Improve VANET Routing by Grey Wolf Optimization and Centrality Approach

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Abstract - VANET) routing, followed by fundamental concepts and operations used in such protocols. The main idea behind the deployment of bio-inspired approaches in the VANET routing arises from the strong similarity between communication scenarios in networking and natural communication between individuals of a species. The chapter explains theoretical aspects, principles and operations of algorithms such as Grey wolf algorithm (GWO), ant colony optimization (ACO) in order to simplify the comprehension of their applications for VANET routing. It presents evolutionary algorithms such as sequential genetic algorithm and parallel genetic algorithm for the VANET routing. used the vehicle position and speed to make predictions on the mobility of the vehicles. My thesis work focuses and emphasize on the use of GWO in the routing algorithms for VANET. In conclusion, the hybrid GWO algorithm is scalable and achieves good network connectivity. To our knowledge is the first ant based routing algorithm for VANET that uses the concept of zones

Keywords - GWO, VANET, Optimization

I. INTRODUCTION

VANET Vehicular Ad-Hoc Network, or VANET, is an innovation that utilizations move autos as hubs in a system to make a portable system. VANET transforms each taking part auto into a remote switch or hub, enabling autos roughly 100 to 300 meters of each other to interface and, thus, make a system with a wide range. As autos drop out of the flag range and drop out of the system, different autos can participate, interfacing vehicles to each other with the goal that a portable Internet is made. It is assessed that the main frameworks that will coordinate this innovation are police and fire vehicles to speak with each other for security purposes [1]. VANET (Vehicular Ad-hoc Network) is another innovation which has taken so much consideration in the current years. Due to rapid topology changing and frequent disconnection makes it difficult to design an efficient routing protocol for routing data among vehicles, called V2V or vehicle to vehicle communication and vehicle to road side infrastructure, called V2I. It is self-sufficient and self-arranging remote correspondence organized, where hubs in VANET include themselves as servers or potentially customers for exchanging and sharing data. Vehicles can collaborate with each other to scatter short recordings of dangerous circumstances to outwardly educate drivers and save groups about them both in the city and on an expressway [4].

The developing interest of remote gadgets and remote communication tends to investigate on self-curing and self-arranging systems without the help of any unified administration or pre-exhibited specialist framework. This type of systems is known as Ad hoc networks. VANET system controls vehicle crashes and movement blockage which are basic issues over the entire world.

Vehicular Ad-hoc Network (VANET) depends on a standard of Mobile ad-hoc network (MANET). It is a process of information exchange with one hub then onto the next hub. Vehicular system is a new encouraging field in remote innovation which is utilized to send a vehicle to vehicle information (V2V) and vehicle to Infrastructure (V2I) information between hubs. It gives a way of communication among vehicles and road side equipment\units (RSU).

Characteristics of VANET:

VANET has some unique characteristics which make it different from MANET as well as challenging for designing VANET applications.

- **High Versatility**: The hubs in the VANET are generally are moving at high speed. This makes harder to predict a hub's position and making insurance of hub protection rapidly evolving.
- **Network Topology**: Because of high hub portability and arbitrary speed of vehicles, the position of hub changes many times. Therefore, arrange topology in VANETs tends to change much of the time.
- **Unbounded Network Size:** VANET can be executed for one city, several urban communities or for countries. This implies that system estimate in VANET is geologically unbounded.
- **Communication with installed sensors**: The present position and the development of hubs can without much of a stretch be detected by locally available sensors like GPS gadget. It helps for successful communication and directing choices.
- **Frequent exchange of information:** The ad hoc nature of VANE motivates the hubs to accumulate data from

alternate vehicles and road side units. Hence the data communication among hub ends up plainly visits [2].

Applications of the VANET:

Commercial Oriented: The Commercial applications can be grouped as: Remote Vehicle Personalization/Diagnostics: It helps in downloading of customized vehicle settings or transferring of vehicle diagnostics from/to foundation. 2) Internet Access: Vehicles can get to web through RSU if RSU is filling in as a switch.

