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MINIMIZING VIDEO TRANSMISSION IN A VIDEO SENSOR NETWORK USING GREEDY WEIGHTED ALGORITHM

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Abstract:

WSN are increasingly used in different types of data-intensive applications scenarios such as micro-climate monitoring, precision agriculture, and audio/video surveillance. The sensor nodes are tiny and limited in power. Sensor types vary according to the application of WSN. Our study focused on the problem of Optimal Mobile Relay Configuration (OMRC) in data-intensive WSNs. The concept of mobile relay is that the mobile nodes change their locations so as to minimize the total energy consumed by both wireless transmission and locomotion. We propose using low-cost disposable mobile relays to reduce the energy consumption of data-intensive WSNs. Our approach differs from previous work in two main aspects. First, it does not require complex motion planning of mobile nodes, so it can be implemented on a number of low-cost mobile sensor platforms. Second, we integrate the energy consumption due to both mobility and wireless transmissions into a holistic optimization framework. For reduce the energy consumption we propose two algorithms that iteratively refine the configuration of mobile relays. The first improves the tree topology by adding new nodes. It is not guaranteed to find the optimal topology. The second improves the routing tree by relocating nodes without changing the tree topology. Third algorithm improves the routing tree by relocating its nodes without changing its topology.

Keywords --WSN, Energy optimization, Relay, Routing tree, mobile nodes.

1. INTRODUCTION

A wireless sensor network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as heat, vibration , pressure,humidity,motion or pollutants and to cooperatively pass their data through the network to a main location.The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control,machine health monitoring, and so on. Recent advancement in mobile sensor platform technology has been taken into attention that mobile elements are utilized to improve the Actor network performances such as coverage, connectivity, reliability and energy efficiency. The concept of mobile relay is that the mobile nodes change their locations so as to minimize the total energy consumed by both wireless transmission and locomotion. The conventional methods, however, do not take into account the energy level, and as a result they do not always prolong the network lifetime.A use of Petersen-size WSAN can gather up to 1 Gb/year from a biological habitat [1].The limited storage capacity of sensor nodes,most data must be transmitted to the base station for archiving and analysis. However, sensor nodes must operate on using of some adjust the max life time power supplies such as batteries or small solar panels(for external use of these both). Therefore, a key challenge faced by data-intensive WSNs is to minimize the energy consumption of sensor nodes so that all the data generated within the lifetime of the application can be transmitted to the base station to destination.Several different approaches have been In this paper, we use low-cost disposable mobile relays to reduce the total energy consumption of data-intensive WSNs.

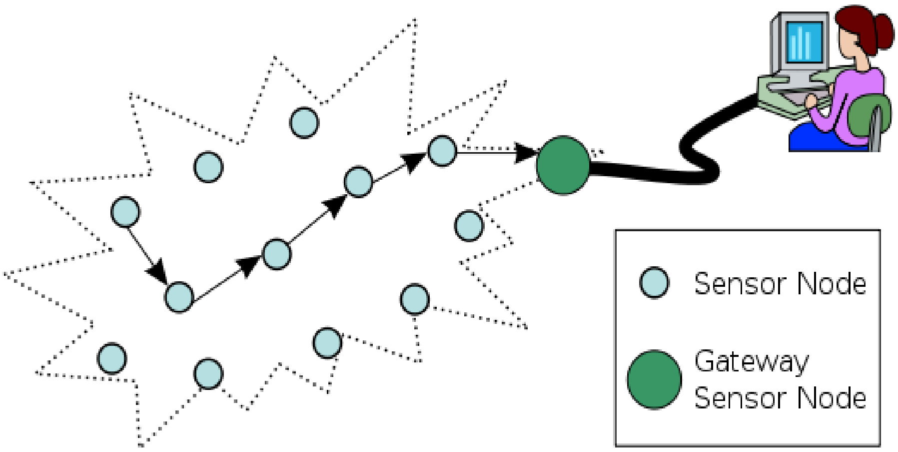

Figure1:Typical multi-hop wireless sensor network architecture

Different from mobile base station or data mules, mobile relays don't send the data to source; instead, they move to different locations and then remain stationary to forward data along the paths from the sources to the base station. Thus, the communication delays can be significantly reduced compared with using mobile sinks or data mules. Moreover, each mobile node performs a single relocation unlike other approaches which require repeated relocations.Com-pared with our approach, existing mobility approaches typically assume a small number of powerful mobile nodes, which does not exploit the availability of many low-cost mobile nodes.

