Energy Efficient Routing Protocol for Wireless Sensor Networks Using the A-Star Algorithm

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ABSTRACT

Sensors are considered as very important electronic equipment modules. Most wireless sensor network presentations should contain critical and sensitive information in the form of a multi-hop and energy-efficient way. Because sensor nodes are limited in. For extending network life to WSNs, energy is a very sensitive problem. Researchers should look at energy consumption in WSN routing protocols to improve network life. This paper proposed the use of the A-star algorithm to build the latest energy-efficient routing protocol WSN process. The suggested routing system enhances the life of the network via data packets transfer through the optimal short route. The correct path for the residual energy of the next-hop sensor node is the great efficiency of the relation between buffer capacity and low hop count minimum. In contrast to the A-star and fuzzy logic protocol, the simulation findings show that the proposed system boost network existence.

Keywords

A-star, Energy efficiency, network lifetime, Wireless sensor networks.

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Introduction

Recent developments have underlined the importance of WSN as the main devices of reporting micro-electro-mechanical systems (MEMS) and in the field of Wireless Communications. True, The WSN's sensor nodes are intended to restrict resources in power, range of communication, processing, and storage capacity. WSN provides features and utilizations like objective tracking, environmental control, and battlefield. WSNs' primary goal is to spread the information in a multi-hop format from source to sink.

Generally, energy sources are forwarded to constrained energy, and low-performance batteries are expected to be a crucial obstacle for WSN applications. As shown by sensor nodes, the fire sensor information is sent effectively in real-time to the sink node. Therefore, it is arguable that power consumption should be handled in this way that WSN 's network life is manageable. However, most algorithms for routing in WSNs involve secure and real-time data transfer in a multifaceted plan to the sink node [2, 3]. Data routing based on QoS and energy efficiency is therefore regarded as an important task for WSN and the energy-efficiency and QoS parameters can be compared to [1, 3-5]. On the opposite, non-uniform consumption of energy and load imbalance are important issues in a variety of WSN protocols for routing that trigger network partitioning. As a result, network partitions affect the efficient distribution of packages and thus prevent the efficiency and optimal functioning of WSNs. Because of the importance of WSN applications, reduced packet transmission may harm the power consumption and consequently the life of the WSNS network.

Data packets are regarded as major energy consumption sources during WSN transmission and reception. Therefore, we need to effectively monitor and manage energy consumption to establish energy-aware routing protocols for WSN. An energy hole issue is the lack of energy consumption controls in a multi-to-one transport system. The periodic selection of the right way and energy hole problem jointly affects the durability of WSNs in most routing algorithms. The network is fragmented due to these two issues and the WSN cannot carry out its intended critical role. The main issue with these routing protocols is the reduction in overall energy usage at the cost of reliable network drainage.

To the above-mentioned challenges in WSN, enhancing network existence is regarded as a key challenge and should be strictly considered in the Routing Protocol. The following criteria should be considered according to the specified aim of growing network life: i) balance of energy consumption, ii) Balance of load, iii) Choice of the shortest path, and iv) Reduction of the reception rate packet retransmission. A new energy-efficient protocol (EERP) is introduced in the present paper. with an optimum aggregate cost and A* algorithm, to increase the network life of WSN.

The proposed algorithm includes node parameters like enhance residual energy, linking efficiency, free buffer, and minimum hop count to prevent network segmentation and to achieve this advantage. The WSN lifetime thanks to the use of energy consumption and moderate consideration of parameters. In terms of high waste energy, choosing nodes at the maximum level of energy will increase traffic load and then prolong the WSN 's life. Besides, these nodes should be picked with the open buffer to prevent loading and thus unnecessary energy consumption, in line with the free buffer parameter. We have done a lot of simulations on the proposed EERP algorithm at MATLAB. The results of the simulation showed a better performance of the EERP algorithm than A&F over the life of the network. The remaining paper is structured accordingly: section 2 covers work related to network life enhancement. Section 3 describes the new proposal and addresses it. Section 4 explains the EERP simulation and performance assessment. Finally, section 5 concludes the paper.

Related Works

The fragmentation of the network due to the WSN energy hole issue and unequaled energy consumed is a crucial challenge in the WSN and thus the network life of WSNs in routing protocols would be affected. So, the extension of network life in WSNs has been considered. In the past few years, technology has been developed to create an energy-efficient route to improve the WSN 's network life. We will analyze the literature that enhances and extend the lifetime of expanded WSN.

Many systems for data transfer employ clustering techniques to minimize and balance energy consumption by aggregating and regularly selecting different nodes like cluster heads. LEACH is considered an essential protocol for the clustering of WSNs.

Both heads of clusters directly transfer their aggregated information to the sink. In an earlier paper, we suggested a geographical energy-efficient routing protocol (EERP) to WSNs, using the optimal cost function to choose the best neighbor's node to optimize its network life. The authors introduced the Hybrid Multi-Hop (HYMH) protocol in [10], that combines flat, hierarchic multi-hop routing algorithms and data add-on schemes to enhance power consumption and a lifetime of WSNs. In [11], the latest program to improve the life of WSNs for each sensor node, with anycast and optimal sleep-wake planning. In this work, data are forwarded and the remaining nodes are switched off to save energy. The selection of a backbone node is a rotational device that measures energy usage of all nodes.

Proposed Energy-Efficient Routing Algorithm

In the analysis, A * algorithm was used to determine the correct route of the source node towards the target node for certain sensor parameters like buffer specified node, residual energy, and packet reception rate (PRR). The sink node must know the process of all nodes to search the correct route. Therefore, every node must submit the parameters above to the node of the sink at the initial step. If the node of the sensor is sent to the node of the sink in the remaining circle, parameters are added to the data packet. The sink node determines and transmits the routing calendar to each sensor node, based on the collected parameters. The A * algorithm searches for the best route from the source node to the target node. Whether the sensor node's residual energy is below the Eth power limit, the node will not be involved during the development and would not give their parameters therefore to the base station. The load of the network is measured via the threshold value of the electricity, which increases network life.

