DEVELOPMENT OF AUTONOMOUS QoS BASED MULTICAST COMMUNICATION SYSTEM IN MANETS

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ABSTRACT
Multicast Routings is a big challenge due to limitations such as node power and bandwidth Mobile Ad-hoc Network (MANET). The path to be chosen from the source to the destination node requires protocols. Multicast protocols support group-oriented operations in a bandwidth-efficient way. While several protocols for multi-cast MANETs have been evolved, security remains a challenging problem. Consequently, MANET is required for high quality of service measures (QoS) such infrastructure and application to be identified. The goal of a MANETs QoS-aware protocol is to discover more optimal pathways between the network source/destination nodes and hence the QoS demands. It works by employing the optimization method to pick the route path with the emphasis on several QoS metrics. In this paper safe routing is guaranteed using the Secured Multicast Routing offered in MANET by utilizing the Ant Colony Optimization (ACO) technique to integrate the QOS-conscious route setup into the route selection. This implies that only the data transmission may select the way to meet the QoS limitations from source to destination. Furthermore, the track reliability is considered when selecting the best path between the source and destination nodes. For the optimization of the best path and its performance, the optimized algorithm called the micro artificial bee colony approach is chosen about the probabilistic ant routing technique.
Keywords:
Mobile ad hoc network; Multicast routing protocols, Ant colony optimization protocols, MABC, PAR, QoS.

1. Introduction
MANET is a group of self-sufficient mobile nodes that transmit radio signals. Mobile nodes within a direct radio range can interact directly, while people without an indirect range can connect by utilizing an intermediary node for interconnection. Each node operates as a host and often functions as a router in a MANET system [1]. One of the connectivity problems in Figure 1 is that the data in the network are routed from one node to another. Mobile Ad-hoc networks without default topology or central control are also termed ad-hoc mobile multi-hop networks. MANET primary characteristic is the lack of current facilities, self-contained nodes, dynamic networking design, and uniqueness of devices, multi-hop routing, physical safety and bandwidth-restricted interconnections. These characteristics are deemed to be advantageous in settings with no reliable or established network. Due to the particular characteristics of MANET, this is advantageous for applications in business, education and military domains. MANET is also linked to the web, so it doesn't have to function by itself and its included in many appliances [2]. This makes MANET capabilities even outside the physical network available to users. However, it is necessary for a reliable track to be developed from a source node to the destination node, such as delays, outputs and energy use, while using this approach to transmit a data packet to fulfill the QoS standards.

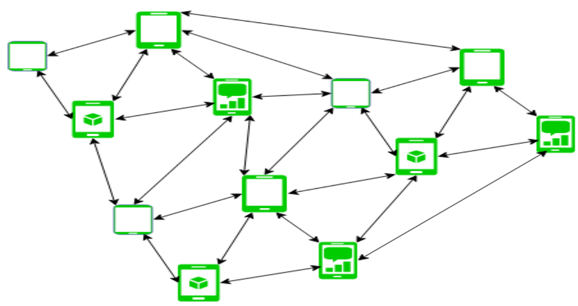

Fig 1: Mobile Ad-hoc network
https://www.geeksforgeeks.org

Quality Of service (QoS) is usually described as a collection of service criteria that the network must meet when transporting the packet source towards its destination. The network should ensure a range of quantifiable service qualities for end-to-end latency and bandwidth, packet loss portability, energy, and time variance to the consumer (jitter) [1,3]. Every mobile node in the Network has to perform traffic conditioning, marking traffic and buffer management (random, early fall), and queue scheduling schemes (priority queuing) to provide QoS regardless of routing protocol. Since MANETs can have various functions (input, interior, and destinations) at the same time as mobile nodes it was observed that all mobile nodes functioning as source (inserted) nodes need traffic conditioning and marking. All mobile nodes must execute buffer management and queue planning schemes[4].

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2.Literature Survey

Md. Mahbubur Rahman et.al [1] designed a weighted metric approach, taking account of various characteristics, including distance, speed between the nodes, and rest of the battery power, to identify the MANET routes. The technique uses a weighted mix of factors, including distance, battery power and speed to select the Radius (MFR) Most Forward method. The procedure increases the network's efficiency and longevity but loses the packet during data sending.

Menaka, R et.al [2] proposed a model that uses fuse variables, trust, and credibility to increase the network performance with non-reliable nodes. Through the evaluation of performance in an unstable environment, a protocol is studied called dynamic source routing (DSR). The reputation system is essential for input from prior success records, node capabilities calculated as confidence value, and node mobility. Reputation and confidence metrics detect the safe path for network data transmission.

S. Sathish et al. [3] designed the IBRDT paradigm for the security of wireless ad hoc networks that provides intelligent beta reputations and dynamical trusts. The concept incorporates beta reputation trust in wireless ad-hoc networks and dynamic trust for safe routing. The packet is discarded because there is a connection mistake with a hostile node that Secured AODV might identify (SAODV). For successful storage scalability, the protocol employs Pseudo-Random Function (PRF), which is used to fix the secret client key via a secret server key.

