DYNAMIC CLUSTERING-GATEWAY MANAGEMENT AND COLLISION DETECTION-SOLUTION TECHNIQUE IN VANET-UMTS NETWORK

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ABSTRACT
VANET is self-organizing network which is created among no of the vehicles. According to survey there is approximate ten million people are dying due to road accident. This is one social as well as industrial challenge to reduce the rate of accident in the world. This reduction is possible if the vehicles can predict the vehicles besides it or around it. Advanced information of the vehicle which is about to crossing a person or sometimes not seen with the eyes that can be collected with the signal coming by the other vehicles and it will be very beneficial for the reducing the rate of accidents. Here, VANET is one option for this scenario. More and more researches are going on this wireless domain to develop a new routing protocol for the VANET. It is very crucial to develop such type of protocol for VANET because of their continually changing speed and direction and the received signal [8].The implementation will be done using the CANU simulator. Recent research work in VANET emphasis on particular areas like routing, security and quality of service but still there are scope for reconstruction or creation of new design of protocol, services for VANET architectures .Vehicular Ad-hoc Networks (VANETs) represent a rapidly emerging, particularly challenging class of Mobile Ad Hoc Networks (MANETs)

KEYWORD: *WSN, MANET, VANET, ONBOARD-DEVICE, UMTS*

I. INTRODUCTION

In today's world the wireless communication is increasing day by day because of its many applications of that in real life like adhoc networks, Wi-Fi, wireless LAN etc. Every day the need of wireless network is increasing because of the Headache of wired network and this leads to reduction in costs. Basically MANET (Mobile Adhoc Network) is popular in wireless technology. VANET is a Vehicular Adhoc Network is particular kind of MANET in which communication occurs among the adjacent vehicles [5]. VANET is a wireless network that is formed between the vehicles on the basis of need that is why it is called as adhoc network. According to survey gateways are normally considered as the static one and it is deployed at fix distance on roadside so the cost is increasing .here is the motivation to make the dynamic gateways. One challenge is that normally we find that mobile device has issues of power [3]. Here, In VANET power issues are not significant constraints because of it can provides continues power supplies to computing device. There are many characteristics of the VANET which attract users or many scientists to make researches on it. The unlimited transmission power, high computational capability, highly dynamic topology, predicable mobility, potentially large scale, partitioned network, network connectivity and many more characteristics which make VANET more and more attractive. The FCC has allotted 75 MHz in 5.9 GHz band for licensed for v2v communication or inter-vehicle communication. It is also called as dedicated short range communication. Many cars like BMW and Toyota have launched important for

v2v communication [7].UMTS is universal mobile telecommunication system. Everyone is talking about the 3G or third generation now days. UMTS is a third generation (3G) mobile communication system that provides a range of broadband services to the world of wireless and mobile communication.V2V is basically communication between the cars or vehicle to vehicle. In v2v system every vehicles have onboard devices or unit which contains the GPS and GPRS also. In each vehicle GPS devices are getting or experiencing different types of UMTS signals at different region of each track.

The remainder part of this paper structure is as follow.

Section II consists of the related work or review of the Exiting literature. Section III consists of the different types of design of system architecture and Exiting algorithms and proposed algorithm. Section IV consists of the result and performance evaluation of exiting system. Section V is the conclusion. Section VI consist the future Work.

II. RELATED WORK

Survey of routing protocols in VANET

Following is a summary of representative VANETs routing algorithms.

2.1 GPCR (Greedy Perimeter Coordinator Routing)

To deal with the challenges of city scenario the GPCR is designed.

Advantages:

- This protocol is a restricted greedy forwarding procedure along a preselected path. When it will choose the next hop, a co-coordinator is preferred to a non-coordinator node even if it is not the geographically closer to destination node [7].

Disadvantages:

- GPCR not handle the low density traffic flow.

2.2 VADD (Vehicle-Assisted Data Delivery)

The guaranteed an end-to-end connection in a network with tolerable delay, Zhao and Cao proposed VADD based on the idea of carry and forward by using predicable mobility specific to the networks [4].

Advantages:

- It is not selecting the already existing path, but VADD chooses next hop based on the highest pre-defined direction priority by selecting the closest node to the destination.
- VADD performs better than the GPCR in terms of packet delivery ratio, data packet delay, and traffic overhead. This method predicts the directions of vehicles movement.

