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Border Effect Tolerance in Wireless Sensor Networks

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Abstract: The research work analyzes the circular area of border effect to be considered. The tradeoff between the number of sensors and their communication range we deploying a wireless network that is connected with the validate analysis through simulation experiments. Additional simulations considering sensor failures ratified that periodic sensor redeployments calculated according to the reliability of WSNs continuously connected through the network. For this applications the network not to be disconnection we use energy for this approach. Using energy efficient routing algorithm for these computations.

Keywords: Availability, border effects identification, fault tolerance, network connectivity, reliability of networks, wireless sensor networks (WSNs).

I. INTRODUCTION

A wireless sensor network (WSN) is a group of special transducers with a communication infrastructure that uses radio to monitor the physical or environmental conditions like temperature, sound etc. Sensor node consists of four basic components such as *communication unit*, *sensing unit*, *processing unit and power unit*.

In the proposed model includes additional simulation of the tradeoffs between the number of sensors and their communication range to keep the network fully connected and to reduce the presence of sensors failure. Many WSN applications the sensor nodes are battery driven and they are often very difficult to recharge or change the batteries. Energy is a precious resource in WSNs. So a good WSN design must be energy efficient. Probably wireless sensor networks are low cost and have high efficiency [1].

In this paper, explain the related work in the section II, Section III is proposed work, the section IV is methodology and section V is experimental results and their simulation result. Finally the Section VI is a conclusion.

II. RELATED WORK

Zhi sun et al the concept of Border Sense, a hybrid wireless sensor network architecture for border patrol systems is introduced. Border Sense utilizes the most advanced sensor network technologies including the wireless multimedia sensor networks and the wireless underground sensor networks. The framework to deploy and operate Border Sense is developed. Based on the framework research challenges and open research issues are discussed. We introduce Border Sense hybrid wireless sensor network architecture for border patrol to reduce the intensive human involvement and to improve the detection accuracy of current border patrol systems [1].

Tao Yang et al propose the scheme to measure and guarantee the coverage quality of WSN. We also design a new coverage model for detecting one directions path. The simulation results show that the new coverage model could not only detect the intrusion in border area well but also extend the network lifetime in an efficient way. We introduce the border intrusion detection. An energy efficient manner for border patrol to reduce the intensive human involvement and to improve the detection

accuracy. In order to guarantee the detection accuracy we mainly discuss the coverage quality and the method to enhance the quality of the detection. [2].

A Matlock et al a team of potentially heterogeneous dynamically constrained UAVs with constant velocities. The problem approached as a finite horizon optimization to account for possible alarm as occur. This approach seeks to optimize the amount of information obtained by the UAVs with the surveillance of pop-up alarms a high but not sole priority. Particle swam optimization (PSO) is used to search the control space and optimize their ward function. This approach guarantees feasible trajectories without smoothing in addition to unpredictable paths. We have demonstrated that the PSO method combines both exploration and exploiting of important areas for surveillance. The algorithm at hand can be used to calculate trajectories online and within reasonable time. Furthermore the PSO algorithm generates unpredictable paths online that makes it difficult for adversaries to predict the paths of the UAVs [3].

Eduardo Am Aldi et al propose an optimization framework for selecting the positions of wireless sensors to detect mobile targets traversing a given area. By leveraging the concept of path exposure as a measure of detection quality we propose two problem versions: the minimization of the sensors installation cost while guaranteeing a minimum exposure and the maximization of the exposure of the least exposed path to a budget on the sensor installation cost [4].

Xiu Deng et al Area coverage is one of key issues for wireless sensor networks. Selecting a minimum number of sensor nodes to cover the whole sensing region and maximizing the life time of the network. In this paper discuss the energy-efficient area coverage problem considering boundary effects in new perspectives that is transforming the area coverage problem to target coverage problem and the achieving full area coverage by covering all the targets in the converted target coverage problem. Thus the coverage of every point in the sensing region is transformed to the coverage of a fraction of targets. Two schemes for the converted target coverage are proposed which can generate cover sets covering all the targets. The network constructed by the sensor nodes in the cover set is proved to be connected. Compared with the previous algorithm and simulation results show that the proposed algorithm can prolong the lifetime of the network [5].