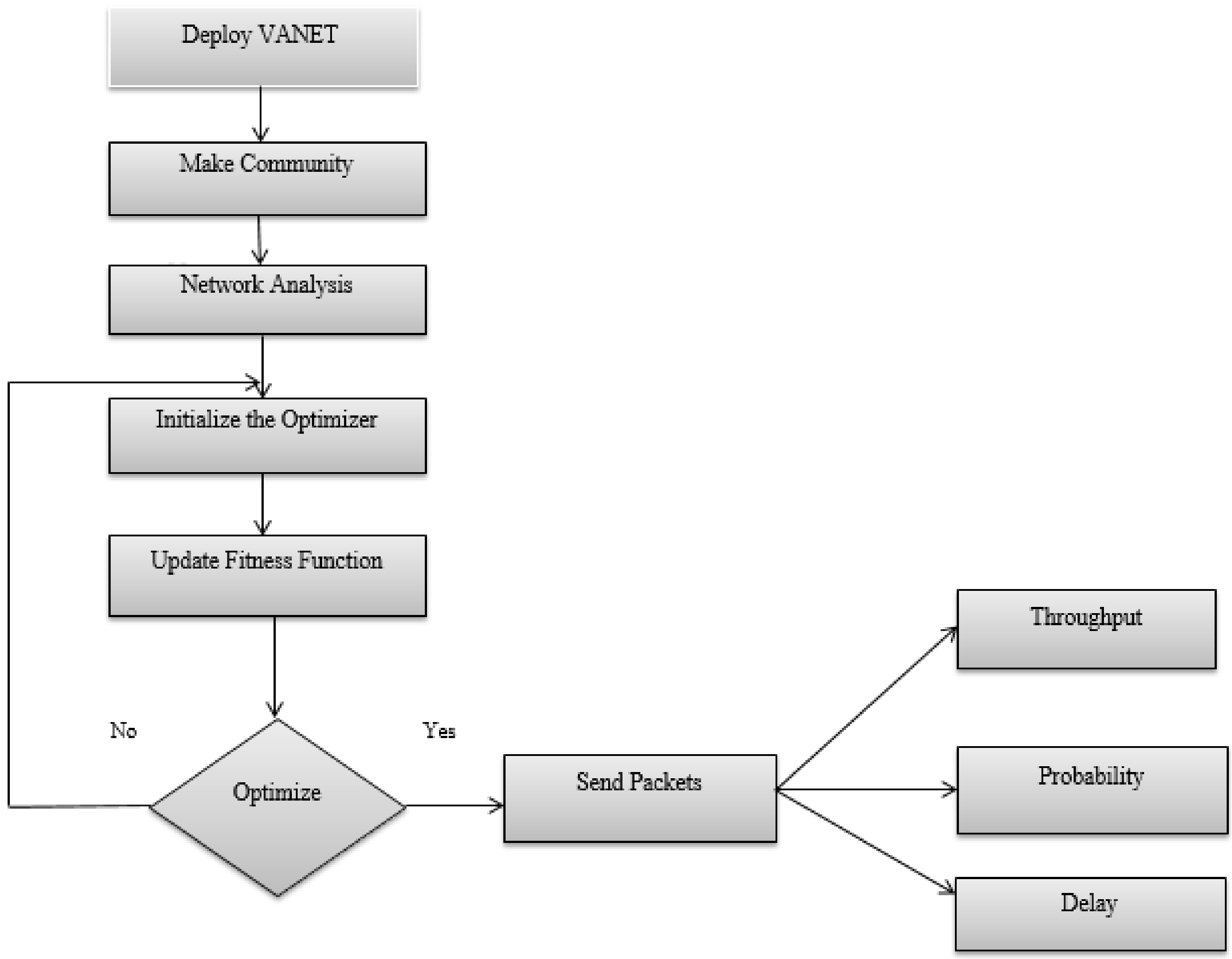
Comfort Applications: Comfort application essentially bargains in movement administration with an objective to upgrade activity productivity by enhancing the level of comfort for drivers. The Convenience applications can be delegated: 1) Route Diversions: Route and trek arranging can be presented in defense of street clogs. 2) Parking Availability: Notifications in regards to the accessibility of stopping in the metropolitan urban communities serves to discover the accessibility of openings in parking garages in a certain land territory.

Safety Applications: Safety applications incorporate observing of the encompassing street, approaching vehicles, surface of the street, street bends and so forth [3].

