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Novel HSM-LEACH for Optimized Energy and Security in Wireless Sensor Networks

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Abstract: A wireless sensor network comprises numerous wireless sensor nodes which are deployed over a large geographical area where human monitoring is unavailable. Each node is battery powered able to sense, transmit, and receive data. Other than establishing communication, the nodes perform some computation. This framework introduces a novel scheme name as Hybrid security-based modified Low-Energy Adaptive Clustering Hierarchy (LEACH) Protocol (HSM-LEACH) provides security, and the energy consumption is reduced. Our work having techniques are, first, the nodes are optimally gathered with the cluster head selection procedure is done by means of LEACH protocol. Once the CH is elected, the intra and inter-cluster message is recognized. Second the Cuckoo Search Optimization (CSO) based Energy and Delay Aware Routing Algorithm is used to resolve the variable delays, packet losses and ensuring scalability of Networks. The energy effectual and delay alert shortest routes are determined by the CSO System. Finally Dynamic Key Management Scheme for security from various Attacks. Tentative results show that the HSM-LEACH deal with Energy and Delay aware Routing scheme with security deals effectual transmitting with better performance in networks, in terms of packet delivery ratio, bandwidth, end to end delay, energy utilization, throughput, and network lifetime.

I. Introduction

Low-energy adaptive clustering hierarchy ("LEACH") is a TDMA-based MAC protocol which is integrated with clustering and a simple routing protocol in wireless sensor networks (WSNs). The goal of LEACH is to lower the energy consumption required to create and maintain clusters in order to improve the life time of a wireless sensor network. LEACH is a hierarchical protocol in which most nodes transmit to cluster heads, and the cluster heads aggregate and compress the data and forward it to the base station (sink). Each node uses a stochastic algorithm at each round to determine whether it will become a cluster head in this round. LEACH assumes that each node has a radio powerful enough to directly reach the base station or the nearest cluster head, but that using this radio at full power all the time would waste energy. Nodes that have been cluster heads cannot become cluster heads again for P rounds, where P is the desired percentage of cluster heads. Thereafter, each node has a 1/P probability of becoming a cluster head again. At the end of each round, each node that is not a cluster head selects the closest cluster head and joins that cluster. The cluster head then creates a schedule for each node in its cluster to transmit its data. All nodes that are not cluster heads only communicate with the cluster head in a TDMA fashion, according to the schedule created by the cluster head. They do so use minimum energy needed to reach the cluster head, and only need to keep their radios on during their time slot. LEACH also uses CDMA so that each cluster uses a different set of CDMA codes, to minimize interference between clusters. LEACH arranges the nodes in the network into small clusters and chooses one of them as the cluster-head. Node first senses its target and then sends the relevant information to its cluster-head. Then the cluster head aggregates and compresses the information received from all the nodes and sends it to the base station. The nodes chosen as the cluster head drain out more energy as compared to the other nodes as it is required to send data to the base station which may be far located.

II. Problem Statement

Sensor networks have some special characteristics compared to traditional networks such as the limitation of the available resources, especially the energy. Sensors often provides low scalability and makes network-wide coordination difficult. To solve this problem, hierarchical architectures (clusters) have been proposed to solve the scalability problem. Appropriate clustering can reduce the need for global coordination and restrict most of the sensing, data processing and communication activities within clusters, thus can improve resource utilization and prolong network lifetime. In this kind of organization, nodes are organized into clusters. Cluster heads (CHs) pass messages members to the base station (BS). Sensor networks often provide services from their in hostile environments, which makes them targets for malicious attacker.

III. Scope Of The Project

The enhancement is done by the addition of security through encrypting and decrypting the data sent. The data is encrypted using homomorphic encryption technique. This project help is securing the data transferred in the WSN. This particular employment of homomorphic encryption technique helps to develop an efficient solution for enhancing the energy efficiency and the security of the existing LEACH protocol. A protocol based on LEACH protocol to balance the energy consumption while providing confidentiality.

IV. LITERATURE SURVEY

[1] VikasNandal and Deepak Nandal.Maximizing Lifetime of Cluster-based WSN through Energy-Efficient Clustering Method: IJCSMS Vol. 12, Issue 03, September 2012. Proposed a progressive algorithm for the cluster head selection. The proposed algorithm for cluster head selection is based on residual energy, distance & reliability. The cluster head generation algorithm with the original LEACH clustering protocol can cause unbalanced distribution of cluster heads, which often leads to redundant cluster heads in a smallregion and thus cause the significant loss of energy.

