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Wireless Sensor Network Lifetime with Multiple Sink Positioning

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Abstract— In the recent years, the fastest attention seeking field that is growing at a very rapid rate in WSN. An introduction of WSN node, ease of gathering information from those areas where our approach is practically impossible. WSN is the collection of similar type of *n* numbers of nodes that are arranged in a specific pattern, known as a cluster. But the main problem is that arises in this is that the lifetime of batteries that are used for running this node. So we use different techniques to overcome a little to this problem. The one of the technique is by making different clusters and one of the nodes as a base station that sent all the information to the main station. But this is not good as such. Another one is the positioning of the base station. In this, the base station is placed as such as that all the nodes are close the base station so that the energy dissipate is inferior. Another technique is the maneuverability of nodes. In this, the base station is elevated such as the node which has more energy become the base station and after a short time period, another node becomes base station so that the energy of node last very long.

Keywords-base station; wireless sensor networks; particle swarm optimization; network lifetime

1. INTRODUCTION

Last few years were the evidence of the growth of WSN among the people. The WSN has a big impact on our life. It brings a drastic change among us. It helps us to know about those areas where our practical presence is not possible so we use some technique which are of WSN. These techniques are very useful but the major drawback in this is that the lifetime of wireless sensor networks node. The WSN has different sensor nodes which are capable of sending and receiving data. We assume that we have a base station that need not to have a battery but practically it is impossible. We have lot of research on WSN that has focused on the lifetime of the base station, one of the techniques that we use is making the cluster of the node and all the nodes are arranged such as all the nodes are reporting to a node known as base station. But the drawback of this is that the life time of all nodes is not so much that it can survive long. All the nodes sent their data to the base station one by one which took so much energy and the lifetime of each node drop at a very rapid rate. And become dead very soon. To overcome this somehow a new technique is introduced. In this all the nodes are arranged in such a way that distance between the nodes and the base station is not for and the data is transmitted to the base station node by node like the most far node send data to the nearer one and this pattern continuous till the data sent to the base station. This led to the consumption of less energy by the node but the node which is nearer to the base station consumes maximum energy to handle the data so it dies very soon.

After all these another theory comes which tells us about the mobility of base station. In this technique the base station of a cluster is shifted according to the energy of the node.

Like a node has maximum energy then that node become the base station and all the transmission take place through this, then the mode which has maximum energy is converted into the base station and this process the base station. By all these, it is shown that the problems that we had discussed till now are like as NP-complete problems mean that these problems do not have a relative solution for a particular time for long networks. In this bulk of the research, the main cause of behind the sensor node failure is the draining of battery and the charging of the battery is practically not possible. So we discuss some techniques to overcome this problem such as the repositioning of the base station of a cluster which increases the lifetime of a network, Mobility of the base station in a cluster which has a drastic effect on the lifetime of a network and also improves the total network data. In this paper the idea that is proposed which is, practical swarm optimization (PSO) the energy efficient protocol in a WSN. Another idea that is to remove the shadowing effect of a particular protocol or algorithm, is used which is named as mixed inter-programming (NIP) framework that allows us to study the design space of a network in detail. Under specific operating conditions. In this mobility pattern of a base station, they use a specific pattern known as relay pattern in which the data of a node along with the data of another node. It is being transmitted further. This flow of data may be used to stop the battery of a sensor node to get drain soon then the other sensor nodes. On the basis of this, we categorize the WSN into two categories.

1. Unstructured WSN.

In this there is dense collection of nodes it is Ad-hoc deployment and this type of networks are difficult to maintain.

2. Structured WSN In this the nodes are few and scarcely distributed. The deployment in pre-planned and this type of networks requires lower maintenance.

2. RELATED WORK

In terms of research a lot of work has been done in this area and different models as well as models were being proposed. The proposed models were: -

Network Model:-

A sensor network includes the given below have features:-

- The data generated per unit time is equal amount for each sensor node and is equal length.

- The nodes which are used are fixed and similar with specific energy.
- The power controlling technique is used by each sensor node to fluctuate their transmitting power.
- The location of base station is fixed in the centre initially, can move according in the starting stage.

Radio Energy Model:-

The energy model on which our sensor node are based on radio model. In which the energy transmitted to operate radio electronics and the power amplifier, and the energy lost by the receiver to operate radio electronics. The power control is also performed by radio so use the energy taken by it reaches the recipient is Maximum.

