology, USA's Federal Communication Commission standardize the 75MHz function bandwidth in 5.9GHz band [01].

Typical VANET communication network involved 2 different types of communication methods

1. Vehicle – to – Vehicle (V2V) Communication.
2. Vehicle – to – Infrastructure (V2I) Communication.

VANET is completely infrastructure less. This is characteristic make VANET communication technologies more complex. The other most important parameter which makes the VANET communication most challenging is listed as

- The surrounding Vehicle environmental condition (i.e. Reflective surface).
- The dynamic speed of vehicles will affect the radio communication.
- Frequency interference of 2 different movable nodes.

These listed characteristics are not eliminated completely, but system can be designed so smartly to meet the efficient communication by using set of routing protocols. V(vehicle) to V communication is the most challenging communication structure. It is decentralized in architecture and communicates with the adjecent node and make the decision based local functional parameter. Car2car communication mainly deal with how designer architect the car i.e. communication method, routing protocols. As per the IEEEE 802.11 standard 5.9 GHz band freq is allocated to the communication purpose. The application V2V communication we only get required nearest neighboring node information. In vehicle to infrastructure, every node can efficiently collect the local and global traffic information [02]. Along with that every node can able to find out road condition etc. more electronic sensors are placed to collect the essential information about vehicle movements. The application both communication methods give security to vehicle movement over the highways. The sample of VANET with both V (vehicle) to V and V(vehicle) two I is presented in Figure 1.

As previously mentioned routing is method of challenging and significance operations of VANET. In which data can be sending from source to destination node either by using multi hop. Routing protocols are used for finding the efficient path forpackettransmission.Theseprotocolroutes

the packets with minimum path and try to keep the desired route and keep track the node within the geographical area. The protocol that transmits the packets to the final position with small amount delay and reduces the packet failure rate followed with this function at minimum bandwidth is considered as good routing algorithm. VANET has own set of routing method. Topology based routing methods and position based routing methods are the two different routing methods of VANET. Every type of routing techniques divided into a set of algorithm depending on the requirement. Compared to the routing based on topology techniques, location based routing method presents best outcome during data communication.

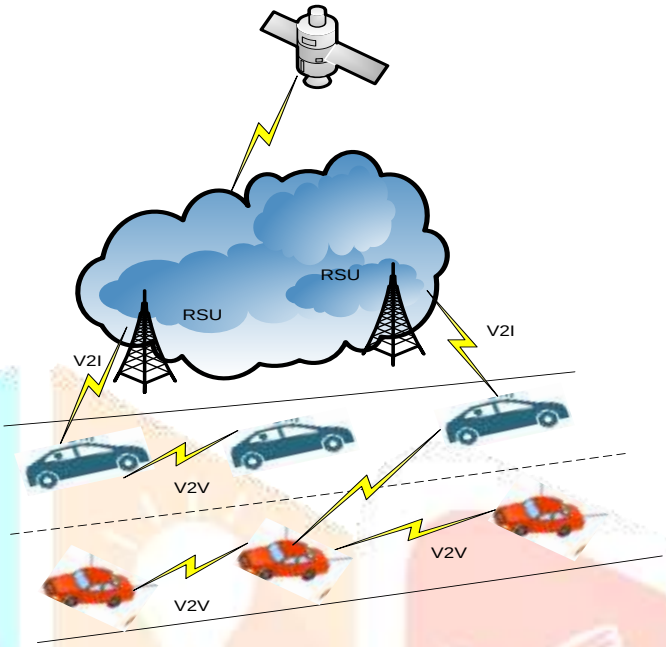


Figure 1: Sample of VANET

Since from few decade lot of research is conducted on VANET and its routing protocols. The survey of little research work is given in below section. Further in proposed paper the designer mainly concentrated on location based routing communication. The designing of system and its functioning is briefly explained in methodology section.

