Higher Energy By Using Data Clustering Methods of Wireless Sensor Network To Improve Lifetime

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***Abstract*- Wireless sensor network (WSN) consists of large number of fine sensor nodes randomly scattered. Those node has some energy. Since providing as neighbor energy if it is needed, as a result, the network lifetime will be suffered. So as to increase the energy efficiency and its lifetime too. To overcome this, the existing Data Clustering Algorithm such as BIRCH, COBWEB Clustering algorithm for Wireless Sensor Network, An Energy-Efficient Unequal Clustering (EEUC), Distributive Energy Efficient Adaptive Clustering(DEEAC), In this paper performance has been analyzed for the above Data Clustering protocols in WSN. The behavior of these protocols has been analyzed under realistic scenarios by means of simulation with a network simulator tool NS-2.**

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Keywords: Wireless Sensor Network (WSN), **BIRCH, COBWEB, EEUC, DEEAC, and Energy consumption**

INTRODUCTION

Wireless sensor node which collect the sensed node available in neighbor node and send to the remote area which is said to be Base Station (BS), with advance in wireless communication technology, sensing technology, micro-electronics technology and embedded system, wireless sensor networks can be used for a wide variety of applications and systems with vastly varying requirements and characteristics, such as environmental monitoring, disaster management, factory automation, health care or military. Due to battery powered back up , lifetime should be increased, by increasing it efficiency are increased. By researching energy are getting low, so clustering the data from one node to other node, this will overcome the issues as efficient in higher energy, by clustering some data are treated as Data Heads, and those Data Heads are collected very fine data resulting that Data Heads are sent to Central Base Station. This lead more energy when transmitting more data at single time, which gives higher energy efficient, from this research distances are not compared, this reveals that whatever distance it transmit the data as higher energy efficient. Data Clustering is projected because of its network scalability, energy saving and network topology stability. Data clustering schemes also reduce the communication overheads among the sensor nodes. Existing Clustering algorithms have some drawbacks Clustering algorithms have some drawbacks such as additional overheads during cluster head selection, cluster formation process..

The following are the components of a clustered WSN.

ENERGY HARVESTING TECHNOLOGIES

Energy scalability is of much importance in energy constrained situations and can be achieved through energy-harvesting technologies. Energy-harvesting technologies are required for autonomous sensor networks, where battery recharging is impossible and thus environmental resources are used for energy scalability. Energy harvesting technologies are used to scavenge energy from ambient sources.

Since the lifetime of a WSN is determined by the energy of the node, which is the scarcest resource of a WSN and, in most cases, cannot be replenished for reasons like, cost or geographic location. In some cases, sensor nodes can potentially operate indefinitely by using environmental energy. In order to increase the lifetime of a sensor node, energy harvesting devices scavenge energy from light, vibration, or thermal gradients and feed the energy-storage component of the sensor node. Solar cells are made up of silicon with some impurities and exploit photovoltaic effect to convert sunlight into electricity. Vibration based harvesting devices can employ electromagnetic conversion, or piezoelectric effect. Thermoelectric devices generate electric energy when a temperature gradient exists across the device. For instance pico-cube is a wireless sensing device powered by harvested energy. Energy delivered by a harvesting device is not directly usable by the node's component due to different voltage requirements and is therefore, buffered. Depending upon requirements, capacitors can be used to buffer energy and can deliver power later.

An optimal energy management policy for a solar powered sensor node was proposed . It considers the channel and queue awareness sleep/wakeup mechanism. The sensor node turns off the radio transmitter when the queue becomes exhausted. However, incoming packets from other nodes can be buffered in the queue. Sensor node switches to the sleep mode if channel quality is bad.

However, since such devices can produce only a limited amount of energy due to environmental conditions, energy saving mechanisms are also required.

POWER MANAGEMENT

With the advent of ad hoc networks of geographically distributed sensors in remote site environments (e.g. sensors dropped from aircraft for personnel/vehicle surveillance), there is a focus on increasing the lifetimes of sensor nodes through power generation, power conservation, and power management. Current research is in designing small MEMS (micro electromechanical systems) RF components for transceivers, including capacitors, inductors, etc. The limiting factor now is in fabricating micro-sized inductors. Another thrust is in designing MEMS power generators using technologies including solar, vibration (electromagnetic and electrostatic), thermal, etc.