Mrs. S. Rajanandini et.al [6] also discussed mobile Adhoc Network (MANET) (QoS) is a frequent area of emergence. A mobile ad hoc network is a group of mobile devices that do not utilize a specified design. In keeping with the fast growth of multimedia technology, mobile, and real-time applications, quality services such as outputs, power consumption, disruptions, etc. are maintained tightly.

P. Mohapatra, J. Li et.al [7] discussed a survey of problems with MANET QoS support. The QoS supply of MANETs has been viewed as a tiered perspective. The paper explains the efforts of QoS support on each tier, beginning from the physical and continuously to the application level, as well as the basic difficulties in QoS. There are also some suggestions for interlayer methods to QoS. The paper provides an analysis of future guidelines and problems in MANET QoS support.

Pravin Kshirsagar et.al [6] Determine the usage for various categorization issues and prediction challenges of artificial intelligence. The application of hybrid artificial intelligence to extract classifies, forecast and model features with various algorithms and strategies of optimization [9]. Major advances in all fields of artificial intelligence include significant machine learning presentations, case-based reasoning [13], data-mining, WebCrawler interpretation and translation, and a view of virtual reality[15].

3. Multi-Cast Routing Protocols In Wireless Network

A wireless network has numerous mobile wireless nodes. The network topology changes randomly with increasing nodes. Because of the ever-changing problem and absence of central management, wireless networks may be used directly to create a route to a destination node. In recent years there have been several ad hoc network routing technologies. Due to the complexity of multi-use routing [5]. Multicast routing protocols have several subcategories; some have functionality categories, some have features. Multicast routing increases and is not continuously stable, thus a short review of the multicast routing techniques is given below [6].

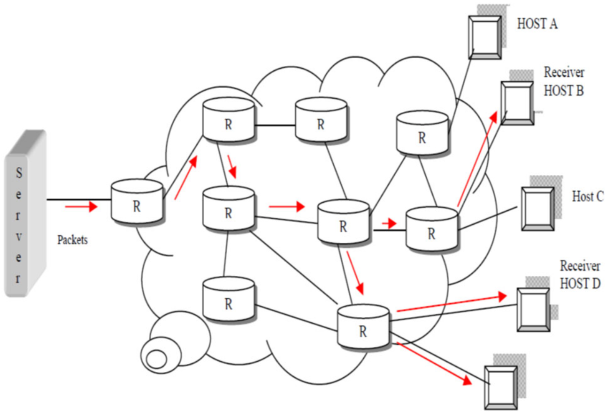

Fig 2: Multicast Routing

3.1 Different Types Of Multi-Cast Routing Protocols

According to the network structure, as shown in Fig.3, the multicast routing algorithms are split into 3 types.

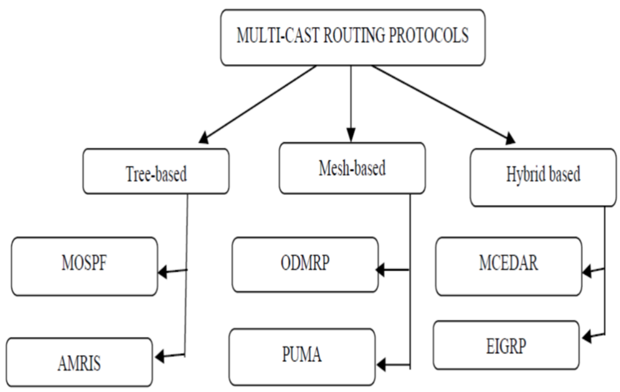

Fig 3: Different types of Multicast Routing Protocols

3.1.1 Tree-Based Multicast Routing Protocols

A tree-based routing protocol [7] offers a common routing tree for transferring data from source to destination, as illustrated in Figure 4. These protocols will also be categorized into the following three types.

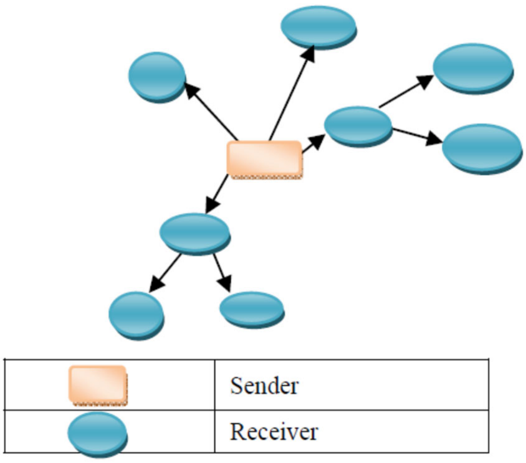

Fig 4: Tree-Based Topology

- Multi-cast Open Shortest Path First Protocol (MOSPF)

The initial protocol for multicast opened short path aims to expand the OSPF (Open Shortest Path) protocol to provide effective multi-cast networks. In this protocol, IGMP is employed by broadcasting IGMP membership requests for participation in a multi-cast group and the host IGMP membership reports are sent [8]. Group data is conveyed by OSPF Link State Publishing floods in the network. The routers utilize this information to construct the shortest path tree with root source and multi-casting leaf nodes. For each source group pair, another shortest route is constructed [3,4].

