A CENTRALISED CLUSTERING ALGORITHM USING COMPRESSING SENSING IN WSN

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ABSTRACT

There are various advantages in Wireless Sensor Networks and hence is used in many applications. Also, there are few disadvantages such as storage, processing, energy and communication range. The main purpose of our project is to improve the load balance and also to rectify the disadvantages of WSN in order to improve the overall performance. Hence, our paper aims to study different energy balance routing protocols of WSN. We have compared different protocols of WSN, ensuring maximum network lifetime by balancing the load using General Self Organized Tree-Based Energy Balance routing protocol. Here in Each round BS assigns a root node and broadcasts this selection to all sensor nodes. Each node selects its parent by considering only itself and its neighbour's details, thus making a dynamic protocol.

Keyword: *GSTEB, routing protocol, self-organized, wireless sensor network.*

1. INTRODUCTION

There are many tiny and cheap sensing nodes present in WSN that focuses on collecting environmental data. They can be used in variety of environmental monitoring and control systems like surveillance, disaster management, outdoor climate, and industrial pollution.
In this paper, we propose a General Self-Organized Tree based Energy Balance routing protocol (GSTEB).A situation where the network collects information periodically from a terrain where each node continually senses the environment and sends the data back to BS is considered. 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
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. Proposed work is discussed in section III. Section IV describes the details of GSTEB. In Section V we have our conclusion.

2. RELATED WORK

2.1 Formation of cluster in WSN

WSN is used to collect information from the sensor node regularly and transmit it to cluster head. By using highest node weighting, the cluster heads are selected .Cluster head keeps track of the information of the entire sensor node. Until a discharge, they keep operating.

2.2 LEACH (LEACH Low Energy Adaptive Clustering Hierarchy)

LEACH is considered as a dynamic clustering method. All the nodes can transmit enough power to reach to the base station and the nodes use power control. In LEACH protocol, 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 delivers data to the sink. Here, Every node could transmit data into the corresponding time-slot by single hop communication.

2.3 ELDC (An artificial neural network based energy efficient using pollution monitoring in WSN)

ELDC, protocol extends our previous protocol, EEMDC, by adding some advantageous features of both EEUC and
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group-based energy saving techniques, and train it with different scenarios using Adaptive Reasoning Theory (ART), which is an adaptive and intelligent type of ANNs. The mixture of well-studied features help in equally utilizing the energy consumption of all nodes, and hence, increases the life-span of the overall network. Since it's a group based protocol, therefore it suggests a new type of node in the network on the boarder level named Chief Node. After training session, ANN based on back propagation (BP) provides an efficient threshold value.

2.4 Generalised Self-Organised Tree based Energy Balanced Routing Protocol (GSTEB)

In this protocol, for each round the sink node assigns a root node and informs its sensors nodes. Root node sends the time slot message to all the sensors nodes and according to this time period allocated, sensors nodes send its message in a round which contains the entire neighbour's information.
GSTEB is made up of 4 phases, namely, Initial Phase, Tree Constructing Phase, Self-Organized Data Collecting and Transmitting Phase, and Information Exchanging Phase.

2.4.1 Initial phase

In this phase, in order to inform all the nodes about the beginning time, BS broadcasts a packet to all the nodes. This packet contains 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:

Residual Energy= [residual energy (i)]/a

EL is a parameter for load balance, and it is an estimated energy value rather than a true one.
i is the ID of each node, and a is a constant which tells the minimum energy unit and can be changed depending on our requirements. This Initial Phase is a significant preparation for the next phases. After this Phase, GSTEB operates in rounds. In each round, the routing tree may need to be rebuilt and each sensor node generates a DATA_PAK that needs to be sent to BS. After BS receiving the data of all sensor nodes, a round ends. 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 in an WSN. In Each round, there are contains three phases, including Tree Constructing Phase, Self-Organized Data Collecting and Transmitting Phase, and Information Exchanging Phase.

2.4.2 Tree constructing

Based on the neighbour's information, a tree is constructed. A parent node is selected by each sensor node based upon the sensor node information and its energy. Also the parent nodes are selected based on the root node selected for the particular round. If a node has no child node it is called as leaf node. Parent node manages the entire child node and directly communicates with the root node.