RF-ID (RF identification) devices are transponder microcircuits having an L-C tank circuit that stores power from received interrogation signals, and then uses that power to transmit a response. Passive tags have no onboard power source and limited onboard data storage, while active tags have a battery and up to 1Mb of data storage. RF-ID operates in a low frequency range of 100kHz-1.5MHz or a high frequency range of 900 MHz-2.4GHz, The required transmission power increases as the square of the distance between source and destination. Therefore, multiple short message transmission hops require less power than one long hop. In fact, if the distance between source and destination is *R*, the power required for single -hop transmission is proportional to R^2. If nodes between source and destination are taken advantage of to transmit *n* short hops instead, the power required by each node is proportional to R^2/n^2. This is a strong argument in favor of distributed networks with multiple nodes, i.e. nets of the mesh variety.

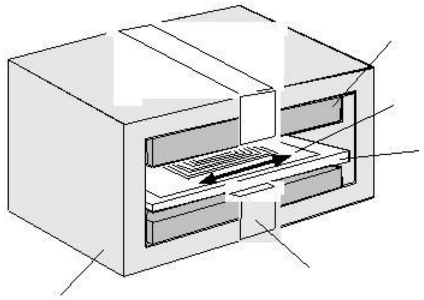
A current topic of research is *active power control,* whereby each node cooperates with all other nodes in selecting its individual transmission power level. This is a decentralized feedback control problem. Congestion is increased if any node uses too much power, but each node must select a large enough transmission range that the network remains connected. For *n* nodes randomly distributed in a disk, the network is asymptotically connected with probability one if the transmission range *r* of all nodes is selected using

$$_{r}\ \backslash \log n \quad (n)\sqrt{_{n}\qquad /}$$

where *(n)* is a function that goes to infinity as *n* becomes large.

which has an operating range up to 30m. RF-ID tags are very inexpensive, and are used in manufacturing and sales inventory control, container shipping control, etc. RF -ID tags are installed on water meters in some cities, allowing a metering vehicle to simply drive by and remotely read the current readings. They are also be used in automobiles for automatic toll collection.

Meanwhile, software power management techniques can greatly decrease the power consumed by RF sensor nodes. TDMA is especially useful for power conservation, since a node can power down or 'sleep' between its assigned time slots, waking up in time to receive and transmit messages.



MEMS power generator using vibration and electromagnetic method

MEMS fabrication layout of power generator dual vibrating coil showing folded beam suspension.

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Heinzelman *et. al* proposed an energy consumption model for sensors based on the observation that the energy consumption would likely be dominated by the data communications subsystem. Table 1 reproduces their model.

Table 1 Radio Characteristics, Classical model

Radio mode	Energy Consumption
Transmitter Electronics ($E_{Tx-elec}$) Receiver Electronics ($E_{Rx-elec}$) ($E_{Tx-elec} = E_{Rx-elec} = E_{elec}$)	$50nJ / bit$
Transmit Amplifier (ε_{amp})	$100\ pJ / bit / m^2$
Idle (E_{idle})	$40nJ / bit$
Sleep	0

The model considers a low power consumption radio that was slightly better than some standard definitions, like Bluetooth . The model provides a commonly used starting point, however, the model has not been verified against the behavior of a physical radio in a wireless sensor network. When computing node energy consumption, the CPU and the sensors are consumers that may or may not be neglected, depending on the nature of the application. So, the radio model must be used jointly with some figure of the energy consumption of those elements, because in the end, power supply must feed all the system and not just the radio

µAMPS Specific Model

Shih *et. al* presented a model developed for a specific platform, the µAMPS Wireless Sensor Node. The platform has a Strong ARM SA 1110 microprocessor with a clock speed from 59 Mhz to 206 Mhz. The model takes into consideration the energy consumed by the microcontroller, energy lost due to leakage and the average consumption of the radio. Table 2 summarizes the model characteristics.

