

CHAPTER 1: INTRODUCTION

1.1 Overview

A Wireless Sensor Network (WSN) is a wireless network consisting of spatially distributed autonomous tiny devices (nodes) using several sensors to cooperatively monitor physical or environmental conditions, such as temperature, lighting, sound, vibration, pressure, motion or pollutants [1].

WSN must send monitoring data from sensor node to base station that is fundamental function of WSN. At the beginning sensor node send data directly to base station this kind of method is used a huge amount energy and can quickly deplete power supply of the node.

To solve this problem many energy efficient routing protocols are proposed to solve high usage of energy during transmission of data from node sensor to base station.

Hierarchy routing protocol is proposed to solve the energy dissipation during transmission and receive data. The routing protocols on this scheme impose a structure on the network to achieve energy efficiency, stability, and scalability. In this class of protocols, network nodes are organized in clusters in which a node with higher residual energy, for example, assumes the role of a cluster head. The cluster head is responsible for coordinating activities within the cluster and forwarding information between clusters. Clustering has the potential to reduce energy consumption and extend the lifetime of the network. They have high delivery ratio and scalability and can balance the energy consumption. The nodes around the base station or cluster head will deplete their energy sources faster than the other nodes. Network disconnectivity is a problem where certain sections of the network can become unreachable. If there is only one node connecting a part of the network to the rest and fails, then this section would cut off from the rest of the network.

LEACH [2] as a member of hierarchy protocol proposes a clustering based protocol that utilizes randomized rotation of local cluster heads to evenly distribute the energy load among the sensors in the network. By rotating the cluster head can avoid network disconnectivity caused by dead node. Other LEACH features are Localized coordination and control for cluster set-up and operation, local compression to reduce global communication.

Although LEACH makes improvement 8x better than direct transmission [2] it still has weakness because using random rotation without energy awareness for electing cluster head still

has possibility to elect node with small residual energy elected as a cluster head. As a result it will not survive to do it's duty.

E-LEACH [3] is improvement from LEACH in the way of election of cluster head. The the process is involve energy residu of node when selecting node as cluster head. E-LEACH used two approach in electing cluster head. When the residual energy is more than 50% node will choose equation 2.3 as a threshold value wich is used in LEACH. When the residual energy drop below 50% node will used equation 2.4 as a threshold. Since threshold value in equation 2.4 is lower then equation 2.3, node with higher residual energy have more probability become cluster head. When the node with more energy choosed became cluster head in certain round as a result in whole round it will further more make energy dissipation spread eventually.

If we observe E-LEACH operation, after all member node send data to cluster head it still use same procedure as LEACH they send the data directly base station. This activity used high energy [4].

Energy depletion cause by data sending from cluster head to base station has effect to whole operation of WSN. Since energy used to send data from cluster head to base station is high, node elected as cluster head will run out it's energy. If some node frequently elected as cluster head it will dead more quickly. As a result WSN lifetime will decrease

1.2 Problem Statement

1. In E-LEACH operation, after cluster heads received data from member node they agregate it and directly send data to base station. Sending directly to base station may consume huge energy because distance to base station is far
2. When energy need to transmit data from cluster head directly to base station is high it will reduce the network lifetime of WSN.
3. Because of huge energy used to sending data to base station, energy in cluster head will deplete more quick than other node.

1.3 Research Questions

1. How to change the way cluster head sending data to base station to conserve more energy?

2. Why change the way cluster head sending data to base station, can prolong the network lifetime?
3. How we distribute energy dissipation more evenly in WSN. So we can conserve energy in elected cluster head?

1.4 Objective

1. To evaluate previous research E-LEACH protocol
2. To design energy base routing combined with spatial distance base on E-LEACH protocol to prolong network lifetime
3. To analyze new approach by decreasing energy usage by cluster head when sending data to base station in E-LEACH.

1.5 Scopes

1. Simulation will run in simulation parameter in table 3.1
2. Only energy used for sending and transmit data will include in simulation. This include sending data from member node to cluster head, sending data from cluster head to base station, cluster head to cluster head and control message used in the protocol. Other activity like sensing, information processing and protocol calculation are ignored.
3. In this thesis we only make improvement to E-LEACH especially in the way of cluster head data sending to base station.

1.6 Hypothesis

1. By changing the way of cluster head sending data from directly to base station to another nearest cluster head we can conserve energy used.
2. When energy need to transmit data from cluster head to cluster head is less than directly to base station as a result we can prolong network lifetime of WSN.
3. Energy needed by cluster head is reduce because of shortening the distance travel, energy dissipation rate of cluster head is lower.

1.7 Significance of the Research

Energy conservation in WSN is a essential for prolong the network lifetime since power supply in sensor node is limited. One of method used to conserve energy dissipation in communication among sensor node is implementation of hierarchy routing protocol. E-LEACH as a member of Hierarchy routing protocol have improve the operation of LEACH. E-LEACH still directly sending information collected from member node to base station. When distance from cluster head to base station is far the amount energy used to sending information also high. This activity can extremely drain energy in cluster head.

When WSN can prolong it's lifetime it can serve us longer. Since WSN is basic of new trend of Internet of things (IoT) this thesis contribute to the research of IoT for the advantage to human beeing.

1.8 Thesis Organization

This thesis is organize as:

1. Chapter 1. Introduction, contain review of current technology of energy efficient routing protocol, problem statement, objective and hypothesis of the thesis,
2. Chapter 2. Review of literature, contain state of the art of energy efficient routong protocol, theory and previous study on the subject.
3. Chapter 3. Research Methodology contain research design and detail of proposed method.
4. Chapter 4. Experiment, Presentation and analysis, contain analysis of data from experiment in previous chapter
5. Chapter 5. Conclusion and recomendation, contain conclusion and recomendation from experiment.