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Approve - Cluster Based Data Dissemination Protocol In VANET

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ABSTRACT

Vehicular Ad-Hoc Networks (VANETs) have received considerable attention in recent years, due to its unique characteristics, which are different from Mobile Ad-Hoc NETworks (MANETs), such as rapid topology change, frequent link failure, and high vehicle mobility. The main drawback of VANETs network is the network instability, which yields to reduce the network efficiency. In this article we propose three algorithms: Affinity PROpagation for VEhiclar networks - Cluster-Based Life-Time Routing (APROVE-CBLTR) protocol, Intersection Dynamic VANET Routing (IDVR) protocol, and Control Overhead Reduction Algorithm (CORA). APROVE – CBLTR forms clusters using the Affinity Propagation algorithm in a distributed manner. It presents a new mobility based clustering scheme for VANET. This algorithm takes into account the mobility and stability. Cluster performance was measured in terms of average CH duration, average cluster member duration, the average number of clusters, and the average rate of cluster-head change. Each node transmits messages of responsibility and availability to its neighbors and then takes a decision on the clustering independently. The Cluster Heads (CHs) are selected based on maximum Life-Time (LT) among all vehicles that are located within each cluster. The IDVR protocol aims to increase the route stability and average throughput, and to reduce end-to-end delay in a grid topology. The elected Intersection CH (ICH) receives a Set of Candidate Shortest Routes (SCSR) closed to the desired destination from the Software Defined Network (SDN). The IDVR protocol selects the optimal route based on its current location, destination location, and the maximum of the minimum average throughput of SCSR. Finally, the CORA algorithm aims to reduce the control overhead messages in the clusters, by developing a new mechanism to calculate the optimal numbers of the control overhead messages between the CMs and the CH. The proposed scheme is validated by real urban scenarios and Experimental results show that APPROVE-CBLTR outperforms the compared routing protocols with respect to the end-end delay, the packet delivery ratio and the path duration time.

Keywords : Clustering, Routing Protocols, Vehicular Ad Hoc Network (VANET), ICH, IDVR, CORA, APROVE-CBLTR

I. INTRODUCTION

The Intelligent Transportation System (ITS) that includes all types of communications between vehicles is an important next-generation transportation system. ITS provides many facilities to the passengers, such as safety applications, assistant to the drivers, emergency warning, etc. Vehicular Ad Hoc NETwork (VANET) is a derived form of self-organized Mobile Ad Hoc NETwork (MANET). In VANET, vehicles are equipped with an On-Board Units (OBUs) that can communicate with each other

(V2V communications), and/or with stationary road infrastructure units (V2I) that are installed along the roads. VANETs have several characteristics that make it different from MANETs, such as high node mobility, predictable and restricted mobility patterns, rapid network topology change, and frequent battery charging, so energy consumption is not a big issue in VANET.

Geographic-based routing protocols or Location-based routing protocols combine the position information with topological knowledge of the actual road map and surroundings. In geographic-based routing protocols, the data is transmitted directly from the source to the destination without initiating any route discovery process. Therefore, each forwarding node assumes to know the following: its current location (using GPS), neighbours locations (by periodically exchanging of Hello messages), and destination location (by using location service protocol).

Intersection-based Geographical Routing Protocol (IGRP) is a location-based routing protocol, which is suitable to urban environments. IGRP is based on an effective selection of road intersections a packet must follow to reach the desired destination. This protocol is characterized by selecting the routes with high route stability. In addition it satisfies QoS constraints with tolerable delay, bandwidth usage, and error rate.
CBR protocols are widely used to improve the scalability of VANET environment and to reduce the control overhead message. Although the clustering techniques are minimizing the routing control overhead, frequent CH elections increase the control overhead associated with the re-election process.

The control overhead messages are produced by: First, ex-changing of HELLO messages between the CMs and the CH, and second, the CH ADvertiSement (CHADS) messages broadcasted periodically by the CH. When control overhead messages are increasing in a cluster topology, it reduces the available bandwidth resources.

CONTRIBUTIONS

In this article, we define three contributions as follow:
1) We combine the characteristics of geographic-based routing protocol with cluster-based routing protocol to produce a novel CBR protocol. The proposed routing protocol is called Cluster-Based Life-Time Routing (CBLTR) protocol, which objects to eliminate the route discovery process and reduces the number of re-election process for new CHs. CBLTR protocol aims to increase the route stability and average throughput in a bidirectional segment scenario.

2) We propose a novel Intersection Dynamic VANET Routing (IDVR) protocol, which aims to increase the overall network efficiency, by increasing the routes throughput, and decreasing end-to-end delay.
3) We propose a Control Overhead Reduction Algorithm (CORA). The proposed protocol aims to minimize the number of the control overhead messages generated by CMs in a clustered segment scenario.

APROVE present two different procedures for selecting and maintaining the cluster-head. It uses a synchronous time interval CI where all nodes have their cluster-head of decision in each CI. The second APROVE asynchronous method does not require time interval for cluster-head decision. Simulation presented a minimization of the relative mobility and the distance of each cluster-head to members of the cluster. The clusters created are stable and have a long average duration of a cluster member, a long average cluster-head, the low average rate of cluster-head variation, and reasonable overhead. However, when the network density increases the size of the neighbour list becomes sufficiently large enough, APROVE will overload bandwidth.

