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Enhanced ant colony optimization to improve performance of VANETs

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Abstract
Routing in Vehicular Ad hoc Networks is a challenging as the nodes keep on moving at higher speeds. This results in the topology of the network changing at faster rates. If any link made by two connecting vehicles has any one of the vehicle moving at relative faster speed as compared to predecessor vehicle, then link breakage is inevitable. This link breakage will not let the packets reach the destination node properly resulting in loss of information (throughput) as well as packet delivery ratio. This paper defines routing scheme that takes into account higher throughput and lesser end-to-end delay of the links between the nodes that constitute the path from source to destination vehicle. The performance of the network was analyzed based on three parameters namely packet delivery ratio, throughput and routing overhead in the network. These parameters have shown to outperform the existing Ant Colony Optimization technique used for routing.

Keywords: VANETs, mobility, throughput, overhead, Ant Colony Optimization

Introduction
In recent years, VANET (Vehicular Ad-hoc Network) has turned into an exceptional region for exploration examination and advancement. VANET is a subgroup of MANET (Mobile Ad-hoc Network). VANET and MANET both are wireless networks, which are portrayed as self-configured and autonomous ad-hoc networks [7]. VANETs contrast from MANETs as far as dynamic topology and high portability is concerned. Because of insecure connectivity, high versatility and system partitioning, information routing in VANETs gets to be troublesome and challenging [9], in this way making a requirement for productive VANET routing protocols. Routing in Vehicular Ad hoc Networks is a challenging undertaking because of the remarkable qualities of the system, for example, high portability of nodes, progressively changing topology and exceptionally partitioned system. It is a challenge to guarantee solid, continuous and consistent communication within the sight of speeding vehicles. The execution of routing protocols relies on upon different inner components, for example, portability of nodes and outside variables, for example, road topology and hindrances that square the sign. This demands a very adaptive way to deal with and manage the dynamic situations by selecting the best routing and sending methodologies and by utilizing suitable versatility and propagation models. Taking the issues during the routing into consideration, this paper represents a routing scheme based on Ant Colony Optimization to reduce the link breakage between the communicating nodes in these kinds of networks. Section II represents the brief survey about the routing techniques in VANETs. Proposed work has been represented in Section III. It gives details about the scheme implemented. The results are shown in Section IV.

Relative Work
Abdelfettah Mabrouk, Essiad Sabir [1]. represents Graph theory. Because of the high versatility of vehicles and the dynamic topology changes of vehicular networks, it is hard to fulfill drivers' needs through a solitary remote network. Consequently, by incorporating diverse remote access networks, for example, LTE and IEEE 802.11p, the vehicular network is relied upon to be a decent stage called Heterogeneous Vehicular Network that can meet different vehicular client prerequisites.

Divya Chadha, Reena [2]. gives a study of routing protocols for VANET. It covers application regions, difficulties and security issues in VANETs. A Vehicular Ad-Hoc Network or VANET is a sub type of Mobile Ad-Hoc Network or MANET that gives communication amongst vehicles and amongst vehicles and roadside base stations with a point of giving productive and safe transportation. A vehicle in VANET is considered a smart mobile node able to do communication with its neighbors and other vehicles in the network.

G.Mary Valantinaa, Dr.S.Jayashri [3]. creators proposed PP-AODV, which is a convenient VANET routing protocol that takes in the ideal path by utilizing a fuzzy constraint Q-learning calculation in view of ad hoc on-demand distance vector (AODV) routing. Vehicular ad hoc networks (VANETs) are profoundly versatile remote network. a rise in packet delivery ratio, reduced end-to-end delay, and low overhead.

Neeraj Sharma et al [4]. perform analyzes the AODV & GPSR routing protocol used in VANET and conclude them. Vehicular ad hoc networks (VANETs) are classified as an application of mobile ad hoc network (MANET) that has the potential in improving road safety and in providing travelers comfort.

Rekha Patil, Pooja Aspalli [5]. emphasizes on adaptive probabilistic broadcast based routing from one unicast group to another and compare the performance with Probabilistic Broadcast based routing. In Probabilistic Broadcast every node broadcast packet with a probability P which depends upon several parameters including bit rate, number of transmitting and receiving nodes, path loss etc.

Venkatesh, A Indra, R Murali [6]. specialist survey of the current routing protocols for VANETs and their arrangement into a taxonomy in view of key properties, for example, system engineering, applications upheld, routing techniques, sending methodologies, versatility models and nature of administration measurements, has been done. Protocols belonging to unicast, multicast, geocast and broadcast classifications are talked about. Qualities and shortcomings of different protocols utilizing topology based, position based and group based methodologies are examined.

