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Scheduling Method to Improve Energy Consumption in Wireless Sensor Networks

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Abstract: ***Owing to the restricted energy supply, extending the network's existence as far as possible is a crucial consideration for the topology of wireless sensor networks. While planning and managing the mobility of sink nodes, this paper attempts to create an energy equilibrium in the system to optimize network life. To determine the network length, a general multi-ring structural model is created, taking data into account, energy usage for the transmission, reception, and wireless processing of data. To study the factors for determining the maximum network life, a general optimization model is developed that considers Ring depth, node densities and probabilities for transmitting the internal ring. In this paper, implement a new algorithm to increase network sensor node lifetime. A few sensors in closed areas are working and the others are fine. All nodes periodically change their status from active to good, desirable to neutral. Whereas optimum nodes require a limited time to test whether or not the disabled nodes are still disabled. If any failure nodes are present, the ideal sensor is active and senses the data. Although all nodes periodically alter their status, few nodes are involved and begin to sense data using their own resources. Therefore, the energy of ideal nodes is only stored and used while it is operating. The proposed algorithm provides almost optimal network life and efficiency six times better than the existing algorithm.***

Keywords: Sensors, energy consumption, lifetime, transmission, efficiency

1. Introduction

The Wireless Sensor Network (WSN) is a mobile machinery wireless network that uses sensors to detect environmental or human movement in different areas. Wireless sensor networks are inspired by military applications like front-line surveillance and sniper location [1]. WSN is also used in a wide range of manufacturing process control and tracking devices, environmental surveillance, habitat control, biomedical applications, home automation and traffic management devices. The main components of a sensor node in Figure.1 are transceivers, microcontrollers, external memory, power and sensors. Microcontroller only performs data and controls other sensor-node system features. The controller can be used as a microprocessor, digital signals, Field Programmable Gate Array and application-specific integrated circuit. The alternative for sensor node and embedded device is microcontroller [2].

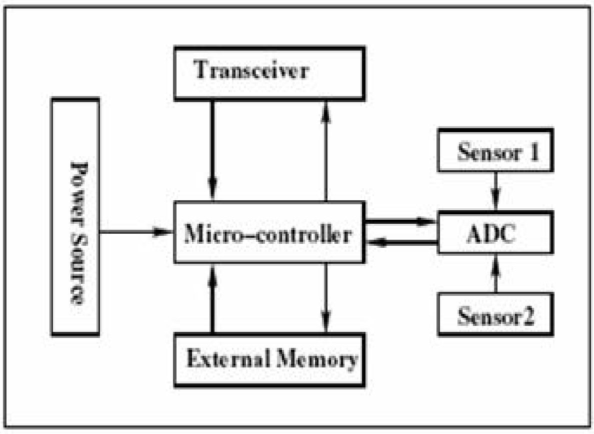

Figure 1: Sensor node Architecture

There are two main techniques for saving electricity. Dynamic Power Management (DPM) and Balancing of Dynamic Voltage. DPM is shutting down active node portions of the sensor[3]. DVS switches power levels by adjusting voltage at frequency depending on a non-deterministic load; this is used to accomplish a quadratic power consumption reduction. Sensors can respond to physical changes such as temperature and pressure measurably. One of the key problems of Wireless Sensor Network Designers is to use resource-controlled sensors to satisfy network requirements including service life, sensing coverage and end-to-end latency [4][5].

Cheap sensors are spaced widely to optimize the resources used per area of the network. For example, where deployment sensors are many times denser than required, create a scheduling scheme to enable them to run in batches to prolong the overall network life[6]. However, dense implementation involves other challenges, such as network maintenance problems and extreme MAC conflicts. Barrier coverage has several benefits over maximum coverage that covers all areas of deployment. However, covering of barriers needs less sensors than full coverage[7]. The sleep-awake question measures the sleep time of the sensor to maximize the network life, is polynomial to solve even though node life is not the same[8].GAF, the energy aware protocol is used to optimize the energy devour[9]. When transmission is done in multiple hops the transmission distances vary thus blurring the region in the optimal range transmission. As a solution the nodes at the farther region are kept dense to avoid the hot spot problem [10].

2. Related Work

Kacimi et al [10] suggested heuristic load-balancing technologies focused on power-control transfer.