[2] Lianshan Yan and Wei Pan,. Modified Energy-Efficient Protocol for Wireless Sensor Networks in the Presence of Distributed Optical Fiber Senor Link: IEEE SENSORS JOURNAL, VOL. 11, NO. 9, SEPTEMBER 2011 Investigated an improved energy-efficient communication protocol for wireless sensor networks (WSNs) in the presence of distributed optical fiber sensor (DFS) links located at the center of WSN fields based on the protocol—lowenergy adaptive clustering hierarchy (LEACH). They investigated a modified energy-efficient communication protocol, called O- LEACH, for wireless sensor networks that consist of DFS links and Implementation of LEACH Protocol Using Homomorphic Encryption 67 randomly scattered wireless sensor nodes. The lifetime of such sensor network with rectangular topology is further investigated. The lifetime ofthe situation that two WSNs are isolated is more than 20% better than that of the case where nodesinside two WSN fields are reachable to any live nodes within the whole sensor field. This can be a deployment
guideline for such hybrid sensor networks.

[3] A.S.Poornima and B.B.Amberker. SEEDA: Secure End-to-End Data Aggregation in Wireless Sensor Networks: IEEE 2010 Proposed a secure data aggregation scheme which provides end-to-end data privacy. Wireless Sensor Network (WSN) consists of a large number of nodes with limited resources. Hence to extend the lifetime of the network it is necessary
to reduce the number of bits transmitted. One widely used method for reducing the data bits is data aggregation. Secure data aggregation schemes are suitable to achieve security in data aggregation. The data encrypted at SN-nodes is decrypted by the sink node. At aggregator nodes, the cipher texts are added. The protocol uses additive homomorphic encryption method to encrypt the data. The additive homomorphic encryption allows addition of cipher texts which when decrypted results in addition of the plain text.

[4] Mona El_Saadawy, et al.Enhancing S-LEACH Security for Wireless Sensor Networks: IEEE 2012 Proposed MS-LEACH to enhance the security of S-LEACH by providing data
confidentiality and node to cluster head (CH) authentication using pairwise keys shared between CHs and their cluster members. The security analysis of proposed MS-LEACH showed that it had efficient security properties and achieved all WSN security goals compared to the LEACH protocol. A simulation-based performance evaluation of MS-LEACH demonstrated the effectiveness of proposed MS- LEACH protocol and showed that the protocol achieves the desired security goals and outperforms other protocols in terms of energy consumption, network lifetime, and network throughput and normalized routing load.

[5] Jia Xu, et al. Improvement of LEACH protocol for WSN: 2012 IEEE Proposed a revised cluster routing algorithm named E-LEACH to enhance the hierarchical routing protocol LEACH. In the E-LEACH algorithm, the original way of the selection of the cluster heads was random and the round time for the selection was fixed. In the E-LEACH algorithm,the remnant power ofthe sensor nodes was considered in order to balance network load. In the E-LEACH they used the minimum spanning tree between cluster heads, the cluster head which has largest residual energy was chosen as the root node. The main idea of the improved cluster head selection algorithm was to avoid the lower residual energy nodes and higher consumed energy nodes to be cluster-head. The simulation results showed that the proposed protocol increases network lifetime at least by 40% when compared with the LEACH algorithm. Coverage control mainly focuses on optimizing nodes deployment algorithms and adjusting nodes positions to construct network with limited resources, it aims to guarantee the Quality of Service (QoS) in monitoring Region of Interest (RoI). Thus, efficient node deployment algorithms are required to solve this problem.

[6] Meenakshi Diwakar and Sushil Kumar. Energy Efficient Level Based Clustering Routing Protocol for Wireless Sensor Networks: IJASSN, Vol 2, No.2, April 2012 Proposed M-Leach with reduced network energy consumption as compared to LEACH. The features that are not supported are: LEACH assumes a homogeneous distribution of sensor nodes in the given area which is not very realistic; LEACH does not really support movement of nodes. The proposed algorithm put some features that LEACH does not support such as:

A. Mobility of cluster head and member node during one round
B. Currently remaining battery power and the number of nodes per cluster

