European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 07, Issue 09, 2020

MOBILE ENERGY AWARE CLUSTER BASED MULTI-HOP USING HYBRID SWARM BASED ROUTING PROTOCOL FOR HIERARCHICAL HETEROGENEOUS WSNS

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Abstract: ***Wireless Sensor Networks (WSNs) are becoming one of the demanding platforms. Environmental or physical conditions are sensed and monitored by sensor nodes and these data are transmitted to base station using multi-hop routing. For enhancing network lifetime and stability, various cluster-based solutions are designed in recent days. For homogeneous networks, various energy efficient solutions are developed and for data communication, distance parameter are used. When compared with location and flat based routing protocols, better performance is shown by hierarchical heterogeneous cluster based energy efficient routing protocols. This because of the presence of heterogeneity of nodes with respect to sensor node's energy level and it enhances network's lifetime. In recent works, mobile sensor nodes are used for enhancing WSNs performance and functionality. In this paper, authors proposed a novel concept of mobile sensor nodes and it is termed as Mobile Energy Aware Cluster Based Multi-hop routing protocol for hierarchical heterogeneous WSNs. It selects CHs according to newly proposed probability equation which selects only that sensor node as Cluster Head (CH) which has highest energy among other sensor nodes. In MEACBM, after sensor nodes deployment and clusters formation, whole network area is divided into sectors and inside every sector a mobile sensor node is placed which act as Mobile Data Collector (MDC) and it collects data from CHs. This technique helps in significantly reducing sensor nodes energy consumption of for transferring information to Base Station(BS). Also energy consumption aware routing by finding path is done by using Hybrid form of Particle Swarm Optimization and Artificial Bee Colony Optimization called (PSOABC) algorithm is also***

proposed. This research work considers the following Quality of Service (QoS) parameters for optimal selection of route paths: network lifetime, throughput and Energy for evaluation purposes.

Keywords: Wireless Sensor Networks (WSNs), Particle Swarm Optimization (PSO), Artificial Bee Colony (ABC) Optimization, Base Station, sensor node, Cluster Head(CH).

I. INTRODUCTION

WSN can be characterized as an assortment of self-composed moment gadgets, termed as nodes with sensor and all these nodes were scattered in an irregular way dependent on ad-hoc infrastructure, for accumulating auditory information over whole system field. In contrast to different remote correspondence advances, the WSNs present novel limitations on the correspondence conventions on account of constrained resources [1]. We plan the routing protocols in the customary systems, in order to organize the executing with respect to the delivery of the data and latency of the network. Further it emphasis on advancing the vitality conservation with the slight correspondence overheads [2]. Over the conventional networking approaches [3], adaptability, negligible costs, steadiness, and effectiveness of circulation are central favourable circumstances of applications with WSN. Energy use is an uncommon source and needs to adapt brilliantly, due to the restricted requirements of in WSN situations [4], for enhancing the system lifetime and routing execution. Conventional and single level directing arrangements aren't practical for an application that depends on sensors, in light of the dynamic conduct of sensor nodes. Therefore, various specialists concentrate on the advancement of the versatile and vigorous routing protocol for upgrading the productivity towards the endpoints [5].

For WSNs [6], Hierarchical-based routing protocols were considered as the substitute are used to help effective discovery of route and utilization of energy. This network is isolated into two principal segments, which is improvement of system framing and information correspondence. However, the current hierarchical-based solutions are engaged with respect to probabilistic strategies and worldview problematic boards [7]. In addition, route discovery instrument in existing arrangements [8] are not advanced by versatile conduct of links which has wireless communication and periodic re-clustering will be executed. Also, to build up a propagation route of end-to-end data, many course demand messages are dazed in a hop-by-hop way, which brings about extra correspondence cost and decreases lifetime of the network [9]. Besides, the ideal determination of directing ways and their re-tuning for information dispersing raises an issue for requesting the data[10].