I. LITERATURE SURVEY

Ye Tao et.al [03] has designed location based routing protocol in VANET, in which they mainly concentrated on duplication of packet and encapsulation. Topology is significant functional characteristics of VANET. Sudden change in the topologies will lead to the loss in the packet network. In the referred paper author is mainly concentrated on this problem. GeoNetworking standard networking infrastructures used to reduce the losses in packet problem. Both routing challenges and routing encapsulation difficulties are reduce by the application of Duplicated Unicast Packet Encapsulation (DUPE) protocols. The system performance is analyzed by using some significance technical parameters i.e. latency, operational frequency range. These parameters are reached up to the reasonable values and in certain outline the level of packet loss is almost minimized.

Mayank Bhatt et.al [04] has designed a VANET module are mainly concentrated how to avoid the traffic collision. VANET is a smart and emerging communication networking topology, where random change in topology and high speed of vehicular moment leads to the traffic jam, possibility of packet collision. As network density increase the level of complexity also increase. In the referred system architecture a VANET is union with Bat Algorithm to presented best node path for communication. Using bat algorithm is to check the validation of the node. After estimating the valid node, VANET compute the best optimal path for data communication. This will reduce the system resources and also track the valid node.

Qing Ding et.al [05] has mainly concentrated on sodium lamp connectivity to the vehicular movement. VANET is completely infrastructure less and frequency of the vehicles is varied because it's rapid movement in the network. odd distribution of the VANET is increasing the difficulties in street connectivity. In the referred paper designer mainly concentrated on traffic light characteristics based on vehicle movements. Initially they estimate the values of vehicle on street and monitor the effect of traffic light. Further based vehicle density it compute the street connectivity. In this paper a Traffic Light alive Routing protocol is preferred for street connectivity. At the result section with the help of act the system designer proves that there is a increase in the packet delivery ration and reduction in node to node delays.

A M. Oranj et.al [06] has designed an Ant Colony Optimization based routing protocol for VANET. Change in the environmental condition increase the complexity of communication. In this paper this complexity is eliminated by integrating the ant colony optimization method with dynamic MANET on demand (DYMO). The integration of this both routing algorithm can effectively find

out optimal communication direction between the nodes. The discovered route path is estimated by considering two functional parameter i.e. delay time involved in communication and trustworthy of the selected path during packet transmission over the network. The ant colony algorithm performance is compared with Demand Distance Vector (AODV) algorithm. Based on the comparison result the designer concluded that proposed routing algorithm presents best simulation result.

Dan Lin et.al [07] designed a pure vehicle to vehicle communication routing network. In which vehicle to infrastructure is completed eliminated by using moving zone based routing protocols. The clustering of the vehicle network is a significance functional parameter in VANET to communicate with the neighboring nodes. The vehicle that has similar speed will form the clusters, and who form the cluster will be the cluster lead. While passing the node information it must be necessary to keep the zone construction and the numbering of sequences of each vehicle in the cluster. The application of moving zone based routing protocol presents a better packet transmission rate and minimize the complexity overhead involved during data communication.

Vehicular Ad hoc network is very challenging concepts and finding optimal path of each node is much more difficult due its functional characteristics. Guangyu Li et.al [09] has designed an Ant Colony Optimization (ACO) based vehicular Ad hoc Network. Due to the characteristics of network i.e. large operating range, speed of vehicular system and rapid change in the network topology increases the difficulty of implementing an efficient Vehicular Ad hoc Network. In the referred paper system designer proposes an AQRV (Adaptive Quality of Service) based data routing protocols. While passing the packets from starting point to destination, the application of routing algorithm efficiently select the optimal path which meets the Quality of Service (QoS) condition. In the referred paper the system performance i.e. QoS is measured in terms of packet delay, packet delivery ratio and node connectivity. The routing selection is mathematically computed and optimization challenges are overcome by using ACO algorithm. Along with the ACO algorithm a Local QoS Models (LQM) is proposed and integrated to join the best QoS for urban vehicular ad hoc network.

