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Review Study of Leach Protocol

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Abstract:-WSN is a wireless Sensor Network which is a power constrained system. In WSN nodes have limited power batteries which depend upon energy efficiency. In WSN there is major issue of energy efficiency. Energy can be consumed by various protocols in WSN. LEACH is one of them. It works on clustering technique. Now a day's so many versions of LEACH occur. From these versions a few latest versions are discussed in this which are A-LEACH, K-LEACH, O-LEACH and V-LEACH, EELBCRP are discussed. All the three are performed best to reduce the consumption of energy. Also helps in increasing the network life time. This paper gives the review study of the latest versions of leach protocol. These are discussed below in different sections of paper.
Keywords:-WSN, Clustering LEACH, K-LEACH, O-LEACH, A-LEACH, V-LEACH, EELBCRP.

I. INTRODUCTION

Wireless sensor networks and new mobile applications are the major areas for researchers to support novel applications and to enhance the overall performance like energy efficiency, network life time, no. of alive nodes etc. These networks are used for different applications such as traffic monitoring, battlefield surveillance, seismic detection, environmental monitoring etc. Energy efficiency is one of the major problems of WSN. Different routing protocols are used for this to maintain secure information delivery, concise and reliable data is send to base station. These different routing protocols works in different ways. Some of them are based on clustering. LEACH is also a clustering algorithm. In clustering hierarchy is formed and data is gathered from all the nodes then send to the one main node and then all main nodes of different groups send data to the base station. This whole technique is known as clustering technique. Energy consumption is the main issue in WSN. It can be reduced by LEACH protocol. In this paper different versions of leach protocol are discussed that are LEACH-A, K-LEACH, LEACH-O, V-LEACH, EELBCRP.[1]

II. INTRODUCTION TO LEACH PROTOCOL

In routing protocols, some are based on hierarchical routing in which clusters are formed. These clusters gathers data from all the nodes and send it to the base station. LEACH protocol is based on clusters. Where each node makes its own decision without any centralized control. Initially a node becomes a cluster head with probability p and then broadcasts its decision to all other nodes. Each non cluster head node chooses its cluster by least communication energy.[5] The process of being CH is rotated periodically among the nodes of the cluster in order to balance the load. Each node chooses a random number between 0 and 1. A node becomes a CH if its random number is less than the threshold value 'T(n)'.

$$T(n)= \frac{p}{1-p*(r \bmod 1/p)} \quad : \text{if n E G}$$

$$T(n)=0 \quad : \text{otherwise}$$

According to this equation p is the desired percentage of CH nodes in the sensor population, r is the current round number, G is the set of nodes that have not been CHs in last 1/p rounds. Since the decision of changing CH is depends on probability. In this if any node has energy less than threshold value become cluster head. If any time cluster head dies due to some critical condition then the whole cluster will dies. Base stations are not always reachable to all the nodes so that CH are choosen that have ability of long communication which gathers the data from all the nodes and send it to the base station. This protocols works in different phases as:-

A. Set Up Phase
Advertisement phase
Cluster set up phase

B. Steady State Phase
Schedule creation
Data transmission

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In setup phase each nodes decides that it will become CH or not for that round. The node becomes CH that has not been CH for long time. CH is choosen with the threshold energy. Firstly random no.s are given for all the nodes then the node which have random number less than the threshold value then it become a cluster head to that cluster. In next cluster set up phase, all the nodes informs the CH that they become a member to that cluster with "Join packet" contains their IDs using CSMA. After this phase CH knows the number of member nodes and their IDs .Based on all messages received within the cluster, that CH creates a TDMA schedule, pick a CSMA code randomly, and broadcasts the TDMA table to cluster members then after this data is transmitted. Then all the nodes transmit data according to TDMA schedule so that no collision occurs. All the nodes according to their schedule this transmission uses minimal amount of energy for data transmission. After this data is transmitted from all the nodes to the cluster head and then cluster heads transfers the all gathered data to the base station.[6] In this way simple LEACH protocol works. It decreases the extra use of energy but still there are some problems these are discussed below.

