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Analysis of Energy Efficiency Routing Protocols for Wireless Sensor Network

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Abstract: A Wireless Sensor Network (WSN)isacollectionoftinypower,multifunctional,andcommunications nodes that observe and records one or more parameters at distinct places. Then,it converts recorded data to signals that can be processed. Such nodes are randomly implementedon a large or small scale, this becomes a significant field for study because these networks areusedtodayinnumerousconsumerandindustrialapplications,forinstanceinhealthcare,industry, transport system, government security, military systems, agriculture, and underwatersensor systems [1, 2]. The deployment of a huge amount of sensor nodes may enable greatermonitoring with high accuracy, but it can be very costly or even impossible to charge or replacebatteries because of the challenging deployed environment. These scattered sensor nodes arecapable of collecting and transferring data back to an internal base station (BS) or other sensors,sending and receiving information drain node's energy, Therefore, the best way to improve thelife of WSN is by selecting information transfer paths to minimize the complete drainage ofenergy along the route and to balance the load between the nodes [3]. The BS can be either amobileora fixed node that connects thesensor network t oacurrent infrastructure for communication or the internet. Since the WSNs have become an important element of the modern infrastructure of communication. To transmit information to t heir destination effectively, the power consumption and maximize network lifetime have become the criticalparameterin routing protocols [4].
Keywords: Sensor nodes, base station,Signals,Consumption, protocols, WSN.

I. INTRODUCTION

The advent of the computer and invent of communication network is raised and itmade the transformation in information processing. The functionalities of network have beenimplemented by many of the professionals, government organization and industries. Theconnection of network is accomplished in two ways that is wired connection and wirelessconnection. The wired connection is established through cables and the wirelesscommunication is established by transmission data through waves. To handle the rapidincreasing of mobile and laptop usage, wireless technology has introduced forcommunication and transmission of data. In addition to that efficiency and capacity isincreased by advancement of the wireless technology.

II. LITERATURE REVIEW

Muhammad Akram et al. (2016) [61] developed a new fuzzy rule-based inference model fornetwork security in which the system selects some intermediate and verification node whichis adaptive in nature with respect to data delivery. They considered the three networkparameters namely the residual energy, the proximity of the intermediate node to the originalcluster and the attack frequency in the network as evaluation parameters and proved that,their model is more efficient with respect to energy conservation and also guaranteedsufficient protection against network attacks. Zhao Han et al. (2014) [62] proposed a newrouting protocol called General Self-Organized Tree-Based Energy-Balance routing protocolwhich was developed using a hierarchical modeling. Moreover, the tree based modeldeveloped by them uses a base station as the root node and sensor nodes as children nodes.Degan Zhang et al. (2014) [63] proposed a new energy balanced routing algorithm in whichthe author shave used forward aware factor for making routing decisions. Moreover, the nexthop node is selected in their model based on the awareness of link weight and forward energydensity. In addition, a spontaneous reconstruction mechanism is proposed by the authors byusing a new method for designing the network topology dynamically.BehrouzMaham et al. (2011) [79] proposed a cooperative protocol for outage restrictedmultihop wireless ad hoc networks. The proposed protocol allocates power, based on channelstatistics and utilizes distributed space-time codes for efficient cooperative transmission. Theproposed protocol achieved up to 72% of energy saving at an outage probability of 10 -3 whencompared to non-cooperative multipath routing. An optimal power control algorithm tomaximize power efficiency for a given QoS in wireless sensor networks was proposed by DiWang et al. (2011) [80].Hongli Xu et al. (2013) [81] studied the problem of constructing an energy efficient topologyin wireless sensor networks using V-MIMO communication. They proposed V-MIMOtopology control algorithm which involves joint optimization of V-MIMO, partner selectionand topology control.

They achieved 32% reduction in the power consumption whencompared to the existing algorithms.Muhammad Kamran Naeem et al. (2014) [82] proposed a cooperative transmission andresource selection scheme for collaborative wireless sensor networks. Energy conservation isobtained by selecting optimal number of cooperating nodes.Yuyang Peng et al. (2016) [83] proposed an energy efficient scheme which combines theconcept of combining cooperative communication with spatial modulation of randomlydistributed nodes for an ad hoc network. They developed an adaptive algorithm which findsthe optimal number of hops while considering the circuit and transmission energyconsumption.

