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AN EMPIRICAL ALGORITHMIC APPROACH FOR POWER THRESHOLDING AND TRANSFER BETWEEN MOTES IN ASSORTED APPLICATION USING CLUSTERING AND OUTLIER IN WSN

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ABSTRACT

A sensor network is comprised of a number of low-power devices with sensing and computing capability. In many sensor network systems, the power supply for the network nodes is usually a depletable power source, such as batteries. To increase the lifespan of sensor networks, researchers have designed a number of power management schemes. It is proposed that for saving energy an algorithm can be designed for energy transfer between nodes to achieve the maximum network lifetime .Instead of using traditional sleep awake mechanism alone, this approach will use the outlired nodes whose energy is squandered unnecessarily. Ever since the advent of wireless telecommunication technologies as well as low-cost, low-power and multifunctional sensor nodes (SNs), WSNs have become the focal point of attention for many researchers. WSNs are comprised of small SNs generally deployed large in number, probably

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hundreds to thousands and one or more base stations (BSs), which are much more powerful nodes that connect the SNs to the rest of the world. The sensing electronics of SN measure conditions related to the environment surrounding the sensor and transform them into an appropriate electric signal. Processing such a signal reveals some properties about objects located and/or events happening in the vicinity of the sensor. This enables their use for monitoring purposes, and can be used in different application areas, ranging from battlefield surveillance, to medical, to coordinated target detection. The nodes are tightly constrained in terms of energy, bandwidth, storage, computation and transmission ranges. For that reason, the protocol running on sensor networks must efficiently reduce the node energy consumed and bandwidth in order to achieve a longer network lifetime. Using sleep and wake protocols enables better resource allocation and helps improve power control in wireless sensor networks. Many sleep wake protocols have been investigated recently as efficient approaches to achieve significant energy savings in WSNs by allowing some nodes to sleep that are not in use and other awake that have to perform task, eliminating redundancy. This paper will propose the sleep wake protocols along with energy transfer among nodes and will also develop the module for integration with the algorithm for simulation of the energy transfer. Before discussing protocol I will describe briefly about WSN.

Index Terms: sleep wake protocol, outlired nodes, clustering, motes, Wireless Sensor Networks (WSN).

1. INTRODUCTION

A wireless sensor networks (WSN) consists of spatially distributed self-reliant sensors to monitor physical or environmental conditions, such as temperature, sound, pressure etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial

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process monitoring and control, machine health monitoring, and so on. The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

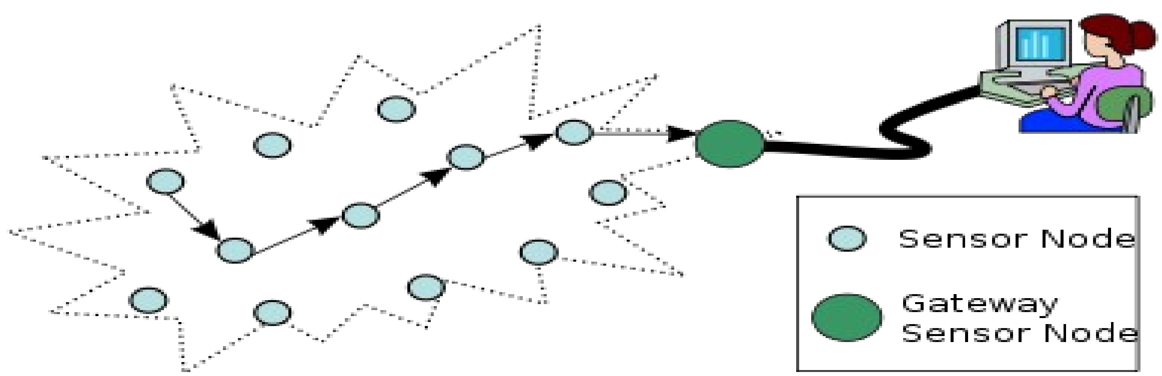

Fig1: Typical multihop Wireless Sensor Network Architecture

1.1 APPLICATIONS

1. Environmental Monitoring

Air quality monitoring

The degree of pollution in the air has to be measured frequently in order to safeguard people and the environment from any kind of damages due to air pollution. In dangerous surroundings, real time monitoring of harmful gases is a concerning process because the

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weather can change with severe consequences in an immediate manner. Fortunately, wireless sensor networks have been launched to produce specific solutions for people.

2. **Habitat Monitoring on Great Duck Island**l

Intel Research Laboratory at Berkeley initiated collaboration with the College of the Atlantic in Bar Harbor and the University of California at Berkeley to deploy wireless sensor networks on Great Duck Island, Maine (in 2002) Monitor the microclimates in and around nesting burrows used by the Leach's Storm Petrel

Goal : habitat monitoring kit for researchers worldwide

3. Forest fire detection

A network of Sensor Nodes can be installed in a forest to detect when a fire has started. The nodes can be equipped with sensors to measure temperature, humidity and gases which are produced by fire in the trees or vegetation. The early detection is crucial for a successful action of the firefighters; thanks to Wireless Sensor Networks, the fire brigade will be able to know when a fire is started and how it is spreading.