V. EXISTING SYSTEM

In previous work, the performance of wireless sensor network (WSN) system is significantly affected by the coverage quality. For the problem of low coverage of static sensor network nodes and high deployment cost of mobile sensor network nodes, a hybrid sensor network based on cuckoo search (CS) is studied. Node deployment optimization strategy. Firstly, the candidate target position of the mobile node is initially determined by the CS algorithm, and then the position optimization scheme is used to reduce the number of mobile nodes and the average moving distance. This multi-objective programming model integrates into CS for the optimal selection of the route for secured transmission. The algorithm considers several QoS parameters, namely energy, distance with a security parameter, trust, as the multi-objective or goal model. Once the algorithm measures the QoS and security parameters, it discovers k possible paths from the source node to the destination node. The objective of the CS algorithm is to select an optimum path from the discovered path, satisfying the multiple objectives considered for a secured routing. The solution encoding, multi-objective fitness, along with the detailed explanation of the proposed algorithm are given in the following sections.

VI. PROPOSED SYSTEM

In this article, propose Energy and Delay aware Routing scheme with security in WSNs which enables to resolve the energy and delay problems in Mobile Ad-hoc networks. In this proposed work, the WSN nodes are optimally gathered with the cluster head selection procedure is done by means of LEACH protocol. Once the CH is elected, the intra and inter-cluster message is recognized. The energy effectual and delay alert shortest routes are determined by the CSO System. Thus, the transmitting paths are chosen with energy efficiency and minimal delay with security from various attacks. Tentative results show that the CSO deal with Energy and Delay aware Routing scheme deals effectual transmitting with better performance in Mobile Ad-hoc networks, in terms of packet delivery ratio, bandwidth, end to end delay, energy utilization, throughput, and network lifetime.

VII. METHODOLOGY

7.1 Clustering and CH - Selection

The LEACH procedure which is a probabilistic technique can be engaged for the cluster formation and cluster head selection grounded on in MANETs. Nevertheless, the assortment of a node is not completed grounded on sum of energy, which could source difficulty in selection procedure to offer importance to a low power node. If low power node is not cast-off competently, added number of nodes has to be engaged to form a group. LEACH practices single hop clustering routing and cannot be cast-off for greater networks. Diverse sums of preliminary energy cannot be measured in LEACH meanwhile CH rotation is achieved at respective round. Nodes with little energy, designated as CH could source energy holes and analysis difficulties. To overwhelmed these problems, energy deliberations and second cluster head are delivered giving importance to low power nodes. Thus, the Improved LEACH (I-LEACH) has been established. I-LEACH practices residual and extreme energy of the nodes to designate a head for every round. The anticipated procedure is cast-off to discovery the life time of the nodes in terms of rounds when the anticipated threshold and energy circumstances are measured. The nodes with energy fewer than to that of the (Etr) least energy prerequisite for transmitting and receiving signals is completed to die as it deficiencies energy to do it. Etr is deducted from the energy of the node s(i). e in each round as that much of energy is expended. Complete number of alive nodes is intended for each round so as to have a trail on the life time of the system. When the network arrives the setup stage, Ep, the probability by means of energy concerns is intended by consuming Emax, Cp and Ep, then the average energy of all the nodes are intended. Then the threshold value is calculated. An amount is haphazardly picked in the range 0 to 1. If the amount selected is fewer than the threshold value and the consistent node is allocated to be cluster head if its energy is added than that of the average energy. The energy essential for data transmission is presumed from the energy of the node in each round. When the energy drops below the least value, it is acknowledged to be dead. A graph is strategized for totality of alive nodes in every round. Thus, the cluster head can be designated. This selection procedure benefits in choosing the optimal node as the cluster head and grounded on this head node, the adjacent nodes are clustered organized to practice clusters.

7.2 Energy & Delay Aware Routing – Cuckoo Search Optimization

The suggested cuckoo search procedure grounded routing system offers energy and delay aware routing. The cuckoo search is an optimization procedure which is cast-off to enhance the Quality of Service (QoS) factors like network life time, energy level, throughput, bandwidth, delay, shortest path distance and packet delivery ratio. These species replicate by laying their eggs in the host birds' nest. Host birds position provides certain reproductive method of cuckoo birds, if a host bird recognize cuckoo eggs available its nest it will either toss away those alien eggs or desert its nest and make a new nest somewhere else. Cuckoo search optimization (CSO) is concerned on certain reproduction behavior, and is beneficial for numerous optimization difficulties. It pertains huge improved method than meta-heuristic algorithms. CSO targets a novel and potentially enhances solutions (cuckoos) to substitute a not-so-good solution in the nests. Fairly an amount of species engage the obligate brood parasitism by laying their eggs in the nests of other host birds (nodes). Some host birds can engage direct conflict with the intruding cuckoos. If a host bird discovers the eggs are not their own, they will either throw these alien eggs away or simply abandon its nest and build a new nest elsewhere. Some species of cuckoo can even mimic the color and pattern of the host bird's egg, so that the probability of the egg being noticed is abridged.

