To Proposed Architecture for Energy Efficient Routing Protocol in WSN

Vipin Kumar Sharma[1], Himanshu Kumar[2], Harish Pratap Singh[3]

[1]*Head of Department(Assistant Professor) , Department of Computer Science, Krishna College of Science & IT, Bijnor, Uttar Pradesh, India*
[2]*Assistant Professor, Department of Computer Science, Krishna College of Science & IT, Bijnor, Uttar Pradesh, India*
[3]*Assistant Professor, Department of Computer Science, Krishna College of Science & IT, Bijnor, Uttar Pradesh, India*

ABSTRACT

In this paper we will discuss to proposed architecture for energy efficient routing protocol in WSN.To the best of our knowledge, energy-efficient clustering in WSN has not been studied from this perspective before. In this paper, a novel Event to-Sink Directed Clustering (ESDC) protocol for WSN is proposed. ESDC realizes energy efficiency in sensor network configuration by employing two techniques: (1) clustering of the nodes only within the event-to-sink data flow corridor to avoid unnecessary cluster formation, (2) directional clustering to minimize the number of hops for data forwarding. Over the last half a century, computers have exponentially increased in processing power and at the same time decreased in both size and price. These rapid advancements led to a very fast market in which computers would participate in more and more of our society's daily activities. In recent years, one such revolution has been taking place, where computers are becoming so small and so cheap, that single purpose computers with embedded sensors are almost practical from both economical and theoretical points of view. Wireless sensor networks are beginning to become a reality, and therefore some of the long overlooked limitations have become an important area of research.

Keywords: *Data, ESDC, WSN, Energy, Resource etc.*

1. Introduction

One of the limitations of wireless sensor nodes is their inherent limited energy resource. Besides maximizing the lifetime of the sensor node, it is preferable to distribute the energy dissipated throughout the wireless sensor network in order to minimize maintenance and maximize overall system performance. Any communication protocol that involves synchronization of peer nodes incurs some overhead for setting up the communication. We will introduce a new algorithm energy-efficient Distributed Dynamic routing algorithm and compare it to two other algorithms, namely directed, and random clustering communication. We will take into account the setup costs and analyze the energy-efficiency and the useful lifetime of the system. Our simulation results show that this protocol performs comparable to its optimal counterpart while having significant less overhead.Wireless sensor networks having limitations such as: limited energy resources, varying energy consumption based on location, high cost of transmission, and limited processing capabilities. All of these characteristics of wireless sensor networks are complete opposites of their wired network counterparts, in which energy consumption is not an issue, transmission cost is relatively cheap, and the network nodes have plenty of processing capabilities. Routing approaches that have worked so well in traditional networks for over twenty years will not suffice for this new generation of networks. Besides maximizing the lifetime of the sensor nodes, it is preferable to distribute the energy dissipated throughout the wireless sensor network in order to minimize maintenance and maximize overall system performance. Any communication protocol that involves synchronization between peer nodes incurs some overhead of setting up the communication. Each node could make the most informed decision regarding its communication options if they had complete knowledge of the entire network topology and power levels of all the nodes in the network. This indeed proves to yield the best performance if the synchronization messages are not taken into account. However, since all the nodes would always need to have global knowledge, the cost of the synchronization messages would ultimately be very

expensive. For both the diffusion and clustering algorithms, we will analyze both realistic and optimum schemes in order to gain more insight in the properties of both approaches.

Over the last half a century, computers have exponentially increased in processing power and at the same time decreased in both size and price. These rapid advancements led to a very fast market in which computers would participate in more and more of our society's daily activities. In recent years, one such revolution has been taking place, where computers are becoming so small and so cheap, that single purpose computers with embedded sensors are almost practical from both economical and theoretical points of view. Wireless sensor networks are beginning to become a reality, and therefore some of the long overlooked limitations have become an important area of research.

Energy consumption of communication is a key factor of the lifetimes of wireless sensor networks. This dissertation presents an energy-efficient routing protocol for wireless sensor network. In the protocol, each sensor node detects the distance between the base station and itself. Then, it calculates a tier ID in according to the distance. A lower tier ID indicates a shorter distance between the base station and the node. Nodes with higher tier IDs send data to their neighbors with lower tier IDs, where data is compressed and forwarded toward nodes of even lower tiers. Eventually the data reaches the nodes at the lowest tier, and then the system selects a node sending data to the base station. Because long-distance communication between the base station and the node is energy-consuming, it will have its energy drained off faster than other nodes. The protocol employs a mechanism to shift the long-distance communication among all network nodes. Thus, energy consumption is evenly distributed among all network nodes.

