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RESEARCH ARTICLE

TO ENHANCE THE LIFETIME OF WIRELESS SENSOR NETWORK USING A NOVEL APPROACH BASED ON NEURAL NETWORK

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Abstract - Wireless sensor network (WSN) is a network of small light weighted wireless nodes which are highly distributed and deployed in large numbers. Wireless sensor networks provide an economic approach for the deployment of the control devices and distributed monitors and avoid the expensive wired system. When the communication takes place in wireless sensor networks then the energy is consumed. Here main concern is to avoid battery wastage. The cluster head is also choosing according to the minimum battery consumption by applying election algorithm. The BS is also placed within the deployed area of wireless sensor network. In our proposed work, NS-2 is used as a simulator to implement whole scenario.

Keywords - battery consumption, clustering, learning, wireless sensor network, sensing nodes

I. INTRODUCTION

Wireless Sensor network is a type of heterogeneous network that composed of large number of small low cost devices. These devices are known as nodes or motes. These nodes are referred information to base station. Wireless sensor network is a deployment of massive numbers of small, inexpensive, self powered nodes. These nodes have

the ability to sense, compute, and communicate with other devices. The nodes are used to gather the information in any physical environment. Sensor networks are massive numbers of small, inexpensive, self-powered devices pervasive throughout electrical and mechanical systems and ubiquitous throughout the environment that monitor sense and control most aspects of our physical world. A sensor node is able to observe condition values of a certain area like temperature, sound, vibration, pressure, motion or pollutants. [1] WSN is a self healing and self organizing. Self-healing networks allow nodes to reconfigure their link associations and find other pathways around powered-down nodes or failed nodes. Self organizing allows a network automatically [2] join new node without the need for manual interference. The wireless sensor network is a computer network that is composed of large number of nodes. These nodes are capable of sensing environment around them. These nodes are capable of gathering, storing, sensing and transmitting information. Sensor nodes can be deployed anywhere without install it.

Wireless sensor network is used to describe an emerging class of embedded communication products. It provides fault-tolerant wireless connections between various devices. [3] A wireless sensor network consists of a large number of nodes spread over a particular area. A sensor node generally consists of memory, a processor, sensors, actuators and they do have communication ability. Through a wireless medium, the sensor nodes are allowed to communicate with each others. The wireless medium may either of radio frequencies, infrared have no wired connection [4]. These nodes are deployed in a randomly and to make an ad-hoc network communicate among themselves. If the node is not able to communicate with other through direct link, i.e. they are out of coverage area of each other; the data can be sending to the other node by using the nodes in between them. This property is referred as multi-hopping. All sensor nodes work cooperatively to serve the requests. Generally WSNs are decentralized systems and peer-to-peer communication is takes place between two nodes.

A. Neural Networks

Artificial neural network is composed of interconnecting of artificial neurons. Artificial neural networks may either be used to gain understanding of biological neuron or to solve artificially intelligence problems without creating any model [5]. Biological neural networks are made up of real biological neurons that are connected or functionally related in nervous system. Neural network has been motivated from human brain. The brain is highly complex, parallel computer and nonlinear. It has capability to organize its constituent's structure known as neurons to perform complex computations. It is faster than digital computer exit in today's world [6]. It is an adaptive in nature that changes its structure based on internal and external information that flows through the networks. In many field it gives the same output as previous some [7]. It resembles with brain in two respects:

- 1) By the network knowledge is acquired from environment.
- 2) Synaptic weights are used to store the acquired knowledge.