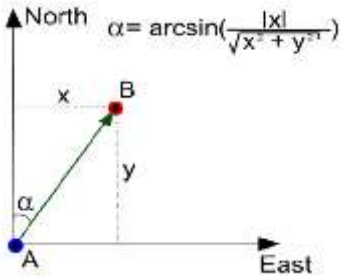
The literature survey reveals that most of the research work is done on both clustering and non clustering based vehicle to vehicle communication but none of the work is union with moving objects in V2V communication. The limitation involved in V2V communication specially with moving object is overcome by application moving object zone based routing protocol. The system architecture, working flow and routing finding methods are presented in below section.

II. METHODOLOGY

The design an inter vehicle communication module there must be necessary to analyze the environmental attribute of the node. In every environmental condition vehicle has its own characteristics. Before designing any VANET inter communication module there must be a necessary to have the knowledge about the characteristics of each node in that particular environmental condition. The random nature of the vehicle i.e. it changes its position randomly, the velocity is going to be changes and obliviously direction is not at all fixed. These characteristics of vehicle increase the level of complexity, vehicle collision is the common and dangerous thing happen in the vehicular movements. This can prevented or eliminated by calculating the optimal position of the each node in a geographical area. The proposed moving object zone based routing system architecture flow in Figure 5.

The architecture is purely providing vehicle-to-vehicle communication. A self formed moving object zone is created to give an extensive routing solution of VANET. The above architecture pictorially explains the concepts of our proposed work. In which moving zones are presented by cloud symbol and propagation connectivity is shown by the arrows. The purpose of the designed system is to combine the functional parameter of moving objects and rule them by providing an effective vehicle management. The location of the moving object is collected from GPSR.

It is always in three dimensional space i.e. ‘r’ is radial distance, θ (theta) polar angle and lastly azimuthal angle is denoted by φ (phi). By using spherical co-ordinate system these values are converted into an x, y and z plane. In which it is assumed that z plane is considered as 0. Based on x and y axes plane a correct position of the node is estimated. The pictorial representation of X and Y axis estimation is shown in below Figure 2. This position information about the vehicular node is applied for routing the data between the movable vehicles.



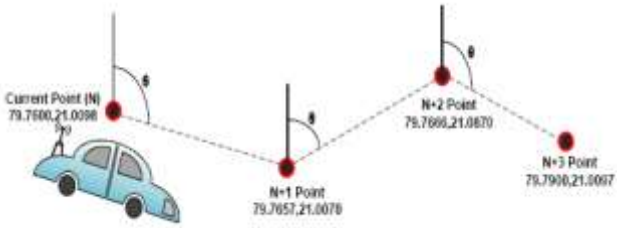


Figure 2: X and Y Distance Computation

Figure 3: Sample Module of X and Y axis of Movable Vehicle

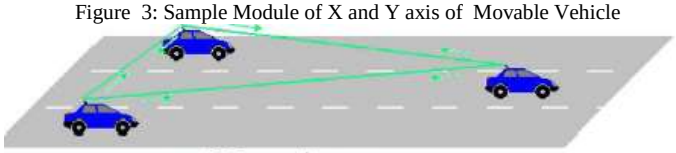


Figure 4: Integration Between Vehicle within a Zone

In the proposed work a respective zone or functional range of each node is estimated based their moving patterns (i.e. Speed, direction and distance). After collecting the proper position details of each node, the movement information is continuously updated in the index of the node storage and vehicle management. The pictorial representation of vehicle X and Y axis and the interrelation between them are shown in Figure 3 and Figure 4.

It presents the reasonable clustered based approach, in which depending on the moving patterns vehicles are grouped. Each moveable node continuously update it information along with that node head is able to finding the current position of the adjacent node by using index information. The use of index information efficiently reduces the network overhead involved in position estimation of each network, path estimation and delay in packet delivery. The working of proposed routing algorithm, zone formation and vehicle - to – vehicle communication

