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An Improved Clustering Method Vanet Routing and Communication

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***Abstract:** The rising popularity of network based technologies has witnessed growing interests in research of inter-vehicular communications. In this scenario, Vehicular Ad-hoc Network (VANET) has evolved as the largely admired network traffic routing and control system. The main idea of this work is to enhance quality of clustering approach implemented in VANET. To achieve this, authors proposed the addition of two new elements in the existing clustering architecture, namely, the number of cluster heads required in a specific simulation area and the selection of paramount candidate to be used as cluster head. Supervised learning technique is implemented in the employed methodology. The proposed architecture is evaluated in terms of Jitter and Packet Delivery Ratio (PDR). The simulation results demonstrated that the node variation with PDR shows relatively higher average PDR for polynomial kernel as compared to the average PDR for linear kernel.*

***Keywords:** Vehicular Ad-hoc Network (VANET), clustering, Polynomial Kernel, Linear Kernel, Cluster Head.*

I. INTRODUCTION

Vehicular Ad-hoc Network (VANET) is a collection of 'n' number of vehicles communicating with each other utilizing the Road Side Units (RSUs) [1-3]. RSU is an assisting unit which takes the information from one vehicle and passes it to another vehicle as per the requirement of the time instance [4]. Vehicles are also referred to as nodes in this paper. The nodes move with a very high speed in the architecture of VANET and hence the responsibility of the RSUs becomes more critical in terms of security and quick data transmission [5-7]. Clustering is observed as a common practice in VANET, though it was not originated in VANET. Clustering got its significance from Wireless Sensor Network (WSN) in which the nodes are fixed and battery along with energy prevention is an important element [8-9]. Hence in order to prevent the energy and the battery, the clusters are created and the cluster heads are selected based on the residual energies of the nodes [10]. The concept of clustering is borrowed from WSN into VANET [11-15].

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The question is why VANET requires clustering concepts and where it is applied. VANET have all kind of vehicles in which some vehicles moves very rapidly and some move quite slow as shown in Figure 1. Some of them are like move in only one area and hence they require steady type of information and based on their stays in the network, they can further act as cluster-heads.

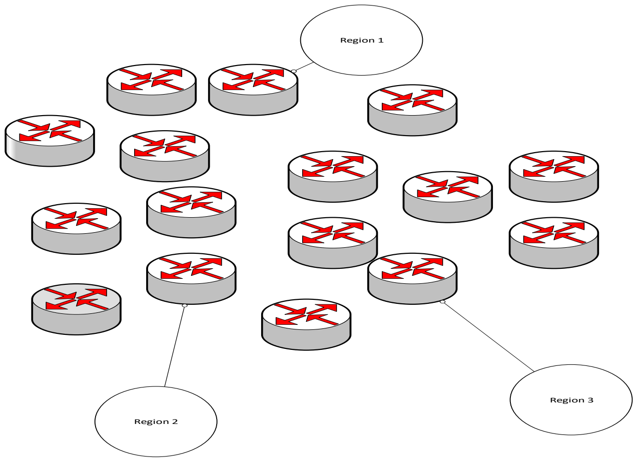

Fig.1.Network with three different regions

There are certain advantages of Clustering

a) Centralized approach
b) Controlled Environment
c) Quick Communication

As everything cannot be 100 % perfect and hence the clustering too is nowhere different. There are certain issues with clustering like the distribution of nodes as per the region and calculation of total number of desired candidates for the Cluster Head. There are previous approaches of clustering in VANET which are discussed in the literature review later in this paper. Though the formation of the clusters is not new in this region but this paper introduces a new fitness function of the selection which enhances the selection procedure and reduces the delay and Jitter of the overall network.
The rest of the paper is organized in the following manner. Section 2 the proposed methodology and Section 3 discusses the results of the paper. The paper is concluded in Section 4.

II. PROPOSED METHODOLOGY

The architecture of clustering of the proposed system comprises of two new elements.

a) How many cluster heads are desired in a given simulation area
b) How to select the best suitable candidate for the Cluster Head

The first issue is how many Cluster heads are required in given region. Hence there are two elements in this issue namely the deployment area and the total number of nodes deployed in the area as shown in Fig.2

Fig.2. Nodes deployed in a given region

The deployment area is represented by $D_A(l * w, n)$ where l is the length of the network and w is the width of the network. n is the total number of deployed nodes in the network. Each node is tagged with a node identity starting from 1 to n. The calculation of total count is as represented by Equation 1. First of all a network deployment is created as mention in Pseudo Code 1.

