

CHAPTER 1: THE PROBLEM

This chapter discusses about the underlying background of the research, followed with the overview of several transmission and routing enhancement for wireless sensor network prior to this research.

1.1 Rationale

Traditional routing and transmission data packet use a single path through the network even the infrastructure of today communication multiple paths are usually available [8]; e.g., in Wireless Sensor Network. Wireless sensor networks (WSNs) consist of distributed and networked sensors which jointly monitor the physical or environmental conditions such as temperature, sound, vibration, pressure, and motion at different locations. There are two distinctive characteristics in WSNs [2]. First, nodes in WSNs communicate with others through wireless channels. Compared to wired networks, the link quality of wireless channels is unsatisfactory due to unstability of wireless channels. Second, the nodes are always deployed in complex environments, and batteries are often used as their energy supply. However, a realistic problem is the energy produced from batteries is always limited. Therefore, the reliable transmission in WSNs can be considered at two levels which are lower energy consumption and higher successful delivery ratio.

Designing an efficient and reliable routing protocol for WSN is a challenging issue. Multipath routing in WSN is used to improve the reliability of WSN by using a lot of tracks or transmission paths from the source to the sink [8] [9], but with high redundancy results in more transmissions, the energy consumption accordingly becomes greater.

1.2 Theoretical Framework

TCP performs poorly over wireless links which suffer from packet losses mainly due to the bad channel. To address this problem, it is useful to incorporate network coding into TCP, as network coding can offer significant benefits in terms of power efficient, reliability, and robustness. Network coding [12] is a technique that successfully increases the transmission capacity of a network by mixing together data from different sources and by broadcasting the coded data. Proposed by Ahlswede et al. [12], network coding promises to offer benefits along very diverse dimensions of communication networks, such as throughput,

wireless resources, security, complexity, and resilience to link. In this project we want to modified existing network coding thus we can use the Multipath TCP in Wireless Sensor Network to improve realibility of a WSN.

1.3 Conceptual Framework/Paradigm

Wireless sensor networks (WSNs) are a kind of communication networks having independent sensor nodes that form multi-hop ad hoc network to transfer data. Many studies have be conducted on this field, especially on the issue of limited resource such as limited power, limited computing, limited buffer, high loss transmission, and redundancy of WSN. Dinusha et al. [1] emerging improvement research on TCP implementation that includes congestion control and reliability for WSN with a novel topology and protocol used. Reliable transport protocols have traditionally been designed to perform end-to-end error control transparently to the intermediate nodes, but with limited of resources that emerging from WSN, the ordinary TCP cannot be implemented on WSN [6]. Nestor Michael et al [5] have conducted an analytical model of end-to-end delivery cost for WSN reliable transport with intermediate caching. The model calculates the cost as the total number of physical layer transmissions using a probabilistic formulation that has been validated through network simulation. But this is not implementative, because many intermediate nodes have limited buffer that make not easy to do the caching process. Leiwang et all [2] [3] [4] have conducted several studies using network coding to enhance the properties of WSN that focus on energy efficiency since all of the sink node use battery for the running life. But still there are possible field of improvement that can be conducted on his research that analys deeper the efective using of network coding on WSN. It would not all of the node do the network coding to achieve the enhancement due to heterogeneous specification of sensor that used.

1.4 Statement of the Problem

The following are some of the problems that become the background of this thesis:

- a. Nodes in WSNs communicate with others through wireless channels. Compared to wired networks, the link quality of wireless channels is unsastifactory due to instability of wireless channels. The nodes are always deployed in complex environments, and

batteries are often used as their energy supply. However, the realistic problem is that the energy produced from batteries is always limited.

- b. Reliable transmission in WSNs can be considered at two levels, lower energy consumption and higher successful delivery ratio.
- c. Multipath routing is applied to increase the reliability of wireless networks, and it creates several paths to the sink node for each source node multipath routing [1-4] increase the reliability of WSN but it needs redundancy. As long as one of these packets is received successfully, the whole process can be considered a success. In this sense, multipath routing improves the reliability by increasing the redundancy. However, the high redundancy results in more transmissions, and as a result the energy consumption becomes greater accordingly.
- d. Error correction mechanism is another technology used to increase reliability: Automatic Repeat Request (ARQ), Forward Error Correction (FEC), and Hybrid Error Correction. This error correction needs greater data redundancy and retransmission when error on transmission occurred.
- e. Previous WSN method for improving successful delivery ratio has a power efficiency tends to be low.

1.5 Hypothesis

The following are the hypothesis that used in this thesis:

In this project we want to use modified network coding multipath routing with a power aware node selection method to improve THE existing network coding multipath routing in Wireless Sensor Network. In this method not all intermediate nodes involved on routing discovery and maintenance which will process and forward the packet data from source to sink. With the proposed network coding multipath routing using this linear network coding can improve the realiblity of WSN in term Successfull Delivery Ratio and Power Efficiency.

1.6 Objectives

The Following are the objectives of the research:

- a. To propose a node selection mechanism with have RSSI and power capacity residual in routing discovery and maintenance of Network coding multipath routing.
- b. To use awareness of own power capacity residual can modify the existing network coding Multipath Routing in WSN.
- c. To improve the reliability of wireless sensor network with this proposed of modified network coding multipath routing coding in terms of Successfull Delivery Ratio and Power Consumption/Recovery.

1.7 Assumption

The following are the assumption used in this thesis:

- a. Algorithm complexity time course is not counted.
- b. WSN use standard NIC of IEEE 802.15.4.
- c. Physical and Mac Layer of IEEE802.15.4 wireless link assumed to be in default function and working well with using MiXiM Framework on OMNET++.
- d. Node WSN not have mobility.

1.8 Scope and Delimitation

The following are the scope and delimitation used in this thesis:

- a. Topology design and test use OMNET++ framework and MiXiM framework modular modification.
- b. Configuration of coverage area for wireless node and wireless parameter use the existing standards.
- c. Routing Protocol used are Multipah routing and modified Network Coding multipath Routing.
- d. Evaluating the simulation performance is limited to Succesful Delivery Ratio, Node energy consumption, BER floor or BER lower bound parameter of NIC layer Node Sensor on MiXiM (physical decider).

- e. The research examination is only focused on the network routing protocol stack rather than many other stacks such as Application, presentation, session, transport, data link, and physical layer stack.

1.9 Importance of the Study

This thesis may give contributions which is believed that the Wireless Sensor Network research community would benefit from such as :

- a. The propose a modified of Network coding multipath routing of wireless sensor network, by doing enhancement of existing network coding multipath routing protocol mechanisms, may improve the reliability of a wireless sensor network.
- b. The result of the research gives the newest information for the implementation of multipath routing protocol IEEE 802.15.4 based WSN that can be used as reference for next development of routing protocol WSN.