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Increasing the Lifetime of Cluster head Using Improved Stability Based Clustering Approach in VANETS

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Abstract: Increasing the lifetime of the cluster head is crucial for most applications and protocol designs in Vehicular Ad-hoc Networks (VANET).In traditional approaches, this is obtained by beacon based techniques, affinity propagation that keeps tracking and forward the message to the cluster group to reach destination. In highly dynamic environment, however these approaches are not efficient to transfer the messages in a cluster group to reach the target vehicles in a group. In this paper, we present a dynamic and stable cluster-based ISBCA with a more realistic selection metric that includes the vehicle's on-road time and position messages like relative speed, direction and connectivity among neighbouring vehicles while giving priority to vehicles joining a cluster. our proposed ISBCA is based on (improved stability based clustering approach) is based on Multi-hop protocols Disseminations which removes the unnecessary nodes in the cluster group using OMNET++ and SUMO. The simulation results show that it allows more nodes to participate in the opportunistic data forwarding and increases a connection's throughput while using existing network capacity compared to traditional routing.
Keywords: Vehicular Ad hoc networks, Cluster, on road time, ISBCA, OMNET++, SUMO

I. INTRODUCTION

Among the various application areas of Mobile Ad hoc Networks (MANET), Vehicular Ad hoc Networks (VANET) looks as the most promising area to be actively implemented in the near future. VANET has caught the attention of the academic community, government and the auto industry and is well positioned to play a major role in the realization of Intelligent Transport Systems (ITS) [1]. ITS have two main functionalities, namely to increase road safety and increase commercial purposes. Road safety can be increased by letting vehicular users to communicate among themselves about road conditions. This communication is further classified into critical messages like accidents or landslides and non critical information like parking lot information and road congestion notification. Since a car user may spend up to two hours a day while travelling, ITS can be made to provide infotainment services like email, newscasts and access to social networking media. Towards these ends, VANET enables the possibility of Vehicle-to-Vehicle (V2V) as well as Vehicle-to-Infrastructure (V2I) communications through a Dedicated Short Range Communication (DSRC) spectrum. Vehicular Ad Hoc Networks (VANETs) have grown out of the need to support the growing number of wireless products that can now be used in vehicles. These products include remote keyless entry devices, personal digital assistants (PDAs), laptops and mobile telephones. As mobile wireless devices and networks become increasingly important, the demand for Vehicle-to-Vehicle (V2V) and Vehicle-to-Roadside (VRC) or Vehicle-to-Infrastructure (V2I) Communication will continue to grow. VANETs can be utilized for a broad range of safety and non-safety applications, allow for value added services such as vehicle safety, automated toll payment, traffic management, enhanced navigation, location-based services such as finding the closest fuel station, restaurant or travel lodge and infotainment applications such as providing access to the Internet.