Furthermore, huge work has been proceeded in the last decade in order to rectify this issue and it is discovered that Cluster based routing by sensor node's energy usage, which can be viably diminished and further it gives more prominent system life expectancy when contrasted with different techniques like transmitting directly. Clustering gives 2 or multiple times better lifetime of the system when contrasted with others [11]. Here, gathering of sensor nodes happens to frame group which brings about sparing of vitality, since the quantity of sensor node's transmission through long distance is limited. Each cluster has CH inside them, which assumes

the liability of each group part sensor nodes that again brings about vitality sparing. Data aggregation at CH likewise brings about sparing of sensor nodes vitality by limiting the transmitted data count [12]. A few leaving approaches of cluster based conventions are proposed by different creators in which Zang et al. in 2015 proposed a fusion termed as Node Density based Clustering and Mobile Collection (NDCM) [13] and it consolidates the idea of Mobile Elements (MEs) and hierarchical routing for information assortment in WSNs. Likewise the author proposed another CH selection plan on node's thickness, which brings about the improvement of lifetime of the system and recoveries the system vitality and this helps only for systems that are homogeneous. Khurana et al. in 2016 proposed a Multi-hop LEACH [14] routing convention in which major two significant modifications were performed, that is communication with multi- hoping helps in both inter as well as intra-cluster. The system lifetime gets enhanced by diminishing vitality disseminated measure. Its downside is that it was just executed in systems that are homogeneous. Cengiz et al. in 2016 talks about Low Energy Fixed Clustering Algorithm (LEFCA) [15] were the sensory nodes turned into the piece of specific bunch at the time of set-up stage will stay in that group all through its lifetime of the system.

Jerbi et al. in 2016 proposed a Orphan LEACH (O-LEACH) [16] idea and its primary point is the network plus inclusion of entire zone. This idea is utilized to wrap-up those sensory nodes which doesn't interface with other clusters because of their distant transmission that the supporters involve in the development stage of the cluster. Its downside is that it was just executed in systems that are homogeneous. Mohan et al. in 2018 suggested another vitality productive hybrid protocol for routing dependent on versatile (mobile) information authorities which utilizes grouping idea and further it utilizes numerous portable information gatherer nodes [EEHPMDC] for gathering information from different Cluster Heads and transmitting it back to BS [17]. This protocol is a mixture and it utilizes both unified and disseminated clustering system and consequently upgrades the life span and saves the vitality sensory nodes that are utilized here. Toor et.al in 2018 suggested a new energy efficient cluster based multi-hop routing protocol (EACBM) [18] for heterogeneous system and further it utilizes the idea of grouping, sub-grouping and multi-hoping for giving a productive and solid convention that upgrades the system lifetime, availability, steadiness, inclusion and throughput.

This exploration paper tends to the issue of rare assets resources of energy, while gathering and sending sensory data in WSNs, which abbreviates lifetime of the network. Our proposed convention centers on creating Cluster-based Energy- aware Routing for heterogeneous WSNs for expanding dependability time with smallest amount of information handing-off interim and course breakages. Initially, the proposed convention parts the sensor nodes into groups. Also, gives a light-weight answer for improve the course discovery process as far as hop-count, leftover vitality. Furthermore, the routing ways are refreshed dependent on estimations of the network for following system dependability. This may prompt a decline in delay of the end-to-end system and vitality utilization with high information delivery.

II. PROPOSED METHODOLOGY

The overall proposed methodology process is described in figure 1.