- Ad-hoc Multi-cast Routing protocol utilizing Increasing id-numbers (AMRIS)

AMRIS constraints are not provided in MAODV, as they are dependent on the related multicasting. AMRIS is a protocol on request that constructs a common multi-cast transmission device supporting many recipients within a multicast and shared data transmission tree. A multi-cast transaction ID is issued to every node in the network [6,8]. Each node in the network will be assigned the multi-transaction Identification number.

3.1.2 Mesh-Based Multi-Cast Routing Protocols

The mesh based protocols provide multiple paths between transmitters and receivers.

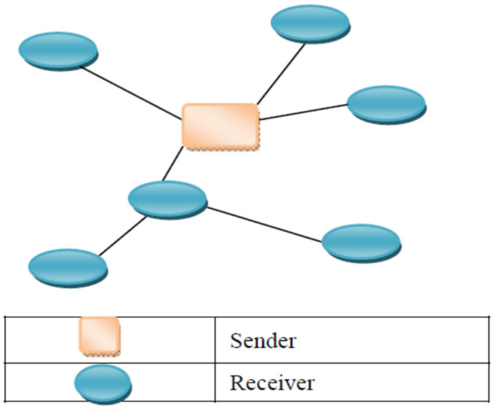

Fig 5: Mesh-Based Topology

- On-Demand Multi-cast Routing Protocol (ODMRP)

The ODMRP multi-cast routing protocol upon request is a mesh method using a node mesh called transmission nodes (TNs) [9]. These nodes transmit information packets from source to destination to maintain a cache to allow duplicate data identification and administration. A soft-state technique is often used to keep group numbers [8,9]. The reduction in delay channel/storage and wide connectivity makes this protocol in mobile wireless networks more appealing.

- Priority Unavoidable Multiple Access Protocol (PUMA)

It allows any source to broadcast multicast packets to a specific multi-cast cluster. The procedure of election is comparable to the tree approach. It uses the distributed method to choose one of the group organizers of the receivers [10]. An end of a packet is one of the shortest pathways between the transmitter and the group organizer. In a network, the data packet is flooded and the packet identification cache is retained in the nodes to discharge duplicate packets.

3.1.3 Hybrid Based Multi-Cast Routing Protocols

The hybrid protocols for the multi-cast routing combine the tree and the mesh characteristics

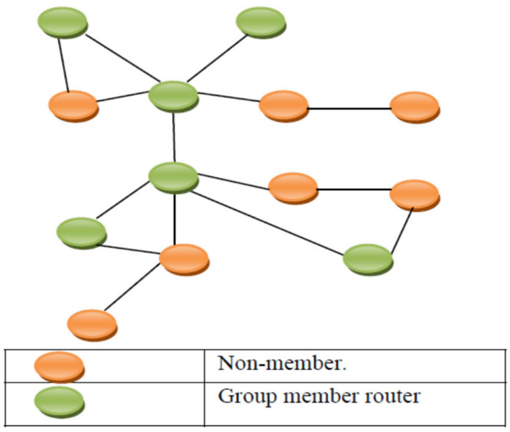

Fig 6: Hybrid Based Topology

- Enhanced Interior Gateway Routing Protocol (EIGRP)

A major enhancement via IGRP is an improved Distance Vector Protocol (DVP) employing the Improved Interior Gateway Routing Protocol (EIGRP). Conventional DV protocols, such as RIP and IGRP, transmit routing updates, vector storage (or hoping next) at an optimal distance from each location (or metric) [3,4]. EIGRP differs by storing not just the optimal route, but also all routes, which means that convergence, may be considerably improved [5]. Furthermore, EIGRP updates are supplied only with a change in the entire network; upgrades are not regularly.

- Multi-casting using Core Extraction Distributed Ad-hoc Routing Protocol (MCEDAR)

The multi-cast routing approach is spread across ad hoc networks for core extraction. It adds the robustness and the efficacy of Tree-based Transfer Protocols to mesh-based routing protocols. It isolates the control technology from the present [2] infrastructure for data transmission. The separation allows for a simple, low-cost control system while providing very efficient data transfer.

4. Ant Colony Optimization Protocols

MANET issues are solved via Ant Colony Optimization (ACO). MANET has a dynamic topology and every node has restricted resources like power and board memory for battery computation [10]. This is referred to as less network infrastructure. MANET uses a variety of routing protocols that regulate the travel in the network of message packets. Each of these protocols is used in the setting of the network.

