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PRESERVING PRIVACY AND LOAD BALANCING FOR WIRELESSSENSOR NETWORKS

Ms. G.Deepika[1], Mr R.Gopinath[2],

[1]IInd ME CSE, K.S.Rangasamy College of Technolog., Tiruchengodu, Tamilnadu, India
gdeepika93@gmail.com
[2]Associate Professor, K.S.Rangasamy College of Technology , Tiruchengodu, Tamilnadu, India

Abstract

Wireless Sensor Networks are constructed to monitor the environment. Sensor databases creates an abstraction between the end users and the sensor nodes. In distributed database approach, each sensor node is considered as a data source and the WSN forms. Distributed database approach is used for sensor networks to support energy efficient data storage and query operations. User query is decomposed, optimized and distributed by the optimizer across the network. Meta data based query optimization is performed in the query execution process. Distributed Database management system is enhanced with power aware load balancing policies. XML based model is proposed for organizing and processing sensor data values to adapt flexible data representations. The system is improved to manage node failures in query process. The experimental results show that the Privacy Preserved Data Query (PPDQ) scheme reduces the access delay with high network lifetime in query process.

Keywords: *Distributed database, query processing, source privacy, authentication.*

I. Introduction

Recent advances in micro-electro-mechanical systems and low power and highly integrated digital electronics have led to the development of micro-sensors. Such sensors are generally equipped with data processing and communication capabilities. The sensing circuitry measures ambient conditions related to the environment surrounding the sensor and transform them into an electric signal. Processing such a signal reveals some properties about objects located and/or events happening in the vicinity of the sensor. The sensor sends such collected data, usually via radio transmitter, to a command center either directly or through a data concentration center. The decrease in the size and cost of sensors, resulting from such technological advances, has fueled interest in the possible use of large set of disposable unattended sensors [1]. Such interest has motivated intensive research in the past few years addressing the potential of collaboration among sensors in data gathering and processing and the coordination and management of the sensing activity and data flow to the sink. A natural architecture for such collaborative distributed sensors is a network with wireless links that can be formed among the sensors in an ad hoc manner.

Sensor nodes are constrained in energy supply and bandwidth. Such constraints combined with a typical deployment of large number of sensor nodes have posed many challenges to the design and management of sensor networks. These challenges necessitate energy awareness at all layers of networking protocol stack. The issues related to physical and link layers are generally common for all kind of sensor applications, therefore the research on these areas has been focused on system-level power awareness such as dynamic voltage scaling, radio communication hardware, low duty cycle issues, system partitioning, energy-aware MAC protocols. At the network layer, the main aim is to find ways for energy-efficient route setup and reliable relaying of data from the sensor nodes to the sink so that the lifetime of the network is maximized.

Routing in sensor networks is very challenging due to several characteristics that distinguish them from contemporary communication and wireless ad hoc networks. First of all, it is not possible to build a global addressing scheme for the deployment of sheer number of sensor nodes. Therefore, classical IP-based protocols cannot be applied to sensor networks. Second, in contrary to typical communication networks almost all applications of sensor networks require the flow of sensed data from multiple regions (sources) to a particular sink. Third, generated data traffic has significant redundancy in it since multiple sensors may generate same data within the vicinity of a phenomenon. Such redundancy needs to be exploited by the routing protocols to improve energy and bandwidth utilization. Fourth, sensor nodes are tightly constrained in terms of transmission power, on-board energy, processing capacity and storage and thus require careful resource management.

II. Related Work

Different from other WSN applications, a large amount of classical SHM algorithms, such as the Subspace method, the ERA method, the LSCE method are computationally intensive and with data-level collaboration of multiple sensors. Data-level collaboration prohibits the possibility that each sensor can process its own data independently without exchanging information with others. In a typical algorithm with data-level collaboration of multiple sensors, data from different sensors are tightly coupled, generally in the form of matrix, and cannot be easily decomposed into smaller sub-tasks.