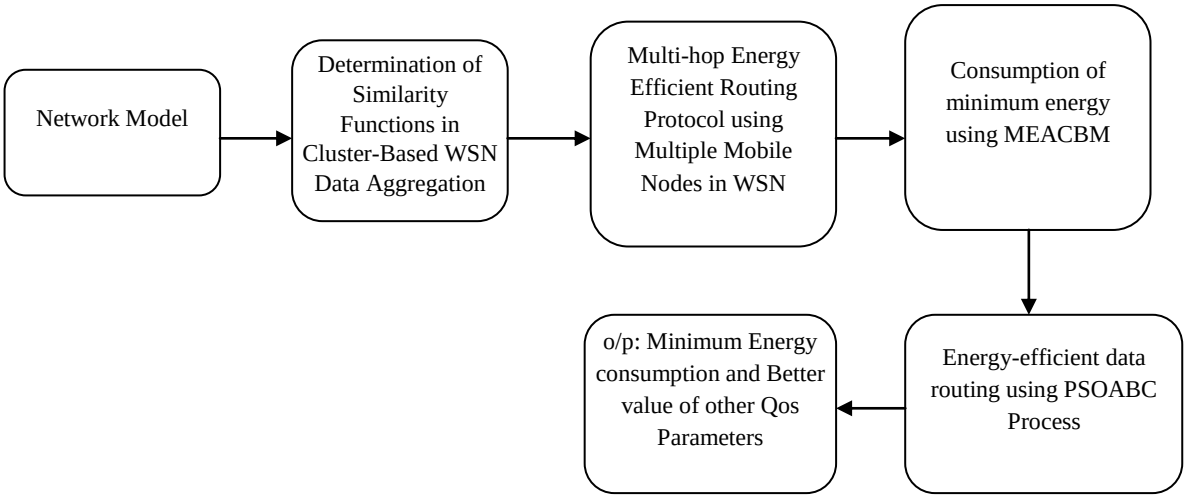

Figure 1: Proposed Methodology Diagram

Right now, a Similarity Functions in Cluster-Based WSN contains the sensor information's and they were grouped to the likeness esteems, for instance gathering information accumulated from the temperature sensor as single gathering. At that point this paper proposes a Mobile Energy Aware Cluster Based Multihop (MEACBM) routing protocol using Mobile data collector sensor nodes by partitioning the system territory into segments, considering three diverse sensor node's energy and it choose CH based on recently proposed likelihood condition which chooses CH based on most elevated leftover vitality of sensor node. Additionally, vitality use mindful steering is finished by utilizing Hybrid PSOABC algorithm.

A. The Radio Energy Model

The Radio energy model helps in registering the total energy scattering during interaction among master (sender) and the beneficiary. Creators utilizes both free space model as like multi-model and multi-path model for registering energy measure disseminated by sender ETX and recipient ERX relies on the distance 'd' between them [18]. The detailed model is explained in [18].

B. Determination of Similarity Functions in Cluster-Based WSN Data Aggregation

Each bunch (cluster) comprises of a Cluster Head (CH) and numerous Cluster Members (CMs). In, Subsequent to the determination of cluster, a CH is answerable for gathering information from its cluster member and broadcasting the information to the sink/BS. Since CHs and aggregators works alike, total information is a significant method in UWSN's cluster-based strategy. Here, concentrates mainly on data aggregation in WSN's cluster-based methodology, four comparability works (Euclidian's separation, cosine separation, Jaccard's separation, and Hamming separation).

In the paper, we discovered standardized limits for each of them so as to figure out which comparability work is the good decision for information joining in wireless sensor network's cluster-based strategy. This assessment inferred that the Euclidean and cosine separations helps in

incrementing the adequacy of UWSN's cluster-based methodology by decreasing the bundle volume and limiting information repetition sent to the sink/BS. Each cluster comprises of a (CH) and a (CMs). In the wake of framing a cluster, a CH is answerable for gathering information from its CMs and broadcasting the information to the sink/BS. Since CHs and aggregators have fundamentally the same as practices, information accumulation is a significant system in cluster-based WSNs. Here we mainly concentrate on information accumulation in cluster based WSN, our recently distributed paper assessed four closeness works (distance of Euclidean, cosine, Jaccard, and Hamming).In this paper, we discovered normalized limits for each capacity so as to figure out which comparability work is good for information incorporation in wireless sensor network's cluster-based methodology. This assessment reasoned that the separations of Euclidean and cosine value helps in incrementing the practicability of WSN's cluster-based methodology by lessening the packet size and limiting information repetition sent to the sink/BS.

In WSNs, position of the node is basic. At each and every position, a node intermittently catches marvels and broadcasts the caught information to the aggregator. By taking out information repetition, it diminishes not just the energy utilization of the general system yet additionally lessens the bundle size being broadcasted to the BS or sink. In information total, every aggregator gathers and supplies lot of estimated information as a vector at a specific time. At that point the aggregator distinguishes the sets whose similitude's are within the provided limit. Thus, enforcing a similitude work is a talented methodology for the aggregator. A similitude work utilizes a limit to choose how comparative two analyzed information are. To assist the objective of restricted system usage and the packet size, we enforce likeness capacities to aggregators. In the event that the contrasted information are found with be like one another, the aggregator doesn't have to broadcast all arrangements of information to the BS or sink.

The primary obligation of an aggregator is to gather detected information on or after neighbour nodes, accumulate the gathered information, look between two arrangements of information (the current and the novel informational indexes) utilizing likeness works, and transmit information to the B or sink. So as to do the correlation, an aggregator supplies the gathered information as a vector arranged by the nodes at the neighbours. An aggregator enforces a closeness capacity to look at the similitude between two informational collections. In the event that the two informational collections (data sets) are finished up are same in the fundamental part, the aggregator broadcasts just a single informational index rather than both to the BS or sink. Else, it forwards all the information to the BS or sink.

