
A Novel Approach for Reducing Energy Consumption using Binary Tree Structure in WSN

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Abstract

Data aggregation is very vital method in wireless sensor networks. As the data aggregation decreases the energy utilization and efficiency increases. We are discussing about data aggregation and its various energy-efficient techniques used for data collection in WSN as well as representing diverse sorts of architectures, its requirements and classification. In our propose work we apply binary based approach for getting better result.

Keywords

Wsn, Data Aggregation, Cluster, Tree Based Approach.

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Introduction

In a typical extensively Wireless Sensor Network (WSN), massive data is generated from sensor nodes and delivered to a sink node and that the collected data is pre-processed, and relayed to a server for various applications. Conventionally, data is forwarded from individual sensor nodes to the base node independently via multi-hopping, which results in heavy communication overhead across the network and gives growth to the so-called bottleneck effect. That is, nodes that are close to the base station will consume much energy due to relay tasks from remote nodes^[1].

A WSN comprises of sensor nodes protect over a environmental region for monitoring physical phenomenon like humidity, vibrations, seismic events, temperature and so on. More commonly, a sensor node is a maintenance tool which comprises three basic elements: a processing subsystem for nearby info processing and storage, a sensing subsystem for data accept from the physical surrounding atmosphere, and also a wirelessly communicate subsystem for data transmission^[2]. In addition, a power source supplies the energy required through the instrument to execute the programmed job. This power source mostly contains of a battery with a fixed energy budget. The development of WSN was originally inspired through military usage like battlefield surveillance. However, WSNs are now exploited in multiple civilian uses field contains the atmosphere and habitat monitoring cause to many restrictions arising from their un-costly nature, fixed size, weight and ad hoc process of spread, every sensor has fixed energy. Moreover, it could be uncomfortable to charge the battery, because nodes may be spread in an impractical atmosphere. At the network layer, the motive is to search methods for energy adapt route setup and credible relaying of data from the sensor nodes to the base, in sequence to maximize the lifetime of the network. Sensors are most sensitive to energy consumption.

Data Aggregation

Data aggregation is the procedure of collecting and aggregating the necessary information. Data aggregation is one of the essential processing method for conserving the energy. In WSN data aggregation is an adapt method to save the bounded resources. The main objective of data aggregation algorithms is aggregate data and to save energy in efficient way so that network span time is prolonged^[3]. The data aggregation is an approach utilized to resolve the overlap and implosion issues in data centric routing. Data incoming from several sensor nodes is combined as if they are about the similar attribute of the phenomenon when they reach the same routing node on the way back to the sink. Data aggregation is a broadly employed approach in WSN. The security problem in data aggregation is integrity and data privacy become necessary when the sensor network is furnished in hostile surroundings. Data aggregation is a procedure of aggregating the sensor data through aggregation manner^[4].

Energy Efficiency in WSN

As energy efficiency is more vital for WSN than any other network, more study works have already been completed in routing for WSN. In common, data transmission in wireless technique takes more power than data processing. When the nodes send more quantity of data their battery power also gets diminished rapidly. We decrease the data size and data fusion for aggregation methods. Data fusion is which the sensed data from multiple nodes are fused at some factor right for the transmission in its diminished size. Even in the data aggregations idea there are two forms of aggregations. The first kind of data aggregation

fuses the data collected from dissimilar sender and transmit the last fused data in diminished size. But the problem behind this approach is it lacks in precision and accuracy of data from various sensor nodes. The second approach combines the data from dissimilar sources under the single header and forward it to the BS. Here header packets combine and pass it to the base station (BS) without any alteration to the newest data from the sensors. Hence correctness is better.

In energy efficient routing in WSN there are two broad classification of procedures. They are,

- Clustering approach
- Tree based approach

Clustering techniques

In this technique separating the sensor network into minor administrable units is known as clustering. Although the main motive behind the execution of the clustering pattern is to progress the scalability of the network, it is an vital element for routing of data within the network. By increasing scalability of the network it has more benefits as conserving bandwidth within the clusters, avert redundant message transmit in the sensor nodes, localizing energy efficient route setup within the clusters. Few of the energy adapt routing protocols depend on clustering are HEED, DECA, LEACH etc.

1. LEACH: Low energy adaptive clustering hierarchy exploits the clustering doctrine to distribute the energy consumption each along its network. Here, depend on data group, network is separated into Clusters and Cluster heads (CH) are chosen randomly. The CH set the info from the nodes that are arrival below its cluster. The steps comprise in every round in the LEACH protocol.
2. HEED: Although the LEACH protocol is much more energy efficient when equated with its predecessors the main weaknesses in this method is the random election of CH. In the worst case, the CH nodes may not be equally distributed amid the nodes and it's going to have its outcomes on the data amassing. To avert the random election of CHs a newest algorithm known HEED was developed that elects the CHs depend on both residual energy phase and communicate price.
3. DECA: DECA is an improved Distributed Efficient Clustering Approach. The basic dissimilarity amid the HEED and DECA is how the nodes take on the basis of score computation and take decision.

