IJCTA, 9(36), 2016, pp. 95-106

An Optimal QOS Concerned Secure Multicast Routing Establishment in Mobile ADHOC Environment

Anandhi Giri* and S.K. Srivatsa**

Abstract : Mobile adhoc network comprises aset of mobile nodes distributed in the environment having no infrastructure. The task of packet transferring in MANET environment becomes difficult owing to dynamic mobility behavior of the mobile nodes. In order to transfer packets to multiple nodes at the same timein the MANET environment, multicast routing is considered as the most preferred routing technique. However, other security issues would occur while performing MANET based real-world applications, the reasons which are attributed to dynamic mobility behavior and the limited resource constraints. In this research novel framework that focuses on achieving the secured multicast routing in the MANET environmentis introduced. It operates by selecting the route path with the help of optimization algorithm thus focusing on the multiple QoS parameters. In the present work, the secure routing is assured by means of proposing Secured Multicast Routing in MANET using Micro Artificial Bee Colony Approach (SMR-MABC) in which the QOS aware path establishment has been integrated with the route selection process.It means the path which satisfies QoS constraints from source to destination can only be chosen for the data transmission. Further, path stability is also considered while doing the process of finding the optimal path between source and destination nodes. In this work, the optimization algorithm named micro artificial bee colony approach is adopted for selecting the most optimal path. The validation of the proposed research work is performed by evaluating in the MATLAB simulation environment which further implied that the proposed approach offers the most optimal solution with improved security level compared to other existing methods.

1. INTRODUCTION

A mobile adhoc network (MANET) forms a continuously self-configuring, infrastructure-less network of mobile devices connected wirelessly. Each MANET device involves in frequent changing of its links to other devices as it can move freely and independently in any direction.An ad hoc routing protocol is a typical standard for controllingthe decision method employed by node in routing packets between computing devices in a mobile ad hoc network. In case of ad hoc networks, nodes remain unfamiliar about their network topology but it can be discovered typically by means of indication by a new node about its presence and listening for announcements broadcast by its neighbors. The information on its neighbors and the method of reaching them will be learnt by each node so as to announce its ability to reach its neighbors.However, multicast routing becomes a more difficult task in case of mobile adhocnetwork due to its multiple distributed mobile nodes present in the environment. The term multicast (one-to-many or many-to-many distribution [1]) in computer networking refers to a group communication [2] by which simultaneous addressing of information to a group of destination computers becomes possible. However, multicast is not the same as that of the physical layer point-to-multipoint communication.The

* Research Scholar, VELS University, Chennai, *Email: giri_anandhi@hotmail.com*
** Senior Professor, Prathyusha Institute of Technology and Management, Chennai

data distribution in terms of audio/video streaming broadcasts is done to multiple recipients by means of the multicast IP Routing protocols. The multicast also helps the source to send a single copy of data to a single multicast address which is then subsequently distributed to an entire group of recipients.A set of recipients that are interested in a particular data stream is identified by the multicast group is represented by an IP address from a well-defined range. Data received by the IP address is then forwarded to all members of the multicast group.At the point of diverging recipients in the path, the routers between the source and recipients duplicate data packets and forward multiple copies. The best routers at which the packets duplicate in the data stream is identified using the group membership information for optimizing the network usage. The destination of the IP address of the datagram is set to the multicast group address by means of sending data to a multicast group. Any host can acts as a source for sending data to a multicast group.Before sending data to a group, sources need not registerand also need not be the member of the group. During multicast routing in mobile adhoc environment, the event of occurrence of the security violations should be concerned and recovered for ensuring the most trustfulenvironment. In this proposed research work, the matter of security in the multicast routing isfocused in order to provide the secured routing in the mobile adhoc environment. The novel framework is built by focusing on the multiple QoS parameters during packet transmission and the optimal path selection by using the micro artificial bee colony approach. This present approach helps to choose the optimal route path for providing better link stability.The overall representation of the proposed research work is organized as follows: In section 2, detailed analysis of multiple and various analysis works which has been reported earlier is discussed. In section 3, detailed discussion of the proposed research methodology is presented. In section 4, evaluation of the proposed and existing research methodologies in the MATLAB simulation environment is given. Finally in section 5, overall research of the proposed work is concluded along with the simulation result.