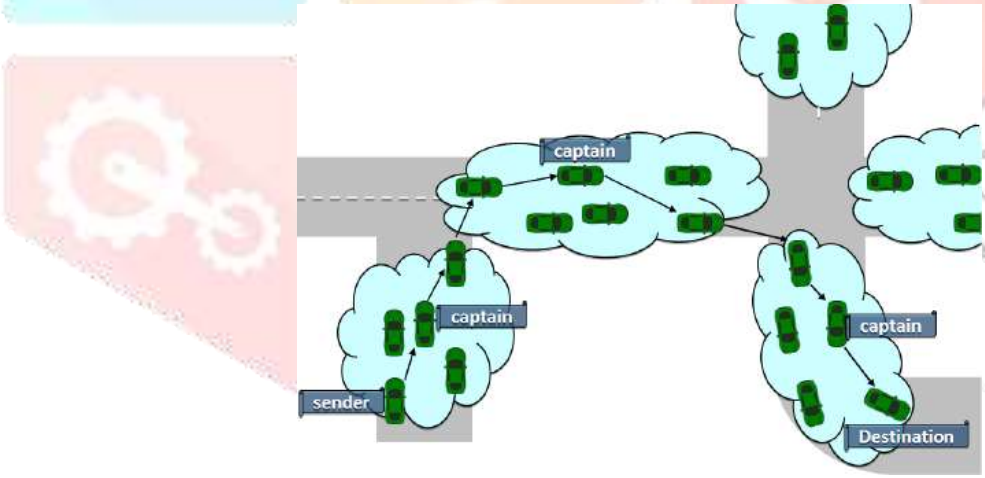


Figure 5: Proposed System Operational Block Diagram

A. Moving Object Zone Based Routing Algorithm

It includes a group of moving zones formed based moving patterns. The object which are in similar movement grouped together. The managing of each node and data transmission is all is handling by the head node which enters first in created node. Before proceeding with vehicular movement observation, imagine that each movable node designed On Board Unit (OBU). This on board unit effectively used for computing messages, networking purpose and for global positioning system (GPS). Along with all these network parameter a digital map is provided to calculate the accurate path. A data link technology is used for data sending between vehicle to vehicle communications. Vehicle on network is identified by its unique ID, this ID is usually used to tract the node on network and especially when it's changing the present zone and join to the another one. . Moving movement is one of the significance functional parameter used zone creation.

B. Moving Zone Formation

Vehicle movement similarity is considered during zone formation. The function zone construction is beings with vehicle logging onto the VANET. To join the zone it need to execute the joining protocols to integrate with existing nearby moving or to form the new one. The head node of the zone is required to maintain all the information about the member nodes.

1) Process of Combining the Node to the Zone

Consider the vehicle V_s which want enter into new zone, to become member of zone it transmit a hello packets to its neighboring nodes. This hello messages include unique ID of V_s, current position ID (ID_r) and the direction it was moving (δ).Further vehicle V_s wait τ time to collect the response for its transmitted hello messages. The captain node or moving object which is in the equal movement collect the hello messages of vehicle V_s and immediately respond it by transmitting its unique ID, recent position and its velocity. Continuingly after the time τ expires, the present node computes the score came from the neighboring nodes V_c and estimate the similarity between them. The vehicle finds the zone which stay in nearest to the vehicleV_s. The average distance between the node V_s and neighbor node V_c 's are computed with specified periodical time. The computation contains three functional steps, firstly direction of the V_c movement, and second one is current point of the node at particular time slot. Third is the weighted distance between the nodes. The node which has the higher similarity is much nearer to the node V_s. After calculation V_s request the node by post a request message. The node V_c conform the request of V_s by sending a conformation message. In different case if V_s not found any nearest node then it creates its own zone become head. The functional procedures involved in joining event are summarized in below section.

***Algorithm 1*: Joining Event of Vehicle V_s to the Zone**

1. Vehicle $\boldsymbol{V_s}$ broadcast the **"Hello"** messages**.**

From Vehicle V_c

2. Collect the **"Hello"** messages from nearest nodes**.**
3. Identify the node $\boldsymbol{V_c}$ which is same movement as $\boldsymbol{V_s}$
4. **if** V_c is in same direction $\boldsymbol{V_s}$
5. **reply V_s by** sending an response messages

Vehicle V_s

6. ***while*** wait time < τ
7. Collect the responses from neighbour node V_c.
8. ***If*** no response from $\boldsymbol{V_c}$
9. than create zone
10. ***else***
11. collect the responses from V_c
12. Compute the score of similarity
13. Consider the V_c which has the higher score
14. Send a request messages to V_c.