II. LITERATURE SURVEY

1. A Survey On Routing Protocols For Vehicular Ad-Hoc Networks

To analyse the performance and to determine the most suitable routing type, to ensure the best efficiency in the VANET. Methods/Statistical analysis: Vehicular Ad Hoc Networks (VANET) constitutes one of the most promising areas of application of ad hoc wireless networks, able to organize without predefined infrastructure. These networks allow vehicle to communicate with each other or with the roadside infrastructure and will ultimately have safer and more efficient roads through the exchange of timely information to drivers and authorities. Findings: The routing information in VANETs is a major challenge because they are characterized by high mobility resulting in a highly dynamic topology. In this article, we present the most popular routing protocols, offered to do the routing. We describe their main features and functions that ensure the flow of data between different mobile units. We are particularly interested in the problem of delay and bandwidth consumption in routing protocols. In this axis, we compare the various recent proposals for routing protocols to determine the most efficient routing types. This article gives readers a deeper insight on the methods proposed in this area and the most effective solutions to improve VANET. **Applications/Improvements:** The results observed from this paper motivate to improve the stability of cluster structure in clustering routing protocols in VANETs.

2.2 An Energy-Efficient Routing Protocol Using Movement Trends In Vehicular Ad-Hoc Networks

Vehicular Ad-hoc Networks (VANETs) are a killer application of Mobile Ad-hoc Networks (MANETs), which exchange data among vehicles and vehicles to roadside infrastructures by routing. To save energy, various routing protocols for VANETs have been proposed in recent years. However, VANETs impose challenging issues to routing. These issues consist of dynamical road topology, various road obstacles, high vehicle movement, and the fact that the vehicle movement is constrained on roads and traffic conditions. Moreover, the movement is significantly influenced by driving behaviours and vehicle categories. To this end, we incorporate them into routing and propose ERBA for VANETs – an energy-efficient routing protocol. The proposed scheme is validated by real urban scenarios extracted from Shanghai Grid project. Experimental results show that ERBA outperforms the compared routing protocols with respect to the end-end delay, the packet delivery ratio and the path duration time.

2.3 A Multi-Objective Genetic Algorithm-Based Adaptive Weighted Clustering Protocol in Vanet

Vehicular Ad hoc NETworks (VANETs) are a major component recently used in the development of Intelligent Transportation Systems (ITSs). VANETs have a highly dynamic and portioned network topology due to the constant and rapid movement of vehicles. Currently, clustering algorithms are widely used as the control schemes to make VANET topology less dynamic for Medium Access Control (MAC), routing and security protocols. An efficient clustering algorithm must take into account all the necessary information related to node mobility. In this paper, we propose an Adaptive Weighted Clustering Protocol (AWCP), We evaluate and compare its performance with other multi-objective optimization techniques: Multi-objective Particle Swarm Optimization (MOPSO) and Multi-objective Differential Evolution (MODE). The experiments reveal that NSGA-II improves the results of MOPSO and MODE in terms of spacing, spread, ratio of non-dominated solutions, and inverse generational distance, which are the performance metrics used for comparison.

2.4 Vehicular Multi-Hop Algorithm For Stable Clustering In Vehicular Ad Hoc Networks

Clustering is an effective mechanism to handle the fast changes in the topology of vehicular ad hoc networks (VANET) by using local coordination. Constructing stable clusters by determining the vehicles sharing similar mobility pattern is essential in reducing the overhead of clustering algorithms. VMaSC is a novel clustering technique based on choosing the node with the least mobility calculated as a function of the speed difference between neighbouring nodes as the cluster head through multiple hops. Extensive simulation experiments performed using ns-3 with the vehicle mobility input from the Simulation of Urban Mobility (SUMO) demonstrate that novel metric used in the evaluation of the least mobile node and multi-hop clustering increases cluster head duration by 25% while decreasing the number of cluster head changes by 10%.

III. RESEARCH DESIGN

3.1 CLUSTERING STABILITY AND EFFICIENCY IMPROVEMENT IN VANET

Recently a considerable research is being conducted on increasing clustering efficiency and cluster stability in VANET. Due to the dynamic nature of VANET, designing efficient clustering protocols with high cluster stability is a challenging task which requires novel ideas and techniques. The most popular methods used in many VANET clustering algorithms are categorized as the following:

Appropriate CH selection metric

The CH is a crucial entity in clustering protocols which should be a long-living node and should be chosen based on application requirements. Proposing an appropriate CH selection metric can help in assigning the most eligible node as CH and increasing CH lifetime which serves towards stabilization of cluster structure. An advantageous technique for CH selection is to employ prediction of node's behaviour to select a node that is an appropriate CH for a longer time period.

Appropriate cluster membership rules

In most VANET clustering algorithms, cluster members are selected based on their relative mobility and movement direction. Typically, in VANET clustering algorithms, the nodes moving on a different direction from the cluster are not added to it. The reason lies in the instability caused by short-time membership of these nodes. However, in some applications and under special conditions adding different direction nodes might be helpful. Likewise, it would be helpful to decrease the number of CM changes and increase CM lifetime. The concept of candidate cluster members and cluster member level is proposed in DCTT algorithm. A candidate CM or a lower level member is a node which does not completely comply with CM requirements; but is highly probable to become an eligible CM in a near future due to its special characteristics.

Reduction of CH changes changing the CH requires making adjustments to cluster structure. Therefore, decreasing the number of CH changes would help in maintaining cluster structure and increasing cluster stability. In most clustering algorithms, CH is defined as the least relatively mobile node compared to all other cluster members. The CH should be evaluated at each defined time interval and re-selected if needed based on CH selection rules. Due to rapid changes in VANET topology, there is a high probability that the current CH would lose its eligibility quickly. Although another node might be more appropriate to be the CH, most algorithms do not change the CH so frequently in order to reduce the number of changes as much as possible. Adding a threshold to change the current CH is the solution that we have used in DCTT clustering protocol.

