OP-LEACH Protocol for Energy Efficiency of Wireless Sensor Network

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Abstract- *In wireless sensor network routing protocols are used to route data packets from sensors to base station efficiently. The main requirement of wireless sensor network is energy efficiency to have prolonged network lifetime. There are many existing routing protocols for e.g. LEACH, PEGASIS, YA-LEACH etc. However, the existing routing protocols have many drawbacks with respect to energy and power consumption. In this paper, we introduce OP-LEACH which is the integration of two existing protocols i.e. YA-LEACH and OPEGASIS. This protocol uses energy efficient routing algorithm to send data from sensor nodes to base station. To validate the energy effectiveness of OP-LEACH, we simulate the performance using Network Simulator (NS2).*

Keywords- OP-LEACH, cluster head, vice-head, residual energy.

I. INTRODUCTION

A Wireless Sensor Networks (WSN) form a subset of Adhoc networks. Wireless Sensor Networks have many restriction compa red to Ad-hoc networks in terms of its sensor nodes capability of memory storage, processing and the available energy source . Wireless Sensor Networks are generally assumed to be energy restrained because sensor nodes operate with small capacity DC source or may be placed such that replacement of its energy source is not possible [1] .

A wireless sensor network (WSN) consists of spatially distributed autonomous sensors to cooperatively monitor physical or environmental conditions, such as temperature, so und, vibration, pressure, motion or pollutant fig.1 . They are now used in many industrial and civilian application area, including industrial process monitoring and control, machine health monitor environment and habitat monitoring , healthcare applications, home automation, and traffic control. Fig. 1 Wireless Sensor Network LEACH protocol is the first protocol of hierarchical routing which proposed data fusion, it is of milestone significance in clustering routing protocol.

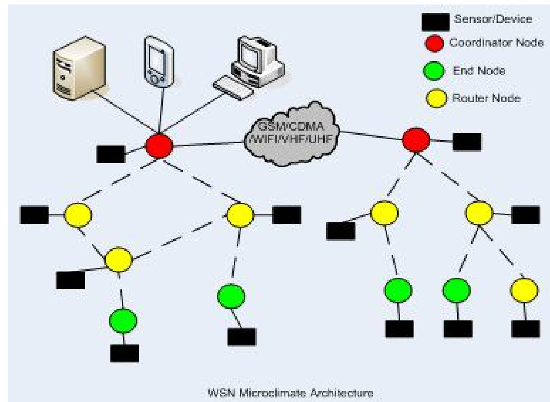

Figure 1. Wireless Sensor Network

II. LITERATURE SURVEY

Yet Another

LEACH (YA-LEACH) which uses centralised cluster formation to ensure optimal clusters and allow Cluster Heads (CH) to extend operation into multiple rounds to achieve energy savings. Also,the proposed protocol will have an alternative (vice) CH that takes over when CH residual energy reaches a critically lowlevel. YA-LEACH considers that the randomly distributed nature of LEACH cluster formation algorithm does not ensure optimal CH distribution [4]. Firstly, the protocol use the centralized approach introduced in LEACH-C which triesto ensure optimal clusters, this will ensure fair CH distribution. LEACH-C however, has higher energy overhead in the communication of cluster formation information in each round. In contrast, to avoid communication costs adjustment has been made so that nodes will communicate their residual energy to BS via CH. Centralized cluster formation ensures highly optimal CH distribution, which translates to minimum energy consumption for data transmission [5].

Secondly, instead of selecting new CHs at the end of each round the CH is allowed to extend operation into another round provided it has enough residual energy. In YA-LEACH the residual energy value is calculated as the minimum energy required for CH to transfer its role to vice-CH. This will be the energy of aggregating data of one round and energy to transmit it to the vice-CH. This allows maintenance of clusters for longer periods as compared to T-LEACH. However, further prolonging CH replacement leads to the depletion of most the CH energy. To provide some energy balancing the CH transfer of its role to vice-CH done at some minimal residual energy helps. This allows CHs to save some of its energy to become a CM until it dies. CMs require much less energy as these nodes mostly sleep and only turn on the radio in their TDMA slot. Prolonged CH replacement further reduces the number of cluster formations which have a high energy cost and the transfer of role to vice-CH before CH death provides for energy balancing as there is high energy dissipation in CH from extended round use[2].

