ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 2, Issue 12, December 2017

Energy Efficient Scheduling algorithm in WSN

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Abstract:-- **The most important research in the field of wireless sensor networks (WSNs) is Localization. The sensor nodes in WSNs are useful for various applications like intrusion detection, target tracking, environmental monitoring and network services etc. Wireless charging is a hopeful way to solve the energy constraint problem in sensor networks. The existing studies were considered the problem of data collection on a pre-defined path using a mobile sink which has a fixed mobility pattern. The energy harvesting into wireless sensor networks, a new type of network named mobile data gathering based wireless rechargeable sensor network is considered in this paper. In this paper, a data gathering problem as a network utility maximization problem is formulated, this aims at maximizing the total amount of data collected by the mobile sink while maintaining the fairness of network. Since the instantaneous optimal data gathering scheme changes with time, in order to obtain the globally optimal solution, first transform the primal problem into an approximate network utility maximization problem by shifting the energy consumption conservation and analyzing necessary conditions for the optimal solution. This may cause the mobile sink to drop energy for unwanted movement. The lifetime of network is optimized by using LEACH algorithm, which is simulated and used for wireless grid and Cluster Head selections. The Cluster Head will gain the data from the group members and the same will be forwarded to static sink using mobile sink. The mobile sink can be discovered and selected as dual mobile sinks are used. The Mobile Sink will move using Random-Way Point model and sense the load of the clusters and create an offline checkpoint using MIN-MAX algorithm. The main advantage of the simulated technique is controlled movement of mobile sink according the load available in the clusters. The simulated will acquire more lifetime and performance as compared to the existing techniques.**

Keywords:-- **Wireless Sensor Network, Mobile Sink, LEACH, LBEERP, MIN-MAX algorithm.**

1. INTRODUCTION

Wireless Sensor Network is called as wireless sensor which is spatially distributed over the region. The autonomous sensors are used to monitor the physical and environmental conditions such as humidity, temperature, mobility of living or non-living things. Sensor Network is comprised of large number of different sensor nodes in a large area.

The sensor nodes are randomly deployed either inside or very close to the sensed circumstance. All sensors have cooperative capabilities that they perform wireless sensing, computing and act as a communication elements for gathering andforwarding data from one place to another in the network. The sensor node is the basic unit in the sensor network. The salient features of sensor nodes are self-organization, self-configuration, wireless infrastructure and ability to withstand in harsh environmental conditions. WSN system acts as a bridge which provides connectivity between virtual and physical world. It allows the ability to sense the unobservable node at a fine resolution over large spatial temporal scales. The potential applications are battlefield surveillance, nuclear, biological and chemical attack detection in military, monitoring of human physiological data and drug administration in hospitals, machine condition monitoring in industry, traffic management in transportation and civil infrastructure.

Every sensor node is filled with energy that should be used efficiently in both active and inactive state. The energy is utilized by minimizing energy consumption in each node and reducing the average communication distance over the area. This can be achieved using LEACH by making cluster.

Mobile Sink is used and often called as data collector. Sink mobility is classified as fixed mobility, random mobility and controlled mobility. The existing system used fixed mobility in which the sink predicts future positions of node without considering the load available in it. The random mobility pattern makes the sink to move autonomously and has no knowledge about mobility in terms of direction and speed. It is highly unpredictable. The simulated system uses controlled mobility and the mobile sink is guided based on residual energy of the nodes.

Static Sink is otherwise called as Base Station. It is fixed in position and gathers sensed data from mobile sink. The network lifetime is prolonged by LEACH and sink's mobility.

II. LITERATURE SURVEY

1. MAXIMIZING LIFETIME FOR THE SHORTEST PATH AGGREGATION TREE IN WIRELESS SENSOR NETWORKS, by D. Luo, X. Zhu, X. Wu, G. Chen.

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 2, Issue 12, December 2017

The paper deal about the problem of finding a shortest path tree with the maximum lifetime when in-network aggregation was used has been studied. The preceding work transformed the problem into the load balancing scheme at each level of the fat tree, proved that the problem was in NP, and solved it by min-cost max-flow approach in polynomial time. A distributed approach has been proposed for the network. The restriction to shortest path tree comes from the requirement of delay. The results show that their approach greatly improves the lifetime of the network. It supports applications that require mobile sensor nodes. It does not require the knowledge of the global network.