CH Recovery Techniques

A CH is a vital entity in a cluster. In some algorithms if the CH is lost, the cluster structure is broken and the initialization phase is required to run again. To avoid switching between cluster maintenance and initialization phases, some algorithms select a candidate CH (CCH) to take the responsibility in case of losing the current CH. Candidate CH selection adds a level of stability to the algorithm and prevents delay caused by re-clustering in case the CH is lost. The other helpful method in case of losing the CH is to assign priority to member nodes. The same procedure as in CCH selection will be applied to give priority to nodes at each time interval based on the defined application metrics. The nodes are supposed to advertise their priority and inform all the member nodes about it. CMs create a member list and save the priority values of the nodes. This method is helpful in the selection of the next CH between nodes without a need for an active CH. The problem with using this method is the high overhead caused by sending beacon messages to announce the priorities. This technique helps in creating robust and stable clusters which do not solely rely on CH to continue their activities. More details on this approach are presented in our distributed clustering algorithm.

Overhead reduction technique

Prediction-based approaches have been employed to decrease overhead caused by sending and receiving control messages for cluster maintenance in VANET algorithms. a prediction-based approach to CH in order to acquire cluster members' information. In this algorithm, the prediction function of CH predicts member nodes' behavior. Therefore, members do not need to send their information periodically to the CH unless they find out the predicted information do not match their actual status. This approach helps reduce the control overhead. Furthermore, the idea of passive clustering is used for reducing the clustering overhead. Passive protocols send control messages inside data packets. This concept is used in many MANET and VANET clustering protocols.

PREDICTION MECHANISM

VANET is a dynamic network consisting of high speed nodes moving throughout roads with movement restrictions due to speed limits, road shapes and conditions, and driver's behaviour. Employing prediction procedures in such networks is feasible, simple, and beneficial. The simplicity of prediction is due to predictable driver behaviour due to road barriers and conditions.

Because of rapid changes in node's location and speed in short time periods, it would be much preferable in VANETs to rely on predicted information rather than use the current information for future decisions since it is conducive to designing more efficient protocols. In this algorithm we rely on prediction to find out the next position of nodes, as well as calculate the CH selection metric. In this section we explain these two procedures briefly.

Prediction based CH selection metric

Our proposed CH selection metric for PCTT is the time period the target spends in the field of view of each vehicle. This time value is referred to as Observation Time (OBT).In DCTT we calculated the CH selection metric (TFP) based on the current movement pattern of each node as compared to the target, such as relative velocity and distance. Each node was supposed to send its TFP value to other nodes for future decisions. Therefore, every decision was made based on the previous information, considering the transmission and processing delays. Assume vehicle C calculates its TFP value for time and broadcasts this value in the cluster. The CH will receive this value at time after a short time interval (due to transmission delay). Therefore, the CH is making decisions based on received data, which is the old data calculated at time, not. The point is, vehicle C's position might have changed during this time interval, which is not considered in making clustering decisions. Thus, estimating the future behavior of nodes for making cluster maintenance decisions helps create a more efficient clustering algorithm for a dynamic VANET environment.

Employing prediction to calculate next location of nodes

In clustering techniques, the CH is supposed to have information about cluster members. If the CH can predict this information, instead of receiving it periodically through beacon messages, the overhead will be decreased significantly. Clearly, by relying on prediction, fewer messages are required to maintain a cluster structure. For instance, in PCTT the CH predicts the future location and velocity of member nodes instead of receiving this information regularly. However, there is always a probability that a node's movement pattern changes and the prediction do not match reality. To address these concerns, a correction mechanism should be considered in every prediction-based method.

Cluster stability can be defined through different mechanisms, but the main mechanisms are CH duration and the number of CH changes. CH duration is the period of time that the CH maintains its status as CH; maximizing CH duration is useful to improve cluster stability, as well as minimizing the control overhead that yields from frequent reelection processes.

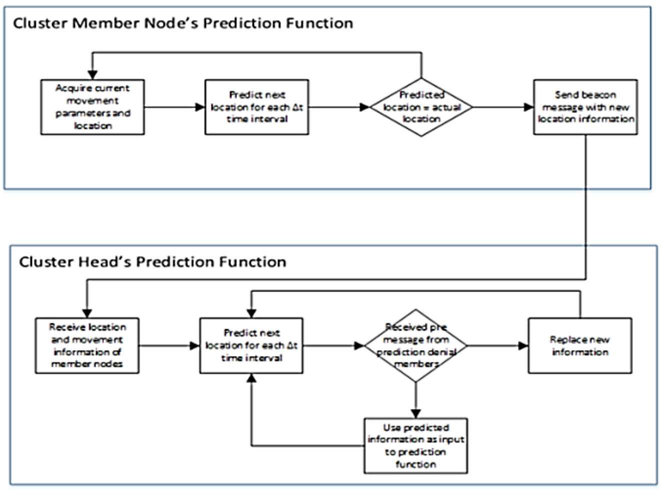

Figure 1. Prediction Mechanisms of the CH and CMs

The number of CH changes is the number of vehicles that change its status from CH to CM within a period of time. The analysis shows that frequently changing CH minimizes network stability. In contrast, the CBLTR protocol elects the CH in each cluster based on periodical calculation of the LT. The selected vehicle maintains and advertises its status as CH until it arrives at the predefined threshold point. we ran the simulation for 500 seconds; then we calculated the average CH duration and the average number of CH re-election by comparing the CBLTR election algorithm with other CH election algorithms mentioned in the literature. We evaluate the performance in terms of average CH duration and average number of CH reelection processes. The results show that the CBLTR protocol outperforms other election algorithms in terms of average CH duration and the average number of CH changes.

