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LEACH Protocol vs Cluster Based Data Aggregation using Bayesian Networks: A Comparison

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Abstract:
Wireless sensor networks are increasingly used in many real-time applications now-a-days for collection of data from remote areas. The efficient approach for aggregation of data is of at most concern as the sensor nodes are of limited energy and computational power. In this paper we discuss the cluster based technique along with the Bayesian network approach to overcome this problem. LEACH (Lower Energy Adaptive Clustering Hierarchy) in wireless sensor networks (WSNs) uses the concept of dynamic clustering when sensor nodes are deploying randomly where number of cluster impact on the network. This paper describes the network quality that depends on different characteristics of data transmission as a Modification on LEACH protocol.

I. INTRODUCTION

A Wireless Sensor Network (WSN) can be defined as a set of spatially scattered intelligent sensors designed to obtain measurements from the environment, abstract relevant information from the data gathered, and to derive appropriate inferences from the information gained. Wireless sensor networks depend on multiple processors to simultaneously gather and process information from many sources. Currently, there has been an increasing interest in the development of WSNs for the process of information gathering. Availability of new technology makes these networks economically feasible.
The increased complexity of today's information gathering tasks has created a demand for such networks. These tasks are usually time -critical and rely on the reliable delivery of accurate information. Thus, the search for efficient, fault - tolerant architectures for WSNs has become an important research area in computer science. All sensor nodes have limited power supply and have the capabilities of information sensing, data processing and wireless communication. WSN has various characteristics like Ad Hoc deployment, Dynamic network topology, Energy Constrained operation, Shared bandwidth, large scale of deployment. Despite of these characteristics routing in WSN is more challenging. Firstly, resources are greatly constrained in terms of power supply, processing capability and transmission bandwidth. Secondly, it is difficult to design a global addressing scheme as Internet Protocol (IP). Furthermore, IP cannot be applied to WSNs, since address updating in a large scale or dynamic WSN can result in heavy overhead. Thirdly, due to the limited resources, it is hard for routing to cope with unpredictable and frequent topology changes, especially in a mobile environment. Fourthly, data collection by many sensor nodes usually results in a high probability of data redundancy, which must be considered by routing protocols. Fifthly, most applications of WSNs require the only communication scheme of many-to-one, i.e., from multiple sources to one particular sink, rather than multicast or peer to peer. Selecting the optimum sensors and wireless communications link requires knowledge of the application and problem definition. The basic idea of clustering routing[3][7] is to use the information aggregation mechanism in the cluster head to reduce the amount of data transmission, thereby, reduce the energy dissipation in communication and in turn achieve the purpose of saving energy of the sensor nodes. In the clustering routing algorithms for wireless networks, LEACH (low-energy adaptive clustering hierarchy) [4][5] is well-known because it is simple and efficient. LEACH divides the whole network into several clusters, and the run time of network is broken into many rounds. In each round, the nodes in a cluster contend to be cluster head according to a predefined criterion. In LEACH protocol, all the sensor nodes have the same probability to be a cluster head, which makes the nodes in the network consume energy in a relatively balanced way so as to prolong network lifetime.

II. LITERATURE SURVEY

[1] discusses the energy hole problem which is caused by turning off the sensor node which is near to sink node which includes in frequent transmission particularly in MAC based WSN. Author proposed an Energy-Aware Hybrid Data Aggregation Mechanism (EHDAM) which controls data transmission with burst length by adjusting threshold value in reciprocal proportion to the remaining energy state of the node. This mechanism increases the lifetime of the nodes that are affected by energy hole problem.
[2] author proposed two aggregation schemes called singlehop-length (SHL) and Multiple-hop-length(MHL) where the WSN are randomly deployed with some node density. It mainly proposes on the study of tradeoffs between aggregation throughput and gathering efficiency. Author showed that a set of symmetric function called Divisible Perfectly Compressible (DPC), mean, max and various kinds of indicator functions, the data can be aggregated to the sink the throughput of a constant order. The author has proved the MHL is scalable.
[3] states that data aggregation significantly reduces the communication overhead and energy consumption. The author proposed a loss-resilient aggregation framework called synopsis diffusion, which uses duplicate insensitive algorithms on top of multipath routing to calculate the aggregates. By doing this there comes a problem of false sub aggregate values to contributed by compromised nodes. This may cause a large errors in aggregate computed at sink node. The author has

proved through attack-resilient computation algorithm which guarantees the successful computation of aggregate at sink node.

[4] proposes a theory due to limited computational power and energy resources, data aggregation is done only on the basis of simple methods like averaging. If a node is compromised then it is vulnerable. Thus trustworthiness of data is crucial part in collecting the data. Iterative filtering algorithms can be trusted for this purpose. These algorithms simultaneously aggregate data from multiple sources and provide trust assessment of these sources, usually in a form of corresponding weight factors assigned to data provided by each source. The author discussed several algorithms that are existing and proposed an improvement for iterative filtering technique by providing initial approximation and making them collision robust, accurate and faster converging.

[5] addressed the problem of localizing an unknown number of energy emitting nodes. They came across Bayesian solution for joint estimation of unknown sources as well as their parameters based on SMC sampler. Author derived posterior Cramer-Rao bound which helped in estimating the characteristics of these multiple energy emitting resources. Author derived the equation which can be used as a criterion to minimize in order to design efficiently the network parameters.

[6] discusses the application over the principal component analysis(PCA) as one of the solution to data aggregation in power and computational limited environments. The author proposed a method known as Jacobi Eigen Value algorithm. Signalling has been reduced by means of exchanging the parameters in order to keep projection basis synchronized. The algorithm is able to sustain the number of projections by a defined threshold value. Author proved that with the proper adjustments of Jacobi updates, there is a minimum loss of energy consumption.

III. COMPARISON

LEACH protocol was carried out and different phase comparison has been made during the design and implementation of the protocols it was clear that performance gains by Modified cluster based data aggregation better than LEACH. The implemented protocols might prove to be more successful when used for routing packets in sensor networks. The LEACH is a well-known routing protocol for cluster based wireless sensor networks. This paper analyses the performance of LEACH-based wireless sensor networks in terms of lifetime and throughput. The reasonable number of frames in a LEACH round is deduced to prolong the lifetime and increase the throughput. Wireless Sensor Networks would be of great use in future mission applications. If we analyze the previous research, we could observe that a lot of work is being carried out on routing i.e. what is the best optimal path for the nodes to communicate with each other. In this paper, we have also discussed LEACH routing protocol. Basically how does it works has been explained above with its advantages and disadvantages. LEACH protocol is also vulnerable to various kinds of attacka. Electing cluster head randomly in LEACH protocol causes that the current energy of some cluster heads are less or their distances to base station are far, because of the heavy energy burden, these cluster heads will soon die. For this issue, this article proposed a new improved algorithm of LEACH pbgvrotocol which is aim at balancing energy consumption of the whole network and extending the network lifetime by balancing the energy consumption of these cluster heads. In comparison with the LEACH protocol the proposed method is energy efficient and responsive to network. The proposed system selects efficient Cluster Heads, optimization of routing and increase the network lifetime. It has been observed that Bayesian Network is used to probabilistically select Cluster Heads in achieving better results as compare with LEACH approach. As compared to LEACH protocol the proposed model performed better performance in the network. A simulation results obtained from a proposed algorithms are more efficient than LEACH algorithm.

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