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Energy Efficient Cluster Head Selection Method in Wireless Sensor Network

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Abstract- Wireless Sensor Network consists of sensor nodes deployed in a network. Each node is used to send and receive the information. Sensor nodes which having the skills to sense the surroundings, to perform the computation and to interact with other sensor nodes or to the Base station .Distinctive routing protocols and algorithms are introduced to locate manner to lessen the energy consumption in most of the research . This paper gives review at synchronous transit algorithm named Ridge Method Cluster Head Selection (RMCHS), which selects efficient Cluster Heads (CHs) to the sensor network. Also the well known routing protocol LEACH is discussed in terms of its strength and limitations. In this paper our goal is to make network energy efficient by using an enhanced Cluster Head selection method based upon weight and our proposed scheme achieve quiet efficient results than previous techniques. This paper is divides into some sections**.**

Keywords:-*Wireless Sensor Network(WSN),Cluster-Heads, LEACH Protocol, Base Station*

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I. INTRODUCTION

These days, the research in wireless Sensor network (WSN) is developing due to the development of embedded machine and wireless generation. WSN has several packages in our surroundings, community, locality, place of work, home and past. It's far offering new origins of thoughts, consolation and ease in the private and expert lifestyles.

The development of WSN was originally encouraged by means of army packages inclusive of battlefield surveillance. Current trends in this generation made those sensor nodes to be had in a extensive variety of programs in army and countrywide protection, environmental tracking, and many other fields.

The sensor node monitors the physical and environmental situation, consisting of temperature, stress, movement, fire, humidity etc. WSN is relevant for monitoring, surveillance, tracking, healthcare, disaster comfort, event detection, biodiversity mapping, intelligent building, facility control, preventive protection, and so forth. Typically, sensor nodes are deployed in unattended
and opposed surroundings for monitoring wild forest, battlefield, chemical plants, nuclear reactors
and so on [9]. So it turns into a strenuous mission to replace or recharge the battery. The sensor node senses now not simplest the surroundings but also forwards the statistics to the base station (sink). A base station is a aid-rich tool having limitless power, communication and storage functionality. It could be a static node or a cellular node based on the programs and scenarios. It may talk with the sensor nodes, to gather the facts and sends to the user through present communication device or the net. The studies have performed on the facts collection amongst sensors, processing and routing the records in the course of current years. As the sensor community operates in energy constraint surroundings, the network regularly requires an electricity-efficient routing protocol to decorate the lifetime of the community.

Routing Protocol specifies how routers communicate with each other . It is used to send data between sensor nodes and the base station for communication.

II. RELATED WORK

In the following section we will discuss some of the different existing methods for energy efficient cluster head selection in wireless sensor network .

LEACH(Low Energy Adaptive Clustering Hierarchy) protocol is a cluster based protocol . LEACH is one of the most known distributed single hop clustering protocols. In this Protocol , the clusters are formed , based on received signal strength . It has attracted in depth attention due to its energy efficient , simplicity, and load balancing properties. LEACH arrange nodes into clusters with one node from each cluster representing as cluster head (CH). It randomly selects some predetermined number of nodes as cluster heads. CHs then promotes itself and other nodes join one of those cluster heads whose signal they found strongest(i.e the CH which is nearest to them). In this way the cluster is fashioned . The CH then makes a Time Division Multiple Access (TDMA) schedule for the nodes under its cluster. The Communication between different clusters is done through CHs in a Code Division Multiple Access (CDMA) manner. The CHs gathered the data from their clusters and aggregate it before sending it to the other CHs or base station (BS). After a predetermined time lapse, the cluster

formation step is repeated so that different nodes are given a chance to become CHs and energy consumption is thus uniformly distributed.

