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Survey on Data Collection Techniques in Wireless Sensor Networks

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Abstract— ***In Wireless sensor networks, data are transfer from sensor node to base station. Sensor nodes are work as a sensor to sense the data from environment depends upon to its functionality and forward data to its base station. To collect data by sensor node or transfer to base station is called data collection. Data is collect by nodes either directly or multi-hop routing. In direct routing technique data is transfer directly by sensor node to base station which influences the energy consumption from sensor node because there is far distance between the sensor node and base station. In second technique multi hop-routing the data is transfer through multiple nodes to the base station, it consume less energy. In this paper discuss various data collection and routing based techniques like LEACH, MODLEACH and RFDMRP.***

Keywords: Data collection; Energy efficiency; Routing protocols; Wireless sensor networks

1. INTRODUCTION

Wireless Sensor Networks (WSNs) is extensively used in numerous real time applications such as military, medical, disaster detection, structural monitoring, etc. These WSNs contains huge set of small sensor nodes, deployed in the environment for monitoring environmental parameters such as humidity, temperature, pressure, etc. The wireless sensor nodes sense the data from environment based on the application and forwards to the central base station or sink for further processing4. This process is called data collection, which is the primary task of the WSNs. In data collection process, the sensor nodes forward the data to the central base station either by direct communication or by multi-hop communication. The direct communication from sensor nodes to base station is energy expensive due the distance between sensor nodes and base station is more, this reduces the lifetime of the network. Alternatively, Multi-hop communication schemes are used for better network lifetime and performance due to its effective utilization of resources. The main objective of data aggregation is to increase the network lifetime by reducing the resource consumption of sensor nodes (such as battery energy and bandwidth). Data aggregation is defined as the process of aggregating the data from multiple sensors to eliminate redundant transmission and provide fused information to the base station. Data aggregation usually involves the fusion of data from multiple sensors at intermediate nodes and transmission of the aggregated data to the base station (sink).

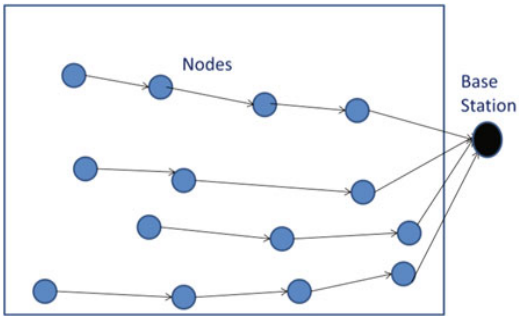

Figure1.1: Data Transfer in WSN

2. LITRATURE SURVEY

Koppala Guravaiah et al. in [1] A new mechanism for data collection and routing based on River Formation Dynamics. The proposed algorithm is termed as RFDMRP: River Formation Dynamics based Multi-hop Routing Protocol. This algorithm is explained and implemented using MATLAB. The performance results are compared with LEACH and MODLEACH. The comparison reveals that the proposed algorithm performs better than LEACH and MODLEACH. In WSN, multi-hop routing is an effective mechanism for data collection. In multi-hop routing, the selection of forward node for relaying data plays a vital role. In this paper, one of the swarm intelligence mechanisms, RFD, is used to propose RFDMRP. RFDMRP is an RFD based multi-hop routing protocol for data collection in WSN to conserve

energy and expand the network lifetime. In RFDMRP, RFD considers the hop count value and residual energy as parameters for forward node selection. Finally, proposed work was compared with LEACH and MODLEACH by considering the performance metrics such as network lifetime and energy consumption. From the results, it is observed that RFDMRP performs better than the existing algorithms.

R. Elankavi et al. in [2] wireless sensor network (WSN) is made up of several autonomous spatially distributed sensor nodes that can be used to sense information about the physical or environmental conditions like pressure and temperature etc. and to cooperatively pass their data to the destination location through the network. Wireless sensor nodes are energy constrained and efficient techniques have to be employed while collecting data to maximize network lifetime. Energy is expended in two ways; in sensing the data and in sending the data to sink. Focuses on data collection and discusses about several ways in which data can be sent to the sink.

