

An Extensive Spirit Standardized Tree Based Routing Protocol for Wireless Sensor Networks

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ABSTRACT: Wireless sensor network contains many sensors nodes which are mainly used to collect and send the message to base station. Energy consumption is one of the main limitations of this technology. In existing system LEACH, HEED, PEGASIS, PEDAP, and TBC are used to achieve prolong lifetime for network. For better performance GSTEB (General Self Organized Tree Based Energy Balance) routing protocol is implemented. It provides prolong network life time and also it balances WSN load. GSTEB assign the root node at each process of packet transmission and it broadcast this selection to all sensor nodes. It changes the root node at stage of packet transmission for reduce the energy consumption. GSTEB is a dynamic protocol because each node selects its parent node itself with the help of neighbour information. GSTEB has a better performance than other protocols and it increase the network lifetime.

KEYWORDS: WIRELESS SENSOR NETWORK, ROUTING PROTOCOL, NETWORK LIFE-TIME, ENERGY CONSUMPTION

I. INTRODUCTION

With the recent advances in Micro Electro-Mechanical Systems (MEMS) technology, low power digital circuitry and RF designs, Wireless Sensor Networks (WSNs) are considered to be one of the potential emerging computing technologies, binding closer towards widespread feasibility. Cheap and smart sensors networked through wireless communication with the Internet hold remarkable prospects for controlling and they monitor variety of ambient conditions of environment and characteristics of object and their motion. A wireless sensor network (WSN) consisting of sensors to monitor physical or environmental conditions. Sensor nodes are used in a variety of applications which require constant monitoring and detection of specific events. The nodes sense the information and transmit it to the base station through intermediate nodes. The base station serves as a gateway to send the data to another network. WSN generate redundant information from the nodes, and the data can be combined to reduce transmission. The size of the sensor nodes can also range from the size of a shoe box to as small as the size of a particle of dust. As such, their prices also vary from a few pennies to hundreds of dollars depending on the functionality parameters of a sensor like energy utilization, computational speed rate, bandwidth, and memory. Many well-known protocols implement data fusion, but almost all of them assume that the length of the message transmitted by each relay node should be constant, i.e., each node transmits the same volume of data no matter how much data it receives from its child nodes. However, there are quite a few applications in which the length of the message transmitted by a parent node depends not only on the length of its node, but also on the lengths of the messages received from its intermediate nodes. In an extreme case, the relay node should transmit the length of the message which is the sum of its own sensed data and the received data from its children. The power for each sensor node is derived from the electric utility or from a battery. A routing protocol uses software and routing algorithms to determine optimal network data transfer and communication paths between network nodes.

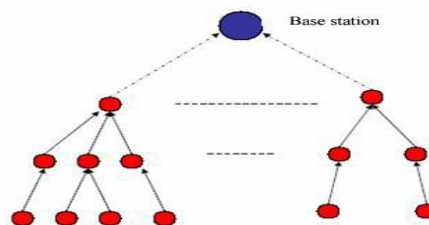


Fig 1. Tree based routing in WSN

A standard set of regulations and requirements that allow two electronic items to connect to and exchange information with one another. A uniform set of rules that enable two devices to connect and transmit data to one another. Internet protocols include TCP/IP (Transfer Control Protocol/Internet Protocol), HTTP (Hypertext Transfer Protocol), FTP (File Transfer Protocol), and SMTP (Simple Mail Transfer Protocol). General Self-Organized Tree-based Energy Balance routing protocol (GSTEB). In which the network collects information periodically from a terrain where each node continually senses the environment and sends the data back to BS.

