A MOVING DIRECTION PROPOSAL TO SAVE ENERGY CONSUMPTION FOR MOBILE SINK IN WIRELESS SENSOR NETWORK

Tran Cong Hung*, Dang Thi Ngoc*, Phan Thi The**, Le Ngoc Hieu*, Luan N.T. Huynh***, Le Dien Tam**

*Department of Information Technology II, Posts & Telecommunications Institute of Technology, Ho Chi Minh, Viet Nam

**Department of Information Technology, Thu Duc College, Ho Chi Minh, Viet Nam

***Department of Computer Science and Engineering, Kyung Hee University, Gyeonggi-do, Republic of Korea

conghung@ptithcm.edu.vn, dangtngoc@gmail.com, phanthithe@gmail.com, occbuu@gmail.com, luanhnt@khu.ac.kr, tamld@tdc.edu.vn

***Abstract*— Wireless sensor network is useful for human that attract more scientists although they are still limited and limited energy is a weakness of wireless sensor that make getting information is interrupted. To improve energy consumption in WSN, in this paper we show a routing algorithm combined of LEACH_C and Dijkstra algorithm. A mobile sink move from Base Station (BS) to the Cluster Head (CHs) to get data, the direction of mobile sink is decided by Dijkstra algorithm. An efficient is saving energy and expand alive time of the sensor network.**

Keywords*— *LEACH-C, Mobile sink, Dijkstra, Cluster Head

I. INTRODUCTION

Wireless sensor networks have sensor nodes that are randomly distributed unstructured, connect together by radio waves, infrared, or optics. A sensor in the WSN can only communicate directly with other sensors in small distances to save power. And a common method for saving energy [1,2] and extending the alive time is the clustering algorithm and rotate cluster head to transmit information to the base station.

In this paper, we propose a new method to reduce distance transmission from the cluster head (CHs) to the base station, to reduce the power consumption of the sensor by using a sink [3,4,5] (Mobile sink - MS) is from the base station that has routing determined by the Dijkstra algorithm.

This article is organized as follows. Part 1 is introduction; Part 2 is a related work describing the clustering protocol for wireless sensor networks; Part 3 investigates routing algorithms proposed to conserve power consumption in wireless sensor networks; Part 4 simulates the proposed algorithm; Part 5 presents the Conclusion and Future Work

II. RELATED WORKS

1. LEACH [6,7]

LEACH organizes network nodes into multiple clusters, each cluster managed by cluster head (CH). All nodes must transmit their data to the CH which performs the task of collecting data from member nodes and transmits the collected data to the base station (BS)[8]. This transmission can be done in a single hop. LEACH divides the activity into rounds, each starting with the set- up phase: the CH cluster selection and clustering process; The steady-state phase is followed by the transmission of data from the node member to the CH group and to the BS base station.

Advantages

- The determination of cluster head and cluster allocation are simple and does not require control information from the base station and requires no understanding of the entire network configuration, which reduces the burden on the base station and the amount of message transmitted. in the network.
- Distributed as a cluster leader for all nodes and through which indirectly makes the power consumption on the nodes roughly equal.

Disadvantages

- There is no fixed number of clusters in a loop, resulting in no clusters being formed, while in other clusters there are too many clusters, so the data sent to the base station may be interrupted.
- The head of the cluster is determined not based on the remaining energy, but only on the number of times he became the head of the cluster in the previous rounds. This may cause the node to be selected as the head of the cluster away from the base station to lose energy sooner.
- If the cluster head is not interested in the location of the network node, it is possible that two cluster heads are adjacent, creating two overlapping clusters, affecting the network performance.

2. LEACH-C [9]

The LEACH-C protocol was developed to overcome the drawback of the basic LEACH protocol and was highly appreciated for its applicability in WSN. Basically, LEACH-C works very similarly to LEACH, only in the Set-up phase, clustering and cluster selection is performed by the BS base station. The BS performs clustering and CH cluster selection based on the information of all the nodes in the WSN sent to

the base station. The root station uses an optimal algorithm to determine clusters and clusters.

Advantages

- Choosing the optimal cluster manager, energy allocation efficiency, improve the energy efficiency of the nodes in the network.
- Centralized network information about base stations, effective cluster allocation based on location and node information across the network.
- Control and balance the number of clusters throughout the network to ensure continuity in the performance of data collection and transmission tasks.

