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# THROUGHPUT IMPROVEMENT AND LIFETIME MAXIMIZATION IN WIRELESS SENSOR NETWORK

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**ABSTRACT**

*Wireless sensor network (WSN) is a network that composed of several sensing nodes which rely on batteries to meet power requirements. These sensor nodes in the network suffers from various resource constraints due to which network life is not that efficient. Improving network lifetime is the primary challenge that is faced in the wireless sensor network due to resource constraints. The network life optimization problem depends on nature of application of wireless sensor network. One efficient way that can be utilized for lifetime maximization is by improving throughput of the network and hence estimating the routing algorithm. The goal of this paper is to maximize throughput by minimizing energy consumption in data transmission by the sensor nodes to the sink node (destination). In this paper an Improved Distributed Clustering Head Scheduling (IDCHS) algorithm is being utilized to optimize and load balance the network limited resources.*

***Keywords-*** *Cluster Formation, Hierarchical Routing, IDCHS, Network lifetime maximization, Routing Algorithm, Throughput,WSN.*

## I. INTRODUCTION

WSN is a very unpredictable dispersed framework containing enormous number of small sensor nodes and base station (BS). These sensor nodes are conveyed over a topographical zone in an ad-hoc manner for event discovery and monitoring different encompassing conditions. The WSN could gather this ongoing information to plan the earth with more knowledge [1]. WSNs broadly deployed for various applications, for example, civil frameworks, hospitals, smart cities, farming, security applications, and modern applications, etc.

In any case, the lifetime of WSN relies on following requirements: correspondence medium, resource constraints, coverage and availability, adaptation to non-critical failure, nature of administration (QoS) prerequisites, portability and deployment [2]. Here energy efficiency is significant reason for system lifetime minimization. Since WSN needs to work on resource-limited condition, either changing or energizing batteries is impossible assignment. Indeed, even the misfunctioning of single node because of low energy can hinder the whole network. Subsequently this issue constrained the scholarly researchers for building up an energy proficient convention considering node and sensor network [3], [4].

Energy proficiency in WSN is accomplished with the help of moving sink or portable base station in which the sink node moves around the system [5]. Within the sight of the mobile sink, sink migration [6], and route

modification [7] plans are engaged by authors. Cluster development and route establishment are considered as real answers for energy efficiency in WSN [8].

First, the minimization of the number of active Cluster Heads (CHs) prompts minimization of the mean energy utilization [9] which thus expands the energy effectiveness [10] of the system. The thought of link quality measures and increment in number of CHs brought about progressively [11] minimized groups and henceforth improved Packet Delivery Ratio (PDR). Clustering conventions [12], [13] which don't consider the minimization of the number of un-bunched nodes exhaust the energy rapidly. Clustering conventions [14] expected that the CHs can transmit [15] their information to the Base Station (BS) directly by expanding their transmission control [16].

Second, the routing conventions in WSN are arranged under three fundamental heads, they are location-based, data-centric, and hierarchical protocols. In location-based routing scheme, the information about the position of the nodes is utilized for communication. In the data centric routing algorithm, the computational power of intermediate nodes is utilized for optimization of routing information. In hierarchical routing scheme, a cluster head is selected and other nodes send their data to their cluster head which is further processed by cluster head and send to sink node.

In this paper, Improved Distributed Clustering Head Scheduling (IDCHS) algorithm which is a hierarchical routing algorithm is being focussed to for network lifetime maximization. In this routing scheme, the network is divided into two clusters. The primary favourable position of the two-cluster architecture is that it impressively lessens the link distance between the cluster nodes and cluster heads. Thus, this methodology makes the likelihood of lessening the transmitting power of cluster heads which will additionally upgrade the network lifetime.

## II. LITERATURE SURVEY

In order to improve the energy consumption in a WSN a PSO based cluster formation is used as it is more energy efficient [17]. Using PSO algorithm helps to divide network region into two areas using partion lines. Fitness value computation was performed based on remaining energy of the nodes and the number of nodes in the area. A node which has the highest energy is automatically selected as CH. Sink movements are performed by using control packets such as hello packet, message-c packet, and message-m packet. Nodes with similar energy levels are clustered together i.e. nodes of higher energy lever together and nodes of lower energy levels together; this method is frequently used. Due to this, energy drop occurs in the cluster with low energy levels. CH which is selected due to its high energy level; it sustains its state for a small amount of time, due to high energy consumption.