Landslide detection

A landslide detection system makes use of a wireless sensor network to detect the slight movements of soil and changes in various parameters that may occur before or during a landslide. Through the data gathered it may be possible to know the occurrence of landslides long before it actually happens.

Water quality monitoring

Water quality monitoring involves analyzing water properties in dams, rivers, lakes & oceans, as well as underground water reserves. The use of many wireless distributed sensors enables the creation of a more accurate map of the water status, and allows the permanent deployment of monitoring stations in locations of difficult access, without the need of manual data retrieval.

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1.2 DESIGN ISSUES

The routing protocols designed for WSN should consider the goal, application area, and architecture of the network. The design of routing protocols is influenced by many challenging factors caused by the nature of the WSNs. These factors must be overcome before efficient communication can be achieved in WSNs.

- **Node Deployment**:

Node deployment can be random, deterministic or selforganizing. For deterministic deployed networks the routes are pre-determined, however for random deployed networks and self-organizing networks route designation have been a challenging subject.

- **Energy consideration:**

Since the life-time of the WSN depends on energy resources and their consumption by sensors, the energy consideration has a great influence on route design. The power consumed during transmission is the greatest portion of energy consumption of any node. Direct communication consumes more power than multi-hop communication; however the multi-hop communication introduces extra topology management and medium access control.

- **Data Delivery Models**:

Data delivery model depends on the application and can be continuous, event-driven, query-driven, or hybrid. In continuous model of delivery, each sensor sends the data periodically. In event-driven and query driven models of the data delivery, the transmission is triggered by an event or a query generated by the sink. Hybrid model is a combination of continuous, event driven and query-driven data delivery models.

- **Node Capabilities:**

The nodes were usually assumed to have equal capacity of computation, power, and communication. However, it is possible for nodes to have different functionalities, such as relaying, sensing, and aggregation.

- **Data Aggregation:**

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Since the sensors are densely deployed by definition, the data gathered from each node are correlated. Therefore data aggregation or in other words data fusion decreases the size of the data transmitted.

- **Fault Tolerance**:

WSNs are prone to failures; some of the nodes may fail or be blocked by physical interference, physical damage, or lack of power. The routing protocol has to be dynamic; failures of specific nodes should not affect network operation.

- **Scalability:**

WSNs may consist of hundreds, thousands or more nodes. Any protocol including routing protocols should manage this huge number of nodes.

- **Network Dynamics:**

Most of the proposed networks are considered to be stationary; however for some application areas WSNs in which some or all nodes are mobile are required. Routing protocols for such networks must cater for mobility requirements.

- **Quality of Service:**

Some applications require QoS; especially there exist some time-critical applications. The relevance of the data expires within some period. For such applications the routing protocols should be designed according to the requirements. However, the general trend is to attribute more importance to energy awareness than QoS requirements.

2. Related work and its challenges:

The idea of wireless sensor networks has attracted a great deal of research attention due to wide-ranged potential applications that will be embedded by wireless sensor networks such as battlefield surveillance, machine failure diagnosis, home security etc. In WSN, energy source provided for sensors is usually a battery power, which has not reached the stage for sensors to operate for long time as sensors are deployed in remote or hostile environment such as battlefield or desert, it is impossible to recharge or replace battery power of all sensors. In WSN,

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all nodes share common sensing task i.e. turning of some nodes does not affect the overall system function as long as there are enough nodes to assure it. Therefore if we can schedule sensors to work alternatively, i.e. the system lifetime can be prolonged by exploiting redundancy, i.e. by eliminating Redundancy , we can save the efficient energy of sensor nodes and increase the overall network lifetime.

This paper [3] presents Random Asynchronous Wakeup, a novel power management protocol for wireless sensor networks. RAW[3] mainly consists of two components routing based on forwarding sets , random wakeup scheme.In routing based on forwarding sets a packet can be forwarded to the active neighbour that is closest to the destination, or the packet can be queued until the closest neighbour among the rest becomes active. This has a drawback if the node never comes in active mode and buffering will keep on taking place, also has a problem when multiple neighbour exist with same distance. Results in large energy consumption and poor network lifetime. Also randomly any node is chosen to switch between active and sleep mode, which wastes a lot of time in switching and hence more energy consumption. It [3] also doesn't provide packet forwarding within one time frame.

In wireless sensor networks that consist of a large number of low power , short-lived, unreliable sensors, one of the main design challenges is to obtain long system lifetime, as well as maintain sufficient sensing coverage and reliability. In this paper[4], it propose a node-scheduling scheme, which can reduce system overall energy consumption, therefore increasing system lifetime, by turning off some redundant nodes. Our coverage-based off duty eligibility rule and back off-based node-scheduling scheme guarantees that the original sensing coverage is maintained after turning off redundant nodes. Experimental results show that enough redundancy still remained although some nodes were turned off. Also this deploy more nodes at the corner which results in lot of energy consumption.

