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Department of ECE, Aarupadai Veedu Institute of Technology, Vinayaka Missions University,

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Energy, Distance and Duty cycle based Reclustering protocol for Wireless Sensor Networks

Aby.K.Thomas, S.Uma Maheswari, R.Devanathan
Research Scholar, Sathayabama University, Chennai, India
M.Tech (Communication Systems), Hindustan University, Chennai, India
School of Electrical Science, Hindustan University ,Chennai, India

Abstract : Wireless sensor network is deployed with sensor nodes which are spatially distributed across a large area of interest to measure and gather information and transmit the data to the user. The nodes communicate with each other; they cooperate by forwarding data packets to other nodes in the network. One critical issue in the wireless sensor network is how to gather information in an efficient way. Clustering is a technique used to reduce the energy consumption in the network. Here we try to implement multiple hop communication and the consideration of duty cycle to reach the base station and the sensor nodes which are placed near the base station have a higher load of relaying packets. The result shows that EDDRP (Energy distance and duty cycle based Reclustering protocol) gives a longer lifetime to the nodes which enhances more data messages transmission than the other protocols.

Keywords: Reclustering, Energy distribution and distance

I.INTRODUCTION

A wireless sensor network is composed of a large number of sensor nodes and a base station.. The nodes are usually developed randomly inside the region of interest. [2] The base station is engaged to give commands to all the sensor nodes to gather information from the sensor nodes.[2] A sensor node is a tiny device that includes three basic components such as sensing subsystem for processing and a storage and wireless communication subsystem for data transmission. Wireless sensor nodes have many limitations including processing power,minimum storage and limited power source.

The applications of sensor networks are environmental monitoring, industrial sensing, diagnostics & infrastructure protection.

Our methodology to study EDDRP based Protocol which uses the multi hop communication when the data are transmitted from the node via the cluster head to the base station. There are many protocols for communication within the nodes of the sensor networks. Some of the protocols are LEACH, LEACH-C, TEEN, PEGASIS & APTEEN.

The implementation of the EDDRP gives an efficiency much better with total of low nodes death during communication in the entire network. When the data are transmitted from one node to another, the sensor nodes periodically switches on their sensors and transmitter. It senses the data from the environment and transmits the data to the base station via the cluster head. In this work the wireless sensor network consists of 41 sensor nodes which are deployed randomly in the sensing field. Clustering means grouping the entire network into clusters and to communicate within the member node via the cluster head. [4] The base station split the network into clusters and elects some sensor nodes as cluster heads and that particular node will have duty cycle as 1 and will be at full power node which means that the head node is always on. The nodes are responsible to find the fresh path to the destination via the cluster head. The

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main objectives of EDDRP are to increase the lifetime of the network and allow local coordination between the nodes and to maximize the energy conservation efficiency within the nodes.

II.RELATED WORK

Studies about the energy minimizations and maximum data transfer are considered depending upon the various protocols that are implemented in the wireless sensor networks.

In LEACH [1] initially the clusters are created, and each and every node calculate the energy to become the cluster head for that particular round. This can be calculated by comparing present energy status of the node to the threshold value. T[n] is given by

$$T(n) = \begin{cases} \dfrac{P}{1 - px\left(r \bmod \frac{1}{P}\right)} & if\ n \in G \\ 0 & otherwise \end{cases}$$

Where p is the pre determined percentage of the cluster heads, r is the current round and g is the set of round that have not been cluster-heads in the last 1/p rounds. The non cluster-head nodes have to be on as it receives the advertisement message from the cluster-head. The nodes select their cluster-head depending upon the signal strength. The cluster head collects the each node during particular interval of time and sends to the base station.

The operation of ADRP (Adaptive De centralized Reclustering Protocol)[2] is divided into rounds and they are divided into two phases: initial phase and cycle phase. In initial phase each node sends the energy & location details to the base station. The base station splits them into clusters and depending upon the threshold of each cluster the member node and cluster head are selected.

$$Tj = \frac{1}{m} \sum_{i=1}^{m} Ei(t)$$

Where m is number of sensor nodes in cluster j

Ei(t) is the current energy of node i. The energy in each and every node is anticipated with the threshold energy and the next cluster head is decided. The node with higher energy will be next head and the present head will be declared as the member node.