2.MOBILE SINK-BASED ADAPTIVE IMMUNE ENERGY-EFFICIENT CLUSTERING PROTOCOL FOR IMPROVING THE LIFETIME AND STABILITY PERIOD OF WIRELESS SENSOR NETWORKS, by M. Abo-Zahhad, S. M. Ahmed, N. Sabor, and S. Sasaki.

The operation of the proposed convention is separated into rounds, where each round starts with a set-up stage, when the sink discovers its area and areas of CHs, trailed by a relentless state stage, when the detected information exchanged to CHs and gathered in edges; then these casings exchanged to the sink.

3. MULTI-HOP ENERGY EFFICIENT RELIABLE AND FAULT TOLERANT ROUTING PROTOCOL FOR WIRELESS SENSOR NETWORKS, by K. Vinoth Kumar, S. Karthikeyan.

This paper work aims at implementing a multi-hop energy effective, fault tolerant and reliable routing protocol. It presents to maintain a network of sensors so that the nodes get a chance to generate their transmission ranges best and thus delivery of data to the base station. This protocol concentrates on the feature of load sharing by maintaining multiple routes and selecting the best one for forwarding the data packets. The problem around the sink is managed by changing the transmission ranges of the nodes timely, which changes the topology, to balance the availability among the nodes in the network. The focus was towards constant distribution of data transmission and dissemination of load among the nodes in the network. The specification of motes are surveyed and concluded that by adjusting per-node transmission power, it is possible to control topology and thus eliminate the bottleneck of the base station. It results in increasing of lifetime of the network.

4.MULTIPATH ROUTING PROTOCOLS IN WIRELESS SENSOR NETWORKS: A SURVEY AND ANALYSIS, by Mohammad Masdari and Maryam Tanabi.

These paper, multipath routing protocols improve the general load balancing and high quality of service in WSN and also generate reliable communication in network. This checks various multi-path routing protocols of the WSN in the literature and displays its benefits. The main elements of these techniques and classifications are based on their attributes which have been discussed in paper. Multipath routing is one of the efficient methods to improve the network capacity and productivity of resources under hefty traffic conditions.

5. A NETWORK LIFETIME ENHANCEMENT METHOD FOR SINK RELOCATION AND ITS ANALYSIS IN WIRELESS SENSOR NETWORKS, by C. F. Wang, J. D. Shih, B. H. Pan, and T. Y. Wu.

In this paper, a sink moving plan is proposed to manage the sink when and where to move to. Some numerical execution examinations are given to show that the proposed sink moving plan can drag out the system lifetime of a WSN. It overcomes the drawbacks of CIDT protocol. It requires fault tolerance to maintain the network connectivity.

III. SYSTEM MODEL

A. Objective

The simulated system designed to minimize energy consumption by reducing multi hop transmissions from sensor nodes to Cluster Heads. The energy consumption of sensor nodes is reduced by forming clusters using LEACH. The controlled mobility pattern of mobile sink is used for data collection from Cluster Heads. The mobile sink checks the workload of CHs and traverses the CH in the optimal path. The delay is consistently reduced as the mobile sink traverses the CH in a controlled pattern and it leads to no unwanted movement of mobile sink. Multiple mobile sinks are used to collect data. To avoid collision and interference, primary mobile sink sense the nodes and collects data while the other is recharging.

- Minimize data collection delay and energy consumption.
- Maximizing the network lifetime.
- Optimal data transmission scheme and sink nodes gather the data along the shortest movement paths.

B. Motivation

Existing techniques failed to perform data collection with different delay requirements. This means a mobile sink is required to visit some sensor nodes or parts of a WSN more frequently than others, while ensuring that energy usage is minimized, and all data are collected within a given deadline. There is a need to extend Weighted Rendezvous Point (WRP) to the multiple mobile sinks/rovers case in order

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 2, Issue 12, December 2017

to improve the scalability. While extending number of mobile sinks, it may involve with many sub problems such as interference and coordination between mobile sinks. This theme was not applied in the existing work.

