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Performance Analysis of Routing Metrics Using Signal Processing Techniques in WSN

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ABSTRACT: In real world wireless sensor networks (WSNs) emerge as an active research area in which challenging topics involve energy consumption, routing algorithms, selection of sensors location according to a given premise, robustness, efficiency, and so forth. Despite the open problems in WSNs, there are already a high number of applications available. In all cases for the design of any application, one of the main objectives is to keep the WSN alive and functional as long as possible. The new localization technique combines the received signal strength indicator method which limits the communications between nodes to the range of accessible radiated signal, with a new trend which is social network analysis that deals with relationships between nodes in any network with metrics and layouts in this paper, the reviewed works are classified into distributed and centralized techniques. The analysis is focused on whether a single or multiple sinks are employed, nodes are static or mobile, the formation is event detection based or not, and network backbone is formed or not. We focus on recent works and present a discussion of their advantages and drawbacks. Finally, the paper overviews a series of open issues which drive further research in the area.

I. INTRODUCTION

The sensor information is usually collected through the available *gateways* in a given topology. This information is then forwarded to a leader node or to a base station known as *sink*. The design complexity of a WSN depends on the specific application requirements such as the number of nodes, the power consumption, the life span of the sensors, information to be sensed and its timing, geography of where the sensors are placed, the environment, and the context. This survey presents most recent formation techniques and mechanisms for the WSNs. In this paper, the reviewed research works are classified into *distributed* and *centralized* techniques. In the former, nodes are autonomous and the communication is only between neighboring nodes while, for the latter, the network formation is controlled by a single device. This research carried out the bandwidth & Energy consumption which related to overcome the transmission of packet- delay.

II. RELATED WORKS

2.1 DATA GATHERING TECHNIQUES

We can classify data gathering schemes on the basis of the research field from which the technique used to exploit correlation among sensor nodes is drawn, that is,

- (i) signal processing;
- (ii) compressive sensing;
- (iii) information theory;
- (iv) networking.

Techniques belonging to the above fields are discussed in the next subsections by highlighting their advantages and drawbacks.

2.2 SIGNAL PROCESSING TECHNIQUES

Frequently high correlations (spatial and/or temporal) among sensor readings exist. In this case, it is inefficient to deliver the entire raw data to the destination [8, 9] and signal processing, in particular Transforms and Encoding Compression (TEC) techniques, can be exploited in order to reduce the amount of data to send.

In the case of local TEC techniques, node collects measurements following the Shannon-Nyquist sampling theorem; these measurements are transformed and properly encoded and the output of such transformation is stored in the payload of one or more packets and sent to the sink. In particular, either lossy or lossless techniques can be used

depending on the particular application scenario. In this technique which signal measures to prevent the delay-convergence. With lossy techniques [3], the original data is compressed discarding some of the original information; this allows achieving higher compression ratios but at the receiver side one can only reconstruct the data with a certain accuracy. However, in some types of monitoring, the accuracy of observations is critical for understanding the underlying physical processes. In other cases, it is not possible to have an a priori knowledge about the magnitude of observational errors that are tolerable without affecting a correct data gathering. Moreover, some application domains (e.g., body area networks BANs in which sensor nodes permanently monitor and log vital signs) demand sensors with high accuracy and cannot tolerate measurements corrupted by lossy compression processes. The Image data can be partially recognized pixels in the position of the image size and clarity.

In all these kinds of WSNs, lossless data gathering is essential and desirable. Examples of local lossless compression schemes have been proposed in [4, 23, and 24].

Lossy compression techniques have been evaluated and compared in terms of reconstruction errors and energy consumptions in [22]; therefore, in this paper we concentrate our attention on lossless techniques.

For the sake of space, we did not consider distributed TEC techniques in this paper but we refer the reader to [13]. Nevertheless, the major distributed approaches of signal processing applied to WSNs will be discussed in the next subsections.

