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A Survey on Energy Efficient Data Mining in WSN

Er. Shalini Chopra, Er.Tarun Dhiman
Dept. of CSE
KUK Kurukshetra
Haryana , India

Abstract- The main motive of this research is to study energy-efficient data-gathering mechanisms to detect sensor data irregularities Detection of sensor data irregularities is useful for practical applications as well as for network management, because the patterns found can be used for both decision making in applications and system performance tuning. For example, irregularities in sensory data are of interest of monitoring applications. In addition, for this kind of applications, the communication cost can be reduced if only abnormal sensory values, as opposed to all values, need to be transmitted.

Keywords:--WSN, Anomalies, data mining, Mobile Robots, TSPN

I. INTRODUCTION

A .WIRELESS SENSOR NETWORKS

A Wireless sensor network is composed of tens to thousands of sensor nodes which are densely deployed in a sensor field and have the capability to collect data and route data back to base station. Wireless Sensor Network is used in many application now a days [1], such as detecting and tracking troops, tanks on a battlefield, measuring traffic flow on roads, measuring humidity and other factors in fields, tracking personnel in buildings. Sensor nodes consist of sensing unit, processing unit, and power unit. The "many - tiny" principle: wireless networks of thousands of inexpensive miniature devices capable of computation, communication and sensing A WSN application there are two types of nodes: source node – the node which actually sense and collect data – and sink node – the node to which the collected data is sent. The sinks can be part of the network or outside the wireless sensor networks. Usually, there is more number of source nodes than sink nodes. In most of the general WSN applications the sink node does not concern itself with the identification of the source nodes but only about the collected data except in situations where it is required to authenticate the sources.

1.2 CHALLENGES FOR WSN

The main design goal of wireless sensor networks is to transmit data by increasing the lifetime of the network and by employing energy efficient routing protocols. Depending on the applications used, different architectures and designs have been applied in sensor networks. Again, the performance of a routing protocol depends on the architecture and design of the network, so the architecture and design of the network is very important features in WSNs. The design of the wireless sensor network is affected by many challenging factors which must be overcome before an efficient network can be achieved in WSNs. In the following section we try to describe the architectural issues and challenges for WSNs.

Node Distribution: Node distribution [12] in WSNs is either deterministic or self-organizing and application dependant. The uniformity of the node distribution directly affects the performance of the routing protocol used for this network. In the case of deterministic node distribution, the sensor nodes are mutually placed and gathered data is transmitted through pre-determined paths. In the other case, the sensor nodes are spread over the area of interest randomly thus creating an infrastructure in an ad hoc manner. Each sensor node consists of four major components: sensing unit, processing unit, power unit and transceiver.

Dynamicity: Since the nodes in WSNs may be static or dynamic, dynamicity of the network is a challenging issue. Most of the routing protocols assume that the sensor nodes and the base stations are fixed *i.e.*, they are static, but in the case of dynamic BS or nodes routes from one node to another must be reported periodically within the network so that all nodes can transmit data via the reported route. Again depending on the application, the sensed event can be dynamic or static. For example, in target detection/tracking applications, the event is dynamic, whereas forest monitoring for early fire prevention is an example of a static event. Monitoring static events works in reactive mode. On the other hand, dynamic events work in proactive mode.

Energy efficiency: The sensor nodes in WSNs have limited energy and they use their energy for computation, communication and sensing, so energy consumption is an important issue in WSNs. According to some routing protocols nodes take part in data fusion and expend more energy. Since the transmission power is proportional to distance squared, multi-hop routing consumes less energy than direct communication, but it has some route management overhead. In this regard, direct communication is efficient. Since most of the times sensor nodes are distributed randomly, multi-hop routing is preferable.

Scalability: A WSN consists of hundreds to thousands of sensor nodes. Routing protocols must be workable with this huge number of nodes *i.e.*, these protocols can be able to handle all of the functionalities of the sensor nodes so that the lifetime of the network can be stable.

Data Fusion: Data fusion [13] is a process of combining of data from different sources according to some function. This is achieved by signal processing methods. This technique is used by some routing protocols for energy efficiency and data transfer optimization.