Some of the algorithms are also used in this study as introduced earlier. To select the optimal position from the cluster head an algorithm named as PSO algorithm is performed by base station. The second PSO algorithm is used by network to find the location of the base station in a cluster. Initially, the position of the base station is fixed in the centre of the cluster as the distance between the base station and all the nodes is equal. These problems that are related to the distance are considered to be NP- Hard problem in this study. To solve these type of the algorithm that we use is PSO algorithm, because the position of the base station has been obtain/find by the first PSO algorithm, By applying the second PSO algorithm the search area is restricted till the boundaries of the cluster to the complexity of the algorithm is decreases. The parameter which are used in PSO algorithm for specific and empirically problems are given as: -

TABLE II. PSO PARAMETERS

PSO Parameters	Values
Swarm size	30
Maximum iterations	500
X_{min}, X_{max} (Case 1)	0, 100
X_{min}, X_{max} (Case 2)	0, 500
c_1, c_2	2.0, 2.0
W	0.70

On the basis of positioning of the base station the networks are divided into two categories the first one is static base station and the second one is dynamic base station.

Static Base Station Positioning:-

A lot of research was done on the basis of single and multiple base stations positioning in WSN. Different research work was proposed on the assumptions which were made. In this we will discuss the static single node and multiple base station positioning.

Optimized Positioning of a Single Base station:-

The energy that is supplied to the network of a single node is limited but somehow the rules of publication are exploited fir the positioning of base station to increase the lifetime of a network. Different positioning is tested. This is done to check the life span of a base station in a network. This work is done taking the limited node and all the reading are observed and collected to see the batter result and aggregated data is used to find the batter positioning of base station in a network.

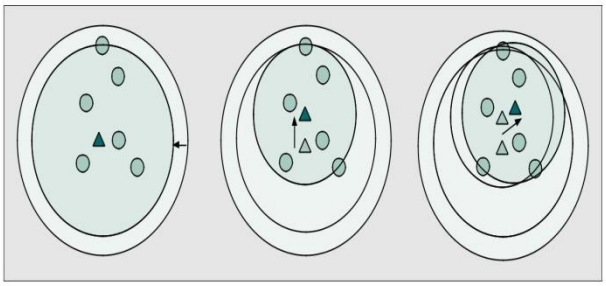

Figure 1. *Finding the minimum enclosing circle for six ANs*

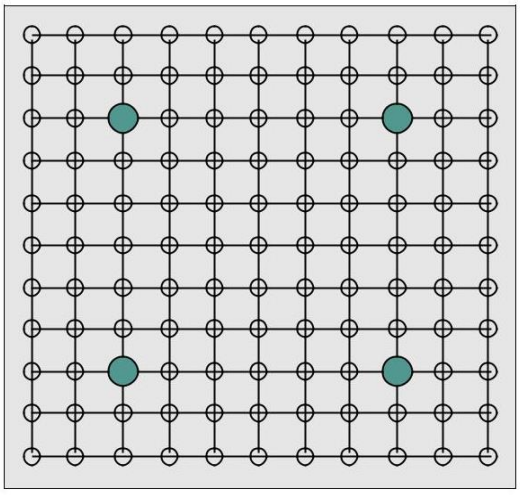

Figure 2. *Optimal solution with local search*

After observing all these result and finding the optimal reading, we observe that the problem is NP- complete and can be solve only using some algorithms by making the complexities minimum. E.g. the search space of is bounded to a limit so that the optimal positioning of the base station is find out, so that the lifetime of the network increases.

3. DYNAMIC BASE STATION POSITIONING:-

From the protocol that we had studied mostly describe the optimal positioning of base station in a network but do not considered the movement of base station.

- We can improve the performance of the network by dynamically repositioning of the base station as the activities of the base station are taken in the consideration with the repositioning in a network. By this the performance of the network is improved, E.g. when the batteries of some nodes become low, they are

not able to send the data with the same transmission rate so it is batter to reposition the base station so that we get the proper functioning of the network and the lifetime of the network may increase.

- During the repositioning of base station we may face a lot of challenges and the handling of base station become very much challenging. As in the initial positioning when the position of base station is fixed. During the repositioning of base station there is interruption in the data transmission so we need to handle it very carefully. As we need to see how the base station is moving and how the data is being transmitted.

