An Overview about QoS Improvement by Enhanced ACO in Hybrid and Reactive Routing Protocols in MANET

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Abstract: Adhoc networks are networks of wireless connectivity between various hops, frequently changing network topology and the efficient dynamic routing protocols that are needed and plays an important role too. Proactive, Reactive and Hybrid are different classes of routing protocols. An on-demand and Hybrid routing strategy are popular routing category in mobile adhoc networks. On comparing the other protocols the ZRP that is Zonal routing protocols the hybrid which provide best node mobility performances. Here the Ant colony optimization approach is introduced in order to get an optimal path selection in network scenario. It is essential for the tactical communication that needs the essential quality of service. By providing enhanced Ant colony optimization the pheromone value that is the behaviour of ants used here are continously updated that is enhancement by using the parameters like residual signal strength, energy, hop count, etc... to get the optimal results which helps to get a very good performance results while in a highly mobile tactical environment too. In this work an attempt of review has been made to study the behaviour of an enhanced technique combining Hybrid routing protocol and the Ad-hoc On Demand Distance Vector protocol with Ant Colony Optimization (ACO) that can increase various QoS requirements.

Keywords: ACO-AODV, FDR-PSO, FF-AOMDV, Sonnet.

I.   INTRODUCTION

Wireless networks are network which are used to communicate between different nodes using radio frequency. Mobile Adhoc Networks means communicating groups of mobile nodes in a wireless media that are operating in distributed manner. Such a network is self-organized. According to the mobility of each node these networks are dynamic in nature hence topology changes frequently. Mobile Ad Hoc Networks (MANETs) are not centralized means in this network the nodes are operating in distributed manners. These are self-organized networks [3]. MANETs are infrastructure less networks because the nodes are mobile. All the nodes can move in any direction while communicating and these nodes can act as both router and host. So, these networks are dynamic in nature means can change their topology. This may cause problems like overhead traffic, memory consumption etc. MANETs also possess multi hop routing means packets are allowed to forward to destination through multiple nodes thus creating each node act as terminal as well as router.

There are some issues in MANET include limited resources, changing network topology, QOS, scalability etc. Routing is task of transferring data from source to destination while maximizing network performance. So it becomes a challenge in MANETs [10]. Because of changing topology and network density, limited resources changes paths which were initially efficient but can quickly become inefficient and infeasible. These nodes have to interconnect from source to destination via intermediate node because these networks have limited bandwidth. To overcome these problems related with MANET, a number of routing protocols have been developed for different scenario. Because of this dynamic behaviour routing in Manet which is very difficult to fulfill the QoS requirements.

The main objective of the approach is that,
- ❖   Introducing new mechanism for route selection of ZRP with ACO.
- ❖   Enhanced Ant-ZRP consider the
- ❖   Congestion,
- ❖   residual energy,
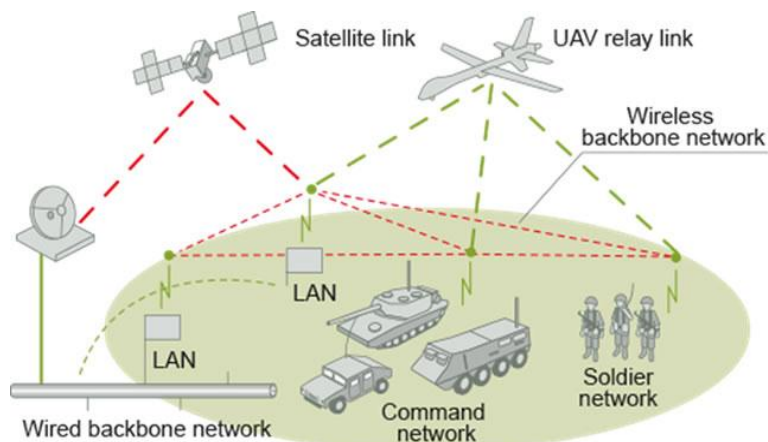- ❖   No: of hops along the path etc…