7.3 Secure Data Transfer

Security is an important issue for mobile ad hoc networks. For security we mainly consider the following attributes: availability, confidentiality, integrity, authentication, authorization and non-repudiation. Certain security mechanisms and protocols have been designed and proposed for wireless network. Key management is the central aspect of the security of wireless sensor networks, and it is still a weak point. In this paper we used a Dynamic key management scheme,, which creates a structure for this type of networks in mobile ad hoc networks. The advantage is that in Dynamic key management it is easier for a node to request service from a well-maintained group.

Server initiates the reply phase. When RR packet reaches the server, following operations are performed in the reply phase.

(1) Server computes RET for all the received RR packets.

(2) Among the multiple paths, server selects a path with higher RET.

(3) RP packet is generated for RR packet which has higher RET. Server forwards RP packet to neighbor address as present in route record by updating RIC at server. Updates RIC with server id/anycast address, path information, RET, hops, and recorded time stamp.

(4) Node receiving RP packet updates RIC by using contents of RP packet, and forwards to next neighbor. Updates will happen only if current time is greater than the time recorded in RIC. If next neighbor or link is failed, sends RE packet to server and visited intermediate nodes and stops RP packet propagation.

(5) Perform step 3 until client is reached without link/node failures.

(6) If client is not found due to link breaks, send RE packet to the server.

(7) Once all RP packets reach the client, the client node chooses a server based on path with higher RET.

(8) For the chosen server, select a path with lesser hops, and keep other paths to the server as backup paths. Chosen path to the server will be used by the client as a source route for data transmission.

VIII. RESULTS AND DISCUSSION

In this research work discussed about our implementation tool of network simulator tool and its functions and also all process in step-by-step explanations. First, Ubuntu OS, this operating system is a Linux based operating system here we use network simulator tool in this operating system. Ubuntu is a Debian-based Linux operating system, with Unity as its default desktop environment. It is based on free software and named after the Southern African philosophy of Ubuntu (literally, "human-ness"), which often is translated as "humanity towards others" or "the belief in a universal bond of sharing that connects all humanity". Second, TCL language - TCL (Tool Command Language) is a scripting language created by “John Ouster out”. Originally "born out of frustration", according to the author, with programmers devising their own languages intended to be embedded into applications, TCL gained acceptance on its own. With this TCL we also discus some protocols and applications in network simulator tool like AODV, DSR, DSDV and LINK LAYER. At last Network Simulator tool (NS2) - In this research work discussed network simulator architecture, feature of ns2, ns2 programming structures, multiple layers in simulator, trace files and trace analysis. Above mention applications are used in network simulator tool for implement simulation projects in NS2.

8.1 End to End Delay Ratio

In figure 8.1, we have compared the end-to-end delay comparison between existing and proposed work.

