

ENERGY EFFICIENT CLUSTERING IN WIRELESS SENSOR NETWORK USING ANFIS

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Abstract:

Wireless Sensor Networks [WSN] is defined as a group of distributed sensors which performs task like monitoring and sensing the physical environmental conditions and also aggregate the collected data at a central location called Base Station [BS]. WSNs consist of sensors [or nodes] – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each sensor is able to sense and send the sensed data to base station. The ability of sensing and transmitting data to BS requires high energy. Hence, the main challenge of WSN is to achieve communications with low energy consumptions. Therefore, it requires a primary goal of energy efficient clustering protocol and cluster head selection using Adaptive Neuro-Fuzzy Inference System [ANFIS]. This model will help in knowing the current scenario of every wireless sensor network.

Keywords: Wireless Sensor Network, Energy Efficiency, Cluster Head, ANFIS

INTRODUCTION

WIRELESS SENSOR NETWORK :-

A wireless sensor network is a self-composing network of small sensor nodes which communicate among themselves and are deployed in such a way to sense, monitor and understand the physical environment. It is a network of highly distributed networks of small as well as light weighted wireless sensor nodes, which are deployed in large number and they monitor the world or any system by measuring the physical parameters. WSNs are used for measuring the environment conditions like temperature, pollution, sound, humidity, wind, etc. There is a wide range of applications like Area Monitoring, Health Care Monitoring, Environment Sensing, Industrial Monitoring etc in which no human intervention is required.

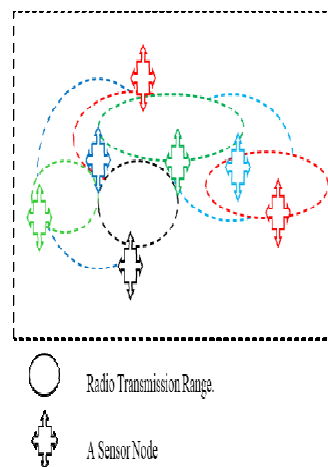


Figure. A Wireless Sensor Network

As shown in the Figure, the network between the sensor devices is established through the radio

component of the sensors. A wireless sensor network can consist of hundreds of sensor nodes. During the communication process, the sensor nodes exchange information and discover the neighbouring nodes easily.

ENERGY EFFICIENCY :-

Energy is required in every mini or major operation of any type of application. Sensors are equipped with batteries, but these batteries do have a limited life time, e.g. in underwater scenario, there are no plug-in sockets to provide the power as per the requirement. The battery technology is still lagging behind the microprocessor technology. Energy-Efficient networking protocols are required now days.

ENERGY EFFICIENT CLUSTERING :-

The term **Cluster** is defined as grouping of similar objects [or nodes] in order to perform a specific task. A network can have one or more clusters at a time. Clustering is defined as one of the most important way to prolong the network lifetime in wireless sensor networks. Energy Efficient Clustering involves grouping of sensor nodes into clusters in order to save more energy for further more clustering.

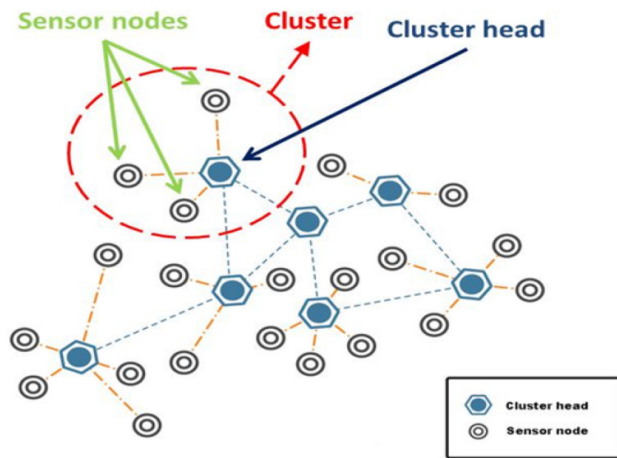


Figure. Clustering of Sensor Nodes

CLUSTER HEAD :-

Election of cluster head [CH] is very important. CHs collect the data from their respective cluster's node and send the aggregated data to base station. Cluster Head is responsible for long range communication, data gathering, data aggregation and transmitting to the BS. In order to avoid the energy depletion of CH, it is better to rotate the role of CH among all nodes in the network.

ANFIS :-

ANFIS stands for **adaptive neuro-fuzzy inference system** or **adaptive network-based fuzzy inference system**. It is defined as a type of artificial neural network that is based on Takagi-Sugeno fuzzy inference system. ANFIS integrates the principles of both neural network and fuzzy logic using the tool **MATLAB**. It has the potential to seize the advantage of both in a single framework. Its inference system assimilate to a set of fuzzy IF-THEN rules that have learning capabilities which help in approximating the non linear functions. Hence, ANFIS is a fuzzy inference system implemented in the framework of adaptive networks.