II. RELATED WORKS

Routing protocols should prolong network lifetime and to allow the data transmission between sensor nodes. The battery recharging in the sensors is infeasible since most of the sensors are randomly placed. The objective of data-gathering problem is to transmit the sensed data from each sensor node to a BS [2]. BS collects data from all the sensor nodes once is considered as one round. The goal of algorithm which implements data gathering is to maximize the number of rounds of communication and the network becomes inoperable. Minimum energy should be consumed and the transmission should occur with minimum delay. Hence, the energy \times delay metric is used to compare algorithms [6]. In direct transmission, BS receives data directly from all the sensor nodes. It consumes more energy, since the BS may be very far away from some nodes. LEACH, a cluster-based distributed routing protocol [3]. In LEACH, each cluster-head collects data from sensors in its cluster, fuses the data, then sends the result to the base station. LEACH utilizes randomized rotation of cluster-heads to evenly distribute the energy load among sensors in the network. Simulation results show that LEACH achieves as much as a factor of 8 reduction in energy dissipation comparing with direct transmission. In PEGASIS, sensors are formed by chain. Each sensor communicates only with a neighbor, and the leader node transmits to the base station to prevent the failure of network [7]. Only one node is designated to communicate with the base station, consequently the energy dissipation is significantly reduced. TBC is also has many clusters similar to LEACH. Each cluster has own cluster head. The nodes within the cluster form a routing tree where the cluster head is root of it. Here clusters are divided into some levels. In TBC, data's are transmitted between the nodes in two neighboring levels. And each node fuses received data and transmits it to its parent. Tree based protocols PEDAP and PEDAP-PA. The goal is to minimize the total energy expended in a round of communication while balance the energy consumption among sensors. In PEDAP, the weights of edges are the transmission cost between two connected sensors. In PEDAP-PA, the weight of edges is the ratio of the transmission cost between two connected nodes to the remaining energy of the sending node. PEDAP prolongs the lifetime of the last node death while PEDAP-PA provides a good lifetime for the first node death. This kind of information exchanging will cause a lot of energy to be wasted or will cause a long delay.

III. PROPOSED METHODOLOGY

In this paper GSTEB (General Self Organized Tree Based Energy Balance) protocol is proposed to prolong the network lifetime. GSTEB use root node for packet transmission and it can be assigned by base station. Base station change the root node during the packet transmission and it can be informed to all other sensor nodes. Here the nodes are formed as a tree and selects its parent node. Trees are reconstructed at each time of root changing with low delay and low energy consumption. GSTEB performs five kinds of operations to increase the network lifetime. They are initial phase, tree construction, data collection and data transmission and information exchange.

A. Initial Phase

In this phase packets are broadcasted with time slot and energy level. Trees are constructed and parents' nodes are selected in tree construction phase. In data collection packets are generated and it can be transmitted in data transmission phase. When tree is reconstructed during the packet transmission at this time the node information is exchanged between the nodes. In first Phase, the network parameters are initialized. When Initial Phase begins, BS broadcasts a packet to all the nodes to inform them of starting time, the length of duration time and the number of nodes. Then each node will compute their own energy-level (EL) using function after receiving the packet. Each node sends the information to their neighbor node to form the topology. The node information's are node energy level, node expire time, location, creation time and so on. By using topology we will find the node location to make communication. After create the topology then find the base station for make packet transmission. Here base station is identified by the node energy level. If one node has highest energy than all other node then this node can be selected as base node. Energy level is identified by using topology. The base station collects the information from the root node. Each root node contains their child nodes information. Each node communicates with their neighbor node through the base station. Base station allows the nodes to communicate after get the nodes information.

B. Tree Construction

BS assigns a root node and broadcasts its ID and its coordinates to all sensor nodes. Data combination procedure is actualized, one and only node which conveys specifically with BS can transmit all the information with the same length as its own, which brings about considerably less vitality utilization. With a specific end goal to adjust the system load. The root node gathers the information of all sensors and transmits the information to BS over long separation. Every node tries to choose a parent in its neighbors by utilizing EL and directions which are recorded in Table I. Each node choose a neighbor that fulfills basis 1 and is the closest to itself as its parent. Also if the node can't discover a neighbor which fulfills basis 1, it chooses the root as its parent. Because each node choose the parent from its neighbors and each node records its neighbors' neighbors' data in Table II, every node can know all its neighbors' parent node by registering. On the off chance that a node has no children node, it characterizes itself as a leaf node, from which the information transmitting starts. The nodes are forming the tree and it selects its parent node. The parent is called as root node. Each node has one parent node as root node. Root node is selected with high energy level. If the node has high energy then it can be selected as root node. Root node contains all of its child nodes information. If the root node depletes its energy, the new root node will be selected and tree is reconstructed. Trees are reconstructed with short delay and low energy consumption.

