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Light Weight VANET using Multi-Hop Cluster Based WAVE and LTE

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Abstract:
Vehicular Ad-Hoc Network (VANET) is a promising Intelligent Transportation System (ITS) technology that enables numerous applications such as safety message dissemination, dynamic route discovery, gaming and entertainment. This paper proposes an architecture which is the integration of IEEE Wireless Access in Vehicular Environments (WAVE), VMaSC: Vehicular Multi-hop algorithm for Stable Clustering and 3GPP networks (LTE),combining these two technologies to achieve the high data rates of IEEE 802.11p-based VANETs and wide coverage of 3GPP (LTE) technology simultaneously. In this architecture, vehicles are clustered based on this approach VMaSC, and elected heads operate as dual-interface node with the functionality of IEEE 802.11p and LTE interface.

Keywords: VANET- Vehicular Ad-hoc network, ITS-Intelligent Transportation System, 3GPP-Third Generation Partnership project, DPDR- Data Packet Delivery Quantitative Relation, Data Discovery, Data Dissemination LTE-Long Term Evolution, UMCS-Universal Mobile Communication System.

I. INTRODUCTION

VANET (Vehicular Ad-hoc network) is the Intelligent Transportation System (ITS) technology that is used for many applications such as safety message dissemination, route planning, content distribution, gaming and entertainment. Vehicular Ad hoc Network (VANET) is special type of MANET (Mobile ad-hoc network) and it provides collection of safety application, High mobility and scalability. High mobility and scalability are use for providing efficient and reliable communication in Vehicular Ad hoc Network (VANET). The purpose of Vehicular ad-hoc network (VANET) is to minimize the number of cluster heads (CHs) communicating with networks. If the number of cluster minimized, then it reduces the cost of infrastructure. Several vehicular ad hoc networks (VANET) have used the communication ways which was supporting IEEE 802.11p, because it was forming the quality for wireless access for vehicular environments. After, cellular technologies have been investigated as an alternate to the IEEE 802.11p-based VANET because of their low latency and wide-range communication. However, a pure cellular-based VANET communication is not possible because of the high value of communication between the vehicles. So that this paper proposes an architecture ie. Hybrid architecture which is the integration of IEEE Wireless Access in Vehicular Environments (WAVE) like VMaSC: Vehicular Multi-hop algorithm for Stable Clustering and LTE (3GPP networks), these two technologies are combined to achieve the high data rates of IEEE 802.11p-based VANETs and wide coverage of 3GPP (LTE) technology simultaneously. This architecture is used with the goal of achieving a high data packet delivery quantitative relation (DPDR) and low delay whereas keeping the usage of the cellular design at a minimum level. In this paper, vehicles are clustered based on the approach of VmaSC algorithm and elected heads algorithm operate as dual-interface node with the functionality of IEEE 802.11p and LTE interface.

Hybrid architecture have recently used to feat both low cost of IEEE 802.11P and wide range of low latency communication. VANET provides broadcasting and multi-hop service by third generation partnership project (3GPP). 3GPP provides efficient message dissemination to many users over geographical area. Third generation cellular system is also called universal mobile communication system (UMCS). Fourth generation cellular (VANET) is special type of MANET (Mobile ad-hoc network) and provides collection of safety application. The cluster joining is used for both one hop and multi-hop vehicular ad-hoc network. Vehicular ad-hoc network clustering performs different purposes like load balancing, quality of services support and information dissemination in high density vehicular network.

II. MOTIVATION

The VANET is traffic transmission on a Vehicular ad-hoc network-long term evaluation (VANET-LTE).The architecture used to select a gateway to connect the source vehicular is advanced infrastructure communication for selection of gateway. VANET should consider Quality of services, traffic classes and use the Fuzzy QoS-balancing gateway selection algorithm. Vehicular ad-hoc network proposes the hybrid architecture combining IEEE 802.11p based multi-hop clustering and the fourth generation (4G) system, Long term evaluation with goal of achieving high data packet delivery ratio and delay at minimum level.

