Weighted Clustering Algorithm based on O-Leach (WC-OLEACH) in Wireless Sensor Network

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Abstract— Wireless sensor system (WSN) is a rising innovation that has pulled in a lot of examination consideration because of the broad capacity to screen and instrument the physical world. An extensive variety of potential applications, for example, environmental monitoring, industrial detecting, infrastructure security, battlefield awareness and so forth, generated by wireless system. WSN encompass many sensors nodes that are thickly appropriated over the locale of interest. These brilliant sensors have capacities like sensing, processing and communicating via wireless medium. To utilize the energy and lessen the consumption of energy, the network is isolated into groups of sensors. Using clustering techniques network becomes more efficient. Various clustering methods are available to reduce energy consumption .Among those most popular are LEACH and various variations with the improvement one over another in specific area like M-LEACH, LEACH-C, O–LEACH. O-LEACH takes account of residual energy of node only. Proposed technique WC-OLEACH also takes into account to more parameters that are distance and degree of connectivity along with residual energy as these parameters also have impact on performance. In proposed technique weight of these parameters are calculated and node with maximum weight elected as Cluster Head.

Keywords- Base station, Cluster, Cluster Head, Degree of connectivity, Distance, LEACH, O-LEACH, Residual Energy.

I. INTRODUCTION

WSNs are accumulations of reduced size, moderately cheap computational hubs that measure neighborhood natural conditions or different parameters and forward such data to an essential issue for proper preparing. WSNs hubs (WNs) can sense environment, can speak with neighboring nodes that is communication, and can, in numerous cases, perform fundamental calculations on the information being gathered. WSNs support extensive variety of valuable applications. Some of common characteristics of sensor networks are: Densely deployed sensor nodes and inclined to failure. Sensor system topology changes as often as possible. Sensor nodes are having limitation in force, computational limits, and memory. Sensor hubs might not have worldwide identification proof on account of the expansive sum of overhead and the large number of sensors [1].

Sensors are of various sorts, for example, seismic, magnetic, thermal, visual, infrared, acoustic and radar to screen encompassing conditions which are temperature, humidity, pressure, vehicular movement, condition of lightning, pressure, soil makeup, level of noise, specific sorts of items present or not, mechanical stress levels on attached objects, and the present attributes, for example, speed, direction, and size of an object [2]

The little sensor nodes, which are made up of detecting, preparing information and communicating , As appeared in Figure1, each hub comprises of four segments: Sensor unit, Central processing unit (CPU), power unit, and communication unit. They are allotted with various tasks.

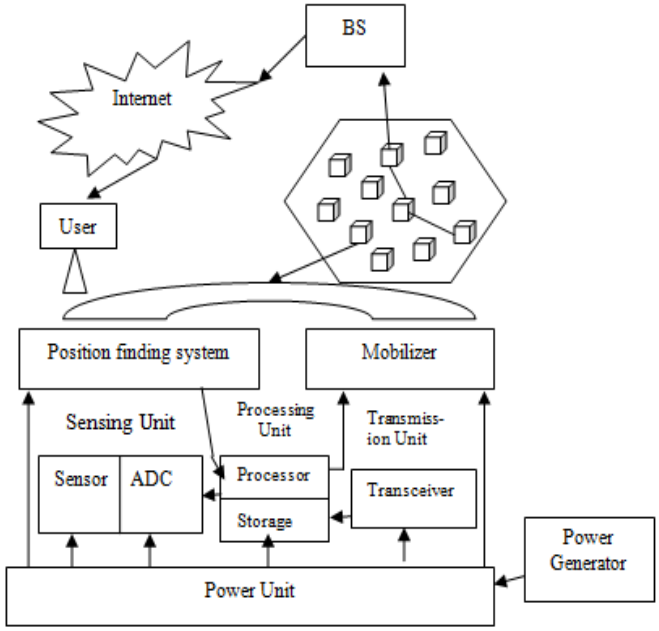

Figure 1.Structural view of Wireless Sensor Network

The sensor unit comprises of sensor and ADC (Analog to Digital Converter). The sensor unit is in charge of gathering data as the ADC asks for, and giving back the simple information it detected. ADC is an interpreter that tells the CPU what the sensor unit has detected, furthermore advises the sensor unit what to do. Communication unit is tasked to get order or question from and transmit the information from CPU to the outside world. Complex unit among them is CPU. It deciphers the order or question to ADC, screens and controls power if vital, forms got information, figures the following bounce to the sink, and so on. Power unit provides energy to sensor unit, processing unit and communication unit. Every hub might likewise comprise of the two discretionary segments specifically Location finding system and Mobilizer. On the off chance that the client requires the learning of area with high exactness then the hub ought to pusses position finding and Mobilizer might be expected to move sensor hubs when it is required to complete the given task [2].

