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Improving the Lifetime of Wireless Sensor Networks

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ABSTRACT: Sensor networks technology has the ability to transform the system that interacts with the physical circumstances. Serving the WSN (wireless sensor network) has a main benefit in different fields particularly in the military where such networks are used for monitoring the borders. Consumption of low power is main need for applications where an extended network lifetime is needed. There are numerous methods to reach better lifetime that encompass characteristics of battery, efficient routing for energy and more.

Routing in WSN is complicated because of certain characteristics which differentiate these networks from other unfixed networks such as cellular, adhoc and mobile networks. These encompass intense implementation of sensor nodes, limited power of transmission, significant redundancy of data, limited bandwidth. Therefore we focus on investigating in detail about the improving the lifetime of wireless sensor networks by framing the connectivity between the sensors. This research develops an approach to extend the lifetime of WSN with the help of connectivity.

KEYWORDS: WSN, energy, adhoc, maximizing lifetime, sensor node, framing, connectivity.

I. INTRODUCTION

In the last decade, the progression and advancement in electronics and communication, information technology and computer science area has resulted in the innovative and new computing and communication period, called as WSN (Wireless Sensor Networks). On the beginning of network architecture and application, the routing protocols vary. Several new and recent protocols have been designed particularly for routing, data dissemination and power management; along with awareness is a necessary design principle (Husain et al, 2013) [1]. In a sensor network, efficient and effective routing needs in which routing protocol should take advantage of network lifetime and reduce energy dissipation of the network. Wireless Sensor Networks has very low power sensor nodes, very low cost, could be arranged in huge numbers and could be utilized even in dangerous environment. On the other hand, the sensor nodes in Wireless Sensor Networks do not have extended lifetime (Priyadarshini et al, 2015) [2].

The network's lifetime raised mainly by the notion of energy harvesting and clustering technique used for efficient and effective exploitation of energy. This rises the lifetime of the field of the sensor nodes prior to their entire degradation. Wireless Sensor Networks are essentially utilized for collecting data and information required by the smart environments but they are specifically helpful in unattended conditions where climate, terrain and other environmental limitations might delay in the consumption of conventional/wired networks. To a certain extent, the individual sensors are operated through battery and the individual sensors' lifespan and therefore the complete network rely profoundly on the duty cycle of such sensors (Halawani and Khan, 2010) [3]. The module of communication is regarded as the major part that consumes mainly the sensor energy and so the conservation of energy is the main optimization goal or intention.

It is inappropriate in various aspects of processing ability, battery power, and communication bandwidth and storage capacity, for each and every node in order to spread data to the sink node, in the energy-limited sensor network environments. This is for the reason that in sensor networks with high exposure, the information accounted by the neighboring nodes has certain level of redundancy, therefore transmitting data independently in each and every node as

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using energy and bandwidth of the entire sensor network that abridges the network lifetime (IEC Market Strategy Board (n.d). In order to stay away from the above mentioned issues and problems, the techniques of data aggregation have been initiated. Data aggregation is regarded as the technique of incorporating numerous copies of data and information into one single copy that is efficient and effective and capable to face needs of the user in middle sensor nodes. The beginning of data aggregation advantages both from acquiring exact information and saving energy. The energy exploited in transmitting data and information is much better than that in processing data and information in sensor networks.

II. RELATED WORK

Dunuka and Para, (2014) [4] explains about maximizing and improving the life time of the Wireless Sensor Network might seems to be challenging task but the two simple approaches are important for maximizing, they are relaying on nodes in a idea of alleviating the geometric deficiencies, as well as particle swarm optimization based on energy efficient network algorithm and routing the protocols along battery by Energy Balanced Transmission Algorithm For Wireless Sensor Networks. These sensors network are capable of even sensing the elements of communication and computation, it also acts as an administrator to measure, reach and observe events in transmission energy in specific environment. In each of the transmission rounds nodes with remaining energy higher than threshold relays addition nodes and this distribution of energy load improves lifetime.