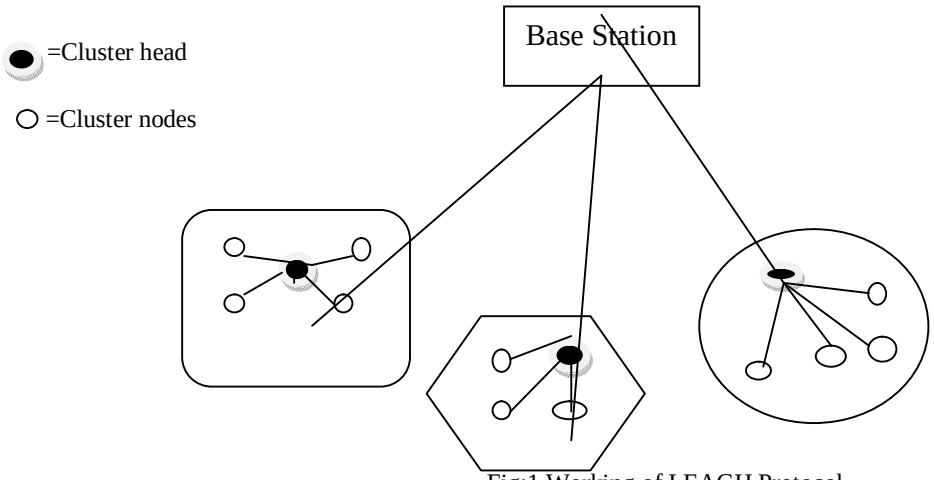

Fig:1 Working of LEACH Protocol

III. SOME DRAWBACKS OF LEACH PROTOCOL

LEACH chooses random number value for becoming cluster head. In this sometimes the nodes have least energy gets the chance to become a CH. If CH node have a less energy then it will die first. Cluster heads communicate with base stations in single hop mode which shows LEACH can't be used in large scale wireless sensor networks.

IV. A-LEACH

In LEACH protocol major drawback is that in random selection of CH it can't guarantees the uniform distribution of space. In this way cluster head nodes consumes too much energy during data transmission. A-LEACH means adaptive LEACH which proposes Eo energy threshold value. Which helps in the less consumption of energy? After cluster head selection the two steps occurs first step is that if the residuary energy of cluster head nodes is greater than Eo,Then the node with largest energy becomes cluster leader. All other cluster heads send data to cluster leader and then to base station. In this way energy use is reduced. In second step if energy of cluster leader becomes less than Eo then we need to find a new cluster leader nearer to base station. Then all the other cluster heads find their shortest path and send data to the base station. In this way it helps in reducing the amount of energy consumption. All this procedure is done after the selection of CH. Then CH leader is also chosen from the CHs. The concept Eo works better than simple CH formation and also better than LEACH-C. So from this point of view this algorithm shows that it works much better than LEACH-C and main LEACH protocol.[4]. In A- LEACH this figure shows all the working of this protocol. Firstly all the working is done according to LEACH protocol. Then after this all the cluster heads are checked and then cluster head which have maximum residual energy is chosen as cluster leader. In this circles with black color are shown as cluster leader. Then all the cluster heads send gathered data to the cluster leader and then cluster leader send it to the base station. In next step if energy of cluster leader is reduced then there is need to choose the new cluster leader then again the same procedure is performed.

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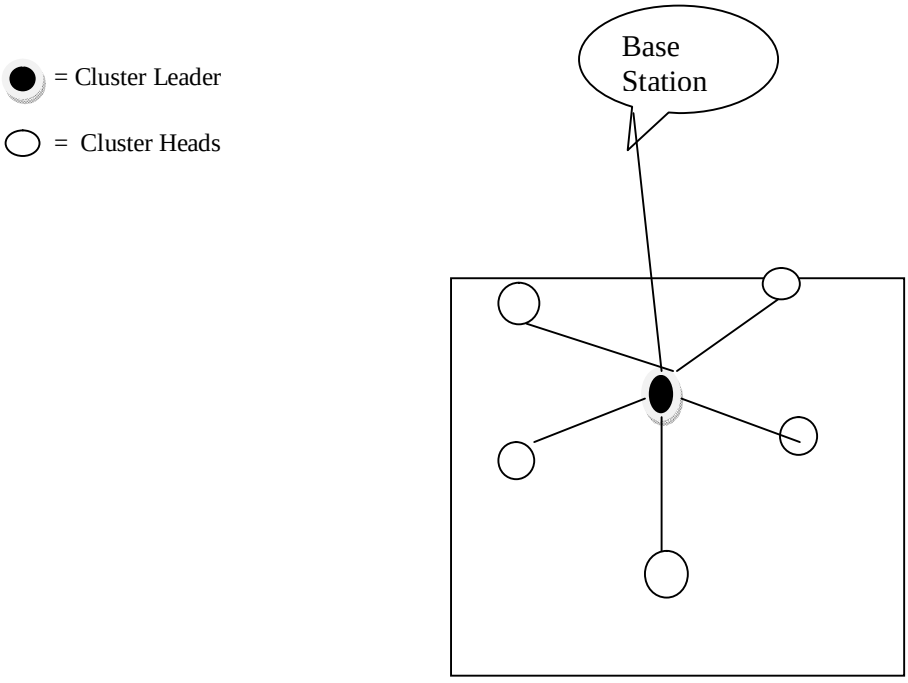