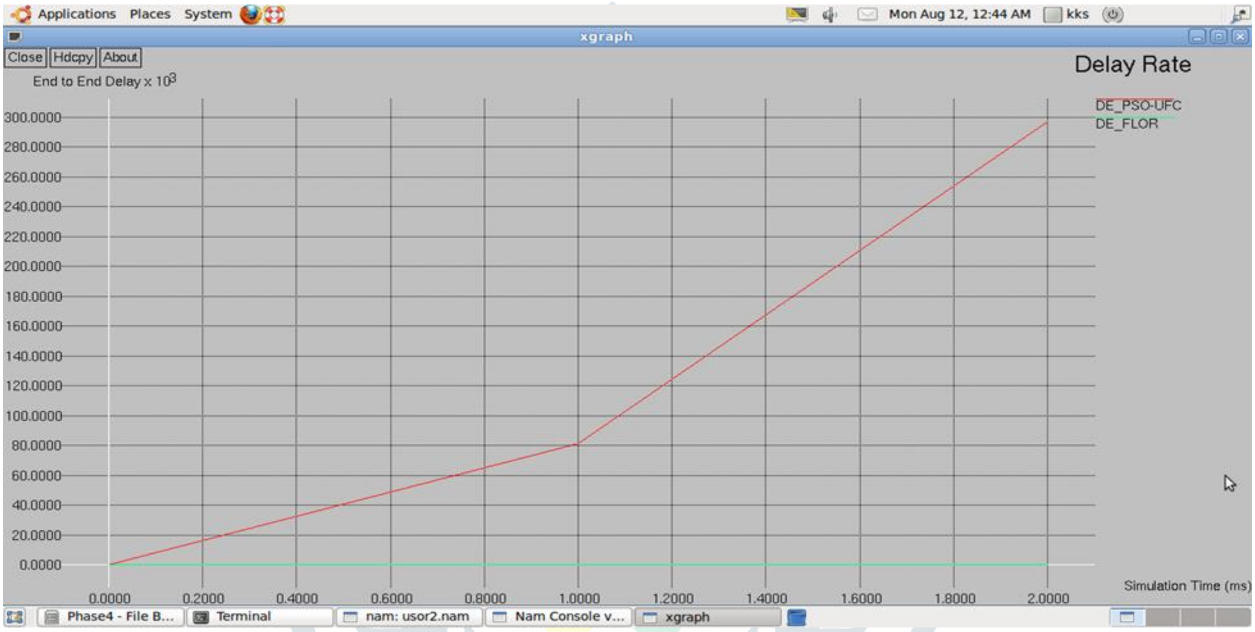

Fig 8.1: End to end delay

8.2 Energy Consumption Ratio

In Figure 8.2, we have compared the energy efficiency ratio between the existing and proposed system.

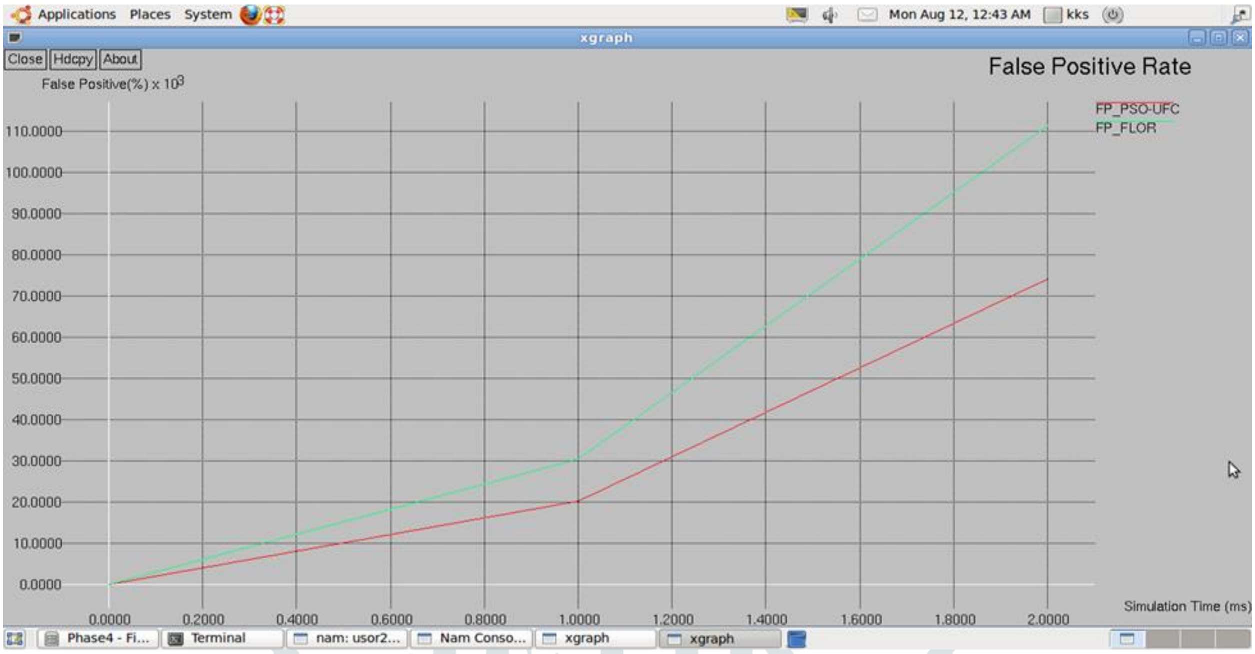

Fig 8.2: Energy efficiency

8.3 Packet Delivery Ratio

In Figure 8.3, packet delivery ratio is compared between the existing and proposed system.