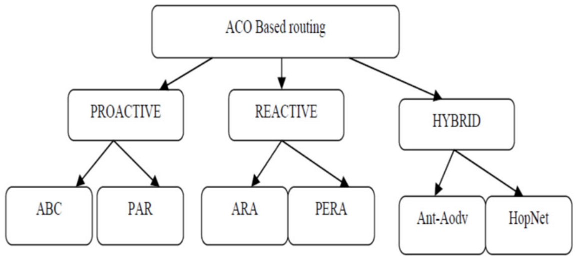

Fig.7: Ant Colony Optimization protocols

4.1 Proactive Ant Colony Optimization Based Routing Protocol

- Ant Based Control (ABC)

Ant Based Control Models is a telecommunications network ant colony optimization (ACO) based method. ABC employs predefined shortest travel routes and uses an alternate mobile agent type for usage with network management on an algorithm basis [11]. The ABC algorithm continually explores the network from source to destination using several agents called ants. When they arrive at a node, they update the pheromones for its whole node, which is the probability that each neighbor node is selected.

- Probabilistic Ant Routing (PAR)

Two types of agents are used in this method known to be forward and backward ants. The FANTs are stochastic and traverse the network to gather data on the network traffic. When the FANT reaches its destination, the rear ant (BANT) is placed and the stack stored in the FANT is inherited. The BANT is decisive, and FANT has been put on a major priority queue [9,10]. The BANT rebuilds the route in the FANT network. This data is used to regularly update the routing tables and other information structures. This ant algorithm is a reinforcing learning version. The parameters for updating the pheromone are the following [11]:

- Increase the node expectation probability, from which the ant packet has arrived instantly.
- Reduce other hops' probability. i.e. offers ant route positive feedback. This positive feedback indicates the optimal way rapidly.

4.2 Reactive Ant Colony Optimization Based Routing Protocol

- Ant Colony-Based Routing Algorithm (ARA).

This method provides a novel way for ad hoc swarm intelligence routing on-demand. Ant colony algorithms (ACO), which constitute a subclass of swarm intelligence, can solve complex issues via collective action by simple ants. The fascinating thing is that the ants don't have to interact directly for the solution but communicate using stigmergy. Stigmergy implies indirect communication through changing the surroundings of persons. In recent times several methods have been proposed to tackle various issues such as optimization issues based on the optimization of the ant colony (ACO) [13]. The anticipated ARA latency is relatively limited, as the routing tables between the nodes are not exchanged. The forward Ant (FANT) and backward Ant (BANT) packets do not convey any significant routing information but do not communicate any routing information. In the data transmission packets, a unique sequence number is delivered. Maintenance of the route is done by data packets; extra routing information must not be transmitted [12,14].

- Probabilistic Emergent Routing Algorithm (PERA)

The PERA is built on the swarm Intelligence concept for probabilistic emerging routing algorithms. This technique uses a flooding search to determine and maintain many pathways between the source target couples in the network to make the process of road find. The finding of the route in the technique is by two sorts of agents or forward ants or backward ants. These agents create and update each neighboring node's probabilistic model. The packets of the agent or Ants are tiny in size [15,16]. A neighbor's potential risk shows the relative likelihood of the neighbor's transport and package delivery. This method has minimal overhead compared to AODV. PERA provides the data packet using an alternate route instead of storing data packets until a new route is identified.

4.3 Hybrid Ant Colony Optimisation Based Routing Protocol

- Ant-Aodv

Ant-AODV is a combination of anti-routing protocols and AODV routing to circumvent the inherent inconveniences. This hybrid technique enhances the connection of nodes, lowers delay from end to end and latency in road find. In typical ant-based routing approaches, the creation of roads depends on the node visitors and the paths provided for them. If the node wishes to transmit data packets into a destination, then it has no route information, the data packets must be kept in the sender buffer until they reach an ant and offer the optimal route to that destination. There is no connection-oriented maintenance in the AODV environment in Ant Routing Algorithms developed so far [17]. On the opposite side, AODV takes too long to make a connection because of the delay in the road discovery phase wherein the data packets are sent without delay in Ant Based Routing when the node has a route to a destination. AODV cannot be used for this lengthy delay before the actual link is formed in real-time communications systems.

- Hybrid Ant colony optimization (HopNet)

Another hybrid ACO protocol based on the ant-natural character of hopping between zones is the HopNet algorithm. Compared with previous hybrid protocols, this method is very adaptable for a wide network. The ZRP and DSR protocol method has the extract features. This method comprises a local proactive route discovery and reactive communication inside a node's district between the districts of the regions. The network is split into areas that are the location of the node. The area's size is not directly defined but by the radius, length measured in hop numbers. An ant selects a node in this manner for the optimum path to the given destination from the sources node. First, an ant picks a node that no other ants have visited [8,9,10]. The ant examines all connections to a node not yet reached before the next-hop node is selected. If no unexplored node exists, then the ant finds the next hop by taking into account the pheromones level.

5. Issues Related To QoS In Manet

QoS (Quality of services) is a feature of MANET. The MANET architecture is changing because the wireless nodes are dynamically connected and disconnected. QoS considered essential from the application layer to ensure that certain network characteristics have the appropriate values like a delay or jitter for bandwidth [8]. The QoS techniques are strictly necessary for most current communication systems. The objective of utilizing QoS is to determine the network when data sent over the network is delivered promptly. The needed quality and use of network sources are optimized in this instance [6,7,8].
The main issues related to QoS in MANET are:

Unreliable communication channel: Bit errors are the biggest problem with wireless connections. This is due to strong interference [3], thermal noise, or a decrease in many directions. MANETs can lead to data leaking using the wireless network.