Drawback

- The algorithm for selecting the optimal CH group leader for base station is complex, with large number of input parameters.
- All sensor nodes must send BS base station information about the location and power state. Although the size of the message is small, if the nodes have a large distance to the BS, the power consumption for sending the packet also affects the lifetime of the node

III. OUR PROPOSALS

The LEACH-C cluster routing algorithm combined with the Dijkstra algorithm finds the shortest path for the mobile sink (MS) to the CHs to gather information.

Sensor nodes are deployed randomly in the area, sensors are organized into clusters and CHs are selected based on the LEACH-C algorithm. Cluster Heads have the role of gathering information from nodes in their clusters, saving data to a buffer, and then transferring data to the mobile sink when it is in range of communication.

Model of energy consumption

Our paper uses the radio energy model proposed by Heinzelman in the LEACH protocol. In order to transmit a k-bit information over a distance of d, the power consumption will be calculated according to the formula

$$E_{Tx}(k,d) = \begin{cases} kE_{elec} + kE_{fs}d^2, d < d_0 \\ kE_{elec} + kE_{mp}d^4, d \geq d_0 \end{cases} \quad (3.1)$$

And to get this message, the power consumption will be calculated according to formula (3.2):

$$E_{Rx}(k) = kE_{elec} \quad (3.2)$$

Where:

- E_{elec} is the power consumed when transmitting or receiving a message bit
- In this model, both parameters of the amplifier are free space (E_{fs}) and multipath (E_{mp}) are used, depending on the distance between transmitter and receiver. Transmission distance threshold d_0 is given by formula (3.3):

$$d_0 = \sqrt{\frac{E_{fs}}{E_{mp}}} \quad (3.3)$$

Our Proposal

We uses Dijkstra algorithm to find the shortest path from one vertex s to the remaining vertex of the graph and the corresponding length (weight).

```
Dijkstra(G, s):
    for v in G:
        dist[v] = INF  # The distance from s to all vertices is infinity
        dist[s] = 0 # the distance from s to itself is 0
        Q = |V| # Q Initially contains all vertices in G
    while Q not empty:
c = Q.min_dist(s) # peaks attached to the nearest s will be selected
Q.remove(c)
for v in neighbor[c]:
temp_dist = dist[c] + length(c,v) # The path from s to v that goes through c
if temp_dist < dist[v]:
dist[v]= temp_dist
    return dist
```

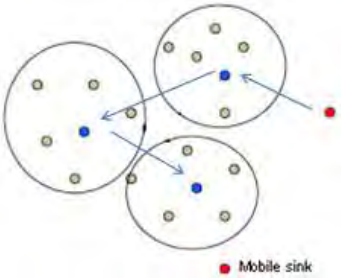
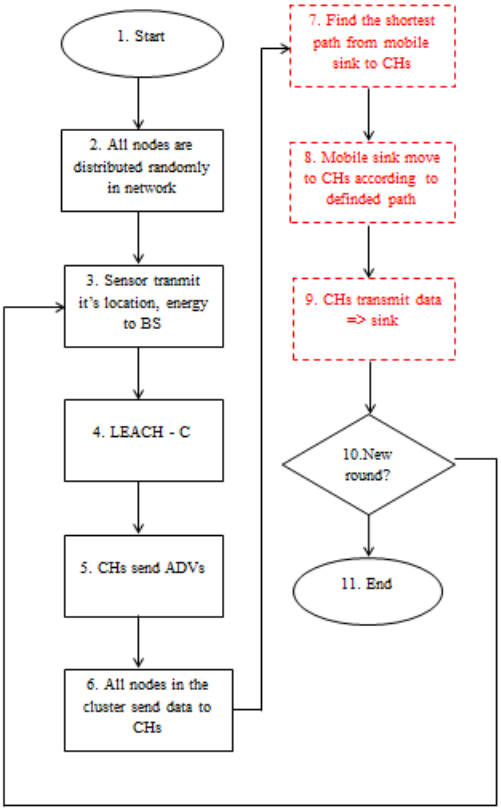


Figure 1: Movement of mobile sink in the proposal

Our proposal is implemented by the following flowchart:



In the mechanism of proposing the direction of change sink based on the algorithm that finds the shortest path from the starting position to the CHs, at each stop of the mobile sink, it will have a certain stop time to synthesize information from stops

1: Initialization
2: Randomly distributed sensors, having initial initial energy
3: Sensors send their power level and location to BS base station node
4: LEACH-C
5: Clustering is based on the remaining energy levels of the sensors
6: CHs information transfer for mobile sink
7: Dijkstra algorithm finds the shortest path

8: The sink moves from the starting position to the CHs along the intended path
9: Sink collects data from CHs
10: Sink moves to base station and transmits data

The proposed algorithm with LEACH-based clustering approach combined with mobile sink can improve network lifetime better because mobile sink has reduced transfer energy consumption from CH versus fixed sink. However, the proposal did not achieve the best performance due to limitations in the CH selection process of the LEACH-C algorithm. All sensors must send status information to the BS. This problem can cause energy wastage sensor.

To demonstrate the effectiveness of the proposed solution, algorithms are simulated, compared, evaluated results on MATLAB simulation software.

IV. SIMULATION RESULTS

Simulate and analyze the proposed method (power consumption), some simulations are done through Matlab R2015a software. The simulation environment is set up with the parameters listed in Table 1. Assuming that all sensor nodes are randomly distributed in a 100m × 100m area, the mobile sink has no limited power and can be move, sensor nodes have limited power. And the proposal called LEACH_CD that is compare to LEACH, LEACH_C algorithm about alive node, average energy.

Table 1: Network parameters

Parameter Name	Value
Area simulation	100m*100m
Number of the sensor nodes (N)	100
The desired percentage becomes CH (p)	0.05
Length of the packet (k)	4000
Initial energy of the sensor nodes (E0)	0.1
Energy consumption on circuit (Eelec)	50nJ/bit
Channel parameter in multi-path model (E_{mp}	0.0013pJ/bit/m^4
Channel parameter in free-space model E_{fs}	10pJ/bit/m^2
Energy data aggregation, E_{DA}	5 nJ/bit
Energy coefficient of transmission amplifiers (E_{Tx} , E_{Rx})	50nJ/bit
Simulation time (r_{max})	1000 vòng

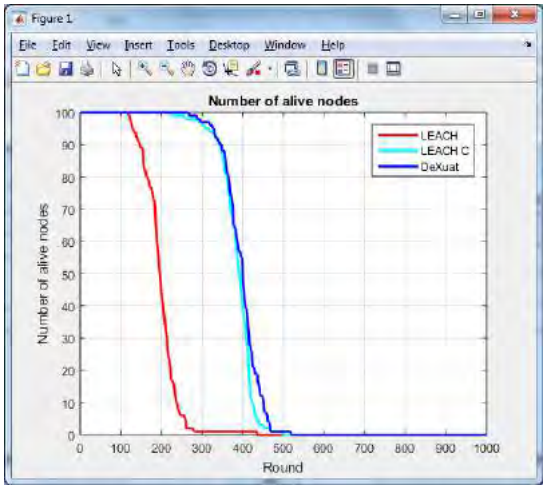


Figure 2: Simulation alive node between proposal LEACH_CD and LEACH, LEACH_C

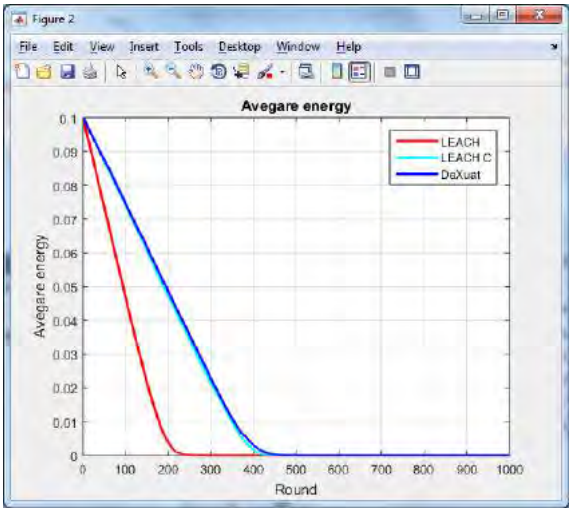


Figure 3 : Simulation average engergy between proposal LEACH_CD and LEACH, LEACH_C

