IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

GSA based clustering scheme to improve QoS in VANET

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Abstract: A VANET is an important, reliable and efficient wireless technology seeking to enhance the quality of traffic safety as well as offer comfort to allow citizens. Even so, the rapid development of vehicles and repeated dynamic topology present a severe obstacle to the fast transmission of sensor networks. Clustering is among the control methods utilize in VANET to reduce the dynamics of repeated topology changes. However, study clearly shows that most of the traditional scheduling approaches focus on CH selection, with very several acknowledging other crucial problems like cluster creation and stabilization. In the current work, the designer took the same view as moving vehicles over the clear highway situation. This spurred to unpredictable clusters that could have an impact on the quick completion of security apps. The objective of this paper is to describe specific branch lanes across straightway in the system model of the base paper to enhance organizational clustering by utilizing the GSA in V2V (VANETs) to make organization efficient, reliable and more extensible. The computation outcomes of the suggested technique showed better performance with a rise in cluster stability contrasted to current approaches.

Keywords: Vehicular ad hoc network (VANET), Clustering, Gravitational search algorithm (GSA), QOS, NS2.

I. INTRODUCTION

The VANET is one of the effective applications used to sustain the allocation of information among neighboring road vehicles with a view to improving traffic safety and providing automotive services[1].

VANET method uses mobile automobiles as modules to establish a mobile wireless network. It intends to include rapid and cost-effective data transmission for the benefit of traveler comfort and safety. ITS has recently been intended to enhance road safety and transportation pleasure for both passengers and drivers. ITS is recommended to handle vehicle traffic, to promote operators with protection and other data, as well as offer certain service providers including automated toll compilation and driver assistance [2]. In actuality, VANETs offer recently updated opportunities to enhance advanced answers for dependable communication among the automobile. It can also be described as portion of the ITS, that always seeks to built systems of transport better, stronger and engines are also outfitted with certain especially (SWC) wireless communication [3]. In VANET's, communication and interaction between wireless vehicles are processed. The wireless vehicles which are interacting with each other provides services such as (emergency vehicle notice, static vehicle warning) and also provide different kinds of services such as (video streaming, web) from base stations (i.e. 3-4G) via RSU. Usually, there are 2 modes of transmission normally used in VANETs i.e.(V2V) and (V2I) i.e. Road side units [4]. One of the core priorities of VANETs is to adopt ITS for security transportation and simplicity of use. For this purpose, the built-in

configuration called the OBU is dispatched in ITS automobiles. In order to supply V2V and V2I conveying, the OBU comprises of a WC unit like (DSRC) 3-4G, GPS), and an operating system with a brain set. The framework of the VANET is demonstrated in Fig 1.

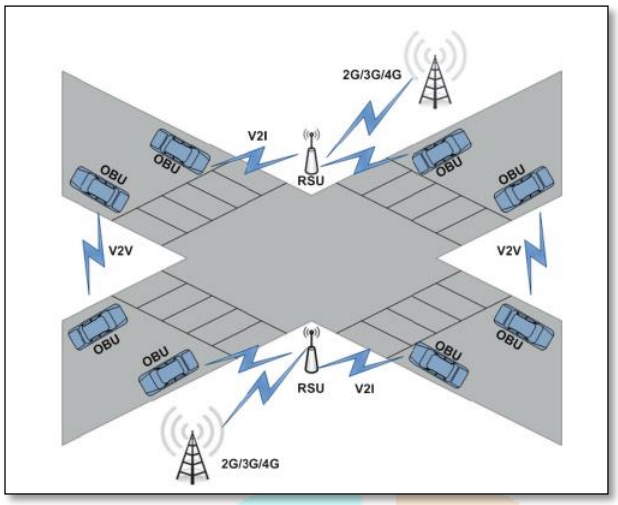


Figure 1. All over structure of VANET.[3]

Usually, VANET design serves two kinds of communication phones, notably OBU contacting with RSU. As mentioned above, OBU boards are constructed in the motor vehicle. RSU is static systems and positioned at roadside. The RSU behave the same way as the base station and are able to supply development interactions (i.e., 2-G, 3-G, fiber optic or any other ray). The OBU offers comprehensive associate safety measure apps (i.e. various warning devices) among cars but also communicates with the RSU to achieve precise apps from wifi network techniques (i.e., downloading and mailing). In addition, VANET area is categorized into RTS (i.e. video conferencing) and non-RTS (i.e. information of traffic and weather) traffic [5]. Transport efficiency is classified, safety and entertainment is classified and information is also presented by these types of apps.