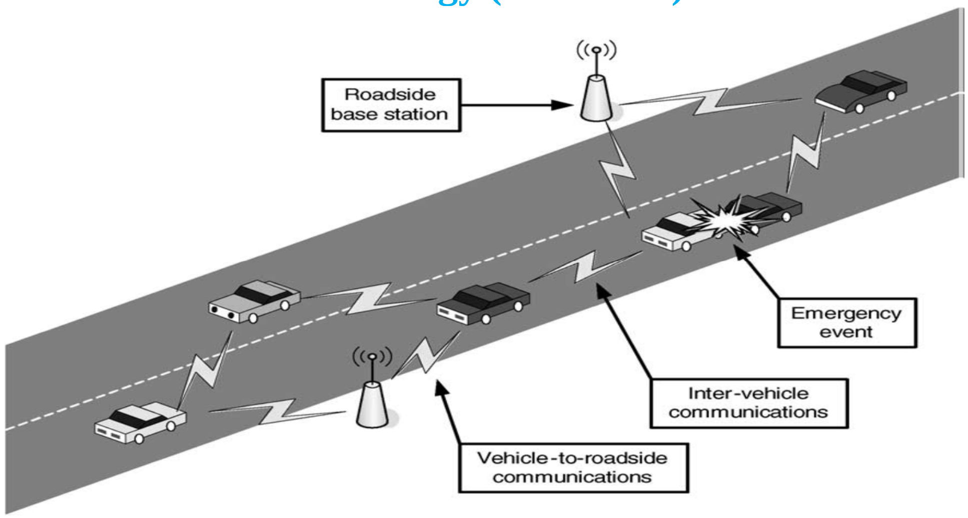

Figure.1 Vehicular Ad hoc Network Architecture

VANET is formed by vehicles with wireless equipment for communication. It allows vehicles to communicate directly to each other without infrastructure deployment. VANET is one of the special form of mobile ad-hoc networks (MANET), which gains interest from many researchers. But VANETs are different from MANETs in several ways. In VANET vehicles are larger in volume, and the network topology changes more rapidly. The mobility of vehicles in VANET is constrained by roads with limitations on driving speed. Although vehicles can move in high speed, their directions and speeds are predictable. Finally vehicles usually do not have tight energy budget. Instead, bandwidth issues are more critical than energy ones in VANETs. Broadcasting is the task of sending a message from a source node to all other nodes in the network. The two major challenges of broadcast are to ensure the reliability of messages while disseminating message over the intended regions and keeping the delay time within the requirements of the application. Applications such as traffic efficiency applications and infotainment services need to disseminate information in larger areas. In these multi-hop scenarios, competition for available wireless bandwidth is an issue. Consequently, numerous proposals exist for efficient multi-hop information dissemination protocols. Two major dissemination patterns that are employed are geo cast and aggregation. To prevent spreading of malicious information, all proposed protocols need to be properly secured. Otherwise, attackers could be able to reroute traffic if they insert malicious messages into traffic information systems, for instance. In cases of safety applications, attackers could be able to cause accidents due to false information, in the worst case. The original approach to protect vehicular communication is based on entity-centric trust, which is established by signing packets with digital signatures and by establishing a public key infrastructure (PKI) that issues certificates to vehicles. Using the obtained keys, attackers can generate wrong information or modify information they process as part of multi-hop dissemination protocols. Hence, cryptographic signatures cannot guarantee that messages contain correct information. This problem is worse in multi-hop protocol.

II. LITERATURE SURUVEY

The authors in [1] propose a protocol which focuses on reducing the communication overhead by formation and maintenance of clusters. The overall cluster architecture has been based on the idea that the mobile node should be associated with the cluster and not to a cluster head. The protocol has two phases, the cluster setup phase and maintenance phase. In the setup phase, nodes with close proximity to each other are formed into a cluster and during the cluster maintenance stage; a Primary Cluster Head (PCH) and a Secondary Cluster Head(SCH) are selected. Whenever the PCH leaves the cluster, the SCH takes over. In [2], the authors proposed a node precedence algorithm and adaptively identify the 1-hop neighbours and selects optimal CHs based on relative node mobility metrics such as speed, location and direction of travel. It also introduces the zone of interest concept that reflects the frequent changes on the network and provides prior knowledge about the neighbours as they travel into new neighbourhood locations.

In [3], a distributed algorithm for cluster stability maintenance is proposed. A one-hop neighbor set is formed and based on which each node forms a cluster with its neighboring nodes. The drawback of this mechanism is its unsuitability under sparse

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traffic conditions. All the protocols discussed so far have their own merits and demerits. All the above approaches tend to focus on just the positional information of vehicles and do not take into consideration the temporal aspects of clustering. In our proposed protocol, we take this often neglected aspect in allowing a vehicle to become a cluster member as well as to function as a CH for longer periods of time. Our proposed protocol has been found to increase cluster stability compared to the existing TDMA based approaches. The authors in [4] have utilized fixed infrastructure like road-side units to gather information from cluster heads and to fill the communication gap that may occur when any data packet is lost. The RSU units are given the role of selecting the CH according to the environment. The above protocol aims to improve communication between Cluster and between neighbouring clusters.

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III. OUR APPORACH

The proposed system provides a To improve the stability of the network by extending the cluster head lifetime by using a algorithm named as ISBCA (Improved Stability based clustering algorithm) in VANET.Cluster stability is the key to maintain a predictable performance and has to consider reducing the clustering overhead, the routing overhead and the data losses .Due to high packet loss rate in VANETs, additional retransmissions might be needed to assure that all vehicles, between two successive forwarders, eventually receive the message. Father, temporary disconnection, which is frequent in VANETs, requires the addition of mechanism to restart message propagation upon discovery of new neighbors. The major challenge is how to coordinate receivers to make message forwarding rapidly and orderly.