II. RELATED STUDY

Sensor network performance is degraded by the complex monitoring terrain, multihop, and interference and time-varying property of the wireless channel [1]. To make effective use of the gigantic amount of individual sensor readings, it is essential to equip WSNs with scalable and energy-efficient data-gathering mechanisms. Some distinct characteristics of WSNs, such as large node density, unattended operation mode, high dynamicity and severe resource constraints, pose a number of design challenges on sensor data-gathering schemes. Many research activities have been carried out on the research issue. Since the fundamental task of WSN is to gather data efficiently with less resource consumption, to address the problem, there are two threads of research to improve the performance of data collecting: optimized data-gathering schemes and mobile collector assisted data-gathering in WSNs. For the first thread, most data-gathering algorithms aim to prolong lifetime with some optimized schemes. The balance energy consumption problem was formulated as an optimal transmitting data distribution problem [2] and minimal aggregation time (MAT) problem are formulated as optimal problems. In [3], the construction of a data gathering tree to maximize the network lifetime was studied, and the problem is also shown to be NP-complete. To balance load within each cluster, an even energy dissipation protocol (EEDP) was proposed for efficient cluster-based data-gathering in WSNs. In [7] a new proposal is to gathers data in high-density WSNs in real-time, which determines network topology by hierarchical clustering to avoid radio collision and enables to gather data with minimum data latency from numerous high-density sensor nodes. To address the problem of gathering information in WSNs, the work in [4] took into account the fact that interference can occur at the reception of a message at the receiver sensor. However it assumes the distribution of sources are known. Another way to save energy is to decrease data transmitting with some schemes. A new distributed framework to achieve minimum energy data-gathering was proposed in [4]. To minimize the total energy for compressing and transporting information, the problem of constructing a data-gathering tree over a WSN was studied in [14]. To some extent, all those schemes require the node has extra computation to optimize the data transmission or compress and decompress data. For the second thread, nodes in WSNs are in multihop and mobile environment in general. The characteristic of each link will change timely. In the content of the WSNs where each node only has a partial view of the network, it is very important for each node to estimate the system status by a simple and accurate method [13]. Especially for data transmission with less power consumption, a mobile data collector is more perfectly suited to such applications, for the collector can be equipped with a powerful transceiver and battery. Instead, it is effective to collect data by assisted mobile collector which can achieve better power saving performance [11]. A new data-gathering mechanism called M-collector for large-scale wireless sensor networks was proposed in [14] by introducing mobility into the network. However, it just considers the single-hop data gathering problem. An adaptive data-gathering protocol was proposed in [15] that employs multiple mobile collectors (instead of sinks) to help an existing WSN achieve such requirements, which adopts a virtual elastic-force model to help mobile collectors adjust their moving speed and direction while adapting to changes within the network. However, the number of collectors can not be predefined, for the irregularity of the information generation rate as well as the cost of mobile collectors. A well-planned adaptive moving strategy (AMS) for a mobile sink in large-scale, hierarchical sensor networks was presented. The mobile sink traverses the entire network uploading the sensed data from cluster heads in time-driven scenarios. However, it just tries to minimize the whole tour length to save energy. An efficient hybrid method for message relaying and load balancing was proposed in low-mobility wireless sensor networks in [14]. The system uses either a single hop transmission to a nearby mobile sink or a multihop transmission to a far-away fixed node depending on the predicted sink mobility pattern. Recently, many research efforts have appeared in the literature to explore the mobility in wireless sensor networks for data collection, we only survey the most related ones here [12]. The mobility-assisted data collection was classified into three categories in [12]: with random mobility, predictable mobility, and controlled mobility respectively. The mobile entities, referred to as Data Mobile Ubiquitous LAN Extensions (MULEs), lie in the middle tier on top of the stationary sensor nodes, move around in the network to collect data from sensor nodes, and ultimately upload the data to the sink. The term *Data MULEs* was widely used in the literature since then. In [10], the data collection process with predictable mobility was modelled as a queuing system, and the success of data collection was analyzed based on it. In [7], a mobile data observer, called SenCar, was used as a mobile base-station in the network. It also showed that the design of the travelling tour is critical for SenCar to accomplish data collection jobs successfully. Observing the importance of the travelling tour, a lot of efforts were put into its optimal design,[2].The tour selection problem can be modeled as a *Travelling Salesman Problem with Neighbourhoods* (TSPN), an NP-hard problem, if we do not consider the data rate constraints between the mobile element (ME) and sensor nodes, where all the *neighbourhoods* are possibly intersected communication disks. It has been proven that approximating Euclidean TSPN within a factor of (2") is also NP-hard [11].

