International Journal of Research and Development in Applied Science and Engineering (IJRDASE)
ISSN: 2454-6844

Q-Leach A New Routing Protocol for WSN

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Abstract: Sensor nodes are noticeably strength pressured devices in view that they are battery labored gadgets and because of brutal environment sending it's far hard to alternate or revive their battery. Energy safety and dragging out the device life are two noteworthy problems in a sensor device. Communication devours the great part of WSN strength. This paper researches the associated works diagnosed with some conventions which have been proposed to renowned energy-efficient conversation in a wireless sensor system. We likewise talked about the troubles in view of directing in a wireless sensor network challenges when contrasted with the conventional systems because of sensors smaller memory, less handling control and obliged strength deliver. It has been shown that within the previous couple of years numerous new routing protocols have been contrived for wi-fi sensor Network. LEACH is suitable for small size networks because it assumes that each one sensor nodes are able to speaking with each different and are capable of attain sink, which isn't always always real for huge size network. Hence, insurance is a problem which we attempt to solve. The essential focus in WSNs is to growth network existence-time as much as viable, so that sources may be utilized effectively and optimally. Different strategies based on clustering are presented for max functioning. Life-time of the network is usually associated with energy of sensor nodes implanted at far flung regions for constant and fault tolerant observation.

Keywords- Coverage, network lifetime, Q-LEACH, flexible cluster head selection.

1. Introduction:

Advancements in technologies related to micro-electro-mechanical systems (MEMS) generation, wireless communications, and virtual electronics in recent times have yielded in improvement of low-value, low-strength; multifunctional sensor nodes that have small length and speak over brief tiers. [5] These tiny sensor nodes have capability of sensing physical parameters, processing the information accrued and speaking over network to monitoring station both thru other nodes or without delay. [4]

A sensor network is made from a large variety of sensor nodes which are densely deployed in utility specific area. The role of sensor nodes isn't always required to be pre-determined. This permits random deployment in inaccessible terrains or at some point of comfort operations in catastrophe prone areas. On the opposite hand, this also approach that sensor community protocols and self-organizing capabilities should be possessed through the algorithms. One greater special characteristic of sensor networks is the cooperative running of sensor nodes. Sensor nodes are attached with an on-board processor. Instead of transmitting the raw statistics to the nodes chargeable for the aggregation, sensor nodes make use of their processing competencies to locally carry out simple computations and send most effective the required and partially processed data. WSNs are applied for the combined bag of functions like military reconnaissance, residing area watching, wooded area fireplace discoveries, and avalanche area.

LEACH (Low Energy Adaptive Clustering Hierarchy) protocol is suitable for networks of small length as it works over assumption that each one nodes can communicate with every other and are capable of reaching the bottom station. This isn't always constantly correct for massive length network. Hence, insurance is a hassle which we try to clear up. The utmost attention in WSNs is to increase the network's existence-time as a lot as viable so that assets may be utilized successfully and optimally. Different techniques based totally on clustering are proposed for max capability. Network existence-time is usually associated with energy of sensor nodes that are implanted at distant regions for regular and fault tolerant monitoring. [3, 11]

2. Related Work:

The protocol Assisted LEACH (A-LEACH) achieves lessened and uniform distribution of dissipated strength by way of keeping apart the responsibilities of records aggregation and routing. It introduces the concept of helper nodes which assists cluster heads for multi-hop routing. To facilitate electricity efficient multi-hop route setup for helper nodes to attain base station a new set of rules has been formulated. The proposed protocol yields extension in the lifetime of the network, reduces overall electricity dissipation inside the network. Their theoretical evaluation has shown that community lifetime reduces whilst each the duties i.E. Records aggregation and routing are achieved with the aid of Cluster Heads on my own. This burden on CH may be eliminated by utilization of Helper Nodes for routing and Cluster Heads for Data Aggregation. The overhead for course components to base station is decreased by means of electing next hop at each Helper Node the use of the beckon sign's Received Signal Strength values from base station. This beckon signal is already available at helper nodes at some point of Helper Node Selection section. Our idea of Helper Nodes in Assisted LEACH (A-LEACH) protocol has enhanced the lifetime of the community by distributing the reduced energy dissipation for the duration of the nodes. This is substantiated through simulation consequences. [1]