Benefits Of LEACH

1. It's far one of the widely used hierarchical routing algorithms in sensor networks.
2. LEACH protocol partition the whole wireless sensor network into distict clusters. Any node that act as a CH in present round cannot be selected as the CH again; therefore each node can share the load equally which is imposed on Cluster heads.
3. The cluster head node is randomly chosen and chance of every node to be selected as cluster head is equal attributable to which energy consumption of whole network is averaged. Thus LEACH will lengthen the network life cycle.

Limitations Of LEACH

1. Due to random selection, Cluster Head may be elected in one Area only leaving other area unattended.
2. Each Cluster Head directly communicate with Base Station that is not efficient if the transmission distance is large.
3. For every round new CH is chosen which consumes more energy thus decreasing network lifetime.
4. LEACH possibly chooses too many cluster heads at a time or randomly selects the cluster head far away from BS without considering nodes Residual energy. As a result some clusters heads drain their energy early thus reducing the lifespan of WSN.
5. This algorithm is very ineffective in case of large area sensor network due to single hop communication of cluster heads to the Base Station.

III. THE RMCHS PROTOCOL

The Ridge Method Based Cluster Head Selection is based upon Euclidian distance cluster head selection

Step 1: Selection of Random Nodes

$$R_n = \frac{p}{1-p(r \bmod \frac{1}{p})}$$

In this equation p is percentage of number of nodes out of total number of nodes in sensor network, r is current round based on this equation. We elected node for cluster head selection.

Step 2: Selection of Neighbourhood Nodes

Neighbourhood Nodes has selected on the basis of Euclidean distance which is given by

$$d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

This gives the distance of nearest node and x, y represents node position. Selected Node is called as Member node.

The RMCHS method only based on distance. No liability of energy ,residual energy and distance from the sink.

Step 3: Ridge Method Based Cluster Head Selection after finding position of two nodes then ridge method will be implemented for distance calculation , wherever distance is calculated by given equation

$dr = d_1 - d_2$

d_1=distance between Random nodes

d_2= distance between member nodes (N_n) and Base station.

Now this method calculate distance between Normal node to Base station. If both distance are matched , the node is elected as CH.

IV. LITERATURE SURVEY

1. K. Arul et al. [6] presents new synchronous transit algorithm named Ridge Method Cluster Selection which selects efficient cluster heads to sensor networks . During this paper, author divides the network into logical regions each area use totally unique conversation hierarchy. 2 areas use direct conversation topology and a pair of areas square measure extra sub-divided into clusters and use multi-hop communication hierarchy. Each node in an exceptionally area elects itself as a CH unbiased of alternative region. This machine encourages higher distribution of CHs inside the network. Simulation effects show that the projected protocol performs well as compared to LEACH in terms of network lifespan, Residual energy and turnout.
2. Salim Khediri et al. had projected a LEACH based mostly new bunch approach of routing [9]. At some stage in this paper, the energy effcient bunch components for wireless sensor network has been introduced. Elaborated simulations of wireless sensors network atmosphere show that authors approach can be a practical candidate to extend the amount of balance of network, and has the strength of extending the technology of the complete network. The writer evaluated O-LEACH completely on static networks. This protocol must be tested on dynamic networks in addition.
3. Fan Xiangning et al. presents development on LEACH Protocol [4]: energy-LEACH protocol and Multi hop-LEACH protocol square degree given for the duration of this paper. Strength-LEACH protocol considers residual energy inside the part of cluster head choice. Multihop-LEACH protocol adopts multi-hop conversation among cluster and Base Station. Simulation outcomes display that energy-LEACH and Multi hop LEACH protocols have better overall performance than LEACH protocol.
4. Rajendra Prasad Mahapatra et al. had survey numerous descendant of LEACH based totally basically Routing Protocols in wireless sensing detail Networks [8]. Although this paper varied LEACH-primarily based

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protocols has been cited in short. Moreover, the timeline and surveyed outline desk of LEACH and its descendant routing protocol has been given. As a result of the drawbacks of LEACH, several protocols are come returned to unravel those troubles. However, a number of paintings is still required to seek out numerous economical, scalable and robust bunch topic to boost energy intake and decorate networks lifespan in little and big WSN.