Transmission power effect on network topology and Connection Quality (LQI) between each node have been studied. The next case was an optimum case for balancing energy consumption and improving the overall grid life by combining the critical nodes in a 2-D grid topology which connects the base station at an angle. With the support of each base station node, they carried out this cycle by making it equal to the transmission power of each node.

In conjunction with the Fuzzy Logic and Search Based Gravitational Routing Protocol (FSBGRP) Yuvaraja and Sabrigiriraj [11] have established a network-life approach and calculated the node expense by using fuzzy logic. In addition to lifetime the efficiency of the link, residual energy and device load are evaluated. To check the FSBGRP, they compared the A-star algorithm developed by AlShawi et al with energy and delay [12].

Kalaiselvi and Priya [13] also have introduced a hybrid-efficient medium access control (MAC) protocol with a load balancing algorithm. The principle of lifetime enhancement is apparent in several respects. This incorporates the power of both multiple access time division (TDMA) and multiple access frequency division schemes (FDMA). All these processes were checked and simulated with the aid of a network simulator in order to check the algorithm efficiency with an unbalanced algorithm, and this is achieved with energy, packet distribution ratio and delay.

Chang and Tassiulas [14] have introduced several routing strategies to expand the network's lifespan to wireless sensor networks. The routing problem was conceived as a linear programming problem and the constant values and arbitrary approach for upgrading functionality were assumed. Finally, they compared the shortest routing routing, including Minimal Overall Energy (MTE), Minimal Hop (MH) and Max-Min Residual Energy (MMRE). Their explanation is that the MTE (Minimum Total Energy) routing is not network focused.

Carle and Simplot [15] have suggested that the safest way to conserve energy is to shut off much of the sensors during service. In the same vein, Pantazis et al. [16] proposed a querying-based protocol to avoid the shortest path routing problem. Milenkovic and Amft [17] have taken an energy-saving solution to office buildings in real time. Few researchers have recently studied the top bound of the network.

2.1 Existing Global Barrier Coverage Method

Localized algorithms are important for scalability due to the growing, unattended existence of the wireless sensor networks. A localized algorithm also adapts better to changes in the network which, due to unattended external installations, are likely to be very frequent within the wireless sensor network. There is therefore a clear need to create a new paradigm to enable the creation of localized algorithms, while maintaining the advantages of barrier covering, in order to realize the advantages of the barrier cover model in motion detection applications.

It should note that the definition of barrier coverage, which we will call global barrier coverage, demands that any crossing route be shielded irrespective of the length of it. Therefore, the sensor deployment in boundary (belt area), as shown in Figure. 2, due to the possibility of an open crossing lane, global boundary coverage is not recognized. In real life, these roads are very rare for intruders; it is more likely that a short route is followed across the belt field.

3. Proposed Scheduling Method

3.1 Network Setup

Assume that sensors are mounted in a 2-dimensional area, i.e. A2DM [0,n]x[o, w(n)] Strip= [0,n]x, where w is w and n is node. The sensors do not move until they are activated because the device is a static sensor. The sensor nodes are randomly distributed based on the position point density rule. All sensor nodes are considered to have a certain sensing capacity, and each sensor can recognize the environment and detect intruders in the sensory area. Services is split into two sections. If one sensor is covered in the field at least and another is complementary to the protected area. Find two Li and Lj sensors. It is connected whether two sensors are identical or overlapped. If–Lj 2r Then–Lj is the distance between two sensors intersecting the left and right boundaries of the rectangle field.

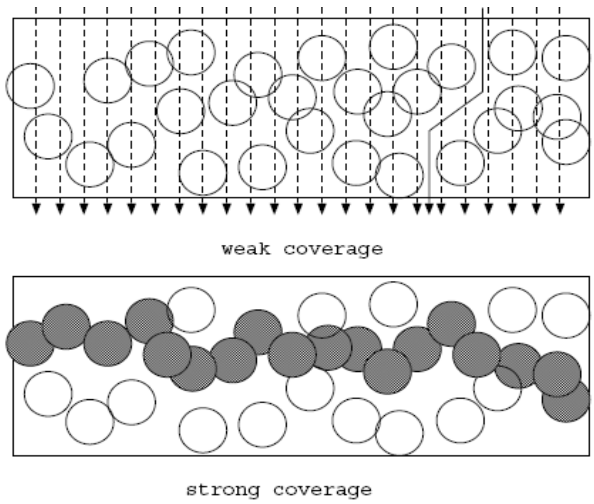

Figure 2: Weak and strong coverage

The decision point crosses one side of the region on the other, where the entrance and the exit point are on the two opposite sides of the region. We assume that intruders are trying to cross the stripe gap for a rectangular 2D field. The severity of a WSN coverage can be measured by the amount of times an intruder reaches a lane. If a path intercepts another sensor at least k, the path is presumed to be k safe. If the probability is 1 as n->α, the case is expected to occur. Weak visibility means that intruders are detected on congruent roads. Good border coverage guarantees that intruders are detected without violating path constraints.

