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"WSN ENERGY OPTIMIZATION WITH ENHANCEMENT OF THROUGHOUT USING CLUSTRING ALGORITHM"

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ABSTRACT

The main concern in Wireless Sensor Networks is how to handle with their limited energy resources. The performance of Wireless Sensor Networks strongly depends on their lifetime. As a result, Dynamic Power Management approaches with the purpose of reduction of energy consumption in sensor nodes, after deployment and designing of the network, have drawn attentions of many research studies. Recently, there have been a strong interest to use intelligent tools especially Neural Networks in energy efficient approaches of Wireless Sensor Networks, due to their simple parallel distributed computation, distributed storage, data robustness, auto-classification of sensor nodes and sensor reading. Dimensionality reduction and prediction of sensor data obtained simply from the outputs of the neural-networks algorithms can lead to lower communication costs and energy conservation. All these characteristics show great analogy and compatibility between wireless sensor networks and neural networks. This paper aims to present the most important possible application of neural networks in reduction of energy consumption according to research studies have been done in the literature so far through a general classification of them.

KEYWORDS Wireless Sensor Networks, Energy Efficiency & Neural Networks

I. INTRODUCTION

With advancements in wireless and related technologies in last two decades, Wireless Sensor Networks (WSNs) become an integral part of our daily life as these networks are being used in wide areas of applications. WSNs consist of Sensor Nodes (SNs) which are equipped with low-power microcontrollers and transceivers to perform various operations in the network field [1]. There is large range of applications such as monitoring of environment, pollution control system, military operations, control of vehicle motion, detection of earthquake, tracking of target and surveillance system, monitoring system for patients [2], where WSNs can play an important role. Routing is one of the critical technologies in WSNs. Opposed to traditional ad hoc networks, routing in WSNs is more challenging as a result of their inherent characteristics [3, 4]. Firstly, resources are greatly constrained in terms of power supply, processing capability and transmission bandwidth. Secondly, it is difficult to design a global addressing scheme as Internet Protocol (IP). Furthermore, IP cannot be applied to WSNs, since address updating in a largescale or dynamic WSN can result in heavy overhead. Thirdly, due to the limited resources, it is hard for routing to cope with unpredictable and frequent topology changes, especially in a mobile environment. Fourthly, data collection by many sensor nodes usually results in a high probability of data redundancy, which must be considered by routing protocols. Fifthly, most applications of WSNs require the only communication scheme of many-to-one, i.e., from multiple sources to one particular sink, rather than multicast or peer to peer. Finally, in time-constrained applications of WSNs, data transmissions should be accomplished within a certain period of time. Thus, bounded latency for data transmissions must be taken into consideration in this kind of applications. Nevertheless, energy conservation is more important than quality of service (QoS) in most applications in that all sensor nodes are constrained with energy which is directly related to network lifetime. Based on network structure, routing protocols in WSNs can be coarsely divided into two categories: flat routing and hierarchical routing. In a flat topology, all nodes perform the same tasks and have the same functionalities in the network. Data transmission is performed hop by hop usually using the form of flooding. The typical flat routings in WSNs include Flooding and Gossiping [5], Sensor Protocols for Information via Negotiation (SPIN) [6], Directed Diffusion (DD) [7], Rumor [8], Greedy Perimeter Stateless Routing (GPSR) [9], Trajectory Based Forwarding (TBF) [10], EnergyAware Routing (EAR) [11], Gradient-Based Routing (GBR) [12], Sequential Assignment Routing (SAR) [13], etc. In small-scale networks flat routing protocols are relatively effective. However, it is relatively undesirable in large-scale networks because resources are limited, but all sensor nodes generate more data processing and bandwidth usage. On the other hand, in a hierarchical topology, nodes perform different tasks in WSNs and typically are organized into lots of clusters according to specific requirements or metrics. Generally, each cluster comprises a leader referred to as cluster head (CH) and other member nodes (MNs) or ordinary nodes (ONs), and the CHs can be organized into further hierarchical levels.

