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A REVIEW: CENTRALIZED ROUTING PROTOCOL BCDCP &SHPER FOR WIRELESS SENSOR NETWORK

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Abstract:*A wireless sensor network (WSN) is an ad-hoc network composed of small sensor nodes deployed in large numbers, to sense the physical world. Sensor networks have the potential to radically change the way people observe and interact with their environment. Sensors are usually resource-limited and power-constrained. They suffer from restricted computation, communication, and power resources. Sensors can provide fine-grained raw data. Alternatively, they may need to collaborate on in-network processing to reduce the amount of raw data sent, thus conserving resources such as communication bandwidth and energy. We refer to such in-network processing generically as data aggregation. Hence, theenergy efficiency is the key design issue that needs to beenhanced in order to improve the life span of the network. There are several network layer protocols have been proposed toimprove the effective lifetime of a network with a limited energy supply. So In this review we are mainly focused on the working of two centralized routingprotocol called Base-Station Controlled Dynamic ClusteringProtocol (BCDCP), which distributes the energy dissipationevenly among all sensor nodes to improve network lifetimeand average energy savings and second one is SHPER.*

Keywords: *data aggregation, wsn's, BCDCP, SHPER, data centric.*

1. INTRODUCTION

Wireless sensor networks [1-2] consist of hundreds to thousands of low-power multi functioning sensor nodes, operating in an unattended environment, with limited computational and sensing capabilities. Wireless incorporated micro sensor technologies have made these sensor nodes available in large numbers, at a low cost, to be employed in a wide range of applications in military and national security, environmental monitoring, and many other areas. In the case of modern wireless sensor nodes, their compact physical dimensions permit a large number of sensor nodes to be randomly deployed in inaccessible terrains. In addition, the nodes in a wireless sensor network are also capable of performing other functions such as data processing and routing, whereas in traditional sensor networks special nodes with computational capabilities have to be installed separately to achieve such functionalities.As well as advantagesthere are certain constraints associated with them. In particular, minimizing energy consumption is a key requirement in the design of sensor network protocols and algorithms. Since the sensor nodes are equipped with small, often irreplaceable, batteries with limited power capacity, it is essential that the network be energy efficient in order to maximize the life span of the network. In addition to this, wireless sensor network design also demands other requirements such as security and reliability. It is therefore critical that the designer takes these factors into account when designing protocols and algorithms for wireless sensor networks.

Since a large number of conventional techniques such as direct transmissions [3] and MTE[5] has been applied but data centric approach was better thanthese two. In the direct transmission protocol, the base station serves as the destination node to all the other nodes in the network. When a sensor node transmits data directly to the base station, the energy loss incurred can be quite extensive depending on the location of the sensor nodes relative to the base station. In such a scenario, the nodes that are farther away from the base station will have their power sources drained much faster than those nodes that are closer to the base station. In MTE, the nodes closest to the base station will rapidly exhaust their energy resources since these nodes engage in the routing of a large number of data messages (on behalf of other nodes) to the base station.

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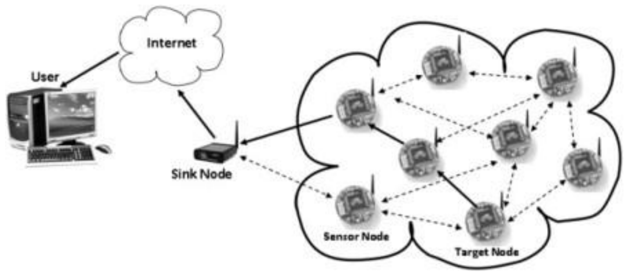

Figure 1: Wireless Sensor Networks

2. LITERATURE REVIEW

2.1 DATA CENTRIC APPROACH:

Various routing protocols have been proposed for wireless sensor networks to alleviate such problems. Data-centric routing [6] is a commonly utilized approach that uses attribute-based addressing to perform the collective sensing task. In data-centric routing, sensor nodes are assigned tasks based on interest disseminations that originate from another node in the network. SPIN [2] and directed diffusion are two network layer protocols based on data-centric routing. In SPIN, the sensor nodes that have data to send broadcast an advertisement to their neighbors and send the actual data only to those nodes that are interested. To reduce the energy expended in the broadcast of advertisements. The directed diffusion however, uses a slightly different type of data-centric routing. In this scheme, the sink broadcasts the interests to all sensor nodes in the network. Each sensor node stores the interest in a local cache, and uses the gradient fields within the interest descriptors to identify the most suitable path to the sink. These paths are then used by source nodes to communicate the sensed data to the sink. Although the data-centric routing approach provides a reliable and robust solution to wireless sensor networks, there are still some shortcomings associated with protocols utilizing this technique. In the worst case, both SPIN and directed diffusion suffer from the amount of overhead energy spent in activities such as advertising, requesting, and gradient setup. Furthermore, the excessive time spent in such activities might not suit some applications that require the sensor nodes to respond quickly to an emergency situation. A more optimal solution for such scenarios is a clustering-based protocol. Hierarchical Routing can be of two types.

