ISSN: 2321-7782 (Online)
Volume 2, Issue 1, January 2014
International Journal of Advance Research in Computer Science and Management Studies
Research Paper
Available online at: www.ijarcsms.com

Energy optimized design for wireless sensor node using data encoding

Nikita Jaideo Gotmare[1]
Department of Electronics Engineering
G.H.R.I.E.T.W
Nagpur - India

Dinesh Rotake[2]
Department of Electronics Engineering
G.H.R.I.E.T.W
Nagpur - India

Abstract: Energy utilisation continues as a foremost obstacle for full deployment and exploitation of wireless sensor network (WSN) expertise nowadays. This paper presents the conceive and implementation of an energy optimize conceive, which can help in assembling energy-efficient WSNs. An energy-efficient scheme, which aspires at minimizing power consumption from both the sensor node grade and the network grade in a WSN, is proposed. To minimize the connection power consumption of the sensor node, data encoding before conveying the facts and figures will help to minimize the power required to transmit a data, then the expanse between the transmitter and the receiver is approximated before available transmission, after that, the smallest transmission power required to transmit the measurement facts and figures is calculated and determined. The sensor nodes are also set to doze mode between two successive measurements for energy keeping in normal functioning situation. Furthermore, power keeping can be achieved by approximating the power utilisation within the entire network under distinct mesh configurations and then by choosing the most energy-efficient one.

Keywords: Data encoding, periodic sleep/wake-up design, wireless sensor mesh (WSN).

I. INTRODUCTION

Fast DEVELOPMENT of system miniaturization, wireless connection, and on-chip signal processing has promoted the development of wireless sensor expertise, which has endowed its broad submissions from condition founded upkeep to developed system monitoring and ecological feeling . The number of wireless sensors, which are normally advised as a wireless sensor network(WSN), established for real-life applications has quickly increased in latest years, and this trend is expected to even more boost in the next years . although, power utilisation still continues as a major obstacle for the full deployment and exploitation of this technology, although electric electric batteries can be recharged, e.g. through solar-energy-harvesting mechanisms. Prior researches have investigated different advances, such as duty-cycling and data-driven advances, for reducing power consumption.The traffic-adaptive intermediate access protocol has been designed to decrease power consumption by permitting sensor nodes to suppose a low-power inactive state when they are not working in transmission or obtaining mode. Data-driven advances can be split up into two distinct classes: data compression and energy-efficient data acquisition. In another study, the sensor mesh was divided into some subsystems, and only high-level inferences are broadcast between the subsystems. In this way, the energy utilisation for communication decreases as the facts and figures to be conveyed decline. For energy-efficient facts and figures acquisition, an adaptive sampling algorithm consisting of duty cycling and adaptive trying is suggested to reduce power utilisation in a sensor mesh. Investigators have also studied other approaches for energy-aware transmission, including modulation climbing designs, multihop routing designs, network sectioning, and low-power hardware. Furthermore, a blend of sleep arranging with impede transmission approach has been proposed to achieve power keeping in a wireless multimedia sensor network. In this paper periodic sleep/wake-up design along with data encoding is added into the sensor node conceive to farther accomplish the node-level energy keeping.

II. SENSING DESIGN

Notion of wireless sensor node suggests that, except for the personal sensing capabilities, the nodes will furthermore be able to process the obtained facts and figures and broadcast the outcomes wirelessly. In latest years, numerous power conservation designs have been proposed in the publications, which suppose that facts and figures acquisition and processing have a power consumption that is significantly smaller than communication. In addition, since each of the sensor nodes in the mesh is power guarded and each constituent in a sensor node consumes a certain allowance of energy, power supply becomes important to double-check correct procedure of the whole WSN as the number of sensors established in a network grows. Therefore, assembling productive network organisations for the application of WSN with concern of power effectiveness is of critical importance.