III. LITERATURE SURVEY

A. Vehicular multi-hop algorithm for stable clustering in vehicular ad-hoc networks(VMaSC) **[7]:** VMaSC is tested with the vehicle mobility input from the Simulation of Urban Mobility (SUMO).SUMO generated by German Aerospace Centre, is an open-source, space-continuous ,discrete time traffic simulator capable of modelling the behaviour of individual drivers. The acceleration and overtaking decision of

the vehicles are determined by using the distance to the leading vehicle, travelling speed, dimension of vehicles and profile of acceleration-declaration. The issue with VMaSC is that integrate clustering approach to heterogeneous architecture of LTE is not possible.

***B.Vehicular Stable Cluster Based Data Aggregation (VeSCA)* [8]:** In order to form a stable cluster structure, the Authors considered some mobility matrix in cluster construction procedure. Hence the Author Proposed a multi-hop clustering algorithm and introduced a new mobility matrix according to relative mobility among vehicles in multi-hop distance and chooses the vehicle with smallest aggregate mobility value as a cluster head .VMaSC is based on the changes in the relative mobility of the vehicles. The problem to obtaining this technique is stability of cluster and changing cluster head is critical.

Table 1: Literature Survey

Sr. No	Year	Method	Approaches	Limitations
1	2003	3hBAC	3-Hop Between Adjacent Cluster heads	Broadcasting numerous control messages in network reduce the efficiency of cluster information
2	2007	VMS	Vehicular Mobility Simulation	Not sufficient to reproduce realistic traffic traces.
3	Mar 2007	RMM	Realistic Mobility Model	Do not reflect all possible realistic Mobility patterns of vehicles.
4	April 2010	DV-CAST	Distributed Vehicular broadcast protocol	In forwarding approach works efficiently in Broadcast mode but fails when target is a single node.
5	May 2010	ALM	Aggregate Local Mobility	Cause constant insecurity of production Policy.
6	2011	LTE4V2X	LTE for centralized VANET	Different networking parameters affect performance of S LTE.
7	2013	VMaSC	Vehicular multi-hop algorithm for stable clustering in vehicular ad-hoc networks.	Integrate clustering approach to heterogeneous architecture of LTE is no possible.
8	2014	VeSCA	Vehicular Stable Cluster Based Data Aggregation	Stability of cluster and changing cluster heads is critical.

***C.Distributed Vehicular broadcast protocol (DV-CAST)*[4]:** The topology of VANET in urban and ruler areas can exhibit fully connected fully, disconnected or sparsely connected behaviour depending on the time of day or the market penetration rate of wireless communication devices. DV-CAST is a distributed broadcast protocol that relies only on local topology information for handling broadcast messages in VANET. DV-CAST does not works when target is single node.

***D. Realistic Mobility Model (RMM)*[3]:**In the performance evaluation of a protocol for a vehicular ad-hoc network, the protocol should be tested under a realistic conditions, including representative data traffic models and realistic movements if the mobile nodes which are the vehicles. RMS is a comparative study between two mobility models that are used in the simulation of vehicular network that is MOVE (Mobility Model Generator for Vehicular Networks) and a mobility pattern generator for VANET.RMM unable to reflect all possible realistic mobility patterns of vehicles.

***E. Vehicular Mobility Simulation (VMS)*[2]:** Vehicular communication is attracting growing attention from both academics and industry, owing to the amount and importance of the related applications ranging from road safety to traffic control and up to mobile entertainment. Vehicular ad-hoc networks are self-organized networks built up from moving vehicles and are part of the broader class of mobile ad-hoc networks(MANET).VANET require the definition of specific networking techniques whose feasibility and performance are usually tested by means of simulation and that technique is Vehicular Mobility Simulation. VMS is not sufficient to reproduced realistic traffic traces.

