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An Energy Efficient Mobile Sink Path Selection And Routing Algorithm For WSN

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Abstract: *Wireless Sensor Network (WSN) is a collection of sensor nodes. A sensor node covers all information which is present in its sensing range. To access the information present in some other sensor range, the networks use a process called Routing. One of the routing problems in wireless sensor network (WSN) is concerned with maximizing the sensor network lifetime while continuously routing the collected data (information) to the base station (central server). A route (sometimes called as Path) is a set of sensors that establish a connection between a source node and a sink node (base station). The routing is used to determine a set of different routes with maximum aggregated lifetime while constraining the life of each sensor by its initial battery life. In WSN, we demand an energy-efficient path which is used to send collected information to the center base station. At the base station, the received data are processed further. Recent advances in wireless sensor networks have led to many new protocols specifically designed for sensor networks where energy awareness is an essential consideration. An energy efficient method for energy balanced routing for WSN is proposed in this paper. In this method, the next-hop node is selected according to the awareness of link weight and forward energy density. The efficiency of proposed energy aware routing method is proved through MATLAB simulation results.*
Keywords: *Energy balanced routing,Wsn*

I. INTRODUCTION

Wireless sensor networks (WSNs) are composed of a large number of sensor nodes deployed in a field. They have wide-ranging applications, some of which include military [1]–[3], environment monitoring [4], [5], agriculture [6], [7], home automation [8], smart transportation [9], [10], and health [11]. Each sensor node has the capability to collect and process data, and to forward any sensed data back to one or more sink nodes via their wireless transceiver in a multi hop manner. In addition, it is equipped with a battery, which may be difficult or impractical to replace, given the number of sensor nodes and deployed environment.Most of the real networks of IA, independent of their age, function, and scope, converge to similar architectures [15], [16], therefore researchers tried to build a unified model for complex networks in the last decades.

The traveling path of a mobile sink depends on the real time requirement of data produced by nodes. For example, in hard real-time applications such as a fire-detection system [22], environmental data need to be collected by a mobile sink quickly. Moreover, a mobile-sink node may change its position after a certain period of time and select another data collection/ feasible site. The feasible sites and corresponding sojourn time are dependent on the residual energy of sensor nodes [23]– [27].

In general, limitations such as the maximum number of feasible sites [28], maximum distance between feasible sites, and minimum sojourn time [24] govern the movement of a mobile sink. In WSNs with a mobile sink, one fundamental problem is to determine how the mobile sink goes about collecting sensed data. One approach is to visit each sensor node to receive sensed data directly [29]. This is essentially the well-known traveling salesman problem (TSP) [30], where the goal is to find the shortest tour that visits all sensor nodes.

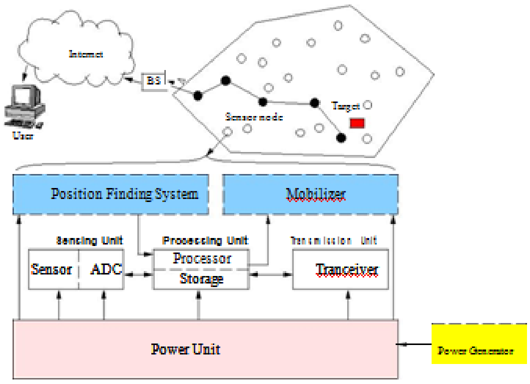

Fig 1: The components of a sensor node

II. RELATED WORKS

A. Sink Mobility Scheme And Optimized Networks Lifetime

Here they used two-level fuzzy logic for sink mobility scheme to optimize networks lifetime and energy consumption .Eligible nodes for routing are selected based on their energy and number of neighbors. Each SINKS are implemented with number of independently fixed or mobile desired location within the network field. Optimizing energy consumption and increasing the network lifetime are the main concern in wireless sensor networks where nodes energy are mostly used for sending data to the sink or base station. Many routing protocols are presented to save energy in data collection and using fixed base station problems are truly recognized. In this paper, we aim to present a sink mobility scheme to optimize networks lifetime and energy consumption using a two-level fuzzy logic. Specifically, the mobile sink moves towards a successful top cluster and reduces the top cluster energy consumption. In the first fuzzy level, eligible nodes are selected based on their energy and number of neighbors. Then in the second fuzzy level, sets of successful nodes are globally evaluated in the network with two phase parameters. We have also tested the effect of network size, sink movement in a random manner or in a controlled movement around square route network. The results show that square routes outperform the others and save more energy in the entire network. Sink route, multiple predetermined routes have been considered here. Whenever link failure occurs, the upstream node immediately identifies the active neighbor of the link. This is repeated until the source node reaches the link. Then route recovery process is initiated.

