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RESEARCH ARTICLE

A LITERATURE INVESTIGATION OF BIO-INSPIRED ALGORITHMS FOR DESIGNING ROUTING PROTOCOLS IN MANET

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ABSTRACT

Mobile Ad-Hoc Network (MANET) is a self-configuring network in which mobile devices are connected by wireless links. MANETs face several challenges due to open network architecture, shared wireless medium, highly dynamic network topology and so on. Recently a new class of routing algorithms based on swarm intelligence has emerged for routing problems in MANET. These algorithms are inspired from nature's self-organizing systems such as ant colonies, bird flocks, honey bee, and fish schools. Nature is of course a great and immense source of inspiration for solving hard and complex problems in computer science since it exhibits extremely diverse, dynamic, robust, complex and fascinating phenomenon. It always finds the optimal solution to resolve its problem maintaining seamless balance among its components. This is the thrust behind bio inspired computing mechanisms. Nature inspired algorithms are meta-heuristics that mimics the nature for resolving optimization problems opening a new era in computation. The common features of these biological systems which include their ability of self-organization, robustness, adaptation, self-healing, and local decision making, make them an appropriate source of inspiration for routing in MANETs. For the past eras, numerous research efforts have been focused in this particular area. Still being young and the results being identical amazing, broadens the scope and feasibility of Bio Inspired Algorithms (BIAs) exploring new areas of application and more opportunities in computing. In this paper provide a complete summary of the nature inspired routing algorithms for Mobile Adhoc networks. Then, numerous existing research papers related to bio-inspired models are also discussed and investigated to find the research gaps.

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INTRODUCTION

MANET [1] is an autonomous system of mobile nodes and associated hosts connected by wireless links, without the need for the infrastructure support or a centralized administration. Nodes in such network act also as routers. Furthermore, these nodes are free to move and organize themselves arbitrarily. Hence, it is highly difficult to confirm the long-term guaranteed path from one node to the other node. The rise of real-time applications and the extensive utilization of wireless and mobile devices have generated the essential to provide quality of service (QoS) support in wireless and mobile networking environments [2]. The performance of wireless network depends on the different factors such as bandwidth, power, QoS, routing efficiency etc.

Due to the random mobility of nodes and decentralized nature it is a precise challenging issue to achieve better performance in MANETs. Among all parameters, routing is one of the core factors that have great influence on network performance. Routing in MANET is a Dynamic Optimization Problematic as the search space changes over time. The routing strategy is defined as the rule that agrees what node to take next at each decision node to reach the destination node. The routing scheme in a MANET can be classified into two major categories – Proactive and Reactive [3]. The proactive or table driven routing algorithms maintain routes between all node pairs all the time. It uses periodic broadcast advertisements to retain routing table up-to-date. This approach suffers from problems like increased overhead, compact scalability and lack of flexibility to respond to dynamic changes.

The reactive or on-demand approach is event driven and the routing information is replaced only when the demand rises. The route discovery is started by the source. Hybrid approaches combines the features of both the approaches [4]. The traditional routing methods do not always show methods of finding optimum solution to detecting novel routes in such dynamic and adaptive situations as being experienced in MANET.

Many MANET routing protocols are already designed such as ad hoc on demand distance vector (AODV) routing, zone routing protocol (ZRP), dynamic source routing (DSR) protocol, cluster based routing protocol (CBRP) and destination sequenced distance vector (DSDV) [5] and tested in different simulators; but up till now, no research effort has been able to provide the optimum routing efficiency to ensure the high network performance. Swarm Intelligence (SI) inspired routing systems have become a investigation focus in recent years due to their self-organizing nature [6], which is very appropriate to the routing problems and energy resources optimization related concerns in Mobile Ad hoc Networks (MANETs). Swarm intelligence, as inspired by natural biological swarms, has numerous powerful properties for distributed problem solving in complex real world applications such as optimization and control. Swarm intelligence properties can be found in natural systems such as ants, bees and birds, whereby the collective behavior of unsophisticated agents interact locally with their environment to explore collective problem solving without centralized control.

