International Journal of Advance Research in Science and Engineering
Vol. No.5, Issue No. 12, December 2016
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

ENHANCED LEVY-FLIGHTCUCKOO SEARCH ALGORITHM (ELCSA) FOR CLUSTER MEMBER SELECTION AND MEMBER REPLACEMENT

D. Gopinath[1], Dr.K. K. Savitha[2]

[1]Research Scholar, Bharathiar University, Coimbatore, Tamilnadu, (India)

[2]Assistant Professor, Department of Computer Application,

Bharathiar University PG Extension Centre, Erode, Tamilnadu, (India)

ABSTRACT

Mobile Ad Hoc Network (MANET) is an upcoming research area due to the improvements in Wireless network technology and its wide usage. It is a decentralized autonomous system consists of free nodes that can move arbitrarily. Routing in MANET is a paramount significance and the limited battery power of nodes in MANET is a crucial factor while establishing routes. In cluster based MANET, the Cluster Head selection and Cluster Member selection should be considered as important aspects. The Cluster Head manages nodes of their own region and Cluster Member plays an important role in transferring information to particular destination during data transmission. In this paper, the Cluster Member Selection is carried to form effective clusters for providingreliable data transmission. In this work, Enhanced Levy-Flight Cuckoo Search Algorithm (ELCSA) is proposed for effective Cluster Member Selection and Member Replacement in a cluster. Member replacement is based on node failure and current status of the particular node.

Keywords:Ad-hoc networks, Clusters, ELCSA, Metaheuristic Algorithms.

I INTRODUCTION

1.1 Wireless communications

Wireless communications have become very pervasive. The number of mobile phones and wireless Internet users has increased significantly in recent year.A wireless ad-hoc network (WANET) [1,2] is a self-configuring, decentralized type of wireless network. With every node that participates in routing, the main characteristic of ad-hoc network is the complete lack of pre-existing infrastructure such as routers in wired networks.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

1.2 MANET

MANET (Mobile Ad Hoc Network) has an infrastructure less environment .There is no fixed infrastructure or topology for MANET. These are collection of several mobile nodes and based on mobility of the nodes the topology chances occur. These nodes are interconnected by wireless link.Because of the change of transmission power, noise, interference the link retention may vary. Here nodes are act has a router to transfer information and there is no separate routers are connected. Science nodes have finite transmission range, a part of nodes cannot communicate with each other, so routing path in MANET contain multiple hops and each of the node in MANET act as a router [3].

But Node mobility causes successive topology changes and system partition. As a result of the variable and eccentriclimit of wireless link and packet losses may happen frequently. Broadcast nature of wireless medium presents hiddenterminal and exposed terminal problems. The malwares can easily analysis and attack the rout or data due to this nature. Furthermore, mobile nodes have confined energy, processing and bandwidthassets and require powerful routing plan. Moreover, these mobile nodes are depends on constrained battery power. The power reduction cases node failer. In an individually organized network many metrics needs to be considered like maximum feasible bandwidth path, most balanced and reliable path etc.[4] Because of the changing characteristics of nodes routing in MANET is veryaccosting. Routing protocol in MANET can be of three types like topology based routing protocol, location basedrouting protocol, and destination based routing protocol [3].

1.3 Metaheuristic Algorithms

More and more modern metaheuristic algorithms inspired by nature are emerging and they become increasingly popular. For example, particles swarmoptimization (PSO) was inspired by fish and birdswarm intelligence, while the Firefly Algorithm wasinspired by the flashing pattern of tropical firefly's [5, 6, 7, 8, 9]. These nature-inspired metaheuristicalgorithms have been used in a wide range of optimization problems, including NP-hard problems suchas the travelling salesman problem [5, 6, 7, 8, 9, 10, 11].

The power of almost all modern metaheuristicscomes from the fact that they imitate the best feature in nature, especially biological systems evolvedfrom natural selection over millions of years.