2. RELATED WORKS

The brief depiction of the various existing research approaches reported so far is provided in this section. The evaluation of routing protocols for ad hoc networks is based on a given set of parameters which has been examined in the work of Royer et al. [3]. The eight different protocols have been reviewed in this work by analyzing the characteristics andfunctionality for comparison of its merits and demerits.An ant agent based adaptive and multicast protocol has been proposed by Sabari et al. [4] in which the group members desire is exploited to simplify multicast routing and invoke broadcast operations in appropriate localized regimes. This type of multicast protocol helps to achieve packet delivery statistics almost equal to that of the typical multicast protocol however with significantly lower overheads. This is done by reducing the number of group members participating in the multicast structure construction and by providing robustness to mobility so as to broadcast in densely clustered local regions. The simulation results also implied the increased Packet Delivery Fraction (PDF) with reduced overhead and routing loads. In the work of Baburaj et al. [5], a GA-based MAODV model has been described in a view to support the multicast routing optimization algorithm in mobile ad-hoc networks. The parameters as evaluated by the simulation results demonstrated the method with high accuracy and efficiency in realistic scenarios. The future need for comprehensive evaluation of multicast protocol has been implied and suggested on the need for evaluating under the range of realistic mobility models including special cases such as high density and high traffic rates. The review on various characteristics and limitations of the routing protocols has been investigated in the work of Gour [6]. Further, a new path discovery strategy with adoptable Quality of service (QoS) parameters has been proposed for dealing with a dynamically changing network. The traditional genetic algorithm and similarity functions have also been included in the proposed technique for improving the performance of the proposed routing algorithm. The most important component of communication protocols in mobile ad hoc networks was given by Lakshmi et al. [7]. The work explains the typical classifications of the routing protocols such as unicast routing protocol and multicast routing protocol. The design of the protocols is based on the specific goals and requirements with respect to assumptions about the network properties or application area. While comparing with proactive and reactive routing protocols, hybrid unicast and multicast routing exhibited better performance. The survey and characterization of energy efficient routing algorithms for MANETs based on the metrics used for energy efficient routing has been illustrated by Asma et al. [8]. The analysis of such algorithms helped to highlight their strengths and deficiencies.

Gupta et al. [9] has given a platform for understanding the existing ACO based routing protocols and also to know about their performance against traditional ad hoc routing protocols which becomes helpful for choosing the appropriate protocols among many. Hence, a comparative study of various proposed ad hoc routing protocols based on ant colony optimization techniques has been presented. The evaluation and comparison of the various ACO based algorithms has been done against the original ones and observed that the performance results in terms of an end to end delay and routing overhead has been found good for environments of dynamic topology. The work also implies the need for critical performance evaluation of the proposed protocols in terms of simulations and various performance metrics.

Based on the work of Deering[11],MOSPF [10] has been studied as a multicast extension of the unicast link-state protocol OSPF.At every node, the protocol maintains the membership information in addition to global state information of every multicast group in the routing domain. The local router enables the detection of group membership changes in a sub-network after which the information gets broadcasted to all other nodes. By using Dijkstra’s algorithm, any node can compute the shortest-path multicast tree from a source to a group of destinations, if provided with the knowledge of the network state and group membership. This protocol finds good in case of delay constrained multicast routing.

The problem in the proposed method by Zhu, Parsaand Garcia-Luna-Aceves (ZPG) [12] is meant on allowing variable delay bounds to destinations. Dijkstra’s algorithm has constructed the shortest delay path tree which the delay constraint, if could not be satisfied for any destination must be renegotiated unless which the algorithm proceeds by iteratively refining the tree for lower cost. The fundamental principle underlying is based on replacing a path in the tree by another path with lower cost until when a replacement cannot be found. The algorithm always finds if there exists a delay-constrained tree (however not of least cost) as it starts with a shortest-path tree. Widyono [13] has proposed many heuristic algorithms for the constrained Steiner tree problem. The algorithm which showed the best performance has been represented as the constrained adaptive ordering heuristic. While executing the algorithm, a constrained Bell-man-Ford algorithm is used in each step to find a delay-constrained least-cost path from the source to a destination which has not presented in the tree. The found path as well as the destination is then inserted into the tree. The cost of links in the tree is set to zero and the algorithm gets repeated until the tree covers all destinations.

Zone-based Hierarchical Link State routing (ZHLS) [14] is a method of hybrid routing protocol in which the mobile nodes are expected to know their physical locations with an aid of a locating system like GPS. ZHLS method involves in hierarchical addressing scheme that contains a zone ID and node ID. As the pre-defined zone map is well known to all nodes in the network, the node determines its zone ID by itself. Also, virtual link is assumed to connect two zones if at least one physical link exists between the zones. A two-level network topology structure involving the node level topology and the zone level topology has been defined in ZHLS which represents the two kinds of link state updates such as the node level LSP (Link State Packet) and the zone level LSP respectively. A node level LSP contains the node IDs of its neighbors in the same zone and the zone IDs of all other zones.

3. SECURED MULTICAST ROUTING IN MANET USING MICRO ARTIFICIAL BEE COLONY APPROACH

In mobile adhoc network, multicast routing is considered asamajor difficult taskand hence must be carried out with great concern to avoid the security problems in terms of packet loss/drop and network performance degradation. In this proposed research work, novel framework called Secured Multicast Routing in MANET using Micro Artificial Bee Colony approach (SMR-MABC) is being introduced which attempts in selecting the optimal route path to provide the stable link connection. The selection is done by checking various QoS parameter values of mobile nodes present in the environment and finding the nodes which would perform routing that satisfy those QoS parameter values. Being the task of multicast routing, more common present between the source node and the destination nodes that satisfies the QoS condition would be selected after which the route tree would be constructed. This is attributed to the fact that the real world environment might consist of multiple route path between the source and the destination nodes. To avoid the redundant data transmission, optimal route path selection has been implied in this proposed work. It could be possible done by using the micro artificial bee colony approach for choosing among the multiple route path between source node and the destination nodes. The steps involved inachieving the secured routing between the source and the multiple destination nodes are given as follows:

1. Find the QoS values of mobile nodes present in the environment and also the stable link paths
2. Construct multicast route tree using QoS parameter values of mobile nodes
3. Find the optimal route path between source and destination nodes using micro artificial bee colony approach

The above steps are adopted in the proposed research framework in order to achieve the secured routing between the source and destination nodes with reduced packet loss/packet delay. In this work, stability being considered as the most important performance metric should be satisfied by the chosen mobile nodes for the packet transmission. The overallsteps of the proposed research methodology is represented as flowchart in the following figure 1.