Let p,q be the two arrangements of gathered information where $p = \{p_1, p_2, \dots p_n\}$is a lot of recently gathered information, $q = \{q_1, q_2, \dots, q_n\}$is another dataset, and n is a neighbour nodes count. Work Similarity Functions (SF) can be any likeness work; we quickly examine the Euclidean's and cosine's distance.

Right now, we portray how the Euclidean's and cosine's distance work and how every one of them influences the system. The Euclidean's distance measures the divergence between each pair of information in the informational collection and is determined by

$$E_d = \sum_{i=1}^{n} \sqrt{(p_i - q_i)^2} \qquad (1)$$

Thus p and q are said to be alike if $E_d \leq t_d$.

The cosine point among the two vectors is one sort of comparability. The cosine's distance on e minus the cosine of the point between two vectors and is spoken to be

$$C_d = 1 - \frac{\sum_{i=1}^{n}(p_i \times q_i)}{\sum_{i=1}^{n}(p_i)^2 \times \sum_{i=1}^{n}(q_i)^2} \qquad (2)$$

Thus p and q are said to be similar if $C_d \leq t_d$.

The cosine and Euclidean distance utilize the gathered qualities straightforwardly to register the difference between sets of information. Be that as it may, the distance of cosine figures the separation dependent on the edge among the two vectors, while the Euclidean's distance ascertains the straight-line distance between two vectors. This, in turn, produces various qualities that have extended for examination, and standardization is the essential technique for action. Some examination led on normalization of vector for specific applications and spaces. It is essential to comprehend the impact of standardization on the separation information. Entire vectors were extended to have a similar variety for executing the precise correlations among those vectors. Consequently then sensor information's are accumulated which would be gathered dependent on similitude esteems. At that point MEACBM will be applied for information at each gathering to get packed information which will be sent to different nodes.

C. Proposed Multi-hop Energy Efficient Routing Protocol using Multiple Mobile Nodes using MEACBM in Wireless Sensor Networks

The MEACBM will be enforced for each gathering of the sensor information to get packed information which will at that point be sent to different nodes of the WSN. As these days in WSNs, main point is system's vitality effectiveness with lifetime and system dependability ought to be augmented. So, mobility is the very good alternative. In such a case that the mobility isn't available, then it will maximize the likelihood of having coverage holes. coverage holes implies that the system is functioning then there is hardly any sensor nodes whose vitality turns out to be low and again turned to be dead then that area will left neglected and is hard to screen the that part, so it results in an energy holes issue. Here, the mobility outcomes proficiently limit the development coverage holes issue plus equalizes the energy usage of the sensor node's energy usage. The proposed MEACBM hierarchical heterogeneous cluster based routing protocols structure with vitality effectiveness focal point in steering (routing) and for that another probabilistic condition which is included by presenting a term S(i).E in likelihood condition; so just that specific sensor node is chosen as CH which has most noteworthy vitality in the remaining sensor nodes. This methodology improves the vitality effectiveness of sensor nodes by lessening vitalities sensor nodes usage inside entire system region and give upgraded organize lifetime, adaptability, availability and vitality proficiency.

In MEACBM algorithm, we assume sensor node's three distinctive vitality levels and executed in network(normal, intermediate and advance). So heterogeneous WSNs initial energy level's summed up value is provided by including the single initial energy levels of standard, midway and proceeded sensor nodes i.e.

$$E_{Total} = NmE_0(1+\propto) + NxE_0(1+\beta) + N(1-m-x)E_0 \qquad (3)$$

So, proposed three level heterogeneous WSN comprises of $NmE_0(1+\propto) + NxE_0(1+\beta) + N(1-m-x)E_0$times more energy when distinguished with harmonized WSN with E_0 initial energy level having equal sensor count.So, new era of network after summing 3 types of SNs will be