2.3 NETWORK CODING BASED TECHNIQUES

A different approach exploits the network coding (NC) paradigm. NC is an effective information transmission approach originally introduced by Allseed et al. [38] to improve network capacity of multicast networks. Differently from the classical store and forward network paradigm where nodes simply replicate and forward incoming packets, using NC intermediate nodes in the network have the ability to forward functions of received packets (e.g., linear combinations). In this manner, throughput gain, robustness, and energy saving can be achieved by exploiting the fact that each newly generated packet carries information contained in several original packets [39]. NC has received increasing attention also in WSNs as a promising tool to improve network lifetime and reliability by exploiting the broadcast nature of the wireless channel [40]. However, most of the proposed techniques developed so far [41–43], whilst being useful for data dissemination (e.g., traffic from the sink node to the sensor nodes), cannot be applied for data collection, which is the most important traffic in WSNs. In fact, to apply NC for data gathering in WSNs, some issues have to be solved.

(i) **Header Overhead.** NC schemes are mostly based on random linear codes [44, 45] which allow implementing them in a distributed manner but introduce large overhead because coefficients used for linear combinations should be specified in packets header. The header size is proportional to the number of aggregated packets that, in the specific case of data collection in WSNs, could be equal to the number of nodes in the network.

(ii) **All-or-Nothing Problem.** When n packets are combined using NC, the sink has to receive at least n packets in order to be able to recover the original information. Thus, even if the sink receives $n-1$ packets, it cannot recover any information. Instead, graceful degradation is desirable in WSNs.

(iii) **Delay.** The delay introduced by NC might be prohibitive for large networks where a large number of packets should be combined and decoded. Instead, many sensor networks applications, for instance, WSNs developed for control/automation or real-time audio/video streaming, require small bounded delays. In the Streaming the video data content this technique is compressed and packet size of the data with maximum data transmission rates to overcome the delay and increase the packet-delivery ratio.

(iv) **Duty Cycling.** Most of NC schemes are based on overhearing; that is, nodes should remain in active mode to participate in NC-based routing, which increases the energy consumption of the sensor nodes. So, it is difficult to couple NC paradigm and duty-cycling techniques commonly used in WSNs.

(v) **Reliability.** Full (or at least high) reliability is desirable in sensor networks and is mandatory in several scenarios, for instance, in new scientific experiments, where accuracy of observations is critical, or in the case of biomedical applications, where it is necessary to ensure that important details are not lost causing errors in medical diagnosis. When random codes are used, even in a reliable network, the original messages can be retrieved with “high probability” (though not “certainty”), and high probability is achieved through the use of large finite fields (i.e., large coefficients and therefore large headers).



(vi) **Complexity.** NC techniques should be simple to cope with low computational and memory resources of sensor nodes. We refer the reader to [46] for further considerations on the applicability of NC to WSNs. The above issues have been solved in [16] where the authors proposed a new forwarding technique for WSNs based on the Chinese Remainder Theorem (CRT) able to achieve different trade-offs between reliability and energy saving.

III. CONCLUSION

WSNs are exposed to numerous security threats that can endanger the success of applications. Security support in WSNs is challenging due to the limited energy, communication bandwidth, and computational power. Also, sensors are often deployed in an open environment where no physical security is available. Given the diversity of WSN applications and possibly different security requirements, we think special enhancing security approaches to securing WSN is necessary. To recapitulate, the contributions of this book are. Security of WSN is considered through QoS. Using QoS components, we evaluated models and system-level test using sensor nodes. One primordial issue is to satisfy application QoS requirements while providing a high-level abstraction that addresses WSN security. With the proposed approach, such tests can be easily parallelized by applying wireless broadcast to many nodes at once. As a result, the proposed approach can be used in variety of testing scenarios. A secure model is proposed with flow of security classes providing different levels of security using QoS. However our finding found that effects of security metrics place a lot of burden on the QoS of the overall system thus decreasing performance. Mathematical model for WSN security. We need a theoretical foundation to determine the minimum number of sensors to be deployed so that intruders crossing a barrier of sensors will always be detected. However the sensor nodes deployed should have the security implemented in them as suggested with our findings. We present the fundamental mathematical model design for sensor nodes that can be used to secure different WSNs topology against intruders.