The data is collected on a pre-specified path using mobile sink which has a fixed mobility pattern. There is an unwanted movement of mobile sink, if no data present in the pre-defined path. So it consumes more energy and delay is occurred due to an unwanted movement of mobile sink.

C. Modules

1.CLUSTER HEAD SELECTION

The Cluster Head collects and aggregates information from sensors in its own cluster and passes on information to the mobile sink. The node with highest residual energy is selected as cluster head.

2.LOAD FINDER

LEACH (LOW-ENERGY ADAPTIVE CLUSTERING HIERARCHY) is an energy efficient routing protocol, which reduce the number of transmissions towards the static sink. It is an application-specific protocol in which Cluster Head is based upon the energy of nodes. The LEACH is a distributed clustering algorithm. The clustering support network scalability, decrease energy consumption through data aggregation, conserve communication bandwidth, limits data transmission by load balancing, improves network lifetime, reduce network traffic and the contention for the channel. Cluster structure gives the impression of a smaller and more stable network. Both inter cluster and intra cluster aggregation takes place. The former cluster aggregation takes place between group nodes and cluster head. The latter aggregation takes place between cluster head and sink node. Each time, data aggregation and updates takes place in cluster heads. The transmission delay is very low. The control message overhead is low as scheduling is allocated to each group nodes.

Algorithm for Leach Energy Model Protocol
STEP 1 : START
STEP 2 : for (i = 0; i <= 80; i++)
loop
deploy sensor nodes end loop
STEP 3 : for (i = 0; i <= 16; i++)
loop
for (j = 0; j <= 24; j++)
loop
form cluster
end loop
end loop
STEP 4 : calculate the energy-levels
for the first time all the nodes have equal energy.
centre node will be selected as cluster head After round 1,
the node with maximum energy will be elected as cluster head and will be repeated until complete data is collected
STEP 5 : Data from the cluster head is collected by mobile sink
after completion of data gathering,
mobile sink goes to its original position
STEP 6 : Sleep mode
STEP 7 : STOP

3.MOBILE SINK

Mobile Sink is used for gathering data from the cluster heads based on the load available in each cluster head. It enables hop by hop communication from cluster head to mobile sink and from mobile sink to static sink. The nodes near to the sink drain its energy rapidly. So mobile sink is used to avoid the draining of energy and thus ensure balancing the energy consumption. It helps to prolonging the lifetime of network.

There are two mobile sinks. The sink have the highest residual energy is selected as primary mobile sink to continue processing the packets. The secondary mobile sink have the residual energy lesser than the primary mobile sink. So the secondary sink is recharging by harvesting energy from the surrounding nodes. It can be used when the primary sink losses its energy.

Once the cluster is formed, the mobile sink initiates its work. The mobile sink follows the mobility model that is Random Way Point model based on the maximum workloads.

4. LOAD BASED ENERGY EFFICIENT ROUTING PROTOCOL

In load based energy efficient Routing Protocol (LBEERP), the sensor nodes are partitioned into subsets for sensing transmission range and network connectivity. The problem with this approach is to find the existence of critical nodes. These nodes may be on all the time and the network will be partitioned if these nodes die.

The mobile sink is parked randomly for certain period of time based on the maximum loads of cluster heads. The parking position is generated randomly by Random Way Point model. This model does not consider the previous position to calculate the next parking position. It is used for sink mobility.

Movement Model Algorithm

STEP 1 : WHILE (NETWORK IS ACTIVE)
//cluster formation phase

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 2, Issue 12, December 2017

STEP 2 : //Determine sink path
FIND optimal path between CHs
WITH improvement MIN-MAX ALGORITHM
FIND sink path points
WITH the sink movement optimal path)
STEP 3 : //steady state phase
MOVE the sink through the sink movement optimal path
gather data
END WHILE

IV. SYSTEM DESIGN

A. PROJECT DESCRIPTION

A successful data collection in wireless sensor network is a trivial task in order to perform the novel scheme called Optimal Multiple Mobile Sink Routing Protocol with dual mobile sinks is simulated. Unlike the existing approaches, this improves data delivery performance by employing several mobile sinks and by deploying fine scheduling at strategically important points in the sensor field, the simulated scheme does not allow packet drop at such situation. It aims to optimize the trade-off between nodes energy consumption and data delivery.