II. RELATED WORK

Energy balancing and network lifetime of WSN have drawn much attention in recent years. Many previous energy efficient mechanisms adopt different means to balance energy consumption among sensor nodes to prolong network lifetime. Energy Aware Routing (EAR) [9] builds multiple paths from data sources to a sink node. Using a stochastic approach, it selects sub-optimal next hops for each node, but it can only gain energy balance locally. There are number of clustering protocols have been proposed in literature e.g. LEACH [14], PEGASIS [10], HEED [15], EEUC [6], and FLOC [7]. The cluster formation overhead of the clustering protocols includes packet transmission cost of the advertisement, node joining and leaving, and scheduling messages from sensor nodes. All these protocols do not support adaptive multi-level clustering, in which the clustering level cannot be changed until the new configuration is not made. Therefore, the existing protocols are not adaptable to the various node distributions or the various sensing area. If the sensing area is changed by dynamic circumstances of the networks, the fixed-level clustering protocols may operate inefficiently in terms of energy consumption. Bandyopadhyay and Coyle [8] proposed the randomized clustering algorithm to organize sensors into clusters in a wireless sensor network. Computation of the optimal probability of becoming a cluster head was presented. Moscibroda and Wattenhofer [9] defined the maximum cluster-lifetime problem, and they proposed distributed, randomized algorithms that approximate the optimal solution to maximize the lifetime of dominating sets on wireless sensor networks. Pemmaraju and Pirwani [2] considered the k-domatic partition problem, and they proposed three deterministic, distributed algorithms for finding large k-domatic partitions.

III. WIRELESS SENSOR NETWORKS STRUCTURE

Wireless Sensor Networks "WSNs" consisting of a large number of small size devices with constrained capabilities named sensors deployed in some area for monitoring and measuring different physical actions, connected by wireless connections for working with each other as a network [8]. The physical actions vary according to the required application, actions like pressure, light, temperature, humidity, and others utilized in applications such as health, environment observation, industry, military, etc. [9]. Thousands to billions of sensors disseminate in a large and far geographic environment or complicated systems that cannot be reached by a human, wherefore sensors must be small, inexpensive, and self-management [10]. Besides, sensors depend on the battery as a power supply which cannot be replaced nor recharged for the same fore mentioned reasons. All these conditions led to limiting in processing, communication, storage, sensing and all other abilities [8]. The main task of the sensor is to sensing or measuring surrounding activities, then transform them into signals to transfer those signals in multi-hop communication to a base station called a sink [10]. One or more of sinks connected to the WSN for collecting sensed data from sensors for more processing, analyzing or sending to the application, end-user or cloud through the internet [11]. The sink or base station has much more capabilities than sensors in term of processing, communication, storage and power [12], figure 1, shows the WSN infrastructure and its connection with an overlay network.

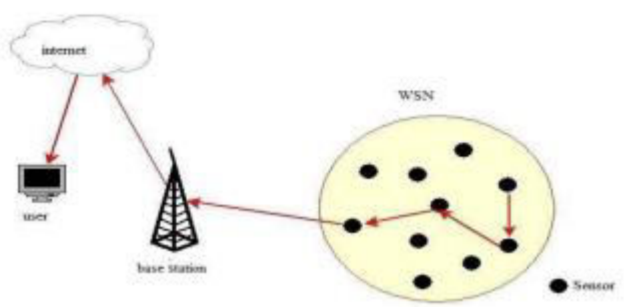

Fig. 1. The Basic Components of WSN

To accomplish that scenario a sensor must at least consist of three main components:

1. Sensing unit: may consist of one or more sensors for acquiring data, sensor type is application dependent [13], and may consist of analogue-to-digital converters (ADC), [10].

2. Processing unit: consist of controller and memory [10].

3. Communication unit or transceiver for sending and receive sensed data between nodes [14].

Routing

Once the clustering is over, the network is ready for communication. The information about the clustering process is broadcasted into the network. The CH in each clusters take care of communication in the network. When a node wants to transfer data to its destination, it sends the packet to the CH, which checks whether the destination is in its cluster. If the destination is found in the cluster, the packet is then transferred to the destination with the help of intracluster routing protocol. This protocol is an ondemand protocol. If the destination is not found in the cluster, then the packet is transferred to the other CH with the help of intercluster routing protocol, which is a tabledriven protocol. The ad-hoc on-demand distance vector protocol and destination sequenced distance vector protocol are modified to implement the proposed routing scheme.

IV. INTELLIGENT ROUTING PROTOCOLS

Designing and developing the routing protocols in WSN is a decisive and serious process for several reasons, including energy constraints in sensor, sensor mobility and multi-hops routing due to the large distance between source and destination. Besides, the absence of centralized communication and using peer-to-peer communication between WSN nodes increases the importance of routing protocol to prevent congestion when all nodes try to communicate with each other to deliver their messages to the destination [9]. Recently, smart routing protocol development has begun taking advantage of artificial intelligent algorithms such as ant colony optimization (ACO), neural networks (NNs), fuzzy logic (FL), genetic algorithm (GA), etc. in finding best path. These algorithms improve network performance by providing adaptability to suit the change of the WSN topology, energy problem and environment complexity and changing through intelligent behavior [2].

