Multi-Hop Cluster Based IEEE and LTE Hybrid-Architecture for VANET Safety Message Dissemination

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Abstract- Several conveyance impromptu Network (VANET) studies have targeted on the communication ways supported IEEE 802.11p, that forms the standard for Wireless Access for conveyance Environments (WAVE). at intervals the networks exploitation IEEE 802.11p only, the printed storm and disconnected network problems at high and low vehicle densities severally degrade the delay and delivery relation of safety message dissemination.Recently, as associate alternate to the IEEE 802.11p based VANET, the usage of cellular technologies has been investigated as a results of their low latency and good selection communication. However, a pure cellular based VANET communication is not potential as a results of the high value of communication between the vehicles and so the bottom stations, and high form of hand-off occurrences at very cheap station considering the top quality of the vehicles. This paper proposes a hybrid style, specifically VMaSC-LTE, combining IEEE 802.11p based multi-hop bunch and so the fourth generation cellular system, long haul Evolution (LTE), with the goal of achieving high data packet delivery relation and low delay whereas keeping the usage of the cellular style at minimum level. In VMaSC-LTE, vehicles ar clustered supported a totally distinctive approach named VMaSC: conveyance Multi-hop rule for Stable bunch. the {choices} of VMaSC ar cluster head choice practice the relative quality metric calculated as a result of the common relative speed with connectedness the neighboring vehicles,cluster relevancy minimum overhead by introducing direct affiliation to the neighbor that is already a head or member of a cluster instead of connecting to the cluster head in multiple hops, disseminative cluster member information within periodic salutation packets, reactive cluster to require care of cluster structure whereas not excessive consumption of network resources, and economical size and hop restricted cluster merging mechanism supported the exchange of the cluster information among the cluster heads. These choices decrease the number of cluster heads whereas increasing their stability thus minimize the usage of the cellular style. From the clustered topology, elective cluster heads operate as dual-interface nodes with the utility of IEEE 802.11p and LTE interface to link VANET to LTE network. victimization varied key metrics of interest along with info packet delivery relation, delay, management overhead and cluster stability, we've an inclination to demonstrate superior performance of the projected style compared to every previously projected hybrid architectures and varied routing mechanisms along with flooding and cluster based routing via intensive simulations in ns-3 with the vehicle quality input from the Simulation of Urban quality (SUMO). The projected style jointly permits achieving higher required reliableness of the appliance quantified by the data packet delivery relation at the worth of higher LTE usage measured by the amount of cluster heads at intervals the network.

Index Terms- vehicular ad hoc networks, clustering, IEEE 802.11p, LTE, safety application, message dissemination

I. INTRODUCTION

Up to now, several VANET studies have focused on the communication ways in which supported IEEE 802.11p, that forms the standard for WAVE. IEEE 802.11p provides rate ranging from vi Mbps to twenty seven Mbps at short radio transmission distance, around 300 m[3]. dispersive safety information over associate degree outsized area wants Associate in Nursing intelligent multi-hop broadcast mechanism handling a pair of major problems: broadcast storm[6] and disconnected network[7]. the written storm disadvantage happens at high traffic density where the packet delay and vary of collisions at the medium access management layer increase dramatically as a result of the vary of vehicles attempting to transmit at identical time can increase. Probabilistic flooding and cluster ar usually accustomed address the written storm disadvantage. On the alternative hand, the disconnected network disadvantage happens at low traffic density where the amount of nodes is not ample to flow into the information to any or all or any the vehicles throughout a certain region. Store-carry-forward, where the vehicles among the alternative lane ar used for message dissemination, is usually used to traumatize the disconnected network disadvantage. The solutions addressing every broadcast storm[6] and disconnected network[7] problems however ar shown to provide network delays variable from several seconds to several minutes and conjointly the proportion of the vehicles successfully receiving the packets happening to hour[22].