Disadvantages:

- It is not use to predict the environmental change in the future.

2.3 PDGR (Predictive Directional Greedy Routing)

Jiayu Gong proposed PDGR in which the weighted score is calculated for current neighbors and possible future neighbors of packet carrier **[4]**.

Advantages:

It is based on the prediction.

Disadvantages:

- In this protocol, the selection of the next hop done on prediction and it is not reliable in all situations.
- It does not give any guarantee of the delivery of packet to the node present in the transmission range of forwarding node which is considered as most suitable next hop due to high dynamics of vehicles.
- It will lead to low packet delivery ratio and also lead to high end to end delay and increased packet drop.

Table 1: From the survey some issues of various routing protocols are observed which are described in following table

Routing protocol	**Drawbacks**				
	Gateways	**Packet delivery ratio**	**Connection to n/w**	**Delay**	**Packet drop**
GPCR (Greedy Perimeter Coordinator Routing)	Static	Low	Frequent N/W Disconnection	Large delay In Low Density Traffic	Higher
VADD (Vehicle-Assisted Data Delivery	Static	Higher than the GPCR	Rare N/W Disconnection	Large delay due to varying topology and varying traffic	Better than GPCR
PDGR (Predictive Directional Greedy Routing**)**	Static	Low	Frequent N/W Disconnection	Large delay In Low Density Traffic	Higher
DYMO	Dynamic	High compared to all above (22.75%)	Rare N/W Disconnection	Less delay from all above	Less then all above
ADOV+	Dynamic	High compared to all above (18.79%)	Rare N/W Disconnection	Less delay from all above	Less then all above
CMGM	Dynamic	High compared to all above(improvement of 10.65% from DYMO and 2.96% of ADOV+)	Rare N/W Disconnection	Less delay around 9.17% reduce from ADOV+	Improvement of 16.74% over DYMO and 8.75% over ADOV+

III. PROGRAMMER'S DESIGN

Various parameter like speed, geographical area and velocity, signal strength, packet size etc. are the input parameter and output will the various result of this new protocol in comparisons with old protocols**.** So, the expected output will be the comparison parameter value and the collision detection is found out as output. After the implementing the routing protocol for dynamic clustering will choose Minimum number of gateway and find out the solution for inter-vehicle collision avoidance technique. And find minimum number of Gateways by doing various operations like multimetric mobile gateway selection, handover support and gateway discovery and advertisement on clustering and adaptive mobile gateway and solution of detection of collision between the vehicles in a cluster**.**
Clustering is performed following three steps:-

- The direction of vehicles' movement (θ).
- UMTS Received Signal Strength (RSS).
- Inter-vehicular distance (IVD).

3.1 Methodology to evaluate the proposed work.

The link stability is defined by the LET and RET metrics between the source and the CH. At a certain time instance, let (xi, yi, zi) and (xj, yj, zj) denote the Cartesian coordinates of two neighboring vehicles i and j, moving at speeds vi and vj, along two roads inclined at θi and θj ($0 < \theta i, \theta j < 2\pi$) with respect to the x-axis, respectively. Let R denote the maximum wireless transmission range of the IEEE 802.11p interface of the two vehicles. *LETij* can be then computed as in Equation given below.

$$LET_{ij} = -\frac{(ab+cd)+\text{square root of } (a^2+c^{2)}R^2-(ab-bc)^2}{a^2+c^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

$$RET_{n-1}=\min \{LET_{i,i+1}\ i=1\ldots.n-1\}. \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

After the clustering operation, the next step is to determine the TTL the TTL (Time to Live) value for each sub-cluster. TTL is used for an effective broadcasting and relaying of control messages within the cluster. For each sub- luster, a Cluster Head (CH), which initiates communication and controls the