B. Low-Energy Adaptive Clustering Hierarchy (Leach)

LEACH is the first and most popular energy-efficient hierarchical clustering algorithm for WSNs that was proposed for reducing power consumption. In LEACH, the clustering task is rotated among the nodes, based on duration. Direct communication is used by each cluster head (CH) to forward the data to the base station (BS). It uses clusters to prolong the life of the wireless sensor network. LEACH is based on an aggregation (or fusion) technique that combines or aggregates the original data into a smaller size of data that carry only meaningful information to all individual sensors. LEACH divides the a network into several cluster of sensors, which are constructed by using localized coordination and control not only to reduce the amount of data that are transmitted to the sink, but also to make routing and data dissemination more scalable and robust.

III. PROPOSED MODEL

A. Energy Aware Routing Protocol

A routing protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Routing algorithms determine the specific choice of route. Each router has a priori knowledge only of networks attached to it directly. A routing protocol shares this information first among immediate neighbors, and then throughout the network. This way, routers gain knowledge of the topology of the network.

B. Network Model

The WSN consists of N nodes which are static and uniformly distributed on a square field using a homogeneous Poisson distribution with node density ρ. The communication is symmetric, and two nodes within the transmission radius r0 are neighbors in the network. To ensure the network connectivity, we assume that the number of neighbors of node, defined as node degree d(i), is satisfied with the conditions in [1]. Nc nodes in the event-sub-network are grouped into clusters. In order to evaluate performance under ideal routing condition, we assume perfect MAC conditions and link quality. Furthermore we use the radio model as follows:

$$Etx = k\ Eelc + k\ Eampd^2 \text{ and } Erx = k\ Eelc \quad (1)$$

where Etx (Erx) the amount of energy required (consumed) to send (receive) k bits. where ET and ER are the energy consumption of transmitting and receiving a 1-bit message respectively, Eelec is the energy consumed by the electronics device for transmitting and receiving a 1-bit message, and Eamp is the transmission amplification energy.

The original energy of the node can be considered as E0. When this energy is drained means node dies,however energy of the sink node can be added. The location of the sink and sensor node can be fixed.

The sink node broadcast the message to all sensor nodes in the sensing field. Received signal strength is used to compute the distance between source and sink node. Central node cannot be nominated initially. It can be selected after the topology development [8]. The communication range of the sensor node is set to d0. The threshold d0 can be defined as d0=√(εfs2/εmp) where εfs, εmp are energy coefficients

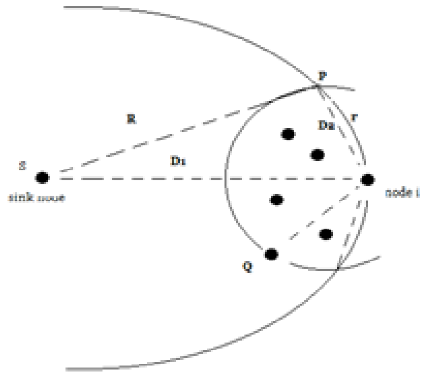

Fig 2 Forward transmission area

From fig.2 d(i, sink) is the distance between the node i and sink node. d(i ,sink) can be defined as

$$R=(X\ ,\ \sqrt{((H/2)2+ (X+W)2)}) \quad (2)$$

When i is the cluster head, the communication radius of the cluster head Ropt(i) is given by

$$Ropt(i)\sim f1(R). \quad (3)$$

Where f1(d(i ,sink) is the function of d(i ,sink). And its ranges are between 0 and d0.

In this routing method, each time the node finishes the transmission, the strength of the next hop node is checked. If the next hop node energy is less than the average value of all sensor node strength in forward transmission area then topology reconfiguration is launched. New node is selected for next round of transmission.

C. Mobile Sink

It's an energy efficient way of data collecting in wireless sensor networks. In this paper, we propose a hybrid unconstrained movement pattern for a mobile sink with the aim of balancing the energy consumption of sensor nodes. Our approach makes the following contributions, as compared with the work reported in the literature. Here maximum energy dissipation happened only at single node in the network and the average energy dissipation over all nodes will get reduced considerably.

