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USING ENERGY CONSERVATION TO IMPROVE THE LIFETIME OF WIRELESS SENSOR

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***ABSTRACT:** In the modern era, Wireless sensor network (WSN) has seen new horizons among the research community. It has largest range of applications in most of the fields. Its beauty lies in its application area and it can be deployed anywhere. WSN has low cost, low power sensor nodes, can be deployed in large numbers and can be even used in hazardous environment. However, the sensor nodes in WSN do not have longer lifetime. Therefore to meet this challenge of increasing the field lifetime of sensor nodes. A fundamental challenge in the design of Wireless Sensor Network is to enhance the network lifetime. Wireless Sensor nodes carry limited irreplaceable power source. In single static sink node based wireless sensor network, a sensor node spends most of its energy for relaying data packets especially which are located in the surrounding area of the sink node. They dissipate their energy so fast due to many to one traffic pattern and finally they die. This uneven depletion phenomenon is known as hot spot problem which becomes more serious as the number of sensor nodes increase. Replacing these energy sources in the field is usually not practicable. So if the distance between a sensor node and sink node is reduced, the energy consumption will also reduce. Here, the proposed system implements multiple sink nodes with an energy efficient routing algorithm based on local information only. Simulation results show that the networks with this lifetime-oriented strategy achieve a significant improvement on network lifetime.*

***Keywords:** Energy consumption, energy efficient Routing, multi-sink, network lifetime, Wireless sensor network*

I. INTRODUCTION

A network of wireless sensor nodes can be formed by densely deploying a large number of sensor nodes in a given sensing area, from where the sensed data from the various nodes are transported to a monitoring station (called as sink node or base station), often located far away from the sensing area. The transport of data from a source node to the monitoring station can be carried out by multi hop routing or flooding. By having more than one Base stations the average number of hops between data source sink pairs can get reduced. This will reduce the energy spent by a given sensor node for the purpose of relaying data from other nodes towards the base station, which, in turn, can potentially result in increased network lifetime as well as in larger amount of data delivered during the network lifetime. So the deployment of communication nodes as well as the multiple sink nodes is most important factors that affect the lifetime in wireless sensor network. Again, in this paper the focus is also on the issue related to reduce power consumption and increase network life time.

So an energy efficient routing algorithm is coupled with multi sink placement scheme as the solution. The power consumption of each node in wireless system can be divided into: (i) the power utilized for the transmission of a packet; (ii) the power utilized for receiving a packet and (iii) the power utilized while the system is idle. Here in each time interval the energy of each node will be calculated. The rest of this paper is organized as following, Related works in the section II, section III describes proposed system, simulation results are in section IV and section V is for conclusion.

Wireless sensor networks (WSNs) lies on the top when we consider its popularity; it is possible due to its innovative and interesting applications in almost all fields ranging from environment monitoring to battlefield scenario. In computing and communication platforms, it sets a new level for monitoring different environments. It concerned to remote geographical area where human intervention is not possible [1, 2, and 3]. Every sensor node in WSN consists of four basic units namely sensor unit, transceiver unit, processor unit, power unit.

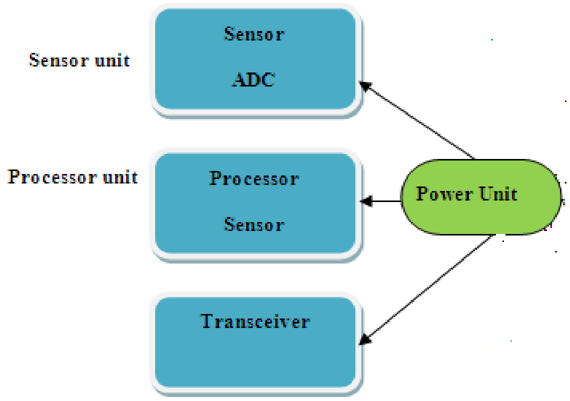

Fig 1 Different units of a typical sensor node

The processor unit includes a microcontroller and memory unit. It saves the sensed data. The transceiver unit comprises of wireless radio transmitters and receiver stations. The power unit consists of batteries that provide necessary power to other units [5, 6]. Many protocols proposed to reduce the energy consumption and thereby increase the lifetime of the sensor network. These protocols categorized into three types. The protocols coming under first class category focuses on controlling of transmission power at node level and at the same time maintain the connectivity of the network; it is possible by increasing the network capacity. However, here we have to compromise with the cost of the network. Protocols referred to next category make routing decisions based upon power optimization goals. Then protocols included in the last category make very important and useful decisions about topology control, that means which sensor nodes take part in the network activity (active mode) and which are not (sleep mode) taking part in the network operations at the same time. [7,8,9,10]. Here the nodes have the good knowledge about their respective positions through GPS or message passing.

Available Energy (Eav) ≥ Consumable Energy (Eout)

II. RELATED WORKS

However, sensor nodes are commonly distributed in inaccessible regions depending on the type of application, and the sink is located far away from sensor nodes. For this reason, sensor nodes with the limited battery resource need to be operated during the assigned time without battery recharge and relocation [1]. If each node transmits its data directly to the sink, some nodes that are far away from the sink will die much earlier than the other sensor nodes. This is as a result of rapid energy depletion due to long distance data transmission. Consequently, this problem limits the use of WSN to gather data in certain regions. This becomes a cause that cannot be done to gather data in certain regions. Thus, a more effective use of energy becomes the major challenge in WSNs [2]. To improve energy efficiency, many researchers have suggested various routing algorithms [3-11]. In most routing protocols, the paths are computed based on minimizing hop count or delay. When the transmission power of nodes is adjustable, hop count may be replaced by power consumption metric. Some nodes participate in routing packets for many source–destination pairs, and the increased energy consumption may result in their failure. A longer path passing through nodes that have plenty of energy may be a better solution. In [12] and [13] the authors describe several localized routing algorithms that try to minimize the total energy per packet and/or lifetime of each node. The proposed routing algorithms are all demand based. These methods use control messages to update the positions of all nodes to maintain the efficiency of the routing algorithms. Singh *et al*. [14] proposed power aware routing and discussed different metrics in power aware routing. Some of the ideas in this paper are extensions of what that paper proposed. Minimal energy consumption was used in [15]. Their main idea, that is, to avoid using low power nodes and to choose the short path at the beginning, has inspired the approach described in this paper.

