Scientific Journal Impact Factor (SJIF) : 1.711
International Journal of Modern Trends in Engineering and Research
ISSN (ONLINE) : 2349 - 9745 ISSN (PRINT) : 2393 - 8161

A Survey on Distributed Database Management for minimizing the energy consumption in Wireless Sensor Network

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Abstract-Environmental information was gathered by various Sensor devices. Basically Sensor Network is constructed by set of data collection units. Base station, sinks and sensor devices are some supporting Components which frame a network namely, Wireless Sensor Network (WSN). Power resources, Bandwidth and Storages are some limitations of sensor devices. Sink nodes collect data from a group of sensor devices. The data sensed and gathered by different sensors devices have spatial and temporal correlations. Wireless Sensor Network is considered as a distributed database model to manage all the data values stored in the sensor nodes. Query schemes are used to collect and transfer the sensor data values. In this paper we choose Distributed database management to perform data storage and query processing tasks. The system is enhanced with security and load balancing features. Multi query processing, metadata management and node failure handling schemes are also integrated with the system.

I. INTRODUCTION

A Wireless Sensor Network is a group of expert transducers with a communications infrastructure for monitoring and recording conditions at varied locations. Commonly monitored parameters are temperature, humidity, pressure, wind direction and speed, lighting intensity, vibration intensity, sound intensity, power-line voltage, chemical concentrations, impurity levels and vital body functions. A sensor network consists of multiple finding stations called sensor nodes, each of which is small, lightweight and transportable. Every sensor node is equipped with a transducer, microcomputer, transceiver and power source. The transducer generate electrical signals based on sensed physical effects and phenomena. The microcomputer process and supplies the sensor output. The transceiver receives commands from a central computer and transmits data to that computer. The control for each sensor node is derived from a battery.

1.1. Applications

- Industrial automation
- Automated and smart homes
- Video surveillance
- Traffic monitoring
- Medical device monitoring
- Monitoring of weather conditions
- Air traffic control
- Robot control.

II. LITERATURE SURVEY

2.1. Insights of Top-k Query in Duty-Cycled Wireless Sensor Networks (2015)

The system is focused to fetch k nodes with the highest readings among sensor nodes. Top-k query model is tuned to fetch data under Duty cycled Wireless Sensor Networks (D-WSNs).

Identifing the data accessibility and network connectivity problems that prevent the implementation of top-*k* query in D-WSNs. In this paper, we originally analyze the research issue when implement top-*k* query in D-WSNs and then propose the DRC-WSNs [D-WSNs with data replication (DR) and connected *kc*-neighborhood (CKN)] method for performing top-*k* query. This paper provide the following two new insights about top-*k* query in D-WSNs: 1) Implementing top-*k* query in DRC-WSNs can achieve the best tradeoff with respect to query data convenience and query cost (total energy consumption and query response time), compared with implementing top-*k* request in DC-WSNs (D-WSNs with only CKN) and A-WSNs; and 2) the query data accessibility and the query cost of DRC-WSNs, DC-WSNs, and A-WSNs can be tuned by unstable number of neighbor nodes. Advantage of this paper is High query data accessibility with low energy cost. Disadvantage is Load level and security factors are not considered.

2.2. Mining Associated Patterns from Wireless Sensor Networks (2015)

Association rule mining methods are applied to fetch occurrence frequency based knowledge under WSN. In this paper, we propose a new type of behavioral prototype called associated sensor patterns which capture association-like co-occurrences as well as sequential correlations which are related with such co-occurrences. To capture such patterns a compact tree arrangement, called Associated Sensor Pattern tree (ASP-tree) and a mining algorithm (ASP) are proposed which use pattern growth-based approach to create all associated patterns with only one scan over dataset. When data stream flows through, old information may lose consequence for the current time. To capture significance of recent data, ASP-tree is then enhanced to SWASP-tree by adopting sliding observation window and updating the tree structure accordingly. Both trees have the build once and mine many property, making it highly suitable for interactive mining. To optimize resource usage, a technique to dynamically adapt window size is also presented. Comparative performance analyses shows that their techniques are very effective and efficient for mining associated sensor patterns over sensor data and outperform existing algorithms in both runtime and memory usage, and also scale well to handle large number of distinct sensors and epochs. The disadvantage of this paper is High computation overhead with minimum network lifetime.

2.3. Distributed Topological Convex Hull Estimation of Event Region in Wireless Sensor Networks without Location Information (2015)

Event report, routes rebuilding and human motion planning tasks are managed with the support of event monitoring methods. Existing works on calculating convex hull of event region usually require location information of sensor nodes, which requires high communication cost or hardware cost. In this paper, to avoid the requirement of location information, we describe Topological convex hull (T-convex hull) which presents the convex contour of an event region directly with a route passing by nodes and becomes more efficient in handling the above tasks. To obtain the T-convex hull of event region we use a low-weight (in terms of computation and storage resource requirement) distributed algorithm, with which sensor nodes just need to calculate the hop counts from some nodes. The distributed estimation of topological convex hull of an event region in WSNs where there is no reference, no location information or pre-knowledge about the region. A novel distributed algorithm with both low computation complexity and communication cost is proposed. Disadvantage of this paper is, Data security is not focused in the system.