Padmavathy and Chitra, (2010) [5] researches about the Wireless Sensor Network which are always found to be deployed in environment based on remote sensing, extending the lifetime of network along with the improving of small size, cost efficiency, limited power supply, and low power device. So the critical factor of designing a network with better battery lifetime of nodes are directly proportional to improving network life time. This can be done by making the nodes of dun-dant to sleep mode which conserves energy, whereas the active nodes provides the k-coverage needs for improvising the fault tolerance. Thus by scheduling the redundant nodes to turn off which are implemented on the schemes based on centralization and Kim, et al (2008) [6] clearly analyses about the Wireless Sensor Network being reason for occurring of infrequent events due to the various factors it is must to, minimize the delay and maximize the network lifetime.

For the basis of energy constrained WSN like radio the energy can be consumed by the scheduling of the sleep wake mechanism to prolong the lifetime, but the negative impact created due to the waiting of transmitting nodes for the next hop relay node in substantial delay of sleep wake up. The reduction of these delays carried out by the 'anycast' time work based on schemes to be forwarded in packets to neighboring nodes which can wake up with nodes based on multiple candidates. Thus the scheduling policy of sleep wake up and 'anycast' can maximize networks lifetime along with practical scenarios proposed prior to heuristics solutions to break the obstruction of the delay and extend the lifetime through process of non-Poisson wakeup.

Mariya, et al (2012) [6] studied about the ubiquitous computing platform being filled with mobile ad-hoc and the key of this technology being the Wireless Sensor Network, the life of these networks are less, so the use of clustering techniques make it possible to save enough energy. The power conservation are limited to the collection of data efficiently and use of modified Tabu search methodology helps in energy consumption. This approach can avoid wastage in energy while transmission of nodes and maximizing sensor networks life. The progress of distributed network along with the use of Maximizing Network Lifetime algorithms (MNL) prolongs the life time of the network in Wireless Sensor Network.

According to Lakshmi and Neelima, (2012) [7] the only solution to maximize the lifetime of networks are by the reduction in the number of nodes involved as communication participants. The data aggregation based algorithms are played as most important power saving and reliable source of routing algorithms and this optimizes the communication via cluster head by the node degree considerations. Whatever algorithms help in minimizing the communication participants, the only way to maximize and improvise the life time of the network sensors are by the increase in sleeping nodes number with reduction in node ratio.

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Papadimitriou and Georgiadis, (2005) [8] addresses about the sink capabilities at different locations while using multiple hops for various energy requirements during the network operations tends to increased the network lifetime. The use of formulation in novel linear program helps to 10 rectify the two joint problems, such as scheduling problem and routing problem that may reduce the lifetime of networks. For achieving the network life time solutions the sojourn times and sink movement should be in focus and the linear programming formulation is taken outside of routing problem. Balancing of the depletion in energy in sensor nodes and measuring the new heuristics order by real practical system implantation helps in increased in network size providing the prolong in sensor network lifetime.

Khedikar, et al (2011) [09] identified the increase in demand for the Wireless Sensor Network makes it crucial for the limitation to save energy and maximize the life time of networks. The two functionalities of single Wireless Sensor Network are sensing and communication the off duty nodes can be maximized in both the domain by the minimization of consumption in energy. The network topology will be changed after the finite batteries energy depletion but network lifetime maximizing is very important as it cannot be carried over if limited supply. So to address these issues WSN schedule four main heads like extraction of scheduled activities, using multiple methods and stimulate lifetime computation by hybrid genetic algorithms, integration of performance parameters and optimizing coverage strategy, and enhancing lifetime by optimal scheduling algorithms.

Dong, (n.d) [10] aims to analyze about the research based on the Wireless Sensor Network receiving an intensive power topology protocol control and routing protocol in the system of maximizing the network. The enhancement of energy can be increase in system lifetime while assuming the consumption of energy carried over by packet transmission. But the complexity in thus WSN can be tractable problem with the use of polynomial time algorithms and intractable problem being the network protocol hardness proofs.

Yun and Xia, (n.d) [11] stated about the mobile sink usage along with delay torrent application tends to maximize the lifetime of the Wireless Sensor Network, but even though the delay in information delivery takes places the each nodes doesn't always need to send data but the nodes can store temporary data and transmit while the mobile sink is favorable, so that the longest lifetime of Wireless Sensor Network can be easily achievable.