$$\frac{1}{P_{opt}}.(1+\propto.m+x.\beta) \qquad (4)$$

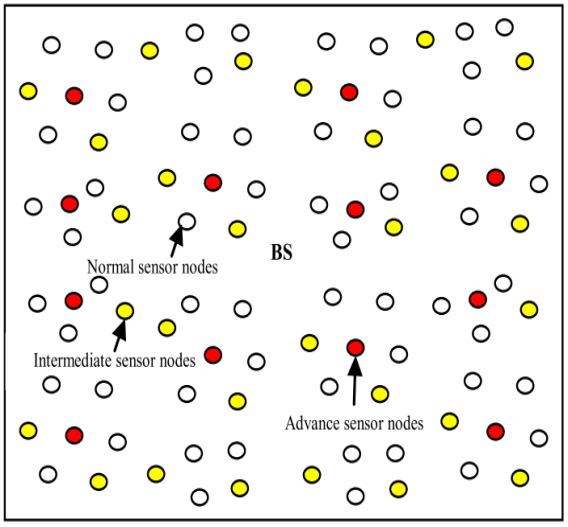

Figure 2: Deployment of Sensor Nodes in Network Area

After arbitrarily organization of SNs in whole system (Fig. 2), MEACBM fires its initial stage. To start CH, each SN should deliver an arbitrarily value worth which lies somewhere in the range of 0 and 1 and on the off chance that that worth is not exactly MEACBM limit esteem; at exactly that point that specific SN (sensor node) is chosen as CH for that specific turn.

The EACBM's new limit estimation is defined as:

$$T_{(n_z)} = \begin{cases} \frac{P_z}{1-P_z(r*mod\left(\frac{1}{P_z}\right))} * [S(i).E] & if \quad n \in G^z \\ 0 & otherwise \end{cases} \qquad (5)$$

where $P_z$is theprobabilityof favoured number of SN to be CHs, Z can be nrm, int, adv for normal, intermediate or advance SNs independently; r suggests current node count, G is plan of SNs isn't picked as CH in last P node. This edge estimation of MEACBM is not quite the same as edge estimation of remaining cluster based routing protocols [LEACH, SEP, ESEP, etc.] in light of the fact that here [S(i).E] term is included, which means SN's current energy and it suggests that only high energy vitality SN should be CH when contrasted with low vitality SN.

For normal, intermediate and advance sensor node's election probabilities were P_N; $P_I$and P_A individually, and P_{opt} is the ideal political race likelihood of sensor node. In the wake of being chosen as CH, it communicates its present position of being CH for specific node to remaining sensor nodes in network area. So, each CH produces a message termed as advertisement message (Advmsg) with CH-ID and Adv Header with non-persistent Carrier Sense Multiple Access (CSMA) MAC protocol. Based on CH Advmsg received signal strength (RSS), each non-CH SN

chooses to which cluster they ought to have a place as well as it should recommend that specific CH regarding its determination. Each non-CH SN must send its join request message (join-REQ) to its related CH of each group utilizing CSMA MAC protocol.

In the wake of cluster creation and sub-clusters, entire system territory is separated into divisions (containing numerous clusters). Also, within every part, a versatile SN is doled out and it have as mobile data collector. This node will navigate inside every division to gather information as of different CHs and transmit that gathered information to the BS. Then the transmission of aggregated data will be done to mobile data collector sensor node by Ch, which come at its exact points only if it is in specified transmission range, else it will remains there, until the mobile data collector sensor node come to its range. Then in the MEACBM's steady state, there occurs the sensed data's transmission from the sensor node to CH and CH to MDC and further from MDC to BS. In allocated TDMA frame, this sensed data will be broadcasted. In both cluster and sub-cluster, this data transmission occurs. And in the main cluster's CH, the collected data and aggregated by sub-CH in sub cluster gets transmitted, using cluster member sensor node, which is nearby the sub-cluster. Then, entire data from these cluster member sensor nodes and also the data from sub-CH, which is gathered from MDC, were aggregated and moved to BS. According to the residual remaining energy of CH, this decision has to be done. So, this process assists CHs in transmitting its data with less energy. The CHs ought to forward data to BS, once after collecting data from various clusters. According to the uppermost residual energy amid the nodes, can choose the forwarding nodes. The highest energy nodes were chosen to forward the data to BS, which assist us to enhance the packet delivery ratio from the packet loss.