2.2 CLUSTERING APPROACH

In the clustered routing approach, nodes are grouped into clusters[7], and a dedicated cluster head node collects, processes, and forwards the data from all the sensor nodes within its cluster. The application of a clustering-based approach helps reduce the amount of information that needs to be transmitted by performing data aggregation at the cluster heads before forwarding the data to the end user. Other key advantages gained through utilizing clustered routing are bandwidth reusability, enhanced resource allocation, and improved power control.In this paper we studied clustering-based routing protocol called Base Station Controlled Dynamic Clustering Protocol (BCDCP), which utilizes a high-energy base station to set up clusters and routing paths, perform randomized rotation of cluster heads, and carry out other energy-intensive tasks.

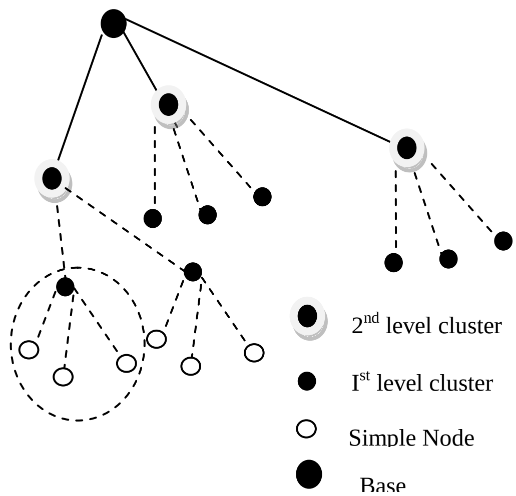

Figure 2: Hierarchical Routing

2.3 BCDCP

The working of BCDCP is divided into two phase setup phase and data communication phase.During each setup phase, the base station receives information on the current energy status from all the nodes in the network. Based on this feedback, the base station first computes the average energy level of all the nodes, and then chooses a set of nodes, denoted S, whose energy levels are above the average value. Cluster heads for the current round will be chosen from the set S, which ensures that only nodes with sufficient energy get selected as cluster heads, while those with low energy can prolong their lifetime by performing tasks that require low energy costs. An iterative cluster splitting [7] algorithm is used for further cluster formation. This simple algorithm first splits the network into two subclusters, and proceeds further by splitting the sub clusters into smaller clusters. The base station repeats the cluster splitting process until the desired number of clusters $N_{CH}$is attained. The iterative cluster splitting algorithm ensures that the selected cluster heads are uniformly placed throughout the whole sensor field by maximizing the distance between cluster heads in each splitting step. Furthermore, in order to evenly distribute the load on all cluster heads, we utilize the balanced clustering technique where each cluster is split so that the resulting sub clusters have approximately the same number of sensor nodes. The second major activity within the setupphase is the formation of routing paths. The BCDCP protocol uses a CH-to-CH multihop routing scheme to transfer the sensed data to the base station. Once the clusters and the cluster head nodes have been identified, the base station chooses the lowest-energy routing path and forwards this info to the sensor nodes along with the details on cluster groupings and selected cluster heads. The routing paths are selected by first connecting all the cluster head nodes using the minimum spanning tree approach that minimizes the energy consumption for each cluster head, and then randomly choosing one cluster head node to forward the data to the base station. The random choice of the cluster head that transmits to the base station is justified since data transmission to the base station is an energy-intensive task, and utilizingthe cluster head closest to the base station to frequentlyperform this task will render heavy depletion of energyresources for the nodes closer to the base station. Thus, byrandomizing the cluster head transmissions to the base station,BCDCP distributes the burden of routing evenly amongall cluster heads.The BCDCP protocol utilizes a time-divisionmultiple access (TDMA) scheduling scheme to minimize collisionsbetween sensor nodes trying to transmit data to the clusterhead.

The data communication phase consists of three major activities:

• Data gathering
• Data fusion
• Data routing

Each sensor node in its TDMA slot transmits the sensed information to its clusterhead. Once data from all sensor nodes have beenreceived, the cluster head performs data fusion on the collecteddata, and reduces the amount of raw data that needs to besent to the base station. The compressed data[4], along with theinformation required by the base station to properly identifyand decode the cluster data, are then routed back to the basestation via the CH-to-CH routing path created by the basestation.