Two important characteristics are selection of the fittest andadaptation to the environment. Numerically speaking, these can be translated into two crucial characteristics of the modern metaheuristics: intensification and diversification [6]. Intensification intends tosearch around the current best solutions and selectthe best candidates or solutions, while diversificationmakes sure the algorithm can explore the search spaceefficiently.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

This paper aims to formulate a new enhanced algorithm,called Enhanced Levy-Flight Cuckoo Search Algorithm (ELCSA)the algorithm is constructed based on the interesting breeding behavior such as brood parasitism of certain species of cuckoos. The algorithm is inspired based on Cuckoo Search Algorithm.

Thebreeding behavior of cuckoos and the characteristics of Levy flights of some birds and fruit flies, andthen formulate the new ELCACS, followed by its implementation. Finally, the algorithm of ELCAA is used to find nearest best node amount group of for data transfer. The main aim to find the optimal solution for node selection in ADHOC network.

II BACKGROUND AND RELATED RESEARCH

2.1 Clustered mobile ad-hoc networks

A cluster is a subset of nodes in a network contains a collection of nodes. A cluster consists of aspecial node called cluster-head and some other nodes called cluster-members. The cluster-head is responsible to relay packets forits cluster-members and packets from other cluster-heads. Theinformation needed when selecting cluster-heads is gathered fromperiodical hello packets. Different criterions are used when selectingcluster-heads, such as node ID [12–14], node degree [15, 16], linkstability [17], battery power, speed, or combinations of them[18, 19]. After cluster construction process has finished, some othernodes are selected by cluster-heads to act as gateways, whichshould rebroadcast every packet it received. Gateways can be selectedimmediately after the cluster construction process has finished,such as source independent connected dominating set(SICDS) in [20, 21], or selected on the fly while performing a broadcastsession, such as source dependent connected dominating set(SDCDS) in [20, 21].

2.2 Cuckoo search

Cuckoo search is a relatively recent nature-inspired metaheuristic algorithm, developed by Xin-She Yang and Suash Deb in 2009. CS was inspired by the brood parasitism of some cuckoo bird species, in combination with the Levy flights [22–24] random walks. Cuckoos are catching scientists' interest because of their aggressive reproduction strategy. Some species lay their eggs in communal nests of other host birds (often other species), and may remove others' eggs to increase the hatching probability of their own eggs.

CS idealized rules can be summarized as:

1. Each cuckoo lays one egg at a time, and dumps its egg in a randomly chosen nest.
2. The best nests with high quality of eggs will carry over to the next generations.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

3. The number of available host nests is fixed, and the egg laid by a cuckoo is discovered by the host bird with a probability $p_a \in [0,1]$, where the host bird can either throw the egg away, or abandon the nest and build a completely new nest.

While exploring new solutions, it is necessary to control the Levy flights random walks, to avoid large moves, causing the solutions to jump outside of the search space. A step size factor that is defined according to the scale of the problem of interest should be used for this purpose. This might be an interesting subject for more research, studying the optimal utilization of the Levy flight in optimization; for simplicity, a typical step size factor of 0.01, as suggested by the authors, is being used in this study [25, 26, 27].

III PROPOSED SYSTEM MODEL: ELCSA ALGORITHM

The cluster based network is formed in the proposed work. The Cluster Head selection should be our upcoming work. In this work, Cluster Member selection for data transfer should be considered as main aspect, because the information transfer should be in trusted and manageable node.The ELCSA is a based onnature inspired metaheuristic algorithm. The main aim is to find better node for communication.

Basic terminology:

Cluster: Collection of nodes (Grouped)

Cluster Head (CH)**:** Cluster head is a responsible node for communicate group of nodes.

Cluster Gateway (CG)**:** Common/Intermediate member of more than one cluster.

Cluster Member Node (CMN)**:** Member of a cluster and control of Cluster Head.