***F. LTE for centralized VANET (LTE4V2X)* [6]:** LTE is the most promising wireless broadband technique that provides high data rate and low latency to mobile users. LTE provide a critical assessment of the unique set of vehicular application. Different networking parameters affect performance of stable LTE [6].

***G. Aggregate Local Mobility (ALM)* [5]:** Clustering algorithm based upon cluster reorganization on new aggregate are decided by local mobility criteria. The criteria incorporates a contention method to avoid triggering frequent reorganization when two cluster heads encounter each other for a short period of time. Improvement of cluster lifetime and reduce node states or role changes compare to previous popular clustering algorithms. In mobility based clustering algorithm the node with the lowest aggregate mobility is chosen as the cluster head, similar to this ALM chooses a node with less variance relative to its surrounding as cluster head. ALM causes constant insecurity of production policy [5].

IV. SYSTEM ARCHITECTURE

Author names and affiliations are to be centered beneath the title and printed in Times New Roman 12-point, non-boldface type. Multiple authors may be shown in a two or three-column format, with their affiliations below their respective names. Affiliations are centered below each author name, italicized, not bold. Include e-mail addresses if possible. Follow the author information by two blank lines before main text.

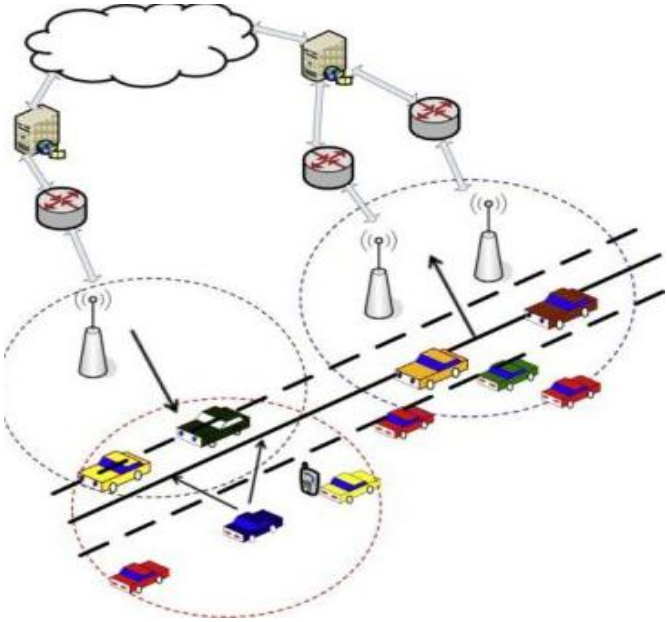

Figure .1.System Architecture

V. IMPLEMENTATION AND RESULT

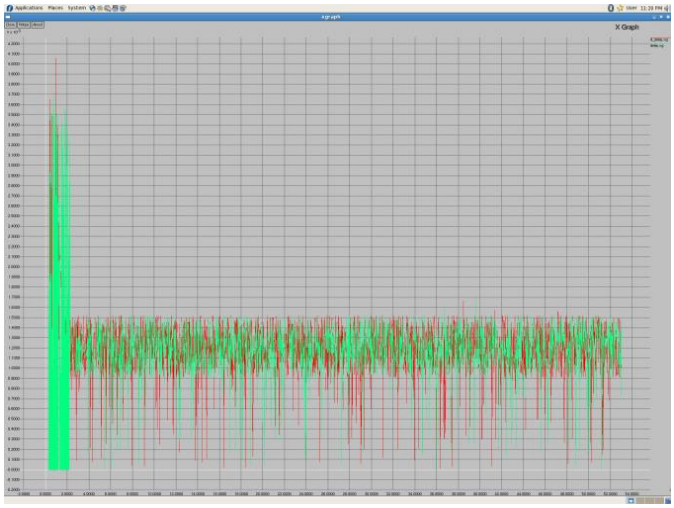

Figure.2.Comparison of delay metric

between previous methods and proposed system This graph shows energy consumed by proposed system is less than that of existing system. Green color shows energy consumed by proposed system and red color shows energy consumed by existing system.