OPEGASIS

Opportunistic Power Efficient GAthering in Sensor Information Systems as by increasing the throughput by communicating the nodes with an opportunistic behaviour. Nodes transmit the data to the nearby node as well as far distant nodes in the direction of base station through opportunistic behaviour.

Consider a network as shown in the diagram node A is the source node which is providing the data to the cluster head. The data must be some 100 packets of energy. According to PEGASIS, some packets are sent to the nearest neighboring node B, but all the packets are not reached to B as some packets are lost due to probability density variation or noise. In order to send the packets to B in a single connection the strength of the signal should be very high.

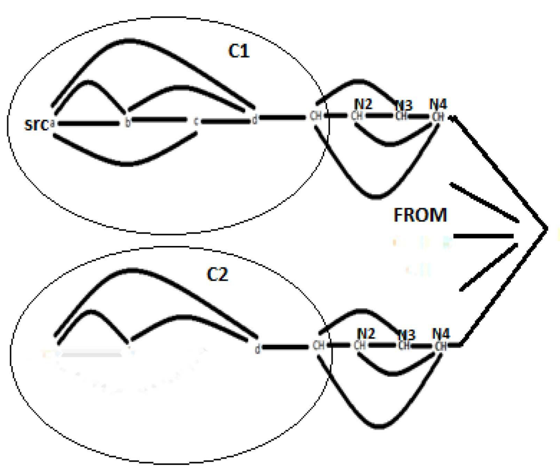

Figure 2.

But in the figure 2 A the packets from A are not only given to B but to all the nodes including the cluster head. No doubts due to low probability density all the packets are not reached to the cluster head but some are reached, thus increasing the throughput. At the same time a similar procedure is applied to all the nodes in all clusters. As the actual data from node B goes to node C and all other nodes including the cluster head. Consider the case of packets from A, in the first connection 10% of the A's packets reached to the cluster head, 80% reached to B. There is a chance that the packets which are not received by B are received by other nodes. All the nodes fuse their data with the data provided by A. Node nearest to the cluster head provides a batch map to its nearest node. It deals with the information regarding the packet number. The nearest node (here C) provided by node D in the fonn of batch map. If any packets found matching than these packets are sent data from the nearest cluster head and the nearest node to D. At the same time a batch map is created by node respectively.

C to B providing the infonnation regarding the packets which are sent to D from C. Node B matches its data with batch map as received by C. It sends the remaining packets to D. At the same time, D continues to send data to cluster head without any interruption. This process is simultaneous continued in all the cluster heads present in the network. The data from entire cluster head needs to be sent to the base station. In this situation, the data bits will be sent from one cluster head to the nearest cluster head in the direction of base station. This process of sending data continues to aggregate up-till the last cluster head. The data is sent to the base station only by the cluster head which is the nearest to the base station[3].

III. MODLUE DESCRIPTION

Network Module: In this module networks (x,y) plane is defined , sensors are created and deployed.

Energy Module: In this module initial energy for each sensor nodes are defined. Also residual energy for sensor nodes is calculated.

Routing Module: In this module cluster formation, cluster head selection and chain formation takes place.

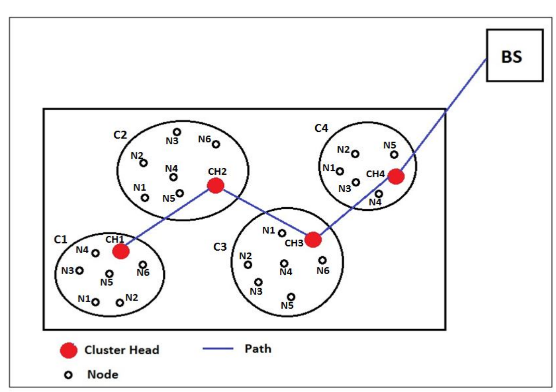

Figure 3. System Architecture

In above fig 3 is the system architecture of proposed system. There are N number of sensor nodes from which C1, C2, C3 and C4 are clusters formed. CH1, CH2, CH3 and CH4 are the cluster heads elected with maximum residual energy. CH1 sends collected data to nearest cluster head i.e. CH2. Next CH2 to its nearest cluster head in this way a chain is formed to BS (Base Station).