Fig: Tactical communication

Tactical communications [35] are military communications in which particularly during the conduct of combat information of any kind, mainly orders and military intelligence, are communicated from one person, or place to another upon a battlefield. While communicating in a tactical environment there should be a multimedia data transfer so data need to be receive with a good quality of service. Ant colony optimization [25] which is mainly based on the behaviour of ants .it works on the basis of the pheromone value that secrete. Here the pheromone value is updating continously to compute the optimum path to transfer data from a sender to the destination. Paper aims to provide a better solution to QoS satisfaction by enhancement of ant colony optimization [36] in different routing protocols. Here this review paper focuses on discussing different papers related to the problem of QoS fulfilment in Manet. Organization of the paper is as follows. Section 2 presents the MANET related works. Section 3 discusses some of the ant colony optimization related papers. The paper related to the methods for improving the QoS is presented in section 4. In Section 5 the proposed idea that is enhancement of ant colony optimization in reactive and the hybrid protocols related papers are discussed. Finally, in Section 6 conclusion has been presented.

II.   REVIEWS RELATED TO DIFFERENT QOS IMPROVEMENT METHODS IN VARIOUS PROTOCOLS

i. MANET

Manet that is mobile ad hoc network which is wirelessly connect the mobile devices and is an infrastructure-less network. There is a shared medium which is highly demandable for radio communication. In Manet any node or mobile device is a router as well as end host. Manet has a dynamic topology nature and which highly promotes mobility. Hiral vegda et al. discusses a review paper on Mobile adhoc networks. The review is about different systems like routing protocols, congestion mechanisms, and layer attacks by adversaries, different security issues and the challenges that are to be faced by Mobile Adhoc Networks. Provides different security solutions for the different attacks related to physical, data link, and the network layers [1].A comparative survey of mobile adhoc network routing protocols was discussed in [8]. Here in this comparative survey there is a comparison between the different routing protocols in Manet like the reactive (AODV), proactive (DSDV) and the hybrid routing protocols. By using the parameters like the routing overhead, packet delivery ratio, delay, packet received, packet transmitted, control packets, packet loss etc... Analalyzed the performance with the variation of nodes density and mobility and the results shows reactive routing protocols is better in different applications.

Haiquan Wang et al. (2009) discusses about the Research on survivability of Manet. The paper analyses the different survivability issues related to the Manet and tests the impacts under the simulation environment [15]. Research on survivability of Mobile adhoc networks by Yuan Zhou et al. analyses the mobile adhoc network on considering the survivability issues in the Manet. Here survivability classifies in to various categories like dynamic topology, faults as well as attacks [16]. In [27] discussing about a discussion of different routing protocols in Manet. In a dynamic environment the process of efficient transfer of data is difficult. This paper discusses about the Mantes, applications, and the qualities of such a network from other wireless environments etc... According to the different applications it is impractical to introduce a single routing protocol.

II. ANT COLONY OPTIMIZATION RELATED WORKS

Ant colony optimization uses the principle of searching behaviour of real ants. Ants communicate through a chemical substance called pheromone. The optimal path is chosen according to the amount of pheromone and this substance fades their concentration and if that path is not in use for long time then it will disappear.

D.Jinil persis et al. (2015) discussed about Ant based Multi-objective Routing optimization in Manet. Ant based routing algorithm is presented in order to solve the problem NP hard problem. Ant based algorithms will results good throughput, packet delivery ratio as well as delay when compared to the adhoc on demand distance vector routing algorithms[4]. Ahmed M Abdel Moniem et al. proposed about different protocols with Ant colony based optimization algorithm for the Mobile Adhoc network routing problem. The main aim of the protocol is to reduce the routing overhead as well as its response time similarly the network performance and the end to end delay. The ant based behaviour algorithm which will help to increase the performance than the other protocols. New modified protocol named as the Multiroute ant routing algorithm for AODV gives better results [5].Ant colony optimization.it is a review about the rapidly growing field of ant colony optimization [7]. The mechanism can be applied or the behaviour of ants can be introduced to the routing protocol widely to ensure the combinational optimization problems.