A centroid based clustering protocol was introduced in a static WSN assisted internet of things (IoT) [18]. For cluster formation, energy distance was considered as major parameter and it was computed between node and energy centroid. Base station (BS) location was major constraint for energy centroid computation. Based on energy distance CH rotation and route selection were enabled. Due to the constant change in energy levels there is a frequent change and rotation in the CH in a random manner, this affects the data aggregation. This method

requires deep analysis on BS placement since the routing metric is computed based on BS position. This method is only suitable for network with BS placed inside.

An improved harmony search based energy efficient routing (IHSBEER) was presented in WSN [19] to enable energy efficient routing. The routing characteristics of WSN were adapted in Harmony search for improvements. Harmony was initialized with source, intermediate nodes, and destination. In each harmony, based on the hop count and the capacity of the node the next hop neighbour is selected. The objective function was formulated by residual energy, number of bits, and distance. In a large-scale network, due to the fact that data forwarding paths from sensor nodes to sink node is determined by BS, due to this it is unsuitable.

For an energy efficient WSN; it is offered with a regional energy aware clustering with isolated nodes (REAC-IN) algorithm [20]. The residual energy of sensor node and regional average energy of all sensor nodes determine the computed based weight value for each node. CH is selected among the sensor nodes based upon the computed weight value of the nodes. Based on distance value the isolated nodes were allowed to communicate with the nearest CH or BS. Inside an efficient clustering algorithm, a few nodes are confined from the system. The disengaged nodes require more energy for interchanges incept empowers direct correspondence.

Prolong stable election(P-SEP) convention was acquainted with acknowledging energy efficient steering in fog supported WSN [21]. The main target of this convention was to keep up the reasonable energy utilization in the system. To accomplish this target, the uniform distribution of nodes was pursued and CH determination arrangement was enabled. The system was structured with ordinary and propelled sensor hubs with two distinctive vitality levels. Maybe, this strategy adjusts vitality utilization in bunch development; this technique can't limit vitality utilization in information transmission due to inefficient course choice.

In energy efficient event-driven hybrid routing protocol (EDHRP), three calculations were exhibited to improve energy efficiency [22]. The beginning cluster development was performed by an active node cluster formation (ANCF) calculation. Energy utilization because of detecting was limited by the active node sensing algorithm (ANSA) by choosing ideal node for detecting. Furthermore, active node sensing algorithm (ANRA) was endeavoured to choose route with active node for energy minimization. Here course determination with dynamic hubs devours more energy for specific node which prompts node early dead.

## III. IMPROVED DCHS ALGORITHM

In this algorithm, initially a node is being considered to be inactive until active signal is received to save battery degradation. Once the sensor node is active it sends beacon signal to base station and receive node RSSI value. The base station then creates sensor node IDs and also corresponding RSSI value. The base station computes mean of all RSSI values. After that, the next step is to compare the mean RSSI values with the corresponding RSSI values. If mean RSSI is greater then the corresponding RSSI values it forms first cluster and all other nodes whose RSSI is less than mean RSSI forms second cluster. The final step is cluster head selection, to achieve this once again RSSI mean of each cluster is calculated and the node whose RSSI value is close to mean RSSI is elected as cluster head. This cluster head of each cluster further communicates with base station to convey information of each their cluster nodes.