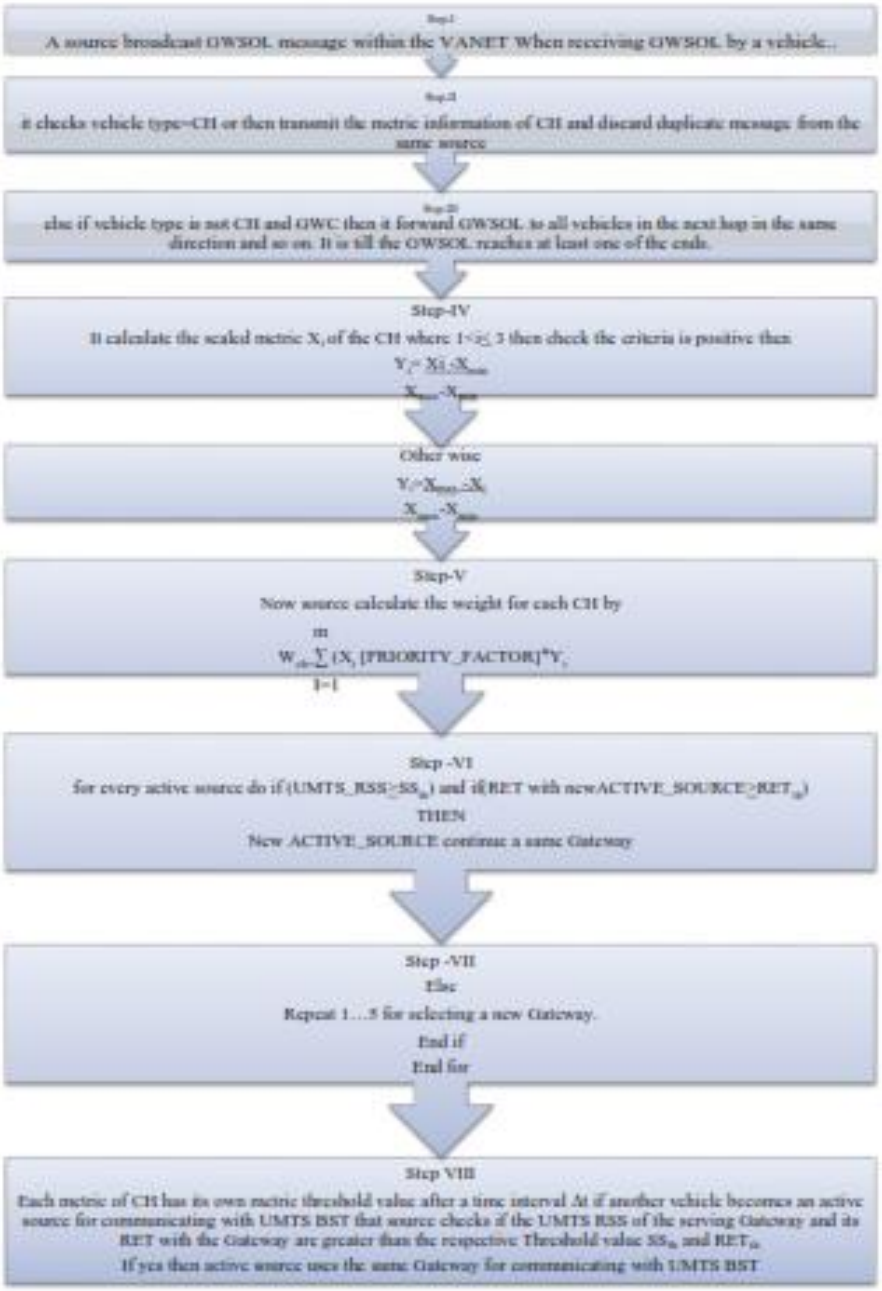
flow of signaling messages within that cluster, needs to be elected. It is required that information on CH can be communicated to each GWC within its corresponding cluster.
Mobile Gateway Management mechanism, consisting of four major operations**:**

1) Mobile Gateway Selection Using Multi-Metric Technique
2) Handover Mechanism
3) Discovery And Advertisement Of Gateway
4) Collision Detection And Solution Technique