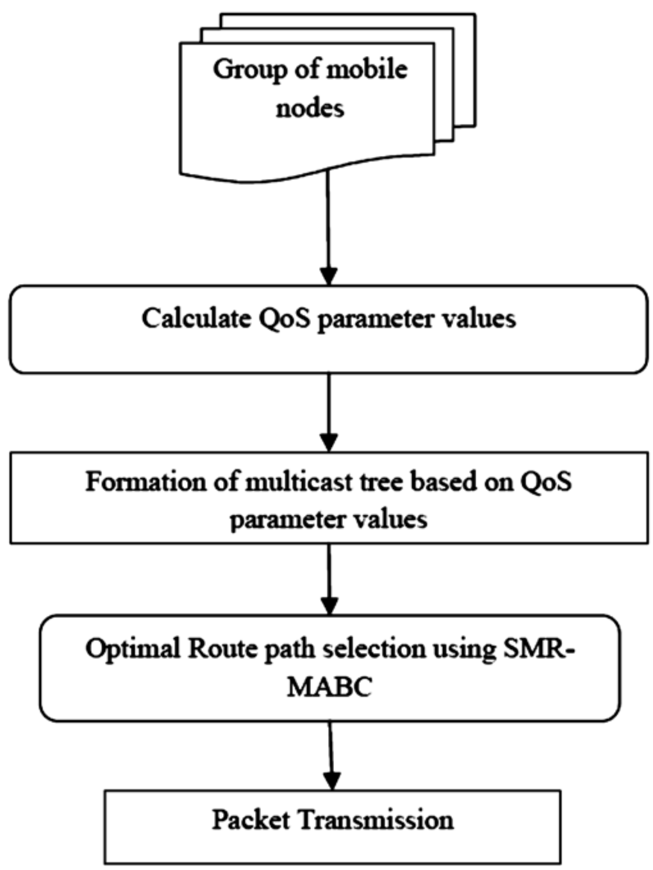

Figure 1: Overall flowchart representing the secured packet transmission through multi cast routing in MANET

The above diagram illustrated the overall flow of the proposed research methodology as it can establish the optimal route path between source and the destination nodes, thus achieving the secured packet transmission. The detailed explanation of every step involved in the approach has been given in the following subsections.

3.1. Qos Evaluation of the Mobile Nodes Present in the MANET Environment

In the mobile adhoc environment wherein the mobile nodes having dynamic mobility behavior are distributed in the environment, routing is considered as the most difficult task. The mobile nodes are infrastructure less nodes in which route path would be established at the time of packet transmission.The mobile adhoc network having limited resources tends to affect the packet transmission and hence must be carefully handledfor secured packet transmission. In this work, QoS based mobile node selection has been done for better routing to secure the data transmission with reduced packet loss/drop. The present work considers the four different QoS constraints such as available bandwidth, available power, end-to-end delay and stability of linkduring the process of route selection.

1. **Available Bandwidth (BW):** Available bandwidth (BW) represents an available link bandwidth in the path from source node to the destination node in the multicast tree. The available bandwidth can be calculated by using Eqn. 1.

   $$BW = \alpha BW_L + (1-\alpha)\frac{T_{idle}}{T_p} B_{Channel}$$

   where, α is the weight factor and its value lies 0 and 1, BW_L is the available local bandwidth of the node in thepreceding period, T_{idle} is the channel idle time, t_p is the timeinterval period and $B_{Channel}$ is the channel capacity in bitsper second.

2. **Available Power (P) :**The available power of a node in multicast tree is denoted by

   $$P = P_{Total} - E_{consumed}$$

   where, P_{Total} is the total energy at a node and it is predefined and fixed for all the nodes in the network and $P_{Consumed}$ is calculated as,

   $$P_{consumed} = \frac{P_{Threshold} d^n}{K}$$

   where, $P_{Threshold}$ predefined threshold power, d is the distance between two nodes, n is path loss exponent and K is predefined constant.