Recently, as another to the IEEE 802.11p based VANET, the usage of cellular technologies has been investigated. The key enabler of such usage is that the standardization of the advanced content broadcast/multicast services by the Third

Generation Partnership Project (3GPP), that gives economical message dissemination to many users over a countryside at fine granularity. the use of the third generation mobile cellular system, said as Universal Mobile Communication System (UMTS), inside the protection application of the vehicles has already been experimented in Project Cooperative Cars (Co-Cars). The traffic risky warning message has been shown to be disseminated in however one second. The fourth generation cellular system, said as long-standing time Evolution (LTE), is academic degree evolution of UMTS increasing the potential and speed using a very completely different radio interface at the facet of core network enhancements. The LTE specification provides down-link peak rates of 300 Mbps, up-link peak rates of seventy 5 Mbps, transfer latency of however 5 ms and transmission vary up to 1 hundred km inside the radio access network. Despite the high rate together with wide-range communication, however, a pure LTE based style is not doable for transport communication attributable to the high worth of LTE communication between the vehicles and conjointly the bottom stations, high vary of hand-off occurrences at very cheap station considering the prime quality of vehicles, and overload of very cheap station by the revealed of high vary of vehicles at high traffic density.

In the literature, VANET cluster has been performed with utterly completely different functions like load deed, quality of service support and data dissemination at high density conveyance networks. Stable cluster with minimum vary of cluster heads and minimum overhead wants economical cluster connexion, maintenance associate degreed merging mechanisms in conjunction with a cost-effective cluster metric considering the top quality of vehicles. cluster metrics utilized within the VANET literature[8] [11] [12] [13] embrace direction; packet delay variation[10]; location difference[9] [14] [16]; speed difference; combination of location and speed variations[15]. although a metric combining the position and speed of the neighboring vehicles may be a better live of their link amount compared to a metric considering their speed entirely, all vehicles may not have localization capability. conniving packet delay variation on the alternative hand wants really correct synchronization among the vehicles with low level time stamping of the packets due to the random access protocol used by IEEE 802.11p. Besides, cluster connexion in every one-hop and multi-hop VANET is on to the cluster head. However, connexion to the cluster through a cluster member and informing the cluster head later via periodic acknowledgment packets can decrease cluster affiliation time and overhead significantly. Such economical mechanisms square measure projected in mobile sudden networks (MANET), that however generally assume stationary of the nodes throughout cluster. to boot, cluster maintenance is achieved through either periodic reclustering [8] [9] [10] [12] where cluster procedure is dead periodically or reactive cluster[14] [15] where cluster is triggered solely the cluster head has lost affiliation to any or all its members or cluster member cannot reach its cluster. Reactive cluster could be a ton of economical since reclustering procedure is activated solely the cluster structure is destroyed whereas not excessive periodic packet transmission overhead. moreover, previously projected cluster merging mechanisms ar activated either once the area between a pair of neighboring cluster heads could be a smaller quantity than an exact threshold or once the cluster heads keep connected for a period of time larger than a predetermined worth. However, cluster merging might find yourself in really large size integrated clusters where cluster head becomes bottleneck due to the high vary of packets of its cluster members and large vary of hops which will increase the delay of packet transmissions. to unravel the cluster head bottleneck and large delay problems, cluster merging have to be compelled to limit every the scale and vary of hops at intervals the following integrated cluster. Also, previously projected multi-hop cluster algorithms entirely specialize in providing cluster stability through metrics like cluster head amount, cluster member amount and cluster head change but do not analyze the performance of their projected decree message dissemination in terms of metrics like packet delivery magnitude relation and delay.

In this paper, we've an inclination to propose a hybrid style, significantly VMaSC-LTE, combining IEEE 802.11p primarily based multi-hop agglomeration and LTE with the goal of achieving high data packet delivery quantitative relation and low delay whereas keeping the usage of the cellular infrastructure at minimum level via minimizing the number of cluster heads and maximizing the agglomeration stability.

II. EXISTING SYSTEM

In the existing System, the written storm and disconnected network problems at high and low vehicle densities severally degrade the delay and delivery quantitative relation of safety message dissemination. Recently we have a tendency to tend to settle on IEEE 802.11p primarily based VANET, the usage of cellular technologies has been investigated due to their low latency and large choice communication. However, a pure cellular primarily based VANET communication is not attainable due to the high worth of communication between the vehicles and so the bottom stations, and high vary of hand-off occurrences at rock bottom station considering the top quality of the vehicles.