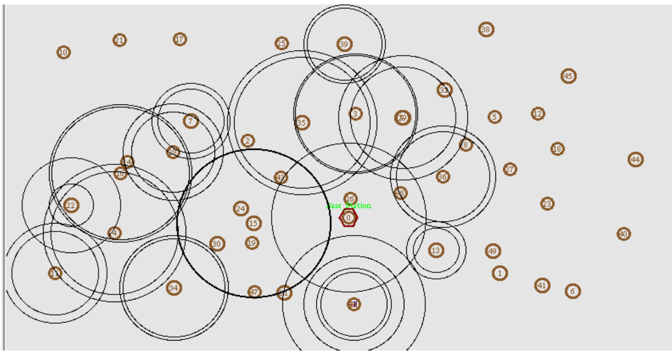

Figure 3: Initial Setup of Network in Simulation

Initially, all sensors are in active mode based on the proposed algorithm, transmitting information packets containing node I d, location and length of life. The node that sends the information packet is u and is called v from the configuration of the network. Visibility of the rectangular path is A.

The suggested algorithm is a central method with four procedures. BEGIN, ACTIVE, IDEAL, CHECK.

Step 1: According to the sensor network implementation, all nodes are in "active" state, and a procedure BEGIN is only called once.

Step 2: Each active invokes a process called Active in a certain time interval after executing BEGIN. The participating nodes determine if they will be active or ideal.

Step 3: During a given time interval, the ideal node is enabled to see if its area is occupied by some other node. If every other node covers it again, it goes to the ideal state. Then the area must be covered by an active state.

Figure 4: Initial Procedure

Node u thus initializes the set A(u)== used in the Active method, calculates, and identifies a region of the RIu). If the procedure cannot locate the area information R, this means that the existing sensor network is not adequate to provide coverage, so node u sends a message indicating this. When the process detects the area in the network node, you need to forward an information packet with node I, location and lifespan to all other nodes. In all a, b nodes, if the virtual area differs from the real area, aαR(b) doesn't mean yμr(x) immediately. Then, all nodes u would have information about Nu Sub-Set Nu={v: uR(v)} until they had sent an information packet, and the packets reached their destination. For the set of nodes knowledge in Nu –N'u={v: I R(v) and vR(u) all nodes in Nu u respond with a packet of acknowledgment.

Step 1: The Node u compute the value based on the distance and initializes the set A(u)= Φ and N_u = Φ .

Step 2 : Node U performs a process for finding its area. If the region is not covered, u forward the information packet to the base station that the node is not covered.

Step 3: If it is covered u sends the data packet consist of Node Id, Position and Life time.

Step 4: If u receives another nodes information packet it records the Node Id, Position and Life time and sets N_u= N_uU[u]. And also if u∈R(v), then v replies with an information packet containing v's ID, Position and life time.

Figure 5: BEGIN Procedure

When the BEGIN method is executed the entire node must perform the Active method as seen in Figure 6. It determines whether or not to live in the ideal location. The node u is optimal if the region is covered without u for every active node v. If the ideal state is available for two nodes, it causes damage. For all u A(i)=, u retains a set A(u) per node. As time passes, nodes tend to reach the optimal state, but they did not know. Putting nodes A(u) means this. From the first step, I search all A(u) nodes, including u, to find a coverage problem in the ideal state. If there's no coverage problem, visit the Nu network node and send query packets to the ideal state. When asked by the node u, v sends information "not needed" to get back to the ideal state. It just occurs if u and A(u)s do not threaten the protected area.