1. $Pseudo\ Code\ 1$
2. $Function\ Deploy\ Network$
3. $For_{each}\ node\ in\ the\ Node_{List}$ // For every node in the architecture
4. $X_{Deployment} = Length * Random(0,1)$ // Generating a random x location which resides within the length of the network
5. $Y_{Deployment} = Length * Random(0,1)$ // Generating a random y location which resides within the width of the network
6. $Deploy(X_{Deployment}, Y_{Deployment})$
7. End_{For}

The nodes are deployed in heterogeneous environment and hence each node will have different attribute values. The nodes are initialized with four different attributes namely the dump ratio normal, dump ratio advanced, movement and distance to central RSU. The pseudo code 1 can be explained by Fig.3.

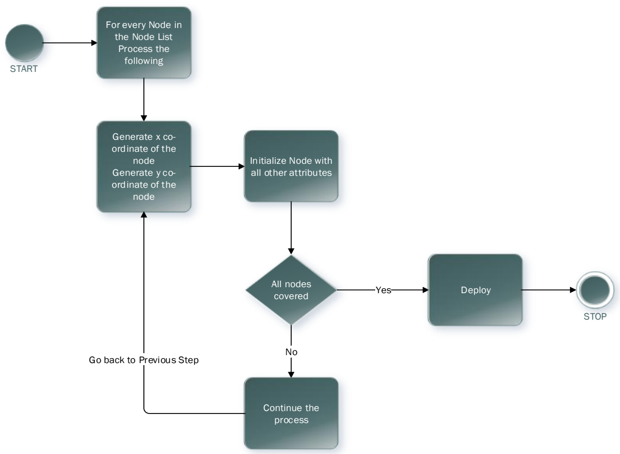

Fig.3.The network deployment model

The total count calculation is as follows.

$$CH_{Count} = \frac{\sqrt{\sum_{i=1}^{n}\frac{drsu}{n}\times\log_{10} n}}{Collection_{Value}} \quad (1)$$

Where $drsu$ is the distance to the RSU which is defined in Equation 2 and the $Collection_{Value}$ is defined in Equation 3.

$$drsu = \sqrt{(x_n - x_{RSU})2 + (y_n - y_{RSU})2}$$

(2)

Where x_n, y_n are the x and y co-ordinates of the node in the network and x_{RSU}, y_{RSU} are the x and y co-ordinates of central RSU.

$$Collection_{Value} = \begin{cases} 2 & if\ \frac{n}{deploymen\,t_{width}}\ is\ greter\ than\ .10 \\ 1 & Otherwise \end{cases}$$

(3)

Based on total number of CHs evaluated in a given region, an intra communication network is to be established. Machine learning is employed for the route formation. The ordinal aspects of machine learning are as follows.

Machine learning is observed to be of three types namely Supervised Learning, Semi-supervised learning and un-supervised learning. The supervised learning mechanism takes all the data as the training data and classifies the same data as the test data. The proposed methodology uses supervised learning mechanism as the expected CHs in the route can be any node out of the context. The proposed mechanism uses a two way proportion discovery mechanism in which the CHs are selected based on least movement in the network followed by QoS based training architecture. Pseudo Code for routing architecture is mentioned in Pseudo Code 2.

Pseudo Code 2

$Function\ CH_{Selection}$ // Function CH Selection

$Input: QoS\ Route\ architecture\ Source, Destination, Current\ Route, Mobility$ // the inputs to this function would be Source, Destination, the current formed route and the mobility of the nodes

1. $Flag_{Destination_{Found}} = 0;$ // A flag is initialized to ensure that the destination is found or not

2. $While\ Flag_{Destination_{Found}} \cong 1$ // Until the destination is not found

3. $Temp_{Source} = Source;$ // The source is initialized as the temporary source

4. $Search\ Nearest\ CH\ for\ the\ Temp_{Source}\ by\ Equation\ 4$ // Search nearby nodes for the cluster heads, just a 25% margin of distance is initialized

$$Nearest = \sqrt{\left(Xloc_{Temp_{Source}} - Xloc_{Chex}\right)^2 + \left(Yloc_{Temp_{Source}} - yloc_{Chex}\right)^2}$$