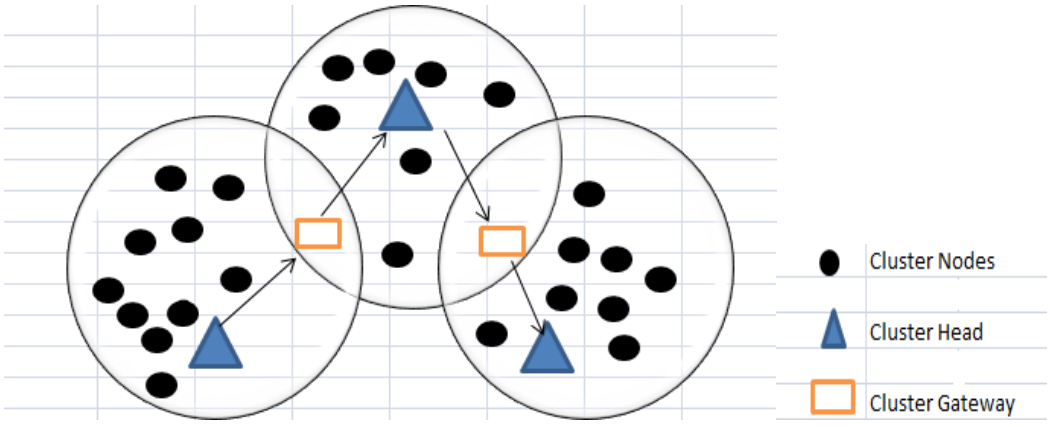


Fig. 1.The states of the Nodes in a clustered MANET with Head and Gateway node.

Black circles indicate the cluster nodes inside the region (before select the cluster member). Brown marks indicate the cluster gateway and Blue marks indicate the cluster head.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

3.1 Proposed Model: ELCSA Algorithm

InELSA (Enhanced Levy-Flight Cuckoo Search Algorithm) the Selection of Cluster Member (CM) for particular Cluster Head is planned. Node collection means collection of multiple nodes in a region.

In this, region should be splits based on boundary (my next paper Next Paper – Regarding boundary).At initial entire nodes in the region should be viewed by firefly. The entire nest/ nearby nodes are verified to check fitness for find the Better Nodes on the Region/nest. Based on Fitness the new nest will formed. Then Rankingwill be performed for Nodes on the Region. Based on the Rank Place the Nodes will be maintained. After Sometime the comparison should be made between the newly Arrived Nodes with Previous nodes to get better node on current. AgainRanking is performed to Replacement Current best Node. At the time of updating failure node also replayed.

Main steps of the ELCSA algorithm

Step 1: Cycle= 1

Step 2:Initialize thepopulation of n host / nests (in a region)

Step 3: Find the new nest using Levy flight (nest contains Secured and Active node)

Check the entire nest in all dimensions

Set new one (new nest contain – currently selected best node)

Collect normal and levy Samples to select best one

Step 4: Evaluate the new nest to calculate fitness

Rank the nests and keep current best nests

Check the entire nest

Compare new nest with previous

Replace the old nest based on fitness

Step 5: Replacement of nest

Check Newly Arrive based on random permutation

Again check the entire nest for ranking

Set new nest

Start from Step 1

Step 6: Evaluate the new nest

Step 7: Rank and keep the current best

Step 8: Store the best solution achieved so far

Step 9: cycle = cycle +1.

Step 10: Until cycle = Maximum best Node Number

International Journal of Advance Research in Science and Engineering
Vol. No.5, Issue No. 12, December 2016
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

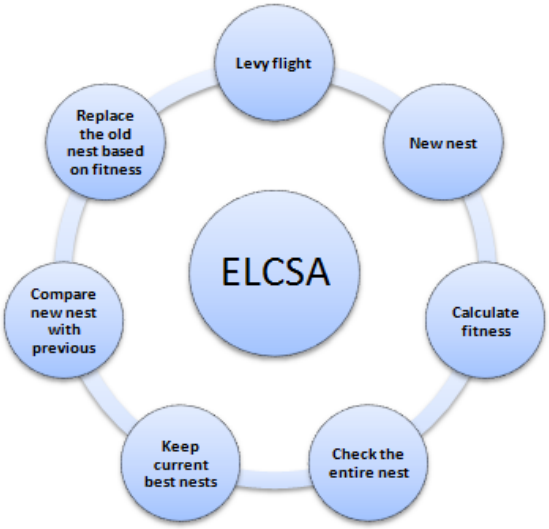


Fig. 2: Cycle of Node Updating

The proposed ELCSA algorithm uses the cluster topology where each node selection should be based on some aspects.