II.RELATED WORK

[2] recognized , a portion of the critical outline issues of routing protocols for sensor networks furthermore thought about and differentiated the current existing routing protocols. As the study uncovers, it is unrealistic to outline a routing algorithm which will have great execution under all situations and for all applications. Although numerous routing protocols in the sensor networks, lot of issues still stay to be addressed.

[3] An essential issue in the configuration of WSNs is energy usage which relies on sources which should be portable such as batteries. To monitor the energy usage of the nodes is the aim of cluster based routing by discussing routing protocols in sensor network.

The proposed work in paper [4] is the upgrade over the LEACH-C by utilizing the advancement strategy that is pollination based optimization. Pollination PBO algorithm is utilized to enhance the lifetime of the system and to diminish the energy utilization of the sensor nodes.

LEACH works well to move forward the system lifetime and the utilization of energy. In any case, there are still a few issues with LEACH protocol so to diminish these deficiencies some new forms of LEACH are presented which are LEACH-K, A-LEACH, O-LEACH, V-LEACH, EELBCRP and so forth these five are additionally examined in this paper, these all performs superior to anything LEACH however from all the five O-LEACH performs vastly improved [5].

Heaps of examination is going on CH (Cluster head) decision, information total, distinctive power levels, Quality of service and decreasing number of transmission. This paper presents different clustering protocols; likewise their favorable circumstances and inconveniences [6].

In paper [7] checked on different energy efficient clustering schemes relevant in wireless sensor systems. The plans split down completely and some of them are simulated to assess performance. A novel scientific classification of clustering routing methodologies taking into account clustering attributes for WSNs is introduced here. Among all plans it can be said that various hierarchical routing have all the earmarks of being promising for point-to point directing that obliges small routing state. The target of many hierarchical routing is to proficiently use and in this manner moderate the energy utilization. This is accomplished through multi hop communication. In various hierarchical WSN some extra overheads because of progress in cluster heads that may influence clustering likewise in expansive WSNs, for example, battlefield scenario. These issues ought to additionally be considered.
In paper [8], new method is proposed as optimization Low Energy Adaptive Clustering Hierarchy (OLEACH) to enhance existing LEACH and LEACH-C by selecting cluster as per the remaining energy of nodes dynamically which implies Election of cluster head in every round with energy value more than ten percent of the leftover value at every sensor. So node which has low energy not gets to be CH; nodes stay alive for next few rounds for correspondence. This protocol is a compelling possibility to expand the time of stability of network, and has the capacity of broadening the system lifetime of the entire system. Energy efficient clustering schemes such as weighted schemes, grid schemes and Hierarchical schemes are studied from [9].This paper shows an inside and out examination around two grouping routing protocol for WSN as this two protocols give fundamental building blocks and support energy efficient protocols[10].
In paper [11] author tries to discover the limitation of work done in heterogeneous sensor network by studying different routing protocols based on stable election.
This paper studies working of LEACH, its benefits to WSN and modification done in LEACH to enhance its execution [12].This paper studies LEACH AND LEACH–C as distributed and centralized protocol for cluster formation [13].
To save the energy consumed [14] proposed an algorithm named Optimization-LEACH to increase reliability and efficiency of network. In this research work, Cluster head is chosen on the basis of energy value which should not be less than 10% that means it lessens the choice as the node which is not able to be Cluster head is out of selection procedure. O-LEACH shows performance better than LEACH, energy consumption and stability period increases.
In this paper, they think about and characterize the routing protocols into three fundamental classifications as Data centric, hierarchical and location based [16].
Lifetime of network can be improved only if the management of resources available is properly done [17].Brief taxonomy of clustering algorithms is shown in [18].
Survey of Leach based protocols is done in [19]. Number of real time applications are discussed in [20]; Military applications among which are monitoring forces, equipment, battlefield surveillance, battle damage assessment; Environment applications as forest fire detection, flood detection, precision agriculture; Health applications as tracking and monitoring doctors and patients inside hospital, drug administration and other commercial applications.

