A Process of Optimizing Energy in Wireless Sensor Networks

R. K. Mishra[1] and Amarjeet[2]

[1,2]Dev Bhoomi Group of Institutions, Dehradun

Abstract: In this paper we discussed about the process of optimizing energy in wireless sensor networks. We know that today has the technology used mobile, internet, Wi-Fi, etc. and Mobile computing will be the buzz of the next century. From our first breath, as soon as the umbilical cord is cut, the individual is free and undeterred. To be tethered is unnatural and soon to be unnecessary for computing environments. Consumers want personalized wireless computing services while they are mobile, and companies want to make money offering those services. The infantile paradigm of mobile computing is opening up new markets never dreamed of before. We are presently at the cusp of the mobile multimedia era. And in this paper we optimize the mobile technology problem. And learned and discussed it on this paper. We present a wireless framework that optimizes these problems.

[R. K. Mishra and Amarjeet. **A Process of Optimizing Energy in Wireless Sensor Networks.** New York Science Journal 2012;5(2):69-71]. (ISSN: 1554-0200). http://www.sciencepub.net/newyork.11

Keywords: Wireless networks, sensors, mobile computing, internet, Optimizing Energy.

Introduction: Mobile computing will be the buzz of the next century. From our first breath, as soon as the umbilical cord is cut, the individual is free and untethered. To be tethered is unnatural and soon to be unnecessary for computing environments. Consumers want personalized wireless computing services while they are mobile, and companies want to make money offering those services. The infantile paradigm of mobile computing is opening up new markets never dreamed of before. We are presently at the cusp of the mobile multimedia era. Buzzwords such as *mobile, ubiquitous, nomadic, untethered, pervasive,* and *any time anywhere,* are used by different people to refer to the new breed of computing that utilizes small portable devices and wireless communication networks. Defining and relating some of these buzzwords is an important prerequisite to this introduction. The difference between nomadic and mobile computing is particularly important to point out. Both nomadic and mobile computing require small portable devices. However, the kind of network used in nomadic computing does not allow mobility, or does so in the confines of a building, at pedestrian speed. Examples of such networks are DIAL-UP lines, which obviously do not allow any mobility, and Wireless Local Area Networks (WLAN), which allow for limited mobility within a building facility. Nomadic computing refers to the interleaved pattern of user relocation and "in-door" connection. Travelers carrying laptops with DIAL-UP modems are, therefore, nomadic users engaged in nomadic computing. Mobile computing, on the other-hand, requires the availability of wireless networks that support "outdoor" mobility and handoff from one network to the next, at pedestrian or vehicular speeds.

Wireless sensor networks (WSN)[1] have emerged as a promising solution for various applications, in fields as diverse as climate monitoring, tactical surveillance, vehicle tracking, and earthquake detection. With improvements in sensor technology, it has become possible to build small sensor devices with a relatively high computational power at a low cost. Yet, the sensor devices' untethered nature also poses interesting design challenges.

Energy consumption is the most important factor to determine the life of a sensor network, because usually sensor nodes are driven by batteries and have very low energy sources. This makes energy optimization more complicated in sensor networks; it involves not only reduction of energy consumption but also prolonging the life of the network as much as possible. This must be done by having energy awareness in every aspect of design and operation.[2]. A single configuration may not fulfill the requirements to work energy-efficiently in different environments. Thus, mechanisms that can change adaptively in response to various situations are critical for energy efficiency in such systems.

Recent advances in wireless communications and computing technology are enabling the emergence of low cost devices that incorporate sensing, processing, and communication functionalities. A large number of these devices are deployed to create a sensor network for both monitoring and control purposes. Sensor networks are currently an active research area mainly due to the potential of their applications. However, the operation of large scale sensor networks still requires solutions to numerous technical challenges that stem primarily from the constraints imposed by simple sensor devices. Among these challenges, the power constraint is the most critical one, since it involves not only reducing the energy consumption of a single sensor but also maximizing the lifetime of an entire network. The network lifetime can be maximized only by incorporating energy awareness into every stage of sensor network design and operation, thus empowering the system with the ability to make dynamic tradeoffs among energy consumption, system performance, and operational fidelity.

Optimizing the energy usage is a critical challenge for wireless sensor networks (WSNs). The requirements of energy optimization schemes are as follows.

(1) ***Low individual energy consumption***: Sensor nodes can use up their limited energy supply, carrying out computations and transmission. In typical WSNs, nodes play a dual role as both data sender and data router. Malfunctioning of some sensor nodes due to power failure can cause significant topological changes and may require rerouting of packets and network reorganization. Therefore, reducing the energy consumption of each sensor node is critical for WSNs.

(2) ***Balanced energy usage***: While minimizing the energy consumption of individual sensor nodes is important, the energy status of the entire network should also be of the same order. If certain nodes have much higher workload than others, these nodes will drain off their energy rapidly and adversely impact the overall system lifetime. The workload of sensors should be balanced in order to achieve longer system lifetime.

(3) ***Low computation and communication overhead***: The resource limitations imposed by sensor hardware call for simple protocols that require minimal processing and a small memory footprint. The extra computation and communication introduced by the energy optimization schemes must also be kept low. Otherwise, energy required to perform the optimization schemes may outweigh the benefits.

Research Description:-

This work concentrates on the energy optimization issues in wireless sensor networks. We shall study the power consumption characteristics of typical sensor platforms, and propose energy optimization schemes in network and application level. We design distributed algorithms that reduce the amount of data traffic and unnecessary overhearing waste in WSNs, and further propose load balancing mechanisms that alleviate the unbalanced energy usage and prolong the effective system lifetime.