Maintenance of the route: The dynamic character of network topology is also very difficult to maintain and the changing behavior of the communication media. During the data transmission process, the established routing path might be disrupted. It thereby takes little overhead and latency to maintain and update routing routes [6]. This means that resources at intermediary nodes must be reserved.

Mobility of the nodes: MANET nodes are regarded as free and randomly moving nodes. The topological data, therefore, has to be constantly updated
Limited power supply: Because of the inefficiency of mobile nodes, enabling QoS uses more power. This is illustrated by a quicker battery discharge.

Lack of centralized control: The Adhoc network mobile nodes can be connected or left. Then the network is automatically formed [9]. Centralized control is not available. This increases the overall complexity of the model.

Collisions: Nodes on the shared medium have to communicate with each other. This creates interference and channel dispute difficulties. TDMA (Time Division Multiple Access) systems can be used for peer-to-peer data transmission, where each mobile node can be transmitted at a predetermined time. Other alternatives for each transmitter include using separate CDMA (Multiple Access Coding Division) frequency bands or scatter codes [12].

Security: It's an essential MANET module. The actual communication channel is insecure. For these networks, safety mechanisms need to be designed.

6. Proposed System

SECURED MULTICAST ROUTING IN MANET USING ANT COLONY OPTIMIZATION APPROACH

Multicasting is regarded as a key challenging task in mobile Adhoc networks, which means that safety issues in terms of packet loss/drop and network performance are prevented carefully. This proposed system introduces the new Secured Multi-Cast Routing Framework in MANET with the Ant Colony optimization technique which aims to choose the optimum route path for a stable connection [20]. The selection is done by examining the different QoS parameter values in moving nodes in the environment and finding the nodes to route to the QoS parameters. The purpose of multicast routing is to pick the most popular route tree between the source node and the destination nodes that meet QoS requirements [1,5]. This is because the ecosystem might consist of many routes in the external world between source and destination nodes. The optimal route selection to avoid repeated data transfer was included inside the suggested system. One may select a technique of Ant Colony Optimize amongst many Paths between the source node and the target nodes [8]. To secure the routing between the source and several target nodes, the following techniques are employed:

1. Determine QoS values of mobile nodes and stable link routes in the ecosystem.
2. Build a multi-cast route tree using the Mobile Node QoS attribute values
3. Find the optimum route between source and destination nodes using an Ant colony optimization approach

To secure routing between both the sources and destination nodes with decreased packet loss/packet delay, the essential techniques are adopted in the proposed model shown in figure 8. The selected mobile nodes for packet transmission should satisfy stability as the most essential performance parameter in this approach [14,15]. The next sections provide detailed explanations of each step involved in the approach.

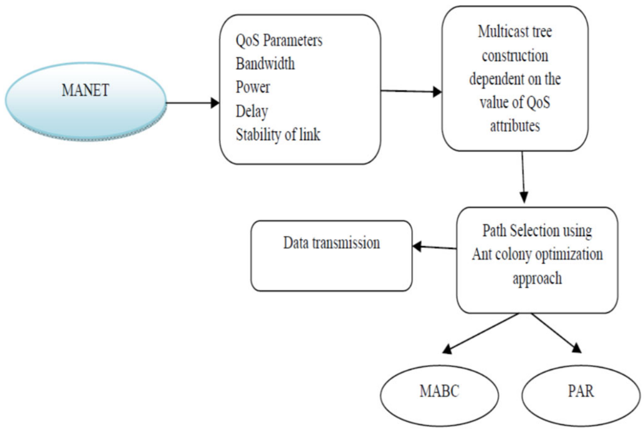

Fig 8: Block diagram for the secured packet transmission through multicast routing in MANET

6.1 QoS Mobile Nodes Assessment available in the MANET environment

Routing is perceived as the most challenging issue in the mobile Adhoc system, where mobile nodes have dynamic mobility behavior. Mobile nodes are the network with fewer nodes to determine the route while the packet is being transmitted. The mobile Adhoc network has scarce resources and therefore has to be managed carefully for safe packet delivery [16]. During this analysis, mobile node selection from QoS has been done to provide improved routing, with less packet loss/drop data transfer [5]. The six distinct QoS restrictions such as the available bandwidth, the available power, end-to-end delay, and packet delivery ratio, throughout the decision phase[20].

1. Available Bandwidth (BW)

The available bandwidth in a multi-cast connection from the source node to the target node is a bandwidth. The bandwidth available may be computed with Eq. (1)

$$BW = \beta BW_N + (1-\beta)\frac{T_{idle}}{T_P}B_{Channel} \quad 1$$

Where β is the weight factor and value is 0 and1, BWN is the local node bandwidth available in the previous time, the channel idle time for t_{idle}, the time-interval for t_p and bits per second for the channel power for $B_{Channel}$ are accessible.