The following aspects should be calculated to find the fitness of the node

1. Environmental distance
2. Clustering stability enhancement
3. Load balancing clustering scheme
4. Energy consumption
5. Remaining battery energy
6. Combined Weight

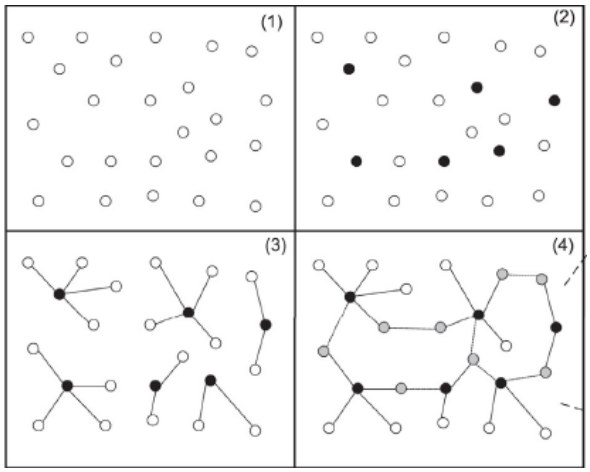


Fig.2: Step by step Cluster formation – Only fitness node is taken for communication process

International Journal of Advance Research in Science and Engineering
Vol. No.5, Issue No. 12, December 2016
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

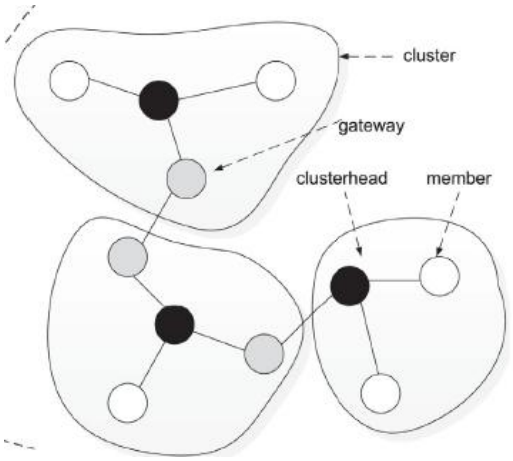
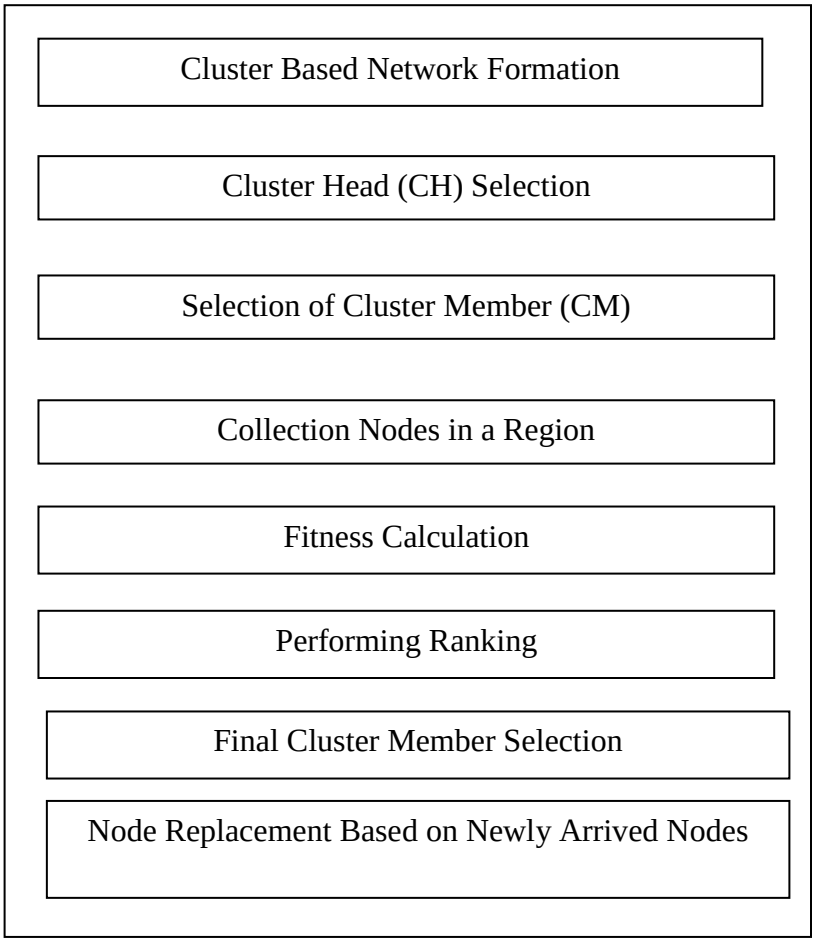