III. PROPOSED ALGORITHM

Sensor networks technology has the ability to transform the system that interacts with the physical circumstances. Serving the WSN (wireless sensor network) has a main benefit in different fields particularly in the military where such networks are used for monitoring the borders. Consumption of low power is main need for applications where an extended network lifetime is needed. In such applications, huge quantity of sensors are expected which need cautious architecture and network management as pointed out by Gnawali et al, 2009 [12] and Liang et al, 2009 [13]. There are numerous methods to reach better lifetime that encompass characteristics of battery, efficient routing for energy and more. Routing in WSN is complicated because of certain characteristics which differentiate these networks from other unfixed networks such as cellular, ad hoc and mobile networks. These encompass intense implementation of sensor nodes, limited power of transmission, significant redundancy of data, limited bandwidth and so on as illustrated by Malkani et al, 2012 [14]. Therefore this research intends to focus on investigating in detail about the improving the lifetime of wireless sensor networks by framing the connectivity between the sensors. This research develops an approach to extend the lifetime of WSN with the help of connectivity.

3.1. Phases Involved in Approach:

The main intention of the research is to improve the lifetime of wireless sensor networks by framing the connectivity between the sensors.

Optimizing the lifetime has attained more attention in WSN. Proposed approach involve 3 phases namely construction of tree, identifying the critical tree through appropriate algorithm and maximizing lifetime of the network through connecting the sensors [15].

3.1.1. Construction of MST: A Minimum Spanning Tree in an undirected connected weighted graph is a spanning tree of minimum weight among all spanning trees.When the implementation is finished, construction of tree processes will begin automatically. Next to that, base station transmits to its neighbours the profounder and identification parent. Every neighbour penetrates in the recursive schedule as well as identifies its neighbours; suppose any neighbour does

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not have profounder and origin of identification but it does not belong to the neighbour of base station, then neigh our penetrates in a schedule, as shown in figure 2.

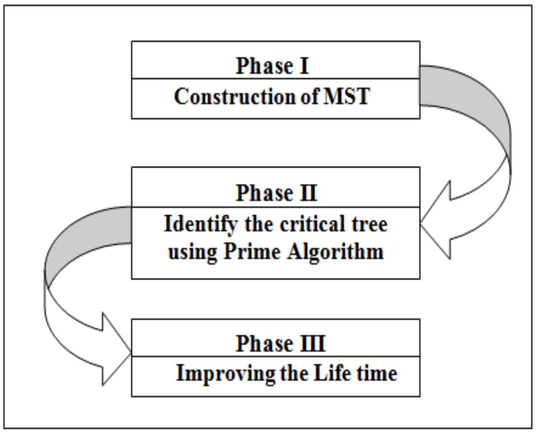

Fig 1: Proposed Scheme

3.1.2 Identify the critical tree: When the tree's construction is completed; next processes begin naturally for identifying the critical tree that denotes a minimum ST (spanning tree) by adopting a greedy algorithm such as Prim's algorithm. The advantages of using Prim's algorithm are that the algorithm is relatively simpler and this algorithm is considerably faster in the limit when there exists a dense graph with more number of edges than vertices.

Prime Algorithm

```
ReachSet= {0};
      UnReachSet = {1,2,....................N-1};
SpanningTree = {};
While (UnReachSet ≠ empty);
{
Find edge e = (x,y) such that;
      1.   X ε  ReachSet
      2.   Y ε  UnReachSet
      3.   E has smallest cost
SpanningTree = SpanningTree U {e};
ReachSet  = Reachset U {y};
UnReachSet + UnReachSet – {y};
}
```

3.1.3. Increasing the network lifetime: After completing 2nd phase, process of optimization begins automatically. Prim's algorithm is to have two sets of nodes of graph, one which are already included into minimum spanning tree and other which are not included yet. Now find an edge with least weight which connects any node or vertex in first set to any vertex in second set. Such an edge is commonly called as cut. Let two sets be A and V where set A contains all vertices of graph which are included in MST and V contains all vertices which are not included in MST yet.