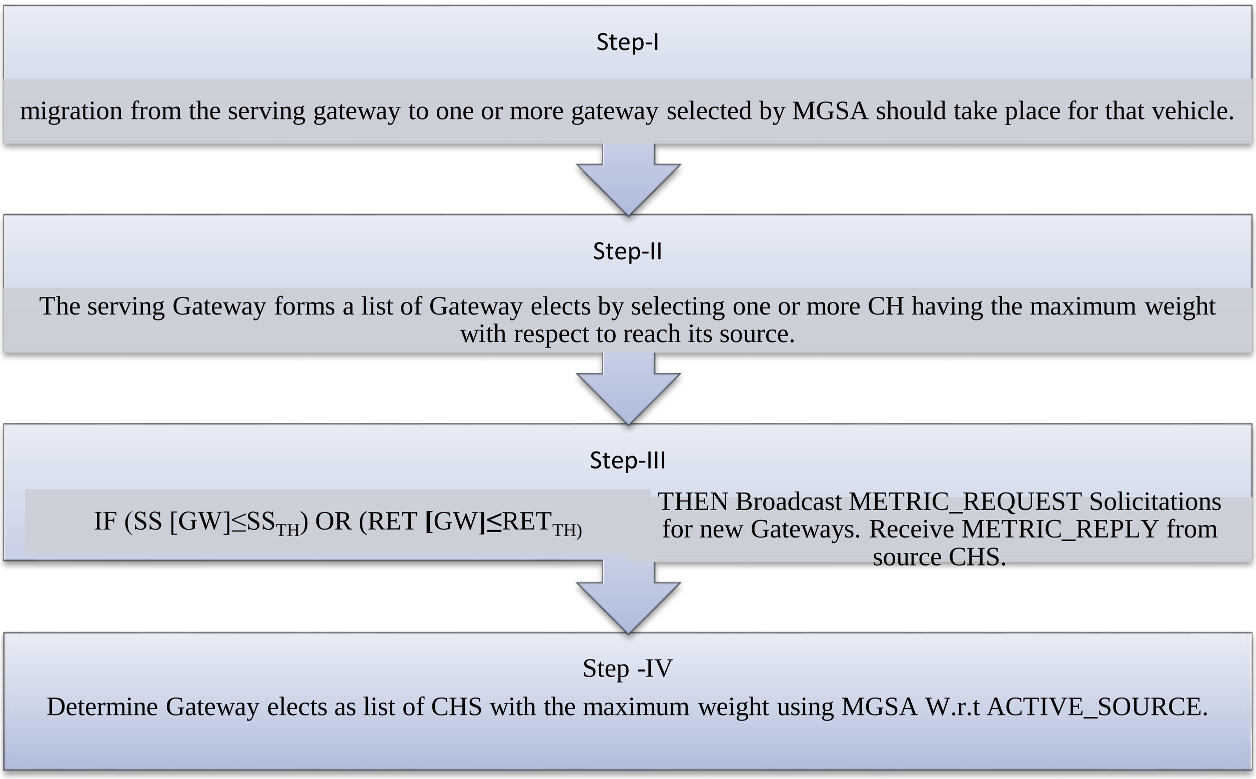
The gateway selection mechanism is initiated to select a minimum number of optimal gateways when VANET sources desire to communicate with the UMTS network. The handover mechanism is employed for migrating the responsibilities of the currently serving gateway to one or more new gateways, when the serving gateway loses its optimality. The gateway discovery and advertisement operation is launched to inform the VANET nodes about a newly-selected gateway **[7].**