An advertisement message is sent to all the nodes which have the ID (Identification Number) of the cluster head. In the cycle phase the cluster head specifies the time slots allocated for each member to transmit the data. The head node collects the data from the ember node and they aggregate the data before sending to the base station. The next cluster head is selected and the nodes join to the cluster head and the previous cluster head switches as a member node and joins the next head.

The Heed protocol [6] which describes about the node residual energy elects as the cluster head. Each and every node execute constant iteration If two nodes have the same energy then the distance and node degree are taken into consideration from their neighbour nodes.

III. SYSTEM MODELLING

The wireless sensor network is deployed with nodes in the sensing field and the base station will split the entire network into cluster and elects the sensor nodes as cluster heads. The data are collected from all the nodes in the cluster and they are sent to the base station. When the nodes transmit the data the energy in that particular node is decreased. The base station that is located in the sensing field which is associated with the sensor nodes for the reception and transmission of the data are usually assigned with a unique identification number. The nodes are fixed and they are usually assigned with the location aware and are monitored by the cluster head. The energy has to be less consumed and the data has to be transmitted with more efficiency. This can be obtained by keeping the nodes in half power mode which will reduce the energy consumption of the nodes. During each and every mode of transmission the nodes will be switched on & off depending upon the need of the transmission of the packets from the source node to the destination node. The base station will compute the average energy in each cluster, and the sensor node that has less energy than the average energy cannot be the next head for that particular iteration.
Here we implement a protocol which is called Energy distance and duty cycle based protocol which may be

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used in the Wireless Sensor Network. The Energy has to be minimized and the network lifetime has to be increased. All the data are obtained from the sensor nodes and are transmitted to the base station and the entire network is divided into two major areas as cluster members and re clustering procedure. The member nodes send the energy status of the nodes to the base station and they are elected with the cluster heads. The identification number of the cluster head is transmitted to all the member nodes. The member with unique identification number is taken as members of that particular cluster within the cluster head. In the transmission stage the data are gathered and aggregated and they are sent to the respective cluster head. The cluster head check the data and then forwards the data to the base station. The data are being received and transmitted which in turn make the energy of the cluster head to be reduced. This is reduced as the cluster head is fully in on mode and as the duty cycle is 1 to be the cluster head.

$Ei(t) \geq Tj, i \in NHj$

[4] Here the next cluster head is taken as NHj where the duty cycle is 1 and Tj is described as the threshold energy. Hence the current energy has to be greater than or equal to the threshold energy of the cluster. The data are sensed by the nodes from the sensing field given to the cluster head which may in turn the messages are sent to the base station. Once the data are collected from the sensing field the nodes are allotted with specific time slot to declare their packets to the cluster head. The energy consumption and distribution among the nodes are periodically taken into consideration for the next cluster head which in turn create a re clustering with new cluster heads and member nodes.

IV. SYSTEM IMPLEMENTATION

1. Deploy 41 nodes in a square area of 1000X1000m
2. Identify each nodes with numbers and their location
3. Initially all nodes have equal initial energy.
4. Each node is capable of working in different power modes (like low power listening, medium power transmission & receiving when they are ordinary node where as in high power mode when the node acts as a cluster head. Each node is capable of working with 2 different duty cycles $D=\frac{Ton}{Ton+Toff}$
5. The cluster head should have duty cycle as 1 it means that particular node has to be ON
6. After deployment the base station should run an initial clustering algorithm to mark different clusters based on their positional information, during which all nodes are in D=1 and at low power listening mode.
7. Base station selects a cluster head in each cluster. Cluster head broadcast packets to inform about its presence to other nodes whichever nodes listen & replies they will be nodes within the range of the cluster head.
8. Once the members of a cluster are identified with them to the designated duty cycle and also to the medium power mode.
9. The transmission and the reception of the packets from any nodes with maximum 2 hops distance from the cluster head.
10. The residual energy lost in each and every node and the cluster head is calculated as (initial available energy – energy lost) in each and every node.
11. Calculate the average energy lost in each and every clusters and if average energy lost is greater than the threshold energy then the next cluster head is selected.