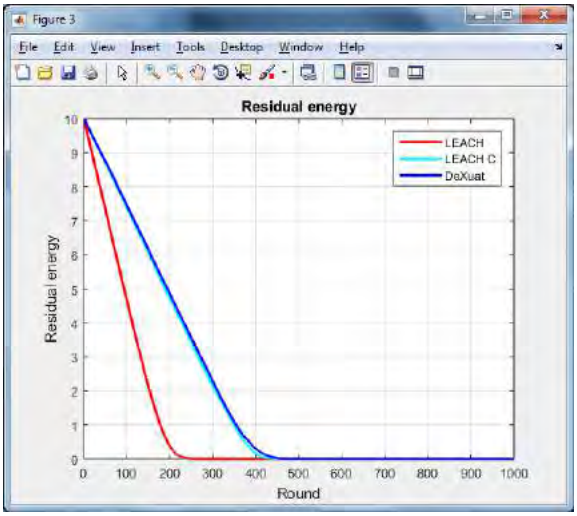


Figure 4: Simulation average resdual energy between proposal LEACH_CD and LEACH, LEACH_C

Table 2: Network lifetime comparison between proposal LEACH_CD and LEACH, LEACH-C

Protocol/Time	The 1st dead time (round)	100% dead time (round)
LEACH	119	433
LEACH_C	224	499
LEACH_CD (proposal)	268	519

V. CONCLUSIONS

This paper has proposed a way to prolong the life span of wireless sensor networks over improvement clustering Leach_C combined with Dijkstra algorithm. With the result of the simulation shows that more efficient for working with homogeneous sensor environments compared to Leach, Leach_C. Therein, combining a fixed-routing sink migration strategy with the Dijkstra algorithm to selection CHs for improving network life span.

For future research, to develop mobile sink routing strategies, we can be consider the following issues: Trying additional algorithms to find the optimal neighborhood clusters head on the mobile sink's direction, trying a different routing protocol and avoid dismiss packet data becase of limited sensor range.

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Tran Cong Hung was born in Vietnam in 1961. He received the B.E in electronic and Telecommunication engineering with first class honors from HOCHIMINH University of technology in Vietnam, 1987. He received the B.E in informatics and computer engineering from HOCHIMINH University of technology in Vietnam, 1995. He received the master of engineering degree in telecommunications engineering course from postgraduate department Hanoi University of technology in Vietnam, 1998. He received Ph.D at Hanoi University of technology in Vietnam, 2004. His main research areas are B – ISDN performance parameters and measuring methods, QoS in high speed networks, MPLS. He is, currently, Associate Professor PhD. of Faculty of Information Technology II, Posts and Telecoms Institute of Technology in HOCHIMINH, Vietnam.

Phan Thi The was born in Vietnam in 1982.She received Master Data Transmission and NetWork in HOCHIMINH PTIT, Vietnam, 2012. She is currently a PhD.Candidate in Information System from Post & Telecommunications Institute of Technology, Vietnam in 2019.She is working as a lecture in Thu Duc College.

Dang Thi Ngoc was born in Vietnam in 1983. She is currently a MSc. Candidate in Information System from Post & Telecommunications Institute of Technology, Vietnam in 2017. She is working as a engineer in District 11 hospital in Ho Chi Minh City.

Le Ngoc Hieu has been working in IT industry as a IT System Architect since 2010. In 2018, He completed Master Degree at Post & Telecommunication Institute of Technology. As now, he is working as an IT lecturer for HCMC Open University. His major study is about cloud computing and cloud efficiency for better service; his minor study is about education, especially education in IT line

Luan N.T. Huynh was born in Vietnam in 1987. He received Master Data Transmission and Network in Posts & Telecommunications Institute of Technology in HoChiMinh, Vietnam, 2012. He is currently a PhD. Candidate in Computer Science and Engineering from Kyung Hee University, Korea in 2017. He is working as a lecture in Thu Dau Mot University.

Dien Tam Le was born in Vietnam in 1987. He received Master Computer science in Universite Pierre et Marie CURIE, France, 2014. He is currently a PhD. Candidate in Computer science and engineering from Kyung Hee University, Korea in 2020.