In 2015 proposes a new technique and the method describes as the data packet delivery is done by the highest pheromone count. Route maintenance is done by the pheromone decay techniques. The self-organization of biological systems of ants is the main inspiration and it will provide much better results than the simple DSR algorithmic network [9]. Jochen seitz et al. proposes a mechanism QoS – aware routing in Multi-rate Adhoc networks based on Ant colony optimizations. The paper describes about the new approach for the QoS calculation by considering there is no congestion at all. The approach of the mechanism results that it performs well in high mobility and also QoS routing based on Ant colony optimization protocol is highly scalable [10]. In [24] Gurpreet Singh et al. proposes an Ant based zonal routing in Manet. A zonal routing protocols is the combination of proactive and reactive routing protocols. Here using Ant based protocols to enhance the routing behaviour. The behaviour is compared with other protocols and it results a superior performance as compared to other protocols. Anuj K Gupta et al. discusses about the Manet routing protocols based on Ant colony optimization. Because of the dynamic topology and the energy as well as limited bandwidth is are the most challenging issues in an adhoc network. The collective behaviour of ants and the pheromone value helps to find the shortest path from the network. Swarm intelligence method which helps to get better end to end delay, routing overhead etc... [25]. Deepshikha Dhiman et al. in 2016 proposes Dynamic source routing protocols using Ant colony optimization Mobile Adhoc network. This method offers better quality of service support routing. Considers acceptable jitter, delay, energy parameters etc… i.e.; quality of service in real time and the multimedia applications. The method ADSR provides the better results on compared to the DSR protocols in terms of parameters like delay, jitter, throughput etc…

In [29] Essam H Houssein et al. discusses about the Ant colony optimization-based hybrid routing protocol for Mantes. Algorithm which is new Ant-HRP and is a combination of proactive reactive protocols. This mechanism which improve the connectivity, packet delivery ratio, and reduced end to end delay as compare with other protocols like AODV, DSDV etc… Explains the short comings of the network and how to enhance their capabilities considering the weakness. Gurpreet Singh et al. discusses about Ant colony algorithms in a Manet as a review. The paper discusses about the different taxonomy of various ant colony algorithms with other algorithms. Helps to find the optimum paths between source and destination and indirectly communicate by means of stigmergy [30]. Anuj K Gupta et al. (2012) reviewed based on the Ant colony based Mobile adhoc networks routing protocols. Review discusses about the different routing protocols and how it will selects an optimal routing protocol and how changes happen when topology changes. It also gives an overview about the ACO based routing protocols and its applications [32]. A new method that is about the performance enhancement of routing protocol in Manet with Ant Colony Optimization by [37] Himanshu Sharma et al. Here introduced to solve problems like link breakage, congestion etc… This algorithm calculates best congestion avoided route and the route will maintained by the method of pheromone updating. This results high packet delivery ratio, low energy consumption, low routing overhead etc…

III. QOS IMPROVEMENT RELATED WORKS

Manet has dynamic nature; hence efficient routing is difficult. Due to the node's mobility, node failures and link breakages in the network is very high. Main issue arising in Manet is the selection of the optimal path to communicate in a wide range of nodes. Routing becomes more challenging in tactical ad-hoc network which has an application used in battle field. In tactical ad-hoc network multimedia data needs to be transmitted requires high Quality of Service (QoS). Here discussing some papers that improves the QoS in Manet.