Another technique changed into proposed to make an attempt to triumph over the assumption of LEACH, which supposes that any node in the community can transmit their immediately to the sink, and this isn't viable particularly in

networks deployed in large regions. LEATCH is a (Low Energy Adaptive Tier Clustering Hierarchy) tier clustering hierarchy that manipulates two hops inter-cluster communication. This paintings presents a two degree hierarchical technique. The first stage is selection of Super Cluster Head (SCH) which is just like the procedure of cluster head selection in LEACH. The 2nd stage corresponds to creation of mini cluster with the aid of choosing some mini cluster head (MCH) in first-rate cluster. This considerably reduces the electricity burden of cluster heads to transmit facts to sink nodes which are at longer distances. [7]

LEACH protocol suffers from the troubles of speedy loss of life of nodes in addition to the short length of the community lifetime. In the paintings offered with the aid of this paper, an improvement is delivered to the original LEACH protocol via the usage of the SPIN protocol idea. That result a new protocol referred to as S-LEACH. The SPIN protocol wherein the nodes transmit metadata (which is very minute in length) to the resource supervisor whose mission is much like CH. If the statistics in the metadata isn't similar to the records packets that belong to other nodes, the aid manager asks the node to transmit full packet; otherwise there is no requirement of that packet. All nodes transmit metadata to the CH, and CH is decided neighbouring nodes. The neighbouring nodes ship the identical facts hence no need for multiple node to transmit the equal information packet. The neighbouring nodes are pressured to be in sleep mode till the demise of the primary node. By incorporating the idea of SPIN in LEACH exact results are obtained. There is important increase inside the variety of rounds, put off in the first node's dying and community lifetime is prolonged. [6]

This protocol offered a new edition of LEACH in which a Vice cluster head is introduced. In the conventional LEACH, the CH is continually on collecting records from cluster participants, combination these records and then transmit it to the BS that might be placed at larger distance from it. Because of its additional operations of receiving, transmitting and over-listening to the CH will die earlier than the alternative nodes. When the CH die, the cluster turns into vain because the facts transmitted by cluster nodes will by no means attain the bottom station. In V-LEACH protocol, aside from a CH in the cluster, there's also a vice-CH that takes the role of the CH right now when the contemporary CH dies. This notably enhances the general network life time considering the fact that no want to decide on a brand new CH each time the CH dies. But in case of Vice Cluster Head Dies the network dies absolutely. This hassle is resolved in an stepped forward model, i.E., while the cluster head dies, its responsibilities are taken via Vice Cluster Head and every other Vice Cluster Head might be chosen on the equal time. The proposed system will increase the network existence and total transmission within the community. [8]

However, the basic concept of our studies comes from paintings proposed in Q-LEACH. In this paintings, it's miles considered that sensor networks are deployed for long term monitoring of fields and are preferred to retain working without any fluctuations. Also, it is also preferred to achieve global information without destroy i.E., better coverage of region must be obtained. Here, Quadrature-LEACH (Q-LEACH) for homogenous networks is proposed. In order to accumulate higher clustering, the community is partitioned into four quadrants. Doing such type of partitioning better coverage of the complete community is carried out. Partitioning of community into quadrants bring about efficient electricity intake of sensor nodes. Because of this department, foremost positions of CHs are defined. Moreover, transmission load on other transmitting member nodes is also reduced. In normal LEACH, cluster are arbitrary in length and numerous cluster contributors are located far away from their respective CH. Due to this dynamic cluster advent the nodes which are some distance far away from the BS suffers high electricity drainage and therefore, community overall performance decreases. Whereas, in Q-LEACH network is partitioned into 4 quadrants and for this reason, clusters created within those quadrants are greater deterministic in nature. Therefore, nodes are lightly dispensed in a particular cluster i.E. Uniform cluster sizes and results in efficient electricity drainage. Q-LEACH substantially stepped forward network parameters inclusive of balance period, community life-time and throughput [2].