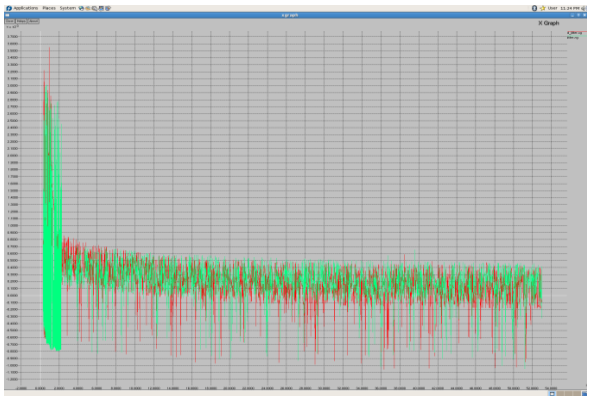

Figure. 3. Comparison of jitter metric between previous methods and proposed system

Above graph shows that metric jitter is good in our proposed system as compared to existing system.

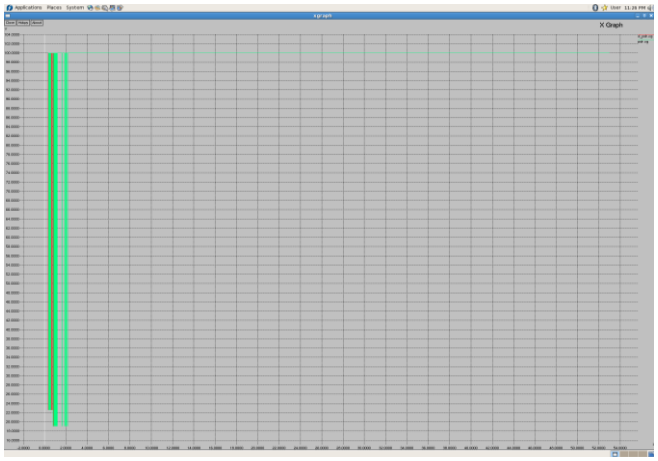

Figure.4. Comparison of packet delivery ratio metric between previous methods and proposed system.

This graph shows that packet delivery ratio is maximum in our proposed system than existing system. This shows that packet delivered is more in proposed system.

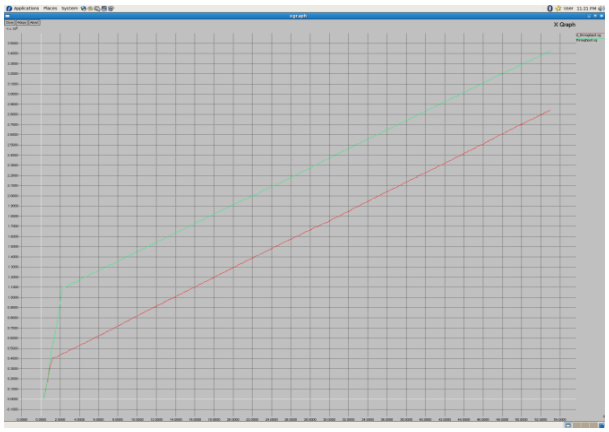

Figure.5. Comparison of throughput metric between previous methods and proposed system.

This graph shows that throughput is high ,using our proposed system as compared to the existing system

VI. CONCLUSION

The hybrid architectures, VMaSC-LTE achieves the lowest delay and highest DPDR due to better clustering stability, minimal clustering overhead and minimal overlap among the cluster. The DPDR and delay analysis at different number of maximum hops allowed within cluster show that increasing the maximum number of hop up to 3.Clustering algorithm for mobile ad-hoc network (MANET) are difficult to implement vehicular ad-hoc network (VANET) as the nodes in network are highly mobile. Traditional system of VANET having key issues of security, stability, speed, DPDR(Data Packet Delivery Ratio).

VII. ACKNOWLEDGEMENT

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