III. METHODOLOGY

1) *Energetic Routing Technique using Latency wise Node Selection*

Wireless sensor networks are widely utilized in the process of sensing diverse applicationsnamely healthcare observation and monitoring of the atmospheric condition. Sensor nodes arealways stable, whereas these nodes are constantly deployed in a specific location. The energylevel of each sensor node is vital in performing the assigned work and it assures the workingcondition of the node. In the communication procedure across the network, it depends on twomodes, namely inactive and energetic state. Some critical condition in the data transmissionenvironmentcausesnodeswithminimumenergycanactasanactiveandproceedpacketsharing, and this node suddenly drops the level of energy, which makes the packet transmissionfailure.

The transmission failure and the maximumenergy utilization iscaused in the transmissionenvironment. This increases energy consumption, network overhead, and the end to end delay.Hence, the Energetic Routing Technique (ERT) is used to obtain energy-efficient communicationin the wireless environment. The proposed ERT efficiently monitors the low energy nodes andprovidesthehighenergyneighbornodelistforfurtherpacketforwardinginasensornetworkand constructing the latency wise promote node selection algorithm, which is applied to removemaximumdelay node, also chooselesser delay nodeforpacket forwarding.

TheEnergeticroutingTechnique(ERT)isappliedtoprovideenergyefficientpackettransmissioninthewirelessenvironment.Unexpectedlya waken bylowenergynodesareobserved efficiently by using ERT, and achieve the maximum energy level of neighbor node listfor more packet sharing along with the sensor network. Designing the latency wise promote nodeselection algorithm is used to reject the higher delay node, also select lower delay node for thecommunication process. This reduces the energy consumption, network overhead, and end to enddelay.

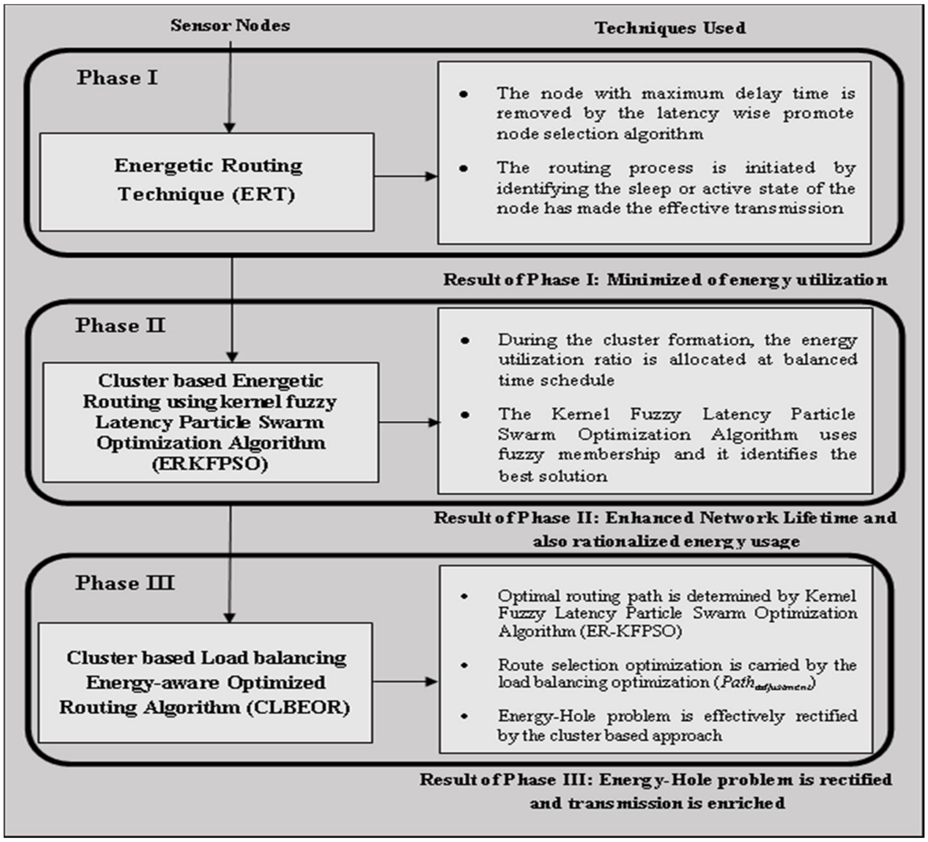
2) *Cluster-basedEnergeticRoutingusingkernelfuzzyLatencyParticleSwarmOptimization Algorithm(ER-KFPSO)*