Table 2 Characteristics model

State	SA-1110	Sensor,A/D	Radio	Pk (mW)
Active	Active	sense	tx/rx	1040
Ready	Idle	sense	rx	400
Monitor	Sleep	sense	rx	270
Observe	Sleep	sense	off	200
Deep Sleep	Sleep	off	off	10

The µAMPS model doesn't specify the power consumed in transmitting or receiving one bit. Nonetheless, the platform uses transmission rate of 1 Mbps, so one can calculate the energy required for transmitting one bit, following a method based in the approach presented by Hill *et. al* in. The energy used in transmitting or receiving one bit and is found by using the power value.

Time to send or receive one bit = 1 / 1 Mbps = 1 µsec

*Energy = Power * Time*

where Power is in Watts and Time is in sec

$$\text{Energy}_{\text{Txonebit}} = 1040 * 1 * 10^{-3}\ \text{W} * 1 * 10^{-6}\ \text{sec}$$

Energy RxonebitReadystate = 0.4 µJ/bit
Energy RxonebitMonitorstate = 0.27 µJ/bit

Mica2 Specific Model

Polastre et. al proposed a model that presents the total energy consumption for Mica2 as the summation of energy transmitting, receiving, listening, sampling data and sleeping. Values are calculated using the expected consumption of the CPU and the radio, which can be found in specific datasheets. Table 3 presents a summary of current consumption.

Table 3 Consumption

Operation	Time (s)		I (mA)	
Initialize radio (b)	350E-6	*trinit*	6	*crinit*
Turn on radio (c)	1.5E-3	*tron*	1	*cron*
Switch to RX/TX (d)	250E-6	*trx/tx*	15	*crx/tx*
Time to sample radio (e)	350E-6	*tsr*	15	*csr*
Evaluate radio sample (f)	100E-6	*tev*	6	*cev*
Receive 1 byte	416E-6	*trxb*	15	*crxb*
Transmit 1 byte	416E-6	*ttxb*	20	*ctxb*
Sample sensors	1.1	*tdata*	20	*cdata*

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*Energy = Current * Voltage * Time*
Where current is in Amperes, Voltage is in Volts and Time is in seconds

$$\text{Energy}_{\text{Tx}} = 20 * 10^{-3}\ \text{A} * 3\ \text{Volts} * 416 * 10^{-6}\ \text{sec} / 8\ \text{bits} = 3.12\ \mu\text{J/bit}$$

$$\text{Energy}_{\text{Rx}} = 15 * 10^{-3}\ \text{A} * 3\ \text{Volts} * 416 * 10^{-6}\ \text{sec} / 8\ \text{bits} = 2.34\ \mu\text{J/bit}$$

The difference with the Heinzelman model is two orders of magnitude. With the µAMPS model, energy for transmission is comparable, while energy for reception is one order of magnitude bigger in the e Mica2 case

Mica2 Specific Model

Values presented in the table are calculated independently. The total current is found by summing the consumption for each active components. As an example, in calculating energy per bit transmitted and received, one may include only the CPU in the active state and presume the radio is transmitting with a power of +10dBm (worst case). The authors don't specify the bit rate used, so, assuming the same time used in the previous model, and using expression , the energy cost per bit transmitted is

$$\text{Energy}_{\text{Tx}} = (8+21.5) * 10^{-3}\ \text{A} * 3\ \text{Volts} * 416 * 10^{-6}\ \text{sec} / 8\ \text{bits} = 4.602\ \mu\text{J/bit}$$

1. Energy $_{Rx}$ = $(8+7) * 10^{-3}$ A * 3 Volts * 416 $*10^{-6}$
2. sec / 8 bits = 2.34 µJ/bit

3. Values obtained for this model are very similar to the values obtained for the model presented. The difference in transmitting one bit may be due to the fact that Polastre *et. al* didn't specify the transmission power they were using and this level may be different than the one used .