Fig.2: Cluster Head Chosen with maximum residual energy

V. K-LEACH

K-LEACH uses the concept of K-mediods as well as Euclidian distance method to chose a cluster head and for cluster formation. It works as LEACH protocol but it improves some parameters by using K-mediod algorithm and Euclidian distance method , In the first round it chooses the cluster head which lies nearer or at center using Euclidian distance method and then inform all the other nodes. Firstly K-LEACH considers the least distance of nodes from the center of the cluster. It works as the same as the LEACH protocol. By this way limitation of random clustering of LEACH protocol is addressed by uniform clustering to balance the load of entire network among all nodes. It uses K-mediods algorithm which improves the cluster head formation and cluster formation. In this all the cluster nodes have uniform energy. And it also uses radio energy dissipation model. Radio energy dissipation model works as it has two parts transmitter and other one is the receiver. Transmitter dissipates energy to run radio electronics and power amplifier. Receiver dissipates energy to run radio electronics. Which helps to calculate the energy consumption of communication by first order model. It increases the network life time and also increases the no of alive nodes after all the rounds.[2]

VI. O-LEACH

O-LEACH is the optimization LEACH protocol. It works better than LEACH and LEACH-C. In this Energy model is used. In this algorithm a new technique is proposed for the selection of sensors cluster heads based on the amount of energy remaining after each round. In this sensor nodes are taken into M×M square region. Uniform nodes are in it and we assume base station is in center and in second simulation it will be in top or square. In this cluster head can be choosen in each round with an energy value greater than the ten percent of the residual value at each sensor. Then after this it will works as simple LEACH. It performs better than LEACH and LEACH-C protocol. It increases the network lifetime and also have ability of extending the life span of network.[3]

VII. V-LEACH

In V-LEACH protocol all the work is done as same as the LEACH protocol. But in this new approach is used to increase the network life time. In V-LEACH protocol some more protocols are discussed whose work is related to V-LEACH that are TL-LEACH, M-LEACH, C-LEACH etc. In this version of LEACH protocol CH is chosen that gathers the data from all the cluster nodes and then send it to the base station. Also a vice CH is chosen which acts as a cluster head in case cluster head dies. V-LEACH is the vice cluster head which is much helpful to the cluster. If in any case cluster head dies then the whole cluster is damaged and the whole data becomes lost. So to recover it from loss vice cluster head is much helpful. Then vice cluster head

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automatically acts as a cluster head and handles the whole situation. In this case there is no need to choose a new cluster head so that energy is saved. And also increases the network life time. It uses less network energy than simple LEACH protocol.[8]

VIII. EELBCRP

EELBCRP is the energy efficient level based clustering routing protocol. It is generated from LEACH protocol. In this new protocol that is EELBCRP is generated. In this idea of LEACH protocol is taken and something new is added to it. In this work done is based on levels. In this firstly cluster head is chosen for the first level and then for the next level. In this cluster heads are chosen as same as the LEACH protocol. Means in this nodes that are occurs in the first level joins the cluster head that is in first level. And the nodes that are far away from the cluster head then they elect a new cluster head for the second level and joins the CH of second level. It works much better than the LEACH protocol. In this all the work is done on the basis of levels. Levels helps to consume less amount of energy. If no. of nodes occurs more in upper level then all these uses the upper level cluster head. And then other uses next levels. In this way energy used for cluster head formation and data gathering is less. So that we can say that it uses less amount of energy than LEACH protocol.[7]

Table1
Comparison of different versions of LEACH protocol

S.No	Year	Author's name	Algorithm	Technique used	Parameters improved
1.	2009	M Bani yassein, W.Mardini	V-LEACH	Vice cluster Head formation	Network Life time increased.
2.	2012	Minakshi Diwakar	EELBCRP	Levels used in Clustering	Consumption of less amount of energy.
3.	2013	Parul bakaraniya and Sheetal mehta	LEACH-K	Euclidian distance and max. residual energy method used.	Network lifetime increased and also no. of alive nodes.
4.	2014	Jinali zhao and Lirong yang	A-LEACH	Eo threshold to make cluster leader.	Network life time increased
5.	2014	Najesh nasri Salim EL khediri et.al	O-LEACH	Energy model	Network lifetime and No. of alive nodes after maximum rounds

IX. CONCLUSION

In this paper main protocol of energy efficiency is discussed which is known as LEACH. LEACH works efficiently to improve the network lifetime and the use of energy consumption. But there are still some problems with LEACH protocol so to reduce these shortcomings some new versions of LEACH are introduced which are LEACH-K, A-LEACH, O-LEACH, V-LEACH, EELBCRP etc. these five are also discussed in this paper, these all performs better than LEACH but from all the five O-LEACH performs much better.