It is mainly used to form a stable based cluster (Clustering stability ,Routing Reliability),It involves 2 phases

A. *Setup Phase*

(Here SCH cluster head works a backup for PCH)

Formula:

$(CH^*=\arg CH \min[\alpha * \sum cluster\ (ch)|V_{ch}-V_i|-฿*N\ neighbours)$

B. *Maintenance Phase*

(Less packet loss and thus better Packet Delivery)It creates a own ID for individual Cluster in the group(PCH generates the ID in the group)Then Computed with the group in the cluster

$SCH^*= \arg i \min[\alpha*V_{pch}-V_i]+\beta*D_j]$

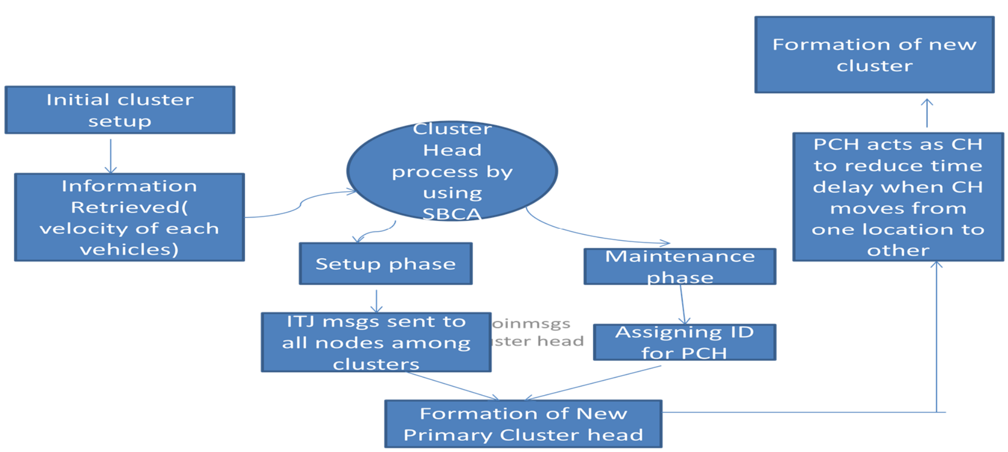


Figure.2 Architecture for ISBCA

IV. SIMULATION SETUP

We have chosen OMNET++/INET [11] as the wireless network simulator since that it implements the IEEE 802.11p standard at both the physical and the MAC layers. We have used the SUMO traffic simulator [12], [13], which is a C++-based open-source space continuous microscopic simulator for vehicular traffic. We use TRACI interface [14] to connect the discrete-event simulator OMNET++/INET with the continuous simulator SUMO. TRACI uses a client/server architecture, where SUMO is configured as a server and OMNET++is configured as a client. The client sends request commands to SUMO to perform the simulation run or for accessing environmental details. SUMO responds with a status response to each command and a traffic trace is generated after each action. Both the requests to the SUMO and the traffic traces from SUMO are transported using TCP/IP written inINET. The TCP segment consists of a small header that gives the overall message size and a set of commands or traffic traces contained in the segment. Each vehicle in SUMO is mapped to a mobile node in OMNET++. We have extended OMNET++ with a module that allows us to define the specification of a single vehicle node which is created in SUMO. However, the calculation for node's travel time and deleting it once it reaches a threshold is performed in OMNET++. SUMO executes in discrete time steps, and the trace generated by SUMO is parsed by a manager module in OMNET++. The manager module then monitors the traffic trace to the nodes. The length of the road is set to 20 kms. We have tested our scheme in a highway scenario with only sedan type of vehicle in our simulation. The clusterhead that is selected is mainly positioned in the middle of the cluster so that the number of links it maintains with its neighbours is high. It essentially continues moving in the same direction as the majority of the traffic flow.Each vehicle can run continuously 10hours, only the last 5 hours can be calculated easily in this process.