V. VARIOUS DESIGN ISSUES OF WIRELESS SENSOR NETWORKS

(a) Hardware Design Range of network devices should be high ranging from 1 to 6 km. Establishing the connection between the networks is difficult and depends upon the node. Battery life should be high and power consumption should be low so that life of the sensor node increased [3].

(b) Operating System for Network It is used to compute, manipulate, and route the data. Various operating systems are used like Tiny OS, Mantis OS, and Nano Q Plus. Operating system must be hardware-independent, application-specific, and easy programmed so that effectively transmit the data to sink from source [4–6].

(c) Deployment Deployment means to set up the sensor node in the practical environment. The deployment may be deterministic and randomly. Deterministic deployment involves proper positioning of sensor node in a predetermined way. Random deployment involves randomly or by dropping it from plane [9]. Congestion is also result due to deployment because so many nodes transmit the data at the same time [7].

(d) Localizationist is the geographical issue to properly deploy the nodes in network so that there islittle effort to trace a source of relevant data that is required. It arises due to improper deployment of the nodes in network. It results in using the localization algorithm to satisfy the various requirements [8]

This paper discusses the applications of bio- inspired computation towards solving the issues and challenges of WSNs. As an example, a novel method of securing WSN against node capture attack is explained in detail. The section highlights a technique of imitating cognitive behavior of vertebrates while defending against attacks. As introduced before in section 2 and section 4, this is achieved by combining game theory with artificial neural networks. Game theory is used for modeling the strategic moves of victim node and attacker node while, ANN is used as pick and play tool by learning the attacker. The proposed methodology can be applied when a malicious intruder is trying for a node capture attack. A node capture attack is defined as an attack where the attacker captures a node and hacks the critical information (eg., cryptographic algorithms) residing in the node. The defense mechanism module is shown in Fig 2. This module is designed to be built in every sensor node, which can combat against such attacks, with minimal help from Base Station. An adversary is assumed to attack any victim node by sending malicious packets to hack the information in the victim node. Intruder node is assumed mobile with its attack packet bit energy varying, such that the intruder's mobility and bit energy of attack packet is highly random in nature. Even, the attacker's strategy is random.

VI. PROPOSED METHODOLOGY

The proposed Intruder Defense System (IDS) has to be installed in a sensor node as an add-on application together with a cryptographic algorithm. The system will be ignited if number of erroneous packets detected by cryptographic scheme crosses beyond a particular threshold. IDS once ignited continuously combats against a malicious intruder until the game between the intruder and the victim reaches a zero sum game i.e., either intruder stops sending poison packets or dies losing its battery power or victim node is infected or dies losing its battery power. The module consists of an ANN, whose inputs are distance, bit energy, attack count and attacker strategy. Distance input of ANN is defined as the distance between the attacker and the victim, which is the information sent by the BS from time to time until the game exists. Bit energy input is the energy per bit of the poison packet reaching the victim node. attack count input is the previous attack counts from that intruder under vigilance, which will be updated from time to time. Apart from these, the neural network chip will be enabled only if the attacker's strategy is in attack mode. The output of the neural network is a decision depending all these inputs fed. It can be either to defend or not defend, depending on which the transmitter module will be enabled, and its transmitting energy per bit of the defense packet will be varied according to the scenario.

Artificial neural networks (**ANNs**), usually simply called **neural networks** (**NNs**) or, more simply yet, **neural nets**,[1] are computing systems inspired by the biological neural networks that constitute animal brains.[2]

An ANN is based on a collection of connected units or nodes called artificial neurons, which loosely model the neurons in a biological brain. Each connection, like the synapses in a biological brain, can transmit a signal to other neurons. An artificial neuron receives signals then processes them and can signal neurons connected to it.

The "signal" at a connection is a real number, and the output of each neuron is computed by some non-linear function of the sum of its inputs. The connections are called *edges*. Neurons and edges typically have a *weight* that adjusts as learning proceeds. The weight increases or decreases the strength of the signal at a connection. Neurons may have a threshold such that a signal is sent only if the aggregate signal crosses that threshold. Typically, neurons are aggregated into layers. Different layers may perform different transformations on their inputs. Signals travel from the first layer (the input layer), to the last layer (the output layer), possibly after traversing the layers multiple times.

