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Efficient and Optimal Routing Scheme for Wireless Sensor Networks

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Abstract: **The Wireless Sensor Networks(WSNs) have emerged as a new category of networking systems with limited computing, communication, and storage resources. In many sensing applications source nodes deliver packets to sink nodes via multiple hops, leading to the problem on how to find routes that enable all packets to be delivered in required time frames, while simultaneously taking into account factors such as energy efficiency and load balancing. To solve this problem one data collection protocol is developed called EDAL, which stands for Energy-efficient Delay-aware Lifetime-balancing data collection. Methods used are centralized heuristic and ant colony gossiping to find best energy efficient path. Then integrate EDAL with compressive sensing to reduce the amount of traffic generated and to reduce delay in the network.**

Keywords**: Energy efficiency, Ant colony gossiping, centralized heuristic.**

1. INTRODUCTION

Wireless Sensor Network (WSN) refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location. A WSN consists of few hundreds to thousands of sensor nodes. The sensor node equipment includes a radio transceiver along with an antenna, a microcontroller, an interfacing electronic circuit, and an energy source, usually a battery. The size of the sensor nodes can also range from the size of a shoe box to as small as the size of a grain of dust.The main constraint of sensor nodes is their very low finite battery energy, which limits the lifetime and the quality of the network . For that reason, the protocols running on sensor networks must consume the resources of the nodes efficiently in order to achieve a longer network lifetime.

This paper develops EDAL, an *E*nergy-efficient *D*elay-*A*ware *L*ifetime-balancing data collection protocol. Specifically, EDAL is formulated by treating energy cost in transmitting packets in WSNs in a similar way as delivery cost of goods in OVR and by treating packet latencies similar to delivery deadlines. So introduce both centralized heuristic based on tabu search and a distributed heuristic based on ant colony gossiping, to obtain approximate solutions. Our algorithm designs also take into account load balancing of individual nodes to maximize the system lifetime.

2. EXIXTING SYSTEM

The vehicle routing problem (VRP) is a well-known NP-hard problem in operational research. VRP finds routes between a depot and customers with given demands so that the transportation cost is minimized with the involvement of the minimal number of vehicles, while satisfying capacity constraints. With additional constraints, VRP can be further extended to solve different problems, where one of the most important is the vehicle routing problem with time windows (VRPTW). This problem occurs 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.

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Once routes have been found using EDAL, further refine the data collection efficiency through an emerging technique called compressive sensing (CS). CS is a technique through which data are compressed during their transmission to a given destination by exploiting the fact that most sensors may not always have valid data to report when they sample the environment , especially for nodes deployed in stable environments with rare and infrequent events to be detected.

A new data aggregation technique derived from CS to minimize the total energy consumption through joint routing and compressed aggregation. Compressive sensing and particle swarm optimization algorithms to build up data aggregation trees and decrease communication rate. These two methods are different from EDAL in that they require all nodes to contribute sensing data during the data collection phase.

3. PROPOSED SYSTEM

Key motivation for this work stems from the insight that recent research efforts on open vehicle routing (OVR) problems are usually based on similar assumptions and constraints compared to sensor networks. Specifically, in OVR research on goods transportation, the objective is to spread the goods to customers in finite time with the minimal amount of transportation cost. One may wonder, naturally, if treating packet delays as delivery time of goods, and energy cost as delivery cost of goods, it may be possible to exploit research results in one domain to stimulate the other.

Motivated by this observation EDAL, an Energy-efficient Delay-Aware Lifetime-balancing Protocol is developed. Specifically, EDAL is formulated by treating energy cost in transmitting packets in WSNs in a similar way as delivery cost of goods in OVR and by treating packet latencies similar to delivery deadlines. To reduce its computational overhead, introduce both a centralized metaheuristic based on tabu search and a distributed heuristic based on ant colony gossiping, to obtain approximate solutions. This also takes into account load balancing of individual nodes to maximize the system lifetime.