2. Literature Review: A Review

This gives a brief survey of previous work that is related to Wireless Sensor Networks. Many protocols have been proposed for ad-hoc and sensor networks in the last few years. Proposed protocols can be classified into data-centric, hierarchical, etc.. Data dissemination protocols proposed for sensor networks consider energy efficiency a primary goal [8, 7, and 6]. SPIN [8] attempts to reduce the cost of flooding data, assuming that the network is source-centric (i.e., sensors announce any observed event to interested observers). Directed diffusion [7], on the other hand, selects the most efficient paths to forward requests and replies on, assuming that the network is data-centric (i.e., queries and data are forwarded according to interested observers).

2.1 What is Wireless Sensor Networks?

Wireless networks use some sort of radio frequencies in air to transmit and receive data. Wireless networks are formed of routers and hosts & the routers are responsible for forwarding packets in the network & hosts may be source or sink of data flows. Since wireless communication does not have the constraint of physical cables, so having the advantage to allows freedom for hosts/routers in the wireless network to move. Network components in a wireless network communicate with each other using wireless channels, so wireless networks become more popular, these are of two types:

1.1.1 Infrastructure Networks

1.1.2 Infrastructure less Networks

2.2. Definitions: Some definitions regarding the distributed web caching are defined below:

2.2.1 Sensor

Sensor; is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. For example, a mercury-in-glass thermometer converts the measured temperature into expansion and contraction of a liquid which can be read on a calibrated glass tube. A thermocouple converts temperature to an output voltage which can be read by a voltmeter. For accuracy, most sensors are calibrated against known standards.

2.2.2 Base Station

A base station is a GPS receiver at an accurately-known fixed location which is used to derive correction information for nearby portable GPS receivers. This correction data allows propagation and other effects to be corrected out of the position data obtained by the mobile stations, which gives greatly increased location precision and accuracy over the results obtained by uncorrected GPS receivers.

2.2.3 Cluster

Clusters are group sensor nodes which work collectively and are isolated with the other clusters and communicate within its own cluster.

2.2.4 Cluster head

A particular node chosen from a cluster to aggregate and transmit the data to the base station.

2.2.5 Clustering

Clustering is a conventional protocol for wireless networks, where nodes are organized into clusters that communicate with a local base station, and these local base stations transmit the data to the global base station, where it is accessed by the end user.

2.2.6 End User

An application program that establishes connections for the purpose of sending requests. These are often browsers, editors, spiders (Web traversing robots), or other end user tools.

2.3 Related Work

[1] Says that conventional routing protocols may not be optimal for sensor networks. LEACH (Low-Energy Adaptive Clustering Hierarchy) is a clustering-based protocol that utilizes randomized rotation of local cluster base stations to evenly distribute the energy load among the sensors in the network. Simulations show that LEACH can achieve as much as a factor of 8 reductions in energy dissipation compared with conventional routing protocols. LEACH also distributes energy dissipation evenly throughout the sensors, increasing the lifetime of the system.

LEACH is promising routing protocol for the sensor networks, however there were not enough experimental data on different network topologies and different radio parameters to make any final conclusions. Further study is required to estimate the full potential of the LEACH routing protocol. Other interesting ideas (not mentioned in the text) would be trying to ensure that the cluster head nodes are uniformly distributed by dividing advertisement phase into smaller sub-phases and decreasing the probability of cluster heads near other cluster heads. The use of combined LEACH and MTE routing with the cluster heads acting as routers.

[2] Explains Wireless sensor networks (WSN) are event-based systems based on the collaboration of several micro sensor nodes. Due to the limited Supply of energy at sensor nodes, energy efficient configuration of WSN has become a major design goal to improve the lifetime of the network. Many clustering algorithms have been proposed as energy-efficient, however, the existing classical pre-event clustering solutions form clusters in the entire network unnecessarily that brings significant overheads in maintaining the network configuration. Unlike pre event clustering, energy-efficient operation of WSN requires the event-to-sink directed clustering notion, which forms clusters when and where they are needed and in the direction of data flow from event location to the sink. To the best of our knowledge, energy-efficient clustering in WSN has not been studied from this perspective before. In this paper, a novel Event to-Sink Directed Clustering (ESDC) protocol for WSN is proposed. ESDC realizes energy efficiency in sensor network configuration by employing two techniques: (1) clustering of the nodes only within the event-to-sink data flow corridor to avoid unnecessary cluster formation, (2) directional clustering to minimize the number of hops for data forwarding. The directional clustering process in ESDC also sets up the routing path of the event flows over the clusters. Performance results reveal that the ESDC protocol achieves the energy-efficiency objectives and outperforms the existing conventional pre-event clustering approaches.

