Excellent and Energy Efficient Data Collection for Wireless Heterogeneous Sensor Networks

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Abstract- Wireless sensor network consist of overhead problem which is also produced in the open vehicle routing protocol. To overcome this problem, energy efficient delay aware lifetime balancing data collection protocol is used. The EEDC protocol is used to reduce the total traffic cost for collecting data. Lifetime of the sensor nodes can be prolonged by avoiding traffic and delay during the transmission process. Both centralize algorithm and distributed algorithm operation are used.

Keywords— Data collection, energy efficiency, heuristic algorithms, delay, routing protocols, wireless sensor networks.

I. INTRODUCTION

Wireless sensor networks have emerged as a unmarked type of networking systems with limited computing, communication, and storage possessions. A wireless sensor networks consists of nodes located to sense environmental condition for a broad range of applications, such as background monitoring, scientific assessment, disaster discovery, field examination, and configuration monitoring. In these applications, prolonging the wireless sensor network lifetime of and guaranteeing packet release delays are important for achieving suitable quality of service.

Most of the sensing applications divide in ordinary that from side to side multihop their source node broadcast the packets to the sink node, most significant difficulty on to determine the routes that permit all packets to be delivered in determined time frames, while concurrently achieving energy efficiency and load balancing. A lot of research firm work to attain tradeoffs in supplies of delay, energy cost, and load matching for such data collection tasks.

The motivation for this employment stems from the fresh study efforts on open vehicle routing problems are characteristically based on similar assumptions and constraints connected to sensor network. Specifically, in open vehicle routing investigate on data transportation, the aim is to add to the data to nodes in finite time with the negligible amount of transmission cost.

To decrease its computational overhead shaped in open vehicle routing protocol, excellent and energy efficient data collection protocol is introduced. In this protocol both a centralized heuristic based on tabu search, and a distributed heuristic based on gossiping is used to obtain estimated solutions. The algorithm designs also take into description for load complementary of every node to boost the lifetime. To end with, this algorithm with compressive sensing, this helps to minimize the traffic created in the network.

Taking into account that in the case of homogeneous sensor network operation, delay and energy efficiency are very dissimilar research challenges of heterogeneous sensor networks to significantly strengthen More Specifically, the major problem which are focused are Data collection protocol called excellent and energy efficient data collection which employs the techniques developed for open vehicle routing in operations examine to find the least amount cost routes to transport packets within the time frame, to a more complete and common description in the context of heterogeneous networks.

In mission-critical applications, such as battleground investigation, fire detection in forests, and gas monitoring in coal mines, wireless sensor networks are deployed in a broad range of areas, with a huge number of sensor nodes detecting and coverage some in sequence of urgencies to the end-users. As there may be no communiqué
infrastructure, users are usually equipped with communicating devices to converse with sensor nodes. When a dangerous event occurs in the monitoring area and is detected by a sensor node, an alarm needs to be televising to the other nodes as soon as possible. Then, sensor nodes can warn users nearby to flee or take some response to the event.

The algorithm is customized for both Tabu search in the centralized heuristic and the status gossiping component in the distributed heuristic is suitable for heterogeneous wireless sensor networks and improving the presentation and permanence in actual deployments. The confront brought by thin incidence discovery and add a systematic set of experiments for tolerant and evaluating the compressive sensing reconstruction errors under different compression rate, data sparsity, and the number of source nodes.

II. BACKGROUND

A. Vehicle routing problems

Open vehicle routing protocol problem is a well known trouble in ready research. It find routing flanked by a depot and user with given demands so that the transmission cost is minimized with the involment of the minimum number of vehicles, while satisfying capacity constraints. With additional constraints, vehicle routing protocol can be further extended to solve different problems, where one of the most important is the vehicular routing protocol with time windows. This problem happens frequently in the distribution of goods and services, where an unlimited number of identical vehicles with predefined capacity serve a set of customers with demands of different time intervals (time windows). VRPTW tries to minimize the total transportation cost through the minimum number of vehicles, without violating any timing constraints in delivering goods. If vehicles are not required to return back to the depot, and if the time windows are replaced by deadlines, VRPTW can be further extended to the open vehicle routing problem with time deadlines (OVRP-TD).

OVRP-TD has inspired many heuristics. In the nearest insertion method, where the farthest node is chosen first to be coupled with a path. Then, repeatedly, every selected node chooses the adjacent neighbor that has not been assigned a route so far, and connects itself to this neighbor. This process is repeats until all the nodes are connected by routes. Developed the push forward insertion heuristic (PFIH) is used to select repeatedly the nodes with the lowest additional insertion cost as the next node, until all nodes are routed. Once initial routes have been found, various algorithms are developed to generate near finest solutions based on simulated annealing, tabu search, or genetic programming.

B. Compressive Sensing

After determining the routes, further refine the data collection efficiency through a promising technique called compressive sensing (CS). In the compressed sensing technique, the data are compressed during their transmission to destination. If suppose that there are N number of nodes generating N segments of data, where the data are K-sparse, meaning only K of them are non-zero. N pieces of data are compressed into M pieces through a linear transformation. Reduce the number of packets, where K < M _ N.

Since CS promises improved energy efficiency and life-time balancing properties, data gathering protocols uses CS for better performance. CS derives a new data aggregation technique to minimize the total energy consumption and compressed aggregation. Compressive sensing and particle swarm optimization algorithms to build up data aggregation trees and decrease communication rate. EDAL is different from these two methods in that they involve all nodes to contribute sensing data during the data collection phase. On the other hand, random routing methods based on different network topologies to collect data from a subset of nodes, which fits to the similar application scenario as EDAL. However, EDAL achieves better energy efficiency because it optimizes on the number of constructed routes such that the total number of packets is decreased. We further compare the performance of EDAL with that in the evaluation section to show that a better gain in energy efficiency is achieved because it exploits the topological requirements of compressive sensing.