Yi Wang et al. in [3] Data collection is one of the main research topics of wireless sensor networks in recent years, and, data collection research outside users through wireless sensor networks to collect perception data from the monitoring area. Formal concept analysis is a data analysis tool, especially for investigation and treatment can be given information to discover important information hidden in the data behind. In addition to these commonalities, each specific application, there are some differences, such as the requirement of real-time, fault tolerance, data acquisition frequency. This paper proposes the data collection methods in Wireless Sensor Networks based on formal concept analysis. Experiments show that the proposed FCA-based data collection algorithm in WSN more effective than the traditional algorithm.

Shivendra Dubey et al. in[4] The challenges in wireless sensor network (WSN) are detecting the relevant quantities, controlling and merging the data, allocating and estimating the information, formulating significant user displays, and performing decision-making etc. Existing work had the intention of reducing the completion time of converge cast. Data collection is one of the most important operations of wireless sensor networks. Various data collection techniques designed for sensor networks and many practical applications require the real-time data transmission, such as controlling, tracking, etc. represent a survey of data gathering techniques to get the increasing capacity, routing protocols along with algorithms proposed for remote wireless sensor networks. We find, these schemes usually try to discover the least amount energy path to optimize energy usage at a node. Our goal is to provide a better understanding of the current research issues in this field. We also try to investigate of its various designing constraints and the use of certain tools to meet the design objectives.

Sumit Chaudhary et al. in[5] Wireless sensor networks (WSN) have been invoked the monitoring of remote physical environment and are used for a wide range of applications ranging from defense personnel to many scientific research, statistical application, disaster area and War Zone. These networks are constraint with energy, memory and computing power enhance efficient techniques are needed for data aggregation, data collection, query processing, decision making and routing in sensor networks. The problem encountered in the recent past was of the more battery power consumption as activity increases; need more efficient data aggregation and collection techniques with right decision making capabilities. proposed the efficient and effective architecture and mechanism of energy efficient techniques for data aggregation and collection in WSN using principles like global weight calculation of nodes, data collection for cluster head and data aggregation techniques using data cube aggregation. the improved technology for energy efficient techniques for data aggregation and collection in WSN. The paper provides the accurate usage of battery and low power consumption so that the user can send multiple messages in limited resources. The parameters that are used manage the cluster head generation, and the node selection methods so that the message can be easily transferred under such circumstances with right decision using principles like global weight calculation of nodes, data collection for cluster head and data aggregation techniques using data cube aggregation.

S.H. Ahmed et al. in [6] energy efficient protocols are categorized into two types (i) heterogeneity based energy efficient routing protocols and (ii) chain based energy efficient routing protocols. Comparisons of various energy efficient routing protocols are specified here with open issues. A systematic and comprehensive taxonomy of various energy aware schemes are discussed in depth. This chapter is focused on various energy conservation schemes and hence, discussion of various routing protocols gives the readers a new insight. An increasing interest towards sparse network architecture can be noticed but such network can be

useful only if the advantages of mobility are exploited. The dependence and complexity upon the collaborative efforts of WSN require use of energy efficient protocols through which connectivity of the network can be maintained. New protocols are required to improve network lifetime, delay and network connectivity.

Feng Wang et al. in [7] Wireless sensor networks (WSNs) have been applied to many applications since emerging. Among them, one of the most important applications is Sensor Data Collections, where sensed data are collected at all or some of the sensor nodes and forwarded to a central base station for further processing. A survey on recent advances in this research area. We first highlight the special features of sensor data collection in WSNs, by comparing with both wired sensor data collection network and other WSN applications. With these features in mind, we then discuss the issues and prior solutions on the utilizations of WSNs for sensor data collection. Based on different focuses of previous research works, we describe the basic taxonomy and propose to break down the networked wireless sensor data collection into three major stages, namely, the deployment stage, the control message dissemination stage and the data delivery stage. low duty-cycle is considered as an effective way to extend the network lifetime of a WSN, yet an interesting topic is to explore how its utilization in networked wireless sensor data collection interacts with other design issues; and another direction is to further optimize the system performance by combining the designs of the deployment, data delivery and control message dissemination stages together.

Mohammad Hossein Anisi et al. in [8] Wireless Sensor Networks (WSNs) are usually self-organized wireless ad hoc networks comprising of a large number of resource constrained sensor nodes. One of the most important tasks of these sensor nodes is systematic collection of data and transmits gathered data to a distant base station (BS). Hence network life- time becomes an important parameter for efficient design of data gathering schemes for sensor networks, cluster and tree structures for data gathering. Proposed energy-efficient mechanism, the most appropriates hops for data forwarding will be selected and the lifetime of the whole network will be maximized. The simulation results show that by using the proposed approach, the lifetime and the throughput of the network will be increased. there are three factors which enable the nodes to choose an appropriate parent in term of energy. These factors are distance, residual energy and data correlation. With the suggested mechanism, the remaining energy of the nodes will be increased and the life time of the whole network will be increased, too.