Clustering is the procedure by which a community of nodes is organized in a way to form a road sub-network on the premise of certain additional unit, including VD, velocity as well as geographic locations [6]. This method builds the network even more reliable, efficient and extensible than before. The basic architecture of clustering and device transmission structure is shown in Fig 2. In this article, the CH is chosen for every community with premise of certain variables defined and surviving nodes of community will be CMs. The appointed CH shall be responsible for coordination of the nodes and interaction of intra-cluster. It usually lessen the hiding node issue and thus improves the speedy completion of security messages[7].

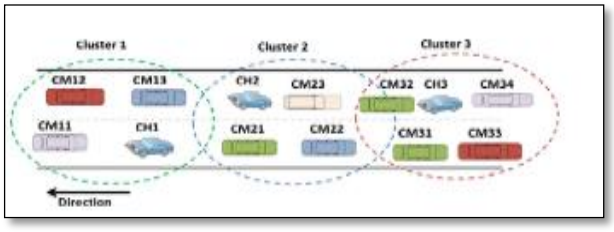


Figure 2. Cluster-based communication architecture.[6]

The remaining section of the paper is organized in a particular format as follows, as defined in Section II discusses the study of the related work of different techniques in VANET. Section III describes the proposed methodology and also explains the gravitational search algorithm. Section IV represents the results. Section V concludes the paper.

II. RELATED WORK

Hassan et al.,[10] This article discusses the clustering of VANETs and use a center-based method in the highway environment to take advantage of the growing rate of V2I infrastructure for present LTE technology. It also offers a clustering type of view-based global that creates a choice reliable and qualitative. This strategy is described as a general VANET clustering system covering all clustering procedures, like assignment, choice of cluster heads, mixing and removal. The three levels were accessed which are based on traffic generation. The statistics metrics for clustering was developed and it was also analyzed. The findings demonstrated the strategy's superiority over the three benchmarks chosen and focused on center-based clustering. From different viewpoints, superiority is identified, namely performance, consistency and a lower amount of clusters.

Khan et al.,[11] By expanding the current VoEG system to enhance the efficiency of vehicle communication, a new (CVoEG) cluster-based VANET-oriented emerging graph framework is designed. Here, as a criteria for the choice of cluster members (CMs) and member nodes (CHs), linkage consistency is used. By using the Eigen gap heuristic, the suggested CVoEG method defines VANET nodes (such as VANET vehicles) into an optimal amount of clusters. A

vehicle will be classified as a CH in a specific frame if it has a highest Eigen-centrality value. To create an efficient journey (MRJ) from origin to destination, a reliable, trustworthy routing approach called CEG-RAODV is suggested which depending upon the CVoEG method. The simulation findings confirm that in simulation the results in the following terms of efficient (RRR), efficiency, PDR, E2E, latency, and throughput, the suggested methodology performs better the current systems.

Nivetha et al.,[12] In WSN, an ACO dependent dynamic CH determination is performed. The residual vitality of the sensor hub and the distance among the sensor hub and BS are used as variables of the ACO input and the yield parameter is the probability of being CHs. It reproduces the suggested approach and compares the suggested model with LEACH. The exploratory results indicate that desired results over LEACH are delivered by the suggested plan. In terms of vitality consumption and device lifespan, the suggested model is contrasting with LEACH. The ACO-focused CH option limits the exploitation of productivity and profoundly magnifies the lifespan of the device. The detailed analysis reveals that the suggested approach agreement lifespan is increased by 55.72 percent and the use of productivity is reduced to half compared to LEACH. The method relies on ACO only decreases the rate of energy consumption by 50 percent. And it generates vagueness of knowledge by using fuzzy results. In this case, to help in boosting the performance of the WSN systems, the same can be introduced via the Fuzzy-based clustering technique.