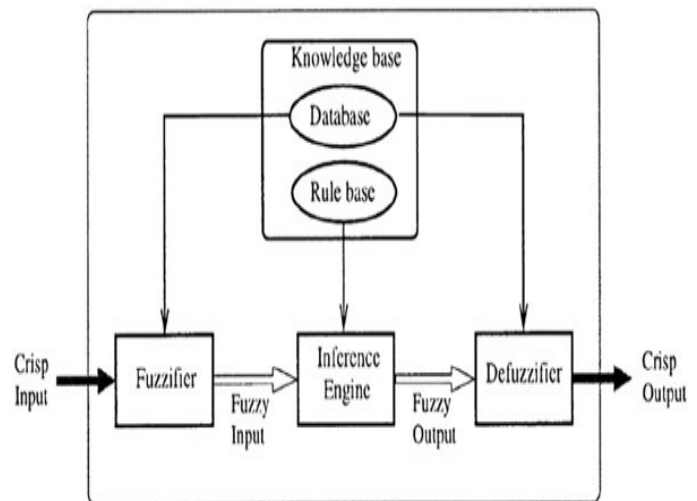


Figure. Fuzzy Inference System

PROBLEM DOMAIN

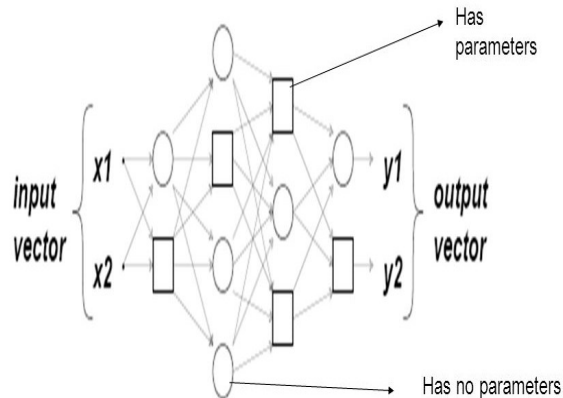


Figure. An Adaptive Network

MATLAB :-

A **matrix laboratory** [MATLAB] is a multi-paradigm numerical computing environment. It is a proprietary programming language developed by MathWorks. MATLAB helps in matrix manipulation, plotting of data and functions, implementation of algorithms, creating user interfaces and interacting with programs written in other languages like C, C++, C#, Java, Fortran and Python.

OBJECTIVE

The objective of this paper is to provide a sight of vision towards the condition of energy efficient clustering algorithm in wireless sensor network. The nodes are provided with the limited power supply, their energy must be used in optimal and effective way to complete the mission time efficiently.

This paper will provide a better way, with respect to CH selection and distance between cluster head to BS, in order to the achieve the goal. Hence, the main goal is energy optimization and to prolong the network lifetime.

According to the research analysis of energy efficient clustering in WSN, sensor nodes have limited energy on their on-board battery. Due to harsh working area, it is imposible to recharge and replace battery of nodes. Lifetime of wireless sensor network depends on these sensor nodes and their energy level. The analysis ststes that the energy of sensor nodes should be consumed very efficiently and economically.

METHODOLOGY

There are two types of wireless sensor network, that are – Homogeneous WSN and Heterogeneous WSN.

In Homogeneous WSN, each node has same energy level. Algorithms like Low-Energy Adaptive Clustering Hierarchy [LEACH], Hybrid Energy Efficient Distribution clustering [HEED], and Power efficient Gathering in Sensor Information System [PEGASIS] are the examples of cluster_based protocols which are performed in homogeneous WSN protocol. In these algorithms, nodes with less energy or limited power supply will die soon as compared to nodes with high energy, because it is imposible to treat every node with respect to energy.

In Heterogeneous WSN, each node is deployed with different initial energy. Algorithms like Stable Election Protocol [SEP], Distributed Energy Efficient Clustering [DEEC], Developed DEEC [DDEEC], Enhanced DEEC [EDEEC] and as well as Enhanced Developed DEEC [EDDEEC] are the examples of heterogeneous WSN protocol. These algorithms works on the parameters for CH selection based on initial and residual energy level of the nodes.

Even some of the protocols like Energy Efficient Distance Based Cluster Head Algorithm [DBCH] and Energy Efficient Clustering Algorithm for Decreasing Energy Consumption and Delay [DECD] works on the parameters that are – distance

between cluster head and base station, energy consumption and consumption delay.

The main agenda of the ANFIS is to determine the optimal values of the equivalent FIS [fuzzy inference system] parameters by applying a learning algorithm. During the training session, the parameters are optimised in such a way that the error between target and the actual output is minimised. If the difference between the ANFIS output and desired output is less then the ANFIS system is more accurate.

Here, In this paper, the parameters are defined as CH selection and distance between CH and BS, these should be trained to obtain an accurate system.

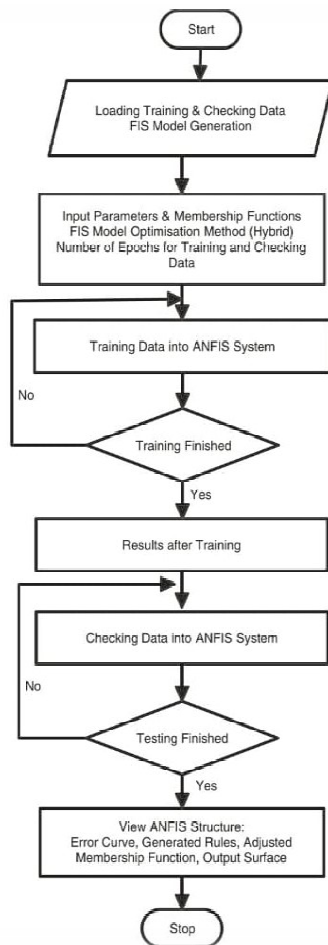


Figure. ANFIS Training System

CONCLUSION

This research paper contributes to the analysis of energy efficient clustering in wireless sensor network using adaptive neuro-fuzzy inference system, to benefit the all other people worldwide. The analysis is done on the basis of the past and current scenarios with respect to energy optimization, selection of cluster head and distance between cluster head and base station. Hence, this paper will help others to get an idea to elongate the network lifetime using ANFIS

FUTURE SCOPE

Now a days, WSN is finding wide applicability and increasing deployment as it enables reliable monitoring and analysis of Environment. The ability of network structure to prolong network lifetime, is one of the premier research topic due to limitation of resources such as energy, processing and memory in sensor network architecture itself.

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