III.EXISTING APPROACH

O-LEACH PROTOCOL. It is the optimization LEACH protocol. It works superior to LEACH and LEACH-C. The BS starts the making of clustering process. The CH is elected by considering the energy of the sensor nodes. Nodes which have energy greater than 10 percentage of minimum residual energy are considered for the selection of CHs. If the energy of nodes are lesser than 10 percentage of minimum residual energy, the original LEACH method is followed for selecting the CH. In this Energy model is utilized. In this protocol, selection of sensors clusters heads relying upon the measure of energy remaining after every round. In this sensor nodes are taken into M×M square locale. Uniform nodes are in it and we accept base station is in focus and in second simulation it will be in top or square. In this cluster head can be picked in every round with energy value more than the 10% of the residual value at each sensor. It increases the network stability, and has the capacity of broadening the life span of the whole network [8].

IV PROBLEM FORMULATION

No doubt, O-LEACH increase the period of stability of network, and has the ability of extending the life span of the whole network. It improves energy efficiency as well as lifetime but O-LEACH takes residual energy only as a base for cluster head selection. As well as in O-LEACH CH selection is not independent decision it's a collaborated decision taken by nodes themselves by transmitting messages to each other informing about their residual energy and node with higher residual energy become CH. Hence, in O-LEACH leader advertisement phase, nodes inform other members about their energy levels; this consumes more energy of each node. O-LEACH only takes account of

residual energy not other parameters such as distance and degree of connectivity which plays important role in energy consumption of nodes.

V. PROPOSED APPROACH

In order to improve the existing O-LEACH protocol, new technique (WC-OLEACH) is proposed, to lessen the constraints of existing technique. As O-LEACH works on cluster head selection phase it selects Cluster head having energy greater than ten percent of residual energy. In O-LEACH leader advertisement phase, nodes inform other members about their energy levels; this consumes more energy of each node. In proposed technique base station will select and nominate random node to elect its cluster head for less energy consumption. It takes only residual energy parameter for selection process; there are some other parameters such as degree of connectivity, distance, mobility also which can be taken while selecting cluster head. In our proposed scheme these parameters should be taken and weight of each node in the cluster will be calculated by $W_E+W_D+W_{DOC}$ and the node having maximum weight is selected as CH. Proposed scheme shown in Figure 2 will improve overall performance in terms of following parameters:

- Energy consumption
- Packet delivery ratio
- Throughput

Performance of Proposed WC-OLEACH is shown in results which depits that energy consumption is reduced as the cluster head selection is done by random node so the number of messsages transmitted is low and energy is saved.Throughput and Packet Delivery Ratio is high as the cluster head is selected based on thre factors energy,distance and degree of connectivity.Maximum weightage is given to energy as energy is most important for sensor node to transmit data,distance is second important factor as if distance of node from base station is more the node can die soon.Degree of connectivity is number of neighbour nodes connected to the node.

Weight of Energy =Residual energy of node / average residual energy of all nodes in the cluster*70 %

Weight of Distance =Distance of node from base station/ Average distance of all nodes from base station*20%

Weight of Degree of connectivity=Degree of connectivity of node/Average degree of connectivity of all nodes in the cluster*10%.

Total weight is calculated by suming up weights of energy,distance and degree of connectivity

W=WE+WD+WDOC

The node within cluster having maximum weight will become cluster head of that cluster.As in table1, node 0 will be elected as cluster head for cluster 1.

Table 1:Values of Weight

Node no	WE	WD	WDOC	W
0	0.932145	0.227939	0.09333	1.25342
1	0.933569	0.209614	0.108889	1.25207
15	0.606942	0.191582	0.108889	0.907412
16	0.607992	0.179316	0.093333	0.880642
17	0.605082	0.219485	0.093333	0.9179
18	0.606321	0.197062	0.108889	0.912272
21	0.60795	0.175002	0.093333	0.876285

