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# Improved Grey Wolf Optimization with Variable Weights for VANETs Clustering

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## Abstract

Vehicular ad hoc networks (VANETs) are wireless communications networks that use low-tech wireless technologies to create unstable networks among road users. These networks are designed to make the connection between vehicle control and road traffic control. Congestion-based collection optimization is used to discovery near-optimal solutions since network clustering has a difficult NP problem. In this paper, the optimization of improved gray wolf with variable weight-based clustering algorithm for VANETs is presented, which mimics the social behaviors and hunting mechanisms of gray wolves to create efficient clusters. The simulation results show that the proposed framework performs better than the previous works compared to the number of group heads with different communication amplitudes, amount of bulges and network size. Minimizes the cost of routing for the entire network connection by efficiently reducing the number of clusters required. Fewer clusters also reduce the need for resources in the vehicle network.

**Keywords:** Clustering, Gray Wolf Optimizer, Improved Gray Wolf Optimizer, VANETs, Artificial Neural Networks.

## I. Introduction

In the present, famous meta-innovative techniques such as Genetic algorithms (GA), Particle Swarm Optimization (PSO) and Ant Clone Optimization (ACO) have become general in computer science and machine learning communities [1-6].

There are many applications listed about the connected devices and autonomous motors that used smart vehicles, control of shaft speeds, manufacturing methods [7-10], IoT networks, applications of aeronautical engineering, solar energy production, and nanotechnology applications [10-13]. The flexibility, non-deflection method, simplicity, easy understanding and avoidance of local optimization are some of their features. The elasticity of meta-heuristic procedures increases their usage. These are flexible sufficient to explain the diverse difficulties of different environments. Also, these approaches are in the soft application. Different meta-initiatives are non-derivative, because meta-innovations solve difficulties by using random variables [14].

Clustering has been extensively researched, which one of the most frequently referred clustering algorithms, MOBIC, focused on mobile ad hoc networks was released in 2001, but its roots are even a few years older. Due to the fact that a few years before VANET, Ad hac Mobile and Sensor networks gained much research popularity [15]. This has significantly improved performance in many applications. The clustering process divides the structure of network nodes into small groups called clusters. Typically, neighboring vehicles are geographically grouped according to different parameters and criteria [16]. The present study presents a clustering algorithm in VANETs.

VANETs are special types of mobile case networks (MANETs) in which vehicles are considered nodes. Unlike MANETs, vehicles travel on predetermined routes (roads) and their speed is Road traffic. The main challenge in VANETs is to establish communication between vehicles for delivery from source to destination node [17]. VANETs join a dynamic topology with a large and variable network estimate and obviously contribute to the rapid nature of vehicles. Based on the clustering and optimization model, the optimal path through which data is transferred from a source node to a target node. Also, we decide whether to use mobile vehicles as a consistent transfer to dependent data Transfer to motion bearings exactly as areas related to the source node and destination node [18].

The vehicle system is a dynamic grid in which bulges have inconsistent/random waves that reasons frequent organizational eccentricities in the bulges. As a result, this sources network fragmentation which leads to network expiration. Bunching is also a convenient method that differs from other bunching methods according to a series of rules and regulations [19]. There are three main components to the VANET architecture: AUs (OBUs), on-board units (RSUs), and roadside units [20, 21]. The VANET 's unique features include: predictable mobility, providing safe driving, improving passenger comfort and increases traffic efficiency, no power limit, variable network density [22-25].

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In [26] a new hybrid scheme called bee genetic clustering (VGBC) based on the bee algorithm and the genetic algorithm for the clustering problem in VANET is presented. In [27] an optimal clustering algorithm is presented (Candles and propellers) for vehicle and case networks. Study [28] inspired evolutionary algorithms to include Comprehensive Learning Particle Swarm Optimization (CLPSO) and Multipurpose Particle Optimization (MOPSO). In [28] the researchers proposed a cluster (CH) suitable for VANETs. The proposed clustering compatible protocol (AWCP) groups random nodes and then the optimal CH is obtained by optimizing the network parameters. In [30] the researchers focused on the clustering of Vehicles. The communications are based on the cluster head (CH). There are various routing algorithms available that be used to direct information between vehicles in an efficient way to optimize the performance of the entire network. In [31] a new algorithm for clustering in VANET based on the Gray Wolf Optimization Technique (GWO) is presented in this paper, the algorithm provides an optimal solution for uniform and robust communication in VANETs.