4. SYSTEM MODEL

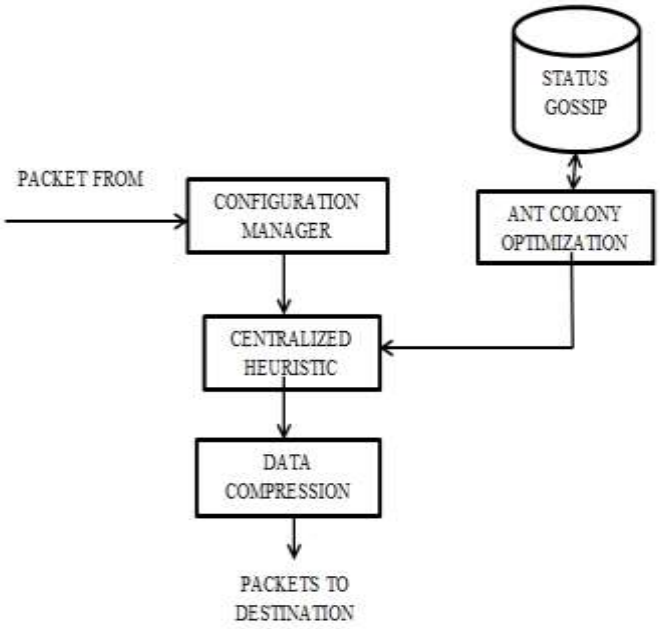

Figure 4.1 System Architecture

In Figure 4.1 the system architecture contains 4 main parts, i.e., Configuration Manager, Centralized Heuristic, Ant Colony Optimization and Data Compression. First create a Wireless Sensor Network .A Wireless Sensor Network consists of many number of sensor nodes. From the large number of sensor node, select a source node so as to transmit data to the destination node. Each node in the sensor network performs status gossiping. Based on centralized heuristic,

route to reach the destination node will be constructed. The status gossip helps to store the details about nodes in the database. For example remaining energy level of nodes, path to reach the nodes are all stored. Sensor network depends on lifetime of the sensor node in the Wireless Sensor Networks.

4.1 Configuration Manger

Configuration Manager is used to configure the network with nodes, connecting devices, etc in the database. This create the sensor nodes in the wireless sensor network. The configuration manager performs the process of monitoring and controlling the network devices to find where the nodes are located. This module organize and maintain the details about all components of the network. This component collects the packets from the networks, which are in-turn specified by the user and transfer it to the destination. This also identifies the source and destination to transfer the data.

4.2 Centralized Heuristic

The centralized heuristic algorithm consists of two phases one is route construction, which finds an initial feasible route solution, and route optimization, which improves the initial results using the tabu search optimization technique.In the route construction phase of this algorithm, we present a heuristic algorithm based on the Revised Push Forward Insertion Heuristic (RPFIH) method. RPFIH repeatedly selects the customer with the lowest additional insertion cost as the next node, until all customers are connected. Finally, RPFIH generates a set of found routes as the final output. Next optimize the initial solution using tabu search. Tabu search is a popular memory-based search strategy for guiding search beyond locally optimal points. Specifically, tabu search keeps the following data structures. One is tabu move list which is a queue with fixed size to keep the recent moves, so that problems such as repetition and cycling can be avoided. Other one is candidate list that stores the best solutions found so far by the search process, ranked by their total route cost.

4.3 Ant Colony Optimization

In Ant Colony Optimization, each node sends forward ants spreading its current status, including its remaining energy level, toward its neighbor nodes within H hops. Meanwhile, the status data of nearby nodes is collected by each source node with the received backward ants. The status Gossipis used to store the status information of various nodes.

In the status gossiping phase, each source node sends forward ants spreading its current status, including its remaining energy level, toward its neighbor source nodes within some hops. Meanwhile, the status data of nearby nodes is collected by each source node with the received backward ants. During the gossip phase, the ants are forwarded with a modified geographic forwarding routing protocol, which chooses the node with the maximum remaining energy while making geographical progress toward 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 RPFIH distributedly based on collected nearby neighbor status and the estimation of node status outside the immediate neighborhood.As all nodes start with a fixed amount of energy according to the node type, the source node can accurately estimate the status of nearby nodes. In that case, the minimal weight path from a source node to a nearby source node can be calculated with the currently held information.

4.4 Data Compression

Once routes have been found using EDAL, refine the data collection efficiency through an emerging technique called Compressive Sensing (CS). CS is a technique through which data are compressed during their transmission to a given destination by exploiting the fact that most sensors may not always have valid data to report when they sample the environment, especially for nodes deployed in stable environments with rare and infrequent events to be detected. CS theory asserts that one can recover the data from far fewer samples than its original dimension.

5. CONCLUSION

An Energy efficient Delay Aware Lifetime balancing EDAL protocol was proposed in wireless sensor a network which is promoted by flourishing techniques developed for open vehicle routing problems with time deadlines. The proposed system EDAL solves the problem of high energy consumption in sensor networks by balancing the loads in nodes. The centralized heuristic algorithm usestabu search method. These generate routes that connect all nodes with minimal total path cost, under the constraints of packet delay requirements. Ant colony optimization is used to find the best path to transfer the data. The lifetime of the deployed sensor network is also balanced by assigning weights to links based on the

remaining power level of individual nodes. Here high energy nodes are chosen to balance the load which in turn increases the lifetime of wireless sensor network. EDAL is closely integrated with compressive sensing, that promises considerable reduction in total traffic cost for collecting sensor readings under loose delay bounds.

6. FUTURE WORK

Future work for the current system includes the technique to reduce the delay than the proposed work and this would help to improve the efficiency of the entire system. This scheme attempts to complement the resource control method with traffic control.

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