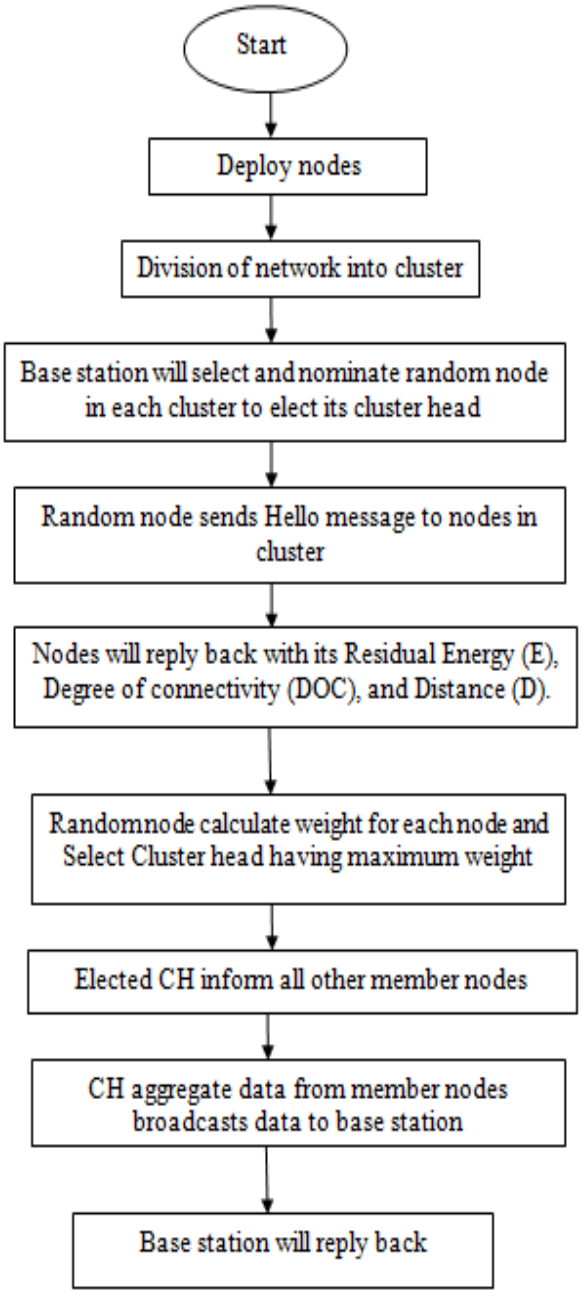

Figure2:Flowchartof proposed algorithm(WC-OLEACH)

VI.SIMULATION AND RESULTS

The performance of proposed WC-OLEACH algorithm is demonstrated by simulation in terms of performance metrics: Energy Consumption, Packet Delivery Ratio and Throughput.Simulaion is performed in NS-2. Radio energy dissipation model is used in this research work.

Table2.Simulation Parameters

Parameter	Value
Simulation area	1100*1100
Number of nodes	50
Routing protocol	AODV
Initial energy	67joules
Simulation time	30 seconds

Energy Consumption: It is the consumption of energy. Energy is measured in joules.Energy consumption is reduced by selecting random node to elect cluster head.

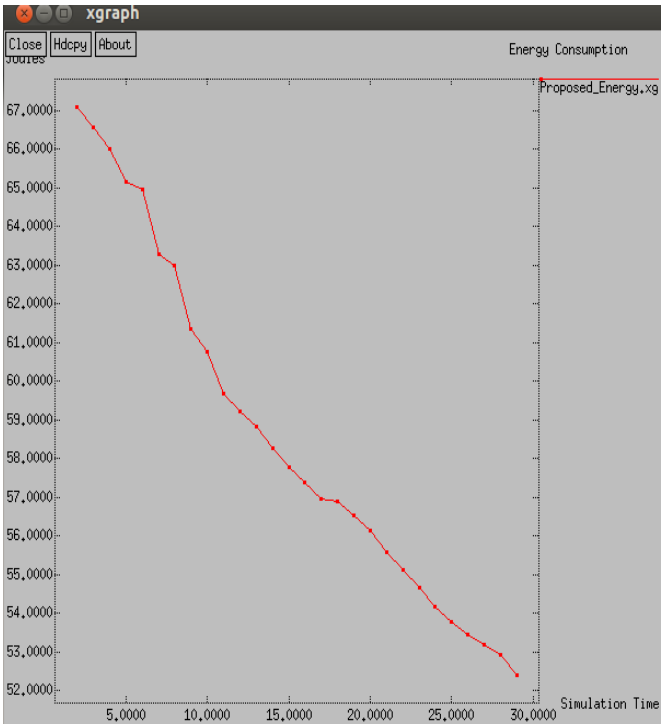

Figure3:Energy consumption graph

Throughput:Number of successfully receive packets per unit time.It is measured in terms of kilobits per second(kbps).It is the total amount of data transmitted in network from nodes to cluster head and cluster head to base station[15].