In this paper, they present Event-to-Sink Directed Clustering (ESDC) protocol that achieves energy-efficient clustering in WSN. Unlike the existing conventional pre-event clustering solutions in the literature, energy-efficient operation of WSN requires forming clusters when and where they are needed and in the direction of data flow from event location to the sink. To the best of our knowledge, energy-efficient clustering in WSN has not been studied from this point of view before. Performance results show that the event-to-sink directed cluster formation and data routing approach of ESDC has the following advantages:

1) With the new *event-to-sink and directed clustering* notion, ESDC avoids the formation of unnecessary clusters in the network. Unnecessary cluster formation causes additional energy consumption, processing and maintenance overhead, and some possible delay in data forwarding.

2) Setting up clusters with respect to the event location prevents redundant nodes from taking part in cluster formation and data transport and avoids the extra energy loss and processing delay they would cause.

3) Event-to-sink cluster setup also utilizes the spatial correlation between the nodes in the event detection area. Since data from individual nodes are often correlated in a micro sensor network, the data sink needs a higher-level description of the event occurring in the environment. Since ESDC considers the correlation between the sensor nodes in the event area, much less actual data

has to be transmitted from the cluster to the sink. This way, energy dissipation and total overhead on the sensor nodes is reduced.

4) Directed clustering is accomplished by selecting cluster heads to be the closest nodes to the sink. Hence, ESDC provides gain in energy, reduces packet transmission and processing overhead, and hence increases network lifetime.

[3] In this paper authors propose PEGASIS (Power-Efficient GAthering in Sensor Information Systems), a near optimal chain-based protocol that is an improvement over LEACH. In PEGASIS, each node communicates only with a close neighbor and takes turns transmitting to the base station, thus reducing the amount of energy spent per round. Simulation results show that PEGASIS performs better than LEACH by about 100 to 300% when 1%, 20%, 50%, and 100% of nodes die for different network sizes and topologies.In that paper, the model of proposed sensor network has the following properties:

- The BS is fixed at a far distance from the sensor nodes.
- The sensor nodes are homogeneous and energy constrained with uniform energy.

No mobility of sensor nodes in the network.

Here BS is located at (25, 150), which is at least 100m from the nearest node. In each round of this data-gathering application, all data from all nodes need to be collected and transmitted to the BS, where the end-user can access the data. PEGASIS: Power-Efficient Gathering in Sensor Information Systems directly to the BS. Since the BS is located far away, the cost to transmit to the BS from any node is high and nodes will die very quickly. Therefore, an improved approach is to use as few transmissions as possible to the BS and minimize the amount of data that must be transmitted to the BS. In sensor networks, data fusion helps to reduce the amount of data transmitted between sensor nodes and the BS. Data fusion combines one or more data packets from different sensor measurements to produce a single packet as described in [8]. The LEACH protocol presented in [8] is an elegant solution to this data collection problem, where a small number of clusters are formed in a self-organized manner. A designated node in each cluster collects and fuses data from nodes in its cluster and transmits the result to the BS. LEACH uses randomization to rotate the cluster heads and achieves a factor of 8 improvement compared to the direct approach, before the first node dies. Further improvements can be obtained if each node communicates only with close neighbors, and only one designated node sends the combined data to the BS in each round.

[4] This paper presents an energy-efficient communication protocol which distributes a uniform energy load to the sensors in a wireless micro sensor network. This protocol, called Distance-Based Segmentation (DBS), is a cluster based protocol that divides the entire network into equal area segments and applies different clustering policies to each segment to reduce total energy dissipation and hence prolong the lifetime of the network. To evaluate the DBS protocol, a simulator was implemented using the MATLAB software. Simulation results show that the DBS can achieve as much as 16% reduction in total dissipated energy as compared with conventional protocols. In addition this protocol is able to distribute energy load more evenly among the sensors in the network, and hence yields up to 24% increase in the useful network lifetime. The DBS guarantees reliable and low-latency communications between sensor nodes by adding a mechanism to media access control (MAC) protocols.