3.2 Algorithm for above four operations is given below:

1. Mobile Gateway Selection using Multi-Metric technique.



2. Handover Mechanism:



3. Discovery and advertisement of Gateways:

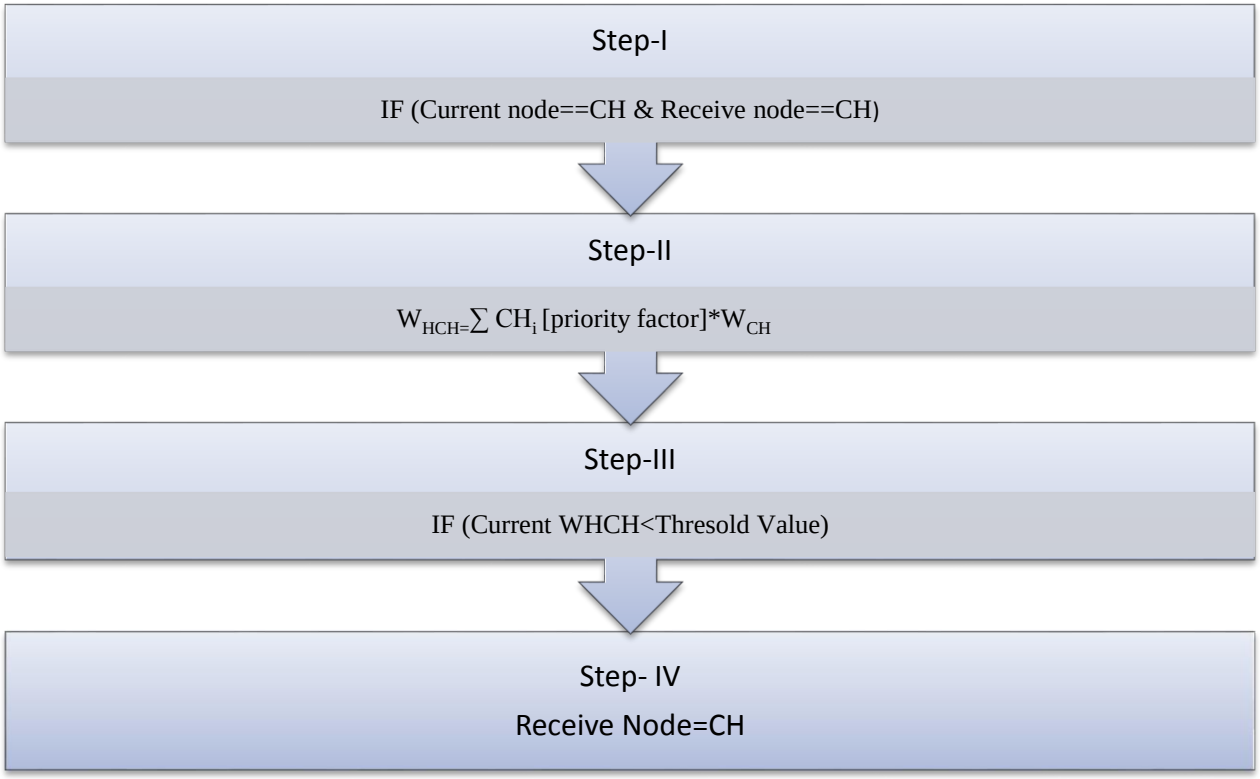
Values for the source to broadcast GWSOL messages within the VANET are computed as TTL_s in the distributed approach.

$$TTL_S = \max\left(\frac{d(s, v1)}{R_s} * \frac{d(s, vn)}{R_s}\right) + 1 \quad \ldots\ldots (3)$$

where v1 denotes the leading edge of the ordinary vehicles; vn is the tail edge of the ordinary vehicle in the cluster. d(s,v1) is the distance between the source and the leading edge v1 and d(s,vn)distance between the source and tail edge. R_s are the maximum hop length between the source and the leading edge v1.

Proposed Algorithm

3.3 Collision Detection and Avoidance Technique



Here The Threshold Value is calculated based on the distance between the tower and the CH

3.4 Design

3.4.1 Use - Case Diagram

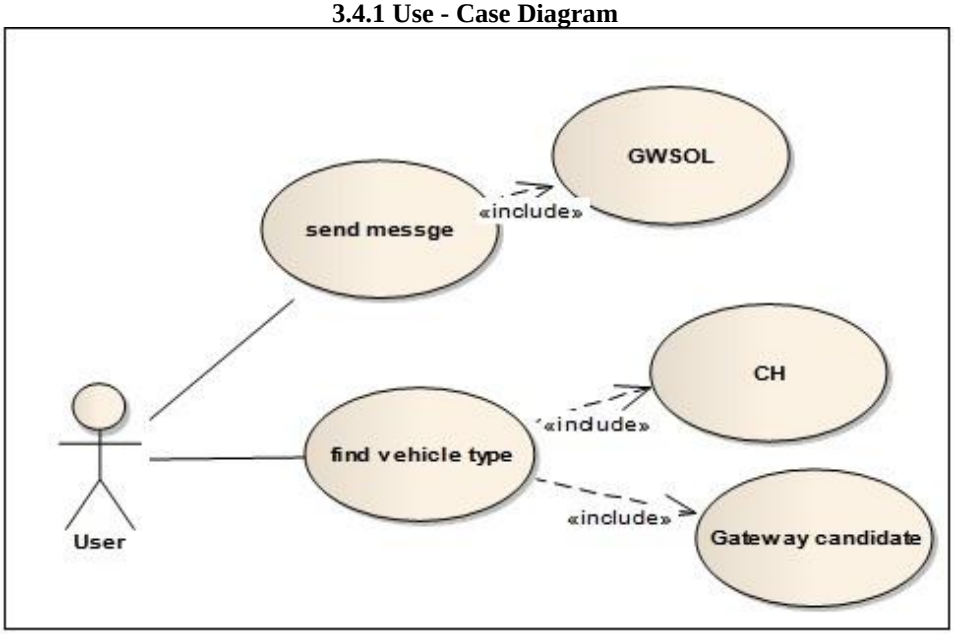


Figure 1 Message Sending Use-Case

A use-case diagram captures use-cases and relationship between actor and the subject. It describes the functional requirement of the system, the manner in which outside things interact at the system boundary, and the response of the system.

