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SECURING WIRELESS SENSOR NETWORK USING GSTEB PROTOCOL

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Abstract—The Sleep/Wake up scheduling for Wireless Sensor Networks has become an essential part for its working. In this work, the Low Energy Adaptive Clustering Hierarchy (LEACH) which introduced the concept of clustering in sensor networks, Energy-Efficient Clustering routing algorithm based on Distance and Residual Energy for Wireless Sensor Networks (DECSA) which describes about scheduling based on distance and energy and the Energy efficient clustering algorithm for data aggregation (EECA) are going to be studied in detail. The LECSA (Load and Energy Consumption based Scheduling Algorithm) which gives a simplified method for scheduling using a node weighting parameter has been previously introduced perform Scheduling and Data Transmission in an efficient manner Every cluster head has to send the data collected from its child node directly to the sink, the cluster head should have a radio with high transmission range. So in this proposed work, the cluster head will find the nearest active node in the neighbor cluster and then it forwards its data to it. This can be achieved by General Self Organized Tree-Based Energy-Balance (GSTEB) using this protocols load balancing energy consumption has been introduced and detailed

Keywords— Energy-balance, network lifetime, routing protocol, self-organized, wireless sensor network.

I. INTRODUCTION

Wireless sensor node that can sense the surroundings and share the message collected from the display field through the network. Wireless sensor network is used for gathering and transmitting different kinds of message to the sink node. The wireless sensor node are made up of tiny nodes that are transmitted in the network. The small sensor network constraint of restriction power supply, memory and communication.Wireless sensor network is that consists of sensor which is distributed in self organizing capabilities and adhoc manner. Wireless sensor network have a wide range of application to the industry, science, transportation and security A sensor network is designed to perform a set of high level information processing task such as tracking and detection.

The wireless sensor network is to determine the node density, which is one of the primary challenges faced by the design of large WSN. The requirements of wireless sensor network are fault tolerance; lifetime, scalability, power management and budget [2].formatter will need to create these components, incorporating the applicable criteria that follow.

In this paper, we propose a General Self-Organized Tree based Energy Balance routing protocol (GSTEB) .We consider a situation in which the network collects information periodically from a terrain where each node continually senses the environment and sends the data back to BS [11]. Normally there are two definitions for network lifetime.

a) The time from the start of the network operation to the death of the first node in the network [13].

b) The time from the start of the network operation to the death of the last node in the network.

The remainder of the paper is organized as follows: Section II Related works. Modules are discussed in section III. Section IV describes the architectures and details of GSTEB. In Section V we present our simulations in contrast to the simulations of other known protocols. Finally, Section VI concludes the paper

I. RELATED WORKS

Sleep/wake-up scheduling the transceiver of sensor node have active state, sleep state and idle state. During its active state data is transferred to sink node. If the transceiver is in idle state it moves to sleep mode to save the lifetime of wireless sensor network. The energy of transceiver must be saved so it is moved to active mode at the required time. Remaining time it is moved to sleep mode. Each frame consists of sleep and wake-up mode by using the sleep/wake up protocol.

In Distance Energy Cluster Structure Algorithm (DECSA) it examines both the distance and residual energy information of the nodes. DECSA protocol can be divided into initialization stage and working stage [4]. In the initialization stage the election of cluster head is elected and coordinates with its cluster member. The cluster's head consider the node's energy consumption and communication between the node. After the election of cluster head, elect the base station cluster head based on the threshold level. In the working stage cluster head collects the data from the cluster member and transmits the data to their nearest cluster head. Then, the cluster head collects the transmitted data to the base station to balance the energy consumption and process the data transmission of the network.

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Energy Efficient clustering Algorithm (EECA) is used to process the data aggregation. EECA algorithm separates sensor network into cluster head and its cluster member. In EECA phases can be divided into setting phase and steady phase [5]. In setting phase cluster head allocates (TDMA) time slot to cluster member. In steady phase cluster member send the data to cluster head within its time slot. Then, the cluster head transmits aggregate data to sink nodes. By considering the cluster head corresponding cluster head is selected and aggregation tree is constructed to save energy.

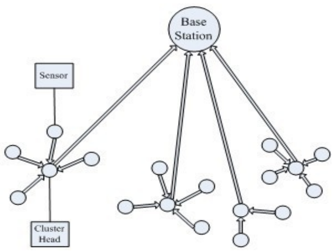

Fig.1 shows the cluster architecture of EECA

In LECSA (Load and Energy Consumption Based Scheduling) protocol is based on two functions. One is clustering and another one is scheduling. Initially cluster head is selected on highest alpha value [2]. The Node transmit the data based on the ascending order to the cluster head. The scheduling is performed by using (TDMA) based protocol. The data can be transfer to the cluster head then cluster head send the data to sink node. So the cluster head should have high transmission energy. In each round the cluster head can dynamically change from one node to another. So that the energy consumption of the nodes are decreased. The energy consumption is reduced.

