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Mapping the Data Elements in Wireless Sensor Network Using Tabu Search Algorithm

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ABSTRACT:

The main challenge in wireless sensor network deployment pertains to optimizing energy consumption when collecting data from sensor nodes. This paper proposes a new centralized clustering method for a data collection mechanism in wireless sensor networks, which is based on network energy maps and Quality-of-Service (QoS) requirements. The clustering problem is modeled as a hyper graph partitioning and its resolution is based on a tabu search heuristic. Our approach defines moves using largest size cliques in a feasibility cluster graph. Compared to other methods (CPLEX-based method, distributed method, simulated annealing-based method), the results show that our tabu search-based approach returns high-quality solutions in terms of cluster cost and execution time. As a result, this approach is suitable for handling network extensibility in a satisfactory manner.

INTRODUCTION:

Increasingly, several applications require the acquisition of data from the physical world in a reliable and automatic manner. This necessity implies the emergence of new kinds of networks, which are typically composed of low-capacity devices. Such devices, called sensors, make it possible to capture and measure specific elements from the physical world (e.g., temperature, pressure, humidity). Moreover, they run on small batteries with low energetic capacities.

Consequently, their power consumption must be optimize in order to ensure increased lifetime for those devices. During data collection, two mechanisms are used to reduce energy consumption: message aggregation and filtering of redundant data. These mechanisms generally use clustering methods in order to coordinate aggregation and filtering. Clustering methods belong to either one of two categories: distributed and centralized. The centralized approach assumes that the existence of a particular node is cognizant of the information pertaining to the other network nodes. Then, the problem is modeled as a graph partitioning problem with particular constraints that render this problem NP-hard. The central node determines clusters by solving this partitioning problem.

DATA COLLECTION MECHANISM:

Generally, sensor networks contain a large quantity of nodes that collect measurements before sending them to theapplications. If all nodes forwarded their measurements, the volume of data received by the applications would increase exponentially, rendering data processing a tedious task. A sensor system should thus contain mechanisms that allow the applications to express their requirements in terms of the required quality of data. Data aggregation and data filtering are two methods that reduce the quantity of data received by applications. The aim of those two methods is not only to minimize the energy consumption by decreasing the number of messages exchanged in the network but also to provide the applications with the needed data without needlessly overloading them with exorbitant quantities of messages.

PROBLEM FORMULATION:

The considered network contains a set V of m stationary nodes whose localizations are known. The communication model can be described as multihop, which means that certain nodes cannot send measurements directly to the collector node: they must rely on their neighbors' service. An application can specify the following QoS requirements:

1. Data collection frequency, fq. The network provides results to the application every time the duration fq expires.

2. A measurement uncertainty threshold, mut. If the difference between two simultaneous measurements from two different nodes in the same zone (fourth requirement) is inferior to mut, then one of them is considered redundant.

3. A query duration, T. The network required for the query run a total time whose value is equal to T.

4. A zone size step. The step value determines the zone length. Within a single zone, measurements are considered redundant. If an application requires more precision, it could decrease the step value or even ignore the transfer of such value. The goal of the clustering algorithm is to 1) split the network nodes into a set of clusters Gi that satisfies the application requirements, 2) reduce energy consumption, and 3) prolong the network lifetime. Clusters are built according to the following criteria:

- Maximize network coverage using the energy map;
- Gather nodes likely to hold redundant measurements;
- Gather nodes located within the same zone delimited by the application.

1. **Initialization**
2. Sort active nodes by their degrees in graph G'
3. $F_0 := \emptyset$ (F_0 embodies the initial solution)
4. **For** i = 0 to m' **do** (m' represents the number of active nodes)
5.   If node *i* is not covered by a clique in F_0 then
6.   Build a new cluster g
7.   Head of g = node i
8.   g = The clique with the maximal size, containing node *i*, as well as all of the nodes adjacent to *i* which are not covered by F_0.
9. $F_0 = F_0 \cup g$
10.   End if
11. End for

Fig: Initial solution algorithm

A TABU SEARCH APPROACH:

In order to facilitate the usage of tabu search for CBP, a new graph called Gr is defined. It is capable of determining feasible clusters. A feasible cluster consists of a set of nodes that fulfill the cluster building constraints . Nodes that satisfy Constraint, i.e., ensure zone coverage, are called active nodes. The vertices of Gr represent the network nodes. An edge (i,j) is defined in graph Gr between nodes i and j if they satisfy Constraints . Consequently, it is clear that a clique in Gr embodies a feasible cluster. A clique consists of a set of nodes that are adjacent to one another.

Five steps should be conducted in order to adapt tabu search heuristics to solve a particular problem:

1. Design an algorithm that returns an initial solution,

2. Define moves m() that determine the neighbourhood N(s) of a solution s,

3. Determine the content and size of tabu lists,

4. Define the aspiration criteria,

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5. Design intensification and diversification mechanisms.