Pinki nayak et al. proposed Energy aware routing scheme using variable range transmission for Mobile Adhoc network. The proposed algorithm is introduced to make an energy aware network. Nodes energy efficient design of the protocol can be generated by varying transmission. In a distributed manner the power level of node will be controlled for each packet and thus energy aware network can be created [2]. Z.Albayrak et al. in 2014 proposed Bee –Manet: a new swarm based routing protocol for MANET.it is a new routing algorithm for mobile adhoc network. Introduced to improve the throughput of network. The Bee-Manet, on reactive adhoc routing protocols and the bee adhoc routing protocols are also compared widely to get better results while go for large scale behaviours [3]. Accurate and energy efficient congestion level measurement in adhoc networks discussed by Yangyong Zhang et al. discussed the. Here proposes a new mechanism the congestion detection which measures the energy efficient network of having congestion level accurately. The measurement is at both node level and the flow level [6]. Sudip Misra et al. introduced an approach using bee algorithm in mobile adhoc networks for the peer to peer file searching. Here the

searching method which is done by using the bee algorithm. It is introduced in order to get an efficient peer to peer search in Manet. The purpose not only provides an efficient optimizes search helps to improve the time efficiency and the robustness also involves a more selective node tracing [11].

Pankaj gupta et al. discusses about the performance measure of Drop tail and the RED algorithm. Here the mechanism trying to detect the congestion by averaging the queuing size. The router drops the packets with respect to the value of threshold and is calculated by some probabilistic distribution. If packet loss is known drop probability can be calculated and the loss is minimized by the modification of the congestion window size [12]. In [14] S Pandya et al. discussed about an Advanced AODV approach for efficient wormhole attack in Manet also detection and mitigation. It is a new approach to mitigate wormhole attack and digital signature is used to make a secure system that efficiently founds the wormhole attack. In order to analyse the behaviour of the wormhole the approach uses calculation of tunnelling time taken by tunnel.In [17] discussed about the Adhoc on demand distance vector routing. In order to get an efficient packet delivery introduced a novel algorithm named AODV. On compared to the DSDV algorithms AODV which stores continously updates each nodes information and about the route. Algorithm results longer latency for route establishment. Jeba Kumar Mohan Singh et al. proposes a unified approach for detecting and eliminating selfish nodes in Manet using TBUT. Token Based Umpiring Technique (TBUT) is introduced here where every node need to participate in an adhoc network and all needs a token which is essential to participate efficiently and the other nodes acts as umpire. Approach results less congestion, less overhead, and efficient with the reduced detection time [18]. Marco fortino et al. (2010) discusses about Evaluating Energy-aware behaviour of proactive and reactive routing protocols for Manet. Here analysis done under considering the residual energy of each node separately in a network. Independently lifetime of node is a serious problem when a mobile network is very dense. Discusses some protocols like OLSR that considers the energy aware metrics in order to improve its performance [19].

Benkappa S M et al. proposes a new method named Energy Efficient AODV- An efficient approach for energy conservation in Manet. It is a new routing mechanism for the energy conservation and to improve the lifetime of nodes. Uses details about the energy constraints like need of energy, energy threshold, remaining energy and future energy computation etc… to provide efficient routing mechanisms [21]. In 2017 discussed about the OEFS: On demand energy based forwarding strategy for named data wireless adhoc networks. Here considers residual energies of the nodes during a data transfer over a network. It is used to solve the security issues, scalability, complex usage etc… Here neural data network is used and provides security mechanisms to provide efficient multipath routing network [22].

In [23] Savitha shivani et al. discussed about Optimized swarm based dynamic Mobile Adhoc on demand routing network protocol. Proposes the ACO mechanisms to enhance the dynamic routing behaviour on considering various performance parameters. Considers the distance between nodes and the density of the neighbouring nodes and results a better performance in almost all performance metrics. Zulkarnain MD Ali et al. (2017) proposes based on hybrid particle swarm optimization with ant colony based energy control routing for enhancement of energy control routing protocol for Manet. According to different routing protocols movement characteristics are discussed and ACECR-PSO gives a better consumption of energy and the extended life time of network [28].Fitness –distance-ratio based particle swarm optimization [31] introduced in 2014. Algorithm introduced a velocity component too in order to update the equation. Particles moved in the direction of considered as a parameter. FDR-PSO shown to perform optimization problems.

