Implementation of energy efficient and trust aware routing for WSNs – Energy Consideration

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Abstract— *Wireless Sensor Networks are gaining popularity due to the fact that they offer low-cost solutions for a variety of application areas, but efficient defense against security attacks is a challenging task in the wireless sensor network environment. Although significant research effort has been spend on the design of trust models to detect malicious nodes based on direct and indirect evidence, this comes at the cost of additional energy consumption. In this paper we are implementing the energy module for wireless sensor network which will calculate the one transmission cost in terms of energy and accordingly find the route with least energy consumption.*

Index Terms— *energy efficient routing, secure routing,, sensor energy, trust-aware routing, trust values, energy cost, WSN.*

1 Introduction

The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on. WSNs comprise battery powered sensor nodes with extremely limited processing capabilities Multi-hop routing of WSNs often becomes the target of malicious attacks. The design aims to secure routing solutions in wireless sensor networks.

2 Assumptions

In a data collection task, a sensor node sends its sampled data to a remote base station with the aid of other intermediate nodes. There could be more than one base stations, our routing approach is not affected by the number of base stations. Still for simplification purpose we are assuming here only one base station. We assume a data packet has at least the following fields: the sender id, the sender sequence number, the next-hop node id (the receiver in this one hop transmission), the source id (the node that initiates the data), and the source's sequence number.

2.1 Goals

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The routing scheme aims to find the shortest path from source node to the destination base station using least energy for the transmission. After each transmission the energy module implemented on each sensor node will record the used energy value and send the energy record to the neighboring nodes. For this purpose, we are using only next hop transmission.

2.2 Energy Module

Data transmission accounts for a major Portion of the energy consumption. We evaluate energy efficiency by the average energy cost to successfully deliver a unit-sized data packet from a source node to the base station, be given enough attention when considering energy cost since each retransmission causes a noticeable increase in energy consumption. If every node in a WSN consumes approximately the same energy to transmit a unit-sized data packet, we can use another metric hop-per-delivery to evaluate energy efficiency. Under that assumption, the energy consumption depends on the number of hops, i.e. the number of one-hop transmissions occurring. To evaluate how efficiently energy is used, we can measure the average hops that each delivery of a data packet takes, abbreviated as hopper- delivery. This Generates energy cost of the neighbor nodes and Monitors energy consumption of one-hop to its neighbor. The module Processes energy cost reports from those neighbors to maintain energy cost entries in its neighborhood table.

3 Design of TARF

3.1 Simulation in WSNs

Implementation of WSNs can be done using various tools. Network simulators like OPNET, NetSim and NS2 can be used to simulate a wireless sensor network. Here we are using NS-2 as a network simulator with TCLscripting and C++ programming language. NS-2 as a non-specific network simu-

lator can support a considerable range of protocols in all layers. For example, the ad-hoc and WSN specific protocols are provided by NS-2. Secondly, the open source model saves the cost of simulation, and online documents allow the users easily to modify and improve the codes.

3.2 Implementation

In energy module, Each node relies on its neighborhood table to select an optimal route, considering energy consumption and reliability. The neighbor energy cost is calculated by

Nb_energy_cost= (e_unit/p_succ)+ e_b

where

e_unit= e_b/distance

p_succ= probability of the request message being acknowledged

According to neighborhood table of energy values forwarding decision is taken.

In this simulation, we are considering a network of 100 wireless sensor nodes and one base station at the center of the network.

3.3 Simulation Results

Initial view of the network is as shown in figure 1.