IV. SYSTEM ANALYSIS

EXISTING SYSTEM

In different types of routing protocols, such as proactive, reactive, hybrid, and geographic-based routing protocols. The proactive and reactive routing protocols are classified under the topology based routing protocol category, which aims to discover the route between the source and destination before starting the data transmission. The main difference between the two is that the proactive routing protocol initiates a route discovery to all nodes located in the entire network, yielding an increase in control overhead and end-to-end delay. While in the reactive routing protocol, a source node initiates a discovery process to reach only the desired destination. This process reduces the control overhead; however, the route discovery process is required in finding a route for every new node. The hybrid routing protocol combines the features of both proactive and reactive routing protocol. The nodes in the hybrid network are grouped together in a particular area called clusters. Hybrid routing protocols, sometimes called Cluster- Based Routing (CBR) protocols, are designed to improve the network scalability by allowing the nodes within the clusters to communicate through a pre-selected Cluster Heads (CHs) using a proactive routing protocol. However, in the case of communication between clusters, a reactive routing protocol is triggered.

Disadvantages

Due to the dynamic nature of VANETs, routing has various challenges and constraints with respect to management of Quality of Service (QoS) for various services:

- ✓ Rapid topology changes due to mobility.
- ✓ Variation in vehicle velocity and density on the road.
- ✓ Sparse distribution of vehicles in some geographical leads to loss in connectivity among vehicles resulting in declining performance of network
- ✓ Efficient clustering and selection of Cluster Head (CH) based upon some predefined criteria
- ✓ Intrusion detection and security

PROPOSED SYSTEM

APROVE forms clusters using the Affinity Propagation algorithm in a distributed manner. It presents a new mobility-based clustering scheme for VANET. This algorithm takes into account the mobility and stability. Cluster performance was measured in terms of average CH duration, average cluster member duration, the average number of clusters, and the average rate of cluster-head change. Each node transmits messages of responsibility and availability to its neighbors and then takes a decision on the clustering independently. The IDVR protocol selects the optimal route based on its current location, destination location, and the maximum of the minimum average throughput of SCSR. Finally, the CORA algorithm aims to reduce the control overhead messages in the clusters, by developing a new mechanism to calculate the optimal numbers of the control overhead messages between the CMs and the CH.

Advantages

1. The clusters created are stable and have a long average duration of a cluster member, a long average cluster-head, the low average rate of cluster-head variation, and reasonable overhead. However, when the network density increases the size of the neighbor list becomes sufficiently large enough, APROVE will overload bandwidth.
2. (CBLTR) protocol, which objects to eliminate the route discovery process and reduces the number of re-election process for new CHs. CBLTR protocol aims to increase the route stability and average throughput in a bidirectional segment scenario.
3. We propose a novel Intersection Dynamic VANET Routing (IDVR) protocol, which aims to increase the overall network efficiency, by increasing the routes throughput, and decreasing end-to-end delay.
4. We propose a Control Overhead Reduction Algorithm (CORA). The proposed protocol aims to minimize the number of the control overhead messages generated by CMs in a clustered segment scenario.

SYSTEM ARCHITECTURE

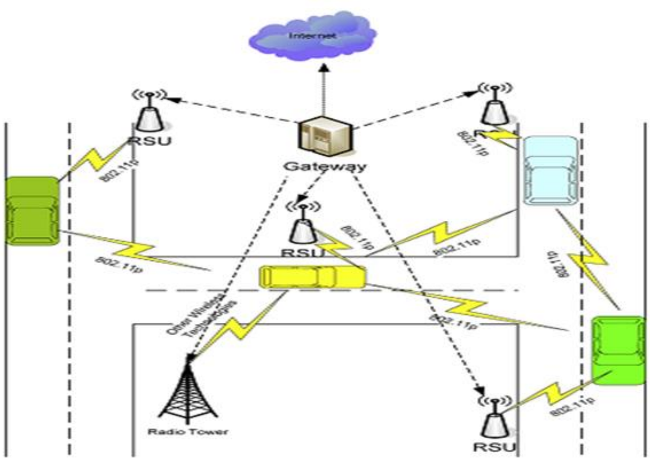

Figure 2. Architecture Diagram

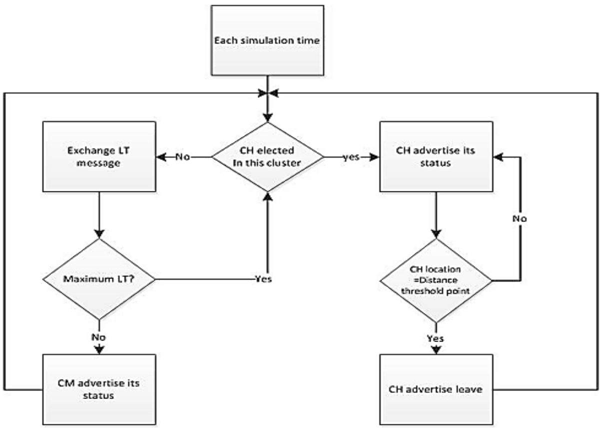

Figure 3. DFT for CH Election

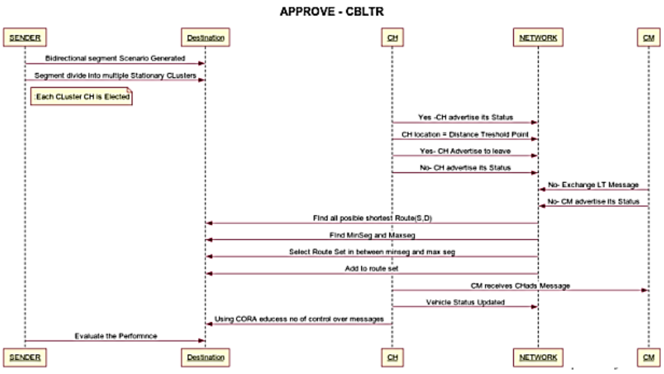

Figure 4. Sequence Diagram

ALGORITHMS

Algorithm 1 Cluster Formation

1: **function** ATTACH-HEADS-MEMBERS

2: Input: Node; $init_H$; NumOfNodes; $init_M$

3: **for** $index_{mem}$ ← $init_H$ + 1 : numOfNodes **do**

4: **for** $index_H$ ← 1: $init_H$ do

5: Calculate the distance

6: **end for**

7: Pick up the nearest head and attach members with that cluster head.