D. Consumption of Minimum Energy through Methods Adopted by MDC Sensor Node in MEACBM

In MEACBM, MDC sensor node's mechanism is that in every round, drive is initiated by sensor nodes from a point termed as "ρ"and passes through its selected minimum energy CHs locations (k) and comes back to same point '"ρ". In one round, this is termed as mobile data collector sensor node's tour. At every CH, there exist a mobile sensor node's stop time for collecting data from CH during particular round 'r' and is termed asδ_k^r. At this time, from CHs, data is collected by MDC sensor node when it reaches its location (k) during specific round (r).The speed of mobile data collector sensor node is fixed as 10-40 m/s. Network lifetime maximization is a major objective of this MDC sensor node and it is done by maximizing sum of all stoppages of MDCs throughout network lifetime

The MDC sensor node's stoppage time at every CHs location must be higher than zero as it needs to collect data from CH only when it is terminated at its location. After checking minimum distance between next selected CH location and mobile data collector sensor node, it moves based on EM algorithm and CH location with minimum distance are selected. So, MDC sensor node has moved to one of minimum energy CH locations from point "ρ" which are at shortest distance from point "ρ".After reaching that point, MDC sensor node collects aggregated data from that CH and moves to next CH location which is at shortest distance. Until MDC sensor

node reaches back to starting point "ρ"this process continuous. So in this way, mobility helps CHs for transmitting its data with minimum energy consumption.

Also while routing the existing routing algorithms are not resourceful in sustaining wireless network's dynamic characteristics and cannot make sure about sufficient service quality in various applications. Most of the routing algorithms did not consider dynamic nature of the wireless networks such as high mobility, high energy consumption, delay, etc. On the other hand, existing routing algorithms are inefficient towards network's dynamic nature and cannot suit wireless network applications requirements for routing and QoS. The problem of finding a path satisfying QoS guarantees for wireless networks is essential and can be put together as a Non-deterministic Polynomial (NP) problem. Therefore, Particle Swarm Algorithm (PSO) integrated Artificial Bee Colony (ABC) (PSO-ABC) called Hybrid PSOABC algorithm is proposed here for efficient data routing.

E. Energy-efficient Data Routing using PSOABC Process

In the primary period of the proposed strategy, vitality utilization mindful routing is finished through Hybrid PSOABC algorithm. This exploration work thinks about the accompanying Quality of Service (QoS) parameters for route way's ideal determination of: "Energy, Processing capacity, Bandwidth, Reliability".

Primarily consider QoS parameter's synthetic effect, comprises of delay, packet loss and bandwidth. The WSNs is denoted as a weighted directed graph $G(V, E)$, where V is a set of sensor nodes by a wireless connection. If there are $n+1$ nodes $V, V = \{v_0, v_1, v_2, v_3, \dots, v_n\}$communication radius of every node is r_i its communication area is A_{vi} and edge $e = (v_i, v_j) \in E$ represents two-way wireless connection among two nodes (v_i,v_j). The path $P(v_1, v_n)$ in G is an orderly compositing sequence of edges:

$$P(v_1, v_n) = \big((v_1, v_2), (v_2, v_3) \dots (v_{i-1}, v_i) \dots (v_{n-1}, v_n)\big), V_i \in V, 2 \le n \le |V| \quad (6)$$

$P(v_1, v_n)$is a multi-hop path, edges count correspond to hop distance between node$v_1$and node v_n.Every node in path is regarded as an independent router. The path's first node is source node, and final node is destination node is called as $v_s$and v_d.Every node has its adjacent nodes. Every edge $e = (v_i, v_j) \in E$ represents v_i and v_j are mutual adjacent nodes. $N_{vi} = \{v_j | e = (v_i, v_j) \in E, i \neq j$ is a set of adjacent nodes ofv_i; it is established by adjacent node's discovery mechanism, which is called as HELLO information exchange. After sending HELLO message, node adds its QoS parameters to HELLO information. Whereas, provided a path $P(v_s, v_d)$its synthetic QoS metrics can be defined by delay, packet loss and bandwidth that can be reflected on node $v$and link $e$for every node$v \in V$ metrics are delay function—$\mathrm{Delay}(v)$,packet loss function— $\mathrm{Packet\ loss}(v)$, band width function— $\mathrm{Bandwidth}(v)$, and energy function— $\mathrm{Energy}(v)$.