Limitations of Traditional Routing Algorithms: In order to measure the performance of routing algorithms, one needs metric to measure its suitability and performance. MANET has number of qualitative and quantitative metrics that can be used to compare ad hoc routing algorithms. Following is a list of popular properties of MANET routing algorithms: Scalability, Routing overhead, Link stability, security, Reliability, Control overhead, Routing loops, Routing philosophy, Energy level, Bandwidth, Storage complexity, etc. The kind of protocols such as, DSDV and OLSR (Optimized Link State Routing (OSLR)) are proactive, DSR, AODV, TORA (Temporarily Ordered Routing Algorithm (TORA)) and ABR (Associativity Based Routing (ABR)) are reactive whereas ZRP is zone-based hybrid routing and FSR(Fisheye State Routing) is Hierarchical based routing. Periodic updates are used in DSDV; therefore, their performance is associated with the network size and node mobility pattern. In OLSR there is excess of bandwidth due to needless advertising of routing information even if there is no change in the network topology. With high density network OLSR works more precisely and requires that it unremittingly have some bandwidth. AODV support multicast and unicast and it are on-demand loop free protocol which has optimized overhead. TORA does not need a periodic update, with that communication overhead and bandwidth utilization is also reduced. TORA are offered to minimize the control traffic overhead and improve scalability. In small to reasonably sized networks, the DSR protocol performs better than AODV, and TORA routing protocols. The DSR protocol also has numerous benefits over the above-mentioned routing protocols, there is no such periodic routing of messages in DSR routing protocol, thus helps in decreasing the network bandwidth overhead. As reactive routing algorithms for MANETs, DSR, AODV and TORA are proposed to decrease the control traffic overhead and improve scalability. ABR has reduced amount limited bandwidth.

DSDV of control packet traffic and FSR have different features and use different mechanisms for loop-free assurance. AODV and ZRP have multicasting capability while other protocols have no such capability. As a Link State routing algorithm, FSR has high storage complexity. ZRP is an efficient and consistent algorithm to be used in any ad hoc network. The shortcomings of proactive schemes are the constant bandwidth consumption due to periodic routing updates. Reactive routing systems overcome this problem by searching the routes presented from source to destinations only when essential, thus keeping bandwidth usage and routing table storage low. One of the two standard on-demand schemes, AODV and DSR, scale well for enormous networks when communication pattern is sparse and mobility is low.

ROUTE OPTIMIZATION TECHNIQUES

The method of either maximizing or minimizing based on the objectives so as to search out the key for the issues is called optimization. To determine the optimal path for a wireless sensor network route optimization is must to minimize the energy utilization and maximize the quality of service between the sensor nodes (Source to Destination) all through the process. On the other hand creating a best routing algorithm is a big challenge by considering all the factors that affects the QoS of the networks. Route optimization plays an imperative role in successful transmission of data, utmost care to be taken during the deployment. Still many of the MANET routing optimization issues has not been addressed so far. To solve the aforesaid issues most of the proposed works relayed on computational and graph theory. Some of the major issues in route optimization are coverage path problems, detecting anonymous areas, poor sensing element and topology management issues, node integration issues etc. All these problems must be taken care to create an energy efficient wireless sensor networks. Many route optimization techniques have been illustrated to find the solution for various routing issues and clustering. Since it is a multi-objective optimization problem an effective optimization algorithm techniques to be deployed to find the optimal solution. Computation times of the traditional techniques don't works and satisfy the real world communication problem. Some of the mathematical algorithms and combinational algorithms used to solve the large scale optimization problem with parallel and distributed search capabilities. Some of the artificial intelligence optimizing techniques shows greater performances in identifying the optimum solution to the complex issues. Usage of single techniques is hard to find the optimal route in the wireless sensor networks. So there is much need of combinational techniques and algorithms to find the best route between the sources and sink with high precision. Though the behavior of MANET system is represented by a mathematical form with the set of given rules, it is highly intricate to capture the unexpected behavior and hard to frame the new models for it. Due to paucity of the nodes and overload the system fails to respond and ends with poor data transmission.