At vehicle V_c

15. Collect the request messages from V_s
16. Pass the conformation messages to V_s
17. Joining the Zone

End Algorithm

2) Data Transmission by MoZo Protocol

The functional characteristics of MoZo are explained above section, this section explains how to utilize the specification of MoZo routing protocol in data transmission between vehicle to vehicle communications. The simple example of proposed system architecture is shown in below steps. It is considered that a vehicle has 'I' piece of information which is, that should be share with neighboring node presented at location L(x, y). The functional steps involved data transmission between the two vehicles is listed as.

*Step.1:*The sending message includes, sending vehicle unique ID (i.e. collected from GPS ID_s), the message (I) which is to be shared and finally location of the surrounding node location i.e. L(x,y).

*Step.2:*The collected message destination is estimated by the captain vehicle, if the destination is within the zone than it directly passes to the destination node. If not the captain vehicle find out the nearest node which is much nearer to the destination node and transmit the message to the selected node. For message propagation there is need to find the good candidate vehicle, the following algorithm used to compute the good path. A Dijkstra algorithm is used by the zone head to find the shortest path to transmit the message to destination node L(x, y). Further the intersection point L_e of the minimum routing path and communication range estimated. The picture of the following operational steps is presented in below Figure 3.

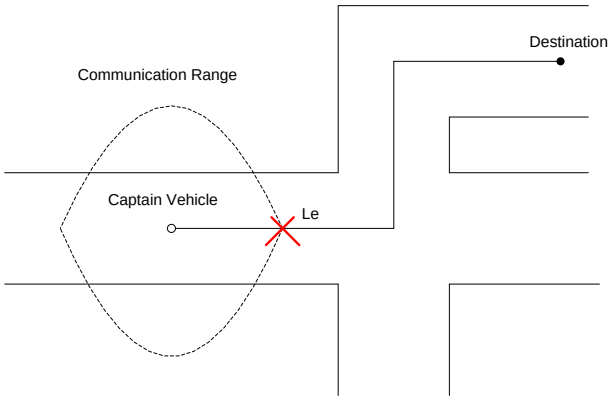


Figure 3: Message Delivery Route Computation between the Two Nodes

*Step.3:*When the message I is collected by the propagation vehicle V_p , than it will be responsible for sending the message to the nearest moving vehicle. In this data transmission the collected previous node information will utilised by the nodeV_p. Every vehicle node in particular zone will maintain the details each capital node of the particular that are replied to its hello message. The propagation node finds out the captain node whose time stamp updating is less than current time minus2τ. The listed nodes are arranged in an increasing order based on their distance to the destination node. The ping message is transmitted by the propagation node and collects the responses. Based on the collected response node V_p select the first top most nodes and send the message to it.

If response is collected within the timeτ, than it is considered that the vehicle within the listed is moved from the zone. So again propagation node ping all the neighbor node based their response it send out the message either to the next propagation vehicle or may be destination node.

*Step.4:*This functional step can be analyzed in two condition i.e. first one when node head received messages from propagation vehicle V_p of different zone. This operation is continued with step 2. Second one when neighbour node belongs to another zone that time the neighbouring node inform its node head for further data transmission.

The functional message routing protocol is shown below Algorithm 2.

