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Energy Efficient Data Collection in Hierarchical Tree with CBR Technique in Wireless Sensor Networks

[1]Rajeswari S., [2]Dr. Ponmuthuramalingam
[1]Department of Computer Science, Karpagam University, Coimbatore, Tamilnadu, India
[2]Head of the Department of Computer Science, Govt. Arts College(Autonomous), Coimbatore, Tamilnadu, India

Abstract-

Wireless Sensor Network lays a great platform to many researchers to apply their new trends, because it is one of the modern fast growing, gaining-momentum technology. Data communication between sensor nodes consumes substantial energy. Energy-efficient power management is required to enhance its lifetime within its prescribed limit of time, to make it useful in regulating a service without break. So many routing protocols like multipath, data centric, tree based, qos based , mobility based and hybrid based are there, in which optimal based routing is achieved in the context of energy. Data collection may be limited to a certain number of sensor nodes and within the particular period of time and mobility, Beyond this network, some other relay nodes have to be accommodated. So, many researchers tried their best to reduces the important power consumption parameter's ratio, which will lead to reduce the overall cost and enhance the data collection ratio.This research suggests an efficient and new technique namely CBR in data collection which will help us to reduce power consumption, within the available resources, The entire data collection process can thus be improved and speeded up. Hence, the potential of CACHE BASED REVISED (CBR)algorithm can be stated to not only excel existing proved energy values but will also help in resolving new output..
The rejuvenation of the failure nodes are replaced by many technical ways, this research work introduces a new technique to overcome this problem.

Keywords – CBR, Protocols, Relay Node, Tree Construction and Cache Technique.

I. INTRODUCTION

The present research investigates three main areas: They are 1) Sensor & Network topology – construction of an efficient structure with special added quality is useful to increase the data collection rate tremendously, 2) Power Management Technique - efficient handling of power-based protocols will reduce cost and 3) Cache - applying Cache Based Revised algorithm with new features to utilize full power within the maximum life time of battery.

The principal work of the sensor is to sense. Following this other processes are, collection of sensed data, sending, processing those data, are of which are inter-dependent processes. If delay in any one of the above said processes takes place, the entire process will be affected. Single-data sensing is inevitable, because of its critical system of operation which is responsible for initiating the other chains of related processes. Inside the CPU, provision of Cache memory for further improvement in the present algorithms will enhance the fast data collection rate. Nowadays, there are many technical challenges associated with sensor networks. One of them is to utilize maximum of network lifetime for fast data collection. Results of recent research papers were compared for strengthening the present area of research. This in turn would help to formulate revised effective algorithms.

II. SENSORS IN WIRELESS NETWORK

A *Sensor* is a device, which responds to an input quantity by generating a functionally related output, usually in the form of an electrical or optical signal. The main purpose is to sense, and channelize it, as quickly as possible, using available facility with modern methods. Earlier, sensor was used for highly confidential Governmental works, but nowadays this new fast growing technology is being applied in many fields such as, Home Security, Real-time Collection of Data, Tracking Forest Fire/Endangered Species and so on. Nowadays, sensor nodes focus on to cover long distance within the available minimum energy.

III. POWER AND TIME

We are in a wire-free world. The numerous mainstream media articles on NBN, particularly the comments sections, are invariably about wireless world. Minimizing the power consumption or using minimum power in a efficient manner is a notable and important issue[1] in the current day scenario.

Energy consumption in network and node level is an important parameter in network design and deployment. Energy consumption estimation techniques for wireless sensor networks can be divided into two categories, namely, the Simulation Oriented and the Hardware Based. The second category is related to Real measurements. Software simulators are based on energy models, in order to accurately predict energy consumption based on execution of real applications, codes and measurements. Software estimators use more realistic models for the accurate prediction of actual energy

consumption of nodes. Energy consumption simulation is the basic component in several simulators such as SensorSim, senQ, SENSE, SENSIM and
J-Sim[2] with detailed energy models, and in some of them, battery discharge rate and relaxation are considered as well.

Total energy consumption in node level comes up as the sum of the energy consumptions of the individual components of the node. Considering a node as a composition of various subsystems, identification of discrete energy states due to specific subsystem function results in composite energy profile consisting of superposition of individual components energy states. State transitions are energy consumable and should be taken into account in calculating the total energy consumption. However, it is hard to identify in measurement stage the energy consumed during the transition.