To design a distributed version for these SHM algorithms, one commonly adopted approach is to re-design the algorithms with data-level collaboration architecture using the template of decision-level or feature-level fusion architectures. For example, a cluster-based ERA has been used in [7] and [8] to identify structural vibration characteristics called modal parameters. In this approach, deployed sensor nodes are divided into a number of clusters. Sampled data from each cluster are transmitted to its cluster head (CH) and each CH then implements the centralized ERA. The local results from each cluster are 'stitched' together to obtain a global one which is used to identify damage. One problem of this cluster-based approach is that the accuracy of damage detection obtained may not be guaranteed to be comparable with the centralized one. This is because each CH only uses its local information, which can result in the ill conditioned problem and this inaccuracy cannot be rectified via the 'stitching' process afterwards. The goal of this paper is to design the distributed SHM algorithm which is able to achieve the same accuracy of the centralized counterpart but uses much less wireless transmission cost. We will show that designing such as a distributed algorithms serve as a guideline for more applications like SHM.

Recently, researchers have focused on devising methods to mine user's interest-based frequent patterns by applying early pruning technique to reduce the size of resultant sets. Omiecinski [9] introduced three alternative interestingness measures, called any-confidence, all-confidence and bond. Later on, Lee et al. [3] used all-confidence to find correlated patterns as it satisfies both null-invariance and downward closure property. The null-invariance property facilitates the measure to reveal true correlation without being influenced by the object co absence in a database. The downward closure property facilitates search space reduction as all non-empty subsets of correlated patterns must also be correlated. Algorithm proposed in [5] made an effort to improve the performance by introducing items' support interval concept. Efficient for transactional database, they are not suitable for sensor data stream because of multiple scan requirement over same dataset. In [4], we presented a technique of mining behavioral patterns for WSN data, its characteristics and performance were not adequately explored.

To find associated sensor pattern from sensor data stream, we no longer have the luxury of performing multiple data scans. Once the stream flows through, we lose them. DSTree and CPS-tree both find the exact set of recent frequent patterns from the data stream with single scan by using the FP-growth algorithm. All the above-mentioned techniques including [6] keep the window size unchanged even though the data flow rate in sensor stream may change unpredictably, resulting in inferior utilization of resources.

III. Distributed Database Management Methods for WSN

Wireless Sensor Networks (WSNs) are composed of a large number of devices, called sensor nodes, which are able to sense, process, and transmit information about the environment on which they are deployed. These devices are usually distributed in a geographical area to collect information for users interested in monitoring and controlling a given phenomenon is shown in figure 1. This information is transferred to a sink node to be accessible by remote users through generally application-level gateway, e.g. global sensor network (GSN).

In wireless sensor networks, the sensor nodes are battery powered and are considered intelligent with acquisitional, processing, storage, and communication capacities.

Sensors can be placed anywhere there is data that should be collected, what makes information omnipresent. In addition to data gathering and data replication issues in such applications, a database oriented approach of WSNs has proven to be useful to manage the large amount of data generated by the sensors. According to this approach, a WSN is viewed as a

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distributed database where sensor nodes are considered as data sources with sensed data stored in the form of rows of a relation distributed across a set of nodes in the network. This database-oriented approach has motivated the design of WSN data acquisition with two fundamental objectives: similarly to traditional database systems, a WSN database should provide SQL-like abstractions so that nodes can be easily programmed for simple data sensing and collection. In addition, the data collection process should minimize the energy consumption in the network.