Biologically-Inspired Methods: There are two main groups of bio-inspired methods used to solve MANET routing problems: swarm intelligence and evolutionary computing [7]. The algorithms based on swarm intelligence include methods inspired by Ant Colony Optimization, Particle Swarm Optimization, and Honey Bee Mating Optimization. Evolutionary methods for MANET routing are mostly based on Genetic Algorithms. The benefits of relating traditional and

bio-inspired routing algorithms have been standard as well. This segment provides a brief summary of the principles of swarm intelligence and evolutionary computing, and the explanation of several selected algorithms. Swarm intelligence is a collection of methods to solve complex, real-world problems using the paradigm of collective behavior of distributed agents. This paradigm has been inspired by the intelligent behavior of systems composed of many simple individuals, such as ants, bees, bats, etc. Similarly, an artificial swarm system consists of many unsophisticated agents that cooperate in order to achieve desired behavior [8]. This approach is concerned with exploiting global behavioral patterns emerging from local interactions, rather than with the design of sophisticated central controllers governing the entire system. Evolutionary Algorithms evolutionary computing is a group of iterative stochastic search and optimization methods based on the programmatically emulation of successful optimization strategies observed in nature [9]. Evolutionary algorithms use Darwinian evolution and Mendelian inheritance to model the survival of the fittest using the processes of selection and heredity [10]. Other Bio-inspired Algorithms Swarm intelligence and evolutionary computation are the two major categories of bio-inspired algorithms. However, a number of other biological methods have served as an inspiration for numerous algorithms. Two exciting bio-inspired approaches that have been newly used for MANET routing are based on cell biology and bacterial foraging.

Swarm Intelligence Techniques: The swarm intelligence technique has been successfully applied in routing and control of telecommunications networks [11, 12]. A computer program based on ant feeding principles that efficiently route phone calls was developed in [12]. Swarm intelligence has several advantages over mobile ad hoc networks due to the use of dispersed control and mobile agents. The swarm intelligent algorithms are distributed, adaptive, robust, and extensible and have several self-organizing properties such as positive feedback, negative feedback, randomization, and multiple interactions where the swarm intelligences. This component allows natural systems to perform complex tasks with simple, easy-to-understand limbs. These characteristics have led to the design of distributed and adaptive algorithms for special self-organizing networks where the need for transparent interaction of many heterogeneous network elements (nodes) is a significant challenge. Some of the most popular swarm intelligence techniques are Genetic Algorithm, Ant Swarm Optimization, Swarm Optimization, Bee Swarm Optimization, and Firefly Algorithm, etc.

RELATED WORK

Numerous analysts have proposed different conventions for executing energetic routing in MANET, but here we are going center primarily on a few approaches that have joined computational insights based strategies (i.e., Swarm Insights) for finding ideal ways and move forward the security. So through this segment we are going show a few of the later studies that examine Bio Inspired Algorithms, Fuzzy, and Machine Learning algorithms in MANET.

Vijayalakshmi et al. [13] A robust and energy-saving ACO routing algorithm called AntHoc MMP has been proposed, which uses the ant agent to find the best route based on the Max-Min-Path (MMP) method. The proposed algorithm first uses the MMP algorithm to select a set of relative paths from the source node to the destination. In the second stage, Forward Ant (FANT) is transmitted on all relevant paths. While traversing the relative path, FANTs update the pheromone value of each intermediate node to find the shortest and most robust path. In addition, AntHocMMP uses an adaptive relay method to detect link failures and select a new relative path. However, in the first stage, the MMP algorithm has traversed all possible energy-saving routes from the source to the destination, and the pheromone deposition does not affect the choice of related routes. Therefore, in this method, the ACO algorithm is not used to find possible paths, but to select the optimal path. This two-process method is different from the traditional ACO-based routing method. However, the algorithm must extend the hierarchical network structure and energy harvesting MANET scenarios.