Tree Based Approach

Apart from clustering techniques in WSN, additional energy efficient way of routing the data over the network is tree depend strategy. In this approach a hierarchical manner of aggregation points are formed which resembles the tree structure. The leaf are the source nodes and the root is the base node. The data when travelling gets aggregated in the middle nodes itself. The most successful energy adapt routing protocol which follows the tree depend method was PEGASIS.

1. PEGASIS: Though the Cluster depend protocols since LEACH have shown a factor of 8 improvements when compared with its previous protocols further improvements were done by forwarding the packets to only one neighbor of the node. This method had been named as Power Efficient Collecting in Sensor Info System. example of forwarding the packets from several CH as since in LEACH protocol here in PEGASIS every node will form a chain structure to the BS through which the data would be forwarded to the BS node^[5].

Literature Survey

Trong Nhan Le^[6] et. al presented that Reconfigurable directional antennas (RDA) bring new opportunities to reduce data collision in WSN. In a newest Reconfigurable Directional Antenna depend Receiver-Initiated Cycled Receiver (RDA-RICER) MAC (Medium Access Control) protocol is defined for WSNs nodes well-found with switched antennas. An energy efficient scanning and low complexity procedure is embedded in RDA-RICER to identify the way endow the maximum RSSI (Received Signal Strength Indicator) amid two nodes. OMNET++ simulation outcomes for a single hop n/w illustrate that data collision rate can be drastically reduced equated to related MAC protocols, leading to a important lessening in energy consumption. A method is also validated in the area exploiting WSN platforms equipped with a four direction RDA and powered thru solar cells.

Han ZhiHui^[7] et. al presented that the characteristics of WSN, this paper puts onward an ant colony optimization-depend WSN routing algorithm. According to WSN routing strategy and ant colony optimization features, this paper establishes artificial ant, designs ant colony optimization-based routing algorithm framework, theoretically analyzes algorithm convergence and verifies NS simulation platform in experiment. The outcomes illustrate that the improved scheme has perfect performance in energy consumption and global optimization ability.

Roshan Zameer Ahmed^[8] In this paper, define a technique named Cluster-Based Data Aggregation (CBDA) for transmitting the information of CWSB existence in the Coffee Arabica plants, from the sensor nodes to the BS. Ultrasonic Active Sensors (UAS) are made use off to detect these pests in the coffee field. The UAS are placed according to their transmission range. A WSN hybrid model is designed that consists of the time-driven and event driven model for transmitting the information procured. The proposed technique involves three phases: WSN initialization with clustering, data aggregation and routing of the aggregated data to its destination. For every sensor node in the WSN, the clustering technique adopted uses, i-band and o-band range for selecting cluster members and assigns one particular state (i-band, o-band, request for cluster-head, idle, cluster-head). To check the presentation of the define technique simulation experiments is conducted. The result shows that the technique is effective in terms of vigor consumption and aggregation ratio.

Shekhar Kumar^[9] et. al presented that A WSN involves of cheap power unaided sensor nodes gathering data from the sensing field and transfers data towards the BS in a synergetic way. WSN seem as an emerging necessity for humanity recent. The basic objective of WSN is to improve the span time of the n/w, and to exploit the energy of nodes capably. The WSN nodes are confined via storage capacity, and computing power and energy. Thus it's necessity to design more effective and energy aware protocols to growth the n/e stability. Energy efficient implementation and design of WSN has become a very prevalent field of study in current years. Magnify the stability and N/w span time is the major matter in WSN. This defines a scrutiny on dissimilar protocols of WSN.

Kalyan Sasidhar^[10] et. al presented that WSN entail of dissimilar subsystems for instance transmission, reception, power and processing systems and sensing. Battery power of sensor nodes is one of the vital factors to consider in a wireless sensor system. Moreover, when such systems are diffuse in remote atmospheres for few usages where the accessibility of electrical power is minus, the element exiting a major duress. Previous work has tackled this problematic thru introducing sense, transfer, accept and sleep states. Although most work employed these states in tree and cluster based networks they only incorporated at the leaf nodes. This paper introduces state transitions for cluster head nodes to further reduce energy. The algorithms essentially superimpose data aggregation and state transition to progress

the overall span time of the n/w. To legalize the algorithm, we enforce to a finding system landslide monitoring and 30% energy saving for CH node and achieve 33% energy savings for leaf node when compared to naive algorithms that don't apply state transitions.