V. METHODOLOGY

STEP 1 The nodes are arranged in random manner

STEP2 Then whole network is splitted into sub networks. These sub networks are considered as the region for cluster selection.

STEP3 Algorithm begins with neighbour discovery phase which is initiated by the sink by sending a "Hello" packet. The structure of "Hello" packet consists of Centre Id , Hop Count ,Energy and Distance to reach sink and Location of the centre.

STEP 4 Then calculate the weight of the node which is given by

$W(U)=(\text{Total Neighbour/ Total Node})^{\alpha}+(1/\text{ Average distance from the sink})^{\beta}+Re(\mu)/E(\mu)$

Where $Re(\mu)$=Remaining Energy

$E(\mu)$= Initial Energy

α and β is parameters which lies in range of [0,1] and $(\alpha+\beta)=0$

Then the highest weight become the cluster head and other nodes are call sensor nodes or cluster member.

This method is quiet useful as the weights are calculated dynamically. As a result, always the best candidate is selected as cluster head. This technique also enhance the network lifetime as energy of all the nodes is used in a fair manner i.e higest node with highest weight is elected as cluster node. Also, we incorporate Sleep Awake Method, in this work, the working of SWM is that whenever a node remains "ideal" for a long time, the node is consuming the energy. So using this technique we always send the status of these nodes to sleep which saves energy and whenever any request is admitted to node , the node immediately turn its status to awake.

Sleep Awake Algorithm

Step 1: While member i is awake

Step2:If the confidence level is higher than threshold value go to

Step 3 :If condition (2) holds;

Step 4 :Let member i power off for Δ second

Step 5 :While member is sleeping

Step6 :If timeout after Δ second then sudden awake member 'i'.

Also, a gateway node is used in this work which assists BS for data aggregation as well as TDMA.

VI. Results And Discussion

In Fig.1. It can be seen that our proposed method is performing best for energy optimization in clustered WSN. The cause for this algorithm is its giving precise performance evaluate than different optimization algorithms.