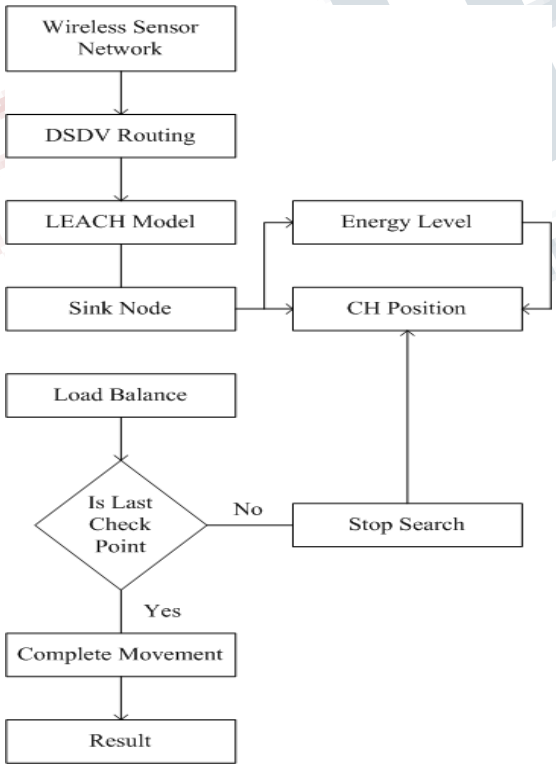

Figure 1: FLOW DIAGRAM

V. PERFORMANCE ANALYSIS

A. PACKET DELIVERY RATIO

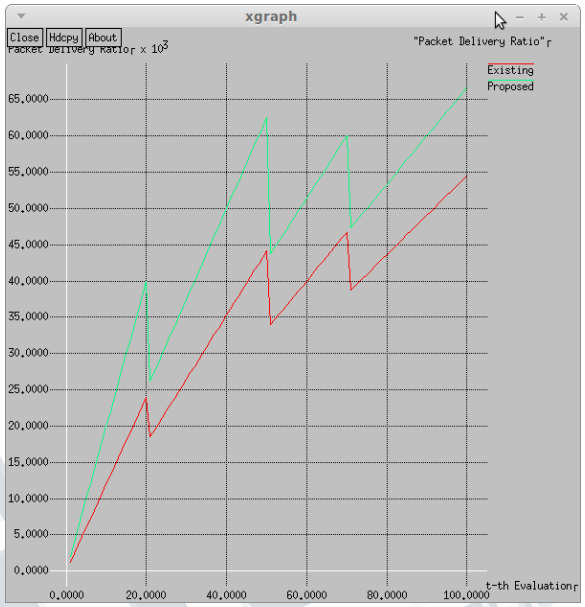

Figure 2: Packet Delivery Ratio

The more packets are delivered to the destination as compared to the existing techniques.

B. ENERGY CONSUMPTION

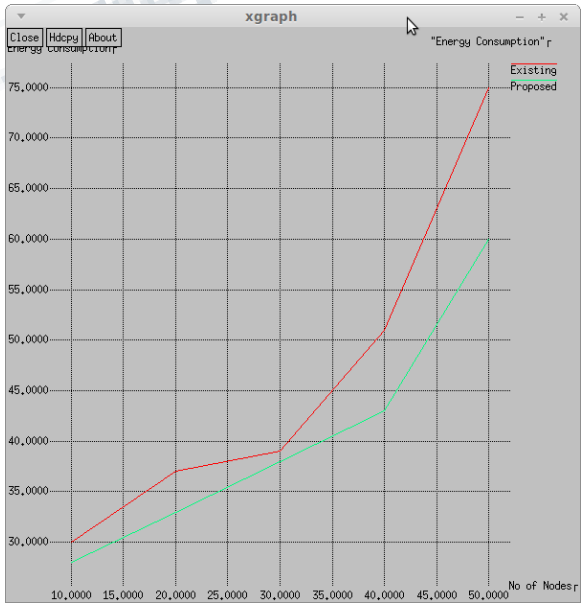

Figure 3: Energy Consumption

The energy consumption is reduced because the energy model LEACH is used. The clusters are formed and after data

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 2, Issue 12, December 2017

aggregation, the group nodes moved to sleep state for reducing energy consumption. The controlled mobility pattern of mobile sink is used to reduce energy consumption.