III. PROPOSED WORK

In this paper we evaluate the effects of borders in wireless sensor network to present a more precious analytical model of their connectivity. At this end we study the effective sensor nodes are located next to the geometrical limits of the area where the wireless sensor network is deployed.

There are four contributions are involved in border effect analysis: 1) a first contribution consists on the derivation of an exact expression for the effective average connectivity of sensor nodes in the border areas of a finite wireless sensor network. Analyzing simulation experiments show that the average sensor nodes connectivity in the border is dominant over the connectivity of the sensor nodes in the region(R) and the values R and N, where N is a number of nodes. 2) A second contribution provided by the tradeoffs between the numbers of sensors deployed and the sensor node communication range in a WSN to produce a connected network is successfully deployed its constituent sensors may fail as a time by due to fire or extreme heat, animal or vehicular accidents, malicious activity or power(battery)exhaustion. 3) A third contribution, a precise analytical evaluation of a sensor redeployment procedure that can keep the network continuously connected thus enhancing its reliability. 4) A fourth and final contribution is the analytical ability to fine tune the referred sensor redeployment period and size to achieve a required level of network availability for applications that can be endure brief periods of disconnection.

A good wireless sensor network design is needed and important to be energy efficient. It is also used to ensure network performance and prolong network lifetime. A wireless sensor network use energy efficient routing algorithm scheme as the solution. The power consumption is divided into: (1) the power utilized for the transmission of a packet. (2) The power utilized for receiving a packet data and (3) the power while the system is idle. Each time interval the energy of each node will be calculated.

Energy Efficient Routing Algorithm

The goal is to design energy efficient routing algorithm that reduce energy consumption while minimizing compromise to service. It is also used to companies, organizations and individuals to save energy and to promote the use of renewable energy resource. Example Google Engineers maintains thousands of server conditions to grow, power cost can easily overtake the network costs.

Algorithm steps

An EERA scheme based on route selection is residual energy of the neighboring nodes. A node having the maximum residual energy is selected to forward the information towards sink node or base station. Energy efficient routing algorithm works as follows. Initialization parameters steps are the step 1-setup a network with n nodes. Step 2-select a node s as the source node. Step 3 select a set of nodes from n apart from s to act as target nodes. Step 4 the delay parameter setup to the channels. Step 5 initialize the type of the packet with these parameters like hop count, path and energy. Step 6 the connections are unidirectional as per the assumptions. Step 7 finally two distinct types of gates are taken for input and output. Step 8 initialize packets hop count set is 0 and also the energy = 0.0mw.

Some of the energy proficient routing protocols include Local Energy-Aware Routing based on (LEARAODV), Power-Aware Routing based on AODV (PAR-AODV) and Lifetime Prediction Routing based on AODV (LPR-AODV).

IV. PERFORMANCE EVALUATION

After the development, analyzes the efficiency of a range query over the data that is encrypted by EOB where the proposed OB is used. The main focus was to analyze the searching efficiency in terms of the false positive rate. To do this, the probability distribution of the rate of the width of a bucket to the size of the plaintext space was first analyzed to show that the width of a bucket is not skewed to be extremely large or small. This even-bucket-width property gives the proposed scheme a good querying performance on average. In the proposed OB, the p_1 points are randomly uniformly sampled in the plaintext space [0,|M|-1]. The width of the ith bucket was determined by the selected points of $(i-1)^{th}$ order and ith order because the width is the difference of these two points. Therefore, to analyze the width of a bucket, it is important to analyze the probability distribution of the position of the selected points.

