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Data Collection In Wireless Sensor Networks Using Optimized Shortest Path Method

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Abstract:

In this paper we investigate solution for efficient data collection in wireless network. Recent work has shown that sink mobility along a constrained path can improve the energy efficiency in wireless sensor networks. However, due to the path constraint, a mobile sink with constant speed has limited communication time to collect data from the sensor nodes deployed randomly. This poses significant challenges in jointly improving the amount of data collected and reducing the energy consumption. To address this issue, we propose a novel data collection scheme, called the Maximum Amount Shortest Path (MASP) that increases network throughput as well as conserves energy by optimizing the assignment of sensor nodes. MASP is formulated as an integer linear programming problem and then solved with the help of a genetic algorithm. A two-phase communication protocol based on zone partition is designed to implement the MASP scheme. We also develop a practical distributed approximate algorithm to solve the MASP problem. In addition, the impact of different overlapping time partition methods is studied. The proposed algorithms and protocols are validated through simulation experiments using OMNET++.

Keywords: *Sensor Node, Efficient Energy, Data Collection, Sink Mobility, Discover Phase.*

Introduction

We mainly focus on how efficiently collect data's in the Wireless sensor network. According to the current status in wireless network, that object with sink is move in a random path which leads to high energy efficiency in network. Due to the selection of random path by a mobile sink with constraint speed there is only limited time available to collect data from sensor nodes. It is possible to guarantee the data delivery efficiency with the help of efficient communication protocols and data collection schemes while the trajectories of the mobile sinks are constrained or controllable.To recover from this issue We formulate the Maximum Amount Shortest Path (MASP) problem as a 0-1 integer linear programming(ILP) problem which aims to find the optimized mapping between members and subsinks to minimize the energy consumption under the condition that the total amount of data collected by the mobile sinks is maximized. A genetic algorithm solution with two-dimensional binary chromosomes is presented to solve the MASP problem. We design a two-phase communication protocol based on zone partition without relying on the knowledge of geographical information.

Proposed Methodology

We propose the Maximum Amount Shortest Path (MASP) problem as a 0-1 integer linear programming (ILP) problem which aims to find the optimized mapping between members and sub sinks to minimize the energy consumption under the condition that the total amount of data collected by the mobile sinks is maximized. A two-phase communication protocol based on zone partition is designed to implement the MASP scheme.We propose an energy-efficient in Network data aggregation approach in WSN. Each node is related to a routing sub tree and each sub tree overwhelms a cluster and the root node of each sub tree is the head node of the related cluster. The energy consumption in wireless transmissions is equal to the square of distance between two nodes in communication. In the proposed approach, all the nodes transmit their data to their neighbour instead of their cluster head. Therefore, the communication distance is reduced and the energy consumption of each node, each cluster and the average energy consumption of the whole networks is reduced and the network lifetime is increased.

Mobile Node Creation

Mobile Node Creation is a first module in our project. The Main purpose of the mobile node creation module is to creating the mobile node dynamically at specified location. Because mobilenodes are always dynamic in nature, so static nodes are not a valid one in our project.

During the mobile node creation, we also predict the Following Details about the mobile node:

- Each mobile node name
- Mobile node location (Point)

- **Local Host Address**
- **Mobile Node Port number**

Mobile Sink Broad Cast Message

The sink attached with the object starts to broadcast message for establishing connection with the sub sinks and members. The broadcast message will send to the whole network or monitored communication area. Those messages are received by all the nodes present in network. The nodes present in the Mobile sink trajectory area which receives broadcast messages are known as Sub sinks and the nodes which are present outside the trajectory path of Mobile sink which to receive the broadcast message(i.e., the node present in MCA) are called as Members.

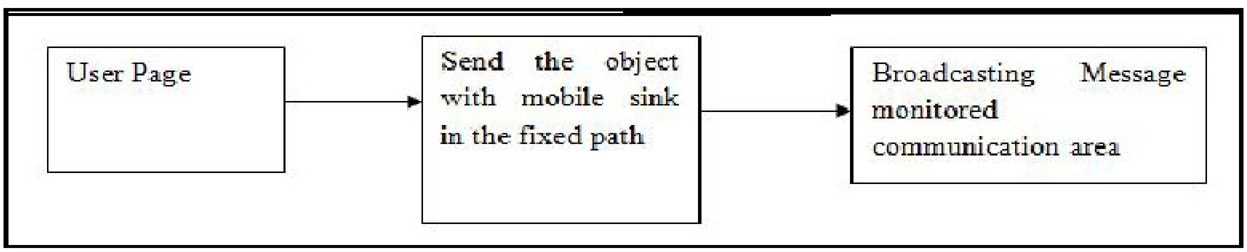

Figure 1

Discover Phase

The main tasks of the discover phase include learning the topology information and assigning the members to their corresponding subsinks. The subsinks start building the shortest path trees (SPTs) rooted from themselves in entire network. As a result, each node obtains the shortest hop information from themselves to all subsinks and then send the related hop information to the corresponding subsink another important task is that the mobile sink needs to record the time when each node enters and leaves its communication range. For the mobile sink, the data collection processes in the forward direction and the reverse direction are symmetrical. The mobile sink calculates the length of the communication time allocated to each subsink according to some rules. The broadcast message consists of the list of the mapping relation between each member and its destination subsink.