The combination of the two most common algorithms in the field of optimization algorithms is based on a hybrid global optimization approach. The artificial bee colony algorithm and particle swarm optimization are these algorithms. The hybrid algorithm initialises the constant first and decides the vector. Both the size of the colony, the number of bees and the PSO function

for the same population. This algorithm is initially generated randomly. These can be considered in terms of ABC as bee colony or PSO terms are particle. Thus, after the health of all bees in the same population, every period is assessed and employed bees are increased. According to the sort f, the world's strongest particle of the population is calculated. We improve the quest capacity by executing a PSO solution on the employed bee. In comparison to particle swarm optimization, ABC has a clear ability to look for the best solution that can be used to determine the system's fitness function.

Each node in the system forms a table routing for the various nodes, and numerous path between node at source s and node at destination d are developed. At the point when a node at source required broadcasting an information packet to node at destination, node at source hopes to assemble a routing with node at destination and starts an operator based routing disclosure system. By routing disclosure system, source node creates a self-assured operator, though note its own location and information produce an opportunity to e specialist, and afterward impart the specialist to each neighbouring node. That is, there will be more ways between node at source and node at destination, which can be viewed as underlying swarm of PSOABC algorithm. The overall algorithmic stepwise procedure is given below

Step 1: Create a radio energy network model

Step 2: Finding of Similarity functions in the cluster based WSN data aggregation

Step 3: Multi-hop Energy Efficient Routing Protocol using Multiple Mobile Nodes in WSN for enhancing network's energy efficiency so that network lifetime and stability network should be maximized.

Step 4: Energy-efficient data routing using PSOABC Process

Step 5: Minimum Energy consumption and Better value of other Qos Parameters are obtained as a output of the research work.

III. EXPERIMENTAL RESULTS

Right now, execution of MEACBM is utilized to by contrasting it and other cluster-based routing protocol utilizing NS2 Simulator. This evaluation is finished by accompanying presentation measurements like Network Lifetime, CHs count, Throughput and dead node's count per nodes. In the system region of 500 m by 500 m; we have thought about 30, 50, 100 ordinary sensor nodes with E0 starting vitality; 45, 70, 150 development sensor nodes (m = 0.2 part of typical sensor nodes) with multiple times more vitality (α= 3) than ordinary sensor nodes; and 75, 125, 250 intermediate sensor nodes (x = 0.3 division of typical sensor hubs) with 1.5 occasions more vitality (β = 1.5) than normal sensor nodes separately. All these sensor nodes will stay alive until their vitality get depleted.

A. Network Lifetime

It is resolved as the quantity of nodes secured until last nodes of the system is dead. It relies upon the system zone. As zone (area) of a similar system builds, life expectancy of the system diminishes in light of the fact, those development path mobile increases, transition time increments and stay time gets affected.

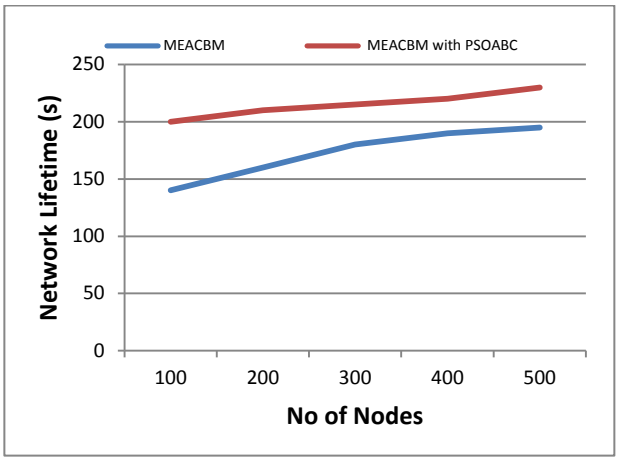

Figure 3: Network Lifetime Comparison Graph

Figure 3 and Table 1 shows the system lifetime correlation of the proposed MEACBM with PSOABC approach and the current methodologies like MEACBM approach. It is noticed that the proposed MEACBM with PSOABC algorithm achieves higher system lifetime when contrasted and the current method.