8: **end for**

9: **for** $index_H$ ← 1 : $init_H$ **do**

10: **return** HM; T otalClusterNodesCount

11: **end for**

12: **end function**

Algorithm 2 Cluster Formation

1: function ATTACH - HEADS - MEMBERS

2: input: Node; $init_H$; NumOfNodes; $init_M$

3: **for** $index_{mem}$ ← $init_H$ + 1: numOfNodes **do**

4: **for** $index_H$ ← 1 : $init_H$ **do**

5: Calculate the distance from each head

6: **end for**

7: Pick up the nearest head and attach members with that cluster head.

8: **end for**

9: **for** $index_H$ ← 1 : $init_H$ **do**

10: **return** HM; T otalClusterNodesCount

11: **end for**

12: **end function**

Algorithm 3 Cluster Throughput of Clusters

1: function CALCULATECLUSTERTHROUGHPUT

2: input: HM; RSULocation; TotalHMCount; $init_H$

3: while ($index_{TH}$ ≤ TotalHMCount) **do**

4: **for** iTemp = 1 : TempMembers **do**

5: TempCluster ←HM

6: **end for**

7: xTH = ThroughputCluster (RSULocation; TempCluster)

8: **end while**

9: **return** HMNode; ClusterT H

10: **end function**

Algorithm 4- Cluster Heads Re-Election

1: **function** MAKEEACHMEMBERASHEAD. This function gets the PickedCluster as minimum throughput cluster and checks the throughput of every member of that cluster by considering it as a head and returns the best suitable member as a head

2: Input: PickedCluster; TotalMembers

3: **for** i ←1: TotalMembers do

4: check every member throughput by considering it as a head and returns the best suitable member as a head

5: **end for**

6: **return** NewCluster← HNewCluster
return NMemebers← NewMembers
return Headcode← PickedCluster

7: **end function**

Table 1. Simulation Parameters For Idvr Protocol

Parameter	**Value**
Simulation time	1000 second
Topology type	Grid topology
Number of intersection	25
Number of segments	40
Communication range	250
Vehicle range speed	(10 - 60) kmph
Packet size	512byte
Data sending rate	2 Mbps
Number of clusters per segment	4
Threshold value	1 Mbps
Maximum number of segments of valid route	Minimum number of segments in a valid route + 2
Type of communication in the segments	**APPROVE**

V. IMPLEMENTATION AND RESULT

MODULE DESCRIPTION

1. Cluster Dividing

The segment is a bidirectional road, and each segment is divided into multiple clusters that equal half of the transmission range of a standard vehicle. We assume that all vehicles have predefined knowledge of cluster coordination and identification. Each vehicle must be assigned to one cluster at each unit of time based on its location, and with a unique ID for each vehicle and cluster. A segment with two clusters; it also shows the cluster edges between the clusters. At any unit of time, if each vehicle enters any cluster zone (enters the cluster edge lines between the clusters), then it becomes a member of this cluster and must send A HELLO message to the CH of the cluster.

2. Cluster Head (CH) Election

Each vehicle that enters a predefined stationary cluster zone should periodically calculate specific cost value, which is called Life-Time (LT). The LT of each vehicle depends on the current velocity of the vehicle as well as the distance to the predefined directional cluster edge (using a Euclidean distance equation). The vehicle with the maximum LT is elected as a CH, then it remains as the CH till it arrives at the directional threshold point; this means there are no new election until the current CH arrives at the predetermined directional threshold point. The directional threshold point is defined as a point distant from the directional edge of the cluster. The distance that separates these two points is calculated by considering the CH velocity, and the time it takes to proceed until the re-election process. The distance from the directional threshold point to the directional edge of the cluster must be enough for a CH vehicle to handover the CH function to another vehicle without losing the communication.

3. Software Defined Network (SDN)

A Software Defined Network is used to provide flexibility to networks and to introduce new features and services to VANETs SDN to define the candidate routes between two intersections; SDN requires creating a table that includes segment IDs, as well as average throughput (as calculated and this information must be updated periodically. The contents of the SDN table. The design of full SDN architecture is beyond the scope of this article. The SDN provides upon request the candidate routes between the source intersection and the destination intersection (the intersection closest to the destination location) using the Dijkstra algorithm. Each candidate route consists of a series of intersections and the corresponding weight.

4. **Intersection Dynamic VANET Routing (IDVR) Protocol**

Intersection Dynamic VANET Routing (IDVR) protocol, which computes the optimal route to the destination taking into account the real-time traffic from source to destination, and the current source and destination intersection location. The IDVR algorithm works in real-time and recursively operates at each intersection until it arrives at the final destination. Our objectives are to increase the route stability and average throughput, and to reduce end-to-end delay in a grid topology scenario.