III. PROPOSED SYSTEM

A. Multi sink placement

Deploying multiple base stations has been shown to be relatively more energy efficient because of reduced number of hops. On the other hand, it brings more system complexity; e.g. a node should be transmitting to which base stations, from an energy efficiency consideration. In this subsection, we introduce the network partitioning method. In the proposed system the whole network is divided into two regions. Individual sink node will be there for each region. Nodes can send data to their next hop neighbor nodes only but not to its previous hop nodes. Each node will be able to send data only to its corresponding sink node i.e. from which region it belongs to.

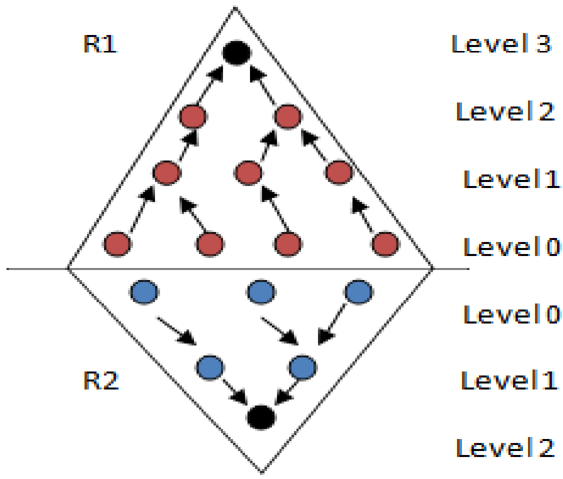

Fig 2: Multi sink placement

In fig 2, partitioned networks are denoted as R1 and R2. Here level 0 nodes send data to level 1, level 1 nodes to level 2 like this. But nodes of region R1 can't send data to region R2 nodes or its sink node and vice versa.

B. Energy efficient routing algorithm

Route is selected based on residual energy of the neighbouring nodes. Node having the maximum residual energy is selected to forward the information towards sink node. Say, S is the set of all nodes in a network, n denotes node that transmits data towards sink node at any instant of time, v is any neighbour node of n, En (v) is the energy of the node v at a particular time, w is any neighbour node of n that is selected for further data transmission and time interval.

Algorithm 1: Energy efficient routing algorithm

1. Initialize S={n}
2. If 'v' is next hop neighbour, calculate residual energy En(v)
3. Compare energy for all 'v' nodes
4. Find node 'w' with maximum En among all 'v' nodes
5. Transmit data through 'w' node
6. Time interval t over
7. Repeat 2-6 steps until packet reaches at sink node

IV. SIMULATION

The simulation work has been carried out using a NS2. Simulation parameters are,

Parameter	Value
Area of simulation	1600*1600
Network density	36
Simulation time	50ms
Physical/ Maclayer protocal	802.11
Traffic type	CBR

Table I : Simulation parameters

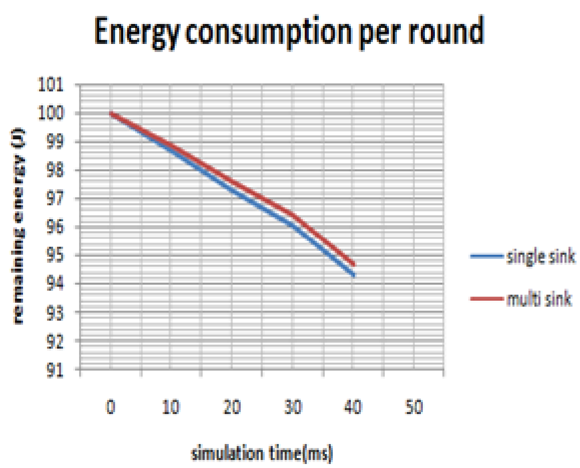

Fig 3: Energy consumption per round

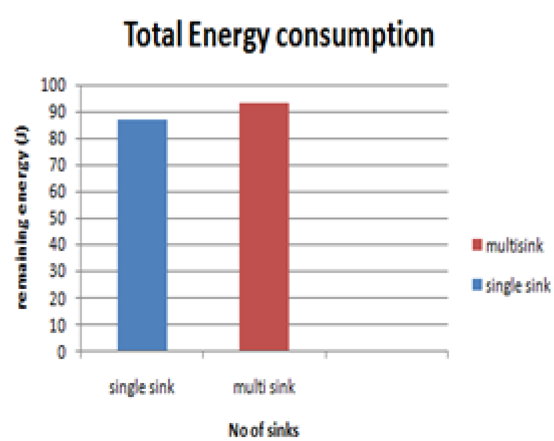

Fig 4: Total Energy consumption

After deploying multi sink nodes combined with the energy efficient routing protocol, the energy consumption in each round is less (Fig 2) than in the case of single sink based network. Remaining energy after the whole execution is also maximum for the proposed system (Fig 3).

V. CONCLUSION

Due multi sink nodes hop distance between node-sink pair is reduced and energy efficient routing avoids the low energy node while routing packets and prevents it from dying early. So together they conserve energy which leads to prolonging the overall network lifetime as well as the lifetime of a sensor node.

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