The algorithm ends when one of the following three conditions occurs:

1. All possible moves are prohibited by the tabu lists;

2. The maximal number of iterations allowed has been reached;

3. The maximal number of iterations, where the best solution is not enhanced successively, has been reached.

INITIAL SOLUTION:

The goal is to find an appropriate initial solution for the problem, in order to get the best solution from tabu search iterations within a reasonable delay. The algorithm depicted in Fig is proposed. It starts sorting active nodes according to their degree in graph Gr decreasingly. For each iteration, the first active node i, not yet covered by the initial solution F0, is selected. The algorithm determines the largest size clique that contains the selected active node i with its adjacent nodes in graph Gr, which have yet to be covered byF0. This clique is considered a new cluster and node I becomes the cluster head. The algorithm does not ensure that all nonnative nodes are assigned to a cluster. Consequently, if node i is not covered by any cluster when the algorithm ends, it is assigned to a cluster whose head is adjacent to node . However, this leads to the fact that an initial solution could not be feasible, i.e., nodes made up of at least one cluster does not consist of a clique in the graph Gr. A penalty equation toevaluate a solution is proposed in the following sections.

EXISTING SYSTEM:

The main challenge when deploying sensor networks pertains to optimizing the energy consumption for data collection from sensor nodes. A new data collection mechanism based on a centralized clustering method distributed clustering method. It uses sensor network energy maps and applies QoS requirements in order to reduce energy consumption.

PROPOSED SYSTEM:

This paper proposes a new centralized clustering method for a data collection mechanism in wireless sensor networks, which is based on network energy maps and Quality-of-Service (QoS) requirements. The clustering problem is modeled as a hyper graph partitioning and its resolution is based on a tabu search heuristic. Our approach defines moves using largest size cliques in a feasibility cluster graph.

IMPLEMEMTATION:

MODULES:

- Client
- Server

SERVER MODULE:

In the transferring of data through wireless networks, the Server and Path of the receiving need to be mentioned, Server checks the connection of the receiving path and establishes the connection, by this server knows the path through which the data has to be transferred. When client clicks send, it sends the data normally, but while retrieval of data, tabu search checks the receiving path mentioned and makes the wireless censors as clusters, this makes the energy consumption less and optimizes the performance. The Consumption of Energy is lessened as the censors are made as clusters and it makes easy to identify the data related censors.

CLIENT MODULE:

Client in the network selects a file from the System by using its path and it clicks on send, before this the Server connection needs to be established. When the connection is established, the data is send to the receiving path of server. and when the client selects the destination path and clicks receive then the data sent is sent into destination path. But the number of packets, energy differs for the same message while transferring and receiving. It is optimized while receiving message, as the receiving is done through the

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Tabu search algorithm. Thus Tabusearch algorithm Consumes less energy and performes high.

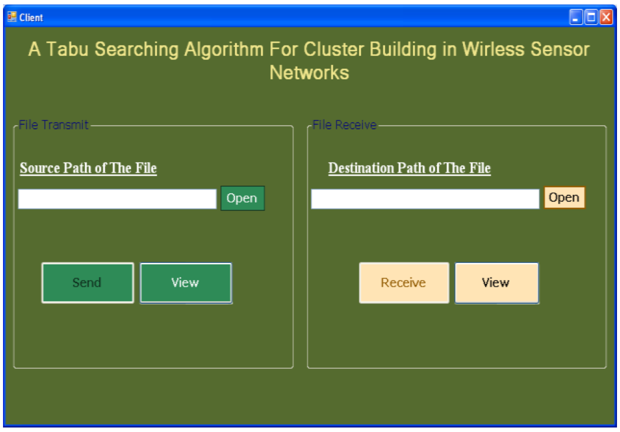
SCREENSHOTS:

Window of Server Page.

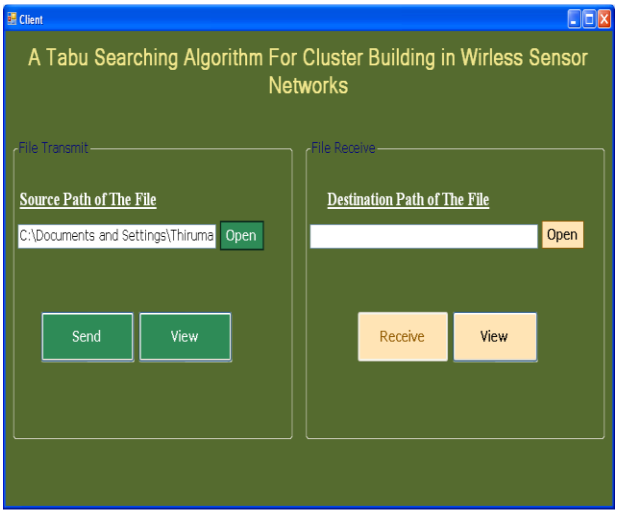
On clicking the Select receiving path button,this window is displayed.

Acknowledge showing connection established on clicking “Start server”

Initial Window of Client.



Select the file on clicking “Open” button.



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CONCLUSION:

Tabu search is used for the optimization of power consumption in censors at wireless networks. Tabu search allows the search to explore solutions that do not decrease the objective function value only in those cases where these solutions are not forbidden. This is usually obtained by keeping track of the last solutions in term of the action used to transform one solution to the next. When an action is performed it is considered tabu for the next T iterations, where T is the tabu status length. A solution is forbidden if it is obtained by applying a tabu action to the current solution.

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