International Journal on Applications in Information and Communication Engineering
Volume 1: Issue 7: July 2015, pp 41-44. www.aetsjournal.com ISSN (Online) : 2394-6237

Secure And Efficient Data Transmission In Cluster Based Wireless Sensor Network

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***Abstract*—** In wireless device network applications wherever information gathered by totally differentdevice nodes is correlated, not all device nodes got tomove for the wireless device network to befunctional. Providing the device nodes that arehand-picked as active kind a connected wireless network, the inactive device nodes are often turned off. Permitting some device nodes tobe active and a fewdevice nodes inactive interchangeably throughout the lifecycle of the appliance helps the wireless device network to owna extendedperiod of time. the matter of decidinga collection of active device nodes in an exceedingly correlate knowledge atmosphere for a totally operational wireless device network are oftendeveloped as an instance of the connected correlation dominating set problem. During this work, our contribution is twofold; we have a tendency to propose a good and runtime-efficient repetitive improvement heuristic to unravel the active device node determination problem, and a benefit function that aims to reducethe amount of active sensor nodes whereasincreasing the residual energy levels of the chosen active devicenodes. In depth simulations we have a tendency to performed show that the planned approach achieves a good performance in terms of each network period of time and runtime efficiency.

Keywords: wireless network, wireless device network, active sensor nodes

I. INTRODUCTION

Wireless sensor networks (WSNs) are composed of a large number of spatially distributed detector nodes that are restricted in power. These detector nodes are Equipped with 3 main elements to hand and glove collect data about a monitored region. These 3 main parts of a detector node are a process unit withlimited capability, surroundings sensors and a short range wireless transceiver. By the use of those parts, detector nodes will form a multi hopwireless network and transmit the detected information about the monitored surroundings to an information gathering node. Sensors are able to get information concerning the monitored surroundings including but not restricted to temperature, humidity, pressure, sound and motion. Some WSN applications include environment and surround observance, health care help, home automation, process observance and management, mind piece of land and border police investigation. Limited energy availability in sensor nodes makes network lifetime a crucial issue in WSN applications. To extend the network lifetime, energy economical wireless detector network protocols and algorithms have been devised in the literature. Node clustering, in-network data processing, data fusion and network cryptography are some of the measures taken to reduce the amount of knowledge that's processed, sensed or transmitted. Diminution of energy spent in processing, sensing and transmittal of knowledge permits detector nodes to avoid wasting energy. Such energy savings facilitate to increase the life of WSN applications. In some WSN applications, not all detector nodes a required to move (turned on, therefore defrayal energy)in order for the WSN application to be fully functional. One example to these types of applications is atmosphere observance applications. In these forms of applications, exploiting the inherent information correlations among the sensor devices could facilitate to prolong the network lifetime extensively. The information correlations between the detector devices might exist attributable to the characteristics of a sensing element region and sensing element node readying like the proximity of the sensing element nodes. Moreover, correlations could also be static (notchanging over time) for a few applications, particularly for applications wher ever knowledge detected by sensing element nodes relyon the placement of the nodes. In such applications,as long as sensing element node are static (not moving), the informationdetectedcanbe location-dependent and there'll be static correlations among the information detected by close nodes.The data correlations among sensing element nodes ismodeled as a collection of two tuples,wher ever every tuple contains a source set of nodes that infers a sensing element node.When a source set is chosen into the active sensing element node set, the sensor node inferred by that supply set might keep in active. In these forms of WSN applications, since the information of some sensor nodes is inferred from the information of anothernodes, it's crucial to work out the set of active sensing elementnodes which will be enough to infer the information of in active sensor nodes. In such scenarios, solely the active sensing element nodes ought to sense, method and transmit knowledge. The inactive nodes are going to be turned off and thus they're going to not spend any energy as long as they continue to be inactive. In this work, we have a tendency to aim to search out an efficient and run time efficient centralized active sensing element node choice heuristics for related knowledge gathering in WSNs to prolong the sensing element network life. For this purpose, we have a tendency to model the active node determination drawback as AN instance of the connected correlation dominating set problem[1]. In connected correlation dominating set drawback, given a network and correlation dataregardingthatnode subsets, i.e., source sets, infer

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thatdifferent nodes, were interested in finding a collection of (dominating) nodes which will infer the (correlated) knowledge of the remainder of the nodes. Gupta et al. [1] proposes a classy however long constructive L hop centralized heuristic. the target of the L hop centralized heuristic is to construct a connected correlation dominating set with minimum range of active sensing element nodes. so asto attain this task, the L hop centralized heuristic uses a profit perform that solely takes into account the amount of active sensing element nodes whereas not considering the remaining energy levels of elite activenodes. Hence, our contribution during this work is two fold:We propose an unvarying active sensing element node determination (IAND) heuristic, that is each effective and runtime efficient. The IAND heuristic consistsof a greedy constructive heuristic followed by AN unvarying improvement heuristic to search out an efficient and runtime efficient correlation dominating set for WSNs. We outline AN energy aware profit perform that's used by each the greedy constructive heuristic and also the unvarying improvement heuristic of IAND. Given an out sized correlation knowledge set because the input, the aim of the greedy constructive heuristic is to construct a correlation dominating set during a runtime efficient manner. The unvarying improvement heuristic is deadonce the greedy constructive heuristic to boost the energy quality of the active sensing element nodes elite by the greedy constructive heuristic. By energy quality we have a tendency to mean the residual energy levels of the active sensing element nodes.