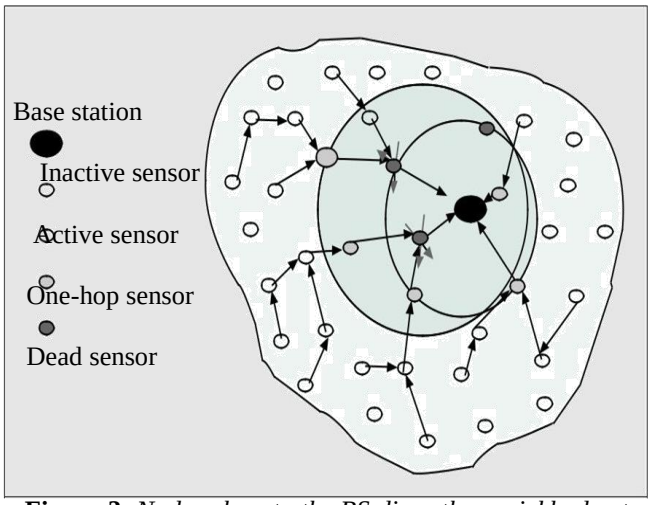

Figure 3. *Nodes close to the BS die rather quickly due to overload, forcing the more distant nodes to relay the data to the BS.*

To overcome this we have another research which was done on the mobility pattern of WSN which increases the lifetime of the network.

In this research different models being proposed to study the optimal positioning of base station to increase the lifetime of a network. Some of the assumption were made before discussing the modals. The assumptions are as follows:-

1. All the information of node is to the base station and enough for processing of data in the base station.
2. The mobility of base station is done when it collects all the data from a point and this movement is done in the negligible time.
3. The total energy loss by a sensor node is overcome by the total energy consumed during the transmission and receiving of data.
4. The moving base station time and the network recognition time is almost same.

Keeping all these assumptions in mind the study of models are being done as:-

1. Energy model:-

The energy loss and gain by a network is finding out in this model. We have a table in this study in which the transmission power at each level for a network consists of *n* nodes is given and the transmission range is also provided.

TABLE

l	$E_{tx}(l)$	$R_{max}(l)$	l	$E_{tx}(l)$	$R_{max}(l)$
1 (l_{min})	0.672	19.30	14	0.844	41.19
2	0.688	20.46	15	0.867	43.67
3	0.703	21.69	16	1.078	46.29
4	0.706	22.69	17	1.133	49.07
5	0.711	24.38	18	1.135	52.01
6	0.724	25.84	19	1.180	55.13
7	0.727	27.39	20	1.234	58.44
8	0.742	29.03	21	1.313	61.95
9	0.758	30.78	22	1.344	65.67
10	0.773	32.62	23	1.445	69.61
11	0.789	34.58	24	1.500	73.79
12	0.813	36.66	25	1.664	78.22
13	0.818	38.86	26 (l_{max})	1.984	82.92

The MIP model:-

The directed graph is used to show the network graph. All the sensor nodes are together connected to prevent a sensor node from the sudden death. As it find another energy source as the neighbor node. The network is design as such that it provides us high performance by consuming low power. The edges of the graph is non-negative as the incoming and outgoing data is balanced for a sensor network.

The total bandwidth we have must be greater or equal to the transmission and received bandwidth. This must be taken in the consideration as the bandwidth exceeding may corrupt the data that is being send or receive by the sensor.

4. CONCLUSION

In this discussed work the main idea behind this is the effective energy of a cluster, for a similar type of sensor node networks. The selection of base station depends upon the amount of energy left. Although the selection of base station is probability not a statically in nature. It is almost dynamic in nature. To find the average energy left for a sensor node need not have a large amount of knowledge about this. This information may be extracted by using some little amount of knowledge about the energy left in this sensor node.

If node density increases:- As the node density increases the energy consumption decreases and the lifetime of the relative sensor node rises as we want.

The transmission rate when goes high (increases) the energy consumption decreases for a sensor node since the method for conservation of power is effective.The packets that are sent per unit time increased in the number. This all improves our technique that we are using in this work for the effective energy consumption of a sensor node.

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FUTURE SCOPE

The work that we had done has lot to do in the future as a lot of research is going on this. Some of the area on which we can proceed are Energy efficient channel adaptive MAC protocol in a wireless sensor network using a static node. This work provided us about the progress that attain in Energy efficiency, Cluster ratio, Bandwidth, Delay etc. The nature of this area has too many environmental factor on which it depends such as Operational scenarios, Specific data type etc.

This work we can implement or do our research work on these topic and proceed further to find our regular application with keeping all these factor in our mind.

In this technique which comes under WSN should work on the sensor node mobility as the mobility was not so much effective in this work. The effect of very large node cluster which increases the cluster node density need to be inspects. Multi hope routing was considered in this work the feasibility of using the clustering technique and data aggregation need to be tested in the same WSN. In this work energy problem was not tacked at the transport layer means to device this scheme from the transport layer view point need to be explored.

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