Training

Neural networks learn (or are trained) by processing examples, each of which contains a known "input" and "result," forming probability-weighted associations between the two, which are stored within the data structure of the net itself. The training of a neural network from a given example is usually conducted by determining the difference between the processed output of the network (often a prediction) and a target output. This difference is the error. The network then adjusts its weighted associations according to a learning rule and using this error value. Successive adjustments will cause the neural network to produce output which is increasingly similar to the target output. After a sufficient number of these adjustments the training can be terminated based upon certain criteria. This is known as supervised learning.

Such systems "learn" to perform tasks by considering examples, generally without being programmed with task-specific rules. For example, in image recognition, they might learn to identify images that contain cats by analyzing example images that have been manually labeled as "cat" or "no cat" and using the results to identify cats in other images. They do this without any prior knowledge of cats, for example, that they have fur, tails, whiskers, and cat-like faces. Instead, they automatically generate identifying characteristics from the examples that they process.

VII. RESULT AND ANALYSIS

ANALYSIS OF ENERGY

A wireless sensor network (WSN) comprises small sensor nodes with limited energy capabilities. The power constraints of WSNs necessitate efficient energy utilization to extend the overall network lifetime of these networks. We propose a distance-based and low-energy adaptive clustering (DISCPLN) protocol to streamline the green issue of efficient energy utilization in WSNs. We also enhance our proposed protocol into the multi-hop-DISCPLN protocol to increase the lifetime of the network in terms of high throughput with minimum delay time and packet loss. We also propose the mobile-DISCPLN protocol to maintain the stability of the network. The modelling and comparison of these protocols with their corresponding benchmarks exhibit promising results

Table (7.1) higher nodes.

S.N.	Node	Previous Energy	Proposed method energy
1	100	20.35	10.5295
2	200	32.1	20.7838
3	300	55.32	31.0830
4	400	96.37	41.29

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Table (7.1) are shows higher node analysis result and comparison between previous method result with proposed analysis result. Now shows these table 400 nodes require 41.29mj Energy.

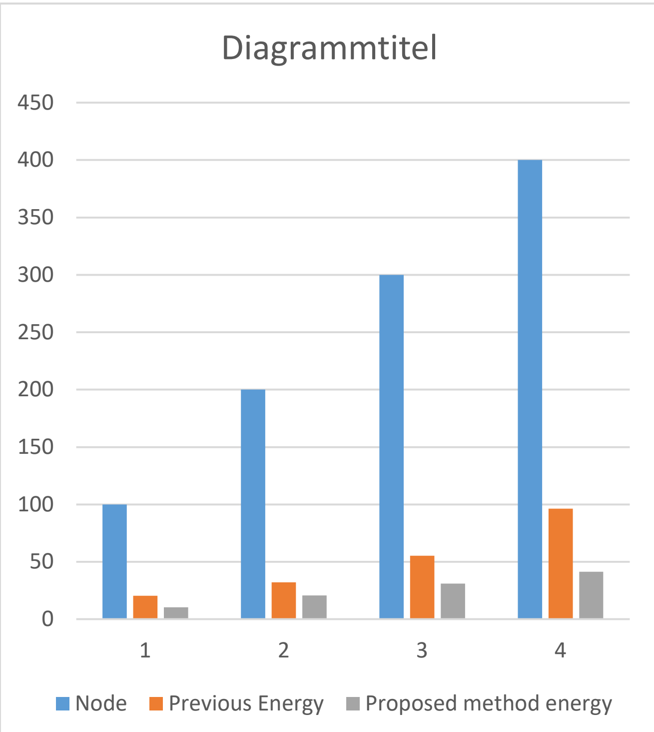

Fig.7.1. ANN based cluster classification energy.

Fig.7.1. are show Bar Graph of comparison table. These Graph are identified node will be increase then energy consumption are also increase.