(4) // Calculating the distance by using Equation (4)

5. Search Nodes in the nearest block

6. For all nearby CH_ex // For all nodes expected to be Cluster Heads

7. $If\ Sim_{Itr} == 1$ // If the simulation iteration is the first iteration,

the selection of the Cluster head will be based on mobility. The least mobile nodes will be termed as CH

8. Sort CH_ex in ascending order, Pic first
9. // Sorting the Expected Heads based on the mobility
10. End
11. $Else$
12. $M = Neutralize\ QoS$ // On the contrary side, if it is not the first simulation iteration, then the structure has Quality of Service (QoS) , mostly Jitter and Throughput … Here Supervised Learning is to be applied
13. $Sort\ M\ in\ Descending\ Order$ // Select the least value node as the next node
14. $Select\ First$
15. End
16. $If\ Contains.Destination\ (Nearest)$ // If the selected node for cluster head has the destination in the reach , the destination flag is set to 1 that means the search is over
17. $Flag_{Destination_{Found}} = 1$
18. $Add\ Destination\ to\ the\ Route\ and\ Transfer$ // Add the destination to the route process
19. $Else$
20. $Temp_{Source} = Selected_{Node}$ // If the selected CH does not have the destination then the selected CH is added to the route and the search goes on
21. $End\ If$

III. RESULT

The results of the proposed algorithm architecture are evaluated using the following parameters.

a) Jitter: It is the total delay counted on the node as well as on the network part. The least delay is best for any network in architecture or construction.

b) Packet Delivery Ratio (PDR): It is the ratio of the total received packets to the total transferred packets.

$$PDR = \frac{Received_{Packets}}{Sent\ Packets} \quad (4)$$

Two scenarios are created for the evaluation of the proposed work model. The first scenario is node variation with “Linear Kernel (LK)” of machine learning and the second scenario is node variation with “Polynomial Kernel (PK)”. As shown in Fig. 4., the PDR for the PK is high as compared to the LK.

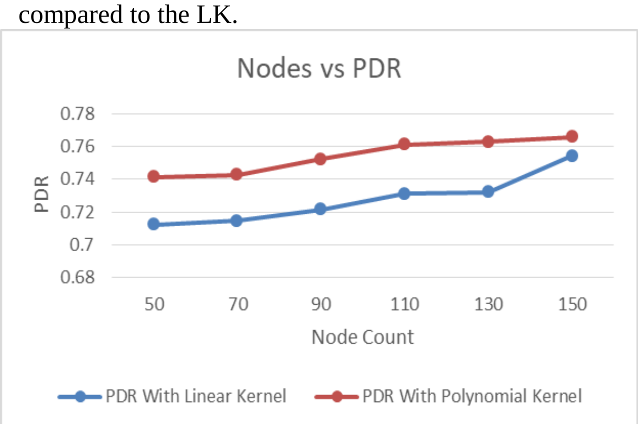

Fig.4. PDR

The PDR is found to be increasing for PK with increasing nodes. When the node increases, it is obvious that the packet flow will increase with increased node count. Polynomial kernel helps in selecting more precise CH and hence resulting into less waste of packets. The maximum attained PDR for polynomial is .7659 for 150 nodes whereas the minimum PDR for same node count is .7415. PDR for LK in the same contrast is .7541 and .7122. The story with Jitter is not the same as that of PDR. Jitter has other factors to be affected like network delay, load on each vehicle, a communication break-down etc. and hence the variation in average jitter is observed as shown in Fig.5.