3. Methodology:

According to this approach it is considered that sensor nodes are deployed in areas. In order to achieve better clustering the network is partitioned into four quadrants. Doing such kind of partitions result in better coverage of the whole network. In addition to this, distribution of nodes in field is also well defined. Fig. 3.3 describes an optimal method of load assignment among sensor nodes. It also presents an idea of efficient clustering mechanism which results in better coverage of whole network. Here, nodes are randomly deployed in a 100m×100m filed. Depending upon location information, network is partitioned into four equal parts i.e., (cluster 1, cluster 2, cluster 3, and cluster 4). Overall network area is defined as below:

$$A=\text{cluster1}+\text{cluster2}+\text{cluster3}+\text{cluster4} \quad (1)$$

$$cluster_n = cluster(x_m, y_m) \quad (2)$$

Where, n = 4 and m = 100. Hence, overall field is distributed as follows:

$$\lim_{Xm=0:50}^{Ym=0:50} an + \lim_{Xm=51:100}^{Ym=0:50} an + \lim_{Xm=0:50}^{Ym=51:100} an + \lim_{Xm=51:100}^{Ym=51:100} an \quad (3)$$

Where, a=cluster.

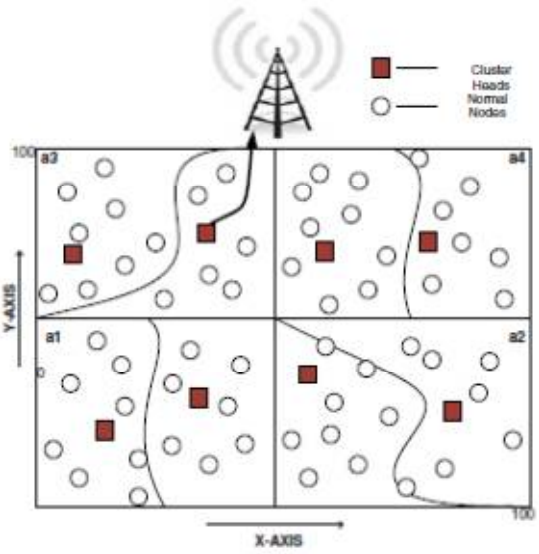

Fig. 1. Network Topology.

Partitioning of network into quadrants result in efficient energy consumption of sensor nodes. Because of this division, optimum positions of CHs are defined. In addition to this, transmission load on other transmitting member nodes is also decreased. In typical LEACH, cluster are arbitrary in size and several cluster members are located far away from their respective CH. Due to this dynamic cluster creation the nodes that are far away from the BS suffers high energy drainage and thus, network performance decreases. Whereas, in Q-LEACH network is partitioned into four quadrants and hence, clusters created within these quadrants are more deterministic in nature. Therefore, nodes are evenly distributed in a specific cluster i.e. uniform cluster sizes and results in efficient energy drainage.

However, partitioning of area into quadrants does not ensure optimum number of cluster heads in each quadrant. Because of random distribution of nodes, large number of cluster head may selected in proportion to the nodes. Optimum number of cluster head is important because the CH performs extra task and drains faster. Selection of larger number of CH effects lifetime of the network. This paper proposes an algorithm to overcome this problem.

A. Algorithm

Step 1: Distribute nodes randomly in the defined area.
Step 2: Perform partitioning of area into four quadrants according to their location.
Step 3: Select cluster heads depending upon probability p and limit the number of cluster heads according to an optimum fraction. This will result in formation of cluster heads according to the presence of randomly distributed nodes in each quadrant.
Step 4: Clusters are formed according to CH's received signal strength.
Step 5: Nodes send their data to CHs, CHs forward this data to BS.

