Advance in Electronic and Electric Engineering.
ISSN 2231-1297, Volume 3, Number 1 (2013), pp. 1-6

http://www.ripublication.com/aeee.htm

Query Processing in Wireless Sensor Network

Akshay Agrawal[1], Lokesh Gupta, Bikash Kr. Behera[1], Reddipalli Balaji[2], Vijender Bhootna[3]

[1]Department of Electronics & Communication Engineering, JRE Group of Institutions, Greater Noida
[2]Department of Electrical Engineering, JRE Group of Institutions, Greater Noida.
[3]Department of Applied Electronics & Instrumentations, JRE Group of Institutions, Greater Noida.

Abstract:

A sensor network is composed of a large number of sensor nodes that are densely deployed either inside the phenomenon or very close to it. The position of sensor nodes does not need to be engineered or predetermined. This allows random deployment in inaccessible terrains or disaster relief operations which in one way or the other is a boon. On the other hand, this also implies that the sensor network protocols and algorithms must possess self-organizing capabilities. Another dispensable feature of sensor networks is the cooperative effort of the sensor nodes. Recent advances in wireless communications and electronics have enabled the development of low-cost, low-power, multifunctional and multitasking sensor nodes that are small in size and communicate undisturbed in short distances. These tiny sensor nodes, which consist of sensing, data processing, and communicating components, leverage the idea of sensor networks. Sensor networks represent a significant improvement over traditional sensors. Wireless sensor networks are formed of tiny, highly energy-constrained sensor nodes that are equipped with wireless transceivers. They may be mobile and are usually deployed in large numbers in unfamiliar environments. The nodes communicate with each other by autonomously creating ad-hoc (inter connected) networks which are actively used to gather sensor data. WSNs also process the data within the network itself and only forward the result to the requesting node.

Keywords: WSN (Wireless Sensor Network)

1. Introduction

Query processing can be briefly described as a database consists of an organized collection of data for one or more users either in digital form or in analog form such that it can describe precisely. A wireless sensor network (WSN's) is a specialized network composed of numerous low cost, and low power sensor nodes which can be defined as the capability of performing some processing, gathering sensory information and communicating with others. WSN's collects the information from target environment by sensor nodes. As the collection of sensed data is more useful than individual sensor readings. WSN's is used to integrate database, such that the management of data processed from sensor networks can be improved. This improved data can be used for query processing using some applied and structured protocols. Each sensor node is a separate data source which can generate records. As the aggregation of sensed data is more useful for user analyses than individual sensor readings, it has been proposed to integrate the sensor network and the use of (Distributed Query Processing Engine) DQPE to improve the management of data processed from sensor networks. Distributed query processing in wireless sensor networks provides declarative access to data from multiple sensor nodes. In distributed query processing, a run time database is maintained about a specific type of query, i.e. how the nodes in a WSN will respond to a particular query.

2. Approach Towards Query Processing

Much research on query processing for Wireless Sensor Networks has done in the past few years and two major.

Prototype sensor network query processors have been built – Cougar and TinyDB, which they used two different Approaches: centralized approach and distributed approach. The traditional database approach where the sensor network keeps sending sensed data to a centralised database and users issue queries over this database. The whole sensor networks as a distributed database with columns for representing sensor attributes and rows clusters. A centralized approach where data are extracted from devices in a predefined way and sent to a unique front-end server for storage and querying, is not suitable for query processing in sensor networks for two reasons [7] : (a) access to the network and processing of queries are separated and (b) valuable resources are used to transfer large amounts of raw (and maybe unnecessary) data to the centralized database; in fact, since sensor nodes are usually powered by batteries with a limited capacity, sensor networks must save energy in order to extend their lifetime, but transmitting all the data to a central node consumes a lot of energy (communication using a wireless medium is more expansive than processing). The database approach can be shown in the following Figure .1(a).