II. LITERATURE REVIEW

Junling Shi et.al. [5] in this paper proposed a social-based routing scheme to empower the productive and powerful message routing among travelers. In the proposed scheme, travelers are isolated into various groups based on the Improved K - Clique community detection algorithm (IKC). For deciding the sending and dropping request of messages, a Social-based Message Buffering scheme at vehicles (SMB) is conceived with their closeness and contribution considered. A Bilateral Forwarder Determination method (BFD) is proposed to make the ideal message sending, including Intra-Community Forwarder Determination (ICFD) and inter-Community Forwarder Determination (ECFD). Simulation comes about demonstrate that the proposed scheme has better message conveyance ratio and lower organize overhead than other existing ones. **Eyuphan Bulut et.al. [6]** In this paper, initially presented a new metric for distinguishing the nature of fellowships accurately. Utilizing the presented metric, every hub characterizes its kinship group as the arrangement of hubs having companionship with itself either straightforwardly or in a roundabout way. At that point, it shows Friendship Based Directing in which transiently separated kinships are utilized to settle on the sending choices of messages. **Cristian Chilipirea et.al. [7]** In this paper, displayed a novel social-driven routing algorithm for ONs, which incorporates energy as vital component in choosing the routing choice. As illustrated, when energy consumption is considered in social-driven ON routing, well known hubs can be spared from their assets being depleted (it illustrated such a conduct for social-based routing algorithms such as BUBBLE Rap). In the wake of presenting energy mindfulness as a critical measure in the routing choice, introduced exploratory outcomes demonstrating that our approach conveys exhibitions like BUBBLE Rap, while adjusting the energy consumption between hubs in the system. **Rashid Hafeez Khokhar et.al. [8]** In this article, proposed a fuzzy-assisted social-based routing (FAST) protocol that takes the upside of social conduct of people making progress toward settle on ideal and secure routing choices. Quick uses earlier worldwide information of continuous vehicular movement for packet routing from the source to the goal. In FAST, fuzzy inference framework influences fellowship component to settle on basic choices at crossing points which is based on earlier worldwide information of real time vehicular activity data. The reproduction brings about urban vehicular environment for with and without hindrances situation demonstrate that the FAST performs best regarding packet delivery ratio with up to 32% expansion, normal postpone 80% lessening, and bounces tally half decline contrasted with the cutting edge VANET routing arrangements. **Wen-Hsing Kuo et.al. [9]** The proposed conspire PBV2V uses the pheromone density diffusion. By intermittently trading data with its neighbors and refreshing its own table, the vehicle can discover the goal without broadcasting extra parcels over the network. This lessens the network overheads and the hunt time. The reproduction comes about demonstrate that the PBV2V conspire performs well as far as the achievement rate and the normal bounce tally. Regardless of the vehicle density, the plan's prosperity rate can achieve 80% of the optimal solution. **Jianqi Liu et.al. [10]** This paper introduced an itemized study of position-based routing protocols for vehicle communication. Toward the start, it laid out the design of Internet of Vehicle, and the convention stack utilized. At that point they talked about a few positioning methods that can be utilized to help GNSS to get more precise position information. By and large, position-based routing protocols give preferred execution over other routing protocols. In any case, these routing protocols rely on upon position exactness, which needs a guide and different methods to determine the "local maximum" issue. Movement information gained by reference point messages can anticipate the following jump successfully. **SHI Yan et.al. [11]** A novel routing plan, Anchor-Geography based routing protocol (AGP), planned particularly for VANET correspondence in city condition is proposed in this paper. The reactive broadcasting is utilized for both getting goal area and routing revelation. Network status and load adjusting is considered in routing choice. Also, the guide data and the kinematics parameters are utilized for the vehicle direction expectation. Such a portability forecast can give answer for the circumstance in which the goal moves far from the area in the routing revelation system. In simulation, Vanet MobiSim, is utilized as the activity generator for more practical movement situations in VANETs than basic portability display definition. **Li-Der Chou et.al. [12]** In this paper, proposed an intersection based routing protocol based on the bearing of bundle exchange and the moving bearing of vehicles. IBR bolsters different activity conditions at the intersections, and exact estimations of parcel routing postponements were likewise proposed. In expansion, a strategy mapping the parameters of the Manhattan grid model to the one-dimensional road environment was proposed.

III. PROPOSED METHODOLOGY



Step1: In this flow chart firstly we can deploy the VANET (Vehicle ad-hoc Network).

Step2. In VANET (Vehicle ad-hoc Network) we make community.

Step3. After making the community we can perform the network analysis.

Step4. When network analysis process is completed then we initialize the WOLF optimizer.

Step5. WOLF optimizer then update the fitness function.

Step6. After this we can check the network is optimized or not, if yes then we transfer the data packet otherwise again we optimize the network.

Step7. If network is optimized and packet is send then we measure the three parameters throughput, delay, probability.