To attain the energetic routing diverse techniques were proposed and the developed techniquesmake significant progress in stabilizing the energy level as it is a vital parameter of a WSN.Inthe existing method particle swarm optimization based nodes and lifetime prediction methodthrough linkage (PNLP) [7], the energy usage and lifetime of the network is not effective. In thisphase, an Energetic Routing which is based on the Kernel Fuzzy Latency PSO (ER-KFPSO) isproposed, which considers the network lifetime and the energy rationalization. Load balancingmethods along with energetic routing is utilized at the time of clustering. An Energetic Routingwhich is based on the Kernel Fuzzy Latency PSO (ER-KFPSO) supports the minimum energyconsumption in WSN that plays a vital role in the improvisation of the lifetime of the network.The proposed method assists in shaping the clusters by making use of the energy fitness valuealongwith the assignment ofCHs.

The proposed method ERKFPSO is performed through a clustering framework that plans toallocate energy utilization mong clustersatabalancedtimeandthusexpandsnetworks'lifetime. The objectives of the proposed algorithm are to reduce energy utilization of sensordevices, diminish latency and message overhead of real-time data access and exploit the lifetimeof WSN. In a cluster, there exists a particular node that is the center of the sub-graph called headandis linked to all other nodescalled cluster members to form anetworktopology.

In wireless sensor networks, the achievement of the selection of CHs algorithm based on thefitness weight function considered to select the nodes as CHs. A novel fitness function is plannedforCHsselection.Thisfunctionincludesthetwo-considerable feature of WSN si.e.initially,the energy utilization among CH and sensor nodes; next, the sum of energy utilization for combiningthe data at CH's stage plus broadcasting the message to BS. The energetic routing techniqueprocess is used to discover the uses connected to the smart node, where real-time data packetobservationis essential in thetransmission process.

The KernelFuzzy Latency Particle SwarmOptimization Algorithm uses fuzzy membershipparticles that update their location qualified to the location and speed of the cluster. To find thebest solution is attained from the group of randomly created primary explanations by movingparticlesapproximatelyinthefoundspace,whichdiscoversthebestsolutionbyswarmssubsequent the finest particle. Every particle has a particular velocity and location in everyiteration a novel velocity rate is considered and it is used to update the particle's location. Byfollowing this procedure data transmission is achieved effectively.



The integration of KFPSO inEnergeticroutingincreasestheperformanceoftheenergy-efficientLEACHmethodconsiderably

3) Cluster-based Load balancing Energy-aware Optimized Routing Algorithm (CLBEOR)

In WSN, sensor nodes are considered to have a short life duration appropriate to continuoussensing, and consequently, the battery drains quickly. Under the heavy load, energy utilizationcondition sensors in closer proximity to Cluster Head expire quickly and initiate the energy-hole problem.Thus,optimal usage of available energy is a key challengein WSN assisted applications.To over come the seissues, aCluster-based Load balancing Energy-aware Optimized Routing Algorithm (CLBEOR) with Energetic Routing aware Kernel Fuzzy LatencyParticle Swarm Optimization Algorithm (ER-KFPSO) proposed, and it is performed with fourmajorsteps;Clustering,CHselection,EnergyUtilization,andoptimization-basedrouteidentification for data transmission. Itfocuseson the problem of traffic overloading near the sink. Ith asbeenela boratedin four steps: network setup,energy model,node clustering,and route identification.