2.4 SHPER

Cluster head selection [6-7]is done by the base station itself. Initially, all nodes have to keep their receivers on.This is because the base station creates a TDMA (Time Division Multiple Access) schedule andrequests the nodes to advertise themselves. In fact, this is the important information that the base station needs tohave about the network area.As soon as the node advertisement procedure is accomplished, the base station chooses in a randomway some of the nodes from which it has received an advertisement message to be the high levelcluster heads. Similarly, the base station elects some of the nodes from which it has not received anyadvertisement message to be the low level cluster heads. The overall number of nodes which areassigned to be cluster heads is considered to be predefined.After that, the base station broadcasts the identities (IDs) of the newly elected cluster heads. Next, each non cluster head node selects for the current round to participate into the cluster of thecluster head, whose advertisement message had been received before with the largest signal strength.Since lower level cluster head nodes cannot transmit directly to the base station, it is necessary forthem to route their messages via a path consisting of an upper level cluster head node and possiblyother lower level cluster head nodes which are located closer to the network upper level. In this wayhowever, there are various alternative paths that may me followed.Each lower level cluster head defines the mostly energy efficientpath to route its messages to the base station and selects the upper level cluster to belong to.After each node has decided which cluster it belongs to, it informs its corresponding cluster headthat is going to be a member of its cluster? Each node transmits this information back to itscorresponding cluster head using a CSMA (Carrier-Sense Multiple Access) MAC protocol.That is why, cluster head nodes have to keep their receivers on during this specific step.Then each cluster head broadcasts this schedule back to the nodes in its cluster, in order to informeach node when it can transmit.Next, the data transmission starts.

Each cluster head collects the data transmitted to it by the nodes of its own cluster. Whenall the data have been received, each cluster head performs signal processing [2] functions to aggregate thedata it has received along with its own data into a single composite message. This message containsthe ID of the node having the highest residual energy [8]among the cluster nodes, along with the mostexcessive (e.g., maximum) value of the sensed variable and the id of the node that has sensed it.After each cluster head has created its aggregate message, it waits until its own time slot in order totransmit this aggregate message to the base station either directly, if this is possible, or via intermediateupper level cluster heads according to the path suggested. After this step is completed, the initialization phase is ended and the steady state phase begins.Hence, the base station determines the new cluster heads by using the data of the receivedmessages. More specifically, the node having the highest residual energy in each cluster is elected tobe the new cluster head. Moreover, the new values of soft and hard thresholds are defined.The steadystate phase is

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further carried on as a continuously recurrent execution of the procedures describedabove.

3. HIERARCHICAL ROUTING

Advantages:

Data Aggregation: With all the messages for a cluster going through a central location, the cluster head is able to perform data aggregation [4] on the information before sending the data to the sink.

Localized Power Consumption: The power consumed in a cluster is less than in a whole network, as there is a smaller amount of overhead when setting up the network. Only a small portion of the network (a cluster) is set up, pointing to a cluster head. Once this has been done, all messages travel a smaller number of hops to reach the cluster head, thereby saving on their available energy resources.

Disadvantages:

Hotspots: Cluster heads perform more functions that the average sensor node and this consumes their energy at a greater rate. To alleviate this problem, some protocols rotate the cluster head amongst all the nodes in the cluster or network. The possibility of a section getting separated from the network still exists. Hardware Requirements: Some protocols require specific hardware, usually a high power transmitter that is capable of reaching the sink node directly. As soon as this happens, the clusterhead position can no longer be rotated amongst the other nodes, unless of course all the nodes have this facility. As with all features, the cost of the development and production of the nodes will increase.

Complexity: To maintain a hierarchical network is more computationally intensive. The algorithms for clusterhead selection and routing decisions are usually more complex. To provide the initial information for these algorithms to be used and calculated usually requires more knowledge about the network. The only way to learn more is to send and receive more transmissions, increasing the power consumption.

Scalability: Networks that employ nodes with specific hardware requirements decrease their ability to scale to a larger size. As the network would grow so too would the number of clusterheads and they would have to be placed in specific spots so that new clusters could be formed from the additional nodes.

4. CONCLUSION

To design a routing protocol requires that some basic knowledge to be gained from existing research. Routing protocols are classified according to their method of operation into three categories namely flat routing architecture, hierarchical routing architecture and location based routing architecture. Further, hierarchical routing may be centralized or non-Centralized.

Hierarchical routing is reservation-based scheduling i.e. TDMA which helps in minimum energy dissipation during its turn and also it has reduced duty cycle due to periodic sleeping. Data aggregation is done by cluster head which is good for energy saving by rest of the nodes. Therefore the energy dissipation is uniform. This approach is useful in collision avoidance. In case of routing approach it uses a simple but not-optimal routing.

5. FUTURE WORK

According to our study on these two protocols i.e. SHPER and BCDCP, both concentrate on energy efficiency. So in future work we can design a new protocol that may have all the good features of these two protocols as well as better energy saver and long life.

We can also work on other transmission techniques like CDMA and FDMA.

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