Grey Wolf Optimization Algorithm (GWO)

The latest bio-inspired algorithm is the grey wolf optimization algorithm. This algorithm's main concept is simulating the behavior of grey wolf living in a pack. They have serious hierarchy of social dominance. Alpha is known as the level leaders and is responsible for decision making in the pack. The wolf pack persistence is based on decision of alpha. Beta is known as the second level subordinate wolves. The beta operation is for helping in making decision for alpha or other activities. Delta is known as the third level subordinate wolves. This category member consists of elders, scouts, hunters, caretakers and sentinels. For region boundary observation and in any danger case, scouts are liable for warning. The protection and pack's safety guarantee is given by sentinels. The expertise wolves are the elders, denoted as alpha or beta. Alphas and betas are helped by hunters while prey hunting and caring for the ill, weak, and wounded wolves by caretakers and providing food for pack. Omega is the lowest level. All dominant wolves with which omega wolves have to comply. Grey wolves have the ability of memorizing the prey position and encircling them. The alpha as a leader performs in the hunt. For simulating the grey wolves hunting behavior in the mathematical model, assuming the alpha (α) is the best solution. The second optimal solution is beta (β) and the third optimal solution is delta (δ). Omega (ω) is assumed to be the candidate solutions. Alpha, beta and delta guides the hunting while position should be updated by the omega wolves by these three best solutions considerations.

Encircling prey

Prey encircled by the grey wolves during their hunt. Encircling behavior in the mathematical model, below equations is utilized.

$$\vec{A}(T+1) = \overrightarrow{A_P}(T) - \vec{X}.\vec{Z}$$

$$\vec{Z} = \left|\vec{Y}.\overrightarrow{A_P}(T) - \vec{A}(T)\right|$$

Where

T←iterative number

$\vec{A}$←grey wolf position

$\overrightarrow{A_P}$←prey position

$$\vec{X} = 2x.\overrightarrow{r_1} - x$$

$$\vec{Y} = 2\overrightarrow{r_2}$$

Where

$\overrightarrow{r_1}$and $\overrightarrow{r_2}$←random vector range[0,1]

The x value decrease from 2 to 0 over the iteration course.

$\vec{Y}$←random value with range [0,1] and is used for providing random weights for defining prey attractiveness.

Hunting

For grey wolves hunting behavior simulation, assuming α, β, and δ have better knowledge about possible prey location. The three best solutions firstly and ω (other search agents) are forced for their position update in accordance to their best search agents position. Updating the wolves' positions as follows:

$$\vec{A}(T+1) = \frac{\overrightarrow{A_1}+\overrightarrow{A_2}+\overrightarrow{A_3}}{3}$$
(1)

Where $\overrightarrow{A_1}, \overrightarrow{A_2}, and\ \overrightarrow{A_3}$ are determined,

$$\overrightarrow{A_1} = \left|\overrightarrow{A_\alpha} - \overrightarrow{X_1}.Z_\alpha\right|$$

$$\overrightarrow{A_2} = \left|\overrightarrow{A_\beta} - \overrightarrow{X_2}.Z_\beta\right|$$

$$\overrightarrow{A_3} = \left|\overrightarrow{A_\delta} - \overrightarrow{X_3}.Z_\delta\right|$$

Where $\overrightarrow{A_\alpha}, \overrightarrow{A_\beta}, and\ \overrightarrow{A_\delta}$← first three best solution at a given iterative T

Z_α, Z_β, and Z_ω are determined,

$$\overrightarrow{Z_\alpha} \leftarrow \left|\overrightarrow{Y_1}.\overrightarrow{A_\alpha} - \vec{A}\right|$$

$$\overrightarrow{Z_\beta} \leftarrow \left|\overrightarrow{Y_2}.\overrightarrow{A_\beta} - \vec{A}\right|$$

$$\overrightarrow{Z_\delta} \leftarrow \left|\overrightarrow{Y_3}.\overrightarrow{A_\delta} - \vec{A}\right|$$

The parameter x updating is the final process. The parameter x exploitation and exploration is updated linearly for ranging [2,0] in every iteration.

$$x = 2 - t\frac{2}{maxI}$$

Where

T←iterative number

MaxI←total number of iteration

Algorithm: GWO

Deploy VANET
Analyze network
Initialize GWO $\boldsymbol{A_i}$(i=1, 2, …n)
Initialize x, X, and Y
Calculate fitness function for every search agent
$\boldsymbol{A_\alpha}$←best search agent
$\boldsymbol{A_\beta}$← second beat search agent
$\boldsymbol{A_\delta}$← Third best search agent

While (T<Max iterations)
  For ($\boldsymbol{X_i}$ in every pack)
    Update current position of wolf by eq. (1)
    Update x, X and Y
    Calculate the fitness function for all search agents
    Update $\boldsymbol{A_\alpha}$, $\boldsymbol{A_\beta}$, and $\boldsymbol{A_\omega}$
  End for
    For best pack insert migration ($\boldsymbol{m_i}$)
    Evaluate fitness function for new individuals selection of best pack
    New random individuals for migration
End if
End while
Calculate throughput, probability and delay.