The networksetupphaseexplainsthesensornetworkcreationanddeployment.The energy model analyses the energy consumption whiletransmittingdataoverthenodes.ThenodeclusteringandCHselectionexplainsgroupingthenodesandcreatingclustersinthenetwork.In the route identificationphase, theoptimal pathfor transmittingthe datawillbe identifiedbyusing the KFPSO algorithm. The proposed load balancing optimization (*Pathadjustment*) is used foroptimal route selection from the cluster head to the sink node. The proposed approach shows animprovement in terms of packet delivery ratio and packet delay ratio as compared to otherexistingPNLP and KFPSO algorithms.

IV. RESULTS AND DISCUSSION

The proposed approaches were simulated using Network Simulator Tool (NS 2.34). The WSN isrepresented by 100 mobile nodes that are deployed in 820 × 620 m^2 square regions. The basestation is located at (50,175). The initial energy is 5 J for each sensor node. The simulation of theproposed approaches is running at an average of 20 times. The proposed mechanisms have beenevaluated against three different performance metrics packet delivery ratio, end to end delay, andnetworklifetime.

Packet Delivery Ratio is a ratio of the total number of packets received at the destination to thenumber of packets sent from the source. The packet delivery ratio of the CLBEOR mechanism ishighwhen compared to theothertwoproposed mechanisms as shown in Figure2.

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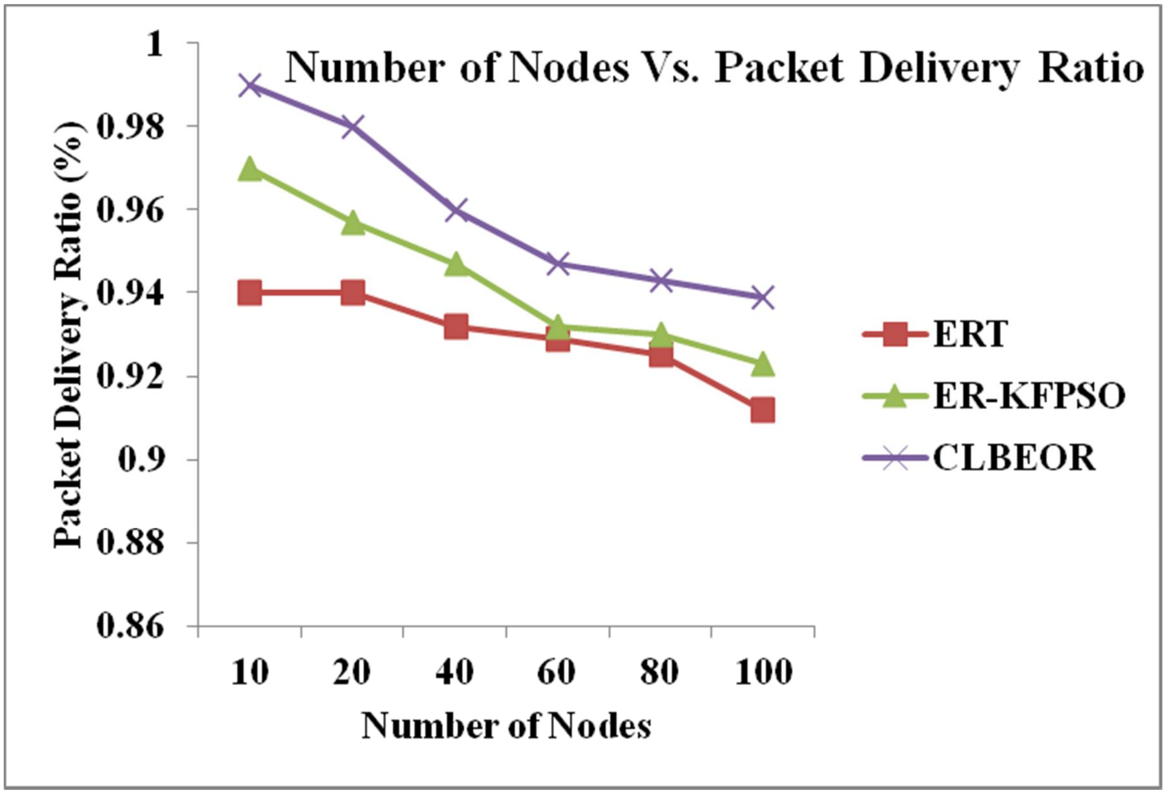


Figure2.NumberofNodesVsPacketDelivery Ratio

End to End Delay is estimated by the amount of time used for packet transmission from thesource node to the destination node. The end-to-end delay of the CLBEOR mechanism is lesswhencompared to theother two proposedmechanisms as shown in Figure 3.