In this paper, improved gray wolf optimization with variable weight-based bunching procedure for VANETs is presented, which mimics the communal behaviors and hunting appliance of gray wolves to create efficient clusters. The objectives of the research are as follows: To reduce the probability of getting caught in the local optimality and Provide optimal results leading to a robust steering procedure for VANETs grouping.

The organization of the content is as follows: we first describe the expression of the proposed method. Then we target the results and evaluation of the proposed algorithm, and at the end, conclusions and suggestions for future work are presented.

## II. THE PROCESS OF THE PROCEDURE

The proposed method is an improved clustering algorithm based on gray wolf optimization for (IGWOCNETs (VANETs) is a new approach to the VANET environment. In the proposed method, goals can be set according to user needs (using four variables: α-Alpha, β-Beta, δ-Delta and ω-Omega). The hunt for prey, siege, attack or targeting is performed by gray wolves and becomes an exact model. This mathematical modeling style it informal to recognize how the procedure works. Using all these notions, a suitable number of clusters is obtained to improve the revealed delinquent. In the related paper [31], collecting is performed using the gray wolf optimization algorithm.

In the gray wolf optimization algorithm, the most suitable solution is α, the second-best solution is β and Likewise, the third-best solution is δ. The rest of the candidate solutions is ω. All ω 's is searching (optimized) and are hunted by three gray wolves. When prey is found, repetition (t) begins. Then, the nodes of α, β, and δ direct the ω 's to chase the prey, and finally to describe the behavior of sieges, it is suggested:

$$\vec{D}_\alpha = \left|\vec{C}_1.\vec{X}_\alpha - \vec{X}(t)\right|$$
$$\vec{D}_\beta = \left|\vec{C}_2.\vec{X}_\beta - \vec{X}(t)\right| \quad (1)$$
$$\vec{D}_\delta = \left|\vec{C}_3.\vec{X}_\alpha - \vec{X}(t)\right|$$

t indicates the current iteration and $\vec{X}$ is the position vector of the gray wolf. The $\vec{X}_1$, $\vec{X}_2$ and $\vec{X}_3$are the position vectors of the gray wolf of α, β, and δ. $\vec{X}$ is calculated as follows:

$$\vec{X}_1 = \vec{X}_\alpha - \vec{A}_1.\vec{D}_\alpha$$
$$\vec{X}_2 = \vec{X}_\beta - \vec{A}_2.\vec{D}_\beta \quad (2)$$
$$\vec{X}_3 = \vec{X}_\delta - \vec{A}_3.\vec{D}_\delta$$

$$\vec{X}(t) = \frac{\vec{X}_1+\vec{X}_2+\vec{X}_3}{3} \quad (3)$$

The $\vec{A}$ and $\vec{C}$ are the controller of $\alpha$ and random numbers of $\vec{r}_1$ and $\vec{r}_2$:

$$\vec{A} = 2\alpha\vec{r}_1 - \alpha \quad (4)$$

$$\vec{C} = 2\vec{r}_2 \quad (5)$$

When the search starts, the α is closest and the rest does not matter. Therefore, its location should help to find new members, while the rest can be ignored. Ultimately, the α, β, and δ wolves must besiege the prey. This means that their weight is equal or if α is high the β, and δ are low. Due to the Search method from beginning to end, beta is associated with alpha because it always takes second place and Delta is associated with beta because of its third place. Alpha weight should be reduced and beta and delta weight Increase. The ideas mentioned above can be formulated mathematically (all weights should be varied and limited to 1):