Table 1: Comparison Graph for Network Lifetime

Number of Nodes	MEACBM	MEACBM with PSOABC
100	140	200
200	160	210
300	180	215
400	190	220
500	195	230

B. Average Energy Consumption

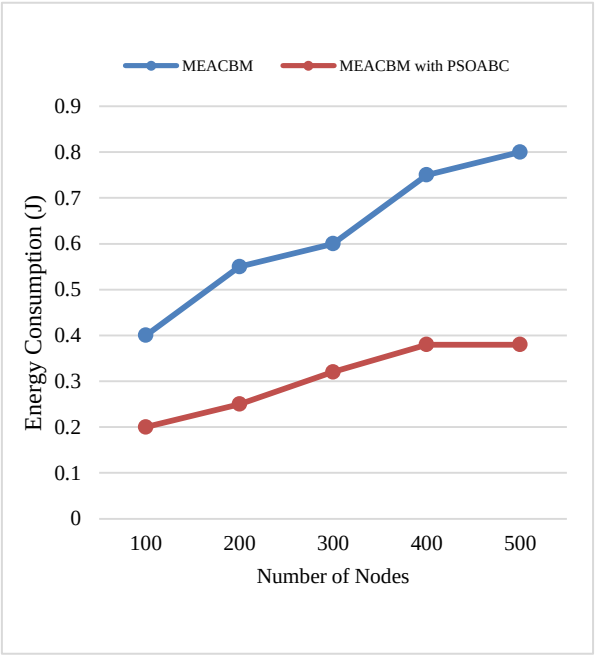

Figure 4: Energy Consumption Comparison Graph

Figure 4 and Table 2 shows Energy Consumption correlation of proposed MEACBM with PSOABC approach and the current methodologies like MEACBM approach. It is noticed that proposed MEACBM with PSOABC algorithm devours less estimation of vitality when contrasted and the current system.

Table 2: Comparison Graph for Energy Consumption

Number of Nodes	MEACBM	MEACBM with PSOABC
100	0.4	0.2
200	0.55	0.25
300	0.6	0.32
400	0.75	0.38
500	0.8	0.38

C. Throughput

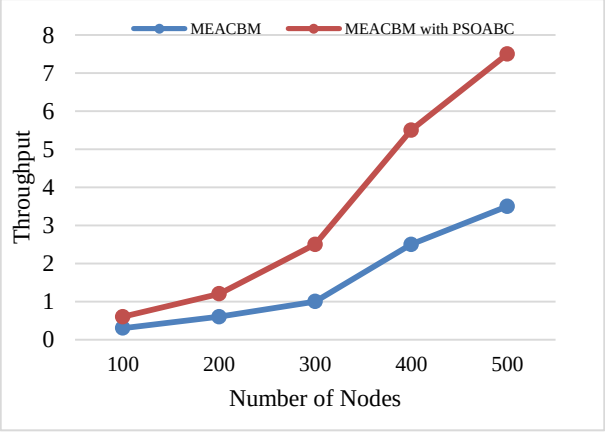

Figure 5: Throughput Comparison Graph

Figure 5 and Table 3 shows Throughput correlation of proposed MEACBM with PSOABC approach and current methodologies like MEACBM approach. It is noticed that proposed MEACBM with PSOABC algorithm achieves higher Throughput when contrasted and the current procedure.

Table 3: Comparison Graph for Throughput

Number of Nodes	MEACBM	MEACBM with PSOABC
100	0.3	0.3
200	0.6	0.6
300	1	1.5
400	2.5	3
500	3.5	4

IV. CONCLUSION

In our work, a Similarity Functions in Cluster-Based WSN contains the sensor information's that are accumulated and it would be assembled according to the comparability esteems, for

instance gathering information accumulated from the temperature sensor as a single cluster. Here, the author proposes a Mobile Energy Aware Cluster Based Multihop (MEACBM) routing protocol utilizing Mobile data collector sensor nodes by partitioning the system zone into areas, considering sensor node's three diverse vitality levels and select CH based on recently proposed likelihood condition, which chooses CH based on most elevated enduring vitality of sensor nodes. Along these lines, in MEACBM, just sensor nodes having most elevated vitality will be chosen as CH when contrasted with low vitality sensor nodes. To cover distant sensor nodes multi-hoping between cluster communication and sub-clustering result in the availability of each sensor nodes in the system. Additionally, energy utilization aware routing is performed through Hybrid PSOABC algorithm. The outcome is better by lessening the measure of energy utilization of sensor nodes in a traditionalist manner and henceforth expands the system lifetime, throughput (parcels transmitted to BS) and dead sensor node's count per nodes in each situation that is considered while simulating. Because of upgraded execution of MEACBM, in future, we will contrast its presentation and other test systems by considering the real time deployment experiment and sensor hub's adaptability inside each cluster will likewise be consider.

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