PSO based Malicious Node Detection and EnergyEfficient Clustering in Wireless Sensor Network

Namratha B S[1], Chinnaswamy C N[2], Dr.T H Sreenivas[3]

[1-3]*PG Student, Associate Professor, Professor Dept. of CS&E, Vidhyavardhaka College of Engineering, Mysore, India*

Abstract **-** In the Wireless sensor network (WSN) grouping is perhaps the main assignment in which any of the hubs from an assortment of hubs is picked to be a bunch head and bunch head deals with standard working just as managing different hubs inside the bunch. Likewise in the remote sensor organization (WSN), noxious hub discovery is the critical assignment, so the malevolent hub can never turn into the group head. Further, as the number of malevolent hubs builds, then, at that point the chance of turning into a noxious hub as a bunch head likewise increments. To distinguish malignant hub just as to choose a high expected hub for group head, a PSO-based noxious hub discovery and bunch head determination procedure are proposed. The proposed calculation decides a possible worth for all hubs from that point a high potential hub is picked as a bunch head. This calculation additionally diminishes bunch covering with the spatial apportioning of group heads just as eliminating malignant hubs explicitly not licenses vindictive hubs to become bunch heads within the general improvement in energy proficiency.

Keywords—PSO, clustering, fuzzy, WSN

I. INTRODUCTION

Wireless sensor network (WSN) is comprised of a gathering of sensor hubs that cooperate in a gathering other to do a doled out task (for example environmental factors oversight, target follow-up, and so on) then, at that point educates the accumulated information by means of a remote medium to a base station or sink hub. WSN can be represented by a gathering of working together hubs having detecting, rationale just as remote correspondence capacities. The sensor hubs assemble just as send information to the far-off base station from that point the end client can get back the necessary information [1]. The Sensed information is gathered also, every once in a while, collected 'inside the organization' at the sink hubs, which may be sensors or they are different hubs lucky to be in potential just as assets. The information are then communicated to the end clients each every now and then in any case on-request by means of the sinks or a higher request hub; the base station [2]. There are wide assortments of uses of Wireless sensor network like from common, medical care and ecological to the military. Various sorts of uses comprise of target follow-up in war, territory oversight, common work management, environmental factors oversight and plant fixing. In light of the work of a colossal amount of sensor hubs in over-the-top conditions, usually some vindictive hubs may go into the organization also, can hamper standard working, decline the energy proficiency [3] too as can impact handling inside the bunch.

II. RELATED WORK

In [4], inside and out prologue to WSNs just as their qualities has been clarified. In past years numerous methods have been proposed for prolongation of organization lifetime, one of them is picking group head contingent upon distance [5]. Numerous procedures found in the writing overview centers around pernicious hub location and counteraction like in [6] blackhole influences on network boundaries are estimated and just as the strategies for avoidance and discovery for blackhole assault in WSN is clarified. In [7], in light of the outstanding trust strategy a procedure has been talked about to distinguish pernicious hubs .previously, different computational methods based bunch determination strategies have been proposed like Cluster Head choice convention, by utilizing Fuzzy Logic (CHFL) [8]. A similar idea of applying Fuzzy Logic was likewise carried out in Cluster Head Election system (CHEF) [9] convention. At long last, to discover capability of hubs loads of work has been accomplished for instance ACE calculation [10] evaluates each hub's potential separately for each for group head determination.

PROPOSED ALGORITHM: PSO BASED MALICIOUS NODEDETECTION AND CLUSTERING (PSO-NMDC)

PSO-NMDC works in four stages.

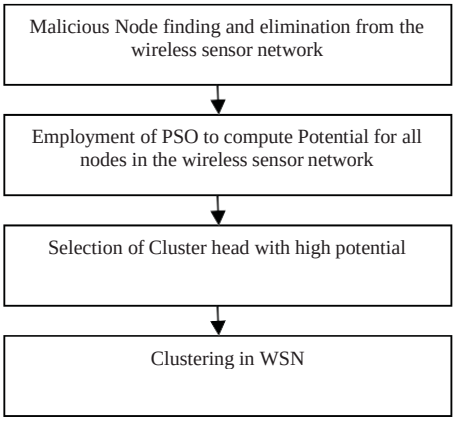

Fig. 1. PSO-NMDC Stages

A. Malicious Node finding and Elimination

In this paper dependent on trust highlight pernicious hub discovering calculation is utilized. The calculation for trust based noxious hub recognition is displayed in fig.2. All recognized

malignant hubs are then wiped out for example while choosing the bunch head they will be not chosen.