I. ENERGY AWARE ROUTING PROTOCOL

A link is used to connect two nodes. If the distance between two nodes is less than the transmission range then we can create a link between them. Each link in our model is a bidirectional link, this is implemented with two one-directional link. Each node has at least one in Link and one out Link. Each link has its own properties such as Cost, TX Node and RX Node. Note that Cost properties are explained in routing section. For each link TX Node and RX Node show which node is transmitter and which node is receiver of that specific link.

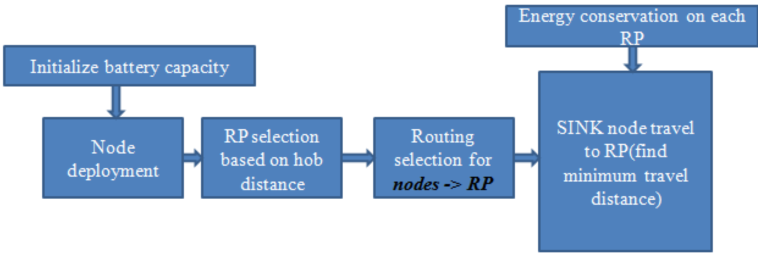

Fig 3. Proposed energy aware sink routing architecture

A. Link Cost:

The primary thing of energy aware WSN is called link cost (or node cost) Cuv of a link (u, v). To determine Cuv, the following four parameters, viz., transmission cost of node u (Etx), reception cost of node v (Erx) and the residual energy of nodes u and v (REu and REv respectively), would be required. It may be mentioned here that the first two parameters are collectively identified as energy efficiency.

The node cost Cuv of a link (u, v), for a transmission from node u to v, is defined using REu, REv, Etx and Erx:

Cu,v = min (REu – Etx ; REv – Erxg) (4)

Thus, computation of Cuv for each node can be done using The level of a node u, designated as level (u), is based on the distance of u from the sink. Nodes deliver packets from higher level to the lower level and finally those packets reach the sink node. Generally, the sink is considered to be in level 0. A level of any node can be determined using strength of a receiver, hop count, delay, etc. In this paper, hop count is used as the metric for determining the level of each node

B. Path Cost:

After setting Cost to each link, we can compute the minimum path cost from each node to sink by using a recursive path cost function. In this function assumed that path cost of sink is zero, whenever a node receive beacon from other node recomputed the minimum path cost to the sink. For computing cost function in algorithms, should have some knowledge about packet energy, available energy.

Therefore, the energy consumption of sensor nodes on the path from node P to the closest RP is

$$Ep = (ETX+ERX)\times(NFD(P)\times H(P,M)) \quad (5)$$

However, if sensor node P becomes an RP, the energy consumption incurred by data packets at P is zero. Similarly, for sensor node Q that forwards NFD(Q) data packets to its closest RP, we have

$$Eq = (ETX + ERX)\times(NFD(Q)\times H(Q,M)). \quad (6),$$

The weight of sensor node P is

$$wp = NFD(P)\times H (P,M), \text{ and}$$

the weight of sensor node

$$Qiswq = NFD(Q)\times H (Q,M).$$

We know that wp >w q; therefore, it can be concluded that Ep >E q, which means selecting sensor node P as an RP, which has a higher weight than Q, leads to less network energy consumption.

Assume node P that has the longest hop distance from the sink, and the average hop distance between sensor nodes and the sink is k; then, the maximum difference between the network energy consumption of WRP op and the optimal is within $((2\times K \times(|V|-1)+1)/(|V|+ 2))$. Proof: The network energy consumption when the mobile sink visits only sensor node P is

$$E\ Network\ (p) = (ETX + ETX \times((|V|-1)\times k)) + (ERX \times((|V|-1)\times k)). \quad (7)$$

On the other hand, the minimum amount of energy consumed by visiting all sensor nodes except node P is E Network(|V|−1) = ETX ×(|V|+ 1)+ERX. (8) This means sensor node P has to send all its data packets to the closest RP, whereas other sensor nodes send their data packets directly to the mobile sink. From (6) and (7),the ratio of energy consumption in WRP in comparison to the optimal model is

$$Ratio = ETX \times(1 +(|V|-1)\times k)+ERX \times((|V|-1)\times k)\ ETX \times(|V|+ 1)+ERX. \quad (8)$$