Energy consumption values of the individual components are extracted, in order to be used in the formula , which calculates node's energy consumption. Hence, the energy consumption formula is a function of the current draw of the microcontroller at every energy state, the current draw of the radio communication subsystem which corresponds to the appropriate function state (Transmitting, Listening), the current consumption of every individual LED and the current consumption of the other components. Measuring current consumption from network nodes at the same time and integrate the product over time is the basic approach for the energy calculation[2].

IV. CACHE BASED-EXTERNAL MEMORY

Cache memory is a very fast memory which is in a computer's CPU, or located next to it. Cache is used to receive CPU attention very fast. It is mainly used to store an important instruction which are often required by the system. Moreover it is very helpful to improving overall system speed.

Three types of Cache are 1) *Level 1* (Within CPU Block) 2) Level II Cache (Located separately near CPU) 3) Level III (Some CPUs have both L1 and L2 cache built-in). Cache is faster than other memory. Cache is more expensive than other memory, but it is worth getting a CPU and motherboard with builtin cache in order to maximize system performance.

V. ENERGY EFFICIENT CACHE BASED REVISED ALGORITHM IN WSN (CBR)

Set of nodes specially designed with cache memory and mainly used for caching sensed data is called *cache node* and *cache-technique*. Cache Layer Formation: CBR constructs cache-based head layer instead of clusters, According to CBR procedure all sensed data reach the head station depending upon priorities .

The entire process of data collection should be designed to utilize the limited energy resources of the sensors. In this paper, Cache Based Revised Algorithm to organize the sensors in a wireless sensor network into groups is proposed. This algorithm is extended to generate a hierarchy group heads and observe that the energy savings increase with the various levels in the topology. Results in some mathematical methods are used to derive solutions for the values of parameters of the Cache Based Revised algorithm that minimizes the complete energy spent in the entire network, when all sensors nodes report their sensed data through the group heads to the processing center.

VI. CACHE LAYER IN CBR

Data cached by the intermediate cache node will decrease the long voyage from sensor to concerned report station, thereby provide the shortest path which will consequently reduce so many important technical values which includes the cost factor. Sensed data will be preserved in one of the important layer formed by CBR technique. So, data provided to the receiver is by the cache and not by the source.

Structure maintenance is one of the tedious and important tasks which should be done in an energy-efficient manner. If a sensing node fails during data collection, the tree structure is disconnected. Even a single node fault will badly affect the researcher's entire result. At the same time, reconstruction also affects the time slot in completing a data collection[3]. Consequently, time delay will be a fatal one. Lower bound on minimizing the power consumption cannot be achieved. Hence, we cannot omit the reconstruction in such a situation. The present algorithm helps us to overcome these problems. Whenever hierarchical tree gets reconstructed due to instability in WSN, updation takes place in cache node and simultaneously in parent node.

In WSN, cache node sends all the new updated information to the parent. This will reduce the scheduled length. In this paper, cache node which is just a substitute or mirror of parent node is introduced. This layer of cache node maintains all its child node details and power consumption record of each node. So there is no need to travel towards parent node to acquire any kind of information. They get it through a shorter route from the nearest cache node.

In order to find out the deficient part of the network structure , many structure fault detection methods are used. Many algorithms have been proposed to find out such faulty conditions in the network. But it involves a tedious process to overcome such tediousness, the present method suggests a good remedial measure in the form of CBR technique. Information is collected with the help of the sensor node, forms a good clustering, makes a clustering head and gives the responsibility to the head[4]. Cache layer along with the head and a speeded up entire process are introduced. CBR algorithm is applied in one of the important layers to recover lost data[5].

6. 1 GROUPING, LAYER & HEAD FORMATION

A hierarchical approach breaks the network into several layers. Network structure play a vital role in minimizing the path of the packets in the concerned route[6]. Nodes are grouped under one branch, with a corresponding part head, that has the responsibility of routing from the one lower part of branch to higher part or base part. Data move from a

lower part to a higher one. Cache layer provides inherent optimization capabilities at the layer heads. In the cache based hierarchical model, data is first collected, grouped under special proposed algorithms and sent to the particular predefined order(Shortest path among the available paths)towards prescribed sink. This technique is better than the one-hop or multi -hop model.

It is known that if the distance decreases between the cache node and base station, the node's lifetime and WSNs lifetime also increase. This will consume less energy in long distance communication. Simulation results show that the protocol offers a better performance. At the beginning, certain validations are there to form cache layer, viz., where and when, at which layer, with how many child nodes and so on.

