A Novel Attention Control Modeling Method for Sensor Selection Based on Fuzzy Neural Network Learning

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Abstract---A sensor network is defined with large number of energy nodes. As of the adhoc network, the nodes are distributed over the network randomly. Because of this, unequal distribution of nodes over the network is occurred. This unequal distribution also raises many communication problems over the network. To resolve this problem, it is required to monitor the critical nodes or area over the network so that effective timely decision can be taken. The identification of these critical nodes over the network is called attention control. In this present work, an intelligent parametric approach is defined to identify the critical nodes over the network so that effective node monitoring will be done. The presented work will be divided in two three main stages. In first stage, the identification of attention nodes will be done. The identification will be done based on multiple vectors such as energy, connectivity, load etc. To perform this identification, a at first fuzzy rules will be derived to obtain the parametric values in nominal form and later on the classification algorithm such as probabilistic neural network will be applied to identify the attention nodes. Once the attention nodes will be identified, the next work is about to identify the agent nodes that will monitor these critical nodes over the network. Here, an intelligent approach will be applied so that minimum nodes will be taken to monitor all the critical nodes. Once the agent nodes will be defined, the next work is to identify the alternate nodes to the attention nodes that can replace the nodes so that effective results will be drawn from the network. The work is about to improve the network again such problems and to improve the network life and communication. The presented work will be implemented in matlab environment.

Index Terms—Sensor Network, Nodes , Clustering, Leach protocol, Data Aggregration

INTRODUCTION

Wireless Sensor network is most adaptive communication network that is used in many applications and organizations. These networks are defined by using the tiny sensor nodes where each node is defined under energy definition. The sensor network is connected with outer network by the help of base station. The base station is defined at specific distance location. All the network nodes transfer the collected information to base station and base station broadcast this information over the web. These networks are defined under some architecture so that effective will be drawn over the network. The parameters in sensor network are defined under memory, time, power and bandwidth parameters. The objective of the communication architecture is to achieve the effective communication and to improve the performance of the network. These networks are defined so that effective data gathering over the network will be performed. Senor network is defined with 3 main components.

- Node itself that sense the environment or the resource
- Another component is process component to perform the communication
- Communication components are responsible for the information exchange.

Clustering is a process in which the network is divided in smaller segments called clusters and each segment is

controlled by a controller node called cluster head.These protocols include the Leach, Pegasis and ESPDA protocols.

LEACH protocol is defined as the basic clustered protocol that follow the cluster structure formation and the clustered communication over the network .The basic features of this protocol are listed here under

- Self configured clustered formation with randomized and adaptive network formation
- Effective location oriented data communication
- Energy effective communication
- Data aggregation is application specification communication.

Data Aggregation is the another communication architecture applied in sensor network to gather the information from different nodes and pass to next node or to the base station.

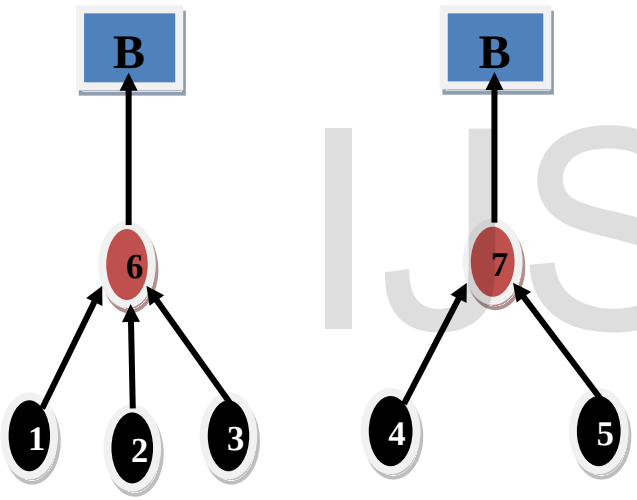

Figure 1.8 Data aggregation model and Non data aggregation Model

II. **Literature Survey**

A wireless sensor network is composed by hundreds or thousands of small compact devices, called sensor nodes, equipped with sensors (e.g. acoustic, seismic or image), that are densely deployed in a large geographical area. These sensors measure ambient conditions in the environment surrounding them and then transform these data into electric signals which can be processed to reveal some characteristics about phenomena located in the area around these sensors. Therefore, we can get the information about the area which is far away. The applications may be environment control such as office building, robot control and guidance in automatic manufacturing environments, interactive toys, high security smart homes, and identification and personalization.