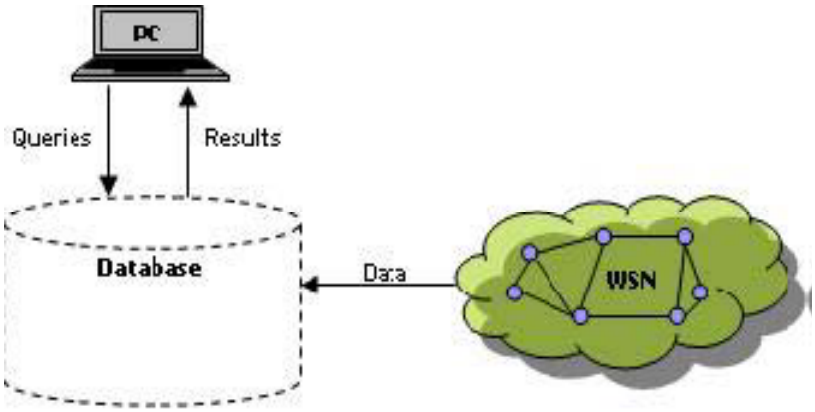

FIGURE 1(a): Centeralised Data Approach for WSN

The following protocols are followed in the Query processing:

2.1 TinyDB

TinyDB is a simple protocol which provides **Structured Query Language** (SQL) Interface which allows user to query the network using declarative queries (retrieves data from one or more sensor nodes). TinyDB collects data from sensor nodes, filters and aggregates it together, and send it to the base station (PC) via an energy-efficient in-network processing algorithm.

2.2 Cougar Approach

Queries usually involve a combination of two types of data: stored data and sensor data. These data are generated by signal processing functions that take as input physical signals like Pressure, Temperature, Light, sound etc. These signals were sensed by sensors and produces as output signal. Sensor data is represented as time series: time is discrete. Sensor nodes share the same time scale and their clocks are synchronized.

2.3 Fjord Approach

This protocol is used for locating proxies for sensors. Users issues queries to the server, The server processes each query, instantiates operators and locates proxies for the sensors that can have data relevant to this query. If proxy accepts then it runs queries on behalf of the sensor, sparing the sensor to send data to all interested users. The proxy converts these values in tuples and sends them to the Query processor.

2.4 HEED (hybrid energy-efficient distributed clustering)

Cluster head selection is based on two parameters: The primary parameter (node residual energy) is used to select an initial set of cluster heads, and the secondary parameter is used to break ties.

2.5 LEACH (Low Energy Adaptive Clustering Hierarchy)

LEACH is a good approximation of a proactive network protocol. Once the clusters are formed, the cluster heads broadcast a TDMA schedule giving the order in which the cluster members can transmit their data. The total time required to complete this schedule is called the frame time. When the last node in the schedule has transmitted its data, the schedule repeats.

Henceforth this implies that all the protocols in query processing can only be worked with the wireless system networks which clearly state that Sensor networks are highly dynamic which means the network topology may be changed. This may be caused because the positions of network nodes have changed or their battery power is low. Thus, sending queries from base station to sensor network or delivering data from sensor network to the base station is a non-trivial problem. As in the above said column here, there are usually a large set of possible query processing plans for a complex query, and it is the query optimizer's responsibility to select the best plan within the set. The traditional query optimization, where queries are optimized before executing is not likely an ideal strategy for long running continuous queries.

The dynamic routing protocol system in Fig. 2 describes the software architecture of a sensor node. The adaptive routing services module supports routing services and control dynamic switching of routing protocols. In this architecture, the Energy Manager is used to keep track of a node's energy. It provides a common interface for the application layer and physical layer to access the energy resource. When physical layer receives packets from MAC layer, it sets the transmit power based on an approximation of distance to receiver, removes the appropriate amount of energy for sending the packet through the interface provided by the Energy Manager, and sends the packet to Channel. Here this can also be described as the process in the architecture of the sensor nodes. Much more can be described in the figure .1(b).