5. Intersection Cluster Head (ICH)

When any vehicle enters the intersection cluster zone, it waits for second. If it receives any CHADS message, then it announce itself as CM and sends a HELLO message to the ICH, otherwise it announce itself as ICH. Vehicles want to enter the cluster intersection zone. The first vehicle that enters the intersection zone will announce itself as ICH, and any vehicle enters after that will announce itself as CM. The ICH keeps its status as ICH and periodically forward CHADS message until it arrives to its corresponding threshold point. At the moment when the ICH arrives at the threshold point a new election process should be invoked.

6. Control Overhead Reduction Algorithm (CORA)

Control Overhead Reduction Algorithm (CORA) that aims to reduce the number of control overhead messages in a clustered topology. We then present a new design for HELLO message, by minimizing the number of parameters in HELLO message. CORA is based on the assumption that each vehicle in the VANET environment knows its current location and cluster ID by using digital map and Global Positioning System (GPS). In the following section, we describe how CORA algorithm is able to minimize the HELLO messages between the CMs and the CH.

7. Evaluation Of Analysis Result

To validate the performance, we select a series of metrics. These metrics are the packet delivery ratio, the end-end delay, and the path duration time. They are given as follows.

- ✓ The packet delivery ratio refers to a fraction of the successfully and correctly delivered data packets to all data packets. This is an elementary metric for APROVE – CBLTR routing protocol, as it implies whether APROVE – CBLTR accurately works or not.
- ✓ The end-end delay denotes the average time, which the routing protocol needs to deliver data packets from the source vehicles to the destination vehicles. This index characterizes the latency that the routing protocol might generate. Usually, given the network bandwidth, the routing protocols require low energy consumption in the case of low end-end delay.
- ✓ The path duration time defines the average duration time of the routes between two communication vehicles. This metric is used to measure the reliability of the routing protocols.

Vehicular Ad-Hoc Networks (VANETs) have received considerable attention in recent years, due to its unique characteristics, which are different from Mobile Ad-Hoc NETworks (MANETs), such as rapid topology change, frequent link failure, and high vehicle mobility. The main drawback of VANETs network is the network instability, which yields to reduce the network efficiency. In this article we propose three algorithms: **A**ffinity **PRO**pagation for **VE**hiclar networks - Cluster-Based Life-Time Routing (**APROVE**-CBLTR) protocol, Intersection Dynamic VANET Routing (IDVR) protocol, and Control Overhead Reduction Algorithm (CORA). APROVE – CBLTR forms clusters using the Affinity Propagation algorithm in a distributed manner. It presents a new mobility based clustering scheme for VANET. This algorithm takes into account the mobility and stability. Cluster performance was measured in terms of average CH duration, average cluster member duration, the average number of clusters, and the average rate of cluster-head change. Each node transmits