Patil et al.,[13] This article presents a new meta-heuristic method for optimizing test paths, namely the GSA. Comparison with the SGA, the acquired results from the newly created meta-heuristic method is evaluated and the findings demonstrate that GSA produces better performance than SGA.

Shashank et al.,[14] This article names are linked to as the suggested message distribution processes. In an LTE network, both algorithms utilize distributed resource allocation methodologies. The productivity of these methods is analyzed using a simulation approach focused on OMNET++ simulator. It demonstrates that results of suggested approach are finer from the previously released procedures that promote hybrid LTE network warning message transmission. The findings of the simulation illustrates that the suggested methods introduce a low delivery delay for WM and keep a strong delivery ratio for WM.

Alsuhli et al., [15] constructing the optimization method of the proposed technique in this paper as a multi-objective optimization concern. They suggest a strategy to optimizing the clustering method's and parameters for configuration. The NSGA-III multi-objective meta-heuristic technique is used as an optimization technique. Then optimization of DHC is processed. After this process the optimization of the output will attempt to evaluate. The recommended approach is performed by experimental results. The optimized process and non optimized process results are also performed. The research data shows the result and the optimum configuration optimization rise life of the optimized cluster with in increasing 134 percent and lessen overhead of the cluster bundle by reducing 30 percent.

III. PROPOSED METHODOLOGY

PROBLEM FORMULATION

In the existing work, the developer has considered same way movement of the vehicles over direct highway scenario. The restriction of the document is that when the highway contributes to a certain branch roads and cars move to their different locations, it may not perform excellently. In such a situation, if the chosen cluster head (as per the base paper) has to keep moving on certain branch road to its destination, then as shortly as the cluster head exits the cluster, it will contribute to cluster re-formation. In such instances, cluster re-formation will boost the expense and destroy the efficiency of the model.

Developers will identify different branch lanes over straight highways in the design architecture to the base paper. In addition to the parameters given in the base paper, the choosing of the cluster heads will have parameters concerning the end stage of the vehicles.

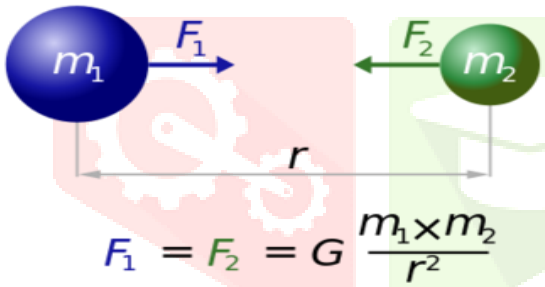
A. GSA Algorithm

GSA is fully focusing on the Isaac Newton’s laws. It is completely redesigned computational optimization study which follows the law of gravity. Rasedi [8] established the

both mass interaction as well as gravity. GSA perceives instead each agent to be an item, and all objects communicate with us by GF. Object results are analyzed by the mass which is in relation with the stated object [9]. Ideal option in space search is the motion of the lighter mass object against a object of heavier mass due to GF with the highest benefit of best fitness. The GF 'F' is fitness and it is also used as a fitness value for the particles present in the finding space. In the search area the distance among the two objects is defined by 'R.' GC as 'G' in 'k' generation is as explored [8]:

$$G(k) = G_0 e^{-\alpha k/K} \quad (1)$$

In equation before G_0 and superscripted 'a' both are represented as variables which are constant in nature. At the starting point G0 and 'a' variables are initialized. 'K' means the objects value amount present in the finding space further small 'k' reflects total amount of the value objects frequented in the search space to date. The severity of the gravitational force 'F' could be determined as [8] as per Newton's Law of Gravity.



$$F = G\frac{M_1 * M_2}{R^2}$$

Figure 3: Newton's Law of Gravity[8]