2.4.3 Self-Organized Data Collecting and Transmitting Phase

After the construction of the routing tree, each sensor node collects information to generate a DATA_PKT which needs to be transmitted to BS. The techniques used here are TDMA and Frequency Hopping Spread Spectrum (FHSS). This phase contains 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, it itself serves as a leaf node and tries to send the aggregated data in the next time slot.

2.4.4 Information exchanging

While exchanging information in each round, Parent node has to transmit the data to the root node. If any child node about to die as it discharges its energy, it should inform to its neighbour node before discharging. Thus, the tree is reconstructed within short time in order to save the energy.

3. PROPOSED WORK

3.1 Enhancement of GSTEB

3.1.1 K-hop

There are Cluster heads that are farther away from the Base station. If the data are transmitted from this CH to the sink, there is a possibility of packet loss.A node is selected as a CH if it has the highest connectivity. Lower the ID, higher the priority. Every node broadcasts its clustering decision once all its k-hop neighbours with larger cluster head priority have done. This is the basic idea behind this k-hop neighbouring scheme.

3.1.2 Re-election

When some local events take place, Clustering schemes may cause the cluster structure to be completely rebuilt over the whole network. Example, 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 network. Thus, the ripple effect of re-clustering may greatly affect the performance of protocols that are present in the upper layer.

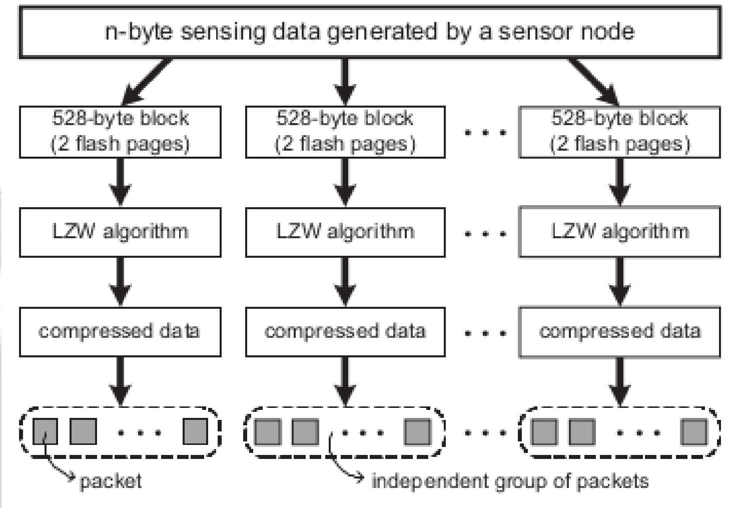

Fig-1.LZW compression

3.1.3 LZW compression technique

The compressed sensing techniques indicate that any sufficiently compressible data can be accurately recovered from a small number of nonadaptive, randomized linear projection samples. Thus, they can exploit compressibility without relying on any prior knowledge or assumption on sensing data. With the above observation, the compressed sensing techniques can provide lossless compression. The data aggregation techniques select a subset of sensor nodes to collect and fuse the sensing data sent from their neighbouring nodes and then transmit the small- sized aggregated data to the sink. Because the original sensing data cannot be derived from these aggregated data, the compression of the data aggregation techniques is thus un recoverable. The LZW algorithm is computationally simple and has no transmission overhead. Because both the sender and the receiver have the same initial dictionary entries and all new dictionary entries can be derived from existing dictionary entries and the input data stream, the receiver can thus construct the complete dictionary on the fly when receiving the compressed data. An S-LZW algorithm (the abbreviation ‘S’ means “sensor”) to support data compression in WSNs. The decoder must have received all previous entries in the block to decode dictionary entry. However, since packet loss is usually common in a WSN S-LZW thus proposes dividing the data stream into small and independent blocks. In this way, if a packet is lost due to collision or interference, S-LZW can guarantee that this packet only affects the following packets in its own block.
S-LZW can guarantee that this packet only affects the following packets in its own block. S-LZW suggests adopting a dictionary with size of 512 entries to fit the small memory of sensor nodes. Besides, S-LZW also suggests compressing sensing data into blocks of 528 bytes (that is, two flash pages) to achieve a better performance. The sensing data of each sensor node will be compressed and divided into multiple independent groups of packets. On the other hand, any two groups of packets will not affect with each other and thus they can be independently decompressed. Therefore, the loss of a packet will affect at most one group of packets. To reduce such an effect, S-LZW suggests that each group contains at most 10 dependent packets.Figure1 shows the LZW compression scheme.