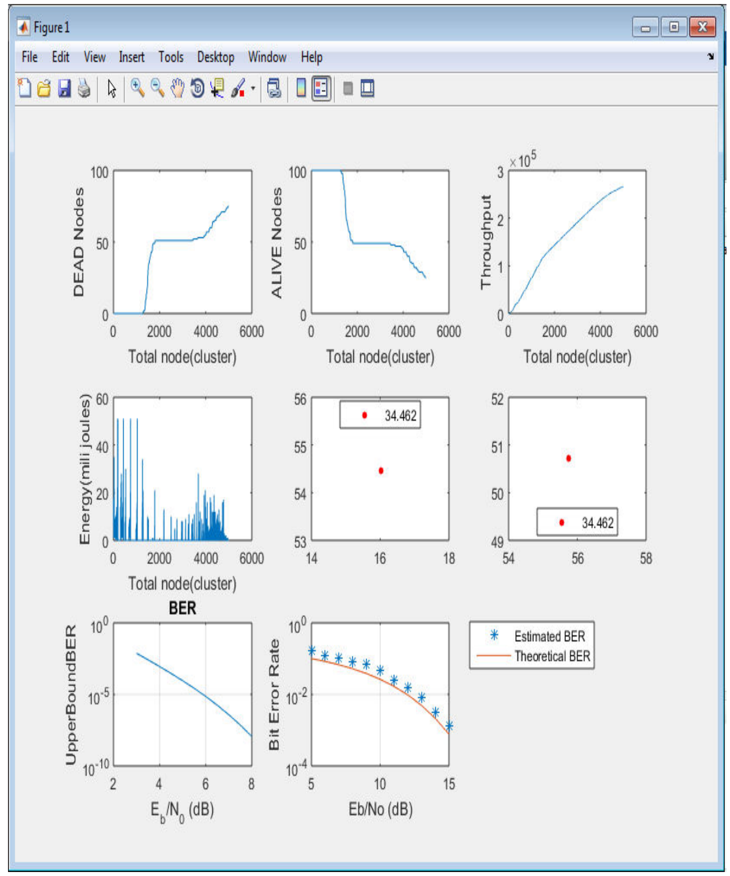

Fig.7.2. All simulation parameters.

Fig.7.2. are shows multiple curve of MATLAB 2015A simulation results. Now all are shows following results-

7.2. (a) These curve X axis are shows Node Cluster and Y axis is Number of Dead nodes.

7.2. (b) These curve X axis are shows Node Cluster and Y axis is Number of Alive nodes.

7.2. (c) These curve X axis are shows Node Cluster and Y axis is Number of throughput.

7.2. (d) These curve X axis are shows Node Cluster and Y axis is Number of Energy mili J.

7.2. (e) X-Y Dead Node position.

7.2. (f) X-Y Alive Node position.

7.2. (g) These curve X axis are shows BER and Y axis is Number of Energy to noise ratio.

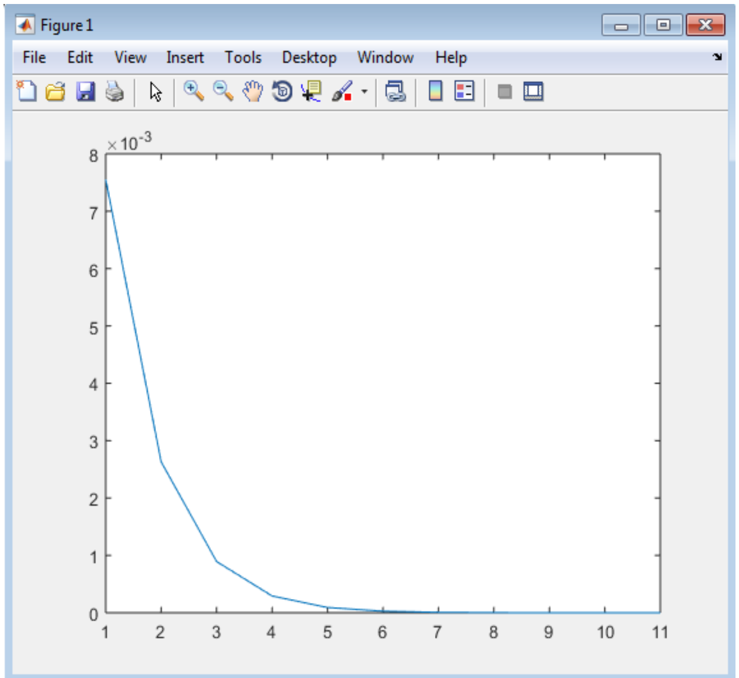

Fig.7.3 BER Reduction curve.

Fig.7.3 Optimize BER reduction curve and Best Fitness result obtained $8x10^{-3}$.

VIII. CONCLUSIONS

The intelligent routing protocol proposed in this paper clearly outperforms the existing routing protocols of WSN. Hence, the intelligent routing protocol is considered as a better routing protocol than other existing protocols in WSN. In this paper, we propose coverage and connectivity aware neural network based routing for WSNs. The problem is formulated as LP with specified constraints. The selection of CH is proposed using neural network with adaptive learning. The neurons are assigned weight according to the residual energy of the nodes in the network. A coverage aware routing metric is also included to choose the best route from the available ones

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