3. **Available Delay(D) :** The delay (D) denotes the maximum value of delay in the path from source node to destination nodes. The delay of multicast tree is calculated as follows

   $$D = N\,[d_{trans} + d_{proc} + d_{prop}]$$

   where, N represents the number of links, d_{proc} represents the processing delay involved with each packet, d_{prop} represents the propagation delaybetween two nodes and d_{trans} represents the transmission delay. The calculation of d_{trans} is done using the following equation,

   $$d_{trans} = N / T$$

   Where, N is the number of bits and T is the rate oftransmission

4. **Stability of link :** QoS-aware metric has been proposed to determine a stable link based on link stability factor or LSF. The estimation of the stability factor is done using contention count by which signal strength and hop count is received as QoS parameters. Contention count represents the number of nodes which lies within the transmission range of any node and can be determined by sending periodic packets to one hop neighbors. On the other hand, the sender node receives periodic packets from all the adjacent nodes for determining the number of its neighbors. The node then estimates the received signal strength using cross-layer interaction approach after which the node with the maximum LSF value has been selected as a forwarding node.

3.1.1. Cross Layer Optimization

Cross-layer optimization method is a derivative of the pure waterfall-like concept of the OSI communications model however having imaginary strict boundaries between layers. The cross layer approach involves in dynamic transport of feedback through the layer boundaries to undergo the compensation. For instance, overload, latency or any other mismatch of requirements and resources can be handled by any control input to another layer however, that layer would also be directly affected by the detected deficiency. In the original OSI networking model, strict boundaries between layers are enforced wherein data are kept strictly within a given layer. Crosslayer optimization avoids such strict boundaries so as to permit the communication between layers. It is done by allowing one layer to access the data of another layer for information exchanging and interaction. For example, with the knowledge of the present physical state, a channel allocation scheme or automatic repeat request (ARQ) strategy at the MAC layer can be performed in optimizing tradeoffs and achieving throughput maximization.

It is more important in case of information routing with concurrent demand for limited capacity of channels as there might be a need for an intervention concept to achieve balance between the needs of intelligible speech transmission and sufficiently dynamic control commands. In case of special operating conditions of operations, a mismatch would result due to fixed resource allocation. Moreover, the dynamic change of resource allocation might also affect the intelligibility of voice or the steadiness of videos. However, the algorithm consumes time as same as that of other optimizing strategies. Cross-layer optimization also involves in contributing to an enhanced quality of services under various operational conditions. Such adaptive quality of service management is a present need in case of various patent applications. The cross-layer control mechanism also gives a feedback on concurrent quality information in order to adaptively set the control parameters as mentioned in the following:

1. The observed quality parameters
2. A fuzzy logic based reasoning about applying the appropriate control strategy
3. The statistically computed control input to parameter settings and mode switches

3.2. Constructing Multicast Route Based on Qos Parameter Values

Once calculating the QoS parameter value of the mobile nodes present in the MANET environment, construction of the multicast tree between the source node and number of destination nodeswould result. This is done by using the mobile nodes which goes in line with its stability link connection value. Considering there are 15 mobile nodes present in the environment among which mobile node 1 is the sender and the destination mobile nodes are 4, 7, 8 and 12, the sample multicast route tree for this case can be constructed as shown in the figure 2.

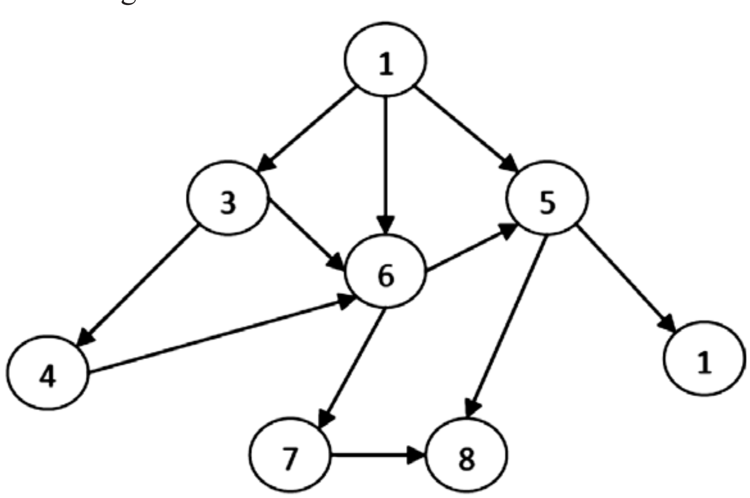

Figure 2: Sample Multicast Tree Constructed

Figure 2 illustrates the construction of a sample multi cast tree based on the knowledge of identifying the possible path that exists between the source nodes and destination node. The above figure shows the mobile name with ids 2, 9, 10, 11 which have not participated in the establishment of routing path. This is owing to its nature of not satisfying the QoS requirements for the packet forwarding. Hence, the remaining mobile node that satisfies QoS parameters would only be selected for ensuring reliable and secured packet transmission.