IV. SIMULATION RESULTS AND ANALYZES

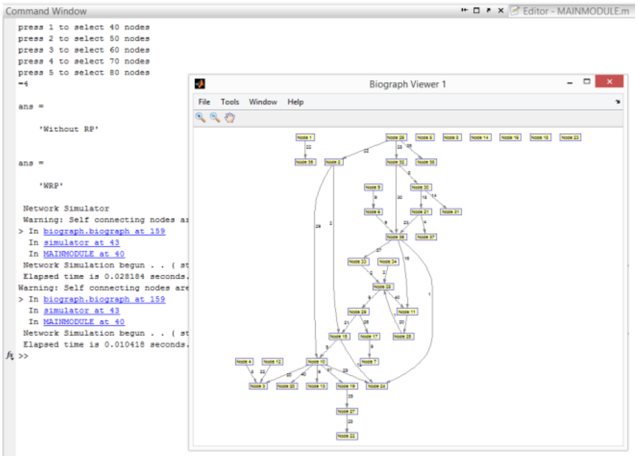

Fig 3. Node deployments and packet delivery

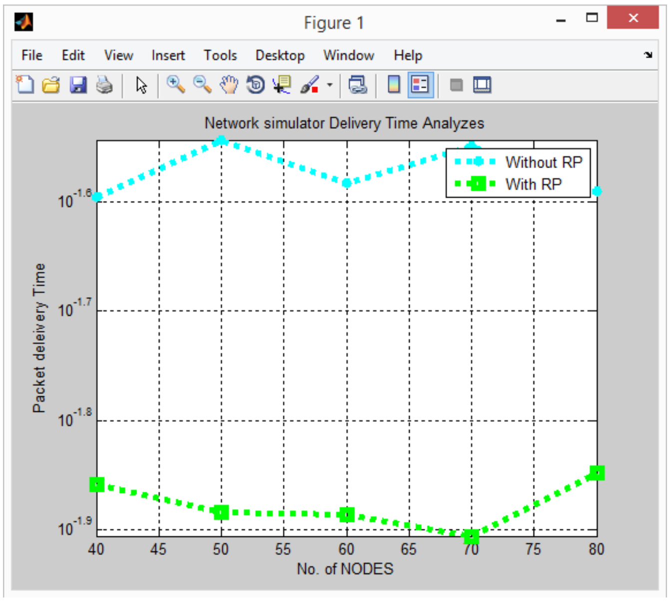

Fig4. Trade off analyzes of nodes vs. delivery ratio

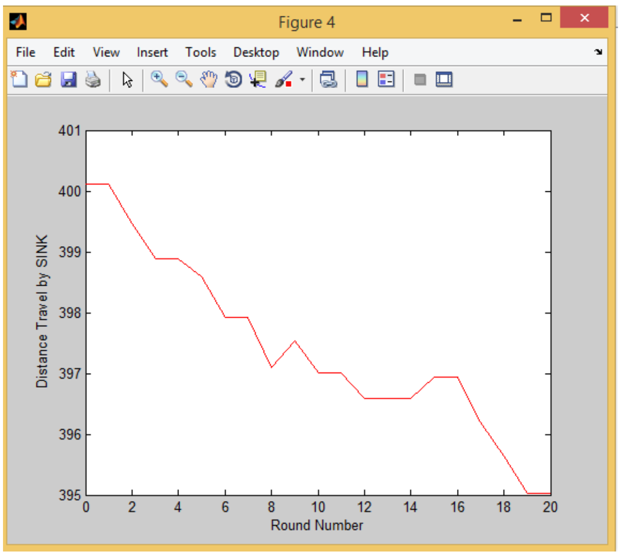

Fig5. SINK code travelling distance

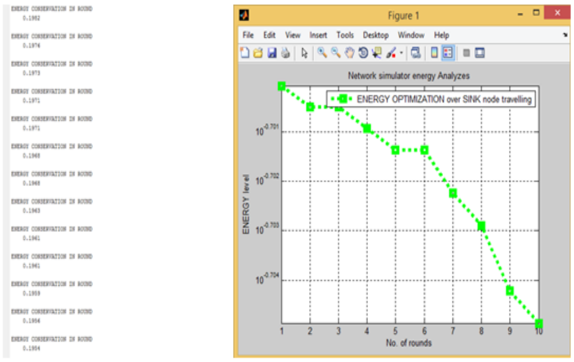

Fig6. Network energy analyzes

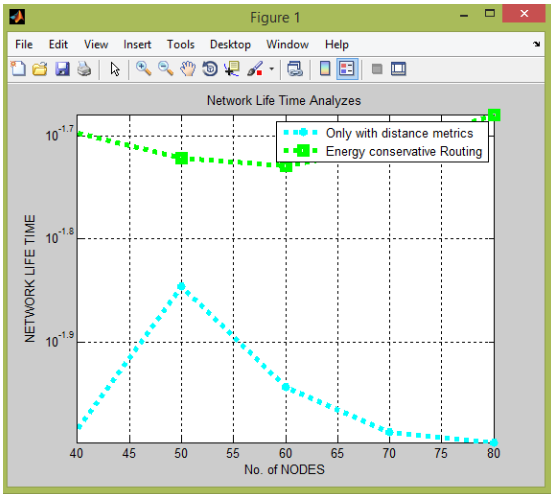

Fig7. Network life time analyzes

V. CONCLUSION

In this paper, we analyzed the performance of WRP with mobile sink based data collection to base station in a WSN. The efficiency of weight age based selection of RPs for the low energy expenditure of sensor nodes and to ensuring sensed data are collected on time. In addition, visiting virtual nodes which are considered to be a RP point with minimum traveling distances through extensive search for minimum path distance along with energy conservation as benchmark for each iteration. Our simulation results proved the efficiency of weight age based RP selection for minimized delay and energy optimized sink node visits to RP points. To extend the analyzes of trade-off between number nodes used over network life time over throughput rate with balanced energy aware routing.

REFERENCES

[1]. I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, “Wireless sensor networks: A survey,” Comput. Netw., vol. 38, no. 4, pp. 393–422, Mar. 2002.

[2]. S. Diamond and M. Ceruti, “Application of wireless sensor network to military information integration,” in Proc. 5th IEEE Int. Conf. Ind. Inform., Vienna, Austria, Jun. 2007, vol. 1, pp. 317–322.

[3]. I. Bekmezci and F. Alagz, “Energy efficient, delay sensitive, fault tolerant wireless sensor network for military monitoring,” Int. J. Distrib. Sens. Netw., vol. 5, no. 6, pp. 729–747, 2009.

[4]. A. Mainwaring, D. Culler, J. Polastre, R. Szewczyk, and J. Anderson, “Wireless sensor networks for habitat monitoring,” in Proc. 1st ACM Int. Workshop Wireless Sens. Netw. Appl., New York, NY, USA, Sep. 2002, pp. 88–97.