The first search method uses A*algorithm and the best path searches between the original node and the target node. There are 2 lists, one accessible list is mainline and keeps priority queue monitors nodes to be reviewed, and already evaluated nodes are tracked in the CLOSED list. A * algorithm applies the distance plus cost function heuristic node to determine the order of the node tree visits. This heuristic function sums up the two subsequent functions that follow.

$$F(n) = g(n) + h(n) \tag{1}$$

Thus, g(n) is the cost for the current n node from the source node and h(n) represents an acceptable heuristic estimate. In the proposed scheme, the function value is the same as the node cost as n. The aim for advancing the packets of data to the closest neighbor with more residual power, better packet receipt, and buffer rate. To accomplish this, we have used the added weight of the following routing parameters. The total aggregate weight of the nearest neighbor node is defined here the number of normalized weighting parameters of its routing:

$$G(n) = \mathrm{Max}\{ \propto \left(\frac{E_{res}(n)}{E_{ini}(n)}\right) + \beta\left(\frac{N_r(n)}{N_t(n)}\right) \} \tag{2}$$

Where, $E_{ini}(n)$ and $E_{res}(n)$ are initial and residual node n energy, respectively. Moreover, $N_t(n)$ and $N_r(n)$ are respectively the number of packets transmitted and received. The node cost parameter is associated with the combination of linear 3 common measures. The first parameter contains the normalized residual energy describing the next node's residual energy. This parameter should ensure the energy consumption of the sensor node is equalized. To expand the network, the energy load should be uniformly dispersed between life nodes for all sensors. The next parameter is the normalized number of node packets that have been obtained. The parameter is the receipt rate for the next node packet. Maximizing this is the same as maximizing the performance of packet transmission. When considering this parameter, the greater likelihood and therefore this prevents data packets from being retransmitted that greatly reduce node power consumption. Parameter 3 of one represents the free buffer magnitude available at the next candidate neighboring node. The parameter plays a great part in the optimal traffic load distribution. The packet is transmitted in a free buffer to the next node.

We use EWMA for updating the packet reception rate

$$PRR(t+1) = \theta(PRR(t)) + (1-\theta)\left(\frac{N_r\,(t+1)}{N_{t\,(t+1)}}\right) \tag{3}$$

Where θ, is parameter waiting and the h(n) value can be determined accordingly:

$$d(n,s) = \sqrt{(x_n - x_s) + (y_n - y_s)} \tag{4}$$

Where d(n, s) corresponds to a distance of the Euclidean node from n to sink.

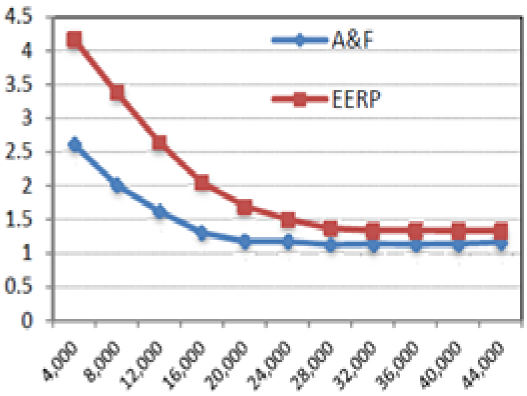
Performance Evaluation

This paper performed the EERP with results for the A&F average residual energy and the number of live nodes in MATLAB 7.10. There are 20 actors on the network to create the network data as a random condition. The signal range for cast radio is 30 m. The range of radio signals of the actors is 30 m and the location of the actors changes every 100 rounds by RWP.

Besides, we analyzed the effect on the total energy of the transmission packets and the number of nodes alive, and the initial node's energy. The number of packets for transmission is between 4,000 and 44,000. Senor nodes report 500 rounds each at A&F 's base station for schedule table updates. The simulation environment parameters are detailed in Table 1.

Parameter	**Value**
Network Area	200 × 200
Number of nodes in sensor	50
Radio transmission range in m	80
Packet 's maximum buffer size	10
sink position	(200,200)
Initial energy	5
Byte size packet	500
Number of packets for transmission	4
Actors number	20
The actors' range of radio signal	30
Node delivery	Uniform random
α, β,	0.6, 0.2, 0.2

The effect of the number of transfer packets in the two simulated protocols on the average remaining energy. It should be remarked that the sink is placed two places on the top right corner (200 m, 200 m) and the area between f (100 m, 100 m) is the same as the simulated area. The goal of change the position of the sink node is to research and to correlate the output of both approaches.



(A) Number of Transmission packets

(A) Number of Transmission packets

In this Figure (A) the simulation results indicate that, under the scenarios, the remaining average nodes' energy in the EERP is above that of A&F. The development of much redundant energy savings packets in A & Faverage. This is because of the packet reception rates of EERP nodes, remaining power and buffer nodes with the least path to count hop. The figure shows that the suggested scheme is better for saving energy nodes than the A&F system.

Conclusions

Increasing the lifespan of WSNs, as battery-powered sensor nodes have limited power
is considered an essential problem. This paper has been used an A * algorithm and suggested the latest framework to boost the existence of WSN. The EERP method contains the residual energy, the packet to find the right path with the reception rate and the free buffer count for Myonium hop. The distinctive aspect of the suggested system was that the dissemination of data was delegated to the node of the sensor with increased residual energy to avoid packet energy drops as a consequence of the end. The outcomes of the simulation demonstrated that our suggested network life was able to increase compared to the A&F method.

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