The figure 1 shows the user send the first message (GWSOL) to find out the cluster head and gateway vehicles in the cluster. Here first vehicle broadcast the message to their cluster.

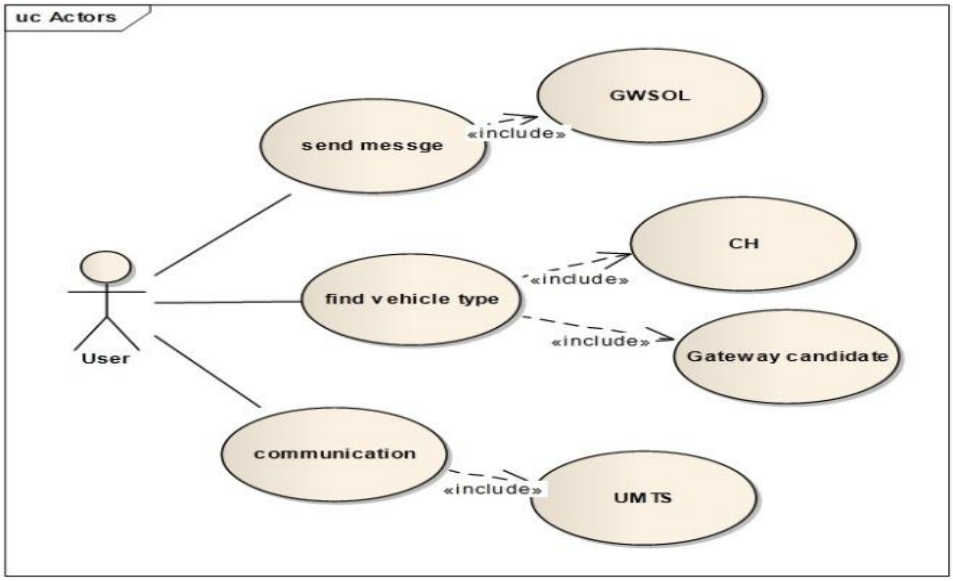


Figure 2 VANET'S Function

Figure 2 shows the how VANET's Scenario in which the user first find the gateway vehicle and cluster head who have all the information about the cluster and the neighbor vehicles. Here new vehicle (user) find from which path the new vehicle can communicate with the UMTS network.