II. Modules

The operation of securing wireless sensor network can be categorized in to the following modules Cluster formation, Leach, GSTEB protocol.

A .Cluster formation of WSN

WSN is to regularly collect information from the sensor node and transmit it to cluster head. The cluster heads are selected by using highest node weighting parameter. Cluster head are organized by the entire sensor node and keeps track of the information of all the sensor node. Once the Sensor node are deployed they will keep operating until there is a discharge

B. LEACH (LEACH Low Energy Adaptive Clustering Hierarchy)

This WSN is considered a dynamic clustering method. All the nodes can transmit enough power to reach to the base station and the nodes use power control. The LEACH network is made up of nodes, which are called as cluster heads. The work of the cluster head is to gather the data from their nearest nodes and transfer it on to the sink node. The LEACH has two phases. They are set-up phase, steady-state phase. In set-up phase cluster heads are chosen. In steady-state the cluster heads are maintained. Every node could transmit data into the corresponding time-slot By single hop communication.

III. Generalized Self -Organized Tree Based Energy-Balance [GSTEB]

In each round the sink node assigns a root node and coordinates its sensors nodes. Root node sends the time slot message to all the sensors nodes. These sensors nodes send its message in a round which contains the entire neighbor's information. If the sensor node not receives the message means not in the range, so the sensor node moves to sleep state. Therefore a better balanced load is achieved compared with the protocols mentioned.

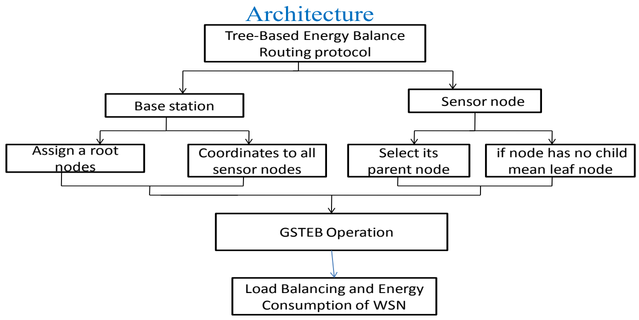

Fig.2 Architecture of GSTEB protocol

The operation of GSTEB is divided into Initial Phase, Tree Constructing Phase, Self-Organized Data Collecting and Transmitting Phase, and Information Exchanging Phase.

1) Initial phase

When Initial Phase begins, BS broadcasts a packet to all the nodes to inform them of beginning time, the length of time slot and the number of nodes N. When all the nodes receive the packet, they will compute their own energy-level (EL) using function:

$$\text{Residual Energy}=[\text{residual energy}(i)/\alpha$$

EL is a parameter for load balance, and it is an estimated energy value rather than a true one and only used, i is the ID of each node, and is a constant which reflects the minimum energy unit and can be changed depending on our demands.

Initial Phase is a significant preparation for the next phases. After Initial Phase, GSTEB operates in rounds. For GSTEB and all other protocols mentioned, the “round” has the same meaning. In a round, the routing tree may need to be

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rebuilt and each sensor node generates a DATA_PAK that needs to be sent to BS. When BS receives the data of all sensor nodes, a round ended. Round is not a real time measurement unit, but it reflects the ability for transmitting the collected data for sensors, so round is a suitable time measurement unit for WSN lifetime. Each round contains three phases, including Tree Constructing Phase, Self-Organized Data Collecting and Transmitting Phase, and Information Exchanging Phase.

2) *Tree constructing*

Tree is constructed based on the neighbor's information. Each node selects its parent node by the sensor node information and its energy. Parent node are computing every node's neighbor record. If a node has no child node it defines itself as a leaf node. Parent node directly communicates with the root node and manages the entire child node.

TABLE 1

NETWORK LIFETIMES FOR DIFFERENT SCHEMES

Energy (J/node)	Protocol	The round a node begins to die	The round all the nodes are dead
0.25	LEACH	118	243
	PEGASIS	246	568
	TREEPSI	267	611
	TBC	328	629
	GSTEB	389	677
0.5	LEACH	209	435
	PEGASIS	485	1067
	TREEPSI	532	1123
	TBC	589	1165
	GSTEB	730	1330

This Figure explains about energy consumption of GSTEB protocol and also compares with other protocols and produces the result.

3) Self-Organized Data Collecting and Transmitting Phase

After the routing tree is constructed, each sensor node collects information to generate a DATA_PKT which needs to be transmitted to BS.