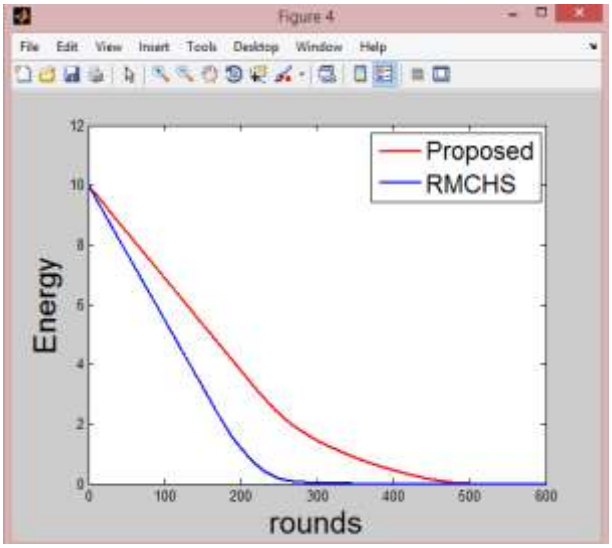

Fig.1.. Residual energy of Individual Nodes

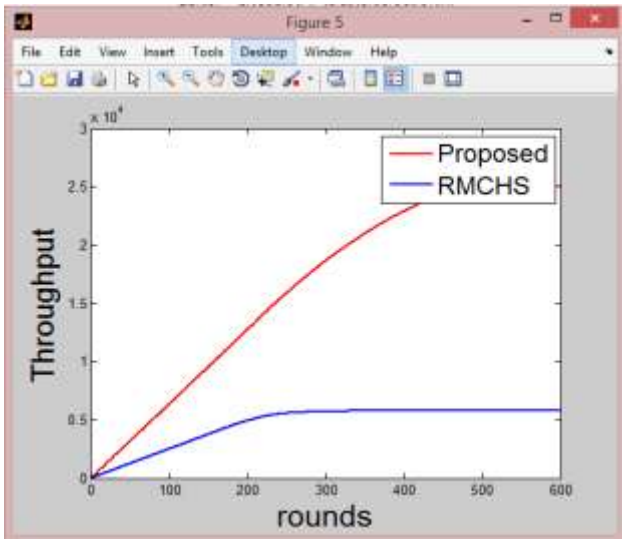

Fig.2. Throughput of the Sensor Network

In Fig.2. It can be clearly notices that the throughput of the network is highest in case of election CHs scheme designed using our proposed algorithm. The cause being since the throughput is directly proportional to the alive nodes. As shown in Fig.3. the number of dead nodes are less in this scheme number of dead nodes is inversely proportional to lifetime of the network. Hence dead nodes

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must be less so as to increase the lifetime of the network. Hence this scheme gives highest lifetime and is preferred.

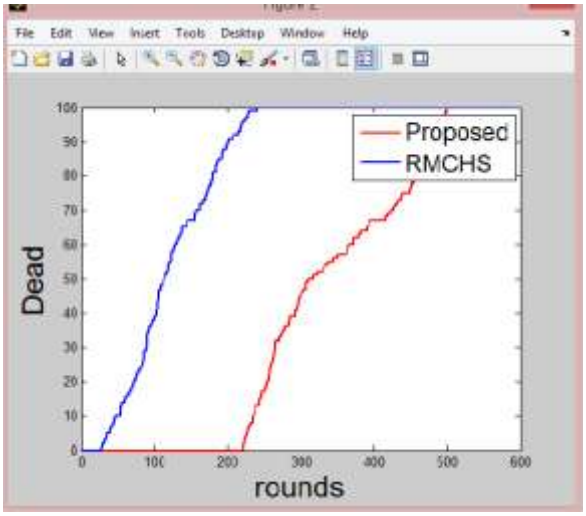

Fig.3. Dead Nodes In Sensor Networks

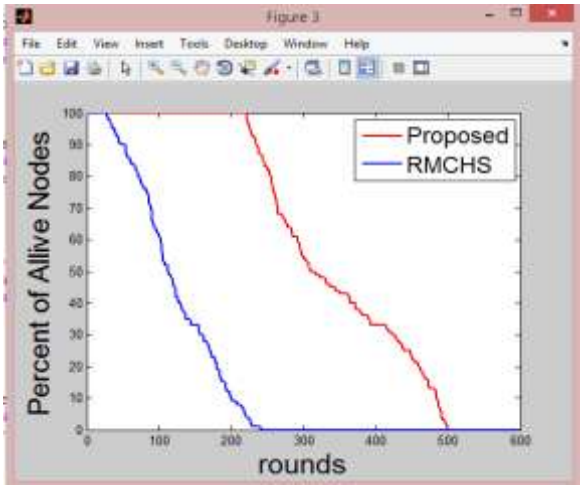

Fig.4. Alive Nodes In Sensor Networks

As shown in Fig.4. it is clear that number of alive nodes in our proposed scheme in which always the best candidate is selected as cluster head when compared to RMCHS. This technique enhance network lifetime as the energy of all nodes used in a fair manner.

VII. CONCLUSION AND FUTURE WORK

One of the principle challenges within the design of routing protocols for WSNs is energy efficiency performance i.e to reduce the energy consumption and increasing the throughput because of the limited energy resources of sensors. The ultimate goal of the routing protocol design is to keep the sensors running for so long as possible, hence prolong the network lifetime.

In our proposed work we perform a efficient CHs method with incorporation of two techniques one is Sleep Away Technique other is using Gateway Node. Our proposed Algorithm is very efficient to save energy and our achieve results are enhance in all forms than the previous RMCHS method. In Future the constrained of security my be considered in this work which make it a Wireless Model which addresses future challenges.

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