Bruno F. Marques^[11] et. al presented that the spread of thousands of small devices inter-networked accessible and together thru the Internet is the outcome of the growing trend towards enabling the thoughts of Internet-of-Things. Since these tool may be outspread in a unplanned way, a routing protocol is required. RPL necessitates which communication paths go thru a vital router that may endow suboptimal pathways, create no difference of the usage the nodes run. To address these matters, an Application-Driven extension to RPL is proposed which enables the increase of the WSN lifetime by limiting the routing and forwarding functions of the n/w mainly to nodes running the same application. Define outcome coded in ContikiOS by means of Cooja simulations, and compares it against regular RPL. Outcomes confirm which the define result endow lower end-to-end delays, and lower whole number of packets transferred and received and lower energy consumption.

Problem Statement

In tree dependent method sink node is consider as a root node and source node deliberate as a leave. Data flowing of data beginning from leaves nodes up to root^[12]. Drawback of this method, we know like WSN are not free from failure. In case of information packet loss at any section of tree, the information can be lost no longer only for sole phase however for complete associated sub tree as well^[13].

Propose Work

The essential objective of data aggregation algorithm is to aggregate and collect data in energy efficient manner so that network lifetime is extended. WSN offer a growing attractive method of data aggregation in distributed system.

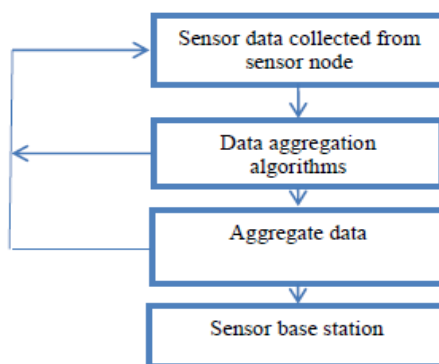


Figure 1. Process of data aggregation

Network aggregation

Aggregation is the worldwide procedure for networking because gathering the information from all nodes by multihop, and reducing resource consumption so that network span time increase. Two approaches for network lifetime.

1. With size reduction
 2. Without size reduction
1. *With size reduction*: In network aggregation with size reduction mentions to the procedure of compressing and joining the data packets obtain through a node from its nearest in sequence to decrease the packet length to be forwarded or transferred towards sink.
 2. *Without size reduction*: In network aggregation without size decrease mentions to the procedure merging data packets obtain from dissimilar nearest node in to a sole data packet but without processing the value of data.

Propose algorithm:

Step1: set GSET = G=T // INITIALLY GRAPH SET EMPTY.

Step2: SINK NODE = // CONNECTING NODE OF SINK.

Step3: put SN (SINK NODE) in middle of sensor area.

Step4: calculate distance of all nodes from sink node.

Step5: minimum distance node become child of sink node.

Step6: then all nodes connected to each other and made complete binary tree.

Step7: every 10 round we change cluster head on the basis of energy and distance.

Step8: all time when we select cluster head these node put in GSET.

Results

Propose result

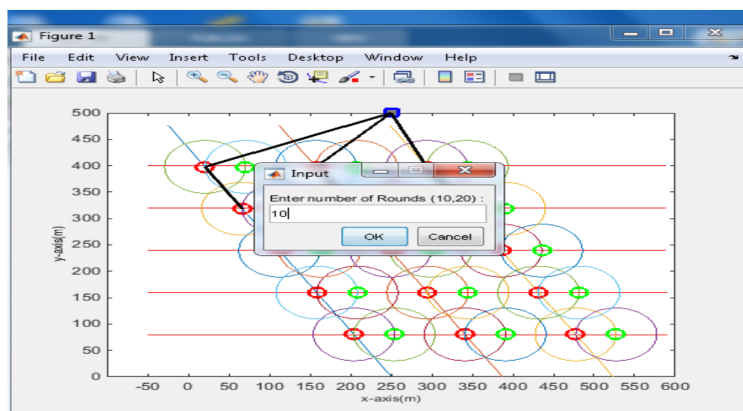


Figure 2. Selection of round

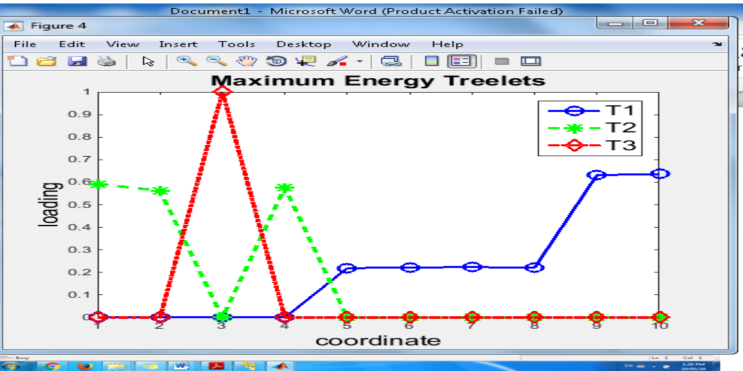


Figure 3. Energy deviation of each round.