TDMA and Frequency Hopping Spread Spectrum (FHSS) are both applied. This phase is divided into several TDMA time slots. In a time slot, only the leaf nodes try to send their DATA_PKTs. After a node receives all the data from its child nodes, this node itself serves as a leaf node and tries to send the fused data in the next time slot.

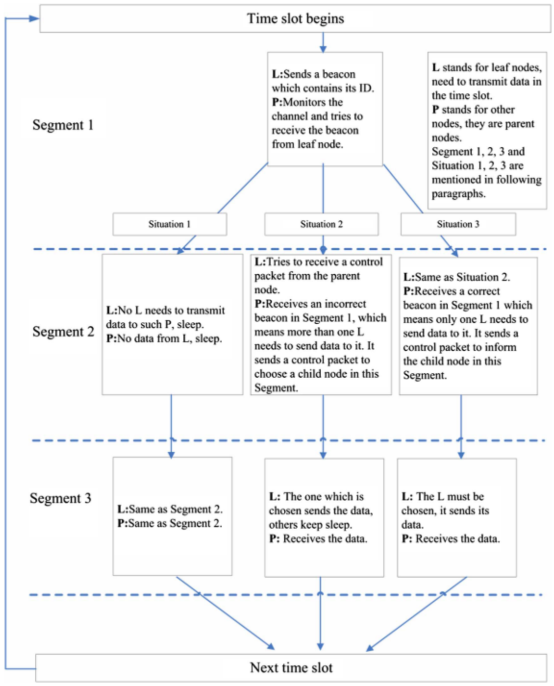

Fig.3 TDMA Time Slots For Each Cluster

As shown in figure.3 TDMA time slot is divided into three segments

Segment1: The first segment is used to check if there is communication interference for a parent node. In this segment, each leaf node sends a beacon which contains its ID to its parent node at the same time.

Segment 2: During the second segment, the leaf nodes which can transmit their data are confirmed. For the first situation, the parent node turns to sleep mode until next time slot starts. For the second situation, the parent node sends a control packet to all its child nodes. This control packet chooses one of its child nodes to transmit data in the next segment

Segment 3: The permitted leaf nodes send their data to their parent nodes, while other leaf nodes turn to sleep mode. The process in one time slot

4) Information exchanging

While exchanging information in each round, Parent node has to transmit the data to the root node. If any child node discharge its energy and die. The dying child node should inform to its neighbor node before discharging. Thus, the tree is reconstructed within short time to save the energy by using this tree based routing load and energy consumption to network. Fig shows the working of GSTEB.

IV. Enhancement Of GSTEB

1) K-hop

The purpose is to minimize the number of clusters formed in the network and in this way obtain dominating sets of smaller sizes. Clusters in the K- CONID approach are

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formed by a cluster head and all nodes that are at distance at most k-hops from the cluster head At the beginning of the algorithm, a node starts a flooding process in which a clustering request is send to all other nodes. In the Highest-degree heuristic, node degree only measures connectivity for 1-hop clusters. K-CONID generalizes connectivity for a k-hop neighborhood. Thus, when k = 1 connectivity is the same as node degree. Each node in the network is assigned a pair did = (d, ID). d is a node's connectivity and ID is the node's identifier. A node is selected as a cluster head if it has the highest connectivity. In case of equal connectivity, a node has cluster head priority if it has lowest ID. The basic idea is that every node broadcasts its clustering decision once all its k-hop neighbors with larger cluster head priority have done.

2) Master and Slave

The purpose of of this scheme is to minimize the transmission energy consumption summed by all master-slave pairs and to serve as many slaves as possible in order to operate the network with longer lifetime and better performance. Two schemes, single-phase clustering and double-phase clustering, are proposed in [15]. In single-phase clustering, initially every master node will page slave nodes with the allowed maximum energy. For each slave that receives one or multiple paging signals, it always sends an acknowledgment message back to the master from which it receives the strongest paging signal. Since a master node can serve only a limited number of slaves, it first allocates channels for slaves that only receive a single paging signal from itself. If any free channels remain, other slave nodes, which receive more than one paging signal, are allocated channels in the order of the power level of the paging signal received from the master node. For those slave nodes, which do not receive a channel from a master in the channel allocation phase, are dropped in the further communication phase

3) Re-election

clustering schemes may cause the cluster structure to be completely rebuilt over the whole network when some local events take place, e.g. the movement or "die" of a mobile node, resulting in some cluster head re-election (re-clustering). This is called the ripple effect of re-clustering. In other words, the ripple effect of re-clustering indicates that the re-election of one cluster head may affect the structure of many clusters and arouse the cluster head re-election over the net- work [18]. Thus, the ripple effect of re-clustering may greatly affect the performance of upper-layer protocols. In addition, most schemes separate the clustering into two phases, cluster formation and cluster maintenance, and assume that mobile nodes keep static when cluster formation is in progress. This is because for the initial cluster formation of these schemes, a mobile node can decide to become a cluster head only after it exchanges some specific information with its neighbors and assures that it holds some specific attribute in its neighborhood. With a frozen period of motion, each mobile node can obtain accurate information from neighboring nodes, and the initial cluster structure can be formed with some specific characteristics. However, this assumption may not be applicable in an actual scenario where mobile nodes may move randomly all the time.