$$\vec{X}(t+1) = w_1\vec{X}_1 + w_2\vec{X}_2 + w_3\vec{X}_3 \quad (6)$$

$$w_1 + w_2 + w_3 = 1 \quad (7)$$

In this work, machines are moving. In addition to position, they have something called a direction of motion, they consider a direction and have a velocity in that direction, and this causes them to move away from or closer to each other, and this causes the problem of clustering. In the clustering method, the goal is to place the nodes in a group based on their similarities and dissimilarities, and in each node, there is a center called the cluster head, and its job is to take data from the other nodes, and the data is aggregated and sent to a server hub. One of the main purposes of clustering in this paper is that we know that two nodes can communicate when there is a distance of up to two with Each other to a certain extent. If the transmission range is large, the size of the clusters will be large, and if the transmission range is small, the size of the clusters will be small. If several cars are next to each other, the car in the middle should be selected as a hinge. The next point is that the machines are in motion, so choose spark plugs that do not change as much as possible over time as the machines move away or close. The pseudocode for the proposed algorithm is given below.

1) Initialize the whole position of vehicles randomly on the highway

2) Randomly set the direction of the vehicle

3) Initially set the speed/velocity of each vehicle

4) Create a mesh topology between nodes, each vertex representing Vehicle ID is

5) Compute the coldness of each truck from other vehicles, and standardize and relate these detachment ethics to the consistent boundaries in the above net topology.

6) Calculate Cluster, Object and Objective Matrixes

Objective matrix= $w_1 * \delta\_difference + w_2 * distance\_neighbor$

7) Calculate the fit of each search factor

8) Calculate the value of the linear reduction variable

9) Update the position of the current search agents

10) Calculate the fit of all search agents X$\delta$, X$\beta$, X$\alpha$ and update all of them

11) Calculate the best solution for clusters

### *A. The progression of simulation*

We use MATLAB software to implement the proposed algorithm. To evaluate the proposed method, the settings of the simulation parameters are evaluated as TABLE I. The outcomes are obtainable using diverse perspectives such as broadcast amplitude, amount of bulges and network dimensions.

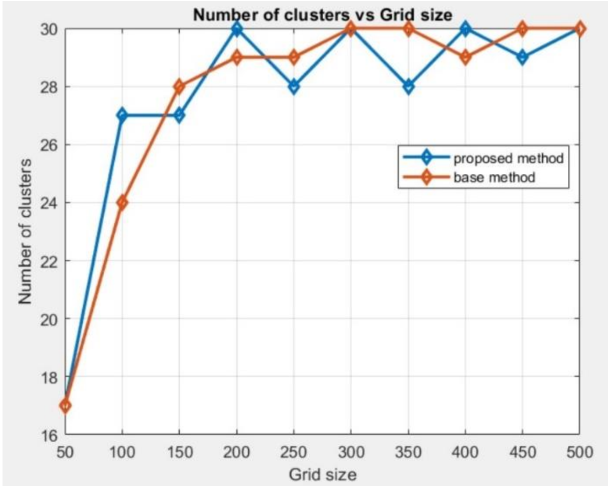
**TABLE I.** THE PRIMARY VALUE FOR PARAMETERS OF ABC

| Parameter | Primary value |
|---|---|
| Total member | 100 |
| The maximum itration | 150 |
| Low band | 0 |
| Up band | 100 |
| Domain | 2 |
| Withs of line | 50 m |
| Hole of lines | 8 |
| Domain od transmission | 10-60 m |
| Number of nodes | 30, 40, 50, 60 |
| Linear reduction factor (A) | [0, 2] |