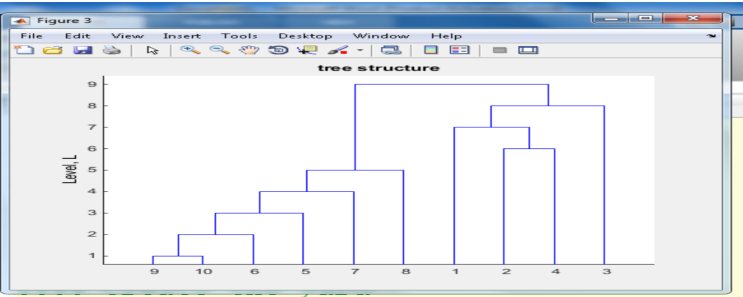


Figure 4. Tree formation for rounds. Tree construction of node at different level of in tree hierarchy

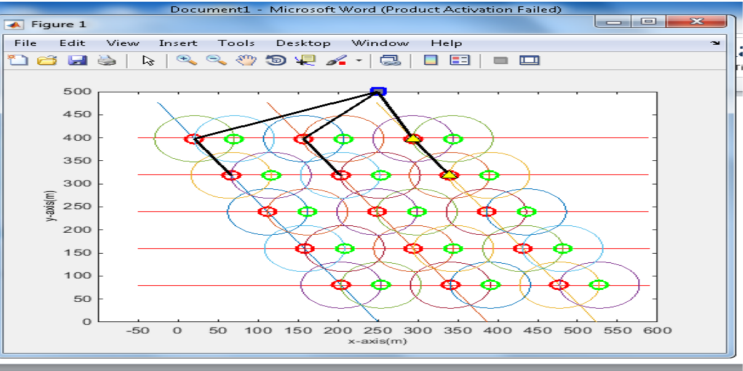


Figure 5. Node selection for data send After selection of round network nodes are ready to event sense and send data.

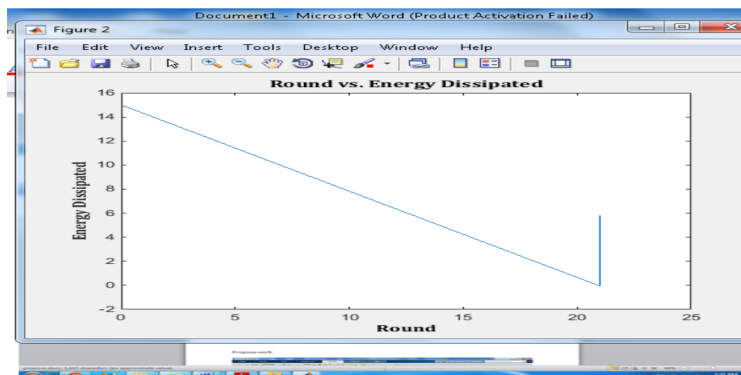


Figure 6. Energy consumption Energy consumption of network in 20 rounds.

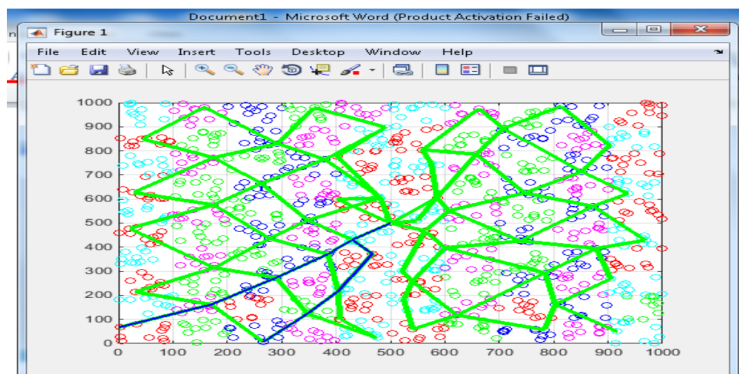


Figure 7. Center approach for data forwarding so that time of should be less for forward data to sink node.

Conclusion

Wireless sensor network is an emerging field in the present era, sensor networks can be used in variety of applications such as weather forecasting, disaster management etc. In tree based approach of data clustering if any level fails then the data gets lost and it will be never be recovered. In our work we will create other active node nearer to the sink node and the packet will be dropped when the sink node forwards the packet.

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