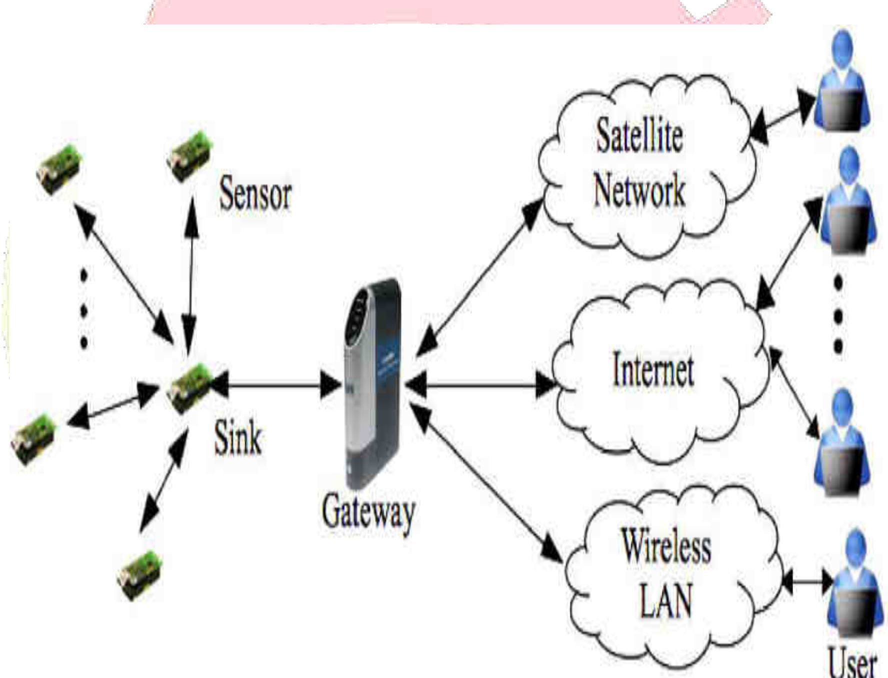

Fig1. Illustration Of Wireless Sensor Network Architecture

The main goal of distributed database management on WSNs is to support the management of the huge amount of sensed data in an energy-efficient manner. In fact, research into sensor hardware has shown that the energy depletion in the network is mainly due to the data communication tasks among the nodes. To deal with this problem, various data reduction techniques exist, including data aggregation, packet merging, data compression techniques, data fusion, and approximation based techniques.

The aim of this paper is to show how distributed database techniques are adapted to wireless sensor networks to improve the management of the great amount of sensed data in an energy-efficient way by presenting and classifying the most recent and relevant proposals of distributed database management on WSNs. A discussion and open issues on distributed database management techniques for wireless sensor networks are identified to facilitate further contributions.

IV. Message Authentication and Source Privacy in WSN

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Message authentication plays a key role in thwarting unauthorized and corrupted messages from being forwarded in networks to save the precious sensor energy and to provide message authenticity and integrity verification for wireless sensor networks (WSNs).These schemes can largely be divided into two categories: public-key based approaches and symmetric-key based approaches.

The symmetric-key based approach requires complex key management, lacks of scalability, and is not resilient to large numbers of node compromise attacks since the message sender and the receiver have to share a secret key. The shared key is used by the sender to generate a message authentication code (MAC) for each transmitted message. The authenticity and integrity of the message can only be verified by the node with the shared secret key, which is generally shared by a group of sensor nodes. An intruder can compromise the key by capturing a single sensor node. In addition, this method does not work in multicast networks.

To solve the scalability problem, a secret polynomial based message authentication scheme. The idea of this scheme is similar to a threshold secret sharing, where the threshold is determined by the degree of the polynomial. This approach offers information-theoretic security of the shared secret key when the number of messages transmitted is less than the threshold. The intermediate nodes verify the authenticity of the message through a polynomial evaluation [2].

For the public-key based approach, each message is transmitted along with the digital signature of the message generated using the sender's private key. Every intermediate forwarder and the final receiver can authenticate the message using the sender's public key. One of the limitations of the public-key based scheme is the high computational overhead. The recent progress on elliptic curve cryptography (ECC) shows that the public key schemes can be more advantageous in terms of computational complexity, memory usage and security resilience, since public-key based approaches have a simple and clean key management.