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SCREENSHOT

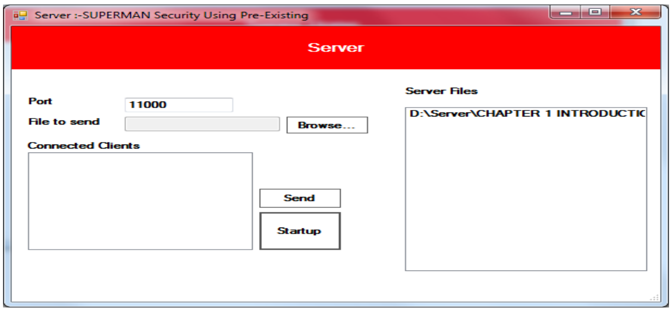

Figure 5. Send Video File Home

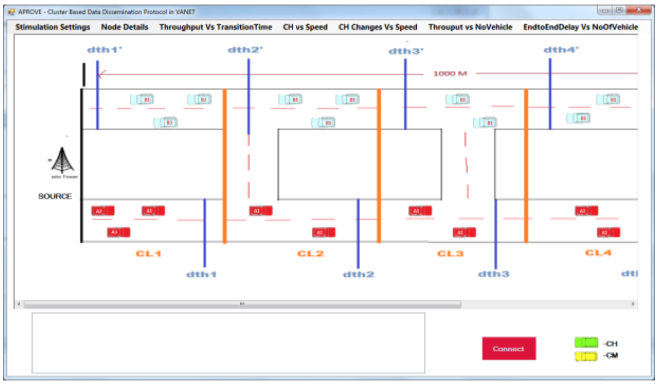

Figure 6. Network Loaded

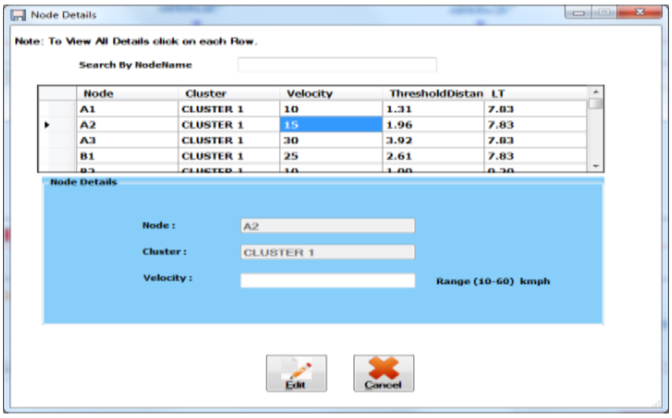

Figure 7. Node Details

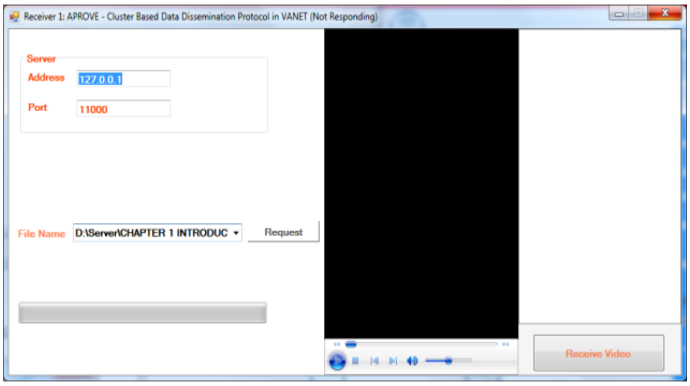

Figure 8. Request Video to Server

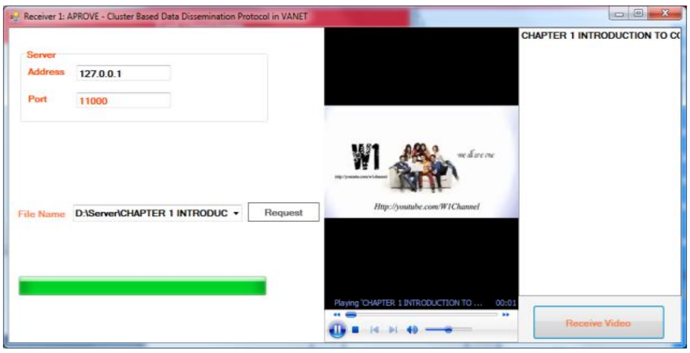

Figure 9. Play Received Video

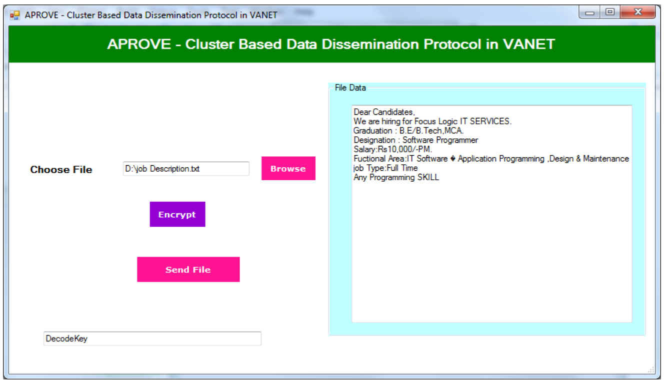

Figure 10. Send Text File

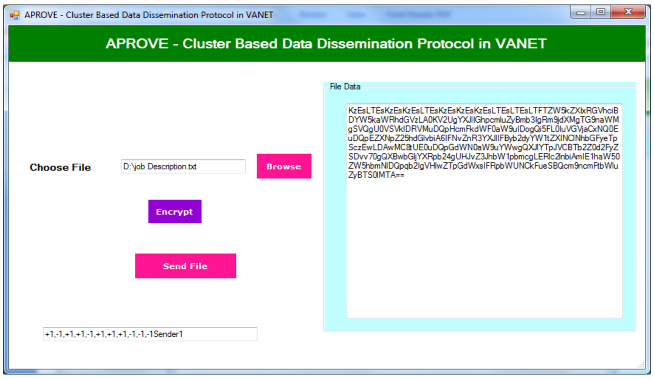

Figure 11. Encrypt File

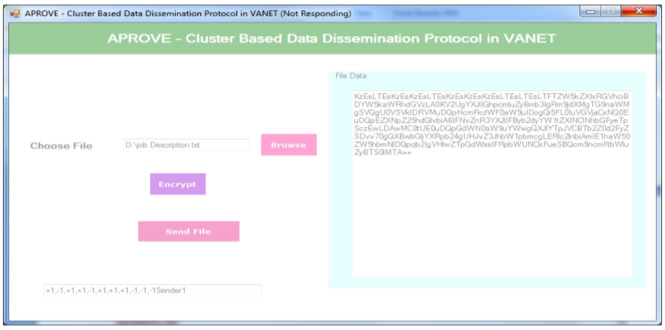

Figure 12. Send File

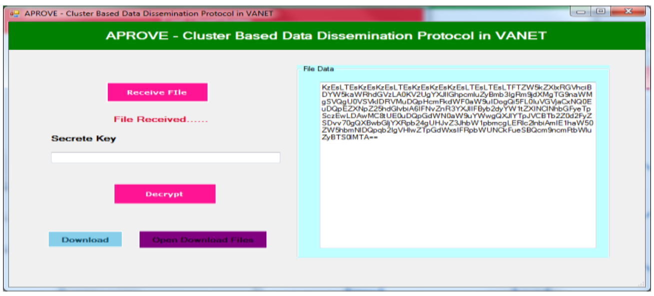

Figure 13. Receive File

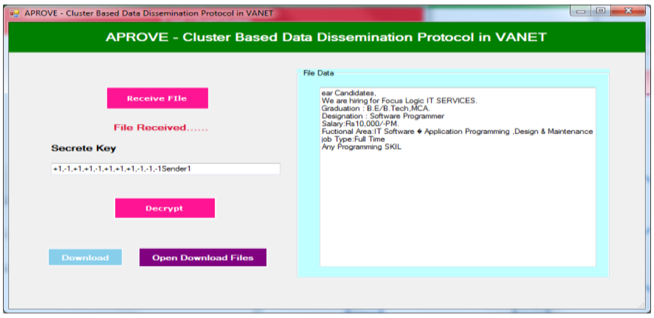

Figure 14. Decrypt File

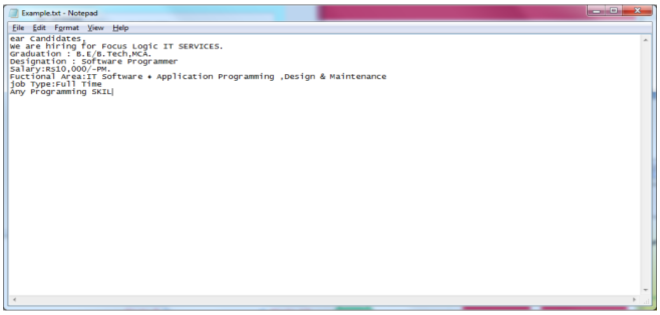

Figure 15. Download File

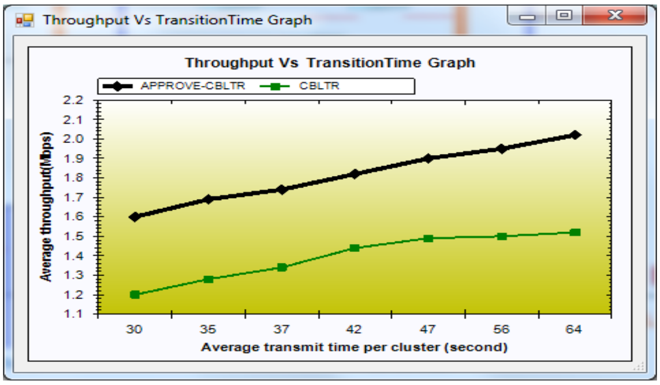

Figure 16. Comparison between Optimal Throughputs with Simulation Results

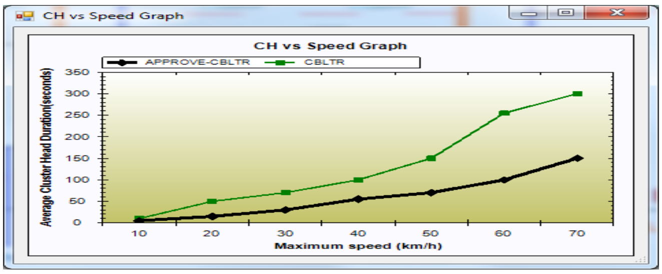

Figure 17. Average Cluster Head Duration Vs Speed

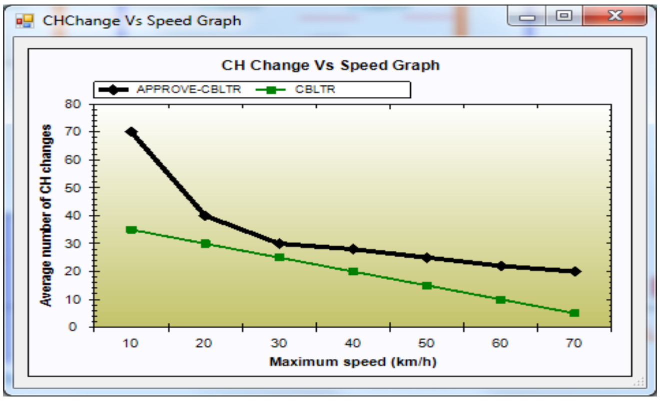

Figure 18. Average Number of CH Changes Vs Speed

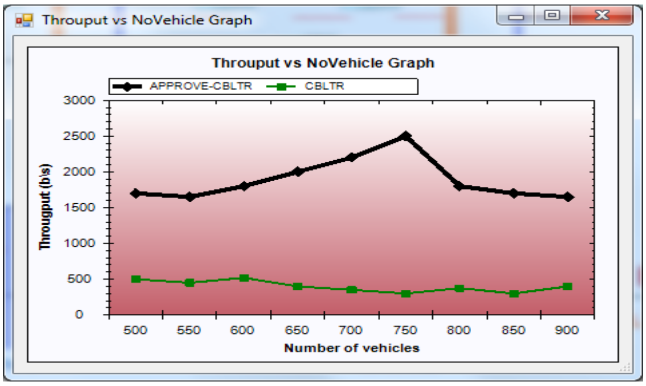

Figure 19. Throughput Comparisons in a Grid Topology

VI. CONCLUSION AND FUTURE ENHANCEMENT

CONCLUSION

A novel APROVE-Cluster-Base Life-Time Routing (APROVE-CBLTR) protocol in a segment topology is introduced. The CHs are elected based on maximum LT, and the reelection process is required only when the CHs reach their corresponding threshold point. Based on the simulation results, CBLTR protocol shows a significant improvement in terms of average throughput. The enhancement in CBLTR protocol is a new mechanism to select new CHs. The selected CHs have longer