3.3. Optimal Route Path Selection using SMR-MABC

In the previous section, multi tree construction is carried out between the source and destination nodes which satisfy the QoS parameter values. The construction of multicast tree represents multiple paths between the source and destination nodes. Let us consider in the above figure the route path between the nodes 1 and 7, so the possible path would be 1-3-4-6-7, 1-3-6-7, 1-6-7. Among these three paths between node 1 and 7, optimal route path will be selected for the final routing in accordance with packet transfer yielding reduced cost and time delay. In this study, optimal route path selection is performed based on the micro artificial bee colony (ABC) approach. The objectivebehind using this approach is to increase network lifetime and to decrease delay. The typical ABC algorithm has been proposed only to solve continuous optimization problems, however recently extended to solve combinational optimization problems [15, 16]. The ABC colony is comprised of employed bees, onlooker bees and scout bees. Basically, the algorithm can be divided into three stages. Initially, all three bee groups are sent out one after another in search of potential food sources. A loop in constituted among the three stages as a cycle of the algorithm as given in Algorithm 1. The target as searched by the bees is mapped to either minimize an objective function or maximize a fitness function. In Algorithm 1, n_s is the number of solutions (*i.e.*, food sources), limit is the number of consecutive evaluations that a solution fails to be updated. In general, both the number of employed bees and onlooker bees are equal to n_s whereas the number of scout bees relies on limit and the algorithm's evolutionary status. To deal with the SMT problem, binary representation is being adopted in this work. As mentioned above, all nodes in graph G except source and destiny nodes represent the candidates for Setiner points. Hence, the problem dimension is given as $| N| -| N^s| -| N^d|$, where $| N^s|$ and $| N^d|$ are the number of source nodes and destiny nodes respectively. The candidate nodes are coded to a binary string wherein all nodes are orderly numbered. Each element in binary string takes either the value 0 or 1, corresponding to a node of G. Here, value 0 means the associated node which is not included in SMT and value 1 means the node as a member of SMT. Thus, forming a subgraph depends considering such kind of binary string. Considering the graph as shown in Fig. 1,N 1 and N 5 are kept as source node and end noderespectively. The other nodes are encoded to a binary string in the order of N2, N3, N4, and N6 . Therefore, the bit string 1010 can be decoded to subgraphas shown in Figure 3.

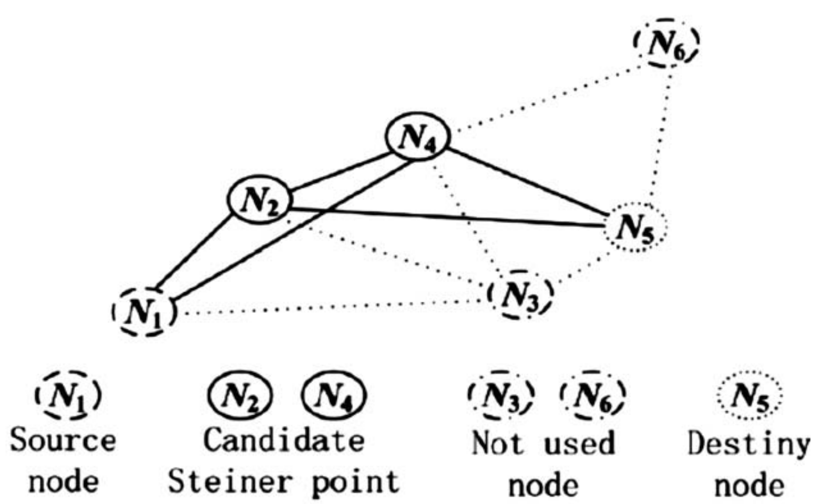

Figure 3: Sub graph associated with bit string 1010 in the order of N2, N3, N4 and N6

In the stage followed by employed bee, the below given formula (1) is designed to generate a variation v_i based on solution x_i:

$$v_{i,j} = \begin{cases} 1 - x_{i,j} & \text{if } j = j1 \\ x_{r1,j} & \text{if } j = j2 \\ x_{i,j} & \text{otherwise} \end{cases}$$

where subscript *i* denotes the solution index and subscript *j* is the bit string index; $j_1 \leq j_2$ are randomly chosen positions; x_{r1} is also randomly selected solutions with $r_1 i$ in the population. This formula is modified based on the proposed one-position inheritance scheme for dealing with continuous variables. In onlooker bee stage, a honey bee chooses a solution to exploit depending on the fitness of solutions in population. As the micro population is employed here, the selection pressure should not be too heavyunlesstrapping the population in local optima. Each solution has at least selection probability 0.7/ *ns* . In the following, the formula (2) is designed to generate v t based on chosen solution x_t:

$$v_{t,j} = \begin{cases} x_{t1,j} \text{ if } j = j3 \text{ and fit } (x_{t1}) \geq \text{fit } (x_t) \\ 1 - x_{t2,j} \text{ if } j - j4 \text{ and fit } (x_{t2}) \leq \text{fit } (x_t) \\ x_{t,j} \text{ otherwise} \end{cases}$$

where $j_3 \leq j_4$ are randomly chosen positions; x_{t1} and x_{t2} are randomly selected solutions with $t_1 \neq t_2 \neq t$ in the population. The physical meaning of this formula is a honey bee would fly toward the same direction given a solution is better than its current choice x_t, and it would fly toward the opposite direction given a solution is worse than x_t. Once the limit flag of a solution becomes true, the associated solution gets inhibited which are then substituted for a new one by randomly exploring a scout bee in search space. This procedure is same as that of initialization. To assure convergence, elitism of size 1 is used in scout bee stage which becomes the best solution that would never be abandoned by honey bees. Theoretical study has also proved that the best solution has so far keptfor converging a SI algorithm to global optimum of a problem with probability one. Hence, the scout bee is employed to solve the SMT problem. The pseudo code of the micro ABC (MABC) algorithm is given in Algorithm 1 with D = | N| −| Ns| −| Nd |. Based on the variation formulas, candidate solution v_i is considered asa feasible solution and also boundary repair method is not employed in MABC. Hence, the inherent problem of selecting a proper repair method is being avoided in this method. In MABC algorithm,no new parameter has been introduced and so the burden of algorithmic parameter control is not increased.