At the network level, *Adaptive Aggregation Tree (AAT)* is proposed to dynamically transform the routing tree, using easily-obtained overheard information, to improve the aggregation efficiency. The local adaptively of AAT achieves significant energy reduction, compared to the shortest-path tree where aggregation occurs opportunistically. We also propose *Neighborhood-Aware Density Control (NADC)*, which exploits the overheard information to reduce the unnecessary overhearing waste along routing paths. In NADC, nodes observe their neighborhood and adapt their participation in the multichip routing topology. By reducing the node density near the routing paths, the overhearing waste can be reduced, and the extremely unbalanced energy usage among sensor nodes is also alleviated, which results in a longer system lifetime. The unbalanced energy usage problem is further addressed at the application level, where we will propose *Zone-Repartitioning (Z-R)* for load balancing in data-centric storage systems. Z-R reduces the workload of certain hot-spots by distributing their communication load to other nodes when the event frequency of certain areas is much higher than the others.

Optimization of energy consumption in wireless sensor networks: Multiple antenna systems are capable of providing high data rate transmissions in a fading environment without the need of increasing the signal bandwidth. This suggests the question whether they can be used to reduce the energy consumption inwireless networks. Before addressing this problem, we must first understand the problem of minimizing transmit powerssubject to some SIR requirements.[3]

Exploit overhearing effect to improve aggregation efficiency and network energy management :- Owing to the broadcast nature of the wireless channel, many nodes in the vicinity of a sender node may overhear its packet transmissions even if they are not the intended recipients of these transmissions. This redundant reception results in unnecessary expenditure of battery energy of the recipients. Especially in dense sensor networks, overhearing costs can constitute a significant fraction of the total energy consumption.

Overhearing problem is common in wireless sensor networks. Although several WSN MAC protocols have been proposed using short control packets to avoid overhearing long data packets, overhearing the control packets still consumes considerable overhead energy. Since overhearing is difficult to avoid and sometimes necessary, we propose distributed energy optimization schemes which exploit the overhearing effect as an approach to gather the required information.

Extend system lifetime through load balancing: Due to the multichip routing nature of sensor networks, the nodes along the routing paths tend to have heavier workload and deplete their energy sources faster than other nodes. Especially in densely deployed sensor networks, the overhearing cost may aggravate the unbalanced energy usage among sensor nodes. Such unbalanced energy usage leads to a premature loss of connectivity in the network and negatively impacts the system lifetime.

Energy-Accuracy: Energy consumption and bandwidth usage must be taken into consideration when developing algorithms for wireless sensor networks. For the incremental subgradient methods described in this paper, the amount of communication is directly proportional to the number of cycles required for the algorithm to converge. Using the theory described in the previous section we precisely quantify the amount of communication needed to guarantee a certain level of accuracy. [4]

Clustering and Density Estimation: The Distributed Expectation-Maximization (DEM) algorithm has previously been proposed in the context of density estimation and clustering for wireless sensor networks. In this scenario, measurements are modelled as being samples drawn from a mixture of Gaussian distributions with unknown means and covariances, with mixture weights potentially being different at each sensor in the network.[5]

An Energy-Efficient Routing Method of Wireless Sensor Networks: In wireless sensor networks(WSNs), as sensor nodes are characterized by having specific requirements such as limited energy availability, low memory and reduced processing power, energy efficiency is a key issue in designing the network routing. In the existing clustering-based routing protocols for the WSNs, the cluster-heads are usually selected randomly and do a lot of work, which may cause unbalanced energy consumption and thus short network lifetime. Based on this approach, the paper proposes a method that a cluster-head distributes energy load evenly among its members based on their energy usage by chain. With the chain, in a cluster, different cycle. The new method balances the nodes' power depletion. Simulation results show that it has better power management performance and can prolong the lifetime of the network. [6]

Conclusion: Wireless sensor Networks have been identified as one of the most important technologies for the newly century. Because every person known that the technology has improve the work efficiency and provide the fast and improved work as well as possible. And in this paper we discussed about this technology that how to improve the efficiency and if we do the sensor based technology then it is provide the fast services. And we optimize the problem and solve the problem on wireless sensor networks. Sensor networks works mostly involved in traffic analysis & modeling, network optimization and network anomaly detection for Wireless sensor networks. And it has we optimize that many of the works involved in network optimization and anomaly detection are based on the research results from traffic analysis & modeling. Actually, network traffic and its associated energy consumption play a key role in most of the works relating to network optimization for Wireless sensor networks.

References:

1. I. F. Akyildiz,W. Su, Y. Sankarasubramaniam, and E. Cayirci. Wireless sensor networks: A survey. Computer Networks, 38(4):393–422, 2002.
2. Kevin Klues, Guoliang Xing, and Chenyang Lu. Link layer support for unified radio power management in wireless sensor networks. In Proceedings of the 6th International Conference on Information Processing in Sensor Networks (IPSN), pages 460–469, 2007.
3. Surendra bilouhan, Prof.Roopam Gupta, Optimization of Power Consumption in Wireless Sensor Networks, International Journal of Scientific & Engineering Research Volume 2, Issue 5, May-2011 ISSN 2229-5518
4. http://nowak.ece.wisc.edu/dosn.pdf
5. R. Nowak. Distributed EM algorithms for density estimation and clustering in sensor networks. IEEE Trans. on Sig. Proc., 51(8), August 2003.
6. Surendra bilouhan, Prof.Roopam Gupta, Optimization of Power Consumption in Wireless Sensor Networks, International Journal of Scientific & Engineering Research.

2/2/2012