2015, Umamaheswari et al., [14] An enhanced ANTEC framework with cluster-based collaborative caching is proposed in MANET. In MANET, there is no centralized control of communication between nodes. By injecting immunity into data packets, the framework improves security, data packet delivery rate through cross-layer design, and minimizes end-to-end delay. Cache management solves the problem of node failures and failures. In the proposal, through the design of the ANTEC framework, the delay caused by node failures is reduced, and the autoimmunity of data packets is improved. The framework implements AIS and the Enhanced Cooperative Cache Scheme (ECOCA), which is a unique combination of data security and cache management. An immune packet is embedded in the data packet, that is, an artificial immune system packet. Therefore, it is more effective to prevent hacker incidents during data transmission. In the proposed system, the problem of cache management is solved through a cluster-based collaborative cache. Compared with the Adhoc on Demand Vector and Cooperative Caching Architecture (AODVCOCA) approach, the proposed ANTEC framework works well in most cases. In this algorithm, the pre fetching scheme can be enhanced to prefect data items when the network traffic is high, and the clustering algorithm can be enhanced to adapt to large networks.

2015, Ali et al., [15] Fuzzy data-driven charging and power-aware multipath routing were introduced to solve power and load balancing issues. In multipath routing based on fuzzy load and power perception, the fuzzy inference engine takes the delay, load, bandwidth, and remaining power as inputs to determine the ability to distribute traffic from the node. The probability of traffic distribution obtained depends on the given fuzzy rules. The fuzzy system output directs traffic through multiple fail safe paths to minimize the load on congested nodes. Multipath routing based on diffuse load and power perception solves dynamic topology and central management problems in MANET. However, the useful life of the network is not long enough.

2016, C.V.Anchugam et al., [16] A fuzzy logic system is used to explain the AODV black hole attack detection method in MANET. In this way, a detection system is used that uses FIS as the routing protocol to detect attacks. Fuzzy Information System (FIS) provides a natural way to express and reason about uncertain and imprecise problems. The goal of the fuzzy system is to identify malicious nodes to determine the type of network conditions when the protocol operates low, medium, and high in terms of performance, packet transmission speed,

end-to-end delay, and dropped packets. However, this work is only applicable to black hole attacks.

2016, S. Rathore et al., [17] An ACO optimized congestion control enhanced multipath routing method is proposed for self-organizing networks, which solves the problem of link congestion. Also, the load on the link will increase rapidly. They proposed an ACO-based multipath congestion control technology, which changes the queue according to the load on the dynamic network. The simulation shows that the proposed ACO protocol has good performance. However, the algorithm does not use multiple channels and does not fundamentally solve the problem of network congestion.

2016, Xia et al., [18] A method for identifying and predicting malicious activities of nodes by using a fuzzy data-based model is proposed. The model has a calculated trust value, which is called a trust-based routing protocol (TSR). You only evaluated the direct trust, but did not solve the indirect trust problem with other node recommendations. In addition, QoS does not consider other criteria, such as battery power and node stability (for link stability). Performance comparison evaluation shows that TSR is a feasible and flexible method that can meet the security requirements of data transmission and successfully defends against some classic attacks such as black holes, gray holes and modified scores, but the algorithm is not handled in different network scenarios.

2016, Al-Ani, et al., [19] A QoS aware Routing based on Ant Colony Optimization (QoRA) is proposed. QoRA calculates QoS parameters locally and avoids congestion throughout data transmission with the help of two architectural components. The first element is the QoRA entity that runs on each node to identify the appropriate route based on the specified QoS requirements. The second component is the SNMP entity, which consists of a Simple Network Management Protocol (SNMP) agent and a management information base (MIB). SNMP obtains the relevant information of the node locally. Based on these information or values, QoS parameters will be calculated and congestion during packet forwarding will be avoided. But this technology has a high end-to-end delay.