Data Collection Phase

In this phase, all nodes start collecting data from the monitored area formally. The members send the sensed data or forward data to the destination subsinks according to the routing table built in the discover phase. The mobile sink may not collect the expected amount of data due to interference between transmission and reception on the subsinks. We propose a Mobile Sink First (MSF) scheme to process the communication between the subsinks and the mobile sink in order to avoid the interference.

In the MSF scheme, the subsink will stop receiving the sensed information from its downstream nodes and make use of all time resource and bandwidth resource to transmit data to the mobile sink when it's current subsink's turn for transmission. After the mobile sink moves away, the downstream nodes will start transmitting buffered data to the current subsink

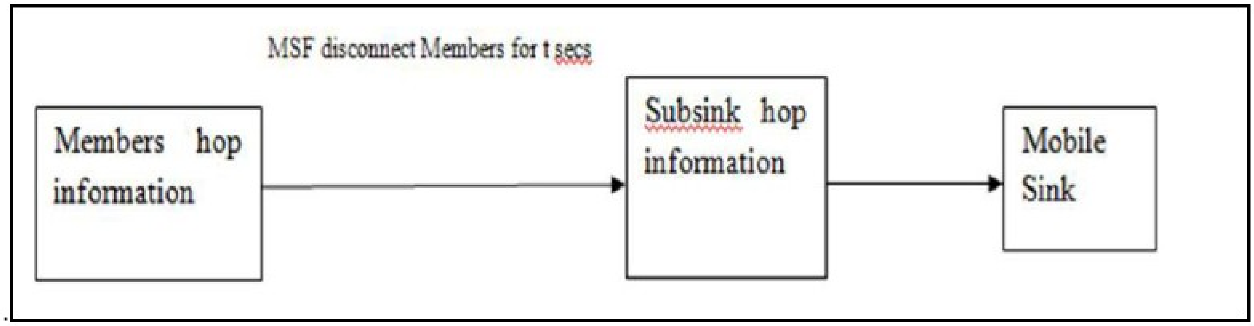

Figure 2: Technique Used MASP (Maximum Amount Shortest Path)

We formulate the Maximum Amount Shortest Path (MASP) problem as a 0-1 integer linear programming (ILP) problem which aims to find the optimized mapping between members and subsinks to minimize the energy consumption under the condition that the total amount of data collected by the mobile sinks is maximized. A genetic algorithm solution with two-dimensional binary chromosomes is presented to solve the MASP problem.

Distributed Solution

We propose a centralized solution to the MASP optimization problem based on a Genetic Algorithm and a corresponding communication protocol to implement the MASP, in which three movement rounds are needed for the mobile sinks to perform the discover phase. Although most of the time-consuming and energy-consuming tasks are executed by the mobile sink, more movement rounds in the discover phase lead to a lower efficiency of total system. To address this issue, we propose a distributed approximate solution in which the mapping relationships between the members and the subsinks are calculated by each member independently, instead of by the mobile sink in a centralized way.

Problem Definition

Recently, sink mobility has become an important research topic in wireless sensor networks.
Multi hop sensor networks with a path-constrained mobile sink where the Shortest Path Tree (SPT) method is used to choose the cluster heads and route data that may result in low energy efficiency for data collection.

The communication time (or duration) between each sub sink and the mobile sink is assumed to be fixed due to the fixed movement path and constant speed of M.

Each member chooses the closest sub sink in terms of hop distance as its destination and then sends its own data or forwards data from downstream nodes to upstream nodes along shortest path trees.

Developing Methodologies

The test process is initiated by developing a comprehensive plan to test the general functionality and special features on a variety of platform combinations. Strict quality control procedures are used.

The process verifies that the application meets the requirements specified in the system requirements document and is bug free. The following are the considerations used to develop the framework from developing the testing methodologies.

Conclusion

In this paper, we proposed an efficient data collection scheme called MASP for wireless sensor networks with path-constrained mobile sinks. In MASP, the mapping between sensor nodes and subsinks is optimized to maximize the amount of data collected by mobile sinks and also balance the energy consumption. MASP has good scalability to support sensor networks with low density and multiple mobile sinks. A heuristic based on genetic algorithm and local search is presented to solve the MASP optimization problem. In addition, we design a communication protocol that supports MASP and adapts to dynamic topology changes. To reduce the computational complexity, we develop two practical algorithms, a zone partitioning-based solution and a distributed solution (MASP-D). For future work, we plan to validate the proposed schemes on different scenarios with various movement trajectories of mobile sinks. Considering that minimizing the total energy consumption may not lead to the maximum network lifetime, we also plan to study the subsink selection problem with network lifetime maximization as the optimization objective as future work.

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