Efficient Source Anonymous Message Authentication (SAMA) scheme based on the optimal modified ElGamal signature (MES) scheme on elliptic curves is proposed for security in wireless sensor networks. By using SAMA, each message is send from source provide hidden security for source. Here source is hidden from the all those node from the network. So the message is kept secret through by this security scheme.

MES scheme enables the intermediate nodes to authenticate the message so that all corrupted message can be detected and dropped to conserve the sensor power.

Problem Statement

The following problems are identified from the current wireless sensor networks.

- Load balancing policy is not considered
- Hierarchical data organization is not supported
- Data and query security is not provided
- Multi query processing is not adapted

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V. Proposed work

Privacy Preserved Data Query Scheme for WSN

Distributed Database management system is enhanced with power aware load balancing policies. Sensor data values are organized and processed in XML based model to adapt flexible data representations. The system is improved to manage node failures in query process. Node level and network level load distribution techniques are integrated with the system. Hierarchical data organization mechanism is employed in the system. The system is divided into six major modules. They are Distributed Database Construction, Meta Data Management, Structured Query Process, Hierarchical Query Process, Security Services and Load Distribution Process.

Distributed database construction module is designed to integrate the sensor databases. SQL based data request operations are carried out under structured query process. XML based data access tasks are carried out under hierarchical query process. Data and query security operations are handled under the security services.

5.1. Distributed Database Construction

Each sensor node is considered as single database. Sensor databases are grouped to construct the distributed database framework. Sensed data values are updated into the local database environment. Node properties are distributed to the network area.

5.2. Meta Data Management

Meta data provides the sensor node and database information. Database name, IP address and capture scheme details are maintained in the database metadata. Data sensing properties are also maintained in the metadata model. Metadata values are distributed with reference to the request information.

5.3. Structured Query Process

Structured Query Language (SQL) based data requests are processed by the nodes. Conditional query values are supported by the system. Parsing mechanism is used to verify the query syntax. Query assistance support model is provided to construct the query values.

5.4. Hierarchical Query Process

The distributed database system is enhanced to manage hierarchical data models. XML is used to organize and query the data values. Multi node data retrieval is supported by the hierarchical query process. Region based data aggregation is provided in the system.

5.5. Security Services

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Source Anonymous Message Authentication (SAMA) scheme is used for the security process. Elliptic Curve Cryptography technique is adapted for the security process. Gamal signature scheme is adapted in the security process

5.6. Load Distribution Process

The system performs the load distribution to manage resource consumption. Computational and energy loads are distributed in the node level load distribution process.

VI. Experimental Analysis

The wireless sensor network data collection process is used in support of database and query management schemes. The data collection is handled using Distributed Database Management (DDM) scheme for Wireless Sensor Network. The Privacy Preserved Data Query (PPDQ) scheme is constructed to privacy and security features. They are access delay and network lifetime. The access delay analysis is carried out to estimate the data delivery period for the sensor networks. The network lifetime analysis is carried out to estimate the network lifetime levels.

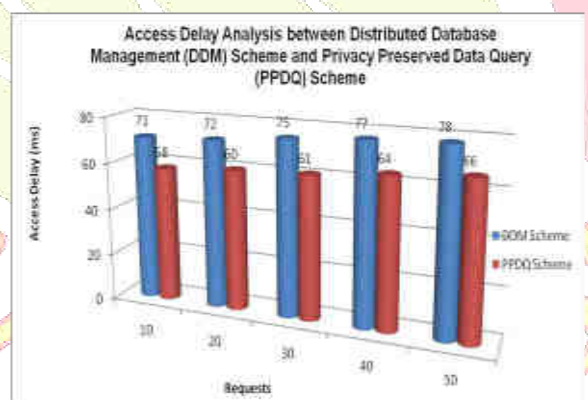

Figure 2: Access Delay Analysis between Distributed Database Management (DDM) Scheme and Privacy Preserved Data Query (PPDQ) Scheme

The access delay analysis between the Distributed Database Management (DDM) Scheme and Privacy Preserved Data Query (PPDQ) Scheme is shown in figure1. The analysis result shows that the Privacy Preserved Data Query (PPDQ) Scheme reduces the access delay 20% than the Distributed Database Management (DDM) Scheme.