2016, S. B. Prabaharan, et al., [20] A hybrid ACO routing protocol that emphasizes safety and energy efficiency is proposed. This agreement is here in after referred to as Hybrid ACO for short. Unlike traditional ACO routing protocols, this hybrid ACO routing method uses simulated annealing (SA) to select the next hop node. SA is a probabilistic method, and the probability of falling into a local optimum is very low. In the initial stage of transmission, each link in the network is assigned a confidence value as the initial pheromone value. Once the source node needs to discover a new route, it will issue a FANT. Before moving on to the next hop, each FANT uses SA to put the five neighboring nodes of the current node on the candidate list and mark it as L1. Each selected neighbor node places its own five neighbor nodes on the candidate list, marked L2, and also uses SA. The best node in L2 is determined based on the confidence value. Once the best node L2 is selected, the corresponding node upstream of L1 is also identified. Then FANT moves to the identified node at L1. Every time FANT moves, the trust value of all links is updated. For links that FANT has not visited, the confidence value steadily evaporates. Repeat the same method until FANT reaches the target node or reaches the maximum path length. The novelty of this proposal is mainly that FANTs identify the next hop node by comparing the confidence values of 25 selected nodes within a two-hop distance. Additionally, to find the path with the least node reuse and distribute the load across the network, this hybrid ACO routing protocol has built in system randomness to determine the path. With the help of randomness in the path selection process, the power consumption of some centralized nodes is reduced. This further improves the stability of the network. However, the definition of confidence-related metrics, such as stability and the selection of appropriate weights for each metric are not clearly described.

2016, Mandhare, et al., [21] The cuckoo search (CS) algorithm is implemented by improving on traditional CS technology by using the reactive routing cuckoo search optimization AODV (CSOAODV) protocol. This investigation aims to secure the QoS path by calculating the best fitness value, because there is no guarantee that the short path can be the best route repetition packet (RRPLY) of the AODV protocol. This model modifies the default settings of the AODV protocol to calculate the best route through the number of hubs from the source to the destination. The minimum number of hubs is considered a route, while CSOAODV considers the best fitness as a calculation of value. The optimal fitness value is determined by three criteria: the calculated remaining power, the number of hops, and the routing load. ***Disadvantage:*** The probability of collision is higher when the node has a long transmission distance.

2017, N. Sureshkumar, et al., [22] The "Design and development of a diffuse and reliable energy efficiency scheme in MANET" was presented. In this research work, they designed and implemented are liability-based stabilization scheme (RSS) to obtain maximum performance. The reliability of the link and the reliability of the node is calculated based on the capacity and mobility indicators. In this sense, they developed a reliability model to obtain the best performance. Based on the analysis of simulation tools, the proposed work has achieved better results than existing solutions in terms of jitter, performance, data packet transfer speed and network reliability. The proposed algorithm provides less data integrity between nodes. The author had to choose some symmetric cryptographic schemes to achieve unlimited complexity.

2017, Masood Ahmad, et al., [23] This document uses the bee algorithm to divide the ad hoc mobile network nodes into different groups. Bees gather for activities. The proposed clustering based on the bee algorithm forms clusters with less resources (such as power and bandwidth utilization) in an efficient way. According to the degree of the node, the behavior of the neighbor, the direction of the movement, the speed of the movement and the remaining energy, a node is selected as the head of the group. Due to the high efficiency characteristics of bees and the consideration of maximum parameters, the proposed technology inspired by the foraging behavior of bees provides efficient and stable cluster formation. It also avoids control message overload. This work has been mathematically verified and simulated for different scenarios. The simulation results are compared with existing grouping schemes. The simulation results show that the clustering technology based on the bee clustering algorithm is better than the existing schemes under consideration. The foraging behavior of bees should be applied to real-time self-organizing mobile network scenarios.

2018, YongQiang et al., [24] In order to improve the reliability of routing protocols in wireless ad hoc networks, a reliable ant colony algorithm suitable for dual-channel systems is proposed. In the DSAR algorithm, a two-layer mechanism for separating the control layer and the data layer is established, which reduces data packet collisions and channel transmission delays, and increases network bandwidth. At the same time, when the data layer has enough free resources, the blocked routing service is transferred to the data layer through the control layer in real time to complete the joint scheduling of the two-layer network and reduces the congestion rate. In addition, a reliability prediction mechanism is also proposed, which improves the reliability of the link and reduces the probability of rerouting. At the same time, in view of the dynamic changes of the ad hoc network topology, the ant colony algorithm is used to adapt to the dynamic changes of the network topology. The integral reliability value of the proposed reliability prediction model is used as one of the bases for the pheromone update of the ant colony algorithm. The simulation results show that, compared to the classic AODV and Energy-Efficient Ant-Based Routing Algorithm (EEABR) models, a reliable ant colony algorithm based on dual-channel conditions (DSAR) improves the reliability of the routing protocol. But this algorithm is not suitable for many real-time applications.