3.1.4 Tree-Based Data Aggregation Schemes

The objective of the tree-based data aggregation schemes is to maximize the network lifetime by jointly optimizing data aggregation and routing tree formation. These schemes organize the sensor nodes into a tree structure, where the data aggregation operation is conducted at the intermediate nodes along the tree and the aggregated data of the whole network will be eventually sent to the root node (that is, the sink). A tree- based data aggregation schemes, where each sensor node i will generate its sensing data and each aggregation node will fuse the data sent from the child nodes with its own sensing data by an aggregation function. This proposal (GSTEB) is to maintain a data aggregation tree in a WSN. To construct such a tree, the sink (that is, the tree root) first broadcasts a control message (ID, parent, power, status, hop count) indicating the identification of the sensor node, the parent node along the tree, the residual power of the sensor node, the status of the sensor node (including leaf, non-leaf, and undefined states), and the hop Counts from the sink. On receiving this control message for the first time, each sensor node sets up a timer that counts down every time when the channel becomes idle. Then, the sensor node selects the neighbouring node with more residual power and a shorter path to the sink as its parent node along the tree. When the timer expires, the sensor node updates the control message and broadcasts the message to its neighbouring nodes. The above process is repeated until all sensor nodes are added into the tree. After constructing the data aggregation tree, a residual power threshold Pth is used to maintain the tree. In particular, when the residual power of a sensor node becomes less than the threshold Pth , this sensor node will broadcast a help message to its child nodes. Then, one of its child nodes will replace this sensor node to maintain the tree structure. Finally maximize the network lifetime in terms of the number of rounds, where each round corresponds to the aggregation of sensing data transmitted from different sensor nodes. To achieve this objective, GSTEB tries to minimize the total energy consumption of sensor nodes in each round by calculating a minimum spanning tree over the network with link costs. Figure 2 shows the tree formation.

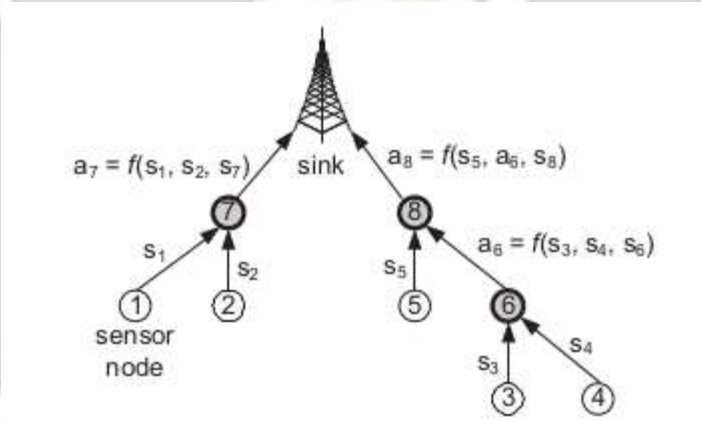

Fig-2.Structure of tree formation between source and sink

4. CONCLUSIONS

GSTEB outperforms compared with ELDC protocol. In ELDC protocol cluster head is selected randomly and it reduces the energy level due to their distances to base station are far, because of the heavy energy burden and these cluster heads will soon die. At the end of each TDMA; each node is either a cluster head or an ordinary node that belongs to exactly one cluster. In GSTEB, the cluster head is selected based on energy and a tree is constructed to transfer the information. Thus GSTEB prolongs the network lifetime compared to other protocols in the network.

The NS2 simulations show that, 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. 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 90% compared with ELDC.

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