2. Available Power (P)

The power available in the multicast tree of a node is indicated in Eq. (2)

$$P = P_{Total} - P_{Consumed} \quad 2$$

Where, P_{Total} is the total energy at the node, and all nodes in the network are predefined and fixed and $P_{Consumed}$ is calculated as,

$$P_{Consumed} = \frac{P_{Threshold}d^n}{H} \quad 3$$

Where, $P_{Threshold}$ threshold power at the node, d is the distance between two nodes, n is path loss exponent and H is constant.

3. Stability of link

A stable connection based on link stability factor or LSF was required to evaluate a QoS aware measure. The stability factor is estimated by the position count, by which signal strength and hop count as QoS parameters are obtained [17]. The dispute count is the number of nodes in the transmission range of any node and may be found by sending regular packets to the one-hop neighbor. On the other hand, for calculating the number of its neighbors, the transmitting node gets regular packets from all the nearby nodes [8].

4. Packet Delivery Ratio (PDR)

The packet delivery ratio is the ratio of acquired data packets at the destination to the number of databases supplied by the source given in Eq (4). The efficiency and precision of MANET routing protocols may be determined by this measuring performance

$$Packet\ delivery\ ratio = \frac{Total\ data\ packets\ received}{total\ data\ packet\ sent} \times 100 \quad 4$$

5. Average End-to-End Delay (AE2ED)

This is the average time that data packets are supplied to the destination node from the source node. Include any delay for each successful data packet delivery to calculate the average final delay and split that amount by the number of successfully received data specified in Eq. (5).

$$Average\ end\ to\ end\ delay = \frac{\sum(Time\ received - time\ sent)}{Total\ data\ packets\ received} \quad 5$$

6. Throughput (TH)

The actual number of bytes which are processed by a host node during the interval is the throughput. Eq. (6) calculates the average performance ATH.

$$ATH = \frac{1}{n}\sum_{i=0}^{n}\frac{Bytes_i}{Time_i} \quad 6$$

6.2 Constructing Multicast Route Based on QoS Parameter Values

The multicast tree would be built between the source node and the number of destination nodes after the mobile nodes in the MANET environment is calculated. This is done by utilizing mobile nodes that match their stability link value [16,17]. Given the 15 mobile nodes in the environment where mobile node 2 is the sender and the mobile destination nodes 5,9, 10 and11, the Multi-Cost Route Tree may be built, as illustrated in Figure 9 for this case.

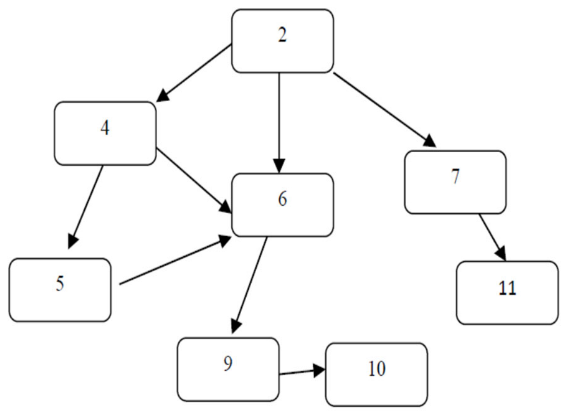

Figure 9: Sample Multicast Tree Constructed

Figure 9 depicts the creation of an example tree based on the potential route between source nodes and the destination node. The figure above illustrates the mobile identity for the routing path with the ids1,3, 8,12,13,14. This is due to its characteristics of not meeting the packet forwarding QoS criteria [19]. Therefore, just for dependable and secure packet transmission, the remaining mobile node which meets the QoS criteria is selected.

6.3 Optimal Route Path Selection using Ant colony optimization approach

In the above section, multi-tree construction between the source and target nodes according to QoS parameter values is performed. The multi-cast tree builds multiple paths between the source and target nodes. Take into account that the alternative path between nodes 2 and 10 is2-4-5-6-9-10,2-4-6-9-10, and 2-6-9-10. The optimal path from node 2 to node 10 is chosen in accordance with the transmission of the packet, which leads to a reduction of costs and delayed time [20]. The Ant Colony Optimization (ACO) technique is used to find and pick the optimal path feasible. The goal is to increase network life and decrease delays. The ACO algorithm is the expected solution [5]. The QoS parameter values may be used as ideal trajectory routes between the source node and many destination nodes to identify optimal solutions. This optimum method enables for a safe, minimal packet loss and packet delay routing. The safe routing may be achieved with the stability of mobile nodes and the resources [19].

7. Result and discussion

The efficient performance measurement of the suggested system is conducted in this section. This software is NS 2.34 and works with the Linux simulation platform. Figure 13 shows the simulation variables utilized for performance analysis of both optimization protocols. . Table1 specifies the major scenario solution parameters. Figure 10 illustrates two optimization protocols with PDR performance assessment. For both optimization protocols Figure 11 displays the delay performance analysis. Figure 12 shows the Number of packets sent Vs Throughput for both optimization protocols. Table 2 describes the comparative performance between proposed MABC and PAR. with existing ACO routing algorithm.