2.4. Practical Data Prediction for Real-World Wireless Sensor Networks (2015)

Data prediction methods are used to estimate the sensor data under the sink nodes within an accuracy threshold. This allows huge reductions in communication. Derivative-based prediction (DBP) technique is used to estimate data values with high accuracy and minimum energy levels. The

practical usefulness of DBP is reinforced by system-wide evaluation, showing that with a properly tuned network stack, DBP can improve system lifetime. Disadvantages of this paper is Data access with structured query model is not provided.

2.5. Distributed Sensing for High-Quality Structural Health Monitoring Using WSNs (2015)

Distributed sensor data analysis operations are performed to support structural health monitoring (SHM) systems. Different from other applications of WSNs which include environmental monitoring, SHM applications are much more data intensive and it is not possible to stream the raw data back to the server due to the severe bandwidth and energy limitations of low-power sensor networks. In this paper, we select a classical SHM algorithm: the Eigen-system Realization Algorithm (ERA), and suggest a few distributed ERAs suitable for WSNs. This paper gives the effectiveness and efficiency of the distributed schemes in terms of required wireless transmissions, computation complexity and the accuracy. The Disadvantage of this paper is Data security features are not supported.

2.6. Novel Є Approximation to Data Streams in Sensor Networks (2015)

Data stream based transmission mechanism reduces the storage cost, bandwidth and energy levels. To reduce the storage cost, transmission and processing of time series data generated by sensor nodes, the need for more compact representations of time series data is compelling. In this paper they proposed an optimal online algorithm GDPLA for constructing a disconnected piecewise linear estimation of a time series. This is not adapted for Instance based query model.

2.7. Data Collection in Multi-Application Sharing Wireless Sensor Networks (2015)

Multi application based data sharing model reduces the communication cost in WSN. This paper is uesd to introduce the interval data sharing problem which is to examine how to transmit as less data as possible over the network, and meanwhile the transmitted data satisfy the requirements of all the applications. The proposed problem is a nonlinear nonconvex optimization problem. 2-factor approximation algorithm and dynamic programming algorithm are involved to handle the data sharing over multiple application environment. Since no efficient universal solution has been found for this problem, they provided a greedy approximation algorithm to lower the high computational complexity of the available solutions. Data security and load management are not provided in this method.

2.8. CDC: Compressive Data Collection for Wireless Sensor Networks (2015)

Compressive data collection methods are used to minimize the bandwidth consumption in Wireless Sensor Networks. They accepted a power-law decaying data model verified by real data sets and then propose a random projection-based estimation algorithm for this data model. This scheme requires fewer compressed measurements, thus greatly reduces the energy consumption. Our scheme consists of two parts: the opportunistic routing with compression, and the nonuniform random projection based estimation. They proved that this scheme can achieve optimal approximation error. Random projection based estimation algorithm on Decaying data model is applied for the data transmission process. The main Disadvantages of this paper is Multiple attribute based compressive data collection is not supported.

2.9. Optimizing Data Forwarding from Body Area Networks in the Presence of Body Shadowing with Dual Wireless Technology Nodes (2015)

Data moves from a Wireless Body Area Network (WBAN) to a gateway is managed with body shadowing affects. To solve this problem we provide a new WBAN architecture that uses two communication technologies. Body coupled communication (BCC) scheme is used to forward the data from WBAN to the gateway. One network is formed between on-body nodes, and is realize with capacitive Body-Coupled Communication (BCC). RF-based WBANs in the face of body shadowing, there is a fundamental tradeoff: Either consume more energy for retransmissions or channel coding in order to increase reliability and also suffer higher delay, or reduce delay and energy at the cost of reduced reliability. The disadvantage of this paper is Query language based data access model is not supported.

III. PROBLEM IDENTIFICATION

From the above papers we studied the following problems: Using data replication (DR) and connected *kc*-neighborhood (CKN) we can identify only top-k query value. It does not provide Load level and security factors. Using Associated Sensor Pattern tree (ASP-tree) and a mining algorithm (ASP) are used to generate all associated patterns with only one scan over dataset. It does not work with High computation with minimum network lifetime. Using the novel distributed algorithm it gives low computation complexity and communication cost. But the Data security is not focused in the system. Derivative-based prediction (DBP) technique is used to estimate data values with high accuracy and minimum energy levels. It does not provide Data access with structured query model. Eigen-system Realization Algorithm (ERA), and distributed ERAs gives the effectiveness and efficiency of the distributed schemes in terms of required wireless transmissions, computation difficulty and the correctness. Even though the correctness is high, Data security features are not supported. Online algorithm GDPLA for building a disconnected piecewise linear approximation of a time series is not adapted for Instance based query model. 2-factor approximation algorithm and dynamic programming algorithm are involved to handle the data sharing over multiple application environment. But it does not used for load management and also data security is low. Compressive Data Collection (CDC) methods are used to minimize the bandwidth consumption in Wireless Sensor Networks. But Multiple attribute based compressive data collection is not supported. RF-based WBANs in the face of body shadowing Either consume more energy for retransmissions or reduce delay and energy at the cost of reduced reliability. It does not used for Query language based data access model. To overcome these problems we are using the Distributed Database management system.

IV. CONCLUSION

We conclude that we are going to use Distributed Database management system to provide the data and query security. 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. Resource constraint based security services and multi query execution methods are integrated with the distributed database model. The system is improved to manage node failures in query process.

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