Algorithm 1: Flow chart of the MABC algorithm with binary representation.

Input : $f(\cdot)$, D, $= \Omega\{0, 1\}$, n_s, limit, $f_{eval} = 0$

Output : a set of optimal solutions found by the MABC algorithm

randomly generate n_s solutions, $f_{eval} = f_{eval} + n_s$;

evaluate the function values of the initialized solutions, and compute their fitness values;

whiletermination criteria are not satisfied do // Main cycle

for $i \leftarrow 1$ to n_s do //Employed bee stage

employed bee *i* flies around solution *i* based on (1) and locates position v_i;

evaluate v_i, $f_{eval} = f_{eval} + 1$;

greedy selection between v_i and x_i;

end

for $t \leftarrow 1$ to n_s do // Onlooker bee stage

onlooker bee *t* chooses a solution x_t based on the fitness of solutions;

onlooker bee *t* flies around the chosen solution based on (2) and produces v_t;

evaluate v_t, $f_{eval} = f_{eval} + 1$;

greedy selection between v_t and x_t;
end
fori ← 1 to n_s do // Scout bee stage
if x_i has not been improved in the last limit evaluations and is not the best one in population then
a scout bee flies out and randomly explores in search space to produce x'_i;
replace solution x_i by x'_i
end
end
end

The above algorithm employs the MABC algorithmwould result in the optimal solutions.The optimal solutions are identified as the optimal route paths between source node and the multiple destination nodes with the concern of QoS parameter values. As a result, routing can be performed through this optimal path thus ensuring secured routing with reduced packet loss and packet delay. The secured routing can be achieved by means of the mobile nodes stability and available resource capacities.

4. EXPERIMENTAL RESULTS

In this section, effective evaluation of the performance metrics isperformed based on both existing and proposed methodologies. It is done by comparing the proposed algorithm namely Secured Multicast Routing in MANET using Micro Artificial Bee Colony Approach (SMR-MABC) and the existing algorithms namely Multicast Routing scheme in MANET using Multiple reliable Rings backbone (MRMR). On comparison, the proposed system exhibits the highest performance as that of the existing system. From the experimental result, it is concluded that the proposed system is more efficient than the existing system. Proposed SMR-MABC method is then evaluated using MATLAB 12 and compared with existing MRMR method. The simulation specific parameters of MATLAB 12 are shown in table 1.

Table 1

Simulation Parameters

Area	*100*100*
Nodes number	100
Initial energy	0.5J
BS location	(50,50)
Packet size	4000bits
E	50nJ/bit
ε_{fs}	10pJ/bit/m2
ε_{mp}	0.0013pJ/bit

A performance of the new routing algorithm is evaluated in comparison with existing algorithms. The simulated traffic is Constant Bit Rate (CBR). The performance of the proposed approach is evaluated in terms of some parameters such as delay, bandwidth, drain rate, hop count, throughput and residual energy.

Routing overhead

This metric describes the number of routing packets required for route discovery and the need for sending route maintenance require so as to broadcast the data packets.

Average delay

This metric represents average end-to-end which is meant by the time taken bythe packets to travel from the source to the application layer of the destination.

Throughput

This metrics represents the total number of bits which has been forwarded to higher layers per second and is measured in bps. Throughput can also be defined as the total amount of data which the receiver actually receives to obtain the last packet.

Packet Delivery Ratio

This metric denotes the ratio of the amount of incoming data packets to the actually received data packets

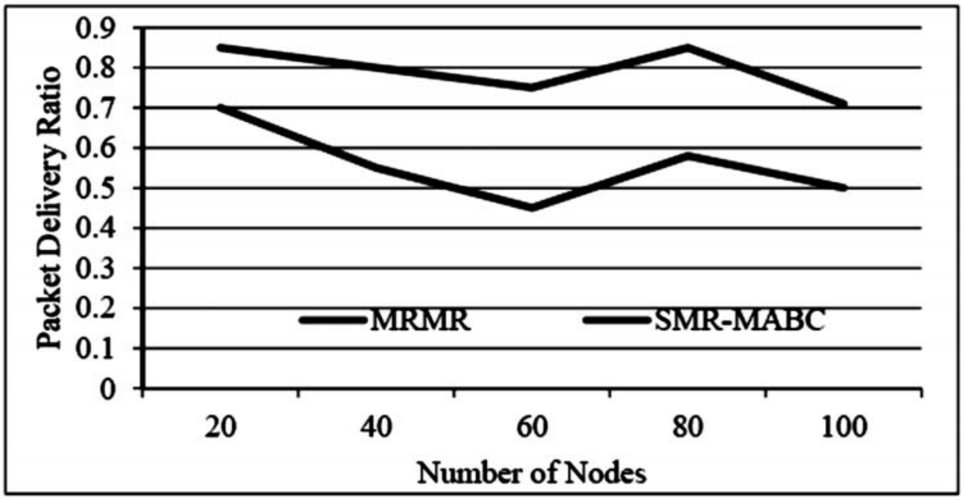

Figure 4: Packet Delivery vs Number of Nodes

The above figure 4shows the comparison of the packet delivery with the number of nodes. From the comparison, the proposed SMR-MABC system shows higher packet delivery ratio than the existing techniques MRMR.