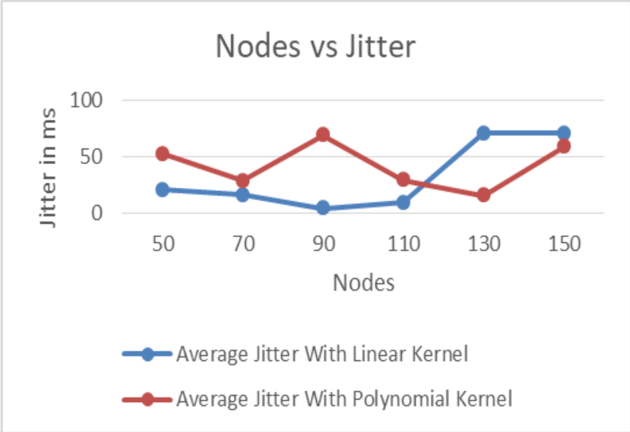

Fig.5. Jitter

IV. CONCLUSION

VANET is a rising future technology to successfully deal with on-road applications. In the proposed architecture, two modifications are incorporated in the clustering technique that deals with Vehicular Ad-hoc Network routing and communication system. The first modification comprises of identification of the number of CHs that are needed for a designed simulation region and the second involves the selection of most excellent candidate that can be used as a CH. The efficiency of the supervised learning approaches implemented in the current methodology is evaluated in terms PDR and Jitter calculations against variation in the number of nodes from 50 to 500. The results demonstrated that polynomial kernel exhibits an average higher PDR as compared to linear kernel over all the nodes.

REFERENCES

1. G. O. Young, “Synthetic structure of industrial plastics (Book style with Abdrabou, A., & Zhuang, W. (2010). Probabilistic delay control and road side unit placement for vehicular ad hoc networks with disrupted connectivity. *IEEE Journal on Selected Areas in Communications*, *29*(1), 129-139.
2. Al-Sultan, S., Al-Doori, M. M., Al-Bayatti, A. H., & Zedan, H. (2014). A comprehensive survey on vehicular ad hoc network. *Journal of network and computer applications*, *37*, 380-392.
3. Ou, C. H. (2014). A roadside unit-based localization scheme for vehicular ad hoc networks. *International Journal of Communication Systems*, *27*(1), 135-150.
4. Nguyen, V., Khanh, T. T., Oo, T. Z., Tran, N. H., Huh, E. N., & Hong, C. S. (2019). A Cooperative and Reliable RSU-Assisted IEEE 802.11 P-Based Multi-Channel MAC Protocol for VANETs. *IEEE Access*, *7*, 107576-107590.
5. Agrawal, A., Garg, A., Chaudhiri, N., Gupta, S., Pandey, D., & Roy, T. (2013). Security on vehicular ad hoc networks (vanet): A review paper. *International Journal of Emerging Technology and Advanced Engineering*, *3*(1), 231-235.

6. Balaji, N. A., Sukumar, R., & Parvathy, M. (2019). Enhanced dual authentication and key management scheme for data authentication in vehicular ad hoc network. *Computers & Electrical Engineering*, *76*, 94-110.
7. Isaac, J. T., Zeadally, S., & Camara, J. S. (2010). Security attacks and solutions for vehicular ad hoc networks. *IET communications*, *4*(7), 894-903.
8. Sarkar, A., & Murugan, T. S. (2019). Cluster head selection for energy efficient and delay-less routing in wireless sensor network. Wireless Networks, 25(1), 303-320.
9. Sarkar, A., & Murugan, T. S. (2019). Cluster head selection for energy efficient and delay-less routing in wireless sensor network. Wireless Networks, 25(1), 303-320.
10. Wang, L., Qi, J., Xie, W., Liu, Z., & Jia, Z. (2019). An enhanced energy optimization routing protocol using double cluster heads for wireless sensor network. Cluster Computing, 22(5), 11057-11068.
11. Pathan, A. S. K. (Ed.). (2016). *Security of self-organizing networks: MANET, WSN, WMN, VANET*. CRC press.
12. Martirosyan, A., Boukerche, A., & Pazzi, R. W. N. (2008). Energy-aware and quality of service-based routing in wireless sensor networks and vehicular ad hoc networks. *annals of telecommunications-annales des télécommunications*, *63*(11-12), 669-681.
13. Zamil, M. G. A., & Samarah, S. (2015). Dynamic rough-based clustering for vehicular ad-hoc networks. *International Journal of Information and Decision Sciences*, *7*(3), 265-285.
14. Khakpour, S., Pazzi, R. W., & El-Khatib, K. (2017). Using clustering for target tracking in vehicular ad hoc networks. *Vehicular Communications*, *9*, 83-96.
15. Song, C., & Wu, J. (2019). Vehicular Ad Hoc/Sensor Networks in Smart Cities. In *Mission-Oriented Sensor Networks and Systems: Art and Science* (pp. 287-310). Springer, Cham.

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