Wireless sensor networks (WSNs) are the products which integrate sensor techniques, embedded techniques, and distributed information processing and communication techniques. The appearance of the wireless sensor network is a revolution in information sensing and detection. Although there have been significant improvements in processor design and computing, advances in battery technology still lag behind, making energy resource considerations the fundamental challenge in wireless sensor networks. Consequently, there have been active research efforts on performance limits of wireless sensor networks. These performance limits include, among others, network capacity and network lifetime. Network capacity typically refers to the maximum amount of bit volume that can be successfully delivered to the base station (“sink node”) by all the nodes in the network, while network lifetime refers to the maximum time limit that nodes in the network remain alive until one or more nodes drain up their energy (LP) problem within which the objective function is defined as the sum of rates over all the nodes in the network and the constraints are: 1) flow balance is preserved at each node, and 2) the energy constraint at each node is met for the given network lifetime requirement.

R. M. Sharma, use the performance of the two common MANET protocols, namely AODV and DSR has been shown .The Average end-to-end delay and the Packet Delivery Ratio have been considered as the two performance parameters .Finally, a new protocol has been introduced, known as AntHocNet, which is the implementation of AntNet protocol for MANET. AntNet is a distributed shortest-path algorithm based on the principles of Ant Colony Optimization that takes care of load

balancing in a very natural way. The comparison of AntHocNet against AODV and DSR, taking into consideration the above performance parameters was then done.

W. Heinzelman, use an improved algorithm, LEACH-C protocol was described. LEACH-C is a centralized version of LEACH where only the advertisement phase differs. In LEACH-C, a centralized algorithm at the base station makes cluster formation. At this phase, each node sends information about its current location and residual energy level to the sink.

W. Heinzelman et.al, use a hierarchical clustering algorithm for sensor networks, called Low Energy Adaptive Clustering Hierarchy (LEACH) was introduced. LEACH is a cluster-based protocol, which includes distributed cluster formation. LEACH randomly selects a few sensor nodes as cluster heads (CHs) and rotates this role to evenly distribute the energy load among the sensors in the network. Although LEACH is able to increase the network lifetime, there are still a number of issues about the assumptions used in this protocol. Main problem with LEACH protocol lies in the random selection of cluster heads. There exists a probability that the cluster heads formed are unbalanced and may remain in one part of the network making some part of the network unreachable. Also, the protocol assumes a homogeneous network i.e., all nodes begin with the same amount of energy capacity in each election round.

III. Proposed Work

A. Problem Definition

A sensor network is defined with large number of energy nodes. In this present work, an intelligent parametric approach is defined to identify the critical nodes over the network so that effective node monitoring will be done.

B. Objectives

The objectives associated with presented work are defined here

- To define intelligent attention node identification and monitoring in sensor network.
- To define an effective fuzzy improved probabilistic neural approach to identify attention nodes.
- To identify the agent nodes so that effective monitoring will be done.
- The objective of the work is to perform network reconstruction by performing the critical node substitution.
- The objective of the work is to improve the network life and communication over the network.

C. Research Methodology

The present work is about to provide the solution to the Attention Node Analysis problem.. The presented work is divided in two mai

n phases. In first phase, we have defined eligibility criteria for the node to be the member of coverset. A node can be the member of coverset and will cover the Attention node if it satisfy the following criteria

(i) Sensing Range : The sensing range is defined in terms of the actual communication distance for that the communication is possible with extra energy loss.