3.4 System architecture

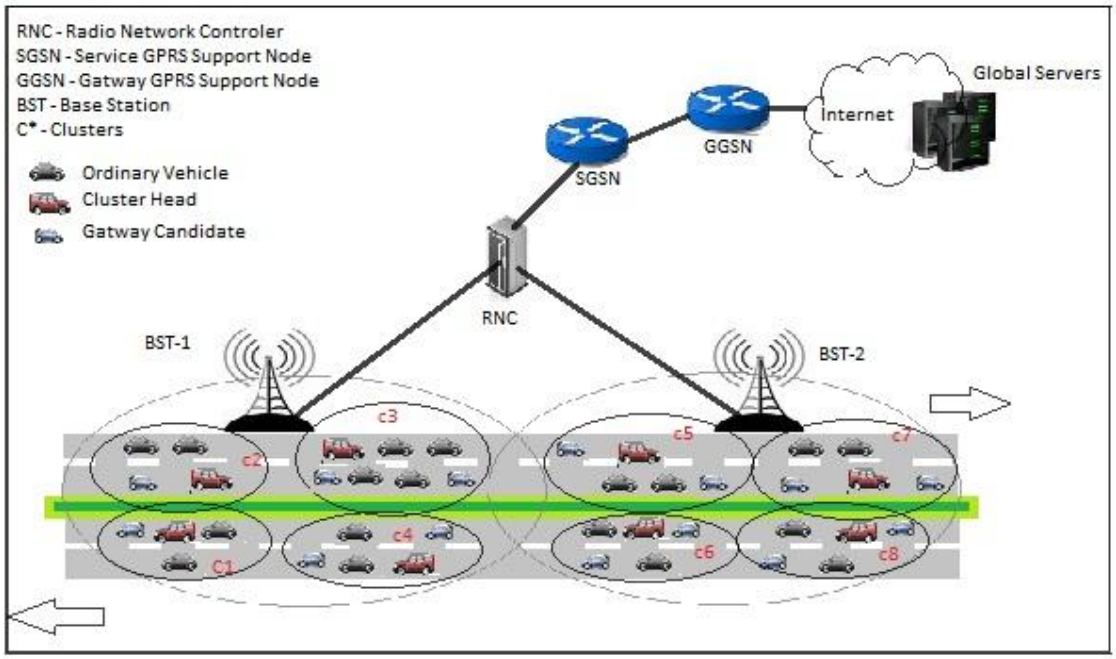


Figure 3 VANET Scenario

Figure 3 shows the VANET Scenario of network .In these figure vehicles are moving two different directions and experiencing the different signal coming from the External UMTS. The Universal Mobile Telecommunications System (UMTS) is a third generation (3G) mobile communications system it provides a range of broadband services to the world of wireless and mobile communications. Universal Mobile Telecommunications System is a third-generation cellular network. It provides high-speed wireless Internet access [1]. It also provides the UMTS system with more than one wireless access options and full IP packet support. The first version of the UMTS Specification contains the functionality of the GPRS and GSM also. A new Universal Mobile Telecommunications System is a 3G cellular network for the commercial service and it is rapidly reach towards the leading global standard. Unlike second-generation networks, UMTS provides a variety of services and data rates up to 2 Mb/s in small scale or indoor and outdoor environments and wide-area coverage of up to

384 kb /s. In addition, the packet-switched mode of UMTS allows mobile users to access unlimited or seamless Internet facility. The most popular and widely used Internet applications are FTP (File Transfer Protocol), HTTP (Hypertext Transfer protocol), email, etc. These Internet applications rely on two common protocols, namely, Transmission Control Protocol and the Internet Protocol (TCP/IP), to reliably transport data across heterogeneous networks. IP is concerned with routing data from source to destination host through one or more networks connected by routers, while TCP provides a reliable end-to-end data transfer service [8].

The main components of UMTS are.

1) Radio network controller
2) Base Station Transceiver
3) Service GPRS Support Node
4) Gateway GPRS Support Node

The UMTS network is connected to external IP networks through GGSN .The GGSN is responsible for converting the packet switch data to circuit-switch data if packet arrives in packet-switched data. SGSN is responsible for routing data packet to correct RNC through the GGSN.

IV. IMPLEMENTATION AND RESULT

4.1 Simulation Setup

Simulation is done using the java programming and Xml files CANU provides highly integrated and professional GUI environment.

Table 2 Simulation Parameter

Parameter	Setting
No. of Simulation	Max 5 Min 3
Simulation area	1000mX1000m
No. of Vehicle	0-100
Speed	0.1-50
Transmission Range	100-300
Constant Bit Rate	100 packet/second
Packet Size	512 Bytes
Routing Protocol	VANET