Table 1: Simulation Parameters

Parameter	Value
Power	6 dbm
Frequency	5.9 Ghz
Data Rate	6 Mbps
Slot time	9 Micro sec
Preamble length	60 bit
Vehicles speed	50 km
Vehicles Accleration	5 m/s2
No of vehicles	100

V. SIMULATIONRESULTS

The simulation results show the performance of the existing SBCA clustering algorithm and our proposed approach under similar operating conditions. The simulation was run for a maximum duration of 10 hours, out of which the cluster performance was noted after an initial cluster formation time of 3 hours. Figure 2 shows the stability of the cluster using MULTIHOP techniques as well as ISBCA at various intervals of time. We measure the stability of a cluster in terms of cluster stability ratio, which is the ratio of the nodes leaving a cluster and the original number of nodes.

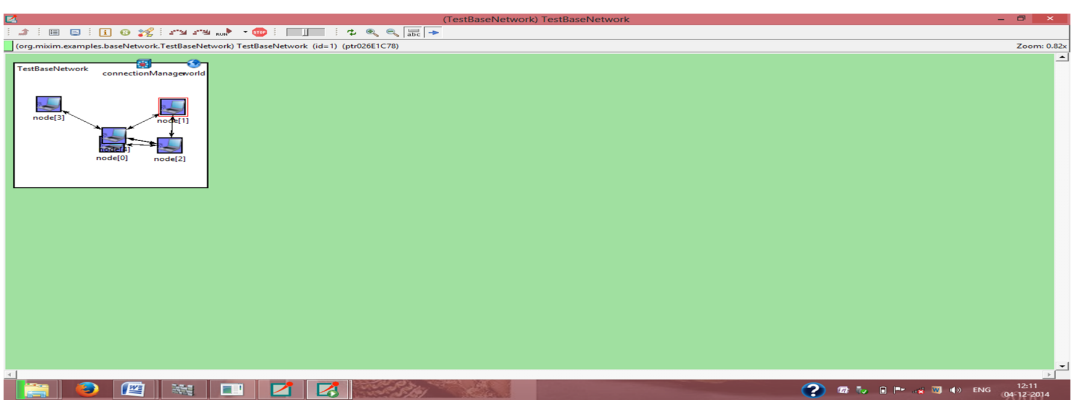
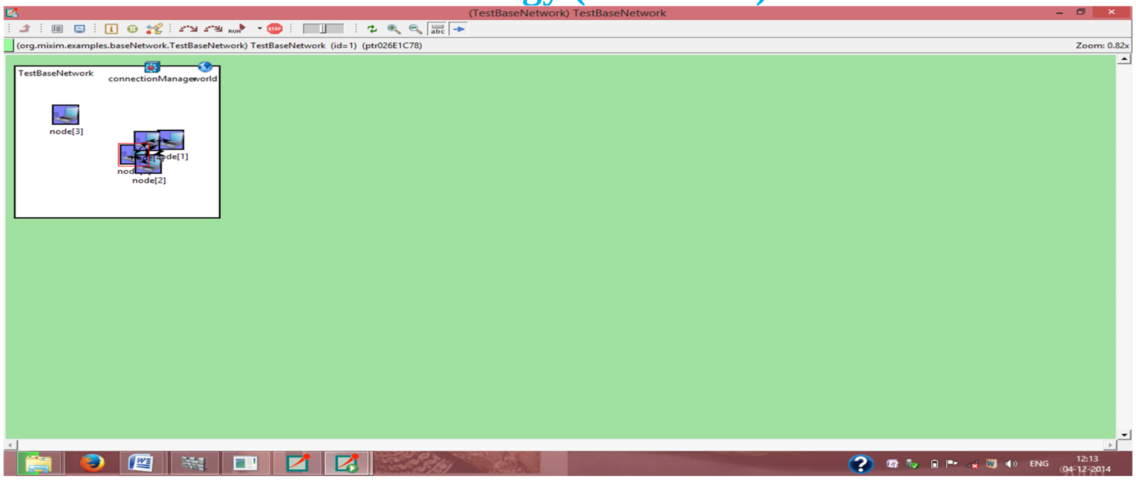


Figure.3 Initial Cluster Setup in setup phase



VI. CONCLUSION

We have presented Improved Stability Based Clustering Approach (ISBCA), a MULTIHOP based cluster scheduling scheme for VANET based on a vehicle's driving time. As per the existing European Union regulations, a vehicle cannot drive continuously formore than 10 hours. We have given consideration to this overlooked parameter along with traditional cluster formation parameters to form a more stable cluster. The simulation results show that ISBCA is able to deliver longer average clusterhead lifetime. In the future, we will further reduce the message overhead of the status message and also extend the functioning of our protocol for inter-cluster communications. Finally prove with simulation results and calculations