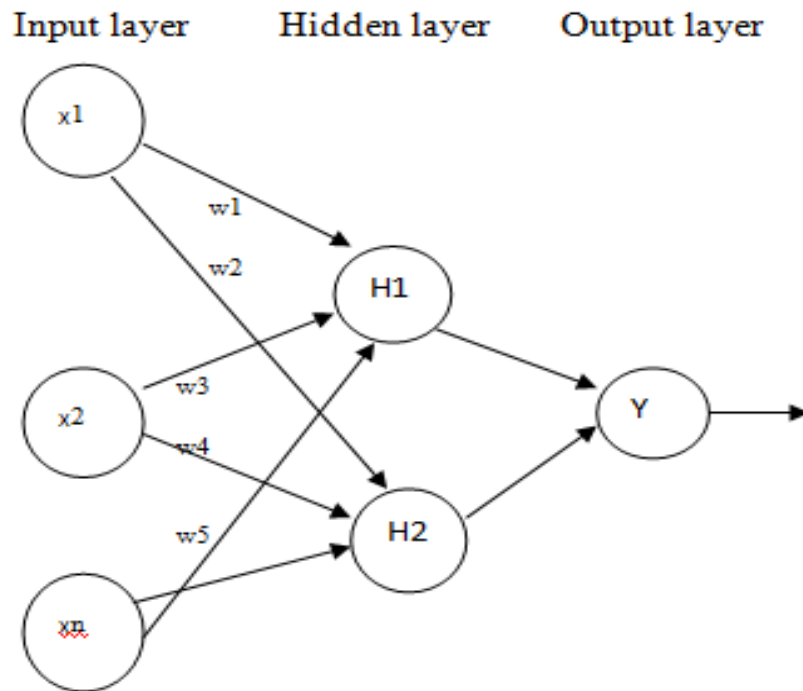


Fig 1: Diagram of feed forward neural network

II. DYNAMIC CLUSTERING

Dynamic clustering is an energy efficient algorithm. Energy dissipation of the network can be reduced by using clustering algorithms. The energy consumption of wireless nodes is depends upon the transmission distance, optimal routing protocols and amount of data to be transmitted. In cluster based wireless sensor networks, cluster heads (CH) meets these requirements 1) same adjacent sensors are grouped into a cluster. 2) High energy resources 3) Network should be distributed. Low Energy Adaptive Clustering Hierarchy (LEACH) gives a simple distributed clustering scheme for evenly distributing energy dissipation. Probability function is used to rotate the position of the CHs. Optimal energy dissipation is not considered by LEACH at each round. CHs are never distributed in LEACH .the main aim of dynamic clustering technique is to assign data set patterns to the cluster.

Main steps of dynamic clustering algorithms are:

- 1) Assigned a cluster number to all the nodes between all the clusters.
- 2) Find the cluster center of each cluster.
- 3) For each node, find the closest to the node is called cluster centre. Assign the node to the cluster whose center is closest to it.
- 4) Re-compute the cluster centers with the new assignment of nodes.
- 5) Repeat Steps 3 and 4 till clusters do not change or for a fixed number of times.[8]

For the objective of scalability of clustering is widely adopted by researchers and to achieve energy efficiency and prolong lifetime. Data gathering protocols and hierarchal imply cluster based algorithm of sensor node so that

aggregation and data fusion is possible. Cluster header is a cluster leader and performs special tasks fusion and aggregation and common sensor nodes as member [9].

III. LITERATURE REVIEW

Chaurasiya, et.al,(2011), proposed a new routing technique. As Wireless Sensor Networks consists of a large number of sensor nodes. These sensor nodes are connected through wireless medium. In the WSN the energy efficiency is the basic need. In this case, author propose an energy-efficient routing scheme called Enhanced Energy-Efficient Protocol with Static Clustering (E3PSC) which is basically a modification of an existing routing scheme, Energy-Efficient Protocol with Static Clustering (EEPSC). [10] The qualitative and quantitative analysis is performed to establish the claim of energy efficiency of the proposed scheme. As, Enhanced Energy-Efficient Routing Protocol in wireless sensor network is a demanding task. This demand has led to many routing protocols. Most of these protocols find the minimum energy path or the shortest path routing. Always using these paths will soon make those nodes to lose their lifetime. Based on our experimental results, it has been found that E3PSC outperforms EEPSC in terms of network lifetime and energy consumption.

Mario Collotta et.al, (2011): in this paper author discuss about the use of WSN in industry. As now days, network plays an important role in WSN. It used to control the sleep and the wake times of the nodes. it helps to make data transmissions in an energy efficient way. The main aim of the wireless industrial network is to meet the requirements of industrial applications. The industrial communications of the network guarantee high reliability, low power consumption. There are huge factories, which may include the large number of nodes and high node density. The main role of industrial WSN is to creating a highly reliable and self healing industrial system. [11] This system helps to responds in real time events with appropriate actions. The nodes activities have to last for a long period of autonomy, in order to prolong the lifetime of the nodes and the lifespan of the network. in this paper, a new energy management approach is purposed. It is able to increase significantly the overall network lifetime through a sleep/wakeup policy based on fuzzy logic algorithm. Our goal is to create a time driven approach that awakens the nodes only when they are really meant to convey. The aim of this paper is to show how, using a fuzzy logic controller, implemented in an industrial WSN, it is possible increasing the life cycle of the batteries of the individual wireless nodes and by exerting continuous control on energy consumption of individual nodes.