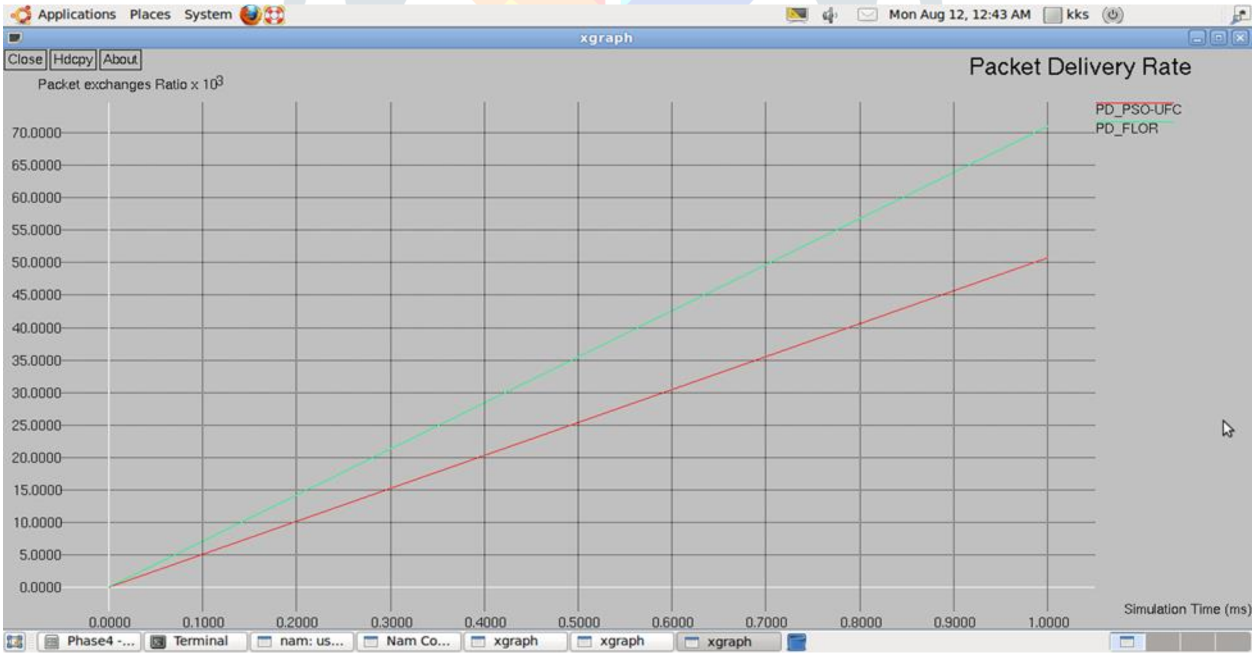

Fig 8.3: Packet delivery

8.4 Average Throughput Ratio

In Figure 8.4, Throughput ratio is compared between the existing and proposed system.