Table 1: Simulation Parameters

Simulation Parameter	Value
Simulator	NS2.34
ANT Optimisation protocol	MABC,PAR
Number of nodes	25,50,75,100,125,150,175,200
Simulation time	120s
Pause time	20 s
Transmission Range	250m
Mobility speed	15s
Number of packets	10,15,20,25,30,35,40,45,50,55,60
Number of runs	5

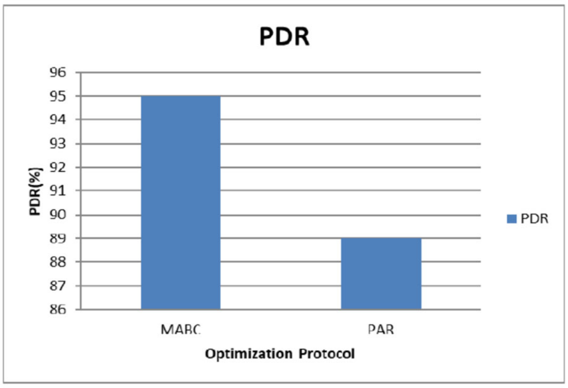

Fig 10: Performance Analysis of PDR

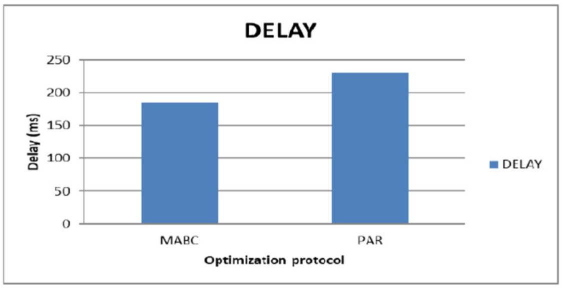

Fig 11: Performance Analysis of Delay

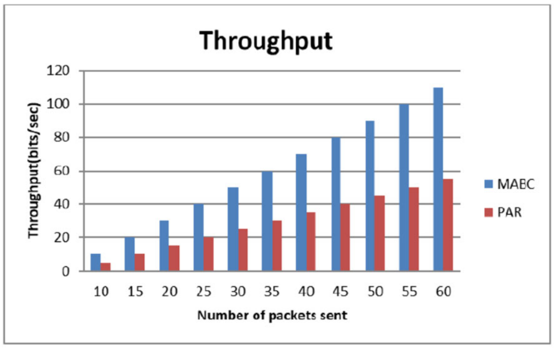

Fig 12: Number of packets sent Vs Throughput

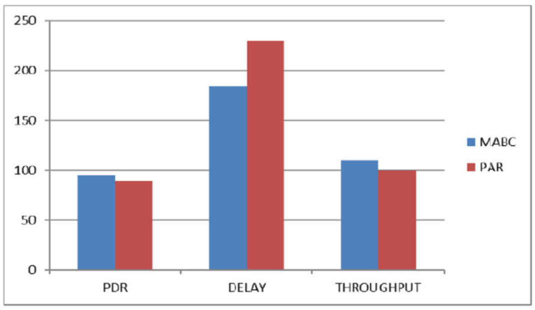

Fig 13: Performance Analysis of MABC and PAR optimization Protocols

Table 2: Comparative Performance of MABC and PAR Optimization Protocol

Scenario	ABC	ARA	PERA	MABC	PAR
Available Bandwidth (BW)	90.22%-89.34%	89.45%-88.23%	922.02%-90.45%	98.3%-96.82%	97.84%-93.5%
Available Power (P)	0.34-1.07	0.44-0.98	0.38-0.99	0.22-0.92	0.82-2.2
Stability of link	1.7s-3.4s	2.3s-3.8s	1.9s-3.2s	2.5s-4.9s	3.3s-7.1s
Packet Delivery Ratio(PDR)	0.3-1.9	0.8-1.7	1.1-3.6	1.7-6.2	1.81-6.91
Average End-to-End Delay	4.9s-5.9s	5.3s-6.4s	5.3s-6.3s	2.48s-3.07s	3.28s-4.01s
Throughput (%)	89.7%-86.3%	88.98%-87.98%	87.34%-85.8%	96.7%-90.89%	95.89%-86.2%

8.Conclusion

For mobile Adhoc networks, such as educational institutions and software companies in various real-world apps, it becomes necessary to play the function of multi-cast routing, as data communication occurs simultaneously among numerous people. The determination of the optimum route for data packet transmission across numerous mobile nodes would ensure the data packet is transmitted securely. The quality of service is based on factors such as the throughput, packet delivery ratio (PDR), a delay. It evaluated the performance of the MABC Protocol above that of the PAR protocol. In this paper, the proposed MANET Secured Multicast Routing with the Micro Artificial Bee Approach (SMR-MABC) helped to determine the mobile nodes, which fulfill the numerous QoS parameter values based on which continuous multicast tree construction can be achievable. The MABC approach was chosen for optimum route path between different possible routes, based on measures such as network life and greater consistency during the construction of the multicast tree. The experimental analysis as carried out in the NS2.34 simulation model further shows that the proposed system contributes to increased performance and improved safety.