V. METHODOLOGY USED

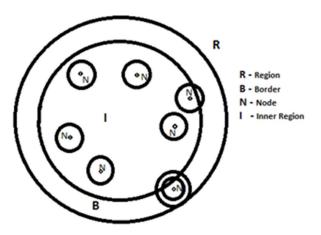


Figure 1: Border Effect Tolerance

A wireless sensor network is a network of wireless sensor nodes can be deploying a large number of sensor nodes in a given sensing area from the various nodes are transporting to a monitoring station (called base station), located from the sensing area. Some applications of wireless sensor network are applying environmental monitoring, military applications,

health care applications and home intelligence. An environmental monitoring and military applications include air or water quality monitoring, hazard monitoring and disaster monitoring. Object protection, intelligent guiding, battlefield monitoring, and remote sensing. A health care applications and home intelligence include behavioral monitoring, medical monitoring, smart home and remote metering. An example application, a network of cameras monitoring the safety of a building compound each sensor does local image analysis to detect event such as motion within its field of view.

An objective of wireless sensor network

- » Low node cost
- » Low power consumption
- » A self configurability
- » Scalability and Reliability
- » Adaptability and Security
- » Fault tolerance
- » QoS support
- » Communication channel utilization

Border Effect Identification

The border effects affect the connectivity of the network and then test our hypothesis by means of simulation experiments. The expected effective node for the network, B is equal to the values of B_{lat} and B_{out} weight is equal to the circular area is measure theses follows

 $B = B * R_I +, B_{lat} * R_B + B_{out} * I_B/R$. Where B_{lat} and B_{out} is the border of nodes and entire network region is R and I is an inner region.

Border Effect Avoidance

To deploy N_c sensors in the larger circular area of R. we propose the border effect avoidance for deploying a connected wireless sensor network. Border effect avoidance solutions are explained in [5].

Some of the technique to avoid such a border effect:

- 1. The first method such as a border zone B_a with a width of at least w_0 and inner zone B_{eff} .
- 2. The second method uses a toroidal distance metric. This both methods are used to avoid the border effects.

Fault tolerance

Some of the sensor networks may be failing or blocked due to lack of power, interference. The failure of sensor nodes should not affect the entire task of the sensor network. Fault tolerance or reliability is ability to sustain sensor network functionalities without any interruption due to sensor node failure. Poisson distribution probability of failure within the time interval (0, t1): $F_n(t1) = \exp(-\alpha_n t)$ Where $F_n(t1)$ is a reliability α and t are failure rate of sensor node n and the time period.

VI. EXPERIMENTAL RESULTS

Routing set-up phase

The operation of this phase is composed of three steps: step 1 is to divide the nodes into mutually exclusive subsets and each node joins any subset randomly, step 2 is to determine the minimal hop count for each node the last step is to construct the connected minimal hop count routing path for each node within any subset.

The detailed process is described as follows:

- Step 1: Nodes are divided into mutually exclusive subsets.
- Step 2: Determining the minimal hop count for each node.
- Step 3: Constructing the connected minimal hop count routing path.

At the end of step 3 some nodes are scheduled in multiple sub- sets and the members in all subsets are not mutually exclusive. Furthermore, in any subset each member is guaranteed to find a connected minimal hop count routing path.

Simulation Results:

The energy efficient routing algorithm is used to tolerate the energy problem and border effect avoidance of the proposed system. To measure the network coverage entire region is divided into multiple circle-shaped small patches with radius 1 m. The coverage degree of a patch is approximated by measuring the number of nodes that cover the center of the patch. That is the patch is covered when the center of the patch is covered by at least one sensor node. In the following experiments each algorithm was executed 100 times to get more reliable results. For each experiment 10 different random network topologies are generated. The simulation results are plotted using the average values derived from these networks with a 95% confidence interval. A more efficient algorithm is signified by the lower values in algorithm delay/data transmission latency and number of active nodes as well as a higher value in packet delivery ratio. Besides, the algorithm also needs to guarantee the sufficient network coverage ratio.