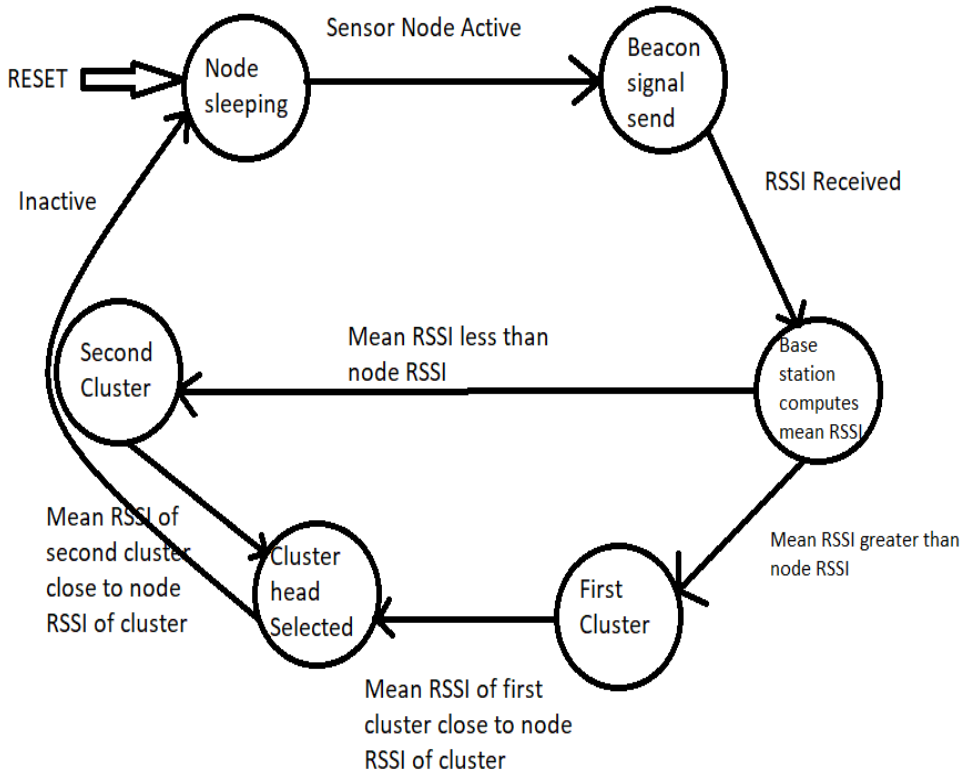


Fig. 1. State diagram of Improved Distributed Cluster Head Scheduling (IDCHS)

## IV. SIMULATION

Simulation of the above state diagram which represent IDCHS routing algorithm is done using VHDL. The coding is done using FSM (Finite State Machine) language in VHDL and result in viewed in HDL designer suite. The following figure shows result of the proposed work.

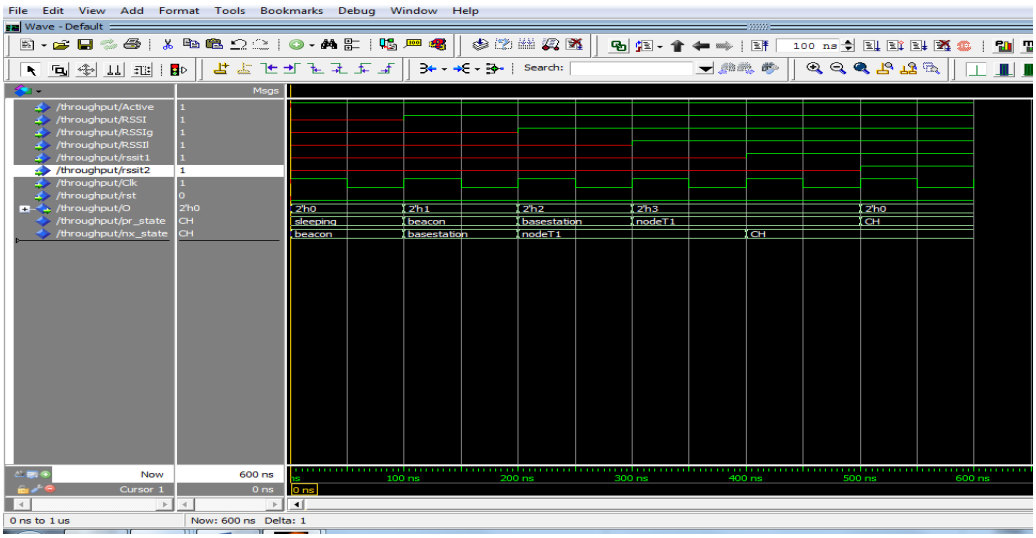

Fig. 2. Simulation result of Improved Distributed Cluster Head Scheduling (IDCHS)

## V. CONCLUSION

From the simulation result it has been seen that using the proposed algorithm it is possible to achieve significant decrease in energy consumption when compared with current progressive protocols. The proposed IDCHS utilizes selection of cluster head on the basis of RSSI value of the cluster nodes. The idea incorporated in this algorithm is to allow sensor to stay in sleep mode and save battery when it is not involved in communicating with the network to maximize throughput. As soon as, they receive signal they become active and sends their data to the corresponding cluster head with their RSSI value. Thus, the proposed IDCHS can be efficiently deployed for energy delicate applications in WSN where network lifetime is of more concern.

## REFERENCES

[1] M. Handy, M. Haase, D. Timmermann, Low energy adaptive clustering hierarchy with deterministic cluster head selection, IEEE MWCN, Stockholm, Sweden (2002).

[2] H. Yetgin, K. T. K. Cheung, M. El-Hajjar, and L. H. Hanzo, A survey of network lifetime maximization techniques in wireless sensor networks, IEEE Commun. Surveys Tuts., 19 (2), 2017, 828–854.