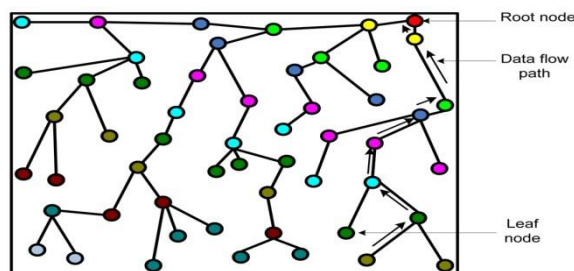


Fig 2. Tree formation

C. Data Collection and Transmission

Each node collects information to generate DATA_PKT which needs to be transmitted to BS. After find the root node and base station then packet transmission is started. Packets are transmitted through the base station. If one node wants to communicate other node first it informs its root node. The root node sends the information to base station then the base station sends the request to corresponded node. The node accepts therequest after it response the base station.

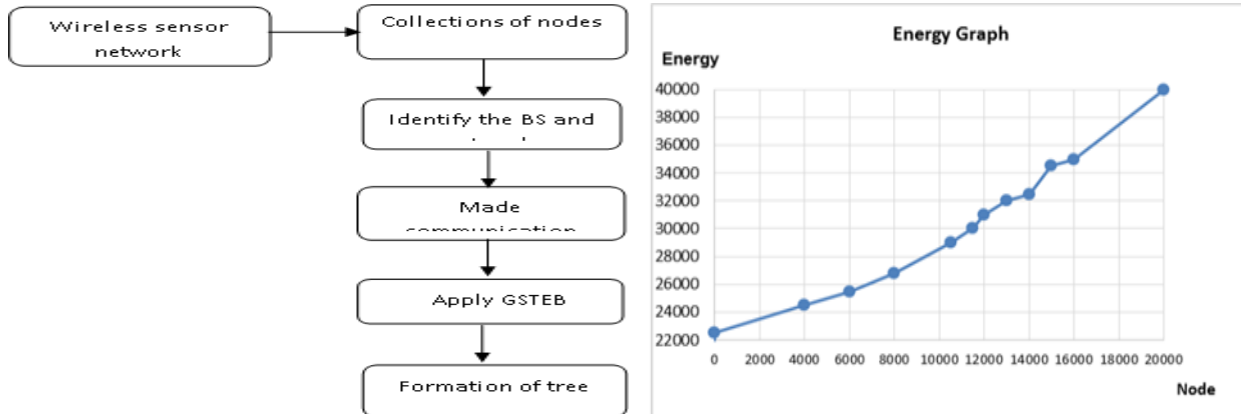


Fig 3. Flow diagram of the proposed methodology Fig 4. Graph for GSTEB

After complete the process then packet transmission is started. Then apply FHSS in which each child node communicates with its parent node using the frequency hopping sequence determined by its parent node ID. Each TDMA time slot is divided into three segments. Leaf node try to send their DATA_PKT in its time slot. First segment to check the parent communication interference. In second segment leaf node conform their data transmission. Only permitted leaf nodes send their data to their parent node in the third segment.

D. Information Exchange

Each node generate and transmit the DATA_PKT in each round it may exhaust its energy. If one node going to dead it informs to all other nodes. For each round BS calculate the energy consumption of sensor node. The methodology is additionally partitioned into time openings. In each one time space, the node whose vitality will be depleted will process an irregular postponement which makes stand out node broadcast in this time opening. At the point when the postponement is finished, these nodes are attempting to broadcast a packet to the entire system. While all different nodes are observing the channel, they will get this packet and perform an ID check. At that point they change their tables. In the event that no such packet is received in the time opening, the system will begin the following round. When this packet is received, BS will get the actual remaining energy of this sensor node and use it to calculate the topology in the next round.