B. System parameters

TABLE I. SYSTEM PARAMETERS

Area(M)	100*100 meters
Location of Base Station	(50,110)
Number of Nodes(N)	100
Cluster Head Probability(p)	0.05
E(elec)	50 nJ/bit
E(amp)	100pJ/bit/m^2
Packet Size(K)	2000
Initial Energy	0.5J
Limit for maximum number of CH(k)	4

C. Flowchart

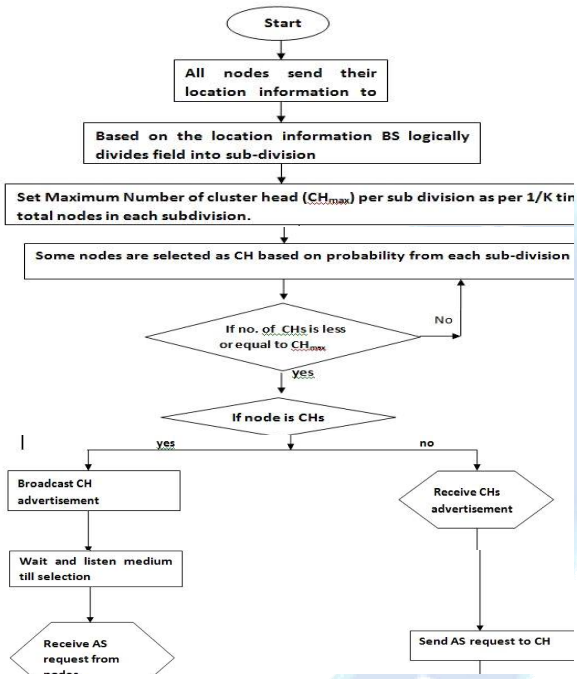

Fig. 2: Working Principle of Improved Q-LEACH.

4. Result and discussion:

We have discussed a WSN energy saving approach for the developed Q-LEACH model with flexible number of cluster heads in each quadrant. The WSN considered here is assumed to be scattered in an area of 100x100 m^2 field with 100 nodes randomly distributed in this area as shown in fig 3.

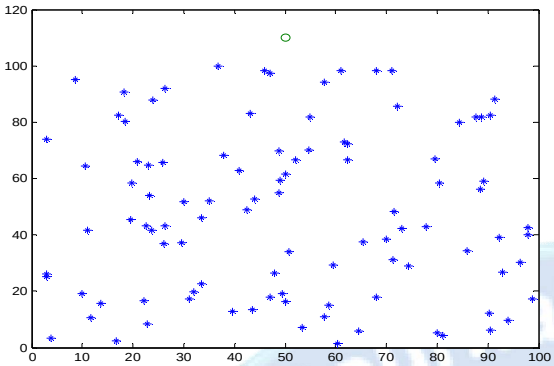

Fig. 3: WSN network with 100x100 m^2 area with randomly distributed 100 nodes.

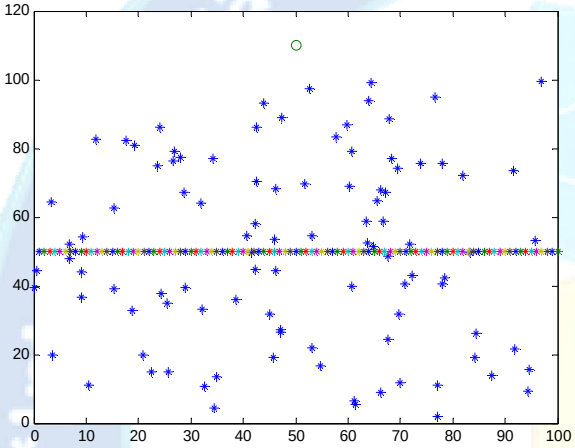

Fig. 4. Partition the area in upper and lower half.

