*Communications on Applied Electronics (CAE) – ISSN : 2394-4714*
*Foundation of Computer Science FCS, New York, USA*
*Volume 1– No.4, March 2015 – www.caeaccess.org*

# Lifetime Enrichment of Wireless Sensor Networks using DEMN Algorithm

B. Raji,
Dept of Computer Science and Engineering,
K.L.N College of Information Technology,
Madurai

## ABSTRACT:

Wireless Sensor networks are mainly used for sensing the parameters such as, temperature, dampness, demands, blustery weather direction and pace, illumination concentration, tremor intensity, noise power, power-line electrical energy, chemical attention, impurity levels and essential body functions. WSN has limited battery size. Lifetime enrichment is a significant one, because replacement of batteries is not possible in WSN. These works concentrate on techniques which are used to increase the lifetime of Wireless Sensor Networks (WSN). Many factors are taken into account for this enrichment of life time of wireless sensor networks, such as minimizing the power consumption, low cost operation, optimal routing algorithms. This work proposes an algorithm namely DEMN, which enriches the lifetime of WSN. By using DEMN algorithm, the physical queue is created and the results of real traffic volume are defined. The simulation result shows that the comparison of Distributed algorithm and DEMN algorithm.

## Keywords

Dampness, Demands, Blustery Weather Direction and Pace, Illumination Concentration, Tremor Intensity, Noise Power, Power-Line Electrical Energy, Chemical Attention, DEMN, Distributed Algorithm.

## 1. INTRODUCTION

In Fig1, It shows a wireless sensor network which consists of a sink node and a large number of sensor nodes. Each sensor node gathers information from its neighborhood and delivers collected data to the sink for further processing.

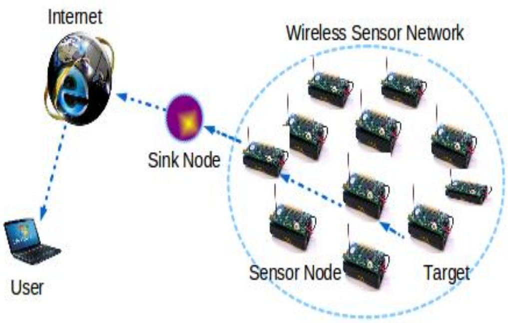

**Fig1. Sensor Network**

Energy efficiency is the most important issue for wireless sensor networks since sensor nodes have limited batteries. Once deployed, it is hard or even impossible to recharge or replace the batteries of the sensor nodes. In WSNs with static (static) sinks, the nodes close to the sinks are more likely to deplete their battery supplies before other nodes due to the intersection of multi-hop routes and focus of data traffic towards the sinks. The traffic imbalance can cause early energy depletion for the nodes near the sink, which creates an “energy hole” around the sink. This problem is referred as the “Hotspot Problem”. To avoid this problem mobile sinks are used. Sink mobility reduces the number of bound on data path, especially in delay-tolerant applications. Other advantages of sink mobility include security benefits. For example, consider habitat monitoring, a mobile robot may be used to collect information from the sensor nodes in the field. If the habitat area is inaccessible by the robot, then the robot will follow predetermined paths and stop by a set of prearranged locations.

One of the problems of mobile sink is, it has only limited speed. The problem of mobile sink routing can be evaluated by using the following cases,

**Case 1:**
An inexperienced approach enables all nodes in the network to obtain the fresh position of the sink regularly and the overhead of global flooding is huge. since it requires all the nodes in the network to communicate routing control packets frequently and redundantly.

**Case 2:**
In this case, the energy consumption could be further decreased by utilizing a sleeping mechanism which allows nodes to wake up only when the sink is nearby. This approach is infeasible because of the large delays introduced by the need to wait for the sink to distribute data. Moreover, the delivery of data might not even be guaranteed in cases where the sink does not travel through the whole network. Also the nodes’ buffers capacity flood and data packets might be dropped when the sink fails to come nearby within reasonable time limits.

## 2. PROBLEM STATEMENT:

Energy efficiency is the most important issue for wireless sensor networks since sensor nodes have limited batteries. Once deployed, it is hard or even impossible to recharge or replace the batteries of the sensor nodes. According to overhead of message passing, frequent radial of data to nodes, load traffic, energy hole between the nodes and sink node, wireless sensor may loss their energy, because of the battery size. So that the lifetime of wireless sensor affected by the energy depletion problem. The techniques like distributed algorithm with delay-tolerance, shortest cost path routing algorithm, q-switch routing, polynomial-time algorithm, distributed refinement algorithm are used for maximizing the lifetime of wireless sensor networks. In this work, one of the algorithms namely DEMN is used for lifetime enrichment.