REFERENCES

1. Akyildiz, I. F., Su, W., Sankarasubramaniam, Y., Cayirci, E. A survey on sensor networks IEEE Communications Magazine 2002 40(8):1021-1030. [10.1109/MCOM.2002.10244222-s2.0-0036688074](https://doi.org/10.1109/MCOM.2002.10244222-s2.0-0036688074)
Google Scholar | Crossref | ISI
2. Xiong, Z., Liveris, A. D., Cheng, S. Distributed source coding for sensor networks IEEE Signal Processing Magazine 2004 21(5):40-50. [10.1109/msp.2004.13280912-s2.0-4544313438](https://doi.org/10.1109/msp.2004.13280912-s2.0-4544313438)
Google Scholar | Crossref | ISI
3. Zordan, D., Martinez, B., Vilajosana, I., Rossi, M. On the performance of lossy compression schemes for energy constrained sensor networking ACM Transactions on Sensor Networks 2014 11(1), article 1510. [10.1145/26296602-s2.0-84907197951](https://doi.org/10.1145/26296602-s2.0-84907197951)
Google Scholar | Crossref | ISI
4. Campobello, G., Giordano, O., Segreto, A., Serrano, S. Comparison of local lossless compression algorithms for wireless sensor networks Journal of Network and Computer Applications 2015 47(2):331-340. [10.1016/j.jnca.2014.09.0132-s2.0-84908450433](https://doi.org/10.1016/j.jnca.2014.09.0132-s2.0-84908450433)
Google Scholar | Crossref | ISI
5. Chou, J., Petrovic, D., Ramachandran, K. A distributed and adaptive signal processing approach to reducing energy consumption in sensor networks 2 Proceedings of the 22nd Annual Joint Conference of the IEEE Computer and Communications (INFOCOM '03) March-April 2003 San Francisco, Calif, USA IEEE 1054106210. [10.1109/INFCOM.2003.1208942](https://doi.org/10.1109/INFCOM.2003.1208942) Google Scholar | Crossref
6. He, X., Zhou, X., Juntti, M., Matsumoto, T. Data and error rate bounds for binary data gathering wireless sensor networks Proceedings of the IEEE 16th International Workshop on Signal Processing Advances in Wireless Communications (SPAWC '15) June 2015 Stockholm, Sweden 505-509. [10.1109/spawc.2015.7227089](https://doi.org/10.1109/spawc.2015.7227089)
Google Scholar | Crossref
7. Karakus, C., Gurbuz, A. C., Tavli, B. Analysis of energy efficiency of compressive sensing in wireless sensor networks IEEE Sensors Journal 2013 13(5):1999-2008. [10.1109/jsen.2013.22440362-s2.0-84876221016](https://doi.org/10.1109/jsen.2013.22440362-s2.0-84876221016)
Google Scholar | Crossref | ISI
8. Zheng, H., Xiao, S., Wang, X., Tian, X., Guizani, M. Capacity and delay analysis for data gathering with compressive sensing in wireless sensor networks IEEE Transactions on Wireless Communications 2013 12(2):792-801. [10.1109/TWC.2012.122212.1210322-s2.0-84874947147](https://doi.org/10.1109/TWC.2012.122212.1210322-s2.0-84874947147)
Google Scholar | Crossref | ISI



