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An Experimental Analysis of Secure-Energy Trade-Off using Optimized Routing Protocol In modern-secure-WSN

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Abstract

In modern secure Wireless Sensor Networks (WSN), the sensor-nodes need extra energy owing to secure transmission of perceived information. So the energy-utilization of sensor-node should calculate while transfer the sensed-attributes securely to network. In this experimentation, we are proposing a revised Low Energy Adaptive Clustering Hierarchy (LEACH) protocol as LEATCH along secure information transmission (privacy and node authentication) in various levels using Quality of Protection Modeling Language (QoPML), which balance the Security-Energy trade-offs. This research experimentally analyzes the impact of data privacy, authentication operations on energy-utilization at sensor-node level while applying a LEACH & LEATCH. The obtained outcomes indicate the optimized LEATCH is outperforming correlated to the basic Leach with respect to minimal energy-utilization, time efficiency and expands life-time of modern-secure-WSNs.

Keywords: Modern-WSN, Energy Efficiency, QoPML, SAMA and LEACH Protocol.

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1. Introduction

The modern-secured-WSN is containing many sensor-nodes, tiny battery-powered gadgets. Their role intends observe, perceive and grasps the info from different ecological-objects and from environment and relay the sensed information securely (by security protocol) directed toward Base-Station (BS) for more investigation [1]. As modern-secure-WSNs contain immense tiny sensor-nodes with minimal energy, so, a routing mechanism has to layout for retaining energy of sensor-nodes in modern-secure-WSN systems.

LEACH method is best hierarchical-routing method, which introduces aggregating the information; it's a turning point in grouping routing techniques. Most of hierarchical-routing methods have drafted working on the perception of LEACH [2. As per figure 1, Cluster_Head (CH) analysis with sensor estimation achieves powerful data communication with server to CH analysis.

To expand system life-time, each component's individual energy must save and for apply new mechanisms while designing modern secure WSN [2][3]. Therefore, it is better to use clustering approaches preferably directly communicating between sensor-nodes to BS that requires more sensor-energy. In modern-secure-WSN applications, activities sensed by many receptors neighbouring the event and distant from the BS or central location. Then, the establishing of short-range interaction (as in Figure-1) brings obligatorily to information packages being submitted through additional nodes along a multi-hop direction in Wi-

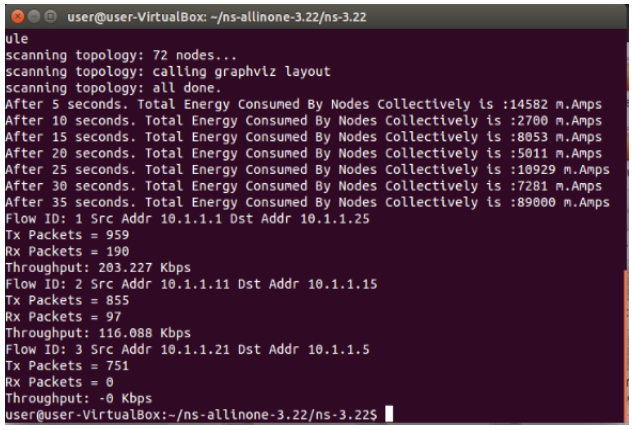

Figure 10. Energy-Utilization w.r.t. LEATCH

LEATCH protocol reduces the energy-utilization of few CH's whose residual_energy is low or is at a distant place from BS by setting level-Two-CH. From the simulation experimental outcomes, we tabulated our outcomes and evidenced that our new LEATCH protocol outperformed than old LEACH in Table 2.

Table 2. Energy results with respect to node communication

No. of Rounds w.r.t. Time Intervals	QoPML (m.Amps)	LEACH (m.Amps)	LEATCH (m.Amps)
50	3420	14582	14582
100	5700	6075	2700
150	11293	12090	8053
200	16306	19560	2011
250	22393	27307	10929
300	27753	17595	7281

Our improved LEACH gives better energy-utilization levels as depicted in Table 2 w.r.t host to host secure transmission in modern-secure-WSNs. After 50 rounds our proposed method consumes more energy but efficiency increased as number of rounds increased and in the same line the number of dead nodes are less.

Communication Results W.R.T to Time:

Time comparison results in Wireless Sensor Networks with nodes communication with respect to time for packets dropping in the middle of data transmission by hop by hop communication. Table 3 shows analysis results with respect to time in data communication between nodes.

Table 3. Time efficiency with respect to node communication

No. of Rounds w.r.t. Time Intervals	QoPML (Seconds)	LEACH (Seconds)	LEATCH (Seconds)
10	0.9	1.2	1.8
20	1.1	1.9	2.4
30	2.1	2.8	3.6
40	3.06	3.9	4.5
50	3.4	4.2	4.5
60	3.9	4.8	5.7

As per the results depicted in Table 3, LEATCH outperformed in terms of time taken for the first to die compared to other two protocols. After 10 rounds, the proposed method took 50% more time for the death of first node and after 60 rounds the proposed method took 46% more time for the death of first node. Whenever the number of rounds increased then the number of outcomes in real-time data transmission of the host to host communication with respect to time in our modified LEACH protocol gives efficient communication without loss of data delivery in WSN.

5. Conclusion

In this experimentation, we conclude total energy-utilization in direct transmission using QoPML (with security aspects) gradually increased throughout simulation period. In this context, comparing LEATCH and LEACH, after 50 rounds of simulation both protocols consumed same energy, our proposed LEATCH protocol has outperformed after 300 rounds of simulation in terms of saving energy which is 36% when compared to QoPML and after 300 rounds of simulation LEATCH has conserved around 56% of energy when compared to LEACH. In the same line we additionally implemented node authentication, message privacy and calculation of energy consumed by each node in the network for each round of simulation when compared to traditional LEACH and LEACH-TLCH protocols [4, 14]. This experimental research is suitable for small-scale WSNs. This can be enhances by implementing dynamic routing for large-scale Secure-WSNs. And this work can be extended for dynamic load balancing by using Evolutionary Computing Tools [15].

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