4. REFERENCES

1. Hou, D. Tipper, D. Yupho and J. Kabara, "GSP: Gossip-based Sleep Protocol for Energy Efficient Routing in Wireless Sensor Networks", The 16th International Conference on Wireless Communications, Calgary, Alberta, Canada, 2004
2. I.F. Akyildiz, W. Su, Y. Sankarasubramaniam and E. Cayirci. "A Survey on Sensor Networks", IEEE Communications Magazine, August 2002.
3. G. Anastasi, M. Conti, A. Falchi, E. Gregori, A. Passarella., "Performance Measurements of Mote Sensor Networks" MSWiM'2004, October 4-6, 2004, Venezia, Italy
4. F. Akyildiz, W. Su, Y. Sankara subramaniam, and E. Cayirci, "Wireless sensory networks: A survey," Comput. Netw., vol. 38, no. 4, pp. 393–422,Mar. 2002.
5. K. Romer and F. Mattern. The design space of wireless sensor networks. IEEE Wireless Communications Magazine,
6. Jennifer Yick, Biswanath Mukherjee, Dipak Ghosal, "Wireless sensor network survey," Computer Networks,Elsevier, vol. 52, pp. 2292-2330, 2008.
7. J. L.Hill, "System architecture for wireless sensor networks," University of California, Berkeley, Ph.D. dissertation 2003.
8. Wadaa, S. Olariu, L. Wilson, K. Jones, and M.Eltoweissy, Training a sensor networks, MONET, January 2005.
9. D.Culler, D. Estrin, M.Srivastava, "Overview ofSensor Networks," Computer Magazine,IEEE,vol. 37, no. 8, pp. 41-49, August 2004.
10. C. Schurghers, V. Raghunathan, S. Park, and M. Srivastava. Energy-Aware Wireless Microsensor Networks. IEEE Signal Proc Mag. 40–50, 2002
11. W. J. Kaiser and G. J. Pottie. Wireless Integrated Network Sensors. CACM. 43(5): 51–58, 2000
12. P. Spanos, V. Raghunathan, and M. Srivastava. Adaptive Power fidelity in Energy Aware Wireless Embedded Systems. IEEE REAL. 2001
13. B. Hohlt, L. Doherty, and E. Brewer. Flexible Power Scheduling for Sensor Networks. IPSN. 205-214, 2004
14. I. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci. A Survey on Sensor Networks. IEEE Commun. Mag. 2002
15. A. Ephremides. Energy concerns in Wireless Sensor Networks. IEEE Wireless Communications. 2002
16. J. Glaser, D. Weber, S. Madani, and S. Mahlknecht. Power Aware Simulation Framework for Wireless Sensor Network and Nodes. Eurasip journal on Embedded systems. 2008
17. A. Savvides, S. Park, and M. Srivastava. Battery Capacity Measurement and Analysis using Lithium Coin Cell Battery. ACM ISLPED. 382-387, 2001
18. E. Shih, S. Cho, N. Ickes, R. Min, A. Sinha, A. Wang, and A. Chandrakasan. Physical Layer Driven Protocol and Algorithm Design for Energy-Efficient Wireless Sensor Networks. ACM SIGMobile. 2001
19. A. E. Gamal, C. N. B. Prabhakar, E. U. Biyikoglu, and S. Zahedi. Energy-Efficient Scheduling of Packet Transmissions over Wireless Networks. IEEE INFOCOM. 2002
20. S. H. Cho, A. Wang, C. G. Sodini, and A. P. Chandrakasan. Energy-Efficient Modulation and MAC for Asymmetric RF Microsensor Systems. ACM ISLPED. 106-111, 2001
21. K. B. Chang, Y. B. Kong, and G. T. Park. Clustering Algorithm in Wireless Sensor Networks Using Transmit Power Control and Soft Computing. IEEE ICIC. 171–175, 2006
22. L. Benini, G. Castelli, A. Macii, and E. Macii. A Discrete-Time Battery Model for High Level Power Estimation. DATE. 35-39, 2000
23. F. Pianegiani, M. Hu, A. Boni, and D. Petri. Energy-Efficient Signal Classification in Ad-hoc Wireless Sensor Networks. IEEE Trans. Instrum. Meas. 57(1), 2008

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