Sanjay Mishra et al. proposes Optimum route selection using improved FF-AODV to increase network lifetime in Manet. It is a new protocol that introduced to find the best path from the availability to the destination. FF-AOMDV with dragon fly algorithmic behaviour is used here for the improvement of energy consumption, network lifetime, packet delivery ratio etc… [33]. In [34] proposed about the Energy efficient multipath routing for Manet based on hybrid ACO-FDRPSO. Here explains about the combination of both ant colony optimization and the fitness distance ratio in order to get efficient and optimized energy. In this paper the duty cycle algorithm along with the ACO helps to get a swapping behaviour between active and sleep modes among the nodes. There will be no active state for a node at all time if there is no communication at all. Helps to reduce the energy and to enhance the lifetime of the node. Zeyad M Alfawaer et al. [35] proposed an enhanced multipath strategy in mobile adhoc routing protocols. Whenever a route is failed, proposed to make there is no node to be overburdened and it is distributed to other nodes by finding an alternate path. Search of Next Node Enquiry Table (SONNET) introduced to find the best neighbouring nodes. Hence reduced number of hops also delay and thus maintained the quality of service.

In 2017 discussed about the Energy efficient multipath routing protocol for Mobile adhoc network using the fitness function. AOMDV protocol is discussed here on considering the fitness function. Helps to find the optimal path and to reduce the routing delay as well as the consumption of energy. Method considers several parameters to compute the fitness factor and this method performs low delay, better throughput, high packet delivery ratio etc. [36]. Navneet Kaur et al. (2018) introduced a method energy efficient and improved network lifetime multipath routing FF-AOMDV and Dragon fly topology. Introduced to solve the energy consumption problems of Manet. Fitness factor is calculated and optimum path is found to the destination in a multipath routing behaviour. Results fitness function with dragon fly topology behaviour improves the packet delivery ratio, end to end delayed…

[38]. Marc Gilg et al. discussed about the Network life time maximization of the AOMDV protocol using nodes energy variation. Overloaded nodes and the nodes having very less remaining energy are not considered on path discovery. Considers each nodes energy to found efficient path and results an efficient path discovery and improves the packet delay ratio [39].

IV. ENHANCED ANT COLONY RELATED WORKS

As we know major challenging issue in Manet is the selection of an optimal. Hence can introduce a new mechanism combining protocol with Ant Colony Optimization (ACO) algorithm with route selection to improve Quality of Service (QoS) in Mobile adhoc networks. Enhancement of such a method will improve QoS very much and can implemented in various protocols too. Dipika Sarkar et al. proposes Enhanced ant AODV for the optimal route selection in Manet. In connection to the ant biological characters the pheromone value will be calculated based on the congestion, end to end reliability, number of hops, residual energy of the nodes and considering the distance of the destination. The path having highest pheromone value will be the best efficient path for the transmission of packets [13]. In [20] proposes Enhancing AODV routing protocol to predict optimal path using Ant Colony algorithm in Manet. Here proposing an enhancement a new method to predict optimal path between mobile nodes based on different parameters using ACO. A self-organized structure of the nodes in a network and can adapt to different topology are the characteristics of Ant colony optimization algorithms. The method will reduce the link failure probability and also increase the stability of the network.