Shilpi Dhankhar, Shilpy Agrawal [7]. Gives an outline on VANET and gives its routing protocols which concentrates on vehicle to vehicle i.e. V2V communication. This paper goes for characterizing the protocols on the ground of routing information and contrasting them using parameters, to be specific, system utilized, advantages/qualities and limitations. The paper analyzes responsive and proactive routing protocols in view of their advantages and disadvantages, additionally talking about the difficulties and exploration related issues for the routing components that exist in VANETs.

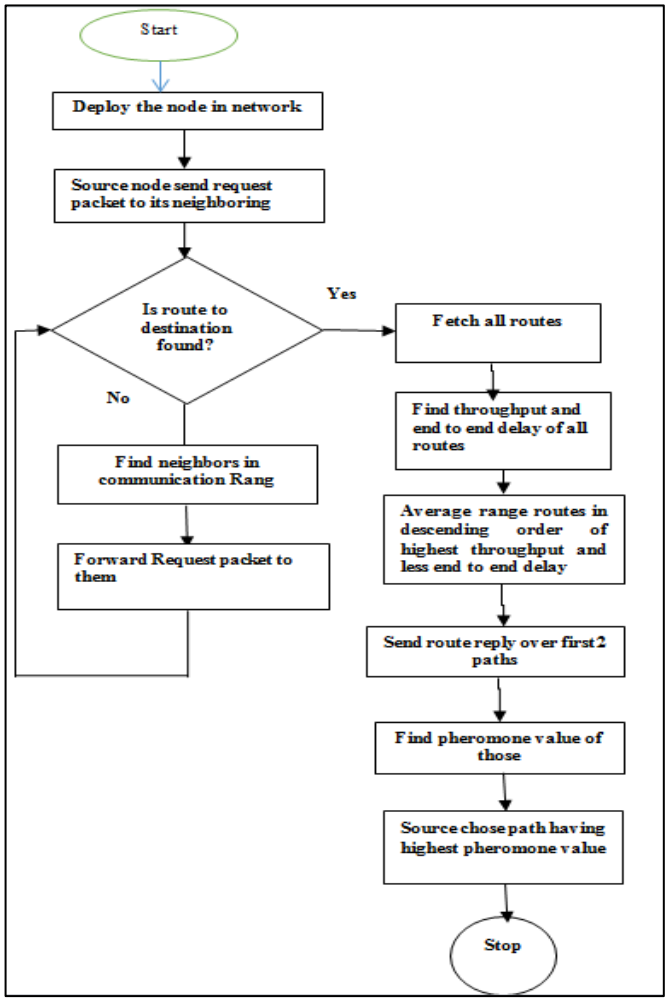
Santanu Majumdar, Shivashankar [**8].** the writers have suggested a bio-inspired meta-heuristic and mathematically probabilistic method of the Ant Colony Optimization (ACO) where proficient route formation and data transmission can be attained. The ants normally travel along the path having the highest pheromone concentration. The unsystematic movements of the ants have showed an effective means for the distribution of packets to the maximum quantity of accessible nodes/vehicles in the network with very little latency. So that although unintentional failure of any node arises, the adjacent ant neighbors will convey the obligatory data to the preferred nodes resulting in enhancement of the throughput.

Proposed Work

The aim of the study will be to further optimize the path selection procedure in the vehicular network. The proposed scheme will initialize the broadcasting of the Forward Ants by the source vehicle. The source vehicle will look out for the neighbors in the communication range, and will forward FANT towards them. The procedure will continue until route to destination vehicle is found. In the proposed scheme, the quality of the links will be taken into account to select the optimal path.

For all the paths via which the forward ants reached the destination, the end-to-end delay and the throughput will be considered. Thus, the backward ants would trace only those paths back to the source node, which have lesser-congested links, i.e., higher throughput and lesser end-to-end delay. When the backward ants would reach the source node, the source node would sort out the paths in the order of highest pheromone value, highest throughput and lowest end-to-end delay. The first path in the sorted order will be considered for data transmission.

Flow Chat of Work



Results

The performance of the network was analyzed based on three parameters namely packet delivery ratio, throughput and routing overhead in the network.