Figure 3 illustrates law of gravity related to Newton. This describes a law including GF 'F' magnitude relative to the particles masses. The volume of every object is grouped into three types: firstly is inertial mass, secondly for the active GM and lastly for the passive GM. At first 'Mi' value denotes that objects inertial mass is defined here, secondly 'Ma' value denotes the objects active GM is defined here and lastly 'Mp' value denotes the passive GM is described. Fij is a Gravity pressure which has some kind of force acting on the reactive gravitational mass Mp of chosen 'object I' by the active GM Ma of chosen 'object j'. This is how the Gravitational Force is measured:

$$F_i = G\left\{\frac{Maj * Mpi}{R * R}\right\} \quad (2)$$

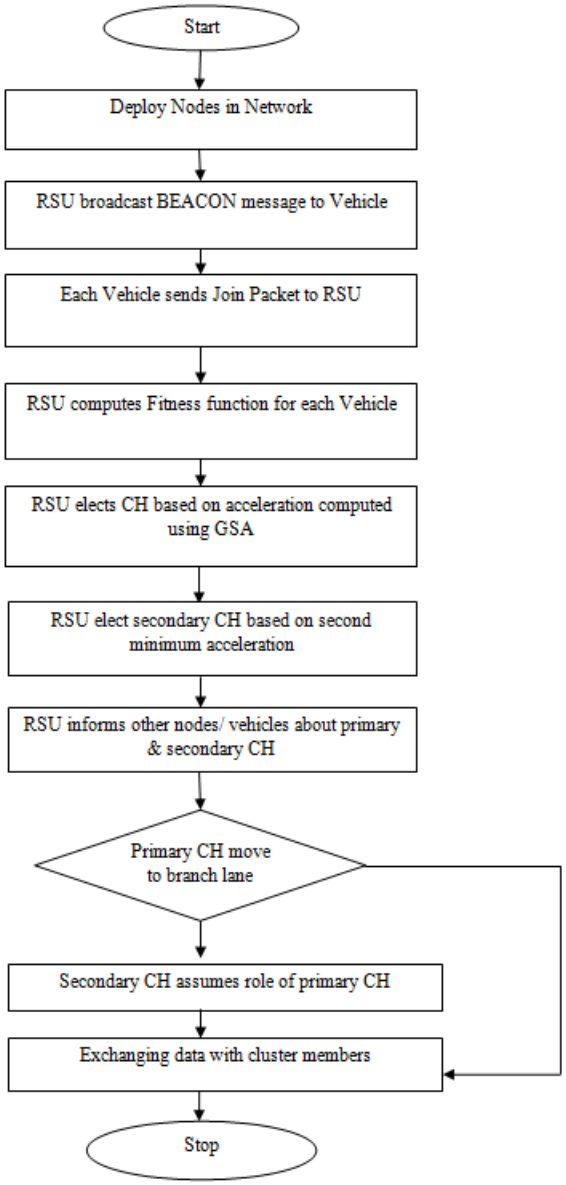


Figure 4: Flowchart of methodology

IV. SIMULATION & RESULTS

In this chapter, outputs of the experiments performed are given in graphical form along with discussion of results.

- **Overhead:** It is the total number of controlled messages or routing packet received by each node once per hop during the period of cluster formation phase. The simulation result shows the far better result than the technique that is used before. The overhead is

less in this simulation result as compared to approach previously used.

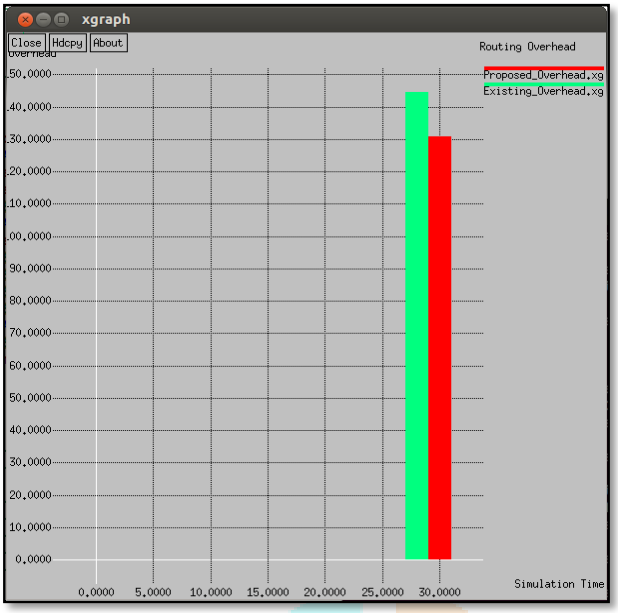


Figure 5: Overhead

- **Throughput:** The message rate which is successfully delivered over a medium or communication channel is referred to as throughput. In this simulation result the throughput rate is far better than the technique used before.