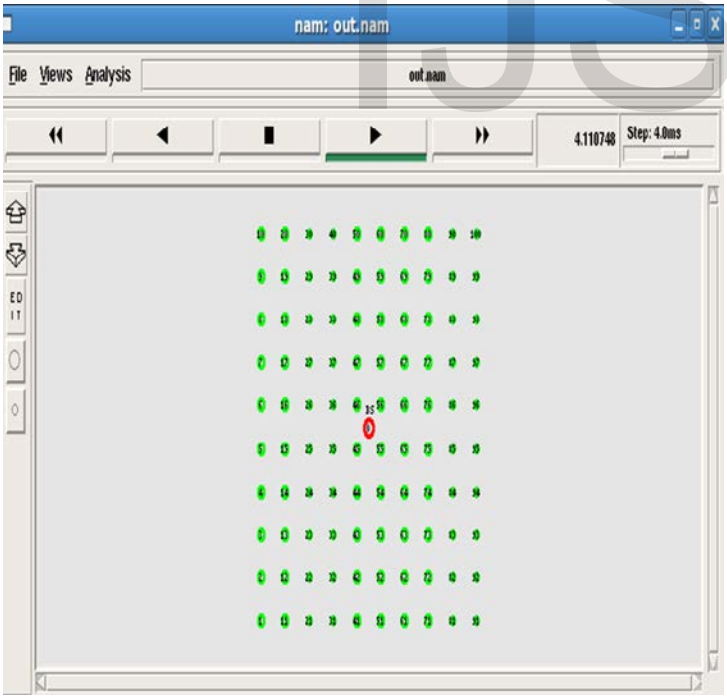

FIG. 1 INITIAL VIEW

When a node wants to deliver the data to the base station, it sends route request message to its neighboring nodes. After receiving the route request message the neighboring nodes will send route reply message.

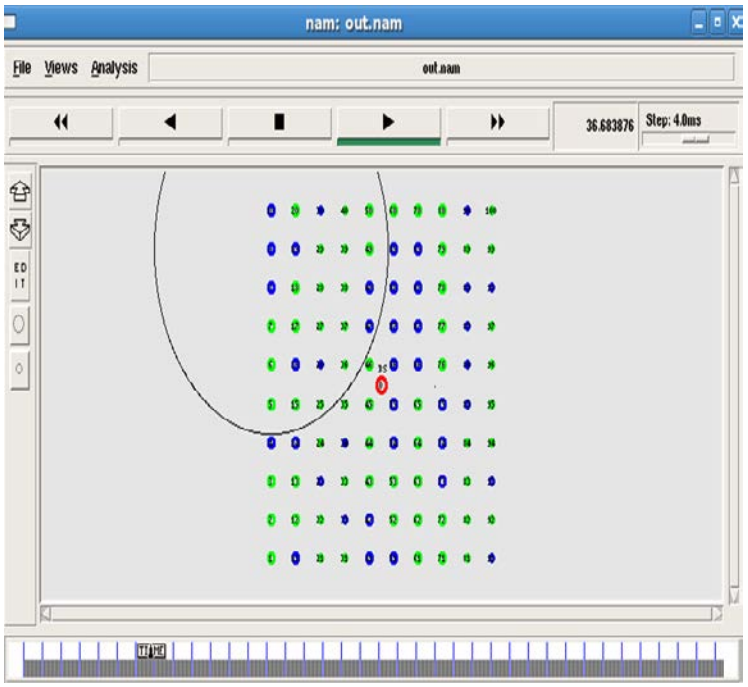

FIG. 2 NODES SENDING ROUTE REQUESTS

The node will find then the next hop for the transmission of the message. Same procedure is applied on the next hop node too. And according the route to the base station is identified.

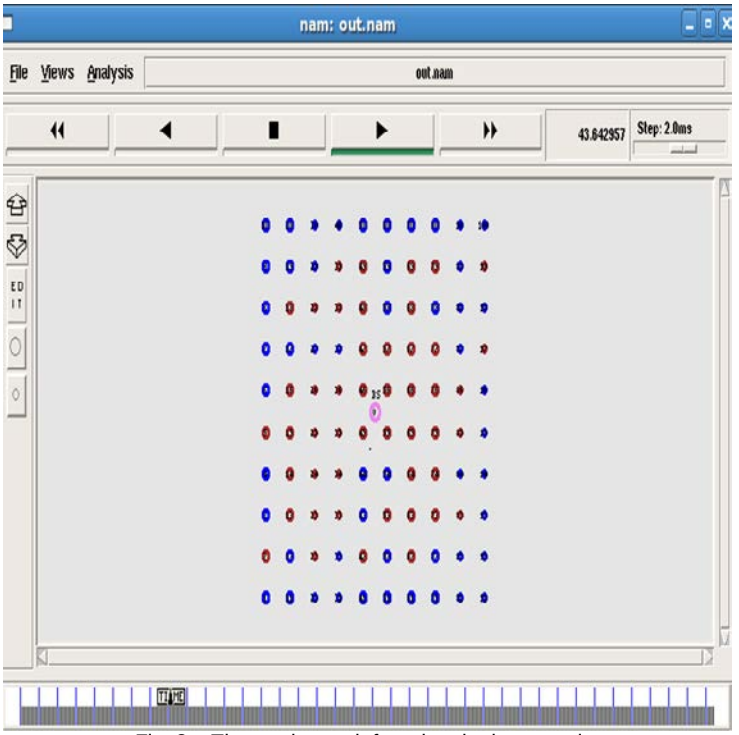

Fig. 3 – The routing path found to the base station

When the energy level of any node is less than the threshold then that node is not considered for the transmission.