A. Power utilization Assessment

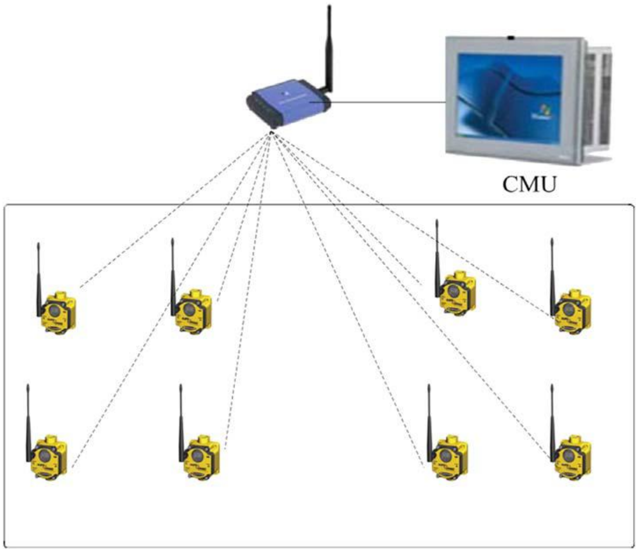

Fig. 1sensing design

After sensing the ecological parameters, the outcomes should be transmitted to the centered supervising unit (CMU) or other sensor nodes. In alignment for two sensor nodes to communicate, the power utilisation required for facts and figures transmission can be expressed as

$$ETx = Ee\_tx \cdot k + \varepsilon amp \cdot d\alpha \ (1)$$

where k is the number of conveyed facts and figures morsels; α is a component valued from 2 to 5, counting on the environment of wireless transmission; d is the expanse between two sensor nodes; εamp (J/b/m2) is the amplification coefficient to persuade a smallest bit mistake rate to double-check reliable greeting at the receiver; and Ee_tx (J/b) is the power dissipated to function the transceiver, which is granted as

$$Ew\_tx = Vcc \cdot ITP/Kdata\_rate \ (2)$$

where Vcc denotes the working voltage, ITP denotes the current for transmission, and Kdata_rate denotes the data transmission rate. The power consumed for obtaining a facts and figures stream can be conveyed as

$$ERx = Ee\_rx \cdot k \ (3)$$

Formula (1) displays that, for a repaired distance, the power consumed is proportional to the number of data bits. On the other hand, the longer the distance between two sensor nodes is, the more energy will be consumed.

III. CONCEIVE OF THE ENERGY AWARE SENSOR MODE

In alignment to supply energy-efficient feeling in a WSN, an energy-aware sensor node is designed and implemented in this part. The comprehensive data is described in the following discussion.

A. Connection Module

In the feeling design designed for the WSN, it is presumed that the transmission power is minimized to ensure dependable reception at the receiver end, according to the connection expanse between two sensor nodes. By assuming a unit pointer gain provided by antennas, the yield power of the connection module is overridden by the utilisation for power amplifier. To convey 1 bit to the receiver, the output power and affiliated received power are expressed as

$$PTx=(\varepsilon amp*R)*\hat{d}^{\propto} \quad (5)$$

$$PRx=PTx/d^{\propto}=(\varepsilon amp*R)*\left(\hat{d}/d^{\propto}\right)^{\propto}=Ps*\left(\hat{d}/d^{\propto}\right)^{\propto} \quad (6)$$

where R denotes the facts and figures transmission rate, ˆ d and d are the approximated and genuine transmission distances between the transmitter and the receiver, respectively, and PS = εamp ・ R is the receiver sensitivity denoting the minimum signal power that the receiver can recognise. From (7), it is seen that, if the estimated expanse ˆd d (overestimation), which means a received power that is higher than receiver sensitivity, then a piece of the transmission power will be lost on the propagation path while not influencing the results of signal greeting. In this case, the power efficiency difficulty is translated to the productive estimation of communication expanse between two sensor nodes.