(ii) Energy Vector**:** The second parameter for deciding the coverset eligibility for a node is the energy of the node.

(iii) Load **:** In the communication, But as the communication over that node is increased or the load over that node is increased it require more energy for the communication. If the load is lesser than the .5 than the node will taken as the eligible to that node.

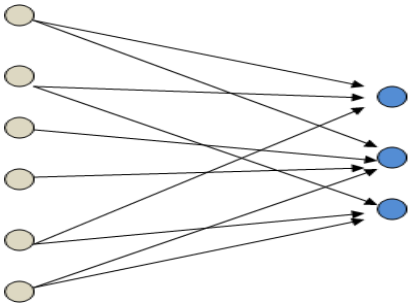

Figure 3.1 : Attention Nodes Covered By Sensor Nodes

As we can see in figure 3.1, the description is identified that nodes Node Criticality to the Attention nodes. As s1 covers t1 and t2 in same way, the Node Criticality of each node is identified. Whereas figure 2 is showing the reverse work, each Attention is covered by k number of nodes. As we can see t1 is covered by s1, s2 and s3.

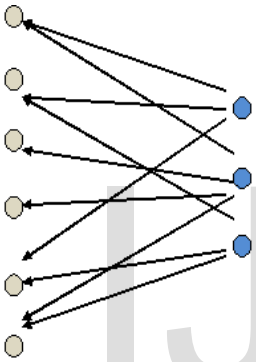

Figure 3.2 : Attention Nodes covered by Nodes

Once we get all the eligible nodes to be the cover node members. The next work is to generate the coverset. A coverset will be defined under the following constraint

- A cover set will contain k number of sensor nodes so that all m number of Attentions will be covered.
- A sensor node can be the part of any number of coversets.

(1) Coverset Energy

A Coverset will be activated, if the overall energy of the nodes is higher than the defined threshold value. Let for any ith coverset we have m number of sensor nodes then the energy required by the cover is

$$\sum_{j=1}^{m} S(i,j).Energy > EnergyThreshold$$

D. Research Design

One of the common problems of sensor network is Attention Tracking problem. According to this problem, N numbers of Attentions are defined over the network with m sensor nodes. To track the Attentions, the ACO based approach is suggested in this work. According to this approach, the ants will be spreaded over the network that will sensing current position of Attentions and activate the relative coverset.

- In this work, each node over the network will communicate to particular Attention node. The communication will be defined as (Si,Tj) i.e. between sensor node Si and Attention node Tj.
- For this communication we have to identify the m disjoint coversets over the network. Each coversets will be active sequentially for a communication session.
- The communication will be performed by a coverset node directly as the Attention node is present in the range of the node itself.
- A coverset will track the Attention nodes effectives.
- The Attention nodes are in moving stage because of which, it is required to track the position of Attentions.
- To track the Attention nodes, ACO approach is suggested in this work.

E. Simulation Parameters

The must simulation parameters include: number of sensor nodes and number of Attention nodes The various simulation parameters are given below:

Parameters	Specifications
Area	500×500
Sensors	30
Attentions	3
Base Station	(450,400)

Energy of each Sensor	0.5 J
Sensing Model	Binary
Sensing Range	150m

Table 4.1: Simulation parameters for the network establishment

Network Establishment

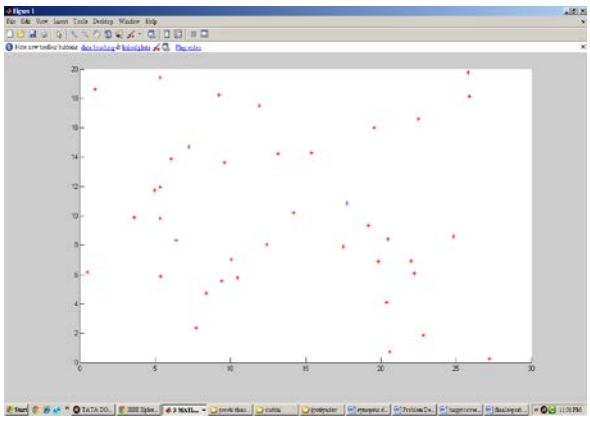

Figure 4.1 Sensor Network Establishment

Sensors and Attentions are generated at random positions in terms of their coordinates assuming that no two sensors are at the same position. The location of base station is fixed and predetermined.