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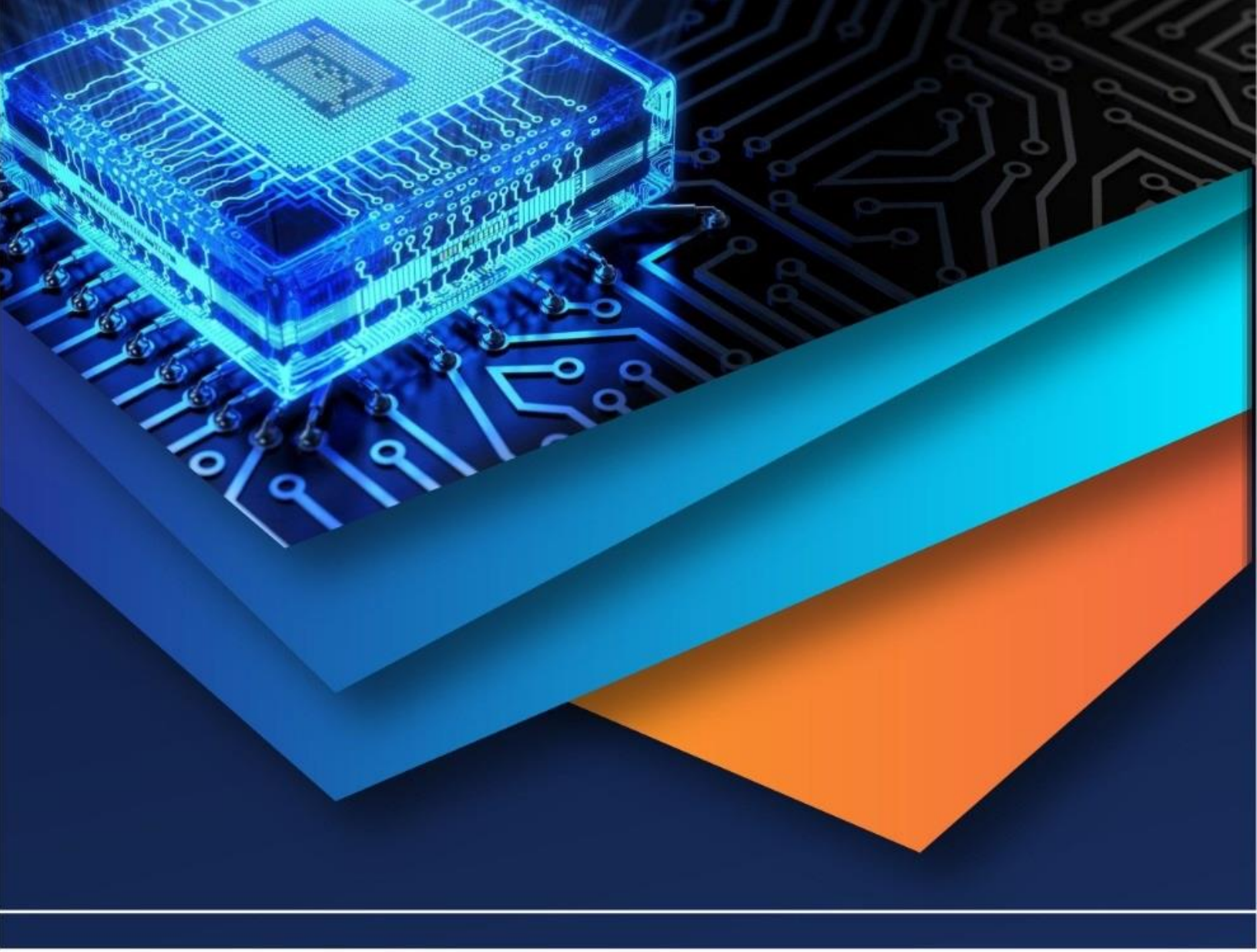

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