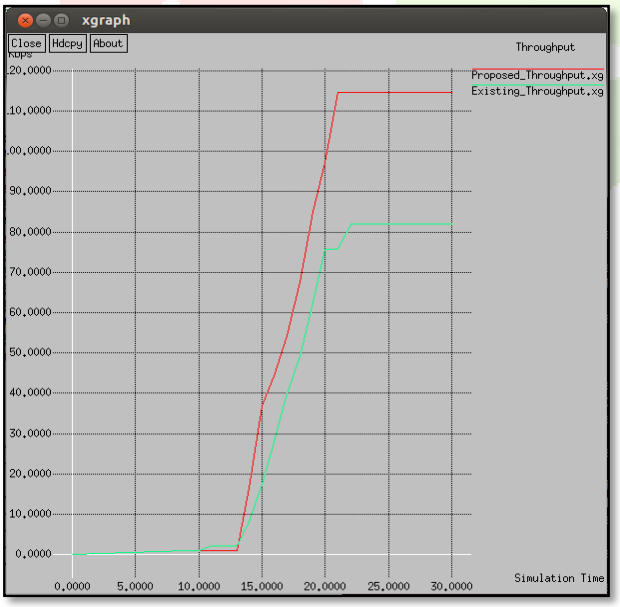


Figure 6: Throughput

- **PDR:** Sender and receiver are two nodes here and the calculation ratio of received packet data varies from the sender's packet data is PDR. In this, result of PDR is way better than the previous PDR.

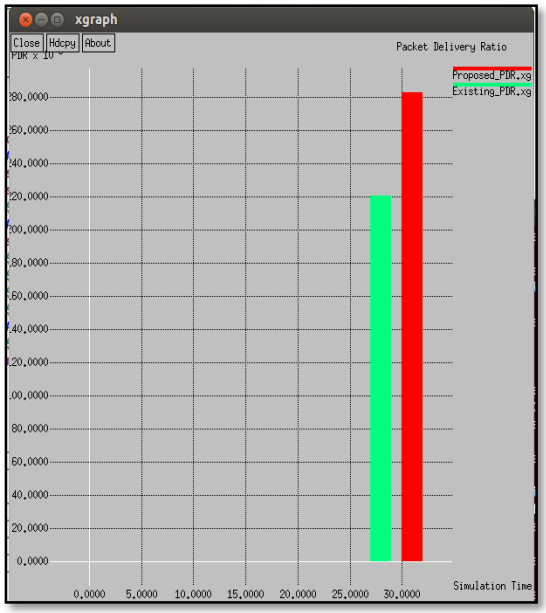


Figure 7: Packet Delivery Ratio

The analysis of the proposed algorithm as well as the stability performance of the proposed algorithm is based on the three metrics: overhead, throughput and PDR. Figure 5, 6 and 7 respectively shows the simulations results for overhead, throughput and packet delivery ratio (PDR). Gravitational search algorithm is applied for the proposed work which focuses on the fitness function for cluster head selection. GSA works on three parameters viz. velocity, degree of connectivity and destination of CH. The value of PDR is more in this case because the existing scheme selects the cluster head on the basis of degree of connectivity, which further results in better optimization. This technique significantly reduces the first parameter i.e. the number of overhead messages as fully compared to the existing scheme.

V. CONCLUSION

Cluster head selection criteria is main point of the critical problems for Vehicle Ad-Hoc Networks, since different methods need to be regarded and it is essential that the method meets all automobiles with varying speeds. This study presented a new GSA clustering approach based on a highway situation. GSA is predicated on Newton's Gravitational Law. The technique is effective in optimizing test routes, but there are some kinds of weakness left over every technique and in the suggested approach an obstruction has occurred. The suggested method approaches the each node of clusters numerous times to optimize the CFG-generated test directions. The computation performances of the suggested method were

also contrasted with the existing strategy and demonstrated a greater standard of supremacy with regard to the formation clusters and the acquisition of moderately several clusters.

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