III. Conclusion

Some distinct characteristics of WSNs such as large node density, unattended operation mode, high dynamicity and severe resource constraints pose a number of design challenges on sensor data-gathering schemes. Many research activities have been studied on the research issue. Since the fundamental task of WSN is to gather data efficiently with less resource consumption, to address the problem, there are two threads of research to improve the performance of data collecting: optimized data-gathering schemes and mobile collector assisted data-gathering in WSNs. Most data-gathering algorithms aim to prolong lifetime with some optimized schemes.

References

[1] Yong Wang ,Garhan Attebury and Byrav Ramamurthy "*A Survey of security issues in Wireless Sensor Networks*", IEEE Communication Survey 2006.

[2] JANG-PING SHEU, "*Design and Implementation of Mobile Robot for Nodes Replacement in Wireless SensorNetworks"* JOURNAL OF INFORMATION SCIENCE AND ENGINEERING 24, 393-410 (2008).

[3] V. Chandola, A. Banerjee, and V. Kumar. Anomaly detection: "*A survey. ACM Computing Survey"*, 41(3):1{58, 2009.

[4] M. A. Batalin and G. S. Sukhatme, "*Efficient exploration without localization,"* in Proceedings of the IEEE International Conference on Robotics and Automation, Vol 2, 2003, pp. 2714-2719.

[5] K. F. Ssu, C. H. Ou, and H. C. Jiau, "*Localization with mobile anchor points in wireless sensor networks,*" IEEE Transactions on Vehicular Technology, Vol. 54, 2005, pp. 1187-1197.

[6] A. Galstyan, B. Krishnamachari, K. Lerman, and S. Pattem, "*Distributed online localization in sensor networks using a moving target*," in Proceedings of the 3rd International Symposium on Information Processing in Sensor Networks, 2004, pp. 61-70.

[7] G. Wang, G. Cao, and T. LaPorta, "*A bidding protocol for deploying mobile sensors*,"in Proceedings of the 11th IEEE International Conference on Network Protocols, 2003, pp. 315-324.

[8] TinyOS, http://www.tinyos.net.

[9] Liang He , "*Reducing Data Collection Latency in Wireless Sensor Networks with Mobile Elements".*

[10] M.R. Garey and D.S. Johnson. *Computers and Intractability: A Guide to the Theory of NP-Completeness.* Freeman, San Francisco, CA, 1979.

[11] M. Gorges-Schleuter. Asparagos96 and the Travelling Salesman Problem. In T. Baeck, Z. Michalewicz, and X.Ya, editors, Proceedings of the IEEE International Conference on Evolutionary Computation (ICEC'97), pages 171{174, 1997.

[12] Debnath Bhattacharyya , Tai-hoon Kim ,and Subhajit Pal "A Comparative Study of

[13] Bellare, M., Canetti, R., Krawczyk, H. "*Keying hash functions for message authentication*"In Proceedings of Advances in Cryptology (CRYPTO'96). Lecture Note in Computer Science, vol. 1109, Springer. 1–15.

[14] M. C_ akiro_glu and A. T. □Ozcerit. Jamming "*detection mechanisms for wireless sensor networks.*" In Proceedings of the 3rd international conference on Scalableinformation systems (InfoScale08), pages 1{8, 2008. [15] K. Ni, N. Ramanathan, M. Chehade, L. Balzano, S. Nair, S. Zahedi, E. Kohler,