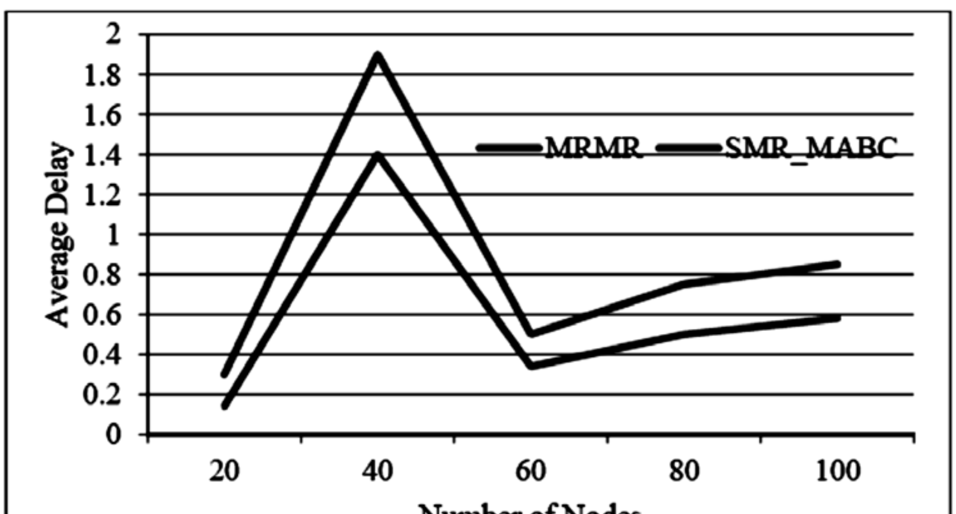

Figure 5: Average Delay Vs Number of Nodes

The figure 5 represents the plot of Average Delay against Number of nodes. From the figure, it could be deduced that the proposed SMR-MABCsystem shows lower Average Delay when compared to the existing technique MRMR.

The above figure 6represents the plot of Throughput Vs Number of nodes. From the figure, it could be inferred that the proposed SMR-MABC system shows higher Throughput value when compared with the existing technique MRMR.