## 3. TECHNIQUES AND ASSUMPTIONS

### 3.1 Shortest Cost Path Routing Algorithm:

Shortest path algorithm is used in this strongly connected backbone network. Flow augmentation (FA) algorithm which iteratively augments traffic flow along the shortest cost path. The proposed link cost reflects both the residual energy at the transmitting node and the receiving node and the energy consumption in unit data transmission over the link.

### 3.2 Distributed Algorithm with Delay-Tolerant WSN:

Delay Tolerant Mobile Sink Model (DT-MSM) is suitable for the applications which support some amount of delay in data delivery to the sink. The sensor nodes may delay the transmission of the collected data and wait for the mobile sink to arrive at the location most favorable for improving the network lifetime. The goal of this paper is to find a distributed algorithm that solves the lifetime maximization problem associated with DT-MSM. This paper has two main contributions. First, this proposed algorithm is both distributed and mostly local. The overall solution is broken down into smaller decision problems and each decision can be done locally in a sensor node. Local algorithms have the additional benefit of restricting the control traffic to be among locally interacting nodes. Second, this paper analyze this algorithm and show that it converges to the optimal objective value for the lifetime maximization problem in the long-run average sense, and that the long-time average of the virtual queue sizes is bounded. The proof is based on analyzing a Lyapunov drift. The Lyapunov drift technique is widely used for studying the stability issue of control and optimization algorithms for a network of queues.

**Table1: Literature Survey**

| METHODOLOGY | RESULT | LIMITATIONS |
|---|---|---|
| Shortest Cost Path Routing Algorithm | ✓ Some information-generation scenarios are possible to make routing decision on-the-fly and obtain close-to-optimal system lifetime.<br>✓ Assume that, there is no *a priori* knowledge about the future information-generation process, the simulation results are too good to believe. | ✓ The effect of network density and quantized residual energy levels on the performance and overhead of the algorithm, to apply the new link metric on the on-demand routing protocols were not studied and medium access layer issues were not considered. |
| Multipath Energy Efficient Data Routing Protocol | ✓ When node density is high, there are more nodes available for data forwarding, and this increases the delivery ratio.<br>✓ The EERP has maintained constant delivery rates throughout the simulated scenarios because the paths are selected based on the energy availability.<br>✓ EERP ensures load balancing among nodes and avoid early network fragmentation. | - |
| Coverage and Connectivity in Wireless Sensor Network | ✓ The proposed joint design has substantial performance improvement comparing with the separate design method, which can achieve below 40% of the upper bound. | ✓ The effect of the transmission channel fading on the network lifetime was not considered. |
| Distributed Algorithm with Delay-Tolerant WSN | ✓ It shows how the Lyapunov drift and the queue size evolved.<br>✓ The cost of transmitting one bit of data between two nodes depends on the distance between them.<br>✓ As a suggestion, the optimal solution of the primal problem is obtained by the CPLEX linear programming solver. | ✓ It was not considered the real queue sizes and real traffic volumes.<br>✓ This distributed algorithm is not a conventional optimization algorithm because its optimality is in the long-run average sense. |

# 4. PROPOSED SYSTEM:

## 4.1 Distributed Energy Mutation Network Algorithm (DEMN):

### *4.1.1 Node Formation without Mobile Sink:*

Sensor nodes are formatted with immobile sink node. That is, the sink location is specified. Static sink is used because, if mobile sink is used then we should specify, "How to move the mobile sink and how long the sink should stay at a stop to gather data". That's why static sink is used. Sink node collects the information from all other sensor nodes. The case of a mobile sink has received less attention than the stationary sink. So, immobile sink is used.

The sink is located at the origin and remains stationary during the operation of the WSN. Data originated from the sensor nodes flow into the sink in a multi-hop fashion. As soon as the data become available at a node, it gets transmitted toward the sink. The data generated by a source are sometimes called a commodity or a sub-flow. Every node can determine its outgoing neighbors and estimate the associated link costs. For each location, a spanning tree, rooted at the sink, is constructed in a distributed manner and used for message exchange between the nodes and the sink.

### *4.1.2 Queue Implementation:*

Queue is used to gather the information from the sensor nodes. Each sensor node has its own queue to store the information which is then forward to the sink node. Queue size and traffic volume is specified in this queue implementation module. In previous work, virtual queues are used. It showed that it converges to the optimal objective value for the lifetime maximization problem in the long-run average sense, and that the long-time average of the virtual queue sizes is bounded. The proof is based on analyzing a Lyapunov drift.