9. Zheng, H., Yang, F., Tian, X., Gan, X., Wang, X., Xiao, S. Data gathering with compressive sensing in wireless sensor networks: a random walk based approach *IEEE Transactions on Parallel and Distributed Systems* 2015 26(13):544-10.1109/tpds.2014.23082122-s2.0-84919680956
Google Scholar | Crossref | ISI
10. Zhu, L., Ci, B., Liu, Y., Chen, Z. D. Data gathering in wireless sensor networks based on reshuffling cluster compressed sensing *International Journal of Distributed Sensor Networks* 2015 2015:1310.1155/2015/260913
Google Scholar | SAGE Journals | ISI
11. Candes, E. J., Tao, T. Near-optimal signal recovery from random projections: universal encoding strategies? *IEEE Transactions on Information Theory* 2006 52(12):5406-5425.10.1109/tit.2006.885507MR23007002-s2.0-33947416035
Google Scholar | Crossref | ISI
12. Donoho, D. L. Compressed sensing *IEEE Transactions on Information Theory* 2006 52(4):1289-1306.10.1109/tit.2006.871582MR22411892-s2.0-33645712892
Google Scholar | Crossref | ISI
13. Srisooksai, T., Keamarungsi, K., Lamsrichan, P., Araki, K. Practical data compression in wireless sensor networks: a survey *Journal of Network and Computer Applications* 2012 35(13):759-10.1016/j.jnca.2011.03.0012-s2.0-82155167426
Google Scholar | Crossref | ISI
14. Chang, J.-H., Tassiulas, L. Maximum lifetime routing in wireless sensor networks *IEEE/ACM Transactions on Networking* 2004 12(4):609-619.10.1109/TNET.2004.8331222-s2.0-4644360171
Google Scholar | Crossref | ISI
15. Wu, Y., Mao, Z., Fahmy, S., Shroff, N. B. Constructing maximum-lifetime data-gathering forests in sensor networks *IEEE/ACM Transactions on Networking* 2010 18(5):1571-1584.10.1109/TNET.2010.20458962-s2.0-77958121214
Google Scholar | Crossref | ISI
16. Campobello, G., Leonardi, A., Palazzo, S. Improving energy saving and reliability in wireless sensor networks using a simple CRT-based packet-forwarding solution *IEEE/ACM Transactions on Networking* 2012 20(19):1205-10.1109/tnet.2011.21584422-s2.0-84857359551
Google Scholar | Crossref | ISI
17. Gong, D., Yang, Y. Low-latency SINR-based data gathering in wireless sensor networks *IEEE Transactions on Wireless Communications* 2014 13(6):3207-3221.10.1109/TWC.2014.042114.1303472-s2.0-84903276735
Google Scholar | Crossref | ISI
18. Hua, C., Yum, T.-S. P. Optimal routing and data aggregation for maximizing lifetime of wireless sensor networks *IEEE/ACM Transactions on Networking* 2008 16(4):892-903.10.1109/TNET.2007.9010822-s2.0-50149087740
Google Scholar | Crossref | ISI
19. Campobello, G., Serrano, S., Galluccio, L., Palazzo, S. Applying the Chinese remainder theorem to data aggregation in wireless sensor networks *IEEE Communications Letters* 2013 17(5):1000-1003.10.1109/LCOMM.2013.040213.1224302-s2.0-84878742044
Google Scholar | Crossref | ISI
20. Xing, X., Xie, D., Wang, G. Energy-balanced data gathering and aggregating in wsns: a compressed sensing scheme *International Journal of Distributed Sensor Networks* 2015 2015:1058-5191.10.1155/2015/585191
Google Scholar | SAGE Journals | ISI
21. Lim, C. Network coding for severe packet reordering in multihop wireless networks *International Journal of Distributed Sensor Networks* 2015 2015:937-910.10.1155/2015/379108
Google Scholar | SAGE Journals | ISI
22. Rossi, M., Hooshmand, M., Zordan, D., Zorzi, M. Evaluating the gap between compressive sensing and distributed source coding in WSN *Proceedings of the International Conference on Computing, Networking and Communications (ICNC '15)* February 2015 Garden Grove, Calif, USA *IEEE* 9119:1710.1109/icnc.2015.7069468
Google Scholar | Crossref
23. Marcelloni, F., Vecchio, M. An efficient lossless compression algorithm for tiny nodes of monitoring wireless sensor networks *The Computer Journal* 2009 52(8):998-710.1093/comjnl/bxp0352-s2.0-77954255661
Google Scholar | Crossref | ISI
24. Liang, Y., Peng, W. Minimizing energy consumptions in wireless sensor networks via two-modal transmission *ACM SIGCOMM Computer Communication Review* 2010 40(1):218-10.1145/1672308.1672311
Google Scholar | Crossref | ISI