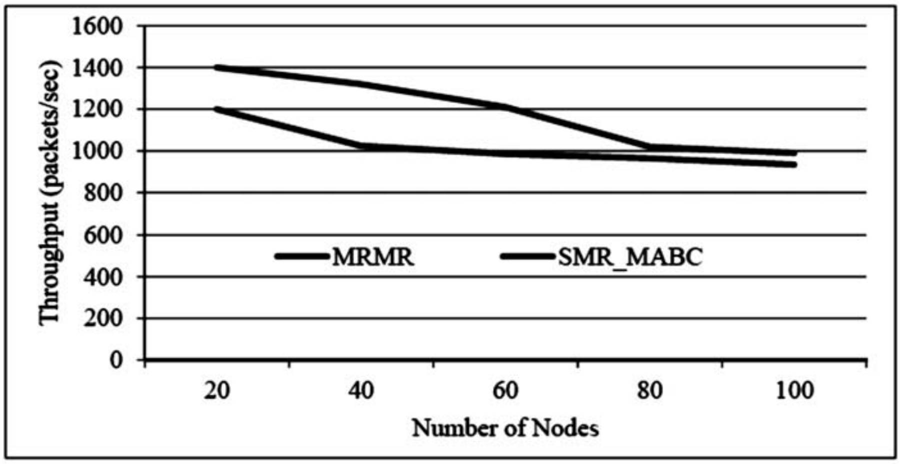

Figure 6: Throughput Vs Number of Nodes

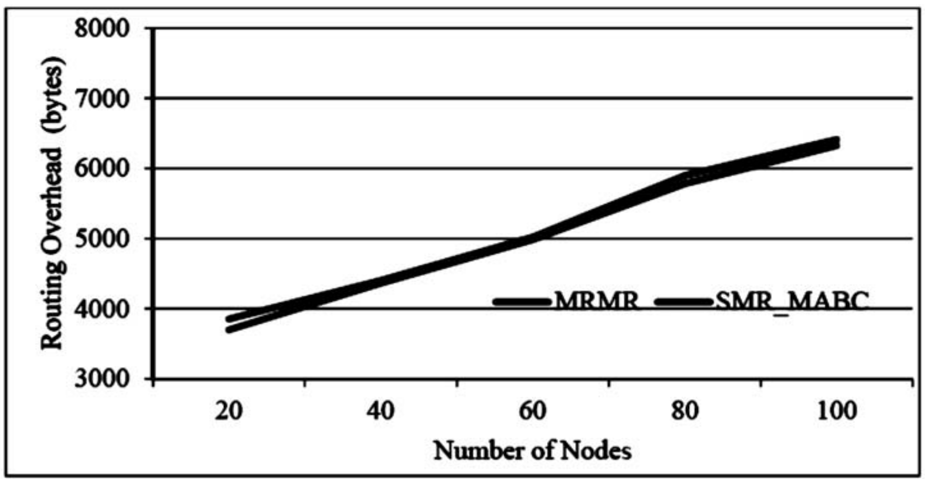

Figure 7: Routing Overhead Vs Number of Nodes

Figure 7given above represents the plot of Routing Overhead against Number of Nodes. From the figure, it could be observed that the proposed SMR-MABC system has lower value of Routing Overhead when compared with the existing technique MRMR.

5. CONCLUSION

In case of mobile adhoc network adopted in several real-world applications like education institutions, software organization, the role of multicast routing becomes important as the data communication is among the multiple persons at the same time. The selection of the optimal route path for data packetforwarding between multiple mobile nodes would result in secured transmission of data packet. In this work, the proposed Secured Multicast Routing in MANET using Micro Artificial Bee Colony Approach (SMR-MABC) has involved in finding the mobile nodes that satisfy the multiple QOS parameter values based on whichfurther construction of multicast tree becomes possible. During the construction of multi cast tree, the optimal route path among different possible route paths has been chosen using the MABC approach based on measures such as network lifetime and higher consistence. The experimental analysis as conducted in the MATLAB simulation environment further proves that the proposed methodology helps to achieve better performance with improved security level.

6. REFERENCE

1. Harte Lawrence. Introduction to Data Multicasting, IP Multicast Streaming for Audio and Video Media Distribution. Althos, 2008.

2. G. Hosszú, "Mediacommunication Based on Application-Layer Multi-cast," Encyclopedia of Virtual Communities and Technologies, pp. 302, 2005.
3. E.M. Royer,and C.K. Toh, "A review of current routingprotocols for ad hoc mobile wireless networks,"Personal-Communications, IEEE, Vol.6, No.2, pp.46-55, 1999.
4. A. Sabari, K.Duraiswamy, "Ant Based Adaptive Multicast RoutingProtocol (AAMRP) for Mobile Ad Hoc Networks", InternationalJournal of Computer Science and Information Security, Vol.6, No. 2,2009.
5. E.Baburaj, and V. Vasudevan, "An Intelligent Multicast Ad-hoc ondemand Distance Vector Protocol for MANETs,"-journal of Networks,Vol.3, No. 6, pp.62-68, 2008.
6. P. Gaur, "Implementation of Multicast Routing Using GeneticAlgorithm," pp. 226-234, 2013.
7. M.V. Lakshmi, and S.Venkatachalam, "Comparative analysis ofQoS routing protocols in MANETS: Unicast &Multicast,"International Journal of Emerging Technology and AdvancedEngineering, Vol. 2, No. 4, pp. 242-250, 2012.
8. A.Asma, and G.Nagib, "Energy efficient routing algorithmsfor mobile ad hoc networks a survey,"International Journal ofEmerging Trends & Technology in computer Science, Vol. 3, No. 1,pp.218-223, 2012.
9. Security in Wireless Sensor Networks: Key Management Module in EECBKM"Presented in International Conference on World Congress on Computing and Communication Technologies on Feb 27- & 28 and 1st march 2014, on St.Joseph college,Trichy
10. J.Moy, "Multicast Extensions to OSPF", Internet Draft, September,1992.
11. Green Technologies for the Energy-optimized Clouds, in Asian Journal of Research in Social Sciences and Humanities, Vol. 6,Issue 6, Special Issue June 2016.
12. Challenges and Surveys in Key Management and Authentication Scheme for Wireless Sensor Networks" in Abstract of Emerging Trends in Scientific Research 2014– 2015. https://ideas.repec.org/s/pkp/abetsr.html Impact Factor: 0.119
13. R.Widyono, "The Design and Evaluation of Routing Algorithms forReal Time Channels", Berkeley:International Computer Science Institute, 1994.
14. C.S.R. Murthy, and B.S. Manoj, "Ad Hoc Wireless Networks:Architectures and Protocols", Prentice-Hall, Upper Saddle River, NJ,USA, 2004.
15. G.Pampará, and A.P. Engelbrecht,"Binary artificial bee colony optimization," in: 2011 IEEE Symposium on Swarm Intelligence (SIS), IEEE, Paris, France, pp. 1–8, 2011.
16. Biologically Inspired Intelligent Robots Using Artificial Muscles" ,International Journal of pharma and bio sciences.
17. R.Biradar, and S.Manvi, "Multicast Routing in MANET using multiple reliable Rings backbone," In Advances in Recent Technologies in Communication and Computing (ARTCom 2011), 3rd International Conference on, pp. 56-61, 2011.