II. RELATED WORKS

In WSNs having knowledge correlations between sensing element nodes, reducing the overall range of bits transmitted to the data gathering node may be a common approach to cut back energy consumption and prolong the network lifespan. Some approaches to attain a extended network lifespan in a correlate knowledge surroundings include using clusters for data aggregation, constructing knowledge aggregation trees, utilizing network cryptography, exploitation probabilistic models and constructing correlation dominating sets.On one hand, there are a unit generic cluster algorithms for WSNs such as HEED[4]and LEACH[5]that don't contemplate knowledge correlations between sensing element nodes. On the opposite hand studies the impact of part related knowledge on the performance of clump algorithms . It uses random pure mathematics methodologies to analyze the energy consumption for forwarding knowledge in a very multihop sensing element network. Moreover the authors mix the result they acquire with rate distortion theory [8]. this manner the authors offer a mathematical analysis framework to check the energy consumption and network time period once there square measure capricious data correlations between sensing element nodes. The analysis frame work permits to see the optimum standardization of the cluster head choice likelihood to balance the trade-off between energy consumption and network time period in clustering algorithms for WSNs. To reduce the amount of transmissions performed in the network devises the Clustered Aggregation (CAG) mechanism, that provides approximate results to combination queries exploitation the spatial knowledge correlations among sensing element nodes. CAG selects a group of cluster-heads, which correspond to a correlation-dominating set, employing a straight forward localized theme throughout the question propagation section. The main pitfall of CAG is that it uses a straightforward notion of correlation, wherever the perimeters of the forwarding tree represent the correlations for the choice of cluster-heads and connecting sensing element. A recent work on the topic, GRASS[10], provides precise and heuristic approaches to search out a minimum range of aggregation points whereas routing knowledge to the information gathering node specified the network time period is maximized .In GRASS, correlations discuss with sensing element nodes' readings, which overlap statistically as they monitor constant event. These overlapping square measure utilized in GRASS to represent the relations among the gathered knowledge. GRASS solves the some body selection and routing issues put to gather at the information gathering node and so sends the results to the sensing element nodes. This way, an optimum resolution that's obtained by the information gathering node can end in an optimum routing and aggregation strategy. Constructing knowledge aggregation trees is another approach to scale back the quantity of information transmitted by the sensing element nodes and prolong the network time period. This approach permits knowledge aggregation at the intermediate nodes of the information aggregation tree. The planned strategies construct economical knowledge aggregation trees that square measures tock-still at the information gathering node. Propose a irregular tree construction formula that achieves a relent less issue approximation of the optimum tree for grid network topologies.

A. ITERATIVE ACTIVE SENSOR NODE DETERMINATION (IAND) HEURISTIC

In order to effectively and expeditiously solve the connected correlation-dominating set drawback for wireless detector networks, we tend to devise a quick energy-aware greedy constructive heuristic that's followed by associate degree unvarying improvement heuristic. The projected approach is mentioned here because the unvarying active node determination (IAND) heuristic. Both the greedy constructive heuristic and unvarying improvement heuristic use associate degree energy-aware profit operate for the determination of that nodes to stay active within the WSN.

However, it doesn't take into account the residual energy levels of the detector nodes whereas constructing the correlation-dominating set. during this work, we tend to develop associate unvaried improvement heuristic as an answer to the primary downside by achieving an efficient associated runtime-efficient correlation-dominating set and that we devise a energy-aware profit function as an answer to the second downside. Therefore, we solve constant drawback as in[1], however during a additional runtime-efficient and network period of time effective approach, as our simulations show. moreover, to the simplest of our data, the sole proposal for determination the connected correlation-dominating set drawback as outlined by Gupta et al. Energy aware benefit function

The profit function B(S,M)determines the amount of recently inferred nodes per new source node supplemental to set Nodes(M)thus the profit function tries to pick the best variety of recently inferred nodes whereas keeping the amount of recently supplemental source nodes to Nodes(M)the littlest. This manner set Nodes(M) is made by choosing the minimum variety of nodes, whereas inferring the utmost variety of nodes. The profit function B(S,M) is as follows

$$B(S,\mathcal{M}) = \frac{\text{Number of newly inferred nodes by } S}{\text{Number of new source nodes added to } Nodes(\mathcal{M})}$$

$$= \frac{|Infer(S) - Infer(\mathcal{M})|}{|Nodes(S) - Nodes(\mathcal{M})|}.$$

Algorithm 1. Energy aware benefit function

```
input : S1, S2, M
if abs(B(S1,M) - B(S2,M)) ≤ ε then
    if E(S1,M) ≥ E(S2,M) then
        return S1
    else
        return S2
else
    if B(S1,M) ≥ B(S2,M) then
        return S1
    else
        return S2
```