25. Chen, S. S., Donoho, D. L., Saunders, M. A. Atomic decomposition by basis pursuit SIAM Review 2001 43:1129-159. 10.1137/S003614450037906XMR1854649ZBL0979.940102-s2.0-0035273106
Google Scholar | Crossref | ISI
26. Tropp, J. A., Gilbert, A. C. Signal recovery from random measurements via orthogonal matching pursuit IEEE Transactions on Information Theory 2007 53:1246-554. 66610.1109/tit.2007.909108MR24469292-s2.0-64649083745
Google Scholar | Crossref | ISI
27. Tropp, J. A., Needell, D. CoSaMP: iterative signal recovery from incomplete and inaccurate samples Applied and Computational Harmonic Analysis 2009 26:330-132. 110.1016/j.acha.2008.07.002MR25023662-s2.0-62749175137
Google Scholar | Crossref | ISI
28. Candes, E., Wakin, M. An introduction to compressive sampling IEEE Signal Processing Magazine 2008 25:22-31. 10.1109/msp.2007.914731 Google Scholar | Crossref | ISI
29. Chandrasekaran, V., Recht, B., Parrilo, P. A., Willsky, A. S. The convex geometry of linear inverse problems Foundations of Computational Mathematics 2012 12:680-584. 910.1007/s10208-012-9135-7MR29894742-s2.0-84868193996 Google Scholar | Crossref | ISI
30. Wang, X., Zhao, Z., Xia, Y., Zhang, H. Compressed sensing for efficient random routing in multi-hop wireless sensor networks Proceedings of the IEEE GLOBECOM Workshops (GC Wkshps '10) December 2010 Miami, Fla, USA IEEE 2010 26:271-10.1109/GLOCOMW.2010.5700323 Google Scholar | Crossref
31. Razi, A., Yasami, K., Abedi, A. On minimum number of wireless sensors required for reliable binary source estimation Proceedings of the IEEE Wireless Communications and Networking Conference (WCNC '11) March 2011 Cancun, Mexico IEEE 2011 18:521-527. 10.1109/wcnc.2011.57794152-s2.0-79959321647
Google Scholar | Crossref
32. Pradhan, S. S., Ramchandran, K. Distributed source coding using syndromes (discuss): design and construction Proceedings of the Data Compression Conference (DCC '99) March 1999 158:1672-s2.0-0032651629
Google Scholar
33. Chang, J.-H., Tassiulas, L. Routing for maximum system lifetime in wireless ad-hoc networks Proceedings of the 37th Annual Allerton Conference on Communication Control and Computing September 1999 Monticello, Ill, USA 1191-1200 Google Scholar
34. Chang, J.-H., Tassiulas, L. Energy conserving routing in wireless ad-hoc networks 1 Proceedings of the 19th IEEE Annual Joint Conference of the IEEE Computer and Communications Societies (INFOCOM '00) March 2000 223:110.1109/INFCOM.2000.832170 Google Scholar | Crossref
35. Guo, S., Yang, Y., Wang, C. DaGCM: a concurrent data uploading framework for mobile data gathering in wireless sensor networks IEEE Transactions on Mobile Computing 2016 15:3610-62610.1109/TMC.2015.2418202
Google Scholar | Crossref | ISI
36. Guo, S., Wang, C., Yang, Y. Joint mobile data gathering and energy provisioning in wireless rechargeable sensor networks IEEE Transactions on Mobile Computing 2014 13:1228-3628. 5210.1109/TMC.2014.23073322-s2.0-84908507221
Google Scholar | Crossref | ISI
37. Zhao, M., Li, J., Yang, Y. A framework of joint mobile energy replenishment and data gathering in wireless rechargeable sensor networks IEEE Transactions on Mobile Computing 2014 13:1226-8927. 510.1109/TMC.2014.23073352-s2.0-84908541632
Google Scholar | Crossref | ISI
38. Ahlswede, R., Cai, N., Li, S.-Y. R., Yeung, R. W. Network information flow IEEE Transactions on Information Theory 2000 46:4120-4121. 610.1109/18.850663MR17685422-s2.0-0034229404
Google Scholar | Crossref | ISI
39. Fragouli, C., Le Boudec, J.-Y., Widmer, J. Network coding: an instant primer ACM SIGCOMM Computer Communication Review 2006 36:16368
Google Scholar | Crossref | ISI
40. Ostovari, P., Wu, J., Khreishah, A. Network Coding Techniques for Wireless and Sensor Networks 2013 Berlin, Germany Springer Google Scholar
41. Chachulski, S., Jennings, M., Katti, S., Katabi, D. Trading structure for randomness in wireless opportunistic routing ACM SIGCOMM Computer Communication Review 2007 37:416-918. 10.1145/1282427.1282400
Google Scholar | Crossref | ISI
42. Hou, I.-H., Tsai, Y.-E., Abdelzaher, T. F., Gupta, I. AdapCode: Adaptive network coding for code updates in wireless sensor networks Proceedings of the 27th IEEE Communications Society Conference on Computer Communications (INFOCOM '08) April 2008 Phoenix, Ariz, USA 2189-2197. 10.1109/infocom.2007.2112-s2.0-51349100852 Google Scholar | Crossref