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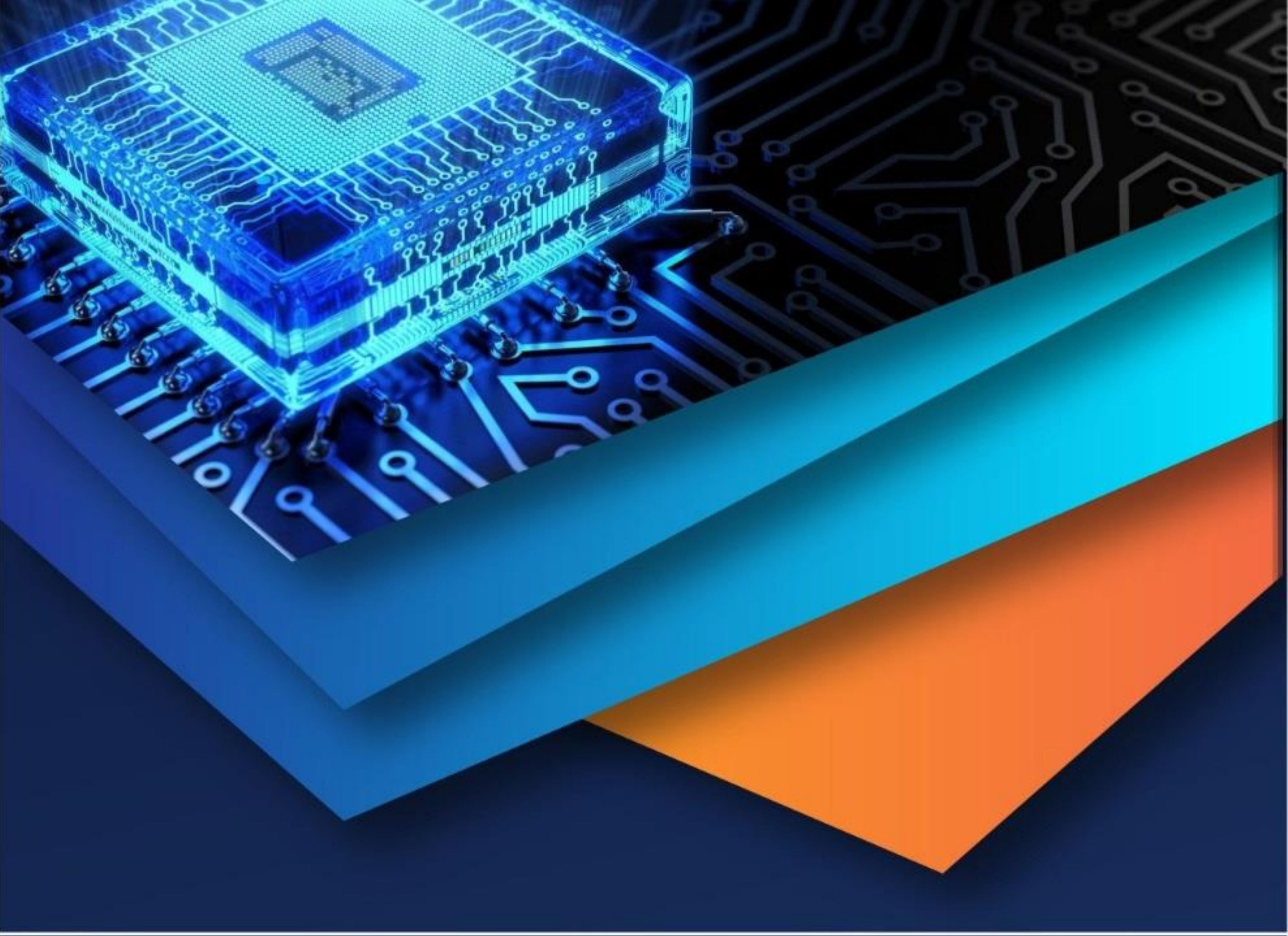

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