V. SIMULATION RESULT

The entire network is simulated using NS2 which provide the simulation of the event that is executed by providing the requirement of the event. It is a Back end C++ Event scheduler which in turn creates the protocols and interface to bring control over the network. This can be used to create the scenario and to change the tool command language

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The topology construction is

Antenna type	Omni directional type
Number of nodes	41
Energy of the nodes	30KJ
Routing Protocols	DSDV (Destination Sequence Distance Vector)
Propagation	Two ray Ground
Traffic Type	Control Bit rate
Simulation Rate	55 Sec
Environment size	1000 x 1000
Simulator Version	NS 2.2

In our work, we have use the nodes that transfer the data from the nodes to the cluster head by the DSDV protocol. They are being implemented by generating a small size network that has 41 nodes and they create a UDP(User Datagram Protocol) connection between the nodes and attach CBR(Constant Bit Rate) which will generate a constant bit packet throughout the entire network. The duration of the scenario is 55seconds and 512 byte long. The duration of the scenario is 55 sec and CBR connection started after a delay of 1 second and every node and continues till the simulation time mentioned.

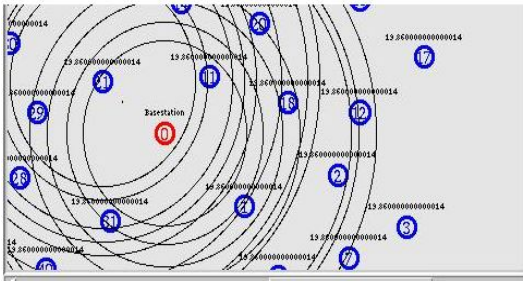

Fig 1 Data transfer from the node1 to the base station

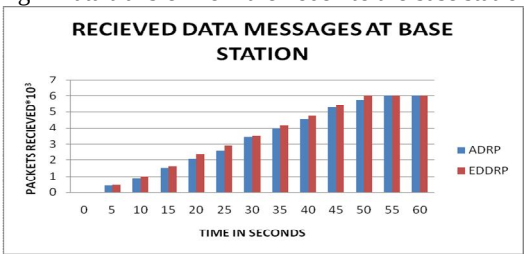

Fig 2 Packet received

Once the data are sent to the base station the packet loss is evaluated. The number of packets from the sending nodes and how many are received by the receiving nodes are calculated. The number of packet loss is compared to that ADRP and found that the packets received is better in EDDRP when the nodes are been kept in half power mode on To evaluate the number of packets transmitted which in turn give the efficiency of the nodes. Here the nodes that transmit the data will lose the energy and the number of death node is less when they are executed with the half power mode and it is compared with the other protocols.

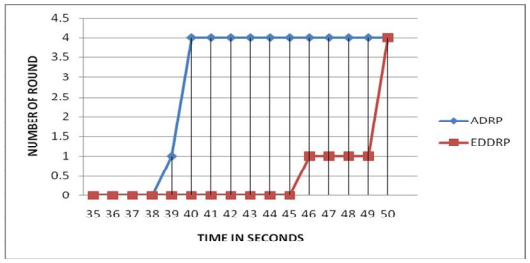

Fig 3 Alive ratio

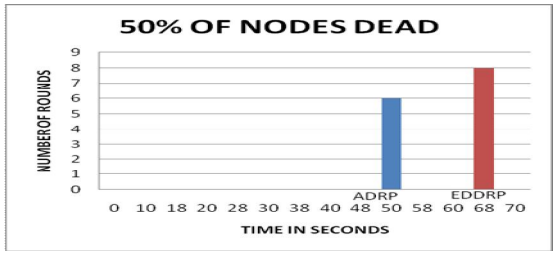

Fig 4 50% of nodes are dead

The fig 3 shows the nodes that are alive for the number of iterations. When the alive ratio is compared with ADRP the first nodes die in 39sec as it is kept full time ON. The EDDRP protocol in the first node dies in 46sec. Hence the EDDRP protocol performs much better than ADRP. Fig 4 shows the network life time which is defined by finding out the number of dead nodes.

VI. CONCLUSION

The Simulation scenario which is implemented with 41 nodes that has constant energy of 30KJ and that uses

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DSDV protocol and also the same is simulated by introducing the half power mode. This shows the number of packet lost and the death rate of the node is less when compared to other protocols. The EDDRP which has an enhanced performance than ADRP over the life time of the nodes in the network. The death ratio of the nodes are less when they are compared with ADRP The transmission is kept in control with the EDDRP protocol as the required node is kept ON which will minimize the unnecessary packet transmissions, which will save the power that reduces the packet loss and which in turn provide the increase in the network performance than ADRP

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