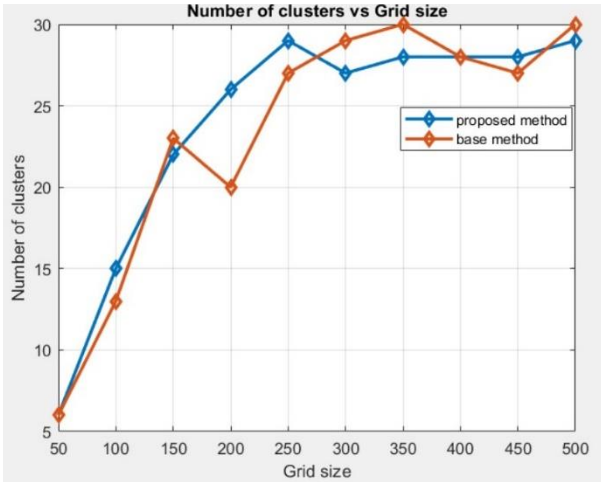
## III. RESULTS

### *A. Number of clusters versus transfer domains*

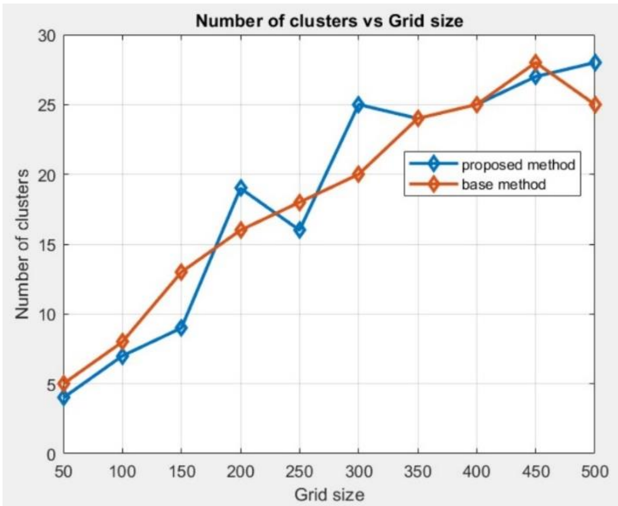
Figs. 1 and 2 show that the number of clusters is plotted from 10 to 40 depending on the different ranges of transmission. These diagrams are pinched using four diverse node quantities 30, 40, 50 and 60. The planned procedure shows the lowest charge in the whole diagram for most of the broadcast choice. Similarly, the proposed improved GWO-based method also shows the cost of the minimum number of nodes mentioned (30, 40). In this diagram we have taken the size of the network from 50 meters to 500 meters.