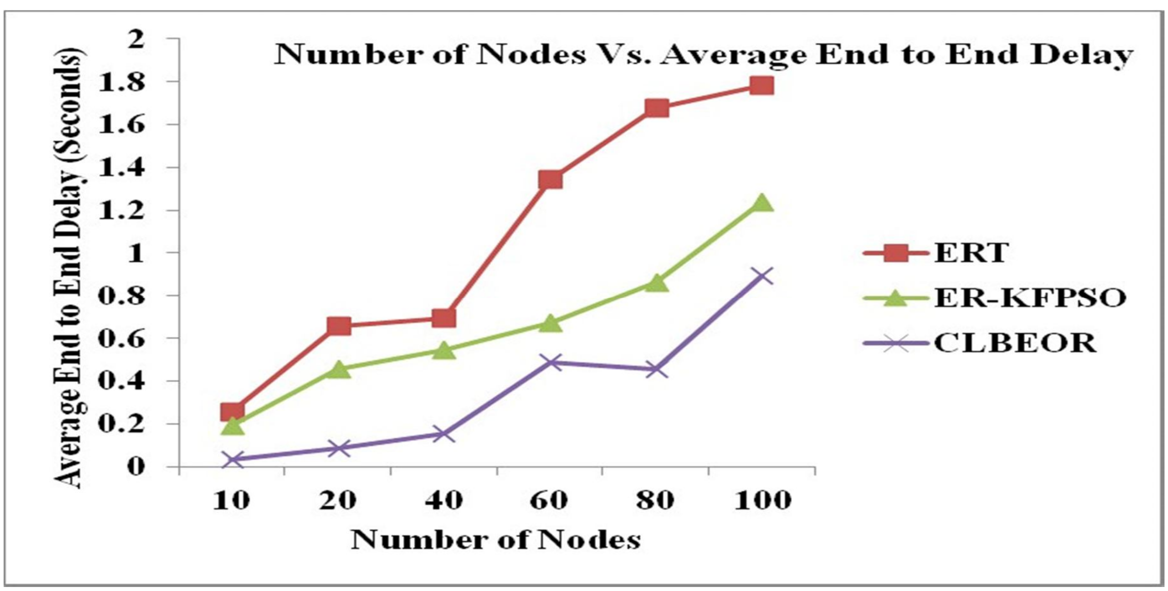


Figure3.Numberof NodesVsEndto EndDelay

Network Lifetime is measured by nodes process time taken to utilize network from overallnetwork ability.The network lifetime of the CLBEOR mechanism is comparatively high whencomparedto theother twoproposed mechanisms asshown in Figure4.