IV. PERFORMANCE ANALYSIS

GSTEB performs better than all other protocols. Both GSTEB and TBC are protocols which require that each node records the information of its neighbors and they use similar approach to transmit data. For GSTEB, each node needs to record the information of its neighbors' neighbors, so it needs more memory. Moreover, there are several cluster-heads that need to communicate with BS in TBC. The simulation results of TBC show that it performs well since BS is located near the sensor field. If BS is located far away, the energy consumption of TBC increases quickly because of the cluster-heads. And GSTEB will outperform it. When the network lifetime is defined as the time from the start of the network operation to the death of the last node in the network, PEDAP achieves an optimal solution. It is because PEDAP builds a minimum spanning tree, and it consumes the least energy for data transmitting in each round. In this situation, make some slight changes to GSTEB. In each round the total energy consumed by the network should be the minimum. LEACH achieves as much as a factor of 8 reduction in energy dissipation comparing with direct transmission. The goal is to minimize the total energy expended in a round of communication while balance the energy consumption among sensors. In PEDAP, the weights of edges are the transmission cost between two connected sensors

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It can achieve a better performance in energy saving, because each node has more opportunities to choose the nearest neighbor as the parent. GSTEB chooses the node nearest to BS as the root like PEDAP, and then GSTEB builds a routing tree and the topology remains unchanged until the root dies. Once the root dies, the network reconstructs a new routing tree in the same way.

V. CONCLUSION

PEGASIS, TBC, PEDAP, LEACH and HEED protocols are used to achieve prolong network lifetime. But it fails to achieve it. Hence GSTEB protocol is for achieve prolong network life time. PEGASIS uses greedy algorithm to make a chain for packet transmission and it selects long path. In long path, node energy level is decreased; chain will be break during the transmission and it also not able to balance the WSN loads. But in the proposed protocol GSTEB, neighbor nodes are selected for transmission and long path is avoided. TBC is similar to GSTEB but the main drawback of TBC is, it only records the neighbor node information but our GSTEB protocols records neighbor's neighbor information so we have a lot of choice to select the node and it can be increase the network lifetime. GSTEB takes more memory to records the information but performance is high compared than other protocols. In PEDAP, least energy nodes are also allowed to transmission so it fails to achieve long lifetime. But our protocol selects the nearest node to the BS as root node and constructs the tree. If the root node depletes its energy then another node is selected as root node. GSTEB protocol can achieve the prolong network life time and balances the loads compared than other existing protocols.

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REFERENCES

- [1] S. Vural and E. Ekici, "On multihop distances in wireless sensor networks with random node locations," *IEEE Trans. Mobile Computing*, vol. 9, no. 4, pp. 540–552, Apr. 2010.
- [2] H. B. Zhang and H. Shen, "Energy-efficient beaconless geographic routing in wireless sensor networks," *IEEE Trans. Parallel Distrib. Syst.*, vol. 21, no. 6, pp. 881–896, Jun. 2010.
- [3] M. Liu, J. Cao, G. Chen, and X. Wang, "An energy-aware routing protocol in wireless sensor networks," *Sensors*, vol. 9, pp. 445–462, 2009.
- [4] F. Nakamura, A. F. Loureiro, and C. Frery, "Data Fusion for Wireless Sensor Networks: Methods, Models, and Classifications," *ACM Computing Surveys*, vol. 39, No. 3, Article 9, 2007, August 2007.
- [5] S. S. Satapathy and N. Sarma, "TREEPSI: Tree based energy efficient protocol for sensor information," in *Proc. IFIP Int. Conf.*, Apr. 2006, pp. 11–13.
- [6] K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks," *Elsevier Ad Hoc Network J.*, vol. 3/3, pp. 325–349, 2005.
- [7] O. Younis and S. Fahmy, "HEED: A hybrid, energy-efficient, distributed clustering approach for ad hoc sensor networks," *IEEE Trans. Mobile Computing*, vol. 3, no. 4, pp. 660–669, 2004.
- [8] W. B. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "An application-specific protocol architecture for wireless microsensor networks," *IEEE Trans. Wireless Commun.*, vol. 1, no. 4, pp. 660–670, Oct. 2002.
- [9] I. F. Akyildiz et al., "Wireless sensor networks: A survey," *Computer Netw.*, vol. 38, pp. 393–422, Mar. 2002.
- [10] W. R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "Energy efficient communication protocols for wireless micro sensor networks," in *Proc. 33rd Hawaii Int. Conf. System Sci.*, Jan. 2000, pp. 3005–3014.
- [11] L. Wald, "Some terms of reference in data fusion," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 37, pp. 1190–1193, May 1999.