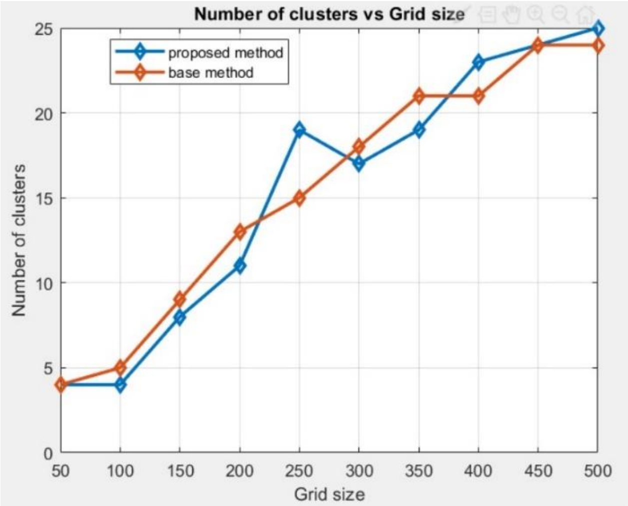

**(a)**




**(b)**

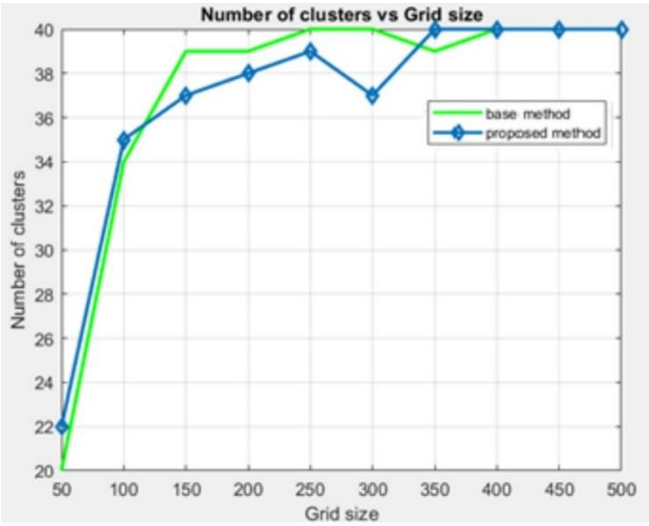



**(c)**

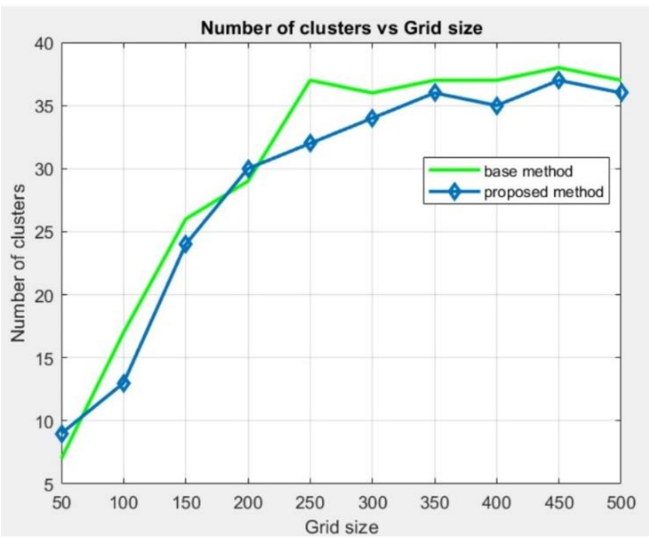



**(d)**

**Fig. 1.** Network nodes versus the number of clusters with the number of nodes 30 with domain transmission of (a) 30, (b) 40, (c) 50 and (d) 60 meters.




**(a)**

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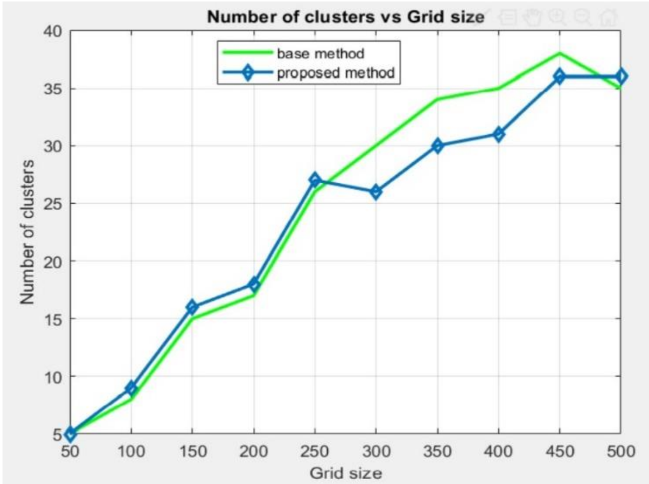
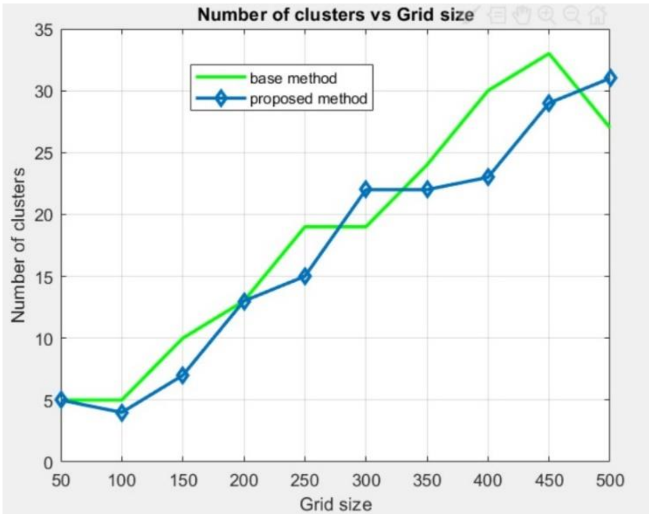



**(c)**

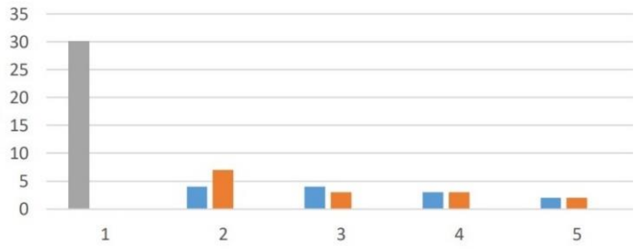



**(d)**

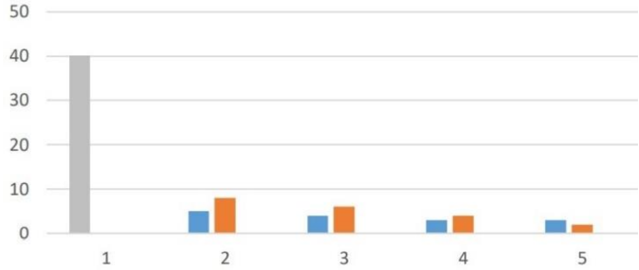
**Fig. 2.** Network nodes versus the number of clusters with the number of nodes 40 with domain transmission of (a) 30, (b) 40, (c) 50 and (d) 60 meters.