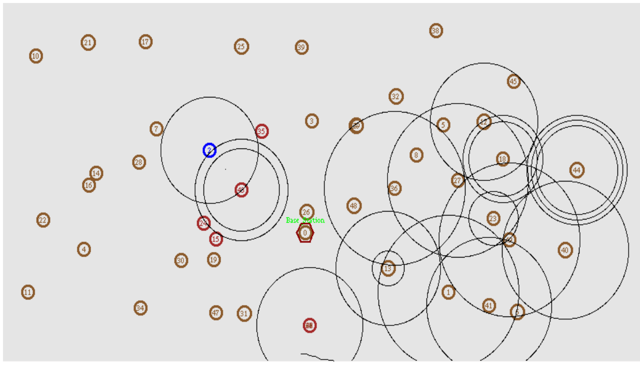

Figure 6: Simulation of broadcoast information from to neighbour node

In step 3 u go to the ideal state if an "No need" information packet has been obtained from all active nodes in this region. If node u is in optimal or active condition, Nu informs all nodes concerning its decision, then they know the state. When you want to go in good shape, it is expected to fail earlier before T later or before the first active sensor node in the network.

Step 1: An active node u checks if the area is covered without u or with u and sends a data packet to the Nu network nodes.

Step 2: Whenever an active node v receives a query packet from u and if R(v) is covered without A(v)U{u}, then v joins u to a (v) and sends an information packet consisting of "not required" message. Otherwise v replies with a "required" message.

Step 3: If u receives a' not received' message from an active node on the network, otherwise it chooses to go to the ideal state or go to the active status and send its node Id, location and lifetime to Nu and an knowledge packet consists of "decision continue" packet.

Step 4: v removes u from A(v) since v have already made its decision. If u wants to go to ideal state in future, it should get permission i.e. it should receive a "not required" information packet from v. Every time (T), u executes active procedure again and again if node u stays active. To increase efficiency, u may check whether there is a new active node added in the Region R(u) in time T. If so, then u executes active procedure else u waits for some period of time T which is pre specified.

Figure 7: Active Procedure

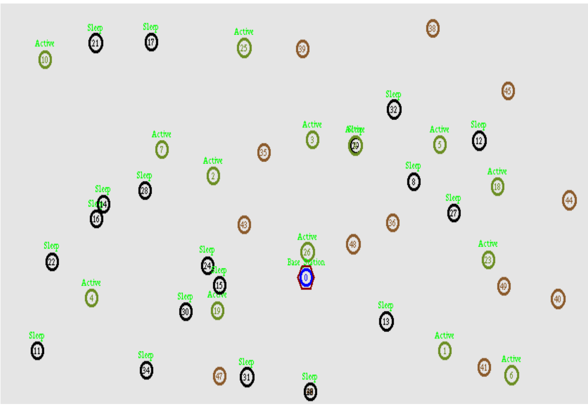

Figure 8: Node with "Active" and "Ideal" states

Step 1: In a particular time interval the ideal node gets active and sends a query packet to the node in the network to get the permission to stay ideal or to get active.

Step 2: When the active node receives a query from u and sends "not required" packet if the region cover with out u.

Step 3: If u does not get any reply from j then u becomes active and set as A(u)= Φ. Otherwise u goes to ideal state again and it records the node Id, Position and life time

Step 4: If u goes to ideal. U become ideal until time T units or till first active node in the network is expected to die whichever is earlier.

Step 5: u sends active state packet with Id, Position and life time when u decides to become active.

Figure 9: CHECK Procedure

When an appropriate node is operational, the CHECK procedure seen in Fig. 9 will decide if the node failure makes it operational or optimum. From stage 1 u all documents are deleted from the table and the status is changed. Instead you send a request packet to other Nu network nodes to find out whether the region needs to be covered. In Step 2 node v α Nu reacts to u whether it wants u to be active or not. If you are in ideal condition, certain nodes in the network may change its status if V answers a packet containing its Node I d, position and durability that is "not needed" or "necessary." It allows node u to manage active node records correctly in the network. Phase 3 indicates that you have an "unrequired" packet and can return to the optimal state. There is no response from v and u to the active state in the case of a network failure node. In step 4 Ideal nodes become active for a given time, review the record and receive permission to remain ideal or active. U notifies all participating Nu nodes whether they choose to join. The next V will change the record