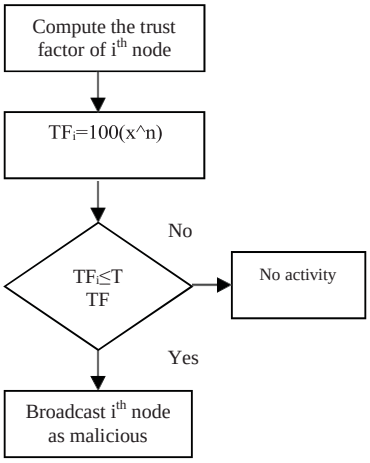

Fig. 2. Malicious node detection

B. Employment of PSO to find the potential of each node

In this stage the capability of every hub in the organization is discovered utilizing PSO. The two known conditions of PSO [11-12] are

$$v_i = v_i + rand * (p_{besti} - s_i) + rand * (g_{best} - s_i)$$

$$s^{k+1} = s^k + v^{k+1}$$

The capability of every hub in the organization is discovered utilizing PSO with fluffy rationale by utilizing three info boundaries, for example remaining energy of a hub, supported inclusion, and connection quality.

Remaining energy: The leftover energy (REi) of every hub (Ni) resulting to doing one information transmission is determined by applying the accompanying condition:

$$RE_i = IE - (TE + RE)$$

where IE is the beginning energy of the hub; TE and RE are the energy used when transmission and gathering of information are finished. Supported inclusion: The detecting locale of a hub encased by its adjoining hub as in the area formed district is known as Sponsored inclusion. In the event that there are two hubs X and Y on a distance d, the supported inclusion of Y for X is can be discovered through the focal point 2σ where σ can be registered according to the accompanying condition:

$$Cos\ \sigma = d^2 + X^2 - Y^2 / 2Xd$$

Link quality: Link quality: It shows about the portrayal of the strength just as the nature of a got bundle. It is directly relies on the gotten signal strength (RSSI). The worth of LQ can go from 0 to 255

$$LQ \uparrow RSSI$$

Presently RSSI can be characterized as the got power (Prx) is to the reference power (Pr). Much of the time, Pr is similar to supreme worth,
i.e 1 mW

$$RSSI = 10.Log\ (P_{rx} / P_{ref})\ \text{dbm}$$

As Prx increments, hence RSSI esteem is also improved which in turns help the connection quality [13]. So these three boundaries as talked about are engaged with the estimation of the capability of every hub. Mamdani's strategy in the derivation cycle has been utilized in this paper as it is more generally utilized in the applications. There are four stages as displayed in Fig. 3 to acquire the fresh worth from our FIS [14] structure. In this paper, fluffy rationale with PSO is implanted in the NS2 test system to assess the organization execution with three info boundaries. Resulting to the execution of these means, boundaries of the reproduction are given to the organization test system. Resulting to reproducing the code, the log documents are then passed to the log analyser from where once again the upsides of target capacities are given to the fluffy deduction motor of PSO-NMDC. Fig. 4 shows the flowchart for PSO-NMDC.

C. Cluster Head Selection

In any case, 7 to 9% of the hubs (Initial) with the most extreme Potential are chosen to be bunch heads. After that, all excess hubs having the most extreme potential are thought of and its distance D to the entirety of the bunch heads is figured. Presently the models for choosing the group head rely on the base distance Dmin and the edge distance Dthreshhold. Dthreshhold is the base distance needed to keep up inside two bunch heads. On the off chance that Dmin more prominent than Dthreshhold the hub is picked to be a bunch head. Something else, if Dmin not exactly Dthreshhold the hub is disposed of for example isn't picked a group head, and this is done to avoid bunch covering.

D. Clustering

In this work, we have done grouping according to the standard in CFHL [8] which is the most widely recognized one in the remote sensor organization. In this grouping technique the chose bunch heads communicate a message to all hubs which comes in their transmission range and once the message is gotten

by the Non-bunch head, then, at that point it can pick the wellspring of the most extreme sign force as their group head. At whatever point there is a tie, the group head with the littlest hub's ID is chosen.