***Algorithm 2*: Data routing between the Nodes**

V_{sen} : Sending Vehicle

1. Transmit the Message $\boldsymbol{M = \{ID_s, I \text{ and } L(x,y)\}}$ to the nearest node$\boldsymbol{V_c}$.

V_c*: *Node Head/Captain Vehicle

2. Collect the Message M from $\boldsymbol{V_{sen}}$ node
3. ***If*** the location information i.e. *L(x, y)* inside the zone
4. search the receiver node $\boldsymbol{V_{rec}}$with location *L(x, y)*
5. Transmit the message to node $\boldsymbol{V_{rec}}$
6. ***Else***
7. Calculate point $\boldsymbol{L_e}$
8. Search the propagation node $\boldsymbol{V_p}$
9. Transmit the message **M to** $\boldsymbol{V_p}$

V_p: Propagation Vehicle

10. Collect M message
11. Arrange the node head in ascending order (i.e. based on their distance).
12. for V_c'
13. V_c' is moved towards L(x,y)
14. Transmit the M message to V_c'.

15. ***Ping to Neighbouring nodes***
16. ***for*** all nearest neighbour i.e. responded ones
17. ***Compute*** V_p' which moves closer to the *L (x, y).*
18. Transmit ***M to*** $\boldsymbol{V_p'}$**.**

V'_p: Next Propagation node

19. Collect message M
20. **If** V'_p is head node
21. Perform Step 2 operation
22. **Else**
23. Transmit message toV'_c.
24. V'_c Perform Step 2 operation.

End Algorithm

C. Zone Maintenance

Main aim of message routing is totally build upon the zone maintenance. It is a continuous operation which monitors the present zone node quality. To increase system performance, there must be need to update the vehicle information time to time. The vehicle updates is efficiently present the node information which present in the existing node as well as the node which want join the present zone or which are going to leave present zone. Zone splitting and Zone merging another functional can be considered to enhance the system performance.

III. EXPERIMENTAL RESULT

A network is initialized with 10 random movables nodes. The distance between the nodes is varied (i.e. from 600 to 3000 meters) to estimate system response for fixed number of data packets. Initially each node broadcast a beacon messages to collect nearest neighbor node information and these beacon messages are retransmitted in every 2s. For each distance a 90 messages are transmitted between the two nodes. The performance of the Mozo (Moving object zone routing protocol is compared with CBLR performance of system is also evaluated with and without traffic controls. From the performance analysis it is proved that proposed moving object zone protocol present the reliable output.

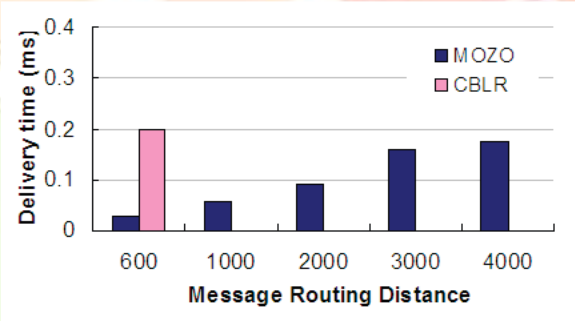


Fig. 7 Average Message Delivery Time

The main purpose of the proposed system is to design simple movable VANET network environment where each network can transmit the data to its neighbor node when it nearer to it or come in functional zone. The proposed Moving object zone based routing protocol efficiently transmit the data packets between nodes i.e. which comes under within the zone. Further this can be enhanced by considering few more traffic parameter like priority based, emergency and VIP based vehicle movement and there data transmission in the network environment.

FUTURE SCOPE

The dynamic movement of vehicle increases the system complexity. A set of position based network communication protocols has been designed to reach the system effectiveness. The performance of the proposed system presents the effective approach towards data transmission within the zone. In future a system performance can be enhanced by considering advanced routing protocols and some more network parameters i.e. network traffic analysis in multiple hops with multiple vehicles, path verification by collecting neighbor node information and priority based data transmission in dense crowd.

CONCLUSION

The safety level of person's life at urban and highways increases by the application or designing of efficient VANET network. The integration of GPS information, spherical ordinates and MoZo routing protocol effectively identifies the nearest node within the predefined clustered zones. In which each node actively communicate with the adjacent node by which come under the. From the simulation result it is proved that designing a VANET by using Moving Zone based routing protocol effectively enhance the system performance in tem of increasing the packet delivery ration and reducing packet delay time between vehicle to vehicle communications.

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