B. Periodic Sleep/Wake-Up Scheme

Except for the adaptive RF power provide as recounted in the preceding part, the node-level energy keeping is furthermore accomplished through the periodic sleep/wake-up design. As we know if a WSN is established in remote areas or under rough environments where manually recharging electric electric batteries for sensors is not feasible, one typical alternate approach for power keeping is to turn off some sensors and to activate only a necessary set of sensors while providing a good feeling treatment and mesh connectivity simultaneously. In gradually varying parameter measurements, such as warmth, not all sensor nodes are required to stay in hardworking mode. Thus, in alignment to save power utilisation, the sensor nodes are conceived to be put into a doze mode with a timer that works out their doze length. When the timer overflows and cut off happens, and it will wake those nodes up and will then present measurements and facts and figures transmission.

IV. EXPECTED RESULTS

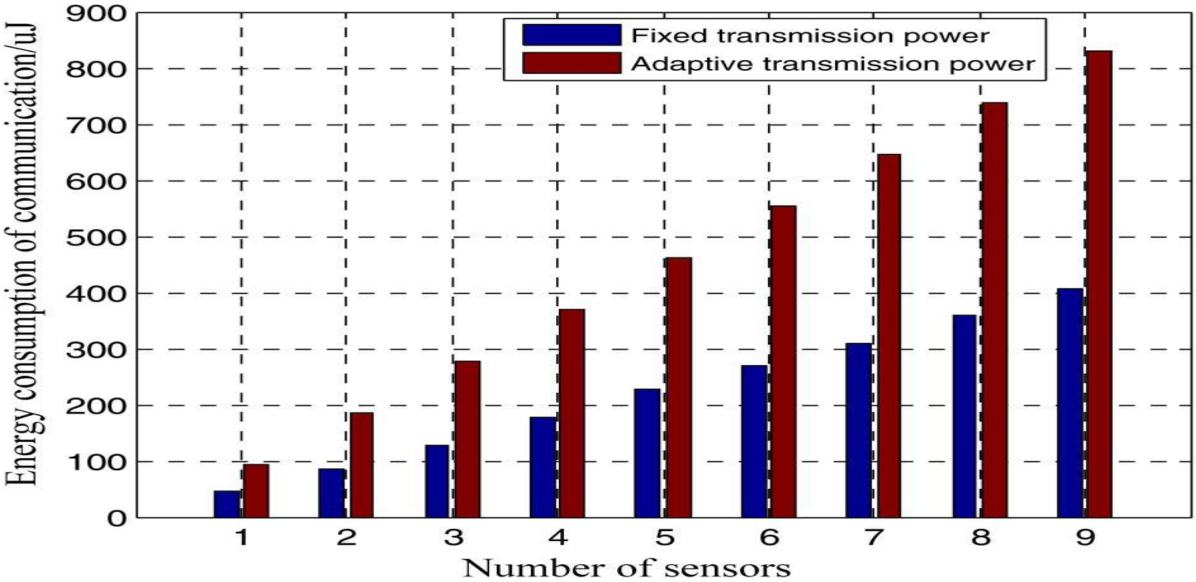

Fig 2. Communication energy consumption of the sensor network with different scales.