[3] Zhenghao Zhang, Ming Ma, Yuanyuan Yang,Energy-efficient multi-hop polling in clusters of two-layered heterogeneous sensor networks, IEEE Trans Comput., 57 (2), 2008.

[4] ZiliangZong, et al.,EAD and PEBD: two energy-aware duplication scheduling algorithms for parallel tasks on homogeneous clusters, IEEE Trans Comput., 60 (3), 2011.

[5] O. Cayirpunar, E. Kadioglu-Urtis, and B. Tavli, Optimal base station mobility patterns for wireless sensor network lifetime maximization, IEEE Sensors J., 15 (11), 2017, 6592–6603.

[6] C.-F. Wang, J.-D. Shih, B.-H. Pan, and T.-Y. Wu, A network lifetime enhancement method for sink relocation and its analysis in wireless sensor networks, IEEE Sensors J., 14 (6), 2014, 1932–1943.

[7] A. W. Khan, A. H. Abdullah, M. A. Razzaque, and J. I. Bangash, VGDRA: A virtual grid-based dynamic routes adjustment scheme for mobile sink-based wireless sensor networks, IEEE Sensors J., 15 (1), 2015, 526–534.

[8] S.P. Singhand, S.C.Sharma,A survey on cluster-based routing protocols in wireless sensor networks, in Proc. Int. Conf. Adv. Comput. Technol. Appl. (ICACTA), 45, 2015, 687–695.

[9] M.Y.M. Ye, C.L.C. Li, G.C.G. Chen, J. Wu, EECS: an energy efficient clustering scheme in wireless sensor networks, 24th IEEE Int. Performance, Comput. Commun. Conf. 2005, AZ, USA, 2005, 535–540.

[10] D. Kumar, T.C. Aseri, R.B. Patel,EEHC: Energy efficient heterogeneous clustered scheme for wireless sensor networks,Comput. Commun., 32, 2009, 662–667.

[11] S.Younis, Ossama, Fahmy, HEED: A hybrid, energy-efficient, distributed clustering approach for ad hoc sensor networks, IEEE Trans. Mob. Comput., 3, 2004, 366–379.

[12] W.B. Heinzelman, A.P. Chandrakasan, H. Balakrishnan, An application-specific protocol architecture for wireless microsensor networks, IEEE Trans. Wirel. Commun.,1, 2002, 660–670.

[13] F. Xiangning, S. Yulin, Improvement on LEACH protocol of wireless sensor network,Int.Conf.Sens.Technol.Appl.Improv.Valencia,Spain,2007,260–264.

[14] S.Randhawa,Comparativeanalysisofflatroutingprotocolsinwirelesssensor network, Int.Conf.Intell.Comput.Control,Coimbatore,India,2017,1–8.

[15] R.Biradar,V.C.Patil,S.R.Sawant,R.R.Mudholkar,Classificationandcomparison of routing protocols in wireless sensor networks, Ubiquitous Comput. Secur.Syst.4, 2015, 704–711.

[16] J.N. Al-Karaki, A.E. Kamal, C. Science, Routing techniques in wireless sensor networks,IEEEWirel.Commun.11, 2012, 6–28.

[17] J.Wang,Y.Cao,B.Li,H.-J.Kim,andS.Lee,Particleswarmoptimization-based clustering algorithm with mobile sink for WSNs, Future Gener. Comput. Syst., 76, 2017, 451–457.

[18] J. Shen, A. Wang, C. Wang, P. C. K. Hung, and A. C.-F. Lai, An efficient centroid-based routing protocol for energy management in WSN-assisted IoT, IEEE Access, 5, 2017, 18469–18479.

[19] B. Zeng and Y. Dong, An improved harmony search based energyefficient routing algorithm for wireless sensor networks, Appl. Soft Comput., 41,2016, 135–147.

[20] J. S. Leu, T. H. Chiang, M. C. Yu, and K. W. Su, Energy efficient clustering scheme for prolonging the lifetime of wireless sensor network with isolated nodes, IEEE Commun. Lett.,19 (2),2015, 259–262.

[21] P. G. V. Naranjo, M. Shojafar, H. Mostafaei, Z. Pooranian, and E. Baccarelli, P-SEP: A prolong stable election routing algorithm for energy-limited heterogeneous fog-supported wireless sensor networks, J. Supercomput., 73 (2), 2017, 733–755.

[22] F. Muhammad, Z. A. Muhammad, G. Tuna, and V. C. Gungor,EDHRP: Energyefficienteventdrivenhybridroutingprotocolfordenselydeployed wireless sensor networks, J. Netw. Comput. Appl., 58 (12), 2015, 309–326.