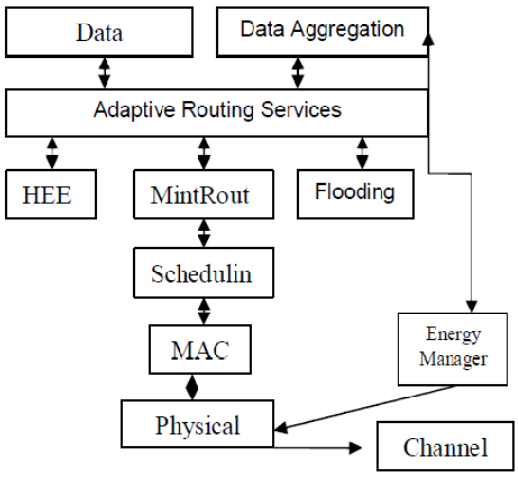

Figure 1: The architecture of sensor node

Hence in the whole pretext described above we can only make a result out of the following that without proper set of protocols and various other systems the query processing cannot be used in the wireless system networks.

3. Conclusions

This deliverable presents the state of the art in query optimization and processing over data produced by sensor networks, considering current networking and architectural issues in such a class of systems. In this respect we assume that the underlying sensor network architecture complies with the following characteristics: the network is wireless and multihop, and it is composed by heterogeneous sensors (with respect to computational, storage, sensing and energy capacity). The network is accessed through one or more special mobile nodes. Soft abstraction could greatly improve the expressive power of databases, processing streams of data produced by sensors. The commonly adopted approach considers sensors as sources of data streams, and the network as a unique table, composed of a set of columns, one for each sensor type. Such a solution is not flexible from the user point of view: these concepts can be generalized, offering the opportunity to create logical table/streams aggregating simple ones, and possibly offering a wide choice of compositional methods

We have combined the approach of Data aggregation and Energy efficiency through Data Dissemination. “The most energy consuming operation a node can perform is the transmission of data”. We have considered the fact as our guideline. On the basis of that we modified the distributed query processing engine (DQPE) and proposed some flow charts to make the query transfer from sink to source energy efficient as well as scalable, both of these are crucial for large-scale battery-powered sensor network. Hence n the following we tend to take the query processing in wireless sensor networks using protocols and various steps.

References

[1] O. Younis, S. Fahmy. HEED: A Hybrid, Energy Efficient, Distributed Clustering Approach for Ad Hoc Sensor Networks. IEEE Transactions on Mobile Computing, Vol. 3, No. 4, pp. 660669, Oct. 2004

[2] Younis, S. Fahmy. An Experimental Study of Routing and Data Aggregation in Sensor Networks. The 2nd IEEE International Conference on Mobile Ad Hoc and Sensor Systems (MASS2005), Nov. 2005

[3] Giuseppe Amato, Francesco Furfari, Query Processing for Mobile Wireless Sensor Networks: State-of-the-art and Enabling Context Awareness through Distributed Query Processing in Wireless Sensor Networks, IEEE 2002

[4] I.F. Akyyildiz, Y. Sankara subramaniam W. Su, and E. Cayirci. Wireless sensor networks: a survey.*Computer Networks*, (38):393–422, 2002.

[5] Z. Zhang, F. Yu. An Adaptive Energy Efficient Clustering Protocol for Data Collection in Sensor Networks. In Proceedings of the IEEE International Joint Conference on Computational Sciences and Optimization, April 2009.

[6] P. Bonnet, J. Gehrke, and P. Seshadri, "Towards sensor database systems," Proceedings of the Second International Conference on Mobile Data Management, vol. 43, pp. 551-558, 2001.

[7] A. Manjeshwar, D.P. Agrawal. TEEN: A Protocol for Enhanced Efficiency in Wireless Sensor Networks. In Proc. the 15th Parallel and Distributed Processing Symp. San Francisco: IEEE Computer Society, 2001.

[8] “Dynamic Routing Layer for Data Query in wireless sensor networks”, Zusheng Zhang, Fengqi Yu, University of Chinese Academy of Sciences.