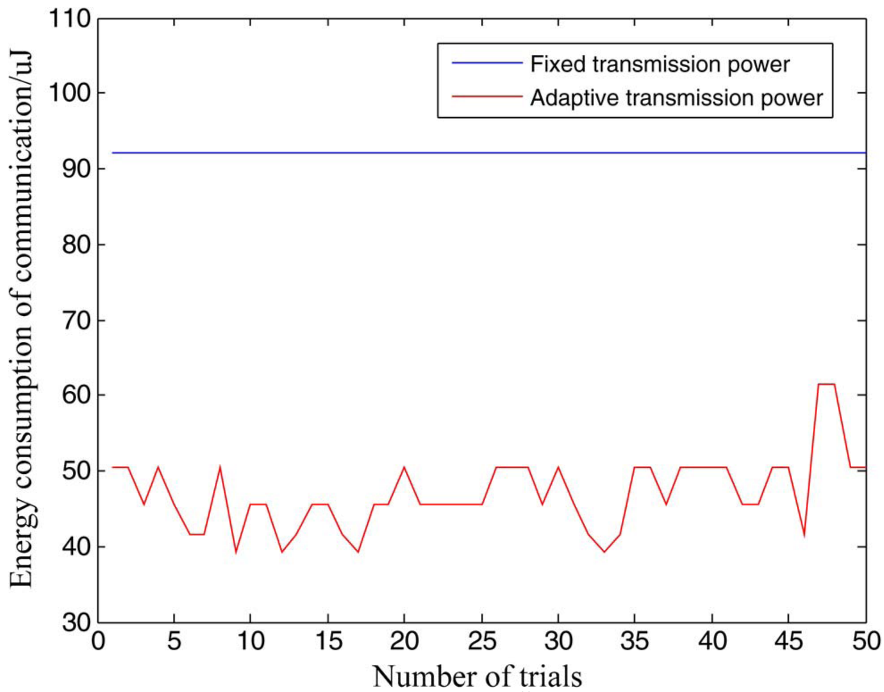

Fig. 3. Communication energy consumption under different transmission power settings.

V. Conclusion

This task, we have offered the design and implementation of an "energy optimized conceive for wireless sensor node using data encoding", which can help in assembling an energy-efficient WSN through facts and figures encoding before conveying the facts and figures and furthermore by "node-level power saving" and "network-level power saving". The "node level power saving is accomplished by adaptive transmission power setting and by the periodic sleep/wake-up design, while the "network-level power saving" is accomplished by adaptive mesh configuration

VI. Future Scope

To implement "energy optimize design for wireless sensor node using data encoding" for mesh as well as tree topology.

References

1. C. Chong and S. P. Kumar, "Sensor networks: Evolution, opportunities, challenges," Proc. IEEE, vol. 91, no. 8, pp. 1247–1256, Aug. 2003.
2. R. Gao and Z. Fan, "Architectural design of a sensory node controller for optimized energy utilization in sensor networks," IEEE Trans. Instrum.Meas., vol. 55, no. 2, pp. 415–428, Apr. 2006.
3. A. Tiwari, P. Ballal, and F. L. Levis, "Energy-efficient wireless sensor network design and implementation for condition-based maintenance,"ACM Trans. SeSns. Netw., vol. 3, no. 1, pp. 1–23, Mar. 2007.
4. F. Salvadori, M. Campos, P. Sausen, R. Camargo, C. Gehrke, C. Rech,M. Spohn, and A. Oliveira, "Monitoring in industrial systems using wireless sensor network with dynamic power management," IEEE Trans.Instrum. Meas., vol. 58, no. 9, pp. 3104–3111, Sep. 2009.
5. D. Gallo, C. Landi, and N. Pasquino, "Multisensor network for urban electromagnetic field monitoring," IEEE Trans. Instrum. Meas., vol. 58, no. 9, pp. 3315–3322, Sep. 2009.
6. ON World Inc., Wireless Sensor Networks: Growing Markets, Accelerating Demands, Jul. 2005. [Online]. Available: http://www.onworld.com/ html/wirelesssensorsrprt2.htm
7. Embedded WiSeNTs Consortium, Embedded WiSeNTs Research Roadmap (Deliverable 3.3). [Online]. Available: http://www.embedded-wisents.org/
8. C. Alippi and C. Galperti, "An adaptive system for optimal solar energy harvesting in wireless sensor network nodes," IEEE Trans. Circuits Syst.I, Reg. Papers, vol. 55, no. 6, pp. 1742–1750, Jul. 2008.
9. A. Giuseppe, C.Marco, and D. F. Mario, "Energy conservation in wireless sensor networks: A survey," Ad Hoc Netw., vol. 7, no. 3, pp. 537–568,May 2009.
10. C. Schurgers, V. Tsiatsis, and M. B. Srivastava, "STEM: Topology management for energy efficient sensor networks," in Proc. IEEE Aerosp. Conf., 2002, pp. 3-1099–3-1108.
11. V. Rajendran, K. Obraczka, and J. J. Garcia-Luna-Aceves, "Energyefficient,collision-free medium access control for wireless sensor networks," Wireless Netw., vol. 12, no. 1, pp. 63–78, Feb. 2006.