Chetan Agrawal et al. in [9] The challenges in wireless sensor network (WSN) are detecting the relevant quantities, controlling and merging the data, allocating and estimating the information, formulating significant user displays, and performing decision-making etc. Existing work had the intention of reducing the completion time of converge cast. Data collection is one of the most important operations of wireless sensor networks. Various data collection techniques designed for sensor networks and many practical applications require the real-time data transmission, such as controlling, tracking, etc The flexibility, fault tolerance, low-cost and quick development characteristics of wireless sensor networks creates many latest and exciting application areas for remote sensing. In further, this broad choice of application areas will construct wireless sensor networks an integral part of our lives.Various data collection methods and routing protocols in Wireless Sensor Network. Many schemes are more efficient in terms of eliminating interference but to achieve power consumption, Qos, fault tolerances, scalability, estimated cost, hardware, topology change, power consumption, fast data transfer etc some different new wireless ad hoc networking techniques are required.

Neethu M. Nair et al. in [10] Data collection is the most important problem in wireless sensor networks. Main goal of data collection is to collect large amount of data and to reduce the data loss due to less memory capacity of sensor nodes. Effective data collection techniques can improve the performance of sensor networks. Many researchers have been proposed various methods to collect data in sensor networks. Describes a survey on data collection in wireless sensor networks. Classifieds the methods into three different categories. First, data collection using static sink approach, then data collection using mobile sensor nodes, finally data collection using mobility based approach, this method is again classified into two groups, and they are data collection using single mobile sinks and data collection using multiple mobile agents. Advantages and disadvantages of each method are also studied and we made the comparison of each method with different constraints such as amount of collected packets, energy efficiency, network lifetime, etc.

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3. VARIOUS DATA TECHNIQUES IN WSN

The primary design goals of traditional wireless networks is to provide high service quality and efficient bandwidth utilization, followed by considering energy conservation; the primary design goals of sensor networks is the efficient use of energy, which is the sensor networks and traditional networks one of the most important distinction. The data collection protocol is the routing layer protocols, research and sensor nodes how the data transmitted to the base station. Sensor node's energy consumption is mainly concentrated in the communications equipment, including transmission of data, receive data, and the listener; the routing nodes consume more energy than in non-routing node [2]. Effective data collection protocol can make the data collection process used to transmit data, receive data , and listen for the energy minimization. Various Techniques are used to collect data in wireless sensor network .we can discuss LEACH, MODLEACH and RFDMRP techniques.

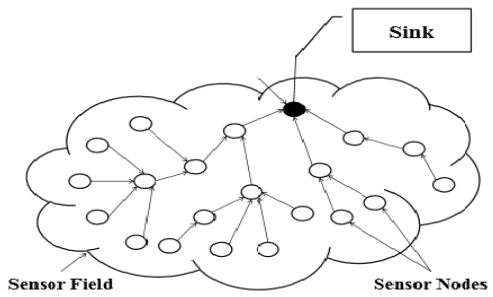

Figure1.2: Data Collection Technique

3.1 LEACH(Low-Energy Adaptive Clustering Hiera- rchy)

The LEACH (Low-Energy Adaptive Clustering Hierarchy) protocol uses a random approach for distributing energy consumption among the nodes. In this approach, the nodes organize themselves as local clusters and one node roles as a local base station or a cluster head. If the cluster heads can be selected base on a priority permanently and they also can be permanent in the whole life time of system, it is obvious that the bad luck nodes which are selected as the cluster heads will be died soon and the life of all the nodes in their cluster will be finished. Thus, LEACH chooses the cluster head among the nodes which have enough energy randomly. This can prevent the discharging of the battery of a special node. In addition, LEACH uses local data fusion for compressing the data which should be sent from cluster heads to the base station. FTEP is a dynamic and distributed CH election algorithm based upon two level clustering schemes. If energy level of current CH falls below a threshold value or any CH fails to communicate with cluster members then election process is started which is based on residual energy of sensor nodes. In EEMC (An Energy Efficient Multi Level Clustering), CHs at each level are elected on the basis of probability function which takes into consideration the residual energy as well as distance factor very efficiently. In this scheme whole information is sent and received by sink node for cluster formation .To reduce the total energy consumption for data transmission between the source node and the sink node, a different virtual grid structure instead of virtual grid in GGR is constructed. The idea is to construct the virtual grid structure based on the square Steiner trees.