The next paper [5] in this paper, we present radio-triggered hardware and explore its applications in power management. Power management is an important technique to prolong

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the lifespan of sensor networks. Many power management protocols employ wake-up/sleep schedules, which are often complicated and inefficient. By extracting energy from the radio signals, the radio-triggered hardware provides wake-up signals to the network node without using internal power supply. If adequate antennas are used, this wake-up mechanism does not respond to normal data communication signals and thus does not prematurely wake up the network node. More importantly, the radio-triggered circuit becomes energized and generates a wake-up signal exactly when suitable wake-up signals arrive. We also explore extensions to radio-triggered hardware to enable longer operating distance and stronger selectivity .It makes use of hardware devices such as comparator, amplifier, capacitor so it is difficult to implement on small-scale applications and it is expensive to implement which overcomes the advantage of little power consumption. This also doesn't fulfil the objective.

This paper describes [6], multiobjective optimization (MO) algorithm to efficiently schedule the nodes of a wireless sensor network (WSN) and to achieve maximum lifetime. The MO algorithm helps to attain a better trade off among energy consumption, lifetime, and coverage. The algorithm can be run every time a node failure occurs due to power failure of the node battery so that it may reschedule the network. This paper is the first of its kind to incorporate differentiated coverage with sleep-scheduling methods in a multiobjective optimization framework. The idea of differentiated coverage is very interesting from a practical point of view as it reduces wastage of energy by reducing the level of sensing in the regions of less interest. Every time a node failure occurs, the multiobjective algorithm is called to rearrange the network to have maximum coverage and minimum energy consumption. This can fail in successfully calling MO algorithm which can lead to complete shutdown of the system. Whereas in Wireless Sensor Networks (WSNs), with growing applications in the environment which are not within human reach have been addressed tremendously in the recent past. In[6] WSNs technique certain issues like network stability, network lifetime and cluster head selection process are evaluated and enhanced. In clustering some of the nodes are selected as CHs and had to spent more energy than rest of nodes for a specific period of time. This technique introduces the

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concept of pairing. Sensor nodes of same application and at minimum distance between them will form a pair for data sensing and communication. In our EESAA protocol, we also enhance CHs selection technique, by selecting CHs on basis of remaining energy of nodes. Initially senor nodes measure their location through GPS (Global Positioning System). The nodes transmit their location information, Application type and Node ID to the Base Station (BS). Then, this gathered information is utilized by BS to compute mutual distance between nodes. During coupling process some nodes are left out because they are not in inter cluster transmission range of any other node. According to the proposed scheme, the nodes switch between "Sleep" and "Awake" mode during a single communication interval. Initially node in a pair switch into awake mode also called Active-mode if its distance from the BS is less than its coupled node. Node in Active-mode will gather data from surroundings and transmit this data to CHs. During this period transceiver of the coupled node will remain off, and switches into Sleep-mode. Sleep-mode nodes cease their communication with CHs and only sense the network status. In next communication interval, nodes in Active-mode switch into Sleep-mode and Sleep-mode nodes switch into awake mode. In this way lot of energy is wasted during waiting period when no imp. event takes place which results in lot of energy consumption. Also many nodes are left out of coupling therefore they always remain in awake mode due to which lot of energy is wasted unnecessary.

3. Work carried out:

In this dissertation we have consider few of the above sleep awake protocol challenges and suggest **An Empirical Algorithmic Approach for Power Thresholding and Transfer between Motes in Assorted Application using Clustering and Outlired in WSN.**

It is simple, consistent and reliable in nature and improving network lifetime by using sleep/awake mode pattern of SNs.

Main highlights of the work are as follows:

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- To develop an algorithm that attempt to reduce the power consumption of motes for data transmission from source to sink by using the concept of energy transfer between nodes.
- To develop the module for integration with the algorithm for simulation of the energy transfer by using the concept of clustering and outlired in WSN.
- To develop an efficient algorithm that ensures reliable data aggregation in terms of energy and improving network lifetime of WSNs in terms of number of rounds.
- solutions provided by the proposed algorithm satisfy the following requirements:

  Energy efficient: Less energy should be spent on effective data delivery by reducing the redundancy.

  High delivery ratio: The network can provide more useful data and more sensing.

  Improving network lifetime: The network lifetime is increasing by considering Sleep/awake mode pattern.

4. CONCLUSION

This paper proposed an energy transfer among outlired motes so as to reduce the energy consumption of nodes using sleep awake protocols making some nodes to sleep and other awake, by reducing redundancy among nodes and increasing the maximum network lifetime. The nodes are tightly constrained in terms of energy, bandwidth, storage, computation and transmission ranges. For that reason, the protocol running on sensor networks must efficiently reduce the node energy consumed and bandwidth in order to achieve a longer network lifetime. Using sleep and wake protocols enables better resource allocation and helps improve power control in wireless sensor networks.

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