In fig 3 the base station is located in the position x=50, y=110 in the middle top of the area and shown as 'o' circle and sensor nodes are shown as blue '*' asterisk markers. We have considered a strategy named as Improved Q-LEACH. We have developed MATLAB programming based WSN network characteristics and working development of proposed scheme for efficient performance. This paper presents key concept of proposed algorithm layout and results for WSN network model. In order to extent of some features such as clustering process, stability period and network life-time for optimized performance of WSNs we present this model. According to this approach sensor nodes are deployed in the territory. In order to acquire better clustering the partition of the network is done into four quadrants. Doing such sort of partitioning better coverage of the whole network is acquired. In addition, it also defines the exact distribution of nodes in field.

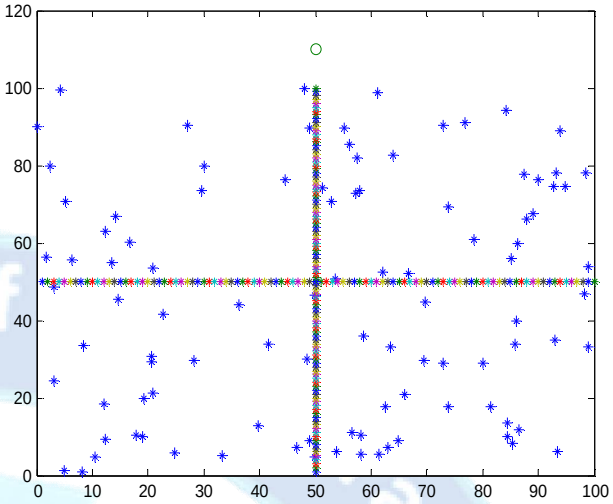

Fig. 5. Partition the area in right and left half.

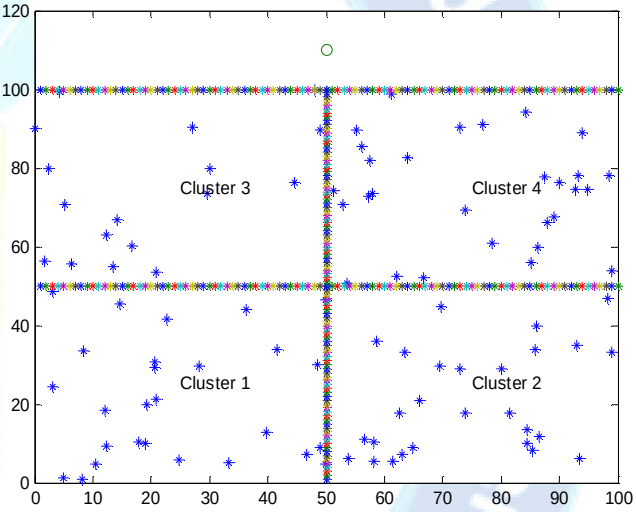

Fig. 6. All the quadrants label definition for developed WSN.

The algorithm is run for several times at different allowable of CH limit in each cluster the nodes which has residual energy less than zero are considered as dead nodes and remaining nodes are considered as alive in each round the number of alive and dead nodes is updated and plotted in fig 5 and 7.

Fig 8 and 9 shows that the proposed flexible cluster head population per cluster is capable of giving higher life time than conventional Q-LEACH approach. We get higher life time, stability period and more packets sending to the base station by the implemented algorithm of proposed scheme as shown in figure 9 to 12 for representing alive nodes, dead nodes, packets send to CH and packets send to base station with respect to no. of rounds.

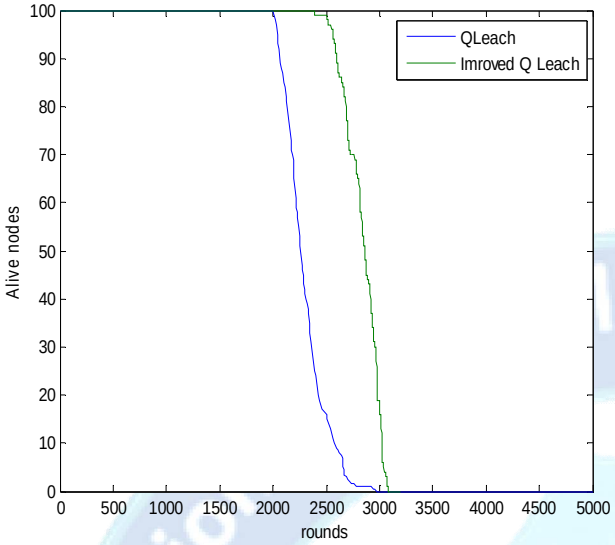

Fig. 7. Alive nodes by proposed (green) and previous Q-LEACH (blue) approach.