[5]. J. Zhang, W. Li, Z. Yin, S. Liu, and X. Guo, “Forest fire detection system based on wireless sensor network,” in Proc. 4th IEEE Conf. Ind. Electron. Appl., Xi’an, China, May 2009, pp. 520–523.

[6]. L. Ruiz-Garcia, L. Lunadei, P. Barreiro, and I. Robla, “A review of wirelesssensor technologiesandapplicationsinagricultureandfoodindustry: State of the art and current trends,” Sensors, vol. 9, no. 6, pp. 4728–4750, Jun. 2009.

[7]. N. Wang, N. Zhang, and M. Wang, “Wireless sensors in agriculture and food industry–recent development and future perspective,” Comput. Electron. Agriculture, vol. 50, no. 1, pp. 1–14, Jan. 2006.

[8]. A. Wheeler, “Commercial applications of wireless sensor networks using zigbee,” IEEE Commun. Mag., vol. 45, no. 4, pp. 70–77, Apr. 2007.

[9]. W. Chen, L. Chen, Z. Chen, and S. Tu, “Wits: A wireless sensor network for intelligent transportation system,” in Proc. 1st Int. Multi-Symp. Comput. Comput. Sci., Hangzhou, China, Jun. 2006, vol. 2, pp. 635–641.

[10]. B. Hull, V. Bychkovsky, Y. Zhang, K. Chen, M. Goraczko, A. Miu, E. Shih, H. Balakrishnan, and S. Madden, “Cartel: A distributed mobile sensor computing system,” in Proc. 4th Int. Conf. Embedded Netw. Sens. Syst., New York, NY, USA, Oct. 2006, pp. 125–138.

[11]. L. Yu, N. Wang, and X. Meng, “Real-time forest fire detection with wireless sensor networks,” in Proc. Int. Conf. Wireless Commun., Netw. Mobile Comput., Wuhan, China, Sep. 2005, vol. 2, pp. 1214–1217.

[12]. I. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, “A survey on sensor networks,” IEEE Commun. Mag., vol. 40, no. 8, pp. 102–114, Aug. 2002.

[13]. J. Lian, K. Naik, and G. B. Agnew, “Data capacity improvement of wireless sensor networks using non-uniform sensor distribution,” Int. J. Distrib. Sens. Netw., vol. 2, no. 2, pp. 121–145, Apr.–Ju