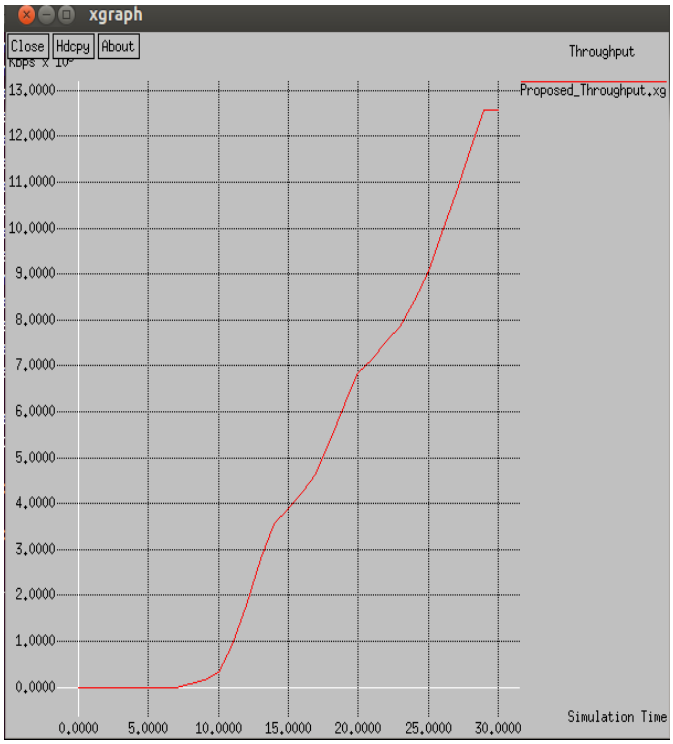

Figure4:Throughput

Packet Delivery Ratio:It is the ratio between number of successfully receive packets at destination by the number of packets send by source.

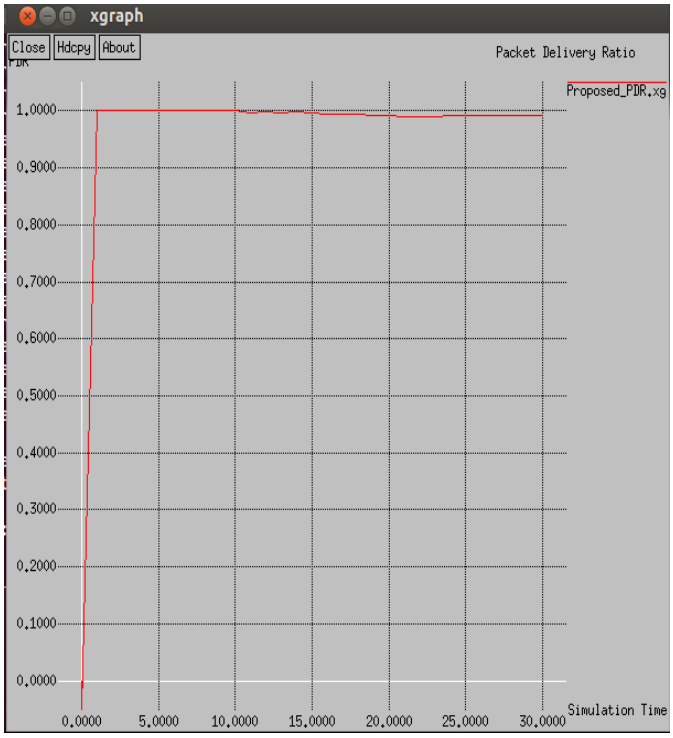

Figure5:Packet Delivery Ratio

VII.CONCLUSION

In this paper we have proposed an algorithm Weighted Clustering algorithn based on O-LEACH which reduces limitation of O-LEACH by selecting random node to elect cluster head.Energy consumption is reduced to improve network efficiency.High Throughput and Packet delivery ratio depicts more amount of data received at the base station. In this research work,we tried to enhance the cluster head selection procedure in O-LEACH algoritm.In future further improvements can be done by taking some other parameters also.

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