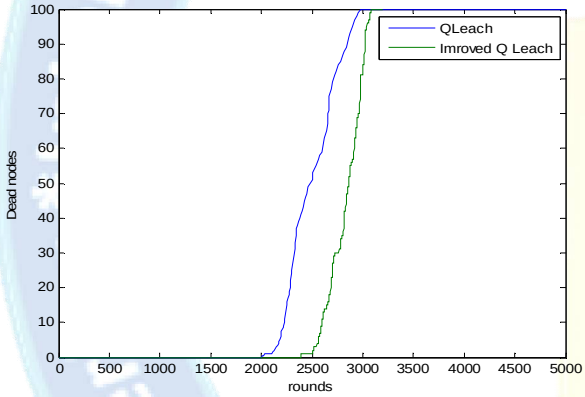

Fig. 8. Dead nodes by proposed (green) and previous Q-LEACH (blue) approach.

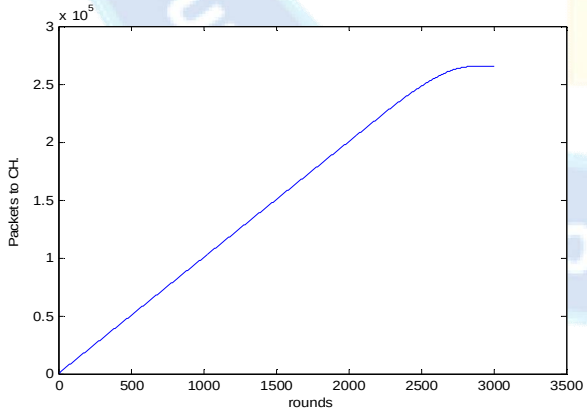

Fig. 9. Packets send to CH by sensor nodes by proposed (green) and previous Q-LEACH (blue) approach.

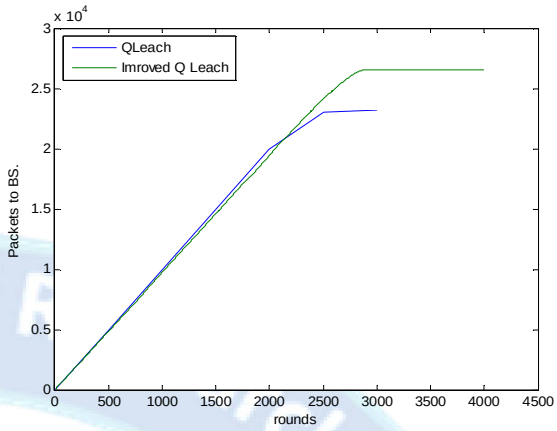

Fig. 10. Packets send to BS by CH nodes by proposed (green) and previous Q-LEACH (blue) approach.

TABLE II. COMPARISON TABLE BETWEEN Q-LEACH AND IMPROVE Q-LEACH

	Q-LEACH	Improved Q-LEACH
Stability Period	2000	2390
Network Life Time	2900	3085
Throughput	23296	24900

5. Conclusion:

We developed our proposed strategy named as Improved Q-LEACH. According to this approach sensor nodes are implanted in the region. For achieving better clustering we partition the network into four areas or quadrants. Doing such type of partitioning causes better coverage of the entire network is achieved. It describes optimal approach of uniform load assignment among sensor nodes. Moreover, it also proposes an idea of efficient clustering mechanism which results in better coverage of entire network. In our improved Q-LEACH WSN the partitioning is in sub-sectors and clusters formed within the quadrants with more deterministic way. Load balancing in between WSN node is the key importance hence it strictly improves stability period and network life-time.

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