III. PROPOSED SYSTEM

we propose a hybrid style, notably VMaSC-LTE, combining IEEE 802.11p based totally multi-hop cluster and LTE with the goal of achieving high info packet delivery quantitative relation and low delay whereas keeping the usage of the cellular infrastructure at minimum level via minimizing the quantity of cluster heads and maximizing the cluster stability.

2. Modules:

1) Creating the VANET environment
2) Route discovery
3) Vehicles to CH communication
4) CH communication with RSU

1) Creating the VANET Environment:

We unit of measurement planning to build the vehicles that unit of measurement inherent with the sensors. Setup the RSU's for the particular coverage house of the vehicles. Build the metal (Trusted Authority) which might check the vehicle moving into the particular coverage house and provide authentication to the user.

2) Route Discovery:

If the supply vehicle has no route to the destination vehicle, then supply vehicle initiates the route discovery in associate degree on-demand fashion . once generating RREQ, node appearance up its own neighbor table to search out if it's any nearer neighbor vehicle toward the destination vehicle. If a better neighbor vehicle is accessible, the RREQ packet is forwarded thereto vehicle. If no nearer neighbor vehicle is that the RREQ packet is flooded to all or any neighbor vehicles.

A destination vehicle replies to a received RREQ packet with a route reply(RREP) packet in only the following three cases:

1) if the RREQ packet is the first to be received from this source vehicle

2) if the RREQ packet contains a higher source sequence number than the RREQ packet previously responded to by the destination vehicle

3) if the RREQ packet contains the same source sequence number as the RREQ packet previously responded to by the destination vehicle, but the new packet indicates that a better quality route is available.

3) Vehicle to CH Communication:

In this module, we have a tendency to area unit implementing CH with forward and backward information assortment during a VANET. The vehicles area unit communicate with the directly with CH may be a act like as a knowledge unit. The CH collects the information from the vehicles and forward to metal or RSU.

4) CH Communication with RSU:

In this module, we tend to show a CH to RSU communication, the CH transfer messages to RSU'S. For mistreatment CH in VANET the Load is balanced and straightforward to information forward to RSU.This communication ought to be service minded so the RSU is exploited from getting the varied kinds of information.

Algorithm:

1) A vehicle Hello Timer is expired.
a) A vehicle has a HELLO_PACKET.
   i) It transmits HELLO_PACKET to build its own VIB.
b) If vehicle receives JOIN_RESP.
   i) Vehicle transmits from state SE to CM.
   Else
   ii) Vehicle transitions from SE to CH.
c) If vehicle receives ISO_CH_FORWARD.
vehicle transitions from SE to ISO_CH.
else
The vehicle is in CH state.
Broadcast the CH_ADV.
2) If vehicle has DATA_PACKET.
   a) It sends information to the CH.
   b) CH sends information to RSU.
3) If RSU receives the information.
a) Multicast data to the CHs.
Else
b) Unicast the data.
c) Update VIB.

Requirements:

Hardware:

- Single PC with
  - 20 Gb Hard disc space
  - 1Gb RAM

Software:

- Linux OS (Ubuntu 10.04)
- NS2.34
- VMware

Languages:

- TCL
- Python (Optional)
- C++ (Optional)

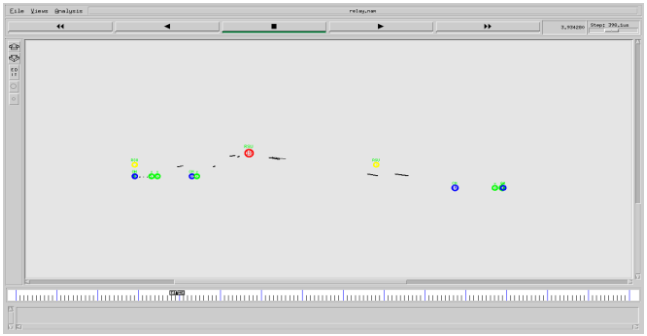
IV. CONCLUSION

In this paper, we have a tendency to tend to introduce a totally distinctive style VMaSC-LTE that integrates 3GPP/LTE networks with IEEE 802.11p primarily based VANET networks. In VMaSC-LTE, vehicles ar clustered throughout a multi-hop primarily based novel approach named VMaSC with alternatives} of cluster head choice victimization the relative quality metric calculated as a result of the typical relative speed with connectedness the neighboring vehicles, cluster relevancy minimum overhead by introducing direct association to the neighbor that is already a head or member of a cluster instead of connecting to the cluster head in multiple hops, spreading cluster member knowledge at intervals periodic how-do-you-do packets, reactive clump to require care of cluster structure whereas not excessive consumption of network resources, and economical size and hop restricted cluster merging mechanism supported the exchange of the