Fig. 3: Formed Final Cluster

3.2 Framework of Clustered ELCSA Based Node Selection



IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

Cluster Based Network Formation:

The cluster count should be based on the number of nodes on the network. Maximum number of nodes in the cluster should be based on the trusted level of nodes.

Cluster Head (CH) Selection:

The Cluster Head (CH) Selection is based on some criteria that should be my future work.

Selection of Cluster Member (CM):Based on fitness the cluster member should be selected.

Collection Nodes in a Region:

In a cluster there are number of nodes should be collected together in a region.

Fitness Calculation:

Calculationof fitness is based on Environmental distance, Clustering stability enhancement, Load balancing clustering scheme, Energy consumption, Remaining battery energy and Combined Weight.

Performing Ranking:

The Ranking should be based on fitness level.

Final Cluster Member Selection:

Basedon raking the number of nodes should be participated for data transfer.

Node Replacement Based on Newly Arrived Nodes:

Failed node was found at the time of updating and Re-Ranking is initialized.

IV CONCLUSION

In this work, Enhanced Levy-Flight Cuckoo Search Algorithm (ELCSA) is proposed for effective Cluster Member Selection and Member Replacement in a cluster. Member replacement is based on node failure and current status of the particular node.The above framework can be enhanced and implemented for the real time environment.

REFERENCES

[1] T. Dutta, Medical data compression and transmission in wireless ad hoc net- works, IEEE Sensors J. 15 (2) (2015) 118–173, doi: 10.1109/JSEN.2014.2354394 .

[2] T. Shu, M. Krunz, Privacy-preserving and truthful detection of packet dropping attacks in wireless ad hoc networks, IEEE Trans. Mobile Comput. 14 (4) (2015) 813–828, doi: 10.1109/TMC.2014.2330818 .

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

[3] S. K. Sarkar, T. G. Basavaraju and C. Puttamadappa, Ad Hoc Mobile Wireless Networks: Principles, Protocols and Applications, CRC Press (2007).

[4] PiyaliKar, MrinalKanti Deb Barma, Sudipta Roy and S. K, Sen, Energy Efficient Weight Based Clustering in MANET, 2nd International Conference on Data Engineering and Communication System (ICDECS), ISSN-0973-4562, vol. 10, pp. 82–86, december 28–29 (2015).

[5] Bonabeau E., Dorigo M., Theraulaz G., Swarm Intelligence: From Natural to Artificial Systems. Oxford University Press, (1999)

[6] Blum C. and Roli A., Metaheuristics in combinatorial optimization: Overview and concepturalcomparision, ACM Comput. Surv., 35, 268-308 (2003).

[7] Deb. K., Optimisation for Engineering Design, Prentice-Hall, New Delhi, (1995).

[8] Yang X. S., Nature-Inspired Metaheuristic Algorithms, Luniver Press, (2008).

[9] Yang X. S., Biology-derived algorithms in engineering optimizaton (Chapter 32), in Handbook of Bioinspired Algorithms and Applications (edsOlarius&Zomaya), Chapman & Hall / CRC (2005).

[10] Goldberg D. E., Genetic Algorithms in Search, Optimisation and Machine Learning, Reading, Mass.: Addison Wesley (1989).