III.   DISCUSSION AND ANALYSIS

Zonal routing protocols, Dynamic Source Routing (DSR) protocols, Adhoc On demand distance Vector Routing (AODV) protocols are routing protocols for wireless mobile adhoc networks. DSR and AODV and the zonal routing protocol can be compared and evaluated based on the different quality of service parameters like packet delivery ratio, throughput by altering the number of nodes, mobility etc...On demand routing protocol is a protocol which makes route only when they need to communicate or to form route according to the demand like DSR and AODV protocols. The main difference between on demand protocols like DSR and AODV is the source routing feature. DSR is based on source routing in which all nodes have the information about the route and it is maintained. In order to pass packet through the route and sender will identifies the entire sequence which is called source routing mechanism. The packet sender lists the route in the packet's header thus identifies the node which is next to transfer the data's according to the address of the destination. AODV protocol is a combination of a DSR and DSDV mechanism. AODV protocol uses the route discovery and route maintenance from a DSR and from DSDV the features like hop-by-hop routing, periodic advertisements, sequence numbers etc... AODV easily overcomes Bellman Ford problems, whenever the topology altered in Manet.

Packet delivery ratio is chosen as the parameter to compare the performance of the different protocols like the DSR as well as AODV and results both of them looks similar in various scenarios. Compared on the basis of various pause time to as well as mobility. . Dynamic source protocol provides stable results while increase the number of nodes but adhoc on demand protocol provide better results. AODV protocol has the less routing overhead than the other protocols while requesting a route. DSR protocol finds the route by the help of aggressive caching mechanism. Frequent route discovery is then avoided and overhead is reduced in DSR on compared to the adhoc on demand protocol.When comparison has been done between different protocols, the MAC overhead is very high and it will degrade the performance of DSR in high mobility scenarios too. At lower-mobility of nodes, the performance of Dynamic Source Routing is better than AODV protocol as the overhead reduced to low and the easier and sudden searching of the optimized path. Also the ZRP Protocol is a combination of reactive as well as proactive protocol, thus the combined operation will provide a better results than the both protocols.

Fig: comparison table of performance

Routing strategy	Proactive routing protocol	Reactive routing protocol	Hybrid routing protocol
Updates	Have update	No updation	Updation exist locally
Overhead	High overhead	Low overhead	Medium overhead
Delay for route acquisition	Low delay	High delay	Lower delay for intra-zone; Higher delay for inter-zone
Band width requirement	High bandwidth needed	Low bandwidth needed	Medium bandwidth needed
Energy requirement	High energy needed	Low energy needed	Medium energy needed

IV.   CONCLUSION AND FUTURESCOPE

Energy, velocity of nodes, and the number of nodes in the network etc. factors that will affect the topology of Manet widely. Ant Colony Optimization can provide a self-organized infrastructure for nodes and can withstand with the changes in topology. Using ACO, an optimal path can be selected and this will increase the stability of the network. In this review, considered various

methods and concludes that enhanced method using ant colony optimization will predict the optimal path between nodes more precisely. Here the basic routing protocols like reactive proactive as well as hybrid were studied. On demand driven protocols, like AODV, DSR etc. Performed very well for packet delivery ratio according to the nodes mobility. AODV seems to perform better than DSR on some situations. However, AODV has generally better performance when mobility increases. But beyond that ZRP provid4es better performance than other protocols. On comparing with the on-demand protocol AODV performed particularly well, while DSR have good packet delivery ratio when frequently mobility increases... DSR is Dynamic source routing protocol, can affect the total byte overhead when the load offered and size of the network increases due to byte overhead in each packet. One advantage of dynamic source routing is that it learns more routes while at route discovery operation. A combination of the DSR as well as proactive protocols can be used to attain good result.

As we know the most challenging issue in Mobile Ad-hoc network (MANET) is the selection of an optimal path. Can introduce a new mechanism by the combination of Zonal routing protocol (ZRP) with Ant Colony Optimization (ACO) to improve Quality of Service (QoS) in MANET for route selection. According to the mechanism of ant colony optimization along with ZRP protocol, pheromone value is used to find the finest route for data delivery along the path. While the pheromone value of a route is calculated based on various parameters like end to end reliability of the path, congestion, number of hops and residual energy of the nodes in the network. Highest pheromone value is chosen to select the path which has better transmission of the data packet as the shortest path.

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