2018, DipikaSarkar et al., [25] In this document, a routing scheme called Enhanced Ant AODV has been proposed for MANET. The performance of the proposed scheme has been evaluated together with the other three reactive protocols AODV, DSR and enhanced Ant DSR. From the simulation results, it can be said that Enhanced Ant AODV provides better results than Enhanced Ant DSR, AODV and DSR in terms of packet transfer rate, throughput, average end-to-end delay and node survival rate. The performance analysis of the proposed scheme in terms of packet loss rate, power consumption and jitter remains to be further studied. The performance comparison between Enhanced Ant AODV and ANT/AODV, Ant DSR and Ant/Dymo can will also be carried out in the future. In addition, the available bandwidth of the link can be used as one of the path selection parameters to ensure the availability of bandwidth in advance. If a routing error occurs, the protocol must also consider using the suboptimal route of the new route. The proposed technology can be applied to the Adhoc Network (MANET). The location of the node is known in MANET because it is a network based on GPS (Global Positioning System). Therefore, the reliability of the link can be measured by considering the distance rather than the strength of the received signal. This will reduce the computational load on the node. However, there are no proposed solutions dealing with packet loss rate, power consumption and jitter measurement.

2018, Hang Zhang et al., [26] This paper proposes SAFEACO, which is a routing protocol based on ant colony optimization, which enhances the MANET of security-conscious fuzzy logic. SAFEACO is a hybrid routing method inspired by the Ant Hoc Net routing mechanism, which applies a distributed fuzzy logic detection system to exclude abnormal or malicious nodes from the routing process. SAFEACO applies the ACO algorithm to find the best route for effective packet transmission. At the same time, the fuzzy logic-based detection system dynamically updates the reliability level of the node. The detection system performs robust evaluation of nodes based on the limited network traffic information in the neighborhood collected by the nodes, and has built-in high fault tolerance, which can reduce misclassification. The performance of SAFEACO in MANET and VANET (self-organized vehicle network) scenarios was studied. In this article, three well-known cyber-attacks are presented and implemented to test the resilience of SAFEACO in complex environments. Simulation results from various experiments show that SAFEACO has good scalability in different MANET and VANET scenarios, and achieves efficient routing by providing high PDR and low or comparable end-to-end delay and overhead. Judging from the results of the evaluation, SAFEACO has demonstrated high efficiency in the routing process. However, so far it does not consider any QoS-related routing metrics.

2018, Aparna A et al., [27] In this research work, a novel opportunistic routing protocol is proposed to meet the challenges of network security and QoS improvement. Two algorithms are designed in this article. First, he proposed and designed a new QoS improvement algorithm based on the Ant Colony Optimization (ACO) scheme of the swarm intelligence method. This method uses Received Signal Strength Indication (RSSI) measurement to determine the distance between two mobile nodes in order to select an effective communication path. This new routing protocol is called the QoS Mobility Aware ACO (QMAA) routing protocol. Secondly, the author designed a security algorithm for secure communication and user authentication in MANET in the presence of an attacker on the network. Combined with the security algorithm, a QoS aware protocol called Secure QMAA (SQMAA) is proposed. SQMAA realizes secure communication while ensuring QoS performance for existing routing protocols. The simulation results show that, in the presence of malicious attackers, compared with QMAA and the next-generation routing protocol, the performance of SQMAA is efficient. This document only evaluates malicious attacks.

2018, Chintalapalli et al., [28] A secure routing algorithm is proposed, which relies on a hybrid optimization technology called M-Lion Whale to find the best routing considering multiple goals such as power, distance, delay, trust, and link life. It consists of two mechanisms: the lion algorithm and the whale optimization algorithm. The fitness function is designed according to the five goals of providing QoS. Trust as a metric provides security for routing and maximizes network performance. The M-LionWhale algorithm is compared with TQR, WOA, and LA in the following indicators: energy, performance, and PDR; the results show that M-LionWhale maximizes security through effective routing methods while ensuring service quality. The M-LionWhale algorithm does not improve other QoS indicators.