4.2 Implementation Architecture

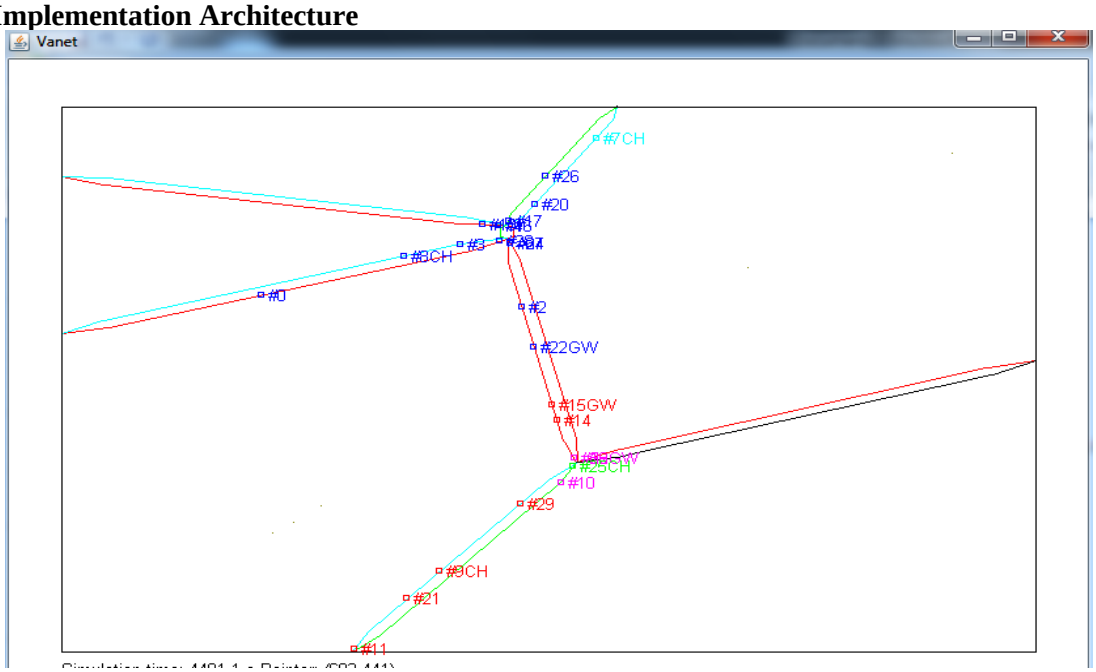


Figure 4. Vanet Architecture.

In above figure shows the different types of lane and the logical tower that makes communication between the vehicles. In the fig 4 the vehicle can communicate with each other through the cluster head (CH) and the gateway (GW).Above figure shows the implementation of the proposed work.

4.3 Result

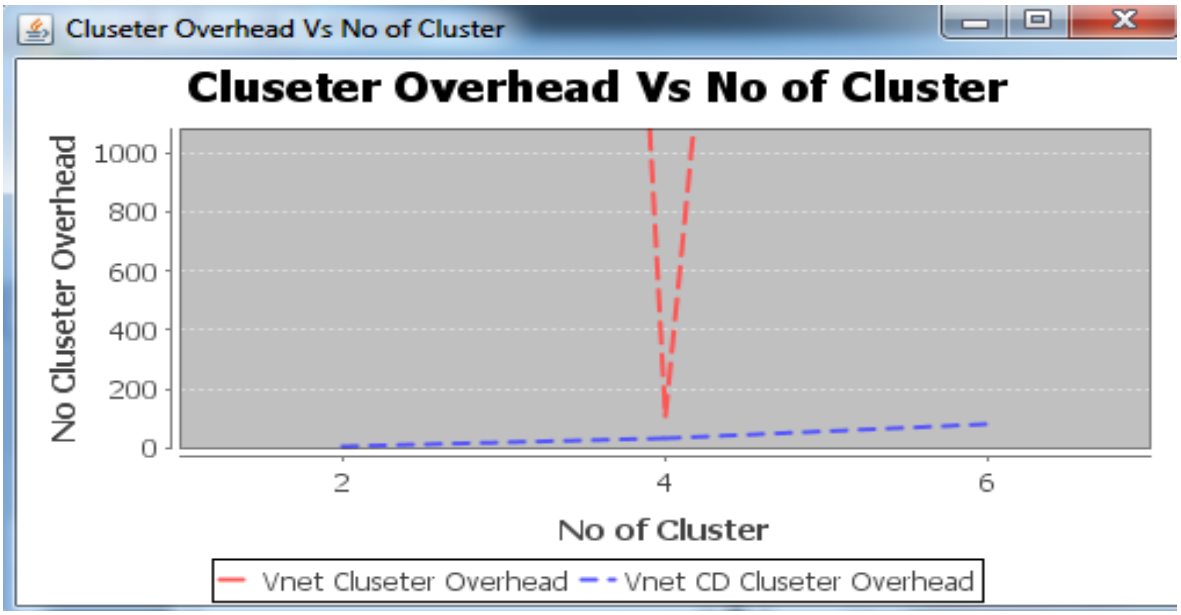


Figure 5 Cluster overhead Vs No. Of Cluster

In figure 5 result of implementation shows that the Existing protocol of Vanet gives more cluster overhead then proposed collision detection protocol.

V. CONCLUSION

This Paper introduced architecture of VANET with integration of VANET-UMTS network. In this architecture normal vehicle is connected to cluster head through that they communicate with the UMTS network. From the analysis the Existing Vanet protocol showing the cluster overhead due continually changing behavior of the cluster head. My proposed protocol showing the better result for cluster overhead.

VI. FUTURE WORK

As a future research direction we plan to improve the delay without using the threshold concept. We also plan to experiment research in an effective real time application. As a future work there will be inclusion of some security issues also.

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