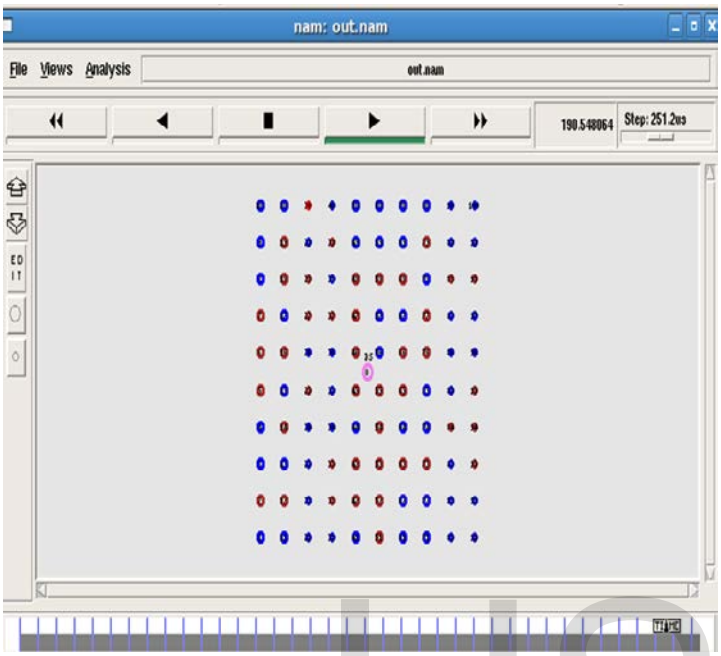

Fig. 4 – Nodes found with energy less than threshold

The trace file outputs of the implementation shows the next hop nodes of the sender node and the energy used for the particular transmission also the route from the source to the destination base station. Some of the outputs of the trace file are as follows:-

Node: 0 p_succ 1 Node: 100 p_succ 1
Energy watcher Node: 56 send Route req to 0 at 35.0187
2 3.26486 Node: 0 send Route reply
11 3.26486 0 56
12 2.67907

Node: 1 p_succ 1 Reply Forward to : 56 dst: 0
Energy watcher Node: 34 send Route req to 0 at 35.0526
1 3.26486 Node: 0 send Route reply
12 3.26486 0 45 34

Node: 2 p_succ 1 Reply Forward to : 45 dst: 0
Energy watcher Node: 93 send Route req to 0 at 35.0633
14 2.67907 Node: 0 send Route reply
4 3.26486 0 56 65 74 84 93
12 2.67907

4 CONCLUSIONS AND FUTURE WORK

We have simulated the energy module of a robust framework to secure multi-hop routing which focuses on trustworthiness and energy efficiency which are vital to survival of WSN. This enables a node to keep track of its neighbor nodes and thus to select a reliable route. In future, we can implement the trust module of the framework.

REFERENCES

[1] G. Zhan, W. Shi, and J. Deng, "TARF: A trust-aware routing framework for wireless sensor networks," in Proceeding of the 7th European Conference on Wireless Sensor Networks (EWSN'10), 2010.

[2] F. Zhao and L. Guibas, Wireless Sensor Networks: An Information Processing Approach. Morgan Kaufmann Publishers, 2004

[3] M. Jain and H. Kandwal, "A survey on complex wormhole attack in wireless ad hoc networks," in Proceedings of International Conference on Advances in Computing, Control, and Telecommunication Technologies (ACT '09), 28-29 2009, pp. 555 – 558

[4] Ms. Dipali G. Dikondwar, Prof. R. K. Krishna, "Survey : Energy-Efficient and Trust-Aware Routing Techniques for WSN", International Journal of Engineering Research and Technology, Vol. 2, Issue 2, ISSN 2278-0181, February- 2013.

[5] G. Zhan, W. Shi, and J. Deng, "Design and Implementation of TARF: A Trust Aware Routing Framework", IEEE 2012 Transactions on Dependable and Secure Computing, Volume: 9 , Issue: 2.

[6] web reference – NS-2 Manual- www.isi.edu/nsnam/ns/.