Chen-Yi Chang,et.al,(2012):discuss about the power consumption optimization for WSN. Author discuss that the minimization of power consumption is a design goal for wireless relay networks. The wireless communication is optimized to minimize the total transmission power. A wireless relay sensor network is an aggregation of sensor nodes. it has the ability to transmit and receive wirelessly. In this network, the battery powered sensors are used. [12] For this purpose, nodes communicate with each other shall be carefully designed. Communication between nodes requires three actions: transmission, detection, and reception. To reduce the energy consumption in reception mode, a popular approach is to switch the sensor node into sleep mode in which a node shuts off its radio transceiver

to disengage itself from the network for a period of time. Compared with the power consumption in transmission mode or reception mode, the power consumption in sleep mode is often negligible. In this paper, we investigate the optimization of power consumption minimization for information exchange. We further include the detection power and the reception power in order to minimize the overall network power consumption for information exchange in wireless-relay sensor networks (WSNs).

Mehrdad Ahadi and Amir Masoud Bidgoli, (2012): In this paper, the author discusses that communication in the WSN. The data received by the nodes of wireless sensor networks should be sent to the sink. It helps in performing calculations and making the right decisions. The density of data packets increases near the sink. This scenario is known as the Energy Hole. In the WSN, the problem of energy hole should be reduced. It is one of the key factors for designing large-scale wireless sensor networks.[13] The multiple sink model is used to reduce the problem of energy hole. It is done by increasing the number of nodes in the vicinity of the sink. This model consists of different levels of sink intensity. The sensor nodes are responsible for processing their surroundings. It sends the collected data to a specific node called sink. Energy maintenance plays a significant role in the consistency of these networks.

IV. PROPOSED WORK

Dynamic clustering provides more scalability and data aggregation and fusion. To eliminate redundant data transmissions, it provides a rich and multi-dimensional view of the targets. It helps to save energy by lowering down consumption. It is more robust in nature and avoids collision and also maximizes the lifetime of a network. A request from the sink may include one of these four dissemination nodes in its path to the sink. The multiple sink could be present at any place in the sensor field and thus a request can be generated from anywhere in the sensor network. Clustering of nodes shows that the network is more stable and efficient. Clustering of nodes is based upon least distance and higher energy by knowing location. Clustering reduces network traffic and increases performance. Through other cluster heads (CH) forward data to sensor nodes.