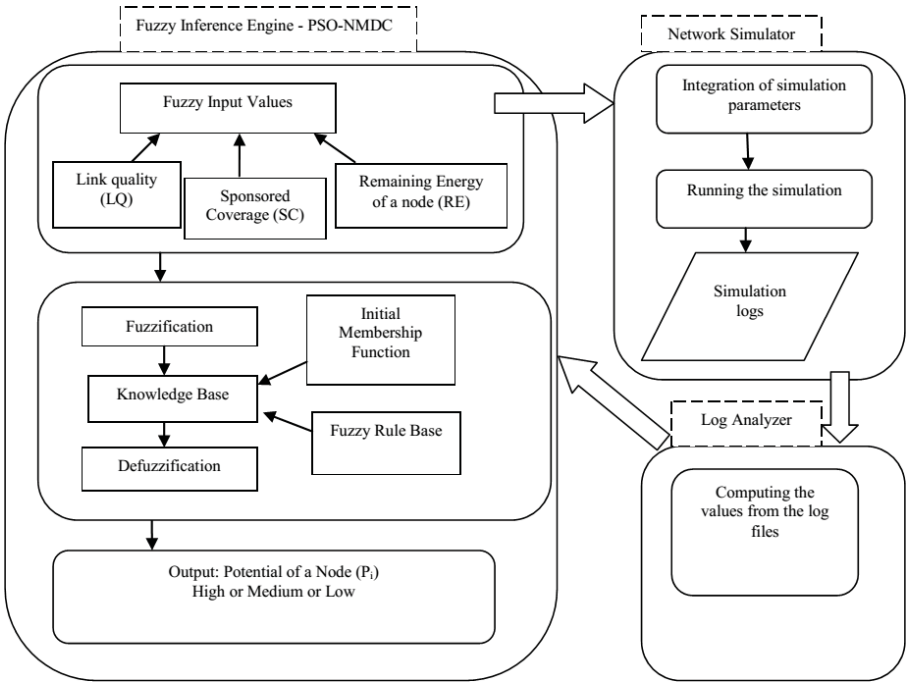

Fig. 3. Fuzzy Inference System for PSO-NMDC

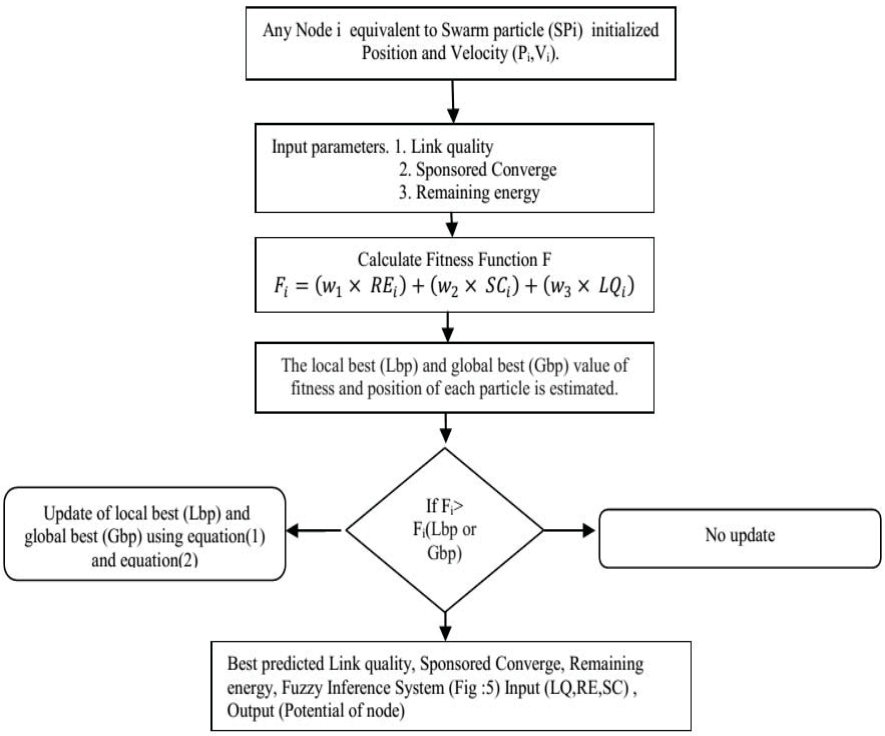

Fig. 4. Description of PSO-NMDC Algorithm

III. PERFORMANCE ANALYSIS

The recreation exhibits that PSO-NMDC set forward group heads in a spatially appropriated path just as producing extra bunches to oblige to hubs at all the route in the organization. So the benefit of spatially appropriated bunches is that it manages the energy usage of hubs in the WSNs. PSO-NMDC also takes out malevolent hubs, which considerably brings about a lesser bundle misfortune as displayed in Fig.5 just as predominant throughput (Fig. 6.). Diagram displayed in fig.7 affirms that the absolute leftover energy of hubs in PSO-NMDC is better as difference than CHFL. PSO-NMDC gives an all-encompassing organization lifetime its hubs in presence in the organization longer than CHFL as displayed in fig. 8.