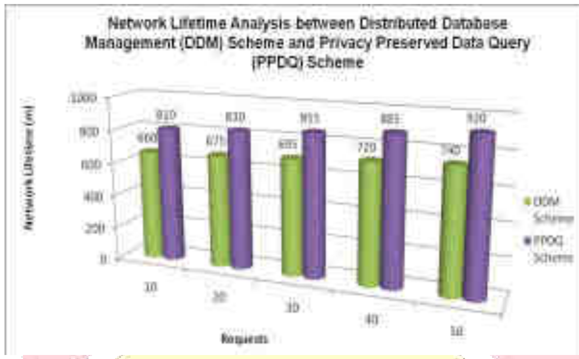

Figure 3: Network Lifetime Analysis between Distributed Database Management (DDM) Scheme and Privacy Preserved Data Query (PPDQ) Scheme

The network lifetime analysis between the Distributed Database Management (DDM) Scheme and Privacy Preserved Data Query (PPDQ) Scheme are shown in figure 2. The analysis result shows that the Privacy Preserved Data Query (PPDQ) Scheme increases the network lifetime 20% than the Distributed Database Management (DDM) Scheme.

VII. Conclusion

Wireless sensor networks are considered as distributed database model. Distributed database management scheme is employed to perform data storage and query processing tasks. The system is enhanced with security and load balancing features. Multi query processing, meta data management and node failure handling schemes are also integrated with the system. The distributed database management system supports load balanced query processing environment. Hierarchical data management provides multi node based data access features. The system is enhanced with security for query and data values. Energy and bandwidth consumption is reduced in the system.

References

[1] Kemal Akkaya, Mohamed Younis, "A Survey On Routing Protocols For Wireless Sensor Networks", Elsevier, 2003.

[2] Jian Li, Yun Li, Jian Ren and Jie Wu, "Hop-by-Hop Message Authentication and Source Privacy in Wireless Sensor Networks", IEEE Transactions On Parallel And Distributed Systems, Vol. 25, No. 5, May 2014

[3] Y. K. Lee, W. Y. Kim, Y. D. Cai and J. Han, "CoMine: Efficient mining of correlated patterns," Proc. Int. Conf. Data Mining, Melbourne, FL, USA, 2003, pp. 581–584.

ISSN 2395-695X (Print)
ISSN 2395-695X (Online)
International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST)

Vol. 2, Special Issue 10, March 2016

[4] M.M.Rashid, I. Gondal and J. Kamruzzaman, “Mining Associated Sensor Patterns For Data Stream Of Wireless Sensor Networks,” in Proc. 8th ACM Workshop Perform. Monitoring Meas. Heterogeneous Wireless Wired Netw., 2013, pp. 91–98.

[5] R. U. Kiran and M. Kitsuregawa, “Efficient Discovery Of Correlated Patterns In Transactional Databases Using Items’ Support Intervals,” in Proc. 23rd Int. Conf. Database Expert Syst. Appl., 2012, pp. 234–248.

[6] W.-Y. Lee, K. Hur and D.-S. Eom, “Navigation of Mobile Node in Wireless Sensor Networks without Localization,” Proc. IEEE Int’l Conf. Multisensor Fusion and Integration for Intelligent Systems (MFI’08), pp. 1-7, Aug. 2008.

[7] B.-G. Lee and W.-Y. Chung, “Multi target Three-Dimensional Indoor Navigation on a PDA in a Wireless Sensor Network,” IEEE Sensors J., vol. 11, no. 3, pp. 799-807, Mar. 2011

[8] E. Omiecinski, “Alternative Interesting Measures For Mining Associations,” IEEE Trans. Knowl. Data Eng, vol. 15, no. 1, pp. 57–69, Jan./Feb. 2003.