4) Multi Input and Output

Two clusters may deploy the same frequency or code set if they are not neigh- boring clusters. Also, a cluster can better coordinate its transmission events with the help of a special mobile node, such as a cluster head, residing in it. This can save much resources used for retransmission resulting from reduced transmission collision. The second benefit is in routing, because the set of cluster heads and cluster gateways can normally form a virtual backbone for inter-cluster routing, and thus the generation and spreading of routing information can be restricted in this set of nodes . Last, a cluster structure makes an ad hoc network appear smaller and more stable in the view of each mobile terminal [8]. When a mobile node changes its attaching cluster, only mobile nodes residing in the corresponding clusters need to update the information. Thus, local changes need not be seen and updated by the entire network, and information processed and stored by each mobile node is greatly reduced.

Algorithms: Gossip Algorithms (or) Recursive Algorithm

Priority mechanisms are used to optimize the network utilization, while meeting the requirements of each type of traffic. The user may generate different priority traffic flows by using the loss priority bit capability and when buffer overflow occurs, packets from the low priority flow can be selectively discarded by network elements. Priority mechanisms can be classified into two categories: time priority and space priority. Time priority mechanisms control the transmission sequences of buffered packets while space priority mechanisms control the access to buffer studied the performance of time priority mechanisms including Minimum Laxity Threshold (MLT) and Queue Length Threshold (QLT) under mixed traffic of real-time and non-real-time packets. Their results show that the First In First Out (no special priority) policy causes relatively high losses for real-time traffic while providing low delays for non-real-time traffic. The converse holds true when priority is given to real-time traffic unconditionally. Space (or loss) priorities propose to provide several grades of services through the selectively discarding low priority packets. This type of priority mechanisms exploit the fact that low priority packets may be discarded in case of congestion, without significantly compromising the source's QoS requirements.

Space priority mechanisms that have been investigated are primarily the Push out mechanisms and Partial Buffer Sharing (PBS) [7]. In both the mechanisms, each source marks every packet with a priority level, indicating high priority and low priority packet. A description of several space priority mechanisms is given in [1]. In the Push out mechanism, high priority packet may enter the queue even when it is full, by replacing a low priority packet already in queue. If a low priority packet arrives at the queue when it is full, then it will be discarded. With this mechanism, vital

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packets will only be lost when the queue is full and there are no ordinary packets waiting for service in the queue. Multi-queue based Push-out policy can achieve highest buffer sharing as well as service differentiation and fairness assurance. A Proportional Loss Rate (PLR) dropper to support proportional differentiated services is presented in [8]. With the PBS mechanism, both high priority packets and low priority packets are accepted by the queue until it reaches a threshold level. When this threshold has been filled only high priority packets will be accepted, provided that queue is not full. The threshold in all the existing PBS schemes are constants and do not change during operation. [9] The analysis of PBS mechanism has been carried out by several authors. They have proposed algorithms to determine packet loss rates considering Markov Modulated Bernoulli Process as the input sources. Consecutive packet loss processes are explored in [10]. In contrast to other works that computed packet loss probabilities based on independent assumptions, they developed an efficient model for the computation of the distribution of the number of lost packets within block of fixed or variable size. Their results show that the independent assumption underestimates the consecutive packet loss probabilities. They also conclude that high correlation between consecutive packet losses may restrict the efficiency of forward error correction.

VI .CONCLUSIONS

The NS2 simulations show that when the data collected by sensors is strongly correlative, GSTEB is a self-organized protocol, it only consumes a small amount of energy in each round to change the topography for the purpose of balancing the energy consumption. All the leaf nodes can transmit data in the same TDMA time slot so that the transmitting delay Is short. GSTEB offers another simple approach to balancing the network load. In fact, it is difficult to distribute the load evenly on all nodes.

When the data collected by sensors cannot be fused, GSTEB offers another simple approach to balancing the network load. In fact, it is difficult to distribute the load evenly on all nodes in such a case. Even though GSTEB needs BS to compute the topography, which leads to an increase in energy waste and a longer delay, this kind of energy waste and longer delay are acceptable when compared with the energy consumption and the time delay for data transmitting. Simulation results show that when lifetime is defined as the time from the start of the network operation to the death of the first node in the network, GSTEB prolongs the lifetime of the network by more than 100% compared with HEED.

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