TABLE I. SUMMRAY OF THE PARAMETERS USED IN SIMULATIONS

Parameter	Value
T_X Power	0.670
R_X Power	0.400
Rate	250 kb
Simulation time	100 s
MAC	802.11
Antenna	Omni antenna
Area	500x500
Initial energy	10.1 J
Number of nodes	100
Traffic Source	CBR
Propagation	Two ray ground

TABLE II. SIMULATION RESULTS

Simulation Results	PSO-NMDC	CHFL
Percentage of cluster head	7%	13%
Number of cluster heads	15	16
Number of malicious nodes	12	12
Number of cluster	11	10
$D_{thershold}$	190m	190m

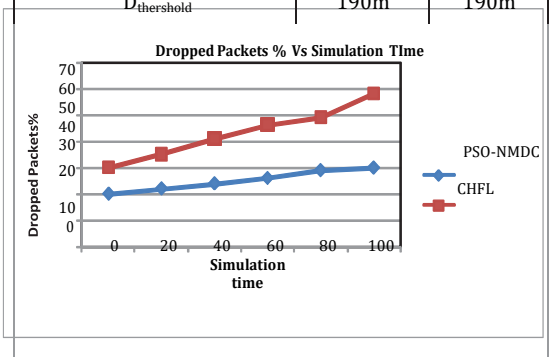

Fig. 5. Dropped packets vs simulation time

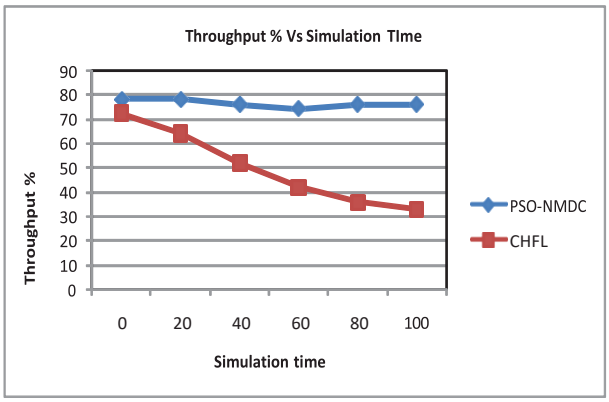

Fig. 6. Throughput vs simulation time

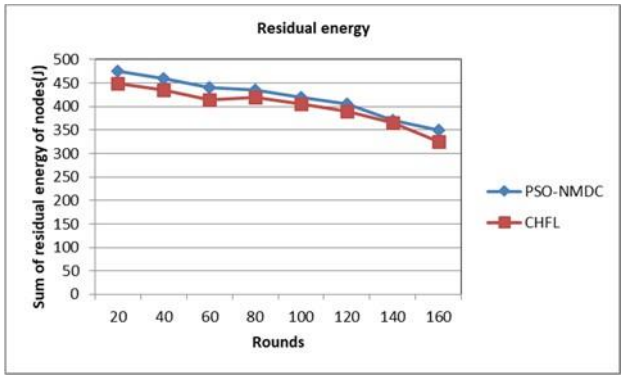

Fig. 7. Total residue energy of network

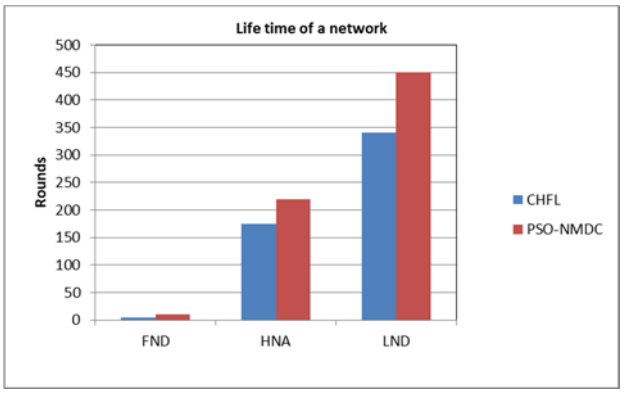

Fig. 8. Life time of network.