Parameter	Value	
Circle Region Radius	250m	
Node Sensing Range	20m	
Number of Nodes	100	
Initial Energy per node	5j	
Network bandwidth	1 mbps/s	
Data Transmission rate	4096 bits/ s	

Table 1: Parameters for Wireless Sensor Networks

Border Effect Analysis:

We first formulate a hypothesis to explain how the border effects (represented by E_{lat} and E_{cor}) affect the connectivity of the network and then test our hypothesis by means of simulation experiments. We assume that the expected effective node degree for the network E^*_d is equal to the weighted average of the values of E_d , E_{lat} and E_{cor} , with weights equal to the areas of the inner region, the lateral border and corner borders, respectively. This gives us

$$E_d^* = \frac{E_d * A_I + E_{lat} * A_E + E_{cor} * A_C}{A}$$

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Border effect avoidance

We used the following metrics to evaluate the proposed EER model:

- 1) Network coverage rate is measure of the quality of coverage.
- 2) Error-rate of node deployment.

It is defined as follows

$$re = \frac{\sum \left| N_{S} - N_{t} \right|}{\sum N_{t}}$$

Where N_t and N_s denote the number of deployed sensor nodes calculated by theoretical analysis, and the number of deployed sensor nodes in practice. This metric is a measure of evaluating the absolute deference between the theoretical analysis and simulation results.

No of Nodes	Routing	Performance	Error Rate
100	70	97.91	2.09
80	70	98.97	1.03
60	90	99.04	0.96
40	90	99.33	0.67
20	110	99.71	0.29

Table 2: Performance Evaluation of Border Effect

Graph

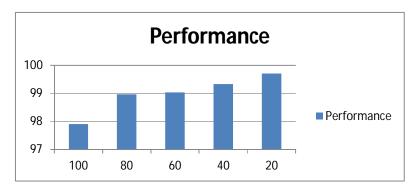


Figure 1: Performance Evaluation of Proposed Work

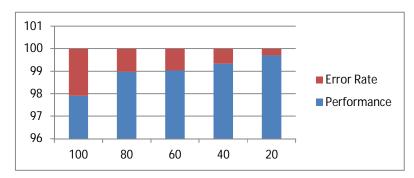


Figure 2: Performance and Error Rate comparison of proposed work

We run new simulation experiments and obtained the minimum number of sensor nodes, for a given R, deployed over a circle area. Then we compared these values of N_a with the values of N_{cbd} needed to obtain a connected network with the same probability but using the corner border dominance. The results of these experiments are summarized in Table. It can be clearly seen that the number of sensors N_a needed to deploy a connected network with high probability (greater than 99%) using the

border effect avoidance solution is considerably smaller than the number of sensors N_{cbd} needed when using the corner border dominance solution.

VII. CONCLUSION AND FUTURE WORK

In this paper, the focus is to reduce power consumption and increase network lifetime. Main aim of this work is to minimize the energy required to transmit or receive packets also called *active communication nodes*. A reliability of wireless sensor networks to the network connectivity and sensor node failures. WSN composed of N uniformly distributed nodes with communication range R deployed over a square area of side L and edge E that influence the physical border on the node. Border effects derived exact expressions for the expected effective connectivity of node located in the borders of the network area was investigated in the first contribution. The second contribution is connectivity of the original network to avoid the physical border effect. Finally the solution is *border effect avoidance*. The deployment of the no sensors and its subject to sensor failures effecting a periodic sensor redeployment specified by a requiring highly reliable network for these applications continuous connectivity. Fourth contribution of our work is a sensor redeployment specified by a highly available network for applications that endure short non-connectivity period.

In future the problem phased in different energy efficient network coverage system. The coverage ratio of the proposed work needs to enhance using square type network coverage also the future of implement in different network environment and coverage possibility wireless sensor network.

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