2019, Kavikondala Praveen Kumar Rao et al., [29] This document suggests a built-in energy saving mechanism with an active MANET routing scheme. The routing scheme is used for the power level and movement of the nodes. The calculation of energy cost is based on the evaluation of the node energy consumption level, using K-Means grouping and AODV (Adhoc On Demand Distance Vector). The data packet is protected by (AES), and the data is sent from the source to the destination. The proposed method model "K-Means-AODV-ACO-AES" is compared with the existing optimal key management (OKMSDT) and protected AODV (Sec-AODV) for secure data transmission. From the comparison results, it can be seen that K-Means-AODV-ACO-AES" increased the

packet delivery rate (5%), while the end-to-end delay (6%) and energy consumption (7%) decreased, and fell in a safe environment (8%). The author it is believed that in the process related to self-organizing network security, any hybrid method improvement can be carried out in the future to further improve.

2019, Rodney Sebopelo, et al., [30] This document proposes an efficient security mechanism based on machine learning as a solution to detect and identify malicious attacks in real time by classifying data packets as normal or abnormal. To this end, the author conducted experiments using Logistic Regression (LR) and Support Vector Machines (SVM) to select the best predictive model using the Iris data set. The results obtained show that the performance of LR is better than SVM, and the detection accuracy is 100%. Therefore, LR is more suitable for identifying malicious attacks in MANET. In addition, the author proposes and designs a framework for real-time detection of malicious attacks on MANET based on packet behavior using the LR model, and gives the components. The author believes that if this framework is implemented in MANET, it can greatly reduce the attack rate on networks without infrastructure. The author must implement the ideas discussed in this document in a real-world MANET network to evaluate its effectiveness and performance.

2020, Taj-Aldeen Naser Abdali, et al., [31] the enhanced conventional Particle Swarm Optimization (PSO) was practical and incorporated into the Location Aided Routing (LAR) algorithm to reduce the essential energy consumption. The estimate results through simulation demonstration that the OPSO-LAR can attain high performance related with the pertinent state of the art work in an analogous network situation. In particular, the PSO algorithm was employed for the parameter's optimization in the computation function. It was also used to select two or more parameters (FR & CZR) that control network flooding and coverage of each node. In the parameters optimization in the computation function the PSO algorithm was employed. In this paper new features that enable the LAR algorithm to avoid end delay by authors, which will increase the whole performance of the entire network, mainly energy consumption.

2021,A.Vani, et al., [32] The author introduced an Artificial Intelligence (AI) algorithm based security framework as an approach that recognizes and distinguishes insider threats in real-time by categorizing data packets as normal or abnormal, as well as recognizing and identifying packet dropping nodes over the vector support and logistic regression. The outcomes showed that LR overdone SVM 97 % while SVM revealed 93 % predictive precision. This means that the revealing or variations among the "normal" and "abnormal" of the SVM algorithm are problematic. LR has retained continuity in terms of correctness, specificities, sensitiveness, misidentification and FP rates as well as restrained the End to End Delay (E2ED), Packet Delivery Rate (PDR), and Average Throughput. MANET network energy is of great significance in each node.

CONCLUSION

This paper, give a complete overview of the numerous nature bio inspired routing mechanisms designed particularly for the MANETs. These algorithms fall under the category of SI (Swarm Intelligence) Mechanisms, ML (Machine Learning) and Fuzzy Logic. Swarm intelligence design features a number of properties that are highly desirable to treaty with the issues posed by these networks. The systematic literature review has been carried out in an order to find techniques that are proposed for using swarm intelligence, Fuzzy, and ML in MANETs. There are various techniques that exist in literature but have limitations and constraints. Therefore, intensive research and study was done in the field to study and get in depth knowledge about this topic. Found out that use of artificial intelligence techniques ie. Swarm intelligence techniques such as Ant Colony Optimization, Glowworm Swarm Optimization, and Artificial Bee Colony are better than the traditional routing techniques used earlier. Conversely the main challenge in Mobile Multi-hop Ad-hoc networks is still the routing problem, which is serious by the node mobility. Various approaches were introduced in the modern years which try to handle the problems in this kind of networks, but no one fits best for all applications.

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