A cache-based model moves the data quickly to the base station thus reducing time and power. The reduced latency is less than that in the multi-hop model. Here, only layer-heads perform data collection, whereas, in the multi-hop model, every intermediate node performs data collection. The grouping technology is more suitable for time conscious applications. The main disadvantages over available methods are long disadvantages and variety of problems will be faced by the data during its travelling. Groups sensor into groups with each led by a cache layer head. Cache guarantees lower energy dissipation and a larger number of sensor alive.

Dynamic sizing of groups based on group distance from the base station determines the cache heads. Clusters at a greater range from the base station require more energy for transmission than those that are closer. The distribution of energy throughout the network is improved, resulting in better resource usage and extended network life time. where the network is partitioned into a set of cache groups with one cache head in each layer. Communication between layer head and base station is single-hop. In the network deployment phase, the base station broadcasts a welcome message to all the nodes at a certain power level, based on the strength of the received signal. The concept of hierarchical routing is to perform energy -efficient routing in WSNs, and hence, to prolong the networks lifetime. The creation of cache layer and assigning tasks to branch heads can contribute to overall system scalability, lifetime and energy efficiency.

6.2 DATA COLLECTION

If sensed data is not sent to sink, it means there is no need to sense again as it will be available in cache. Duplicate sensing of data will be filtered by cache. If the sensor is inactive, cached data will be invalid. If there is more sensor sense, the same data will move them in a single packet to sink, meaning there is a duplication held. So, duplication will vanish.

Each node is defined on the basis of its required energy. Based on this, all nodes are arranged accordingly. High energy nodes will be categorized and grouped with cache layer. This will help us to enhance the network's lifetime. Incase of any failure, revised algorithm will check for alternate route.[7]. CBR is easy quite easy to handle and it is flexible as well as accessible to any type of change in the network. This CBR technique can be visualized metaphorically in the form of the tree. In this technique , collection is done by constructing a tree, which could be named as spanning tree. In the spanning tree, sink is considered as root and source nodes are considered as leaves. Each child node has a parent node to forward its sensed data. Data flow starts from last nodes or end node up to the Collection Center, and data collection is carried out by parent nodes. Throughput[8] is one of important parameter in this CBR algorithm.

VII. SOME HIERARCHAL PROTOCOLS IN WSN

1. TDMA : Protocol [9]As many transmissions as possible during every timeslot.
2. LEACH[1] : Leach is usually called as Low Energy Adaptive Clustering Hierarchy protocol. The randomised protocol has been used in order to balance the energy consumption between the nodes by allocating the Cluster Head role to the other nodes in the network. In LEACH there is a Single-hop routing from node to cluster head, thus saving energy.
3. PEGASIS[10] is a near optimal chain-based power efficient protocol, based on LEACH . This protocol is in position to outgo LEACH for different or various network sizes and topologies cluster creation in LEACH. This decreases the number or quantity of data transmission volume through the chain of information aggregation. Within the network, the energy load is distributed consistently, so that, the subsequent early deaths of sensor nodes are prevented successively. All sensor nodes act as leaders.

VIII. CONCLUSION

The highlight of this paper is to signify the imperativeness of power,time and cost effectiveness relating to fast data collection. In this regard the researcher proposes the CBR algorithm. This CBR is meant to meet network lifetime challenges through focusing on factors such as energy efficiency, scalability, reliability, mobility adaptability, QoS support and Node Deployment and many other related factors. Though many ongoing processes are there to enlarge the lifetime of the wireless sensor network,.it is to be mentioned that sensor nodes are uniformly distributed[11] all around, which necessitates lot of energy to cover all nodes. Therefore this research analysis suggests within the current resources, how quickly the data can be acquired, using this cache technique, and suggests the best possible solution leading to fast data collection. The disjointing edge of the current trees namely spanning tree is also to be preserved. Building a new technique is always a legal restriction of the original tree. Before adopting the revised techniques, the new algorithms will check all the conditions using perfect qualitative algorithm. This will greatly help to eliminate interferences and the Cache Based Revised algorithm will attempt appropriate use of data structure. An appropriate technique is followed to speed up the fast and energy-efficient data collection significantly. The accuracy of this analysis, along with the performance evaluation of the data, will be verified through proper simulation methods.

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