Suppose there are constants $B \geq 0$, $\varepsilon > 0$, $v \geq 0$, $p^*$ such that for all t and all possible vectors Q(t) the following drift-plus-penalty condition holds:

(Eq.1) $E\,[\Delta\,(t) + Vp(t) \mid Q(t)\,] \leq B + V\,p^* - \varepsilon\,\sum_{i=1}^{N} Qi(t)$

Then for all t>0 the time average penalty and time average queue sizes satisfy:

- $\frac{1}{t}\sum_{r=0}^{t-1} E\,[p(T)] \leq\ (p*) + \left(\frac{B}{V}\right) + \left(\frac{E[L(0)]}{Vt}\right)$

- $\frac{1}{t}\sum_{r=0}^{t-1} \sum_{i=1}^{N}\quad E[Q(T)] \leq\ + \left(\frac{B+V(p*-pmin)}{\varepsilon}\right) +$ $(EL0\varepsilon t)$

**Proof:**
Taking expectations of (Eq. 1) and using the law of iterated expectations gives:

$E\,[\Delta\,(t) + VE\,[p\,(t)] \leq B + V\,p^* - \varepsilon\,\sum_{i=1}^{N} Qi(t)$

Since L (t) and Q_i(t) are non-negative quantities, it follows that:

$-E\,[L\,(0)] + V\sum_{r=0}^{t-1} E\,[p(T)] \leq\ (B + Vp*)t$

Dividing the above by Vt and rearranging terms proves the time average penalty bound. A similar argument proves the time average queue size bound. To make it more like an adaptive network algorithm, it is desirable to incorporate real queue sizes and real traffic volumes into the DEMN algorithm. This will allow the nodes to send real traffic while the algorithm is being executed.

### *4.1.3 DEMN Algorithm Implementation*:

It is desirable to incorporate real queue sizes and real traffic volumes into the algorithm. This will allow the nodes to send real traffic while the algorithm is being executed. The proposed link cost reflects both the residual energy at the transmitting node and the receiving node and the energy consumption in unit data transmission over link. This DEMN algorithm is proposed based on the DROPTAIL algorithm. This algorithm iteratively augments traffic flow along the shortest cost path. If any node cannot find the path to its destination, then it will stop at a certain point.

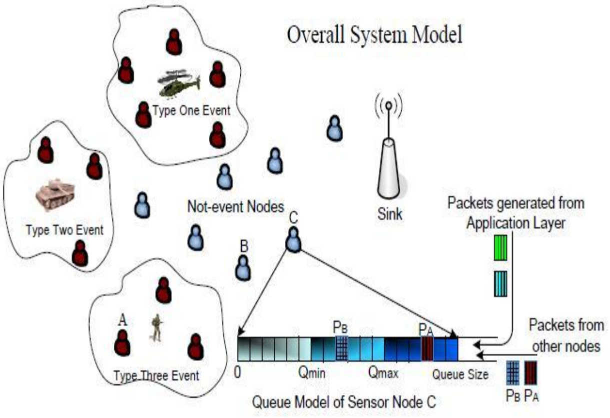

**Fig2. Queue Model of Sensor Nodes**

The weighted moving average queue size is calculated. If average-queue size is less than min then the packet is sent to sink. If min is less than or equal to average-queue size and less than max means then the packet is marked with probability and stored on a separate queue. If it is greater than max then the packet is dropped with probability one. Then all lifetime upper bounds are refined.

**Algorithm: DEMN (Distributed energy Mutation Network)**

1. Find Shortest Path
2. If any node cannot find the path to its destination, then stop. Else continue.
3. Calculate weighted moving average queue size (avg_size).
4. When avg_size < min_size, packet is sent to sink.
5. When min_size <= avg_size < max_size, the packet is marked with probability.
6. When max_size <= avg_size, the packet is dropped with probability one.
7. Refine all lifetime upper bounds.

### *4.1.4 Result Evaluation:*

This module includes the comparison of the physical queue with the virtual queue and it compares the result of using immobile sink. Simulation on randomly generated graphs is performed to evaluate the performance of the proposed algorithm both for the fixed information-generation rates and for a certain scenario where information is generated at monitoring nodes that detect moving targets.