Let S be set of all vertices of a graph. Relationship between these three would be **S = AV.** To start with A will be empty and V will be equal to S. Start with one vertex and add it to A. Also, cost of all nodes initially is INFINITE.
We add the vertex to A, update the cost of all neighbour vertices based on cost to reach vertex added in A and cost of edge between this vertex and neighbouring vertex. Remove vertex from V. Once update is done, greedy strategy comes into effect. Select the edge which has minimum cost and connects one vertex in A and other in V, more simply said does not form a cycle. (If both the ends of an edge are in same component of the graph there is bound form a cycle.

$$(|N2| - |N1| > [(|N2| - |N'1) – (|N1| - | N'1)] \text{ ------- } 6.1$$

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Where |(Ni)| is represented as amount of nodes in tree Ni. For any kind of network namely S, there are numerous probable tress for collecting the data. For instance: Every tree R has a lifetime T, where T(R) is explained as time of 1st node until its energy exhausts[15].

Aim of the proposed study is to identify the tree which increases the network lifetime for balancing the load in the network S:

$$(B)\ \max T(R) \text{ such as } R \in B(S) \text{ ------------------ } 6.2$$

Where B (S) is represented as trees collection of data for the network S.
For acquiring an explicit form of issue below, these has to be characterized for dissipation of energy for every node of sensor in given tree R [15].

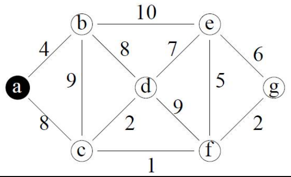
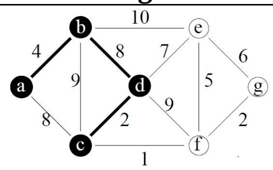
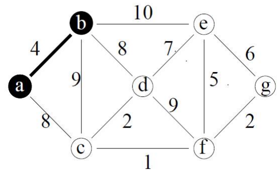
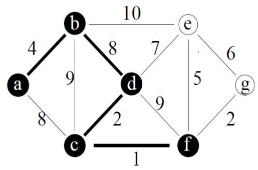
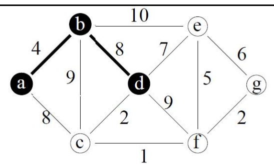
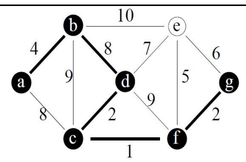
Figure	Explanation	Figure	Explanation
	Step 1 S={a} V\S = {b,c,d,e,f,g} *Lightest edge = {a,b}*		Step 4 S={a,b,c,d} V\S = {e,f,g} A={{a,b}, {b,d},{c,d}} Lightest edge = {c,f}
	Step 2 S={a,b} V\S = {c,d,e,f,g} A={{a,b}} Lightest edge = {b,d},{a,c}		Step 5 S={a,b,c,d,f} V\S = {e,g} A={{a,b}, {b,d},{c,d,{c,f}} Lightest edge = {f,g}
	Step 3 S={a,b,d} V\S = {c,e,f,g} A={{a,b}, {b,d}} Lightest edge = {d,c}		Step 6 S={a,b,c,d,f,g} V\S = {c} A={{a,b}, {b,d},{c,d,{c,f},{f,g}} Lightest edge = {f,c}

Figure 2: Calculation of MST

Let N(R, i) the quantity of children for node namely p_i in R and E (R, i) in R. At the same time, it is notes as node pi has to be as follows:

- Collect a message or letter of C-bit from every child
- Group letters obtained along with own message in 1 message of c-bit
- Send this collective letter to its parent

Therefore at every time, consumption of energy in the node p_i is:

$$\alpha_p FN (R,i) + \alpha_o F \text{ ------------------------------------- } 6.3$$

And then lifetime is calculated as

$$T (R,i) = A(i) / \alpha_p FN (R,i) + \alpha_o F \text{ ------------------ } 6.4$$

Network lifetime is the calculated as the amount of time taken for 1st node to die.

$$T (R) = \min_{i= 1, 2, 3, 4, 5..... m} T (R,i) = \min_{i= 1,2,3,4,5..... m} A(i) / \alpha_p FN (R,i) + \alpha_o F \text{ -------------- } 6.5$$

IV. Conclusion

The most Change-able feature of Wireless Sensor Network is to curtail energy consumption. To achieve this task, proposed work is designed with three approaches i.e. Construction of MST, Identifying critical tree through appropriate algorithm and maximization of lifetime of network through connecting the sensors.

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BIOGRAPHY

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