### *B. Number of clusters versus the number of nodes*

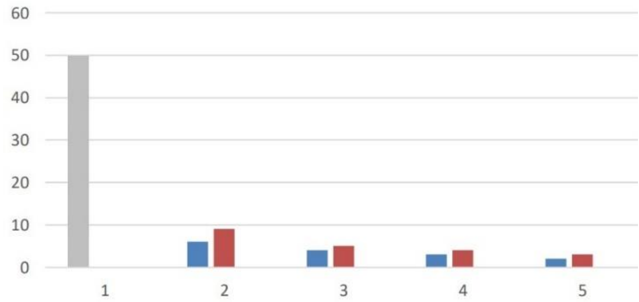
To discover the number of corresponding bulges in each bunch, the research is performed by adjusting the transfer amplitudes of 10, 20, 30, 40, 50, and 60 with the number of bulges from 30 to 40. Fig. 3 displays the outcomes by fixing the net to 100 m by 100 m and fluctuating the broadcast range from 30, 40, 50 and 60. From this experiment, it is clear that using the proposed method algorithm, if we reduce the number of collections by increasing the bulges and keeping the transmission amplitude constant, the transmission amplitude will increase. The proposed algorithm has elasticity and resistance in relation to metric ethics and displays better outcomes in rapports of the regular amount of bunches compared to other procedures. The analysis clearly displays the better performance of the proposed method in increasing the traffic load.



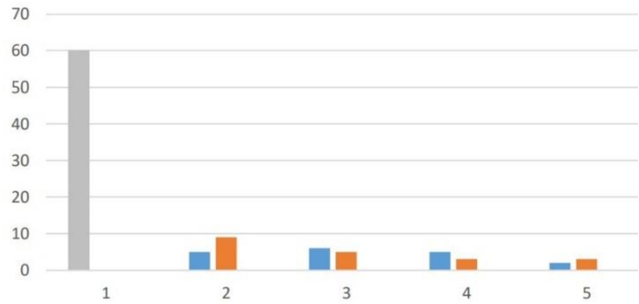

**(a)**




**(b)**




**(c)**




**(d)**

**Fig. 3.** Network nodes in front of the number of clusters in the network size of 100 meters × 100 meters with a transmission range of (a) 30, (b) 40, (c) 50 and (d) 60 ( proposed protocol, related study [29], total number of clusters).

## IV. CONCLUSION AND FUTURE WORKS

Improved Gray Wolf Clustering Algorithm Proposed for Temporary Vehicle Networks Inspired by the Gray Wolf Daily Schedule, which uses four diverse situations illustrated by α, β, ω and δ to occurrence quarry. In the planned technique, the number of optimized bunches is occupied by converging the α-wolf value, because α-wolfs reach their best value. In this study, an improved gray wolf optimization for a variable weight-based bunching procedure for VANETs is presented, which mimics the communal behaviors and stalking apparatus of gray wolves to create efficient clusters. The results show that the proposed framework performs better than the related article compared to the number of bunch bonces with different broadcast amplitudes, amount of bulges and network size. By efficiently reducing the number of clusters essential, the cost of routing for the complete system connection is minimized. Fewer clusters also reduce the need for resources in the vehicle network.

Regarding the upcoming course of this exertion, the VANET clustering procedure can be extra studied by executing various bio-inspired procedures such as candlestick and butterfly optimizer, dragonfly optimizer, ant milk optimizer and wall optimization procedure. In addition, the planned task can be improved by modifying the dispassionate task based on user needs, and can also be used for multi-objective utilities. The planned procedure can also be used for active broadcast domains to vehicle bulges in the upcoming.

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