LT span making the protocol more stable. Second; an Intersection Dynamic VANET Routing (IDVR) protocol in a grid topology is proposed. Each time the packet reaches the intersection, ICH recursively applies the IDVR protocol between the current intersection and the desired destination intersection, taking into account the stability of the connected route. The IDVR protocol selects the optimal route based on its current location, destination location, and a maximum of the minimum average throughput for SCSRs. IDVR increases the overall network efficiency, by increasing the route throughput, and decreasing end-to-end delay. As in our simulation, we have proved that the IDVR protocol outperforms VDLA, IRTIV, and GPCR in terms of end-to-end delay and throughput. Finally; we proposed a Control Overhead Reduction Algorithm (CORA), which aims to reduce the control overhead messages in the clusters, by developing new mechanism for calculating the optimal period for updating or exchanging control messages between the CMs and the CH. CORA propagate the HELLO messages in three scenarios: when the CM enters the cluster zone, second; when the CM leave the cluster zone, and when new CH announces itself. Based in the simulation results, CORA significantly minimized the number of HELLO messages in each cluster and in the segment with multiple clusters in general.

FUTURE WORK

In future, we are working on identification of the parameters to form more stable clusters; therefore, the connectivity of the vehicle can be further improved. We would implement one of the above defined schemes and compare its performance over the other schemes of its category.

VII. REFERENCES

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