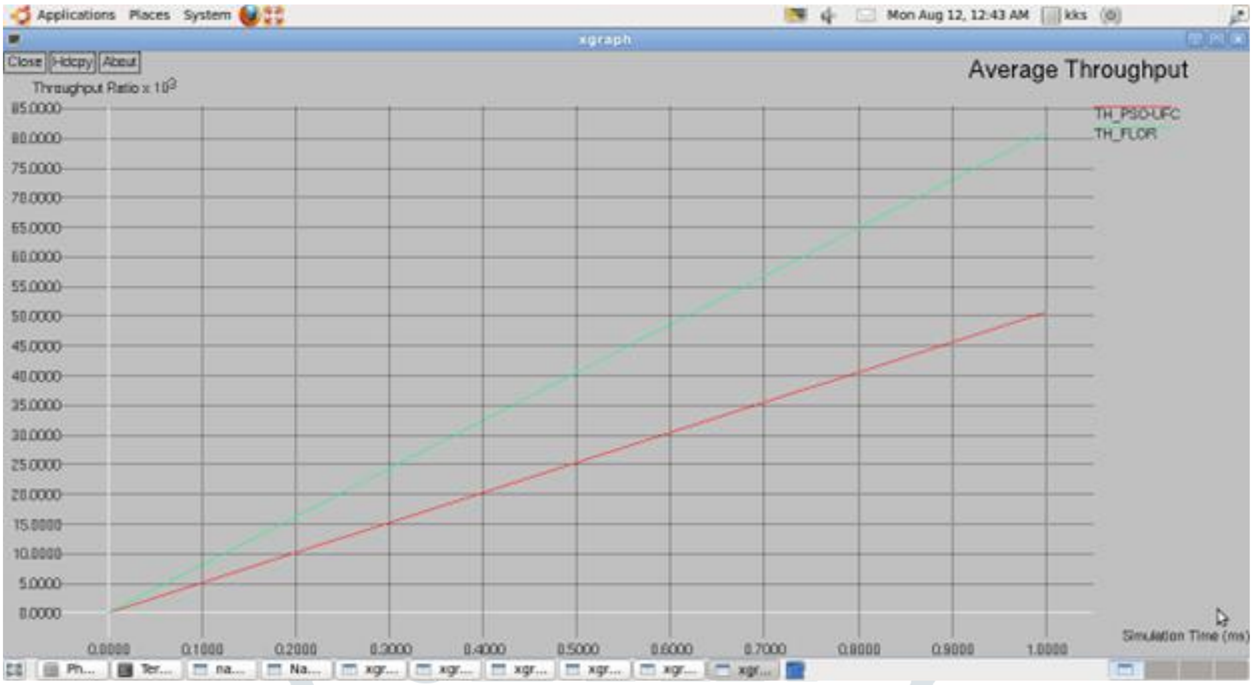

Fig 8.3: Average throughput

8.5 Network Lifetime Ratio

In Figure 8.3, Network lifetime ratio is compared between the existing and proposed system.

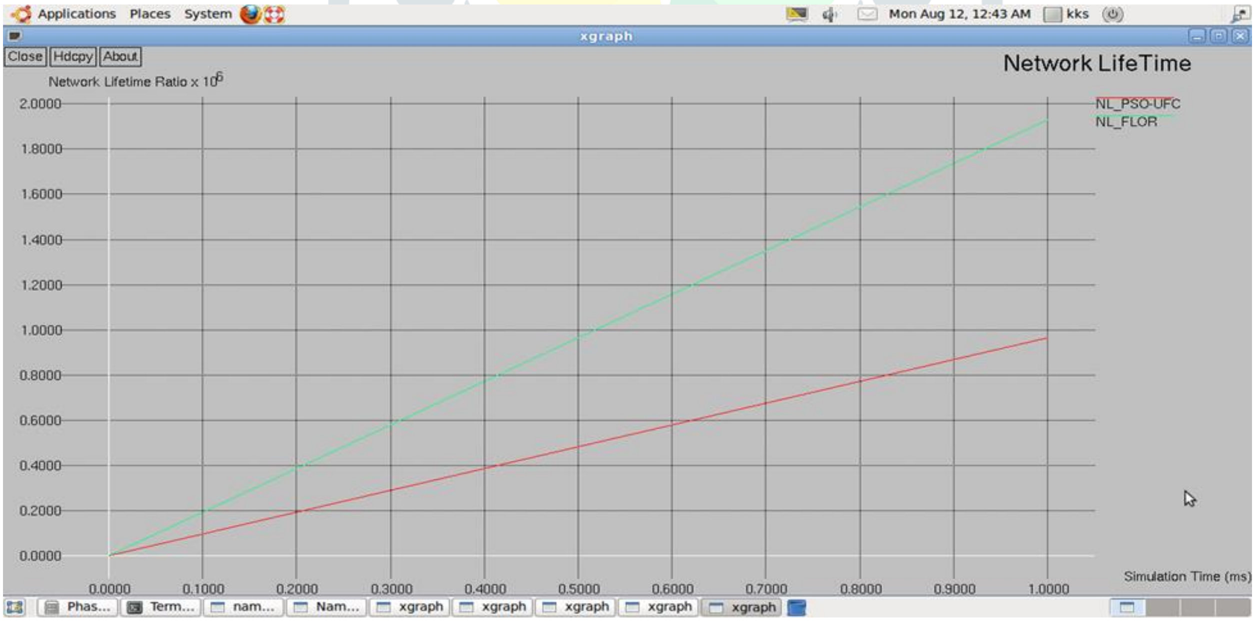

Fig 8.3: Network lifetime

8.6 Attacker Detection Ratio

In Figure 8.3, Attacker detection is compared between the existing and proposed system.