References

1. Md. MahbuburRahman and Md. Akhtaruzzaman, *"An Efficient Position Based Power Aware Routing Algorithm In Mobile Ad-Hoc Networks,"* International Journal of Computer Network and Information Security, vol. 7, pp. 43-49, 2016.
2. Menaka, R., V. Ranganathan, and B. Sowmya, "*Improving performance through reputation based routing protocol for MANET," Wireless Personal Communications,* Vol. 94, No. 4, pp. 2275–2290, 2017.
3. Sathish, S., Ayyasamy, A. and Archana, M., *"An Intelligent beta reputation and dynamic trust model for secure communication in wireless networks,"* In Industry Interactive Innovations in Science, Engineering and Technology, Springer, vol.11, pp. 395-402, July 2018.
4. S. Sharma, *"A secure reputation-based architecture for manet routing,"* in proceedings of 4th International Conference on Electronics and Communication Systems (ICECS), Coimbatore, pp. 106-110, 2017.
5. Singal, G., Laxmi, V., Gaur, M.S., Todi, S., Rao, V., Tripathi, M. and Kushwaha, R., *"Multi-Constraints Link Stable Multicast Routing Protocol In Manets," A*d Hoc Networks, vol. 63, pp. 115-128, 2017.
6. Dr. Sudhir Akojwar, Pravin Kshirsagar, Vijetalaxmi Pai *"Feature Extraction Of Eeg Signals Using Wavelet And Principal Component Analysis"*, National Conference on Research Trends In Electronics, Computer Science & Information Technology and Doctoral Research Meet, Feb 21st & 22nd ,2014
7. Mrs. S.Rajanandini, K.Reshma, *"Quality Of Service In Manet"*, IJCSMC, Vol. 5, Issue. 3, March 2016, pg. 186 – 191, ISSN 2320–088X
8. P. Mohapatra, J. Li and C. Gui, *"Qos In Mobile Ad Hoc Networks"*, QoS in Next Generation, Wireless Multimedia Communication Systems, IEEE Wireless Communications , June 2003, pp 44-52.
9. Pravin Kshirsagar and Dr. Sudhir Akojwar, *"Novel Approach For Classification And Prediction Of Non Linear Chaotic Databases"*, International Conference on Electrical, Electronics, and Optimization Techniques, March 2016.
10. Amit Garg" *Modified Energy Efficient Quality Of Service Provisioning Based On Energy And Preemption*

For Mobile Ad Hoc Networks" International Journal of Future Generation Communication and Networking Vol. 13, No. 2, 2020 pp.889-907

11. Orchu Aruna, A.K. Prathipati, *"Qos Signing And Routing In Manet",* International Journal of Engineering Science Invention, Volume 6 Issue 9,September 2017 , PP. 14-19
12. Himnashu Sharma, Omkar Singh, Vinay Rishiwal, M I H Ansari, *"Energy Efficient Routing Protocol Prolonging Network Life Time For Manets"*, International Journal of Scientific & Technology Research (IJSTR), Volume 8 - Issue 8, pp 1902-1908 August 2019.
13. Pravin Kshirsagar, Dr. Sudhir Akojwar, *"Classification & Detection Of Neurological Disorders Using Ica & Ar As Feature Extractor",* International Journal Series in Engineering Science (IJSES), Volume 1, Issue 1, 2015.
14. P. Lobo, S. Acharya, R. O. D'souza*, "Quality Of Service For Manet Based Smart Cities",* International Journal of Advanced Computational Engineering and Networking, Vol 5, Issue-2, Feb.-2017
15. Nitin Goyal *"A Review Over Manet- Issues And Challenges"* International Journal of Enhanced Research in Management & Computer Applications, ISSN: 2319-7471 Vol. 2, Issue 5, pp: (24-36), May-2013.
16. Neeraj sathawane1 & Pravin kshirsagar *"Ecg Signals For Chaotic Diagnosis Using Ann, Pso And Wavelet"* International Journal of Electronics, Communication & Instrumentation Engineering Research and Development (IJECIERD) ISSN(P): 2249-684X; ISSN(E): 2249-7951 Vol. 4, Issue 2, Apr 2014, PP.127-136
17. N. Kasthuri *"Qos Analysis Of Wireless Network In Manet"* International Journal of Engineering Research & Technology (IJERT), Vol-5, Issue 17,pp. 1-5,2017
18. Suganyadevi Devaraju *"Dynamic Clustering For Qos Based Secure Multicast Key Distribution In Mobile Ad Hoc Networks"* IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 5, pp.30-37, September 2010
19. Jogendra Kumar *"Application-Independent Based Multicast Routing Protocols In Mobile Ad Hoc Network (Manet)"* Network and Complex Systems, Vol 2, No.1, pp.13-18 2012
20. Rahul P. Bhoyar *" Comparative Study Of Multicast Routing Protocols In Mobile Ad Hoc Networks"* International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Vol 2, Issue 7,pp.692-696 July 2013

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