12. A. Kadrolkar, R. Gao, and R. Yan, “Energy efficient data transmission for manufacturing system health monitoring,” in Proc. 9th Int. Conf. Frontiers Des. Manuf., Changsha, China, Jul. 2010, pp. 65–70.
13. R. Yan, D. Ball, A. Deshmukh, and R. Gao, “A Bayesian network approach to energy-aware distributed sensing,” in Proc. IEEE Sens. Conf., Vienna, Austria, Oct. 2004, pp. 44–47.
14. C. Alippi, G. Anastasi, M. D. Francesco, and M. Roveri, “An adaptive sampling algorithm for effective energy management in wireless sensor networks with energy-hungry sensors,” IEEE Trans. Instrum. Meas.,vol. 59, no. 2, pp. 335–344, Feb. 2010.
15. V. Raghunathan, C. Schurgers, and S. Park, “Energy-aware wireless microsensor networks,” IEEE Signal Process. Mag., vol. 19, no. 2, pp. 40–50, Mar. 2002.
16. C. Schurgers, V. Raghunathan, and M. Srivastava, “Power management for energy-aware communication systems,” ACM Trans. Embedded Comput. Syst., vol. 2, no. 3, pp. 431–447, Aug. 2003.
17. E. Biyikoglu, B. Prabhakar, and A. Gamal, “Energy efficient packet transmission over a wireless link,” IEEE/ACM Trans. Netw., vol. 10, no. 4, pp. 487–499, Aug. 2002.
18. R. Gao, A. Deshmukh, R. Yan, and Z. Fan, “Energy efficient wireless sensor network for dynamic system monitoring,” in Proc. SPIE, 2005, vol. 5999, no. 4, pp. 1–10.
19. D. Ball, R. Yan, T. Licht, A. Deshmukh, and R. Gao, “A strategy for decomposing large-scale energy-constrained sensor networks for system monitoring,” Product. Plann. Control, vol. 19, no. 4, pp. 435–447, 2008.
20. A. Wang, W. Heinzelman, A. Sinha, and A. Chandrakasan, “Energyscalable protocols for battery-operated microsensor networks,” J. VLSI Signal Process. Syst. Signal Image Video Technol., vol. 29, no. 3, pp. 223–237, Nov. 2001.
21. C. Sha, R. Wang, H. Huang, and L. Sun, “An energy-saving strategy based on sleep scheduling and block transmission for wireless multimedia sensor networks,” Int. J. Pervas. Comput. Commun., vol. 6, no. 2, pp. 248–267, 2010.
22. H. Sun, Y. Qian, and R. Yan, “Design and realization of an intelligent sensor node with its application in energy-aware WSNs,” in Proc. IEEE I2MTC, Graz, Austria, May 11–13, 2012, pp. 941–946.
23. A. Wang and A. Chandrakasan, “Energy-efficient DSPs for wireless sensor networks,” IEEE Signal Process. Mag., vol. 19, no. 4, pp. 68–78,Jul. 2002.
24. Texas Instruments, CC1101 Data Sheet 2010. [Online]. Available: www.ti.com.cn
25. A. Chehri, P. Fortier, and M. Tardif, “UWB-based sensor networks for localization in mining environments,” Ad Hoc Netw., vol. 7, no. 5,pp. 987–1000, Jul. 2009.
26. G. Nan, G. Shi, Z. Mao, and M. Li, “CDSWS: Coverage-guaranteed distributed sleep/wake scheduling for wireless sensor networks,” EURASIP J. Wireless Commun. Netw., vol. 44, pp. 762–776, Feb. 2012.

AUTHOR(S) PROFILE

Miss Nikita Jaideo Gotmare, doing M.tech in V.L.S.I (4th Sem) from G.H.R.I.E.T.W under R.T.M.N.U and possessing B.E degree in Electronics and telecommunication engineering from R.G.C.E.R. under R.T.M.N.U in 2012.