43. Yang, Z., Li, M., Lou, W.R-code: network coding based reliable broadcast in wireless mesh networks with unreliable links Proceedings of the IEEE Global Telecommunications Conference (GLOBECOM '09) November 2009 Honolulu, Hawaii, USA IEEE 1610.1109/glocom.2009.54261752-s2.0-77951615036
Google Scholar | Crossref
44. Ho, T., Koetter, R., Medard, M., Karger, D. R., Ho, T., Effros, M. The benefits of coding over routing in a randomized settings Proceedings of the IEEE International Symposium on Information Theory July 2003 Yokohama, Japan 10.1109/ISIT.2003.1228459 Google Scholar | Crossref
45. Ho, T., Medard, M., Koetter, R., Karger, D. R., Effros, M., Shi, J., Leong, B. A random linear network coding approach to multicast IEEE Transactions on Information Theory 2006 52:1044-1344 10.1109/tit.2006.881746 MR23008272-s2.0-33947399169
Google Scholar | Crossref | ISI
46. Voigt, T., Roedig, U., Landsiedel, O., Samarasinghe, K., Prasad, M. B. On the applicability of network coding in wireless sensor networks ACM SIGBED Review 2012 9:346-48 10.1145/2367580.2367588
Google Scholar | Crossref
47. Campobello, G., Leonardi, A., Palazzo, S. On the use of Chinese remainder theorem for energy saving in wireless sensor networks Proceedings of the IEEE International Conference on Communications (ICC '08) May 2008 Beijing, China 27232727 10.1109/icc.2008.5142-s2.0-51249098030
Google Scholar | Crossref
48. Leonardi, A., Campobello, G., Serrano, S., Palazzo, S. Trade-offs between energy saving and reliability in low duty cycle wireless sensor networks using a packet splitting forwarding technique EURASIP Journal on Wireless Communications and Networking 2010 2010:932345 10.1155/2010/9323452-s2.0-77957832082
Google Scholar | Crossref | ISI
49. Campobello, G., Leonardi, A., Palazzo, S. A novel reliable and energy-saving forwarding technique for wireless sensor networks Proceedings of the 10th ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc '09) May 2009 New Orleans, La, USA 26927810.1145/1530748.15307862-s2.0-70450207962
Google Scholar | Crossref
50. Alsoufi, T. A. A., Hammoudeh, M., Bandar, Z., Nisbet, A. An overview and classification of approaches to information extraction in wireless sensor networks Proceedings of the 5th International Conference on Sensor Technologies and Applications (SENSORCOMM '11) August 2011 Nice, France IARIA 255260
Google Scholar
51. Cover, T. M., Thomas, J. A. Elements of Information Theory 1991 New York, NY, USA Wiley-Interscience 10.1002/0471200611MR1122806



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