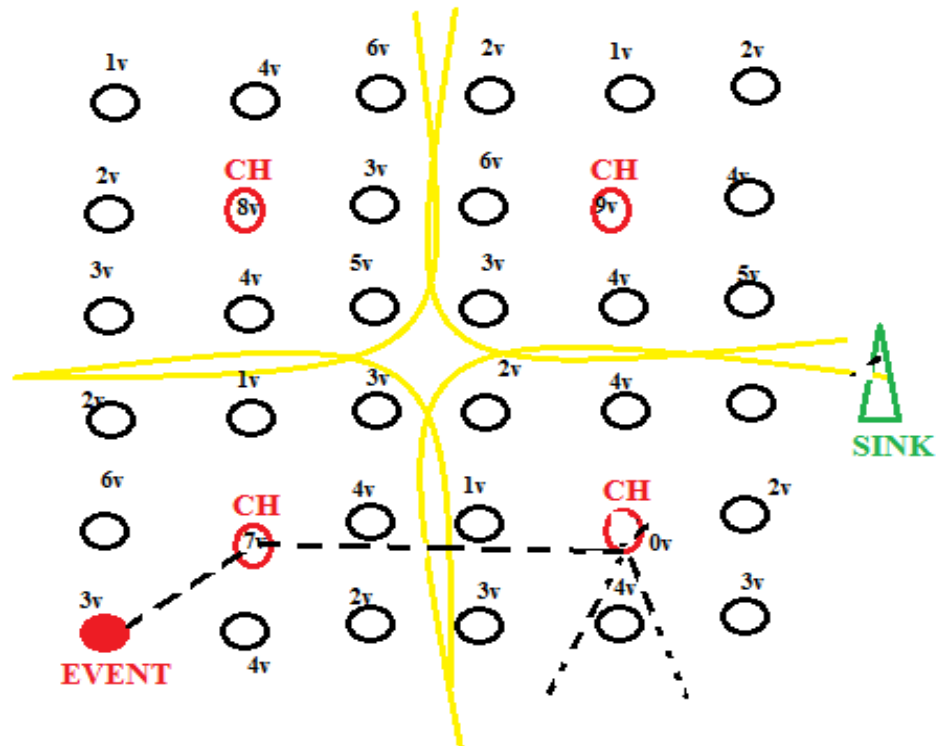


Fig 2: Packet loss

In previous scenario due to cluster head died problem the path gets broken in between communication and packet loss occur. The Learning is a process by which free parameters of a neural network are adapted through a process of stimulation by the environment through which it is embedded. A Neural network performs linear tasks. During the failure of any element, it continues works without any problem in its parallel nature. A neural network learns, it does not need to reprogram. It can be implemented in any application. It can be implemented without any problem. Neural networks, has an ability to derive meaning from complicated or imprecise data can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. Adaptive learning is an ability to learn how to do tasks based on the data given for training or initial experience. Self-Organization can create its own organization or representation of the information it receives during learning time in artificial neural network. Neural network has capabilities it may be retained even with major network damage. There are number of nodes present in a network. These nodes participate to communicate with one another nodes. When all the nodes are combined then cluster are formed. So clustering is a combination of nodes. There is a controller of these nodes is also present. This controller is known as cluster head. In each cluster one cluster head is present. All the nodes in a cluster communicate with their cluster head. Then cluster head of a cluster further communicate with other cluster head to send data packets from source to destination. Cluster head control all the activities done by the nodes in a cluster. A source sends information that is called source point and wants to send data to the sink which is base station or destination. The communication between sink to source is possible with the help of cluster head only.

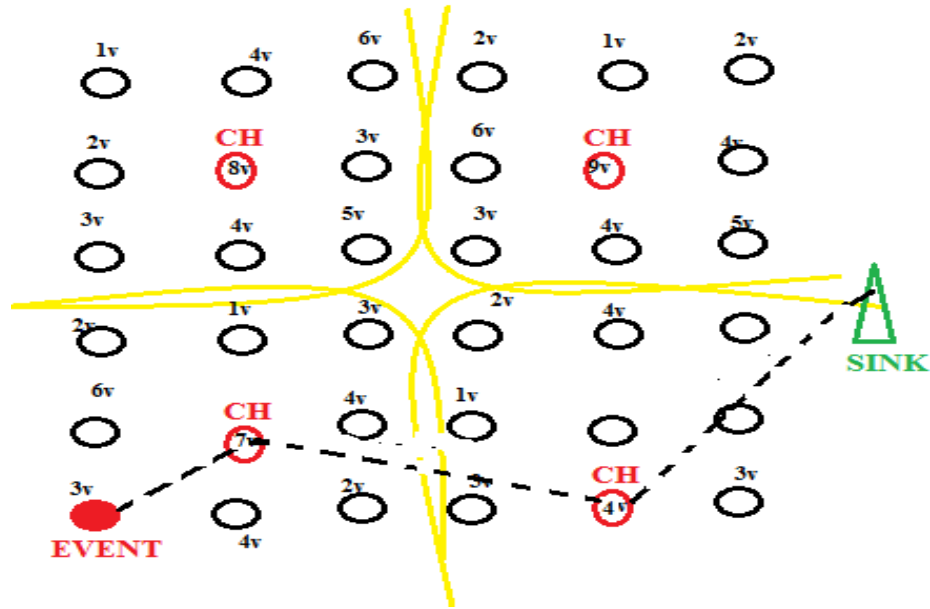


Fig 3: CH selection

To avoid this problem, here we are using dynamic cluster head selection using adaptive learning, it will automatically change the cluster head when its battery power gets lower than other nodes present in same cluster. To choose the cluster head between numbers of nodes in a cluster is also an important task. The node in a cluster which consumes lowest battery power as compare to other nodes is select as cluster head. The cluster head is select according to the AODV algorithm. All the cluster head which participate in a selection of final path of route consume minimum battery power means have minimum energy consumption. If we select the cluster head which consume maximum battery then that cluster head will die very soon so all the system is effected with it and will dead soon. So the selection of cluster head is very important. The cluster head which will dead soon degrades the performance of the system. With the failure of cluster head all the setup rearrange again. As all the setup arrange again then it become costly and time consuming also. So it is necessary that selection of cluster is important. Here we will use learning algorithms to select the cluster head to enhance the life time of WSN.

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