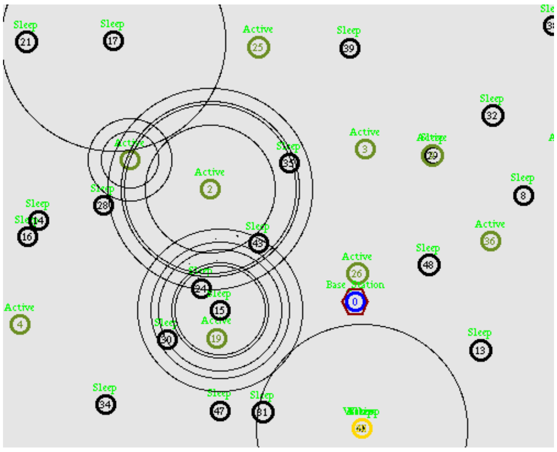

Figure 10: Execution of Check Procedure

4. Performance Evaluation

It is simulated by a proposed NS2 algorithm with 100 nodes. We describe network lifetime as the total time consumed by a local or global firewall. We find lifetime enhancements when accomplished using the proposed algorithm and the global barrier coverage algorithm. To compute the increase in lifespan, the suggested algorithm is equated with the RIS algorithm [5][6] and the number of nodes ranges from 50 to 100. The results of the simulation of the remaining life are based on the time T shown in Table 1. The capital wasted during the simulation in Table 2.

Table 1: Comparison of Lifetime Based on Time Interval

Time Interval	% of Life time	
	Existing Algorithm	Proposed Algorithm
0	100	100
10	93.1	98.11
20	85.3	96.12
30	78.78	94.92
40	76.10	93.85
50	72.12	93.51
60	68.25	93.50
70	62.96	93.37
80	59.92	90.91
90	55.91	90.7

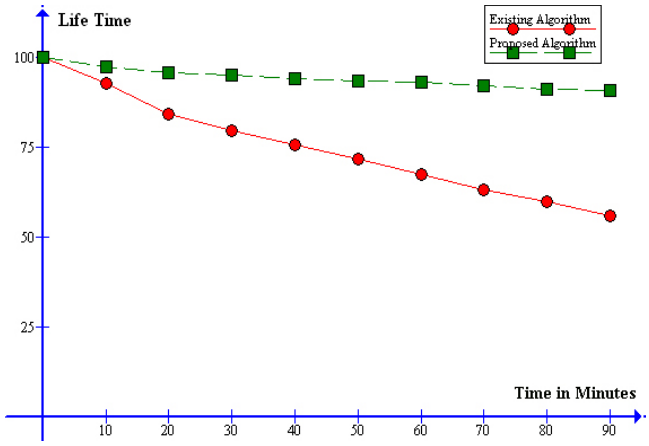

Figure 11: Remaining life time

Table 2: Comparison Table for Energy Consumption

Time Interval	Energy Consumption	
	Existing Algorithm	Proposed Algorithm
0	0	2.51
10	7.3	4.2
20	16.1	4.69
30	21.15	5.82
40	23.91	6.62
50	27.92	6.69
60	31.85	7.69
70	37.21	8.61
80	40.17	9.3
90	44.16	10.31

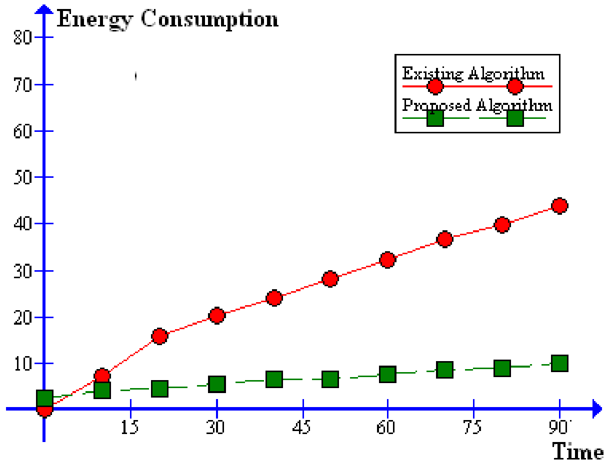

Figure 12: Energy Consumption

5. Conclusion

In this paper, a new algorithm is implemented to boosts efficiency and extends the network life of wireless sensors. The new algorithm for simulation is six times faster than the current algorithm. This work may have opened up several research questions by allowing the development of coverage algorithms. The life time of sensors be able to enhanced if there is substantial decline of energy consumption of nodes closer to the sink.

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