B. GREEDY CONSTRUCTIVE HEURISTIC

We introduce the greedy constructive heuristic, which generates correlation-dominating set from the given set C of information correlations because the input. The made correlation-dominating set are going to be associate input to the repetitive improvement heuristic for refinement. The aim of the greedy constructive heuristic is to perform the active detector node choice as quick as doable for an outsized information correlation input. the aim of the greedy constructive heuristic isn't to seek out the simplest or the minimum set of active detector nodes. it's supposed to be used alongside the repetitive improvement heuristic in order that the energy quality of the chosen active detector nodes are often additional improved. The greedy constructive heuristic uses the energy-aware profit perform for computing the profit values of supply sets. AN optimum resolution that's obtained by the information gathering node can end in AN optimum routing and aggregation strategy. Our constructive heuristic in short works as follows. It first computes the energy-aware profit values for every source set through one successive leave out the given source sets. Then the supply sets area unit sorted employing a quick sort-based algorithm into decreasing order according to the energy-aware profit values. Finally, supply sets with higher profit area unit side to set M until M becomes a correlation dominating set. The pseudo code of heuristic is given as

Algorithm 2. greedyConstructiveHeuristic

```
input : N, C, dataGatheringNode d
output: M
M ← ∅;
S_List ← ∅;
Nodes(M) ← d;
foreach correlation C = {S, s} ∈ C do
    S.benefit1 ← B(S, M);
    S.benefit2 ← E(S, M);
    S_List ← S_List ∪ (S, S.benefit1, S.benefit2);
//sort in descending order;
S_SortedList ← Sort(S_List);
while IsCorrelationDom(M) = FALSE do
    S ← next source set in S_SortedList;
    M ← M ∪ {S};
```

C. ITERATIVE IMPROVEMENT HEURISTIC

The selected set of active sensor nodes that constitute the correlation-dominating set found by the constructive heuristic is an initial solution to our iterative improvement heuristic. The purpose of our iterative improvement heuristic is to go through the initial solution and try to improve the quality of the selected active sensor nodes while preserving the correlation-dominating set property. The iterative improvement heuristic is composed of 4phases;

1. Induction of source sets that are not in M due to the sensor nodes of source sets in M.
2. Identification and removal of redundant nodes in Nodes (M).
3. Performing a sequence of swaps between selected sensor nodes and unselected source sets to improve the energy quality of M.
4. Identification and removal of redundant nodes in Nodes (M)

Algorithm 3. Iterative Improvement Heuristic

```
//First phase;
sourceSetsInduction()
//Second phase;
eliminateRedundantNodes()
//Third phase;
performSwaps()
//Forth phase;
eliminateRedundantNodes()
```

III. CONCLUSION

In wireless detector network (WSN) applications wherever data gathered by completely different detector nodes is related, all sensor nodes needn't move for the WSN to be practical. In such WSN applications, choosing a group of active sensor nodes within the network could be a vital issue for the performance of the WSN. during this work, we have a tendency to thought of the problem of finding a full of life set of nodes that are connected and might infer the related knowledge of the inactive detector nodes. This downside was developed as an instance of the connected correlation-dominating set downside. so as to unravel the connected correlation-dominating set problem within the context of WSNs, we've got projected and developed an unvaried Active detector Node Determination(IAND) heuristic that's composed of a quick constructive heuristic followed by a good and runtime-efficient iterative improvement heuristic.

The constructive heuristic a quick rule that has AN initial answer for the iterative improvement heuristic. The unvaried improvement heuristic performs a sequence of swap operations to additional improve the standard of active detector nodes where as conserving the correlation dominating set property of the set of active detector nodes. The swap operations occur between the chosen detector nodes within the current correlation-dominating set and the unselected supply sets. the matter of finding a' 'good'' swap for a given elite supply node was developed as a sub problem of the first correlation-dominating set problem. we have a tendency to used the 0-hop centralized heuristic of Gupta et al. [1] for resolution this swap sub problem because of the small-size of the sub problem. The in depth simulations that we have a tendency to performed showed that the projected approach will with efficiency figure a full of life detector node set and might be effective in prolonging the network period of time. e have a tendency to additionally compared our approach with a state-of-the-art approach.

The simulation results showed that our approach will perform significantly higher in terms of WSN period of time than the prevailing approach, while achieving drastically higher runtime efficiency.

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