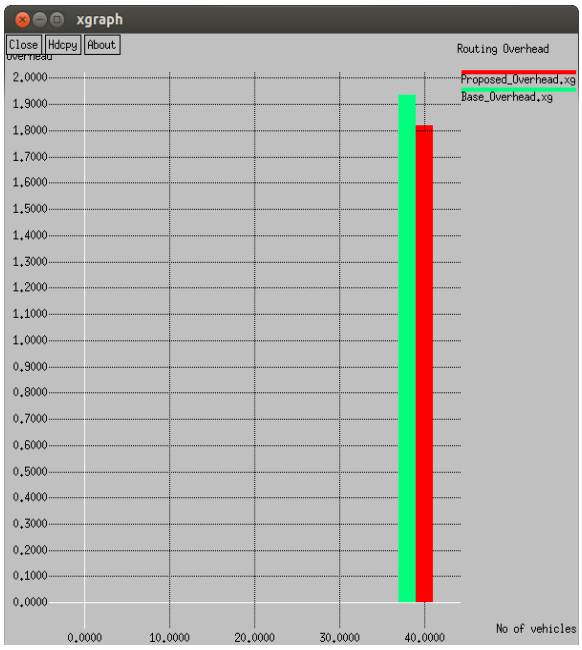


Fig. 1: Comparison of Routing Overhead

This figure shows the overhead obtained using proposed scheme and the existing for 40 vehicles simulation scenario. The value for proposed scheme is found to be 1.81 and for the existing scheme is found to be 1.92 approx.

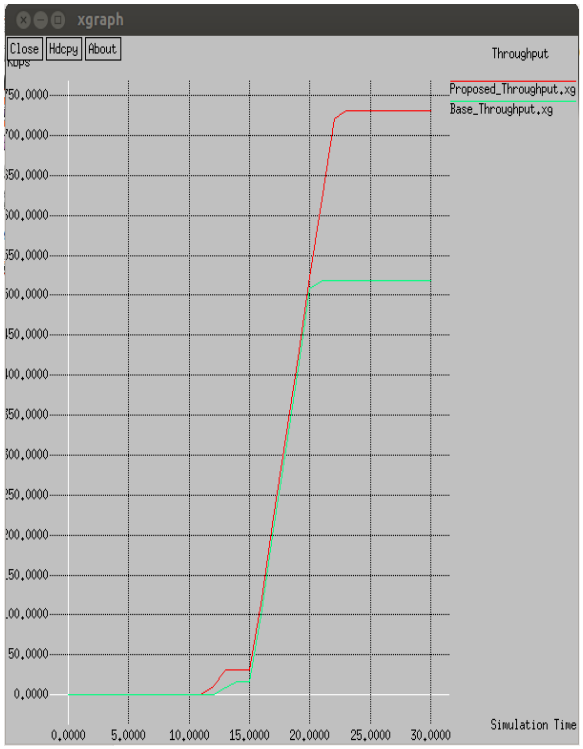


Fig. 2: Throughput comparison

This graph shows the value of throughput achieved in the network. This value is found to be higher for the proposed scheme at 740 Kbps as compared to 520 Kbps for the existing scheme.

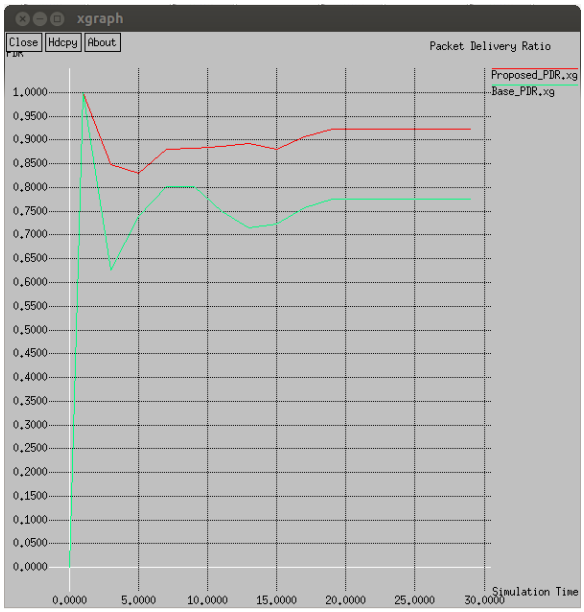


Fig. 3: PDR Comparison

This graph shows the values for packet delivery ratio obtained for both the schemes. This value for the proposed scheme has been found to achieve better values than the existing ACO scheme.

Table 1: Results Comparison

	Base Scheme	Proposed
PDR	0.77	0.92
Throughput	520 Kbps	740 Kbps
Overhead	1.92	1.81

Conclusion

This study has focused on improving the quality of the links in the vehicular networks in order to minimize the loss of packets and reduced link breakages. The proposed scheme has taken into account higher throughput and lesser end-to-end delay of the links between the nodes that constitute the path from source to destination vehicle. So while selecting the path, one should always consider the node for which the throughput is highest. This was substantially proved by the higher values of the packet delivery ratio and the throughput obtained using the proposed scheme. Thus, inclusion of the high quality throughout links and lesser delay links has helped proposed scheme outperform the existing scheme.

Vehicular ad hoc networks have found the use in the driverless concept, which has been seen in many developed countries. In such kind of networks, the collision avoidance must be of very high priority. Thus, the proposed scheme can be further extended on the collision avoidance applications.

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