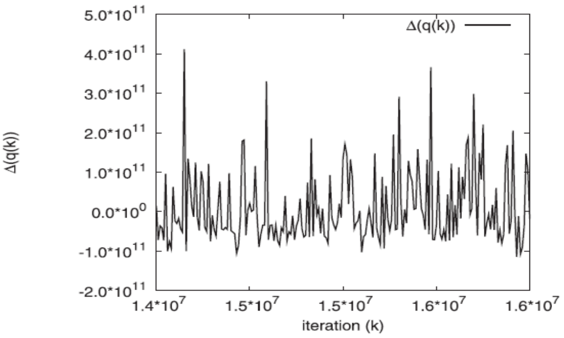

**Fig3. Lyapunov drift of the algorithm over time.**

Another one of contributions is that this work compares our proposal with several other lifetime maximization proposals and quantifies the performance differences among them. Computational experiments shows that this proposal increases the lifetime significantly when compared to not only the stationary sink model but also more traditional mobile sink models without delay tolerance.

## 5. CONCLUSION:

This project concentrates on techniques which are used to enrich the lifetime of wireless sensor networks. In this model, the sink is situated at the source and remains inactive during the operation of the WSN. Data originated from the sensor nodes flow into the sink in a multi-hop fashion. As soon as the data become available at a node, it gets transmitted toward the sink. From the simulation results, it is possible to make routing decision on-the-fly and obtain close-to-optimal system lifetime. By using the physical queue, real traffic volumes are considered. It has maintained a constant delivery rates throughout the simulated scenarios because the paths are selected based on the energy availability with the shortest path.

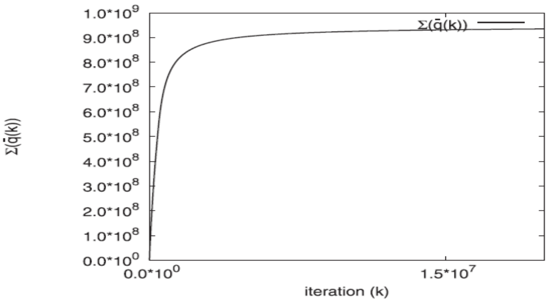

**Fig4. Time average of total Physical queue size over time**

This is a result of the impact of the process it uses to create a routing path. In the queue-based formulation, it allows buffering of any traffic, which naturally leads to the best lifetime performance among different strategies.

In future, the effect of network density and quantized residual energy levels on the performance and overhead of the algorithm, to apply the new link metric on the on-demand routing protocols can be studied and medium access layer issues can be considered. The effect of the transmission channel fading on the network lifetime can be considered. Under that case, the transmission energy by each sensor is a random variable and also considers other random field models and the corresponding network lifetime maximization methods. The problem formulation can be incrementally enriched to reflect additional constraints or cost considerations. It is possible to enhance the lifetime of wireless sensor network by using solar plates and various kinds of energy efficient algorithms.

## 6. REFERENCES

[1] Jae-Hwan Chang, Member, IEEE, and Leandros Tassiulas, Member, IEEE,” Maximum Lifetime Routing in Wireless Sensor Networks,” IEEE/ACM TRANSACTIONS ON NETWORKING, VOL. 12, NO. 4, AUGUST 2004.

[2] Samra Boulfekhar · Mohammed Benmohammed, “A Novel Energy Efficient and Lifetime Maximization Routing Protocol in Wireless Sensor Networks,” Published online: 10 March 2013

[3] Lu, Y.-M., & Wong, W.-S.(2007), “An energy-efficient multipath routing protocol for wireless sensor networks,” International Journal of Communication Systems, 20(7), 747–766.

[4] YoungSang Yun, Ye Xia, Behnam Behdani, and J. Cole Smith, “Distributed Algorithm for Lifetime Maximization in a Delay-Tolerant Wireless Sensor Network with a Mobile Sink,” IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 12, NO. 10, OCTOBER 2013.

[5] YoungSang Yun, Student Member, IEEE, and Ye Xia, Member, IEEE, “Maximizing the Lifetime of Wireless Sensor Networks with Mobile Sink in Delay-Tolerant Applications,” IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 9, NO. 9, SEPTEMBER 2010.

[6] Zichuan Xu ; Res. Sch. of Comput. Sci., Australian Nat. Univ., Canberra, ACT, Australia ; Weifa Liang ; Yinlong Xu, “Network Lifetime Maximization in Delay-Tolerant Sensor Networks with a Mobile Sink,” Distributed Computing in sensor Systems (DCOSS), 2012 IEEE 8th International Conference on 16-18 May 2012.