III. EDAL ALGORITHM DESIGN

A. Centralized Heuristics

In this section, we propose a centralized heuristic that to find estimate solutions. Assume that M nodes have been chosen as sources at the
creation of each data gathering period. The heuristic algorithm consists of two phases: route construction, which finds an early possible route solution, and route optimization, which improves the initial results using the tabu-search optimization technique.

Centralized Algorithm:
1. Set of route with minimum cost.
2. Candidate list
3. Minimum path cost for all source node.
4. A node with maximum path cost is selected.
5. Select the particular from the list.
6. This process is continued based on the remaining time until all the nodes are selected.
7. If no maximum path cost node is found, then route construction process will be started.

In our tabu search implementation, the local search descent (LSD) method is used, which uses a regular insertion and exchange of nodes between routes to create mutations of the current solution. Up to λ nodes can be exchanged. For example, if λ = 2, a total of eight transaction operations are possible, including (0;1), (1;0), (1;1), (0;2), (2;0), (1;2), (2;1) and (2;2), where (ij) means to prefer i nodes in route r1 and change it with j nodes in route r2, while r1 and r2 may not essentially be dissimilar.

The tabu search exploits LSD in two steps: intensification and diversification. In intensification, the algorithm implements the transaction LSD procedure on each route individually to find the best possible order of nodes. The diversification step enables the algorithm to explore out of the local best possible by making random 2-interchange operations among routes so that improved routes that are combinations of the unique ones can be found.

Distributed Algorithm:
1. Collect neighborhood status using ant gossiping based algorithm.
2. Minimum path cost is selected using Dijkstra’s algorithm.
3. Send packets to determine the source node.
4. Select the next node and send the construction packets.

This algorithm is based on the ant colony optimization and geographic forwarding. It consists of two phases: status gossiping, and route construction. In the status gossiping phase, each source node sends forward packets spreading its current status, including its energy level, in the direction of its neighbor source nodes within H hops.

Status Gossiping Algorithm:
1. Sending the status of source node to its neighbor nodes.
2. The packets during the transmission, collects the information
3. It again travels back to source node and inform their pass by nodes about the collected information.
4. The most remaining energy node is select from this information.
5. If two source packets meet each other, it exchange its information.

In the meantime, the status data of nearby nodes are gathered by all source node with the received backward packets. During the gossip phase, the packets are forwarded with a modified geographic forwarding routing protocol, chooses the node with the maximum remaining energy while making geographical progress towards the destination as the next hop. Once a node collects status information of all its nearby sources, it enters the route construction phase, and runs revised push forward insertion distributed based on collected nearby neighbor status, and the estimation of node status outside the immediate neighborhood.

B. Distributed Heuristics

The centralized heuristic algorithm have developed in EDAL requires information to be collected from every node to a centralized one. In distributed sensor networks, this step will typically incur additional overhead. Consequently, it is typically attractive to distribute the algorithm computation into individual nodes. In this section, we develop a distributed heuristics algorithm for EDAL, where at the beginning of every period, each source node independently selects the most energy-efficient route to forward packets.
IV RESULTS
Evaluate the average time extreme to finish one round of algorithm computation to show the scalability and practicability of algorithm. The scalability of the centralized heuristic, based on computational time overhead against network size. This examination provides a logic of possibility for implementing the centralized heuristic in real sensor network, although centralized heuristic provides better performance, it is infeasible to run the centralized heuristic for large topologies with more than 400 nodes, as the computation takes longer than the communication period.

The time worn by every source node for constructing the routes in a distributed way, based on time overhead against gossip range. The overhead of the distributed heuristic algorithm on every node is tightly correlated with the gossip range, while the it completion time is firmly correlated with the network size.

In such a case, it collected the time for finishing algorithm computation on every node with different gossip ranges. Apparently, the better the gossiping range, the more network status needs to be collected. However, this also lead implementing the centralized heuristic in a real sensor network.

As one goal of EDAL protocol is to attach source nodes with minimum number of communicate nodes, the number of nodes used to appearance routes under different delay bounds.

The regular node used by MST and LRR are almost constant. For MST, the routing tree is unchanging, and the source nodes are arbitrarily selected with a constant probability. For LRR, the routes are randomly constructed based on predefined rules. Therefore, the finishing result does not have significant fluctuations. For C-EDAL and D-EDAL algorithms, the number of participating nodes is decreasing with the increasing of delay constraints. Because as the delay condition is comfortable, additional source nodes can be further into the same route, a characteristic that is made probable by the tabu search and ant-colony algorithms adopted by EDAL. As a result of that, fewer nodes are chosen due to triangle dissimilarity, where relay nodes can serve more source nodes concurrently.

V CONCLUSION.
An Energy-efficient Delay-Aware Lifetime-balancing protocol for data collection in heterogeneous wireless sensor networks, which is stimulated by new techniques residential for open vehicle routing protocol with time deadlines in operational research. The goal of EDAL protocol is to produce routes that attach all source nodes with minimal path cost, below the constraints of packet delay necessities and load opposite needs. The lifetime of the deployed sensor networks is used for assigning to link based on the remaining power level of each sensor node. centralized heuristic algorithm is used to reduce its complexity, distributed heuristic algorithm is used to reduce the computational overhead for large networks.

REFERENCES