IV. CONCLUSION

As to improve the association lifetime similarly concerning strong and viable correspondence in distant sensor network the show used should be energy use, which can be furthermore refined by using a nice quality grouping strategy. In this paper, PSO-based methodology for noxious center acknowledgment and picking a bundle head in a distant sensor network is proposed. The computation proposed relies upon the three data limits, for instance remaining energy of the center point, upheld consideration, and the association quality, which picks the capacity of each and every center point in the WSN. The ability of each center point is enrolled using PSO these three data limits. The computation (PSO-NMDC) proposed in this paper for gathering presents a spatially scattered system for picking bundle heads, altogether decreasing the pack covering and extending the energy usefulness. PSO-NMDC perceives harmful centers henceforth not awards them to be the gathering head; this suggests PSO-NMDC constructs the unwavering quality similarly as creates sensor networks as imperfection merciful associations. Therefore, PSO-NMDC routs the current insufficiencies of CHFL for instance bunch covering and overhead. So with these attributes, the proposed computation PSO-NMDC attests to be the predominant decision where less energy utilize similarly as the improvement of the association lifetime is required.

REFERENCES

[1] Shabana Mehfuz , Sumit Kumar "Energy Aware Probabilistic Broadcasting for Mobile Ad Hoc Network" in 2nd IEEE International Conference on Computing for Sustainable Global Development,2015,pp 1028 - 1033

[2] Sumit Kumar, Shabana Mehfuz "Energy Efficient Probabilistic broadcasting for mobile ad hoc network" Journal of the Institution of engineers (India): Series B, Volume 98, Issue 3, pp 289–294, June 2017.

[3] Raghavendra V. Kulkarni, Anna Forster, and Ganesh Kumar Venayagamoorthy, "Computational Intelligence in Wireless Sensor Networks: A Survey," IEEE Communications Surveys and Tutorials, vol. 13, no. 1, pp.68- 96, 2011.

[4] Bhawnesh Kumar, Vinit Kumar Sharma, Distance based Cluster Head Selection Algorithm for Wireless Sensor Network. International Journal of Computer Applications (0975 – 8887) Volume 57– No.9, November 2012.

[5] Mohammad Wazid, Avita Katal, Roshan Singh, Sachan, R H Goudar, D P Singh, Detection and Prevention Mechanism for Blackhole Attack in Wireless Sensor Network. International conference on Communication and Signal Processing, April 3-5, 2013.

[6] Yuanpeng Xie, Jinsong Zhang, Ge Fu, Hong Wen, Qiyi Han, Xiping Zhu, Yixin Jiang, Xiaobin Guo, The Security Issue of WSNs Based on Cloud Computing. IEEE Conference onCommunications and Network Security 2013 - Poster Session.

[7] Sachin Gajjar, Mohanchur Sarkar, Kankar Dasgupta, Cluster Head Selection Protocol using Fuzzy Logic for Wireless Sensor Networks. International Journal of Computer Applications (0975 – 8887) Volume 97– No.7, July 2014.

[8] J. M. Kim, S. H. Park, Y. J. Han, and T. M. Chung, "CHEF: cluster head election mechanism using fuzzy logic in wirelesssensor networks", Proc. of International Conference on Advanced Communication Technology, pp.654–659, 2008.

[9] Chan H. and Perrig A. "ACE: An Emergent Algorithm for Highly Uniform Cluster Formation", Proc. of 1st European Workshop on Sensor Networks, pp. 154–171, 2004.

[10] Sumit Kumar, Shabana Mehfuz, "Intelligent probabilistic broadcasting in mobile ad hoc network: A PSO approach", Vol. 2, Issue 2, pp. 107-115, July 2016.

[11] Shabana Mehfuz, Sumit Kumar "Two dimensional particle swarm optimization algorithm for load flow analysis" International Journal of Computational Intelligence Systems, Vol. 7, Iss. 6, pp. 1074-1082, Sept 2014.

[12] Bagheri, T.: 'DFMC: decentralized fault management mechanism for cluster based wireless sensor networks'. Second Int. Conf. on IEEE Digital Information and Communication Technology and it's Applications (DICTAP), 2012, 2012, pp. 67--71.

[13] Sumit Kumar, Shabana Mehfuz, "Efficient Fuzzy Logic Based Probabilistic broadcasting for mobile ad hoc network", International Journal of Computational Intelligence Systems, Vol. 9, No. 4, pp. 666-675, June 2016.