3.2 MODLEACH(Modified LEACH)

Wireless sensor network's routing protocol "LEACH "as modified LEACH (MODLEACH) by introducing efficient cluster head replacement scheme and dual transmitting power levels. Our modified LEACH, in comparison with LEACH out performs it using metrics of cluster head formation, through put and network life. Afterwards, hard and soft thresholds are implemented on modified LEACH (MODLEACH) that boasts the performance even more. MODLEACH, a new variant of LEACH that can further be utilized in other clustering routing protocols for better efficiency. MODLEACH tends to minimize network energy consumption by efficient cluster head replacement after very first round and dual transmitting power levels for intra cluster and cluster head to base station communication. In MODLEACH, a cluster head will only be replaced when its energy falls below certain threshold minimizing routing load of protocol. Hence, cluster head replacement procedure involves residual energy of cluster head at the start of each round. Further, soft and hard thresholds are implemented on MODLEACH to give a comparison on performances of these protocols considering throughput and energy utilization.

3.3 RFDMRP(River Formulation Dynamics based Multi-Hop Routing Protocol)

RFDMRP is one of the heuristic optimization method and a subset topic of swarm intelligence. RFDMRP is based on replicating the concept of how water drops combine to form rivers and rivers in turn combine to join the Sea by selecting the shortest path based on

Protocol	Classification	Data Collection	Energy Efficient	Failure Recovery	Network Type
LEACH	Hierarchical cluster based	Yes	Average	No	Homogenous
MODLEACH	Multi-Hop	Yes	Good	No	Homogenous
RFDMRP	Multi-Hop	Yes	Very Good	Yes	Heterogeneous

TABLE 1 Compare by Performance

altitudes of the land through which they flow. In the process of river formation, the water drops are always flowing from higher altitude position to lower altitude positions. Since, the slope of the two positions is more, then the water flowing from higher positions to lower positions erode and carry the eroded soil to be deposited in the lower positions. By this deposit the altitude of the lower position get increased. Also shortest path is formed from higher to lower position. The process of RFDMRP mainly consist of two stages viz., Initialization stage and River formation stage11. In initialization stage, three different positions (called water drop generating positions or Source (S), intermediate positions (I), and destination (D) or sea) are initialized. All these positions are represented with different altitude value (S and I are represented with positive altitude values and D is represented with Zero). The water drop generating positions always generates water drops. The intermediate positions receives the water drops from source and forward towards the Sea. In river formation stage, the river is created between drop generating positions and Sea using the iterative process having the functions select–Forward–Position(),move–Drops(), erode–Path(), and add–Sediments(). The iterative process is repeated until either all drops follow the same path or satisfying the other ending conditions such as limited number of iterations, limited execution time.

4. COMPARATIVE ANALYTICAL TABLE FOR MULTI-HOP ENERGY EFFICIENT PROTOCO

In Table 1, we can clearly observe difference in the parametric values of all the energy efficient protocols. All protocols have different measures. As LEACH, MOD LEACH etc. are less scalable as compared to RFDMRP etc. protocol. Due to load balancing few protocols are more energy efficient than other protocols. Focusing the energy parameter develops these protocols. In this chapter, we have surveyed the many approaches to energy conservation techniques in wireless sensor networks. Main objective is to discuss the comprehensive and systematic categorization of the solutions proposed in the literature.

5. ACKNOWLEDGMENT

A large number of energy efficient protocols have been proposed in recent past. Still there is lot of work to be done and research is continued. We have stressed on many approaches, like data driven and mobility based ideas. Final observations can be drawn on the basis of different techniques of energy management. An increasing interest towards sparse network architecture can be noticed but such network can be useful only if the advantages of mobility are exploited. The dependence and complexity upon the collaborative efforts of WSN require use of energy efficient protocols through which connectivity of the network can be maintained. New protocols are required to improve network lifetime, delay and network connectivity.

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