Distance-Based Segmentation (DBS) protocol is an adaptive clustering hierarchy based on the distance of each node from the base station within the wireless micro sensor network. In this protocol, nodes burn energy in a more equitable way across the network ensuring a more tolerable degradation of service with time. Furthermore, the DBS guarantees reliable and low-latency communications between sensor nodes by adding a mechanism to media access control (MAC) protocols. Results from our experiments verify that regarding total energy consumption, network lifetime and reliability, DBS protocol can outperform conventional cluster-based protocols.

[5] A wireless network consisting of hundreds or thousands of cheap micro sensor nodes allow users accurately monitor the characteristics of the remote environment or detect an event. As the sensor nodes have limited energy resources, so the routing protocol designed for the wireless sensor networks should be energy efficient and provide low latency. So an advanced low-energy adaptive clustering hierarchy (ALEACH) is proposed which is a clustering-based protocol architecture where nodes make autonomous decision without any central intervention. ALEACH proposes a new cluster head selection algorithms that enables selecting best suited node for cluster head, algorithms for adaptive clusters and rotating cluster head positions to evenly distribute the energy load among all the nodes. Simulation results show that ALEACH can improve system life time and energy efficiency in terms of different simulation performance metric.

In this paper, authors devise a new technique to select the cluster heads in every round which depends both on current state probability and general probability. In performance simulations, they compare their protocol with prevalent protocols LEACH and Static-Clustering. As they select the most eligible nodes as the cluster-heads in terms of its current state and general probability, so the nodes die rate is less than the other compared protocols. This incurs great impact incase of data messages reception at the base station and energy loss of the nodes. Since ALEACH appears to be a promising protocol, there are some areas for improvement to make the protocol best suited everywhere. As the sensor nodes have limited energy, so the nodes die after a certain time limit. Future work directions are to take the nodes as solar aware nodes which regain energy it selves, so that our protocol will be more energy sufficient. And another provision is to make our protocol in to hierarchal protocol by forming ”super clusters” out of the cluster head nodes and super clusters will process all the data from the cluster heads. So the energy loss of every cluster heads will be reduced to send the data messages to the BS and aggregation. This improvement will make ALEACH effective for a wider range of wireless micro sensor networks.

3. Proposed Architecture /Model/Reasearch/Methology:

In this Dissertation we are going to use clustering in homogeneous nodes in WSN. In addition to collect data from non cluster nodes the cluster head will aggregate the data which is to be transmitted to base station here we will use multi hop routing technique to transmit data to the base station .In addition to just use shortest path (Energy Conserved) we will also prefer to transmit data through the other nodes which have high energy difference as compared to the nodes which is transmitting data to base station. In short, some time we will prefer longer path to increase the network stable life time.

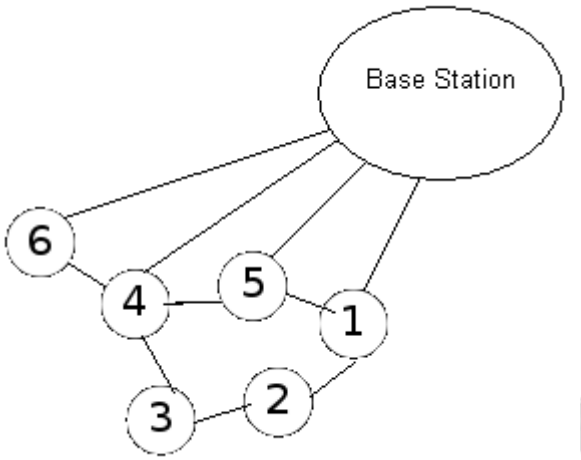

Fig. Connection of different cluster heads with base stations

In addition here we are considering homogeneous nodes, so here all nodes having same energy. Initially a node chosen randomly as a cluster head will communicate with the base station .After some time this node will be replaced by some other node which will act as cluster head for a short period and this procedure will be repeated for the entire network. We will implement this with the concept of Max-Priority queue. The node having the highest energy will be chosen as cluster head.After some time when energy of cluster head is reduced we will call heapify procedure for the rearrangement of nodes such that the node having high energy will be placed as the root of heap. We will call the heapify procedure after a particular interval which can be defined by a particular threshold value.

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