[11] Kennedy J., Eberhart R., Shi Y.: Swarm intelligence, Academic Press, (2001).

[12] X. Niu, Z. Tao, G. Wu, C. Huang, L. Cui, Hybrid cluster routing: An efficientrouting protocol for mobile ad hoc networks, in: Communications, 2006. ICC '06. IEEE International Conference on, vol. 8, 2006, pp. 3554–3559.

[13] Y. Ge, L. Lamont, L. Villasenor, Hierarchical olsr – a scalable proactive routing protocol for heterogeneous ad hoc networks, in: Wireless And Mobile Computing, Networking And Communications, 2005. (WiMob'2005), IEEE International Conference on, vol. 3, 2005, pp. 17–23.

[14] L. Villasenor-Gonzalez, Y. Ge, L. Lament, Holsr: a hierarchical proactive routing mechanism for mobile ad hoc networks, IEEE Communications Magazine 43 (2005) 118–125.

[15] T. Rasheed, K.A. Agha, U. Javaid, L. Reynaud, Cluster-quality based hybrid routing for large scale mobile multi-hop networks, in: Wireless Communications and Networking Conference, 2007.WCNC 2007. IEEE, 2007, pp. 3052–3057.

[16] K. Xu, X. Hong, M. Gerla, An ad hoc network with mobile backbones, in: Communications, 2002. ICC 2002. IEEE International Conference on, vol. 5, 2002, pp. 3138–3143.

[17] K. Xu, M. Gerla, A heterogeneous routing protocol based on a new stable clustering scheme, in: MILCOM 2002. Proceedings, vol. 2, 2002, pp. 838–843.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

[18] A. Iwata, C.-C.Chiang, G. Pei, M. Gerla, T.-W.Chen, Scalable routing strategies for ad hoc wireless networks, IEEE Journal on Selected Areas in Communications 17 (1999) 1369–1379.

[19] C. Lin, M. Gerla, Adaptive clustering for mobile wireless networks, IEEE Journal on Selected Areas in Communications 15 (1997) 1265–1275.

[20] M. Gerla, J. Tsai, Multicluster, mobile, multimedia radio network, in: Wireless Netw 1, 1995. Highest Connectivity Clustering.

[21] C. Chiang, H. Wu, W. Liu, Routing in clustered multi-hop, mobile wireless networks with fading channel, in: Proceedings of IEEE SICON, 1997. Least Cluster Change (LCC).

[22] Pavlyukevich, I. 2007. "Lévy flights, non-local search and simulated annealing." Journal of Computational Physics. 226, 2 (2007), 1830–1844.

[23] Yang, X.-S. 2010. Nature-Inspired Metaheuristic Algorithms: Second Edition. Luniver Press.

[24] Yang, X.S. and Deb, S. 2010. "Engineering optimisation by cuckoo search."International Journal of Mathematical Modelling and Numerical Optimisation. 1, 4 (2010), 330–343.

[25] Barthelemy, P. et al. 2008. "A Lévy flight for light."Nature. 453, 7194 (2008), 495–498.

[26] Gutowski, M. 2001. "Lévy flights as an underlying mechanism for global optimization algorithms." arXiv preprint math-ph/0106003. (2001).

[27] Gutowski, M. 2001. "Lévy flights as an underlying mechanism for global optimization algorithms." arXiv preprint math-ph/0106003. (2001).

Biography

Mr.D.Gopinath received his B.Sc, M.Sc and M.Phil degree in Computer Science from the Bharathiar University. He is currently working as a Assistant Professor in Kongu Arts and Science College. He has presented papers at various National and international conferences. His area of interest includes Wireless sensor Network Security, Network Security, Ad Hoc Network, especially design and implementation of security metrics.

Dr.K.K.Savitha is currently working as an Assistant Professor at the Department of Computer Applications, Bharthiar University PG Extension Centre, Erode and also holds B.Sc, MCA and M.Phil degrees. She completed her PhD from Anna University, Chennai in2013. Her research interest includes mobile computing, Cloud Computing and Soft Computing. She is a Life member of ISTE, CSI.