2. METHODOLOGY

A mobile base station is a sensor node collects the data by moving around the network from the nodes [4]. In some work, in order to balance the transmission load, all nodes are performing multiple hop transmissions to the base station. The goal is to rotate the nodes which are close to the base station. Before the nodes suffer buffer overflows, the base station computes the mobility path to collect data from the visited nodes.The battery life of the base station gets depleted very quickly due to the sensor nodes which are located near to the base station relay data for large part of the network. The proposed solution includes the mobility of the base station such that nodes located near base station changes over time. These approaches incur high latencies due to the low to moderate speed. They pick up data from the sensors and transport it to the sink. In [7], the data mule visits all the sources to collect data, transports data over some distance, and then transmits it to the static base station through the network. The goal is to find a movement path that minimizes both communication and mobility energy consumption. Similar to mobile base stations, data mules introduce large delays since sensors have to wait for a mule to pass by before starting their transmission. In the third approach, the network consists of mobile relay nodes along with static base station and data sources. Relay nodes do not transport data; instead, they move to different locations to decrease the transmission costs. We use the mobile relay approach in this work. Goldenberg et al. [8] showed that an iterative mobility algorithm where each relay node moves to the midpoint of its neighbors converges on the optimal solution for a single routing

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path. However, they do not account for the cost of moving the relay nodes. In [9], mobile nodes decide to move only when moving is beneficial, but the only position considered is the midpoint of neighbors. Unlike mobile base stations and data mules, our OMRC problem considers the energy consumption of both mobility and transmission.

3. ANALYSIS

Different applications may apply different constraints on the routing tree. When only optimizing energy consumption, a shortest path strategy (as discussed below) yields an optimal routing tree given no mobility of nodes. However, in some applications, we do not have the freedom of selecting the routes. Instead, they are predetermined according to some other factors (such as delay, capacity, etc.). In other less stringent cases, we may be able to update the given routes provided we keep the main structure of the tree. Depending on the route constraints dictated by the application, we start our solution at different phases of the algorithm. In the unrestricted case, we start at the first step of constructing the tree. When the given tree must be loosely preserved, we start with the relay insertion step.