F. Generate the sensor covers

The sensor covers are generated till all the Attentions are covered. For the generation of sensor cover we first find the Euclidean distance of each Attention from the sensor. Figure 4.2 shows the matrix containing the Euclidean distance of sensors from Attentions.

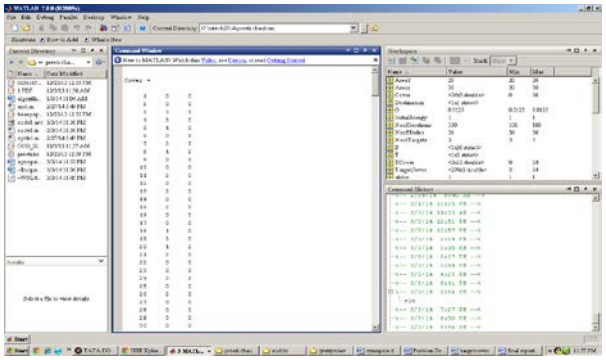

Figure 4.2: Euclidean Distance Matrix

G. Assign lifetime

Each generated cover is assigned a lifetime. And the cover will be active only until its lifetime expires. The total network lifetime is the product of number of sensor covers and their respective lifetime associated with each cover.

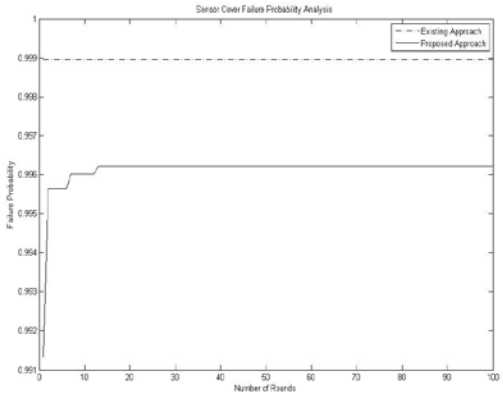

Figure 4.3: Number of iterations vs. Failure Probability

Figure 4.3 shows that the presented work has reduces the failure probability of the network. Here x axes represents the rounds and y axis represents the number of rounds and y axis represents the failure probability.

Number of Sensors	20	25	30	35	40	45	50
Proposed Algorithm	10.5	19.5	24.50	25.5	38.25	45.25	55.5
Existing Algorithm	8	12.25	15.25	20.5	30.25	40.25	45.5

Table 4.2 The lifetime of Sensor Networks with 5 Attentions and 30m sensing range with G=0.0125

Table 4.3 The lifetime of Sensor Networks with 5 Attentions and 30m sensing range with G=0.025

V.Conclusion

A sensor network is generally a hybrid communication network in which some nodes are identified as critical nodes called attention nodes. It is required to monitor these critical attention nodes regularly. The presented work is about to identify a set of nodes that can monitor the attention nodes regularly. The work is here defined under criticality vector and fault factor so that effective generation of coverset will be done. The coversets are here defined to perform regular monitoring of attention node. The work is also define a scheduling mechanism to

decide the order in which these coverset will be activated. The presented work is here implemented in matlab environment and analyzed under the network life parameter. The obtained results from the work shows the effective generation of coversets so that network life get improved.

VI. Future Work

In this present work, an effective identification of coverset is defined to monitor the critical attention nodes. The can be improved in future in following ways

- In this work, a fault based analysis approach is identified to generate the coverset. In future some other parameters can be used such as barrier analysis, inconsistent localization etc.

- In this work, the statistical and mathematical model is defined for failure node identification, in future some optimization approach can be implemented to track the failure nodes.

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