IV. ALGORITHM

Step 1: Initializing the Network (Nodes (N), Base Station (BS), Location L (x,y),
Ni = 1 to 16)

Step 2: Initializing the Energy (E), Transmitting power (Tx), Receiving power (Rx)
Ei = E1 to E16
Residual energy= E-(Tx-Rx)
Ni – sends Ei info to BS
Ni -- sends L(x,y) to BS

Step 3: Cluster Head Selection
For (i=0; i<=16; i++)
{
If
Ei = Emax
Then
Ni = Chi
}
End if
End for

Step 4: Giving and receiving messages internally
BS -> CH to Ni
Ni <- ack to BS

Step 5: Chain Formation and selecting a leader
Leader -- Chi (min L(x,y) & Emax)
Path -- CH1 – CH2 – CH3- CH4- BS

Step 6: Transferring the Data
Ni of respective CHi -> D(Ni) to CHi
CHi <-D(Ni)
CH1->CH2->CH3->CH4(L)->BS

Step 7: Stop

V. EXPERIMENTAL RESULTS

We consider two existing protocols YA-LEACH and OPEGASIS for comparison of performance metrics with our proposed system.

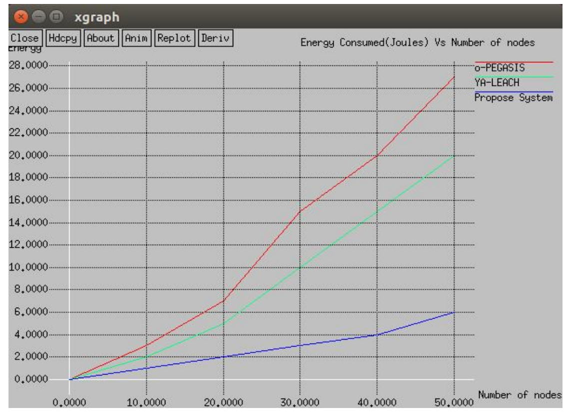

Figure 4. Comaprison of Energy Consumption

In above fig. 4 energy consumption of three protocols is compared and the result depicts that OPEGASIS consumes 30 joules, YA-LEACH 15 joules and proposed protocol consumes least 6 joules out of 100 joules of energy.

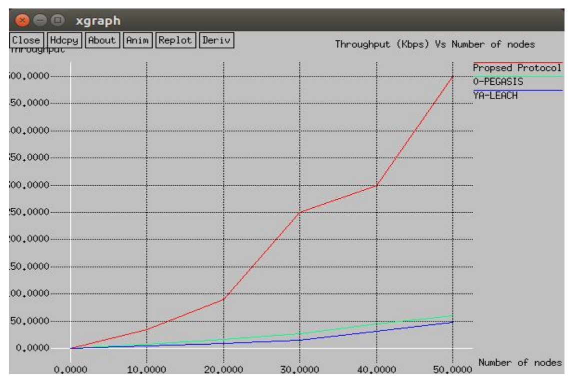

Figure 5. Comparison of throughput

In above fig throughput is considered, proposed system has more throughput than other two protocols.

VI. CONCLUSION

In this paper, we proposed the OP-LEACH Routing Protocol for improving energy efficiency in wireless sensor networks. The performance of OP-LEACH is compared with the YA-LEACH and OPEGASIS protocols. With simulation we observed that OP-LEACH performs much better than YA-LEACH, and OPEGASIS in terms of energy consumption and throughput.

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