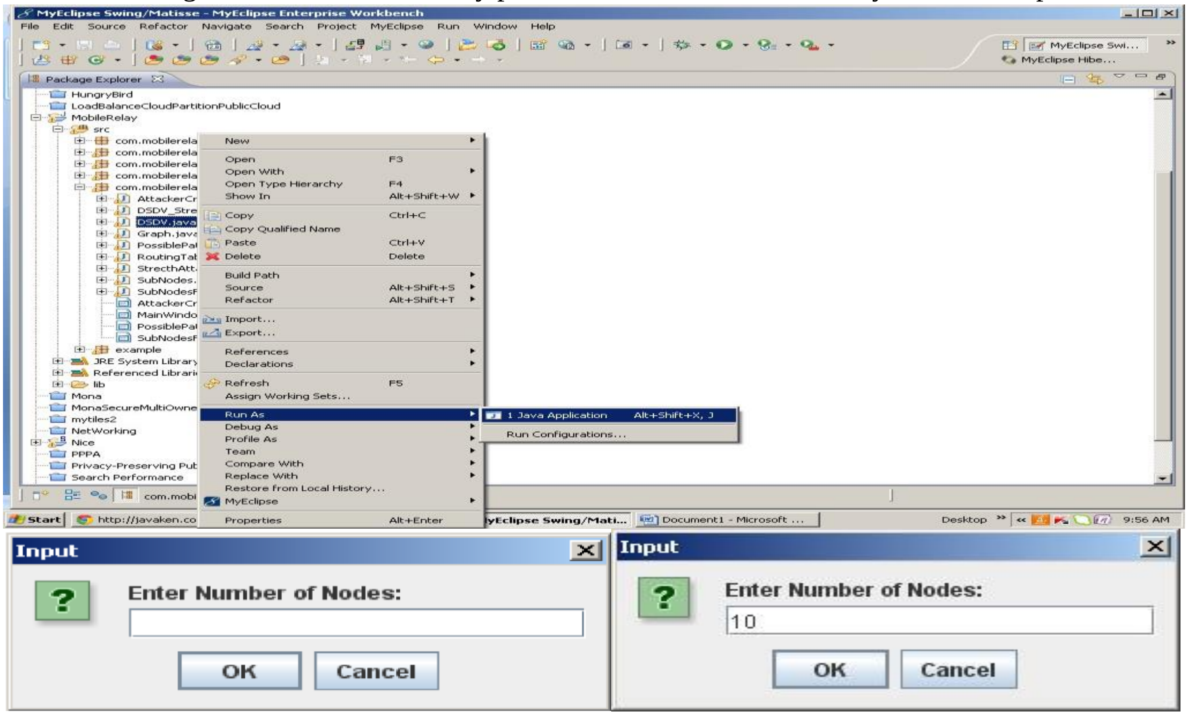

Fig.2.Implementation

Finally, with fixed routes, we apply directly our tree optimization algorithm.We construct the tree for our starting configuration using a shortest path strategy. We first define a weight function w specific to our communication energy model. We observe that using this weight function, the optimal tree in a static environment coincides with the shortest path tree rooted at the sink. So we apply Dijkstra's shortest path algorithm starting at the sink to all the source nodes to obtain our initial topology. We improve the routing tree by greedily adding nodes to the routing tree exploiting the mobility of the inserted nodes. For each node sout that is not in the tree and each tree edge sisj , we compute the reduction (or increase) in the total cost along with the optimal position of sout if sout joins the tree such that data is routed from si to sout to sj instead of directly from si to sj using the LocalPos algorithm described in algorithm 1. We repeatedly insert the outside node with the highest reduction value modifying the topology to include the selected node at its optimal position, though the node will not actually move until the completion of the tree optimization phase. After each node insertion occurs, we compute the reduction in total cost and optimal position for each remaining outside node for the two newly added edges (and remove this information for the edge that no longer exists in the tree).

4. IMPLEMENTATION

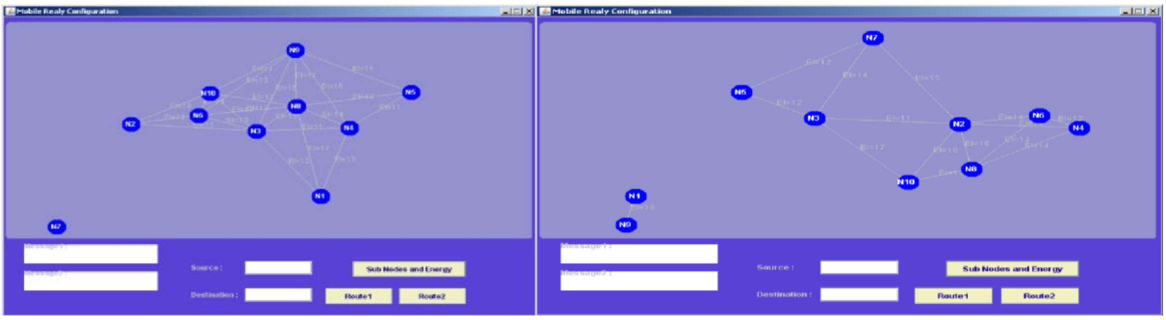

Fig.3. Example of configuration

As future work, particular cases may be studied by the consideration of additional features related to the link level, routing scheme or application layer in the constraints of the optimization problem. This may lead to a more reduced solution space, reaching optimal results and narrowing the gap to the simulation results obtained by our study. On the other hand, feasibility/compatibility studies between our OPT-PRIM proposal and WSN routing algorithms, such as ALBA-R (Adaptive Load-Balanced Algorithm, Rainbow version)] or XLP (Cross Layer Protocol), might mean the enhancement of network lifetime and other network performance figures, such as end-to-end delay or packet delivery ratio.

CONCLUSION

We proposed a holistic approach to minimize the total energy consumed by both mobility of relays and wireless transmissions. Most previous work ignored the energy consumed by moving mobile relays.When we model both sources of energy consumption, the optimal position of a node that receives data from one or multiple neighbors and transmits it to a single parent is not the midpoint of its neighbors; instead, it converges to this position as the amount of data transmitted goes to infinity. Ideally, we start with the optimal initial routing tree in a static environment where no nodes can move. However, our approach can work with less optimal initial configurations including one generated using only local information such as greedy geographic routing. Our approach improves the initial configuration using two iterative schemes. The first inserts new nodes into the tree. The second computes the optimal positions of relay nodes in the tree given a fixed topology. This algorithm is appropriate for a variety of data-intensive wireless sensor networks. It allows some nodes to move while others do not because any local improvement for a given mobile relay is a global improvement. This allows us to potentially extend our approach to handle additional constraints on individual nodes such as low energy levels or mobility restrictions due to application requirements.

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