C. COMMUNICATION OVERHEAD

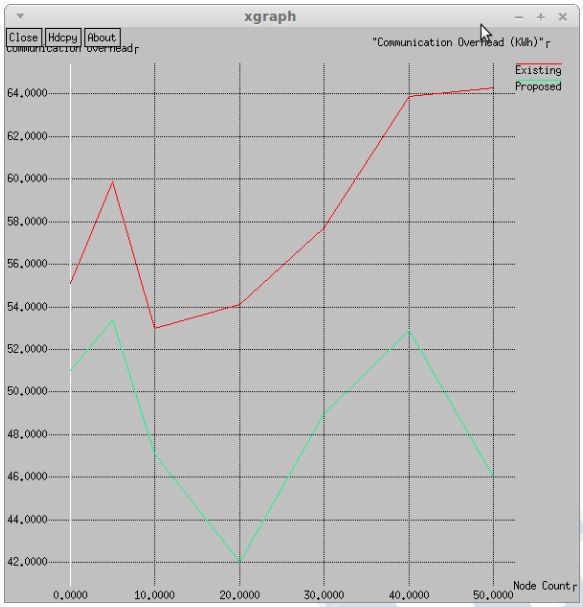

Figure 4: Communication Overhead

The communication overhead is reduced as the mobile sink collects data from cluster heads without any congestion.

D. THROUGHPUT RATIO

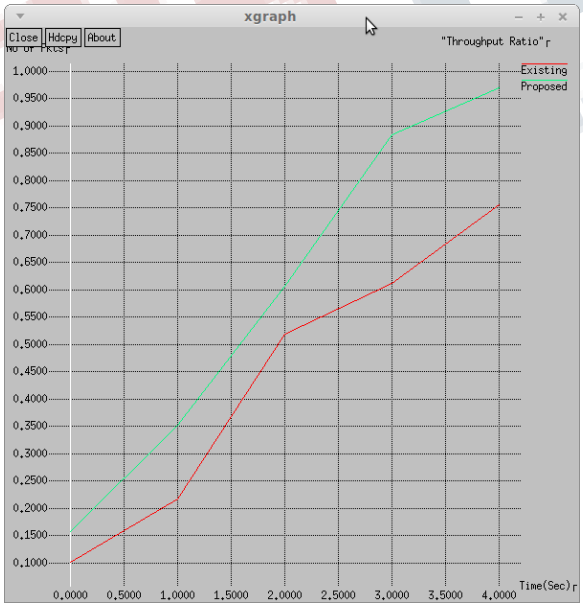

Figure 5: Throughput Ratio

The number of packets is successfully delivered to the static sink in a given period of time.

VI. FUTURE SCOPE

An interesting issue for future research is to develop an online heuristic algorithm which can be used in an adaptive environment, where the sensors do not know the schedule of the sink in advance and the information generation process is arbitrary. Such an approach could use one of the energy-aware routing algorithms of Section II for a given sink location. After an update interval, the sink can decide whether to stay at its current location or move to another place. The remaining lifetimes of sensors can be used by the routing algorithm to determine new paths to the sink, so that the bottleneck nodes are avoided and more balanced energy depletion is achieved. Another interesting issue is the implementation of model in a distributed environment where the sink sojourn times and the information transfer rates are not determined by a central node (possibly the sink). Distributed maximum lifetime routing algorithms exist. Such algorithms could be used in an approach where the sink determines on-line the time to spend in every location and the sensors route the data to the sink distributively.

VII. CONCLUSION

The problem of maximizing the lifetime in a wireless sensor network is addressed where the information generated by the monitoring sensors needs to be routed efficiently to a rechargable mobile sink. The simulated model determines the optimal sink sojourn times at different locations, and the optimal rates at which the sensed data must be transmitted from one sensor to another in order to be routed to the sink. However, implementing this model implies that the information obtained by solving the linear programming problem must be flooded to the network, so that every sensor is aware of the sink sojourn times and of the rate at which it has to transmit data to its neighboring nodes.

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