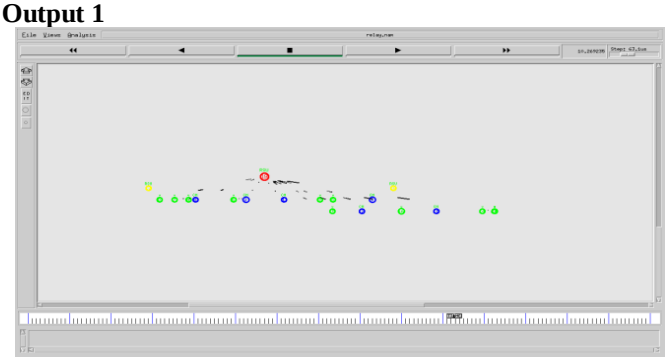
cluster knowledge among the cluster heads. at intervals the created clusters, cluster heads activate the LTE interface to connect the VANET network to LTE.

As future work, we've an inclination to aim to analysis the use of VMaSC-LTE in urban traffic eventualities and extend VMaSC-LTE style with info aggregation and calculation of the bunch metric with any information just like the foremost probable path information of the vehicles.

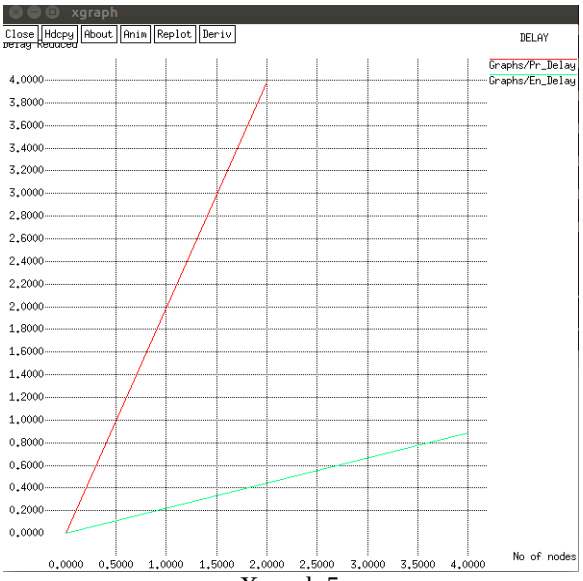
V. OUTPUTS



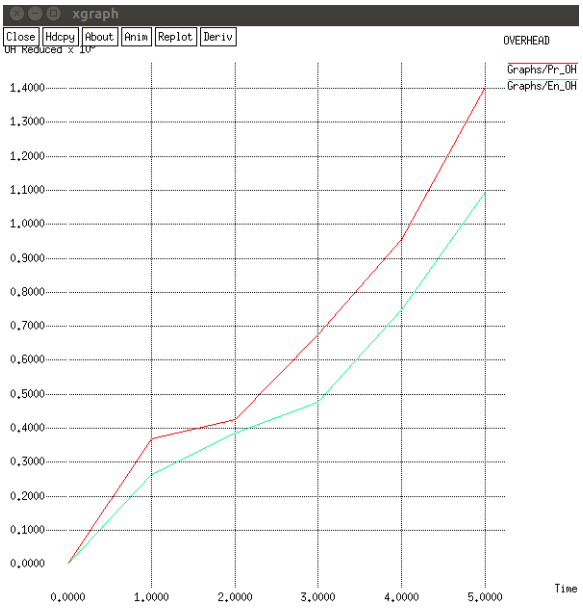
Output 1



Xgraph 4



Xgraph 5



Xgraph 6

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