IV. RESULTS

Table 1: Comparison table of the parameter throughput: The table1 and graph1 shows the comparison of the parameter throughput. In different nodes throughput values are different. As compare to Ant Colony Optimization (ACO) the Gray wolf optimization (GWO) have better throughput.

No. of Nodes	Throughput	
	GWO	ACO
Nodes-30	390052	412266
Nodes-60	399734	428070
Nodes-90	408658	430881
Nodes-120	405675	433406

Graph 1: Comparison table of the parameter throughput

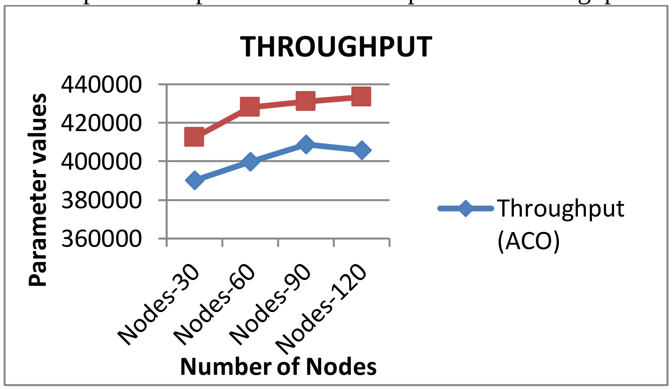


Table 2: Comparison table of the parameter Delay: The table2 and graph2 shows the comparison of the parameter time delay. In different nodes time delay are different. As compare to Ant Colony Optimization (ACO) the Gray wolf optimization (GWO) have low time delay.

No. of Nodes	Delay	
	ACO	GWO
Nodes-30	4070	3780
Nodes-60	3854	3513
Nodes-90	3617	3371
Nodes-120	3763	3442

Graph 2: Comparison table of the parameter delay

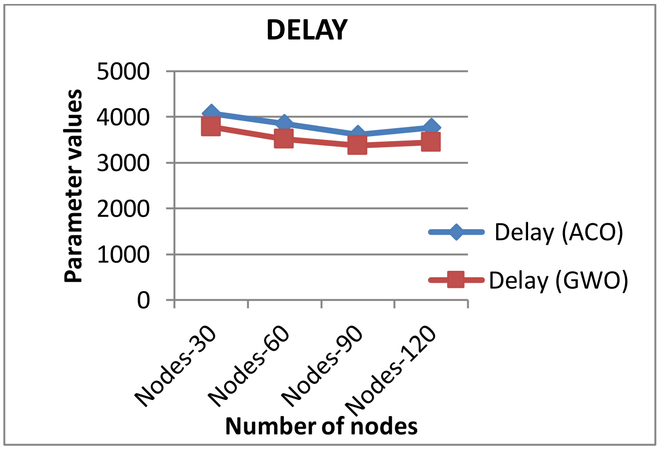
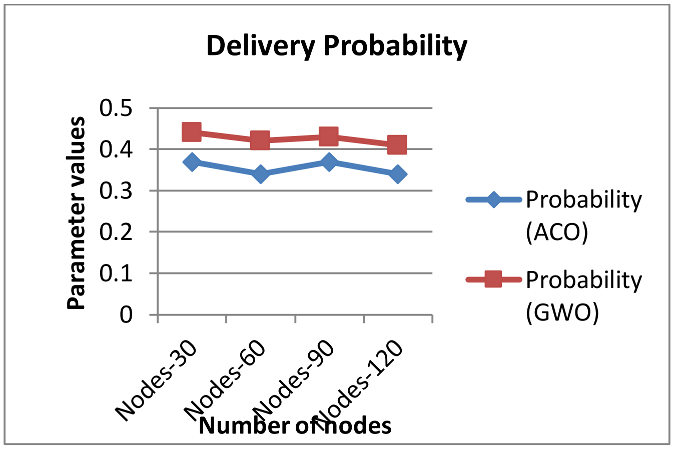


Table 3: Comparison table of the parameter Probability: The table3 and graph3 shows the comparison of the parameter probability. The figure and table displays the analysis of delivery probability in both the algorithm. It can be seen that the chances of a packet to reach destination is more in case of GWO. For the same reason as delay i.e. the number of drop packets are less in case of GWO.

No. of Nodes	Probability	
	ACO	GWO
Nodes-30	0.37	0.44
Nodes-60	0.34	0.42
Nodes-90	0.37	0.43
Node-120	0.34	0.41



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