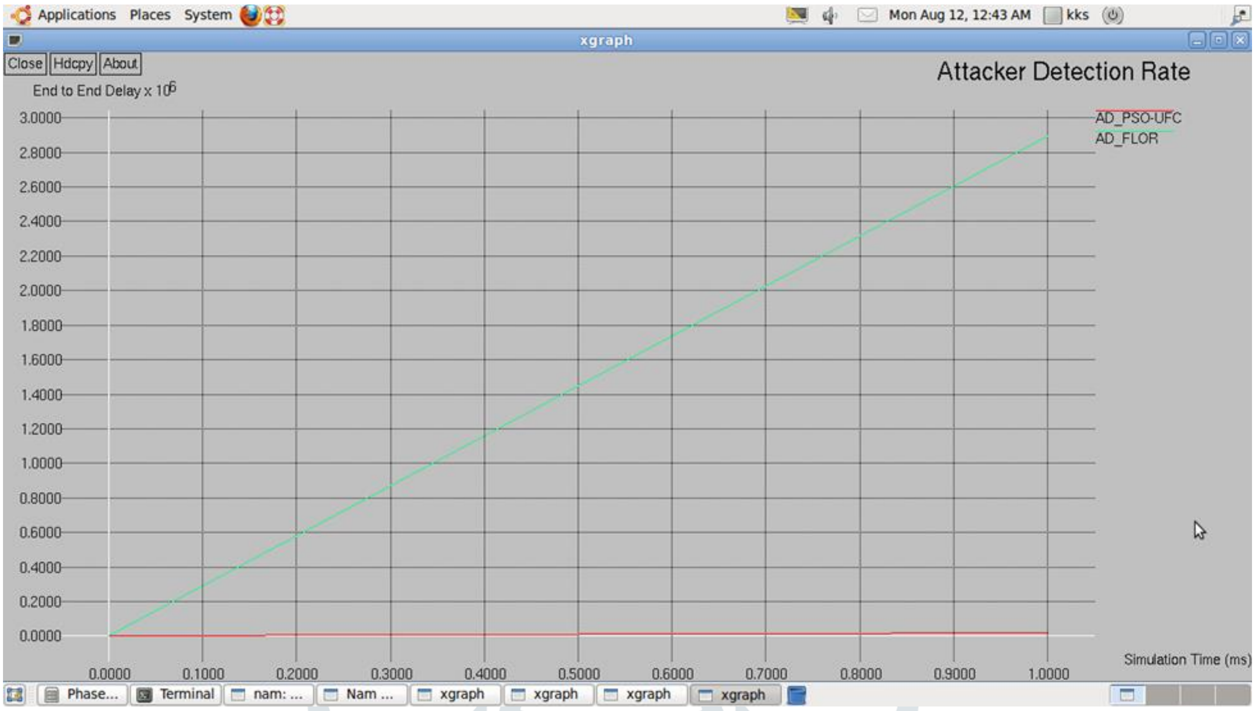

Fig 8.6: Attacker detection

IX.CONCLUSION AND FUTURE WORKS

In this framework used a novel scheme name as Hybrid security-based modified Low-Energy Adaptive Clustering Hierarchy (LEACH) Protocol (HSM-LEACH) provides security, and the energy consumption is reduced. Our work is having the techniques, first, the nodes are optimally gathered with the cluster head selection procedure is done by means of LEACH protocol. Once the CH is elected, the intra and inter-cluster message is recognized. Second the Cuckoo Search Optimization (CSO) based Energy and Delay Aware Routing Algorithm is used to resolve the variable delays, packet losses and ensuring scalability of Networks. The energy effectual and delay alert shortest routes are determined by the CSO System. Finally Dynamic Key Management Scheme for security from various Attacks. This investigation suggests CSO grounded energy-delay aware routing procedure for well-organized routing in WSN for the rescue and crisis application. This method optimally groups the nodes with the cluster head assortment procedure is completed using an Improved LEACH protocol. The energy efficient and delay aware shortest paths are resolute by the CSO Algorithm. Thus, the routing paths are designated with energy efficiency and minimal delay with abridged security intimidations from diverse attacks. This method offers low energy and small delay with improved packet delivery and load circumstances than most prevailing cluster grounded routing organizations. The outcomes accomplish that the suggested routing algorithm offers well-organized routing for rescue operations in relationship to enhanced performance.

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