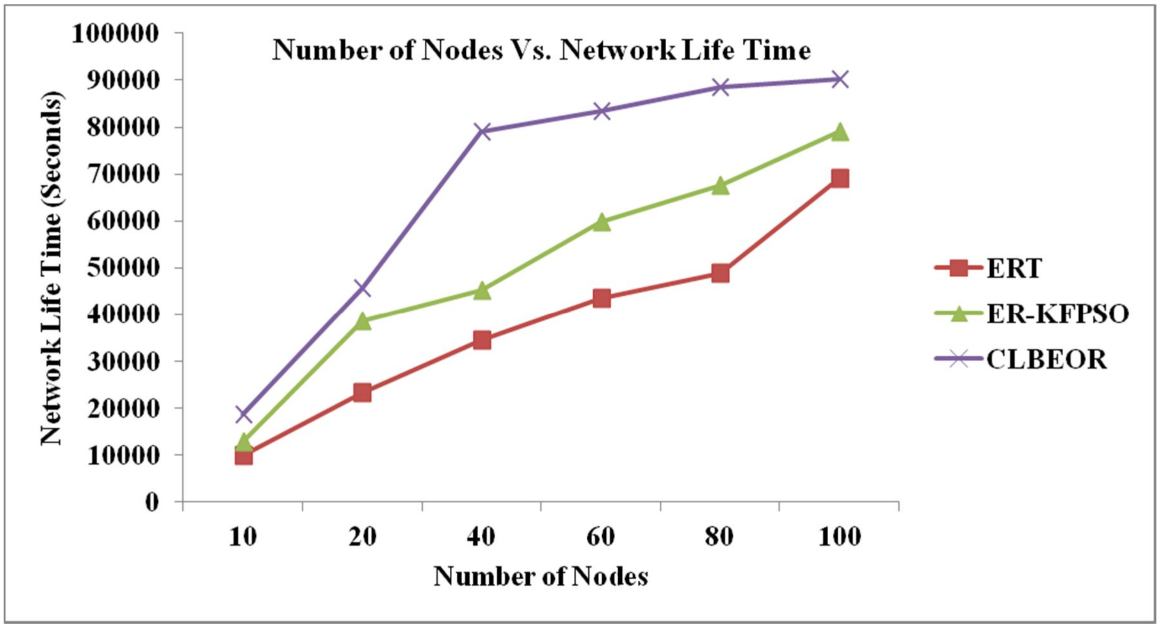


Figure4.NumberofNodesVsNetworkLifetime

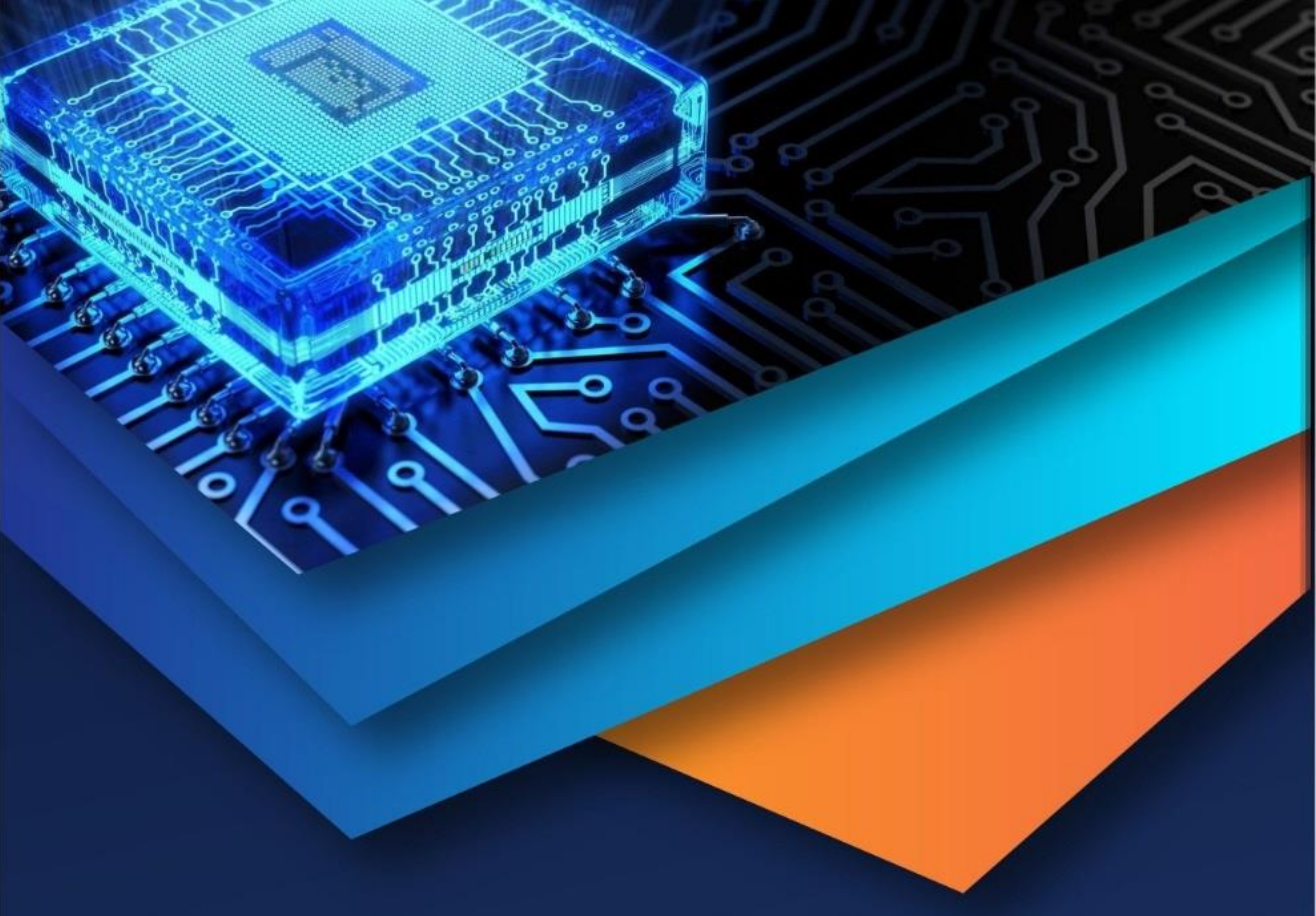
V. CONCLUSION

The network of WSN is comprised of several senor nodes with constrained resource and they areinstilled with non-researchable batteries. The sensors in the WSN consume more energy duringtransmission rather than computation. It increases energy consumption and drops the data packet,whereas the communication process is interrupted. Retransmission makes the maximum networkoverhead and an end to end delay is increased. Under the heavy load, energy utilization condition sensor sin close proximity to CH expire quickly and initiate the energy-hole problem.By considering all these drawbacks,this research workis formulated.TheEnergeticroutingTechnique(ERT)isusedtoprovideenergy-efficient packet transmission in the wireless environment. This process minimizes the utilization of energy, delay, and network overhead.

TheEnergeticRoutingwhichisbasedontheKernelFuzzyLatencyPSO(ERKFPSO)isperformedthroughaclusteringframeworkthatplanstoallocateenergyutilizationamongclustersatabalancedtimeandthusexpandsnetworkslifetime.TheCluster-basedLoadbalancingEnergy-awareOptimizedRoutingAlgorithm(CLBEOR)withEnergeticRoutingawareKernelFuzzyLatencyParticleSwarmOptimizationAlgorithm(ER-KFPSO)isproposed to support the energy consumption in WSN. The CLBEOR algorithm uses an energy-efficientcluster head selection method based on multiple objectives like proximity, cost, residual energy,and coverage. The proposed load balancing optimization (*Pathadjustment*) is used for optimal route selection from the cluster head to the sink node. The performance of the proposed ERT,ERKFPSO, and CLBEOR are compared and the effectiveness of the result is investigated.

REFERENCES

[1] Ashish, A., Desai, A., &Sakadasariya, A. (2017, May). A review on energy efficient data centricr outing protocol for WSN.InTrendsinElectronicsandInformatics(ICEI),2017InternationalConferenceon (pp. 430-434). IEEE.
[2] Patil, S. S., Gudnavar, A., &Chandan, K. (2017, April). Energy efficient and reliable routing indenselydistributedWSN.InCommunicationSystems,Computing andITApplications
[3] AitAoudia, F., Gautier, M., Magno, M., Berder, O., &Benini, L. (2017). A generic framework formodelingMAC protocols inwirelesssensornetworks.IEEE/ACM TransactionsonNetworking(TON),25(3), 1489-1500.
[4] Sabri A, Al-Shqeerat K, "Hierarchical cluster-based routing protocols for wireless sensor networks asurvey",IntJ ComputScience 11(1):13, 2014.
[5] Misra S, Kumar R, "A literature survey on various clustering approaches in wireless sensor network" ,International conference on communication control and intelligent systems(CCIS).pp18–22,2016.
[6] Verma, P., Shaw, S., Mohanty, K., Richa, P., Sah, R., Mukherjee, A., "A Survey on Hierarchical Based Routing Protocols for Wireless Sensor Network", 2018 InternationalConferenceonCommunication,Computing andInternetof Things(IC3IoT), IEEE,338-341, 2018.
[7] Devi Manickavelu and RhymendUthariarajVaidyanathan, "Particle swarm optimization (PSO)-basednodeandlinklifetime predictionalgorithmfor routerecoveryinMANET", Springer,2014.



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